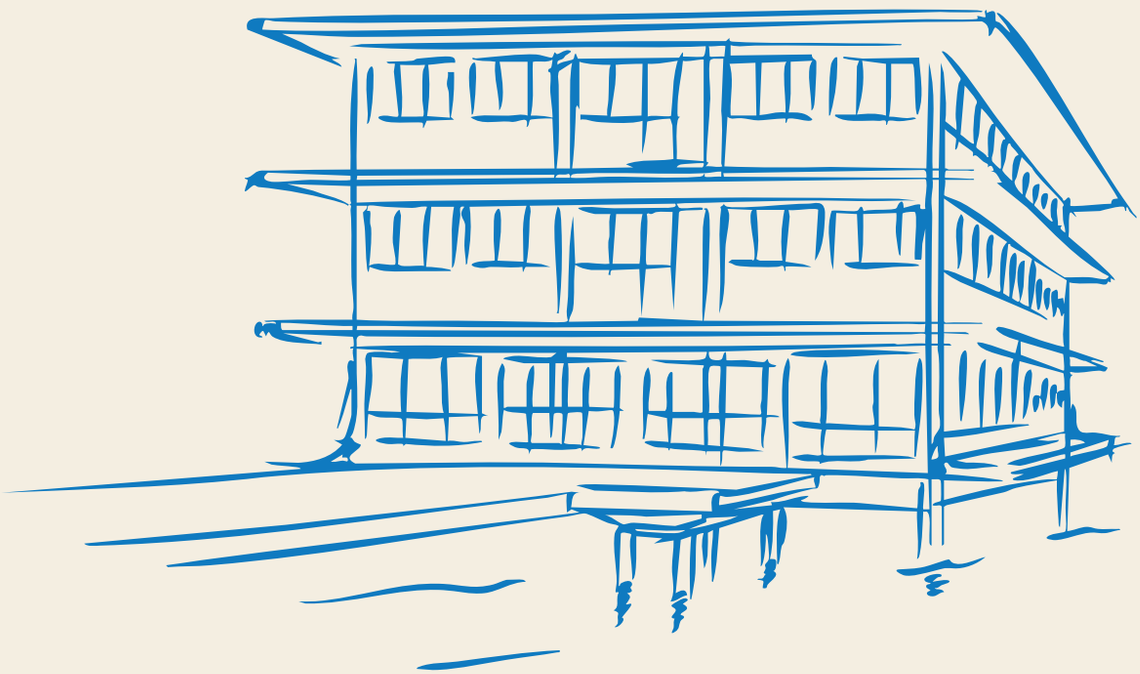
Centro de Investigacións Mariñas de Galicia



Desde 1975

XUNTA
DE GALICIA

XUNTA
DE GALICIA

CENTRO DE INVESTIGACIÓNS MARIÑAS DE GALICIA

CONSELLERÍA DO MAR

Exemplar numerado 0/200

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XUNTA
DE GALICIA

50 anos de investigación ao servizo de Galicia

O Centro de Investigacións Mariñas cumpre 50 anos ao servicio de Galicia, dos seus recursos mariños e da súa cadea mar-industria. É, por méritos propios, un símbolo do coidado do noso mar sen o cal non podemos entender o desenvolvemento e riqueza acadados nun sector clave para a nosa economía e vertebración territorial.

O mar, patrimonio de todos os galegos, é á vez parte da nosa fronteira e unha ventá aberta ao mundo, a través da cal producíronse movementos comerciais e humanos durante séculos.

Queremos e precisamos investigalo para comprendelo mellor e garantir a súa sustentabilidade, ao igual que con todos os recursos naturais da nosa terra. Así, grazas á labor do Centro podemos situar a Galicia á vangarda da investigación mariña, actor activo e esencial na evolución do coñecemento científico sobre o noso medio mariño.

Seguiremos apostando polo coñecemento, neste campo e en todos os que estean ao noso alcance, con convencemento e paixón, conscientes de todas as posibilidades que ten e da riqueza e progreso que achega.

Na celebración dunha efeméride como esta, é de xustiza lembrarse daqueles que iniciaron este camiño, dos coñecementos e traballo que aportaron. Do mesmo xeito, o labor de todos os que seguiron os seus pasos ata o día de hoxe é a mellor garantía de éxito no futuro.

Grazas por conseguir, nestes 50 anos de vida, ser un referente a nivel estatal, europeo e internacional, sempre innovador e sempre comprometido coa sustentabilidade.

Alfonso Rueda Valenzuela
Presidente da Xunta de Galicia

A investigación científica permitiunos comprender que os océanos e mares, lonxe de seren fontes inesgotables, son ecosistemas valiosos e sensibles que debemos coidar. Este coñecemento abre novas oportunidades para xestionar de forma sostible os seus recursos, promovendo un equilibrio entre o desenvolvemento económico e a protección ambiental fronte aos desafíos do cambio climático.

Neste contexto a relación entre a innovación e o mundo mariño é determinante para abordar os desafíos globais que afrontan os ecosistemas mariños, en aras, non só de buscar novas oportunidades económicas, senón tamén solucións para a súa conservación e o seu coidado. Un escenario que pon de relevo a importancia dos centros de investigación que, como acontece co Centro de Investigacións Mariñas, o CIMA, leva cinco décadas traballando neste senso e hoxe, con gran orgullo podemos dicir, primeiro, que é un gran piar científico do sector pesqueiro e acuícola da comunidade e, segundo, que sitúa a Galicia á vangarda da investigación mariña.

Toda unha experiencia que vai dende o estudo e coñecemento dos procesos oceanográficos, á bioloxía, á ecoloxía e á dinámica dos recursos mariños; á mellora dos procesos de cultivo e ata ás alteracións patolóxicas que poidan afectar aos moluscos bivalvos, e que se plasma nesta publicación que pon en valor o enorme traballo que desenvolven os traballadores e traballadoras deste centro, abrindo luz sobre o futuro do mar no que, por certo, tan implicados estamos dende o Goberno galego.

En resumo, nun proceso de transición cara unha economía azul como o que estamos, a investigación e a ciencia preséntanse como claves para abordar os desafíos relacionados co mundo mariño. A Unión Europea realiza unha forte aposta e demostra un compromiso integral cara a sostibilidade mariña, destacando a importancia da colaboración tanto interdisciplinar como internacional, sendo a busca de solucións innovadoras mediante o investimento en proxectos sostibles a chave cara unha prosperidade económica en harmonía coa preservación dos océanos, asegurando así un futuro máis verde ou, simplemente, un futuro para as xeracións que veñen.

Por iso, esta publicación cumpre unha función tan importante como a de dar visibilidade ao CIMA e ao extraordinario e necesario traballo que nel se realiza en prol da conservación e mantemento do mundo mariño. Dende a Consellería así o entendemos e así o defendemos. Parabéns por estes 50 anos pero, sobre todo, parabéns polos éxitos acadados, xa que eses éxitos son os éxitos do noso mar e os éxitos de Galicia.

Marta Villaverde Acuña
Conselleira do Mar

Pasados xa 50 ANOS NA BEIRA DO MAR, esta publicación ten o propósito de ser un recopilatorio da actividade investigadora do Centro de Investigacións Mariñas de Galicia nestas cinco décadas, recollendo unha gran parte dos traballos científicos e de divulgación realizados polo persoal do Cima.

A procura destas pezas levounos ata o ano 1978, no que se publica a revista *Cuadernos Marisqueros* con dúas series, unha de divulgación e outra técnica, que ocupan o primeiro capítulo deste libro.

O segundo capítulo, *Pósteres Científicos*, rexistra 875 traballos presentados a congresos ou eventos de ciencia, organizados en cidades dos cinco continentes, entre o ano 1993 e 2024. Complementariamente, esta colección de pósteres científicos é obxecto dunha exposición que ilustra os corredores do Cima no seu 50 aniversario.

O terceiro capítulo, *Actividades científicas*, dedica as súas páxinas á enumeración de investigacións presentadas en congresos e ás publicacións en revistas científicas, cunha recompilación de máis de 380 artigos desde 1990 ata 2025, como unha mostra evidente da intensa investigación mariña realizada neste período.

A procura deste material histórico non estivo exenta de dificultade. Por iso, agradecemos a todas e cada unha das persoas que fixeron posible esta recompilación. Grazas a ese empeño compartido, ve a luz este libro sobre a longa e fascinante traxectoria investigadora do Cima.

Agardamos que esta publicación sexa entendida como unha obra colectiva e como un motivo de orgullo para todas aquelas persoas que participaron na construción da historia do Cima e que coa súa dedicación engrandeceron este centro. E tamén desexamos que estimule ao equipo actual, a todas as compañeiras e compañeiros, para continuar no relevante labor de investigar sobre o medio mariño de Galicia e os seres vivos que nel habitan.

Carlos Gabín Sánchez
Director do Centro de Investigacións Mariñas de Galicia

Centro de Investigacións Mariñas de Galicia

50 ANOS NA BEIRA DO MAR

1975-2025

XUNTA DE GALICIA

CIMA
CENTRO DE INVESTIGACIÓNS MARIÑAS DE GALICIA

Cadernos marisqueiros

Nº:1 Villanueva, diciembre 1978

Notas sobre las variaciones de salinidad en la Ria de Arosa, durante el primer trimestre de 1.978.

por:
A. Landin y S. Gerrero.

CUADERNOS MARISQUEROS
PUBLICACION TECNICA DEL PLAN DE EXPLOTACION MARISQUERA DE GALICIA

Villanueva, enero 1979

PLAN DE EXPLOTACION MARISQUERA

PRODUCCIÓN DE SEMILLA DE ALMEJA Y OSTRA EN LA PLANTA DE CULTIVOS MARINOS

por:
ALEJANDRO GUERRA DIAZ.

PLANTA DE CULTIVOS MARINOS. Muelle de Porcillán. Ribadeo (Lugo)

Nº 2 Vilanova, febrero 1979.

Estado inicial de la población de bivalvos en la zona recuperada de "O Cebal do Medio", Ensenada de San Simón (Ria de Vigo), Sep. 1977.

F. FERNANDEZ CORTÉS, X.M. ROMARIS PAIS, A. CERVIÑO EIROA y J. P. PAZÓ.

COLABORÓ: J.A. FARIÑA IGLESIAS.

CUADERNOS MARISQUEROS

PUBLICACIÓN TÉCNICA DEL PLAN DE EXPLOTACIÓN MARISQUERA DE GALICIA.

Nº2 Vilanova, septiembre 1979

TANATOGENESIS DE LAS OSTRAS

A Figeras
Instituto de Investigaciones Pesqueras de Vigo. C.S.I.C.

CUADERNOS MARISQUEROS
PUBLICACION DE DIVULGACION DEL PLAN DE EXPLOTACION MARISQUERA DE GALICIA

Cuad. Marisq. Publ. Divulg., 2, 1-113 pp.
Centro Experimental del Plan Marisquero, Apdo. 208, Vilagarcía (Pontevedra).

Nº 3 Vilanova, marzo 1979

Experiencias de obtención de semilla de ostra (Ostrea edulis) en estanque.

S. Guerrero.

Colaboraron: A. Silva Abuin.
S. Cores Robado.
M.J. Cores Gonzalez.

CUADERNOS MARISQUEROS

PUBLICACIÓN TÉCNICA DEL PLAN DE EXPLOTACIÓN MARISQUERA DE GALICIA.

Cuad. Marisq. Publ. Tec., 3, 15pp.

Centro Experimental del Plan Marisquero, Apdo. 208, Vilagarcia.

Nº 3 Vilanova, Junio 1981

NOTAS DIVULGATIVAS SOBRE EL CULTIVO DE CRUSTACEOS I. GENERALIDADES

A. LANDIN

CUADERNOS MARISQUEROS

Publicación de Divulgación del Plan de Explotación Marisquera de Galicia

Cuad. Marisq. Publ. Divulg. nº 3

Centro Experimental del Plan de Explotación Marisquera de Galicia

Apdo. 208 - VILLAGARCIA DE AROSA - (Pontevedra)

Nº 4 VILLANUEVA, abril 1.979

ARTES DE PESCA ARTESANAL EN LA RIA DE AROSA.

I. Artes de enmalle.

por:

R. Arnáiz y A. de Coo.

CUADERNOS MARISQUEROS

PUBLICACIÓN TÉCNICA DEL PLAN DE EXPLOTACIÓN MARISQUERA DE GALICIA

Cuad. Marisq. Publ. Tec., 4-94 p p.
Centro Experimental del Plan Marisquero, Apdo. 208, Vilagarcía.

Nº 4 Vilanova, Diciembre 1981

BIOLOGIA Y ECOLOGIA DEL MEJILLON

A. LANDIN

CUADERNOS MARISQUEROS

Publicación de Divulgación del Plan de Explotación Marisquera de Galicia

Cuad. Marisq. Publ. Divulg. nº 4

Centro Experimental del Plan de Explotación marisquera de Galicia

Apdo. 208 - VILLAGARCIA DE AROSA - (Pontevedra)

N° 5 VILLANUEVA, mayo 1.979

ARTES DE PESCA ARTESANAL EN LA RIA DE AROSA

II. Artes de arrastre.

por:

R. Arnáiz y A. de Coo

CUADERNOS MARISQUEROS

PUBLICACIÓN TÉCNICA DEL PLAN DE EXPLOTACIÓN MARISQUERA DE GALICIA

Cuad. Marisq. Publ. Tec., 5- 60 pp.

Centro Experimental del Plan Marisquero, Apdo. 208, Vilagarcía.

Nº 6

Vilanova. Marzo 1982

A. de COO y R. ARNAIZ.

ARTES DE PESCA ARTESANAL: III NASAS EN LA RIA DE AROUSA ____ Pag.: 3

A. LANDIN, A CERVIÑO y J.L. ALONSO F. DE LANDA.

CONTRIBUCION AL CONOCIMIENTO DE LOS EFECTOS DE VERTIDOS INDUSTRIALES DE UN COMPLEJO PASTA KRAFT - CLORO, SOBRE LA TAXOCENOSIS DE BIVALVOS ASENTADA EN UN BANCO NATURAL (PLACERES - RIA DE PONTEVEDRA) ____ Pág: 51

CUADERNOS MARISQUEROS

Publicación Técnica del Plan de Explotación Marisquera de Galicia

Cuad. Marisq. Publ. Téc.

Centro Experimental del Plan de Explotación Marisquera de Galicia

Apdo. 208 - VILLAGARCIA DE AROSA - (Pontevedra)

Pósteres científicos

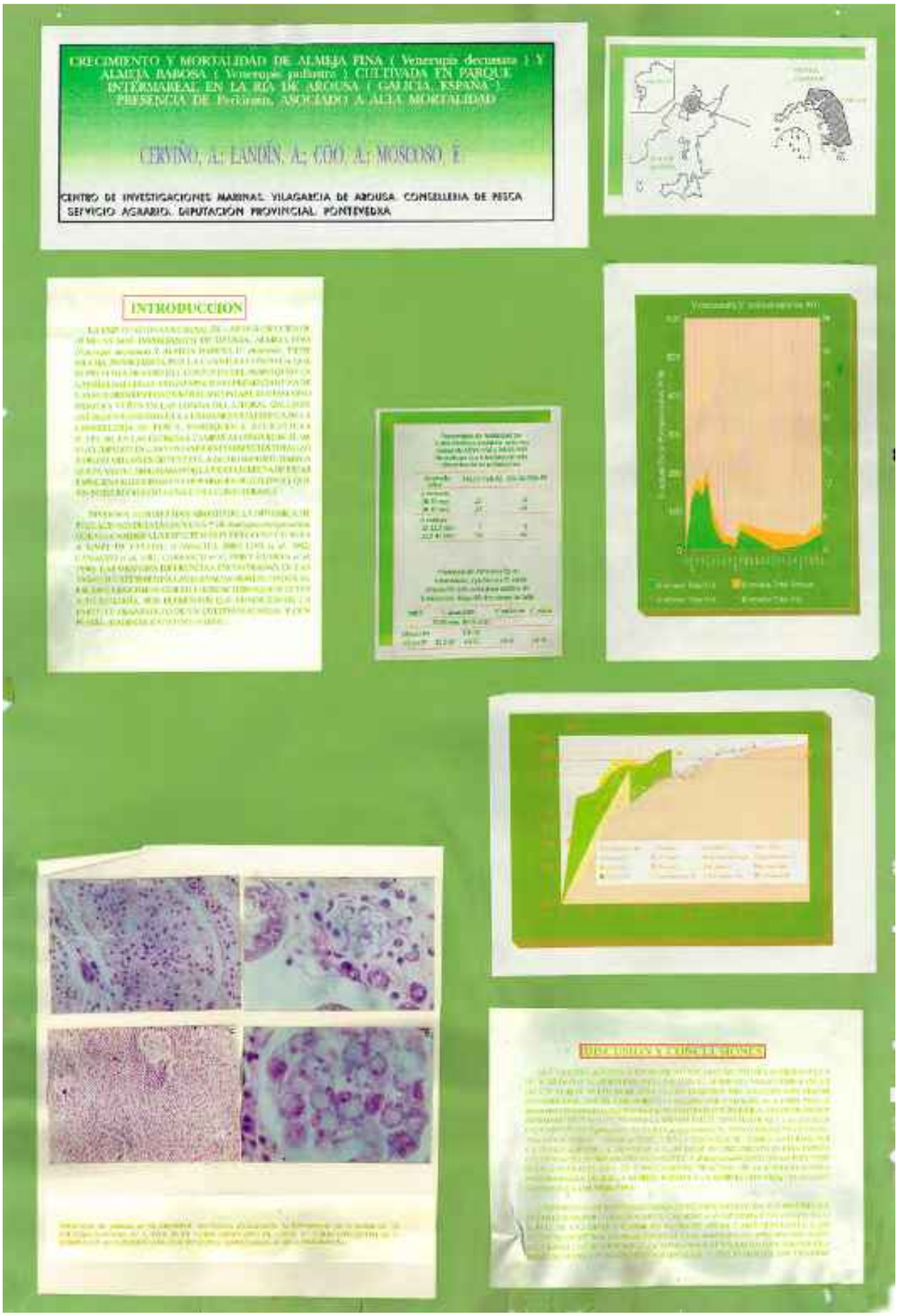
Autoría: Cerviño, A.; Landín, A.; de Coo, A.; Moscoso, E.

Título: Crecimiento y mortalidad de almeja fina (*Venerupis decussata*) y almeja babosa (*Venerupis pullastra*) cultivada en parque intermareal en la Ría de Arousa (Galicia, España). Presencia de *Perkinsus* asociado a alta mortalidad

Evento: IV Congreso Nacional de Acuicultura

Lugar: A Illa de Arousa - Galicia (España)

Ano: 1993


CRECIMIENTO Y MORTALIDAD DE ALMEJA FINA (Venerupis decussata) Y ALMEJA BABOSA (Venerupis pullastra) CULTIVADA EN PARQUE INTERMAREAL EN LA RÍA DE AROUSA (GALICIA, ESPAÑA). PRESENCIA DE Perkinsus, ASOCIADO A ALTA MORTALIDAD
CERVIÑO, A.; LANDÍN, A.; COO, A.; MOSCOSO, E.
CENTRO DE INVESTIGACIONES MARINAS. VILAGARCÍA DE AROUSA. CONSELLERÍA DE PESCA
SERVICIO AGRARIO. DIPUTACIÓN PROVINCIAL. PONTEVEDRA
INTRODUCCIÓN

Autoría: de Coo, A.; Moscoso, E.; Arnaiz, R.; Corcobado-Oñate, F.; Rúa, N.; Varela, J.A.; López, M.

Título: Estudio histológico, de crecimiento, mortalidad y desarrollo de aparato digestivo, branquial e hígado en larvas de rodaballo sometidas a ayuno y diferentes niveles de deficiencias en hufas w3

Evento: IV Congreso Nacional de Acuicultura

Lugar: A Illa de Arousa - Galicia (España)

Ano: 1993

ESTUDIO HISTOLÓGICO, DE CRECIMIENTO, MORTALIDAD Y DESARROLLO DE APARATO DIGESTIVO, BRANQUILA E HÍGADO, EN LARVAS DE RODABALLO, SOMETIDAS A AYUNO Y DIFERENTES NIVELES DE DEFICIENCIAS EN HUFAS W3

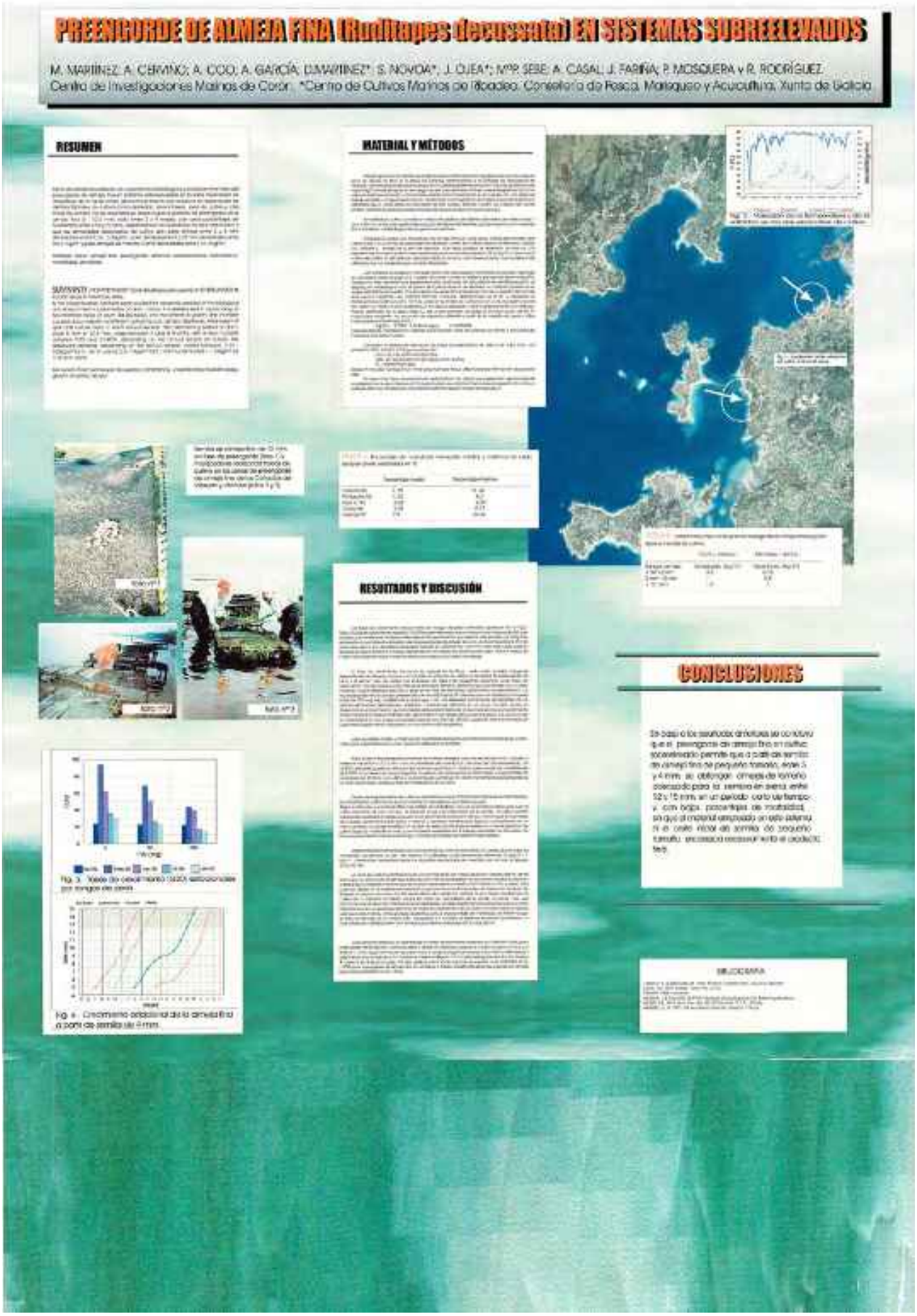
Autoría: Martínez, M.; Cerviño, A.; de Coo, A.; García, A.; Martínez, D., Nóvoa, S.; Ojea, J.; Sebe, M.P.; Casal, A.; Fariña, J.; Mosquera, P.; Rodríguez, R.

Título: Preengorde de almeja fina (*Ruditapes decussata*) en sistemas sobreelevados

Evento: VI Congreso Nacional de Acuicultura

Lugar: Cartagena - Murcia (España)

Ano: 1997


PREENGORDE DE ALMEJA FINA (Ruditapes decussata) EN SISTEMAS SOBREELEVADOS
M. MARTÍNEZ; A. CERVIÑO; A. COO; A. GARCÍA; D.MARTÍNEZ*; S. NOVOA*; J. OJEA*; Mª P. SEBE; A. CASAL; J. FARIÑA; P. MOSQUERA y R. RODRÍGUEZ
Centro de Investigaciones Marinas de Corón. *Centro de Cultivos Marinos de Ribadeo. Consellería de Pesca, Marisqueo y Acuicultura. Xunta de Galicia
RESUMEN
MATERIAL Y MÉTODOS
RESULTADOS Y DISCUSIÓN
CONCLUSIONES
BIBLIOGRAFÍA

Autoría: Martínez, M.; Cerviño, A.; de Coo, A.; García, A.; Rodríguez, V.; Sebe, M.P.; Seoane, M.I.; Casal, A.; Fariña, J.; Mosquera, P.; Rodríguez, R.

Título: Cultivo de ostra plana (*Ostrea edulis*) en sistemas sobreelevados

Evento: VI Congreso Nacional de Acuicultura

Lugar: Cartagena - Murcia (España)

Ano: 1997

CULTIVO DE OSTRA PLANA (Ostrea edulis) EN SISTEMAS SOBREELEVADOS
M. MARTÍNEZ; A. CERVIÑO; A.COO; A. GARCÍA; V. RODRÍGUEZ*; Mª P. SEBE; Mª I. SEOANE*; A. CASAL; J. FARIÑA; P. MOSQUERA y R. RODRÍGUEZ.
Centro de Investigaciones Marinas de Corón; *Centro de Experimentación en Acuicultura de Cousa. Consejería de Pesca, Marisqueo y Acuicultura; Xunta de Galicia.
RESUMEN
MATERIAL Y MÉTODOS
RESULTADOS Y DISCUSIÓN
CONCLUSIONES
BIBLIOGRAFÍA

Autoría: García, A.; de Coo, A.; Sebe, M.P.; Martínez, M.; Cerviño, A.; Cabada, A.

Título: As normas de explotación no marisqueo galego, a súa vixencia e utilidade actual

Evento: I Foro dos Recursos Mariños e Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 1998

AS NORMAS DE EXPLOTACIÓN NO MARISQUEO GALEGO, A SÚA VIXENCIA E UTILIDADE ACTUAL

Antón García (1), Coca,A. (1), Sebe Mª P. (1), Martínez, M. (1), Cerviño, A. (1), Cabada, A.(2).
(1) Centro Investigacións Mariñas de Corón. (2) Delegación Territorial da Ría de Arousa. Consellería de Pesca, Marisqueo e Acuicultura

SITUACIÓNS A CAMBEAR

- Días de traballo non hábiles
- Veda reproducción
- Tallas ríxidas de extracción
- Cupos ríxidos de capturas
- Artes prohibidas

CAUSAS LIMITANTES

Descoñecemento real e pormenorizado dos parámetros bioléxicos e as posibilidades de explotación.

Non aplicabilidade real dos modelos analíticos de pesquerías

Concepción base da existencia dunha escasez de reproductores

O peso da idea conservacionista do recurso frente as posibilidades reais de incremento da producción

ALGUNHAS ALTERNATIVAS

- Coñecer os parámetros bioléxicos reais
- Descentralización da xestión productiva
- Planos de desenvolvemento da producción
- Introducción de elementos organizativos i económicos

Autoría: de Coo, A.

Título: Resultados e cambeos no ”Plan Galicia” de marisqueo a pé. Unha primeira análise

Evento: I Foro dos Recursos Mariños e Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 1998

RESULTADOS E CAMBEOS NO " Plan Galicia " DE MARISQUEO A PÉ. UNHA PRIMEIRA ANALISE

ALBERTO DE COO MARTÍN. Centro investigacións Mariñas de Corón

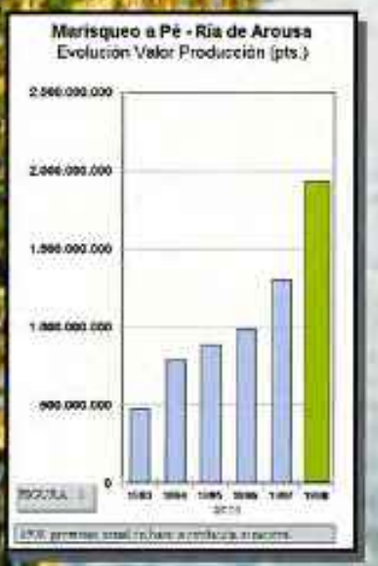
EIXOS ESTRUCTURAIS " Plan Galicia "

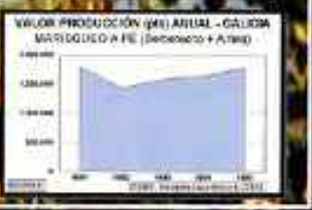
Aplicación no tempo — 5 anos

- COMPROMISO CRECEMENTO PRODUCTIVO E ECONÓMICO
- ESFORZO ORGANIZATIVO E PROFESIONAL
- CONVERSIÓN SECTOR EMPRESARIAL E COOPERATIVO
- DESENVOLVEMENTO SUBSECTORES / RÍA

CAMBEOS E EFECTOS " Plan Galicia "

- REDUCCIÓN DA SÚA DIMENSIÓN
- RELACIÓN ENTRE PRODUCCIÓN/ORGANIZACIÓN
- RELACIÓNS SECTOR E ADMINISTRACIÓN
- PROVISIONALIDADE
- DIMISIÓN MARISCADORAS





Sin crecemento non hai medro organizativo

Primeiras Conclusións

Na actualidade o marisqueo a pé está moi vencellado por diversas liñas positivas a continuidade cualificativa deste. Os avances nos niveles económicos nos últimos anos son importantes para a vida marisqueira de Ría de Arousa, a nosa ría sobre estudiada e sua producción desde fai anos. Neste tempo ha que valorar con realismo o poder político, económico e normativo da Consellería de Pesca, frente a un sector marisqueiro moi fragmentado e moitas veces desmotivado, enfrontado entre si

Neste contexto, o máis previsible é un retroceso xeneralizado das expectativas creadas e un eclipse parcial das liñas de desenvolvemento. A actividade inconsistencia dos datos estatísticos de explotación e os intentos de aportar e marisqueo da actualidade informativa son o contexto necesario para realización de todos estes cambios descritos anteriormente e a base que posibilita una interpretación definitiva

Autoría: Villalba, A.; Carballal, M.J.; López, C.; Casas, S.

Título: Temporal patterns of perkinsosis in carpet-shell clam, *Ruditapes decussatus*, from the Ría de Arousa (Galicia, NW Spain)

Evento: 9th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Rodas (Grecia)

Ano: 1999

TEMPORAL PATTERNS OF PERKINSOSIS IN CARPET SHELL CLAMS, *RUDITAPES DECUSSATUS*, FROM THE RÍA DE AROUSA (GALICIA, NW SPAIN)

Antonio Villalba, María J. Carballal, Carmen López and Sandra Casas

Centro de Investigacións Mariñas. Consellería de Pesca Marisqueo e Acuicultura. Xunta de Galicia. Apdo. 13. 36620 Vilanova de Arousa, Spain

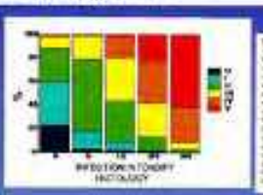
INTRODUCTION

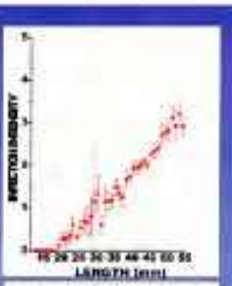
MATERIALS AND METHODS

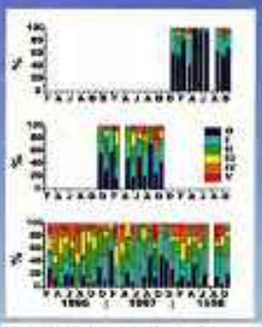
RESULTS

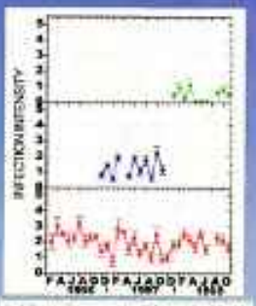
DISCUSSION

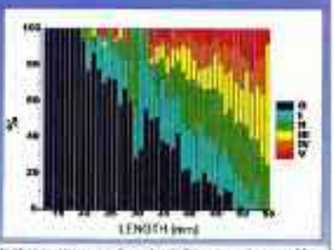
REFERENCES

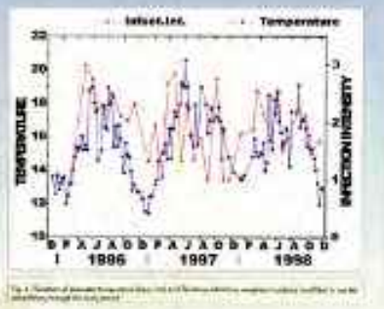












Autoría: Casas, S.M.; Villalba, A.; López, C.; Carballal, M.J.

Título: *In vitro* study of temperature and salinity effects on viability and longevity of free stages of the life cycle of *Perkinsus atlanticus*, a parasite of carpet-shell clam, *Ruditapes decussatus*

Evento: 9th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Rodas (Grecia)

Ano: 1999

IN VITRO STUDY OF TEMPERATURE AND SALINITY EFFECTS ON VIABILITY AND LONGEVITY OF FREE STAGES OF THE LIFE CYCLE OF *PERKINSUS ATLANTICUS*, A PARASITE OF THE CARPET-SHELL CLAM, *RUDITAPES DECUSSATUS*

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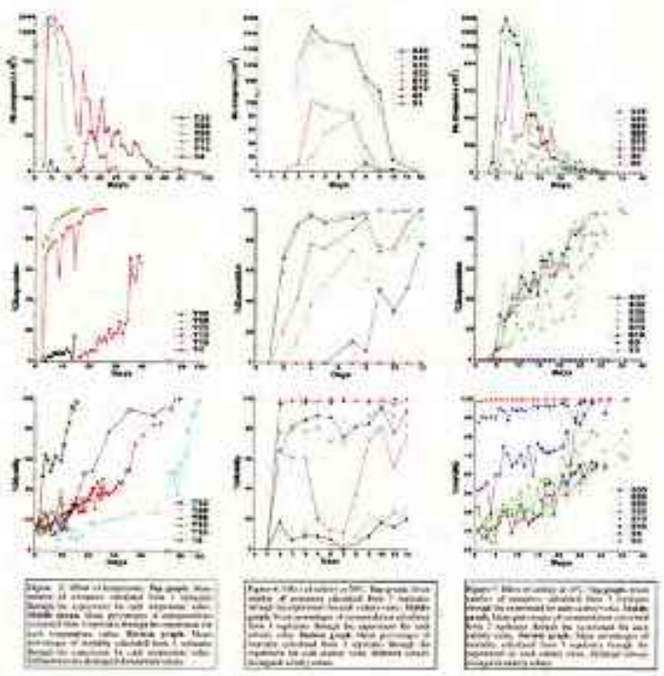


Autoría: Cerviño, A.; de Coo, A.; García, A.; Cabada, A.

Título: Evolución de los parámetros de temperatura, salinidad y fluorescencia en los años 1996 a 1998 en la Ría de Arousa

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

Ano: 1999

EVOLUCIÓN DE LOS PARÁMETROS DE TEMPERATURA, SALINIDAD Y FLUORESCENCIA EN LOS AÑOS 1996 A 1998 EN LA RÍA DE AROUSA

Cerviño, A.; Coo, A.;García, A.; Cabada, A.

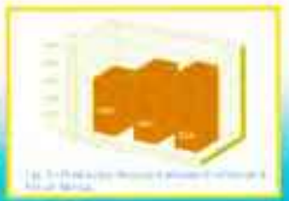
INTRODUCCIÓN

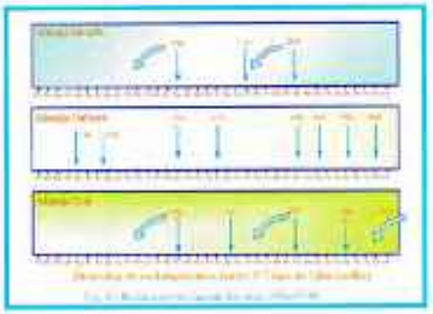
La producción comercial de mejillones en un ecosistema como el de las rías gallegas está influenciada por diversos factores.

A) Stock reproductor.
B) Condiciones ambientales.
C) Gestión extractiva.
D) Interacción con el sistema de cultivos intensivos.

Dentro de estos, son de gran importancia las condiciones ambientales que interaccionan con la fisiología de los organismos. Entre ellas, las más importantes que podemos considerar serían la temperatura, la salinidad y la disponibilidad de alimento.

Su estudio y extrapolación anual nos puede permitir una predicción de los reclutamientos, crecimientos y épocas de puesta de evidente utilidad en la gestión del recurso.





EXPERIENCIAS Y RESULTADOS

Los datos utilizados para este estudio proceden de la red de control C.C.C.M.M. (Centro de Control de Calidade de Medio Mariño) y ofrecen los resultados medios de las muestras obtenidas en diferentes profundidades de 10 estaciones ubicadas en la ría de Arousa (A2-A11).

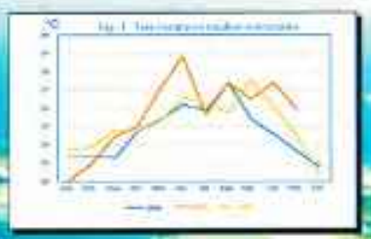
La temperatura media de la Ría (Fig 1) evoluciona entre 12/14 ºC a principios de invierno, 15/17 ºC en primavera y verano, para descender en otoño. Resalta el valor tan elevado de Junio de 1997, lo que implica que determinadas zonas (interior de la ría) alcanzan valores extremos, lo cual provoca mortalidades anormales de moluscos. La salinidad (Fig 2) presentó dos períodos de valores bajos (principios de invierno y primavera) que en las desembocaduras de las rías más importantes, como el Ulla y el Umia, pueden provocar pérdidas importantes.

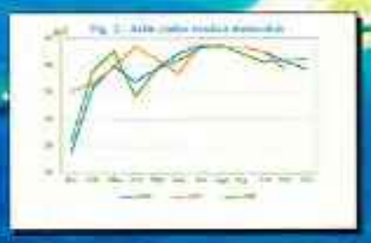
La disponibilidad de alimento, medido en unidades de fluorescencia (Fig 3), presenta un crecimiento invierno-primaveral, un mantenimiento durante el verano y un posterior descenso otoñal. A resaltar el repunte de Octubre durante el año 1997.

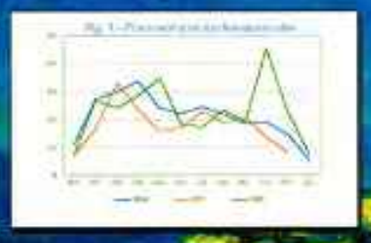
En la tabla de todos ellos, y de los valores obtenidos y reunidos en la tabla 1, nuestra hipótesis de trabajo se enmarca del siguiente modo:

- El año 1996 es el menos favorable para acelerar los procesos de reproducción y crecimiento.
- El año 1997 de acuerdo con el calentamiento de T°, adelantaría la época de puesta y el crecimiento de la población, poniendo una mayor biomasa a disposición del sector extractivo.
- El año 1998 supone el más completo, por cuanto unido a la mayor T°, cuenta con la mayor disponibilidad de alimento de los 3 años estudiados.

De los datos experimentales contrastados se puede constatar un incremento en el nº de reclutamientos y un adelantamiento de los mismos (Fig 4), así como mayor crecimiento y una mayor producción global en los años 1998 y 1997 que en 1996 (Fig 5).







CONCLUSIONES

La disposición y actualización de series históricas de condiciones ambientales y alimentarias de las diversas Rías y zonas, permite una previsión y seguimiento de las posibilidades productivas de los bancos naturales de moluscos bivalvos. Ello es así, debido a la gran dependencia de estos bancos naturales respecto de estas condiciones.

Autoría: de Coo, A.; Abella, E.; Alcalde, A.; García, A.; Parada, J.M.

Título: Primeros datos sobre el reclutamiento y el crecimiento de las poblaciones naturales de almeja japonesa *Ruditapes philippinarum* (Adams & Reeve 1850) en la zona de Vilaxoán, Ría de Arousa, Galicia

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

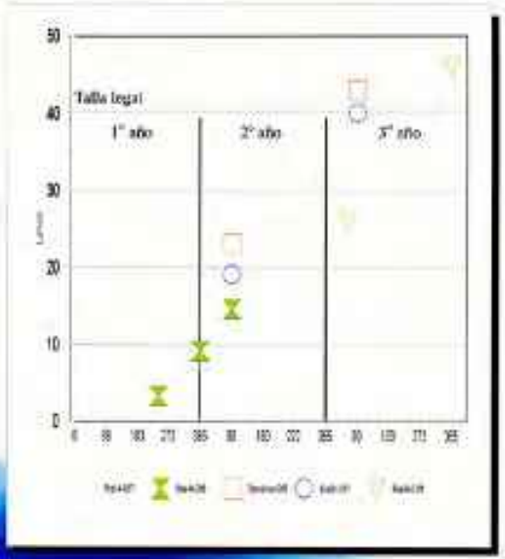
Ano: 1999

PRIMEROS DATOS SOBRE EL RECLUTAMIENTO Y EL CRECIMIENTO DE LAS POBLACIONES NATURALES DE ALMEJA JAPONESA *Ruditapes ph!!ppinarum* (Adams & Reeve 1850) EN LA ZONA DE VILAXOÁN, RÍA DE AROUSA, GALICIA.

Coo , A.; Abella, E.; Alcalde, A.; García, A.;

INTRODUCCIÓN

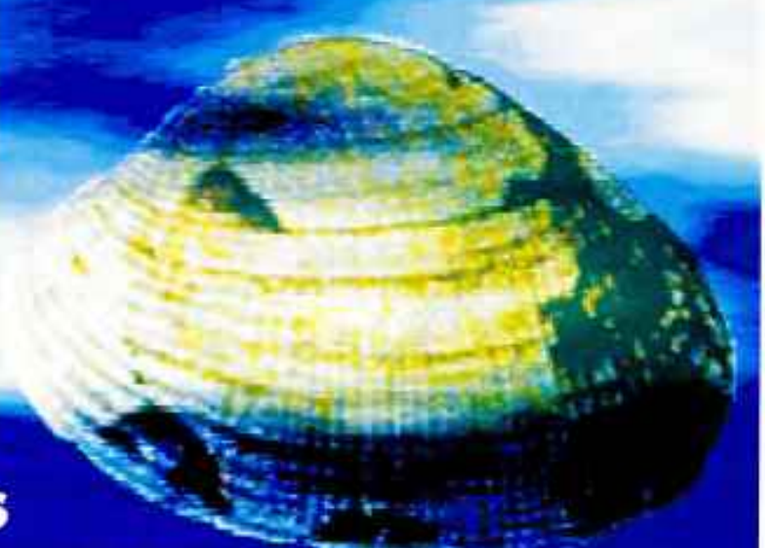
La almeja japonesa *(R. philippinarum)* es una especie alóctona en las rías gallegas que ha sido introducida estos últimos años en los parques privados de Carril de la Ría de Arousa por la vía de cría italiana de importación. Existía una controversia sobre la capacidad reproductiva de esta especie en las condiciones ambientales de las rías gallegas (P. CAMACHO et al, 1985, MOSCOSO et al, 1992). La realidad ha demostrado que, a partir de su cultivo masivo en Carril, desde 1995, se ha producido una rápida colonización en el resto de la ría, alcanzando, en el año 1998, la producción natural de esta especie, en la Ría de Arousa, las 230 Tm, con un valor económico de 195,3 millones de pesetas, a un precio medio de 849 pts/Kg .



RESULTADOS

Durante los años 1997 y 1998 se han realizado muestreos periódicos en dos zonas de la playa del Rial, así como en las playas de Borreiros y Corón en la zona intermareal de Vilaxoán, en la banda sur de la Ría de Arousa. La presente comunicación pretende mostrar los primeros datos sobre el reclutamiento y el crecimiento que han alcanzado las poblaciones naturales asentadas en esta zona. Los muestreos abarcan zonas de diferente nivel mareal lo que ha permitido establecer la influencia del mismo en las tasas de crecimiento.

La fijación, con tallas de cría de 3-5 mm, se detecta a finales de Agosto, situándose los individuos en el mes de Noviembre entorno a los 10 mm. En la figura 1 se representa la evolución de la curva general de crecimiento de la almeja japonesa para las diferentes zonas que entran en el estudio. El reclutamiento presenta, dependiendo de las condiciones ambientales, una o dos cohortes diferenciadas. Completado el reclutamiento se alcanzan unas densidades medias del mismo, situadas entre de 16,7 y 156,3 ind/mt2. Todo ello indica un inicio de puesta a mediados-finales de verano. Estas poblaciones alcanzan, una vez cumplido el año y medio desde la puesta, una longitud entre 31,81 y 33,76 mm dependiendo del nivel de emersión. De acuerdo a lo anterior, la tasa media de crecimiento interanual (G-30) entre los 0,5 y 1,5 años, para la zona intermareal de +0,5 metros se sitúa en 10,9 y para el periodo de 1,5 a 2,5 años de 2,4. En las zonas menos sumergidas la tasa es menor. La almeja japonesa alcanzaría la talla legal de 40mm, a los 20 meses de edad.



CONCLUSIONES

- **El crecimiento encontrado resulta intermedio entre la almeja babosa (superior a R. phillipinarum) y la almeja fina (inferior).**
- **El reclutamiento encontrado resulta asimismo intermedio entre las dos almejas antes mencionadas, siendo superior en la babosa e inferior en la fina.**
- **Dado el precio que alcanza y la colonización existente, sería importante el desarrollo de trabajos que aporten datos sobre la biología de esta especie.**

Autoría: Cerviño, A.; García, A.; Abella, E.; Sebe, M.P.; Cabada, A.

Título: Primeros datos sobre el reclutamiento y el crecimiento de las poblaciones naturales de almeja bicuda *Venerupis aurea* (Gmelin, 1750) en la Ría de Arousa, Galicia

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

Ano: 1999

PRIMEROS DATOS SOBRE EL RECLUTAMIENTO Y EL CRECIMIENTO DE LAS POBLACIONES NATURALES DE ALMEJA BICUDA *Venerupis aurea* (Gmelin, 1750) EN LA RÍA DE AROUSA, GALICIA.

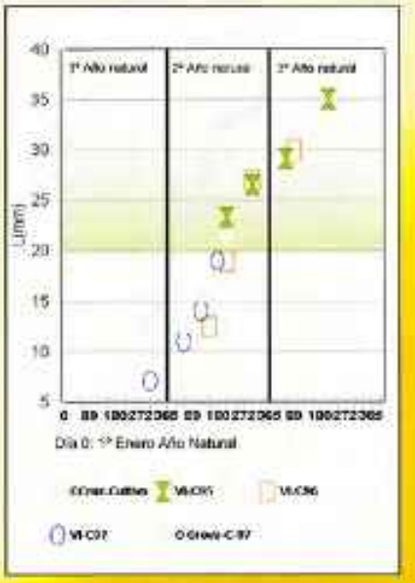
Cerviño, A.; García, A.; Abella, E.; Sebe, Mª P.; Cabada, A.

INTRODUCCIÓN

La almeja bicuda (*V. aurea*) forma parte de las especies acompañantes de la producción del marisqueo a flote de Galicia realizandose sus capturas fundamentalmente en la Ria de Arousa. La producción global, en esta ria, durante el año 1998, alcanzó las 37,8 Tm, con un valor económico de 22,1 millones de pesetas, a un precio medio de 585 ptas/Kgr. Esta especie se asienta en fondos arenosos, con grava y arcilla, desde la zona intermareal baja hasta fondos sumergidos de 20 m de profundidad. Sobre esta especie no existen estudios de dinámica de poblaciones en las ría gallegas. Su talla legal de extracción ha sido establecida en los 20 mm, respondiendo a la creencia de que es un molusco de pequeña talla y que a partir de este tamaño su crecimiento se ralentiza considerablemente.

EXPERIENCIAS Y RESULTADOS

En este trabajo se exponen los primeros datos y conclusiones sobre *V. aurea* de los muestreos de diversas zonas intermareales y sumergidas, durante los años 1997 y 1998, en la Ria de Arousa. Así mismo se ha seguido el cultivo en intermareal de una partida de 30.000 unidades de cría sembrada en un parque de 300 m², en septiembre de 1996. La fijación, con tallas de cria de 3-5 mm, se detecta a finales de septiembre, continuando hasta abril de año siguiente, lo que indicaría un inicio de puesta desde mediados del verano de 1997, hasta el otoño . En el mes de junio de 1998, con un año de vida, la almeja bicuda alcanza una talla media entre 21 y 26 mm, con una tasa de crecimiento (G30) de 12,5 entre los 0,5 y 1,5 años de vida. La talla legal se alcanzaría a los 9-11 meses de edad, un poco antes de iniciarse la primera puesta. En los muestreos se han detectado individuos de 2 años de edad con tallas comprendidas entre los 37 y 40 mm. La densidad media de las poblaciones es baja, entre 11,9 y 39,9 ind/m², estando constituida en su mayor parte por individuos juveniles. Los datos de cultivo confirman el potencial de crecimiento de esta especie pasando de 12,4 mm a 34,3 mm en 12 meses de engorde.



Evolución de las tallas medias de *V. aurea* en las diferentes zonas entre 1996 y 1998.

CONCLUSIONES

A la luz de los resultados obtenidos, previa comprobación en estudios posteriores, parece evidente que sería necesario proceder a una revisión de las tallas mínimas de captura de esta especie, de modo que se pueda producir una recuperación efectiva de la población actual.

Autoría: García, A.; Alcalde, A.; de Coo, A.; Martínez, M.; Parada, J.M.; Sebe, M.P.

Título: Dinámica de poblaciones de almeja fina *Tapes decussatus* (Linné, 1767) de fijación natural en diferentes zonas marisqueras intermareales de la Ría de Arousa, Galicia

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

Ano: 1999

DINÁMICA DE POBLACIONES DE ALMEJA FINA *Tapes decussata* (LINNÉ, 1767) DE FIJACIÓN NATURAL EN DIFERENTES ZONAS MARISQUERAS INTERMAREALES DE LA RÍA DE AROUSA, GALICIA.

García, A.; Alcalde, A.; Coo, A.; Martínez, M.; Parada.J.M.; Sebe, Mª.P.

INTRODUCCIÓN

La almeja fina *T. decussata* por su calidad y alto valor económico puede considerarse como la especie más importante dentro de la producción de moluscos bivalvos en la zona intermareal. Se ha tenido la creencia de que el crecimiento de la almeja fina era demasiado lento, alcanzando la talla legal (40 mm) a los 4 años, lo cual ponía en entredicho su idoneidad como una especie interesante dentro de una explotación. Sin embargo las últimas experiencias tanto con almeja de fijación natural como sembrada demuestran que esta idea, tenida a priori como verdad, no es real.

Tabla I.- Reclutamiento en ind./m² en diferentes playas de la Ría de Arousa

	RIAL B	PEX BB	RIAL A	CASTELETE	BORREIROS	RAPOSINOS	AREOS
OCTUBRE-97	507.0	400.0	356.9	10.2	171.4	25.5	0.1
OCTUBRE-98	10.4	20.0				2.88	

RESULTADOS

Durante los años 1996, 1997 y 1998 se realizaron muestreos en diferentes zonas explotadas y no explotadas de la Ría de Arousa. En la figura 1 se expone el crecimiento de las distintas clases de edad presentes en la población. La fijación aparece a finales de primavera y principios de verano, situandose en Octubre-Noviembre(5-6 meses) entre los 7 y 8 milímetros. Junto con esta clase existen otras dos, una que se sitúa sobre los 24 mm que correspondería a una edad de 1,5 años, y otra en los 39 mm para los individuos que ya alcanzan los 2 años y medio de edad. Según estos datos nos encontraríamos con unas tasas medias interanuales de crecimiento de 9,69 para el período de 0,5 a 1,5 años, y de 3,99 para el de 1,5 a 2,5 años. Esta última clase esta influida por la actividad marisquera, produciendose por tanto una subestimación de su crecimiento.

El seguimiento del índice de condición (figura 2) muestra que este baja, tanto en los períodos invernales, como en la época en que se produce el proceso de reproducción, que se situaría en primavera. Esto indicaría que la época de reproducción es algo anterior a la que se pensaba (meses de Julio e Agosto).

Se presentan, asimismo, grandes variaciones en la densidad del reclutamiento, como se pone de manifiesto en la tabla I alcanzando en 1997 para algunas zona del Rial en Vilaxoán cantidades de hasta 500 ind/m² . Por el contrario, otras zonas cercanas como el Castelete tienen una fijación mucho menor. Las zonas pertenecientes a la banda norte de la Ría presentan asimismo números mas bajos. En el año 1998 la fijación es muy inferior en todas las zonas muestreadas. Al mismo tiempo, la gran fijación de 1997 disminuye al pasar el invierno, reduciendose de forma importante el número de individuos.

Fig.1.- Evolución de la longitud media para las diferentes clases de edad presentes en la población de almeja fina.

Fig.2.- Evolución del índice de condición para las diferentes clases de edad presentes en la población.

CONCLUSIONES

- La almeja fina alcanza la talla legal a partir de los 2 años o 2 años y medio, entrando ya en el proceso de explotación.
- La época de reproducción se sitúa en el final de la primavera y principios de verano, siendo algo anterior a la hasta ahora establecida.
- Existen grandes diferencias en la densidad de reclutamiento entre los diferentes años y diferentes zonas.

Autoría: Parada, J.M.; Abella, E.; Alcalde, A.; García, A.; Mosquera, P.

Título: Dinámica de poblaciones de berberecho *Cerastoderma edule* (Linné, 1767) en diferentes zonas intermareales de la Ría de Arousa, Galicia

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

Ano: 1999

DINÁMICA DE POBLACIONES DE BERBERECHO *Cerastoderma edule* (LINNÉ, 1767) EN DIFERENTES ZONAS MARISQUERAS INTERMAREALES DE LA RÍA DE AROUSA, GALICIA.

Parada, J.M.; Abella, E.; Alcalde, A.; García, A.; Mosquera, P.

INTRODUCCIÓN

El berberecho, Cerastoderma edule, con una media de 2,5 Tm extraídas en los últimos cinco años, se sitúa como la primera especie dentro de la producción marisquera de Galicia. Aunque su valor en primera venta es el más bajo de las principales especies de bivalvos comerciales, su precio medio ha evolucionado en los últimos cinco años desde 237 a 325 pts/Kg. lo que supone un aumento del 37% y constituye, para alguna de las Cofradías de Pescadores, una fuente de recursos fundamental.

RESULTADOS

Durante el trienio 96-98 se ha efectuado un seguimiento periódico de las poblaciones de berberecho en diferentes zonas explotadas del norte y sur de la ría de Arousa. En cada muestra, la capa más superficial de sedimento se ha triado sin tamizado previo con el fin de detectar la fijación, lavando en un tamiz de 6 mm de luz de malla el resto de la muestra.

La figura 1 muestra la estructura de la población de berberecho en el mes de Julio de los tres años del periodo de estudio en la playa del Rial A. Los primeros reclutas se detectan en esta playa con una talla media de 5 mm durante el mes de Mayo, tanto para el año 1997 como para 1998. El proceso de reclutamiento se prolonga durante varios meses, observándose 2 o hasta 3 cohortes de diferente magnitud durante el año aunque la mayor fijación se obtiene en el mes de Julio. Los individuos fijados durante primavera-verano alcanzan un año después una talla media entorno a los 30 mm, con una tasa media de crecimiento (G-30) para este periodo de 14,82.

En la tabla I se exponen las densidades de los reclutamientos observados en el mes de Julio del trienio estudiado para las playas de Barraña, Mañóns, Areos y Raposiños (costa norte de la Ría de Arousa) así como en Rial A, Ría B y Castelete (costa sur de la misma ría). Los datos expuestos en esta tabla muestran la gran variabilidad entre las diferentes zonas y años.

El índice de condición, expresado como porcentaje del peso de la vianda con respecto al peso fresco, experimenta descensos en primavera y durante el invierno (figura 2). Del mismo modo, las mortalidades observadas llegan a alcanzar valores próximos al 50% durante la primavera y el invierno.

Las grandes mortalidades experimentadas por esta especie están asociadas a la mayor incidencia de las variaciones climáticas como consecuencia de su poca profundización en el sustrato, a la intensidad de su estrategia reproductiva y al método de extracción que produce grandes mortalidades de juveniles por roturas y encarramiento.

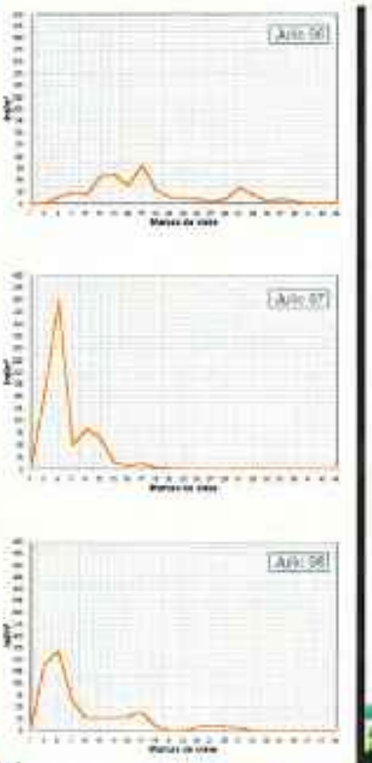


Fig 1

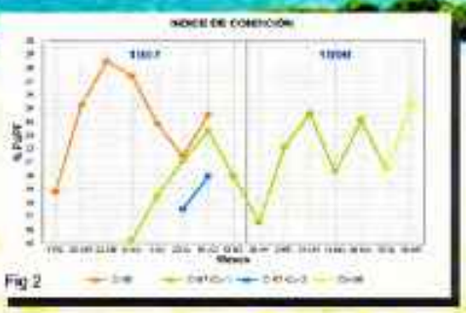


Fig 2

CONCLUSIONES

La alta tasa de reclutamiento y el elevado crecimiento hacen que se alcance la talla comercial entre 9 y 12 meses.

La tasa de mortalidad del berberecho es la mayor de los bivalvos comerciales.

Esta dinámica de poblaciones tan corta en el tiempo plantea la necesidad de una gestión adecuada al ritmo de estos procesos.

Esta gestión ha de abordar tres planos:

A) Aprovechar los aspectos positivos como el alto reclutamiento y el elevado crecimiento.

B) Disminuir los factores negativos como el reclutamiento en zonas inadecuadas, la escasa densidad de adultos o la poca resistencia a las condiciones ambientales adversas mediante actuaciones de traslados, riegos y limpieza de algas.

C) Disminuir la mortalidad por explotación mediante rotación de playas y el uso de artes menos dañinos para los reclutas.

Table I

	BARRAÑA	MAÑÓNS	AREOS	RAPOSIÑOS	RIAL A	RIAL B	CASTELETE
JULIO-96					347	4	47
JULIO-97		11	355	523	741	532	5
JULIO-98	566	88	42		225	162	15

Autoría: Mosquera, P.; Martínez, M.; Sebe, M.P.

Título: Primeros datos sobre el reclutamiento y el crecimiento de las poblaciones naturales de reloj *Dosinia exoleta* (Linnaeus, 1758) en la Ría de Arousa, Galicia

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

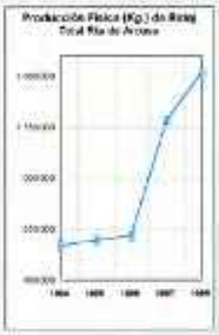
Ano: 1999

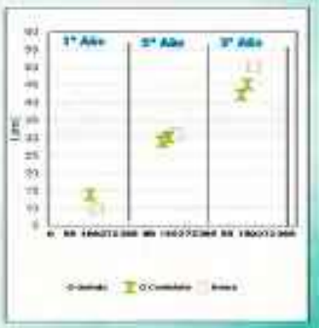
PRIMEROS DATOS SOBRE EL RECLUTAMIENTO Y EL CRECIMIENTO DE LAS POBLACIONES NATURALES DE RELOJ *Dosinia exoleta* (Linnaeus, 1758) EN LA RÍA DE AROUSA, GALICIA.

Mosquera, P.; Martínez, M.; Sabo, Mª P.

INTRODUCCIÓN

El reloj (*D. exoleta*) vive en fondos sumergidos de tipo arenoso o arcilloso, localizándose hasta los 50 m de profundidad. Esta especie posee una baja cotización en el mercado y forma parte de las especies acompañantes de la producción del marisqueo a flote de Galicia. Sus capturas se realizan fundamentalmente en la Ría de Arousa. La producción global en esta ría, durante el año 1999, alcanzó las 1.414 Tm, con un valor económico de 146,5 millones de pesetas, a un precio medio de 104 ptas/Kgr. Sin embargo, dado el estancamiento productivo del marisqueo a flote, la extracción de esta especie ha experimentado un crecimiento muy elevado los últimos años y, a la vez, una revalorización de su precio. Sobre esta especie no existen estudios de dinámica de poblaciones en las rías gallegas estableciéndose su talla de extracción legal en los 30 mm, por razones que desconocemos.





EXPERIENCIAS Y RESULTADOS

En este trabajo se exponen los primeros datos y conclusiones sobre *D. exoleta* de los muestreos de diversas zonas sumergidas durante los años 1997 y 1998 en la Ría de Arousa. El reclutamiento con cría de *D. exoleta* de 3-5 mm de talla, se detecta a finales de mayo hasta el mes de agosto, lo que indicaría un inicio de puesta desde finales de invierno-principio de primavera. Se detectan varias cohortes que configuran una clase de edad amplia, y que en septiembre abarca tallas comprendidas entre 7 y 25 mm. Las densidades de reclutamiento detectadas son bajas y situadas entre los 10 y 30 ex/m². Al primer año de edad alcanza una talla media sobre los 20-25 mm, a los dos años, entorno a 42 mm y al tercer año se situaría sobre los 55 mm. El reloj presenta una tasa de crecimiento (G30) de 8,2 entre los 0,5 y 1,5 años de vida. La talla legal se alcanzaría sobre los 15 meses de edad, un poco después de iniciarse la primera puesta.

CONCLUSIONES

Dado el fuerte incremento extractivo y los datos obtenidos en este trabajo, sería razonable una revisión de la explotación de esta especie.

Autoría: Prado, S.; Núñez, S; Toranzo, A.; Montes, J.

Título: New attemps to optimization of production of flat oyster (*Ostrea edulis* L.) spat

Evento: 9th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Rodas (Grecia)

Ano: 1999

NEW ATTEMPTS TO OPTIMIZATION OF PRODUCTION OF FLAT OYSTER (*Ostrea edulis* L.) SPAT.

Autoría: Carballal, M.J.; Villalba, A.; López, C.; Casas, S.M.

Título: Defence reactions of clam *Ruditapes decussatus*, induced by *Perkinsus atlanticus*

Evento: 9th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Rodas (Grecia)

Ano: 1999

DEFENCE REACTIONS OF CLAM, *RUDITAPES DECUSSATUS*, INDUCED BY *PERKINSUS ATLANTICUS*

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INTRODUCTION

The presence of many bivalve molluscan parasites induces a host defence reaction, in which hemocytes accumulate in the infected tissues. In some cases, this hemocytic response is also detected as hemolymph cells count changes as the number of circulating hemocytes (Anderson et al., 1992; Ford et al., 1993; Chu and La Peyre, 1993 a, 1993 b; Ordóñez et al., 1993, 1994, 1996; Pauley et al., 1996; Carballal et al., 1996). *Perkinsus atlanticus* is a parasite of the carpet-shell clam widespread through the Galician coast. Clams react against this parasite producing a cellular response involving infiltration of hemocytes. These cells encapsulate granulocytomas that necrotize and destroy the parasite (Figure 1).

Lysozyme is a cytotoxic enzyme with an important defence role, since it can hydrolyze components of bacterial walls. Lysozyme activity has been detected in the hemolymph of many molluscs (Chu, 1988; Pipe, 1990; Carballal et al., 1997).

The aim of this study was to investigate the hemocytic response induced by *P. atlanticus* in both tissues and circulation of clams *R. decussatus*. The association between levels of hemolymph lysozyme activity and intensity of *P. atlanticus* was also evaluated.

MATERIAL AND METHODS

Samples of 25 adult clams from a natural bed of Vilanova (Ría de Arousa, Galicia, NW Spain) were collected monthly for a year. Clams were bled and then processed by histological methods. Moreover, individual gill lamellae were excised and incubated in Ruiz thioglycolate medium (RTM). Total hemocyte counts were performed in fresh extracted samples. Lysozyme activity was estimated by Shugam method. Five clams were retrieved monthly to study the activity of this enzyme. Water temperature was measured weekly during the period of sampling, and also on sampling days.

On histological sections, the intensity of infection caused by *P. atlanticus* was ranked as uninfected, infection restricted to the cytoplasm of connective cells, the latter with three levels of intensity: light, moderate and heavy. Six levels of intensity (0 to 5) were considered with the RMT technique, using a scale similar to that described by Mackin (1962). Four levels of hemocytic response intensity (0 to 3) were established, on basis of gill sections, according to the tissue area occupied by infiltrating hemocytes or granulomatous.

Pearson's correlation was used to analyse the association of infection intensity with number of circulating hemocytes or lysozyme activity. T tests were used to evaluate the association between intensity of parasite infection with hemocytic infiltration or development of granulomatous. Pearson's correlation was used to analyse the relationship between hemocytes activity and water temperature.

Table 1. Contingency tables used to evaluate the association of intensity of *Perkinsus atlanticus* infection with intensity of hemocytic infiltration or development of granulomatous by χ^2 test

RESULTS

A decreasing tendency of the number of circulating hemocytes as infection intensity increased was observed with RMT technique (Figure 2). Results of histological diagnosis showed that clams with infections restricted to the gills had less circulating hemocytes than clams with light systemic or moderate systemic infections, and a similar number of cells to hemolymph in that of clams with intense systemic infections (Figure 2). Nevertheless, these differences among infection intensity classes were not statistically significant with both diagnosis techniques.

Analysis of the results by χ^2 have indicated that both intensity of hemocytic infiltration and development of granulomatous increased significantly as infection intensified (Table 1).

Differences of lysozyme activity among levels of infection intensity were not statistically significant (Figure 3). Pearson's correlation coefficients indicated a light negative association of lysozyme activity with values of water temperature measured on the sampling days ($r = -0.322$, T-Value $= -0.019$), and with monthly mean values of water temperature ($r = -0.264$, P-Value $= 0.05$).

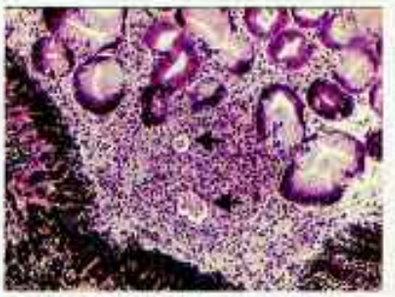


Figure 1: Histological section through digestive gland of a clam, *Ruditapes decussatus*, showing a granulocytoma with *Perkinsus atlanticus* trophozoites (arrows) encapsulated.

Figure 2

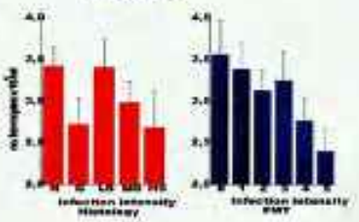
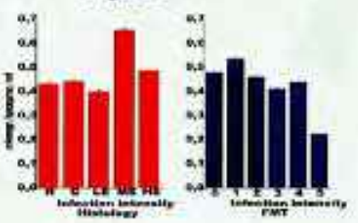


Figure 3



DISCUSSION

Results indicated that clams reacted against *P. atlanticus* producing hemocytic infiltration and granulocytomas. This defence response increased as infection intensified. On the contrary, the number of circulating hemocytes decreased as infection intensified, probably as a consequence of migration of cells from circulatory system to the tissues. A hematopoietic process could occur when the infection became intense since the number of circulating hemocytes was higher in clams with light and moderate systemic infections than in clams with infections restricted to the gills. When the infection became severe, the number of cells in tissues increased enormously, and for this reason the number of cells decreased in hemolymph. This hypothesis of the hematopoietic process is supported by the study of Montes et al. (1995). These authors demonstrated that a hemocytic proliferation occurred in the epicardial connective tissue of the clam *Tapes semidecussatus* after inoculation of prezoosporangia of *P. atlanticus*. Also, a hematopoietic process is probably to occur in animals infected by *Marteilia refringens* (Carballal et al., 1996).

An increment of number of circulating hemocytes as a defence response against some parasites has been reported in other bivalve molluscs (Anderson et al., 1992; Ford et al., 1993; Ordóñez et al., 1993; Pauley et al., 1996; Carballal et al., 1996). A higher concentration of hemocytes was found in hemolymph of the oysters *C. virginica* infected by *P. marinus* (Chu and La Peyre, 1993 b). Nevertheless, results of the present study indicated a decrease of number of circulating hemocytes as infection intensified because of their heavy accumulation in tissues. Moreover, the hemocytic response of clams is different from that of oysters in other aspect, since *P. marinus* is mainly phagocytosed by hemocytes and *P. atlanticus* is mainly encapsulated by granulocytes.

Results of present study showed that the activity of hemolymph lysozyme was neither related with *Perkinsus* species infection (Chu and La Peyre, 1993 b). These results suggest that hemolymph lysozyme has not a relevant role in the defence against *Perkinsus*-like parasites.

Autoría: Darriba-Couñago, S.; Guerra-Díaz, A.; San Juan-Serrano, F.; Montes-Pérez, J.

Título: Estudio del ciclo reproductivo de la navaja (*Ensis ensis,* L.) en las Islas Cíes (Ría de Vigo – N.O. de España)

Evento: VII Congreso Nacional de Acuicultura

Lugar: La Palmas de Gran Canaria (España)

Ano: 1999

ESTUDIO DEL CICLO REPRODUCTIVO DE LA NAVAJA (*Ensis ensis*,L.) EN LAS ISLAS CIES (RIA DE VIGO- N.O. DE ESPAÑA)

S. Darriba Couñago[1] ; A. Guerra Díaz[1]; F. San Juan Serrano[2]y J. Montes Pérez[1].

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INTRODUCCION:

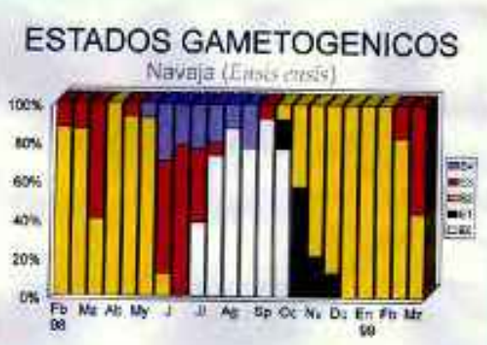
La navaja *Ensis ensis* (Linnaeus, 1785) pertenece a la familia Solenidae, incluida en el filo Moluscos, clase bivalvos. Los individuos de esta familia tienen las valvas alargadas e iguales, el ligamento es externo, están abiertos en la parte anterior y posterior, el músculo aductor anterior es alargado y carecen de bisa. Viven enterrados en la arena en la zona intermareal baja y en la Infralitoral. Los sexos están separados, las gónadas son pares y expulsan los gametos por un gonoducto que se abre en la cavidad del manto. La fecundación es externa.
Esta especie se captura en las playas de las Islas Cies (Ría de Vigo) donde se encuentra el banco natural. La extracción de este recurso se está llevando a cabo por la "Agrupación de mariscadores" que se desplazan en embarcación y bucean en apnea para recoger los ejemplares.

Son escasos los trabajos en los que se trata el ciclo reproductivo de especies de la familia Solénidos y no se conocen para la especie objeto de estudio (*Ensis ensis*).

El objetivo de este trabajo es conocer el ciclo reproductivo de la navaja capturada en las Islas Cies para aportar información imprescindible para una explotación racional del recurso y evitar el posible agotamiento del banco natural.

MATERIAL Y METODOS:

Quincenalmente, desde febrero de 1998 a marzo de 1999, se recoge una muestra de individuos adultos (aproximadamente 20 ejemplares, mayores de 10 cm.) de la playa de Rodas en las Islas Cies (Ría de Vigo).
Los individuos son capturados, empleando la técnica del "buceo en apnea", por profesionales del sector a profundidades que alcanzan los 8 m.
En el laboratorio se diseccionan los individuos y se procesa parte del tejido gonadal para la obtención de cortes histológicos con tinción hematoxilina-eosina.
A partir del peso gonadal y del peso seco de las valvas se elabora el siguiente índice de condición:
índice de condición gonadal= peso gónada/ peso seco valvas.
En función de las observaciones macroscópicas del tejido gonadal y de las observaciones microscópicas a partir de los cortes histológicos se elaboró la escala gametogénica que se indica.



ESTADO	SEXO	MACROSCOPICAMENTE	MICROSCOPICAMENTE
E0: Sexo indeterminable	hembra/ macho	Membrana fina de color amarillento sobre el músculo aductor anterior, no hay gónada cubriendo el hepatopáncreas ni en el interior del pie.	Tejido conectivo predominante, aparecen algunos folículos, la pared está ocupada parcialmente por gonias, pueden estar en mitosis, lumen con células de reserva.
E1: Desarrollo temprano	hembra	Similar al estado anterior.	Presencia de tejido conectivo todavía inaparente; mitosis gonial muy intensa, aparecen los primeros ovocitos jóvenes en distintas fases.
	macho		Tejido conectivo presente, folículos con el contorno más definido por la proliferación de espermatocitos en distintas fases de la meiosis.
E2: desarrollo Avanzado	hembra	Presencia de tejido gonadal destacable, sobre el músculo aductor anterior. Es un tejido espeso de color y textura variable según el sexo (blanco en hembras y verge en machos), cubre el hepatopáncreas parcialmente y aparece en el interior del pie.	El tejido conectivo se ha reducido casi en su totalidad, aparecen células en todas las fases de la ovogénesis: gonias, ovocitos adheridos a la pared, ovocitos pedunculados, ovocitos libres y también ovocitos flotados.
	Macho		El tejido conjuntivo sufre una reducción drástica, aparecen células en todas las fases de la espermatogénesis.
E3: Madurez-puesta	hembra	El tejido gonadal ha aumentado considerablemente de volumen, cubre el músculo aductor y el hepatopáncreas en su totalidad la ocupación del pie es mínima.	La pared folicular es muy fina, apenas aparecen ovocitos previtelogénicos, el folículo está lleno de ovocitos maduros, algún oparecido roto. Puede aparecer tejido gonial en cantidades importantes.
	macho		Algunos folículos [illegible] o externa y permanecen [illegible] pudos por espermatozoide
E4: Post-Puesta	hembra	El volumen ocupado por el tejido gonadal se ha reducido mucho volviendo a una situación similar al E0.	Los folículos q[illegible]n presentan algunos ovocit[illegible]ucos. En el lumen, se observan lisosomas, las paredes de los folículos se desintegran, hay material residual de la desintegración. Se pueden observar zonas de E0.
	macho		Aparecen grupos de espermatozoides residuales entre el tejido conjuntivo. Se pueden observar zonas de E0.

CONCLUSIONES

a) La evolución de los estados gametogénicos muestra tres períodos de madurez que corresponden con los valores máximos alcanzados en el índice de condición gonadal.

b) En el banco natural de Islas Cies, la navaja (*Ensis ensis*) presenta una época de reposo durante los meses de verano ; la gametogénesis se inicia a partir del mes de octubre y alcanza la madurez en el mes de febrero. Observa varias puestas sucesivas hasta finales de junio y sigue un vaciamiento total de la gónada.

Autoría: García, A.; Cerviño, A.; Martínez, M.; Sebe, M.P.

Título: Efecto de las artes de pesca tradicionales del marisqueo a pie ”sacho” y ”ganchelo” sobre el reclutamiento en los moluscos bivalvos

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

Ano: 1999

EFECTO DE LAS ARTES DE PESCA TRADICIONALES DEL MARISQUEO A PIE "SACHO" Y "GANCHELO" SOBRE EL RECLUTAMIENTO DE LOS MOLUSCOS BIVALVOS

Garcia, A.; Cerviño, A.; Martínez, M.; Sebe, Mª P.

INTRODUCCIÓN

El conocimiento de los efectos que sobre las fijaciones de nuevos individuos tienen las tareas de extracción del marisco, con las diferentes artes que para ello se emplean, es uno de los aspectos menos conocidos de la evolución de las poblaciones de moluscos bivalvos sometidos a explotación. La utilización de artes de pesca muy poco evolucionadas, y con una selectividad y eficacidad baja, puede llevar aparejado que el uso indiscriminado e intensivo en la época de fijación produzca efectos perniciosos sobre la supervivencia de los individuos recientemente fijados.

RESULTADOS

Durante finales de 1997 y el año 1998 se realizaron pruebas con dos de las artes de pesca mas utilizadas en el marisqueo a pie, "sacho" y "ganchelo" en la zona del Rial en Vilaxoán, Ría de Arousa. El arte del sacho consiste en la misma herramienta de uso común en agricultura, y trasladada al medio marino. El ganchelo es un arte con forma de cuchara que se utiliza para la extracción individual de los moluscos, previa localización mediante los agujeros que dejan los sifones. Para la realización de la prueba, se conformaron en Agosto de 1997 varios parques experimentales contiguos, en uno de los cuales se utilizó el sacho, en otro el ganchelo quedando un tercero libre de la utilización de cualquier arte. Se realizaron muestreos periódicos de la fijación de la almeja fina *Tapes decussatus* (Linné, 1767), el termino de los cuales se procedía a la utilización de las artes. Hay que señalar, no obstante, que el trabajo marisquero tradicional es mucho mas intensivo.

En la Tabla 1 se presenta la evolución de la densidad en ind/m² para las tres zonas del estudio. Los resultados muestran que no existen diferencias significativas entre la zona del ganchelo y la zona testigo, presentando una evolución en ind/m² muy similar. Por el contrario en el parque donde se trabajo con sacho, se produce una clara disminución del reclutamiento encontrado, situándose este entorno al 30 % del obtenido en las otras dos zonas. Se observa que el efecto del sacho se produce sobre los individuos recientemente fijados, y que la evolución posterior es básicamente la misma en los diferentes parques.

Autoría: Linares, F.; Olmedo, M.; Ortega, A.; Peleteiro, J.B.

Título: Experiencias de engorde de besugo, *Pagellus bogaraveo*, (Brünich, 1768) en jaulas y tanques de cultivo

Evento: VII Congreso Nacional de Acuicultura

Lugar: Las Palmas de Gran Canaria (España)

Ano: 1999

EXPERIENCIAS DE ENGORDE DE BESUGO, *Pagellus bogaraveo*, (Brünich, 1768) EN JAULAS Y TANQUES DE CULTIVO

EXPERIENCES WITH ONGROWING BLACKSPOT SEA BREAM, *Pagellus bogaraveo*, (Brünich, 1768) IN CAGES AND CULTURE TANKS

F. Linares[1], M. Olmedo[2], A. Ortega[3] & J.B. Peleteiro[3].
(1) Centro de Investigacions Marinas. Apdo.13. Vilanova de Arousa. 36620 Pontevedra. España. (2) Instituto Español de Oceanografía. C.O. de Vigo. Cabo Estay. Canido. Apdo. 1552. Vigo. 36080 Pontevedra. España. (3) Centro de Experimentación en Acuicultura. Couso. Ribeira. 15960 La Coruña. España.

Resumen

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Summary

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Introduccion

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Bibliografia

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Material y Metodos

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Resultados y discusion

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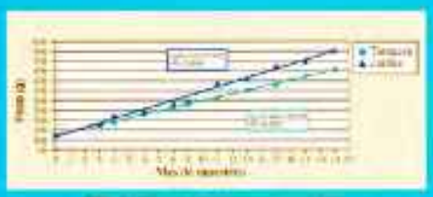

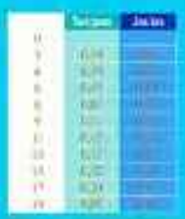

Conclusiones

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Autoría: Darriba, S.; Martínez, D.; Guerra, A.

Título: Study on the razor clam's growth (*Ensis arcuatus*, Jefferys, 1865) on the Galicia coast (Northwest of Spain)

Evento: V Congreso de Ciencias del Mar. Marcuba 2000

Lugar: La Habana (Cuba)

Ano: 2000

STUDY ON THE RAZOR CLAM'S GROWTH (*Ensis arcuatus* JEFFREYS, 1865) ON THE GALICIA COAST (NORTHWEST OF SPAIN).

S. Darriba (1), D. Martínez (2) & A. Guerra (1)

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(2) Centro de Cultivos Mariños (CIMA). Muelle de Porcillán s/n -27720- Ribadeo. Lugo. Spain. E-mail: teamp@cimacoron.org Telf: +34 982100100. Fax: +34 982130391.

Razor clam (*E. arcuatus*) is a bivalve mollusc of the Solenacea superfamily, lives buried in the substratum of intertidal and subtidal zone. Commercial value of captures has considerably grown over the last years in Galicia. Sale data show an increase (from 133 kg to 109 Tm between 1990 and 1999).

The apnea diving technique is the normal catching system. The most selective method does not affect the environment and is the method which best controls exploitation.

In this work we analyse culture and growth of razor clam seed obtanined in a hatchery.

1. Hatchery phase.

Larvae are obtanined from natural bed broodstocks by using inducing spawning techniques. The cultivation is carried out trhrough the usual hatchery cultivation techniques. The metamorphosis of larvae undergoes occurs on 19-20 days, with 400 µm size.

Post-larvae razor clam 20 days old (400 µm)

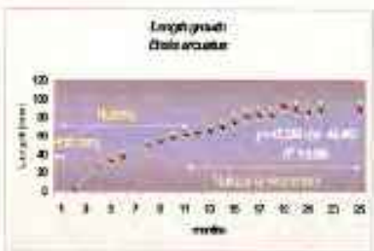
Juvenile razor clam: 12 months (6 cm)

2. Nursery phase.

Seed was kept in nursery during the first twelve months of live. During the first three months they were maintained in trays an upwelling system, and fed additionally with fitoplancton until 2,7 ± 0,3 cm of size; subsequently, sand trays were used, adquiring a size of 6,5 ± 0,3 cm and weight 5,3 ± 0,9 g.

3. Exterior culture.

In the natual environment, seed was introduced in net protected cages on intertidal zone (120 us/m2). During this period monthly controls followed regarding to size, weight and mortality: after 24 months of cultivation the seed reaches an average length of 9,0 ± 0,7 cm and 11,7 ± 2,1 g (see figures).



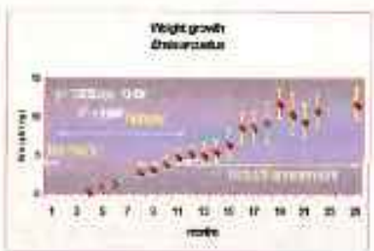


Fig 1 & 2.-Growth curves, in size and weight, for the first two years of live. They follow a logarithmic model shown on the figures.

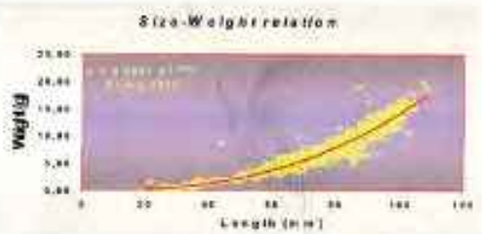


Fig 3.- *E. arcuatus* size-weight relation. Red line shows the potential equation model.

Autoría: Molares, J.; Macho, G.; Gregorio, V.; Giráldez, R.; Fuentes, J.

Título: Breending period, larval abundance and recruitment of the barnacle *Elminius modestus* Darwin in the estuary Ría de Arousa (NW Spain)

Evento: 4th International Larval Biology Meeting

Lugar: Santa Cruz - California (EE. UU.)

Ano: 2000

BREEDING PERIOD, LARVAL ABUNDANCE AND RECRUITMENT OF THE BARNACLE *Elminius modestus* Darwin IN THE ESTUARY RÍA DE AROUSA (NW SPAIN)

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STUDY SITE

METHODS

- Sampling every 14 days and
- 50 adults were fixed at the same intertidal level to analyse the percentage of brooding with eggs in the population
-
- Sampling every 14 days
- Samples from the first 20 cm were obtained by vertical hauls by a plankton net, which was 100 cm. mesh width and a mouth diameter of 20 cm
- Filtered volume measured with flowmeter. = 500 litres. % of the sample was analysed.

- Artificial substrate (tiles) of 5 panels of 20 x 20 cm/tile), changed every 14 days
- Checked at the daytime low tide
- Cleaning the panels, brushed under fresh water, 1 hour in bleach, rinsed in running fresh water

RESULTS AND DISCUSSION

BREEDING PERIOD

The studied population of *Elminius modestus* in the Ría de Arousa showed egg masses all the year round. There were several peaks during the year, as in the period March–June and others in the months of August and October, when between 58–85 % of the adult population have egg masses. There is not a period in the year when reproduction stops completely, although in the months of November and December, the percentage fall to less than 20 %. Our results are similar to those of Crisp & Davies (1955) in the south of England. The population, they studied, also has egg masses all the year round, with several peaks not uniformly distributed, in spring and summer, but the maximum percentage of adults with egg masses in the two populations are in different months. In our study it is in December (95 % of adults) and in February (89 %).

LARVAL ABUNDANCE AND RECRUITMENT PERIOD

The recruitment from March to November was observed with three successive high intensities: the first at the end of May, the second in the period July–September and the third in November, with their peaks in the abundance of cyprids larvae, except in November. In March and April the recruitment was very low, although in view the high percentage of adults with egg masses in the population was broadest, an unbalanced was detected between December and February. The cause is explained to an increase in the period of the cyprid stage (a subspecies) (3 days at 19°C, 10 days at 9°C and 45 at 6°C, Pyefinch & Crisp, 1950). We think, this is not the reason, because we found cyprid larvae in stages II–V in this period. The fact that no cyprids larvae were found between December and February made us think that the reason is unknown factors as other cyprids recruitment, caused by the [illegible], while are recruitment in these months (in March [illegible]

INTRODUCTION

Elminius modestus is a New Zealand species barnacle which appeared on the south coast of England in 1943. This species spread quickly all around European Atlantic coasts, reaching Galicia (NW Spain) in 1958 (Barreiro & Anger, 1989). Nowadays it is very abundant in the lower part of the estuaries, as member of the fouling, it settles over substrates of various causing economic losses to the marine industry and transport. In this, only two papers, one by Crisp & Davies (1955) are reported about and another by Barreiro & Anger (1989) are occasionals, studied the biology and ecology of this species in Europe.

In the present work, we have studied the reproductive period of *Elminius modestus* from the Ría de Arousa, from January 1998 to May 2001. We examined the presence of egg masses on the epithelium of adults, the larval abundance and the recruitment on artificial panels. These variables were analysed together with oceanographic and atmospheric variables (air, water and sea temperature, salinity, chlorophyll phytoplankton and rainfall) to identify environmental factors there.

OBJECTIVES

To describe the reproductive cycle of *Elminius modestus* from Ría de Arousa in correlation with oceanographic and atmospheric variables.

- To determine the breeding period
- To determine the abundance of the three larval developmental stages (cyprid II–III, nauplii IV–V and zoeidea)
- To determine the recruitment period

CONCLUSIONS

- [illegible]
- The maximum number of broods per adult per year is 10
- Recruitment takes place in several pulses along the year
- Our data confirm Crisp and Barnacle's (1955) observation. The recruitment variations of the population is clearly adapted to the [illegible] (temperature) which controls the [illegible]

REFERENCES

- [illegible]
- [illegible]
- [illegible]

Autoría: Guerra, A.; Darriba, S.; Martínez, D.; Catoira, J.L.; Montes, J.

Título: Commercial razor clams in Galicia (NW Spain): The new candidates for the shellfish-culture

Evento: Workshop on New Species for Aquaculture

Lugar: Algarve (Portugal)

Ano: 2000

COMMERCIAL RAZOR CLAMS IN GALICIA (NW OF SPAIN): THE NEW CANDIDATES FOR THE SHELLFISH-CULTURE.

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1 Centro de Investigacións Mariñas (CIMA)- Xunta de Galicia - Apdo 13 Vilanova de Arousa 36620 -Pontevedra-Spain. E-mail: guerrad@cimacon.org
2 Delegación Territorial da Consellería de Pesca, Marisqueo e Acuicultura - Casa do Mar 5ª planta - A Coruña -

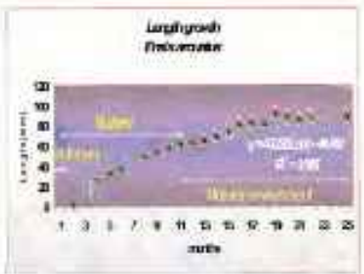
Invertebrate usually named *solenidae* are a group of bivalve molluscs who live buried in the substrata of intertidal and subtidal zones. In Galicia, the most important commercial species of razor clams belong to the Ensis genus: *Ensis arcuatus* (Jeffreys, 1865) (109 Tm captured in 1999) and *Ensis siliqua* (Linnaeus, 1758) (35 Tm captured in 1999).

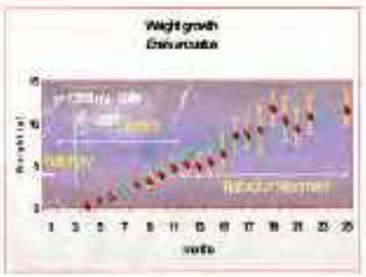
E. siliqua

E. arcuatus

The apnea diving technique is the normal catching system. The most selective method does not affect the environment and is the method which best controls exploitation.

The increase in the extractions of this resource together with its market value increase makes necessary the launch of culture strategies.
The CIMA has been developing a new research proyect since 1997 which covers several research areas: fishing arts, biology (reproduction, growth, biochemical composition...), cytogenetic and techniques to obtain seed in hatchery.

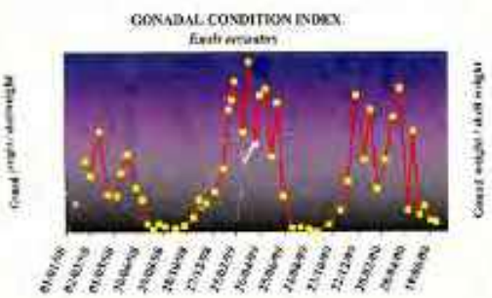


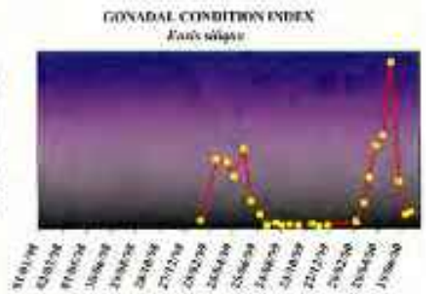


Growth. We studied that by using seed of *E. arcuatus* produced in a hatchery, larvae was obtained by induced spawning techniques from mature broodstocks which were captured in natural beds. The metamorphosis takes place after 19-20 days from fertilized eggs with a size of around 400 µm. Once the seed is placed in the natural environment(12 months old) it falls to the substrata in net protected cages (120 us/m2). Control of the biometric parameter is carried out periodically.

Post-larvae razor clam with 20 days old (400x200 µm)

Juvenile razor clam 12 months old (6 cm).





Reproductive cycle. It is observed that the razor clam (*E. arcuatus*) has ripe gametes from January, followed by consecutive spawning up to June. The gonad remains inactive from July to October. The *E.siliqua* has a longer inactive period than the razor clam. It lasts from June until late February. The maturity period is shorter in *E. siliqua* and consecutive spawning has not been observed as in *E. arcuatus*.

Autoría: Prado, S.; Osorio, C.R.; Barja, J.L.; Montes, J.

Título: Studies on the bacteria causing mortalities in cultures of oyster and clams larvae and the probiotic strain used for their control

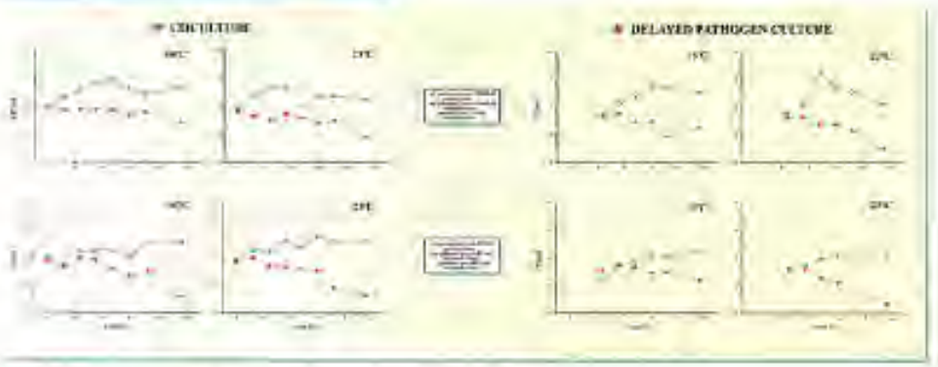
Evento: 3rd International Conference on Molluscan Shellfish Safety

Lugar: Southampton (EE. UU.)

Ano: 2000

STUDIES ON THE BACTERIA CAUSING MORTALITIES IN CULTURES OF OYSTER AND CLAMS LARVAE AND THE PROBIOTIC STRAIN USED FOR THEIR CONTROL

ABSTRACT



MATERIAL & METHODS

RESULTS

Autoría: Linares, F.; Olmedo, M.; Peleteiro, J.B.; Ortega, A.

Título: Composición lipídica del besugo (*Pagellus bogaraveo*) procedente del medio natural y de cultivo intensivo. Resultados preliminares

Evento: V Congreso de Ciencias del Mar. Marcuba 2000

Lugar: La Habana (Cuba)

Ano: 2000

Composición lipídica del besugo (*Pagellus bogaraveo*) procedente del medio natural y de cultivo intensivo. Resultados preliminares.

Lipid composition in blackspot sea bream (*Pagellus bogaraveo*) from the natural environment and from intensive culture.Preliminary results.

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Resumen

En este trabajo se estudia la composición lipídica del hígado, músculo y gónada de ejemplares adultos de besugo (*Pagellus bogaraveo*) con dos procedencias distintas: capturados del medio natural y procedentes de cultivo intensivo. La cantidad de lípidos totales en hígado es mayor en los ejemplares de cultivo (16-70%) que en los del medio natural (13,4-40%). En el músculo los valores de lípidos en los ejemplares de cultivo son mucho más altos (6-32%) que en los procedentes del medio natural (2,5-17%). Existe también una relación directa entre el grado de madurez de las hembras y la cantidad de lípidos totales.

En lo referente a las clases de lípidos, el hígado y músculo de los ejemplares del medio natural presentan un porcentaje más alto de fosfolípidos que los cultivados, mientras que los triglicéridos alcanzan valores más altos en el hígado y músculo de los ejemplares de cultivo.

Abstract

This work studies the lipid composition of the liver, muscle and gonad in blackspot seabream adults from two sources: caught in the natural environment and from intensive culture and farming. The total amount of lipids in liver is higher in farmed individuals (16-70%) than in wild individuals (13,4-40%). In the muscle, the lipid values in farmed individuals are far higher (6-32%) than those from the natural environment (2,5-17%). There is also a direct relationship between the degree of maturity in females and the total amount of lipids.

As regards lipid classes, liver and muscle in the wild individuals have a higher percentage of phospholipids than in the farmed individuals, conversely triacylglycerols attain higher values in the liver and muscle of the farmed individuals.

Introducción

El besugo, *Pagellus bogaraveo*, es una de las especies potencialmente cultivables a nivel comercial. En los últimos años se han hecho grandes avances en lo que se refiere a la reproducción, cultivo larvario, preengorde y engorde en tanques y jaulas (Linares et al., 2000, Olmedo et al., 1997, 1998, Peleteiro et al., 1994, 1997). Uno de los problemas que se presentan en el cultivo, especialmente en la fase de engorde es la gran cantidad de grasa que acumulan los ejemplares alrededor de las vísceras (grasa perivisceral) y en el músculo e hígado comparado con los ejemplares del medio natural. Este problema tiene una relación directa con la alimentación, por lo que la solución deberá ir hacia la obtención de una dieta idóneada, que cubra los requerimientos nutritivos del besugo.

Material y métodos

Se muestrean un total de 48 ejemplares de besugo del medio natural y 39 de cultivo intensivo. Se realiza la disección de los ejemplares y se toman muestras de hígado, músculo y gónada. Los lípidos totales se extraen por el método de Bligh & Dyer (1959) modificado por Fernández Reiriz et al. (1989) y posteriormente se cuantifican por gravimetría, en balanza analítica de precisión (0.001 mg). Las clases de lípidos se separan por Cromatografía en Capa fina (TLC) según Freeman & West (1966) y Braun & Wood (1982) y posteriormente se cuantifican por Densitometría.

Resultados

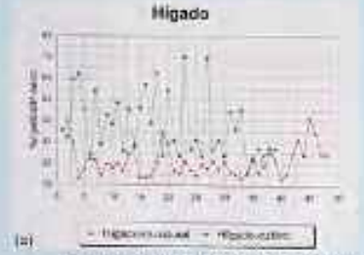

Fig.1 Composición lipídica de hígado (a) y músculo (b) de besugos del medio natural y de cultivo

Fig.2. Composición lipídica de la gónada femenina a lo largo del desarrollo

	HIGADO		MUSCULO	
	Medio Natural	Cultivo	Medio Natural	Cultivo
Lipidos totales	21,48±6,99	37,79±14,66	7,59±3,40	16,44±7,03
Triglicéridos	20,46±18,31	46,98±17,40	46,68±21,22	73,51±14,22
Fosfolipidos	51,43±20,99	37,82±17,32	21,38±7,84	10,51±3,33

Tabla 1.Composición en lípidos totales (% del peso seco), triglicéridos y fosfolípidos (% del total de lípidos) de ejemplares de besugo del medio natural y de cultivo

Bibliografía

Brinan, J.& Wood,D.L. 1982. *J. Chromatogr., 5:1155-1167*

Bligh, E.G. & Dyer, W.J. 1959. *Can.J. Biochem. Physiolog., 37:911-917*

Fernández-Reiriz, M.J et al. 1989. *Aquaculture,83:17-37*

Freeman, C.P. & West, D. 1966. *J. Lipid Res., 7:324-327*

Linares,F et al. 2000. *Monografías del Instituto Canario de Ciencias Marinas, nº4*

Olmedo,M. et al.1997. *Actas del VI Congreso Nacional de Acuicultura,Cartagena,Spain:879*

Olmedo, M et al. 1998. *ICES C.M. 1998/L21.*

Peleteiro, J.B.et al. 1994. *Aquaculture Europe1994 18(4):6-10*

Peleteiro, J.B.et al. 1997. *ICES CM 1997/H:19.*

Conclusiones

- La cantidad de lípidos totales es mayor en el hígado y músculo de los ejemplares de cultivo que en los del medio natural.
- Existe una relación directa entre el grado de madurez de los hombras y la composición lipídica, alcanzándose valores más altos cuando las hembras están maduras, que en estado de inmadurez ó en el periodo posterior al desove.
- Los fosfolípidos son más altos en el hígado y músculo de los ejemplares del medio natural, mientras que los triglicéridos alcanzan valores superiores en el hígado y músculo de los ejemplares de cultivo.
- Los resultados obtenidos en cuanto a contenido y calidad de los lípidos en besugo nos muestran la necesidad de la obtención de una alimentación más adecuada a esta especie que evite la excesiva acumulación de grasa que se produce en los ejemplares procedentes de cultivo intensivo.

Autoría: Linares, F.; Olmedo, M.; Peleteiro, J.B.; Gianzo, C.

Título: Biochemical composition of Blackspot seabream larvae *Pagellus bogaraveo*, throught larval developments. Initial results

Evento: International Conference and Exhibition - Aqua 2000

Lugar: Niza (Francia)

Ano: 2000

Biochemical composition of Blackspot seabream larvae, Pagellus bogaraveo throught larval developments. Initial results

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[2] [illegible] Cabo Estay, Canido, [illegible] Vigo, [illegible] Pontevedra, España

Introduction

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Abstract

[illegible]

Materials and Methods

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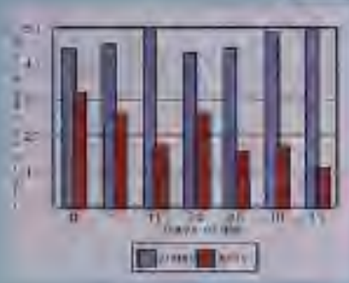
Results



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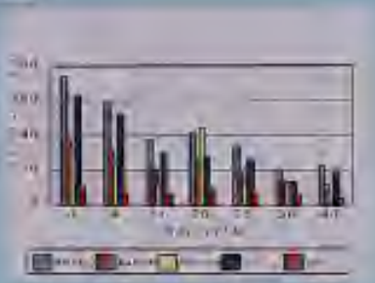


[illegible]

Conclusions

The percentage of protein is maintained in values ranging from 44 to 49% throught larval development of blackspot seabream.

-the decrease in total lipids corresponds with a marked consumption of lipids in [illegible] being cured during the initial days of [illegible]. From day 28 of life [illegible] there is a complete disappearance of lipids in [illegible].

-the [illegible] in fatty acids from 6 to 40 days of life [illegible] and [illegible] in the PUFA n-3 and PUFA n-6.

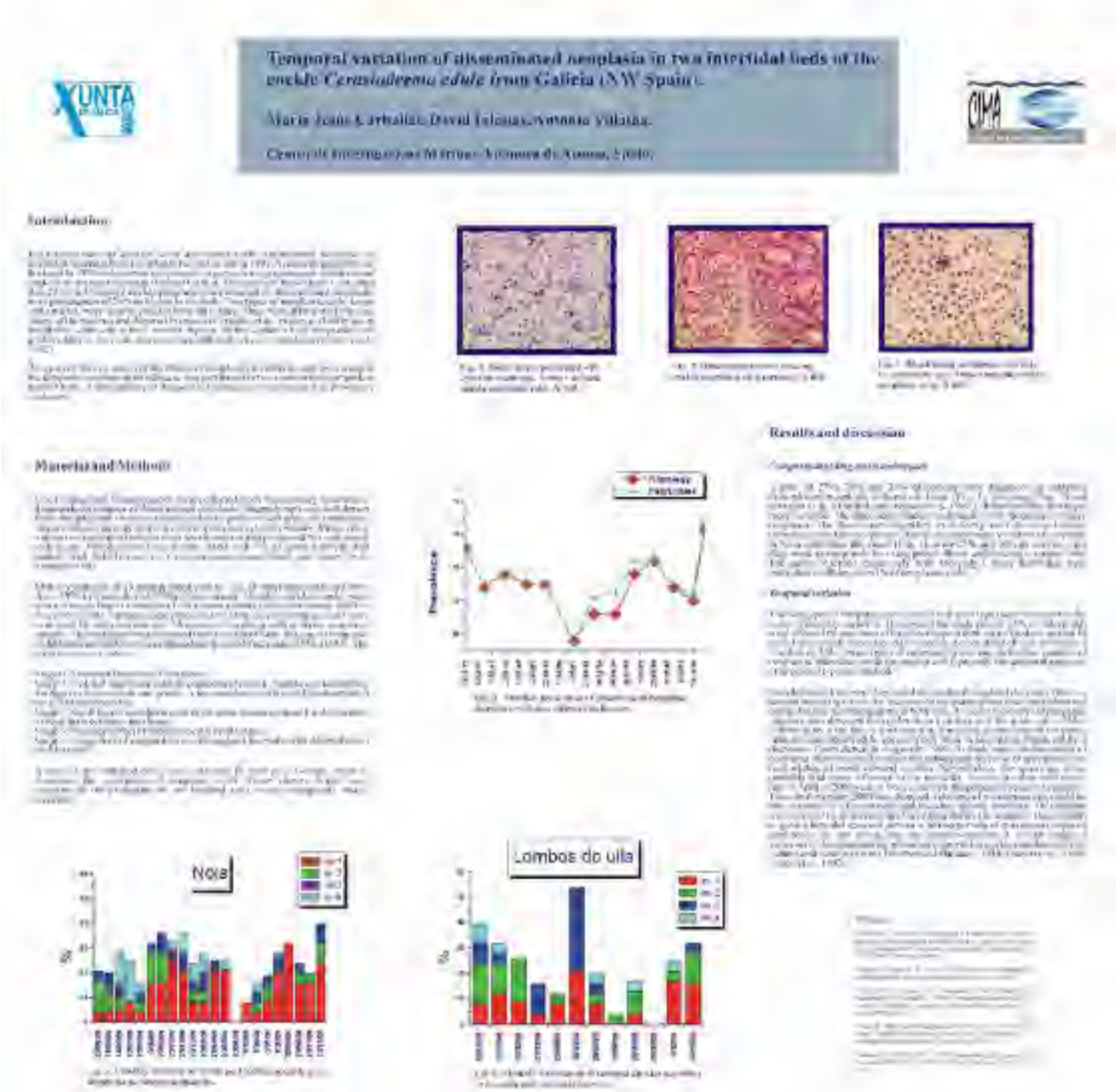
Autoría: Carballal, M.J.; Iglesias, D.; Villalba, A.

Título: Temporal variation of disseminated neoplasia in two intertidal beds of the cockle *Cerastoderma edule* from Galicia (NW Spain)

Evento: 10th International Conference of the European Association of Fish Pathologists

Lugar: Dublín (Irlanda)

Ano: 2001


Temporal variation of disseminated neoplasia in two intertidal beds of the cockle Cerastoderma edule from Galicia (NW Spain).
Introduction
Materials and Methods
Results and discussion
Nota
Lombos do ulla

Autoría: Iglesias, D.; Carballal, M.J.; Villalba, A.

Título: Influence of neoplastic disorders in the cockle *Cerastoderma edule* from an intertidal bed in the Ría de Noia (NW Spain): age and sex susceptibility and effects on the condition

Evento: 10th International Conference of the European Association of Fish Pathologists

Lugar: Dublín (Irlanda)

Ano: 2001

Influence of neoplastic disorders in the cockle *Cerastoderma edule* from an intertidal bed in the Ria de Noia (NW Spain): age and sex susceptibility and effects on the condition.

D. Iglesias*, M.J. Carballal and A. Villalba.

Centro de Investigacións Mariñas. Apdo. 13. E-36620 Vilanova de Arousa. Spain.

Introduction.

Material and Methods.

Results and Discussion.

Autoría: Villalba, A.; Casas, S.M.

Título: Effect of perkinsosis on the energetic physiology of the carpet-shell clam *Ruditapes decussatus*

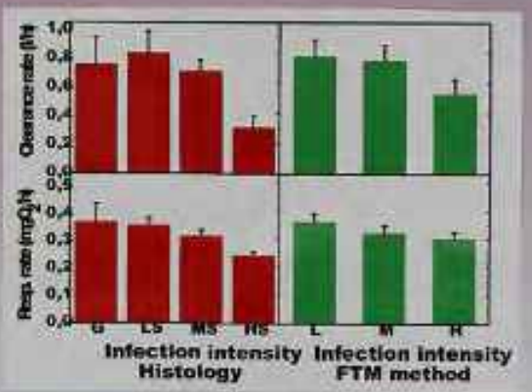
Evento: Aquaculture 2001-The Annual International Meeting of World Aquaculture Society

Lugar: Orlando - Florida (EE. UU.)

Ano: 2001

EFFECT OF PERKINSOSIS ON THE ENERGETIC PHYSIOLOGY OF THE CARPET - SHELL CLAM, *RUDITAPES DECUSSATUS*.

Antonio Villalba, Sandra M. Casas



Autoría: Molares, J.; Freire, J.

Título: Fisheries and management perspectives of the goose barnacle *Pollicipes pollicipes* of Galicia (NW Spain)

Evento: Life Histories, Assessment and Management of Crustacean Fisheries

Lugar: A Coruña - Galicia (España)

Ano: 2001

FISHERIES AND MANAGEMENT PERSPECTIVES OF THE GOOSE BARNACLE *Pollicipes pollicipes* OF GALICIA (NW SPAIN)

Molares, J. (Centro de Investigacións Mariñas) and Freire, J. (Universidade da Coruña)

INTRODUCTION

Text 1
GENERIC MODEL OF EXPLOITATION PLAN

- General objectives
  - Production objectives
  - Economic objectives
  - Number of fishers
- Assessment of resources
  - Methods
  - Conclusions
- Harvesting plan and modelling
  - Accessible areas
  - Number of boat days
  - Maximum and global quota
  - Market system
  - Market rules
- Impact control systems
  - Description
  - Cost
- Financial chart
  - Expenses
  - Capitalization funds

Figure 3

Text 2
OFFICIAL PLAN MODEL FOR GOOSE BARNACLE

- **General Data**
  - **Number of fishers (number of vessels)**
  - **Number of boats (maximum number of crewmen)**
  - **Production areas (sites/Lat-long)**
- General objectives
  - Production objectives
  - Economic objectives
- Assessment of resources
  - Methods
  - Conclusions
- **Control of exploitation**
  - **Daily effort**
  - **Daily production**
- Harvesting plan and control scheme
  - Accessible areas
  - Number of fishers (day)
  - Maximum individual quotas
  - Quota used
  - Control points
  - Market system
  - Vigilance organization
- Impacts on ecosystem
  - Description
  - Cost
- Financial chart
  - Income
  - Expenses, investments and capitalization

Figure 4

Figure 5

METHODS

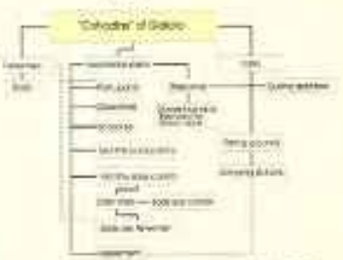


Figure 1

RESULTS

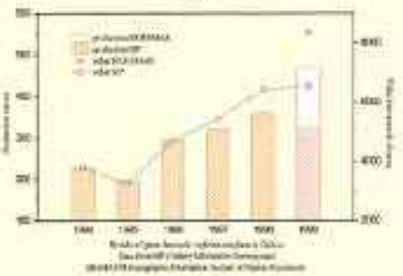


Figure 6

Figure 2

http://sigmour.cesga.es

Text 3
Advantages (and risk) to the use of the database system
OBJECTIVES AND NEED

- Rationalization, history to achieve rational use
- To obtain potential sources of the official statistical of plan
- To obtain potential sources of the official non-statistical sources (zoning, areas)
- Statistical analysis of daily catch and revenues
- Assessment of exploited natural populations
- Creation of a general database (daily activity or statistical)
- Communication system between fishers
- Analysis of the system of research of barnacle fishing grounds
- Trends in fishery activity
- Classification of fishers (by segments, daily activity collected etc)

BIBLIOGRAPHY

Barnes, H. 1956. Pollicipes polymerus sp. nov. from the Pacific coast of North America. Oikos, 7: 213-220.
Freire, J. 1996. Biología y ecología de las percebes, Pollicipes pollicipes (Gmelin, 1790), en el noroeste de la península ibérica. Ph.D. Thesis. Universidade da Coruña, 1996. 2 vols. 1-197 pp. 198-367 pp.
Molares, J. 1994. Estudio del ciclo biológico del percebe (Pollicipes cornucopia LEACH) en las costas de Galicia. Xunta de Galicia.
Molares, J. 1998. Biología y explotación del percebe (Pollicipes cornucopia) en las costas de Galicia. In: Pérez Pereiro, X. (ed.) Mariscos e Galicia. 3º Xornadas de estudo sobre o mundo do mar. Sada, 1998. Edicios do Castro, Sada, p. 115-150.
Pérez, A.C. 1996. O percebe en Galicia. Fundación Caixa Galicia. Area art. text.

Autoría: Darriba, S.; Fernández, J; González-Tizón, A.; Martínez-Lage, A.; Méndez, J.; Guerra, A.

Título: Características biométricas de dos especies comerciales de solénidos: navaja (*Ensis arcuatus* Jeffreys, 1865) y longueirón (*Ensis siliqua* Linneo, 1758)

Evento: VIII Congreso Nacional de Acuicultura

Lugar: Santander - Cantabria (España)

Ano: 2001

Características biométricas de dos especies comerciales de solénidos: navaja (*Ensis arcuatus* Jeffreys, 1865) y longueirón (*Ensis siliqua* Linneo, 1758).

Darriba, S.[1]; Fernández, J.[2]; González-Tizón, A.[2]; Martínez-Lage, A.[2]; Méndez, J.[2] & Guerra, A.[1]

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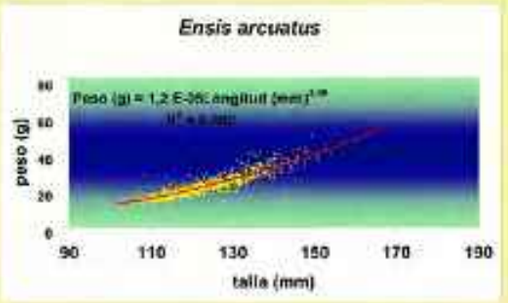
Ensis siliqua

Ensis arcuatus

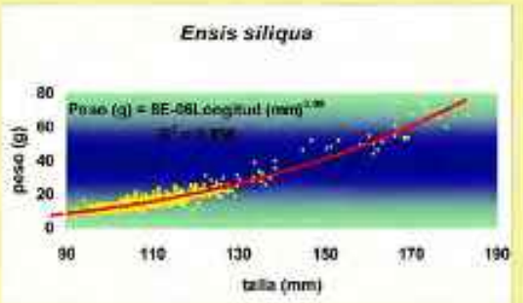
La navaja (*E. arcuatus* Jeffreys, 1865) y el longueirón (*E. siliqua* Linneo, 1758), pertenecen a la superfamilia Solenacea, incluida en el filo Moluscos, clase Bivalvos. Los individuos de esta superfamilia tienen las valvas alargadas y iguales, el ligamento es externo, están abiertos en la parte anterior y posterior, el músculo aductor anterior es alargado y convexo dorsal. Viven enterrados en la arena en zona intermareal baja y en la infralitoral.
La navaja (*E. arcuatus*) presenta el margen dorsal casi recto y el margen ventral algo convexo los márgenes anterior y posterior están ligeramente truncados, convexos redondeados.
El longueirón (*E. siliqua*) tiene los márgenes dorsal y ventral paralelos casi rectos los márgenes anterior y posterior están ligeramente truncados, convexos redondeados.

Las dos especies indicadas representan el 90% de las extracciones de solénidos comerciales en Galicia. El nivel de capturas se ha incrementado notablemente desde el año 1991 hasta la actualidad; pasando de 39 toneladas en ese año a 344 toneladas en 1999. Los ingresos por ventas alcanzaron los 2.0 millones de pesetas en 1999 (datos de la Consellería de Pesca, Marisqueo e Acuicultura).
Los escasos estudios existentes y la necesidad de un mejor conocimiento de estas especies con el fin de lograr una explotación racional del recurso y el ensayo de estrategias de cultivo para convertirlas en un nuevo cultivo para la acuicultura, han hecho necesaria la puesta en marcha de proyectos de investigación que aporten información básica sobre estas especies.
En este trabajo se muestran resultados del estudio de parámetros morfológicos y biométricos.

Durante 1998, 1999 y 2000, periódicamente, se recogen muestras de *E. arcuatus* del banco natural de las Islas Cíes, situadas en la boca de la Ría de Vigo (N.O. de España), de individuos de talla comercial (mayores de 10cm). Durante 1999 y 2000, periódicamente, se recogen muestras de *E. siliqua* de la playa de Sociñeiro (Ría de Corcubión), de individuos mayores de 9 cm.
En ambos casos se trata de poblaciones que habitan bancos sumergidos.
La técnica de captura de las muestras es el de buceo en "apnea".
Se realiza un análisis biométrico de diferentes parámetros entre los que se seleccionan para el presente trabajo la longitud total o talla (distancia antero-posterior) y el peso fresco total (peso del individuo vivo sin dejar secretar).
Los datos se procesan utilizando el programa estadístico SPSS 8.0; se calcula la mejor línea de ajuste de la relación talla-peso para un total de 867 pares de datos de *E. siliqua* y 1000 de *E. arcuatus*.



La relación talla-peso obtenida para *E. arcuatus* en individuos que superan la talla comercial sigue una relación potencial según la siguiente ecuación:
Peso (g) = 1,2E-05 x Longitud (mm)^{2,99} R^2=0,802.
Para *E. siliqua* la relación obtenida sigue, igualmente, una relación potencial de ecuación: Peso(g) = 8E-06 x Longitud (mm)^{3,09} R^2=0,896.
Los coeficientes elevados (b=2,99 y b=3,09) indican, para ambas especies en individuos mayores de la talla comercial, una relación isométrica entre los parámetros estudiados.



Los resultados obtenidos por Gaspar (1996) para *E. siliqua* de la costa del Algarve (Sur de Portugal), en individuos de todas las tallas, muestran una relación alométrica negativa (b=2,92) lo que indica que la talla aumenta relativamente más que el peso. Darriba et al. (2001) en un estudio de crecimiento de *E. arcuatus*, a partir de semilla obtenida en criadero, calculan la relación talla-peso a partir de los datos derivados de los controles biométricos realizados a lo largo de los dos primeros años de vida (individuos menores de 10cm) obteniendo una relación alométrica negativa (b=2,59).
El presente trabajo se realiza con individuos que superan la talla comercial, mientras que en los estudios mencionados anteriormente se incluyen especímenes de menor talla; por ello se concluye, para ambas especies, que durante los primeros años de vida el incremento en talla es mayor que el incremento en peso y en tallas superiores a los 9-10 cm los incrementos de los parámetros estudiados son similares.

Bibliografía
-Darriba, S.; Martínez, D. & Guerra, A. 2000. Study on the razor clam's growth (Ensis arcuatus Jeffreys, 1865) on the Galicia coast (Northwest of Spain). 5º Congreso de Ciencias del Mar. Montreal'2000.
-Gaspar, M.B. 1996. Bivalves do Litoral Oceânico Algarvio. Aspectos da biologia, ecologia e da pesca dos mariscos de interesse económico aplicados à gestão dos recursos. Tese Doctoral.

Autoría: Búa, I.; Graña, I.; Graña, L.; García, L.; Muñiz, V.; Guerra, A.

Título: Desarrollo de un modelo piloto de criaderos de moluscos bivalvos -bajo cubierta ligera-

Evento: IV Foro dos Recursos Mariños e da Acuicultura da Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2001

DESARROLLO DE UN MODELO PILOTO DE CRIADEROS DE MOLUSCOS BIVALVOS -BAJO CUBIERTA LIGERA-

[1] Bóa I., [2] Graña L., [2] Graña L., [2] García R., [1] Muñiz V. y A. Guerra [1].
1.- Centro de Investigacións Mariñas (CIMA). Xunta de Galicia
2.- Instituto Galego de Formación en Acuicultura (IGAFA). Xunta de Galicia

FINALIDAD
Poner a punto unos modelos de planta de producción de semilla de moluscos, que puedan proyectarse y aplicarse, con razonables garantías, al sector marisquero y de cultivo tradicional de moluscos (ostra y almeja). Para ello se establecerán los protocolos operativos y sistemas de producción adecuados a este tipo de instalación.

Características de las instalaciones:

- El cuerpo principal es un invernadero que integra las partes esenciales de un criadero de moluscos tradicional.
- Versátiles y de bajo coste.
- Operan estacionalmente, aprovechando los periodos de reproducción y puesta natural de los moluscos.
- Utilización de sistemas en flujo continuo: se **previenen problemas** bacteriológicos y por economía de trabajo.
- El suministro del agua es por filtrado natural y efecto de gravedad.
- El control de temperatura, automático, por ventilación y sombreado interior.

Antecedentes:

Los criaderos tradicionales de producción de semilla de moluscos no han logrado en Galicia desarrollarse según lo previsto en los años setenta.
En la actualidad, las necesidades de semilla de determinadas especies de moluscos (ostra y almeja), para poder adoptar medidas de protección del recurso y corregirlo, de forma notable semilla de bivalvos en criaderos.

Justificación:

- Existe demanda creciente de semilla, para repoblaciones o para el cultivo tradicional.
- Se conoce suficientemente la tecnología de producción de semilla de moluscos bivalvos.
- Se cuenta con técnicos formados en Acuicultura (IGAFA).

Gestión.:

Cada planta estará gestionada por los técnicos en acuicultura (TPH).

Costes totales de la instalación y elementos:

Alrededor de 18 millones de pts. Que pueden variar en función del emplazamiento.

Capacidad de producción:

Variable según las especies. Se estima una producción anual/u. mínimo a 5 millones de unidades (>5 mm). La producción se verá ingrandida con la existencia de semillero.

"Las instalaciones se desarrollan a través de una Acción de Investigación (código PGIDTCIMA 003), titulada "*Acondicionamiento, puesta en marcha y control de dos criaderos -bajo cubierta ligera- para obtención de semilla de moluscos bivalvos comerciales*", en cuyo desarrollo participan personal del Instituto Galego de Formación en Acuicultura (IGAFA), e investigadores del Centro de Investigacións Mariñas (IGAFA).

Autoría: García, A.; de Coo, A.; Cerviño, A.; Bao, M.; Domínguez, M.

Título: Primeros resultados de crecimiento de semilla de moluscos en batea, con circulación de agua por sistema forzado en la Ría de Arousa

Evento: VIII Congreso Nacional de Acuicultura

Lugar: Santander - Cantabria (España)

Ano: 2001

PRIMEROS RESULTADOS DE CRECIMIENTO DE SEMILLA DE MOLUSCOS EN BATEA, CON CIRCULACIÓN DE AGUA POR SISTEMA FORZADO EN LA RÍA DE AROUSA.

García Fernández, A.; De Coo Martín, A.; Cerviño Eiroa, A.; Bao Iglesias, M; Domínguez, M.

INTRODUCCIÓN

Las fases de preengorde de semilla de bivalvos de pequeño tamaño (1-5 mm) presentan, en la actualidad, diversas limitaciones. En los criaderos en tierra hay que señalar los elevados costes de energía para el movimiento de agua y la fabricación de fitoplancton. El preengorde en cestillos suspendidos en bateas o en balsas sobreelevadas en playa, aminora los gastos en aguas y alimentación, pero plantea problemas por la baja tasa que se ejerce el paso del agua marina, y por la variabilidad y límites de las corrientes naturales.

La posibilidad de obtener energía renovable en una batea, en este caso por medio de energía eólica, permite diseñar un sistema autónomo con el que controlar los flujos de agua deseados. Con ello podemos disponer de flujos de agua natural controlables y regulables, y con un coste mucho menor que el que sería necesario en un criadero situado en tierra. Al mismo tiempo, la situación de la batea en zonas de elevado enriquecimiento como son las Rías Gallegas nos suministra una gran cantidad de alimento de forma natural.

Podemos, por tanto obviar dos de los principales problemas que dificultan y encarecen el preengorde de semilla de pequeño tamaño.

RESULTADOS

Los resultados (tabla I y figuras 4, 5 y 6) (Ab-A. babosa, Op- O. plana, Af= A. fina) muestran en primer lugar, y a igualdad de carga de semilla (Densidad - Kg/m²), que las tasas de crecimiento son superiores en los tubos de circulación de agua forzada respecto de la semilla estabulada en cestillos y todo ello con unos resultados de crecimiento en cestillos muy importantes. Este resultado favorable en los tubos supone un 84,3 % más que en cestillos en el caso de Op1-Exp 2, un 41,3 % en Ab1-Exp 1, el 32,8 % en Af2-Exp 3, y ya muy superiores en la Af1-Exp 3.

Los datos de mortalidad indican un muy buen comportamiento del preengorde en tubos, incluso a densidades altas como los 10 Kg/m² de Ab1-Exp 1, los 25 Kg/m² Op1-Exp 2 y los 20 Kg/m² de Af2-Exp 3. Se puede deducir que la tasa de crecimiento tiene una clara correlación con el flujo de agua suministrado por la bomba de semilla (Exp 1, Op1 y Af2), y además esta influencia positiva del flujo tiene un nivel asintótico máximo donde ya no se produce un incremento del crecimiento, incluso puede perjudicarlo por una excesiva movilidad de la semilla en el tubo (Af1-Exp 3).

Los crecimientos obtenidos en los tubos de flujo forzado son superiores a los resultados en bibliografía para las tres especies, tanto en condiciones naturales (P. CAMACHO, 1991, PORTMO, 1992, CABADA et al, 1997, GARCÍA et al, 1999), en cultivo sobreelevado en playa (MARTÍNEZ et al, 1997 a y b; ABELLA et al, 1999), y en cultivo en balsa (UEHARENO, 1995, PÉREZ CAMACHO & CUÑA, 1991).

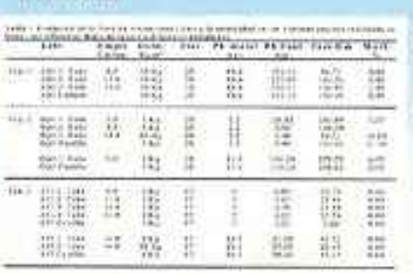
CONCLUSIONES

Teniendo en cuenta que se trata de los primeros resultados, y tras las pruebas y ajustes necesarios de flujos, épocas anuales, densidades, y tallas por especie, consideramos que la circulación forzada de agua marina natural, puede constituir un buen avance en el preengorde de moluscos bivalvos en las Rías Gallegas.

Los datos de crecimiento y mortalidad existentes en bibliografía y en nuestra propia experiencia, refuerzan esta conclusión.

LOCALIZACIÓN

Tabla



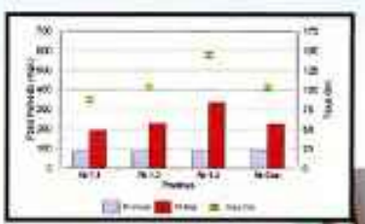


Fig 4.- Representación gráfica de los datos de crecimiento para la Almeja babosa

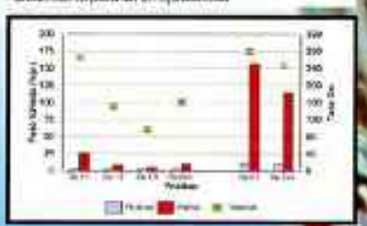


Fig 5.- Representación gráfica de los datos de crecimiento para la Ostra plana

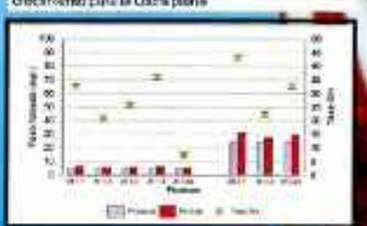


Fig 6.- Representación gráfica de los datos de crecimiento para la Almeja fina

Agradecimientos

A la empresa Cultivos [illegible], por las facilidades en la utilización de sus instalaciones, así como la aportación del material biológico para las experiencias. Agradecemos también la ayuda prestada por [illegible] durante la estancia de [illegible] en el buque oceanográfico [illegible] y a todos los trabajadores de la batea, como también a [illegible] por su colaboración en [illegible].

Bibliografía

Autoría: Cerviño, A.; Bao, M.; de Coo, A.; García, A.; Domínguez, M.

Título: El aprovechamiento de energías alternativas en la acuicultura. Energía eólica en una batea

Evento: VIII Congreso Nacional de Acuicultura

Lugar: Santander - Cantabria (España)

Ano: 2001

El aprovechamiento de energías alternativas en la acuicultura

ENERGIA EOLICA EN UNA BATEA

Cerviño Eiroa, A.; Bao Iglesias, M; De Coo Martín, A.; García Fernandez, A.; Dominguez, M.

INTRODUCCIÓN

La disponibilidad de energía de menor coste en las instalaciones de cultivo marinas es hoy día una asignatura pendiente. Esta vía se puede solucionar por el aprovechamiento de energías renovables. En el caso que nos ocupa, dentro de Galicia tiene un alto potencial eólico, hemos instalado en una batea de la Ría de Arousa, un sistema basado en el aprovechamiento de los vientos y calcular el potencial de energía eólica generado.

Dentro de un amplio abanico de las posibles utilizaciones de esta energía, nuestro trabajo estudia el rendimiento en su aprovechamiento para provocar flujos de agua de mar negativos y controlables que permitan optimizar el presupuesto de semilla de moluscos bivalvos.

Para ello la energía eléctrica se las transformado en aire comprimido acumulado en los *pequeños flotadores* de la batea y que comparte un buen sistema de reserva. Desde estos depósitos se impulsa aire al sistema de presupuesto provocando el mezclamiento del agua. Igualmente se han suspendido nuevas experiencias, donde el flujo de agua se fuerza mediante la utilización de pequeñas bombas, directamente conectadas al sistema de energía eléctrica.
En base a flujos medios para una hipótesis estudiar se estudia el potencial productivo de este sistema experimental y como primer resultado indicativo de la posibilidad de desarrollo de una línea de trabajo.

RESULTADOS

En el intervalo de vientos entre 3-22 m/s, que son aquellos viables económicamente para la generación de energía, habría los meses mas ventosos con unas horas superiores al 50% al año en febrero y octubre. En contrapartida en que la temperatura del agua y la producción de fitoplancton es mayor (abril a octubre). La hora de agosto el momento del mínimo es una época superior al 60 %. La especial media de generación energética en horas es del orden de un 35,50 %, lo que equivale a un aprovechamiento de 8.125 horas al año y una producción media de 17. Un emplazamiento, con aprovechamiento Tyldesley-ola. Con esta energía producida y almacenada en cinco grupos de baterías, se alimenta un pequeño compresor de 0,5 HP, capaz de producir un volumen de aire de 200 litros/minuto, al mencionado en los flotadores de la batea.

El punto mas eficiente es el que corresponde a la velocidad correspondiente entre los 5-8 m/s. La intensidad media de corriente eléctrica producida en un mes, es de 12,65 amp/h. Esto y que es correspondiente con un 21,47% del total. En consecuencia fue hasta que la producción energética no cubrió todo nuestro requerido.

Para los demandados más extremos se comprobó que los flujos de agua son directamente proporcionales al consumo de aire con una relación de 1:3 (lo que fue), lo que significa que se pueden invertir a través de la semilla, del orden de 11.000 litros de agua diarios.

Otro aspecto importante es el relativo a la presencia de colmas. Se pudo comprobar que durante el año 2000, todo durante el mes de febrero, un periodo un periodo de tres días de inactividad del generador. Esto puede considerarse como excepcional. De todos modos predicciones vientos suficientes para la generación de energía en algún periodo a lo largo de las 24 horas. Los vientos dominantes actuales 8 - 9W con una media de 6 m/s.

INSTALACIÓN

FOTOGRAFÍAS

1 Detalle eólico
2 Regulador e inversor
3 Presostatos
4 Transductor
5 Electroválvulas
6 Sistema Programación
7 Acondicionador digital

LOCALIZACIÓN

CONCLUSIONES

Las capacidad de producción energética necesaria para llevar la circulación de agua a través de sistema de presupuesto de semilla de moluscos es perfectamente viable con la instalación de pequeños generadores eólicos instalados en viveros distantes (juveniles) situados en las rías gallegas. La instalación de un generador más potente que el utilizado en las experiencias (de 5 a 10 Kw nominales), sería suficiente para el presupuesto de la semilla producida en un criadero y de varios bateas con moluscos engordados. Para la instalación se puede considerar relativamente sencilla y el mantenimiento no supone una gran complejidad. Los riesgos por fenómenos de huracanado de viento en determinados periodos son altos, y en el peor de los casos imprevisto es un problema inevitable. En definitiva el uso de pequeños grupos electrógenos portátiles (o ubicados en las embarcaciones de trabajo) que facilitan la generación de energía eléctrica necesaria para puesta en marcha en circulación del agua es viable y fácil.

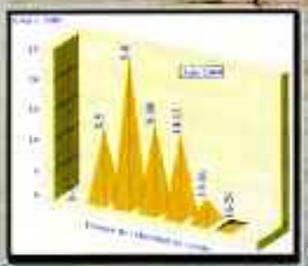


Fig.1 - Se muestra la distribución de amperios producidos durante el año 2000 en función de los rangos de velocidad del viento. Se comprueba que el rango de 5-8 m/s es el más rentable.

Fig.2 - Se muestra la distribución de amperios producidos durante el año 2000 en función de los meses. El periodo de marzo a septiembre fue en el mayor capacidad energética.

Agradecimientos

A la empresa A'Ostreira S.L. por facilitarnos la utilización de sus instalaciones y el apoyo de su socio A. Manuel Domínguez Otero por su ayuda, tanto en el transporte como en el montaje de los elementos de instalación en la batea. Igualmente a Electro Deporte Barreiro y su hijo Tito, que siempre nos han cedido la paciencia y la mejor material desde el taller de Cambados a la Batea.

Bibliografía

Bao Iglesias, M. de Carmen Eiroa, A. 2001. Cuantificación de la producción de semilla. *Revista galega de cultivos* nº 10: 57-58

Heilweil, M; Spotkill, M & Fedrizi, M. 1989. Alternative energy in aquaculture: cost effective use of windmills. *Water Pollution Research Journal* 24: 65-100

Delgado Lac. J.L. 1983. Energía hidráulica y eólica práctica. *Ed. Nver Limpio Pamplona*. 180 pp.

Xunta de Galicia. Consellería de Industria e Comercio. 2000. Plan galego de eficiencia.

Autoría: Linares, F.; Olmedo, M.; Peleteiro, J.B.; Echabe, A

Título: Ongrowing and biochemical composition of blackspot sea bream (*Pagellus bogaraveo*) juveniles fed with different dry food

Evento: Larvi 01. Fish & Shellfish larviculture Symposium

Lugar: Ostende (Bélgica)

Ano: 2001

ONGROWING AND BIOCHEMICAL COMPOSITION OF BLACKSPOT SEA BREAM (*PAGELLUS BOGARAVEO*) JUVENILES FED WITH DIFFERENT DRY FOOD

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INTRODUCTION

Blackspot sea bream *Pagellus bogaraveo* ranks as one of the economically favorable species at commercial level. Over the past few years, considerable progress has been made in terms of reproduction, and fattening and ongrowing in cages and cages (Fernández-Palacios et al., 1995; Linares et al., 2001; Olmedo et al., 1997, 1999; Peleteiro et al., 1994, 1997). One of the problems still existing, particularly in the fattening stage, is the occurrence of fat deposits, which are located all around the viscera (perivisceral fat) and inside the muscle and liver (Linares et al., 2000). This problem is directly related to feed, so that certain commercial diets containing a low crude fat content are considered as the most suitable for the fattening of blackspot sea bream.

This work is a comparative study on growth and the biochemical composition of blackspot sea bream juveniles fed with four different types of dry feed, at regional, protein and fat content.

MATERIALS AND METHODS

The experiment was conducted over a six-month period, and carried out at the premises of the Lodo Aquarium (Cantabria, Northern Spain). For this purpose, 1,000 specimens of the initial average weight of 22.0g (±0.88g), from the Oceanographic Center of Vigo, were randomly distributed into 8 circular tanks (containing 4m³ in groups of 125 with 1 density of 1 kg/m³). Each one group were fed with a different feed. Feeds, supplied by Dibaq, had the following composition in terms of protein and fat content: D1 (54%P; 6%F); D2 (48%P; 8%F); D3 (47%P; 12%F); D4 (42%P; 16%F). Likewise, the quality of the process in the tanks was the same and below in field D1 and D2, in comparison with feeds D3 and D4, which had a lower quality and its viscosity. Sampling of weight (g) and size (cm) was carried out on a monthly basis, and 3 individuals were extracted from each tank for dissection. For visceral fat weight was used for calculation of the Viscerosomatic index (VSI = [visceral weight/body weight] x 100). Samples were taken in duplicate to analyze the biochemical analysis. Analysis included: moisture (Bradford, 1976), total lipids by extraction with chloroform-methanol (3:1) (Bligh and Dyer, 1959, modified by Fernández-Reiriz et al., 1989) and gravimetric determination; fatty acids prior to transesterification and methanol (Lepage and Roy, 1986) were analyzed by Gas Chromatography.

Data were analyzed using one-way ANOVA and differences between means were tested by an a posteriori test (P < 0.05).

RESULTS AND DISCUSSION

Figure 1 shows overall growth throughout the experiment. The point to be noted was that D1, at the end of the experiment, presented an average weight of 72g, which is significantly higher than that recorded in the remaining feeds (D2, D3, and D4: 41.6, 40.6, and 41.8g, respectively). These results also indicate that the protein levels of the diet needs an important influence on the growth of juvenile Blackspot sea bream were accompanied by adequate levels of fat, since juveniles of blackspot fed with D1, despite showing the lowest fat content, also had the best and most efficient feeds to grow properly during.

As regards to the perivisceral fat (Table I), there appears to be no noticeable variation in the content of the diet and the percentage of perivisceral fat found in the juveniles, which ranged from 2.2 to 7.5% of body weight. Nor are there significant differences between the experimental diets of many studies such as the influence that. The fat ranged from 2 to 3%.

In terms of the biochemical composition of juveniles (Table II), the crude content of dry matter in the fish fed with diet D1 generally showed slightly higher values than those obtained with the other diets, reaching 21.9% dry weight by the end of the experiment. As for muscle, protein ranged from 64-80%, no differences being observed between the juveniles fed with the different feeds.

The percentage of lipids in liver decreased at the end of the experiment in the juveniles fed with feeds D1 and D2, from 36 to 42 and 47%, respectively. Conversely, in juveniles fed with diets D3 and D4, although there was an initial reduction in lipid in the liver, an increase was subsequently observed. Moreover, juveniles fed with D3 and D4 showed slightly higher lipid values than those fed with D1 and D2. As regards fatty acids, there is no clear relationship between the higher growth obtained with the D1 diet and the content in PUFAs in the liver. In all cases, an increase was noted in the ratio 18:1/16:1, the weight and the highest value was recorded in the ranged between 5.1 and 12.9 g.g.d. dry weight.

Table I. Perivisceral Fat (PF) and the Hepatosomatic Index (HSI) in Blackspot seabream juveniles

Month	Feed D1		Feed D2		Feed D3		Feed D4	
	PF	HSI	PF	HSI	PF	HSI	PF	HSI
November	4.47	1.97	4.47	1.97	4.47	1.97	4.47	1.97
December	3.71	1.84	3.84	1.66	5.11	1.77	5.24	1.6
January	3.93	1.69	3.13	1.23	3.57	1.68	5.1	1.71
February	3.11	1.5	3.83	1.26	3.52	1.47	3.4	1.71
March	2.94	1.43	3.33	1.53	2.78	1.3	3.98	1.79
April	3.97	1.47	3.76	1.49	3.45	1.94	3.46	1.77
May	4.16	1.41	3.71	1.49	4.11	1.91	5.18	1.94

Table II. Composition in proteins, lipids and PUFAs in Blackspot sea bream juveniles fed

	Start	Diet 1	Diet 2	Diet 3	Diet 4	Control	Wild
Protein (D.W.)	78.46	77.76	78.1	74.70	71.46	65.11	70.46
Lipids (D.W.)	55.06	21.85	45.48	47.06	46.97	47.76	44.86
PUFA (mg/g D.W.)	34.97	55.43	49.55	49.9	61.45	56.9	58
Liver							
Protein	78.46	72.46	72.53	68.82	73.36	69.28	74.12
Lipids	55.06	37.97	56.86	45.09	56.60	51.40	51.62
PUFA	28.92	74.02	79.2	100	111.6	86.65	96.5
Muscle							
Protein	78.46	78.6	77.56	83.53	77.01	77.89	77.22
Lipids	55.06	62.84	47.06	56.82	53.01	52.65	45.94
PUFA	33.91	53.8	51.1	71.85	96.2	100.9	77.9
Gut							
Protein	78.46	80.51	73.62	77.56	75.11	71.47	76.88
Lipids	55.06	53.11	44.06	50.65	47.66	51.13	54.51
PUFA	33.92	66.65	122.2	109.1	97.15	109.4	94.05

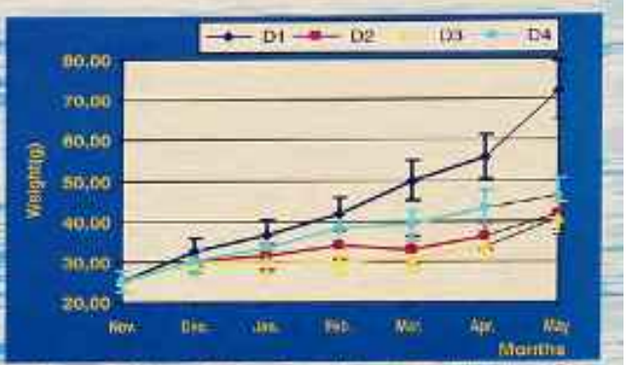

Fig. 1. Growth of juvenile Blackspot sea bream fed with different feeds

CONCLUSIONS

Protein quality in the diet exerts a clear influence on the growth of blackspot sea bream juveniles.

A high fat content in the diet delays growth of blackspot sea bream juveniles.

There appears to be no relationship between perivisceral fat content and the weight of the fish grown with the fat content in the diet as considered.

Protein composition in the juveniles liver is slightly higher in those fed with a diet with a better balance in essential amino acids in relation to that with the other diets.

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Autoría: Miguens, J.L.; Molares, J.; Pavón, R.; Laza, R.

Título: Xestión do marisqueo mediante a aplicación informática SIGREMAR

Evento: V Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

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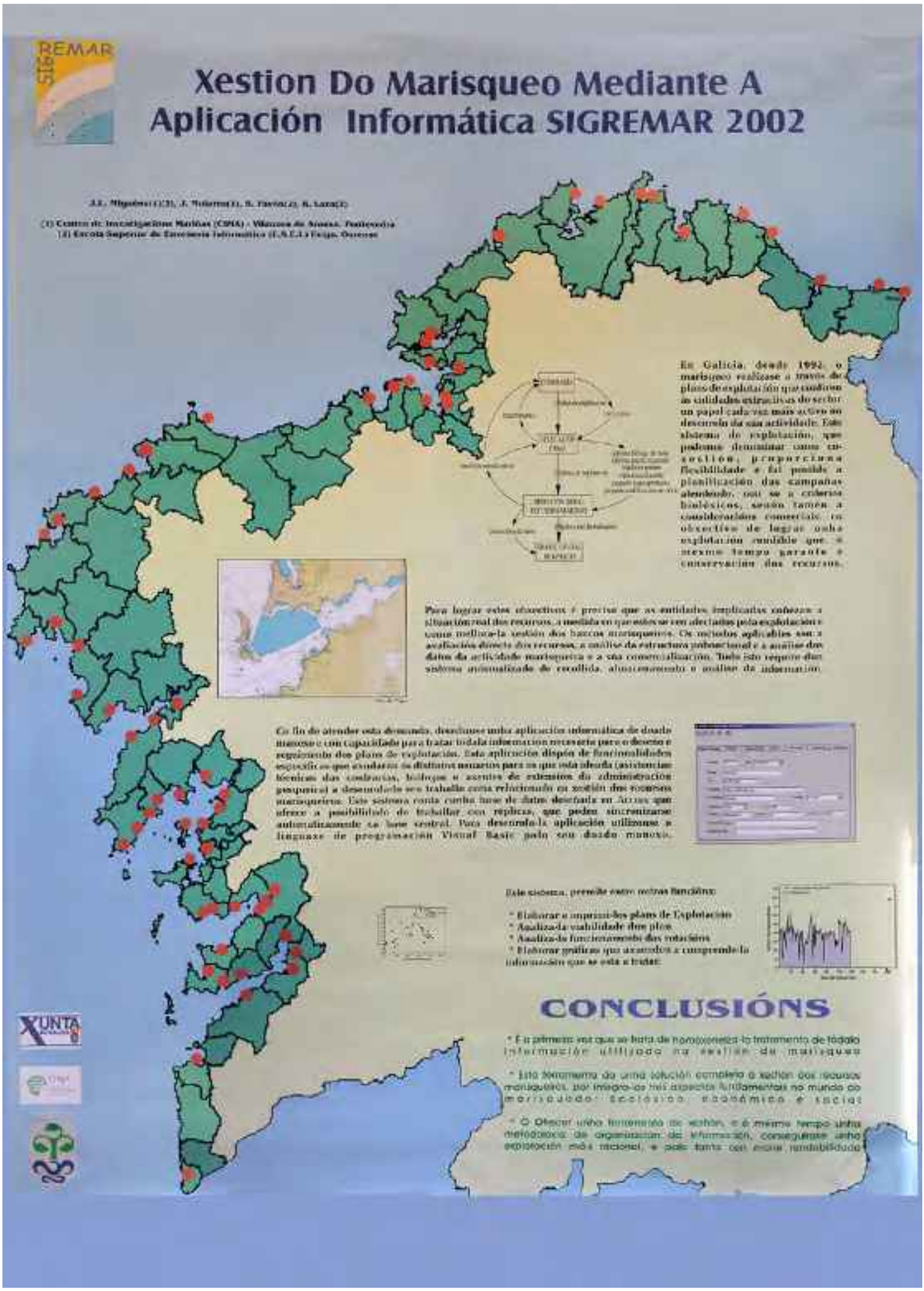
Ano: 2002


SIGREMAR
Xestion Do Marisqueo Mediante A Aplicación Informática SIGREMAR 2002
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En Galicia, desde 1992, o marisqueo realízase a través de plans de explotación que confieren as cidades extractivas do sector un papel cada vez máis activo no desenrolo da súa actividade. Este sistema de explotación, que podemos denominar como co-xestión, proporciona flexibilidade e fai posible a planificación das campañas atendendo, non se a criterios biolóxicos, senón tamén a consideracións comerciais, co obxectivo de lograr unha explotación rendible que, e mesmo tempo garante e conservación dos recursos.
Para lograr estes obxectivos é preciso que as entidades implicadas coñezan a situación real dos recursos, a medida en que estes se ven afectados pela explotación e como melhora-la xestión dos bancos marisqueiros. Os métodos aplicables son a avaliación directa dos recursos, a análise da estructura poboacional e a análise dos datos da actividade marisqueira e a súa comercialización. Todo isto requere dun sistema automatizado de recollida, almacenamento e análise da información.
Co fin de atender esta demanda, desenhouse unha aplicación informática de doado manexo e con capacidade para tratar toda la información necesaria para o deseño e seguimento dos plans de explotación. Esta aplicación dispón de funcionalidades específicas que axudarán os distintos usuarios para os que está ideada (asistencias técnicas das contrarias, biólogos e axentes de extensión da administración pesqueira) a desenrolado seu traballo cada relacionado co xestión dos recursos marisqueiros. Este sistema conta cunha base de datos deseñada en Access que ofrece a posibilidade de traballar con réplicas, que poden sincronizarse automaticamente co base central. Para desenrolo-la aplicación utilizouse o linguaxe de programación Visual Basic pelo seu doado manexo.
Este sistema, permite entre outras funcións:
* Elaborar e imprimi-los plans de Explotación
* Analiza-la viabilidade dos plan
* Analiza-lo funcionamento das rotacións
* Elaborar gráficas que axuden a comprende-la información que se está a tratar.
CONCLUSIÓNS
* É a primeira vez que se trata de homoxeneiza-lo tratamento de tódala información utilizada na xestión do marisqueo
* Esta ferramenta da unha solución completa a xestión dos recursos marisqueiros, por integra-los tres aspectos fundamentais no mundo do marisqueo: ecolóxico, económico e social
* O Ofrecer unha ferramenta de xestión, e é mesmo tempo unha metodoloxía de organización da información, conseguirase unha explotación máis racional, e pois tanto con maior rendibilidade
XUNTA

Autoría: Linares, F.; Olmedo, M.; Peleteiro, J. B.

Título: Biochemical composition of blackspot seabream larvae, *Pagellus bogaraveo*, fed with rotifer enriched with three different microalgae

Evento: Aquaculture Europe 2002. Seafarming Today and Tomorrow. European Aquaculture Society

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Ano: 2002

Biochemical composition of Blackspot sea bream larvae, *Pagellus bogaraveo* fed with Rotifer enriched with three different microalgae

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INTRODUCTION

Blackspot seabream, *Pagellus bogaraveo*, is one of the farmable species at commercial level. The success of larval rearing is greatly influenced by first feeding regimes and the nutritional quality of starter diets (Izquierdo et al. 2000). Obtaining larvae with a suitable biochemical composition is the result of good food and is essential to obtain good quality young individuals. This work studies the biochemical composition of blackspot seabream larvae at the feeding stage, fed with rotifer enriched with three different microalgae, *Isochrysis galbana*, *Tetraselmis suecica* and *Nannochloropsis* sp2.

Blackspot seabream larvae

Brachionus plicatilis

MATERIAL AND METHODS

The experiment was conducted with blackspot seabream larvae from spawns obtained during the year 2000 from the broodstock belonging to the I.E.O. in Vigo and CIMA (Local Government of Galicia). Three samples of larvae were taken at the start (day 0) and at the end of the experience (day 15 of life). Analyses were performed on proteins (Bradford, 1976), total lipid by extraction with chloroform:methanol (2:1) (Bligh & Dyer, 1959 modified by Fernández-Reiriz et al. 1989) and gravimetric determination. Fatty acids prior to transesterification and methylation (Lepage & Roy, 1986) were analyzed by Gas Chromatography.

RESULTS AND DISCUSSION

Protein values ranged from 47% in recently hatched larvae, to 49, 48 and 53% in larvae fed with rotifer enriched with Isochrysis, Tetraselmis and Nannochloropsis respectively (Fig.1). Considerable lipid consumption was noted in the initial 15 days of larvae life, falling from the 25% achieved in recently hatched larvae to values close to 15%. The constant values in proteins and the decrease in total lipids throughout larval development in blackspot seabream was noted down previously (Linares et al. 2000). No significant differences were noted in the composition of lipids and proteins in larvae fed with rotifer enriched with the three mentioned microalgae. Table I shows the fatty acid composition in blackspot seabream larvae. The PUFA percentage, in terms of the total amount of fatty acids varied from 38% in recently hatched larvae to 37,34 and 38% in 15 day old larvae enriched with Isochrysis, Tetraselmis and Nannochloropsis respectively.

Significant differences were noted between the docosahexaenoic fatty acid content, 22:6(n-3), among larvae fed with rotifer enriched with Isochrysis, which accounted for 16% of the total of fatty acids, in contrast with the 6.8 and 6.2% obtained in larvae fed with rotifer enriched with Tetraselmis and Nannochloropsis respectively. This may be relevant in view of the considerable importance of this fatty acid in marine fish.

Table I. Fatty acids (% of total) in larvae of blackspot seabream newly hatched and fed with rotifer enriched with microalgae.

	Larvae newly hatched	15 d. larvae fed with I+Iso	15 d. Larvae fed with Te+Tetra	15 d. larvae fed with N+Nanno
PUFA	38.02	36.63	33.57	37.73
Saturates	36.03	33.97	34.67	35.86
Monounsaturates	26.74	26.30	21.16	19.29
Sum. (n-3)	32.74	22.05	25.51	27.29
Sum. (n-6)	5.57	13.11	6.52	8.42
20:5 (n-3) EPA	6.33	2.34	9.34	11.71
22:6 (n-3) DHA	22.15	15.79	6.06	6.21

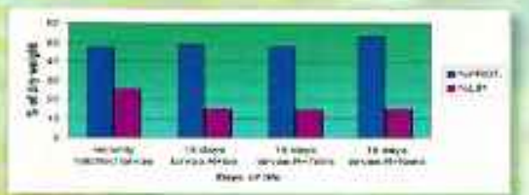

Fig.1. Biochemical composition (proteins and lipids) of blackspot seabream larvae

REFERENCES

Acknowledgements: This work was financed by the PGIDT Project "Estudio de las necesidades nutritivas del besugo (*Pagellus bogaraveo*, Brünnich, 1768) en fase de engorde". Special thanks to the valuable assistance of the CIMA and IEO technicians.

Autoría: Darriba, S.; Martínez, D.; Guerra, A

Título: The razor clam *Ensis arcuatus*: perspectives for hatchery outgrowing culture

Evento: Aquaculture Europe 2002. Seafarming Today and Tomorrow. European Aquaculture Society

Lugar: Trieste (Italia)

Ano: 2002

THE RAZOR CLAM *Ensis arcuatus*: PERSPECTIVES FOR HATCHERY OUTGROWING CULTURE

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Introduccion

The razor clam *Ensis arcuatus* Jeffreys, 1865) is a bivalve mollusc species of the Solenidae family (fig 1), which lives buried in the sand in the intertidal and infralittoral zone. In Galicia (N.W. Spain) (fig 2) extractives and their commercial value have increased in the last few years: in 2006, 72% of the total national captures were of razor clams. The FAO (2000) statistics yearbook (2000) indicates that in 1998, 25% of the National production corresponded to Spain. These razor clams are mainly obtained along the Galician coast (Darriba, 2002).

The development of techniques that allow the obtaining and culture of larvae and the posterior maintenance and fattening of the seed for their transfer to the natural environment are of great importance in beginning the culture of this species from seed obtained in a hatchery.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Material and Methods

Adult individuals of *E. arcuatus* (of between 12-14 cm) are extracted by "skin diving" (Fig 3) from the subtidal bank of the Islas Cies (Ría de Vigo, Pontevedra). The collections are made in the month of April, during the period of sexual maturity (Darriba et al., 2001) and they are transferred to the Centro de Cultivos Mariños de Ribadumia (mollusc hatchery - fig 4). They are kept in tanks with sand and water at room temperature and fed with supplementary microalgae. Trials to stimulate spawning (thermal shock, addition of microalgae and addition of gonadal extracts) are performed using individuals from the reproductory stocks to obtain mature gametes. The larvae are grown in 450 l tanks, with aerated water at a temperature of 21±0.5 ° C, following methods similar to those used in several authors (Martínez et al., 2006). The feeding is with microalgae (*Pavlova lutheri*, *Isochrysis galbana*, *Skeletonema costatum* and *Chaetoceros calcitrans*) at a 40 cel/l/day in the first days of larval culture and 80 cel/l after metamorphosis.

The post-larvae culture is carried out in closed circuit, in quadrangular tanks of 1000 litres, in sieves with covered flow caused by air-lifts. When seed reaches a size of approximately 1.5mm they are transferred to tanks in open circuit with the bottom sand layer of 40 cm of fine and medium grain with a low content in organic matter. When size is appropriate for their progress and control in their natural environment, they are transferred to cages (50x50x30 cm) built with stainless steel rods and plastic mesh with 8 mm gaps (fig 5). These cages are buried in the intertidal zone so that twice-monthly sampling is possible. The initial density of seed sown is 400 ind/m².

Results

The release of mature gametes commences at 2-4 hours after the beginning of the inductive spawning and when the oocytes have an average size of 73±6.2 0 mm later monotrochal larvae actively swimming are observed. In the following days they become D-veliger larvae, similar to those of the veneroids, increasing progressively in length as they approach the pediveliger phase. Metamorphosis occurs at approximately 19-20 days, with an average maximum length of 400m, in this phase the different organs and an elongated siphon are clearly visible, this being a characteristic of adult specimens. An average size of 10mm is reached when one month old, therefore are transferred to open circuit where they continue growing. They stay in the hatchery until they are one year old, when they reach an average size of 64.1±3.4 mm. Later they are transferred to the natural environment. After six months, with an age of one year and a half, the average length of the individuals is 70.7±5.1 mm and their weight is 6.0±0.8 g.

Discussion

For a better understanding of suitable spawning and extraction times of mature adults, a study of reproduction was completed based on gametogenic analyses (Darriba et al., 2001). Spawning and larvae culture in hatchery are obtained following the usual induction techniques used for veneroids and other species of solenoids. Although the life cycle is very similar to that of the clam species, there are several aspects that hamper studies of the solenids. On the one hand, their great mobility in reacting to even small stimuli causes them to bury into the substratum, this hinders the location and extraction of the individuals for sampling. On the other hand, their necessity to remain buried, implying a limited capacity of the adductor muscles to maintain the valves closed, shortens their survival outside the substratum and makes them set about to extinguishes.

In this study we reflect on a series of problems that are necessary to solve if obtaining *E. arcuatus* seed is to be economically profitable. One of them is the obtaining of larvae at times other than the natural time of spawning, from parents kept in a hatchery. Another aspect to be determined is the most suitable size for sowing in the intertidal and the conditions in which this must be performed to obtain the greatest survival rate.

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References

Darriba S. 2002. Biología de la navaja (*Ensis arcuatus* Jeffreys, 1865) de la Ría de Vigo (N.O. de España): crecimiento y reproducción. Tesis Doctoral. Universidad de Vigo. España.
Darriba S., A. Guerra, F. San Juan and J. Moreira. 2001. Estudio del ciclo reproductivo de la navaja *Ensis arcuatus* en las Islas Cíes (Ría de Vigo, N.O. de España). *Serie Monografías del ICCM*, n°4: 544-548.
FAO. 2000. Estadísticas de pesca. Capturas. 1998. Vol 86/1.
Martínez D., S. Novoa, J. Ojea and L.M. Alvarez. 2000. Larval rearing of razor clam *Solen marginatus* (Pennant, 1777), *Ensis siliqua* (Linné, 1758), and *Ensis arcuatus* (Jeffreys, 1865). AQUA 2000. E.A.S. Special publication n° 28.

Autoría: Darriba, S.; Guerra, A.

Título: La navaja de la Ría de Vigo (España): ¿*Ensis ensis* o *Ensis arcuatus*?

Evento: II Congreso Internacional das Sociedades Malacológicas Europeas

Lugar: Vigo - Galicia (España)

Ano: 2002

LA NAVAJA DE LA RÍA DE VIGO:
¿Ensis ensis o Ensis arcuatus?

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INTRODUCCIÓN

La navaja es la especie comercial de solénido más importante en España, su extracción representa el 72% de las las especies comercializadas (navaja, longueirón y longueirón vello).

En las Illas Cíes (boca Norte de la Ría de Vigo) existe un importante banco natural de navajas explotado actualmente por la Agrupación de buceadores de la Cofradía San José de Cangas. La extracción se realiza mediante el método de buceo en "apnea", desde la embarcación.

La identificación de las especies de solénidos se basa, hasta el momento, en caracteres externos tales como la curvatura de las valvas, las impresiones musculares, los bordes anterior y posterior, el número de dientes... Las especies Ensis ensis y Ensis arcuatus presentan ambas un diente cardinal y otro lateral en la valva derecha y dos dientes cardinales y dos laterales en la izquierda. Sus diferencias se limitan al nivel de curvatura, a la relación largo/ancho y al perfil de los bordes anterior y posterior.

A la vista de las discrepancias existentes en la denominación científica de la navaja de la Ría de Vigo, por parte de los Organismos oficiales (que la denominan E. ensis) y en las escasas publicaciones en que figura, donde aparece como E. arcuatus (Rolán et al. 1989; Rolán & Otero-Schmitt, 1996), se aborda la caracterización e identificación de la especie de solénido que habita ésta y otros zonas del litoral gallego.

MATERIAL Y MÉTODOS

1.- Análisis biométrico

Se analizan valvas de un total de 276 especímenes pertenecientes a ejemplares de navaja procedentes de las Illas Cíes, obtenidos durante los años 1998, 1999 y 2000.

De cada individuo se selecciona una de las valvas y se miden los siguientes parámetros: longitud (L), ancho (A), ancho en la zona media (Am), curvatura dorsal (Cd) y curvatura ventral (Cv) (Figura 1).

Figura 1

2.- Análisis morfológico

En la colección de moluscos del Departamento de Zoología del Museo de Historia Natural de Londres, donde se encuentran valvas de E. ensis y E. arcuatus, se analizan las diferencias externas de ambas especies utilizadas por diversos autores en las claves de identificación, y se comparan con la navaja de la Ría de Vigo.

Figura 2

RESULTADOS y DISCUSIÓN

1.- Análisis biométrico

Las longitudes de los especímenes analizados están entre 3,1 y 15,0 cm. La talla máxima registrada está fuera de la longitud máxima referida para *E. ensis* por diversos autores (8-12 cm) y se encuentra en el rango de talla máxima citada en la bibliografía para *E. arcuatus* (12-17,5 cm) (Holme, 1951; Tebble, 1966; Rolán et al., 1989; Poppe & goto, 1993; Henderson & Richardson, 1994; Hayward & Ryland, 1998).

Las relaciones L-A y L-Am siguen un modelo potencial con coeficientes dentro del margen considerado para una relación isométrica por Gaspar (1996).

El cociente L/Am ha sido utilizado por Holme (1951) para distinguir especies de solénidos. En la especie estudiada hay un rango (6,06-8,36) más próximo al citado por este autor para *E. arcuatus* (6,20-8,29) que al de *E. ensis* (6,83-9,07), con un mínimo y un máximo más altos debido a su contorno más delgado.

Las curvaturas dorsal (Cd) y ventral (Cv) son distintas para todas las tallas analizadas (figura 2), siendo la ventral mayor, lo que confirma que los bordes no son paralelos. Esta es una característica que aparece en las claves de identificación como diferenciadora entre *E. arcuatus* y *E. ensis*.

La relación entre L y la Cd en estas especies fue representada por Holme (1951), observándose una clara diferencia entre ambas. Los resultados de la especie de las Cíes se solapan perfectamente con los valores de *E. arcuatus* (figura 3).

Figura 3

2.- Análisis morfológico

E. ensis se caracteriza por presentar el borde anterior redondeado y un pronunciado alfamento de las valvas en el borde posterior debido al estrechamiento en esa zona, mientras que *E. arcuatus* tiene el borde anterior truncado y no existe el marcado alfamento observado en la otra especie. Los márgenes, dorsal y ventral, están igualmente curvados en *E. ensis*. En *E. arcuatus* el margen dorsal es casi recto y el ventral algo más curvado (fig. 4).

Figura 4

Según se observa en la figura 4, la "navaja" objeto de estudio carece de alfamento posterior pronunciado, el borde anterior es truncado y sus márgenes dorsal y ventral no están igualmente curvados, coincidiendo claramente con *E. arcuatus*.

Conclusión: La especie de navaja que habita el banco natural sumergido de las islas Cíes (Ría de Vigo) es *E. arcuatus* y no *E. ensis* como consta actualmente en publicaciones oficiales y de carácter divulgativo.

Bibliografía:

-Gaspar, M. B. 1996. Biología do litoral Occidental Algarvio. Aspectos da biologia, ecologia e do pescado dos moluscos de interesse económico: aplicação à gestão dos recursos. Tese Doctoral. Faro. 282pp.

-Hayward, P. J. & Ryland, J. S. 1998. Handbook of the Marine Fauna of North-west Europe. Oxford University Press. 615-617.

-Henderson, J. M. & Richardson, C. A. 1994. A comparison of the age, growth rate and burrowing behaviour of the razor clams, Ensis siliqua and Ensis ensis. J. mar. Biol. Ass. U. K. 74: 859-874.

-Holme, N. A. 1951. The identification of the British species of the Genus Ensis (Lamellibranchiata). J. mar. Biol. Ass. U.K. 29: 635-647.

-Poppe, G. & Goto, Y. 1993. European Seashells (Scaphopoda, Bivalvia, Cephalopoda). European Seashells (Scaphopoda, Bivalvia, Cephalopoda). 2: 103-108.

-Rolán, E. & Otero-Schmitt, J. 1996. Guía dos moluscos de Galicia. Ed. Galaxia. 256-259.

-Rolán, E., Otero-Schmitt, J. & Arias Alvarez, E. 1989. Moluscos de la Ría de Vigo. Thalassa. 7 (): 147-166.

-Tebble, N. 1966. British bivalve seashells. Publication of the British Museum (Natural History). 647 (p):1-155.

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EXTRACELLULAR ENZYME ACTIVITIES OF *PERKINSUS ATLANTICUS* IN CULTURE AND COMPARISON WITH *PERKINSUS MARINUS*

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Abstract

Perkinsus atlanticus (Azevedo, 1989) is a protozoan parasite found along the Iberian Peninsula coast. P. atlanticus has been associated with mortalities in cockle populations in the south of Portugal (Sousa & Azevedo 1992, Azevedo 1993) and in the Ría de Arousa (NW Spain) (Navarro et al. 1992). Perkinsus marinus (Mackin et al. 1950) is an eastern oyster (Crassostrea virginica, Gmelin) pathogen along the Gulf of Mexico and the Atlantic coasts of USA. P. marinus is the major cause of mortality in this species in the Atlantic coastal areas.

With the objective of a better knowledge of the various ecologic and life cycle traits developed by the in vitro cultures of Perkinsus spp. for the second time ever, the Perkinsus genus have been investigated in other Perkinsus species (La Peyre et al. 1995). Perkinsus olseni/atlanticus (Delaney et al. 1992) and recently Perkinsus qugwadi (Blackbourn et al. in press).

The study of P. atlanticus culture in vitro allows to know that this species produces extracellular proteases, some of the most potent proteolytic activity described in the genus Perkinsus (La Peyre et al. 1995, Faisal et al. 1995, Volety et al. 1999, Oliver et al. 2002). P. marinus' proteases are able to degrade collagen of the extracellular matrix and usage was the main source and nutrient detected (La Peyre et al. 1995, Garreis et al. 1996, Silverio et al. 1999, Tall et al. 1999). Furthermore, the presence of host plasma proteins (Hegaret et al. 2003) and collagen, and the presence of proteases in host tissues, might indicate that these enzymes are important factors in the parasite pathogenesis (Faisal et al. 1995, Oliver et al. 1995, Perkins et al. 1996, Oliver et al. 1999).

Acid phosphatase is another virulence factor connected to the ROP of P. marinus cultures (Volety & Chu 1994). The secretion of this protease may be responsible for the detected suppression of reactive oxygen intermediate (ROI) production by the oyster hemocytes (Volety & Chu 1995) and can be related with the regulatory mechanism of the parasite cycle (Volety & Chu 1997).

Using proteases' role in vitro culture of Perkinsus species, the first objective is the detection of enzyme activities in the ROP of this parasite in culture in vitro, with a special interest in the enzymes with proven participation and role in other parasitic species.

Introduction

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Using proteases' role in vitro culture of Perkinsus species, the first objective is the detection of enzyme activities in the ROP of this parasite in culture in vitro, with a special interest in the enzymes with proven participation and role in other parasitic species.

Materials and Methods

- Perkinsus atlanticus extracellular enzyme activities

Twelve *P. atlanticus* cultures, five cultures isolated from infected clam hemolymph, and four cultures isolated from *P. marinus* trophozoites were investigated using the protocol and assay methods described for Faisal et al. (1995) and Oliver et al. (1995) with modifications.

- *P. atlanticus* cultures. 2.5 x 10^5 cells/15 mL) were inoculated at 20 °C in Ammonia Sterile Seawater (ASW), thus, a 1/6 ASW (v/v) dilution.

- Cell density and viability. Cell density was corrected five weeks post seeding. Two aliquots were used to determine the cell density: the second aliquot was used to determine the cell viability (%) (cell count in cm³ and the remaining volume was centrifuged at 1500 g for 10 min).

- The cell-free culture supernatant was filtered (0.22 µm) and concentrated 4 times using the Vivaspin 15R (5K molecular weight cut-off, Sartorius Stedim Biotech, Germany).

- Enzyme activities were detected and measured using the API ZYM® (BioMerieux SA, France) according to the instructions of the manufacturer.

- Substrate was added to the reagent strips (65 µL/well), and incubated at 37°C for 4 h. 2 drops/well of reagents (reactions were added the reagents ZYM A and ZYM B (BioMerieux SA). The results of enzyme activities were expressed with a colorimetric scale and expressed in nanomoles of hydrolyzed substrate.

- Extracellular enzyme activities as the time a passage of the host's plasma proteins

The enzyme activities were compared the cell-free culture enzyme activity in the supernatants of flasks in which *P. atlanticus* cultures (Culture Clone 1 and Culture Clone 2) were grown with the supernatants of flasks containing cells of *P. marinus* cultures (cultures isolated from the *C. virginica* host). The enzyme activity in the supernatants was detected as described above.

- Statistical analysis

Differences between total enzyme activity levels in the supernatants of *P. atlanticus* cultures were detected using one-factor ANOVA and Tukey HSD multiple comparisons.

Results

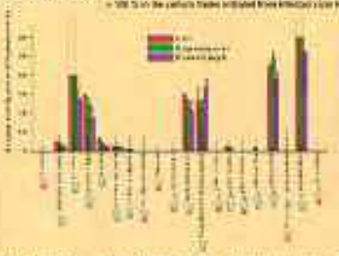
- Extracellular enzyme activities in *P. atlanticus* cultures

P. atlanticus density

- 170,833 x 10^3 cells in the control flasks, isolated from infected clam gills
- 163,33 x 10^3 cells in the culture flasks, inhabit from parasite homogenates
- 176,66 x 10^3 cells in the culture flasks, isolated from infected clam hemolymph

P. atlanticus viability

- 100 % in the control flasks, isolated from infected clam gills
- 100 % in the culture flasks, isolated from parasite homogenates
- 100 % in the culture flasks, isolated from infected clam hemolymph



Enzyme activities: determination of hydrolyzed substrate (nanomoles) after 4 h of incubation at 37°C. Values are means of triplicate assays. Error bars represent standard deviation. Enzyme activities: alkaline phosphatase, esterase, esterase lipase, lipase, leucine arylamidase, valine arylamidase, cystine arylamidase, trypsin, α-chymotrypsin, acid phosphatase, naphthol-AS-BI-phosphohydrolase, α-galactosidase, β-galactosidase, β-glucuronidase, α-glucosidase, β-glucosidase, N-acetyl-β-glucosaminidase, α-mannosidase, α-fucosidase.

- Total enzyme activity levels in the supernatant of *P. atlanticus* cultures from gill were significantly higher than those from hemolymph ($F = 10.655$, post-comparison $P < 0.05$).

- Total enzyme activity levels in the supernatant of *P. atlanticus* cultures from hyperosmotic were significantly higher than those from hemolymph ($P = 0.04$).

- Extracellular enzyme activities in *P. atlanticus*/*P. marinus* cultures

Results of API ZYM assay carried out with the supernatants of *P. marinus* cultures. First 5 rows of the heatmap show whether *C. virginica* hosts, and the 6 heatmap rows underneath (no.1, no.2, no.3) show cultures subcultured with whether *C. virginica* gills. The most differences between both sources in the enzyme activities is indicated with a green arrow.

Discussion

In the ROP of *Perkinsus atlanticus* cells cultured in vitro were detected the following enzyme activities: esterase, esterase lipase, lipase, leucine arylamidase, valine arylamidase, cystine arylamidase, trypsin, α-chymotrypsin, acid phosphatase, naphthol-AS-BI-phosphohydrolase, α-galactosidase, β-galactosidase, α-glucosidase, β-glucosidase, N-acetyl-β-glucosaminidase, α-mannosidase, α-fucosidase. These hydrolytic enzymes could degrade tissue matrix and to the host tissues, and could have a important role in the parasite nutrition and in the host's cell invasion process.

The activity of esterase activity was detected in the ROP of *Perkinsus atlanticus*, this enzyme has been described in *P. marinus* and in several species as an indicator of the respiratory burst of the phagocytic cell in the host. (Tasca & Da 1994, Blackbourn et al. 1994, De Wu et al. 1997). *P. atlanticus* hemolysates don't have the respiratory burst mechanism associated with the phagocytosis process (Lopez et al. 1994). Nevertheless, the acid phosphatase could be related as the invasion and the regulation of the cell lysis cycle in *P. atlanticus*.

The main difference between the enzyme activities detected in the ROP of *P. atlanticus* and *P. marinus* is the absence of some enzymatic activities in the ROP of *P. atlanticus*, while these enzymatic activities were detected by *P. marinus* were detected in vitro. Also in *P. marinus*, besides the N-acetyl-β-glucosaminidase activity, an esterase activity was detected in *P. atlanticus* ROP. On the contrary, *P. atlanticus* cells cultured in vitro secrete the cysteine-class proteases, absent or present in very low concentration in the cultures on *P. marinus*.

The possible presence or very low production of some proteases in the ROP of *P. atlanticus* compared to the enzymatic activity observed in the ROP of *P. marinus*, its extremely important, considering the enzymatic behavior that the tissues and the associated pathogenicity of the parasite in in vivo infections. Regarding the host's role in degrade the cytotoxic of the parasite and the mobility of the host tissues, the host's enzymes produced by *P. marinus*, it has to be added the reduced capacity of the hemocytes for ROI (the parasite, probably created by the parasite acid phosphatase. However, the absence lack or very low production of some enzymes detected in *P. atlanticus*, can like the consequence of the cytotoxicity and in place to the phagocytosis. In the future, further cultural tissues studies of the parasitism of *P. atlanticus* in *T. decussatus*.

Literature cited

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Autoría: Iglesias, D.; Carballal, M.J.; Villalba, A.

Título: Digenean parasites of the cockle *Cerastoderma edule* populations from Galicia (NW Spain) natural beds

Evento: 11th International Conference of the European Association of Fish Pathologists

Lugar: Malta

Ano: 2003

DIGENEAN PARASITES OF THE COCKLE *CERASTODERMA EDULE* POPULATIONS FROM GALICIA (NW SPAIN) NATURAL BEDS.

D. Iglesias*, M. J. Carballal and A. Villalba.
Centro de Investigacions Mariñas, Vilanova de Arousa, Spain.

INTRODUCTION

A parasitological survey was performed in 1999 to determine the parasitic organisms and pathological conditions that affected the most important natural populations of cockle *Cerastoderma edule* from Galician (NW Spain) (Carballal *et al.*, 2001). One of the most common causes observed were digenean trematode larvae. This survey was performed using histological methods and then it was impossible to characterize which trematode species were involved. In the present work the principal digenetic trematode species affecting Galician cockles were isolated and characterized.

MATERIAL AND METHODS.

Cockles of commercial size (>28 mm) were collected from the intertidal bed of Ons (N 42° 24', W 8° 55') in the west coast of Galicia (NW Spain) because previous surveys evidenced a high prevalence of different types of trematode larvae affecting cockles from this bed. Cockles were carried to the lab in refrigerated conditions and keeped in aerated sea water until to be processed. Cockles were dissected under binocular microscope and specific larvae were isolated by separating different target organs (mainly gills, digestive gland, gonad, foot, mantle lobes and palps). Isolated larvae were identified according to optical microscopic characteristics when it was possible. Bucephalidae metacaria excluded in sporocyst of Gasteropod snail of the host, and metacercariae encysted in the host were processed for scanning electronic microscopy (SEM) in order to describe their surface ultrastructure characteristics. After histological sections of cockles, emerging larvae previous surveys were analysed.

RESULTS AND DISCUSSION.

Data from the in vivo isolation of trematode larvae confirm that cockle *Cerastoderma edule* from Galician coast act as first intermediate host of sporocysts of the family Bucephalidae, and second intermediate host of metacercariae of Gymnophallidae and Fellodistomatidae. Data from the histological analyses show that there are other trematode larvae affecting Galician cockles.

Fam. Bucephalidae (Fig. 1)

Undetermined bucephalid sporocysts of *Labratrema minimum* were detected infecting the gonad and digestive gland of some cockles, and causing in some cases the complete castration of the host. Inside dilated sporocyst walls of these sporocysts there were metacariae in different stages of development (preliminary and morphologically different larvae were in agree with previous descriptions (Dobrovolskij & Ilkiv, 1990; Matthews, 1973; Maitland, 1974). SEM permitted to describe the cercarian surface ultrastructure, these observations were concordant with the previous description of Russell-Pinto (1983).

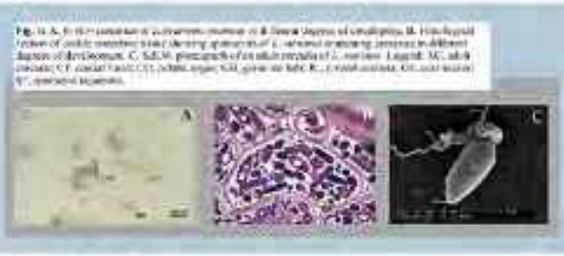


Fig. A, B, C: Microscopical observations of bucephalid metacariae in different degrees of morphological development. D: Histological section of cockle connective tissue showing sporocysts of *L. minimum* containing cercariae in different degrees of development. E, SEM photographs of two adult metacariae of *L. minimum*. Legend: AC, adult cercaria; CT, cercarial tail; CO, cephalic organ; GM, germ cell mass; HC, cercarial cystogenous gland; OC, oral sucker; V, ventrolateral appendix.

Fam. Gymnophallidae (Fig. 2).

Unencysted metacariae of *Hemigymnophallus mikrovum* were observed in cockles parasitized previously by cockle, *M. fenestrata* metacercariae were also observed in the same tissues than in the gonad host. There were a previous reference to subdivision of this two different species in the same host in the Ria de Aveiro (Portugal) (Russell Pinto, 1990; Russell Pinto & Bartell, 1992), but the present work is the first reference of coinfestation of these species in a northern cockle population.

The majority of *Hemigymnophallus mikrovum* metacariae observed in cockles could be parasitized by a unencysted cercaria, probably *Cercaria parvigloi*.

Fig. 2: A, B: Microscopical observations of hemigymnophallid metacariae. C: Histological section of *M. mikrovum* metacariae. D, E: Histological sections of cockle tissues where all *M. mikrovum* metacariae are encysted by parasite modification of the cockle. Legend: AC, acetabulum; ES, excretory vesicle; MT, muscle; MP, parasite metacercaria; PG, parasite modified tissue; VE, vesicle.

Fam. Echinostomatidae (Fig. 3)

Metacercariae of *Himasthla* sp. were observed encysted in the foot of some cockles. Cyst diameter was between 182 and 260 µm. Attending to Lauckner (1985) it is probable these cysts correspond to at least three different species of *Himasthla*, but the impossibility of control the number of host species did not permit to conclude which species were. SEM observations of dorsally and metacercariae were done about the surface morphometrics differences these and head organs.

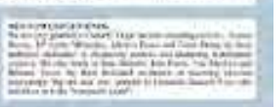
Fig. 3: A, S.C.M. photomicrograph of a *Himasthla* sp. metacariae. B, Detail of oral region. C, Region of the body surface (AS, aspinous; SP, spinous; PP, head papillae; OS, oral sucker).

Other digenean trematode larvae observed in histological sections (Fig. 4).

Sporocysts containing unidentified metacariae (< 80 ± 15.2 µm in size ± standard deviation) were observed commonly in ovarian tissue and gonad, and rarely the foot of one cockle corresponding to a previous survey. The characteristics suggested that these were sporocysts of *Meiogymnophallus minutus* (Odhner *cercaria parvigloi*) (Fig. 4A). This species were likewise to cause massive cockle mortalities in Swedish waters (Jansson & Andrée, 1992).

Also were detected sporocysts containing bifurcate cercariae and unencysted metacercariae in two cockles. Probably they were sporocysts of *Leucochloridium* sp. (Fig. 4B). Encysted metacariae were detected in digestive gland and labial palps, likewise reference suggests that probably they correspond to *Diplostomum lonyclastite* and *Posthodiplostomum minimum* (Lauckner, 1985).

Fig. 4 (A, B): Histological sections showing other trematode larvae affecting cockle tissues. A, sporocysts containing cercariae; B, sporocysts containing metacercariae; C, sporocysts.



Autoría: Acosta, C.P.; Blanco, J.

Título: Clearance rate of *Pectem maximus.* V: Effect of oxigen supply, size and food

Evento: 14th International Pectinid Workshop

Lugar: Florida (EE. UU.)

Ano: 2003

CLEARANCE RATE OF *PECTEN MAXIMUS*

V - EFFECT OF OXIGEN SUPPLY, SIZE AND FOOD

INTRODUCTION

EXPERIMENTAL DESIGN

RESULTS AND DISCUSSION

REFERENCES

Autoría: Acosta, C.P.; Blanco, J.

Título: Clearance rate of *Pecten maximus*. III: Inter-individual variability

Evento: 14th International Pectinid Workshop

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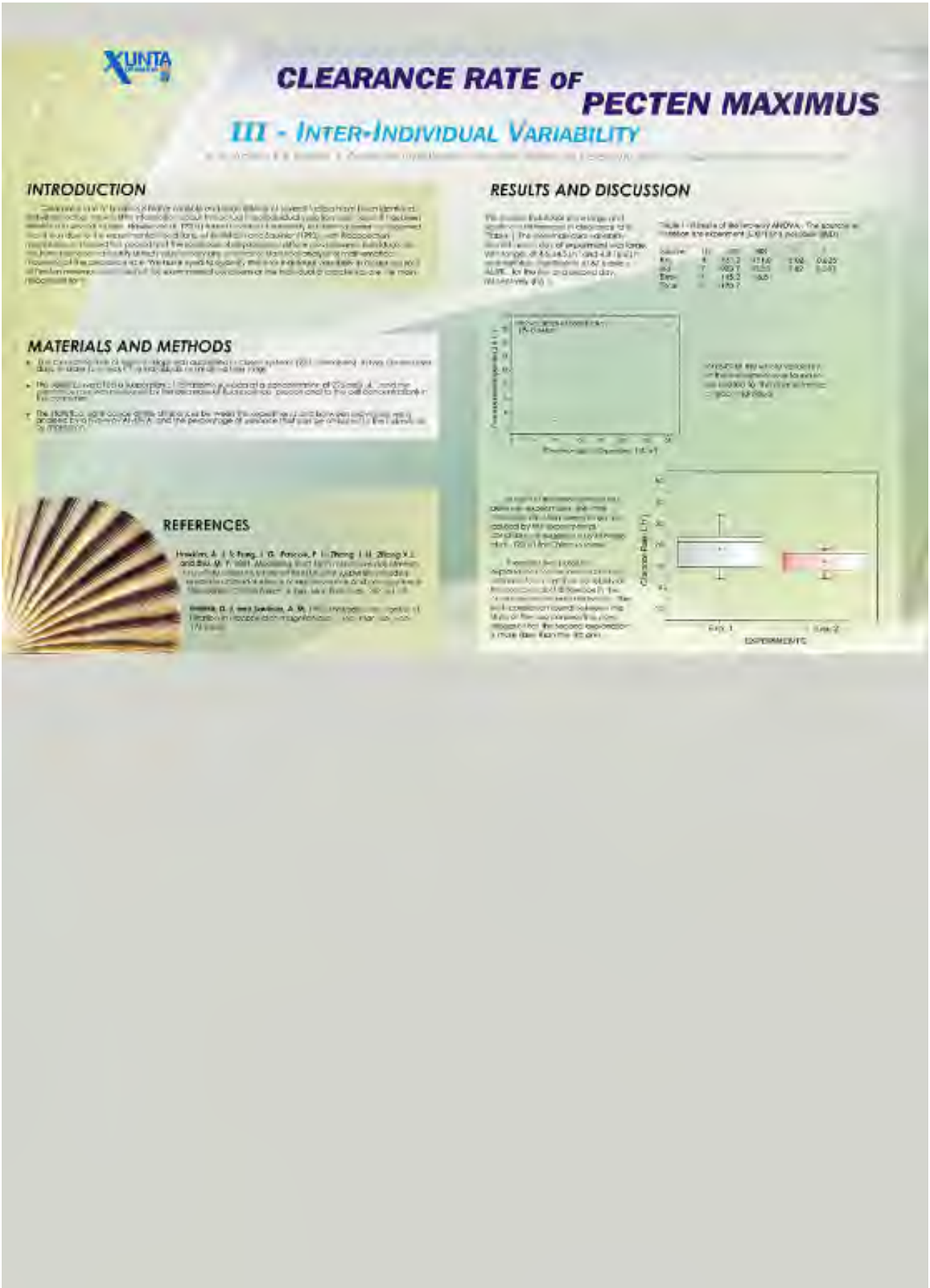
CLEARANCE RATE OF PECTEN MAXIMUS
III - INTER-INDIVIDUAL VARIABILITY
INTRODUCTION
MATERIALS AND METHODS
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RESULTS AND DISCUSSION
EXPERIMENTS

Autoría: Acosta, C.P.; Blanco, J.

Título: Clearance rate of *Pecten maximus*. II: Optimal food concentration

Evento: 14th International Pectinid Workshop

Lugar: Florida (EE. UU.)

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CLEARANCE RATE OF *PECTEN MAXIMUS*

II - OPTIMAL FOOD CONCENTRATION

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INTRODUCTION

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MATERIAL AND METHODS

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RESULTS AND DISCUSSION

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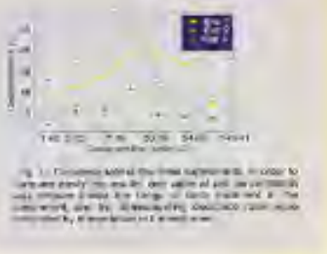

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REFERENCES

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Título: Clearance rate of *Pecten maximus*. I: Effect of flow and food concentration

Evento: 14th International Pectinid Workshop

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CLEARANCE RATE OF *PECTEN MAXIMUS*

1 - EFFECT OF FLOW AND FOOD CONCENTRATION

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INTRODUCTION

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EXPERIMENTAL DESIGN

	Flow	Food
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RESULTS AND DISCUSSION

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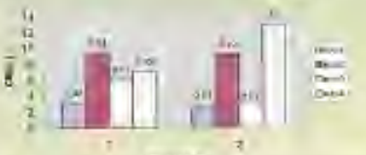

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REFERENCES

[redacted]

Autoría: Acosta, C.P.; Blanco, J.

Título: Clearance rate of *Pecten maximus*. IV: Effect of the acclimatacion and food concentration

Evento: 14th International Pectinid Workshop

Lugar: Florida (EE. UU.)

Ano: 2003

CLEARANCE RATE OF *PECTEN MAXIMUS*

IV - EFFECT OF THE ACCLIMATION AND FOOD CONCENTRATION

INTRODUCTION

EXPERIMENTAL DESIGN

RESULTS AND DISCUSSION

REFERENCES

Autoría: Cerviño, A.; García, A.; de Coo, A.; Bao, M.; Domínguez, M.

Título: Mejoras tecnológicas en el preengorde de moluscos bivalvos. Aplicaciones en el cultivo en batea en las rías bajas gallegas. Galicia. España

Evento: IX Congreso Nacional de Acuicultura

Lugar: Cádiz - Andalucía (España)

Ano: 2003

Mejoras tecnológicas en el preengorde de moluscos bivalvos. Aplicaciones en el cultivo en batea en las rías bajas gallegas. Galicia. España.

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INTRODUCCIÓN

RESULTADOS

MATERIAL y METODOS

CONCLUSIONES

1.- EL SISTEMA DE FLUJO FORZADO

2.- EL SISTEMA DE BOLSAS

3.- EL RENDIMIENTO DE ENERGÍA EÓLICA

4.- BAJOS COSTES DE PRODUCCIÓN

5.- APROVECHAMIENTO ENERGÉTICO

6.- POSIBILIDADES DE PREENGORDE EN BATEA, CON FLUJO FORZADO

Este trabajo se ha desarrollado dentro del proyecto I+D financiado por PEIDT-GIMA

Autoría: de Coo, A.; Cerviño, A.; García, A; Bao, M.; Domínguez, M.

Título: Tasa de crecimiento, formación de colas y mortalidad en el preengorde la ostra plana *Ostrea edulis* (Linné, 1758) en batea en las rías bajas de Galicia. Su relación con las densidades de cultivo y las operaciones de manejo

Evento: IX Congreso Nacional de Acuicultura

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Ano: 2003

Tasa de crecimiento, formación de colas y mortalidad en el preengorde la ostra plana Ostrea edulis (Linné, 1758) en batea en las rías bajas de Galicia. Su relación con las densidades de cultivo y las operaciones de manejo.

De Coo Martín A.; Cerviño Eiroa A. García Fernández, A; Bao Iglesias, M [1], Domínguez , M[1]

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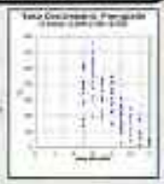
INTRODUCCIÓN

La fase de preengorde es la que más problemática del cultivo de ostra plana en los bateas de las rías bajas de Galicia. Los extractores optan por comprar directamente ostra semicomercial o semilla de gran tamaño, dados los bajos crecimientos, formación continua de colas y altas mortalidades que se presentan en esta fase. Estos malos resultados están reflejados por una extensa bibliografía donde muchos ensayos registran altas mortalidades y presencia de numerosos individuos que no experimentan crecimiento. En diversos trabajos se ha establecido la importancia de la densidad en obtener buenos resultados en esta fase del cultivo. Dado que el parámetro determinante de la capacidad de carga de un cultivo específico por unidad de volumen de agua marina (en unas condiciones oceanográficas y productivas determinadas) es la tasa de crecimiento que puede tener una especie a una edad y talla concretas, el presente trabajo intenta conocer esta tasa en la fase de preengorde de la ostra plana en las condiciones de las rías bajas gallegas y establecer las relaciones entre esta tasa y las técnicas de manejo empleadas.

RESULTADOS



MATERIAL y MÉTODOS

Durante los años 2.000, 2.001 y 2.002 se realizaron ensayos de preengorde de semilla de ostra plana en una batea situada en el polígono de O Grove/Aldán, en las proximidades de la Illa de Arousa. Se llevaron a cabo un total de 12 ensayos de diferente complejidad y duración con 13 partidas distintas de semilla de ostra plana de criadero industrial, con un peso fresco comprendido entre 2,2 y 1.710,0 mg, sembradas a 1,5 millones de tasa de crecimiento y mortalidad. Las condiciones de estos ensayos se detallan en la comunicación también presentada en este IX Congreso Cerviño et al.(b).

La estimación de tasas de crecimiento ocurrió en los ensayos realizados, en todos estos ensayos, partidas a baja densidad y, en cuatro de ellos, sistema de flujo forzado de agua marina, de forma que se suministrará alimento suficiente a la semilla de ostra. Cada determinación se realizó sobre submuestras aleatorias de la población total (n=100 individuos).

Se estimó el Peso Medio Individual medio inicial (PMi) y final (PMf) para cada submuestra y se obtuvieron las curvas de regresión talla/peso y el porcentaje de mortalidad producida.

Las tasas de crecimiento se calcularon en base a la expresión: $Dm=(Ln(PMf)-Ln(PMi))/t^{a}$ de días (SEIDERER, 1971). En varios ensayos se estableció la distribución de tallas de la población analizada antes y después del periodo de cultivo en una submuestra aleatoria (n=100), estableciéndose la tasa de su crecimiento por diferencia con la frecuencia de nuevos de clase del cultivo de baja densidad.

Las fechas de cosecha se calcularon como porcentaje de entre fresco en peso húmedo total, después de 2 meses de secado a 60ºC en estufa de 2mm.

La mayoría de los ensayos se han realizado por duplicado o fin de conocer la variabilidad inherente a una única unidad de cultivo.

Además se registró en continuo la Temperatura y Salinidad en la zona de ensayos.

CONCLUSIONES

1.- TASAS DE CRECIMIENTO ELEVADAS

Que explican gran parte de las continuas problemas registrados en el preengorde del mejillón y que facilitan otras enfermedades alimenticias y una técnica de cultivo económica, sobre todo en zonas pequeñas y temporalmente expuestas a épocas elevadas.

2.- DENSIDAD INICIAL : FACTOR BÁSICO

Trabajar a una densidad inicial adecuada a cada talla y zona, evitando así los fallos de la zona y fijando el preengorde, resulta dentro mucho del éxito en el manejo de la ostra plana.

3.- CONTROL OPERACIONES MANEJO

Las operaciones de desdoble, limpieza y manejo en zona deben ser adaptadas a la talla inicial y zona de las características concretas. Trabajando con tallas pequeñas los periodos de desdoble se deben realizar en periodos cortos de tiempo.

4.-IMPLICACIÓN DE FORMACIÓN DE COLAS

Los parámetros de crecimiento relativos de cada ensayo y densidades iniciales correspondientes, impone un retraso importante en el cultivo y puede representar pérdidas económicas por mortalidad. La aplicación de densidad inicial y tasas de crecimiento dentro son marcadas por un preengorde con densidades y manejo adecuados.

5.- TEMPERATURAS LÍMITE

En varios de los investigación específicos para calcular la densidad inicial adecuada para evitar la mortalidad de la ostra en el cultivo en épocas en que la T° igual o superior a 20ºC. Los resultados del estudio indican que la mortalidad es mayor a la temperatura de aguas marinas.

6.- FLUJO FORZADO

Dado un elevado flujo de circulación y la mortalidad disminuye en el cultivo natural, parece evidente la necesidad de aplicar sistemas de flujo forzado en aguas marinas durante que puedan permitir una mejor productividad y mejor control del cultivo en el preengorde.

Este trabajo se ha desarrollado dentro del proyecto I+D financiado por PGIDIT-CIMA

Autoría: García, A.; Cerviño, A.; de Coo, A.; Bao, M.; Domínguez, M.

Título: Tasa de crecimiento y mortalidad en el preengorde de la almeja fina, *Ruditapes decussatus* (Linné, 1758), la almeja babosa, *Venerupis pullastra* (Montagu, 1803) y la almeja japonesa, *Ruditapes philippinarum* (Adams & Reeve, 1850), en batea en las Rías Bajas de Galicia. Su relación con las densidades de cultivo y la operaciones de manejo

Evento: IX Congreso Nacional de Acuicultura

Lugar: Cádiz - Andalucía (España)

Ano: 2003

Tasa de crecimiento y mortalidad en el preengorde de la almeja fina, Ruditapes decussatus (Linné, 1758), la almeja babosa, Venerupis pullastra (Montagu, 1803) y la almeja japonesa, Ruditapes philippinarum (Adams & Reeve,1850), en batea en las Rías Bajas de Galicia. Su relación con las densidades de cultivo y las operaciones de manejo.

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INTRODUCCIÓN

El cultivo de almejas constituye un negocio de futuro en muchas zonas del mundo. De acuerdo con las estadísticas de la FAO (1999) la producción de este subgrupo alcanza los 2.744.848 TM por un valor de 3.359 millones de euros, con un crecimiento medio interanual, los últimos 5 años, del 9,5 % en peso y 7,5% en valor. Así mismo, las Rías Bajas presentan unas condiciones climáticas y oceanográficas muy adecuadas para desarrollar el cultivo masivo de estas especies. Sin embargo, estas posibilidades real es no se han desarrollado fundamentalmente por la escasez de semilla de estas especies de moluscos bivalvos de talla de engorde adecuado (10-15mm). Para obtenerla es necesario disponer de instalaciones de preengorde baratas y adaptadas a las condiciones geográficas de las Rías Bajas de Galicia. El presente trabajo intenta conocer las posibilidades que presentan las bateas de mejillones y otra para desarrollar esta fase del cultivo comercial de estas tres especies.

RESULTADOS

MATERIAL y METODOS

CONCLUSIONES

1.-CONPORTAMIENTO DIFERENCIADO

Las tres especies de almeja presentan una tasa de crecimiento diferente y en épocas distintas, y todo ello implica una programación específica de la densidad inicial y las operaciones de manejo.

2.- DENSIDAD INICIAL

La densidad inicial adecuada a cada especie, talla y condiciones ambientales concretas evitará retrasos y pérdidas en el preengorde. Da especial importancia en la especie de mayor GNS: R. philippinarum.

3.- REPRODUCCIÓN

El estudio comparado de los ciclos sexuales de reproducción y la densidad poblacional que supone el cultivo de puesta, es necesario tenerlo en cuenta en las épocas de preengorde y la elección de épocas de siembra.

4.-DEFORMIDADES CONCHA

Datos propios no publicados indican que el nivel de las deformidades en concha es proporcional a las densidades de cultivo, en la cual acumulan con un tallo oval de deformidad especialmente en la especie japonesa con el consiguiente

5.- FORMACIÓN BISO

El biso es un buen indicador de la marcha del cultivo, pues su formación depende de la formación de pequeños conjuntos de filamentos individuales preagrupados, y se diferencian del tipo cultivado tanto en la cantidad como en la calidad de los filamentos que lo forman.

6.- FLUJO FORZADO

Por las facilidades de programación especificas que presenta este sistema parece muy adecuado para su aplicación en operaciones de preengorde hasta tamaños de 5-7 mm.

Este trabajo se ha desarrollado dentro del proyecto I+D financiado por PGIDT-01MA

Autoría: Carballal, M.J.; Villalba, A.; Iglesias, D.

Título: Virus-like particles associated with large foci of heavy hemocytic infiltration in cockles *Cerastoderma edule* from Galicia (NW Spain)

Evento: 11th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: St. Julian's Bay (Malta)

Ano: 2003

Virus-like particles associated with large foci of heavy hemocytic infiltration in cockles *Cerastoderma edule* from Galicia (NW Spain)

María Jesús Carballal, Antonio Villalba, David Iglesias

Centro de Investigacións Mariñas, Vilanova de Arousa, Spain

Introduction

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Material and methods

[illegible]

[illegible]

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[illegible]

Results and discussion

[illegible]

[illegible]

Autoría: da Costa, F.; Martínez, D.; Nóvoa, S.; Ojea, J.; Darriba, S.; Guerra, A.

Título: Cultivo de 3 especies de Solénidos de interés comercial en Galicia

Evento: VI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2003

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
Dirección Xeral de Recursos Mariños

Cultivo de 3 especies de Solénidos de interés comercial en Galicia

CIMA

da Costa, F; Martínez, D; Nóvoa, S; Ojea, J; Darriba, S. & Guerra, A.

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Introducción.

Ensis arcuatus (Jeffereys, 1865), *Ensis siliqua* (Linneo, 1758) y *Solen marginatus* (Pennant, 1777) son bivalvos pertenecientes a la Familia Solenidae. Presentan valvas alargadas e iguales, abiertas en la parte anterior y posterior, con ligamento externo y viven enterrados en la arena en el intermareal e infralitoral.
Estos moluscos son de gran interés económico en Galicia y algunos bancos naturales están en regresión. Para responder a estas dos demandas se ha intentado optimizar las metodologías de cultivo en criadero y su posterior trasvase al medio natural.

Material y Métodos.

Las muestras se recogieron en bancos naturales y se transportaron al Centro de Cultivos Marinos de Ribadeo-CIMA (Xunta de Galicia) donde se estabularon en tanques rectangulares de fibra de vidrio de 200 litros. El acondicionamiento de cada especie se realizó en 2 tanques con una capa de arena y una temperatura del agua de 16º±1 C y una dieta mixta de microalgas (Fig. 1.1). Se obtuvieron puestas que se cultivaron en tanques troncocónicos de 150 litros a 20º±1 C con aireación (Fig. 1.2). Se utilizó una dieta compuesta por *Tetraselmis suecica*, *Isochrysis galbana*, *Pavlova lutheri* y *Chaetoceros calcitrans* en proporción (1:1:1:1) con una ración inicial de 40.000 células/ml incrementándose paulatinamente a medida que avanza el cultivo. Tras la metamorfosis se ponen a fijar en cilindros (150 micras de malla) con una fina capa de arena colocados en tanques troncocónicos con un sistema de air-lift (Fig. 1.4). Al alcanzar una talla aproximada de 10 mm se pasan a tanques en circuito semiabierto hasta que alcanzan una talla de unos 20 mm para su siembra en el medio natural. Al trasladarse al medio natural se disponen en unas jaulas cúbicas con una malla resistente enterradas en el sustrato del intermareal bajo e inframareal para seguir su crecimiento (Fig. 1.6).

Resultados.

En este trabajo se muestran los resultados de las primeras experiencias de cultivo larvario en las 3 especies. En la figura 2. se muestran fotografías de las distintas fases de desarrollo en las 3 especies estudiadas. La fase larvaria dura en *E. arcuatus* aproximadamente 20 días y en *E. siliqua* 16 días, mientras que en *S. marginatus* la vida larvaria es de tan solo 9 días, siendo las tasas de crecimiento diario para las 3 especies 13; 16 y 23 micras/día respectivamente (Fig. 3).

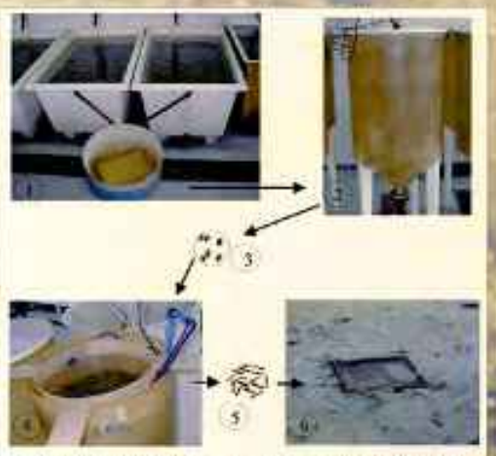


Figura 1. Sistema de cultivo anfibio. 1.-Tanque de acondicionamiento, 2.-Cultivo larvario, 3.-Postlarvas, 4.-Sistema de fijación, 5.-Semilla, 6.-Jaula en el medio natural.

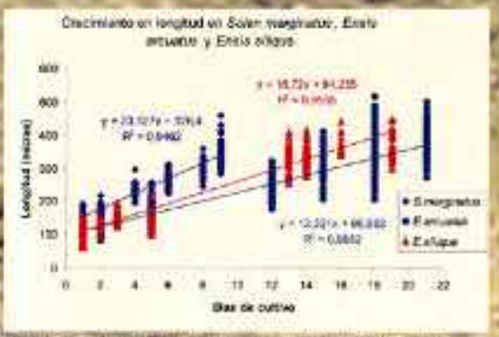


Figura 3. Crecimiento en longitud durante el desarrollo larvario en *E. arcuatus*.

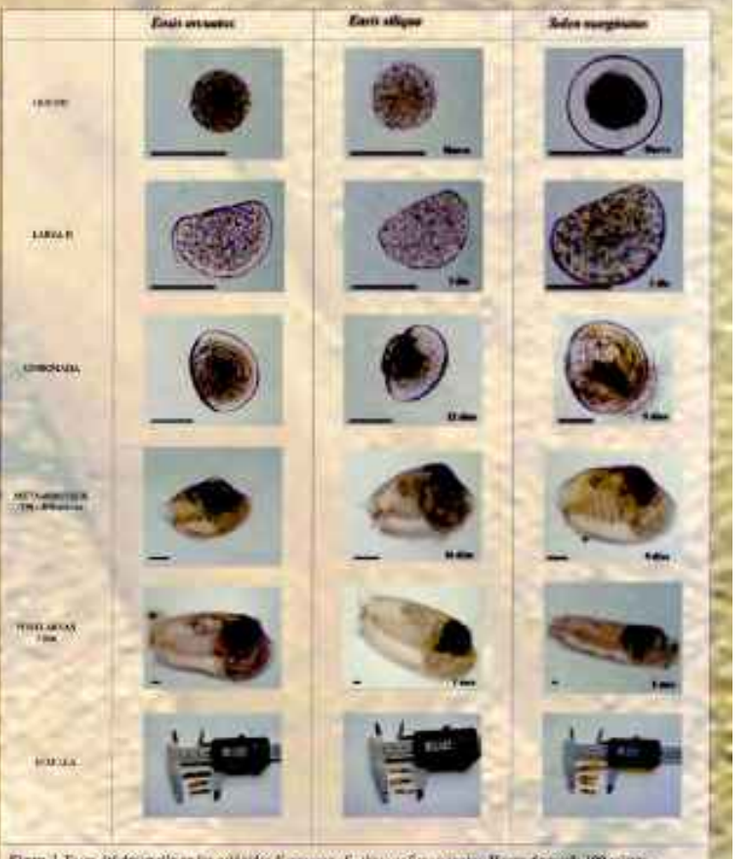


Figura 2. Fases del desarrollo en los solénidos *E. arcuatus*, *E. siliqua* y *S. marginatus*. Barras de escala 100 micras.

Conclusiones

- *Solen marginatus* presenta un ciclo larvario muy corto y su tasa de crecimiento diario es elevada.
- *Ensis arcuatus* y *E. siliqua* muestran una duración del ciclo larvario y tasas de crecimiento similares.

Agradecimientos: Este estudio está financiado a través de un proyecto JACUMAR del Plan Nacional de Cultivos Marinos de Solénidos.

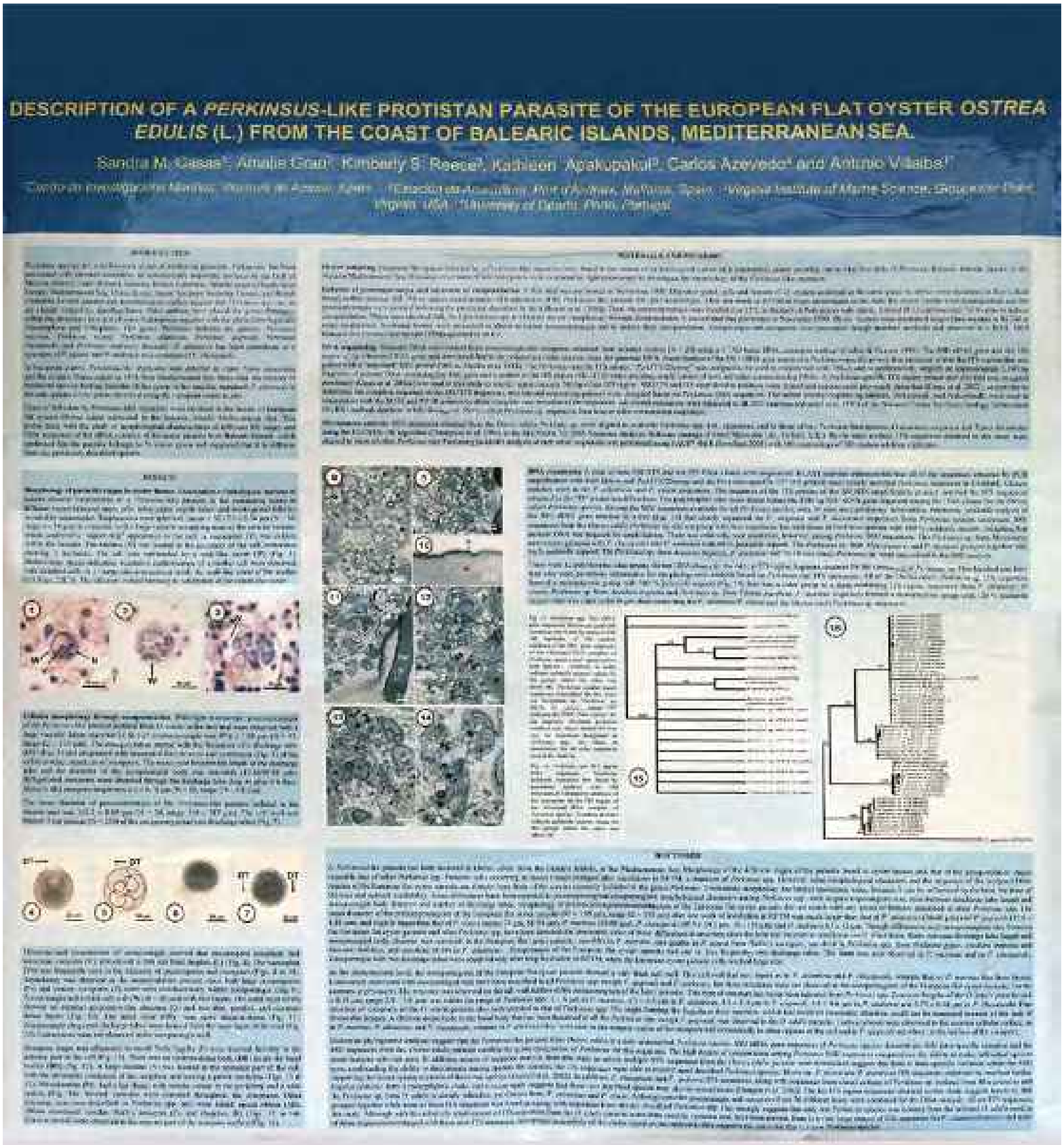
Autoría: Casas, S.M.; Grau, A.; Reece, K.S.; Apakupakul, K.; Azevedo, C.; Villalba, A

Título: Description of a *Perkinsus*-like protistan parasite of the European flat oyster *Ostrea edulis* (L.) from the coast of Balearic Islands, Mediterranean sea

Evento: 11th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: St. Julian's Bay (Malta)

Ano: 2003


DESCRIPTION OF A PERKINSUS-LIKE PROTISTAN PARASITE OF THE EUROPEAN FLAT OYSTER OSTREA EDULIS (L.) FROM THE COAST OF BALEARIC ISLANDS, MEDITERRANEAN SEA.

Autoría: Mirella, P.; Villalba, A.

Título: Comparison of histological techniques for the diagnosis of the infection of the European flat oyster *Ostrea edulis* by the protozoan *Bonamia ostreae*

Evento: 11th International Conference of the European Association of Fish Pathologists

Lugar: Malta

Ano: 2003

COMPARISON OF HISTOLOGICAL TECHNIQUES FOR THE DIAGNOSIS OF THE INFECTION OF THE EUROPEAN FLAT OYSTER *Ostrea edulis* BY THE PROTOZOAN *Bonamia ostreae*.

P. Mirella da Silva and Antonio Villalba

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INTRODUCTION

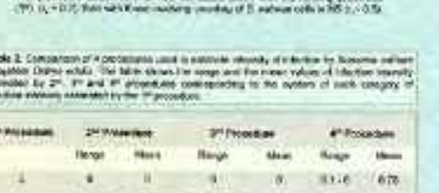
The disease caused by the protozoan parasite *Bonamia ostreae* Pichot et al., 1980 is responsible of mass mortalities of the European flat oyster *Ostrea edulis* throughout the Atlantic coast of various European countries from Spain to Ireland (Tige et al., 1982; Hudson and Hill, 1987; Van Banning and Lynne, 1992; Culley and Mullaney, 2000). The parasite also affects *O. edulis* populations of Atlantic and Pacific coasts of USA (Elston et al., 1986; Friedman et al., 1994; Friedman and Perkins, 1994). Elston et al. (1987) hypothesized that this disease was introduced into Europe by transferring oysters infected by *B. ostreae* from California (EGAS) to France.

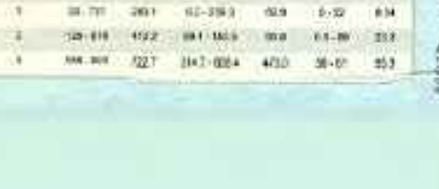
The parasite invades the host hemocytes, which are the effector cells of the host immune system. Haemocytes not killing the parasite, the latter begins to divide, first forming "pansporocytes" regularly and evolving a "plasmodium"-like stage (Carnegie et al., 1997; Chagot et al., 1992; Montes et al., 1992; Montes et al., 1994). Bonamiosis, because of its high pathogenicity and wide geographic range, *Bonamia ostreae* deserves a special attention in the European union legislation (EEC, 1993) as well as for the "Office international des Epizooties" (OIE, 1997), in order to avoid its spreading to disease free areas.

Reliable and sensitive methods for detection of the parasite are essential to prevent the introduction of the parasite in disease free areas and for management and research purposes. Traditionally diagnosis have been done on histological techniques in addition to sensitivity, accurate observations of infection intensity are required in epizootiological and other host studies.

The aim of this study was to compare different histological techniques for detection of *Bonamia ostreae*, by evaluating their sensitivity and discussing their suitability for different purposes. Specifically, the comparisons included examination of (1) histological sections, (2) tissue imprints from various organs, and (3) haemocytes cell monolayers, prepared through various protocols. Four procedures to estimate infection intensity based on histological sections were also compared.

MATERIALS AND METHODS





RESULTS

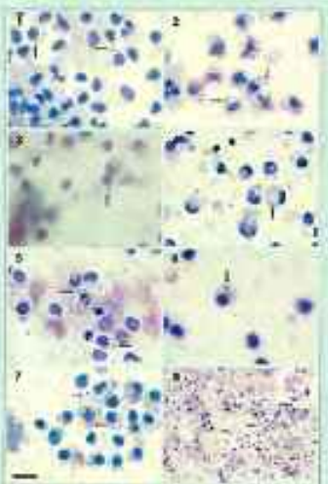


Fig. 1-8. Histological tissue layers used for detection of *Bonamia ostreae* in *Ostrea edulis*. Arrows: (1) *Bonamia* cells. (Bar = 10 µm). Fig. 1. Haemocytes cell monolayer prepared by capture technique. Fig. 2. Haemocytes cell monolayer prepared by cell adhesion stained with Hemacolor. Fig. 3 Haemocytes cell monolayer prepared by cell adhesion stained with Schiff's reagent. Fig. 4. Ventricular heart imprint. Fig. 5 Intestinal imprint. Fig. 6 Gonad imprint. Fig. 7 Digestive gland imprint. Fig. 8 Histological section showing intracellular forms (infection of infected haemocytes (H+E).

DISCUSSION

REFERENCES

Bushek D., Ford S.E., Burt I., 1994. Journal of Shellfish Research 13: 571-583.

Carnegie R.B., Barber B.J., Culloty S.O., Figueras A.J., Distel D.L., 2000. Diseases of Aquatic Organisms 40: 167-175.

Chagot D., Grizel H., Glemarec M., Tigé G., 1992. Aquaculture 107: 1-18.

Culloty S.O., Mulcahy M.F., 2001. Aquaculture 192: 1-7.

Elston R.A., Farley C.A., Kent G., 1986. Diseases of Aquatic Organisms 2: 49-54.

Elston R.A., Hasegawa H., Humphrey K.L., Polyak I.K., Häse C.C., 2008. Diseases of Aquatic Organisms 82: 119-134.

Friedman C.S., Perkins F.O., 1994. Journal of Invertebrate Pathology 63: 165-174.

Friedman C.S., Robinson T., Gulli J.M., Hollibaugh J.T., Vacelet J., Bower S.M., 1994. Journal of Invertebrate Pathology 64: 109-119.

Hudson J., Lynch S., 1996. Bulletin of the European Association of Fish Pathologists 16: 144-146.

Montes J., Arzelus M., Navarro E., 1994. Journal of Invertebrate Pathology 63: 1-6.

Montes J., Durio S., Knapp C., Merino C., Sanchez C., Muñoz C., Outeiro A., 1992. Aquaculture 107: 249-260.

Pichot Y., Comps M., Tige G., Grizel H., Raguenes G., 1980. Revue des Travaux de l'Institut des Pêches Maritimes 44: 131-140.

Tige G., Grizel H., Robert M.F., Comps M., Joly J., Langlade A., 1977. Revue des Travaux de l'Institut des Pêches Maritimes 41: 71-81.

Van Banning P., 1991. Aquaculture 93: 265-277.

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Autoría: Conchas, R.F.; Montes, J.; López, C.; Darriba, S.; Iglesias, D.

Título: Bucephalidae Trematode affecting razor clam *Ensis arcuatus* from the coast of Galicia (NW Spain)

Evento: IX European Multicolloquium of Parasitology

Lugar: Valencia - Valencia (España)

Ano: 2004

BUCEPHALIDAE TREMATODE AFFECTING RAZOR CLAM, *ENSIS ARCUATUS*, FROM THE COAST OF GALICIA (NW SPAIN).

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INTRODUCTION.

Razor-clam, *Ensis arcuatus* (Jeffreys, 1865), is a relatively important shellfish resource in Galicia (NW Spain). Total landings in 2001 were 123 tons valued at 1.4 million €. The increase in the extractions of this resource makes necessary the development of management strategies. Some aspects about the biology -growth, reproductive cycle- and biochemical composition and pathology of this specie have been studied in previous works (Darriba, 2004; Conchas *et al.*, 2001, 2003). Reports based in the analysis of histological sections confirmed the presence of different parasites mainly gregarines, coccidians and trematodes.

The most pathogenic parasites reported were trematode sporocysts (Lauckner, 1983) developed in the gonad of the razor-clam. These sporocysts castrate most of the hosts and were observed in different natural seabeds along the galician coast since 1998 to 2003, with prevalences that ranged from 3.3 to 6.6 %.

The present work reports the first record of the solenacea *Ensis arcuatus* as host of a bucephalid trematode in Galicia. Provides light microscopical observations of sporocysts and cercariae enclosed within them, and some surface topography characteristics of cercariae are described using scanning electron microscopy (SEM). Additionally, the systematic position of this parasite is discussed.

MATERIAL AND METHODS.

Razor-clams of commercial size (>100 mm) were collected from the subtidal bed of Cies Isles (Galicia, NW Spain) by commercial divers and carried to the lab in refrigerated conditions. Razor-clams were dissected under binocular microscope and sporocysts and cercariae enclosed within them were isolated. Living cercariae were analysed by light microscopy and some of them were processed for SEM in order to describe their surface ultrastructure characteristics. Cross-sections of host tissues were also processed using histological techniques.

RESULTS AND DISCUSSION.

A yellow to pale orange mass of dichotomously branched sporocysts of a bucephalid trematode were detecting affecting the gonad of some razor-clams, causing in some cases complete castration of the host. Inside dilated chambers of these sporocysts there were cercariae in different stages of development. Adult cercarial stage had the typical morphology of Gasterostomata (Fig. 1) a ventral mouth (Fig. 2 A, B) leading directly into the pharynx, two long contractile furcae resembling horns attached to a tail stem (80.5 ± 13.6 µm (mean ± standard deviation, n=10) long, 28.3 ± 5.3 µm wide), and an anterior thynchus (Fig. 1, 2 A) independent of the digestive system. The body when relaxed was slightly pear shaped with the anterior end being the narrowest. The main measures were 276.5 ± 20.4 µm long and 56.0 ± 9.1 µm wide.

Histology sections confirms that the gonad is the primary target of infection and sporocyst proliferation. As infection intensified, sporocysts branched, apparently using only connective passages, and emerged from the gonads into other body regions, such digestive gland and gills. In such advanced infections, gonadal tissues were often completely destroyed, causing castration of the host. Cercariae in a wide range of developmental stages, were commonly observed within sporocyst branch lumina. Depending of the angle of the section, cercariae could occasionally be seen with the typical bucephalid features (Fig. 3).

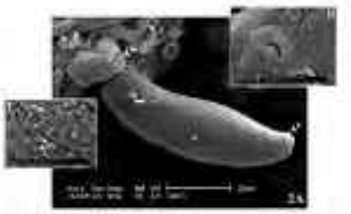

Fig. 1: *In vivo* bucephalid cercaria showing the most important body features.
Fig. 2: A. SEM photomicrography of bucephalid cercaria. B. Details of the mouth at SEM. C. Surface topography detail at SEM.
Fig. 3: Histological section of razor-clam gonad tissue showing bucephalid sporocysts containing cercariae in different degrees of development.
Legend: f, Furcae; **grt,** gonadal connective tissue (*); **m,** mouth; **r,** thynchus; **rs,** row of scales; **s,** spine; **sw,** sporocyst wall; **ts,** tail stem.

The determination of the systematic position of this trematodes is really difficult, and we can only conclude that belong to the family Bucephalidae. In general, bucephalid cercariae do not even show any of the features which are used to distinguish genera. The "excretory formula" (i.e., the number and arrangement of flame cells) - generally accepted as an important key in trematode classification - is not very useful with Bucephalidae because there are no agreement between accepted generic features and the excretory system. Hence, the assignment of a given cercaria to a known adult worm is not possible until the life cycle has been worked out by means of experimental infestation (Stunkard, 1974).

Labratrema minimus (Bucephalidae) sporocysts and cercariae were reported affecting cockles *Cerastoderma edule* in different intertidal beds along the coast of Galicia (Iglesias *et al.*, 2003). Taking into account the fact that bucephalids are markedly specific with respect to the choice of their intermediate hosts (Lauckner, 1983) it is not probably that the cercariae affecting *Ensis arcuatus* was the same specie.

REFERENCES

Conchas, R.F., Alonso, B. & Montes, J. (2001). Patología y mortalidad en la coquina (*Donax trunculus* (Navaja) y *E. siliqua* (Longueirón) en Galicia. Proceedings of the IX Congreso Nacional de Acuicultura.

Conchas, R.F., Darriba, S., Montes, J., Iglesias, D. & Lodeiros, C. (2003). Descripción de un nuevo parásito gregarino en Navaja (*Ensis arcuatus*, L.) y Longueirón (*E. siliqua* L.) de Galicia. Proceedings of the VII Congreso Ibérico de Parasitología.

Darriba, S. (2004). Biología de la navaja (*Ensis arcuatus* Jeffreys, 1865) de la Ría de Vigo (NW de España). Crecimiento y reproducción. Tesis Doctoral. Universidade de Vigo. 238 pp.

Iglesias, D., Carballal, M.J. & Villalba, A. (2003). Digenean parasites of the cockle *Cerastoderma edule* populations from Galicia (NW Spain) intertidal beds. Proceedings of the 11th International Conference of the European Association of Fish Pathologists.

Lauckner, G. (1983). Diseases of Mollusca: Bivalvia. In: Diseases of Marine Animals. Vol. II. O. Kinne (Ed.). Biologische Anstalt Helgoland, Hamburg, 477-961.

Stunkard, H.W. (1954). The life cycle of the bucephalid trematode, *Prosorhynchus crucibulum* (Rud.). Biological Bulletin of the Marine Biological Laboratory, Woods Hole, Massachusetts, 107: 418-440.

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Autoría: Blanco, J.; García, A.; Vázquez, M.C.; Mariño ,M.C.; Gómez, M.J.; Cano, J.; Campos, M.J.

Título: Kinetics and anatomical distribution of Paralytic Shellfish Poisoning (PSP) toxins in the king scallop *Pecten maximus*

Evento: 5th International Conference on Molluscan Shellfish Safety

Lugar: Galway (Irlanda)

Ano: 2004

Kinetics and anatomical distribution of Paralytic Shellfish Poisoning (PSP) toxins in the king scallop *Pecten maximus*

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1.- Abstract

The toxin kinetics of the anatomical depuration of scallops (*Pecten maximus*) during an episode of hardcore Shellfish Poisoning (PSP) was studied. Toxins in the part of the scallops were mainly ranked as digestive gland, followed by gills + mantle, gonad and kidneys. adductor muscle and finally foot. The relative contribution of digestive gland to the total toxin content was substantially smaller at the beginning and the end of the episode, indicating a fast toxin incorporation by and a fast elimination. Several mathematical models of the toxin kinetics were fitted to the obtained data and used to estimate the transfers between organs and to explore the ways of toxin elimination. From the models it seems likely that kidneys play an important role in PSP toxins depuration from the scallops, having a large depuration rate and receiving toxins from other body fractions. Digestive gland depurates toxins at a lower rate than kidneys but the high toxin content make this organ the main responsible for depuration. The importance of this organ for depuration of PSP toxins may well have been overestimated because a substantial part of its toxin loss can be attributed to the transfer to other body fractions and not to a real depuration. The role of gonad during spawning produced an important decrease in the toxin contents of the gonad, indicating, as well as other aspects of evolution of the toxin content, that toxins are transported to gametes during gametogenesis. Stating the maximum of toxin concentration in a random manner a fluctuation was observed. Digestive gland seem to have not been able to efficiently retain the toxins, which were directly derived to other organs (mainly kidney and gills + mantle).

2.- Methods

Dive (50 m) → Water sampler/water → extraction → Acid Hydrolysis → HPLC-FD

12 scallops/week → 3 scallop groups → Dissection (digestive gland-adductor muscle-kidneys, gills+mantle, foot, gonad) → Extraction → Acid Hydrolysis → HPLC-FD analysis (Oshima 1995, Franco and Fernández-Vila 1993) → modeling

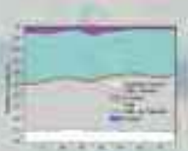
3.- Results

3.1.- Observations

PSP toxin contents in scallop

Weight of the scallop body fractions during the sampling period. Spawning can be inferred from the gonadal weight decrease after day 24th

PSP toxins accumulated in the different body fractions. Digestive gland incorporate toxins quickly but eliminate them also quickly. Kidneys maintain toxin because of its small

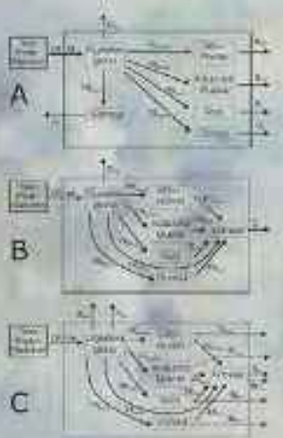


Relative contribution of the body fraction to total weight. The importance of gonad decreased throughout most of the sampling period but that of gills + mantle increased

Relative contribution of the body fractions to the total PSP toxin contents of the scallops. There were large changes in contributions that took place in a short period of time

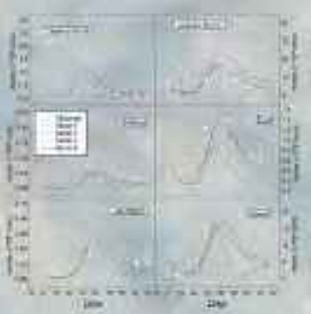
PSP toxin concentration in the scallop body fraction. Digestive gland and kidneys had similar concentrations most of the sampled period but that of digestive gland decreased substantially later at the end of the episode. Gonad showed an important increase during gametogenesis

3.2.- Models



Models fitted to the data of PSP toxin content of the body fractions. A, B, and C corresponds to models 1, 2 and 4, respectively. Model 3 differs from model 4 in by-passing the dual tissues with stomach of all fractions but gonad

3.3.- Fits



Fit of the five studied models to the data. Models 1 and 2 gave very similar results. Model 3 fits the samples with high toxin content better than models 4. Some mismatch is observed in model 5 related specially in digestive gland, kidney and gills + mantle, with inverse deviations in the first and the two other fractions.

4.- Conclusions

-Ingested PSP toxins are certainly incorporated to digestive gland, but some unobserved factor seem to go to other organs (gills + mantle, kidney) during the early phases of the episode.

-Depuration seems to take place from digestive gland basically.

-Very likely kidneys receive toxins from other organs and eliminate them at a higher rate than any other organ. Their toxin content is high because the inputs from all fractions.

-toxins are actively transported to gonad during gametogenesis. They are very likely stored in gametes or they are excreted with them during spawning.

-Selective contribution of the different body fractions change quickly during the episode making difficult the use of selective evisceration as a reliable method to decrease PSP toxin content in the organism.

5.- References

Blanco J., Marino C., Vilanova de Arousa, Spain. Centro de Investigacions Mariñas. Vilanova de Arousa. Spain. Centro Costeiro de A Coruña. Instituto Español de Oceanografía. A Coruña. Spain. Centro Costeiro de Málaga. Instituto Español de Oceanografía. Fuengirola. Spain.

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Título: Influence of feeding with feeds having a different fat content on the growth and composition of blackspot seabream (*Pagellus bogaraveo*) juveniles

Evento: Aquaculture Europe 2004. Biotechnologies for quality

Lugar: Barcelona - Cataluña (España)

Ano: 2004

Influence of feeding with feeds having
a different fat content on the growth and composition
of Blackspot sea bream (Pagellus bogaraveo) juveniles.
CIMA
INTRODUCTION
RESULTS AND DISCUSSION
MATERIAL AND METHODS
CONCLUSIONS
REFERENCES

Autoría: Darriba, S.; Miranda, M.; da Costa, F.; Catoira, J.L.

Título: Estudios para la gestión de la explotación de solénidos

Evento: VII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2004

Estudios para la gestión de la explotación de Solénidos

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"La explotación de los recursos marinos de Galicia podrá tener objetivo la preservación de los mismos, su rentabilidad económica, el mantenimiento de la actividad pesquera y laboral derivada de su explotación, la conservación tradicional, la mecanización de la pesca artesanal y la existencia estable de sectores primero y de empleo variados" (Ley 6/93, del 11 de mayo, de Pesca de Galicia).

La *pesquería de los solénidos*, a la que se hace referencia en la Ley de Pesca, implica una gestión basada en el conjunto al ciclo reproductivo de las especies y un control de la explotación en función del estado de las poblaciones.

En el año 2004 existían aprobados en Galicia 28 Planes de Explotación de Solénidos navaja (*Ensis arcuatus*), longueirón (*Ensis siliqua*) y longueirón vello (*Solen marginatus*) (Orden del 30 de diciembre de 2003) en la cornisa cantábrica, de acuerdo con lo señalado en la figura 1.
El peculiar modo de extracción y la escasa explotación de estos moluscos justifica su inclusión en el grupo de los "recursos específicos".

Figura 1

Con el objetivo de aportar información necesaria para la gestión de la explotación de los solénidos, en este trabajo se presenta un estudio comparativo, simultáneo en el tiempo, del ciclo reproductivo de las tres especies comerciales de solénidos (navaja, longueirón y longueirón vello) en bancos con condiciones oceanográficas diferenciadas.

Navaja (*Ensis arcuatus*)

Durante 2007, periódicamente (15-30 días) se tomaron muestras de 15-20 ejemplares de cada especie en los bancos estudiados. Se pesan las valvas y se determina la ginada para la estimación del índice de condición gonadal (ICG) (peso gonada /peso sin valvas), que se emplea como indicador del estado de desarrollo gametogénico. En las figuras 2 a 6 se muestran los resultados del ICG en las especies y bancos estudiados.

Figura 2

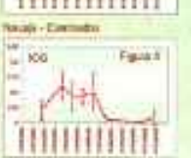
Figura 3

Longueirón (*Ensis siliqua*)

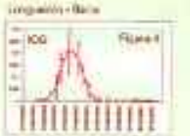
Figura 4

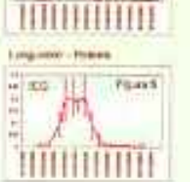
Figura 5

Longueirón vello (*Solen marginatus*)

Figura 6

- Las tres especies presentan un ciclo anual, con una época de reposo sexual del ICG que abarca el verano, el otoño y parte del invierno en longueirón (Figs. 4 y 5) longueirón vello (Fig. 6) y que se inicia al terminar el verano (en la navaja (Figs. 2 y 3).
- El mínimo presenta un pequeño rebote en el mes de diciembre en la navaja y en el mes de enero en el longueirón vello y longueirón. El objetivo es conocer la época de puesta en cada especie (duración del periodo) y la magnitud de la misma (valor máximo del ICG).
- La comparación en cada localización (con características diferentes para cada especie) la convierte en una estrategia eficaz de los recursos en función del ambiente más favorable. Por lo que, la gestión de las especies de explotación pueda ser particularizada en las distintas localidades que forman el entorno de una.
- Este conjunto de datos es una valiosa información necesaria para el establecimiento de las vedas en la explotación de los bancos de solénidos en Galicia.

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Título: Gonadal cycle of the cockle *Cerastoderma edule* of Galicia (NW Spain)

Evento: Aquaculture Europe 2004. Biotechnologies for quality

Lugar: Barcelona - Cataluña (España)

Ano: 2004

Gonadal cycle of the cockle *Cerastoderma edule* of Galicia (NW Spain)

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Introduction

The edible cockle *Cerastoderma edule* is one of the most important infaunal bivalve mollusc resources exploited in Galicia. The knowledge of the reproductive cycles of marine bivalves is essential to develop management strategies to guarantee the sustainability of fisheries. In this study the gonadal cycle of *Cerastoderma edule* from four different natural beds of the coast of Galicia was studied using histological methods. The influence of disseminated neoplasia in the gonadal development was also evaluated in one of the studied populations in which this pathological condition was more prevalent.

Material and methods

Four natural beds (Fig. 1) were considered in this study, three in the *Ría Ibaiza* (southern estuaries of the Galician coast): *Carril*, *Cunxas Muelle* and another in the *Ría Arousa* (northern estuaries): *Villabril*. Random samples of 25 cockles were taken monthly - from 1999 to 2000 in the southern populations, and from 2000 to 2001 in *Villabril*-, carried to the lab and processed using histological techniques. Histological cross-sections of cockles were examined by light microscopy for analysis of the gonad condition and diagnosed for disseminated neoplasia. Gonad development was determined using a scale with 7 different gametogenic stages: 0, *Resting stage*; 1, *Initiation of gametogenesis*; 2, *Developmental stage*; 3, *Ripe stage*; 4, *Spawning*; 4B, *Redevelopment*; and 5, *Recharging*.

Disseminated neoplasia effects were studied in Misela, where the prevalence was high. The disease was staged from 0 to 4 -higher numbers indicating more advanced disease stages (Fig. 2)- (Mix, 1983).

Results and discussion

The general pattern of gonadal cycle found in cockle populations of the 3 sampled beds of Ría Ibaiza (Fig. 3A) involved a resting stage and initiation of gametogenesis in late autumn-early winter, a rapid development of gonads from January to March and the achievement of ripeness in late March-early April. Partial spawning and redevelopment of gonads occurred during the spring and summer. A reabsorption phase took place at late summer-early autumn.

Gonadal cycle of the Galician northern seabed Villabril in 2001 (Fig. 3B) was slightly different and delayed in its time, compared to the data from the southern estuaries in 1999-2000. Beginning of gametogenesis took place in late autumn-early winter. Gametogenesis progressed slowly so most of the population was not ripe until May. Spawning began at June and continued - simultaneously with gonad redevelopment- until mid October. It seemed that there was a delay in the gametogenesis in the northern estuaries (ripeness in May) versus the southern populations (ripeness in April) but the available data correspond to different years. Therefore this should be further assessed.

Fig. 1: Map of Galicia showing the location of the sampled beds: *Carril* (1), *Cunxas* (2) and *Villabril* (3) in the *Ría Ibaiza*, and *Villabril* (4) in the *Ría Arousa*. Fig. 2: Cockle histological sections (H&E) showing high intensity levels stage 4 of the Mix scale of disseminated neoplasia (Resting Stage (2A) and male (2B) gonadal tissue.

Cockles from Misela (Fig. 4) with high intensity levels of disseminated neoplasia (4) had higher proportion of resting (20 %) and reabsorption gonad stages compared to unaffected (0) cockles (only 5% of individuals showed resting gonads). A significant association between disease intensity and gonad condition was detected (TABLE 1: χ^2=39.556; DF=24; P<0.024).

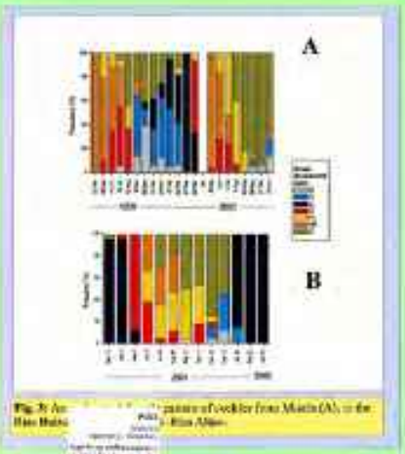

Fig. 3: Annual pattern of cockle from Misela (A), in the Ría Ibaiza and Villabril, in the Ría Arousa.

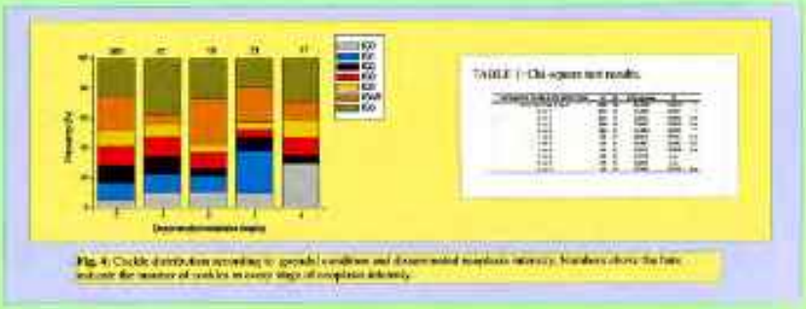

Fig. 4: Cockle distribution according to gonadal condition and disseminated neoplasia intensity. Numbers above the bars indicate the number of cockles in every stage of neoplasia intensity.

References

Mix, M.C. 1983. Bacterial neoplasm of bay mussels, *Mytilus edulis* L., from Oregon: occurrence, prevalence, seasonality and histopathological progression. Journal of Fish Diseases 6: 239-248.

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AQUACULTURE EUROPE 2004 Barcelona, Spain, October 20-23

Autoría: Blanco, J.; Mariño, C.; Martín, H.; Acosta, C.

Título: Anatomical distribution of DSP toxins in the mussel *Mytilus galloprovincialis* during the depuration proccess

Evento: Marine and Freshwater Toxins Analysis. First Joint Symposium and AOAC Task Force Meeting

Lugar: Baiona - Galicia (España)

Ano: 2005

Anatomical distribution of DSP toxins in the mussel *Mytilus galloprovincialis* during the depuration proccess.

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Abstract

The anatomical distribution of okadaic acid and DTX2 analogues in different depuration trials studied, by means of HPLC-MS, at different stages of the depuration process in the mussel *Mytilus galloprovincialis*, in order to know the anatomical origin of DSP toxins in the process and to explain the possible changes throughout depuration. Even when large changes in the toxin content of the mussels were observed, no relevant contribution to the toxin burden of any organ other than digestive gland was found at any stage of depuration. The presence of esterified forms of the toxin of the experimental trial was demonstrated and some hydrolysis seems to have taken place during the depuration, notwithstanding, these compounds were not the detected ones in non-digestive tissues.

Localization of toxins in non-visceral tissues have been reported in other species (*Nodilittorina exigua* and *Aequipecten tehuelchus*) with little health or food safety concern during the feeding process. In the species we have studied the toxin content in non-visceral tissues is very low. For the depuration trial of the mussels, very little toxins (for the detection limit of the technique).

Figure 1 - Concentration of okadaic acid (A) and DTX2 (B) during the depuration process of the mussels. Concentrations in non-visceral tissues were always below LOQ. For the detection limit of the technique.

Introduction

Main monitoring systems use mussel digestive gland to quantify DSP toxins due to its richness.

Main supposing:

- Assumed to be the main accumulator
- Justified (chemical)

But... is the digestive gland the main accumulator of the mussel tissues?

- No published evidence
- Some genetic differences between tissues (more toxin in digestive gland) (Nagai et al. (2010), 1979)
- Some supporting comments by Lassus et al. (1992) in mussels (*Mytilus edulis*, and Wohlrab et al. (2010) in the scallop *Pecten maximus*.
- A non-negligible contribution of non-visceral tissues to the total DSP burden found by Blanco et al. (2005) during depuration of the mussel *Mytilus galloprovincialis*. Soudant et al. (2007).
- An important contribution of non-visceral tissue to the total DSP burden found by Blanco et al. (2006) during experimental contamination of the mussel *Mytilus edulis*. 50% of DSP burden in non-visceral tissues.
- A more and important subtitle from other exotic toxins (pectenotoxins) among the mussel *Mytilus edulis* tissues (Jenkinson et al. 2010)

Objectives:

- Is the contribution of the non-visceral tissues of *Mytilus galloprovincialis* to the total okadaic acid and DTX2 burden neglectable?
- Does the relative contribution depend on the depuration time?
- How the distribution of the main DSP toxins is different and how is it distributed?

Methods

Samples and treatments

For okadaic acid, fourteen samples from 1 mussel of the Mytilus Partnership of the first stage of a toxic proliferation outbreak (dinoflagellate *Dinophysis acuminata*) in the mussel bags, during 15 weeks. >1 sample per week was every week.

For DTX2, fourteen samples for 1 mussel per week in the 15 weeks after the disappearance of toxic phytoplankton from the water (around 100 cells/l) in a hydrographic farm mussel bags with different temperature and food conditions for 5 days. Examples (bags) of the beginning of the season (>1) (Galicia) and the end.

Extraction and analytical techniques

10 mussels were dissected, digestive gland and remaining tissues were extracted: 2 g of tissue (mix of MeOH/Water 80:20) + sonication + Centrifugation (Quilliam 2003).

Analysis: UPLC-MS/MS: a Waters Acquity system coupled to a Waters Micromass Quattro Premier tandem mass spectrometer, chromatographic method as described in Wohlrab and Holmes (2010).

Okadaic acid and DTX2 identified and quantified in negative mode. Two ions: Specific ion (m/z = 803.5, Cone voltage, 38V; Capillary kV, 3.5kV; Collision energy, 45V; Collision exit energy, 2V; Auxiliary gas, 7V; MAF, 803.5; collision energy intermediate: 42%; Characteristic fragment masses (355, 357, 705.7)(1%; Retention time: about 10 C.

Some samples were hydrolysed to check if some hydrolysable derivatives (Yasumoto 2000; Suzuki et al., 2001; Nishimura et al., 1995; Suzuki et al., 1999; Hu et al., 1992; Hu et al., 1992) were present in the non-visceral tissues (see Method - alkaline hydrolysis (Vale and Sampayo 2002).

We acknowledge the Sampling, dissections and Phytoplankton Identification to all the Centro de Control do Medio Mariño for their collaboration of the outbreaks and Mari Jorge for their collaboration on the use of mussel bags.

Results and Discussion

The okadaic acid concentration in the digestive gland of the *Mytilus galloprovincialis* mussels under commercial depuration process. Nevertheless, in non-visceral tissues the compound was not detected in the non-visceral tissue fraction. Pectenotoxin-2 has been described that, with this technique, there is no relevant matrix effect neither in digestive gland nor in the remaining tissues. For Blanco et al. (2006) this fact could be due to the use of a more complex sample clean-up procedure (solid phase extraction) and the use of a more complex ionization conditions (ion trap mass spectrometry). On the contrary, in the present study, a simple clean-up procedure has been applied and the mass spectrometer used was a triple quadrupole.

Figure 2 - Typical chromatograms (HPLC-MS/MS) of the okadaic acid obtained as from supernatants: OA and DTX2 in digestive gland (upper panel), and OA and DTX2 in other tissues (bottom panel), corresponding to the two outbreaks studied (A and B). The presence of one of the ions could be observed in the non-visceral tissues.

No significant change was observed in the DTX2 concentration of the digestive gland of mussels in the second toxic outbreak studied after 8 days of depuration, but the loss of okadaic acid (the initial concentration was observed in tissues other than digestive gland).

Figure 3 - Typical chromatograms (HPLC-MS/MS) of the okadaic acid obtained in the upper panel, and DSP toxins in mussel tissues other digestive gland/stomach, corresponding to the two outbreaks studied (A and B). OA and DTX2 in digestive gland (center panel), and OA and DTX2 in other tissues (bottom panel). Samples corresponding to "other tissues" are the mixture constituted from tissues corresponding to the digestive samples. It seems that a very small concentration of okadaic acid and DTX2 can be observed in "other tissues" other hydrolysis test clearly below.

Fatty acid esterification and conversion of the toxins (also analysed but not shown) were present (Fig. 4). The isotopes of these ions is very likely. The process responsible for the increase on OA concentration in the mussels during the first weeks (Fig. 5A), as supported by the results of Pernice et al., 1998), is still standing, even when different processes may taking place, as for toxin concentrations of esters together with the (main) toxins were found in the non-visceral tissues, suggesting that esterification takes an important role in the toxin dynamics in the mussel tissues.

Figure 4 - Typical chromatograms (HPLC-MS/MS) of one sample of digestive gland of the second outbreak (upper panel) and hydrolysis samples of the same organ (center panel). In concentration panel, the presence of neither OA nor DTX2 of the toxins.

Other studies have found a minor contribution of non-visceral tissues to the toxin burden of the whole body of several molluscs. Pilot et al. (1993), looking at toxin depuration (after mussel *Mytilus galloprovincialis*) with a toxic dinoflagellate, show that the contribution of the non-visceral tissues to the total toxin burden was approximately 5%, which was roughly not supported in the study. There are several possible explanations for this discrepancy. The first and more simple one is that there can substantial interspecific differences in the anatomical distribution of DSP toxins. The depuration could be discarded but it seems a likely because differences such as in *Mytilus galloprovincialis* are so small that are very related, as the toxin. In most cases, even, to believe phytoplankton is very similar, with. The second possibility is that the non-visceral tissue accounts the toxins better than the digestive gland. We suppose, in the scallop *Aequipecten irradians* (Lassus et al., 2001), since its main contaminants are toxin that, in the encapsulation, one of the toxins is one, then they very slowly can not excreted/eliminated in the non-visceral tissues, and that consequently the contribution of these tissues to the total toxin burden can increase substantially with depuration time.

As a conclusion, it seems that for *Mytilus galloprovincialis*, the contribution of the non-visceral tissues to the total DSP toxins burden is, in general, negligible and that might only have some importance during toxic events/outbreaks in which the digestive gland of the mussels shows

References

Autoría: Moroño, A.; Arévalo, F.; Pazos, Y.; Muñiz, S.; Correa, J.; Salgado, C.; Maneiro, J.; Blanco, J.

Título: Estudio comparativo del perfil de toxinas en agua durante dos episodios de *Dinophysis acuminata* y *Dinophysis acuta*

Evento: Marine and Freshwater Toxins Analysis. First Joint Symposium and AOAC Task Force Meeting

Lugar: Baiona - Galicia (España)

Ano: 2005

Estudio comparativo del perfil de toxinas en agua durante dos episodios de *Dinophysis acuminata* y *Dinophysis acuta*

Ángeles Moreno, Fabiola Arévalo, Yolanda Pazos, S. Muñiz, Jorge Correa, Guadalupe Salgado, Juan Manuel, Juan Blanco

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INTRODUCCIÓN

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MATERIAL Y MÉTODOS

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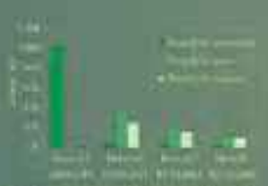

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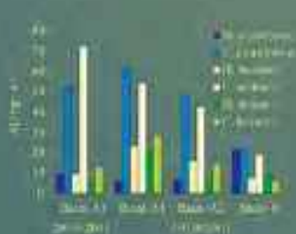

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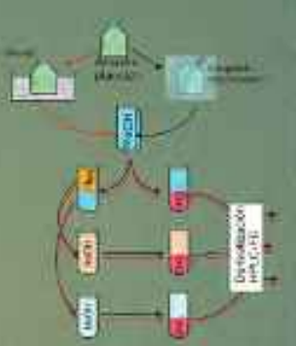

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Análisis de AO y derivados en los extractos metanólicos de Dinophysis

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Autoría: Díaz, S.; Carballal, M.J.; Villalba, A.

Título: Alteraciones patológicas del berberecho, *Cerastoderma edule*, de un banco natural del NO. de España

Evento: III Congreso Internacional de Ciencia e Tecnoloxía Mariña "Océanos III Milenio"

Lugar: Puerto Real - Andalucía (España)

Ano: 2005

ALTERACIONES PATOLÓGICAS DEL BERBERECHO, *Cerastoderma edule*, DE UN BANCO NATURAL DEL NO. DE ESPAÑA

S. Díaz, M.J. Carballal y A. Villalba

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS

INTRODUCCIÓN

Los moluscos bivalvos, Cerastoderma edule, tienen una gran importancia económica, son de elevado consumo y por lo tanto se pescan en el mercado de los alrededores, sin embargo, son pocos y escasos estudios sobre análisis patológicos de este bivalvo. Varios estudios relacionan altas mortalidades de este recurso con diversos parásitos o anomalías patológicas como: moluscos hermafroditas, trematodos, grandes focos de infección hemocitaria (Hibbert y Hodgkiss, 1980; Tapiador y Mucoño, 1980; Arnaud y Amice, 1982; Carballal et al. 2001; Villalba et al. 2001; Daskalov et al. 2004). En este trabajo se estudian las alteraciones patológicas del berberecho, C. edule, procedente

ORGANISMOS BACTERIANOS

NEOPLASIA DISEMINADA

PROTOZOOS

MATERIAL Y MÉTODOS

Se muestrearon mensualmente, un 25 berberechos de talla comercial (> 28 mm de longitud) durante el año 2004 en el intermareal del banco de Mijara (Ría de Muros y Noia). De cada individuo se separó una porción de víscera que incluyó glándula digestiva, gónada y manto, que fueron fijados en solución de Davidson y procesados por parafina. Se realizaron cortes de 5 µm que se desparafinaron y tiñeron con hematoxilina Harris y eosina (H&E) (Howard y Smith, 1983) para su observación con microscopio óptico.

METAZOOS

Toda recogida en periodo de estudio muy largo para conocer una variación estacional de la prevalencia de los parásitos, pero en algunas especies se puede observar una tendencia de aumento de la prevalencia al invierno (gonadales, hialinos en presencia y corazón) del orden (especialmente relacionadas y neoplasia diseminada) y a finales de verano y principios de otoño (hialinos y corazón). Además parece existir una correlación entre la temperatura y prevalencia de protozoos (r_s = -0,857; 0,022) y de los especímenes de berberechos (r_s = 0,812; 0,021). ¿Cuál sería la correlación de Spearman?

RESULTADOS Y DISCUSIÓN

Los parásitos y alteraciones patológicas encontradas en este berberecho como: neoplasia diseminada, protozoos ciliados, Trematoda sp. y Rhabditis sp. gregarinas, nematodos sp. y otros ciliados. Predominan los moluscos acompañados de otros y metazoos de nematodos, Rhabditis sp., copépodos y parásitos de las branquias y colonias de tipo hemocitario.

Los protozoos ciliados se encontraron en periodos de primavera/verano.

El berberecho C. edule, en comparación con otros bivalvos comerciales, es una especie con una gran carga parasitaria, aunque sólo un pequeño número de parásitos y alteraciones patológicas le producen lesiones importantes que podrían estar relacionadas con la mortalidad.

En este banco comercial la neoplasia diseminada y la infestación por hemocitos ciliados parecen ser las principales causas de las mortalidades observadas en el invierno y verano.

Los organismos patológicos podrían ser una importante herramienta de trabajo para la realización de modelos de predicción de mortalidades y de su enfermedad, que podrían ser utilizados en las plantas de depuración del berberecho para un mejor aprovechamiento de esta.

BIBLIOGRAFÍA

AGRADECIMIENTOS

Autoría: López, C.; Darriba, S.; Miranda, M.; Álvarez, C.

Título: Depuración de *Ensis arcuatus* y *Ensis siliqua* (Solenacea)

Evento: X Congreso Nacional de Acuicultura

Lugar: Gandía - Valencia (España)

Ano: 2005

Depuración de *Ensis arcuatus* y *Ensis siliqua* (Solenacea)

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Justificación

Los solénidos poseen un importante valor comercial en España, fundamentalmente en Galicia (NO España). El sistema habitual empleado para la depuración de moluscos bivalvos en instalaciones comerciales ha presentado numerosos problemas cuando se pretende trabajar con especies del grupo de los solénidos. La débil musculatura que poseen, en comparación con otros moluscos bivalvos filtradores, provoca la fácil apertura de las valvas en cuanto llevan un tiempo desenterrados, acelerándose su degradación. En este trabajo se estudia la respuesta de la navaja (*Ensis arcuatus*) y el longueirón (*Ensis siliqua*) a determinadas condiciones de depuración.

Material y Métodos

El sistema de depuración consiste en el apilamiento vertical de tanques donde se colocan las bandejas con los moluscos. Durante el proceso de depuración se realizan controles a las 0, 4, 16 y 21 horas midiendo los niveles de coliformes fecales, *E. coli* y la presencia de *Salmonella* spp empleando las técnicas estandarizadas. La legislación actual sitúa los niveles tolerables para el consumo de moluscos en menos de 300 coliformes fecales / 100 g de producto o menos de 230 *E. coli*/ 100 g, además de la ausencia de *Salmonella* spp.

Depuración en sistema vertical

Análisis de coliformes y *Salmonella*

Tabla 1. *Niveles de coliformes fecales y E. coli por 100 gramos de navaja (Ensis arcuatus) en los controles realizados en noviembre y febrero.*

	coliformes fecales (/100g)		*E. coli* (/100g)	
horas	noviembre	febrero	noviembre	febrero
0	9100	3500	750	1700
4	2400	900	200	300
16	1750	710	160	160
21	40	160	20	70

Tabla 2. *Niveles de coliformes fecales y E. coli por 100 gramos de longueirón (Ensis siliqua) en los controles realizados en noviembre y febrero.*

	coliformes fecales (/100g)		*E. coli* (/100g)	
horas	noviembre	febrero	noviembre	febrero
0	>18000	90	1300	90
4	16000	70	700	70
16	1100	20	100	20
21	1100	40	90	40

Resultados y Discusión

Hemos comprobado que manteniendo los ejemplares atados y en posición horizontal en las bandejas de depuración, superan sin problemas el tiempo necesario para la depuración.

En la tabla 1 observamos que *E. arcuatus*, a pesar de encontrarse en diferentes momentos del ciclo reproductivo presenta un patrón de depuración muy similar.

E. siliqua (tabla 2), en la experiencia de noviembre muestra un rápido descenso del contenido en *E. coli*, quedando aptas para el consumo en menos de 16 horas, mientras que los coliformes fecales no descienden por debajo del límite establecido por la legislación vigente.

No se ha detectado *Salmonella* spp. en ninguna muestra.

Agradecimientos:

Al personal del laboratorio de microbiología del CCMM por su participación en los análisis, a la depuradora "Análisis do Cerril" por el uso de las instalaciones, en especial a Mafia Fariña, encargada del laboratorio, por la ayuda prestada.
Este trabajo ha sido financiado por la Junta Nacional Asesora de Cultivos Marinos (JACUMAR) dentro del Plan Nacional de Cultivos Marinos: Cultivo y Gestión de Solénidos.

X Congreso Nacional de Acuicultura. Valencia 2005

Autoría: Cerviño-Eiroa, A.; García-Fernández, A.; de Coo-Martín, A.

Título: Resultados de preengorde da almeja fina, *Ruditapes decussatus* (Linné, 1758), en diversos sistemas en las Rías Baixas de Galicia

Evento: X Congreso Nacional de Acuicultura

Lugar: Gandía - Valencia (España)

Ano: 2005

Resultados de Preengorde de la almeja fina, Ruditapes decussatus (Linné, 1758), en diversos sistemas en las Rías Baixas de Galicia.
A. Cerviño Eiroa, A. García Fernández y A. De Coo Martín
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INTRODUCCIÓN
RESULTADOS
Localización
Abstract
MATERIAL y METODOS
CONCLUSIONES
Bibliografía
Este trabajo se ha desarrollado dentro del Plan Nacional de Cultivo de Almeja (JACUMAR).

Autoría: Darriba, S.; Miranda, M.

Título: Impacto del descenso de la salinidad en la reproducción de la navaja (*Ensis arcuatus*)

Evento: VIII Foro dos Recursos Mariños e da Acuicultura das rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2005

Impacto del descenso de la salinidad en la reproducción de la navaja (Ensis arcuatus)

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Navaja (*Ensis arcuatus*)

La navaja (*Ensis arcuatus*) es un molusco bivalvo del grupo de los solénidos que se encuentra englobada en los denominados recursos específicos, por su reciente explotación y el peculiar modo de extracción. Esta especie tiene un gran valor socioeconómico, ya que, a pesar de no encontrarse entre los bivalvos cuantitativamente más importantes en producción, se sitúa entre las tres especies con los precios medios anuales más elevados.

La escasez de estudios científicos sobre los solénidos y la necesidad de realizar una gestión racional del recurso, impulsó el esfuerzo investigador en Galicia, durante los últimos años, para incrementar el conocimiento de la biología de la especie.

Desde 1998 a 2001, periódicamente (15-30 días), se recogieron muestras de 15-20 ejemplares de navaja. Durante el procesado, se pesaron las valvas y se diseccionó la gónada para la elaboración del índice de condición gonadal (ICG = peso gónada / peso valvas) que se usa como indicador del estado de desarrollo gametogénico. Durante 2003 y 2004, tras el accidente del petrolero Prestige, se continuó con el estudio del mismo banco. Para completar el estudio, el Centro de Control do Medio Mariño (CCMM) nos cedió los datos de los parámetros oceanográficos registrados en esos años de la estación de muestreo de la boca Norte de la Ría de Vigo, próxima a las Islas Cíes.

Los resultados obtenidos, a partir del ICG, mostraron que la navaja presenta un ciclo reproductivo anual, compuesto por una época de reposo sexual centrada en el verano, el inicio del ciclo durante el otoño y una época de puestas consecutivas durante parte del invierno y la primavera. Este patrón se vio interrumpido en el ciclo 2000/2001, observándose que ICG presentaba unos valores anormalmente bajos durante el invierno de 2001, sin registrarse ningún máximo hasta la primavera (Figura 1).

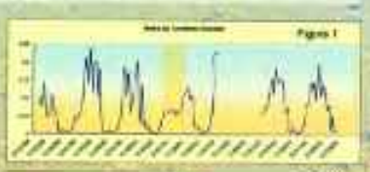

Figura 1

La temperatura del agua de mar mostró un patrón general similar desde 1998 a 2004. Durante el invierno la temperatura fue similar en los distintos rangos de profundidad, indicando un proceso de mezcla vertical. En invierno y verano se intercalaron episodios de temperaturas más bajas en el fondo debido a los "afloramientos" de aguas frías tipo en continentes (Figura 2). Durante el invierno de 2001 destacó la presencia, durante un periodo largo, de temperaturas más altas en el fondo.

Figura 2

La salinidad del agua de mar se mantuvo dentro del rango 28-36 ‰ excepto en el invierno de 2001, cuando se llegaron a registrar valores próximos al 24‰ (Figura 3). Las intensas lluvias registradas durante el otoño de 2000 e invierno de 2001 fueron las causantes de esta situación oceanográficamente anómala.

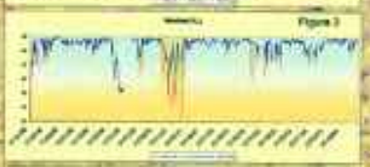

Figura 3

La clorofila "a" es un parámetro indicativo de la cantidad de alimento disponible en el medio. Las concentraciones más altas de clorofila "a" en la columna de agua se observaron durante la primavera y el verano, mientras que en invierno los niveles eran mínimos (Figura 4).

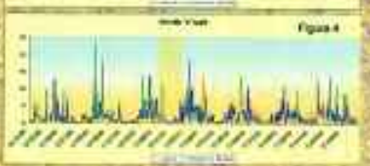

Figura 4

La influencia de las condiciones medioambientales en la reproducción de los moluscos ha sido puesta de manifiesto en diversos trabajos, no obstante, las variables de las que más se conoce su efecto son la temperatura y la clorofila (abundancia de alimento). Este estudio adquiere una gran relevancia al poner de manifiesto la interrupción del desarrollo normal del ciclo reproductivo de la navaja (*E. arcuatus*) coincidiendo con un descenso brusco de la salinidad de la columna de agua debido a las intensas lluvias caídas en Galicia durante meses en el otoño-invierno de 2000-2001.

AGRADECIMIENTOS:
Al Centro de Control do Medio Mariño (CCMM) por la cesión de los datos oceanográficos que han sido fundamentales en este estudio. A Ivar por la colaboración en los muestreos. A la Junta Nacional Asesora de Cultivos Marinos (JACUMAR) por la financiación de este trabajo, dentro del Plan Nacional de Cultivos Marinos: Cultivo y Gestión de Solénidos.

VII FORO DOS RECURSOS MARIÑOS E EA ACUICULTURA, O GROVE, OUTUBRO 2003

Autoría: Guerrero, S.; Santos, I.; Outón, M.J.

Título: Uso de subprodutos de conchas de bivalvos en Galicia

Evento: X Congreso Nacional de Acuicultura

Lugar: Gandía - Valencia (España)

Ano: 2005

USO DE SUBPRODUCTOS DE CONCHA DE BIVALVOS EN GALICIA

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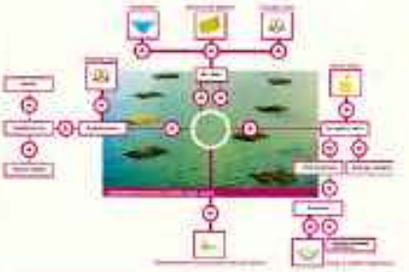

Subproductos obtenidos de concha de bivalvos en la empresa AROMOMAR (Tabla I)

SUBPRODUCTOS	CANTIDAD PRODUCIDA	DESTINO
AROMOMAR (Carbonato cálcico)	1.500 Tm/año	Agricultura
CAMTAMAR (Biocarbón en estudio)	3.000 Tm/año	Ganadería
PASTILLAS FERTILIZANTES (P. sólidos y vol)	500 Tm/año	Agricultura
CONCHA BLANCA (Complemento alimenticio)	1.000 Tm/año	Avicultura
PRODUCCIÓN TOTAL	5.500 Tm/año	

RESIDUOS	ESTIMACIÓN	CANTIDAD (Tm/año)	COSTE DE GESTIÓN
Fijación de bateas	10 x 2.500 Tm	2.500	0
Pisaderos	4.000 x 0,4 x 4000	1.600	-
Cuerdas de mejillón	500 x 5.000 x 0,0017 kg	425	-
Cuerdas de cultivo	600 x 5.000 x 0,0017 kg	51	-
Boyas/flotes	0,027 x 0	0.000	0
Fangos de mejillón	0,067 x 4000	227.000	
Cuerdas de mejillón	20.000 x 1,68 x 0,25	10.000	-
Cuerdas blancas	20000000	1.000	0
TOTALES			60.041

Producción de mejillón
+ 295.622 Tm/año
+ 132.115.140 Euros

JUSTIFICACIÓN

MATERIAL Y METODOS

RESULTADOS Y DISCUSIÓN

AGRADECIMIENTOS

Autoría: García-Fernández, A.; Cerviño-Eiroa, A.; de Coo-Martín, A.

Título: Potencial de crecimiento y resultados de mortalidad en el preengorde de la almeja babosa, *Venerupis pullastra* (Montagu, 1803), en diversos sistemas en las rías Baixas de Galicia, con especial atención a los factores que interactuan en su evolución

Evento: X Congreso Nacional de Acuicultura

Lugar: Gandía - Valencia (España)

Ano: 2005

Potencial de crecimiento y resultados de mortalidad en el preengorde de la almeja babosa, *Venerupis pullastra* (Montagu, 1803), en diversos sist[illegible] en las Rías Baixas de Galicia, con especial atención a los factores que interactúan en su evolución.

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INTRODUCCIÓN

Se ha producido un cierto impulso en los últimos años en la creación de criaderos y establecimientos a nivel privado como primera fase de engorde para el cultivo en parques de arena y explotaciones mariscadoras. Sin embargo este proceso no ha venido acompañado de la base de conocimiento científico y técnico que sustente y optimice su desarrollo. Se incluyen por ello algunos datos en el conocimiento del potencial de esta especie y se cuantifican los resultados que presenta en la fase de preengorde.

Localización

Abstract

[illegible]

MATERIAL Y METODOS

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RESULTADOS

La primera figura muestra los resultados obtenidos en los crecimientos de esta almeja babosa en las diferentes pruebas a lo largo de un periodo de tres años. El potencial de crecimiento varía entre una Gan de 200-250 para 1-400 mg, Gan de 150-200 para 400-700 mg y Gan 50-100 para >1.000 mg. Sin embargo este crecimiento está afectado por diversos factores fundamentales tipo de cultivo, densidad de cultivo/nivel, talla-edad y calidad/talla/semilla, además del nivel reproductivo que se detalla en otra comunicación presentada a este Congreso.

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CONCLUSIONES

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Bibliografía

[illegible]

Este trabajo se ha desarrollado dentro del Plan Nacional de Cultivo de Almeja (JACUMAR).

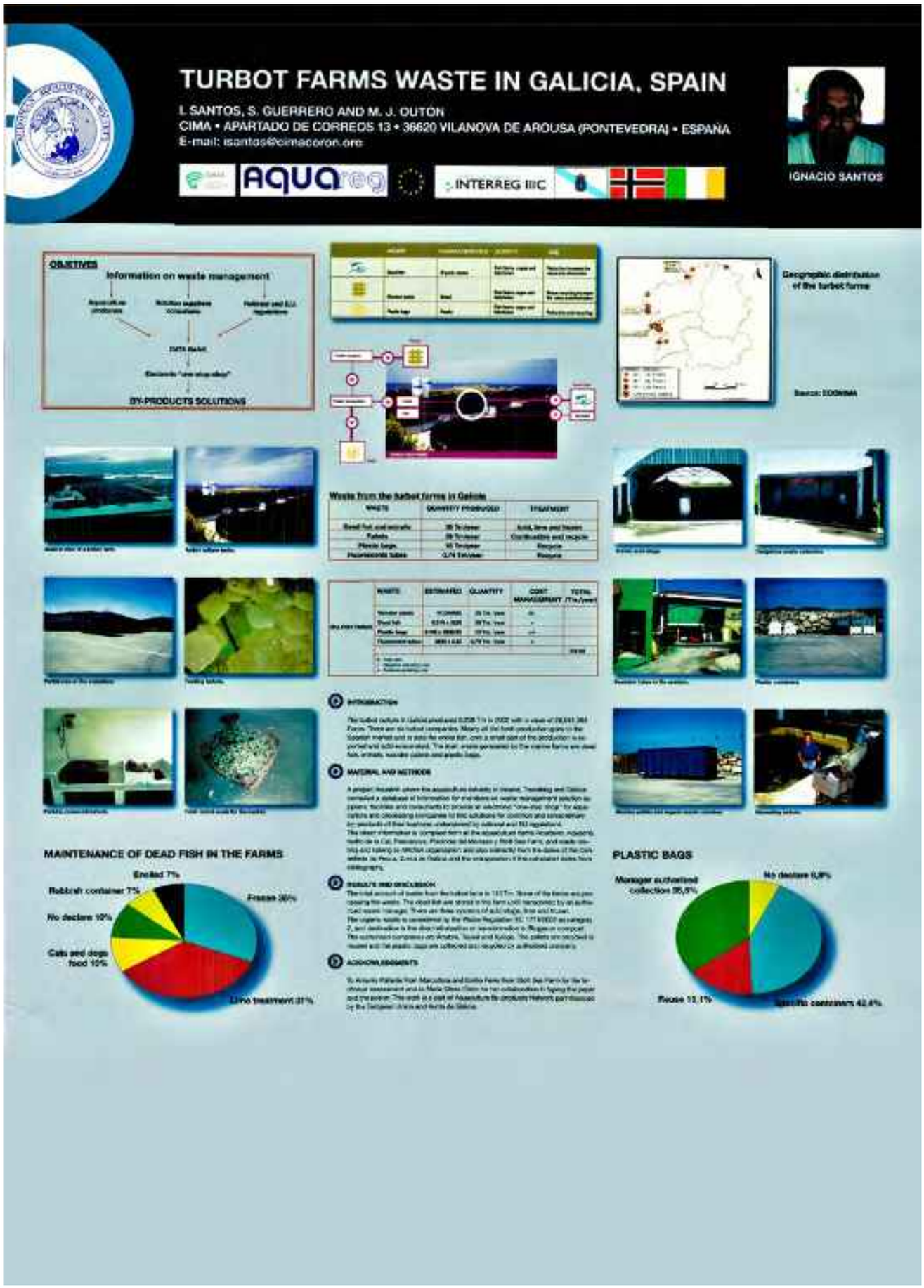
Autoría: Santos, I.; Guerrero, S.; Outón, M.J.

Título: Turbot Farms waste in Galicia, Spain

Evento: Aquaculture Europe 2005

Lugar: Trondheim (Noruega)

Ano: 2005


TURBOT FARMS WASTE IN GALICIA, SPAIN
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INTERREG IIIC
IGNACIO SANTOS
OBJETIVES
Information on waste management
BY-PRODUCTS SOLUTIONS
Geographic distribution of the turbot farms
Source: EDONIMA
Waste from the turbot farms in Galicia
MAINTENANCE OF DEAD FISH IN THE FARMS
Enclad 7%
Rubbish container 7%
No declare 10%
Cats and dogs food 10%
Frozen 36%
Lime treatment 31%
PLASTIC BAGS
Manager authorized collection 35,5%
No declare 0,8%
Reuse 13,1%
Specific containers 42,4%

Autoría: Guerrero, S.; Santos, I.; Outón, M.J.

Título: Mussel and white shell by-products in Galicia, Spain

Evento: Aquaculture Europe 2005

Lugar: Trondheim (Noruega)

Ano: 2005

MUSSEL AND WHITE SHELLS BY-PRODUCTS IN GALICIA, SPAIN

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Shellfish shell by-products from ARCHICMAR

BY-PRODUCTS	QUANTITY TN/YEAR	DISTRIBUTION
ARCHICMAR (Golden Carbonate)	1500 Tn/year	Agriculture
CARMAR (Coral beds in shell)	3000 Tn/year	Grafts
PARTELLAS (PEATLESATES) (Shell piece for fertilizer)	600 Tn/year	Agriculture
CORCHA BLANDA (Shell and shellfish flesh mixed)	1500 Tn/year	Feeding farming
TOTAL PRODUCTION	6600 Tn/year	

Geographical Distribution of 3.537 Rafts

Mussel production
• 256.827 Tn/year
• 132.115.140 Ejems

Geographical Distribution of shellfish beds production (cockles and clams)

Autoría: de Coo-Martín, A.; Cerviño-Eiroa, A.; García-Fernández, A.

Título: El período crítico de mortalidad en el preengorde de la ostra plana *Ostrea edulis* (Linné, 1758) en batea, en las Rías Baixas de Galicia. Su relación con las densidades de cultivo y las operaciones de manejo

Evento: X Congreso Nacional de Acuicultura

Lugar: Gandía - Valencia (España)

Ano: 2005

El periodo crítico de mortalidad en el preengorde de la ostra plana *Ostrea edulis* (Linne, 1758) en batea en las Rías Baixas de Galicia. Su relación con las densidades de cultivo y las operaciones de manejo.

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INTRODUCCIÓN

Localización

Abstract

The seed of the flat oyster *ostrea edulis* develops very high growth rates when water temperature exceeds 19ºC (Gm > 300) and a high mortality rate in production a few days. This rate being different and proportional to the density of cultivation. In this same way, this rate of mortality is higher in the small baskets which withstand higher temperatures, even at low densities. These results show that a high low densities and dividing operations lessen the consequences of the critical mortality period, an intensive factor which requires another type of complementary treatment.

MATERIAL y MÉTODOS

RESULTADOS

La evolución de la temperatura entre las dos profundidades de cultivo presenta diferencias relevantes, tanto durante todo el periodo que abarca la experiencia, con unos valores de grados*hora a -2 m de 47.300 y a -5 m de 35.021 (un 25% menos), como en la temperatura soportada por encima de 19ºC, alcanzando en este caso a -2 m los 333,3 grados*hora y a -5m los 143,4 (un 58% menos). Durante la prueba se superaron los 19ºC en 3 ocasiones por un total de 22 días. Esta diferencia de temperatura se refleja en la evolución de la mortalidad de cada cuestión (Tabla 1). Los datos se presentan el 30/07/03, dos semanas después de sobrepasado por primera vez la T° de 19ºC y el final de la experiencia el 23/09/03. La tasa de mortalidad del preengorde industrial en la balsa el 30/07/03 era mucho mayor que las observadas en la experiencia, llegando a multiplicar por 2 los valores.

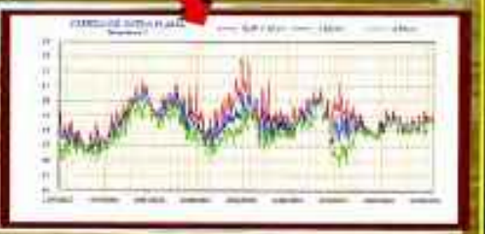

Tabla 1. *Crecimiento en Peso Húmedo individual (PHind-mgr) y Mortalidad en Porcentajes sobre el total de la semilla inicial, en ostra plana a diferente densidad y profundidad de cultivo*

El crecimiento durante toda la experiencia es muy fuerte multiplicando por 50 el peso inicial de partida el 19/06/03. Alcanzamos la T° de 19ºC después de sobrepasar esta barrera térmica (el 17/07/03) presentaban una Gm de 342,5 para -2 m profundidad y 114,0 para -5 m profundidad. Sin embargo en la siguiente semana, hasta el 24/07/03, en que ya había valores sobre 19ºC, las Gm se sitúan en 353,7 y 334,7 para 2 m y 5 m respectivamente. En los pesos finales alcanzados no se dan diferencias significativas entre las dos profundidades pero sí entre las densidades baja y media (dB y dM) y la densidad alta (dA).

CONCLUSIONES

El periodo crítico durante los meses estivales y en las condiciones ambientales de cultivo, con un incremento grave y provisto elevados períodos de semilla y mortalidad en el resultado final del engorde de la ostra plana.

El trabajo con densidades de cultivo menores favorece en gran medida la supervivencia de nuestra planta y reduce sobremanera la mortalidad durante este periodo.

El periodo crítico parece estar relacionado directamente con la temperatura y el tiempo de exposición a esta mayor superficie. En las ría, durante este periodo de 3°> 19°C, habría que buscar agua más frías, en las zonas de afloramiento internas de las rías.

El periodo crítico debe prevenirse porque la ostra plana en Galicia está situada en el límite de mayor temperatura de su área de distribución biogeográfica y por lo tanto en el límite de sus condiciones ambientales favorables.

Bibliografía

Walne, P.R. (1970). Studies on the food value of nineteen genera of algae to juvenile oysters. *Fish. Invest. Lond.* Ser. 2, 26(1): 1-62.

Autoría: Cerviño-Eiroa, A.; García-Fernández, A.; de Coo-Martín, A.

Título: El preengorde de la almeja japonesa, *Ruditapes philippinarum* (Adams & Reeve, 1850), en diversos sistemas de cultivo en las Rías Baixas y litoral de Galicia

Evento: X Congreso Nacional de Acuicultura

Lugar: Gandía - Valencia (España)

Ano: 2005

El preengorde de la almeja japonesa, *Ruditapes philippinarum* (Adams & Reeve, 1850), en diversos sistemas de cultivo en las Rías Baixas y litoral de Galicia.

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INTRODUCCIÓN

Localización

Abstract

MATERIAL y METODOS

RESULTADOS

CONCLUSIONES

Bibliografía

Este trabajo se ha desarrollado dentro del Plan Nacional de Cultivo de Almeja (JACUMAR).

Autoría: Cerviño-Eiroa, A.; García-Fernández, A.; de Coo-Martín, A.

Título: Sistema de bolsas para preengorde de almejas en batea

Evento: VII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2005

Sistema de Bolsas para preengorde de almejas en batea

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DESARROLLO

El preengorde es uno de los cuellos de botella más importantes para la optimización del cultivo de almejas en Galicia. Para su solución es necesario el desarrollo de nuevos sistemas de preengorde lo más eficientes, seguros y rentables posible.

De las experiencias realizadas por este equipo de investigación en los diversos sistemas tradicionales de preengorde tanto en nursery, batea, intermareal y sumergido, cabe concluir que, a partir de una talla determinada, los nuevos sistemas de preengorde deberían estar situados en el medio natural para aprovechar la ventaja del suministro directo de alimento y agua marina y resolver, además, algunas formaciones que presentan los sistemas más usados en el medio natural: cestillos, bolsas y cajas. Estos últimos funcionan como un estabulador físico de la semilla, pero también como un filtro del agua marina que puede penetrar al interior de los mismos de modo que en mayor o menor grado, cada uno de ellos, desaprovecha parte del agua marina disponible de la zona de cultivo. Además, en el interior, donde está depositada la semilla, se acumulan los desechos y dado que el agua marina penetra en los mismos por una zona limitada, se generan gradientes de crecimiento y se facilita la formación de colas. Así mismo, estos sistemas permiten escapes de los individuos estabulados y en el caso de las bolsas estandar de cultivo sobreelevado en intermareal, dadas sus dimensiones y flexibilidad, la semilla de almeja colocada en la bolsa se agrupa en los extremos de la misma, por efecto de las corrientes marinas y el oleaje, generándose, algunas veces, problemas de crecimiento. El diseño y realización de este nuevo sistema presentado en este VIII Foro pretende la resolución de estos problemas así como facilitar los procesos de mecanización de todo el proceso.

Este proyecto ha sido financiado por IACUMAR.

Diseño y Estructura

Dado que las almejas aprovechan el agua que pasa por el exterior de las bolsas de estabulación, se optó por una estructura que permitiese mantener las bolsas en diferentes niveles.

Para ello se diseñó una jaula construida en hierro galvanizado o acero inoxidable en la que se colocan unas barras del mismo material en forma de U con una separación entre ejes de 7 cm, de forma que se disponga de dos zonas o áreas donde introducir las bolsas.

Los tubos de PVC ranurado que forman el cierre de las bolsas de malla (2, 3 y 4 mm de luz, según tamaño de almeja), son los que se introducen en la canaleta formada por la U y sirven de sostén a las mallas de estabulación.

El ancho de las bolsas es de 19 cm, con objeto de aprovechar al máximo el material de origen que no es otro que las propias bolsas ostrícolas o "pachones".

Esta jaula, cuyas dimensiones totales pueden ser diferentes según las características particulares, se cuelgan directamente a la estructura (bateas, boyas, long-line) para llevar a cabo el preengorde.

Otras aplicaciones

- El sistema se ha ensayado en mesas sobreelevadas en zonas intermareales de la Ría de Arousa con resultados igualmente satisfactorios.
- Igualmente los módulos completos con los niveles y dimensiones que se consideren aconsejables se pueden utilizar directamente en fondos marinos de zonas acotadas para labores de preengorde o en sistemas de long-line.

CONCLUSIONES

- Los resultados de crecimiento y supervivencia son muy buenos, alcanzando la almeja babosa Gm medias de 200, la japonica de 150 y fina de 100, con supervivencias superiores al 95% durante la fase de preengorde.
- Las almejas captan directamente del exterior de la bolsa el agua y con ella, el alimento y oxígeno que precisan (foto), optimizándose la utilización del agua de mar disponible y por ello la capacidad de carga es máxima.
- Se minimizan las pérdidas de unidades de semilla por escape.
- La captación de agua es más homogenea por toda la biomasa minimizándose la formación de colas.
- Gran proporción de superficie de contacto con el agua de mar por unidad de biomasa con lo cual se preveen problemas por fijación momentanea de epiblantes.
- El sistema presenta muchas posibilidades de mecanización posibilitando la disminución de los costes y tiempo de manipulación.

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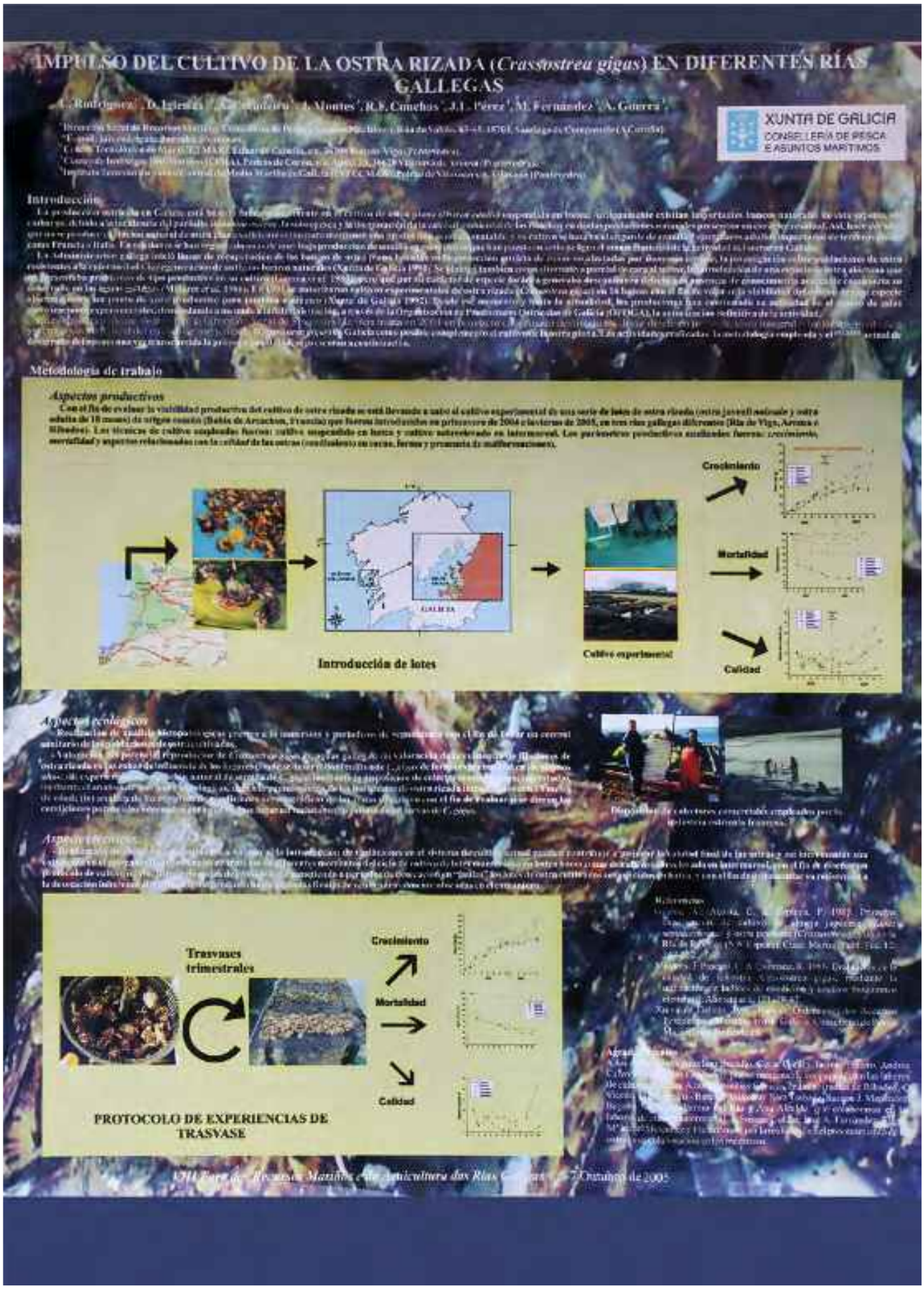
Título: Impulso del cultivo de la ostra rizada (*Crassostrea gigas*) en diferentes rías gallegas

Evento: VIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2005


IMPULSO DEL CULTIVO DE LA OSTRA RIZADA (Crassostrea gigas) EN DIFERENTES RÍAS GALLEGAS
XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
Introducción
Metodología de trabajo
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Trasvases trimestrales
Crecimiento
Mortalidad
Calidad
PROTOCOLO DE EXPERIENCIAS DE TRASVASE

Autoría: Carballal, M.J.; Díaz, S.; Villalba, A.

Título: *Urosporidium* sp. hyperparasite of the turbellarian *Paravortex cardii* in the cockle *Cerastoderma edule*

Evento: 12th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Copenhague (Dinamarca)

Ano: 2005

Urosporidium sp. hyperparasite of the turbellarian *Paravortex cardii* in the cockle *Cerastoderma edule*.

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Introduction

In a histopathological survey of a cockle *Cerastoderma edule* population located in Vilanova (Galicia, Spain), plasmodia, sporoblasts and spores were observed in the connective tissue of a turbellarian *Paravortex cardii* that occurred in the digestive lumen of one cockle.

Material and Methods

A section of tissue (5 mm thick) containing visceral mass, foot, mantle lobes, and gills was taken from each of 30 cockles and processed by standard histological techniques to examine by light microscopy. Small pieces of tissue (1 mm thick) were removed from the paraffin block containing the cockle with the hyperparasite, deparaffinized in xylene, rehydrated in a descending ethanol series and postfixed in 2% osmium tetroxide. The small pieces were cut (1 mm³ blocks), dehydrated and embedded in Epon. Ultrathin sections (50-90 nm thick) were doubled contrasted with uranyl acetate and lead citrate and observed in a JEOL 100 transmission electron microscope.

Fig. 1. Cysts (arrows) with sporoblasts and spores of *Urosporidium* sp. infecting *Paravortex cardii* (*) in the connective tissue of *Cerastoderma edule*. Bar: 40 µm.

Fig. 2. A plasmodium (Pl), spore (S) stages and spores of *Urosporidium* sp. in the connective tissue of *Paravortex cardii*. Spores with different stages of maturation can be observed (sporoblasts). Bar: 70 µm.

Fig. 3. Cross section of an *Urosporidium* sp. parasite of *Paravortex cardii*. C = cuticle; E = ectoplasm; Periodic structure could be observed in the connective tubes. Bars = 200 nm.

Results and discussion

The turbellarian *Paravortex cardii* was observed in the digestive lumen of 3 cockles. The connective tissue of 2 turbellarian sections in one cockle appeared to be invaded by cysts containing spores or uninucleated sporoblasts (Fig. 1). A plasmodium with 8 nuclei was also observed in one of the sections (Fig. 2). The spores were uninucleated and contained abundant haplosporosome-like structures limited structures in their cytoplasm (Fig. 3). The spore wall was about 120 nm thick and consist of 2 layers with different electron density. An internal flap of wall material was observed covering the spore orifice in the anterior end of mature spores (Fig. 4). Two types of spore filaments were observed, ribbon and extrusion. Until 3 extrusions by spore were seen (Fig. 5). Each extrusion was membrane limited and contained 1 to 2 tubes each about 80 nm thick; periodic structure could be observed in the tubes (Fig. 6).

According to spore morphology, the hyperparasite described in this study belongs to the phylum Haplosporidia. The presence of an internal flap of wall material covering the spore orifice allows placing this hyperparasite in the genus *Urosporidium* (Caullery & Mesnil 1905; Perkins 1990; Bonnelye & Ford 2004). Up 3 tails were seen in the spores described in the present study. This character separates it from other urosporidians, although is shared with *U. pelseneeri* (Caullery & Chappellier 1906) and *U. spinuli* (Perkins et al. 1973), which also have 2 or 3 tails. The spore diameter of these 3 species share a similar range. Further studies are needed to allocate the hyperparasite described in this study, whose only difference with *U. spinuli* and *U. pelseneeri* thus far is the host.

Fig. 4. Spore with internal flap of wall material (arrow) covering the spore orifice. Bar = 200 nm.

Fig. 5. Spore with 3 extrusions (arrows). Bar = 200 nm.

Fig. 6. Spore with 2 extrusions (arrows). Periodic structure could be observed in the tubes. Bar = 200 nm.

References

Bonnelye S. M., Ford S. E., 2004. A review of host taxonomy in the Haplosporidia, with special reference to Haplosporidium nelsoni (MSX) infection. Aquat. Living Res. 17: 409-417.

Caullery M., Mesnil F., 1905. Sur quelques nouveaux Haplosporidies parasites de Cestodes. C.R.S. Soc. Biol. Paris 58: 383-385.

Caullery M. M., Chappellier A., 1906. Haplosporidium pelseneeri, n.g.n.sp., haplosporidie nouveau [sic] parasite de Dendrocoelum lacteum (Turb. Dendrocoela). C.R. Soc. Biol. Paris 60: 525-528.

Perkins F. O., Zwerner D. E., Ivey R. K., 1973. The haplosporidan, *Urosporidium spinuli* sp.n. (Urosporidae), and its effects on the surf clam *Spisula*. The Journal of Parasitology 59: 903-909.

Perkins F. O., 1990. Phylum Haplosporidia. In: Margulis L., Corliss J. O., Melkonian M., Chapman D. J. (Eds) Handbook of Protoctista. Jones and Bartlett Publishing, Boston, MA, pp 98-121.

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Título: Flow cytometric DNA content analysis of normal haemocytes and neoplastic cells in the haemolymph of the cockle *Cerastoderma edule*

Evento: Aquaculture Europe 2005

Lugar: Trondheim (Noruega)

Ano: 2005

FLOW CYTOMETRIC DNA CONTENT ANALYSES OF NORMAL HAEMOCYTES AND NEOPLASTIC CELLS IN THE HAEMOLYMPH OF THE COCKLE *Cerastoderma edule*.

S. Díaz*, P. Soudant†, P.M. da Silva‡, M.J. Carballal*, C. Lambert† and A. Villalba*

XUNTA DE GALICIA
CONSELLERIA DE PESCA E ASUNTOS MARÍTIMOS

INTRODUCTION

Disseminated neoplasia (DN) has been associated with high mortalities of various bivalve species (Barber 2004), cockles (*Cerastoderma edule*) of Galicia (NW Spain) among them (Villalba *et al.* 2001). DN in *C. edule* was characterized by Villalba and Carballal (2001) by means of various organs by detection large cells, with high nucleus-cytoplasm ratio, one or more prominent nucleoli and irregular chromatin. Abundant mitotic figures were seen in histological sections and haemolymph cells membranes containing neoplastic cells (Carballal *et al.* 2001). Flow cytometer analyses (FCM) have been used to characterize different immunological and pathological parameters of bivalves and as per how DNA content and cell cycle analyses. This work aimed the use of FCM to evaluate the ploidy level of cells in the haemolymph, both normal and neoplastic cells.

MATERIAL AND METHODS

Eighty-seven cockles, *C. edule*, were collected in 2004 from natural beds of Ría de Arousa (Galicia, NW Spain). Every cockle was analyzed by histopathology and haemocytes histology and FCM to diagnose DN.

Haemolymph cell monolayers

Haemolymph was withdrawn from the adductor muscle of the cockles. Haemolymph (50µL) was mixed with cold Alsever's anticoagulant solution (ASW) and centrifuged (1 500*g*, 5 min, 4ºC). The haemolymph cell monolayers were fixed and stained with Hemacolor kit (Merck).

Histological analyses

A piece of tissue (from digestive gland) was taken from every cockle, fixed in Davidson's solution and embedded in paraffin. Serial sections were stained with Harris' hematoxylin and eosin.

Flow cytometry analysis

One volume of haemolymph was diluted in 20% cold ethanol (60% vol/vol in 30ºC Hanks' haemolymph was centrifuged (400*g*, 12 min, 4ºC) and the ethanol discarded. The pellet was resuspended in 0.8 ml PBS (2% NaCl, pH=7.4) for 30 min and then centrifuged (400*g*, 10 min, 4ºC). The pellet was resuspended in PBS and filtered through 50 µm Pitex. Propidium Iodide (Sigma PI (1?) and Dnase free Rnase A (Sigma Rnase (1?) were added. The samples were incubated at room temperature in the dark for 45 min and then were analysed using a FACSCalibur Flow Cytometer (BD Biosciences). A total of 50,000 particles were analysed for each sample at a low flow rate.

WinMDI 2.8 program was used to analyzed the flow cytometer data. Doublets (pairs or aggregates) recorded as a single events and aggregates were then discriminated from single cells using pulse height and pulse width analysis.

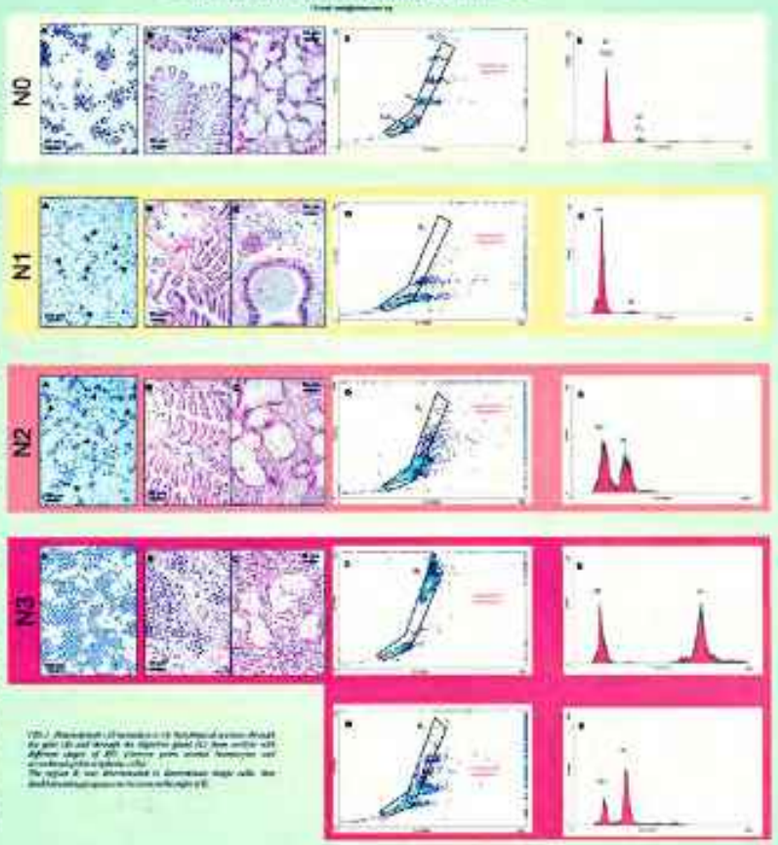

Fig. 1. Haemolymph cell monolayers (A) and histological sections through the gonad (B) and through the digestive gland (C) from cockles with different stages of DN. *Cerastoderma edule*: haemocytes and neoplastic cells in cockles. (D)
The region R was determinated to discriminate single cells. (See details in text) (Bar = 10 µm in A and B; 50 µm in C).

RESULTS AND DISCUSSION

The results of the examination of haemolymph cell monolayers and histological analysis showed that 14 cockles were diagnosed as normal (N0) and 17 cockles showed DN with light (N1(14), moderate (N2(4)) and heavy (N3(1)) infection.

Six no neoplastic cockles were used to obtain a haploid (DNA level) using a FCM. This was taken as the diploid DNA value.

Cockles' haemolymph cells showed different ploidy levels: hypodiploids (<2c), diploid (2c), triploid (3c), tetraploid (4c), pentaploid (5c), hexaploid (6c) and octaploid (8c).

The systematic gentle of cockles diploid or normal considered as a known fluorescence peak (2c) and a second smaller peak (4c). 2c cells representing the G_0 phase of the cell cycle and the population representing the G_2 phase of cells. The percentage of cells allocated in the 2c peak was 64% ± 1.1 and the second one was 4% ± 1.2.

Flow cytometric analysis indicated that haemolymph cells from positive DN cockles cases studied (neoplastic cells) was aneuploid.

Two peaks were observed in cockles diagnosed as **light neoplasia** (n). The first peak was hypodiploids percentage of cells 48 % ± 13.6 and the second one with two different ploidy levels according to the cockle, cockles showed the second peak in the range with a percentage of cell abundance of 17 % ± 1.1 and others cockles showed the second peak in the range with a percentage of cells of 9 % ± 1.1.

In cockles diagnosed as **moderate neoplasia**, the first peak (hypodiploids) decreased in frequency (40 % ± 13.5) in comparison with light neoplasia cockles and the second peak, increased in frequency, corresponding to tetraploid cells (6 % ± 1.1) or although we have individuals showed triploid (10 % ± 1.1) and hexaploid (15 % ± 0.1) cells.

In cockles with **heavy neoplasia** the second peak had more percentage of cells than the first one, in the first peak had hypodiploids (35 % ±10.8) cells and the second peak had triploid (10% ± 1.6), tetraploid (32 % ± 1.9), pentaploid (15 % ± 0.4), hexaploid (17 % ± 1.5) and octaploids (5% ± 1.1) cells (Table I).

The ploidy level was associated with DN intensity, the heavier the DN intensity, higher the ploidy. FCM-DNA-content analyses were successfully applied to identify neoplastic cells of cockle *C. edule* and can be useful to study the DN progression or to focus on cell's disease.

Table I – Ploidy level in the haemolymph of cockles with different state of DN

DISEASE STATE	Nº ANIMALS OR COCKLES	2c (mean ± Sd) (mean ± Nº)	% of cells 2c (mean ± Nº)	3c (mean ± Sd)	% of cells 3c (mean ± Nº)	4c (mean ± Sd)	% of cells 4c (mean ± Nº)	5c (mean ± Sd)	% of cells 5c (mean ± Nº)	6c (mean ± Sd)	% of cells 6c (mean ± Nº)	7c (mean ± Sd)	% of cells 7c (mean ± Nº)	8c (mean ± Sd)	% of cells 8c (mean ± Nº)	>8c (mean ± Sd)	% of cells >8c (mean ± Nº)
N0	14																
N1	14																
N2	4																
N3	1																

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Título: Evidencia de la presencia de fijaciones naturales de *Crassotrea gigas* en las Rías de Ribadeo y O Barqueiro, basada en el análisis de secuencias mitocondriales del gen 16S rDNA

Evento: VIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2005

EVIDENCIA DE LA PRESENCIA DE FIJACIONES NATURALES DE *CRASSOSTREA GIGAS* EN LAS RÍAS DE RIBADEO Y O BARQUEIRO, BASADA EN EL ANÁLISIS DE SECUENCIAS MITOCONDRIALES DEL GEN 16S rDNA

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XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS

Introducción

La producción ostrícola gallega se basa fundamentalmente en el cultivo de ostra plana *Ostrea edulis*. El cultivo de esta especie presenta en la actualidad múltiples problemas que han motivado que el sector demande a la Administración autonómica la autorización del cultivo de la especie de ostra foránea *Crassostrea gigas*. En respuesta a dichas demandas, la Dirección Xeral de Recursos Mariños inició en 2004 un proyecto [illegible] la viabilidad del cultivo de esta especie en Galicia como posible complemento al cultivo de la ostra plana.

Crassostrea gigas es endémica de Japón [illegible] a nivel mundial (Ayres, 1991). [illegible] (Smaal et al., 2001; [illegible], 1999; [illegible] 1998). En las Rías Baixas gallegas [illegible] de *C. gigas* en bateas desde los años 90, sin que se hayan detectado hasta el momento [illegible]. En las Rías Altas, el cultivo de *C. gigas* se realiza en la margen asturiana de la Ría de Ribadeo [illegible]. En la Ría de O Barqueiro [illegible] *Crassostrea angulata* [illegible] (Salvador Guerrero, com. pers.) [illegible] *Crassostrea gigas* (Thunberg, 1793) y *Crassostrea angulata* (Lamarck, 1819) [illegible] (Boudry et al., 1998; O'Foighil et al., 1998; Huvet et al., 2000; Boudry et al., 2004). El análisis filogenético de secuencias parciales del gen 16S rRNA [illegible] (Quinteiro et al., 2001). [illegible] en las rías de Ribadeo y O Barqueiro. La identificación del status taxonómico de dichas poblaciones podrá constituir una herramienta útil para la toma de decisiones de la Administración a fin de una mejor gestión y conservación de las poblaciones naturales así como del cultivo de *C. gigas*.

Material y Métodos

En junio de 2005 se recogieron muestras de ostra de tres procedencias diferentes: Muestra 1: individuos de *Crassostrea gigas* procedentes de Arcachon (Francia) [illegible] en la Ría de Ribadeo; Muestra 2: individuos de *Crassostrea* spp. [illegible] en la Ría de Ribadeo; Muestra 3: [illegible] *Crassostrea* spp. [illegible] en la Ría de O Barqueiro. [illegible] Se analizaron un total de 18 individuos, 6 de cada procedencia. [illegible] -20ºC. El ADN fue aislado a partir de 40mg del [illegible] DNeasy Tissue Kit (Qiagen). Un fragmento, conteniendo una secuencia parcial del gen mitocondrial 16S rRNA, fue amplificado mediante los cebadores 16Sa y 16Sb [illegible]. La reacción de PCR fue llevada a cabo en un volumen de 25 µl, [illegible] Para la PCR se usó un termociclador GeneAmp PCR System 9700 (Applied Biosystems), [illegible] 94ºC [illegible] 72ºC [illegible]. Los productos de PCR fueron [illegible] ExoSAP-IT [illegible] BigDye versión 3.1 (Applied Biosystems). La detección de los fragmentos de secuenciación se llevó a cabo [illegible] ABI PRISM 377 XL (Applied Biosystems). Los electroferogramas obtenidos fueron revisados y las secuencias editadas y alineadas con BioEdit v. 7.0 (Hall, 1999). Además de las secuencias obtenidas, también fueron incluidas en el análisis las secuencias de *Crassostrea* disponibles en el GenBank (Table 1), permitiendo un completo análisis filogenético del género y la determinación de la especie en las muestras de *Crassostrea* sp. de Ribadeo y O Barqueiro. Los análisis filogenéticos fueron realizados con el programa MEGA, usando el modelo de Tamura-Nei y el método de neighbor-joining.

Table 1. [illegible]

Figura 1. [illegible]

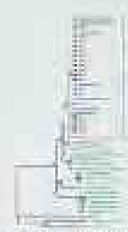

Figura 2. Árbol filogenético [illegible] neighbor-joining [illegible]

Resultados y Discusión

La secuencia parcial del gen 16S rRNA obtenida contiene 480 pares de bases (pb); sin embargo, para realizar un análisis comparativo con secuencias homólogas del género *Crassostrea* disponibles en el GenBank (Table 1), se elaboró un alineamiento limitado a 288 pb de largo. [illegible]

La totalidad de los individuos analizados (N=18), procedentes de las muestras de *Crassostrea gigas* [illegible] (N=6) y de muestras de *Crassostrea* sp. de poblaciones naturales en la Ría de Ribadeo (N=6) y O Barqueiro (N=6), presentan el mismo haplotipo para la secuencia parcial del gen 16S rRNA. La secuencia obtenida es idéntica a las descritas en los haplotipos C y D de *Crassostrea gigas*, [illegible] (Boudry et al. 2003) [illegible] *C. gigas*. [illegible] (Figura 1) respecto a las secuencias de *C. angulata*. [illegible] de *C. gigas* y 241 de la secuencia [illegible] de *C. angulata* (Figura 1). En consecuencia, todas las secuencias obtenidas son agrupadas [illegible] (98%) junto a las secuencias de *C. gigas*, [illegible] a las secuencias de *C. angulata* (Figura 2). Ello permite identificar las secuencias problema, obtenidas a partir de especímenes de las rías de O Barqueiro y Ribadeo como pertenecientes a la especie *C. gigas*.

La distancia genética (Tamura-Nei) media [illegible] entre las secuencias del clado que agrupa a *C. gigas* y el que agrupa a *C. angulata* es de 0,007. [illegible] *C. ariakensis* (0,004) y claramente inferior al valor de 0,12 de distancia media [illegible] *C. gigas* y *C. angulata* como una única especie [illegible] (Boudry et al., 1998; O'Foighil et al., 1998; Huvet et al., 2000; Boudry et al., 2004).

La confirmación de que las fijaciones detectadas en la Ría de Ribadeo corresponden a *C. gigas* es un hecho de por sí esperado, ya que el cultivo de esta especie en esta Ría lleva más de una década realizándose en la margen asturiana a escala industrial. La confirmación, sin embargo, de que el ostión presente en la Ría de O Barqueiro desde hace más de 20 años corresponde a la especie *C. gigas* supone una novedad y constituye una oportunidad para profundizar en el estudio de viabilidad del cultivo de *C. gigas* en Galicia.

Bibliografía
[illegible]

Agradecimientos
[illegible]

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Título: Presence of *Marteilia* sp. in razor clam, *Solen marginatus* (Pennántt, 1777) in Galicia (NW Spain)

Evento: IX Congresso Ibérico de parasitologia

Lugar: Coimbra (Portugal)

Ano: 2005

Presence of *Marteilia* sp. in razor clam *Solen marginatus* (Pennántt, 1777) in Galicia (NW Spain)

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Introduction

Marteliosis is a disease of molluscs caused by protistan parasites of the genus Marteilia, phylum Paramyxea (Desportes & Perkins, 1990; Villalba *et al.* 1993; Berthe, *et al.* 2000).

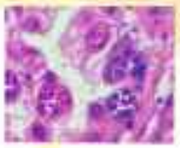
This parasite caused mortalities in several bivalve molluscs (Berthe *et al.*, 2004).

In this work we show results of the first identification of *Marteilia* sp. in *Solen marginatus*.

Material and Methods

We took monthly samples of 20 razor-clams, *Solen marginatus*, from a intertidal natural bed in Ría de Arousa (Galicia, NW Spain). We used standard techniques for light microscopy, transmission electron microscopy (TEM) and polymerase chain reaction (PCR). PCR was performed in a 25-µl vial using different conditions and primers previously designed: Pr4/Pr5 (Le Roux *et al.*, 1999). DNA amplified was analyzed by electrophoresis on ethidium bromide-staining agarose gels.

Results



The different stages of the life cycle of the genus *Marteilia* were found in histological sections of *S. marginatus*. We observed evolutionary stages, with refringent granules, located in the epithelial cells of digestive ducts and tubules.

Ultrastructurally, the primary cells were delimited by a plasmalemma containing multivesicullar bodies. The secondary cells were surrounded by two membranes and contained the tertiary cells (spore primordia). Mature spores presented 3 uninucleate sporoplasms (outermost, intermediate and innermost) one inside the other. Spore nuclei was in the innermost sporoplasm. We found sporangia with up to six spores. Flattened, vermiform, double membrane limited vesicles were located into the intermediate sporoplasm. The outer sporoplasm contained several haplosporosomes. Spores were involved by a thickened wall.

Detection of *Marteilia* sp. by PCR analysis.
Lane 1, 100 Base-Pair Ladder Marker; lanes 2 and 19, +ve control;lanes 4, 11, 13, Marteilia +ve; and lanes 3, 5-10, 12, 14-18, Marteilia -ve.

Conclusion

We detected for first time the parasite *Marteilia* sp. in the razor clam *S. marginatus*.

References

Berthe *et al.* 2000. J. Euk. Microbiol. 47: 288-293.
Berthe *et al.* 2004. Aquat. Living Resour. 17: 433-448.
Desportes & Perkins, 1990. Handbook of Protoctista, pp. 30-35.
Le Roux, *et al.* 1999. Marine Biotechnology 1: 588-597.

ACKNOWLEDGEMENTS:
Thanks to Maribel Meléndez, Elena Penas, Ana González, Mercedes Miranda, and Guadalupe González for technical support. Jesús Méndez and Inés for ultrastructural techniques from CACTI (Vigo Univ.).
This work was financed by Junta Nacional Asesora de Cultivos Marinos (JACUMAR) in the Plan Nacional de Cultivos Marinos: Cultivo y Gestión de Solénidos.

Autoría: Díaz, S.M.; Carballal M.J.; Villalba A.

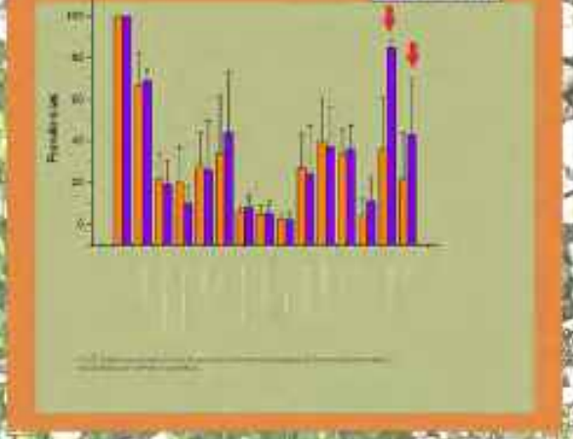
Título: Diferencias de alteraciones patológicas entre berberechos enterrados y desenterrados

Evento: IX Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2006

DIFERENCIAS DE ALTERACIONES PATOLÓGICAS ENTRE BERBERECHOS ENTERRADOS Y DESENTERRADOS



Autoría: Acosta, C.P.; Mariño, C.; Martín, H.; Blanco, J.

Título: Lack of effect of temperature on the depuration of domoic acid from the King scallop *Pectem maximus*

Evento: 12th International Conference on Harmful Algae

Lugar: Copenhagen (Dinamarca)

Ano: 2006

LACK OF EFFECT OF TEMPERATURE ON THE DEPURATION OF DOMOIC ACID FROM THE KING SCALLOP *PECTEN MAXIMUS*

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XUNTA DE GALICIA
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ABSTRACT

Some previous observations, in laboratory and field studies, have suggested the possibility that temperature plays a foremost role in controlling the velocity of depuration of domoic acid from the scallop species *Pecten maximus*. We have maintained scallops in temperatures from 13 to 19ºC during ca. 75 days and checked the effect of this factor on the domoic acid contents of four body compartments (digestive gland, adductor muscle, gonad and remaining tissues. No significant effect of temperature on the final domoic acid content was detected in any of the studied compartments nor in the total soft tissues. A slight increase of in the contribution of the toxins in the adductor muscle to the total pool of toxins was the only effect detected

MATERIAL AND METHODS

56 Scallops of commercial size (ca. 12 cm wide) were maintained in 7.25 L tanks (8 scallops/tank) for ca 75 days. Seawater in the tanks was continuously renewed, at a rate of 2 L/h except during four hours a day that were used to fed the scallops with Tetraselmis suecica. Temperature was maintained by means of circulating heated coolers with a precision of 0.5ºC (Mini Cooler, Aquamedic). At the end of the experiment the scallops were dissected in separate four groups of organs: a) digestive gland, b) gonad, c) adductor muscle and d) the rest of the tissues. The domoic acid of each of them was extracted with 50% aqueous methanol (v/v) after homogenization with Ultraturrax (IKA) and analysed by the method of Quilliam (1989) using a Beckman System Gold with a PDA 168, and a Thermo Surveyor Pump and PDA.

Most statistical procedures were carried out using Minitab 14 statistical package. Power of the tests were computed with PS, based on Dupont and Plummer (1997).

INTRODUCTION

The king scallop *Pecten maximus* is one of the bivalve molluscs that retain more strongly the ASP toxins (Blanco et al 2003). This characteristic of the species has been producing important problems for fisheries and has considerably reduced the interest in culturing it. In several studies aimed in finding a way to accelerate domoic acid depuration from *Pecten maximus*, we have found a strong statistical relationship between temperature and depuration rate, (with a Q_{10} of more than 6) but, as other environmental variables, covariate with temperature, it was not possible to establish a cause-effect relationship (Blanco et al, in press).

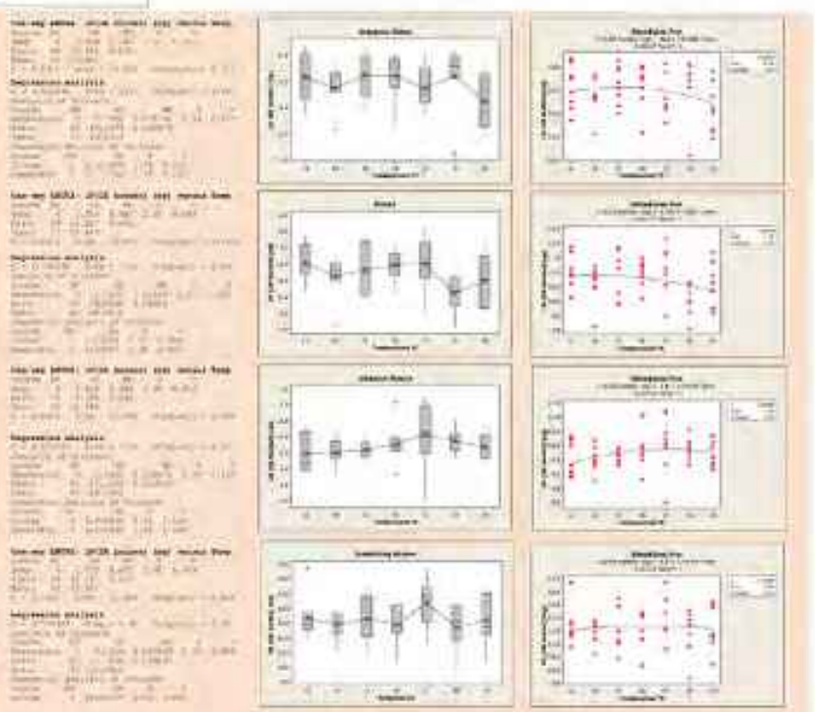
In order to check unequivocally if temperature has an important effect on domoic acid depuration we have carried out a laboratory experiment maintaining the scallops at temperatures ranging from 13 to 19ºC.

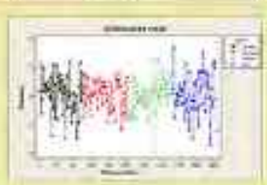
RESULTS

1.- No effect of temperature on the domoic acid content of any organ was statistically significant. With the design used and the variance observed, a Q_{10} of 2.2, typical of many enzymatic reactions, would have been detected (power > 80%).

2.- The observations of domoic acid burden in all tissues followed a distribution that was approximately log-normal

3.- Coefficients of variation for each combination organ-temperature range from 42 (digestive gland) to 72% (rest of tissues), but the dispersion was not statistically different between organs.





References

Blanco J., Acosta C.P., Bermúdez de la Puente M., Salgado C., 2003a. Depuration and protein-bound distribution of the amnesic shellfish poisoning (ASP) toxin domoic acid in the king scallop *Pecten maximus*. Aquat. Toxicol. 65, 111-121.

Blanco J., Acosta C.P., Mariño C., Muñoz S., Martín H., Morales K., Correa J., Arévalo J., Salgado C. (in press). Discretion of domoic acid (amnesic shellfish poisoning) from different body compartments of the king scallop *Pecten maximus* given in rafts culture and relaxed bed. Aquatic Living Resources.

Dupont W.D. and Plummer W.D. (1997). PS power and sample size program available for free on the Internet. Controlled Clin. Trials 18:274.

Quilliam M.A., Sim P.G., McCulloch A.W., Mohnes A.G., 1989. High-performance liquid chromatography of domoic acid, a marine neurotoxin, with application to shellfish and plankton. Internat. J. Environ. Anal. Chem. 36: 139-154.

Autoría: Sánchez-Mata, A.; Molares, J.; Parada, J.M.; Martínez, G.

Título: Changes in salinity and current speed induce cockle (*Cerastoderma edule*, L.) transport in Lombos do Ulla Estuary

Evento: XIV Simposio Ibérico de Estudios de Biología Marina

Lugar: Barcelona - Cataluña (España)

Ano: 2006

CHANGES IN SALINITY AND CURRENT SPEED INDUCE COCKLE (*Cerastoderma edule*, L.) TRANSPORT IN LOMBOS DO ULLA ESTUARY

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XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS

The Ulla's river mouth, located at Ría de Arousa and known as "Lombos do Ulla", consists of a system of mobile sandy banks in which cockle (*Cerastoderma edule*) is the dominant species. The main economic activity in the adjacent coastal area is based on the collection of this species, with more than 300 Tm extracted annually in recent years.

The production in some sectors of the river bed in the last years, together with the silting movement, an important transport mechanism, associated to storms and winter strong winds, has promoted the formation of intertidal sedimentary deposits with deleterious effects on the cockle stock and fishing activity. An identical modification on sandy bottoms has been observed for more than 24 h and the burying effect on the adult cockle stock.

Water depth ranges between 0 m at the lower tidal level and 4 m in the fluvial influenced area, exceeding these values by up to 2 m high over the tidal level.

The channel, at the central part of the estuary, is the main navigation channels that surrounded the sandy platforms. The maximum depth is 7 m at the entrance of Ría de Lombos do Ulla, where the tidal prism reaches 3.5 hm³ and it was about 1.5 hm³ in the inner estuary. The area of the outer estuary, which marks a clear limit to the estuarine environment, from where it is mostly...

The mixture of the seawater and the river has been excited and displaced, with the formation of a big band of fresh water in the proximity of these particular dunes. Other causes which explain the affection and therefore have a significant mortality are the combined effect of the strong winds, and also the important heavy rainfalls caused by the storm located upstream.

During the summer period 2002 - 2003 a decrease on cockle stock was observed close to the inner river mouth area, whereas adult cockle beds abundance were found at a nearby intertidal sedimentation area. A hypothesis was raised on cockle displacement and transport to the nearby sedimentation zones, under currents low salinity and adequate current speed conditions.

The follow-up of Lombos do Ulla hydrographic conditions was achieved by means of 8 oceanographic buoys recording salinity and temperature.

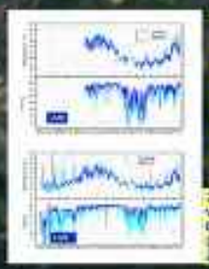
INNER ESTUARY

Salinity on stations LU5, LU4, LU3 and LU2 registered values below 20 units during the winter months. At station LU5 the salinity decrease was more marked, with values below 15 units in December 2003, and January and February 2004. The described oligohaline conditions were observed on all the water column and no stratification was found in the inner estuary.

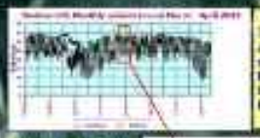
OUTER ESTUARY

Salinity values above 30 units in the outer area closely connected to the Ría de Arousa (LU6, LU2, LU3 and LU7), with an exception at the end of January 2003, where a salinity fall down (5 units) was registered as the consequence due to strong rainfalls occurred during the period (more than 100 l/m²). Salinity decrease in this area, however, is more slowly and the superficial water layer (continental water) than in deeper oceanic waters, that is to say there exists a better mixing stratification.

1- Oceanographic stations in Lombos do Ulla estuary

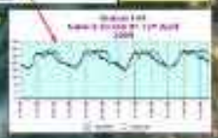


2- Temperature and salinity variations of surficial and bottom waters in LU5 and LU1 (December 2002 – June 2004)



3- Monthly and daily salinity fluctuations in station LU4

Salinity analyses on two tide cycles reveal the strong trend on the inner tidal satellites from 30 to 10 units, for neap and the tides respectively.



5- Cockle movement and transport with current speed higher than 15 cm s⁻¹

4- Cockle digging up under salinity variations

In those areas where the seawater salinity decreased below 20 units for periods of 6 hours or more, an important decrease of the cockle stock was observed. Cockle disappearance from these areas was not caused by an in situ mortality, since values of dead cockles were lower.

In addition, after the recruitment events occurred in autumn throughout the year, a high density of adult cockles was found where (seed) no bed had previously been found. In a nearby sandbank (2 m deep, 5 m deep), with water salinity above 30 units.

To verify the hypothesis of cockle transport by the current, several experiments were designed in mesocosms conditions, in collaboration with the EDOF University of A Coruña. It was run by means of Laser Particle Image Velocimetry (PIV) system in a laboratory channel to analyse the hydrodynamic velocity profiles in a series of 10 cockles of different sizes. Results showed that at 10 cm s⁻¹ some individuals began to roll (<10 %) at 30 cm s⁻¹, 30 % of individuals had moved from the initial position. At current speed higher than 35 cm s⁻¹ more than 50% of cockles were liberally dragged by the current. Cockle settlement was also impossible.

6- Current speed higher than 35 cm s⁻¹ occurs in Lombos do Ulla

F6

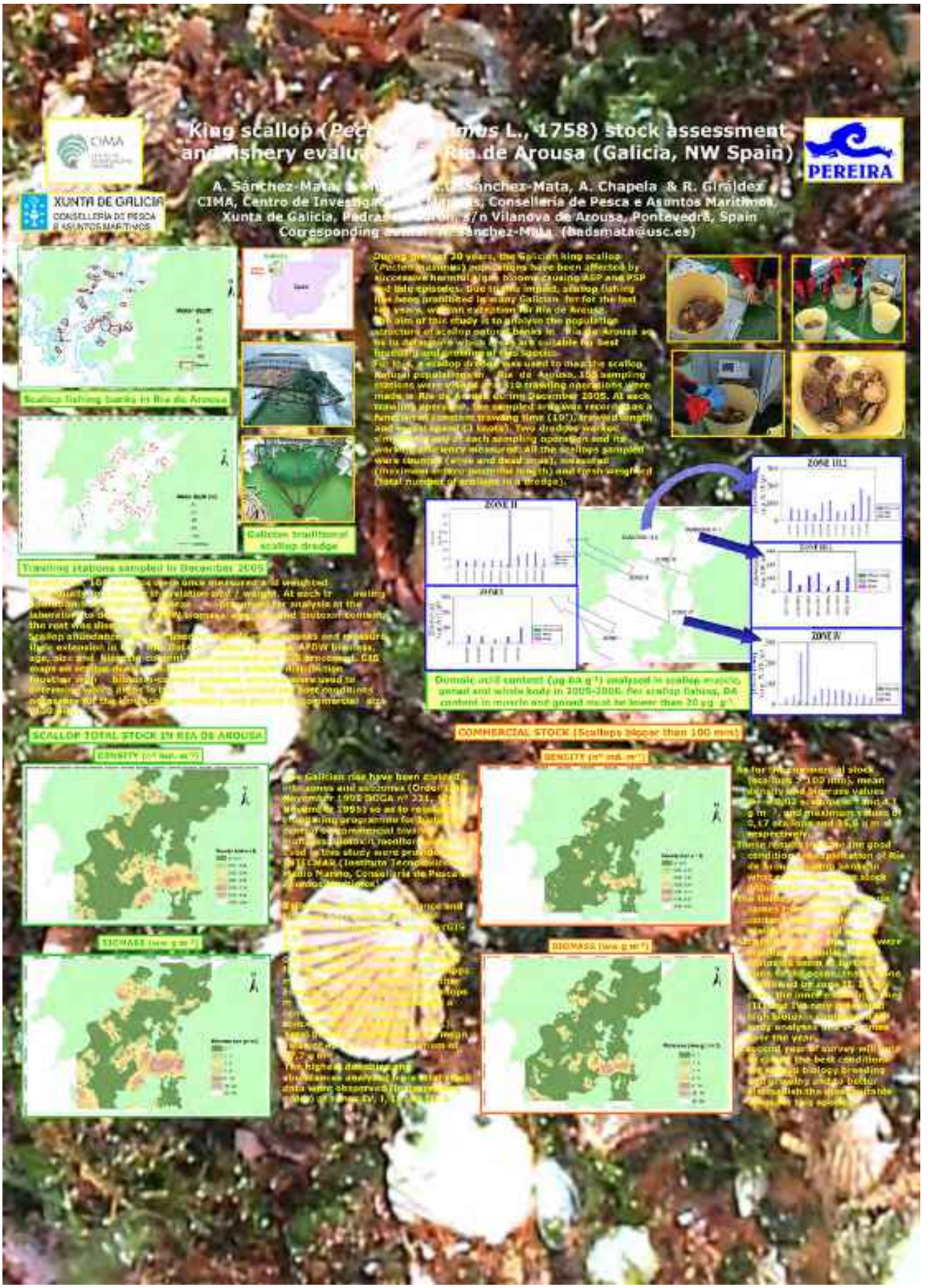
Autoría: Sánchez-Mata, A.; Molares, J.; Sánchez-Mata, A.G.; Chapela, A.; Giráldez, R.

Título: King scallop (*Pecten maximus*) stock assessment and fishery avaliation in Ría de Arousa (Galicia, NW Spain)

Evento: 41th European Marine Biology Symposium

Lugar: Cork (Irlanda)

Ano: 2006



King scallop (Pec
mus L., 1758) stock assessment
and fishery evalu
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CONSELLERÍA DE PESCA
E ASUNTOS MARÍTIMOS
PEREIRA
Scallop fishing banks in Ría de Arousa
Galician traditional scallop dredge
Trawling stations sampled in December 2005
ZONE II
ZONE III
ZONE IV
Domoic acid content (µg DA g⁻¹) analysed in scallop muscle, gonad and whole body in 2005-2006. For scallop fishing, DA content in muscle and gonad must be lower than 20 µg g⁻¹
SCALLOP TOTAL STOCK IN RIA DE AROUSA
COMMERCIAL STOCK (Scallops bigger than 100 mm)
DENSITY
BIOMASS

Autoría: Mariño, C.; Martín, H.; Acosta, C.; Blanco, J.

Título: Effect of emersion on diarrhetic shellfish toxins depuration from the blue mussel *Mytilus galloprovincialis*

Congreso: 12th International Conference on Harmful Algae

Lugar: Copenhagen (Dinamarca)

Ano: 2006

EFFECT OF EMERSION ON DIARRHETIC SHELLFISH TOXINS DEPURATION FROM THE BLUE MUSSEL *MYTILUS GALLOPROVINCIALIS*

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ABSTRACT

The effect of emersion on the depuration of DSP toxins DTX2, okadaic acid and conjugated forms of these two compounds, in the mussels *Mytilus galloprovincialis*, was studied. Contaminated mussels were placed in tanks with running seawater and maintained for one week. On days 2 and 5 of the experiment a subgroup of mussels was kept out the water for one day, other subgroup for 12 hours and a third subgroup was maintained submerged. The observed depuration was slow for the three treatments. Emersion seems to have no relevant effect on DSP toxin depuration. Notwithstanding, the relative contribution of conjugated forms was lower in the two treatments that involved emersion than in the one in which mussels were always submerged and in the initial samples, probably because an increased esterase activity in the two former treatments. This likely hydrolytic activity produces an increase of the free forms of the toxins after one week of depuration in the mussels subjected to emersion.

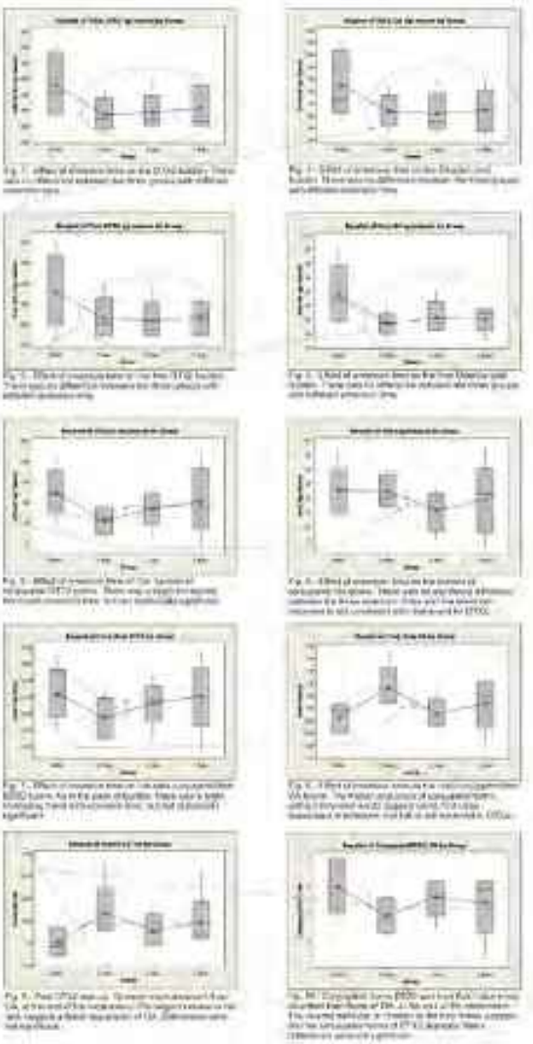
INTRODUCTION

DSP outbreaks are the main cause of market closure of the cultured mussels in Galicia (Spain). Consequently, a considerable number of studies have been carried out in order to understand the DSP toxin accumulation process and to achieve methods to avoid/reduce the elevation of this group of toxins (Blanco et al 1995; Blanco et al 1999; Mariño et al 1999; Morono et al 2003; Fernández et al 1996). Several environmental factors have been studied because of their effect on many metabolic processes of the bivalves, in general with little or no effect on the depuration rate of these toxins. One of the ways we have studied was the reduction of the unassayable metabolism, in order to change many metabolic routes that might affect toxin accumulation. In our preliminary study (Mariño et al 1999) we did not found any significant increase in the depuration rate. Notwithstanding, these tests made interesting to re-assess the possible effect. The first one is that by the time the study was made, the actual importance of conjugated forms of the main toxins was not realized, and therefore, not taken into account. The second one was a number of mussel growers observed during re-colonization of the depuration farm mussels which have been hatched and that have to be returned to the water because of a ban of farming. The third was that the time which the mussel growers kept the mussel in emersion was longer (ca. 1 day) than the one we used in our preliminary experiment (4 hours/day).

To check the possible effect of the unassayable metabolism induced by maintaining mussels in emersion, we have designed a new experiment with longer emersion times and with quantification of conjugated forms of the toxins.

RESULTS

1. Mussels contained DTX2, OA and conjugated forms of the two toxins, but in a much larger proportion those of the OA (ca. 60% of OA and 10% of DTX2).
2. No effect of emersion on the average rate in levels after the 8 days of depuration can be observed.
3. No effect of emersion on free DSP toxins was detected.
4. Opposite effects were estimated for conjugated forms of okadaic acid and DTX2 but they were not statistically significant.
5. The same opposite effects were detected for the ratio free/conjugated forms of neither of the toxins was found.
6. It seems that the loss of okadaic acid was larger than that of DTX2 as the proportion DTX2/OA is increased in the samples taken at the end of the experiment. The inverse was observed in the case of the corresponding conjugated forms.



MATERIAL AND METHODS

Mussels of *Mytilus galloprovincialis* were obtained from the Galician rías. They were distributed randomly into 20 mesh bags with 25 mussels each. Five bags were used to evaluate the initial toxin concentration and the remaining three groups of 5 bags each received air for 8 days in running water and subjected to the three emersion treatments: 1) no emersion (permanently immersed), 2) 12 hour emersion during 2 of the 8 days of the experiment, or 3) 24 hours of emersion during 1 day/day.

Toxins were extracted from the mussels by means of homogenization with 1 M acetic (HAc) in four vol. of 80% (v/v) aqueous methanol (pH-value of 3.0) mixture. Extracts were centrifuged at 1000 *g* for 10 minutes, and the supernatant was evaporated using the technique of Dudaniec (2000) but using a Thermo Delta pH Plus ion exchange solid phase extraction cartridge (Thermo Hypersil-Keystone, Runcorn, Cheshire, UK) instead of the Sep-Pak C18 cartridge described in reference made. The deep clean of the hydrolysed extracts was done following Pocklington and Holland (2000).

REFERENCES

Blanco, J., Fernández, M.L., Míguez, A. and Mariño, J. (1999) Okadaic acid depuration in the mussel *Mytilus galloprovincialis*: one and two compartment models and the effect of environmental conditions. *Mar. Ecol. Prog. Ser.* 176: 153-63.

Blanco, J., Fernández, M., Martín, L., Reguera, B., Míguez, A., Mariño, J., Cacho, E. and Martínez, A. (1995) Fijan Dinophysis spp. linked to DSP outbreaks. A preliminary model of toxin accumulation in mussels. In P. Lassus, G. Arzul, E. Erard, P. Gentien and C. Marcaillou (eds.) *Harmful Marine Algal Blooms*. Lavoisier, Intercept Ltd., Paris, pp. 777-82.

Richard, R. and Hotier, G. P. (2003) Using liquid chromatography-mass spectrometry to manage shellfish harvesting and protect public health. In: Botana, A., Reguera, B., Rodríguez, J.L. and Botana, R., (Eds.) *Molluscan Shellfish Safety*. Proceedings of the 4th International Conference on Molluscan Shellfish Safety, pp. 179-192. Santiago de Compostela, Spain: Consellería de Pesca e Asuntos Marítimos, Xunta de Galicia and IOC of UNESCO.

Morono, A., Arévalo, F., Fernández, M.L., Mariño, J., Correa, J., Reguera, B., Míguez, A., Cacho, E. and Blanco, J. (2003) Accumulation and transformation of DSP toxins in mussels *Mytilus galloprovincialis* Lmk. during a toxic episode caused by *Dinophysis acuminata*. *Aquatic Toxicology* 62: 259-69.

Morono, A., Fernández, M.L., Franco, J.M., Martínez, A., Reimer, I., Míguez, A., Cacho, E. and Blanco, J. (1999) PSP and DSP detoxification kinetics in mussels, *Mytilus galloprovincialis*: Effect of movement of attached and unattached. In S. Wang, ed., J. Blanco, M.L. Fernández, and T. Wyatt (eds) *Harmful Algae*. Xunta de Galicia and IOC of UNESCO, Santiago de Compostela, pp. 443-6.

Quilliam, M.A. (2003) Chemical methods for toxins and their fates. In G.M. Hallegraeff, S.I. Blackburn, C.J. Bolch and R.J. Lewis (ed.) *Harmful Algal Blooms 2000*. IOC of UNESCO, pp. 211-48.

Autoría: Blanco, J.; Mariño, C.; Acosta, C.; Martín, H.

Título: The use of biopsies to quantify domoic acid concentration in the king scallop *Pectem maximus*

Evento: 12th International Conference on Harmful Algae

Lugar: Copenhagen (Dinamarca)

Ano: 2006

THE USE OF BIOPSIES TO QUANTIFY DOMOIC ACID CONCENTRATION IN THE KING SCALLOP *PECTEN MAXIMUS*

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XUNTA DE GALICIA
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ABSTRACT

Several biopsy methods, to obtain samples of several organs of the king scallop *Pecten maximum* were checked. Aspiration methods or open concentric needles were found to be inefficient to obtain samples of digestive gland, gonad and adductor muscle. Cutting devices dose well good, consistent samples of the three organs. Tru-Cut biopsy devices show the important drawbacks that it cannot be operated if there is not ca. 1 mm of distance between the target of the biopsy and the shell, in the direction of the insertion of the needle. BioPince devices do not need additional space but the existing commercial model has a minimum core length of 13 mm. This device obtains cylindrical samples of about 7 mg that can be easily extracted by means of a freezing-thawing process or other extraction techniques. Scallops subjected to biopsies with BioPince and Tru-Cut show a relatively low mortality. The coefficient of variation of the biopsies of the digestive gland was found to be between 27 and 71%, depending on the extraction procedure.

INTRODUCTION

The king scallop *Pecten maximus* is a species with high commercial value and good characteristics to be cultured. Notwithstanding, its strong capability for retention of ASP toxins (Blanco et al. 2003) makes it not only unsuitable for its cultivation but also unsuitable for its exploitation by means of fisheries. This species presents a high inter-individual variability for the accumulation of ASP toxins (Arévalo et al. 1999; Blanco et al. 2003). This fact is both positive and negative in order to find a solution of the problem study. The positive part is that the variability can be used to select low accumulation strains or to find the mechanisms involved in the differences. The negative part is that it becomes extremely difficult, especially because of the large number of scallops needed, to design experiments to test the effect of any factor even with a relatively low statistical power.

In this study we have tried to find a technique which allows to quantify the domoic acid concentration in scallops, and especially in their digestive gland, that usually contains more than 95% of the total toxin (Blanco et al. 2003), in order to be able to characterize the individual deposition capability of these scallops.

RESULTS

BIOPSY OBTENTION

1. Aspiration with strategies (with different kinds of needle) did not obtain adequate samples of digestive gland, gonad or adductor muscle.
2. Tru-Cut biopsy devices obtained good samples of gonad and adductor muscle. Notwithstanding, the relatively small size of digestive gland together with its location inside the scallop and the design of the needle, makes it difficult to operate this device without hitting the shell behind that organ.
3. BioPince devices were shown to correctly obtain biopsies of the three organs. These biopsies are cylindrical and weigh ca. 8 mg.

SURVIVAL

4. Survival of the scallops after the obtention of biopsies using BioPince is high, even when the process is carried out several times (Table 1).

DOMOIC ACID EXTRACTION

5. The extraction techniques used did not differ substantially in their extraction efficiencies. Freeze-thawing was the most efficient and easy to use of the three techniques tested.

RELATIONSHIP WITH WHOLE ORGAN DETERMINATIONS AND VARIABILITY

6. Replicate biopsies of one digestive gland gave estimates of domoic acid concentration that were distributed following a normal distribution, with a coefficient of variation of 35%.
7. This relatively high coefficient of variation is mostly due to the internal distribution of domoic acid in the digestive gland that showed a CV of 25% when it was split into 3 parts.
8. The concentration of the whole organ is related to that of the biopsies but the dispersion is considerable.

ADVANTAGES AND DRAWBACKS

9. It makes possible to characterize each individual scallop
10. Decreases cost of some monitoring efforts
11. There is a considerable inherent dispersion
12. It can only estimate toxin concentration and no toxin burden.

MATERIAL AND METHODS

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REFERENCES

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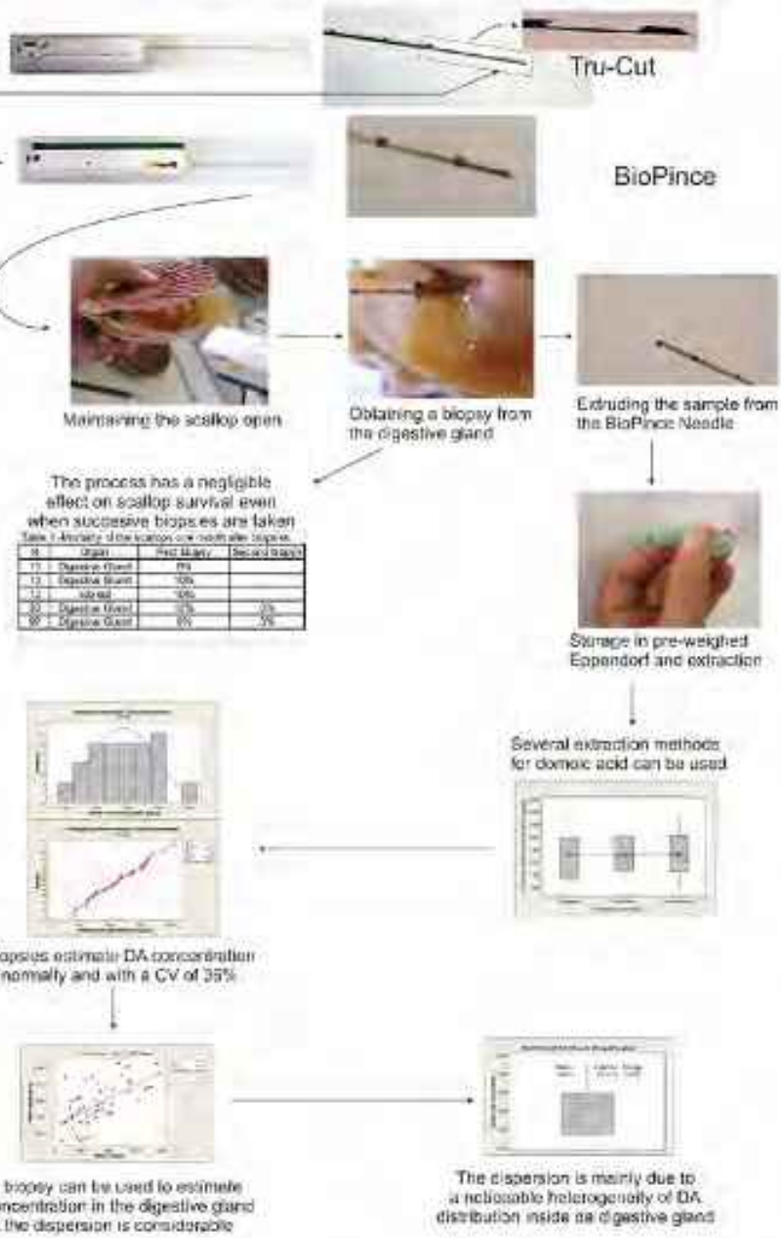

Autoría: Abollo, E.; Casas, S.M.; Ceschia, G.; Villalba, A.

Título: Differential diagnosis of *Perkinsus* species by polymerase chain reaction-restriction fragment length polymorphism assay

Evento: 5th International Symposium on Aquatic Animal Health

Lugar: San Francisco - California (EE. UU.)

Ano: 2006

Differential diagnosis of *Perkinsus* species by polymerase chain reaction-restriction fragment length polymorphism assay

Abollo E.[1], Casas SM.[1], Ceschia G.[2], Villalba A.[1]

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ABSTRACT

A polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) assay of the rDNA ITS region was developed to identify and distinguish among *Perkinsus* species. This taxonomic key allows unequivocal identification of *Perkinsus* species using a single restriction enzyme (*Dra* I) to discriminate *P. olseni*/*P. chesapeaki* and *P. marinus*, or to a combination of two other enzymes (*Dra* I plus *Nde*I) to distinguish *P. olseni* and *P. mediterraneus*. Novelty in this first report of *P. olseni* in Mytilus edulis from the NW Atlantic (Ria de Arousa, Galicia, Spain) is also described by employing this method.

INTRODUCTION

Species of the genus *Perkinsus* are parasites of a wide variety of mollusks around the world, and have been associated with severe mortalities and significant economic losses [1]. Until recently, *Perkinsus* infections were diagnosed by histology or culturing mollusk tissues in a fluid thioglycollate medium [2][3][4]. Despite some host-related variations in specificity and sensitivity, polymerase chain reaction (PCR)-based approaches utilizing species-specific nucleic acid probes provided useful tools to overcome the limitations for the diagnosis of *Perkinsus* species [5][6].

Recent molecular studies have recognized five species of the genus *Perkinsus* which *P. marinus*, *P. olseni*, *P. mediterraneus*, *P. qugwadi* and *P. chesapeaki* [1]. The present study reports a rapid and inexpensive method for the specific identification of *P. olseni*, *P. mediterraneus*, *P. marinus* and *P. chesapeaki* by PCR-RFLP assay. The accuracy of this method allows us to report for the first time the parasite assemblages of *Perkinsus* spp. species infecting the Manila clam *Ruditapes philippinarum* and the NW Atlantic Ria [6][7].

MATERIALS AND METHODS

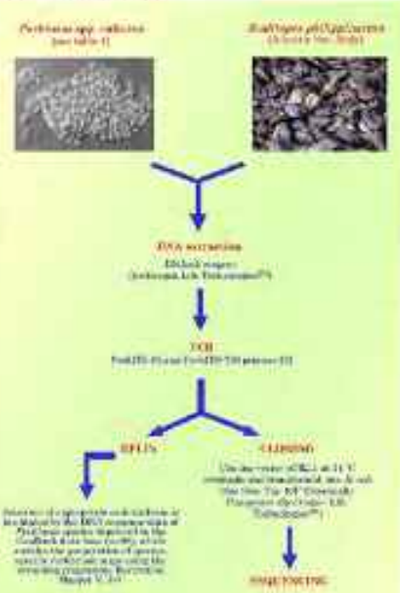
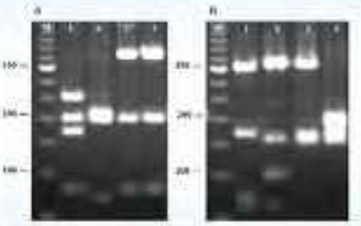


Table 1. Oligonucleotide primers used to develop a inter-specific diagnostic kit targeted to the rDNA ITS region. Nt indicates base number. Tm, melting temperature. GC, guanine-cytosine content. Sequences are shown 5'-3'.

Primer/probe designation	Sequence	Nt	Tm	GC	Target species	Reference
P. olseni	5'-CCTTGTGTGTTGCCTCGTCG-3'	20	60.0	60.0	*Perkinsus olseni*	Present study
P. marinus	5'-GCTGCTTTGTGCACTGACGTC-3'	21	60.0	57.1	*Perkinsus marinus*	Robledo et al. (1998)
P. mediterraneus	5'-GCTGCTTTGTGCACTGACGTC-3'	21	60.0	57.1	*Perkinsus mediterraneus*	Robledo et al. (1998)
P. chesapeaki	5'-GCTGCTTTGTGCACTGACGTC-3'	21	60.0	57.1	*Perkinsus chesapeaki*	Robledo et al. (1998)

RESULTS



DISCUSSION

CONCLUSIONS

REFERENCES

Acknowledgements

Autoría: Sánchez-Mata, A.G.; Sánchez-Mata, A.; Chapela, A.; Giráldez, R.; Molares, J.

Título: The effects of a PSP episode on mortality of king scallop (*Pecten maximus* L., 1857) in Ría de Vigo, Galicia, NW Spain.

Evento: XIV Simposio Ibérico de Estudios de Biología Marina

Lugar: Barcelona (España)

Ano: 2006

THE EFFECTS OF A PSP EPISODE ON MORTALITY OF KING SCALLOP (*Pecten maximus* L., 1857) IN RÍA DE VIGO GALICIA , NW SPAIN.

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INTRODUCTION

The king scallop *Pecten maximus* L. (1857) is a very valuable selfish recorded along a great range location, from northern Norway and the Faroe Islands to the Iberian Peninsula, the Azores and the Canary Islands, around Madeira and off West Africa.

Galician rias have been damaged by successive red tides episodes since the first occurred in Outumn 1976, caused by the PSP toxin from the dynoflagellate Gymnodinium catenatum (Graham). The increasingly eutrophic conditions of galician coastal waters are favourable to toxic dinoflagellate blooms during spring and summer when pectinid reproduction is at a maximum. These harmful algal blooms effect against *P. maximus* L. (1857) causing high mortality rates in relation with the biotoxin levels occurred over a range of scallop natural banks of Ría de Vigo.

This impact has affected *P. maximus* L. (1857) galician fishery, taking serious economic losses since scallop fishing hasn't been allowed in most rias.

Pecten maximus L. (1857)

OBJECTIVE

The main purpose of this study is to analyse the population structure of King scallop natural banks in Ría de Vigo and to determine the effects of the last PSP episode occurred on scallop mortality.

MATHERIAL AND METHODS

Study Site.-Field sampling was conducted at Ría de Vigo, located on the south west coast of the Galician Region, NW Spain.

Sampling strategy.- King scallop Sampling was carried out after the last PSP episode, from 22th December 2005 to 27th January 2006. Scallop natural populations were mapped using the conventional sampling dredge for scallops, recording the sampled area at each dredging operation. Sampling was carried out using a scallop dredge, recording the sampled area at each dredging operation along the Ría de Vigo natural banks, resulting a total number of 203 trawlings.

Data on scallop densities (ind m^{-2}), wet weigh biomass, age, size, weight, number of freshly dead individual and biotoxin content were recorded. Water environmental variables such as salinity, oxygen content and temperature were measured.

Scallop dredge

Sampling weigh and size of *P. maximus* L. (1857)

RESULTS

Scallop Total Stock and Total Biomass.- The bank scallop extension is set along the northern margin of the ría. The highest values of total abundance and total wet weigh biomass are stressed at Cangas, Moaña and Domaio localities.

Commercial Abundance and Biomass.-The commercial scallop size is > 10 cm. Commercial scallop abundance (density (ind m^{-2})) and wet weigh biomass highest values were found between Cangas and Moaña sites. The lowest values for these variables were shown on the opposite coast, towards Vigo and Redondela.

Biotoxin Analysis. The Domoic Acid concentration values for scallop commercial extraction must be lower than the 20 µg D.A. g^{-1} stationary safety limit. Galician scallop is sold with the mental. According the biotoxin analysis from the INTECMAR, Xunta de Galicia, the highest D. A. concentration found in gonad was shown in Zones I and II. D. A. concentration in whole body reached the minimum value in Zone II.

Domoic Acid Concentration (µg A.D./g) values in Muscle, Gonad and Whole Body

Scallop Mortality.- The highest scallop mortality is shown on the northern margin and in the external zone of the ría, following a decreasing gradient towards the southern margin and the internal zone of the ría. This happening can be explained because organic toxins inputs with major southwest winds, that take place in Galicia rivers drive the PSP toxin to these locations.

Abundance of alive and freshly dead scallop along the three zones of Ría de Vigo

SUMMARY/CONCLUSIONS

- The *Pecten maximus* L. (1857) stock analysis at the studied ría indicated that some gradient exist, with a Northward increase in the king scallop density and wet weigh biomass.
- Cangas, Moaña and Domaio sites reached the highest values of total and commercial density and biomass.
- Domoic acid concentration values and scallop mortality along the ría followed a similar geographic trend, increasing towards the Northern and the external zone of the ría.
- It is recorded a relationship between domoic acid concentration and scallop mortality in relation to the coastal water inputs with major southwest winds that take place in Galicia rivers and drive the PSP toxin to this location.

Acknowledgements

This research was supported by the project "EVALUACIÓN DEL STOCK DE LAS POBLACIONES NATURALES DE VIEIRA (*Pecten maximus* L. (1857)) EN LAS RÍAS GALLEGAS DE ARGOSA, ARES Y VIGO" (Pereira Productos del Mar S.A. and the Marine Research Center of Xunta de Galicia).

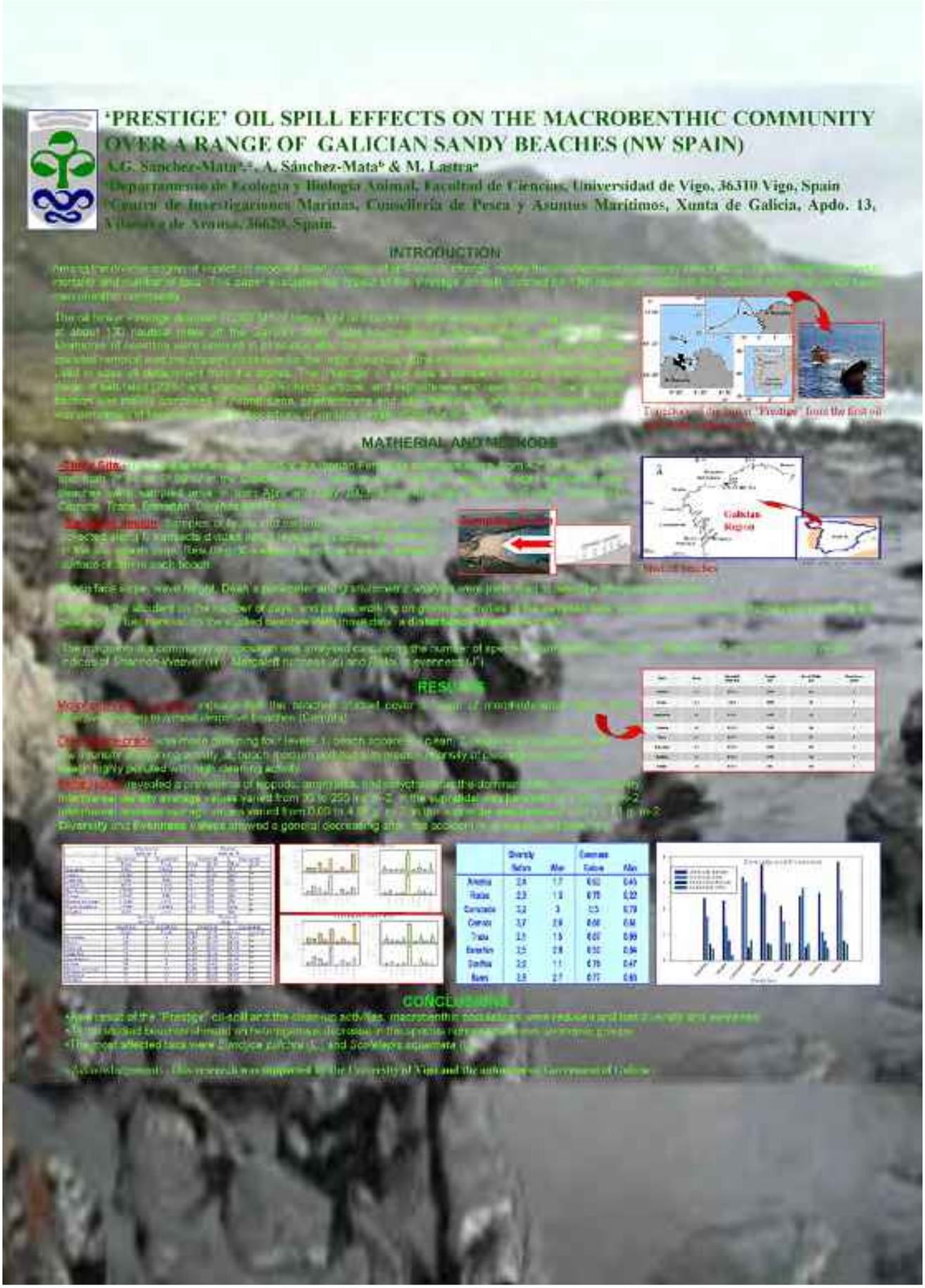
Autoría: Sánchez-Mata, A.G.; Sánchez-Mata, A.; Lastra, M.

Título: Prestige oil spill effects on the macrobenthic community over a range of Galician sandy beaches (NW Spain)

Evento: 41th European Marine Biology Symposium

Lugar: Cork (Irlanda)

Ano: 2006


'PRESTIGE' OIL SPILL EFFECTS ON THE MACROBENTHIC COMMUNITY OVER A RANGE OF GALICIAN SANDY BEACHES (NW SPAIN)
INTRODUCTION
MATHERIAL AND METHODS
Galician Region
RESULTS
CONCLUSIONS

Autoría: Darriba, S.; Guerra, A.

Título: Estudio de dos poblaciones de oreja de mar (*Haliotis Tuberculata*) en Galicia (NO de España)

Evento: IX Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2006

Estudio de dos poblaciones de oreja de mar (*Haliotis tuberculata*) en Galicia (NO España)

Susana Darriba y Alejandro Guerra

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scamba@cimacoron.org

Illa de Arousa

Illas Cíes

Introducción

La oreja de mar (*Haliotis tuberculata*), comúnmente denominada "peneira" en Galicia, es un molusco gasterópodo que habita en zonas de rocas refugiándose en las grietas durante el día y saliendo durante la noche para alimentarse, desplazarse e incluso desovar. Aunque en Galicia no es habitual su consumo, su explotación se inició en la década de los 80 por el alto precio alcanzado en el mercado asiático. La extracción estuvo prohibida desde 1993 hasta 2002 por la presencia de la toxina PSP. Desde el reinicio de la actividad en 2002 hay tres cofradías intentando la reactivación de su comercialización.

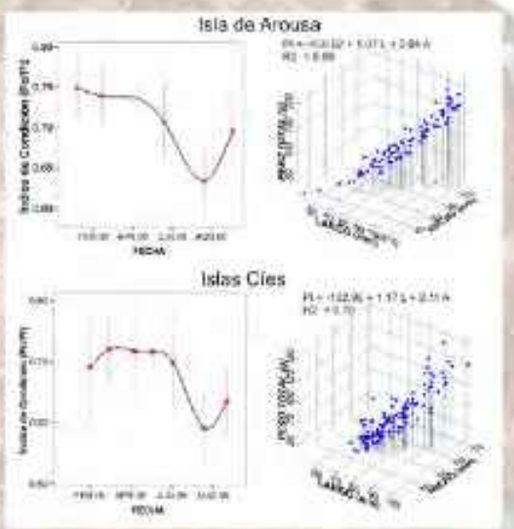
Actualmente, se está llevando a cabo en el CIMA un estudio de dos bancos naturales de oreja de mar en Galicia dentro de un proyecto de los Planes Nacionales de la Junta Nacional Asesora de Cultivos Marinos (JACUMAR). En este trabajo se presentan los primeros resultados obtenidos de este estudio.

Material y métodos

Desde enero de 2006, mensualmente, se recogen muestras de 20 ejemplares de oreja de los bancos de las Islas Cíes (Ría de Vigo) y de la Isla de Arousa (Ría de Arousa).
De cada ejemplar se registran los siguientes parámetros: longitud, ancho, peso total, peso de la concha, peso de la carne y peso del apéndice cónico, que incluye glándula digestiva y gónada.
Con los valores obtenidos se evalúan diferentes índices de condición y se analizan las relaciones biométricas para cada uno de los bancos.

Resultados y discusión

De los resultados obtenidos, destaca la evolución del índice de condición de la carne (Peso carne / Peso total) con un patrón marcadamente estacional, mostrando niveles elevados de enero a julio seguidos de un brusco descenso en agosto y una posterior recuperación en septiembre. La evolución observada en el índice de condición puede ser debida a la reproducción y/o a la disponibilidad de alimento en el medio, cuestión que se confirmará en cuanto se finalice el estudio gametogénico del tejido gonadal.
Del análisis de las relaciones biométricas destacamos la relación del peso total con los parámetros longitud y ancho, así como el modelo de ajuste que no revela diferencias importantes entre ambos bancos.



Agradecimientos.
A. María Otero y Mercedes Fernández por su colaboración en el procesamiento de los ejemplares y a las Cofradías de Cangas y A Illa de Arousa por la colaboración en la obtención de las muestras.
Este estudio se enmarca en el proyecto "Cultivo y Gestión de oreja de mar", financiado por la Junta Nacional Asesora de Cultivos Marinos (JACUMAR).

Autoría: López, C.; Darriba, S.; Cutrín, J.M.; Conchas, R.

Título: Presence and characterization of *Marteilia* sp. in razor clam, *Solen marginatus* (Pennántt, 1777) in Galicia (NW Spain)

Evento: Aquaculture Europe Conference 2006 - Linking Tradition & Technology

Lugar: Florencia (Italia)

Ano: 2006

Presence and Characterization of *Marteilia* sp. in razor clam *Solen marginatus* (Pennántt, 1777) in Galicia (NW Spain)

Carmen López (1) , Susana Darriba (1), J. Manuel Cutrín (2) and Ramón F. Conchas (3)

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(2) Unidad de Biotecnología. Instituto de Acuicultura. Universidad de Santiago de Compostela 15782. Santiago de Compostela
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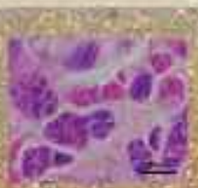
Introduction

Marteliosis is a disease of molluscs caused by protistan parasites of the genus *Marteilia*, phylum Paramyxea (Berthe, et al. 2000). This parasite caused mortalities in several bivalves molluscs (Berthe et al., 2004). The disease caused by *Marteilia refringens* is currently listed by the Office International des Epizooties (OIE) (2003) as a notifiable disease. *Solen marginatus* (Solenidae) is one of the three commercial razor clams in Galicia (NW Spain).

Material and Methods

We took monthly samples of 20 razor-clams, *Solen marginatus*, from a intertidal natural bed in Ría de Arousa (Galicia, NW Spain). We used standard techniques for light microscopy, transmission electron microscopy (TEM) and polymerase chain reaction (PCR). PCR was performed in a 25 µl vial using different conditions and primers previously designed: Pr4/Pr5 (Le Roux et al 1999). DNA amplified was analyzed by electrophoresis on ethidium bromide-staining agarose gels. Sequencing of the resultant purified fragment was performed using the CEQ™ Dye Terminator Cycle Sequencing kit and the CEQ™ 8000 Genetic Analysis System (Beckman Coulter). Multiple sequence alignments and phylogenetic tree were performed using the DNASTAR Lasergene v.6 software.



Results

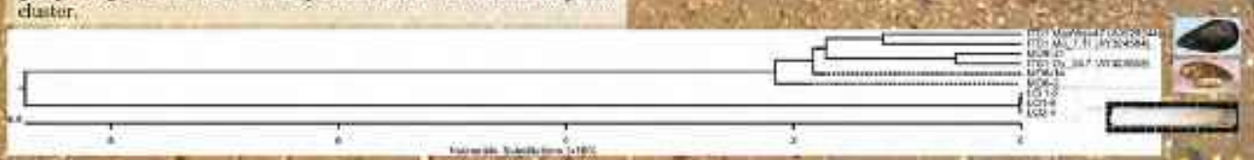
The different stages of the life cycle of the genus *Marteilia* were found in histological sections of *S. marginatus*. We observed evolutionary stages, with refringent granules, located in the epithelial cells of digestive ducts and tubules.

Ultrastructurally, we observed a complex of cells-within-cells (secondary and tertiary cells) culminating in spores. The secondary cells were surrounded by two membranes and contained the tertiary cells (spore primordia).

Detection of *Marteilia* sp. by PCR analysis.
Lane 1, 100 Base-Pair Ladder Marker; lanes 2 and 19, +ve controls lanes 4, 11, 13, *Marteilia* +ve; and lanes 3, 5-10, 12,

We found sporangia with up to six spores. Mature spores presented 3 uninucleate sporoplasms (outermost, intermediate and innermost) one inside the other. Spore nuclei was in the innermost sporoplasm. The outer sporoplasm contained several haplosporosomes. Spores were involved by a thickened wall. Ultrastructural results showed some differences to data of other authors (Villalba et al., 1993; Renault et al., 1995; Longshaw et al., 2001).

Nucleotide sequences of three *Marteilia* sp founded in razor clams (LO1-2, LO1-9 and LO2-4) showed high diversity with sequences of *Marteilia refrigens* founded in mussels (MO6-2, MO6-14 and MO8-21) from the same geographical area. Phylogenetic analysis based on these sequences and previously sequences deposited in the GeneBank showed a tree with two groups or clusters. *Marteilia refrigens* from oysters and mussels were grouped together while *Marteilia* sp from razor clams were in a separate cluster.



Conclusion

The parasite *Marteilia* sp detected in the razor clam *S. marginatus* is different to *Marteilia refrigens*.

References

Berthe et al. 2000. J. Eukl. Microbiol. 47: 386-391.
Berthe et al. 2004. J. Invertebrate Pathology. 85: 49-58.
Le Roux et al. 1999. Mar. Biol. 133: 527.
Longshaw et al. 2001. Dis. Aquat. Org. 44: 107-116.
OIE. 2003. International Animal Health Code. Aquatic Animal Health. 6th ed. OIE, Paris.
Renault et al. 1995. Dis. Aquat. Org. 21: 169-174.
Villalba et al. 1993. Dis. Aquat. Org. 16: 51-57.

ACKNOWLEDGEMENTS

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ICSIA 2008 | Florencia, May 2008

Autoría: López, C.; Darriba, S.; Iglesias, D.; Harshbarger, J.C.

Título: Presence of germinoma in razor clam *Ensis arcuatus* (Jeffreys, 1865) in Galicia (NW Spain)

Evento: Aqua 2006 - Linking Tradition & Technology

Lugar: Florencia (Italia)

Ano: 2006

Presence of Germinoma in Razor Clam *Ensis arcuatus* (Jeffreys, 1865) in Galicia (NW Spain)

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Introduction

The superfamily Solenaceae has three commercial species, for human consumer, in Spain: *Ensis arcuatus*, *Ensis siliqua* and *Solen marginatus*. *E. arcuatus* is the most important in production and Galicia (NW Spain) (Fig. 1) is the first producer.

Neoplasms (tumors) have been described from nearly all organ systems in marine bivalves over the past century. The two types of neoplasms described in marine bivalves are hematopoietic neoplasm or disseminated sarcoma (proliferation of abnormal circulating cells) and gonadal neoplasm (proliferation of abnormal cells in gonads).

Figure 1 - Visitation of the bed sampled (Cline islands) in the SW of Galicia

Material and Methods

Samples of 15-20 adults of *E. arcuatus* (>200 mm in length) were collected diving each three months during 2003, from a natural bed in Ría de Vigo SW of Galicia (NW Spain) (Fig. 1) and processed with standard techniques for histology.

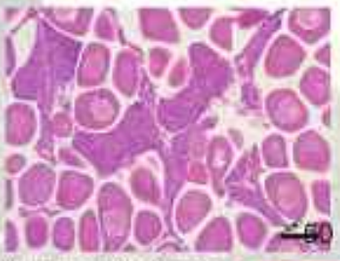

Figure 2 - Female gonad of *E. arcuatus* with germinoma

Results and discussion

Histodides of gonad of *E. arcuatus* showed a type of germinoma in females (Fig 2 and 3) and males (Fig 4 and 5) specimens. The germinoma observed was characterized by the uncontrolled proliferation of undifferentiated germ cells forming tight clusters in wall and/or lumen of gonadal follicles. The germinoma of *E. arcuatus* was characterized by the presence of basophilic, undifferentiated germ cells that appear initially as small foci in one or few follicles, but can affect partially most of the follicles. The germinoma was observed on January, April and October, and on July was absence. Nevertheless, data was insufficient to establish a statistically valid temporal pattern. It is necessary to analyse more data and another variables (pollution, oceanographic conditions etc.) to discuss the possible etiology of the germinoma in this natural bed of *E. arcuatus*. This is the first reference of a gonadal neoplasm in the superfamily Solenaceae.

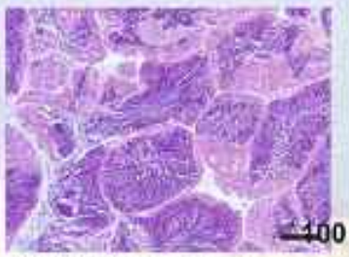

Figure 3 - Male gonad of *E. arcuatus* with germinoma

Figure 4 - Germinoma in the wall of a female follicle in *E. arcuatus*

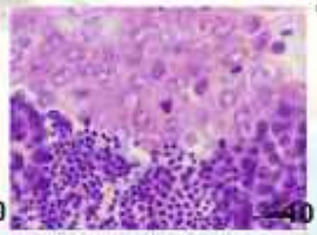

Figure 5 - Germinoma in the wall of a male follicle in *E. arcuatus*

ACKNOWLEDGEMENTS
Thanks to Manfred Meléndez, Elena Pérez, Ana González and Mercedes Miranda for technical support.
This study was supported by a Xunta de Galicia research program PGIDT03RMA50101PR.

Autoría: Guerrero, S.; Alonso-Fernández, J.L.; Otero, M.

Título: Generación de residuos de la acuicultura en Galicia

Evento: IX Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2006

Generación de Residuos de la Acuicultura en Galicia

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Introducción

Este trabajo se ha desarrollado dentro de un proyecto Aqualink sobre "Subproductos Procedentes de la Acuicultura" perteneciente al Programa AQUAREG cofinanciado por la Comisión Europea y realizado conjuntamente por la región Irlandesa Border, Midland and Wester (BMW), la región noruega de Trondelag y Galicia.

Para facilitar intercambios de información entre los productores y los gestores de residuos, se consideró prioritario elaborar una base de datos conjunta de las tres regiones que posibilitara acceder a todas las soluciones viables en la práctica y/o potenciales sobre la generación y tratamientos de estos residuos en el campo de la acuicultura.

Metodología

Una vez obtenida la información, la cual fue recogida agrupando los datos proporcionados por las asociaciones de productores a través de encuestas y por medio de información bibliográfica disponible en la Consellería de Pesca y Asuntos Marítimos de la Xunta de Galicia, se elaboró una base de datos en la cual están representadas las empresas generadoras de residuos (piscifactorías, granjas marinas productores de mejillón, cofradías de pescadores, ectáreas, depuradoras...), los gestores y transformadores de los diversos tipos de residuos, junto con la legislación aplicable a residuos en acuicultura a nivel regional, nacional y de la Unión Europea.

Resultados

El listado de gestores de residuos se ha hecho según las directrices de la Consellería de Medio Ambiente e Desenvolvemento Sostible (www.siam-cma.org), donde se encuentra una base de datos sobre legislación ambiental (AMBILEX), y que se clasifican los residuos en peligrosos o no peligrosos, entendiendo como tales los que son más o menos peligrosos para el medio ambiente.

En noviembre de 2005 se realizó el I Seminario sobre Residuos Procedentes de la Acuicultura en la Sede del CETMAR (Centro Tecnológico del Mar). A lo largo del Seminario tuvieron lugar exposiciones relativas a residuos y subproductos procedentes de instalaciones del cultivo de peces, tanto de piscifactorías de agua dulce, como de granjas marinas, como también de residuos generados en el cultivo de moluscos. Se expusieron métodos de compostaje de eviscerados y de algas, tratamientos de residuos orgánicos e inorgánicos, aprovechamiento de conchas de bivalvos, y proyectos sobre la recuperación de los fangos procedentes de bateas de mejillón.

Así mismo, en el transcurso del seminario se hizo la presentación de la base de datos disponible en Internet a través de la pagina Web http://www.aquabyproducts.com en la que desde entonces se puede consultar en los tres idiomas (inglés, español y gallego) toda la información disponible de las tres regiones en los ámbitos de la generación, gestión y legislación de los residuos en la acuicultura.

Agradecimientos
Queremos expresar nuestro agradecimiento a todas aquellas personas que colaboraron con nosotros.

IX Foro dos Recursos Mariños e da Acuicultura das Rías Galegas
O Grove, 10 - 11 de Outubro 2006

Autoría: Guerrero, S.; Pascual, C.; Barja, J. L.; Romalde, J.L.; Alonso-Fernández, J.L.; Brea, M.D.; Prado, S.; Rodríguez, C.J.

Título: Tratamiento de residuos de la acuicultura de rodaballo en Galicia mediante ensilados

Evento: MarCuba 2006

Lugar: La Habana (Cuba)

Ano: 2006

TRATAMIENTO DE RESIDUOS DE LA ACUICULTURA DE RODABALLO EN GALICIA MEDIANTE ENSILADOS

Salomão Guimarães, Cruz Pérez, Mª Ángeles, Pastor, Jesús, Fernández, José Luis A. Campañas de Investigación, Universidad de Vigo, Facultad de Ciencias del Mar, Campus Universitario, Vigo, España
Departamento de Química Analítica, Nutrición y Bromatología, Facultad de Veterinaria, Universidad de Santiago de Compostela, Campus Universitario, Lugo, España

Introducción

La generación de residuos biológicos es una de las principales preocupaciones a nivel mundial para la industria de la acuicultura, a causa de los elevados costes económicos que conllevan el cumplimiento de las Directivas de la Unión Europea para protección ambiental. El rodaballo (*Scophthalmus maximus*) es la especie de acuicultura marina más importante de Galicia. Hasta la fecha no se ha aplicado ningún tratamiento a los residuos orgánicos generados durante el cultivo de esta especie. Una posible solución al problema de residuos es la realización de procesos de ensilado de los residuos orgánicos. Los ensilados químicos se obtienen por la adición de ácidos orgánicos o inorgánicos, que reducen el pH hasta valores en los que la actividad microbiana es inhibida. Los ensilados químicos son una alternativa de alto rendimiento, ya que no requieren una gran inversión inicial en equipamiento y son fáciles de producir. Los ensilados químicos pueden ser clasificados en función del ácido utilizado en su producción: ácidos orgánicos (ácido fórmico (FA) y ácido propiónico (PA)) y ácidos minerales (ácido clorhídrico (HCl) y ácido sulfúrico (SA)). Para el FA la literatura indica que es necesaria una concentración mínima del 2% para conseguir un ensilado estable en el tiempo. Para los ensilados químicos con ácidos minerales se recomienda una concentración mínima del 3%. Para los ensilados con ácidos orgánicos se recomienda una concentración mínima del 2%. Para los ensilados con ácidos minerales se recomienda una concentración mínima del 3%.

Materiales y métodos

Los ensilados químicos de rodaballo se prepararon de acuerdo con el procedimiento descrito por Raa y Gildberg (1982). Los residuos de rodaballo (cabeza, vísceras, piel y espinas) fueron molidos en un molinillo de carne (Moulinex, Francia) y mezclados con los ácidos orgánicos (FA y PA) y minerales (HCl y SA) en proporción 4:1 (p/p). Las concentraciones de ácido utilizadas fueron 2% y 3% (v/p). Los ensilados se mantuvieron a temperatura ambiente (20°C) durante 30 días en botellas de plástico herméticamente cerradas. Durante el periodo de ensilado se tomaron muestras a los 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 y 30 días para determinar el pH, la humedad, la materia seca, la proteína bruta, la grasa y la ceniza. Todas las determinaciones se realizaron por triplicado. Los resultados se expresaron como media ± desviación estándar.

Figura 1

Los ensilados químicos se prepararon de acuerdo con el procedimiento descrito por Raa y Gildberg (1982). Los residuos de rodaballo (cabeza, vísceras, piel y espinas) fueron molidos en un molinillo de carne (Moulinex, Francia) y mezclados con los ácidos orgánicos (FA y PA) y minerales (HCl y SA) en proporción 4:1 (p/p). Las concentraciones de ácido utilizadas fueron 2% y 3% (v/p). Los ensilados se mantuvieron a temperatura ambiente (20°C) durante 30 días en botellas de plástico herméticamente cerradas. Durante el periodo de ensilado se tomaron muestras a los 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 y 30 días para determinar el pH, la humedad, la materia seca, la proteína bruta, la grasa y la ceniza. Todas las determinaciones se realizaron por triplicado. Los resultados se expresaron como media ± desviación estándar.

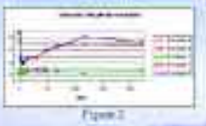


Figura 2

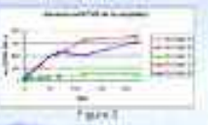


Figura 3

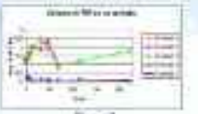


Figura 4

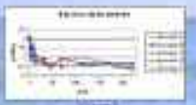


Figura 5

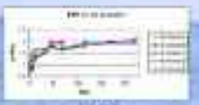


Figura 6

Figura 7

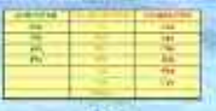


Tabla 1

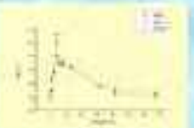
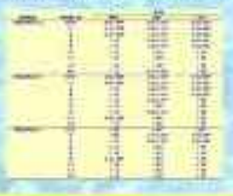


Figura 8

Figura 9



Conclusiones

Raa, J. & Gildberg, A. (1982). Fish silage: a review. *Critical Reviews in Food Science & Nutrition*, 16(4), 383–419.

Autoría: Villalba, A.

Título: Different types of neoplasia in *Crassostrea gigas*, *Venus verrucosa* and *Mytilus galloprovincialis* from the Spanish coast

Evento: 98th National Shellfisheries Association Annual Meeting

Lugar: Monterrey - California (EE. UU.)

Ano: 2006

Different types of neoplasia in *Crassostrea gigas*, *Venus verrucosa* and *Mytilus galloprovincialis* from the Spanish coast

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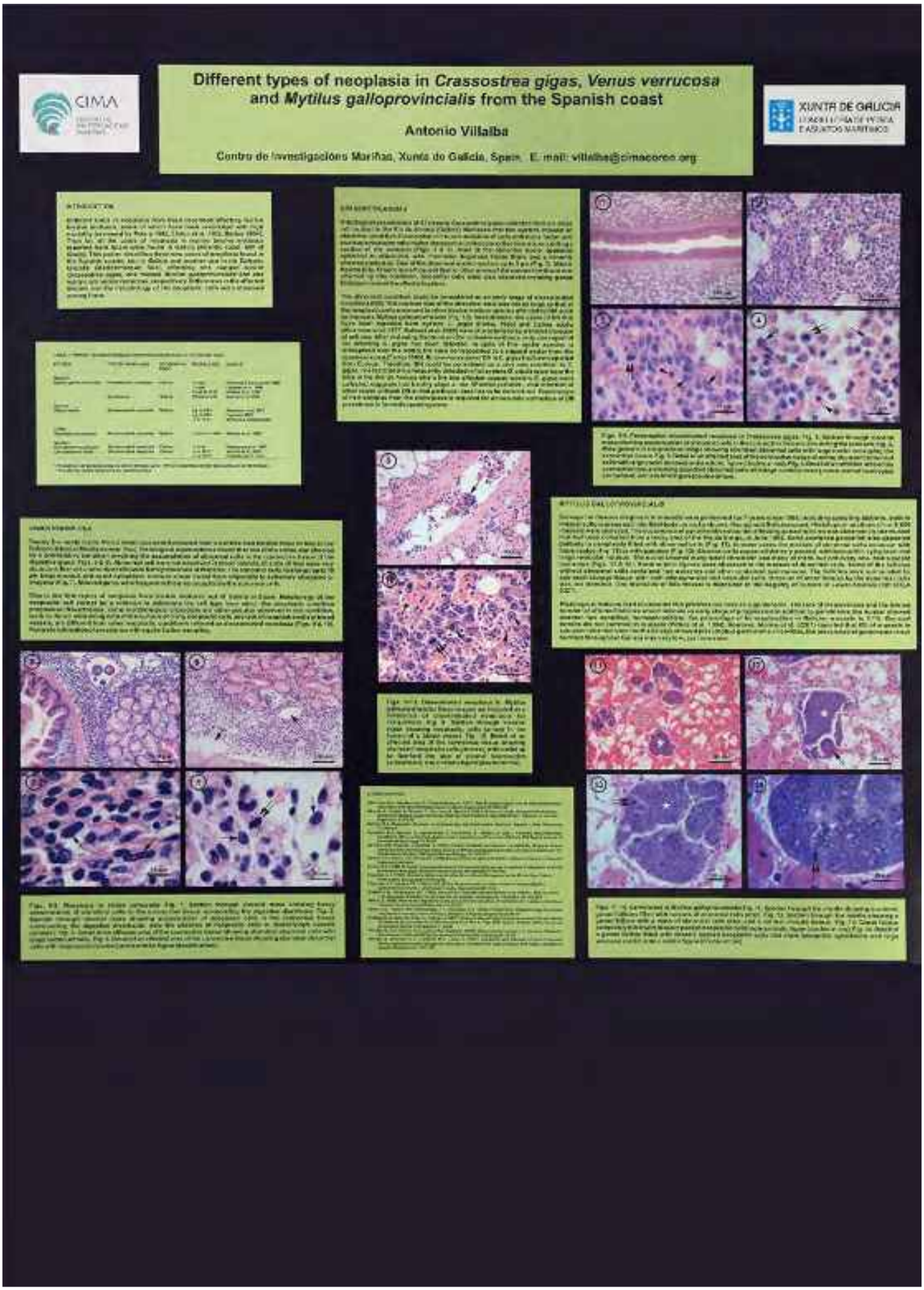

Autoría: Guerrero, S.; Pascual, C.; Barja, J. L.; Romalde, J.L.; Brea, M.D.; Prado, S.; Rodríguez, C.J.

Título: Preliminary results on the silage of residues from marine and freshwater aquaculture

Evento: Aquaculture Europe 06 – Linking Tradition & Technology

Lugar: Florencia (Italia)

Ano: 2006

ESULTS ON THE SILAGE OF RESIDUES
E AND FRESHWATER AQUACULTURE

INTRODUCTION

OBJECTIVE

RESULTS

Autoría: Abollo, E.; Comesaña, P.; Casas, S.M.; Cao, A.; Villalba, A.

Título: Co-infection of two *Bonamia* species in the European oyster *Ostrea edulis* from Galician coast (NW Spain)

Evento: 5th International Symposium on Aquatic Animal Health

Lugar: San Francisco - California (EE. UU.)

Ano: 2006

Co-infection of two *Bonamia* species in the European oyster *Ostrea edulis* from the Galician coast (NW Spain)

Abollo E., Comesaña P., Casas SM., Cao A. & Villalba A.

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ABSTRACT

Bonamiosis of European oyster *Ostrea edulis* is caused by a protozoan parasite, *B. ostreae*, which has been detected in subtidal and cultivated European localities and USA. Recently another species has been identified parasitizing the European oyster in Galicia (NW Spain) by employing molecular techniques. In the present study we report the co-infection of two *Bonamia* species occurring in cultivated Galician stocks.

INTRODUCTION

The haplosporidian parasite belonged to the genus *Bonamia* (sensu Hine) the haplosporidian of different oyster species around the world. Currently, the genus comprises four species restricted to O.D.V. by molecular analyses: *B. perkinsi* which infects the flat oyster *Ostrea stentina* in Europe and North America [1]; *B. exitiosa*, which parasitizes the flat oyster *Ostrea chilensis* in New Zealand [2] and *Ostrea angasi* in New South Wales [3]; *B. roughleyi*, also known as *Mikrocytos roughleyi*, in the flat oyster *Ostrea angasi* in Australia [4]; and *B. ostreae*, which infects *Ostrea edulis* (previously in Northern Europe [5], and *O. puelchana* in Argentina [6]). The aim of the present study was to establish the specific identification of the recurrently co-occurred in *O. edulis* in Galician coast, by using molecular methods.

MATERIALS AND METHODS

Flat oysters (n = 60) were collected in the Corrubedo inlet (Ría de Aldán) (NW Spain). Of each oyster tissue smears of digestive gland, gill, mantle, gonad and labial palp were fixed for histopathology and DNA isolation, respectively. Diagnosis was carried out employing the DNA hybridization (Dot-blot) assay [7] according to the manufacturer's instructions.

The pair of primers BO1 (5'-ATCGCTTTGTTGCTTTCGGC-3') and BO2 (5'-GACACACCTTCCTCCGTTTG-3') [8] was used to amplify a fragment of the ITS region of *Bonamia* sp. To perform a species-specific identification of the same, fresh PCR products of each oyster were spotted onto nylon membranes (ABN) (Amersham) at 70 °C overnight and pre-hybridized at 42 °C for 1 hour with DIG Easy Hyb (DIG Chemicals) (Amersham). The positive clone with a fragment length about 450 bp were thereby sequenced. The PCR products were cleaned for sequencing using the commercial kit Roche PCR Purification system (Roche Diagnostics, Inc.) according to the manufacturer instructions. The sequence analyses were performed on an ABI PRISM™ 3100 Applied Biosystems Genetic Analyzer. BigDye Terminator v3.1 Cycle Sequencing Kit (Applied Biosystems) as supplied by the manufacturer. Each PCR product was sequenced with forward and reverse primers. The electropherograms were analyzed using ChromasPro version 1.34 (Technelysium Pty, Ltd.). All sequences generated were searched for similarity using BLAST (Basic Local Alignment Search Tool) at web servers of the National Center of Biotechnology Information.

In order to identify *Bonamia* species a RFLP analysis was performed according to protocol Lee et al. [9]. Bands of fragments after electrophoretic analysis were excised from agarose gel and the DNA extraction was performed using the Illustra Gel Extraction Kit (GE) as per DNA extraction manufacturer's instructions and sequencing.

RESULTS

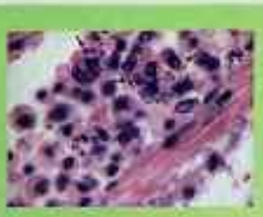

Figure 1. Histological section showing intense infection of haemocytes, mainly forming infiltrates, found in infected haemolymph. Sections were stained with Harris' haematoxylin and eosin.

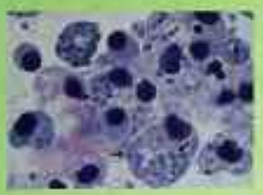

Figure 2. Smear-test with infected haemocytes of *Ostrea edulis*. Haemocytes cell monolayer was prepared by smear-technique and stained with Giemsa-test.

	% match (by searched)	Best scored GenBank match
Clon 1	99 % (551 / 555)	*B. ostreae* (AF017985)
Clon 2	99 % (554 / 560)	*B. ostreae* (AF017985)
Clon 3	100 % (560 / 560)	*B. ostreae* (AF017985)
Clon 4	100 % (560 / 560)	*B. ostreae* (AF017985)
Clon 5	100 % (560 / 560)	*B. ostreae* (AF017985)
Clon 6	99 % (555 / 560)	*B. ostreae* (AF017985)
Clon 7	99 % (554 / 560)	*B. ostreae* (AF017985)
Clon 8	99 % (554 / 560)	*B. ostreae* (AF017985)
Clon 9	99 % (554 / 560)	*B. ostreae* (AF017985)
Clon 10	99 % (547 / 550)	*B. ostreae* (AF017985)
Clon 11	99 % (554 / 560)	*B. ostreae* (AF017985)

Table 1. Results of BLAST searches of *Bonamia* spp. partial sequences. The results are based upon BLAST searches against GenBank.

Figure 3. RFLP patterns of PCR products digested with *Rsa* I. A profile with two fragments of approximately 230 and 190 bp, which is corresponding with the restriction profile of *B. ostreae*, (lanes 2-5, 7, 8, 10-13) and other individuals patterns with 3 fragments corresponding to bands of 230 and 190 bp, plus a band of 400 bp, which is corresponding with the restriction profile of *B. exitiosa* and *B. ostreae* are shown (lane 6). Lanes 1, 9 and 14: Markers revealed that 92% of the 60 flat oysters were identified as *B. ostreae* and 8% as co-infection of *B. ostreae* and *B. exitiosa*.

DISCUSSION AND CONCLUSIONS

BIBLIOGRAPHY

[1] Carnegie RB, Barber BJ, Culloty SO, Figueras A, 2003. *Int. J. Parasitol.* 33: 1549-1560.
[2] Hine et al., 2001. *Dis. Aquat. Org.* 46: 215-227.
[3] Corbeil et al., 2006. *Dis. Aquat. Org.* 71: 91-97.
[4] Parker et al. 2002. *Bull. Eur. Ass. Fish Pathol.* 22: 169-175.
[5] Carnegie et al., 2000. *J. Parasitol. Microbiol.* 86: 1402-1410.
[6] Comtet et al. 2000. *Bull. Eur. Assoc. Fish Pathol.* 20: 69-81.
[7] Ramilo et al. 2003. *J. Appl. Aquac. Health* 16: 1-9.
[8] Lynch SA, Mahon A, 2005. *Dis. Aquat. Org.* 65: 231-239.
[9] Carnegie RB, et al., 2006. *J. Invert. Pathol.* 91: 81-88.
[10] O'Neill et al., 2008. *Bull. Eur. Assoc. Fish Pathol.* 28: 117-120.
[11] Culloty et al. 2001. *Bull. Eur. Assoc. Fish Pathol.* 21: 47-51.
[12] da Silva M, Villalba A, 2001. *J. Invert. Pathol.* 77: 95-104.

Autoría: García-Fernández, A.; Cerviño-Eiroa, A.

Título: Nuevos avances y resultados de crecimiento y mortalidad en el preengorde de almejas, en diversos sistemas en las Rías Bajas de Galicia

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007

Nuevos avances y resultados de crecimiento y mortalidad en el preengorde de almejas, en diversos sistemas en las Rías Bajas de Galicia.

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INTRODUCCIÓN

Abstract

Localización

MATERIAL y METODOS

RESULTADOS

Tabla 1.- Tasas de crecimiento para ensayo de 1 año

Mes	12/05/06	12/07/06		26/09/06		12/01/07		21/03/07	
Prueba1	P.Ini	P.Fin	Tcc	P.Ini	Tcc	P.Fin	Tcc	P.Fin	Tcc
T1-T2	0,26	2,09	12,08						
T1-T4	0,26	0,87	5,07						
T1-T3	0,26	1,61	9,46						
T2-T3-T5		0,36				7,16	24,13	23,89	23,76
T2-T4-T5		0,48				2,87	14,92	15,52	20,76
T2-T3-T5		0,87				2,16	13,51	10,89	20,09
T2-T5-T6		0,44				4,67	24,71	4,61	19,47
T2-T4-T5-T6		0,48				4,04	27,42	4,61	20,46
Prueba2									
T1-T2				11,39		24,29	207,57		
T1-T3				11,0		23,66	21,26		

Fig 1.- Crecimiento en peso individual

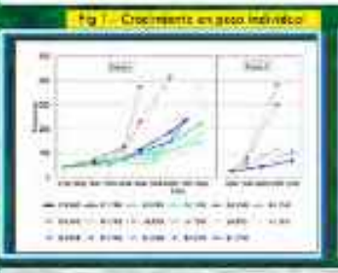
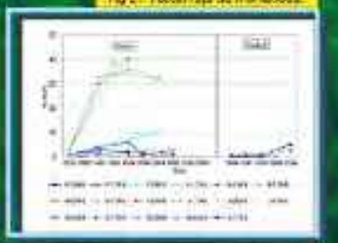


Fig 2.- Porcentaje de mortalidad



CONCLUSIONES

El preengorde realizado en las bolsas plásticas de malla de 1 mm para almeja de 1,5 a 2 mm se ha demostrado como viable, obteniéndose un buen crecimiento y no presentándose problemas de mortalidad, lo cual indica que es un sistema válido para el preengorde de semilla de muy pequeño tamaño. Una vez que alcanzan el tamaño adecuado, que en épocas favorables de crecimiento puede ser del orden de 15/20 días, puede estabularse ya en las mallas de 2 mm y posteriormente de 3 mm para seguir el proceso hasta el final de la etapa de preengorde.

Los resultados confirman que la situación más favorable de preengorde se da en la batea, debido a la mayor estabilidad del medio, ya que la continua inmersión de la almeja en los sistemas de cultivo utilizados, al no estar afectado por la influencia de las mareas, hace que exista una mayor disponibilidad de alimento y una mayor estabilidad de las condiciones ambientales, lo que al final se traduce en una mejora del crecimiento. El potencial de crecimiento de la almeja babosa es muy elevado y superior a las otras dos especies. La almeja japónica se sitúa en un nivel intermedio, siendo la almeja fina la que presenta una menor tasa de crecimiento.

Este trabajo se ha desarrollado dentro del Plan Nacional de Cultivo de Almeja (JACUMAR-MAPA).

Autoría: Sánchez-Mata, A.; Molares, J.; Rodal, M.; Carreira, P.; Varela, T.; Crego, A.; Parada, J.M.; Martínez, G.; Darriba, C.; Mariño, J.

Título: Gestión del banco marisquero O Bohído (Ría de Arousa) en el periodo 2006-2007: Análisis de las poblaciones de bivalvos comerciales

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007

Gestión del banco marisquero O Bohido (Ría de Arousa) en el periodo 2006-2007: Análisis de las poblaciones de bivalvos comerciales

A. Sánchez-Mata[1]; J. Molares[1]; M. Rodal[2]; P. Carreira[2]; T. Varela[1]; A. Crego[3]; J.M. Parada[3]; G. Martínez[3]; C. Darriba[3] y J. Mariño[3]

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Resumen

[illegible]

Introducción

[illegible]

Tabla 1.- Balance económico de la campaña marisquera 2006-2007 en el banco marisquero O Bohido

[illegible]

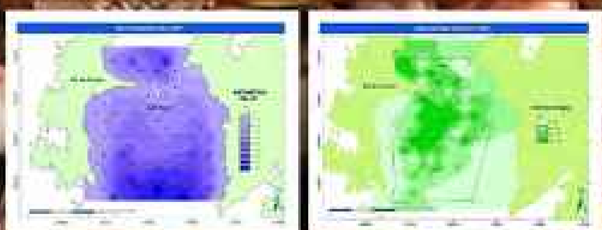
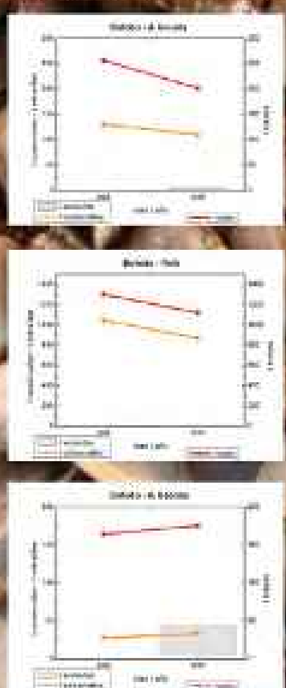


Figura 1.- Situación geográfica del banco "O Bohido": (A) [illegible] (B) [illegible] 2006.

Material y Métodos

[illegible]



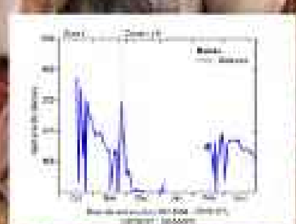


Figura 2.- Esfuerzo diario aplicado al banco en la campaña marisquera 2006-2007.

Figura 3.- [illegible] de las tres especies [illegible] 2006-2007 [illegible]

Resultados

[illegible]

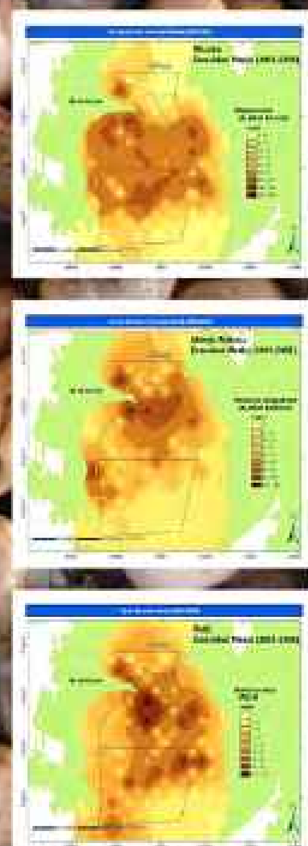


Figura 4.- Distribución espacial [illegible] de las tres especies [illegible] en el banco: almeja babosa, almeja fina y [illegible] septiembre de 2006 y septiembre de 2006.

Discusión

[illegible]

Conclusiones

[illegible]

Autoría: Navarrete-Taito, C.; Freire, J.; Molares, J.; González-Ronda, A.

Título: A GIS prototype as a support tool for management of the goose barnacle (*Pollicipes pollicipes*) fisheries in Galicia (NW Spain)

Evento: CoastGIS'07

Lugar: Santander - Cantabria (España)

Ano: 2007

A GIS PROTOTYPE AS A SUPPORT TOOL FOR MANAGEMENT OF THE GOOSE BARNACLE (*Pollicipes pollicipes*) FISHERIES IN GALICIA (NW SPAIN)

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INTRODUCTION

The goose barnacle, *Pollicipes pollicipes* (Gmelin, 1790), is an intertidal cirripede that lives attached to rocks on very exposed shores, forming dense aggregations. It occurs in the west Atlantic coast of Europe and North Africa (Barnes, 1996). Commercial fisheries have been developed in several countries, but most of its production has been traded in the Spanish market, where the average price last year was 30 €/kg, reaching up to 340 €/kg in first-sale auctions. Most part of the Spanish catches come from Galicia, average landings were 414 t/year in the last 5 years and first-sale economic value was estimated at 31 million €/year.

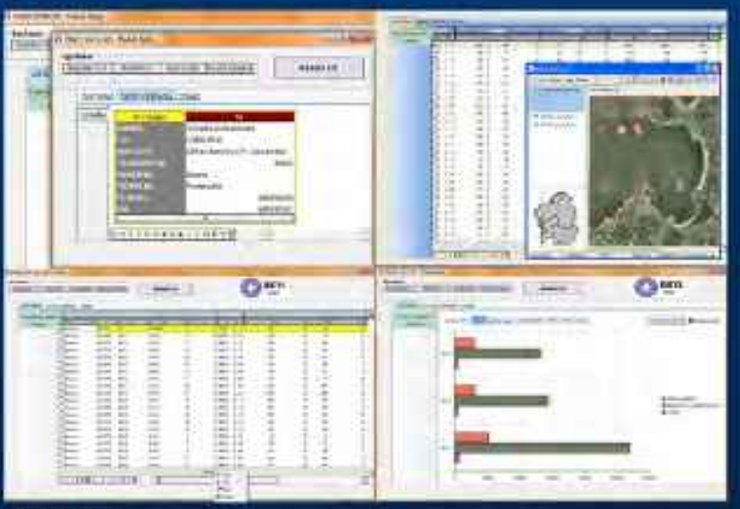
In Galicia, fishery regulations depend on the regional government, promote a co-management system between artisanal fishers' organizations ("cofradías") and the fisheries authority through territorial user rights for fishing (TURFs). There are 63 "cofradías" located in the coastal villages and rias along the coasts. Galicia, however only 32 of them have harvestable goose barnacle stocks in their territory. In 2006, the total number of fishers holding goose barnacle licenses was 1514, 395 of them being intertidal harvesters and remaining 1119 using boats (340 boats altogether). Since 1992, exploitation is granted to "cofradías" after submission of an annual plan of exploitation and management, where fishing activity (daily allocation of effort, maximum daily individual quotas and areas of exploitation), surveillance and the commercialisation processes are established (Molares and Freire, 2003). Since 2000, new regulations defined a new official management plan model for the goose barnacle fisheries, which requires more information to assess previous seasons (i.e., daily production and fishing effort distribution through out the year). Main objectives of these new requirements are to allow evaluation of performance of previous plans and to make better stock assessments for new management plans for this valuable resource.

Here is presented a GIS (Geographic Information System) based prototype as a support tool, to be applied in the "cofradía" system of Galicia for the management of the fisheries of goose barnacle.

METHODS

The data series of the barnacle fishery in Galicia was obtained from information of fishermen and technicians of the "cofradías". Data integration was necessary: homogenization of information, integration of catch with daily management of the "cofradía" and to link it with the GIS software. The project was developed using NAZCAOIS software developed by INCA Ingeniería S.L. To design the GIS-based tool, the OPENGIS model and the SECDATABASE administration were used.

Considering available information and current technology, an advanced software tool that incorporates databases and GIS to improve assessment and management work for goose barnacle fisheries was developed. **MARES DATAGIS** (GIS Software for Assessment and Management of Coastal Marine Resources) was designed to simplify work, from the daily data entry to statistical analysis until the output report and mapping requested. In this sense, these new tool presents "spread-sheet" style powerful interface close to and proposes a logical architecture of information adequate for an efficient utilization of data and different functionalities to implement required tasks in the stock assessment and management plan development.



RESULTS AND CONCLUSIONS

Some functionalities and characteristics of this novel GIS-based tool are: Spanish language, display of raster and vector data structures, varied options of edition (polygons, lines and point shapes), zooms, scales and advanced searching (queries), georeferencing, automatic calculation (coordinates, areas, length, and others), calculator, legend editor, catalogue (raster, vectorial and CAD), different layouts/windows for maps, graphics and others. The GIS data-sheets are very easy to operate, including advanced options (grouping data, filter queries, selection zoom ...) and exportation tools to MS Excel (Navarrete and González, 2007). The Database allows for an organized and flexible collection of data. It includes tool-bar to add, modify or delete data from the database, query using the data stored and produce detailed output reports.

MARES DATAGIS can integrate fishery, economic, administrative and spatial information. Accordingly, its main objectives is to improve data organization and statistical analysis, and therefore, to facilitate decision-making, stock assessment, and control and management of the marine resources in the "cofradías" system in Spain. This tool may be efficiently used to avoid over-fishing and to optimise solution strategies to improve profitability of fishermen. Its application will assist technicians and managers on design processes, development and performance assessment of annual plans of exploitation, as well as facilitate detailed review of management plans carried out by Galician fisheries authorities.

Future application of this novel GIS-based tool for benthic fisheries management has interesting possibilities to incorporate several plans of exploitation, being able to manage data of conservation-based systems at local, provincial and regional levels.

REFERENCE

Barnes, M. (1996). Pedunculate cirripedes of the genus *Pollicipes*. Oceanogr. Mar. Biol. 34:303-394.
Cruz, T. 2002. Ecología e explotación de *Pollicipes pollicipes* do litoral rudoeste portugués. PhD.
Molares, J. and Freire, J. (2003). Development and perspectives for community-based management of the goose barnacle (*Pollicipes pollicipes*) fisheries in Galicia (NW Spain). Fisheries Research, 65: 485 – 492.
Navarrete, C. and González A. (2007). Manual de usuario del Sistema de Información Geográfica NAZCAOIS versión 1.0. 48 pp.

Autoría: Carballal, M.J.; Louzán, A.; Martínez-Patiño, D.

Título: Primeros resultados de un estudio histopatlógico de la coquina *Donax trunculus* en Galicia

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007

Primeros resultados de un estudio histopatológico de la coquina *Donax trunculus* en Galicia.

María Jesús Carballal, Andrea Couzan, Dorotea Martínez
Centro de Investigaciones Marinas. Xunta de Galicia

Abstract

Parasites and pathological conditions were studied in clams *Donax trunculus* from a Galician natural bed. Samples of 25 individuals were processed by histology. Colonies of rickettsiae organisms in digestive tubules, *Nematopsis* sp. in connective tissue of gill and visceral mass, indeterminate gregarines in intestinal epithelium and surrounding connective, and ciliates in gill were detected. These parasites did not cause significant damage.

Introducción

En el otoño de 2006, iniciamos un proyecto de investigación sobre el cultivo de coquina en cmadero, dentro de este proyecto se evalúa el estado patológico de poblaciones de coquina de Galicia para su utilización como reproductores. En esta comunicación se presentan los resultados preliminares de este estudio.

Material y Métodos

Se recogieron muestras mensuales de 25 coquinas del banco natural de Villarrubio (Cedeira). De cada coquina se tomó una pieza de 5 mm de espesor que contenía masa visceral, pie, lóbulos del manto y branquia, y que se fijó en solución Davidson e incluyó en parafina. Se hicieron cortes histológicos de 5 micras que se desparafinaron y tiñeron con hematoxilina y eosina para su examen al microscopio óptico. A partir de Abril, se estimó la posible presencia de *Perkinsus* sp. por cultivo de lamina branquial de cada coquina en caldo de tioglicolato y posterior tinción con lugol (Ray, 1966).

Figura 1

Figura 2

Figura 3

Figura 4

Figuras 1 a 4: Parásitos observados en la coquina *Donax trunculus*. Figura 1: Organismos de tipo rickettsiano en túbulos digestivos. Barra = 50 micras. Figura 2: Gregarina de *Nematopsis* sp. surtido conjuntivo de branquia. Barra = 40 micras. Figura 3: Gregarina indeterminada en epitelio de intestino y tejido conjuntivo de mediolitos. Barra = 50 micras. Figura 4: Ciliados en branquia. Barra = 50 micras.

Resultados

Tabla 1: Prevalencias de los parásitos observados en las coquinas *Donax trunculus*

Fecha	Talla + ES (mm)	% *Nematopsis* sp.	% Ciliados en branquia	% *Rickettsiae* digestivo	% Gregarina indeterminada
23/11/06	27,3 ± 0,3	23	0	4	0
21/12/06	36,1 ± 0,2	84	0	4	23
24/1/07	42,8 ± 0,3	92	0	12	8
22/2/07	40,1 ± 0,6	80	12	32	8
22/3/07	39,6 ± 0,6	80	4	44	48
20/4/07	36,1 ± 0,5	52	32	28	16

Conclusiones

Los parásitos detectados no suponen una amenaza para las explotaciones de esta especie ya sea por su baja intensidad o prevalencia o por su escaso poder patogénico. Sin embargo, la presencia de rickettsias constituye un peligro potencial pues se han registrado mortalidades en Francia asociadas con esta patología.

Agradecimientos

A Isabel Meléndez, Elena Pesas y Fátima Ricoma por la realización de las técnicas histológicas, y a Irene Estévez Santo de la Cofradía de Cedeira por su colaboración en la realización de este trabajo. Estos estudios se engloban en el proyecto de investigación "Cultivo de nuevas especies de moluscos bivalvos de interés en hatchery" financiado por los Planes Nacionales de Cultivos Marinos (JACUMAR-Secretaría General de Pesca Marítima).

Bibliografía

Ray, S. M. 1966. A review of the culture method for detecting *Dermocystidium marinum*, with suggested modifications and precautions. *Proc. Nat. Shellfish. Assoc.* 54: 35 - 80

Autoría: López, C.; Darriba, S.; Iglesias, D.

Título: Parasites and pathological condition of two natural beds razor clam *Ensis arcuatus* (Jeffrees, 1865) (Pharidae) in Galicia (NW Spain)

Evento: Aquaculture Europe 2007

Lugar: Estambul (Turquía)

Ano: 2007

Parasites and Pathological Conditions of Two Natural Beds Razor Clam *Ensis arcuatus* (Jeffreys, 1865) (Pharidae) in Galicia (NW Spain)

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E-mail: clopez@cimacoron.org

Introduction

The superfamily Solenacea has three commercial species, for human consume, in Spain: *Ensis arcuatus*, *Ensis siliqua* and *Solen marginatus*. *E. arcuatus* is the most important of these marine bivalve molluscs in Spain (78% of production). Some biological aspects (growth, reproductive cycle and biochemical composition) of this species have been studied recently (Robinson and Richardson, 1998; Fahy *et al.*, 2002; Darriba *et al.* 2004 and 2005; nevertheless, few pathological aspects have been considered (Fahy *et al.*, 2002; Darriba et al., 2004; Darriba et al., 2006).

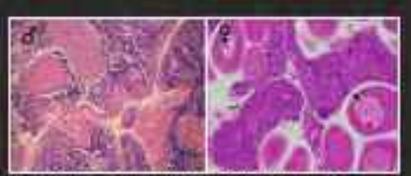
Material and Methods

Samples of 15-20 adults of razor clams *E. arcuatus* (>100 mm in length) were collected diving, from natural beds in Ría de Vigo and Ría de Arousa (NW Galicia – NW Spain) from January 2003 until July 2004 every two months. Samples were processed using with standard techniques for histology. Davidson's solution and Harris' hematoxylin and eosin (HHE) were used (Howard and Smith, 1983).

Results

Items	*Haplosporidium*-like		*Rickettsia*-like		*Nematopsis* sp.		*Coccidium*		*Marteilioides*-like		*Trichodina*		*Urosporidia*		*Ichthyobodo*		*Metacercaria* cysts		*Gastrodermal*	
	RV	RA	RV	RA	RV	RA	RV	RA	RV	RA	RV	RA	RV	RA	RV	RA	RV	RA	RV	RA
Jan-03	5	0	11	44	0.5	0.7	5	0	5	0	0	0	5	0	0	0	5	0	11	0
May-03	5	0	7	20	10.0	0.5	0.5	1.7	0.5	0	0	0	5	0	0	0	5	0	0	7
Sep-03	5		6		0.0		22		21		0		5		16		0		21	
Jul-04	5	0	7	11	0.5	0.0	0.5	0	0	0	0	0	7	0	0.5	0	0	0	0.5	0
Jan-03	5	0	0.0	0	1.1	0.5	0	0	0.0	0	0	0	0	0	0	0	0	7	0	0
Mar-04	5	0	20	5	0.5	0.7	20	0	0.7	0	0	0	5	0	0	0	0	7	0.5	0
Jun-04	7	0	0	0	1.0	0.5	0	0.5	20	0	0	0	0	0	0	0	0	7	0	0
May-03	5	0	0	7	0.0	0.0	7	0.0	20	0	0	0	7	0	0.5	0	0	7	0.5	0
Sep-03	7	0	0.5	0	0.0	0.7	0.7	0	20	0	0	0	7	0	0.5	0	0	0	0.5	7
Jul-04	5	0	47	20	0.0	0.0	20	0	0.0	0	0	0	20	0	0	0	0	0	0.5	7

Table 1.- Prevalences of various symbionts and gametocysts affecting razor clam *E. arcuatus* from Ría de Vigo (RV) and Ría de Arousa (RA) (Galicia, NW of Spain).



Conclusion

Razor-clam from Cies (Ría de Vigo) was more parasited than that from Combarro (Ría de Arousa). *Rickettsia*-like, *Haplosporidium*-like, sporocysts of nematode and turbellarian were absent in razor-clam from Combarro, and *Trichodina* sp (ciliate) was the only absent in razor-clam from Cies. The most important pathology detected in this study was the presence of a gametosome, and its prevalence was also higher in Cies (Ría de Vigo) than in Combarro (Ría de Arousa).

References

Autoría: Díaz, S.; Carballal, M.J.; Villalba, A.; Cao, A.

Título: Expression of the mutant protein p53, Hsp70 and Hsp90 chaperons in haemolymph of neoplastic cockles, *Cerastoderma edule*

Evento: XIIIth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Grado (Italia)

Ano: 2007

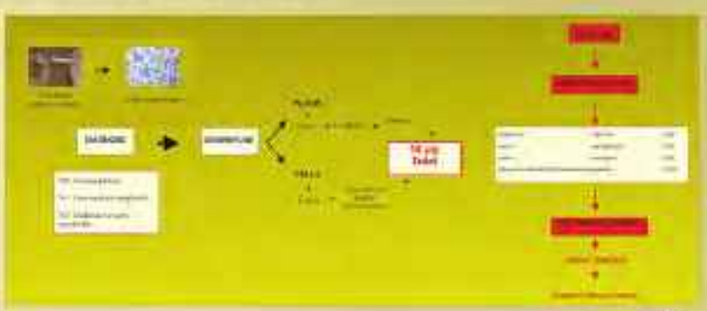
EXPRESSION OF THE MUTANT PROTEIN p53, HSP70 AND HSP90 CHAPERONS IN HAEMOLYMPH OF NEOPLASTIC COCKLES, CERASTODERMA EDULE.

S. Díaz, M.J. Carballal, A. Villalba and A. Cao

Centro de Investigacións Mariñas, Xunta de Galicia, Spain

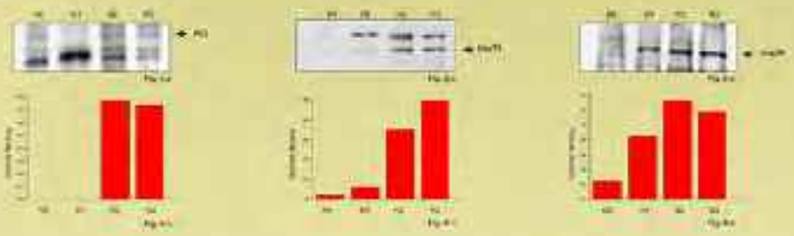
INTRODUCTION

MATERIAL AND METHODS



DISCUSSION

RESULTS



REFERENCES

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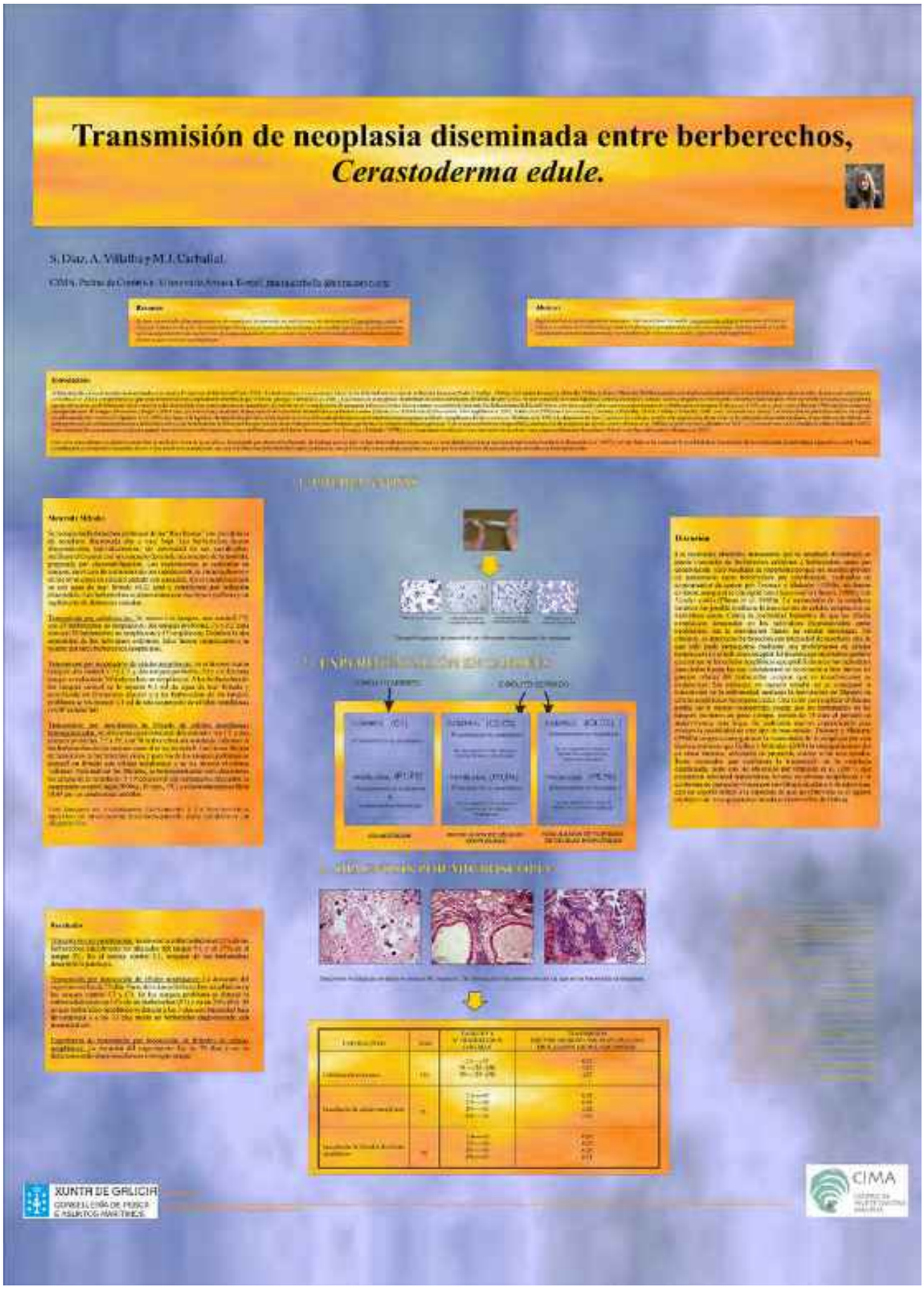
Autoría: Díaz, S.; Villalba, A.; Carballal, M.J.

Título: Transmisión de neoplasia diseminada entre berberechos *Cerastoderma edule*

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007


Transmisión de neoplasia diseminada entre berberechos,
Cerastoderma edule.
S. Díaz, A. Villalba y M.J. Carballal.
XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
CIMA

Autoría: Iglesias, D.; Carballal, M.J.; Villalba, A.

Título: An epizootic proliferative disorder detected in a natural population of the clam *venerupis aurea* in Galicia (NW Spain)

Congreso: 13th International Conference of the European Association of Fish Pathologists

Lugar: Grado (Italia)

Ano: 2007

An epizootic proliferative disorder detected in a natural population of the clam *Venerupis aurea* in Galicia (NW Spain)

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2. Centro de Investigacións Mariñas, Vilanova de Arousa, Spain

INTRODUCTION

Natural populations of the clam *Venerupis aurea* are a resource for shellfishermen in Galicia (NW Spain), especially when the catches of other more valued venerid clams become low. A survey to estimate stocks of this and perkinsosis affecting the clam *V. aurea* population of A Lanzada bed (O Barbanza, located in the Ría de Arousa (Galicia), is being performed since September 2006 by periodic sampling. High mortality has been estimated and a pre-patent disorder has been detected in the clams, which could contribute to the wide yearly clam mortality.

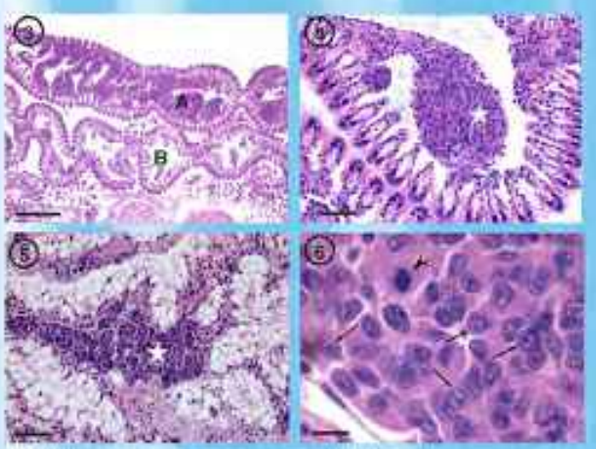

Fig. 3. Histological section through the gills showing a lamella (G heavily affected by abnormal cell proliferation, which reduces the water channels, and a less affected lamella (L). (Bar = 200 µm). Fig. 4. Detail of a gill plica showing clumps of neoplastic cells (*). (Bar = 50 µm). Fig. 5. Histological section through the kidney showing a large mass of neoplastic cells (*) and a connective tissue layer (>). (Bar = 50 µm). Fig. 6. Detail of a mass of neoplastic cells with large pleomorphic nuclei, some of them with conspicuous nucleoli (arrows); amitotic figure (arrowhead) is shown. (Bar = 10 µm).

MATERIALS AND METHODS

Monthly samples of 30 clams were taken from the subtidal bed, at approx. monthly intervals, using a specific clam dredge handled from a boat. The clams were carried to the laboratory for histopathological examination. In addition, 75 clams were collected monthly from the bed and distributed into 5 plastic boxes (60x40x20 cm) that had been filled with bottom sediment (Fig. 1). The boxes were covered with a mesh to avoid clam losses and set in a steel frame (Fig. 2) that was laid on the bottom. Each month, the trays were raised onto the sampling boat and live and dead clams in the trays were counted to estimate monthly mortality. Clams were not re-used.

Processing for histopathological analysis involves taking a cross piece of clear (including foot, gills, mantle and visceral mass) of each clam and producing histological sections through a standard procedure, which were examined with light microscope. Additionally, some clams were processed for ultrastructural examination: haemolymph was withdrawn in bulks from the posterior adductor muscle, centrifuged and the cell fraction was processed for transmission electron microscopy (TEM) examination. Gill fragments were processed for TEM as well.

RESULTS

1. Histopathology. Histopathological analysis disclosed a proliferative condition characterized by the occurrence of compact masses of abnormal cells in multiple foci of the connective tissue of different organs (gills, organs of the visceral mass, foot) (Figs. 3-5). The abnormal cell proliferation throughout the connective tissue of the interlamellar septa led to gross dilation of the latter and extensive narrowing of gill water channels (Figs. 3-5, 4). The abnormal cells were large in size (mean = 9.7 µm; SD = 1.47 µm; range = 6 - 13 µm; N = 30) and showed a large oval or irregular nucleus (mean = 7.1 µm; SD = 0.93 µm; range = 5 - 8 µm; N = 30), voluminous, pleomorphic nucleus. A conspicuous nucleolus-like inclusion, basophilic and 1-2 µm in diameter, some times with halated appearance, was observed in many abnormal cells (Fig. 6). Normal haemocytes or trailing connective tissue cells were smaller (mean = 6.6 µm; SD = 1.35 µm; range = 4 - 10 µm; N = 30) with smaller nucleus (mean = 3.5 µm; SD = 0.55 µm; range = 3 - 4 µm; N = 30). Mitotic figures were abundant in the abnormal cell masses (Fig. 6). A scale of decreasing intensity could be established: **stage 0**, no abnormal cell was detected in the section; **stage 1**, the abnormal cells were exclusively observed in the gills; **stage 2**: the abnormal cells were also observed in the connective tissue and blood vessels of the mantle, gonad and digestive gland; **stage 3**, large masses of abnormal cells occurred in every organ associated with disruption of their normal architecture.

2. Ultrastructure. TEM examination of haemocytic cells and gill tissues showed that the abnormal cells had a large pleomorphic nucleus with some chromatin clumps and, frequently, a large nucleolus (Figs. 7 - 9). The cytoplasm contained very abundant mitochondria (Fig. 7) with long cristae (Fig. 10). Some abnormal cells showed a well developed Golgi apparatus (Fig. 11). No virus-like particle was detected through the TEM study.

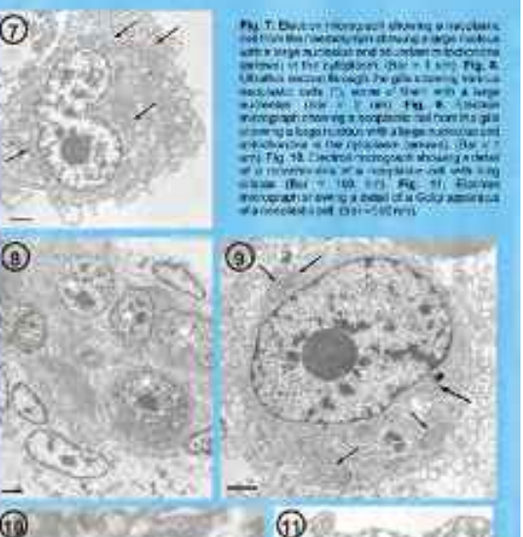

Fig. 7. Electron micrograph showing a neoplastic cell from the haemolymph showing a large nucleus with a large nucleolus and abundant mitochondria (arrows) in the cytoplasm. (Bar = 1 µm). **Fig. 8.** Ultrathin section through the gills showing various neoplastic cells (*), some of them with a large nucleolus. (Bar = 1 µm). **Fig. 9.** Electron micrograph showing a neoplastic cell from the gills showing a large nucleolus and mitochondria in the cytoplasm (arrows). (Bar = 1 µm). **Fig. 10.** Detailed micrograph showing a detail of a mitochondria of a neoplastic cell with long cristae. (Bar = 100 nm). **Fig. 11.** Electron micrograph showing a detail of a Golgi apparatus of a neoplastic cell. (Bar = 100 nm).

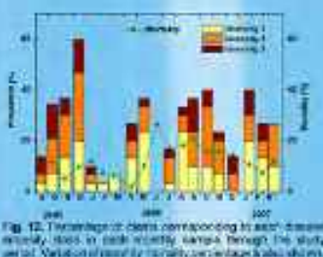

Fig. 12. Percentage of clams corresponding to each disease intensity class in each monthly sample through the study period. Variation of mean monthly mortality percentage is also shown.

3. Epizootiology. The temporal variation of the prevalence of the proliferative condition is shown in the Fig. 12. After the analysis of 18 monthly samples, the prevalence ranged from 0% to 57 %. The temporal variation of the prevalence did not fit a seasonal pattern. The 4 intensity categories occurred in at least every monthly sample. The prevalence of severe cases (intensity 3) ranged from 0% to 53.6%. The monthly mortality percentage ranged from 1.6% to 20.3%, with a mean of 12.2%. The monthly mortality showed a temporal variation coupled to that of the prevalence, especially in the first half of the study period: increases or drops of prevalence were associated with the same trend of the mortality in the next month estimation. That coupling was not so clear in the second half of the study period, perhaps because both variables were higher and showed less marked variations.

DISCUSSION

Histopathological features of the proliferative disorder strongly suggest a neoplastic condition. The condition seems to start in the gills, although the cell type involved in the abnormal proliferation was not stated. Ultrastructure characteristics suggest that the abnormal cells have a high metabolic activity (numerous mitochondria) and high nuclear activity (large nucleolus very frequent). The prevalence of the condition could suggest that an infectious agent was involved, although no virus-like particle was detected. However, that is not enough to discard viral involvement. Existence of viral aetiology in the disseminated neoplasia affecting cockle *Cerastoderma edule* throughout Galicia has been reported recently (Villalba et al. 2007).

The severity of the lesions of heavily affected clams and the coupling between the temporal variation of the prevalence and the mortality percentage could suggest that the proliferative condition could be the high clam mortality recorded through the study. Further studies should be performed to confirm a cause-effect relationship and to evaluate how spread is this pathological condition through the clam *V. aurea* beds of the Galician coast, to estimate the impact of this condition on the shellfisheries.

Autoría: Gabín, C.; Otero, M.; Guerra, A.

Título: Navajas y longueirones en Galicia (N.O. de España)

Evento: X Foro dos Recursos Mariños e da Acuicultura nas Rías Galegas

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XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS

CIMA

NAVAJAS Y LONGUEIRONES EN GALICIA (N.O. DE ESPAÑA)*

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Resumen

Los solénidos navaja (*Ensis arcuatus*), longueirón (*Ensis siliqua*) y longueirón vello (*Solen marginatus*) son moluscos bivalvos englobados en los llamados recursos específicos. En Galicia se extrae más del 95% de la población de solénidos del litoral español. La producción más destacada procede de las especies del género *Ensis* cuya extracción se realiza principalmente desde embarcación por mariscadores-buceadores en el método de extracción en apnea. Su pesquería y captura tiene dos referentes principales: Fisterra en la Costa da Morte (provincia de A Coruña) y Cangas (provincia de Pontevedra) y se orientan principalmente al mercado de consumo en fresco.

Nombre vulgar: **NAVAJA**
Género: *Ensis*
Especie: *arcuatus*

Nombre vulgar: **LONGUEIRÓN**
Género: *Ensis*
Especie: *siliqua*

Nombre vulgar: **LONGUEIRÓN VELLO**
Género: *Solen*
Especie: *marginatus*

I. Evolución de las capturas en los últimos años

Según los datos de primera venta en lonja, aportados por la Consellería de Pesca e Asuntos Marítimos de la Xunta de Galicia se muestran los mínimos de producción en los años 2002 y 2003, coincidiendo con el hundimiento del petrolero "Prestige" frente a las costas gallegas, que provocó la prohibición de las capturas durante 6 meses y afectó significativamente su extracción. La tendencia en los últimos años indica:

- Incremento en la producción de navaja.
- Mantenimiento, con ligero incremento, en la producción de longueirón, y
- Descenso en la producción de longueirón vello.

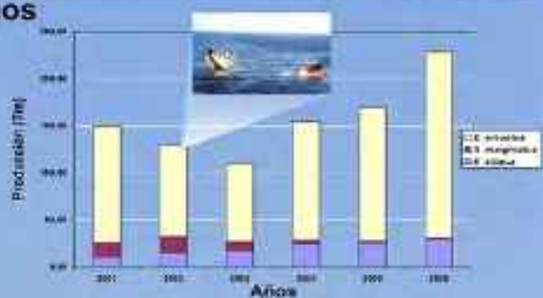

Fig. 1: Evolución de las capturas de solénidos en los últimos años

II. Zonas principales de captura: Fisterra y Cangas

Fig. 2: Evolución de las capturas de Ensis spp. en las dos cofradías de pescadores con más tradición de capturas de solénidos: Fisterra y Cangas.

Fig.3: Extracción por el método apnea.

Zona	Nº de buques
Ría de Ferrol	2
Costa Noroeste	31
Ría de Muros-Noia	10
Ría de Arousa	81
Ría de Pontevedra	36
Ría de Vigo	40

Fig. 4: Distribución de buques que se dedican a la pesquería de solénidos en Galicia

III. Evolución de los precios.

Fig. 5: Evolución de los precios medios (€/kg). 11 cofradías de pesca gallegas en los últimos años

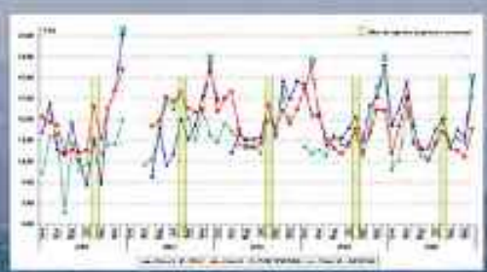

Fig. 6: Evolución de los precios medios (€) en las lonjas más importantes de las Rías Baixas en el período 2000-2005. Las flechas indican los mayores repuntes de los precios en cada año.

* La información procede del Cáp. 11 del libro "Los Solénidos: un recurso pesquero con futuro" (en prensa).

Autoría: Guerra, A.; Nóvoa, S.; Besada, M.; Búa, I.; Lastres, M.; Fernández, J.; Asela, R.

Título: Crecimiento y composición bioquímica de semilla de almeja japonesa (*Tapes philippinarum*) y almeja babosa (*Venerupis pullastra*), obtenida en criadero y cultivada en diferentes sistemas de preengorde y en parque de cultivo

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
Dirección Xeral de Innovación e Desenvolvemento Pesqueiro

Crecimiento y composición bioquímica de semilla de almeja japonesa (*Tapes philippinarum*) y almeja babosa (*Venerupis pullastra*), obtenida en criadero y cultivada en diferentes sistemas de preengorde y en parque de cultivo

JACUMAR

CIMA

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(Autor para correspondencia)

Resumen

En el presente trabajo se analizan dos sistemas de preengorde de semilla de almeja obtenida en criadero, de dos especies: almeja japonesa (Tapes philippinarum) y almeja babosa (Venerupis pullastra). El preengorde se efectúa en tambores con flujo invertido procedente de: a) efluente de granja de rodaballo y b) semillero tradicional de agua de mar enriquecida con fitoplancton. Se aportan datos de crecimiento al inicio y final del preengorde y en el parque de cultivo, también la composición bioquímica a lo largo del preengorde.

Summary

In the present work two nursery systems of hatchery produced clam seed of two species are analyzed: Manila clam (Tapes philippinarum) and pullet carpet shell (Venerupis pullastra). Seed are held in containers with inverted sea water flow from: a) effluent of a turbot farm and b) a traditional nursery system enriched with phytoplankton. Growth data at the beginning and end of the experiences is provided, also the biochemical composition throughout both phases of on-growing.

Material y métodos

1.- La semilla

La experiencia se realizó con juveniles de 1 mm y 2 mm (Ø) que se indican en la Tabla I.

2.- El cultivo

2a.- Semillero: fase de preengorde

Los sistemas para el preengorde, fueron los tradicionales de flujo invertido. En uno (a) se trata de agua de mar suplementada con microalgas de forma natural exterior (semillero de mejillón tradicional), y en el segundo agua de efluente de granja de rodaballo (piscifactoría en tierra).

2b.- Cultivo en parque

Cuando la semilla alcanza la talla adecuada para cultivo exterior, se siembra en un parque intermareal en Carril (interior de la Ría de Arousa), a 500ind/m². El cultivo exterior duró ocho meses.

3.- Análisis de crecimiento

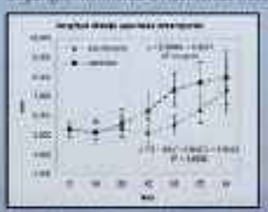
Se tomaron muestras (n=30) en fecha aleatoria en cada lote. Se determinó: longitud (L) y Peso (W) a partir de cada individuo de la muestra.

4.- Composición bioquímica

Los muestreos se realizan al inicio y al final de la fase de preengorde, analizándose proteínas, lípidos y carbohidratos (Tabla II).

Resultados

La fase de preengorde se efectuó entre febrero y mayo de 2008, sembrando la semilla en un parque intermareal en las mareas vivas de junio de mismo año.



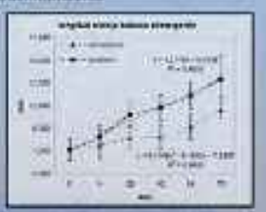


Figura 1. Crecimiento en longitud (mm) y peso (g) de la semilla en los sistemas de preengorde ensayados.

Tabla I. Evolución de la talla (L: longitud (mm), Ø de la concha (Ø) y peso (g) (W) de la semilla en preengorde y parque de cultivo (Carril, Pontevedra).

		L (mm)	Ø (mm)	W (mg)	W (mg)
I.- Fase preengorde					
Ini.	*T. philippinarum*	7,1±0,9	10,6±1,1	76,1±22,2	185,7±56,1
efluente	*T. philippinarum*	8,3±0,4	7,2±1,2	24,3±7,4	85,7±32,2
Ini.	*V. pullastra*	7,1±0,9	13,3±2,1	76,1±22,2	323,6±104,8
semillero	*T. philippinarum*	8,3±0,4	7,0±1,4	24,3±7,4	160,1±49,0
II.- Cultivo en parque					
De efluente	*T. philippinarum*	12,4±1,2	25,3±2,1	406,4±110,4	2377,0±580,2
	T. philippinarum	7,9±1,2	14,4±1,3	131,2±59,9	1571,8±633,5
De semillero	*V. pullastra*	13,4±1,4	26,9±3,1	280,1±110,6	2267,7±902,3
	T. philippinarum	7,9±0,9	19,7±2,8	131,6±41,3	1017,4±754,1

Tabla II. Composición química (proteínas, lípidos y carbohidratos) en base seca (% ss) de semilla de almeja japonesa (*T. philippinarum*) y babosa (*V. pullastra*) producida en criadero y cultivada en diferentes sistemas de preengorde y en parque de cultivo.

		Preengorde en semillero					
		Inicial		Final			
		A	B	A (efluente)		B (semillero)	
				agua de ría	efluente	agua de ría	efluente
Proteínas (%)		48,24	38,04	39,87	47,36	34,04	32,33
Lípidos (%)		7,85	11,78	14,45	12,88	9,26	9,85
Carbohidratos (%)		1,77	1,84	5,61	2,17	4,87	6,48

Conclusiones

- De los dos sistemas ensayados el correspondiente al semillero basado en agua de mar suplementada con fitoplancton resultó más eficiente que el basado en efluente de granja de rodaballo en tierra.

- Las dos especies crecen satisfactoriamente en ambos sistemas, con resultados más elevados en longitud para la variedad de *T. philippinarum*.

- Los resultados de estos ensayos son orientativos, deberían realizarse con varios efectivos en diferentes zonas de ría, semilla de menor tamaño y con características similares en cuanto a parámetros ambientales.

Agradecimientos

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Autoría: Molares, J.; Parada, J.M.; Sánchez-Mata, A.; Martínez, G.; Darriba, C.; Rodal, M.; Carreira, P.; Varela, T.; Crego, A.; Mariño, J.

Título: Gestión del banco marisquero de "Lombos do Ulla" (Ría de Arousa) desde 2002 hasta 2007

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007

GESTIÓN DEL BANCO MARISQUERO DE "LOMBOS DO ULLA" (RÍA DE AROUSA) DESDE 2002 HASTA 2007

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Resumen

Se describe la evolución del banco marisquero de "Lombos do Ulla" (Ría de Arousa) desde su apertura en 2002 hasta 2007. Se analizan los datos de densidad, talla y biomasa de almeja fina (*Ruditapes decussatus*) y almeja babosa (*Venerupis pullastra*) en relación con la gestión del banco. Se discuten los resultados de la explotación y se proponen medidas para mejorar la gestión del recurso.

Material y Métodos

Los muestreos se realizaron en 9 estaciones fijas distribuidas en el banco. En cada estación se tomaron muestras con draga hidráulica de 0,25 m² de superficie de apertura. Se midió la longitud de todos los ejemplares capturados y se calculó la densidad y la biomasa por estación.

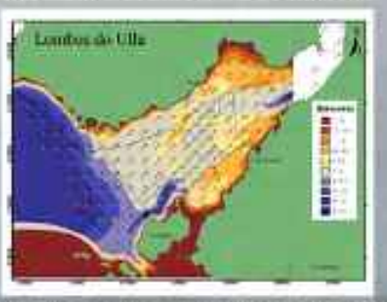

Figura 1 – Mapa del banco "Lombos do Ulla" mostrando la batimetría, la localización de las estaciones de muestreo y diferentes áreas de explotación.

Abstract

In this paper we present the evolution of the bivalve populations with commercial interest in the bottom of "Lombos do Ulla" (Ría de Arousa) from the year of its opening in 2002 up to the year 2007. The analysis of the data of density, size and biomass of cockle (*Cerastoderma edule*) and grooved carpet shell (*Ruditapes decussatus*) in relation with the management of the bottom is described. The results of the exploitation are discussed and some proposals to improve the management of the bottom are made.

Introducción

El banco marisquero de "Lombos do Ulla" se encuentra situado en la parte sur de la Ría de Arousa, en el límite de los municipios de Vilanova de Arousa y Pontevedra. Está situado en la zona baja del estuario del río Ulla, en el límite de la ría de Arousa. El mismo fue acotado en abril de 2002 y desde entonces ha sido explotado anualmente durante periodos de tiempo variables. Se encuentra dividido en 9 parcelas de explotación. Durante el transcurso de la campaña 2004-2005 se produjo un episodio de mortalidad masiva de almeja babosa (*Venerupis pullastra*) que afectó a gran parte de la población existente en el banco. Desde entonces la Administración Pesquera ha llevado a cabo un seguimiento quincenal de la evolución de la población de almeja babosa con el objeto de determinar el momento óptimo de apertura del banco a la explotación marisquera.

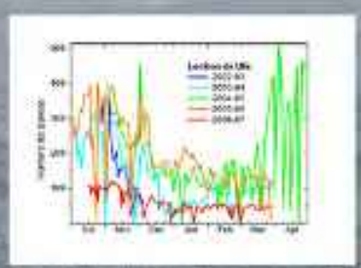

Figura 2 – Evolución temporal de la densidad de almeja babosa en las diferentes parcelas del banco.

Resultados

Las campañas marisqueras de dragado duran entre diciembre y marzo de cada año. La campaña 2002-2003 se cerró a los 24 días de su inicio por exceso del "Prestige" y en ella se extrajo la totalidad del remanente tamaño de las almeja de primera al inicio de esa campaña. Las demás tuvieron una duración próxima a los 120 días (Tabla 1). De forma excepcional, la campaña 2004-2005 se prolongó durante casi dos meses y medio debido a la gran abundancia de almeja de tamaño comercial a finales de mayo de ese año y que no había sido retirada hasta el final de diciembre. La gran afluencia de embarcaciones al comienzo de las tres primeras campañas (campaña 2002-2003, campaña 2003-2004 y campaña 2004-2005) dieron lugar a un gran volumen de descarga en el muelle de Carril (Figura 3).

Los tamaños medios de las capturas han sido bastante estables a lo largo de las cinco campañas de explotación. Los valores medios de talla de la almeja fina (*Ruditapes decussatus*) oscilaron entre 24,2 mm y 26,4 mm, mientras que los de la almeja babosa (*Venerupis pullastra*) lo hicieron entre 31,1 mm y 33,1 mm. Las tallas medias de la almeja babosa fueron siempre mayores que las de la almeja fina (Figura 4).

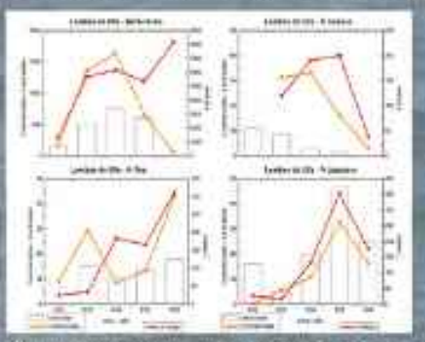

Figura 3 – Distribución temporal de las capturas y tamaño de los ejemplares de almeja en los cinco años de explotación.

Tabla 1. Datos económicos de las cinco campañas marisqueras.

Campaña	Duración (días)	Esfuerzo (marisqueadoras/día)	Capturas (kg)	Ingresos (euros)	Ingresos/jornal (euros/marisqueadora)
2002-03	24	250,2	181.193		
2003-04	118	204,6	545.386	1.787.716	74,04
2004-05	139	325,6	981.222	2.401.447	62,84
2005-06	104	303,1	647.973	2.210.972	70,40
2006-07	114	89,9	94.542	408.123	47,23

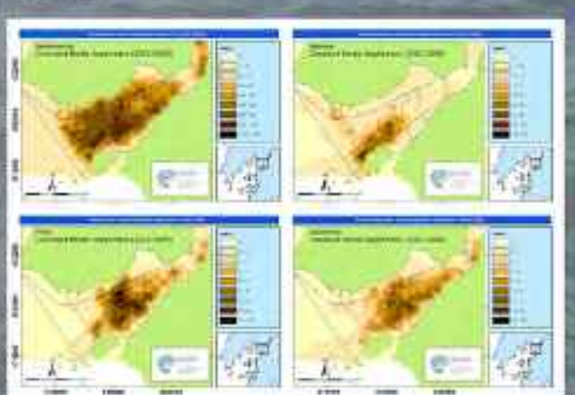

Figura 4 – Distribución espacial promedio de las cuatro especies de bivalvos en los cinco años.

Discusión

La creación, mediante real orden, del estudio de las zonas de libre cesión y la subsiguiente apertura a explotación marisquera de las mismas, ha supuesto un importante beneficio económico para el sector marisquero de la ría de Arousa. Sin embargo, la gestión de estos recursos ha estado caracterizada por una serie de problemas que han dificultado la consecución de los objetivos marcados en el momento de la creación de la reserva. Entre estos problemas destacan el reducido tamaño de las parcelas de explotación, la falta de información científica sobre la evolución de la población y la ausencia de un plan de explotación.

Conclusiones

El banco marisquero de "Lombos do Ulla" ha sido explotado anualmente desde su apertura en 2002. Las densidades de almeja fina y almeja babosa han mostrado una gran variabilidad interanual. Las tallas medias de ambas especies han sido estables a lo largo de las cinco campañas de explotación. La mortalidad masiva de almeja babosa ocurrida en la campaña 2004-2005 supuso un importante impacto económico para el sector. Se recomienda la ampliación del número de parcelas de explotación y la implantación de un plan de explotación que incluya medidas de control del esfuerzo pesquero y de protección de la población de almeja babosa.

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
CIMA

Autoría: Parada, J.M.; Molares, J.; Otero, X.

Título: Episodios de mortalidad en el banco marisquero "Lombos do Ulla" (Ría de Arousa - NO de España) deducidos a partir de datos meteorológicos de los últimos 45 años

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007

Episodios de mortalidad en el banco marisquero "Lombos do Ulla" (Ría de Arousa - NO de España) deducidos a partir de datos meteorológicos de los últimos 45 años

J.M. Parada[1], J. Molares[2] y X. Otero[3]

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Abstract

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Introducción

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Material y Métodos

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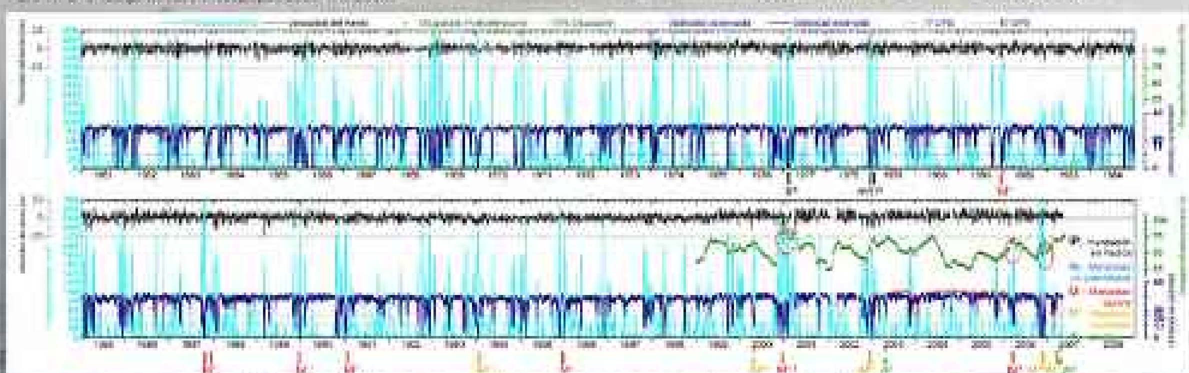

Resultados

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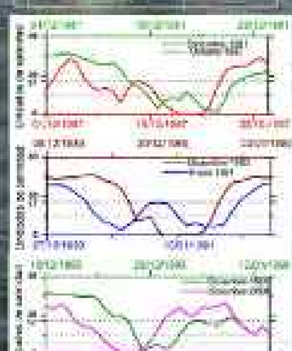

Discusión

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Agradecimientos

[illegible]

Bibliografía

[illegible]

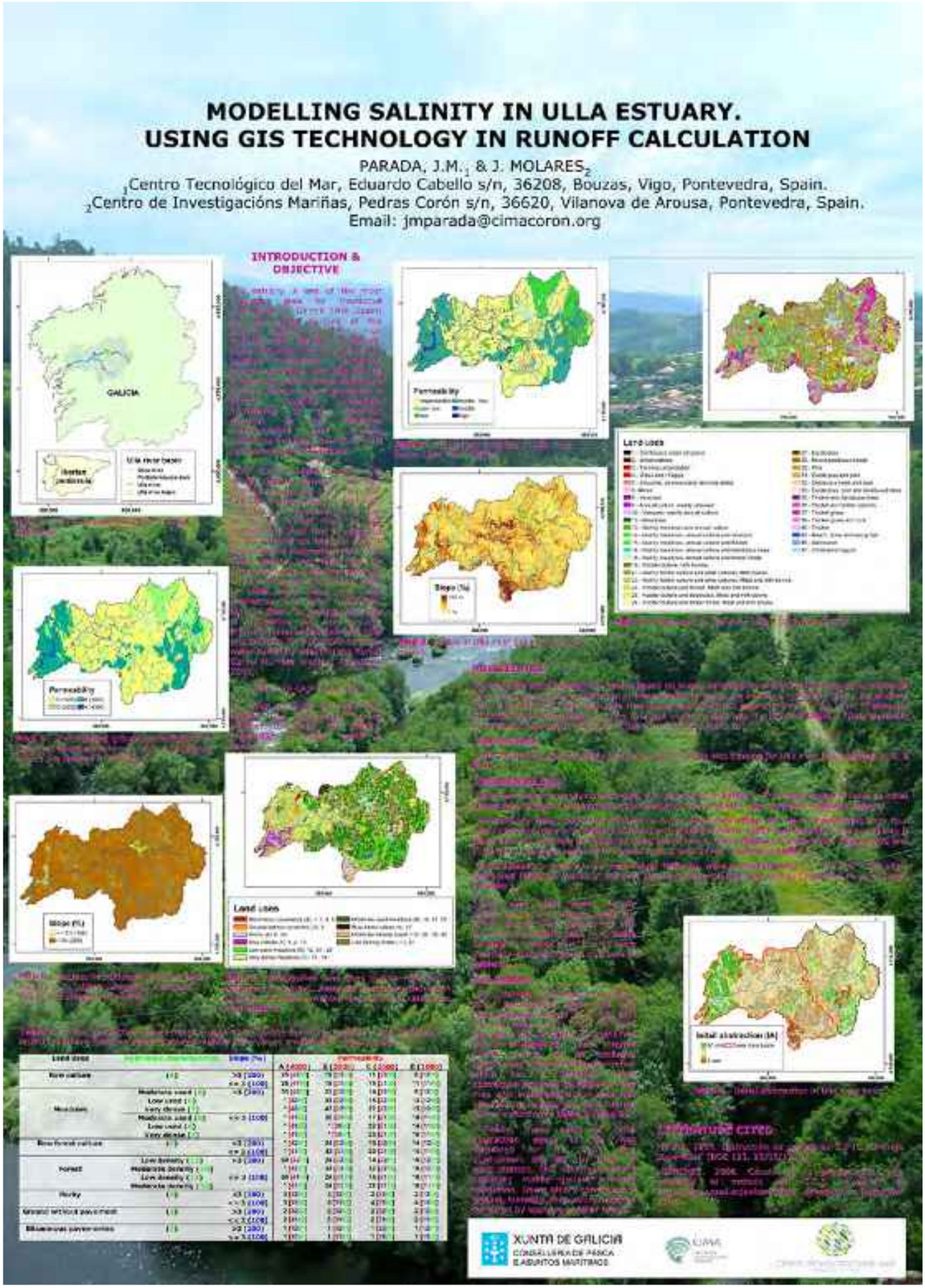
Autoría: Parada, J.M.; Molares, J.

Título: Modelling salinity in Ulla estuary using GIS technology in runoff calculation

Congreso: 8th International Symposium on GIS and Computer Mapping for Coastal Zone Management

Lugar: Santander - Cantabria (España)

Ano: 2007


MODELLING SALINITY IN ULLA ESTUARY.
USING GIS TECHNOLOGY IN RUNOFF CALCULATION
PARADA, J.M.1 & J. MOLARES2
1Centro Tecnológico del Mar, Eduardo Cabello s/n, 36208, Bouzas, Vigo, Pontevedra, Spain.
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INTRODUCTION & OBJECTIVE
GALICIA
Permeability
Land uses
Slope (%)
Permeability
Slope (%)
Land uses
Initial abstraction (A)
XUNTA DE GALICIA
CONSELLERIA DE PESCA E ASUNTOS MARITIMOS

Autoría: Abollo, E.; Ramilo, A.; Cao, A.; Comesaña, P.; Villalba, A.

Título: Natural and experimental transmission of the protozoan parasite *Bonamia ostreae* to the Pacific oyster *Crassostrea gigas*

Evento: XIIIth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Grado (Italia)

Ano: 2007

Natural and experimental transmission of the protozoan parasite *Bonamia ostreae* to the Pacific oyster *Crassostrea gigas*

Abollo E., Ramilo A., Cao A., Comesaña P. & Villalba A.

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INTRODUCTION

Haplosporidian microcells belonging to the genus *Bonamia* infect the haemocytes of different oyster species around the world. Currently this genus comprises four species recognized as valid by molecular analyses: *B. ostreae*, *B. exitiosa*, *B. roughleyi* and *B. perspora* [1,2]. In the late 1970s and early 1980s, mass mortalities attributed to *B. ostreae* caused the drop in oyster production in some countries of Europe and favoured the development of different management strategies to counteract the threat of bonamiosis. In France, the oyster industry that supported the highest world production of flat oyster, replaced this species, *O. edulis* by the non-susceptible *Crassostrea gigas*.

At present, methods for the eradication of bonamiosis are not available [3], being necessary a strict sanitary control in the importation activities. The OIE (Office International des Epizooties) has included *B. ostreae* in the list of notifiable diseases in order to avoid the spread of the bonamiosis and the European Commission (92/65/CEE) recognized *C. gigas* as a non carrier species for the bonamiosis. To study the carrier status of *C. gigas* two transmission experiments were designed, performing the diagnosis of the bonamiosis by histological and molecular analyses.

MATERIALS AND METHODS

TRANSMISSION EXPERIMENT I: *NATURAL CHALLENGE*

In December 2006, 200 Pacific oyster were set in trays and hung from a raft, from which flat oysters also hung, in an area of the Ría de Arousa (Galicia, NW Spain) affected by bonamiosis. From December 2006, 15 *C. gigas* were randomly taken monthly and transported to the lab to be processed.

TRANSMISSION EXPERIMENT II: *EXPERIMENTAL CHALLENGE*

STEP 1. ISOLATION OF BONAMIA CELLS

Heavily infected flat oyster (accounting for 8 - 28 % of haemocytes infected by *Bonamia*) exhibiting were used as source of *Bonamia* cells, which were purified according Mialhe *et al.* [4].

STEP 2. EXPERIMENTAL INOCULATION

Forty five *C. gigas* were inoculated with the purified *B. ostreae* cells and other 45 individuals were inoculated with the same volume of filtered seawater. After 10 days from inoculation, a first sub-sample of 40 oysters (20 infected and 20 control) were processed for diagnosis of bonamiosis; after 80 days, the remaining live individuals (19 infected and 22 control) (second subsample) were also processed.

DIAGNOSIS

Of each oyster a cross section of tissue was fixed in Davidson fixative for histopathology, and a piece of gill tissue and the heart were fixed in 96% ethanol for DNA isolation. Histological sections (5 µm) were stained with Harris hematoxylin and eosin [5] and observed under a light microscope for diagnosis. Genomic DNA was isolated employing the DNAzol reagent® (Invitrogen Life Technologies™) according to the manufacturer' instructions. The pairs of primers BO/ BOAS [6] and Cr / Cit [7] were used to amplify a fragment of the 18S gene of *Bonamia* species.

RESULTS AND DISCUSSION

No infection was observed by histopathological analyses in any of the transmission experiments. Positive PCR results were observed for template obtained from gills (20/20 and heart (0/20) for the experiment of natural challenge.

In the experimental inoculations, negative PCR results were obtained for control and infected individuals from first subsample, and for control individuals from second subsample. Nevertheless, positive PCR results were observed for inoculated individuals (12/19) of the second subsample (Fig. 1).

Figure 1. Detection of *Bonamia ostreae* PCR using Cr/Cit primers. Observations after experimental inoculated after 10 days (A) and 80 days (B). 1-8, DNA isolated from *C. gigas* treated as negative controls; positive control; M, 100 bp molecular marker.

Although the OIE recommend that *Bonamia* diagnosis must be carried out by examination of heart imprints and histological sections, some limitations of these diagnostic methods have been observed by different authors [8, 9, 10], which suggested the need for a critical review of them. The extreme sensitivity of molecular techniques allow the detection of target DNA present at very low levels, but as pointed out Walker and Subasinghe [11] DNA probes can not be used to determine the carrier status and the viability of the pathogens. However the combined use of histopathological and molecular techniques can provide an assessment of the infection level. Our histopathological results showed that the infection did not develop to a clinical level in both transmission experiments, which is according with previous works [12, 13]. However molecular results showed that the infection did progress and remained latent to very low levels in Pacific oysters. With these data, the possibility of that *C. gigas* can be a carrier of *B. ostreae* should be further tested.

REFERENCES

[1] Carnegie R.B., Cochennec-Laureau N. 2004. *Journal Invertebrate Pathology* 85: 69-83.
[2] Carnegie R.B. *et al.* 2006. *J Fish Wildl Dis* 42: 232-240.
[3] Bower S.M. 2001. OIE. http://www.oie.int/eng/maladies/fiches/a_f166.htm
[4] Mialhe E. *et al.* 1988. *Aquaculture* 71: 211-220.
[5] Howard D.W., Smith C.S., 1983. Histological techniques for marine bivalve mollusks. NOAA technical memorandum NMFS-F/SEC-25. Woods Hole, MA.
[6] Abollo E. *et al.* 2006. *J Invertebr Pathol* 91: 29-32.
[7] Carnegie R.B. *et al.* 2003. *Dis Aquat Org* 55: 289-300.
[8] O'Neill G. *et al.* 1998. *Bull Eur Ass Fish Pathol* 18: 117-120.
[9] Cullis, R.C. *et al.* 2000. *Bull Eur Ass Fish Pathol* 20: 67-71.
[10] La Rosa M., Villalba A. 1994. *J Invertebr Pathol* 63: 91-101.
[11] Walker P., Subasinghe R. 2000. FAO Inaworld in Brandsted 37 pp.
[12] Renault T. *et al.* 1995. *Bull Eur Ass Fish Pathol* 15: 78-80.
[13] Culloty S.C. *et al.* 2001. *Dis Aquat Org* 47: 57-69.

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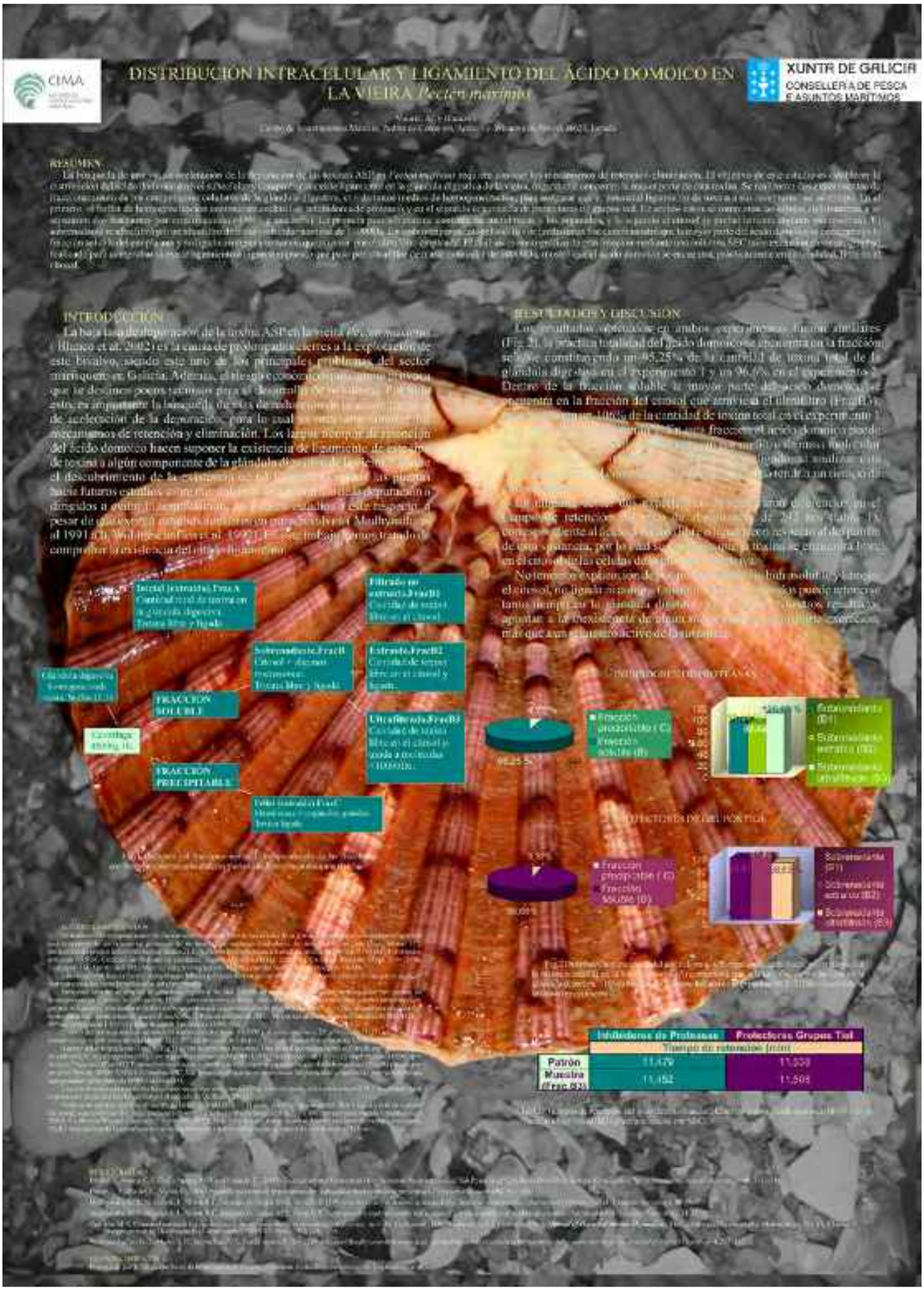
Autoría: Mauriz, A.; Blanco, J.

Título: Distribución intracelular y ligamiento del ácido domoico en la vieira *Pecten maximus*

Evento: IX Reunión Ibérica de Fitoplancton Tóxico y Biotoxinas. Universidad de Cartagena

Lugar: Cartagena - Murcia (España)

Ano: 2007


CIMA
DISTRIBUCIÓN INTRACELULAR Y LIGAMIENTO DEL ÁCIDO DOMOICO EN LA VIEIRA Pecten maximus
XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
RESUMEN
INTRODUCCIÓN
RESULTADOS Y DISCUSIÓN
FRACCIÓN SOLUBLE
FRACCIÓN PRECIPITABLE
Inhibidores de Proteasas
Protectores Grupos Tiol
Tiempo de retención (min)
Patrón
Muestra (Frac B2)

Autoría: Escudeiro, A.; Martín, H.; Blanco, J.

Título: Distribución celular del ácido okadaico en la glándula digestiva de *Mytilus galloprovincialis*

Evento: IX Reunión Ibérica de Fitoplancton Tóxico y Biotoxinas. Universidad de Cartagena

Lugar: Cartagena - Murcia (España)

Ano: 2007

DISTRIBUCION CELULAR DEL ACIDO OKADAICO EN LA GLANDULA DIGESTIVA DE *MYTILUS GALLOPROVINCIALIS*

Araceli Escudeiro*, Helena Martín*, Juan Blanco*

XUNTA DE GALICIA

CIMA

ACIDO OKADAICO

Figura 1. Concentración de toxina (ng/g) (1 A) y Porcentaje de toxina (%) (1 B) bioacumulada en glándula digestiva.

Autoría: Sánchez-Mata, A.; Molares, J.; Sánchez-Mata, A.G.; Varela, M.T.

Título: Análisis cartográfico GIS de los bancos de *"Pecten maximus"* (L. 1758) de las rías de Ferrol, Muros-Noia, y Pontevedra

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

ANÁLISIS CARTOGRÁFICO GIS DE LOS BANCOS DE *Pecten maximus* (L. 1758) DE LAS RÍAS DE FERROL MUROS Y PONTEVEDRA

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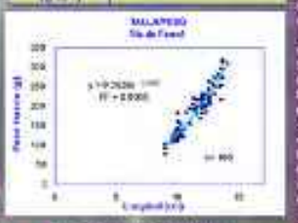
Introducción

Este estudio forma parte del Proyecto PGIDIT "Estudio del ritmo de los parámetros de vieira (Pecten maximus L. 1758) en las rías gallegas" PGIDIT04MAR30E, del Plan INCITE, financiado por la Consellería de Innovación, Xunta de Galicia. En el mismo se muestran los resultados correspondientes a la prospección de bancos de vieira en las rías de Ferrol, Muros y Noya, y Pontevedra. Los objetivos se basaron en la localización y cuantificación de los bancos naturales de vieira en las tres rías, la determinación de la estructura del stock y el análisis de densidad, biomasa y dispersión de las poblaciones en relación con las variables ambientales del medio (Cho Yusaf et al., 1996).

RÍA DE FERROL

Ría de Ferrol: 10 radiales, 7 bancos de vieira

RÍA DE FERROL Stock comercial (> 100 mm)	Promedio	Máximo
DENSIDAD (ind m⁻²)	0.038	0.14
BIOMASA (g m⁻²)	2.2	22.7



Se delimitaron un total de 7 bancos en la Ría de Ferrol (Castilla, San Cibrao, San Martín, San Felipe, Magdalena, A Graña y Ferrol), 6 en la Ría de Muros (San Francisco, Muros, Bornalla, Esteiro, O Coelleiro, y Portiño), y 3 en la Ría de Pontevedra (Aguiño, Pontevedra, Bueu, Rande y Tambo).

La densidad media del stock comercial (> 100 mm) varió de 0.038 ind. m⁻² en la Ría de Ferrol, 0.019 ind. m⁻² en la Ría de Muros y 0.02 ind. m⁻² en la Ría de Pontevedra. Los máximos valores de densidad registrados fueron: 0.14 ind. m⁻² (Ferrol), 0.17 ind. m⁻² (Muros) y 0.18 ind. m⁻² (Pontevedra).

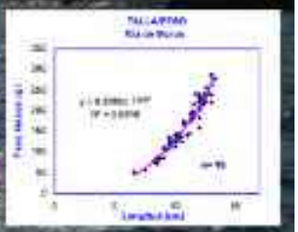
El promedio de biomasa fresca (g m⁻²) de vieira de talla comercial varió entre 2.2 g m⁻² (Ferrol) y 4.0 g m⁻² (Pontevedra), siendo de 3.7 g m⁻² (Muros). Los máximos se situaron en los 22.7 g m⁻² de aguas de Pontevedra, 22.1 g m⁻² de aguas de Ferrol y 35.6 g m⁻² de aguas de Muros.

La talla y peso promedios individuales (sin valva) de las tres rías fue de 13.8 cm y 100.7 g (Ferrol), 15.7 cm y 143.7 g (Muros) y 16.8 cm y 116.5 g (Pontevedra).

RÍA DE MUROS-NOYA

Ría de Muros-Noya: 12 radiales, 6 bancos de vieira

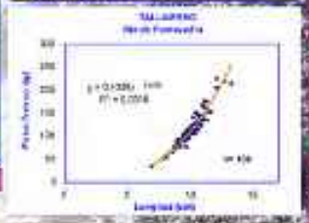
RÍA DE MUROS-NOYA Stock comercial (> 100 mm)	Promedio	Máximo
DENSIDAD (ind m⁻²)	0.019	0.17
BIOMASA (g m⁻²)	3.7	22.1



RÍA DE PONTEVEDRA

Ría de Pontevedra: 12 radiales, 3 bancos de vieira

RÍA DE PONTEVEDRA Stock comercial (> 100 mm)	Promedio	Máximo
DENSIDAD (ind m⁻²)	0.02	0.18
BIOMASA (g m⁻²)	4.0	35.6



Metodología

Se realizó una localización precisa de los bancos de pectínidos usando como medios utilizando la información sobre zonas de producción y extracción de vieira de los cofrades de Ferrol, Muros y Pontevedra, de la base de datos de la Consellería de Pesca y Asuntos Marítimos (Portafolios Tecnológico de Pesca), así como observaciones in situ con cámara de video submarina (Underwater et al., 1994) y análisis del tipo del sustrato previo arrastre de los rastros.

Los campañas de muestreo se realizaron tomando una retícula homogénea georeferenciada, con cuadrícula UTM de 800 m de longitud, mediante el uso de SIG. En cada cuadrícula se realizaron un mínimo de dos operaciones de rastro (Jenkins Stewart et al., 2001) a velocidad constante, con registro mediante GPS de las coordenadas geográficas inicial y final. Ancho horizontal y dimensiones de los rastros empleados en cada ría.

Las variables ambientales pH, Eh (mV), T (°C), la granulometría (Buchanan, 1984) y el contenido en materia orgánica del sustrato fueron registradas y analizadas siguiendo la recolección con draga Van Veen de muestras de sedimento. Asimismo se registraron los valores de pH, Eh (mV), T (°C), concentración de O_2 (mg l⁻¹), salinidad (‰) y conductividad (mS/cm) del agua de fondo recogida con botella Niskin.

Los valores de densidad (ind m⁻²), biomasa (g m⁻²) en peso fresco, talla y contenido en biotoxinas de los individuos de cada banco fueron registrados y procesados mediante SIG (ArcGis 9.1).

NORMATIVAS

La ría gallegas han sido clasificadas en zonas y salazones (Orden de 14 de noviembre 1995, DOGA nº 221 de 17 de noviembre 1995) para la regulación en el programa de seguimiento y control de moluscos en factorías. Los criterios de la clasificación de vieira se basaron en una concentración de escherichia coli (AD) en triplicado y número inferior a 230 NMP.

Los datos relativos a niveles de concentración de toxina diarreica en vieira fueron facilitados por el INTECMAR (Instituto Tecnológico de Medio Marino, Centro de la Consellería de Pesca y Asuntos Marítimos).

Resultados que en los rangos en los que se vieira presentan en menor concentración se encuentran dentro los más elevados al oscilar entre los bancos de Ferrol y Muros. En la Ría de Pontevedra, en los años 2 y 3.

CONCLUSIÓN

Los datos obtenidos indican que el stock de los bancos de vieira en estas rías no permiten la explotación del recurso en cuanto a la estabilidad de su estructura de poblaciones, que no son por los elevados valores en parámetros encontrados durante el desarrollo del presente estudio.

Referencias bibliográficas

Autoría: Sánchez-Mata, A.; Molares, J.; Rodal, M.; Carreira, P.; Giráldez, R.

Título: Estudio en mesocosmos del crecimiento y mortalidad de dos poblaciones de bivalvos en medio natural controlado (O Bohído y Lombos do Ulla): II. Almeja babosa (*Venerupis senegalensis* G.1791)

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

Estudio en mesocosmos del crecimiento y mortalidad de dos poblaciones de bivalvos en medio natural controlado (O Bohido y Lombos do Ulla): II. Almeja babosa (*Venerupis senegalensis* Gmelin, 1791)

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Introducción

El proyecto de investigación "Plan de actuación para la recuperación del banco de libre marisqueo *O Bohido* ", es una iniciativa financiada por la Consellería de Pesca y Asuntos Marítimos de la Xunta de Galicia, desarrollada por el Departamento de Recursos Marinos del CIMA desde el año 2005.

Uno de los objetivos del mismo está orientado al análisis del crecimiento y reclutamiento natural de almeja fina *Ruditapes decussatus*, babosa *Venerupis senegalensis* y bicuda *Pepha aurea*, así como a la investigación de las causas que provocan elevada mortalidad en estas especies y al seguimiento de su dinámica de poblaciones, con aplicación directa como herramienta predictiva en la estimación de la producción anual de bivalvos del banco.

En este trabajo se presentan los resultados correspondientes a 21 meses de seguimiento a mesoescala en medio natural controlado, de dos poblaciones de almeja babosa de los bancos submareales O Bohido y Lombos do Ulla, situados en la Ría de Arousa.

TASA INSTANTÁNEA DE CRECIMIENTO MENSUAL(G30)

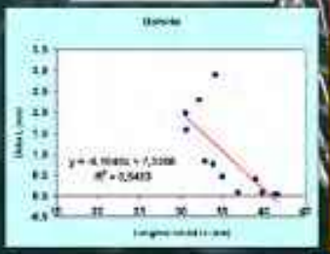
Métodos

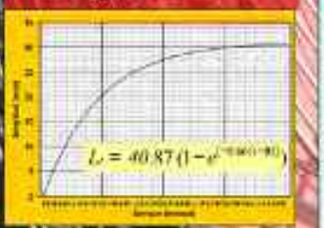
Se realizó un seguimiento en mesocosmos para analizar el crecimiento y la mortalidad de almeja babosa de las dos poblaciones. Para ello se instalaron dos plataformas metálicas con capacidad para albergar 6 cajas de material plástico, que fueron depositadas en el lecho marino; las cajas, de dimensiones 56,5 x 36,8 x 23 cm, fueron rellenadas con arena del banco y en cada una se dispusieron 15 ejemplares de almeja babosa capturados con rañe en las proximidades del banco, previamente medidos e identificados mediante marcaje; las cajas se cubrieron con malla de 1 cm de luz. Cinco cajas se destinaron al estudio mensual de la mortalidad y la restante se destinó al estudio bimensual del crecimiento. En todos los casos se sustituyeron los ejemplares utilizados en el período anterior por nuevos individuos, con el fin de evitar que el estrés provocado por los sucesivos controles afectara a las tasas estimadas. En cada muestreo se procedió al análisis biométrico (longitud antero-posterior) de ejemplares y recuento de supervivientes.

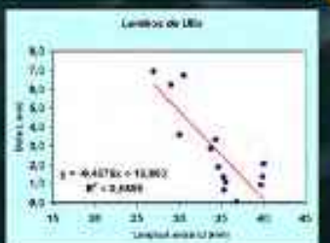
CRECIMIENTO

Curva de crecimiento de von Bertalanffy

$$L_t = L_\infty (1 - e^{-k(t-t_0)})$$





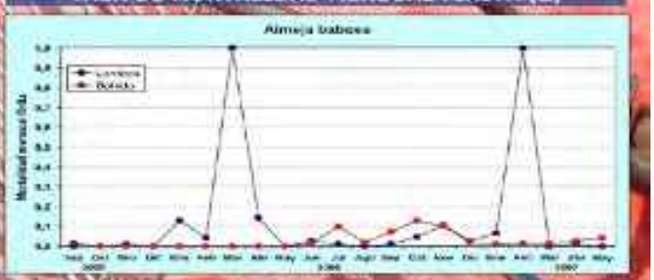


Delta L = $(L_{inf}-L_t)(1- e^{(-k\ Delta\ t)})$

Método Fabens

(Malcolm Haddon, 2001)

TASA DE MORTALIDAD MENSUAL FINITA (Z)



Resultados y discusión

CRECIMIENTO.

Los parámetros de crecimiento estimados para un periodo de 17 meses, a partir del modelo de Von Bertalanffy fueron K= 0.05, $L\infty$ = 80,75, t_0 = 0, en la población de Lombos y K= 0.72, $L\infty$ = 45,66, t_0 = 0, para la población de O Bohido.

La tasa instantánea de crecimiento mensual de almeja babosa, calculada como G30 = $[\ln(L_t/L_{t-1})/\ln(t)]$.30 (Ricker, 1975), registró los máximos valores en las cajas de O Bohido en octubre de 2005, abril y agosto de 2006 y abril de 2007. En Lombos do Ulla los máximos de crecimiento se detectaron en junio de 2006 y abril de 2007.

MORTALIDAD.

Se encontraron dos episodios de mortalidad elevada de almeja babosa en Lombos do Ulla en marzo de 2006 y febrero de 2007, ambos provocados por descensos en la salinidad. La población de almeja babosa no es muy abundante en este banco debido principalmente a los frecuentes descensos en la salinidad, provocados por la mezcla con aguas continentales, causantes de fuertes mortalidades. Por el contrario, la tasa de mortalidad para esta especie en O Bohido fue muy reducida durante el ciclo de seguimiento mensual de 21 meses.

Este estudio forma parte de los resultados del proyecto Plan de actuación para la recuperación del banco de libre marisqueo O Bohido, financiado por la Consellería de Pesca y Asuntos Marítimos, Xunta de Galicia.

Autoría: Sánchez-Mata, A.; Molares, J.; Rodal, M.; Carreira, P.; Giráldez, R.

Título: Estudio en mesocosmos del crecimiento y mortalidad de una población de bivalvos en medio natural controlado (O Bohído, Ría de Arousa): III. Almeja bicuda (*Paphia aurea* G. 1791)

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

Estudio en mesocosmos del crecimiento y mortalidad de una población de bivalvos en medio natural controlado (O Bohído, Ría de Arousa): III. Almeja bicuda (*Paphia aurea* Gmelin, 1791)

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( )

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Introducción

La extracción de moluscos bivalvos especies constituye en Galicia una actividad de gran importancia socioeconómica para el sector marisquero. Las principales especies explotadas forman bancos naturales tanto en playas arenosas como en zonas calcáreas someras permanentemente sumergidas. La importancia ecológica, biológica y económica de estas zonas de producción marisquera ha promovido diversas acciones por parte del sector implicado y la administración gallega para su conservación e incremento de la producción. Sin embargo, durante los últimos años se ha venido observando una disminución en la producción de diferentes especies de almejas, principalmente japónica y babosa, en gran número de bancos naturales afectados por episodios anuales de mortalidad.

El proyecto de investigación "Plan de actuación para la recuperación del banco de libre marisqueo O Bohído", es una iniciativa financiada por la Consellería de Pesca y Asuntos Marítimos de la Xunta de Galicia, desarrollado por el Departamento de Recursos Marinos del CIMA desde el año 2005.

Uno de los objetivos del mismo está orientado al análisis del crecimiento y reclutamiento natural de almeja fina (*Ruditapes decussatus*), almeja blanca (*Venerupis senegalensis*) y almeja bicuda (*Paphia aurea*), así como a la investigación de las causas que provocan elevada mortalidad en estas especies y al seguimiento de su dinámica de poblaciones, con calificación directa como herramienta predictiva en la estimación de la producción anual de bivalvos del banco.

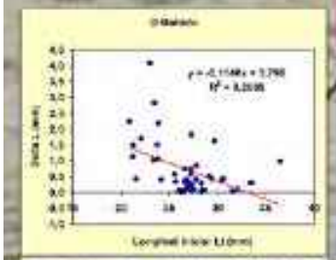
En este trabajo se presentan los resultados correspondientes a 21 meses de seguimiento a mesocosmos en medio natural controlado, de la población de almeja bicuda del banco submareal O Bohído, situado en la Ría de Arousa.

TASA INSTANTÁNEA DE CRECIMIENTO MENSUAL (G30)

Métodos

Se realizó un seguimiento en mesocosmos para analizar el crecimiento y la mortalidad de la población de almeja bicuda en el banco de libre marisqueo O Bohído. Se diseñó una plataforma metálica con capacidad para albergar 6 cajas de material plástico, que fue depositada en el sustrato submareal del banco; las cajas, de dimensiones 56,5 x 36,8 x 21 cm, fueron rellenadas con arena de la zona previamente tamizada y en cada una se dispusieron 10 ejemplares de almeja bicuda capturados con rastro en las proximidades del banco, previamente medidos e identificados mediante marcaje; las cajas se cubrieron con malla de 1 cm de luz. Cinco cajas se destinaron al estudio mensual de la mortalidad y la restante se destinó al estudio bimensual del crecimiento. En todos los casos se sustituyeron los ejemplares utilizados en el periodo anterior por nuevos individuos, con el fin de evitar que el estrés provocado por los sucesivos controles afectara a las tasas estimadas. En cada muestreo se procedió al análisis biométrico (longitud antero-posterior) de ejemplares y recuento de supervivientes.

CRECIMIENTO



Delta L = $(L_{sup}-L_t)(1-e^{(-k\ Delta\ t)})$
Método Fabens
(Malcolm Haddon, 2001)

Curva de crecimiento de von Bertalanffy
$L_t = L_{\infty}\ (1 - e^{-k\ (t-t_0)})$

TASA DE MORTALIDAD MENSUAL FINITA (Z)

Resultados y discusión

CRECIMIENTO. En la población de almeja bicuda de O Bohído los parámetros de crecimiento estimados para un periodo de 17 meses, a partir del modelo de Von Bertalanffy fueron: $k = 0,72$, $L\infty = 33,29$, $t_0 = 0$.

La tasa instantánea de crecimiento mensual (G30) para esta especie registró los máximos valores en octubre de 2005 y 2006 y abril de 2007. Los valores de la tasa de mortalidad mensual finita se mantuvieron en torno al 0,1 durante el periodo comprendido entre septiembre de 2005 y febrero de 2006, incrementándose hasta valores próximos a 0,2 en julio y noviembre de 2006. A partir del mes de abril de 2007 los valores de la tasa de mortalidad se mantuvieron alrededor de 0,2.

MORTALIDAD. Los máximos de mortalidad se registraron en mayo de 2005 y abril y junio de 2007. En esta población se han observado altas prevalencias de neoplasia en individuos adultos (*Ab Villalba, com. pers.*) que están siendo analizadas por los Departamentos de Patología del CIMA e INTECMAR.

Este estudio forma parte de los resultados del proyecto *Plan de actuación para la recuperación del banco de libre marisqueo O Bohído*, financiado por la Consellería de Pesca e Asuntos Marítimos, Xunta de Galicia.

Autoría: Sánchez-Mata, A.; Molares, J.; Rodal, M.; Carreira, P.; Giráldez, R.

Título: Estudio en mesocosmos del crecimiento y mortalidad de tres poblaciones de bivalvos en medio natural controlado (Sarrido, Placeres y Lombos do Ulla): I. Almeja fina *Ruditapes decussatus* (L. 1758)

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

Estudio en mesocosmos del crecimiento y mortalidad de tres poblaciones de bivalvos en medio natural controlado (Sarrido, Placeres y Lombos do Ulla): I. Almeja fina *Ruditapes decussatus* (L. 1758)

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Introducción

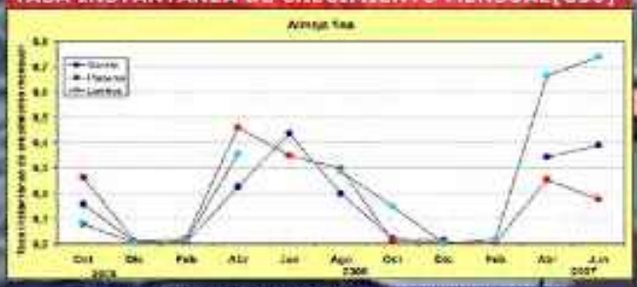
El proyecto de investigación "Plan de actuación para la recuperación del banco de libre marisqueo *O Banlán*", es una iniciativa financiada por la Consellería de Pesca y Asuntos Marítimos de la Xunta de Galicia, desarrollada por el Departamento de Recursos Marinos del CIMA desde el año 2005. Uno de los objetivos del mismo está orientado al análisis del crecimiento y reclutamiento natural de almeja fina *Ruditapes decussatus*, babosa *Venerupis senegalensis* y bivalvo *Paphia aurea*, así como a la investigación de las causas que provocan elevada mortalidad en estas especies y al seguimiento de su dinámica de poblaciones, con aplicación directa como herramienta predictiva en la estimación de la producción anual de bivalvos del banco.

Este estudio forma parte del citado objetivo y en él se presentan los resultados correspondientes a 22 meses de seguimiento a mesoescala en medio natural controlado, de tres poblaciones de almeja fina de los bancos intermareales O Sarrido (Cambados, Ría de Arousa) y Placeres (Ría de Pontevedra) y del banco submareal Lombos do Ulla (Ría de Arousa).

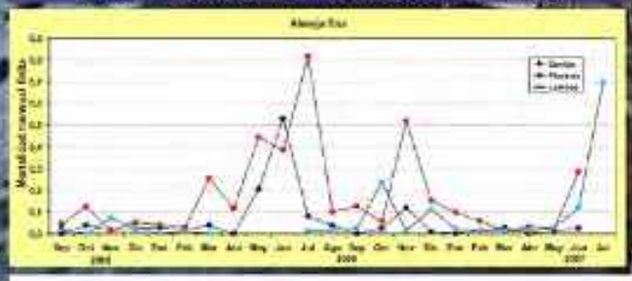
Métodos

Se diseñó un experimento en mesocosmos con el fin de investigar el crecimiento y la mortalidad de la almeja fina, consistente en la instalación de un grupo de 6 cajas (56,5 x 36,8 x 23 cm), enterradas a nivel en cada uno de los bancos intermareales y en una estructura de soporte de las 6 cajas, depositada en el fondo, en el caso del banco submareal; las cajas se rellenaron con arena del banco y en cada una se dispusieron 15 ejemplares del banco capturados con rapa, previamente medidos e identificados mediante marcaje; las cajas se cubrieron con malla de 1 cm de luz. Cinco cajas se destinaron al estudio mensual de la mortalidad y la restante se destinó al estudio bimensual del crecimiento. En todos los casos se sustituyeron los ejemplares utilizados en el período anterior por nuevos individuos, con el fin de evitar que el estrés provocado por los sucesivos controles afectara a las tasas estimadas. En cada muestreo se procedió al análisis biométrico (longitud antero-posterior) de ejemplares y recuento de supervivientes.

TASA INSTANTÁNEA DE CRECIMIENTO MENSUAL (G30)



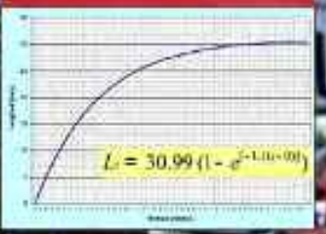
TASA DE MORTALIDAD MENSUAL FINITA (Z)

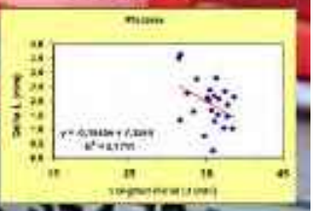


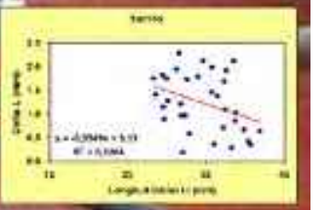
CRECIMIENTO

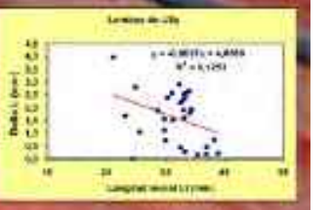
Curva de crecimiento de von Bertalanffy

$$L_t = L_\infty (1 - e^{-k(t-t_0)})$$









Delta L = $(L_{t+\Delta t} - L_t)(1 - e^{-k \cdot \Delta t})(1 - e^{-k \cdot \Delta t})$

Método Fabens (Malcolm Haddon, 2001)

Resultados y discusión

CRECIMIENTO.

Los parámetros de crecimiento estimados para un periodo de 22 meses, a partir del modelo de Von Bertalanffy fueron K= 0.62, L∞ = 53,06, t_0 = 0, en la población de Lombos, K= 0.25, L∞ = 62,67, t_0 = 0, para la población de Sarrido y K= 0.38, L∞ = 67,04, t_0 = 0 para la población de Placeres.

La tasa instantánea de crecimiento mensual de almeja fina, calculada como G30 = [ln(L_t/L_{t-1})/ln(t)].30 (Ricker, 1975), registró los máximos valores en abril (Placeres) y junio (Sarrido) de 2006 y en junio (Lombos) de 2007.

MORTALIDAD.

Se observó una mortalidad elevada de almeja fina en el Sarrido, en el mes de junio de 2006, coincidente con elevadas temperaturas del agua y acumulación de algas en la zona de estudio. Ambos factores van ligados a problemas de hipoxia en el medio pudiendo ser la causa de la mortalidad detectada. En Lombos do Ulla los máximos de mortalidad se registraron en julio de 2007.

En la población de Placeres se detectaron elevadas mortalidades de almeja fina en dos momentos del año, julio y noviembre de 2006. En esta población se han observado altas prevalencias del protozoo *Perkinsus olseni*, con una intensidad de infección comprendida entre 1,5 y 3 (valor máximo= 5) durante todo el periodo estudiado, detectándose una intensidad máxima de infección en octubre de 2006 y siguiendo una pauta temporal, detectada mesualmente, que consiste en la aparición de máximos valores de mortalidad en el mes siguiente a una detección de intensidad máxima de infección (A. Villalba, com. pers.).

Este estudio forma parte de los resultados del proyecto *Plan de actuación para la recuperación del banco de libre marisqueo O Banlán*, financiado por la Consellería de Pesca e Asuntos Marítimos, Xunta de Galicia.

Autoría: López, C.; González, A.; Quintáns, J.M.; Rodríguez, J.L.

Título: Datos preliminares del control de parámetros físico-químicos y bacteriológicos en circuito cerrado de peces planos

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
Dirección Xeral de Innovación e Desenvolvemento Pesqueiro

Datos preliminares del control de parámetros físico-químicos y bacteriológicos en circuito cerrado de peces planos.

Carmen López (1), Ana González (2), Jesús M. Quintáns (3) y José Luis Rodríguez (4)

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Introducción

Descripción del sistema

Medición de los parámetros físico-químicos

DIARIAMENTE: temperatura, oxígeno, salinidad y pH

SEMANALMENTE: nitritos, amonio y CO_2

Temperatura	19,5 ºC	13,5-20,5 ºC	19,5 ºC	13,5-20,5 ºC
Oxígeno	7,5 ppm	6-7,5 ppm	7 ppm	7-8 ppm
Salinidad	35%	35%	35%	35%
pH	7,8	8,0	7,8	8,0
Nitritos	0,1-0,3 ppm		0,1-0,3 ppm	
Amonio	0,3 ppm		0,3 ppm	
CO_2	0,0 ppm		0,0 ppm	

Control microbiológico

Conclusión

X FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS
I FORO IBEROAMERICANO DOS RECURSOS MARIÑOS E DA ACUICULTURA

Autoría: de Santiago, J.A.; Fernández, A.; Ruíz, M.; Guerra, A.

Título: Preengorde de almeja babosa (*Venerupis pullastra* Montagu, 1803), almeja fina (*Ruditapes decussatus* Linné, 1758) y almeja japonesa (*Ruditapes philippinarum* Adams & Reeve, 1850) en tres sistemas de preengorde

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

Preengorde de almeja babosa *Venerupis pullastra* (Montagu, 1803), almeja fina (*Ruditapes decussatus*, Linné, 1758) y almeja japonesa (*Ruditapes philippinarum*, Adams & Reeve, 1850) en tres sistemas de preengorde

J.A. de Santiago[1], A. Fernández[2], M.Ruiz[3] y A. G. Díaz[3]

[1]Centro Tecnológico del Mar. Eduardo Cabello s/n. Bouzas 36208. Vigo. jalberto_desantiago@hotmail.com
[2]Centro de Investigaciones Marinas (C.I.M.A.). Consellería de Pesca e Asuntos Marítimos. Xunta de Galicia. Centro de Cultivos. Muelle de Porcillán s/n 27700 Ribadeo. Lugo. (España)
[3]Centro de Investigaciones Marinas (C.I.M.A.). Consellería de Pesca e Asuntos Marítimos. Xunta de Galicia. O Pedras do Corón s/n. 36620 Vilanova de Arousa. Pontevedra. (España).

Resumen:

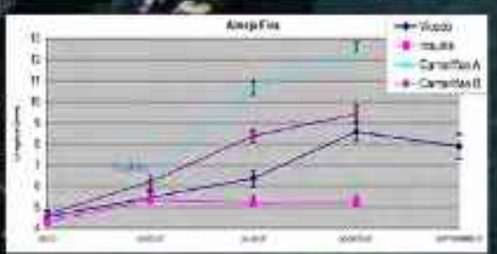
Se presentan los resultados de los ensayos de crecimiento de almeja babosa, *Venerupis pullastra (Montagu, 1803)*, almeja fina(*Ruditapes decussatus*, Linne, 1758) y almeja japonesa (*Ruditapes philippinarum* Adams & Reeve,1850) procedente de criadero que se ha preengordado, en tres sistemas diferentes: en pantalán del puerto deportivo de Camariñas y O Vicedo; en instalaciones de criadero tradicional, con aporte de fitoplancton, aprovechando el efluente de una granja de rodaballo. Se analiza el crecimiento de lotes de semilla, a través tasas de crecimiento (G$_{SW}$) fueron más altas en longitud y peso.

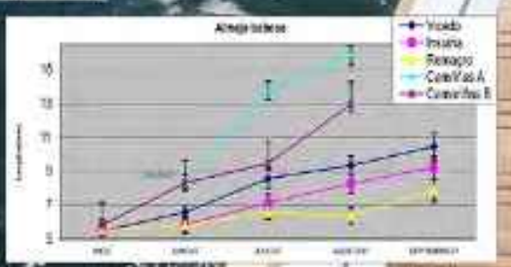
Material y Métodos:

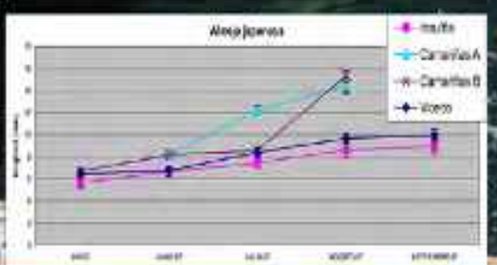
1.- Preengorde en semillero tradicional con aporte de fitoplancton.
2.- Preengorde con aprovechamiento del efluente de una planta de rodaballo.
3.- Preengorde en pantalán, del cuerdo d portivo de Camariñas (A Coruña) y O Vicedo (Lugo)

Resultados y discusión:

Vicedo	Lo (mm)	LF (mm)	G(SW)	A %	Wo (mg)	Wf (mg)	G(SW)	A %
Babosa	5,48±0,305	10,46±0,780	**0,192**	190,88	22,740,116	185,4±0,847	**0,624**	816,74
Fina	4,55±0,231	7,89±0,570	**0,164**	173,41	18,73±0,153	168,3±1,884	**0,521**	578,22
Japonesa	6,46±0,356	9,86±0,526	**0,126**	152,63	51,67±2,635	190,37±10,298	**0,387**	368,43
Insuña								
Babosa	5,57±0,361	9,24±0,647	**0,147**	167,09	25,33±1,341	160,47±11,074	**0,527**	633,52
Fina	4,34±0,228	5,23±0,332	**0,083**	120,51	17,6±0,677	33±2,142	**0,180**	187,5
Japonesa	5,64±0,459	8,96±0,687	**0,132**	158,87	45±1,466	178±2,011	**0,393**	395,56
Remuiño								
Babosa	5,53±0,301	7,58±0,655	**0,101**	142,5	25,33±1,341	162,27±7,282	**0,399**	404,15
Camariñas A								
Babosa	5,85±0,321	15,83±0,569	**0,395**	270,6	25±0,350	512,2±6,614	**1,192**	2048,8
Fina	4,65±0,185	12,31±0,506	**0,384**	264,73	18,53±0,013	346±5,408	**1,154**	1861,8
Japonesa	6,68±0,301	14,67±0,662	**0,305**	216,62	51,33±3,472	473,47±16,547	**1,779**	9053
Camariñas B								
Babosa	5,85±0,269	12,91±0,460	**0,313**	221,03	25±0,350	269,5±4,637	**0,939**	1078
Fina	4,65±0,185	9,4±0,383	**0,259**	202,8	18,53±0,0133	137,27±3,360	**0,790**	740
Japonesa	6,68±0,301	11,52±0,566	**0,228**	172,54	51,33±3,472	885,51±28,751	**0,962**	1742,9







Conclusiones:

+ La semilla preengordada en el pantalán, se ha mostrado más eficiente que los otros sistemas probados, lo que se ha hecho más palpable con la almeja fina.
+El desdoble realizado en Camariñas, mejoró las tasas de crecimiento, tanto en las cabezas como en las colas del lote.
+El correcto manejo del semillero, es un elemento esencial para la obtención de buenos resultados en todas las especies.

Este trabajo está financiado por la acción de investigación "Seguimiento y valoración de los mejilloneros de roquetas" a través de la Dirección Xeral de Innovación e Desenvolvemento Pesqueiro, de la Consellería de Pesca e Asuntos Marítimos de la Xunta de Galicia.

Autoría: Fuentes, J; Villalba, A.

Título: Selective breeding programme for bonamiosis tolerance of the European flat oyster *Ostrea edulis* in Galicia: preliminary results

Evento: 10th Internacional Conference on Shellfish Restoration (ICSR)

Lugar: Vlissingen (Países Bajos)

Ano: 2007

SELECTIVE BREEDING PROGRAMME FOR BONAMIOSIS TOLERANCE OF THE EUROPEAN FLAT OYSTER *Ostrea edulis* IN GALICIA: PRELIMINARY RESULTS

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS

CIMA

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INTRODUCTION

Galician natural populations of the European flat oyster, *Ostrea edulis*, supported an intensive fishery for centuries. This overexploitation led, at the middle of the past century, to the complete exhaustion of the natural beds and to the decline of the oyster industry (Andreu 1968). As an alternative, oyster farming was started but, due to the scarcity of local supply of oyster seed, it was necessary the importation of large amounts of oysters from different countries, mainly from France. Together with this importation, the parasite *Bonamia ostreae* was also introduced in the Galician waters (Polanco et al. 1984). This parasite, which infects and destroys the oyster haemocytes, causes recurrent episodes of mass mortalities in the late stage of the oyster on-growing and is nowadays the most important constraint for the development of the flat oyster industry in Galicia. To keep their business, Galician oyster farmers adopted a strategy involving the immediation of submarket or even market sized oysters from other countries, which are on-grown for short periods of time (less than one year) and harvested before bonamiosis decimates the oyster stocks. This strategy is close to storing rather than farming and involves a risky dependence on the availability of submarket sized oysters from other countries.

A more interesting approach, performed with encouraging results to face some devastating diseases of other oyster species of the genus *Crassostrea* and *Saccostrea*, is the development of resistant strains by selective breeding programmes (Haskin et al. 1988; Ford and Haskin 1988; Davis and Barber 1999; Nell et al. 2000; Nell and Hand 2003; Ragone-Calvo et al. 2003). In the flat oyster *O. edulis* selective breeding programmes for bonamiosis resistance have also been carried out in France (Martin et al. 1993; Baud et al. 1997; Naciri-Graven et al. 1998, 1999) and Ireland (Culloty et al. 2001) and have yielded higher oyster survival and lower *B. ostreae* prevalence.

With these precedents in mind, in 2000 a selective breeding programme was started in Galicia (NW Spain) with the aim to produce flat oyster strains tolerant to bonamiosis. The first stage of this programme was an evaluation of the performance of 19 full- and half-sib families produced from broodstocks coming from four oyster populations of Greece, Ireland and two localities in Galicia: Ortigueira and Coroso (da Silva et al. 2005). In 2005, a second stage started with the production of 8 families of the first generation of selected oysters, using as broodstocks combinations of oysters from the most favourable families of the previous evaluation stage, and also 4 families of non-selected oysters from broodstocks of two Galician natural populations. The performance of these families was compared under raft-cultivation conditions in an area heavily affected by bonamiosis.

This poster shows some of the results obtained in this second stage. At the end of the two-year on-growing period (September 2007), significant advantages of selected families versus non-selected for survival and growth rate has been observed. Selected families coming from the autochthonous Ortigueira origin were the most favourable.

EXPERIMENTAL DESIGN

Right through the winter and spring of 2005, 12 oyster families were obtained by standard hatchery and nursery techniques (da Silva et al. 2005). Eight of these families (ORM2-1, ORM3-1, ORM4-1, OR2-2 and COM6-3, COM6-1, COM4-1, CO5-1) came from conditioned broodstocks composed of surviving individuals of those families of Ortigueira (OR) and Coroso (CO) origin, respectively, that showed the best performance in the previous experiment (da Silva et al. 2005). These 8 families were called "SELECTED" and two of them, OR2-2 and CO5-1, were "INBRED" families. The other four families (ORS2-1, ORS2-3 and POS1-3, POS1-6) came from conditioned broodstocks of wild individuals obtained from natural oyster beds from the "rias" of Ortigueira and Pontevedra (PO) (Galicia, NW Spain), respectively. These 4 families were called "WILD". In September 2005, oyster seeds of each family were transferred to a raft located in an oyster culture area of the Ria de Arousa (Galicia, NW Spain) heavily affected by bonamiosis since 1980s (Montes et al. 1989). Seed was on-grown following culture procedures similar to those of the previous stage of the programme (da Silva et al. 2005). Approximately every three months, oysters were sampled and the growth and mortality of the 12 families calculated. Sampling finished in September 2007, after 2 years of raft on-growing.

RESULTS AND DISCUSSION

Figure 1 shows the variation of the mean values of shell height, total weight and cumulative mortality of oysters of the 12 families through the whole on-growing period (Sept. 2005 to Sept. 2007). Figure 2 shows the same variables but now with selected and wild families grouped by geographical origin of the stock.

After 2 years of raft on-growing, statistically significant ($F=4.85$; $P=0.009$) and commercially relevant differences in the cumulative mortality of the oysters were detected between families. In September 2007, cumulative mortality ranged from the very low values of some selected families (23.46 % and 34.30 % of COM6-1 and ORM3-1, respectively) to the commercially unacceptable very high values of some of the inbred (80.35 %, CO5-1) and wild (92.03 %, POS1-6) families (Figure 1). Half of the tested families, 4 selected and 2 wild, showed two-year cumulative mortalities lower than 50 % (Figure 1). When selected and wild families were grouped by the geographical origin of the stock (Figure 2), the oysters from Ortigueira origin (both selected and wild) showed the lower final mortality values (41.88 % and 43.81 %, respectively). Selected oyster from Coroso (50.66 %) and the inbred family from Ortigueira (67.07 %) showed intermediate values and the highest final mortalities corresponded to the wild families from Pontevedra (80.13 %) and the inbred family from Coroso (80.35 %).

The average values of shell height and total weight of the oysters followed similar patterns of variation. At the end of the on-growing period (September 2007), significant differences ($F=6.29$; $P<0.001$) in total weight were detected between families. The two families showing the biggest total weight (76.51 g, ORM3-1 and 62.80 g, COM6-1; Figure 1) were the same two families showing the lowest mortality. When families were grouped by family origin (Figure 2), the average total weight of the selected families from Ortigueira (58.51 g) and Coroso (56.47 g) were clearly higher that those of the wild families from Ortigueira (44.32 g) and Pontevedra (42.31 g).

The results obtained in this second experiment of the selection programme are promising and show an important and fast reduction of the oyster mortality of some of the selected families. This is particularly clear-cut when final cumulative mortalities of the selected families from both Ortigueira and Coroso and the wild families from Pontevedra are compared (Figure 2). However, results are less conclusive when we compare selected and wild families from Ortigueira. From this last comparison it could be concluded that a process of natural selection of bonamiosis-more tolerant oysters could be occurring in Ortigueira, an area of the Galician coast with a well known and long history of exposure to this parasite. At least part of the gain obtained in this experiment could be explained by this natural process. Together with the reduction of the total mortality a concomitant increase of the growth rate of some of the selected families was also observed, which would suggest a higher general vigour of these selected families.

CONCLUSIONS

- The fastest growth rates and lowest mortalities have been recorded in some of the SELECTED families (COM6-1 and ORM3-1).
- On average, SELECTED families have shown faster growth rate than WILD families.
- On average, oysters of Ortigueira origin, both SELECTED and WILD, have shown the lowest mortalities. This suggests that a process of natural selection of bonamiosis-more tolerant oysters could be occurring in this coastal area of Galicia.
- INBRED families (OR2-2 and CO5-1) have shown a lower performance, particularly due to their high mortality.

Figure 1

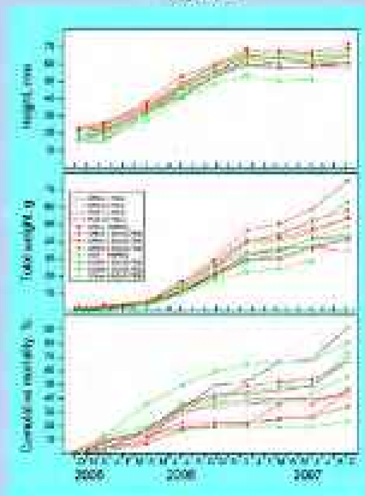
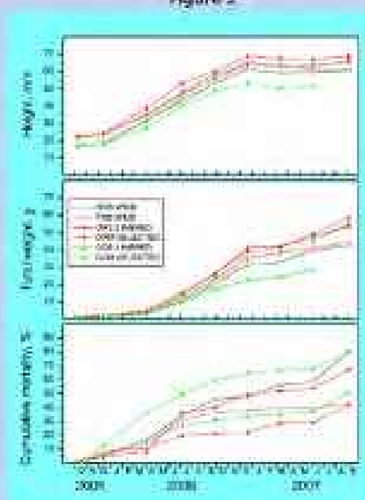


Figure 2



REFERENCE LIST

[illegible]

Autoría: Andrés, M.C.; Lastres, M.A.; Santamaría, I.; Ruiz, M.; Guerra, A.

Título: Desarrollo reproductivo y acondicionamiento de la oreja de mar (*Haliotis tuberculata*, Linnaeus, 1758), en Galicia (NO de España)

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España)

Ano: 2007

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
Dirección Xeral de Innovación e Desenvolvemento Pesqueiro

Desarrollo reproductivo y acondicionamiento de la oreja de mar (*Haliotis tuberculata* Linnaeus, 1758), en Galicia (NO de España)

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Resumen

En el presente trabajo se estudia el desarrollo reproductivo en dos poblaciones naturales de *Haliotis tuberculata* L., y se presentan los datos preliminares obtenidos en el ensayo del acondicionamiento de reproductores de dicha especie, utilizando tres fotoperiodos distintos. Los individuos fueron capturados mediante técnicas de buceo en apnea, siendo de procedencia local, en dos puntos diferentes de la costa de Galicia (Illa de Arousa, en el interior de la Ría de Arousa, y Illas Cíes, en la boca exterior de la Ría de Vigo).

Abstract

In this work the reproductive development in two native populations of *H. tuberculata*, has been studied, and preliminary data of the influence, in hatchery facilities, of three different photoperiod conditions, in a conditioning system for abalone, on ripe feed are presented. Adult specimens were captured in two populations located in two different points on the coast of Galicia (Arousa's Island, inside of the Ria of Arousa, and Cies islands, at the external zone of the Ria de Vigo).

Resultados y Discusión

1. Estudio de las poblaciones en los bancos naturales.

1.1. Índice de condicion gonadal (ICG)

En la zona de Cíes los valores más elevados de I.C.G se dan entre abril y julio. Este periodo se produce un descenso posiblemente asociado con un proceso previo de puesta natural, correspondiendo en abril (Figura 1). En la zona de A Illa de Arousa la puesta natural se produce en el mes de octubre.

1.2. - Sex ratio en las poblaciones naturales.

En A Illa de Arousa la proporción de sexos hallada es de 1 H: 0.6 M y en Illas Cíes es de 1 H: 0.74 M. El test Chi cuadrado indica que en ambas zonas dicha proporción difiere de forma significativa ($P \leq 0.05$) de la proporción 1:1 esperada (H: hombre; M: mujer).

2- Resultados de la estabulación de reproductores en criadero.

En esta experiencia los reproductores fueron estabulados a tres fotoperiodos diferentes (N: fotoperiodo natural; A: fotoperiodo adicionado; O: oscuridad) para determinar el posible efecto del fotoperiodo sobre los consumos.

Los datos (Figura 2) indican menor consumo de alimento en los primeros días de estabulación, que se podría corresponder con la adaptación a las condiciones de cautividad. Seguidamente un mayor consumidad durante el tiempo ensayado, en el lote mantenido en fotoperiodo natural (N), aunque los resultados del test estadístico indican que no existen diferencias significativas respecto a la tasa de ingesta, cuando se comparan los tres tratamientos de estabulación entre sí.

Figura 1. Evolución del índice de condición gonadal (Medias ± SD) en las dos poblaciones.

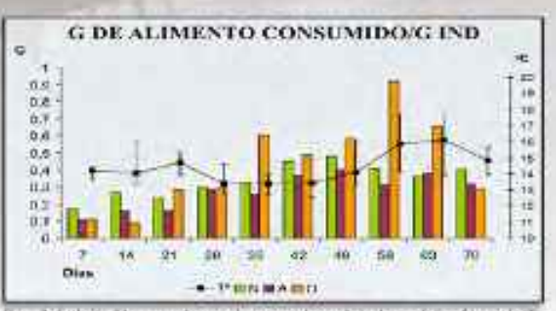

Figura 2. Evolución del consumo de mexillón, para cada uno de los tres fotoperiodos (T: tratamiento; N: fotoperiodo natural; A: fotoperiodo adicionado; O: fotoperiodo oscuridad).

Agradecimientos

Este estudio se realizó en el ámbito de un proyecto titulado "Cultivo y gestión de la oreja de mar (*Haliotis tuberculata* spp.)", financiado por la Junta Asesora de Cultivos Marinos (JACUMAR).

Autoría: Lastres, M.A.; Andrés, M,C.; Santamaría, I.; Rubirosa, M.J.; Ancosmede, C.; Pérez, N.; Guerra, A.

Título: Cultivo y gestión de la oreja de mar: *Haliotis tuberculata* spp.

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
Dirección Xeral de Innovación e Desenvolvimiento Pesqueiro
Cultivo y gestión de la oreja de mar
(Haliotis tuberculata spp.)
JACUMAR
CIMA
M.A. Lastres, M.C. Andrés, I. Santamaría, M.J. Rubirosa, C. Ancosmede, N. Pérez, A. G. Díaz
Introducción
Con este proyecto se pretende mejorar el control de la reproducción de ejemplares de H. tuberculata spp. para su puesta a punto, así como su potencialidad comercial y la viabilidad de su introducción en el mercado como nuevo producto procedente de la acuicultura. Para ello se plantea abordar varias líneas de investigación por parte de los equipos científicos de cada una de las comunidades autónomas participantes (Canarias, Galicia y Asturias). En este trabajo se presentan las áreas de trabajo en las que participan los investigadores de la C.A. de Galicia (CIMA-Corón, CIMA-Ribadeo, IGAFA)
LÍNEA 1: Evaluación del recurso (en proceso)
1.1 Estudio del grado de explotación del recurso en la C.A. de Galicia
1.2 Seguimiento de las patologías en las poblaciones estudiadas pertenecientes al ámbito geográfico de la C.A. de Galicia
LÍNEA 2: Mejora del control de producción de H. tuberculata spp. (en proceso)
2.1 Caracterización del ciclo reproductivo. Análisis histológico del ciclo gonadal, mediante muestreos mensuales, para establecer relaciones biométricas del índice de condición de carne y apéndice cónico.
2.2 Adaptación de ejemplares en diversos sistemas de cultivo.
2.3 Evaluación de los parámetros óptimos para el acondicionamiento del stock de reproductores.
3.1 Determinación de la dieta idónea para la maduración gonadal.
LÍNEA 3: Optimización de las técnicas de reproducción de semilla (en proceso)
3.1 Estudio del desarrollo larvario. Técnicas de producción larvaria.
3.2 Evaluación de los cuatro-los óptimos para la producción larvaria.
3.3 Ensayos de producción de
LÍNEA 4: Difusión de la información web (en proceso)
4.1 Base de datos bibliográfica
X FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS
I FORO IBEROAMERICANO DOS RECURSOS MARIÑOS E DA ACUICULTURA

Autoría: Iglesias-Estepa, D.; Rodríguez-González, L.; Montes-Pérez, J.

Título: Estudio histopatológico de *Crassostrea gigas* (Thunberg, 1793) cultivada en las rías gallegas

Evento: XI Congreso Nacional de Acuicultura

Lugar: Vigo - Galicia (España), Pontevedra

Ano: 2007

Estudio histopatológico de *Crassostrea gigas* (Thunberg, 1793) cultivada en las rías gallegas

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ABSTRACT

A histopathological survey of oysters *Crassostrea gigas* (Thunberg, 1793) cultured in Galician rias

A survey of pathological conditions affecting oysters *Crassostrea gigas* experimentally cultured in Galician rias was performed to assess the feasibility of the production of that species in Galicia. The cultured oysters were devoid of serious pathogens.

RESUMEN

Como parte fundamental de un estudio de viabilidad del cultivo de *Crassostrea gigas* en las rías gallegas se realizó el análisis patológico de las ostras introducidas para su cultivo experimental. No se detectaron patologías importantes que puedan poner en riesgo el cultivo de esta especie.

INTRODUCCIÓN

En Galicia la producción ostrícola se basa fundamentalmente en el engorde de ostra plana importada de otros países de la UE. [illegible]

MATERIAL Y MÉTODOS

[illegible]

Fig. 1: Ubicación geográfica de los diferentes puntos de estudio. [illegible]

[illegible]

RESULTADOS Y DISCUSIÓN

[illegible]

Fig. 2: [illegible] Fig. 3: [illegible] Fig. 4: [illegible]

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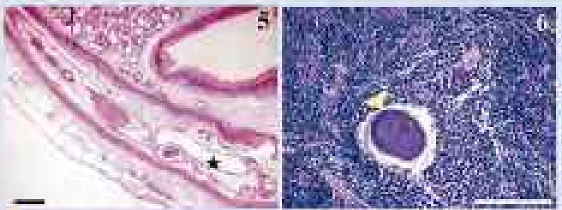

Fig. 5: [illegible] Fig. 6: [illegible]

CONCLUSIONES

[illegible] (ICES, 2005).

BIBLIOGRAFÍA

[illegible]

AGRADECIMIENTOS

[illegible]

XI CONGRESO NACIONAL DE ACUICULTURA. Vigo, 2007

Autoría: Arévalo, F.; Iniesta, R.; Vidal , A.; Goicoechea, M.; Correa, J.; Muñiz, S.; Blanco, J.

Título: Comparison of pre-column HPLC, post-column HPLC and mouse bioassay methods for the quantification of PSP toxicity in mussels and their implications in monitoring systems

Evento: International Symposium on Algal Toxins

Lugar: Trieste (Italia)

Ano: 2007

Comparison of pre-column HPLC, post-column HPLC and mouse bioassay methods for the quantification of PSP toxicity in mussels and their implications in monitoring systems.

Arévalo, F.[1] Isasti, R.[2] Vidal , A.[1] Goicoechea, M.[1] Correa, J.[1] Muñiz, S.[1] Blanco, J.[1]

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[2] INTECMAR. Edificio Administrativo. 11071 Algeciras. Spain

ABSTRACT

[illegible]

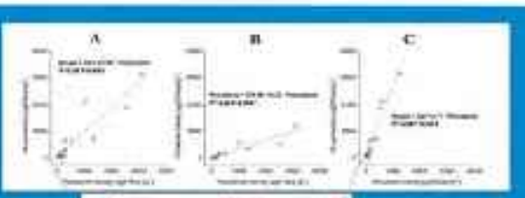
MATERIAL AND METHODS

[illegible]

Fig 1. Geographical location of harvest sampling with in Mean T. from Pacific Environmental (NE Galicia)

Fig 2. Sampling of mussels in a Galician raft

RESULTS AND CONCLUSIONS



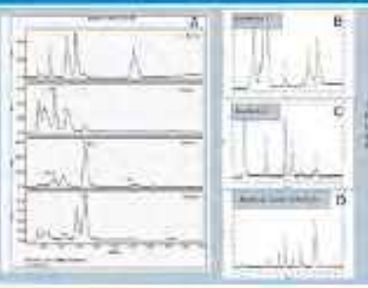
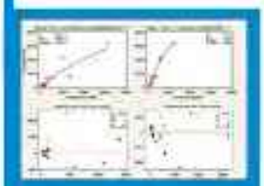


Fig. 4. Comparison of PSP toxin profiles in mussels from Galicia (NW Spain) and Chile (SE Pacific) by pre-column oxidation HPLC (A) and post-column oxidation HPLC (B). Showing the significant contribution of non-sulfated toxins (GTX1 and GTX4) in Chilean mussels.

Scenario	< 4000 µg STX eq/kg		> 7200 µg STX eq/kg	
	Mouse bioassay	Post-col. HPLC	Pre-col. HPLC	Mouse bioassay
False negatives	3	2	3	1
False positives	0	2	------	------
Correct	5	4	9	11

Fig. 5. Scatter plot (left) for lateral migration behavior (pairs of studied scallops).



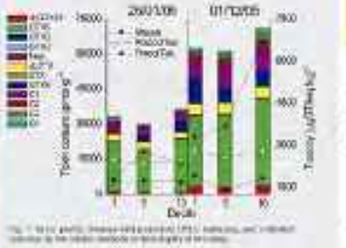


Fig. 6. Mussel toxicity, Pseudonitzschia spp. (PSU), Dinophysis spp. (DSP) abundance recorded by the routine monitoring programme in Galicia.

REFERENCES

[illegible]

ACKNOWLEDGEMENTS

[illegible]

Autoría: Macías, C.; Aguado, F.; Henríquez, N.; Guerrero, S.; Estévez, A.; Valencia, J.M.; Cremades, J.

Título: Acuicultura Integrada: desarrollo de experiencias de cultivos multitróficos en la costa española

Evento: X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2007

ACUICULTURA INTEGRADA: DESARROLLO DE EXPERIENCIAS DE CULTIVOS MULTITRÓFICOS EN LA COSTA ESPAÑOLA

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ABSTRACT

The proposal defined in this project is based on the development of several pilot experiences of Integrated Farming Systems based both inland and marine facilities. This initiative is coordinated by the Marine Farming National Program (*Plan Nacional de cultivos Marinos "JACUMAR"*).

Two main aims are pursued in this project, on the one hand, the economical profit through the increase of the production in the same area and on the other the environmental benefit of making the most of the existing resources through removing from the environment the remaining compounds from the farming activities (fish farming in our study case); therefore, each participant Autonomous Region will make an experience of integrated aquaculture depending on its specific characteristics and interesting species. To evaluate the economical and technical viability of the proposed system, an integrated monitoring of each experience will be carried out to obtain the degree of success as a grade of extensive competitive.

INTRODUCCIÓN Y OBJETIVOS

Este estudio forma parte del Plan Nacional de cultivos marinos JACUMAR "Acuicultura Integrada: desarrollo de experiencias de cultivos multitróficos", financiado entre la Secretaría General de Pesca Marítima del Ministerio de Agricultura, Pesca y Alimentación y las distintas Comunidades Autónomas participantes. Aprobado para el periodo comprendido entre 2007-2010.

¿QUÉ ES ACUICULTURA INTEGRADA? combinación de diferentes cultivos marinos empleando especies de diferentes grupos tróficos en un mismo sistema físico o instalación productiva, con el fin de mejorar el aprovechamiento de los recursos del sistema y de mejorar la calidad ambiental del medio.

OBJETIVOS DEL PROYECTO:

1.- Búsqueda de un aumento de la rentabilidad y eficiencia de las empresas de acuicultura aprovechando todo el potencial de los recursos marinos y la capacidad de carga del sistema.

2.- Mejorar los posibles efectos ambientales sobre el medio ambiente, y más concretamente sobre la columna de agua, aprovechando para ello especies complementarias-que ayuden retirar del medio materia orgánica particulada y nutrientes.

Por tanto, se realizará un seguimiento técnico-científico sobre los policultivos en cultivo, con el fin de evaluar sus ritmos de crecimiento y viabilidad, para lo cual se ubicarán experiencias piloteo de las especies complementarias. Además se realizará un seguimiento ambiental sobre el sistema natural, analizando parámetros indicadores de la posible afección ambiental.

MATERIAL Y MÉTODOS

Se realizarán experiencias en instalaciones en tierra y en mar abierto. Existen numerosas combinaciones posibles, para el esquema teórico, susceptible de cambios en función de las características de la zona, de la especie y de la rentabilidad para la empresa, tales como:

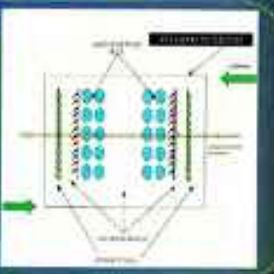
Cultivo Peces: generan:
- Materia Orgánica Particulada: aprovechado para **Cultivo de Moluscos o Equinodermos**
- Nutrientes (Nitrógeno y Fósforo): aprovechado para **Cultivo de Macroalgas**

EXPERIENCIA EN INSTALACIONES DE TIERRA

REGIÓN	GRUPO DE ESPECIES	ESPECIES DE CULTIVO
ANDALUCÍA	Peces – Moluscos – Algas	Lubina, Almeja ga, Ulva Lactuca
CANARIAS	Peces – Moluscos – Algas	Dorada – Lubina, Mugílidos, Oreja de Mar
CATALUÑA	Peces – Moluscos – Algas	Dorada – Lubina, Almeja es, Macroalgas
GALICIA	Peces – Moluscos – Algas	Rodaballo, Almeja es, Ulva sp.

EXPERIENCIA EN INSTALACIONES EN MAR

REGIÓN	GRUPO DE ESPECIES	ESPECIES DE CULTIVO
ANDALUCÍA	Peces – Moluscos – Algas	Dorada-Lubina, Mejillón, Laminaria
CANARIAS	Peces – Moluscos – Equinodermos	Dorada-Lubina, Oreja de Mar, Pepino de
BALEARES	Peces – Moluscos	Dorada-Lubina, Mejillón
GALICIA	Peces – Moluscos – Algas	Rodaballo, Mejillón, Laminaria
MURCIA	Peces – Moluscos – Equinodermos	Dorada-Lubina, Mejillón, Verdolaga



METODOLOGÍA PLANTEADA PARA EL DESARROLLO

FASE 1: DISEÑO Y PLANIFICACIÓN DE LA EXPERIENCIA

DISEÑO DE LA EXPERIENCIA EN CULTIVO
- Localización Geográfica y Características Ambientales
- Identificación de la Especies Objetivo de Cultivo
- Disponibilidad de Infraestructuras, Equipamiento y Acceso

DISEÑO Y PLANIFICACIÓN DEL SEGUIMIENTO
- Seguimiento Científico-Técnico sobre los Cultivos
- Seguimiento Ambiental del medio

CARACTERIZACIÓN AMBIENTAL DEL EMPLAZAMIENTO DE CULTIVO

FASE 2: PUESTA EN MARCHA DEL SISTEMA INTEGRADO

INSTALACIONES EN TIERRA
- Instalaciones de Cultivo de Peces
- Tecnologías Particulares de Tratamiento de Efluentes y Aguas de los Peces
- Instalaciones de Cultivo Asociadas (Moluscos, Algas, Equinodermos)

INSTALACIONES EN MAR ABIERTO
- Instalaciones de Cultivo de Peces
- Instalaciones de Cultivo Asociadas (Moluscos, Algas, Equinodermos)

FASE 3: SEGUIMIENTO AMBIENTAL Y SOCIO-ECONÓMICO

SEGUIMIENTO AMBIENTAL
- Muestreos de Parámetros Físicos, Químicos, Biológicos y Sedimentológicos del entorno
- Parámetros Físicos, Químicos, Biológicos de la Columna de Agua

SEGUIMIENTO SOCIO-ECONÓMICO
- Evaluación de la generación de empleo de los Cultivos

RESULTADOS

Las experiencias de cultivo planteadas en este proyecto se desarrollarán en las Comunidades Autónomas de Andalucía, Baleares, Canarias, Cataluña, Galicia y Murcia, entre los años 2008 y 2010, por lo que los resultados se encontrarán a obtener a partir del primer año. Actualmente se encuentra en la Fase 1: Diseño de Diseño de la Experiencia de Cultivo.

Este proyecto presenta un gran interés para el sector debido al conocimiento de las posibilidades que ofrecen estas para la optimización de la producción mediante la producción de diversas especies y mitigación de impactos ambientales negativos para el medio.

BIBLIOGRAFÍA

Ackefors, H. y Enell M. 1990. Discharge of nutrients from Swedish fish farming to adjacent sea areas. Ambio 19 (1): 28-35.

Gowen, y Rosco A., 1991. Dissolved nutrient fluxes from intensive mussel, Mytilus edulis production in suspended culture systems. Mar. Ecol. 68: 209-230.

Silva Matos, M. y Pellerone, C. 1991. Acuaculture systems for waste treatment: EAS of Lemna. Aquaculture Systems Concise Australasian 181-82-93.

Edwards, P. 1993. A systems approach for the promotion of integrated aquaculture. Aquat. Living Resour. 6: 1-12.

Chopin, T., Robinson, T., Fugelli-Egan, M.S., y Porter, C. 2001. Integrated multi-trophic aquaculture systems. European Aquaculture Soc., special publication 31: 1-12.

Autoría: Carballal, M.J.; Cerviño, A.; Martínez, D.

Título: Parasites and gonad development in clams pre-fattened in three different systems

Evento: Aquaculture Europe 2007

Lugar: Estambul (Turquía)

Ano: 2007

Parasites and gonad development in clams pre-fattened in three different systems.

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Centro de Investigacions Mariñas. Spain

CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
JACUMAR

Introduction

A comparative study was carried out on the parasites of three batches of seed clams *Ruditapes decussatus* (3-4 mm), *Venerupis pullastra* (7-8 mm) and *Ruditapes philippinarum* (7-8 mm) pre-fattened in three systems: buckets in a raft, trays in an intertidal area, and in tanks with inverted flow of effluents of a turbot factory. These experiments begin in the autumn of 2004 (experiment 1), and in spring (experiment 2) and summer (experiment 3) in 2005, and finished when clams had the adequate size (11-16 mm) to be fattened in the sand of an intertidal area.

Materials and Methods

Pathological analysis were performed previously to place the clams in the three systems and in the end of experiments. Twenty-five or thirty clams were collected from each experimental system, and processed by standard histological techniques. The shell of the smallest clams was decalcified in EDTA, and then processed by histology. The gonad was classified according to a modified scale on Holland and Chew (1974) as follows: 0 (without gonads), 1 (first stages of gonad development), 2 (development of gonad), 3 (ripeness and spawning) and 4 (spent and reabsorbed).

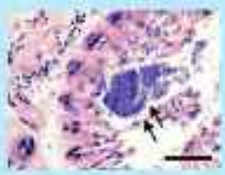
Discussion and conclusion

In the first analyses, the small seed clams were only affected by ciliates. In the final analyses, clams were affected by several parasites and symbionts. Among them, *Perkinsus olseni* and rickettsia-like organisms were the most pathogenic. Clams with only 9 and 12 mm long were affected by rickettsiae and *P. olseni*, respectively. *Perkinsus olseni* was only observed in clams *Ruditapes philippinarum* with light intensities with the exception of a clam which showed a moderate intensity of this parasite. The intracellular colonies of rickettsiae did not cause any visible damage to clams. Nevertheless, heavy gill infections of these parasites have been associated with mortality in clams *Venerupis rhomboides* and scallops (Villalba et al., 1999; Renault et al., 1994). The other parasites and symbionts detected in seed clams showed a low prevalence and intensity without causing important damage.

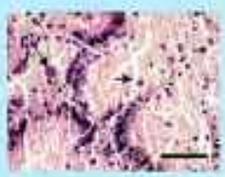
Clams *R. philippinarum* and *R. decussatus* with only 3-4 mm long and *V. pullastra* with 7 mm long showed first stages of gonad development. Different stages of gonad development were observed depending of the period of the year that clams grew. Clams obtained ripeness and spawning at sizes 11-13 mm long.

Clams pre-fattened in raft had the adequate size to be fattened before the clams were pre-fattened in the other systems and were less affected by parasites. In the experiment 3 developed in summer-autumn, clams were more parasitized than in the other experiments. On the contrary, in the experiment 1 developed in autumn-winter, the clams were less parasitized. Clams *Ruditapes philippinarum* were more parasitized than clams of other species.

Bacterial Organisms observed in seed clams



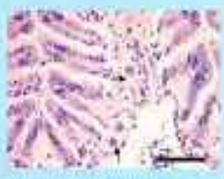
Gill cysts enclosing bacteria-like organisms (arrows). Bar = 47 µm



Intracellular colonies of rickettsia-like organisms (arrows) in digestive cells. Bar = 47 µm

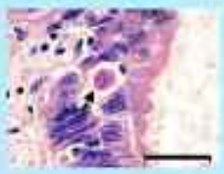
Protozoa observed in seed clams

Perkinsus olseni (arrows) in connective tissue of digestive gland. Bar = 47 µm



Nematopsis sp. (arrows) in connective tissue of gill. Bar = 47 µm

Oocyst of a ciliary coccidian (arrows). Bar = 24 µm



Plasmodium (arrows) of an haplosporidian in digestive epithelium. Bar = 24µm

Sporoblast of *Rickettsia*-like microorganisms (arrows) in an oocyst. Bar = 47µm

Ryncheleids-like ciliates (arrows) associating gill fibrocytes. Bar = 47 µm

Metazoa observed in seed clams

Trematode metacercaria (arrow) encysted in host. Bar = 190 µm

Pericardial cyst (arrow) containing larvae. Bar = 120 µm

References

Holland D. L., Chew K.K. 1974. Reproductive cycles of two clams, *Venerupis japonica* Tate Host seed. Washington. Proc. Nat. Shellfish Assoc. 64: 31-39.

Acknowledgements

Isabel Velando, Elena Pinas and Fatima Bouza performed histological techniques. This study was financed by JACUMAR.

Autoría: Abollo, E.; Ramilo, A.; Villalba, A.

Título: DNA probes as tools for the specific diagnosis of *Bonamia exitiosa* (Haplosporidia)

Evento: X European Multicolloquium of Parasitology (EMOP X)

Lugar: París (Francia)

Ano: 2008

DNA probes as tools for the specific diagnosis of *Bonamia exitiosa* (Haplosporidia)

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Haplosporidian microcells belonging to the genus *Bonamia* infect the hemocytes of different oyster species around the world. *Bonamia ostreae* was the only species of this genus reported infecting the European flat oyster *Ostrea edulis* in Europe. Nevertheless, recently Abollo et al. (2008) have reported the presence of *Bonamia exitiosa* infecting the flat oyster grown in Galician waters (NW Spain). Bonamiosis caused by *B. exitiosa* is responsible for extensive oyster mortalities in the southern Hemisphere. This species has been reported infecting *Ostrea chilensis* in New Zealand (Hine et al., 2001; Bertho and Hine, 2003) and *Ostrea angasi* in Australia (Corbeil et al., 2006). Currently, various undescribed *Bonamia* species found in locations as disparate as Australia, Chile, Argentina, and the United States have been also identified as *B. exitiosa* (López-Flores et al. 2007). *B. exitiosa* is included in the list of notifiable diseases by the World Organization for Animal Health (OIE) (Manual of Diagnostic Tests for Aquatic Animals (2009 version); Aquatic Animal Health Code (2007 version)). *B. exitiosa* is also subject to legal provisions in both the current legal regime (Directives 91/67/EEC and 95/70/EC) and in the new aquatic animal health Directive (2006/88/EC).

Currently, the OIE recommends tissue imprints and histopathology for surveillance and prescriptive diagnostic, and PCR-RFLP and transmission electron microscopy for confirmatory diagnostic. Some morphological characteristics allow discrimination between *B. ostreae* and *B. exitiosa* when histological sections are examined by trained staff. However, in geographic areas, such as Galicia, where the bonamiosis of the flat oyster has been always attributed to *B. ostreae*, the occurrence of a new *Bonamia* species could be unnoticed using official diagnostic methods. Moreover PCR protocols previously described are not species specific (Cochennec et al. 2000; Carnegie et al. 2006).

In this study, an *in situ* hybridization (ISH) assay and a PCR assay have been developed and optimized for the specific identification of *B. exitiosa*. The ISH assay used a DIG-labeled 20-mer oligonucleotide probe and the specificity was assessed by applying the probe to a variety of protozoan parasites of molluscs. The polynucleotide probe (not *Bonamia* species-specific) recommended by the OIE Manual of Diagnostic Tests was used as positive control. The probe recognized only *B. exitiosa* (Fig. 1) and failed to detect *B. ostreae* (Fig 2), *Haplosporidium armoricanum*, *H. nelsoni*, *Marteilia refringens* and *Perkinsus olseni* (Fig. 3). The PCR assay amplified a 247 bp region of *B. exitiosa* DNA and did not detect *B. ostreae*, *H. armoricanum*, *H. nelsoni*, *M. refringens*, *Mikrocytos mackini*, *P. olseni* (Fig.4). The comparison of diagnostic techniques is summarized in Table 1. The results suggest that the PCR and *in situ* hybridization tests developed and optimized in this study are more sensitive than the histology and PCR-RFLPs.

References
Abollo et al., 2008. *Aquaculture* 275, 213-217.
Bertho and Hine, 2003. *Dis. Aquat. Org.* 57, 101.
Cochennec et al., 2000. *J. Invertebr. Pathol.* 75, 32-37.
Carnegie et al., 2006. *Dis. Aquat. Org.* 69, 219-226.
Corbeil et al., 2006. *Dis. Aquat. Org.* 71, 81-86.
Hine et al., 2001. *Dis. Aquat. Org.* 47, 65-72.
López-Flores et al., 2007. *Parasitol.* 134, 1941-1948.

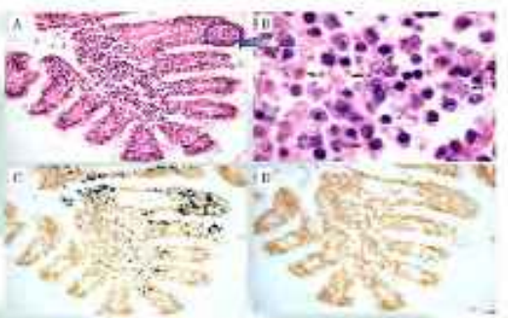

Figure 2. (A) Basal sections of flat oyster gill tissue infected by *B. ostreae*. (A) H&E stained section (400x). (B) H&E stained section for in the same region showing *B. ostreae* cells (arrows) (400x). (C) *in situ* hybridization with a polynucleotide probe for *Bonamia* spp. (positive control). Parasites are identified by a darker coloration (200x). (D) *in situ* hybridization with the oligonucleotide probe specific for *B. exitiosa* (200x).

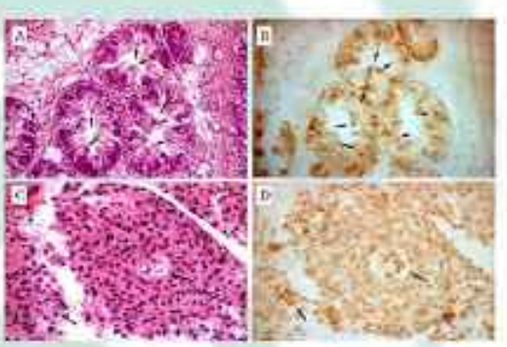

Figure 3. *Mytilus galloprovincialis* serial sections of digestive gland tissue infected by *Marteilia refringens*. (A) H&E stained section showing the parasite (arrows) (250x). (B) *in situ* hybridization with the oligonucleotide probe specific for *B. exitiosa* (250x). *Ruditapes decussatus* serial sections of connective tissue infected by *Perkinsus olseni*. (C) H&E stained section showing the parasite (arrows) (400x). (D) *in situ* hybridization with the oligonucleotide probe specific for *B. exitiosa* (400x).

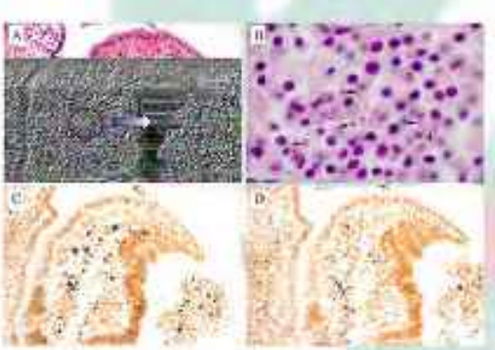

Figure 1. Basal sections of flat oyster gill tissue infected by *B. exitiosa* and *B. ostreae*. (A) H&E stained section (200x). (B) H&E stained section from the same region showing *B. exitiosa* cells (arrows) (400x). (C) *in situ* hybridization with a polynucleotide probe for *Bonamia* spp. (positive control) (400x). (D) *in situ* hybridization with the oligonucleotide probe specific for *B. exitiosa* (400x). Parasites are identified by a darker coloration.

Figure 4. Agarose gel electrophoresis of the PCR products showing the specificity of the primers for *Bonamia exitiosa*. Lanes: 1, *B. exitiosa*; 2, *B. ostreae*; 3, *H. armoricanum*; 4, *H. nelsoni*; 5, *M. refringens*; 6, *P. marinus*; 7, *P. olseni*; 8, *M. mackini*; 9, negative control; MW, 50-bp molecular weight marker.

Table 1. Comparison of histology, PCR-RFLPs, *in situ* hybridization and specific PCR for detecting *Bonamia exitiosa* in 52 European flat oysters.

	Official diagnostic methods		This study	
	Histology	PCR-RFLPs	ISH	PCR
Positive	32 (61.5%)	32 (61.5%)	34 (65.3%)	37 (71.1%)
Negative	20 (38.5%)	20 (38.5%)	18 (34.6%)	15 (28.8)

Autoría: Martín-Gómez, L.; Abollo, E.; Villalba, A.

Título: Identification of differentially expressed genes in the European flat oyster (*Ostrea edulis*) in response to infection by the haplosporidian *Bonamia ostreae*

Evento: 100th National Shellfisheries Association Annual Meeting

Lugar: Providence - Rhode Island (EE. UU.)

Ano: 2008

Identification of differentially expressed genes in the European flat oyster (*Ostrea edulis*) in response to infection by the haplosporidian *Bonamia ostreae*.

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INTRODUCTION

The haplosporidian parasite *Bonamia ostreae* is responsible for significant mortalities of the flat oyster *Ostrea edulis* in Europe and North America[1]. *B.ostreae* parasitizes and proliferates into the haemocytes of the oyster. The parasite, once phagocytosed within the haemocyte, appears to have some evasive mechanisms, which turn off the haemocyte's metabolic destructive capacity, so that the parasite survives within the cell. Within the haemocyte the parasite multiplies by binary fission and finally the haemocyte is lysed and the parasites are released. Circulating haemocytes may play a key role in the immune response of molluscs as vehicle and/or effectors [2], however there are currently few published works characterizing genes involved in the molecular mechanisms of resistance[3, 4, 5]. In this study we have explored the Suppression subtractive technique (SSH) to investigate the genes expressed in the haemocytes of the flat oyster, *O.edulis*, in response to bonamiosis.

MATERIALS AND METHODS

1.Experimental challenge of *Bonamia ostreae* in healthy oysters.

B. ostreae cells was purified according to the protocol of Mialhe *et al.* [6] and resuspended in filtered seawater. A batch of healthy oysters were inoculated with the purified *B. ostreae* cells (+/-2%) (infected individuals) and other healthy batch (+/- 30) was inoculated with the same volume of filtered seawater (control individuals). The histological state of the oysters was addressed after 90 days post-inoculation and the individuals were diagnosed for bonamiosis using PCR and standard histopathological procedures.

2. RNA extraction and cDNA synthesis

Haemocytes were pooled as control and infected individuals, and the total RNA was extracted using Tri-reffi Reagent (Invitrogen). cDNA was synthesized from 1 µg of each RNA pool using the SMART PCR cDNA synthesis kit (Clontech).

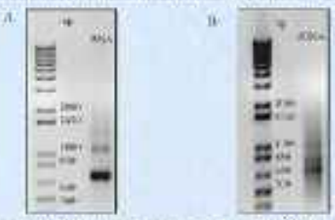

Figure 1. (A) RNA extracted from *Bonamia* (1µg). (B) cDNA synthesized by LD PCR after SMART.

3.Suppression subtractive technique (SSH)

SSH technique was used to characterize new genes involved in the flat oyster's innate immune response against bonamiosis. SSH was performed using the PCR-Select cDNA subtraction kit (Clontech). SSH involves hybridization of infected and control cDNAs , and the elimination of the hybrid sequences. The remaining (subtracted) cDNAs represent the differential expressed genes (7). The differentially expressed transcripts were inserted into a cloning vector PCR 2.1 (Invitrogen) and transformed into TOP10F' bacteria (Invitrogen). Two DNA (expressed sequence tags) libraries were obtained one for the upregulated transcripts in response to infection and another for the downregulated transcripts.

4.Sequencing and analysis

Sequencing was performed on an ABI PRISM™ 3100 (Applied Biosystems). All sequences generated were analysed using Generaffics 1.0, and searching for similarities with known genes was done using BLAST (*Basic Local alignment Search tool*). ESTs that matched known genes (E value < 10^{-5}) were functionally classified according to KEGG database (Kyoto Encyclopedia of Genes and Genomes).

RESULTS AND DISCUSSION

PCR- ANALYSIS OF SUBTRACTION EFFICIENCY

The subtraction efficiency was estimated by comparing the amount of expression of constitutive genes before and after SSH. Transcripts of constitutive genes should disappear in the sample of subtracted transcripts and become visible in the unsubtracted sample.

Figure 2. PCR analysis of subtraction for the hsp70 amplified.

FUNCTIONAL CLASSIFICATION OF OSTREA HAEMOCYTE ESTs

The sequenced cDNA libraries showed that 54% of the sequences were new ESTs with unknown functions, whereas 13% had already been identified as other ESTs. 33% of the clones were identified as known genes, some of them with unexpected functions in oysters.

Figure 3. Functional classification of differentially expressed oyster genes in response to *Bonamia ostreae*.

Although we are still in the process of sequencing the last library clones, our preliminary results show differences in expression levels between infected and control oysters. Once obtained the sequenced ESTs libraries, we will proceed to the selection of candidate genes for its characterization and quantification by IQ-PCR. All these studies would allow us a better understanding of the molecular mechanisms involved in host-parasite interaction.

REFERENCES

1.Cochennec N. *et al.* 2000. Int J Syst Evol Microbiol 50, 1975-1983.
2. Hine PM. 1999. Fish Shellfish Immunol 9, 367-385.
3. Hervio D. *et al.* 2003. Gene 303, 213-223.
4. Wegner K. *et al.* 2004. Gene 338, 121-131.
5. Gueguen Y. *et al.* 2003. Gene 303, 139-145.
6. Mialhe *et al.* 1988. Aquaculture 71, 293-299.
7. Diatchenko *et al.* 1996. Proc Natl Acad Sci USA 93, 6025-6030.

Acknowledgments: This work was supported by Xunta de Galicia under the projects PGIDIT03PXIA30001PR and PGIDIT04PXIA30, LMG is supported by a fellowship from the Xunta de Galicia (PC/DIST 2005-2008).

Autoría: Martín-Gómez, L.; Villalba, A.; Abollo, E.

Título: Molecular identification of differentially regulated genes of the European flat oyster (*Ostrea edulis*) in response to experimental infection by *Bonamia ostreae* (Haplosporidia)

Evento: XX International Congress of Genetics

Lugar: Berlín (Alemania)

Ano: 2008

Molecular identification of differentially regulated genes of the European flat oyster (*Ostrea edulis*) in response to experimental infection by *Bonamia ostreae* (Haplosporidia).

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INTRODUCTION

The immune system of molluscs is endowed with an innate immune response, which involves cellular and humoral components. Cellular responses are mediated by haemocytes (basophilic granulocytes and various eosinophilic cell types) [1], which contain humoral defense factors, such as soluble lectins, hydrolytic enzymes and antimicrobial peptides [1, 2]. A few molluscan species have shortened responses to bivalves which is a potential role in immune surveillance [3, 4, 5].

Bonamia ostreae belongs to the family of the Haplosporida and parasites and proliferates into the haemocytes of the native flat oysters, *Ostrea edulis*. The parasite was first reported within the haemocytes, appears to have tropism for the basophilic cells [6] and, to date, the host-parasite relationship remains unclear, so that the present research is focused on this issue. In this study we have employed the Suppression subtractive hybridization (SSH) [7] to investigate the genes expressed in the haemocytes of the flat oyster, *Ostrea edulis*, in response to bonamiosis.

MATERIALS AND METHODS

1. Experimental challenge of *Bonamia ostreae* in native oysters

A native site was studied according to the presence of *Bonamia ostreae* [8] and was considered a disease free area. A batch of healthy oysters was inoculated with the purified *B. ostreae* cells (at 2% infected haemocytes) and other healthy batch (n= 20) was co-cultured with the same volume of filtered seawater (control individuals). The haemolymph of the oysters was withdrawn after 90 days post inoculation and the individuals were diagnosed for bonamiosis using PCR and confirmed histologically [9] (results).

2. RNA extraction and cDNA synthesis

Haemocytes were pooled as control and infected individuals, and the total RNA was extracted using TRIzol® Reagent (Invitrogen). mRNA was concentrated from 1 µg of each RNA pool using the SMART PCR cDNA synthesis kit (Clontech).

3. Suppression subtractive hybridization (SSH)

SSH technique was used to characterize new genes involved in the flat oyster's immune response against *Bonamia ostreae*. SSH was performed using the PCR-Select cDNA subtraction kit (Clontech). SSH involves hybridization of infected and control cDNA [10] and the elimination of the shared sequences. This results in a subtracted cDNA population of differentially expressed genes. The differentially expressed transcripts were cloned using vector PCR 2.1 (Invitrogen) and transformed into TOP10F' bacteria (Invitrogen). Two SSH (reciprocal subtraction cDNA libraries were obtained, one for the up-regulated transcripts in response to *B. ostreae* and another for the down-regulated transcripts.

The subtraction efficiency was evaluated by comparing the amount of expression of housekeeping genes before and after SSH. Transcripts of constitutive genes should disappear after subtraction. A forward and reverse set of primers specific to the candidate reference gene

SUBTRACTED UNSUBTRACTED
PCR CYCLES 18 23 28 33 18 23 28 33

Figure 1. PCR analysis of the subtraction for the actin candidate

4. Sequencing and analysis

Sequencing was performed on an ABI PRISM™ 3100 (Applied Biosystems). All sequences generated were analyzed using CodonPro Tool, and searching for similarities with known genes was done using BLAST (Basic Local Alignment Search Tool). The most expressed known genes (E-value < 10^{-5}) were functionally classified according to KEGG database (Kyoto Encyclopedia of Genes and Genomes).

RESULTS AND DISCUSSION

Suppression subtractive library was used to identify specific up and down-regulated transcripts in oyster haemocytes in response to infection. The results of a total number of 300 sequences are represented in Figure 2. Putative function could be assigned to 104 of the 203 sequenced up-regulated ESTs and to 58 of the 97 down-regulated ESTs. The functional classification of the known genes was done according to the KEGG database. Some of the ESTs had already been identified in oysters, as well as some of the genes, but an interesting group of genes were found to have no reported homologs in oysters.

Up-regulated genes

Down-regulated genes

Figure 2. Functional classification of differentially expressed genes in response to *Bonamia ostreae*

After tag(s) was cut off in the presence of *Bonamia ostreae* for the down-regulated library, our previous study showed differences in expression levels between infected and control oysters. Once obtained the sequenced ESTs libraries, we will proceed to the selection of candidate genes for its characterization and quantification in RT-PCR. All these results are of great importance for understanding of the molecular mechanisms involved in oyster immunity.

REFERENCES

1. Cheng T. *et al* 1981. *Adv. Comp. Environ. Physiol.* 8: 1-43.
2. Renwrantz L. and Stefano G.B. 1988. *Curr. Topics Invert. Res.* 11: 1-17.
3. Hibino A. *et al* 2003. *Genes Immun.* 4(3): 212-218.
4. Zhang G. *et al* 2004. *Genes Immun.* 5(6): 406-417.
5. Gerdol M. *et al* 2011. *Gene Rev.* 1: 39-54.
6. Hervio D. *et al* 1996. *Dis. Aquat. Org.* 25: 69-77.
7. Diatchenko L. *et al* 1996. *Proc. Natl. Acad. Sci. USA.* 93: 6025-6030.
8. Abollo E. *et al* 2008. *Aquaculture.* 277: 281-285.

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Autoría: de Coo, A.

Título: Marisqueo de bivalvos e crise económica en Galicia

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

MARISQUEO DE BIVALVOS E CRISE ECONÓMICA EN GALICIA

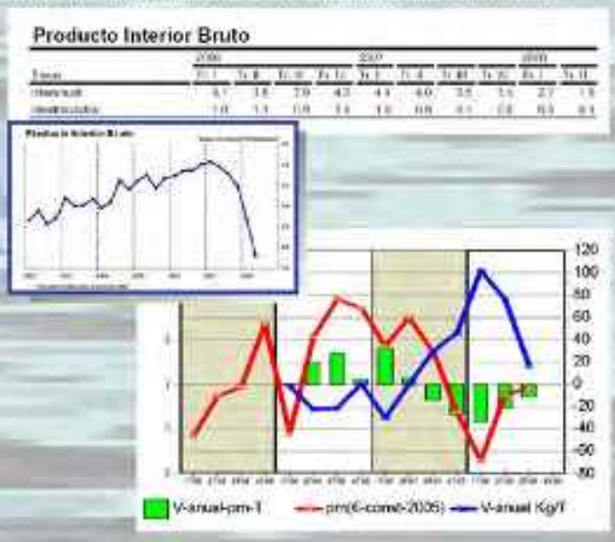
ALBERTO DE COO (Centro Investigacións Mariñas de Corón.CIMA)

INTRODUCCIÓN

[illegible]

RESULTADOS

Dacordo cos datos do INE nos seus ultimos informes, a partires do 3º Trimestre de 2.007 iniciase a desaceleración economica da presente crise achegandose ao periodo actual de estancamento e inicio da recesión.



O primiero efecto desta desaceleración económica foi un descenso dos precios reais dos productos marisqueros, fenómeno que se está a profundizar no momento actual.

A sua vez, a producción de moluscos bivalvos comerciais experimentou unha subi importante que se mantee durante o ano 2.008, pero tal como mostra a variación intertrimestral da producción da figura anterior (V-anual Kg/T), este impulso productivo esta a decaer nos últimos meses (III Trimestre 2008).

TABOA II.- Incrementos productivos e de facturación nos últimos meses de 2.007 e os 8 primeiros de 2.008

	Producción Kg	Facturacion €	% Inc-Pd.	% Inc Fc
7-12 m. 2006	4.258.000	40.265.200		
7-12 m. 2007	5.954.718	45.595.888	39.85	13.24
1-8 m. 2007	3.291.438	29.508.412		
1-8 m. 2008	5.220.810	37.838.326	58.62	28.24

Sin embargo, estos datos (tabea II) non deberían ocultar o cambio de ciclo que se está a dar pois tal como decíamos antes, o impulso de crecemento productivo no terceiro trimestre de 2008 da síntomas de estancamento e existen datos series que más ben apuntan a un novo periodo de descenso productivo. Por outra parte a evolución descendente dos prezos parece afianzarse e profundizarse e os primeiros resultados da apertura marisqueira non son nada favorables. En base a todo o anterior, se tan realizado unha previsión para o ano 2.008 que, apoiados nos bos datos dos primeiros meses do ano, poden superar os 10.000 Tm e os 70 millóns de € para as 5 especies analizadas neste trabalho e que son os resultados más elevados registrados nas estatísticas oficiais. As previsións para 2.009 son as contrarias de descenso importante coincidindo co época pior da crise económica e unha tendencia forte a

CONCLUSIÓNS

[illegible]

Autoría: García, J.; Solis, L.; Alcalde, A.; Conde, M.L.; de Coo, A.; Fariña, J.; García, A.; Poza, G.; Santos, I.

Título: Unha visión actual dos depredadores de moluscos bivalvos comerciais en Galicia

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

UNHA VISIÓN ACTUAL DOS DEPREDADORES DE MOLUSCOS BIVALVOS COMERCIAIS EN GALICIA.

García Javier (5); Solís, Liliana (1); Alcalde, Ana (2); Conde, Mª Lourdes (3); De Coo, Alberto (4); Fariña, Juan (4); García, Antonio (4); Poza, Graciela (6); Santos, Ignacio (4).

(1): Confraría de Noia; (2):Confraría de Vilanova; (3): Confraría de Cariño; (4) CIMA; (5) Confraría de Ribeira; (6): Confraría de Illa de Arousa e OPP-28.

INTRODUCCIÓN

As especies depredadoras de moluscos bivalvos comerciais de Galicia son un tema recorrente en numerosas publicacións (Figueiras,1979; Paxo, 1994,1997; Carrillo, 1994; De Coo,1994) que abordan as operacións de melloro dos bancos naturais de bivalvos. Sen embargo esta mención non pasa de ser na maioría dos casos unha cuestión puramente descritiva sen que se abordan cuestións máis concretas sobre este asunto. A escasa extensión dos bancos naturais, e a relativa vulnerabilidade gráfica das especies depredadoras, fai que o asunto sen adquira a importancia de outros países a beiras de algas, melloro de substratos, mediante o semeamento. Sexa a través de cultivos en parques que esta acción da depredación sexa un fenómeno moito profundo (Perez Camacho y Cruz, 1991) e protagonizado os propietarios dos propios diversas iniciativas para a protección da súa inversión. Nos últimos anos a consideración deste problema se ven ampliada a diversas confrarías e bancos naturais.

No presente traballo pretendese abrir vías de reflexión e liñas de actuación máis acordes cos coñecementos actuais e a incertanza e posibilidades de futuro da actividade marisqueira en Galicia.

MATERIAL E MÉTODOS

Para a elaboración das ideas que se desenvolven no apartado seguinte, foi de especial axuda:

a).- A revisión da valoración do problema de depredación no noso país tanto no que respecta ao marisqueo tradicional como nos diversos cultivos mariños.
b).- Revisión deste problema na acuicultura doutros países
c).- A experiencia e vivencia directa de este problemática polos técnicos e biólogos de países e profesionais das Confrarías implicados na acción de investigación
d).- A perspectiva das posibilidades de futuro da actividade marisqueira e os cultivos bivalvos de areas nas nosas rías e litoral.
e).- Os intercambios de opinión e reunións realizadas no equipo e investigación

Fotos : (1),(2),(3) Sementeira con malas horizontais en Vilaxoan, (4),(5),(6) extracción de depredadores en Riveira e (7) en Noia (8) vista típica dunha explotación acuícola na Bretaña francesa con valos e bolsas plásticas en aproveitamento

RESULTADOS E CONCLUSIÓNS

En primeiro lugar e sobre a importancia e vulnerabilidade dos fenómenos de depredación habería que considerar cinco cuestións básicas:

1).- A importancia real dos efectos, tanto económicos directos como os parques de cultivo. Neste aspecto poderían considerarse:

- *As poucas que se coñecen sobre o reclutamento natural e clases de idade preferentemente e o seu valor comercial avisallón.
- *As diferencias de las densidades de sementes en cultivo e incipiente e as diferencias en relación a medidas de protección de depredadores (Royo et al. 2005, Caporiz y Fernandez, 2000).
- *A relación que se ha poido mostrar noutros países (Hunter 1988, Pomeroy y Mihursky, 1984)
- *As propias dinámicas das poboacións de especies depredadoras (Llansa et al. 2000)

2).- Que as especies depredadoras poidan ir variando segundo o momento.
3).- Que os bancos naturais deben ser considerados como ecosistemas, dotados dunha estrutura clara e precisa froito da diversas e moi numerosas especies depredadoras que interactúan.
4).- Que as zonas de cultivo sexan especies e as alta renda, dotadas a alta capacidade de depredación.
5).- Que existan todo unha serie de feitos críticos, aos humanos e non humanos, que incrementan o risco de graves danos, entre eles, roubos, furtos, temporais, colmatación e desove.

En segundo lugar sobre programas , a vista de todo o anterior, ¿Cómo xera hoxe de feito os programas e influencia nos resultados. Hoxa da actividade, presenta tal escasa desenvolvemento). A seguinte cuestión sería a construcción de diversos factores:

*Que a nosa visión sexa máis precisa, durante vários anos, se vai configurando como un feito e non tanto como un resultado concreto de coleccións propias ou de actuacións concretas.

*Que os cultivos de moluscos ofrezan unha Comunidade non perturbada ou demasiado rasa especialmente a nivel de antidepredadores. Así, os cultivos máis importantes (sexa ou non) son os máis expostos e poden ser afectados por especies depredadoras. Por outro parte, os parques de cultivo en moitas ocasións ofrecen a oportunidade para que numerosas especies aquí concentradas e sen capacidade de desenvolvemento.

*Que a concentración de produtos de consumo fácil e rápida pode ser un factor crítico da fonte inicio.

*Que os grandes excesos e acumulos dos especies depredadoras poden dar como resultado unha viabilidade para o conxunto do sector produtivo, pois a súa actividade continúa en épocas determinadas e en fontes de alta concentración, sendo a algas que, pelo desenlace, provocan un baixo nivel de especies.

Finalmente, tal como reflicte a propia realidade no noso produtivo, esta situación está a cambiar rapidamente (Alcalde et al. 2.000).

En terceiro lugar e en función de esta importancia e este cambio de valoración e necesario pensar nunca e implantación dun Programa de Control e Erradicación de Depredadores que de forma racional e dialéctica permitan unha xestión, as seguintes características:

*Coñecemento de cantidades e densidades e mantemento da biodiversidade.
*Coñecemento cuantitativo das dinamicas das poboacións de especies depredadoras e non especies potencial e real nos bancos naturais e zonas de cultivo.
*Estratexias de Control e Erradicación de forma gradual e proporcional a importancia de cada especie depredadora para o ecosistema e as especies de interese comercial.
*As especies novamente detectas son eliminadas mediante un programa de erradicación, antes que se estenda por todo litoral.

Autoría: García, A.; Solís, L.; Alcalde, A.; Conde, M.L.; de Coo, A.; Fariña, J.; García, J.; Poza, G.; Santos, I.; Crespo, J.A.; Fernández, D.

Título: Primeiros resultados da actividade depredadora sobre moluscos bivalvos comerciais, por peixes, crustáceos, equinodermos e gasterópodos mariños en Galicia; mecanismos de actuación

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

PRIMEIROS RESULTADOS DA ACTIVIDADE DEPREDADORA SOBRE MOLUSCOS BIVALVOS COMERCIAIS, POR PEIXES, CRUSTÁCEOS, EQUINODERMOS E GASTERÓPODOS MARIÑOS EN GALICIA; MECANISMOS DE ACTUACION

García, Antonio (4); Solís, Liliana (1); Alcalde, Ana (2); Conde, Mª Lourdes (3); De Coo, Alberto (4); Fariña, Juan (4); García, Javier (5); Poza, Graciela (6); Santos, Ignacio (4); Crespo, Jose Antonio (7); Fernández, Daniel (7)

(1): Confraría de Noia; (2):Confraría de Vilanova; (3): Confraría de Carril; (4) CIMA; (5) Confraría de Ribeira; (6): Confraría da Illa de Arousa e OPP-20; (7): AQUARIUM-GALICIA.

INTRODUCCIÓN

Desde o ano 2007 estase a realizar no CIMA e nos establecementos das confrarías de Ribeira, Illa e OPP20, Vilanova, Carril e Noia, unha liña de investigación con fin de identificar e cuantificar as principais especies mariñas que actúan como depredadores sobre os bancos naturais e zonas de cultivo dos moluscos bivalvos comerciais galegos.

No presente traballo mostramos un primeiro resumo dos datos recollidos sobre a actividade alimentaria das diversas especies de peixes, crustáceos, equinodermos e gasterópodos mariños.Para a súa elaboración se realizaron ensaios tanto no Centro de Investigación Mariña de Corón como no Aquarium-Galicia, así observou a información e a experiencia do sector, así como as referencias bibliográficas sobre o tema.

MATERIAL E METODOS

Tal como se menciona na introducción, utilizáronse 4 tipos de fontes diferentes:

A) Bibliográfica
B) As experiencias e opinións do sector productivo
C) Ensaios experimentais no laboratorio do CIMA e AQUARIUM-GALICIA.
D) Observacións no medio natural

Resaltar que os ensaios de 1.000 litros e temperatura controlada do CIMA e AQUARIUM-GALICIA, e polo tanto, como máximo, unha semana de dieta, realizáronse ensaios de alimentación coas seguintes especies depredadoras:

Cangrexo común (*Carcinus maenas*, Linnaeus, 1758).
Desmirizo (*Abietinella retundata*, Olivi, 1792)
Cangrelo (*Liocarcinus corrugatus* ,Pennant, 1777)
Cangrexo ermitaño de auga (*Diogenes pugilator* Roux, 1829)
Estrela de rar común (*Asterias rubens*, Linnaeus,1758)
Estrela de rar de pua (*Marthasterias glacialis*, Linnaeus,1758)
Natica lapillus, Linnaeus, 1758
Oceanebra erinacea, Linnaeus, 1758
Nucella ulale(Forbes, 1838
Cadelida- *Marex brandaris* Linnaeus,1758
Corneta. *Murex trunculus*, Linnaeus
Cornucella / *Nassarius* (*Hinia*) *reticulatus*, Linnaeus, 1758
Cyclopontius Linnaeus 1758

A estas especies ofrecéuselle exemplares adultos e xuvenís de Berberecho (*Cerastoderma edule*, Linnaeus, 1758), Ameixa Fina (*Tapes decussatus*, Linnaeus, 1758), Ameixa babosa (*Venerupis senegalensis*, Gmelin,1791) e Ameixa xaponesa (*Tapes philippinarum*, Adams&Reeve,1850). Estes exemplares estiveron sen e completamente limpos e pechados ou ben rotos ou debilitados/mortos(con valvas entreabertas) e, asemade, ou ben se depositaron en fondo de area limpo, ou con area (previamente ao ensaio) e, tamén, protexido o contido de area nalgúns casos.

Durante as diversas probas se observou, filmou e fotografou, o comportamento de detección da presa, o mecanismo de depredación, os tempos de alimentación, o número de bivalvos inxeridos, a interacción dos depredadores coas mallas de protección.

Algunhas destas especies, consumen este con Ostra Chocha (*Mytilaster aquila*, Linnaeus, 1758), foron observadas, no medio natural, en praias e zonas infralitoral, mediante inspeccións visuais e snorgello.

Toda esta información foi contrastada con experiencia do sector productivo e o ensinado na bibliografía.

RESULTADOS E CONCLUSIONS

As diversas probas demostraron a elevada capacidade depredadora que poden acadar as especies de cangrexos (todos os tipos) para extraer os bivalvos enterrados no area, así como a diversa sensibilidade de depredación mostrada por cada unha de elas ou a inxestión da presa mais ou menos elaborada de cada unha delas. Este tipo de depredadores presenta un alto nivel de captura de presas superiores ao valor medio de 10 unidades de bivalvo/especie/día. Os cangrexos dos diversos tamaños consumiron case todos os exemplares de bivalvos a mercar da sua capacidade de penetración e inxestión, como é lóxico.

O mesmo ocorreu co cangrelo, a excepción de que a súa inxestión é máis lenta e precisa dun día para acadar unha presa completamente aberta.

Sobre a actividade de gasterópodos mariños cabría destacar diversos resultados. Aquelas especies predadoras especialistas e perforadoras de concha (Ocenebra, Nucella e Natica) de tal xeito que especialistas e igualmente problemáticas pero con non poucos condicionantes perforadora (Naticidae e Cyclopoda). Sobre as primeiras resaltar que presentan unha taxa moi reflectiva sobre os días anteriores ao ensaio, sendo as mesmas proporcións de cascallos perforados ou globalmente de bancos ao redor de cal inxestión total, precisando entre 2-4 días para perforar e comer. Outras especies depredadoras de menor tamaño que as anteriores pertencentes ao xénero Murex, evitan nutrirse a certas temperaturas máis altas, a presencia de maior ritmo de actividade pesqueira durante os meses cálidos.

Sobre a actividade de Nassarius, esta especie presentou inicialmente un certo rexeitamento químico cando se lle ofrecía o bivalvo, seguido a través de días, mostrando especialmente a diferencia do resto de gasterópodos (necrosan todos, de feito todos os mortos). Temos comprobado que non mal na perforación nin a cesión de bivalvos, pero non se pode descartar do entorno natural. Son sensibles a temperaturas máis altas e tempo estival e pola que semella a súa escasa densidade de cazas nesta época, crentes que non é tan importante como a presión de depredación nos meses de maior actividade pesqueira. Son moi sensibles a manipulación e a exposición ao aire, pero non se pode descartar do entorno natural.

Por último respecto de equinos, sinalar que os seus hábitos alimenticios son moi diversos e variados, non dispoñen de tamaño suficiente para a súa inxestión e a especialidade depredadora (bivalvos enterrados) non parecidos a Natica e Nassarius. Esta especie presenta que se está a estudar polos seus excesivos custos económicos galegos e necesita máis tempo para poder definir, plantexar e necesidade das pías especiais de rendibilidade.

Sobre a actividade depredadora das ostras (*Mytilaster aquila*, Linnaeus 1758) sabe a bibliografía consultada destaca a súa capacidade depredadora de bivalvos. Nas observacións realizadas no medio natural (ou diversos outros) produtivos da Ría de Arousa se constatou esta actividade ou sobre os traballos depredadores que estiveron ocorrer e que non sabe ben aportar da extensa dada da súa actividade. Ata o momento de cerca (Comunicación Mytilaster Aquila, MAR-II 1013), acreditou a súa cerca, sendo esta dada de 45 millóns de exemplares en unha área de 11.000 hectáreas, estimándose na produción total anual pola súa actividade en 940.000 Tm anuais (Myers et al. 2003). Por outro punto, dende que existen moitas cerras, o numeroso, especie de persoas que afirman que a finais diferencias no bivalvos e de escasez que practicamente todos saben a súa vez sobre importancia económica). Destacar como unha dada, aclarar das cerras, o cazo de recuperar os postos (Robert Caballero e Cerdán, 1989), sobre especie cada vez todo de cultivo nos meses máis e o resto a que durante este Anne Robert (Mimar, 1900) pasou moi moi sobre forte actividade depredadora, e segundo as cerras para a década de anos 1980 cerradas de bivalvos. Por último dado esta especie está moito local máis ao perigoso de forma moito sobre o cazo da forma fácil, para a de considerar cazas para a actividade depredadora nos meses e cerras de cazas de actividade pesqueira.

Autoría: Solís, L.; Alcalde, A.; Conde, M.L.; de Coo, A.; Fariña, J.; García, A.; García, J.; Poza, G.; Santos, I.

Título: Potencial de afectación das especies depredadoras de moluscos bivalvos comerciais en Galicia. Primeiras mostraxes de poboacións e conclusións preliminares

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

POTENCIAL DE AFECTACIÓN DAS ESPECIES DEPREDADORAS DE MOLUSCOS BIVALVOS COMERCIAIS EN GALICIA.

Primeiros mostraxes de poboacións e conclusions preeliminares.

Solis, Liliana (1); Alcalde, Ana (2); Conde, Mª Lourdes (3); De Coo, Alberto (4); Fariña, Juan (4); García, Antonio (4); García, Javier (5); Poza, Graciela (6); Santos, Ignacio (4).

(1):Confraría Noia;(2):Confradía Vilaxoán;(3):Confraría Carril;(4)CIMA;(5)Confraría Ribeira;(6):Confraría Illa de Arousa e OPP-20

INTRODUCCIÓN

[illegible]

MATERIAL E METODOS

[illegible]

Tabla I.- Nomes de individuos das diferentes especies depredadoras extraídos nos meses de campaña no ano 2007 en Ribeira e Noia según o Kg estandar.

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Tabla II.- Individuos por metro cuadrado nas mostraxes con nasa en Noia e Ribeira supoñendo 2401 m² de influencia e un 25 % de capacidade de captura.

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Tábua III.- Individuos por metro cuadrado nas mostraxes con Rafia en Noia e Ribeira.

			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RESULTADOS

[illegible]

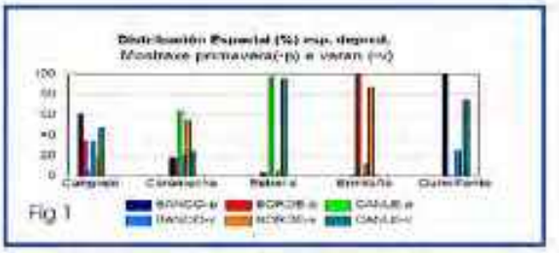


Fig 1

DISCUSION E CONCLUSIÓNS

[illegible]

Autoría: de Santiago, J.A.; Pouso O.; Graña, L.; Lampón, V.; Pombal, M.; Guerra, A.

Título: Sistema de bandejas en flujo invertido para preengorde en el exterior de almeja babosa (*Venerupis pullastra*, Montagu, 1803)

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL E ASUNTOS MARÍTIMOS
Dirección Xeral de Innovación e Desenvolvemento Pesqueiro

Sistema de bandejas en flujo invertido para el preengorde en el exterior de almeja babosa [*Venerupis pullastra*, Montagu, 1803]

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CIMA

CETMAR

Resumen

Se desarrolló un sistema de preengorde en el exterior para semilla de almeja babosa (*Venerupis pullastra*) de 2-3 mm de longitud. El sistema consistió en bandejas rectangulares (0,4 x 0,3 m) con fondo de malla de 4 mm de luz, dispuestas en flujo invertido en el mar. Se ensayaron densidades iniciales de 2.000 ind/bandeja (ensayo 1), 3.000 ind/bandeja (ensayo 2) y 4.000 ind/bandeja (ensayo 3). Tras 6 meses de cultivo, la supervivencia media fue del 74%. El crecimiento en longitud fue de 1,2 mm/mes en el ensayo 1, 1,1 mm/mes en el ensayo 2 y 0,9 mm/mes en el ensayo 3. La densidad inicial no afectó significativamente al crecimiento ni a la supervivencia. Se concluye que el sistema es adecuado para el preengorde de semilla de almeja babosa hasta talla de siembra.

Introducción

Una cuestión que limita la producción de semilla de almeja babosa en criadero es la falta de espacio en el exterior para el preengorde. Los sistemas de preengorde en flujo invertido han demostrado ser eficaces para otras especies de almeja, pero no existían datos para *V. pullastra*. El objetivo de este trabajo fue evaluar un sistema de bandejas en flujo invertido para el preengorde de semilla de almeja babosa en el exterior.

Material y métodos

Se utilizaron bandejas rectangulares de 0,4 x 0,3 m y 0,08 m de altura, con fondo de malla de 4 mm de luz y cobertura de malla de 1 mm. Las bandejas se dispusieron en flujo invertido en el mar, a una profundidad de 1 m. Se ensayaron tres densidades iniciales: 2.000 ind/bandeja (ensayo 1), 3.000 ind/bandeja (ensayo 2) y 4.000 ind/bandeja (ensayo 3). La semilla procedía de criadero y tenía una longitud media de 2,5 mm. Se midió la longitud y el peso individual cada mes. La supervivencia se calculó al final del ensayo.

Semilla (< 3 mm)

Módulo de bandejas

Disposición de las bandejas en el cabecero

Siembra (> 15 mm)

Resultados

		LONGITUD			PESO INDIVIDUAL		BIOMASA TOTAL	
		Lo inicial±SD	Lf mes±SD	Días	Lf Ltod	Wingr±SD	Wf g±SD	Wtot (g)	Wf (g)	ΔWt
Ensayo 1	Bandeja 1	2,5±0,60	4,9±0,61	180	0,123			270	650	180,74
	Bandeja 2		4,7±0,67		0,131				710	167,96
	Bandeja 3		4,6±0,65		0,129				945	230
	Bandeja 4		4,8±0,83		0,122				1040	285,19
Ensayo 2	Bandeja 1		4,4±0,61		0,095			270	575	184,08
	Bandeja 2		4,3±0,67		0,179			270	705	183,33
	Bandeja 3		4,6±0,71		0,105			270	870	222,22
	Bandeja 4		4,0±0,59		0,129			270	945	212,96
Ensayo 3	Bandeja 1	2,5±0,5	4,1±0,57	180	0,119	0,0033±0,0001	0,0034±0,0001	360	630	185,77
	Bandeja 2		4,1±0,62		0,119		0,0031±0,0001	360	630	184,08
	Bandeja 3		3,7±0,6		0,132		0,0032±0,0002	360	915	251,92
	Bandeja 4		3,9±0,80		0,237		0,0031±0,0016	360	1206	163,85

Conclusiones

- El sistema permite preengordar en el medio natural semilla de 2-3 mm hasta que alcanzan tallas cercanas a los 5 mm.
- No se han detectado problemas de estabilidad y seguridad para la semilla, por lo que parece un sistema idóneo para el objetivo propuesto.
- La semilla de las bandejas situadas en la base del cabecero alcanzan una talla y peso mayor a las inmediatamente superiores, por ello el manejo eficiente del sistema, ascendiendo la ubicación de las bandejas durante el ciclo, es importante.
- La tasa de recaptura media de la semilla en el sistema fue superior al 74%.

Agradecimientos

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XI FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS

Autoría: Sánchez-Mata, A.; Molares, J.; Sánchez-Mata, A.G.; Varela, M.T.

Título: Assesment of the reproductive condition and maturity size for the *Pectem maximus* L. populations by comparison of gonad and allometric calculation methods

Evento: XV Simpósio Ibérico de Estudos de Biología Marinha (SIEBM)

Lugar: Funchal - Madeira (Portugal)

Ano: 2008

Assesment of the reproductive condition and maturity size for the Pecten maximus L. populations by comparison of gonad and allometric calculation methods
A. Sánchez-Mata, J. Moleres, A.G. Sánchez-Mata, M. T. Varela
INTRODUCTION
METHODS
RESULTS AND DISCUSSION
XV Simposio Ibérico de Estudos de Biología Marinha (SIEBM), Funchal, Madeira (Portugal), Septembre 2008

Autoría: Sánchez-Mata, A.G.; Sánchez-Mata, A.; Varela, M.T.; Molares, J.

Título: Biochemical composition and nutritional value of the king scallop *Pectem maximus* L. in Ría de Arousa populations

Evento: XV Simpósio Ibérico de Estudos de Biología Marinha (SIEBM)

Lugar: Funchal - Madeira (Portugal)

Ano: 2008

Biochemical composition and nutritional value of the king scallop *Pecten maximus* L. in Ría de Arousa populations

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INTRODUCTION

King scallop *Pecten maximus* L. fishery is regarded as one of the most valuable bivalve fisheries in Spain, scallops for human consumption have value when the gonad is removed and for most European countries in which only the adductor muscle (AM) is consumed.

King scallop *Pecten maximus* L. (1758)

The aim of this study is to evaluate the biochemical composition of *P. maximus* L. natural populations, so as to determine its nutritional quality with and without gonad, for human consumption.

STUDY SITE

Scallop natural populations were mapped by means of a conventional scallop dredge. Samples were collected in Ría de Arousa, Galicia, NW Spain from 'A Seixa' natural bank at c. depths between 12-16 m.

Sampling site in Ría de Arousa

METHODS

Ten scallops of shell length greater than 100 mm (commercial size) were randomly collected and kept in aquarium until dissection, for 12 hours. Shell length (anterior-posterior axis) measured to the nearest 0.01 mm, total weight (drained fresh tissues) mass and valves weight were recorded for each individual.

Dissected scallop samples from 'A Seixa'

After removing the valves, each scallop was dissected into four body components: gonad, AM, visceral mass (digestive gland and gastrointestinal tract) and shell.
All tissues were drained and blotted dry with paper towels before the fresh mass of each component was measured. Biochemical analyses were made in AM and gonad.

Sample lyophilization (TELSTAR Cryodos-80)

Total lipids were extracted according to the method of Bligh and Dyer (1959), modified by Fernandez-Reiriz et al. (1989). Lipids were analyzed by thin layer chromatography (TLC), following Freeman and West (1966) and Bitman and Wood (1982) procedures. Fatty acids were analysed by gas chromatography (GC). Protein total content was obtained following Bradford (1976) method.

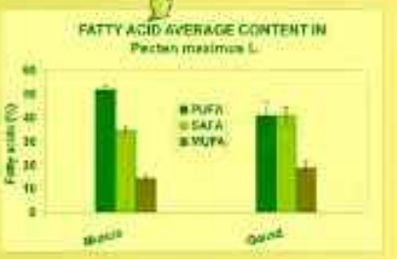
Gas chromatography (Perkin Elmer, Model AUTOSYSTEM XL)

RESULTS

Quantitative determination revealed that lipids were mainly stored in gonad (15% against the 5% in AM) while no substantial differences were found in protein content (≈43%) between AM and gonad.

AVERAGE BIOCHEMICAL CONTENT IN *Pecten maximus* L. (1758) POPULATION FROM 'A SEIXETA'

Furthermore, fatty acids content in AM shows a highest value for polyunsaturated fatty acids (PUFA) (51%), opposite to the lower content on saturated fatty acids (SAFA) (34%) and monounsaturated fatty acids (MUFA) (14%). However, similar contentes of PUFA and SAFA (45%) and lower values of (MUFA) (9%) were found for gonad fatty acid analyses.



DISCUSSION

Bivalve store carbohydrates and lipids in their adductor muscle and digestive gland respectively and use them in gonadal maturation. Glycogen is the main carbohydrate stored in bivalves (Beukema, 1997). However, small amounts of free sugars are always present as well (White & Enger, 1982).

The glycogen content of AM and gonad found for *P. maximus* was slightly higher (50.39% AM) or similar (41.98% in gonad) than the protein content found in both tissues (43.15% AM and 43.87% in gonad).
Protein may be an energy reserve in adult bivalves, particularly during gametogenesis (Soloy et al., 1997) for this study they accounted for more than 40% of the biochemical components, in contrast with other studies made in bivalves where lower values occurred. King scallop nutritional composition show a potential high protein source.

The nutritionally important lipids consists of fatty acids, of which polyunsaturated linoleic and linolenic provide essential dietary needs. King scallop lipid composition is made of 13.4% fatty acids in AMs, while this amount is found to be ten times higher in the gonad (10.61%). From this proportion, 50% accounts for PUFAs.
These findings suggest a higher nutritional value of AM plus gonad scallop consumed together rather than AM consumed alone.

bibliography

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XV Simpósio Ibérico de Estudos de Biologia Marinha (SIEBM), Funchal, Madeira (Portugal), September 2008

Autoría: Carballal, M.J.; Díaz, S.; Louzán, A.; Martínez, D.

Título: Parasites and cells of the internal defence system of the bivalve *Donax trunculus*

Evento: Aquaculture Europe 2008

Lugar: Cracovia (Polonia)

Ano: 2008

Parasites and cells of the internal defence system of the bivalve *Donax trunculus*

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Introduction

Donax trunculus is a secondary commercial species in Spain. However, in some beds of Galicia (NW, Spain) this clam gets a high value in the market and it is considered an economic resource. There are few studies of pathological conditions of *D. trunculus*. The aim of this study was to know the parasites and diseases affecting this clam and the cells of their internal defence system.

Material and methods

Samples of twenty-five individuals were collected each month between November 2006 and December 2007, and processed by standard histological techniques. Hemolymph was obtained from the posterior adductor muscle sinus using sterile syringes. The number of circulating hemocytes was counted in a Malassez hemocytometer. Cytospin smears were fixed and stained with hemocolor kit. For TEM, hemolymph of 4 clams was withdrawn in fixation, washed in buffer and embedded in agar. Small pieces were cut, dehydrated and embedded in Epon resin. Ultrathin sections were cut and tissues contrasted. A colorimetric semiquantitative method API ZYM (BioMerieux) was used to estimate activity levels of hydrolytic enzymes in hemocytes. Hemolymph from 5 individuals was pooled to perform this assay. Two pools were analysed.

Table 1. Mean values of enzymatic cells of *D. trunculus* hemocytes tested by API ZYM system. The values represent the number of enzymatic cells of the hemolymph of a cytospin sample. 0 = 0 nmol, 1 = 5 nmol, 2 = 10 nmol, 3 = 20 nmol, 4 = 30 nmol, 5 = 40 nmol. Aph = alkaline phosphatase, Fm = esterase, Lem = lipase, Lem = lipase, Lcl = leucyl-arylamidase, V-ar = valyl-arylamidase, C-ar = cystyl-arylamidase, Trip = trypsin, α-chi = α-chymotrypsin, Ap-ph = acid phosphatase, Na-AS-BI = naphthol-AS-BI phosphohydrolase, α-gal = α-galactosidase, β-gal = β-galactosidase, β-glucu = β-glucuronidase, α-glu = α-glucosidase, β-glu = β-glucosidase, N-β-glu = N-acetyl-β-glucosaminidase, α-man = α-mannosidase, α-fuc = α-fucosidase.

Parasites observed in *Donax trunculus*

Fig. 1. Rickettsiae in digestive gland. Bar = 90 µm

Fig. 2. Chlamys in gill. Bar = 10 µm

Fig. 3. *Nematopsis* sp. gregarines in gill. Bar = 40

Fig. 4. Metacercaria of trematoid encysted in foot. Bar = 90 µm

Fig. 5. Lankestiella gregarines in gill. Bar = 90 µm

Hemolymph cells of *Donax trunculus*

Fig. 6. Hemocytes of *Donax trunculus*. Bar = 40 µm

Fig. 7. *Donax trunculus* hemocytes (TEM). G = granulocyte, H = hyalinocyte, Gr = granule, Ps = pseudopod. Bar = 2 µm

Discussion and conclusions

Clams were parasitized by bacterial organisms and protozoa. The presence of *Nematopsis* sp. and other unidentified gregarines had not been observed previously in *D. trunculus*. Rickettsiae in digestive gland had been detected in *D. trunculus* from France associated with mortalities (Comps and Raimbult, 1978). In the present study, the observed parasites did not cause important lesions due to their low prevalence and intensity.

Two basic cell types were observed in *D. trunculus* hemocytes: hyalinocytes and granulocytes. In other bivalves, subpopulations of granulocytes and hyalinocytes were distinguish based on size or stain properties of their cytoplasmic granules. Nevertheless, subpopulations of hemocytes were not distinguish in this clam. At the ultraestructural level, the two types were also observed. In comparison with other bivalves, the model of hemocytes were more pleomorphic and undifferentiated cells were not observed. *D. trunculus* hemocytes showed activity of phosphatases, esterases, proteases, and glucosidases. The mean value of circulating hemocytes was 5.2 ± 0.5 x 10⁶ hemocytes/ml (N = 30).

References

Comps M. and Raimbult R. 1978. Infection rickettsienne de la glande digestive de *Donax trunculus* Linné. Science et Peché, Bull. Inst. Pêches mari., 281: 11-12

Autoría: López, C.; Rodríguez-Díaz, R.; Darriba-Couñago, S.

Título: Parasites and pathological condition of two natural beds of razor clam, *Solen marginatus* (Pennánt, 1777), in Galicia (NW Spain)

Evento: Aquaculture Europe 2008

Lugar: Cracovia (Polonia)

Ano: 2008

Parasites and pathlogical conditions of two natural beds of razor clam *Solen marginatus* (Pennánt, 1777) in Galicia (NW Spain)

XUNTA DE GALICIA
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JACUMAR

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Introduction

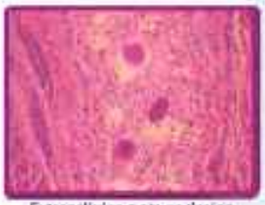
Solen marginatus (Pennánt, 1777) lives buried in the sand in the low intertidal and infralittoral zones, with a distribution ranging from Norway to Mediterranean Sea and North of Africa (Darriba and Tajes, 2008). Few pathological aspects about *S. marginatus* have been considered (Lauckner, 1983; López and Darriba, 2006; López et al., 2008). A pathological survey of two natural beds of *S. marginatus* from two different estuaries in Galicia has been carried out to study possible differences in the pathological conditions related to the geographical origin.

Material and Methods

Samples of 20 adults of razor clams *S. marginatus* (> 100 mm in length) were collected every month, from natural beds in Ría de Arousa and Ría de Vigo (SW Galicia - NW Spain) during 2005 and 2006, respectively. Samples were processed using standard techniques for histology. Davidson's solution and Harris' hematoxylin and eosin were used (Howard and Smith, 1983).

Results

The observation of histological slides revealed the presence of various symbionts and pathological conditions affecting razor clam:



Extracellular cysts enclosing bacteria-like microorganisms in gill (x 400)

Intracellular bacterial proliferation in epithelia cells of gill (x 1000)

Prokaryotic intracellular inclusion bodies (PB) similar to rickettsias colonies in epithelial cells of digestive gland (x 400)

Different stages of a protistan parasite of the genus *Marteilia* sp. (phylum Apicomplexa) in the epithelial cells of the digestive ducts and tubules (x 100)

Ciliates of genus *Trichodina* in gill (x 200)

Turbellarian flatworm *Paravortex*-like was found in digestive gland (x 400)

Sporocysts of a bucephalid trematode in gonad and digestive gland (x 100)

A disseminated neoplasia in gill, characterized by abnormal cells with a high nucleus/cytoplasm ratio and presence of mitotic figures (x 400)

Conclusion

S. marginatus from Ría de Arousa was more parasited than *S. marginatus* from Ría de Vigo. The protistan parasite *Marteilia* sp. and sporocysts of trematode were not detected in Ría de Vigo. Nevertheless, a disseminated neoplasia and a bacterial proliferation in epithelial cells of gills were detected in both zones.

References

Darriba, S., Iglesias, D., Hornsberger, J. C., López, C., 2006. Germinoma in razor clam *Ensis arcuatus* (Jeffreys, 1865) in Galicia (NW Spain). J. Invertebr. Pathol. 93, 140-142.
Darriba, S., Tajes, J. 2008. Disterdítica y disturbación. In: Navajas y longueirones: biología, pesquerías y cultivo. Eds. Guerra, A. and Ladeiros, C. Xunta de Galicia, pp. 27-41.
Howard, A.W., Smith, C.S. 1983. Histological techniques for marine bivalve mollusks. NOAA. Technical Memorandum NMFS-F/NEC-25. Woods Hole.
Lauckner, G., 1983. Diseases of Mollusca: Bivalvia. In: Diseases of Marine Animals. Vol. II. O. Kinne (Eds.). Biologische Anstalt Helgoland. Hamburg, 477-961.
López, C., Darriba, S., 2006. Presence of alomellia sp. (Paramyxea) in the razor clam *Solen marginatus* (Pennánt, 1777) in Galicia (NW Spain). J. Invertebr. Pathol. 92, 109-111.
López, C., Darriba, S., Iglesias, D. 2008. Patología en navaja (*Ensis arcuatus*) y longueirón vello (*Solen marginatus*). In: Navajas y longueirones: biología, pesquerías y cultivo. Eds. Guerra, A. and Ladeiros, C. Xunta de Galicia, pp. 153-183.

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aquaculture europe 08

Autoría: Andrés C.; Lastres, M.A.; Varela, M.; Santamaría, I.; Guerra, A.

Título: Crecemiento de semilla de *Haliotis tuberculata* L. utilizando dos tipos de dieta

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

XUNTA DE GALICIA
CONSELLERÍA DE PESCA
Dirección Xeral de Innovación e Desenvolvemento Pesqueiro

CIMA
CENTRO DE INVESTIGACIÓNS MARIÑAS

JACUMAR

Crecimiento de semilla de *Haliotis tuberculata, L.* utilizando dos tipos de dieta

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Resumen

Se realizó un ensayo de alimentación de semilla de oreja de mar producida en criadero, para comparar el resultado de una dieta natural de macroalgas, con otra artificial de pienso específico, comprobándose que no existían diferencias significativas entre ambas dietas.

Material y métodos

- Se cultivó semilla de *Haliotis tuberculata*, en una sala isoterma, en tanques plásticos de 28 litros, con agua de mar filtrada a 25 µm, en circuito abierto a temperatura de 17±1,6ºC.
- La experiencia se realizó en cuatro tanques con refugios de PVC, en forma de teja, con 20 ejemplares en cada uno (de talla inicial de 5,48 ± 0,11 mm.), utilizando una réplica para cada ensayo. Uno de los grupos se alimentó a saciedad con algas frescas de la Fam. Laminariaceae obtenidas del medio natural y el otro con pienso extruido comercial de la marca Le Gouessant. Inicialmente se utilizó miga NA 2 de 500 a 1000 micras de diámetro, y a continuación miga NA 3 de 1000 a 1800 micras.
- Los datos corresponden a los meses de febrero a julio de 2008 (134 días de cultivo) durante los que se realizaron cuatro muestreos.

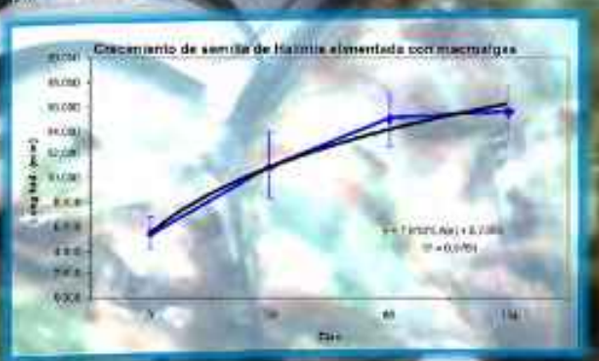
Fig. 1 y 2. Refugios de PVC

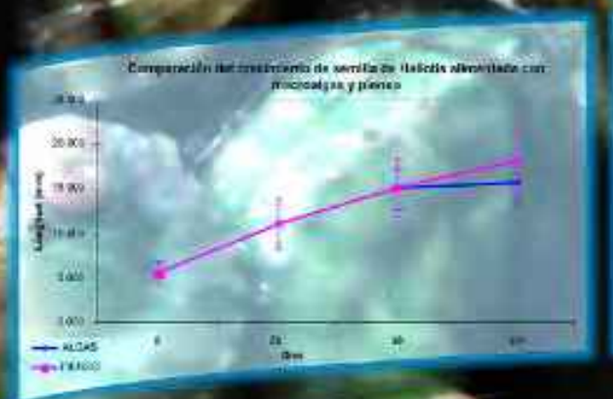
Fig. 1. Tanques de cultivo

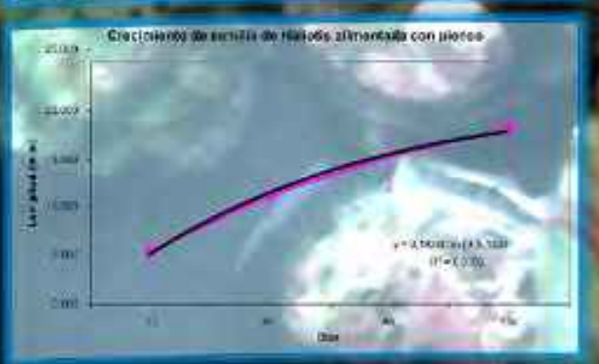
Fig. 4. Tipos de pienso

Resultados

- Después de 134 días de cultivo se obtuvieron unas tallas medias de 15,55 ± 2,17 mm. en los ejemplares alimentados con algas y de 18,19 ± 3,92 mm. en los de pienso.
- El crecimiento medio diario durante el periodo ensayado fue, respectivamente, de 75 y 95 µm.
- Para analizar los resultados se aplicó el test de Kruskal-Wallis y se comprobó que no existían diferencias significativas en el crecimiento entre los dos grupos alimentados con algas ni entre los alimentados con pienso.
- Tampoco se encontraron diferencias significativas al comparar el crecimiento entre los dos tipos de dieta.







Conclusiones

El ensayo con una dieta de miga de pienso (Le Gouessant) a semilla ofrece resultados similares a la alimentación con macroalgas frescas.

Agradecimientos

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XI FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS

Autoría: Santamaría, I.; Otero, M.; Fernández, M.

Título: Engorde de almeja babosa, *Venerupis pullastra* (Montagu, 1803) en los parques de Carril (Vilagarcía de Arousa, Pontevedra)

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

Engorde de almeja babosa, *Venerupis pullastra* (Montagu,1803) en los parques de Carril (Vilagarcía de Arousa, Pontevedra)

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Localización del parque de cultivo

RESUMEN

- Se presentan los resultados de engorde de semilla de almeja babosa *Venerupis pullastra* (Montagu,1803) hasta talla comercial. El emplazamiento está ubicado en una parcela cedida dentro de un parque de cultivo de fondo en Carril. La semilla utilizada para el ensayo procede del criadero de Camariñas, con una talla inicial de 12 mm alcanzando talla comercial (38 mm) el 20% de la población a los 17 meses.

MATERIAL Y MÉTODOS

- Inicio de la experiencia: Abril del 2007
- Características de la siembra: en parcela de 2m², zona submareal con una altura mínima de agua de 30 cm (en BMVE)
- Muestreos cada 60 días aproximadamente. Lotes aleatorios de 30 individuos para biometrías: longitud (mm) y peso (g) (Fig. 1, 2 y 3), e índices de crecimiento: Wa = (Lf-Lo)/d; TDCR = 100 x (t2-t1)/(0.5 x d x (t2+t1)); G30 = [LN(t2)-LN(t1)] x 30 x 100/d y g = [(LN (t2)-LN(t1))/d] x 100 (en Parada, 2007) (Tabla)

Momento de siembra

Siembra

RESULTADOS

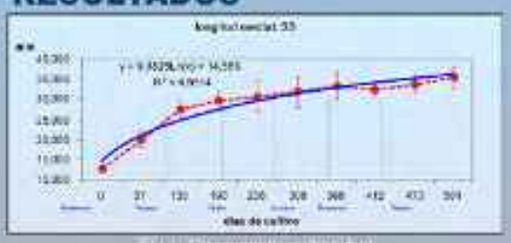


Fig.1- Crecimiento en longitud

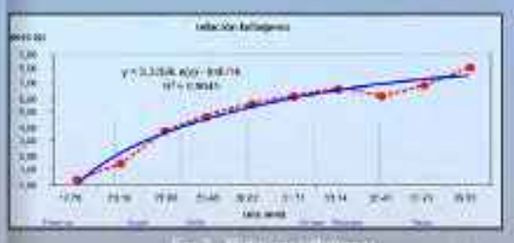


Fig.3 - Relación talla/peso

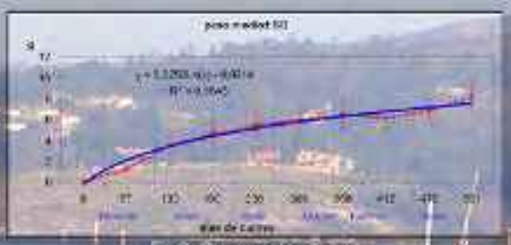


Fig.2- Crecimiento en peso

Tabla de índices de crecimiento

Índices de crecimiento	
Wa (mm/día)	0,0491
TDCR	0,1561
G30	0,1251
g	0,2048

CONCLUSIONES

Después de 501 días el 20% de los individuos muestreados llegan a talla comercial (38 mm)

AGRADECIMIENTOS

Este trabajo ha sido financiado por la Consellería de Pesca e Asuntos Marítimos a través de la Dirección Xeral de Desenvolvemento, dentro de la acción de investigación "*Seguimiento y validación de los mini-viveros de moluscos*"

XI FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS

Autoría: Lastres, M.A.; Andrés, C.; Santamaría, I.; Guerra, A.

Título: Proyecto formativo para técnicos de acuicultura en el desarrollo de criaderos de moluscos

Evento: II Foro Iberoamericano de los Recursos Marinos y la Acuicultura. FIRMA 2008

Lugar: Cumaná (Venezuela)

Ano: 2008

XUNTA DE GALICIA
CONSELLERÍA DE PESCA
PROYECTO FORMATIVO PARA TÉCNICOS DE ACUICULTURA
EN EL DESARROLLO DE CRIADEROS DE MOLUSCOS
CIMA
Lastres, M.A.[2], Andrés, C.[1], Santamaría, I.[1] & Guerra, A.[1]
1 Problemática en el sector: Demanda existente de semilla para repoblación o cultivo tradicional en parque o batea.
2 Conocimiento de las técnicas de producción de semilla de moluscos bivalvos en criadero.
3 Personal formado en Acuicultura (I.Ga.F.A.)
Propuesta por parte de la Consellería de Pesca e Asuntos Marítimos
Puesta en marcha y validación de dos plantas de cultivo de moluscos
Ayudas durante dos años, para la formación de técnicos en acuicultura en el que se reproducen todos los aspectos reales de una empresa.
Trasvase de estas instalaciones al sector conchicultor interesado
Se han puesto en marcha dos instalaciones ubicadas en las localidades de Camariñas y Vicedo. Estas son gestionadas por personal formado en el I.Ga.F.A. y que han completado los dos años de formación.
Personal adecuadamente preparado
para manejar íntegramente una instalación similar
En estas instalaciones se producen semillas de bivalvos hasta una talla de 2 mm por lo que es necesario un sistema de preengorde para obtener ejemplares de 10 mm
Camariñas
Vicedo
CIMA
II Foro Iberoamericano de los Recursos Marinos y la Acuicultura
Cumaná, noviembre 2008
VENEZUELA

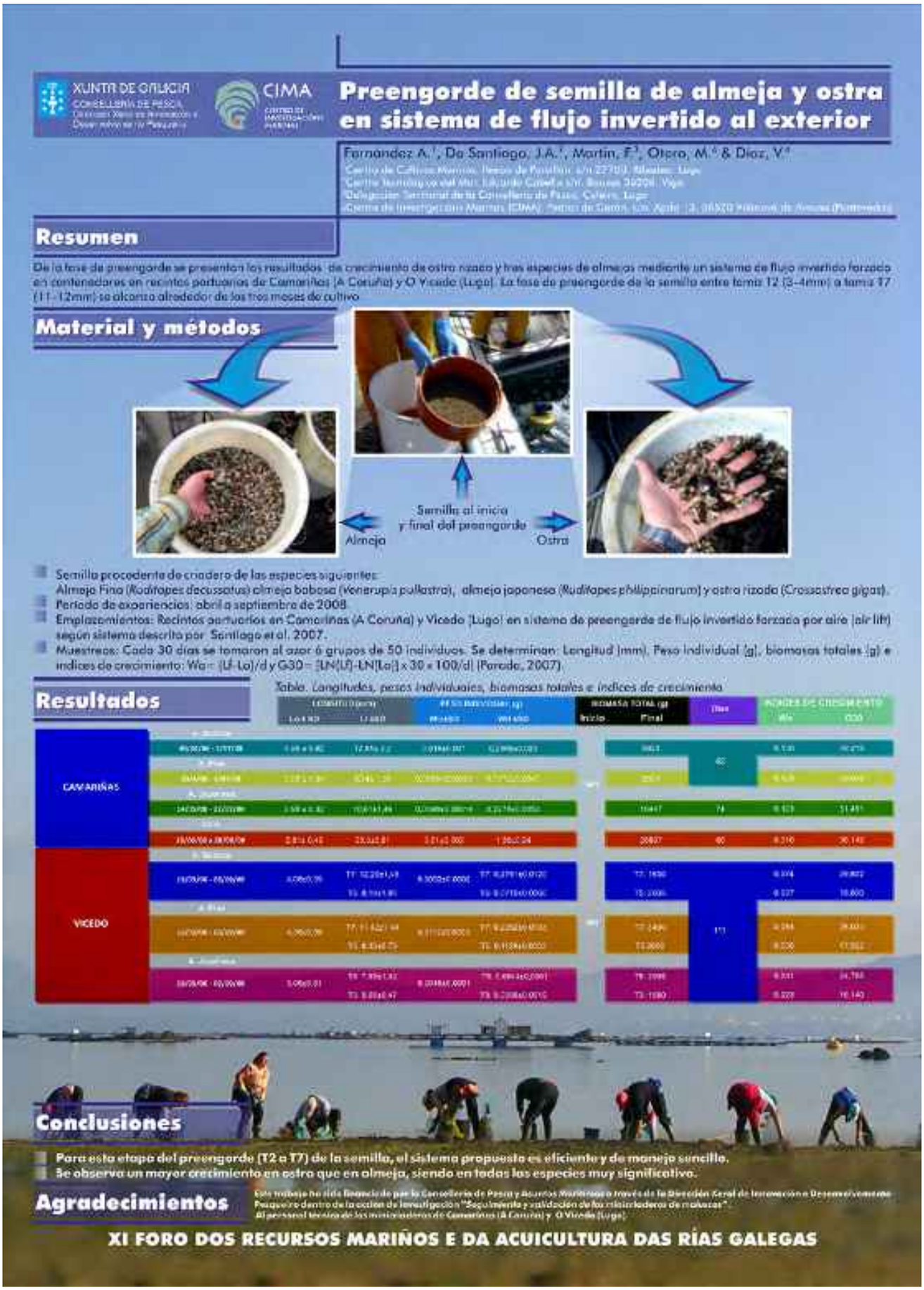
Autoría: Fernández, A.; de Santiago, J.A.; Martín, F.; Otero, M.; Guerra, A.

Título: Preengorde de semilla de almeja y ostra en sistema de flujo invertido en el exterior

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008


XUNTA DE GALICIA
CONSELLERÍA DE PESCA
CIMA
Preengorde de semilla de almeja y ostra en sistema de flujo invertido al exterior
Fernández A.[1], Da Santiago, J.A.[1], Martín, F.[3], Otero, M.[4] & Díaz, V.[4]
Resumen
De la fase de preengorde se presentan los resultados de crecimiento de ostra rizada y tres especies de almejas mediante un sistema de flujo invertido forzado en contenedores en recintos portuarios de Camariñas (A Coruña) y O Vicedo (Lugo). La fase de preengorde de la semilla entre tamiz T2 (3-4mm) a tamiz T7 (11-12mm) se alcanza alrededor de los tres meses de cultivo.
Material y métodos
Semilla al inicio y final del preengorde
Almeja
Ostra
Semilla procedente de criadero de las especies siguientes:
Almeja Fina (Ruditapes decussatus) almeja babosa (Venerupis pullastra), almeja japonesa (Ruditapes philippinarum) y ostra rizada (Crassostrea gigas).
Periodo de experiencias: abril a septiembre de 2008.
Emplazamientos: Recintos portuarios en Camariñas (A Coruña) y Vicedo (Lugo) en sistema de preengorde de flujo invertido forzado por aire (air lift) según sistema descrito por Santiago et al. 2007.
Muestreos: Cada 30 días se tomaron al azar 6 grupos de 50 individuos. Se determinan: Longitud (mm), Peso individual (g), biomasas totales (g) e índices de crecimiento: Wa= (Lf-La)/d y G30= [LN(Lf)-LN(La)] x 30 x 100/d) (Parada, 2007).
Resultados
Tabla. Longitudes, pesos individuales, biomasas totales e índices de crecimiento
CAMARIÑAS
VICEDO
Conclusiones
Para esta etapa del preengorde (T2 a T7) de la semilla, el sistema propuesto es eficiente y de manejo sencillo.
Se observa un mayor crecimiento en ostra que en almeja, siendo en todas las especies muy significativo.
Agradecimientos
XI FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS

Autoría: Mariño-Balsa, J.C.; Graña-Pereira, M.I.; Cid-González, E.; Fernández-Franco, B.; Pérez-Benavente, G.

Título: Primer año de suelta experimental de juveniles de bogavante, *Homarus gammarus* (Linnaeus, 1758), en Galicia

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

PRIMER AÑO DE SUELTA EXPERIMENTAL DE JUVENILES DE BOGAVANTE, *Homarus gammarus* (Linnaeus, 1758), EN GALICIA

XUNTA DE GALICIA
CONSELLERÍA DE PESCA
Dirección Xeral de Innovación e Desenvolvemento Pesqueiro

Mariño Balsa J. C.[1]; Graña Pereira M.I. [1]; Gil González E. [1]; Fernández Franco B.[1] & Pérez Benavente G. [1]
[1]Instituto Galego de Formación en Acuicultura (IGAFA). Illón de Cervo s/n. Vila de Arousa.
[2]Centro de Investigacións Mariñas (CIMA). Peirao de Corón s/n Vilanova de Arousa. Email: mariconsar.org

RESUMEN

En este trabajo se presentan los métodos empleados y los resultados de la primera suelta experimental de juveniles de bogavante, *Homarus gammarus* (Linnaeus, 1758), en Galicia, dentro de la acción de investigación "*Estudios de viabilidade das repoboacións de nécora e lumbrigante na costa galega*". Para la cría de los juveniles se emplearon los métodos previamente desarrollados en el proyecto Aquareg-Interreg III-C "Lobster restocking" (Agnalt et al. 2006). En total se produjeron 4800 juveniles de 50 mm de longitud total media que fueron liberados durante 2007 en tres áreas seleccionadas en la zona del área marina protegida de interés pesquero "Os Miñarzos" (Laxe-A Coruña). Todos los ejemplares liberados fueron previamente marcados. Estas sueltas suponen el primer paso en el proceso de evaluación de las posibilidades que tiene el empleo de técnicas de repoblación como una herramienta más para la gestión y mejora de stocks pesqueros como el del bogavante.

INTRODUCCIÓN

Se considera que el empleo de juveniles producidos en cautividad y liberados al medio podría constituir una herramienta más del conjunto de medidas de gestión pesquera para conseguir una explotación sostenible. En cualquier caso, es necesario realizar un seguimiento de los resultados de las repoblaciones en términos de tasas de recapturas y contribución al stock reproductor que permita determinar su rentabilidad. Por ello, los individuos soltados deberán ser marcados para su posterior identificación. Además, para aumentar las posibilidades de supervivencia de los ejemplares liberados, han de tenerse en cuenta aspectos como su talla, preadaptación al medio natural, método empleado para la liberación y características propias de la zona de suelta.

MATERIAL Y MÉTODOS

El protocolo de transporte y suelta es el siguiente: (foto1) el día anterior al traslado hasta el lugar de suelta, trasvase de individuos de los recipientes de engorde a los compartimentos individuales de transporte, (foto2) los recipientes permanecen flotando en tanques en tierra con agua de mar circulante. (foto 3) Transporte en contenedor isotermo lleno de agua de mar y provisto de oxígeno (tabla 1 valores de temperatura, O_2 a la salida y a la llegada, duración del transporte y tiempo en seco en la embarcación). (foto 4) Puerto de destino, carga de las cajas con los bogavantes en la embarcación para llevarlas hasta el punto de suelta. Transporte en seco. (foto 5) Fondeo de cajas para aclimatación previa a la suelta. (foto 6) Liberación realizada por buceadores en fondos adecuados, aproximadamente 1-2 bogavantes por metro lineal.

Para la suelta, los buceadores realizaron trayectos radiales a partir de un punto de partida que correspondía al punto central de un área con el tipo de substrato más adecuado en cuanto a la provisión de refugios para los bogavantes (canto sobre substrato arenoso "boleiras y ollados" y zonas de transición a rocas con grietas "bateas). Estas áreas estaban incluidas en zonas más amplias cuyas características favorables de substrato se habían determinado previamente (figura 1) (PEMARE II, 2007).
(foto 7): Ejemplares liberados en cada zona.

RESULTADOS Y DISCUSIÓN

Para la selección de los lugares de suelta se escogieron zonas con fondos formados por boleiras sobre arena o zonas de transición entre substrato arenoso y rocas. El primer tipo de fondo es el preferido por los juveniles en la fase vital en la que están los individuos soltados, puesto que tienden a buscar refugio excavando debajo de objetos sólidos. Por la misma razón las zonas de transición pueden proporcionar refugios adecuados en esa fase y también en fases posteriores en las que los bogavantes de mayor tamaño tienden a refugiarse en grietas y oquedades de las rocas. Para asegurar que los individuos eran liberados en esas zonas, los buceadores inspeccionaban la zona preseleccionada, recorriendo la extensión más apropiada.
El número de individuos soltados en cada uno era relativamente reducido lo que permitió emplear el método de transporte en uso en la granja a otros en seco (Linnane et al., 1997). Este método mejora el porcentaje de supervivencia en el transporte y el estado fisiológico previo a la suelta. En la tabla puede apreciarse que la supervivencia en transporte fue siempre igual o superior al 96% salvo para la suelta 3, en la que los animales permanecieron en seco en la embarcación durante más de una hora.
En el mismo sentido, la suelta en el fondo mediante buceadores, aunque más costoso, evita la depredación en el momento de la liberación que se puede producir si se emplean otros métodos menos costosos en tiempo y dinero pero que provocan una mayor exposición a los predadores por el tiempo que tardan en llegar al fondo, caso de las sueltas desde superficie, o por la desorientación inicial producida si se emplea el método de mangueras sumergidas (Bannister, C.A., 2003).
En conjunto, se ha pretendido evitar la pérdida de individuos por depredación en los primeros momentos post liberación, que en algunos casos se ha demostrado que puede ser muy elevada (Van der Meeren, G.I., 2000).

SUELTA	FECHA	Transporte (Horas)	T° Inicial	T° Final	O_2 Inicial	O_2 Final	TIEMPO EN SECO (min)	N° Individuos soltados	Longitud Total (mm)	% Supervivencia
1	23/03/07	3.5	16	-	12	-	-	522	50.17±3.62	100
2	29/03/07	2.25	15.3	16	13.7	8.1	45	1270	53.14±5.68	100
3	6/07/07	2.5	18.2	19.3	7.8	8	60	976	51.01±4.68	86
4	13/09/07	2.3	16.1	17.3	9.2	8.3	40	928	42.28±3.02	99
5	8/11/07	3	13.8	14.2	11.8	8.5	45	1497	47.33±3.82	100
6	29/11/07	2.25	12.5	13.2	9.8	8.7	50	533	50.91±4.34	100

Tabla 1

BIBLIOGRAFÍA

Agnalt, A.-L., Farestveit, E., Grefsrud, E.S., Kristiansen, M., Jørstad, K.E. (2006). Survival and growth of cultured European lobster (*Homarus gammarus*) juveniles released in different habitats in Southwestern Norway. Journal of Shellfish Research, 25(3): 1069-1077.
Bannister, C.A. (2003). Lobster restocking in the United Kingdom: a review. Crustaceana, 76(4): 455-468.
Linnane, A., Mercer, J., Hickey, D., McGarvey, R. (1997). Transportation survival of cultured juvenile southern rock lobster, *Jasus edwardsii*. Aquaculture, 158: 1-13.
Van der Meeren, G.I. (2000). Predation on hatchery-reared European lobster (*Homarus gammarus*) released in a coastal area in Norway. ICES Journal of Marine Science, 57: 1239-1252.

Autoría: Marcet, P.; Otero, M.; Asela, F.; Fernández, J.; Guerra, A.

Título: Valorización de residuos de efluente de piscifactoría

Congreso: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

Valorización de residuos de efluente de piscifactoría

Marcet, P.[1], Otero, M.[2], Asela[3], Fernández, J.[3] Et Guerra, A.[3]

[1]Área de Edafología. Escuela de Ingeniería Técnica Forestal. Campus de Pontevedra. Universidade de Vigo.
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Resumen

Los efluentes que llegan al mar, procedentes de establecimientos de cultivo en tierra, poseen una alta concentración de nutrientes; su reutilización en los ciclos de cultivo de otras especies animales o vegetales es una alternativa a valorar en piscifactorías marinas en tierra. En sistemas intensivos los residuos proceden del pienso no utilizado por los peces, del pienso digerido y eliminado como heces (compuestos solubles excretados como nitrógeno, fósforo,...). El tratamiento de los vertidos y sus posibilidades de reutilización promueven el desarrollo de sistemas de aprovechamiento del particulado fino del efluente (preengorde de especies de moluscos), así como del grueso para compostaje y uso agrícola-forestal, mediante su valorización (regeneración de áreas degradadas). En este trabajo se caracteriza el lodo con vistas a sus posibilidades para uso agrícola-forestal.

Material y métodos

- Toma de muestras de lodos decantados, filtrado y preparación para análisis
- Caracterización físico-química y microbiológica de los lodos
- Pruebas de compostaje de lodos con materia complementaria

Caracterización de los lodos

Tabla. Caracterización particulado efluente grueso

PARÁMETROS								
Humedad %	88,7 ± 0.7	NH4 (mg/kg)		5,28 ±0.7	Metales pesados (mg/kg) materia seca	Hg	0,093 ± 0.01	16
pH	7,56 ± 0.04	NO3 (mg/kg)		2,61 ± 0.3		Cd	1,21 ± 0.	20
% C	16,94 ± 0.5	Cl (g/Kg)		171,5 ± 14,8		Cr	53,26 ± 10	1000
% N	2,59 ± 0.08	Conductividad ms/cm		50,55 ± 1.6		Ni	29,67 ± 0.6	300
% Mat. Orgánica	33,8 ± 1	% sales		3,25 ± 0.03		Pb	34,95 ± 0.8	750
C/N	6.38 ± 1	Patógenos	Salmonella (ufc/100 ml)	Ausencia		Zn	718,8 ± 43	2500
PO4 (mg/kg)	550,0±27,4 (0,05%)		E.coli (ufc/100 ml)	0		Cu	68,67± 3,24	1000

Valor límite (mg/kg)

Conclusiones

A pesar del carácter salino de este lodo, en conjunto se considera un material válido para ser utilizado en tareas de recuperación de suelos degradados, tratando de reducir su humedad, aumentar relación C/N reducir su contenido en sales, todo ello posible a través del proceso de compostado con materia complementaria.

Agradecimientos

Este trabajo está financiado por la Junta Nacional Asesora de Cultivos Marinos (JACUMAR) dentro del Plan Nacional " Reutilización de las aguas de vertidos de los establecimientos de cultivos marinos y auxiliares ubicados en zona terrestre".

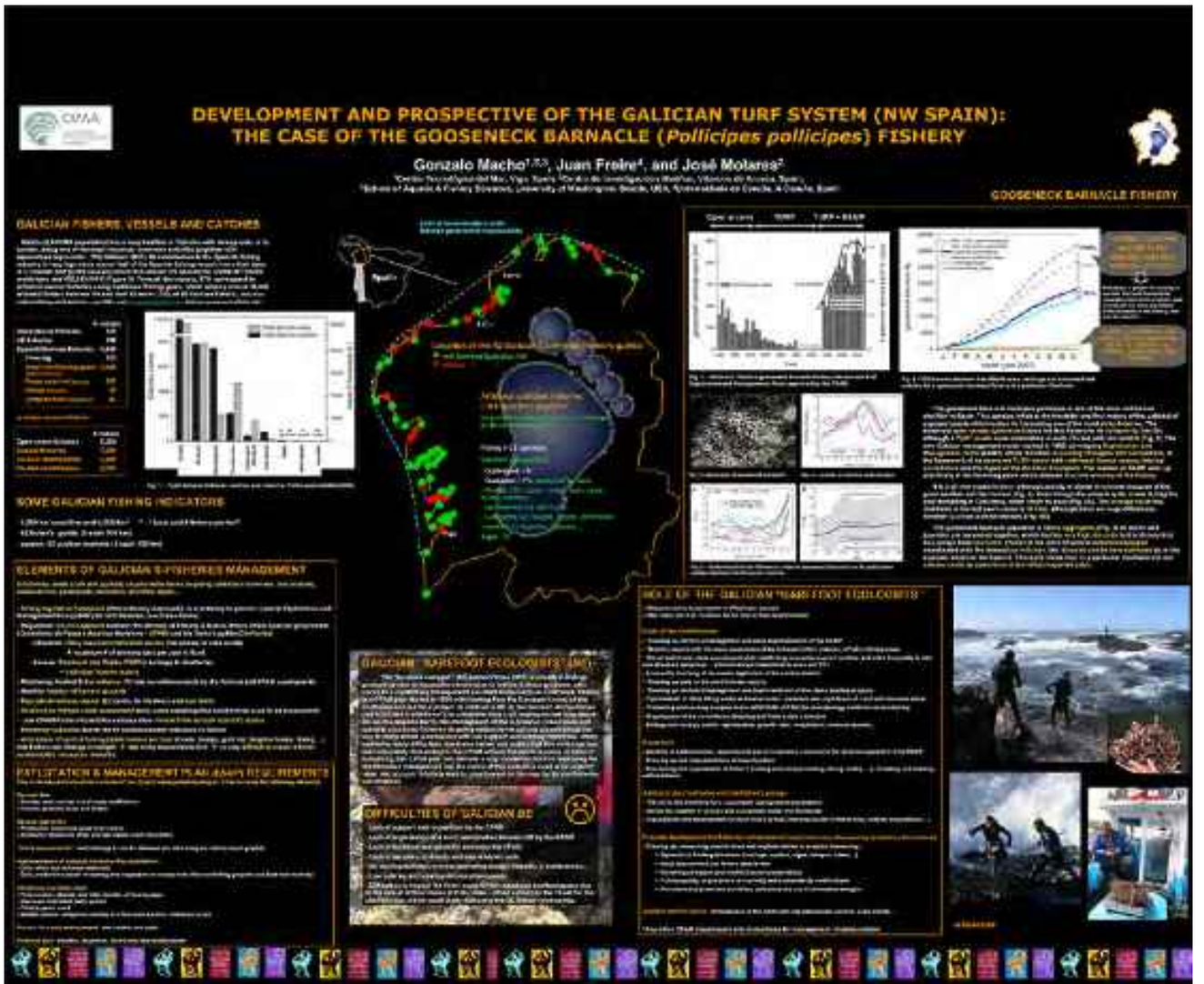
Autoría: Macho, G.; Freire, J.; Molares, J.

Título: Development and prospective of the Galician turf system (NW Spain): The case of the gooseneck barnacle (*Pollicipes pollicipes*) fishery

Evento: The Seventh William R. and Lenore Mote International Symposium in Fisheries Ecology

Lugar: Sarasota - Florida (EE. UU.)

Ano: 2008


DEVELOPMENT AND PROSPECTIVE OF THE GALICIAN TURF SYSTEM (NW SPAIN):
THE CASE OF THE GOOSENECK BARNACLE (Pollicipes pollicipes) FISHERY
Gonzalo Macho[1,2], Juan Freire[1], and José Molares[2]
GOOSENECK BARNACLE FISHERY
GALICIAN FISHERS, VESSELS AND CATCHES
SOME GALICIAN FISHING INDICATORS
ELEMENTS OF GALICIAN S-FISHERIES MANAGEMENT
EXPLOITATION & MANAGEMENT PLAN (MAIN FEATURES)
GALICIAN "BAREFOOT ECOLOGISTS" (BE)
DIFFICULTIES OF GALICIAN BE
ROLE OF THE GALICIAN "BAREFOOT ECOLOGISTS"

Autoría: Guerrero, S.; Cremades, J.; Salinas, J.M.; Ocaña, S.; Fuertes, C.; Sanmartín, J.J.; Devesa, S.; Muiños, A.; Pallarés, A.

Título: Desarrollo de experiencias de cultivo multitrófico integrado aplicables a la acuicultura marina gallega

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

DESARROLLO DE EXPERIENCIAS DE CULTIVO MULTITRÓFICO INTEGRADO APLICABLES A LA ACUICULTURA MARINA GALLEGA

Guerrero¹, S.; Cremades¹, J.; Gómez², J.M.; Cuiñas², S.; Fuentes², C.; Salgado², J.J.; Devesa², S.; Muñoz², A. & A. Peteiro¹

INTRODUCCIÓN Y OBJETIVOS

Dentro del proyecto "Acuicultura Integrada: desarrollo de experiencias de cultivos multitróficos (2005-2007)" que forma parte del Plan Nacional de Cultivos Marinos (ACUIMAR), coordinado por la Secretaría General de Pesca Marítima del Ministerio de Medio Ambiente y Medio Rural y Marino y las distintas Comunidades Autónomas participantes, en Galicia (según las palabras "una serie de experiencias que se desarrollan a continuación. El objetivo de las mismas es la puesta a punto de distintas fases de acuicultura multitrófica integrada con vistas a garantizar en el futuro la rentabilidad de la acuicultura marina, minimizando su posible impacto ambiental y buscando otras soluciones.

EXPERIENCIAS EN TIERRA

PUNTA MORERAS S.L.

AQUACRIA PROIBA S.L.

Biofiltración de los efluentes del efluente de una planta de cultivo de rodaballo en sistema abierto con cultivos filtradores (almeja), invertebrados sedimentívoros (sipuncúlidos) y macroalgas alimenticias (Codium spp., Ulva spp., Gracilaria spp. y Chaetomorpha spp.)

Beneficios de la integración:

- Mejora de la calidad del agua del efluente por la retirada de CO_2 y nutrientes tanto disueltos como en suspensión.
- Aumento y diversificación de la producción asociada de la planta.

Evaluación de los resultados y de los beneficios de la integración:

Para ver de forma conjunta los distintos beneficios y analizar conjuntamente del agua antes y después de pasar por el biofiltro.

ESQUEMA DE LA INSTALACIÓN Y DE LA EXPERIENCIA DE CULTIVO

DESCRIPCIÓN DE LA EXPERIENCIA

Incorporación de un cultivo de macroalgas alimenticias (Saccharina latissima) a un circuito cerrado de producción de rodaballo y renegado

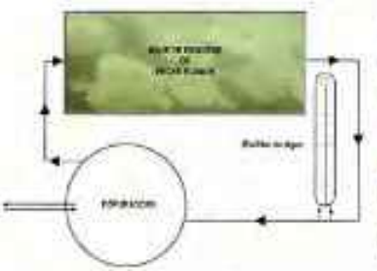
Beneficios de la integración:

- Mejora de la oxigenación del agua por la retirada del circuito de CO_2 y nutrientes disueltos.
- Aumento y diversificación de la producción asociada de la planta.

Evaluación de los resultados y de los beneficios de la integración:

Para ver de forma conjunta los resultados y analizar conjuntamente del agua antes y después de pasar por el biofiltro.

ESQUEMA DE LA INSTALACIÓN Y DE LA EXPERIENCIA DE CULTIVO



DESCRIPCIÓN DE LA EXPERIENCIA

EXPERIENCIAS EN MAR

Cultivo en mar abierto del alga alimenticia *Saccharina latissima* cosechado a balsas de engorde y jaulas de cultivo de peces (rodaballo)

Consorcio PORTO MUIÑOS

Beneficios de la integración:

Mejora de la calidad del agua por la reducción de la eutrofización y retirada de CO_2 disuelto.

Aumento y diversificación de la producción asociada del polígono.

MARICULTURA S.A.

ESQUEMA DE LAS INSTALACIONES Y DE LAS EXPERIENCIAS DE CULTIVO

DESCRIPCIÓN DE LA EXPERIENCIA

Autoría: Alcalde, A.; Conde, M.L.; de Coo, A.; Crespo, J.A.; Fariña, J.; Fernández, A.; García, A.; García, J.; Poza, G.; Santos, I.

Título: Depredadores asociados a bancos naturais e parques de cultivo de moluscos bivalvos. A opinión do sector extractivo e cultivador galego

Evento: XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2008

DEPREDADORES ASOCIADOS A BANCOS NATURAIS E PARQUES DE CULTIVO DE BIVALVOS. A OPINIÓN DO SECTOR EXTRACTIVO E CULTIVADOR
Alcalde Creo, Ana (1); Conde Varela, Mª Lourdes (2); De Coo Martin, Alberto (3); Crespo Lorenzo Jose Antonio (4); Fariña Iglesias, Juan (3); Fernández Otero, Daniel (4); García Fernández, Antonio (3); García Gaido Javier (5); Poza Chaves Graciela (6); Santos Piñeiro, Ignacio (3);
(1) Confradía de Vilasoán; (2) Confraría de Carril; (3) CIMA; (4) Aquarium Galicia; (5) Confraría de Ribeiro; (6) Confraría da Illa de Arousa e OPP-20
INTRODUCCIÓN
ENQUISA + ENTREVISTAS
RESULTADOS
Bivalvos afectados e niveis de depredación
Medidas de Protección e Prevención
CONCLUSIÓNS PROVISIONAIS
CIMA
acquarium galicia

Autoría: Rodríguez, R.; Iglesias, D.; Ruiz, M.; López, C.

Título: Digenean trematodes affecting razor clam *Solen marginatus* populations from Galicia (NW Spain) natural beds

Evento: XIVth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Praga (República Checa)

Ano: 2009

DIGENEAN TREMATODES AFFECTING RAZOR CLAM *SOLEN MARGINATUS* POPULATIONS FROM GALICIA (NW SPAIN) NATURAL BEDS

R. Rodriguez[1], D. Iglesias[2], M. Ruiz[1] and C. López[1]

INTRODUCTION

Natural populations of the razor clam *Solen marginatus* are a resource for shellfisheries in Galicia (NW Spain), especially when the cultures of other razor clam's more valued become low. Few pathological aspects of this species have been studied until now, nevertheless were important parasites like the protozoan *Marteilia* sp. have been recorded affecting *S. marginatus*. A pathological survey is being performed in the area to establish baseline data to assess the razor clam's health status.

MATERIAL AND METHODS

During 2008, a total of 880 razor clams were collected in different periods of the year from six natural populations along the coast of Galicia (NW Spain), and processed using classical histological techniques. Digenean metacercariae were collected by squeezing the flesh between two large glass of slides and examinated under a stereomicroscope. Encysted metacercariae were isolated using a sharp pin. Cysts diameter were measured and the number of collar spines was also counted when possible, using phase contrast microscopy.

RESULTS AND DISCUSSION

The analysis of histological slices revealed the presence of different stages of digenean trematode larvae using *S. marginatus* as intermediate host. Razor clams act as first intermediate host of unidentified digenean sporocysts that were detected particularly in gonad (Fig. 1) and less commonly in gill and kidney of specimens from three natural populations. Prevalence (mean population ± 2 S.E.) and intensity of infection were very low and severe damage was not observed.

Encysted metacercariae were seen embedded in the connective tissue of the visceral mass (in regions near digestive gland and gonad (Fig. 2), gill (Fig. 3) and foot of mollusks from four natural beds. In one of this beds metacercariae were also detected encysted in pericardial glands (Fig. 4). Diameter of cysts (measured in histological sections) ranged from 106 to 247 µm. In general, prevalence and intensity of infection by metacercariae were low (mean prevalence 18 % ± 3.2; cysts per histological section) with the exception of those detected encysted in pericardial glands, where they reach epidemic levels (mean prevalence 88.6 %), quite high intensities (1-36 cysts per section; mean 12,4 cyst per section) and some inflammatory host reaction was detected (Fig. 4).

Histological sections are not the best tool to identify metacercarian cysts, but the broad range of cysts diameter and the variety of macrostructure observed inside the hosts suggests that several different digenean species (probably belonging to Echinostomatidae, Renicolidae and/or Psilostomidae (Lauckner 1983)) could be using *S. marginatus* as second intermediate host. In late location of metacercariae could partly ascertain their taxonomic position but it was only possible to obtain cysts from the pericardial glands because metacercarial infections in other organs had very low prevalences.

Live encysted metacercariae isolated from pericardial glands (Fig. 5) were spherical with cysts measuring 152.4 ± 19.6 µm (mean ± SD; n= 102) in diameter. It was possible to count the number of collar spines in 33 metacercariae. It was observed a 23-spined circumoral collar ventrally interrupted, bearing 27 spines disposed in a single row around the cephalic region, with 3 additional angle spines on each collar corner (Fig. 6). Cyst diameter, number and arrangement of collar spines agree well with previous descriptions of metacercariae of the genus *Curtuteria* (Echinostomatidae Himasthlinae) also affecting cockle *Cerastoderma edule* (Deslaux et al. 2006; Russell-Pinto et al. 2006). Nevertheless, further studies are needed to conclude their taxonomic position.

Bower et al. (1994) reported that most species of Echinostomatidae infecting marine bivalves were relatively non-pathogenic, but they have been shown to reduce growth and survival in bivalves with a heavy parasite load (Lauckner 1983). Metacercarial infections detected with low intensities in visceral mass, gill and foot of *Solen marginatus* probably cause little or no negative effect on the host. Nevertheless, high intensities of infection detected in pericardial glands causing inflammatory lesions in such an organ with vital functions as the heart-kidney system (Lukes et al. 1993) could cause disease. This could then could even have a great significance at population level due to the high prevalence detected. Pathogenicity must be further assessed.

REFERENCES

Bower, S. M., McGladdery, S.E., Price, I.M., 1994. Synopsis of infectious diseases and parasites of commercially exploited shellfish. Annual Review of Fish Diseases, 4: 1-199.

Deslaux D., Russell-Pinto F., Montiel-Soulin X., Bachelet G. 2006. First record and description of metacercariae of *Curtuteria australis* n. sp. (Digenea: Echinostomatidae) parasite of cockles *Cerastoderma edule* (Mollusca: Bivalvia) in Arcachon Bay, France. J. Parasitol., 92(3): 578-587.

Jokela, J., Uotila, L., Taskinen, J. 1993. Effects of the castrating trematode parasite *Rhipidocotyle fennica* on energy allocation of host freshwater clam *Anodonta piscinalis*. Functional Ecology, 7: 333-338.

Lauckner G., 1983. Diseases of Mollusca: Bivalvia. In: Diseases of Marine Animals. Vol. II. O. Kinne (Eds.). Biologische Anstalt Helgoland, Hamburg, pp. 477-961.

Russell-Pinto F., Gonçalves J.F., Esteves E.2006. Digenean larvae parasitizing *Cerastoderma edule* (Bivalvia) and *Nassarius reticulatus* (Gastropoda) from Ria de Aveiro, Portugal. J. Parasitol., 92(2): 319-332.

ACKNOWLEDGEMENTS

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

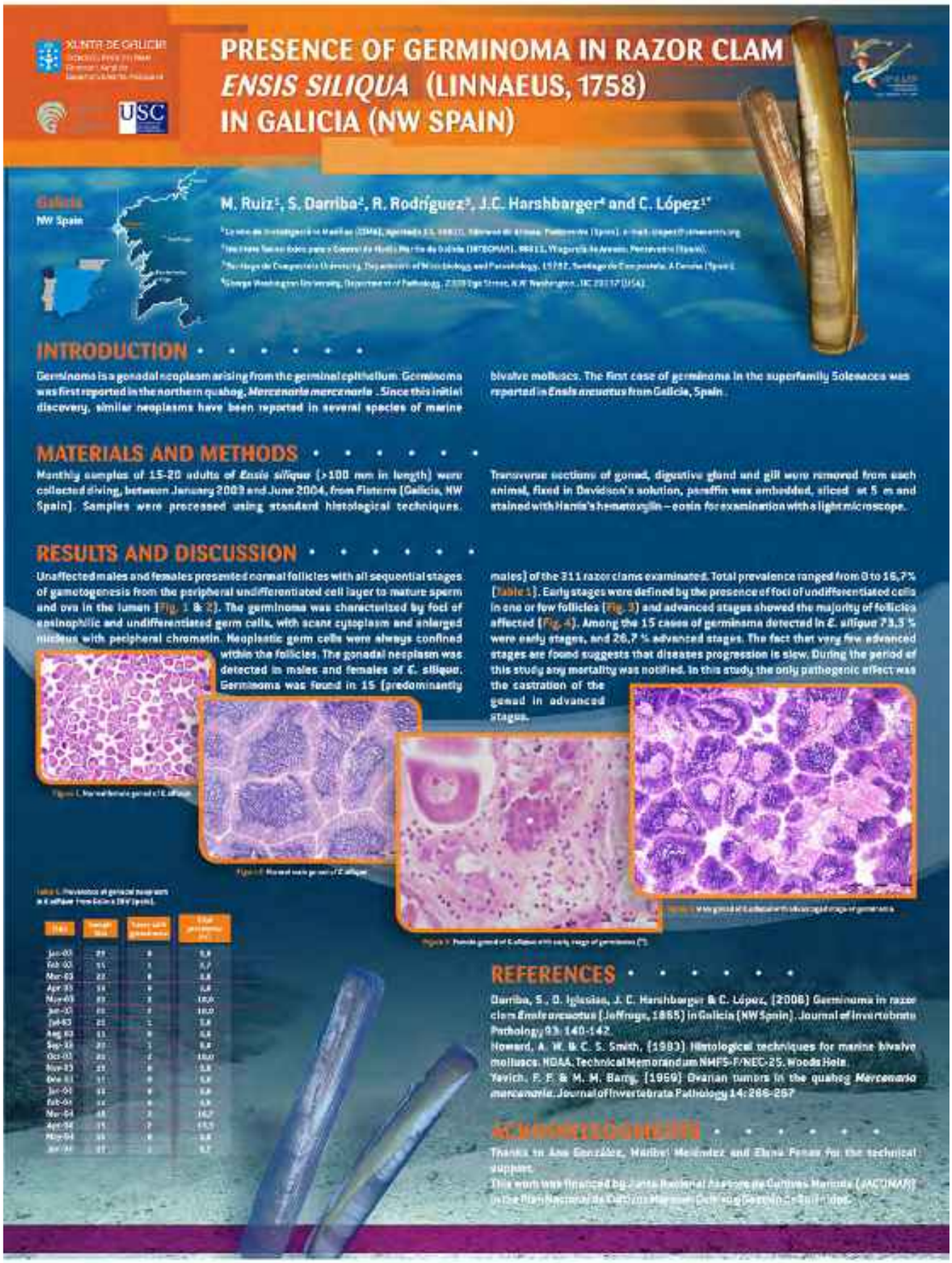
Autoría: Ruiz, M.; Darriba, S.; Rodríguez, R.; Harshbarger, J.C.; López, C.

Título: Presence of germinoma in razor clam *Ensis siliqua* (Linnaeus, 1758) in Galicia (NW Spain)

Evento: XIVth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Praga (República Checa)

Ano: 2009



PRESENCE OF GERMINOMA IN RAZOR CLAM *ENSIS SILIQUA* (LINNAEUS, 1758) IN GALICIA (NW SPAIN)

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INTRODUCTION

Germinoma is a gonadal neoplasm arising from the germinal epithelium. Germinoma was first reported in the northern quahog, *Mercenaria mercenaria*. Since this initial discovery, similar neoplasms have been reported in several species of marine bivalve molluscs. The first case of germinoma in the superfamily Solenacea was reported in *Ensis arcuatus* from Galicia, Spain.

MATERIALS AND METHODS

Monthly samples of 15-20 adults of *Ensis siliqua* (>100 mm in length) were collected diving, between January 2003 and June 2004, from Fisterra (Galicia, NW Spain). Samples were processed using standard histological techniques. Transverse sections of gonad, digestive gland and gill were removed from each animal, fixed in Davidson's solution, paraffin was embedded, sliced at 5 m and stained with Harris's hematoxylin – eosin for examination with a light microscope.

RESULTS AND DISCUSSION

Unaffected males and females presented normal follicles with all sequential stages of gametogenesis from the peripheral undifferentiated cell layer to mature sperm and ova in the lumen (Fig. 1 & 2). The germinoma was characterized by foci of eosinophilic and undifferentiated germ cells, with scant cytoplasm and enlarged nucleus with peripheral chromatin. Neoplastic germ cells were always confined within the follicles. The gonadal neoplasm was detected in males and females of *E. siliqua*. Germinoma was found in 15 (predominantly males) of the 211 razor clams examinated. Total prevalence ranged from 0 to 16,7% (Table 1). Early stages were defined by the presence of foci of undifferentiated cells in one or few follicles (Fig. 3) and advanced stages showed the majority of follicles affected (Fig. 4). Among the 15 cases of germinoma detected in *E. siliqua* 73,3 % were early stages, and 26,7 % advanced stages. The fact that very few advanced stages are found suggests that diseases progression is slow. During the period of this study any mortality was notified. In this study the only pathogenic effect was the castration of the gonad in advanced stages.

Figure 1. Normal female gonad of *E. siliqua*.

Figure 2. Normal male gonad of *E. siliqua*.

Figure 3. Female gonad of *E. siliqua* with early stage of germinoma (*).

Figure 4. Male gonad of *E. siliqua* with advanced stage of germinoma.

Table 1. Prevalence of gonadal neoplasm in *E. siliqua* from Galicia (NW Spain).

Date	Sample size	Razor clam germinoma	Total prevalence (%)
Jan-03	29	0	0,0
Feb-03	15	1	6,7
Mar-03	22	0	0,0
Apr-03	14	0	0,0
May-03	22	1	10,0
Jun-03	20	2	10,0
Jul-03	21	1	5,0
Aug-03	11	0	0,0
Sep-03	22	1	5,0
Oct-03	20	2	10,0
Nov-03	23	0	0,0
Dec-03	11	0	0,0
Jan-04	14	0	0,0
Feb-04	14	0	0,0
Mar-04	15	2	16,7
Apr-04	15	2	13,3
May-04	15	0	0,0
Jun-04	17	1	5,7

REFERENCES

Darriba, S., D. Iglesias, J. C. Harshbarger & C. López, (2008) Germinoma in razor clam *Ensis arcuatus* (Jeffreys, 1865) in Galicia (NW Spain). Journal of Invertebrate Pathology 93: 140-142.

Howard, A. W. & C. S. Smith, (1983) Histological techniques for marine bivalve molluscs. NOAA, Technical Memorandum NMFS-F/NEC-25. Woods Hole.

Yevich, P. P. & M. M. Barry, (1969) Ovarian tumors in the quahog *Mercenaria mercenaria*. Journal of Invertebrate Pathology 14: 266-267

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Autoría: Parada, J.M.; Molares, J.

Título: ARouSA. Una aplicación en Visual Basic para la evaluación de stocks de bancos marisqueros

Evento: XII Congreso Nacional de Acuicultura

Lugar: Madrid (España)

Ano: 2009

ARouSA. Una aplicación en Visual Basic para la evaluación de stocks de bancos marisqueros

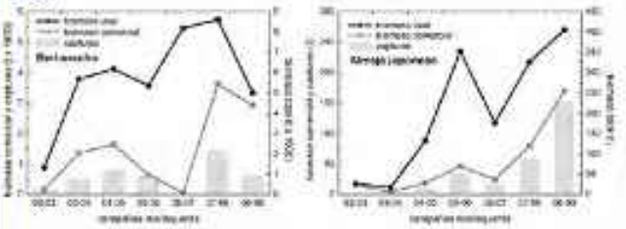
Parada, J.M.[1] y Molares, J.[2]

Origen y objetivos

Desde 2002 el CIMA y el CETMAR vienen desenvolviendo, por encargo de la Consellería do Mar el "Plan de actuación para la recuperación de los bancos marisqueros Lombos do Ulla y O Bohído (Ría de Arousa)". En el ámbito del proyecto se ha desarrollado una serie de procedimientos técnicos para el análisis del stock de los bancos marisqueros, que facilitan la recogida de los datos necesarios para el asesoramiento en formatos homogéneos y compartibles. La aplicación ARouSA recopila parte de estos procedimientos para dar respuesta a la demanda de convergencia metodológica por parte de los técnicos de las cofradías de pescadores y de la propia Administración, permitiendo su empleo en la evaluación de stocks, su análisis y la elaboración de informes.

Algunos resultados

Las evaluaciones de stock realizadas con ARouSA en el banco marisquero de Lombos do Ulla (Ría de Arousa) han arrojado unas estimaciones satisfactorias, en cuanto a concordancia entre el stock comercial estimado previamente al inicio de cada campaña extractiva y las capturas obtenidas en cada una de ellas.



Interacción con otras aplicaciones

Cada uno de los análisis permite la emisión de un informe estándar en formato Excel o html que posibilita el tratamiento posterior de los resultados numéricos y gráficos con otras aplicaciones.

Los resultados de cálculos de stock y de la herramienta de corrección de la batimetría pueden ser exportados a herramientas de interpolación espacial.

Referencias

Elliot, J., M. 1967. *Freshwater Biological Association. Scientific Publication.* 25: 1-160.

Krebs, C., J. 1998. Addison. Wesley Longman. Menlon Park. 320 pp.

Parada, J., M. y Molares, J. 2008. *Revista de Biología Marina y Oceanografía.* 43(3): 501-511.

Núcleo de la aplicación

La aplicación está basada en Visual Basic para Excel (Microsoft Office 2003) y permite realizar dos tipos de cálculos de stock. El primero para poblaciones distribuidas en agregados, a partir de muestreos grandes (n>30) o pequeños (n<30) (Elliott,1967), y el segundo toma los resultados del primero como pertenecientes a estratos homogéneos de un banco, para incluirlos en el procedimiento específico de muestreos estratificados (Elliott, 1967; Krebs, 1999).

Para cada especie en cada estrato o en el conjunto del banco se obtiene, con un intervalo de confianza del 95%, estimaciones de densidad, peso por unidad de superficie y peso total, para cada clase de talla, así como para el conjunto del stock, el stock de talla comercial y el no comercial.

Otras herramientas incluidas

- Cálculo, comparación y almacenamiento de regresiones talla-peso.
- Cálculo de tasas de mortalidad natural y por pesca para cohortes predefinidas (Parada y Molares, 2008).
- Análisis de poblaciones virtuales, que permite realizar inferencias sobre la evolución de una población o una cohorte en el tiempo.
- Corrección de datos batimétricos en función de la altura de la marea y la presión atmosférica.

Uso libre

La aplicación desarrollada puede descargarse en http://sites.google.com/site/arousa09 y es de uso libre por personas, instituciones o entidades para actividades sin ánimo de lucro.

Se agradecerá la comunicación de referencias de trabajos en los que se haya empleado la herramienta ARouSA.

Contacto

arousa2009@gmail.com

CETMAR 1.- Centro Tecnológico del Mar

CIMA 2.- Centro de Investigación Mariñas (Xunta de Galicia)

XII Congreso Nacional de Acuicultura. Madrid, 24-26/XI/09

Autoría: Marcet, P.; Guerra, A.; Otero, M.; González, S.

Título: Compostaje de lodos residuales procedentes del cultivo de rodaballo: Aplicación en un suelo degradado

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2009

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Compostaje de lodos residuales procedentes del cultivo de rodaballo: Aplicación en un suelo degradado

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RESUMEN

El compostado de lodos procedentes de explotaciones piscícolas se convierte en la mejor opción frente a la eliminación de los mismos, de este modo los lodos dejarían de ser un problema económico y sanitario cuando se les atribuye un valor y un destino.
El objetivo de este trabajo es evaluar la idoneidad de los lodos de piscifactoría compostados como sustituto de todo o en parte de la fertilización inorgánica y sus efectos sobre el suelo.
Para ello se estudia la evolución de las propiedades químicas del suelo en función de los distintos tratamientos y dosis de compost. También se lleva a cabo una evaluación de la tasa de mineralización del nitrógeno con los diferentes tratamientos aplicados.
Lodos procedentes de efluente de la granja de rodabello Insuiña S.L. (O Grove, Pontevedra).

MATERIAL Y MÉTODOS

- Determinación de un estructurante sólido (serrín de pino) debido al carácter líquido del lodo para la obtención del compost. Una vez obtenido, inoculado de lombrices (vermicompost).
- Ensayo de aplicación del vermicompost a un suelo procedente de una cantera.

Efluente de piscifactoría

Proceso de compostaje de lodo con serrín de Pinus pinaster y vermicompostaje

Suelo degradado utilizado procedente de la explotación de una cantera

RESULTADOS

	Conductividad	%N	C/N	% Materia	NH4+ (mg/kg)	NO3- (mg/kg)	PO4- (mg/kg)
Suelo	16,17 µS	0.07	0.071	0.086	9.5	6.3	0.27
Compost	4.78 ms	0.08	37.5	62	101.1	115.6	443.1
Lodo	50,5 mS	2.59	6.38	33.8	5.2	2.51	550

AGRADECIMIENTOS

Este trabajo ha sido financiado por la Junta Nacional Asesora de Cultivos Marinos (JACUMAR) dentro del Plan "Reutilización de las aguas de los vestidos en los establecimientos de cultivos marinos y auxiliares ubicados en la zona terrestre".

Autoría: Otero, M.; Bua, I.; Guerra, A.

Título: Crecimiento y producción de tres especies de almejas procedentes de diferentes sistemas de preengorde

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2009

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Crecimiento y producción de tres especies de almejas procedentes de diferentes sistemas de preengorde

Otero, M., Bua, I. & Guerra, A.
Centro de Investigacións Mariñas (CIMA). Pedras de Corón, s/n. Apdo 13. 36620 Vilanova de Arousa. Pontevedra.

RESUMEN

En la zona litoral de la Comunidad Autónoma de Galicia más de 4.600 personas ejercen la actividad del marisqueo (recolectores de mariscos), de las cuales 4.190 son mujeres -mariscadoras-, con una producción anual alrededor de 10.000 t. De instalaciones de preengorde procede la semilla que se siembra (repuebla) en parques de cultivo o bancos naturales para complementar y reforzar la producción natural y recuperar nuevas zonas de producción. El objetivo es doble, el crecimiento y producción de semilla de tres especies de almeja sembradas en substrato de parque de fondo y por otra parte determinar si el sistema de preengorde previo usado introduce algún factor en el rendimiento posterior de la siembra.

Playa da Aduana Corón (Vilanova de Arousa)

MATERIAL Y MÉTODOS

Semilla de tres especies, almeja babosa (*Venerupis pullastra*), almeja fina (*Ruditapes decussatus*) y almeja japonesa (*Ruditapes philippinarum*) preengordada en dos sistemas diferentes de cultivo, con talla inicial Ts (7-9 mm).
Zona intermareal ubicada en las inmediaciones del CIMA en 6 parcelas de 1m², playa da Aduana (Corón).

Muestreos iniciales (septiembre 2008) y finales (octubre 2009) para longitud (mm), peso (g) y tasa de crecimiento.

RESULTADOS

Babosa

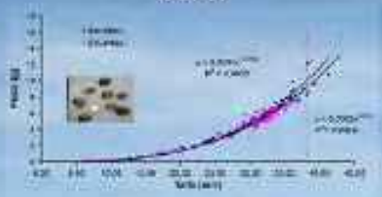


Fig.1- Relación talla/peso A.babosa

Fina

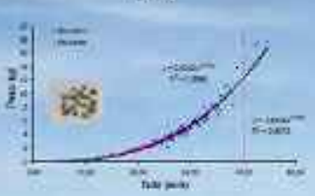


Fig.2- Relación talla/peso A.fina

Japonesa

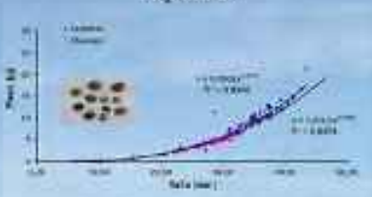


Fig.3- Relación talla/peso A. japonesa

Tabla. Longitudes, pesos e índices de crecimiento

		Días de cultivo	L_t (mm) std	L_t (mm) std	Gr (L)	P (g) std	P_t (g) std	Gr (P)
Semillero	Babosa	364	9,25 1,39	21,00 3,05	0,101	0,120 0,052	0,624 2,522	0,223
	Fina		8,53 0,99	28,73 3,56	0,160	0,130 0,038	4,781 1,888	0,207
	Japonesa		7,69 1,27	33,95 2,78	0,120	0,111 0,039	0,787 2,373	0,309
Efluente	Babosa	364	9,432 1,026	20,999 2,711	0,265	0,101 - 0,053	4,781 7,189	0,804
	Fina		8,499 0,998	32,806 3,888	0,286	0,044 0,008	3,874 1,377	0,836
	Japonesa		6,913 0,997	31,474 3,183	0,265	0,077 0,023	4,206 1,348	0,840

CONCLUSIÓN

La evolución del crecimiento en las tres especies es similar independientemente del origen del sistema de preengorde.

AGRADECIMIENTOS

Este trabajo ha sido financiado por la Junta Nacional Asesora de Cultivos Marinos (JACUMAR) dentro del Plan "Reutilización de las aguas de los vertidos en los establecimientos de cultivos marinos y auxiliares ubicados en la zona terrestre".

XII FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS, 2009

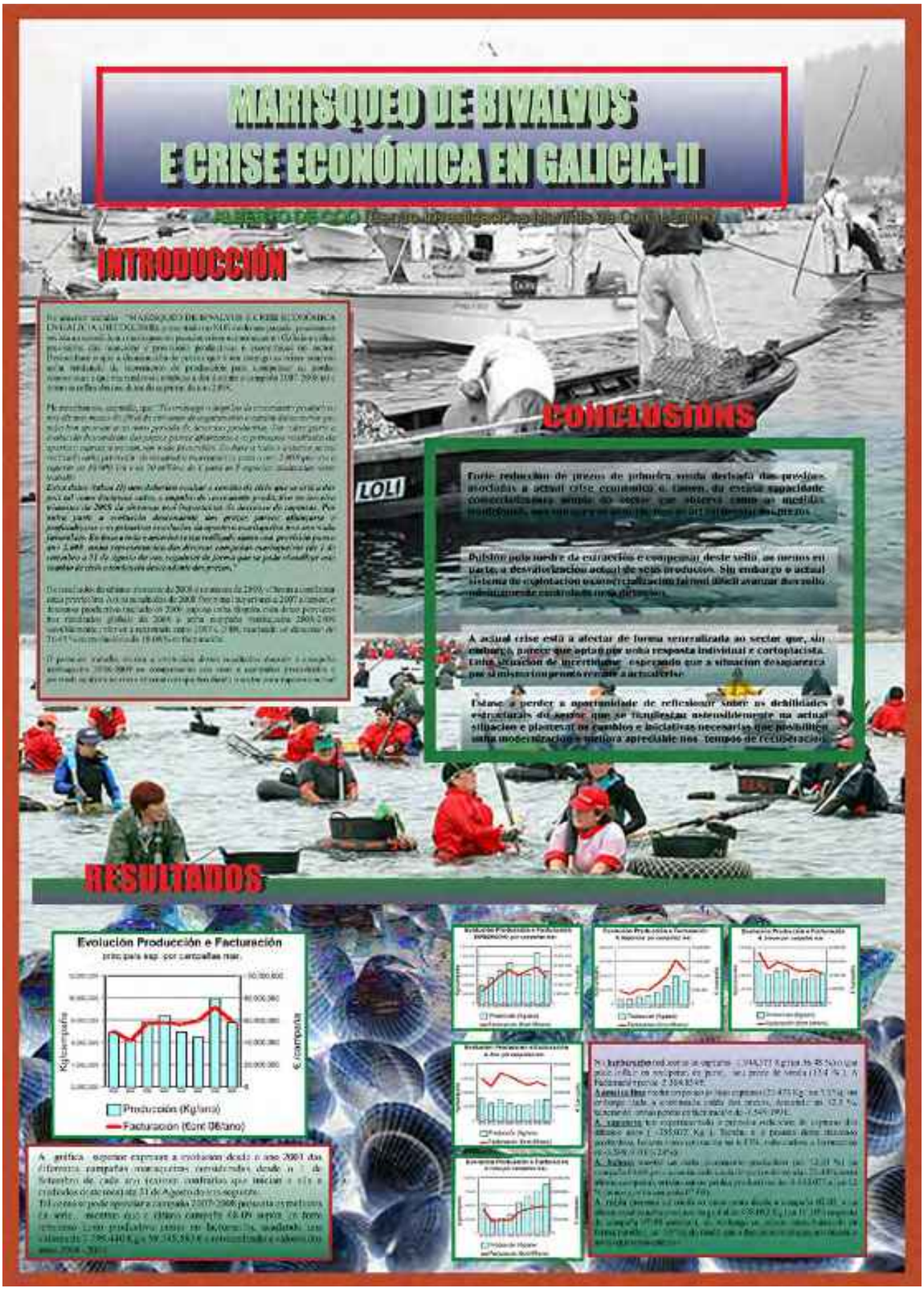
Autoría: de Coo, A.

Título: Marisqueo de bivalvos e crise económica en Galicia II

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2009


MARISQUEO DE BIVALVOS
E CRISE ECONÓMICA EN GALICIA-II
INTRODUCCIÓN
CONCLUSIONS
Forte reducción de prezos de primeira venda derivada das prácticas asociadas a actual crise económica e, tamen, da escasa capacidade comercializadora simple do sector que observa como as medidas modelando, [illegible] prezos.
Pulsión pola medre da extracción e compensar deste sello, ao menos en parte, a desvalorización actual de seus produtos. Sin embargo o actual sistema de explotación [illegible] difícil avanzar [illegible].
A actual crise está a afectar de forma generalizada ao sector que, sin embargo, parece que optan por unha resposta individual e cortoplacista. Unha situación de incertidume esperando que a situación desaparezca por si mismo [illegible] a actual crise.
Estase a perder a oportunidade de reflexionar sobre as debilidades estructurais do sector que se [illegible] na actual situación e plantear os cambios e iniciativas necesarias que posibiliten unha modernización e melhora apreciable nos tempos de recuperación.
RESULTADOS
Evolución Producción e Facturación
Kg/campaña
€/campaña
Producción (Kg/ano)
Facturación (€cent 06/ano)

Autoría: Santamaría, I.; Fernández, M.; Otero, M.; Guerra, A.

Título: Relaciones biométricas en la oreja de mar en zonas de producción natural de la Ría de Vigo (España)

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2009

XUNTA DE GALICIA
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Haliotis tuberculata

RELACIONES BIOMÉTRICAS EN LA OREJA DE MAR EN ZONAS DE PRODUCCIÓN NATURAL DE LA RIA DE VIGO (España)

Santamaría, L.; Fernández, M.; Otero, M.; Varela, M.; Cuenta, A.

Resumen

Para el control de un recurso pesquero es necesario su conocimiento. Para ello se realizan muestreos de las poblaciones que en el caso de la oreja de mar implican el sacrificio de los individuos. El objetivo es aportar datos biométricos de las poblaciones naturales, que sirvan como herramienta para facilitar su control "in situ", en definitiva permitir la gestión y sostenibilidad de la explotación de la pesquería de oreja.

Material y métodos

Situación: Los muestreos se realizaron en la costa de la Isla Norte de las Illas Cíes (Ría de Vigo).
La captura: se realizo mensualmente por buceadores profesionales en barcos submarineles.
Mediciones: en el laboratorio se tomaban los datos biométricos (longitud, ancho, peso) de 20 individuos por muestreo. Los datos fueron tomados desde febrero 2006 a septiembre 2008. Los primeros meses de muestreo, se tomaron los datos biométricos incluyendo las incrustaciones que aparecían en los ejemplares. A partir de noviembre 2007 se tomaron estos datos eliminando todas estas incrustaciones.

Resultados

- En la **figura 1** se representa la relación del la talla frente al peso de los individuos incluyendo en este último dato las incrustaciones (epibiontes). Las mediciones abarcan de febrero 2006 a octubre 2007.
- En la **figura 2** se representa la relación talla frente a peso de los individuos eliminando las incrustaciones (noviembre 2007 a septiembre del 2008).
- En la **figura 3** se relacionan los dos ejes (largo-ancho).
- En la **figura 4** se relaciona la longitud al peso húmedo de la carne.
- En la **figura 5** se representan los datos de pesos de individuos en épocas de maduración frente a la talla.
- En la **figura 6** se representan el peso de individuos en periodos de reposo frente a la talla.

figura 1

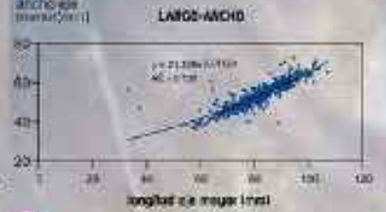
figura 3


figura 5

figura 2

figura 4

figura 6

Conclusiones

Con estas relaciones biométricas, los buceadores, a partir de una serie de parámetros tomados en la zona de muestreo, podrán determinar el estado de la población sin proceder a la extracción física de la muestra.

XII FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS, 2009

Autoría: de Santiago J.A.; Graña, L.; Lampón, V.; Pombal, M.; Pouso, O.; Guerra, A.

Título: Rendimiento de un sistema de preengorde para semilla de almeja, en flujo de invertido y forzado por "air-lift", en un pantalán del recinto portuario de Camariñas (A Coruña)

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2009

XUNTA DE GALICIA
CONSELLERÍA DO MAR

CETMAR

Rendimiento de un sistema de preengorde para semilla de almeja, en flujo de agua invertido y forzado por "air lift", en un pantalán del recinto portuario de Camariñas (A Coruña).

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Resumen

Se presentan los resultados del sistema de preengorde por flujo invertido forzado por "air-lift", en el puerto deportivo de Camariñas (A Coruña), durante un ciclo de producción; éste abarca lotes de semilla de almeja (***Tapes philipinarum*** y ***Veneropiss pullastra***) procedentes del criadero próximo (Tamiz 11 - 1 mm - 2 mm) y con entrada entre 2008 y 2009, que fueron entregadas a lo largo del año 2009 (talla igual superior a 11 mm) después del proceso de preengorde en dicho sistema. La tasa de recaptura osciló entre el 55.6 y el 81.03% para la babosa y la japonesa respectivamente. El tiempo de residencia global en el preengorde, fue de 12 meses. Se hace una proyección, del beneficio bruto que se obtendrá con la semilla una vez sembrada y sulfinada hasta la talla comercial.

Fecha	Especie	Tamiz (1 mm)	Total ud
09/09/2008	A.Babosa	1000	
12/09/2008	A.Japonesa		A.Japonesa 7.254.376
07/10/2008	A.Japonesa		
08/10/2008	A.Japonesa		
06/10/2008	A.Japonesa		
17/10/2008	A.Japonesa		
20/11/2008	A.Japonesa		
23/02/2009	A.Babosa		A.Babosa 2.566.648
12/03/2009	A.Babosa		
08/04/2009	A.Babosa		
20/05/2009	A.Babosa		
		Total	**9.821.024**

Tabla I. Relación de salidas, con fechas y cantidades, de los lotes de semilla al preengorde en el semillero de Camariñas. La semilla que en el criadero quedó retenida en 11, pasa al cultivo exterior.

	A.japonesa	A. Babosa	Total ud.
Vigo	1.386.720	116.653	1.503.373
Pontevedra	400.000		400.000
Arousa	3.103.611	720.214	3.823.825
Muros		176.075	176.075
A Coruña		413.940	413.940
Corcubión	200.000		200.000
Cariño	282.000		282.000
Ares-Betanzos	506.000		506.000
	5.878.331	**1.426.882**	**7.305.213**

Tabla II. Relación de los lotes de semilla entregados para siembra en las rías y fechas que se indica.

Especie	Unidades preengordadas	Unidades sembradas	% Recapt.Final
A.Japonesa	7.254.379	5.878.331	81,03
A.babosa	2.566.648	1.426.882	55,59*
Total	**9.821.027**	**7.305.213**	**74,38**

*Indicar la Recaptura de un mes Para los mes 2009/2010 [illegible]

Tabla III. Rendimiento del sistema de preengorde en función de los porcentajes de recaptura de semilla destinada a siembra.

Especie	Unidades Sembradas	Precio estim. unidad	Total €	% recaptura	Peso Adulto (kg)	Biomasa Produc.	€/kg	Total € Produc.	Beneficio bruto (€)
A.Japonesa (7 meses)	5.878.331	0,0091	53.463	70	0,017	69.952,14	7,96	556.819,30	503.355,61
				50		49.965,81		397.727,88	344.264,46
				30		29.979,49		238.636,73	185.173,30
A.Babosa (6 meses)	1.426.882	0,0096	13.741	70	0,014	13.963,44	11,87	165.963,44	152.242,60
				50		9.088,17		118.559,63	**104.818,75**
				30		5.932,90		71.135,78	57.394,90

Tabla IV. Proyección del beneficio bruto esperado en el engorde, para tres supuestos de tasas de recaptura.

Conclusiones

- El porcentaje de recaptura en el semillero de Camariñas, durante un ciclo de producción, fue del 74.38%, partiendo de tamiz 1000, hasta tamiz 5 y/o 7; en función de la especie es del 81,03% para la almeja japonesa y del 55,59% para la almeja babosa.
- Haciendo una estimación del rendimiento de la inversión inicial en semilla, una vez se cosecha y se vende en lonja, se observa que es rentable para ambas especies, aun en el caso más desfavorable (30% de recaptura).

XII FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS, 2009

Autoría: No-Couto, E.; de Santiago-Meijide, J.A.; Guerra-Díaz, A.

Título: Seguimentos de semente de ameixa procedente de minicriadeiros

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2009

XUNTA DE GALICIA
CONSELLERÍA DO MAR

CIMA

CETMAR

Seguimentos de semente de ameixa procedente de minicriadeiros

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INTRODUCIÓN

Malia os bos resultados que nestes momentos se están a obter a nivel principal obxectivos das unidades modulares de produción de semente de ameixa ou minicriadeiros, dende o CIMA e a D.X. de Desenvolvemento Pesqueiro detectamos que existe un déficit de información sobre algúns aspectos fundamentais para poder avaliar correctamente os rendementos finais e a viabilidade económica da producción, especialmente respecto do tratamento e a evolución experimentada pola semente despois da súa entrega ás entidades asociativas mariscadoras.

NOVA LÍÑA DE TRABALLO

Dende o ano 2009 iniciase unha nova liña de traballo orientada a recoller a *información necesaria para poder solventar esta situación*. Para isto, efectuamos por técnicos técnicos do CIMA, e que precisa da colaboración imprescindible dos técnicos responsables e cotalogando zona da D.X. de Ordenación e Xestión Recursos Mariñas consiste en:

1- A recollución de dadores informativos completos sobre o acontecido con cada unha das partidas de semente, que inclúen:

-Informes exactos e fotográficos das actividades de sementeira: Localización, meteorolóxicas de preenchida e sementeira ut ilizadas, desenvolvemento e resultados. Valoración das axudas e as facilidades logísticas obtenidas.

-Follas de rexistro nas que figuren de xeito pormenorizado as datas e cantidades reais subministradas na entrega de sementes e tamaño mínimo.

-Estudo da evolución das partidas e estimación do rendemento produtivo final de cada unha, a partires de follas de censo con rexistro dos controis de follas mensais e posteriores.

-Cadros-resumo dos plans de explotación desenvolvidos de cada partida de semente, para situar as entregas no contexto produtivo e regulamentario correspondente.

2- A creación e mantemento dun arquivo unificado co obxectivo de que teñamos toda a información precisa para realizar as oportunas valoracións.

Recollida de produto por Pure Seaweed

Instalación de cestas (Illas Cabicesa Grande)

Estado final da cesta no momento da entrega

SEGUIMENTOS NO 2009

Neste ano, a producción de semente entregada ás entidades mariscadoras do concello a principios de marzo e procedente dos minicriadeiros de concellería situados no porto de Carnoxiñas. Ata setembro de 2009 foron entregadas a 16 confrarías un total de 8.930.000 unidades de ameixa xaponesa (*Ruditapes philippinarum* Adams & Reeve, 1850) e o ameixa bastarda (*Venerupis corrugata* Chiaje, 1791) distribuídas en 23 lotes.

A semente foi entregada despois de ser sometida a peneirado en torno 15 ou 12 mm(este no que acada unha lonxitude antero-posterior superior de 9 e 11 mm respectivamente. Con este tipo empregouse tanto a densidade baixa de 50 exemplares/m² como a densidade alta o dobre. Este último foi empregado no subministro ou sobreestocado consistiu en semente depositada directamente en parcelas acondicionadas na area.

Localización das entidades mariscadoras que recibiron semente de ameixa no 2009 (dos seleccionadas)

Illas de Martín e Pinta. Localización dentro bolsa de mexillón e do sementado por banco submarial

Sementeira en parcelas acondicionadas

Propietarios dos polígonos nos "bouchots"

PRIMEIRAS OBSERVACIÓNS

Nas liñas xerais resultados ata setembro foron estes:

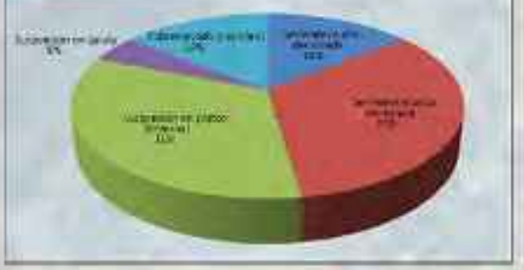
-Considerable variabilidade nas características de peneirado e sementeira empregadas, debido fundamentalmente ás diferentes características físicas do medio no ámbito de cada entidade ou confrarías de crecemento (usuarios) e as procedementos organizativos dos colectivos mariscadores adscritos.

-Alto grado de profesionalización na división das actividades de sementeira por parte dos técnicos dos artesáns mariscadores, producindo todos os casos de densidade empregados aceptablemente, aínda sistema de peneirado en superficie con rede de plano ou garda en barco, sobreestando (positiva) ou de sementeira en zonas acondicionadas.

-As mortalidades naturais de incremento neste tipo de sementeira a baixa densidade e o peneirado en baixa densidade columna de auga os fondos.

- Os resultados de crecementos e supervivencia das ameixas obtida ata o momento consideranse satisfactorios.

TRATAMENTOS INICIAIS REALIZADOS



XII FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RÍAS GALEGAS, 2009

Autoría: Conchas, R.F.; Montes, J.; González, G.

Título: Control de la bonamiosis en Galicia con técnicas de diagnóstico rápido

Evento: XI Congresso Ibérico de Parasitoloxía

Lugar: Lisboa (Portugal)

Ano: 2009

CONTROL DE LA BONAMIOSIS EN GALICIA CON TÉCNICAS DE DIAGNÓSTICO RÁPIDO

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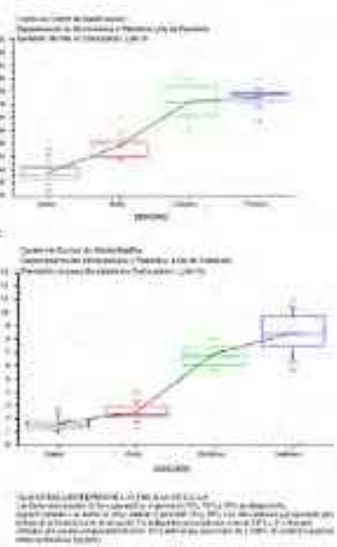

Autoría: Cao, A.; Fernández, S.; Carballal, M.J.; Hermida, M.; Casa, A.; Villalba, A.

Título: Comparative analysis of in vitro cell proliferation rate among several isolates from three *Perkinsus* species (*P. marinus, P. chesapeaki* and *P. olseni*)

Evento: XIVth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Praga (República Checa)

Ano: 2009

COMPARATIVE ANALYSIS OF *IN VITRO* CELL PROLIFERATION RATE AMONG SEVERAL ISOLATES FROM THREE *PERKINSUS* SPECIES (*P. MARINUS*, *P. CHESAPEAKI* AND *P. OLSENI*).

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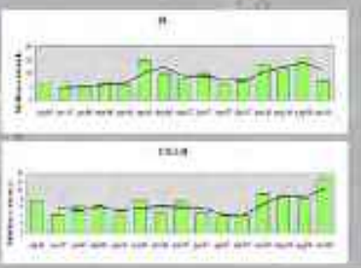
INTRODUCTION

Perkinsus species (Perkinsozoa, Apicomplexa-like protozoans) are parasites of a variety of molluscan species. Far worse than species, such as the eastern oyster *Crassostrea virginica*. *Perkinsus* species infections cause widespread mortality in both cultured and farmed oyster populations, resulting in severe economic losses to the shellfishery, and detrimental effects on the environment [1]. *P. marinus* (Dermo), the most studied of the *Perkinsus* species, causes mortalities in the eastern oysters *Crassostrea virginica* along the Gulf of Mexico and Atlantic coasts of the United States [2]. Overlapping the distribution of *P. marinus* is *P. chesapeaki* [3], which has been found to infect the soft shell clam *Mya arenaria* and has been associated with recent declines in some intertidal stocks [4]. Of the *Perkinsus* species characterized to *P. olseni*, a parasite of the cultivated clam *Ruditapes decussatus* in Portugal and Spain [5].

The development of *in vitro* proliferative cultures of *Perkinsus* species can lead to a better understanding of this genus of parasites [6]. Cultures of the easiest to be cultured species, *P. marinus*, for example, have been used to evaluate a wide range of studies to address the parasite's environmental tolerance, virulence, genetic composition, metabolism and drug resistance [7]. Cultures of the 3 *Perkinsus* spp. have been established from various sources including hearts, mantle, gonad, and haemolymph of eastern oysters, gills and haemolymph of a softshell clam, and gills, kidney, mantle and haemolymph of the Manila clam and fragments of oyster and clams [8].



MATERIALS AND METHODS

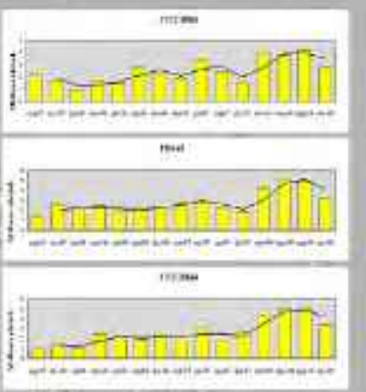
Samples. Two *Perkinsus* isolates were established [10] (USA) from *P. chesapeaki*-infected soft shell clams (ATCC50804, ATCC50805, PRA48) and eighteen *P. olseni* isolates (Pog1F, PRA-31, Pog1-K3, Pog1F, Pattern1, Pattern2, Pattern3, Poly1F, Poly1F, Poly1F, Pog1-B6-A1, Pog1-B6-A2, Pog1-B6-A3, Pog1-B6-A4, Pog1-B6-A5, Pog1-B6-A6, Pog1-B6-C1, Pog1-B6-C2, Pog1-B6-C3, Pog1-B6-C4) were used to analyse in vitro cell proliferation rate (Figure 1). *P. marinus* cultures were established from hearts of infected Crassostrea virginica from Bayou Lacassine (USA). *P. chesapeaki* cultures were established from three oysters (ATCC50806, PRA-49) and *Tapes japonica* (ATCC50807) from Maryland (USA) [9]. *P. olseni* cultures were established from the hemolymph, gill and hypnospores of *Ruditapes decussatus* from Galicia (NW Spain). The growth culture medium JL-ADAM [5] was used to maintain and propagate the isolates in this study (Table 1).

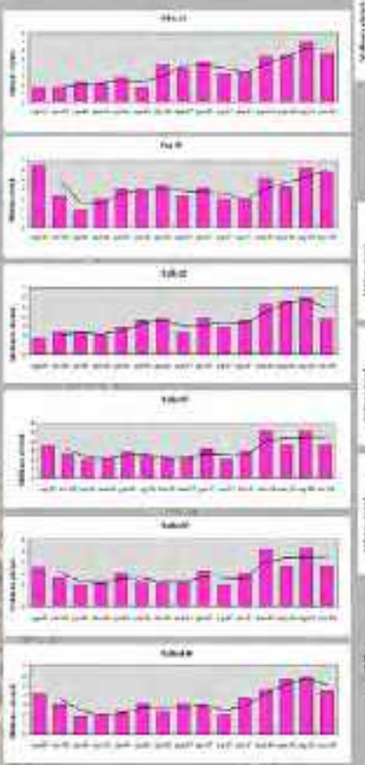
Maintenance of cultures. The cultured tissue have been sub-cultured for 3 years. Sub-culturing was performed every 2-3 months, to analyse any possible seasonal interspecific differences in total cell count, as well as the temporal variation. For sub-culturing, the cells in culture flasks were harvested and passed 3 times through a 23G needle with a 5ml syringe to break up cell aggregates. The cells were placed 5 times in culture medium (5000 x g, 10 min, 25ºC). Cell viability was assessed by staining with acridine red, and the cell concentration was then adjusted to 1 x 10⁶ cells/ml culture medium.

Statistical analysis. Differences in total cell count among isolates from three *Perkinsus* species were tested, as well as differences among *P. olseni* isolates due to tissue source and geographical origin. Temporal variation was also tested. One-way ANOVA with Tukey's post hoc test and T-test were employed for comparisons using SPSS Statistics 17.0 software.

Figure 1. Examples of different stages, spindle and globular, of *Perkinsus olseni* in culture at 25ºC and 5% NaCl.

Table 1. Isolates of different species, tissue and location of *Perkinsus* used to establish *in vitro* cell proliferation rate.





RESULTS AND DISCUSSION

Cells/tissue (cpt) concentrations varied among different species of *Perkinsus*. *P. olseni*, *P. chesapeaki* and *P. marinus* were significant ($F = 56.287$, $P < 0.001$). Tukey's post hoc test found no significant pairwise comparisons ($P > 0.05$). However, it could be concluded that the variation was mainly from different organs and different origins in each species. *P. olseni* clearly grew with more protein deficient medium. It was also evident that the species can tolerate and thrive in relatively large changes in culture conditions. Oysters hearts were used to establish *P. marinus* cultures because the organ is relatively free of mineral and debris and is supposed to be more sterile [10].

Comparisons of the proliferation rate between *P. olseni* isolates with the same geographic origin (Arousa) but deriving from a different organ showed no significant differences ($F = 0.672$, $P = 0.618$). Therefore, tissue used for the isolation is not significant for proliferation rate. However, Casas et al., 2007 found that in *P. olseni* cultures started with hemolymph, the parasite cells began to divide new cells earlier than in cultures established from gills or haemolymph, and that cells from cultures initiated with hemolymph were smaller than cells from cultures initiated from other tissues. Furthermore, the volume of the organelles (vacuoles and the number of dividing cells per cytocentrum) was different depending on the organ source of *P. olseni* culture cells.

Significant differences ($P < 0.001$) were found between *P. olseni* isolates deriving from the same organ (gill or gut) with different geographic origins (Arousa and Villalonga), using a T test. However, the differences might be due to the fact that the isolates from Villalonga were more resistant than those from Arousa. A new strain of tissue has the advantage that sites of infection can be easily located by looking for brown areas and tissue taken with a high parasite load can be selected to initiate cultures. The apparent role of establishing conditions, cultures of *P. olseni* depended crucially on the absence of bacterial contamination because all cultures were initiated from infected clams. Gills, haemolymph and hypnospores of oyster shell stages were used instead of hearts as isolates. In earlier cultures, because the stock host is sacrificed to the isolation, this increasing the chance of microbial contamination.

The variation in cell proliferation rate between different years was significant. However, Tukey's test showed that the differences were not homogeneous, with better proliferation in 2005 and more homogeneous rates in the years 2006, 2006 and 2007. This would be due to better association of the host cells and cells resulting cell and a thus a regular review of the components of culture medium, trying to get that all this is were in optimal conditions. The proliferation rate over the months also varied significantly, but again the significance was due to the differences on those months. When data for each were removed, the differences among them were not significant ($F = 1.345$, $P = 0.142$) and the overall differences were only significant at the 0.01 level (Figure 2).

Figure 2. A. *olseni* cell proliferation rate from *P. olseni* cultures (years) B. comparisons between the *P. olseni* isolates in each year. Error bars show 95% confidence intervals in each case. Letters a and b indicate homogeneous subsets.

REFERENCES

[1] Ford et al. (1999). Parasitology today (Personal ed.) 15: 28-31.
[2] Villalba A, Reece K S, Ordás M C, Casas S M and Figueras A (2004). Diseases of aquatic organisms 61: 159-74.
[3] Perkins F O (1996). Journal of Parasitology 82: 234-254.
[4] Reece K S, Siddall and Burreson E M (2008). Journal of Parasitology 94: 71-86.
[5] Casas S M, La Peyre J F, Reece K S, Azevedo C and Villalba A (2008). Diseases of Aquatic Organisms 78: 241-251.
[6] Gauthier J D, Vasta G R (1993). Journal of Eukaryotic Microbiology 40: 7-16.
[7] Ford S E, Kraeuter J N, Hamilton R M, Faisal M and Haskin H H (2002). Journal of Shellfish Research 21: 159-167.
[8] Villalba A, La Peyre J F, Casas S M and Carballal M J (2004). Journal of Invertebrate Pathology 85: 18-30.
[9] Casas S M, La Peyre J F, Reece K S, Azevedo C and Villalba A (2007). Diseases of Aquatic Organisms 77: 177-187.
[10] Gauthier J D, Vasta G R (1993). Journal of Eukaryotic Microbiology 40: 7-16.

Autoría: Díaz, S.; Renault, T.; Villalba, A.; Carballal, M.J.

Título: Comparison of immune parameters between healthy and Disseminated neoplasia affected-Cockles

Evento: XIVth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Praga (República Checa)

Ano: 2009

Comparison of Immune parameters between healthy- and Disseminated neoplasia affected-Cockles.

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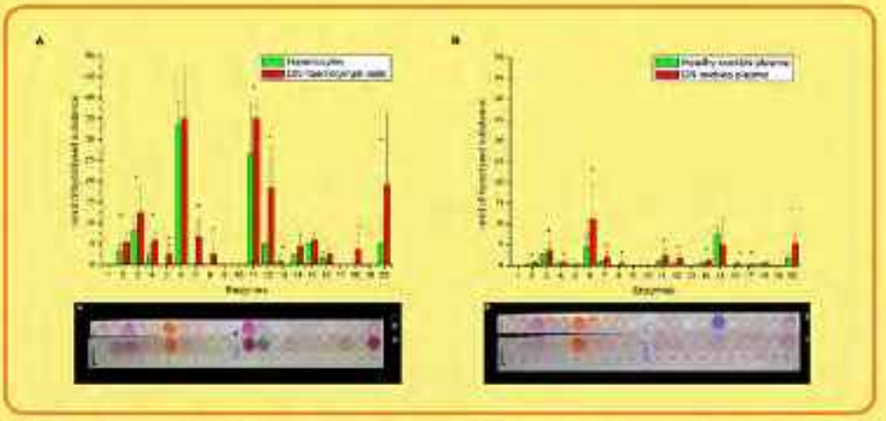
INTRODUCTION

Disseminated neoplasia (DN) is a pathological condition reported for 15 species of marine bivalves throughout the world (Peters, 1988). High prevalence of neoplasia has been reported in Galician cockles (Carballal et al., 2001). High mortality has been associated with DN (Barber, 2004).
The haemocytes are progressively replaced by neoplastic cells as disseminated neoplasia advances in cockles. Thus, the loss of haemocytes and their associated defense function could leave the host immune-compromised.

The aim of present work was to compare various immune parameters of cockles affected by disseminated neoplasia with those of healthy cockles.



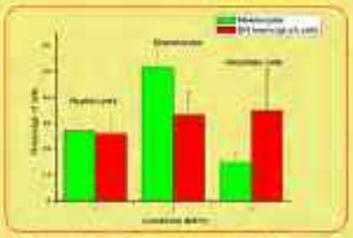
MATERIAL AND METHODS

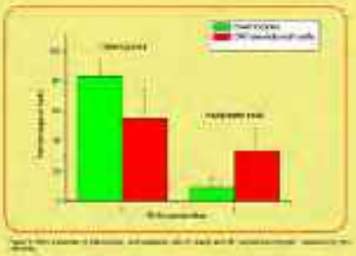
Disseminated neoplasia was diagnosed in cockles by examination of histological sections and haemolymph monolayers using the following scale for disease intensity and neoplasic (0% of neoplastic cells in haemolymph), light neoplasia, moderate neoplasia and heavy neoplasia. Haemolymph from 4 non-neoplastic cockles and from 4 cockles with moderate or high intensity of disseminated neoplasia were pooled to reduce individual variation of the analyses. Three pools of each intensity category were used in the analyses. Aliquots of 2x105 cells of each pool were centrifugated to separate cells and plasma.
Enzyme activities in the plasma and haemolymph cells of healthy- and neoplasia affected-cockles were analysed with the commercial Apy zym for the detection of 19 lytic enzymes. It consists of a gallery of 20 pits, each one containing a specific substrate for the enzyme to be tested. The result of the enzyme-substrate reaction is a coloured product. The colour intensity is directly correlated to the degree of substrate hydrolysis. Discretion analysis were performed with Kruskal Wallis test using Minitab 15 software. Phagocytosis, lysosomal activity and production of reactive oxygen intermediates (ROIs) were analysed by flow cytometry using green fluorescence. Phagocytosis was measured as the proportion of cells that had ingested three or more carboxylate-modified microspheres (1µm diameter, Molecular Probes). Presence of lysosomes was measured using a commercial kit (LysoTracker Green DND-32, Molecular Probes). Production of ROIs was measured using 2'-7'-dichlorofluorescein-diacetate (DCFA-DA).

RESULTS AND DISCUSSION

Significant quantitative and qualitative differences in enzyme activity between cells of healthy- and neoplasia affected-cockles were found.
Lipase, valine arylamidase, cystine arylamidase and N-acetyl-β-glucosaminidase were found in neoplastic cockle cells but not in cells of healthy cockles. Cystine arylamidase was previously detected in neoplastic cells of Mytilus trossulus (ed 4 was also detected in non-neoplastic mussels (Noel, 1992). N-acetyl-β-glucosaminidase had not been found in enzymatic cells of Mytilus edulis (Lowe and Moore, 1978) whereas only non-diseased haemocytes of Mya arenaria exhibited very little reaction of this enzyme (Bockmann et al., 1992). α-Glucosidase was only synthesized in cells of healthy cockles in very low concentration. Trypsin, α-chymotrypsin, β-glucosaminidase, α-mannosidase were not detected. Haemolymph cells of neoplastic and non-neoplastic cockles. Trypsin, α-chymotrypsin are serine proteases and they evolved by gene duplication to serve functions in blood clotting, the immune system, and inflammation, as mammals but they are not frequent in bivalve mollusc (Carballal et al., 1997; López et al., 1997). However, glucosidase was detected in neoplastic cells of Mya arenaria (Bockmann et al., 1992) and α-mannosidase was detected neoplastic cells of Mytilus trossulus and hyperacetylase of Mytilus edulis (Noel, 1992).

There were not previous studies about the enzymatic activity levels of plasma of DN bivalve mollusc. The enzymatic activity in plasma was lower than in cells. Cystine arylamidase, esplanadase and N-acetyl-β-glucosaminidase enzymes were only detected in plasma of DN cockles. The level of activity of β-Glucosidase was higher in healthy cockles plasma than in DN affected ones but this enzyme showed higher level in haemolymph cells of DN affected cockles than in healthy ones. Trypsin, α-chymotrypsin, α-mannosidase were not detected in plasma of healthy and DN affected cockles.





CONCLUSION

Disseminated neoplasia involved qualitative and quantitative increment of lytic enzyme activity in haemolymph cells and plasma of cockles. Moreover, cells of neoplasia affected-cockles showed higher activity of other parameters related to phagocytosis (lysosomal activity, ROIs production) but, remarkably, neoplastic cells were not be able to carry out phagocytosis of beads.

REFERENCES

Autoría: Acosta, C.P.; Cerviño-Eiroa, A.

Título: Spat culture of queen scallop *Aequipecten opercularis* in the Ría de Aldán

Evento: 17th International Pectinid Workshop

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2009

Spat culture of queen scallop *Aequipecten Opercularis* in the Ría de Aldán

XUNTA DE GALICIA
CONSELLERÍA DE PESCA E ASUNTOS MARÍTIMOS
Dirección Xeral de Innovación e Desenvolvemento Pesqueiro

CIMA
CENTRO DE INVESTIGACIÓNS MARIÑAS

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INTRODUCTION

In Galicia, Aequipecten Opercularis spat is detached from collectors [illegible] after the settlement. At this time the spat range usually 15-20 mm height. However, as several cohorts attach along the settling period, very often important amounts of spat less than 15 mm height are obtained at the detachment season. This small sized spat must be cultured in special trays with narrower mesh (4 mm) than the usually employed (15 mm). In this paper we describe the growth of small spat (13 mm height) maintained at 2 different stocking densities and compare it with the growth of the bigger spat (18 mm height).

MATERIAL AND METHODS

Spat settled on collectors deployed between May and July 2008 in the Ría de Aldán (Galicia, NW of Spain) were detached between August and October 2008. It has been observed that at least 4 cohorts settle on the collectors along the suspension period (Iglesias et al, 2007). Consequently, at detachment period most of the spat height range between 15 and 20mm, but is obtained [illegible] a important amount of spat less than 15 mm which can represent a significant proportion of the total spat production. As there is not information about the culture of this small sized spat, experimental culture of spat 13 mm height was performed at two stocking densities. Detachment took place 25th September 2008, when 200 and 300 spat mean height 19.1 ± 1.6 mm were placed in plastic trays mesh size 4mm, bottom area 0.125 m2. Experiments were carried out by triplicate. Samples of each stocking density were performed monthly, mean size and the weight was determined.

Bigger spat 15.1±3.7 mm height was placed on trays in August 23rd at a stocking density of 100.tray^{-1}.

	L_p (mm)	L_f (mm)	%ΔL	DW_f (g)	WShell	IC
D100.Tray^{-1}	18	42.416	131.08	0.505	4.746	10.66
D200.Tray^{-1}	13	33.222	152.88	0.179	2.153	8.32
D300.Tray^{-1}	13	31.104	137.36	0.145	1.818	7.99

The bigger spat (D100) (%, 1) presented an increment of size of 134.08% (42.4±2.03 mm) after 100 days and showed the highest IC (IC D100=10.66 > ICD200 = 8.32 > ICD300 = 7.99) by the presence of a developed gonad.

An one-way ANOVA comparing the dry weight do not showed differences (P=0.057) among the two densities D200 and D300.

The similar condition indexes (IC = (WDmeat/Wshell) x 100), recorded in the small spat grown at 200 and 300.tray^{-1}, suggest a good strategy for the small spat stocked at high densities. Initially (D300). Like in other species (Lauro et al, 2007) the culture at high densities requires less equipment and provides more space on rails for another number of trays. After 4 months growing spat at high stocking density scallops should be thinned out. The results showed a fast growth rate in this area for this species.

RESULTS AND DISCUSSION

After 104 days of cultivation, the seed of initial size 13.1 ± 1.6mm (height of the shell) presented an increment of size of 152.88% and 137.36% for the density D200 and D300 respectively. An one-way ANOVA showed significant differences among the two densities (P<0.005) being D200>D300 (33.2±2.2 mm and 31.2± 2.3 mm).

Fig. 1. Growth of the spat (height of the shell) in three detachments of culture (Sp. stocking density)

BIBLIOGRAPHY

Iglesias, P.; Lauro, A.; Ferreiro, F.; Gandón, R.; Esti, D.; Román, G. "Obtención de Cantidad de Volantes (Aequipecten Opercularis) por Medio de Colectores en la Ría de Aldán. Resultados Preliminares". Foro Ac. Rec. Mar. Rías Gal. 10: 439-445. 2008
Lauro, A.; Christophersen, G.; Magnesen, T. and Román G. "Suspension Culture of the Great Scallop Pecten Maximus in Galicia, NW Spain: Intermediate Secondary Culture from Juveniles to Young Adults". J. Shellfish Res. 26(1): 1-8. 2007

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Autoría: Vidal, A.; Arévalo, F.; Blanco, J.

Título: Effects of baking on domoic acid concentration in King Scallops (*Pecten maximus*)

Evento: Internacional Symposium in Marine Sciences

Lugar: Vigo - Galicia (España)

Ano: 2009

Effects of baking on domoic acid concentration in King Scallops (*Pecten maximus*)

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ABSTRACT

[redacted]

MATERIAL AND METHODS

Sampling

Scallops (*Pecten maximus*) naturally contaminated with ASP toxins were obtained from the Ría de Arousa (NW Spain). Approximately 100 scallops were collected and transported to the laboratory in a box below 15 cm. In the laboratory were carefully selected 25 specimens rectangular with different size of meat/shell. The length parameter of each scallop was measured and the meat was weighed, prior to being subjected to the experimental treatments.

Experimental design

The experimental design used had two parts but were mostly focused on the second part of the work. In order to quantify the effect of the variability of the cooking process, 2 "cooks" (natural pool of 25 scallops) were used. For testing solely the effect of the included way of cooking, a simple experiment was performed, in which cooking was carried out in the laboratory under controlled conditions (Oven: complete and Steam: pressure).

A second part, the variety based on the work and experience of us with the gas, the factors considered in the factorial plan were: 1) baking temperature, 2) baking time, 3) % of brine (salt) and 4) cooking method (Oven and Microwave). Each factor was studied in two levels (minimum and maximum), and the factorial design used was a fractional factorial design of resolution IV, which allows to study all the main effects free of interactions between two factors. Each of the 8 experiments was carried out in duplicate and randomized to avoid systematic errors.

Once the experiments were finished, the meat was separated from the shell and the viscera. The meat was weighed and then homogenized with a blender. Samples were frozen (-20 °C) until analysis.

Toxin analysis, quantification and validation

Domoic Acid calibration solutions were prepared from certified reference materials (NRC Canada, CRM-DA-dc Mixture) stock pure was obtained from Sigma (purity of 90 % (w/w) and used as received). Stock solutions were prepared in 50 % (v/v) methanol/water and stored at 4 °C in polypropylene vials. Working solutions were obtained from stock solutions by appropriate dilution with 50 % (v/v) methanol/water and stored at 4 °C in polypropylene vials.

Domoic acid was extracted from the flesh using the method of Quilliam et al. (1995). The tissues were homogenized and 4 g of this homogenate were mixed with 8 mL methanol (50 %). The mixture was centrifuged at 3000 rpm for 10 min. The supernatant was collected and stored at 4 °C until analysis. Before HPLC analysis, the extract was filtered through a 0.45 µm syringe filter (Millex-HV, Millipore Ltd, Molsheim, France).

HPLC analyses were carried out by the method of Pocklington et al. (1990) with some minor modifications. A Waters HPLC system consisting of a gradient pump (Waters 600 E) and a Waters 717plus autosampler was used. The analytical column was a Supelcosil LC-18 (25 cm × 4.6 mm i.d., 5 µm particle size) with a guard column (2 cm × 4.6 mm i.d.) of the same material. The mobile phase consisted of 10 % (v/v) acetonitrile with 0.1 % (v/v) trifluoroacetic acid. The flow rate was 1 mL/min. The column was heated to 40 °C. The injection volume was 20 µL.

Quantification of domoic acid was made by comparison of the retention time with that of a reference solution prepared from NRC, Halifax, Canada, and the concentration of the CRM solution was calculated according to the manufacturer's instructions. The concentration of domoic acid in the reference solution was 1.0 µg/mL.

RESULTS

Effect of standard cooking

The weight of the scallops decreased during baking, as predicted by the new kinetic concept of cooking, which considers the existence of a "core" and a "surface" of the food, each one with a different rate of weight loss. In both, the core and the surface, the rate was modified by baking, so the concentration was not significantly different after cooking.

Effect of variations in cooking conditions

Cooking method had a positive effect on the final concentration of domoic acid, while the other variables were not significant. Weight losses have been positively affected by baking time and temperature. Water retention was affected by the cooking method and temperature, while the other variables were not significant. Time when compared to salt effect were reversed from the previous. The results have been analyzed and results to be significant. Regression equation with a efficient using $y = a + bx$.

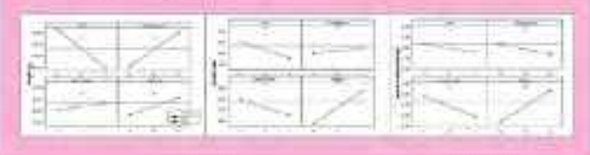

Table 1

Results of the analysis of the factorial experiment for scallops, for the variables studied which have significant effects. The upper part of the table shows the coefficients of the effects, their corresponding confidence and t and the associated probabilities. The lower part shows the ANOVA of the design including the interaction between [redacted]. Parameters significant at 95 % of confidence level.

Variables considered	Weight				DA Concentration			
Terms	Effect	Coef.	T	P	Effect	Coef.	T	P
Time	-13.53	-7.143	-2.35	0.049	-0.71	-0.36	-3.51	0.013
Salt Water	–	–	–	–	-0.46	-0.23	-2.27	0.347
Time*Salty Water	–	–	–	–	-0.41	-0.21	-3.06	0.018

Source	DF	MS	F	P	DF	MS	F	P
Main effects	1	2483.2	6.61	0.049	2	0.61	9.17	0.276
2-way interac.	–	–	–	–	1	9.26	9.61	0.018

DISCUSSION

1. Baking process does not significantly affect weight, thus the acid concentration on basis to scallops.

Likely, the stabilities of cooking fluids controlled the redistribution due to the heat treatment.

2. There was a significant loss of domoic acid. This is in agreement with the results obtained by Lawrence et al. (1994) which found that the canning process of toxic scallops does not destroy domoic acid.

3. The different levels of the variables studied have no effect in domoic acid concentration, only interaction between time and acetic acid seems have some effect. It seems, in order that addition of acetic acid increases the degradation of domoic acid during baking (concerning this it is difficult to detect when the long time is used, but that becomes detectable when longer baking time).

4. None of the variables studied had significant effect on water loss/loss, although weight was significantly affected by baking time.

But, is the fact that scale humidity did not change with treatments and that these weight decreased with baking time, were a concentration, but in the ratio of these two amounts, compensated effects.

References

- Quilliam MA., Xie M, Hardstaff WR., 1995. Rapid Extraction and Cleanup for Liquid Chromatographic Determination of Domoic Acid in Unsalted Seafood. JAOAC international 78: 543-554.
- Lawrence JF., Menard JM., Beaulieu DM., Cleroux MR. Domoic Acid Levels of Naturally Contaminated Scallops as Affected by Canning.

Acknowledgements

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Título: Fijación de la ostra japonesa (*Crassostrea gigas*) en la Ría de O Barqueiro

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove

Ano: 2009

Fijación de la Ostra Japonesa (*Crassostrea gigas*) en la Ría de O Barqueiro

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INTRODUCCIÓN

Situación del área de estudio en la Ría de O Barqueiro

MATERIAL Y MÉTODOS

DISCUSIÓN

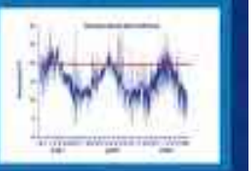
RESULTADOS

Número de individuos recogidos y superficie de colectores (1 m²)

Fijación sobre el sustrato rocoso (1 m²)

Fijación sobre los colectores (1,49 m²)

Variables medioambientales en la Ría de O Barqueiro



REFERENCIAS BIBLIOGRÁFICAS

Autoría: Vidal, A.; Correa, J.; Blanco, J.

Título: The effect of some habitual cooking processes on the domoic acid concentration in the cockle (*Cerastoderma edule*) and Manila clam (*Ruditapes philippinarum*)

Evento: 7th International Conference on Molluscan Shellfish Safety

Lugar: Nantes (Francia)

Ano: 2009

The effect of some habitual cooking processes on the domoic acid concentration in the cockle (*Cerastoderma edule*) and Manila clam (*Ruditapes philippinarum*)

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Abstract

The effect of cooking on the domoic acid content of domoic acid in two bivalve species was studied. The Manila clam (*Ruditapes philippinarum*) and cockle (*Cerastoderma edule*) were selected as edible species. Two cooking methods, steaming and boiling, were used. In both cases, different cooking times were used to evaluate the effects of common cooking methods and the variations likely to occur in cooking to satisfy consumer preferences. Cooking time and cooking method were found to be significant factors affecting the domoic acid concentration in both species. However, the effect of cooking was different in the two species. The domoic acid concentration and toxic content were different in the two species and between the different cooking methods. In both species, the concentration decreased with increasing cooking time, but the decrease was greater in the clam, where the toxic burden was already low. In the cockle, which accumulated the toxin, where the toxic burden was also affected by cooking, the decrease was relatively slow.

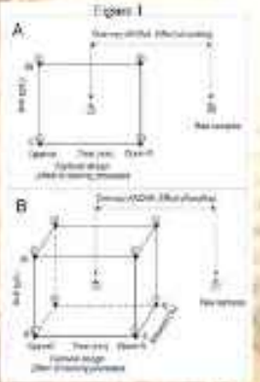
Experimental design

The experiment was designed to evaluate the effect of cooking on the domoic acid content of two species of bivalve molluscs: the cockle (*Cerastoderma edule*) and the Manila clam (*Ruditapes philippinarum*). Two cooking methods were used: boiling and steaming. Different cooking times were applied to each species, to cover a range of conditions that could be found in practice. The experiment was carried out in the laboratory of the Centro de Investigacións Mariñas (CIM) in Vilanova de Arousa, Spain.

Cockles were collected from the natural beds in the Ría de Arousa, Galicia, Spain. Manila clams were obtained from a commercial supplier. Both species were depurated in clean seawater for 24 hours before the experiment to remove any residual toxin. Only individuals of a similar size were selected for the experiment.

Cooking was carried out in a laboratory steamer and in boiling seawater. For steaming, the shellfish were placed in a perforated container above boiling water. For boiling, the shellfish were placed directly in boiling seawater. The cooking times were 3, 6, 9 and 12 minutes. After cooking, the shellfish were cooled rapidly in ice-cold water and shucked. The meat was then homogenised and stored at -20°C until analysis.

Figure 1

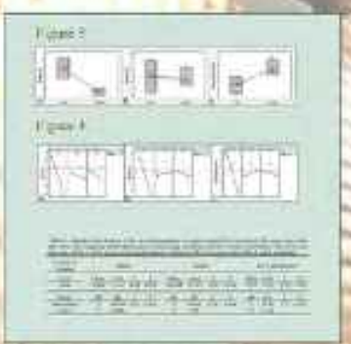


Material and methods

Results

Figure 2

Figure 3



Discussion

Cooking can affect the domoic acid concentration and toxicity of species in different ways. Two species were discussed in the cockle, while it increased in Manila clam.

The difference is due to two factors:

1) during cooking, the cockle loses a significant proportion of its mass, but Manila loses almost no

2) in both cases, the weight of the soft tissues decreased, thus causing the toxin concentration to increase.

In both cases, the cooking processes should have reduced the toxicity, but there the same basic characteristics, i.e., there is a thermal treatment to an aqueous environment, which would suggest that the differences that are more likely related to the species rather than to the differences in cooking.

Only some fat-soluble toxic acids, domoic acid is very soluble in fat, but it is soluble in water, so it is likely that some of the toxin is lost during the cooking process. In fact, in fry cooking, the toxin is lost, but a significant effect, i.e., a reduction in toxin content and concentration, but concentration during cooking has no effect on it.

References

G. Ovelar M.A., Xie M., Herbert W.V. 1995. Rates, Evaluation and Clean up for Liquid Chromatographic Determination of Domoic Acid in Shellfish Samples. JAOAC Analyst. 78:992-995.

Acknowledgements

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Autoría: Álvarez, G.; Uribe, E.; Vidal, A.; Ávalos, P.; González, F.; Mariño, C.; Blanco, J.

Título: Paralytic Shellfish Poisoning from the subtropical zone of the Southeastern Pacific Ocean: First report and toxin profiles

Evento: 7th International Conference on Molluscan Shellfish Safety

Lugar: Nantes (Francia)

Ano: 2009

Paralytic Shellfish Poisoning from the subtropical zone of the Southeastern Pacific Ocean: First report and toxin profiles.

Abstract

In the framework of the Chilean molluscan shellfish safety programme blooms of *Alexandrium* were detected in some aquaculture sites in North Chile (Fig.1). An outbreak of *Alexandrium* (Fig.2) was detected on May 2005 in Mejillones Bay. Phytoplankton, culture and shellfish samples from that bloom were analyzed by HPLC-FD. Phytoplankton net tows and an *Alexandrium* culture started from the bloom were found not to contain PSP toxins at detectable levels. Shellfish, nevertheless, showed the presence of C2, GTX2, GTX3 and dcGTX2 (Table 1). Two new PSP episodes were recorded on June 2006 in Guanaqueros and Tongoy Bays. In these occasions, shellfish samples were analyzed by mouse bioassay and by HPLC-FD (Fig. 3), showing PSP toxicities ranging from 27 to 34 µg STX eq/100g and a toxin profile characterized mainly by the presence of STX, GTX2 and GTX3 (Table 1). Differences in toxic profiles of Mejillones Bay and the other two locations suggest that this kind of toxicity in the area is likely produced by different regional populations or strains of the genus *Alexandrium*. Additionally, the causative species would probably be other than *Alexandrium catenella* because the toxin profiles and the optimal environmental conditions for that species are noticeably different from those recorded in the proliferations from North Chile. This is, therefore, the first report of PSP toxicity from the sea area between parallels 18°30'S and 43°0'S which comprise the subtropical zone in Southeastern Pacific Ocean and suggest that PSP toxicity, as in the northern Pacific coast of America, can be widely distributed in the southern coast.

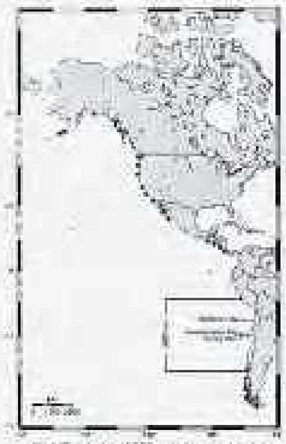

Fig. 1. Distribution of PSP toxin events reported in the Pacific coast of America [illegible] and sample locations in North Chile [illegible].

Results

Fig. 2. (A) *Alexandrium* sp. from Mejillones Bay. [illegible]

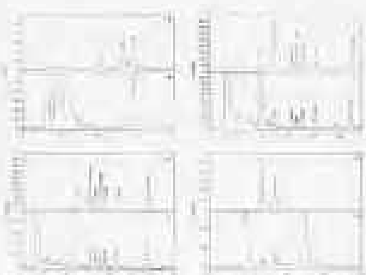

Fig. 3. PSP toxins in *A. purpuratus* from Guanaqueros Bay. [illegible]

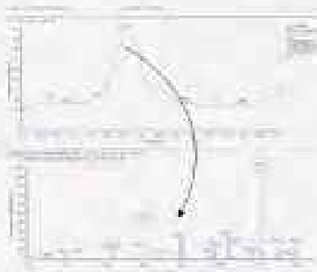

Fig. 4. HPLC-MS/MS chromatograms and spectrum of PSP toxins in *A. purpuratus* from Tongoy Bay [illegible]

Table 1. Comparison of toxin profiles [illegible] from the sample locations in North Chile [illegible]

Conclusions

In this work, we have identified three events of PSP toxicity. This suggests that, like along the Pacific coast of North America, this toxicity may be widely distributed on the coast of South America.

The three observed PSP episodes coincide in time with *Alexandrium* blooms. Notwithstanding, no phytoplankton samples for toxin analysis were available from Guanaqueros and Tongoy Bay and those collected from Mejillones Bay (phytoplankton and culture started) were not found to contain PSP toxins at detectable levels.

The toxin profiles of *A. purpuratus* found in the two southern bays (Guanaqueros and Tongoy) coincided in more than six toxins (Table I) and were probably caused by the same agent, but from different populations or strains, because the presence of GTX1 in Guanaqueros cannot be explained by biotransformation in the other toxins present.

The toxin profile of *A. purpuratus* from Mejillones Bay differs from the other bays by the absence of STX. Even when STX can be originated from GTX2 by enzymatic desulfonation this transformation did not seem to take place in *A. purpuratus*. Consequently, it would seem clear that the species or strain that originated the northern episode was different from that of the southern one.

Toxin profiles suggest that PSP events in Northern Chile were produced by *Alexandrium* species, but not by *A. catenella* (causative agent in South Chile), because these areas were substantially different in their oceanographic and biogeographic characteristics and because the toxin profiles found in this study are considerably different from those described for *A. catenella* from South Chile.

Materials and methods

References

Acknowledgments

Autoría: Álvarez, G.; Uribe, E.; Ávalos, P.; Mariño, C.; Blanco, J.

Título: First identification of azaspiracids and spirolides in two shellfish species from Northern Chile

Evento: 7th International Conference on Molluscan Shellfish Safety

Lugar: Nantes (Francia)

Ano: 2009

First identification of azaspiracids and spirolides in two shellfish species from Northern Chile

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Abstract

In an attempt to evaluate the risk for human consumption associated to the accumulation of lipophilic toxins by two bivalves, macha (*Mesodesma donacium*) (Fig.1) and *choro* (*Mulinia edulis*) (Fig.2) in Coquimbo Bay (30°15'S, 71°30'W) (Fig.3), monitoring of these species was carried out from March to September 2008. The samples were analyzed by liquid chromatography mass spectrometry (LC-MS) to detect okadaic acid, dinophysistoxins, pectenotoxins, azaspiracids, yessotoxins and spirolides. Low levels of Azaspiracid-1(AZA-1) (Fig.4) and 13-desMeC spirolide (SPX-1) (Fig.5) were found in both shellfish species. Toxins were detected at different dates throughout the monitoring and co-occur in some samples (Table I). In all cases, the concentration of the toxins was below the limit of quantification of the technique used and therefore these detections are only indicative of a potential risk and were below the regulatory limits. This is the first report of the occurrence of these groups of toxins in Chile and suggests that it is necessary to implement the routine monitoring of these substances by LC-MS to warrant public health and shellfish exportations.

Fig.1. *Mesodesma donacium*

Fig.2. *Mulinia edulis*

Fig.3. Sampling locations

Results

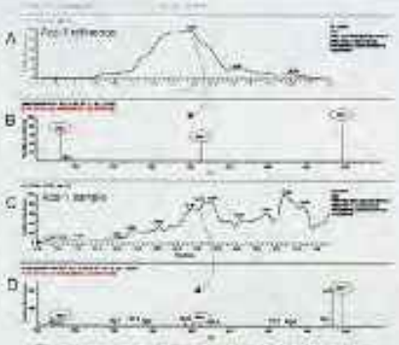


Fig.4. Chromatogram and mass spectra from the LC-MS/MS analysis of AZA-1 present in reference material (A and C) and in an extract from *M. Edulis*. Both the retention time for AZA-1 and MS/MS mass spectra by the product ions at 824, 806, 706 and 360 m/z differed with those found by Gagliardone et al. (2008).

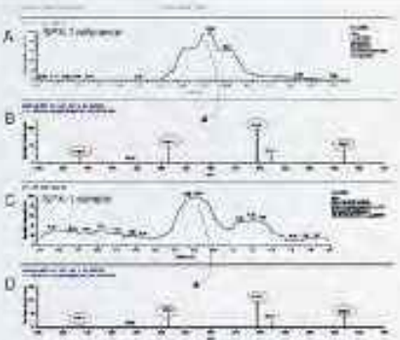


Fig.5. Chromatogram and mass spectra from the LC-MS/MS analysis of SPX-1 present in reference material (A and C) and in an extract from *M. Edulis*. Both the retention time for SPX-1 and MS/MS mass spectra by the product ions at 670, 654, 636 and 360 m/z were coincident with those found by Miles et al. (2004).

Table I. Summary of lipophilic toxin concentrations in samples of macha (*Mesodesma donacium*) and *choro* (*Mulinia edulis*) between March to September 2008. In positive samples, toxin concentrations were between the detection limit and the quantification limit of the technique (not detected (ND), Not sampled (-)).

	Mesodesma donacium		*Mulinia edulis*	
Date	OA/DTX	AZA	SPX	AZA
14/03/08	Positive	Positive	-	-
19/03/08	ND	ND	Positive	Positive
26/03/08	ND	ND		
02/04/08	ND	ND		
09/04/08	ND	ND		
16/04/08	ND	ND	Positive	Positive
23/04/08	ND	ND	ND	Positive
30/04/08	ND	ND		
07/05/08	ND	ND		
14/05/08	ND	ND	ND	Positive
21/05/08	Positive	Positive	-	-
28/05/08	ND	ND		
04/06/08	Positive	Positive	Positive	Positive
11/06/08	ND	ND		
18/06/08	ND	ND		
25/06/08	Positive	ND	Positive	Positive
02/07/08	ND	ND	ND	ND
09/07/08	ND	ND	ND	Positive
16/07/08	ND	ND	Positive	Positive
23/07/08	Positive	ND	Positive	Positive

Conclusions

This is the first report of these toxins in Chilean shellfish and, as far as we know, also in the Southern Hemisphere. AZA-1 and SPX-1 frequently co-occurred (Table I).

Even when *M. edulis* was sampled less frequently than *M. donacium* the two toxins were found in this species in more occasions. These differences could be explained by heterogeneity in the composition of phytoplankton in Coquimbo Bay in which both shellfish are separated by a river or by a higher capability to accumulate lipophilic toxins of *Mulinia edulis*.

The toxin concentrations were below the limit of quantification of the technique used and below the regulatory limits in most countries, notwithstanding their detection indicates that they are a potential risk and suggests that it is necessary to routinely monitor these substances in order to warrant public health.

Material and methods

Mussels and clams were randomly caught from March to September 2008. Shellfish samples were delivered periodically and immediately and stored at -20°C until to analysis. Lyophilized samples were milled and a subsample equivalent to 2 g of wet weight was taken and extracted at MeOH (100%) at a ratio of 1:4 (weight:vol/vol). Extracts were clarified by centrifugation (10 000× g, 10 min) and by filtering through syringe filters (0.45 µm). A 10 µL aliquot was injected into a HPLC-MS. The presence of lipophilic toxins was checked by means a Surveyor MS HPLC system, coupled to a Deca XP plus ion trap mass spectrometer (Thermo Fisher Scientific) with no enrichment step. The chromatographic separation was carried out using a column Hypersil BDS (Thermo Scientific) following the method of Stobo et al. (2005). The mass spectrometer was operated in negative mode for OA, DTX, PTX-1 and PTX and in positive mode for SPX, PTX2, PTX2sa and AZA, in all cases. The identity of the toxins was confirmed by a MS/MS spectrum (dependent scan) and by comparing the retention time of chromatograms with those of reference materials (Trilogy, CIFGA, Lugo, Spain). The limits of detection of the technique were: 1.676 µg/kg for OA, 25 µg/kg for YTX, 5.760 µg/kg for SPX, 10.866 µg/kg for PTX2 and 3.420 µg/kg for AZA.

Acknowledgments

This research was funded by the project DGI 1602-01 FONDEF CHILE I (Innovación en Pesca y Acuicultura) and by a cooperation agreement between the Universidad de Vigo and the Xunta de Galicia, Spain, and the Universidad Católica del Norte, Chile. We would also like to thank Marian Vieites, Olga Jaén and Ana Tenorio for their technical assistance. We also acknowledge the Asociación General de Pescadores Artesanales de Caleta Peñuelas A.G. (Sindicato de Mariscos y Otros), Coquimbo and Asociación General de Pescadores y Buzos

References

Gagliardone, M.S., Uribe, E., Alvez, G., Fernández, M.L., Furey, A., James, K.J. 2008. First identification of azaspiracids in shellfish from Chile and Puerto Montt harbour. Harmful Algae 7, 697-705.

Miles, C.O., Wilkins, A.L., Hawkes, A.D., 2004. Detection of yessotoxin analogs in shellfish using solid-phase adsorption toxin tracking (SPATT) technology. Toxicon 44, 383-391.

Autoría: García, A.; Alcalde, A.; Conde, M.L.; de Coo, A.; Fariña, J.; García, J.; Solís, L.; Poza, G.; Santos, I.; Simón, A.; Otero, J.; Crespo, J.; Fernández, D.

Título: Avances no coñecemento e defensa das especies depredadoras de moluscos bivalvos comerciais en Galicia

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2009

AVANCES NO COÑECEMENTO E DEFENSA DOS DEPREDADORES DE BIVALVOS COMERCIAIS

García Antonio (1) Ayala Ana (2) Conde M Lourdes (3) Da Cuz Ricardo (4) Farfa Juan (5) García Javier (6) Sole Llauradó Pilar (seccio 6) Santos Ignacio (6) Simon Angela (7) Otero Amparo Despoi José (8) Fernández Daniel (9)

(1) Cofradía de Noia (2) Cofradía de Vilanova (3) Cofradía de Cariño (4) CIMA (5) Cofradía de Ribeira (6) Cofradía de Santa Comba (7) Cofradía de Cangas (8) Cofradía de O Grove (9) Asociación Galicia

INTRODUCCIÓN

No Simposio XII Foro presentáronse varios traballos que daban resultados os primeiros datos acadados no CIMA sobre os mecanismos de depredación, a súa intensidade e importancia e distribución de todas estas especies en diversas zonas marisqueiras de Galicia.

No presente traballo ofrécese un resumo dos principais avances rexistrados neste lento este último ano. Os datos se agrupan en tres áreas: (a) Procesos e intensidade depredadora, (b) Caracterización das poboacións de especies depredadoras e (c) Sistemas de Prevención e Protección.

Procesos e intensidade depredadora

Dimensións das poboacións de especies depredadoras

	Noia		Pontevedra			Cariño
	Cangrexo	Nécoras	Cangrexo	Nécoras	Cangrexo	Nécoras
Xaneiro 08	2.340.750	8.891.175				
Abril 08	2.388.141	9.749.238				
Maio 08						2.65.340
Agosto 08			2.387.470	10.170.600	11.455.800	
Setembro 08	2.349.750	9.324.300				

Sistemas contra depredadores

Autoría: Guerrero, S.; Cremades, J.; Salinas, J.M.; Ancosmede, C.; Ocaña, S.; Andrade, M.

Título: Interacción de los gametos de las algas verdes *Codium spp*. y *Ulva spp*. en el crecimiento y supervivencia de semilla de almeja babosa (*Venerupis pullastra*), almeja japonesa (*Ruditapes philippinarum*) y ostra rizada (*Crassostrea gigas*)

Evento: XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2009

INTERACCIÓN DE LOS GAMETOS DE LAS ALGAS VERDES *Codium* spp. y *Ulva* spp. EN EL CRECIMIENTO Y SUPERVIVENCIA DE SEMILLA DE ALMEJA BABOSA (*Venerupis pullastra*), ALMEJA JAPONESA (*Ruditapes philippinarum*) Y OSTRA RIZADA (*Crassostrea gigas*)

XUNTA DE GALICIA
CONSELLERÍA DO MAR
UNIVERSIDADE DA CORUÑA
CIMA
JACUMAR

Guerrero¹, S.; Cremades², J.; Salinas², J.M.; Arcos-Ramos³, C.; Ocaña¹, S. & Andrade¹, M.

INTRODUCCIÓN Y OBJETIVOS

Dentro del proyecto "Acuicultura Integrada: desarrollo de experiencias de cultivos multitróficos (2010-2011)", que forma parte del Plan Nacional de Cultivos Marinos (ACUMAR), cofinanciado por la Secretaría General de Pesca Marítima del Ministerio de Medio Ambiente y Medio Rural y Marino y las distintas Comunidades Autónomas participantes, en Galicia están plantead[illegible] una serie de experiencias que tienen como objetivo común el poner a punto de distintos tipos de acuicultura multitrófica integrada (AMI) con vistas a aumentar en el futuro la rentabilidad de la acuicultura marina, minimizar en la posible su impacto ambiental y, por todo ello hacerla más sostenible (http://www.acuicultura-integrada.com/proyectos/).

La experiencia que aquí se plantea tiene como objeto la observación del crecimiento y supervivencia de semilla de distintos bivalvos de interés comercial, almeja babosa (*Venerupis pullastra*), almeja japonesa (*Ruditapes philippinarum*) y ostra rizada (*Crassostrea gigas*) mantenidas en cultivo cerrado junto con distintas macroalgas verdes productoras de esporas y/o gametos (*Ulva* sp. y *Codium* spp.) y en circuito abierto con agua procedente del efluente de una granja de engorde de peces planos (rodaballo).

Se trata de valorar en que medida las esporas y/o gametos emitidos por las macroalgas así como los restos, restos de heces y posible fitofiltración presentes en el efluente del cultivo de peces sirven como alimento para estos bivalvos. Esta información será de mucha utilidad para el diseño futuro de sistemas de cultivo multitrófico que integren estos tres elementos productivos.

MATERIAL Y METODOS

Sistema de cultivo en circuito cerrado (CIMA Centro)

- Tres tanques de polietileno con una capacidad de 500 l.
- Agua de mar cruda.
- Circuito cerrado con dos renovaciones semanales.
- Tres tamices con luz de malla de 750 µm, con sistema anti-vacío.
- Aireación del tanque de cultivo para mantener las algas en suspensión.

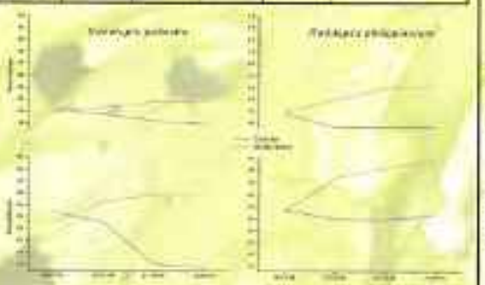
Sistema de cultivo en circuito abierto (PUNTA MOGRUDAS S.L.)

- Tanques con luz de malla de 500 µm.
- Alimentación ocasional con el efluente de una granja de engorde de rodaballo.
- Limpieza con manguera de presión dos veces por semana.
- Tratamiento para evitar el desarrollo de algas en los tanques.

RESULTADOS Y DISCUSIÓN

EXPERIENCIA PRELIMINAR EN 2008 CON ALMEJA Y CODIUM EN CIRCUITO CERRADO

EXPERIENCIA CULTIVO MULTITRÓFICO ALMEJAS-ALGAS-OSTRA		Agosto			Octubre-noviembre		
		Long. (mm)	Peso (g)	% MORT	Long. (mm)	Peso (g)	% MORT
Almeja babosa (*Venerupis pullastra*) Lote 1	Inicial 17/08/08	3,8	0,026	0	5,7	0,084	0
	Final 18/09/08	6,72	0,051	6,1	9,13	0,246	0
Almeja babosa (*Venerupis pullastra*) Lote 2	Inicial 17/08/08	10,02	0,32	0	10,18	0,13	0
	Final 18/09/08	8,2	0,16	15,2	10,12	0,24	0
Almeja japonesa (*Ruditapes philippinarum*) Lote 1	Inicial 17/08/08	5,1	0,047	0	5,87	0,083	0
	Final 18/09/08	6,64	0,058	13,6	8,02	0,1	0
Almeja japonesa (*Ruditapes philippinarum*) Lote 2	Inicial 17/08/08	9,83	0,19	0	9,81	0,19	0
	Final 18/09/08	8,83	0,095	71,9	11,34	0,21	0

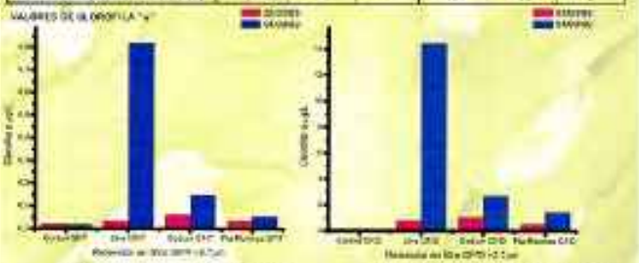


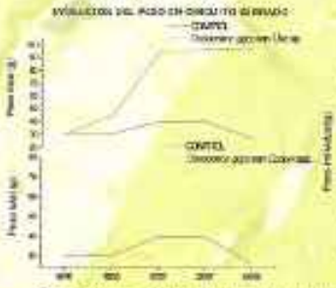
Como se puede observar en ambas tallas de las dos especies de almeja la presencia de *Codium* spp. en el tanque de cultivo durante el periodo ensayado, además de reforzar en un momento moderado tanto de la longitud como del peso de [illegible] especies (más acusado en almeja japonesa) redujo a cero la tasa de mortalidad. Sin embargo en los lotes control no hubo en ningún caso crecimiento y el fuertes tasas de mortalidad, sobre todo en el lote 2 de almeja babosa.

La explicación de estos resultados debe buscarse en que las algas utilizaron como fuente de alimento los gametos liberados por los talos de *Codium* y/o los restos orgánicos de la propia descomposición de estos talos o del crecimiento bacteriano fomentado por su presencia en el tanque de cultivo.

EXPERIENCIA EN 2009 CON OSTRA, *CODIUM* Y ALGA EN CIRCUITO CERRADO Y ABIERTO (EFLUENTE)

[illegible] MACROALGAS - OSTRA	Mayo 09/05/09			Final 24/06/09		
	Long. (mm)	Peso (g)	% MORT	Long. (mm)	Peso (g)	% MORT
Agua (Control)	3,29	00	0	4,79	34,8	10,0
[illegible]	3,29	00	0	5,86	67,5	0
Ulva (cultivo)	3,29	00	0	6,1	87	5,0
Ulva + Codium (cultivo rodaballo)	3,29	00	0	7,86	106	0





En esta experiencia de nuevo la presencia de algas supuso significativamente el desarrollo de la semilla de ostra frente al control, a la vez que disminuyó la tasa de mortalidad. En el caso de *Codium* los resultados fueron pareos que con *Ulva* y con un fuerte incremento de la mortalidad al final del periodo experimental. Esto fue debido al efecto mecánico de amontonamiento por acumulación de algas desprendidas de los talos de esta especie. El mejor resultado se obtuvo en el circuito abierto con el agua del efluente, sin duda por la abundancia de restos de plancton y otras partículas.

CONCLUSIONES

-La presencia de macroalgas es positiva para el crecimiento de la semilla de distintos bivalvos.

-Este efecto beneficio parece ser debido a que las esporas o gametos que ellas liberan son una fuente de alimento adecuada para estos organismos filtradores.

-Se puede optimizar un sistema de cultivo en tierra de peces/moluscos/algas incluyendo algas de macroalgas liberadoras de esporas o gametos y ubicándolas, con anterioridad a los moluscos, donde puedan servir como fuente más o menos constante de "fitoplancton".

Agradecimientos a la empresa PUNTA MOGRUDAS, S.L. y a todos aquellos que de una forma u otra han contribuido a la realización de este trabajo.

Autoría: Guerrero, S.; Cremades, J.; Ancosmede, C.; Muñíz, V.; Domínguez, J.

Título: Aproximación a la utilización de anémonas y poliquetos como sedimentívoros dentro de un cultivo multitrófico integrado (AMTI)

Evento: XIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2010

APROXIMACIÓN A LA UTILIZACIÓN DE ANÉMONAS Y POLIQUETOS COMO SEDIMENTÍVOROS DENTRO DE UN CULTIVO MULTITRÓFICO INTEGRADO (AMTI)

XUNTA DE GALICIA
CONSELLERÍA DO MAR

UNIVERSIDADE DA CORUÑA

JACUMAR

Guerrero[1], S.; Cremades[1], J.M.; Ancosmada[1], C.; Muniz[1], V.; Domínguez[1], J.

[illegible]

[illegible] Plan Nacional de Cultivos Marinos (JACUMAR) Secretaría General de Pesca Marítima [illegible]

INTRODUCCIÓN

Dentro del proyecto "Acuicultura Integrada: desarrollo de experiencias de cultivos multitróficos (2009-2011)", que forma parte del Plan Nacional de Cultivos Marinos JACUMAR, cofinanciado por la Secretaría General de Pesca Marítima del Ministerio de Medio Ambiente y Medio Rural y Marino y las distintas Comunidades autónomas participantes, en Galicia están planteadas una serie de experiencias que tienen como objetivo común la puesta a punto de distintos tipos de acuicultura multitrófica integrada (AMI) con vistas a aumentar en el futuro la rentabilidad de la acuicultura marina, minimizar en lo posible su impacto ambiental y, por todo ello hacerla más sostenible (http://www.acuiculturaintegrada.com/proyectos/).

La experiencia que aquí se plantea tiene como objeto la puesta en marcha en el Centro de Investigaciones Marinas (CIMA) de Corón, de diversos experimentos encaminados al estudio de la posibilidad de cultivo de *Anémona sinifa* y de diversas especies de poliquetos para una vez controlado dicho cultivo introducir estas especies en los cultivos multitróficos que se están llevando a cabo.

Actualmente estas especies están adquiriendo especial relevancia debido a su potencial económico en la acuicultura. Además, se trata de especies potencialmente utilizables dentro de un contexto multitrófico, en donde se incrementaría la productividad por el uso de aguas enriquecidas de estos cultivos asociados y la capacidad de depuración del afluente.

Anémonas

OBJETIVOS

[illegible]

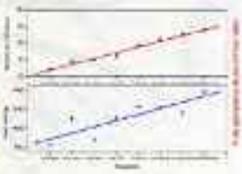
MATERIAL Y MÉTODOS

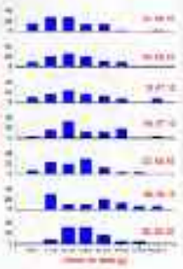
Experiencias en acuarios

[illegible]

RESULTADOS

- De los experimentos realizados, se ha observado que la reducción al cabo de apenas 3-4 meses se ha duplicado tanto en peso como en número de individuos.
- A lo largo del experimento hemos constatado un elevado porcentaje de hibridación en la población.





Poliquetos

OBJETIVOS

[illegible]

MATERIAL Y MÉTODOS

[illegible]

- Posteriormente se ha realizado un estudio de supervivencia comparando con nuestros diferentes [illegible]

1º sustrato arterial [illegible]

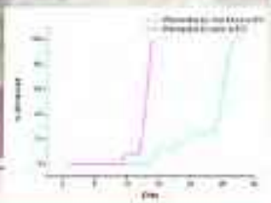
2º sustrato arterial [illegible]

[illegible]

RESULTADOS

[illegible]

- Por desgracia, nos realizar la prueba de experimentos posibles conducir que manteniendo a los ejemplares en acuarios formados por tapas, existe una supervivencia de 100% hasta el día 15.



CONCLUSIONES

- Podemos concluir que las posibilidades potenciales de cultivo de *Anémona sinifa* son muy elevadas y determinamos que la importancia de la reproducción asexual puede ser un factor muy importante sobre todo de cara a una posible explotación de este recurso dentro de un marco costumbre.
- El campo de cultivo de los poliquetos es muy poco conocido, pero al mismo tiempo el potencial es muy alto, por lo que dentro de este proyecto continuaremos con experiencias orientadas a obtener una información preliminar para introducir esta especie dentro de los cultivos multitróficos.

Autoría: Guerrero S.; Cremades, J.; Ancosmede, C.

Título: Preengorde en parque de cultivo de semilla de almeja fina y japonesa procedente de semillero multitrófico

Evento: XIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2010

PREENGORDE EN PARQUE DE CULTIVO DE SEMILLA DE ALMEJA FINA Y JAPONESA PROCEDENTE DE SEMILLERO MULTITRÓFICO

XUNTA DE GALICIA
CONSELLERÍA DO MAR

UNIVERSIDADE DA CORUÑA

JACUMAR

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Guerrero[1], S.; Cremades[2], J.; Ancosmede[1], C.;

Este estudio está enmarcado en el Plan Nacional de Cultivos Marinos (ACUMAR). Financiado (Parcial) por Xunta Galicia. "Ayudas a Grupos Emergentes de Investigación en Cultivos Marinos".

INTRODUCCIÓN Y OBJETIVOS

La experiencia que aquí se plantea tiene como objeto el estudio en la evolución del crecimiento en parque (entorno real de cultivo) de dos especies de bivalvos comerciales: almeja fina y almeja japonesa, procedente de criadero y engordada mediante un sistema de acuicultura multitrófica; el cual consistió en un circuito cerrado de agua procedente del efluente de una granja de engorde de peces planos (rodaballo), combinando con la etapa de engorde tradicional mediante su siembra en un parque de cultivo.

MATERIAL Y MÉTODOS

Sistema multitrófico

Consiste en la biofiltración de los sólidos del efluente de una planta de cultivo de rodaballo en sistema abierto con extracción (bivalvos (almeja), invertebrados suspensívoros (erizos)) y macroalgas alimentarias (Laminaria., Ulva spp.).

-Beneficio de la integración:
+ Mejora de la calidad del agua del efluente por la retirada de CO2 y nutrientes (pelo disuelto como en suspensión).
+ Aumento y diversificación de la producción acuícola de la planta, en este caso engorde de semilla de moluscos bivalvos.

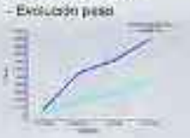
1. Preengorde multitrófico: 15/10/08-05/05/09

Siembra el preengorde en bandejas con:

	almeja fina	almeja japonesa
Talla	2,16mm	2,26mm
Peso individual	0,004g	0,04g
Peso total	500g	1000g
Nº ind. sembrados	125.000	25.000

Evolución almeja fina y japonesa en el semillero multitrófico: Octubre-08 Agosto-09

- Evolución peso



- %Supervivencia

2. Siembra: 05/05/09

Una vez la semilla ha alcanzado la talla de salida (1 centímetro o un tamaño a medio entre las dos clases de Carril) se siembra en los parques de cultivo de Carril.

Carril

El parque consiguiente de Carril, consta de 1320 parcelas divididas a 800 productores.

Para complementar la producción procedimiento el cultivo (almeja, mejillón) la producción de ostras, en torno una hectáreas tanto de dique, flotante y bateas/líneas. Estas tienen las mayor parte producción en el periodo estacional por cuestiones del ciclo natural de bivalvos, y almejas exclusivas del 02 % complementando la producción con especies cercanías de cultivos.

Parque de cultivo:
Nº parque: 755ª
Superficie: 600m²

	almeja fina	almeja japonesa
Talla	2,16mm	2,26mm
Peso individual	0,004g	0,04g
Peso total	500g	1000g
Nº ind. sembrados	125.000	25.000

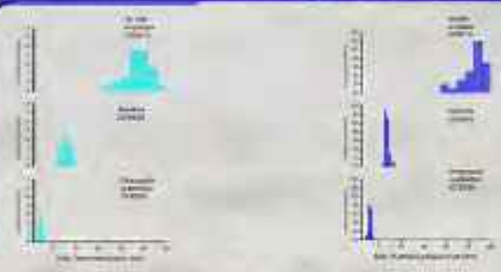
3. Primer año en parque 05/05/09-19/05/10

Revisión de la semilla en dos ocasiones: durante el mes de octubre de 09 (otoño) se almacenan a menos ocasiones, midiendo el peso total de la semilla con un cuentagotas y la longitud individual de cada una de las especies.

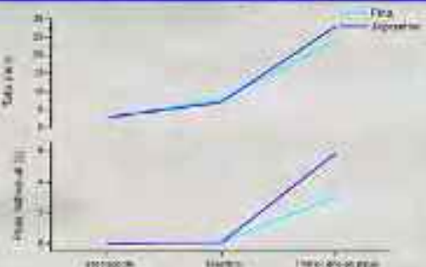
	almeja fina	almeja japonesa
Talla	23,16mm	27,51mm
Peso individual	4g	8,44g

Posteriormente se realizan la siembra en parques exclusivos algas, mejillones, redes de cultivo y bivalvos nuestra

RESULTADOS



Distribución de tallas (mm) de almeja fina y japonesa desde el preengorde en semillero multitrófico hasta el primer año en parque de cultivo.



Evolución de talla y peso individual durante el periodo de estudio de las dos especies.

CONCLUSIONES

- Mientras que durante el preengorde multitrófico no hay diferencias significativas en el crecimiento entre la almeja fina y la japonesa, al final del primer año en cultivo en parque sí existe una diferencia entre ambas especies, creciendo en mayor medida la almeja japonesa.
- Podemos pensar en un futuro en potenciar un esquema de cultivo de semilla de bivalvos, tanto de almeja fina como de almeja japonesa a partir de un preengorde de tipo multitrófico en granja de peces/moluscos/algas, ya que tanto la potencial alimento llegado al momento, como el engorde en el intermareal no difiere de un cultivo de semilla de almejas procedentes de un semillero tradicional.

Agradecimientos a José Antonio Fernández de Carril y colaboradores, personal de la empresa Punta Monteiro, S.L. Punta Monteiro, Ría, O Grove, 36380 Pontevedra, por facilitarnos amablemente las instalaciones para la realización de este estudio.

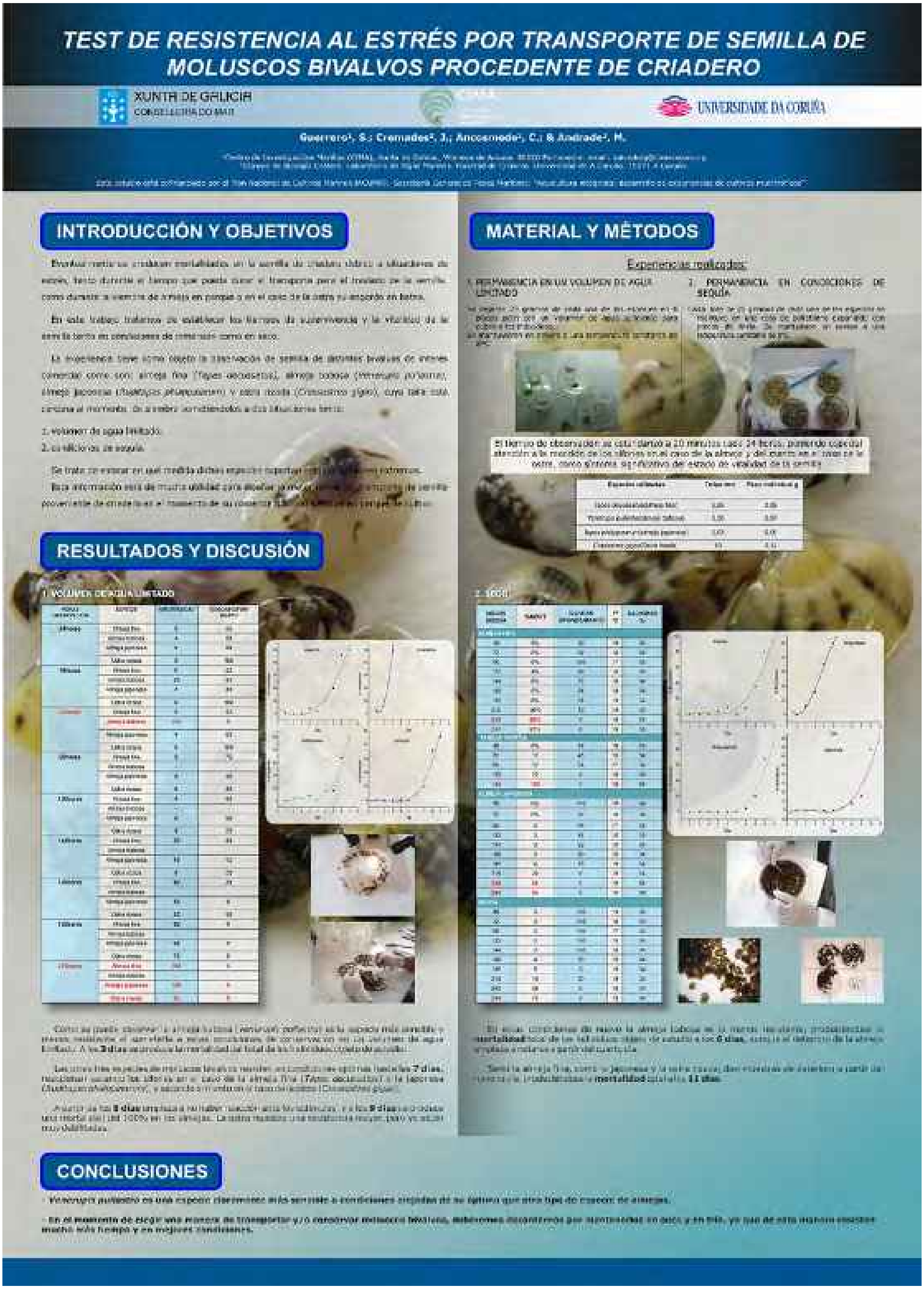
Autoría: Guerrero S.; Cremades, J.; Ancosmede, C.; Andrade, M.

Título: Test de resistencia al estrés por transporte de semilla de moluscos bivalvos procedente de criadero

Evento: XIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2010


TEST DE RESISTENCIA AL ESTRÉS POR TRANSPORTE DE SEMILLA DE MOLUSCOS BIVALVOS PROCEDENTE DE CRIADERO
XUNTA DE GALICIA
CONSELLERÍA DO MAR
UNIVERSIDADE DA CORUÑA
Guerrero[1], S.; Cremades[2], J.; Ancosmede[1], C.; & Andrade[2], M.
INTRODUCCIÓN Y OBJETIVOS
MATERIAL Y MÉTODOS
Experiencias realizadas:
RESULTADOS Y DISCUSIÓN
1. VOLUMEN DE AGUA LIMITADO
2. SECO
CONCLUSIONES

Autoría: Acosta, C.P.; Cerviño-Eiroa, A.

Título: Cultivo de volandeira *Aequipecten opercularis*: Comparación de sistemas

Evento: XIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2010

Cultivo de volandeira *Aequipecten opercularis*: comparación de sistemas

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Justificación

Material y métodos

- Semillas: mallas de entrada (N=40 ind.) y malla (2 ind./cesto) y cestos de engorde malla (N= 40 ind.) y malla (2 ind./cesto) de malla flexible, colocados suspendidos (4 por cuerda) y separados para evitar el pastoreo (malla de entrada) y la colonización
- Seguimiento mensual desde el inicio del ensayo en 2009, con ligeras variaciones en la fecha de inicio y finalización, que se ajustaron en función de la talla
- Aproximadamente cada mes, se midieron 20 individuos de cada cultivo para determinar los datos biométricos. La talla se midió con un pie de rey (precisión 0,1 mm)
- La calidad del agua (clorofila a) osciló entre 0,27 y 0,7 mg/m³

Resultados

- En la fase de pre-engorde (100 días desde el inicio del ensayo) los cestos alcanzaron una talla media de 31,7 mm y un peso medio de 5,2 g (> crecimiento) frente a los 30,8 mm y 4,85 g de la malla. El ANOVA de una vía indica diferencias significativas en peso ($F_{1,1}$ = 6,005; p = 0,015) pero no en talla ($F_{1,1}$ = 0,078; p = 0,781).
- En la fase de engorde (180 días desde el inicio del ensayo) se alcanzaron tallas de 50,6 mm y 50,9 mm y pesos de 30,25 g y 31,68 g en cestos y linternas, respectivamente. Estas diferencias no son significativas ($F_{1,1}$ = 0,001; p = 0,971 para talla y $F_{1,1}$ = 0,016; p = 0,898 para peso). Los valores de mortalidad acumulada a los 180 días fueron del 50% en cestos y del 30% en linternas.
- Durante el periodo de ensayo se registraron dos episodios de mortalidad masiva, uno en cada cultivo, coincidiendo con el descenso de la concentración de oxígeno disuelto en el agua por debajo de 3 mg/l.
- Las estimaciones de crecimiento individual en peso y talla se ajustaron a una función de crecimiento de von Bertalanffy. Los parámetros de crecimiento estimados fueron: L_∞ = 60,3 mm; K = 0,0124 días⁻¹; t_0 = -1,5 días para la talla y W_∞ = 33,5 g; K = 0,0124 días⁻¹; t_0 = -1,5 días para el peso.
- Desde el punto de vista económico, el sistema japonés es más eficiente, ya que los rendimientos son mayores tanto en la fase de pre-engorde (25% más) como en la fase de engorde (hasta un 30% más). Además, el sistema japonés requiere menos mano de obra para su manejo, lo que reduce los costes de producción.

Conclusiones

- El sistema de pre-engorde en panel con malla superior resultó ser el más eficiente, tanto en términos de crecimiento como de supervivencia, principalmente debido a la protección que ofrece contra depredadores y competidores.
- En la fase de engorde, las linternas y los cestos mostraron resultados similares en cuanto a crecimiento y supervivencia, sin diferencias significativas entre ambos sistemas.
- El uso de linternas japonesas para el engorde de volandeira puede ser una alternativa viable a los cestos tradicionales, ofreciendo ventajas en términos de eficiencia y facilidad de manejo.
- Es importante considerar factores económicos y logísticos al elegir el sistema de cultivo más adecuado para cada situación específica.

Este trabajo ha sido financiado por el proyecto de investigación "Pre-engorde y cultivo de volandeira (*Aequipecten opercularis*) y vieira (*Pecten maximus*)" a través de la Dirección Xeral de Investigación e Desenvolvemento Pesqueiro de la Consellería do Mar de la Xunta de Galicia (PGIDIT07PXIB30E).

Autoría: Lastres, M.A.; Andrés, C.; Santamaría, I.; Guerra, A.

Título: Resultados de la aplicación de técnicas de cultivo de moluscos bivalvos en criaderos bajo el modelo de empresa tutelada

Evento: III Foro Iberoamericano de los Recursos Marinos y la Acuicultura (III FIRMA)

Lugar: Hermosillo (México)

Ano: 2010

RESULTADOS DE LA APLICACIÓN DE TÉCNICAS DE CULTIVO DE MOLUSCOS BIVALVOS EN CRIADEROS BAJO EL MODELO DE EMPRESA TUTELADA

XUNTA DE GALICIA
CONSELLERÍA DO MAR

CIMA

IGAFA

Lastres, M.A[2]., Andrés, C[2]., Santamaría, I[2]. & Guerra, A[1]
1.Centro de Investigaciones Mariñas (CIMA). Pedras de Carón, s/n. 36620. Vilanova de Arousa. Pontevedra.
2.Instituto Galego de Formación en Acuicultura (I.Ga.F.A.). Niño do Corvo, s/n. 36626. Illa de Arousa. Pontevedra.

1. El sector productivo

Galicia (N.O. de España) explota parte de sus aproximadamente 1500 km de costa para la obtención de moluscos bivalvos entre los que se encuentran las almejas (*Venerupis pullastra*, *Tapes decussatus*, *Ruditapes philippinarum*) por un valor, en el año 2009, de 43.963.235,75 € (Xunta de Galicia).

2. Proyecto formativo

En el año 2000, la "Dirección Xeral de Desenvolvemento Pesqueiro" de la "Consellería do Mar" construyó dos criaderos piloto para realizar transferencia tecnológica al sector y que éste pudiera producir semilla de almeja para cubrir parte de su demanda, de forma autónoma.

La puesta en marcha y validación de estas plantas de cultivo se realizó mediante técnicos en acuicultura titulados en el IGAFA que recibieron una beca post-formativa de 2 años de duración bajo tutela de profesores de este centro y personal investigador del CIMA.

3. Trasvase y aplicación tecnológica

Utilizando como modelo los criaderos piloto, se construyó en el año 2004 una instalación industrial en el N. de Galicia (Camariñas) que en 2009 produjo 9.821.027 unidades de almeja con talla de 2-3mm destinada a preengorde.

Este criadero cuenta con una plantilla de 4 técnicos en acuicultura formados en las instalaciones del IGAFA.

4. Instalación de preengorde piloto

Instalación anexa al criadero (pantalán) para el preengorde de semilla de almeja 2- 3 mm hasta alcanzar una talla cercana a 10 mm (siembra en medio natural).

Año	Especie almeja (uds)		
	Venerupis pullastra	*Tapes decussatus*	*Ruditapes philippinarum*
2009	1.426.582	-	5.878.331
2008	4.596.081	543.120	1.639.463
2007	4.561.443	7.023.297	2.018.507
2006	3.755.252	355.793	1.788.982

Tabla 1. Resultados de producción en el preengorde (unidades de semilla para siembra en playa), de 2006 a 2009.

Año 2009	Unidades iniciales en preengorde (2-3 mm)	Unidades finales del preengorde (> 10 mm)	Unidades recaptura engorde en playa (talla comercial)	Valor en € de la producción (talla comercial)
Ruditapes philippinarum	7.254.379	5.878.331	2.939.166	405.604,84
Venerupis pullastra	2.596.648	1.426.882	213.441	135.992,83
Total	9.821.027	7.305.213	3.652.607	541.597,67

Tabla 2. Desglose de la producción del año 2009

Autoría: Martín-Gómez, L.; Villalba, A.; Abollo, E.

Título: Identification of genes involved in the immune response of the flat oyster to bonamiosis

Evento: 7th International Conference on Innate Immunity

Lugar: Rhodes (Grecia)

Ano: 2010

IDENTIFICATION OF GENES INVOLVED IN THE IMMUNE RESPONSE OF THE FLAT OYSTER TO BONAMIOSIS

Martín-Gómez L[1], Villalba A[1] & Abollo E[2]

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INTRODUCTION

The immune system of mollusc is endowed with an innate immune system, which involves cellular and humoral components. Cellular responses are mediated by haemocytes through phagocytosis and various cytotoxic reactions. Haemocytes secrete numerous humoral defense factors, such as soluble lectins, hydrolytic enzymes and antimicrobial peptides. A few molecular studies have identified sequences of genes with a potential role in the immune response of *Ostrea edulis*. The genus *Bonamia* (Perkinsea, Haplosporidia) includes parasites that are found within oyster haemocytes. The parasite once phagocytosed within the haemocyte, appears to have some evasion mechanism that turns off the haemocyte's metabolic bactericidal capacity, so that the parasite survives within the cell. In this study we isolated and characterized the full-length of various immune genes expressed in the haemocytes of the flat oyster, *Ostrea edulis*, in response to bonamiosis.

MATERIALS AND METHODS

SSH technique (PCR-Select cDNA subtraction kit, Clontech) was used to discriminate the genes involved in the flat oyster's response against bonamiosis. A SSH library was produced with the haemocytes of oysters experimentally infected with *Bonamia ostreae* comparing the cDNA's in that of uninfected (control) individuals. The results, another SSH library was produced by comparing thirteen severe and thirteen mildest infected oysters versus non infected ones. The each EST (Expressed Tag sequence Tag) library obtained the up-regulated transcripts sequences in infected and the down-regulated transcripts. Selected genes were cloned using the Rapid 5'-prime/3'-prime cDNA's ends kit (Clontech). The mRNA expression for each gene in different necropsy levels of infection was examined by real-time PCR using the Bio-Rad IQ5 thermocycler system. Data were analyzed using the Bio-Rad IQ5 system software and quantification was performed using the Gene Manager Software. Differences in mRNA level were analyzed using ANOVA or, non parametrical tests depending on the data. Data with a significant value less than 0.05 were considered to be statistically different. Phylogenetic trees were constructed based on the deduced amino acid sequences of immune-related genes using the Maximum Likelihood (ML) algorithm with an NJ/JTT tree as ML start. The trees were constructed using the Bootstrap consensus tree. Branch points were validated by 10000 bootstrap replications.

RESULTS AND DISCUSSION

A high number of ESTs were found to be up or down regulated in the infection, and genes were grouped according to their main function (Figs. 1 and 2). We identified an interesting group of ESTs that play a role in the immune response, such as cytokines, stress proteins, chemokines, proteins implicated in antigen-presentation or cell function as well as in intracellular signaling (MAPK, cAMP). Transcription expression analysis (Real Time PCR) showed up-regulation expression (Pr0.05) in mRNA levels of CLTA, LDP/DH, Perlucin, TIMMT1, Dectin, and H. Contortus-like. Inh. Proteinase, MAP3, Kin of IRRE-like, TNF, AIF and VAMP and down-regulated expression for Annexin, Tropomyosin β subunit, Lectin and Dermatopontin genes (Fig 3). Phylogenetic trees of TNF and AIF show the relationships with the same proteins in invertebrates, fish and mammals (Fig. 4).

In response to an infection, invader haemocytes secrete soluble proteins that recognize and interact with microorganisms as sensors. TNF (Tumor necrosis factor) and AIF (Allograft inflammatory factor) are cytokines with an essential role in the innate immune response in invertebrates. VAMP (Vesicle associated membrane protein) and Dermatopontin seem to play as well an important function during a pathogen invasion. We hope this work contributes to gain knowledge on the molecular immune responses of molluscs.

Acknowledgements: This work was supported by Xunta de Galicia under the projects PGIDIT03MAR30103PR and PGIDIT05CRVIA 1C. LMG is supported by a fellowship from the Xunta de Galicia (I2C program). PGIDIT 2006 2010

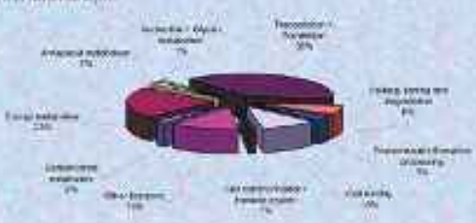

Figure 1. Functional classification of up-regulated genes in response to *Bonamia ostreae*.

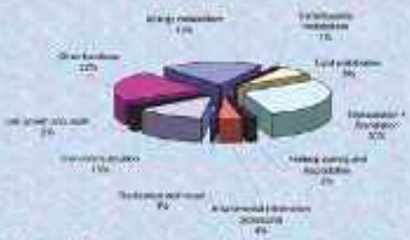

Figure 2. Functional classification of down-regulated genes in response to *Bonamia ostreae*.

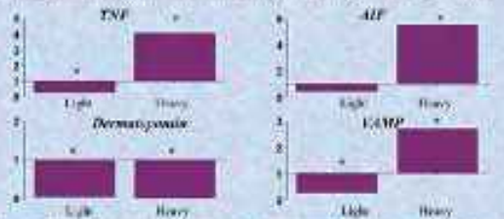

Figure 3. RT-PCR analysis of gene expression in haemocytes of flat oysters infected by *Bonamia ostreae*. Level 1 corresponds to expression in non-infected oysters and level 2 corresponds to the expression level in lightly or heavily infected oysters. * Statistically significant differences with regard to non-infected oysters ($P<0.05$).

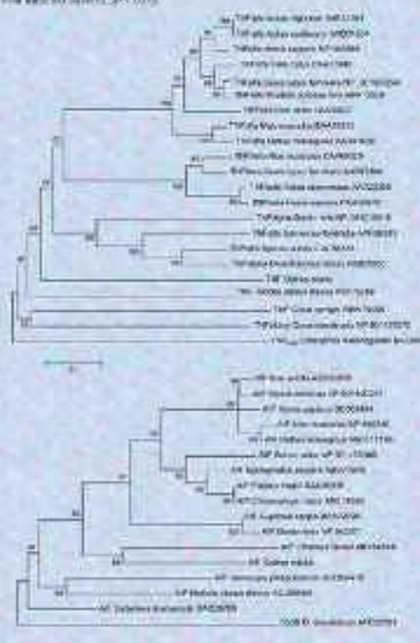

Figure 4. Phylogenetic relationships among TNF and AIF deduced amino acid sequences of mammals, fish and invertebrates.

Autoría: Cerviño, A.; Blanco, E.; Montes, J.; Prado, S.; López-Jimeno, G.C.; Barja, J.

Título: Survival and growth of flat oyster (*Ostrea edulis*) spat in floating rafts using three culture systems

Evento: Aquaculture Europe 10 – Annual Meeting of the European Aquaculture Society

Lugar: Porto (Portugal)

Ano: 2010

SURVIVAL AND GROWTH OF FLAT OYSTER (*Ostrea edulis*) SPAT IN FLOATING RAFTS USING THREE CULTURE SYSTEMS

A. Cerviño(1), E. Blanco(2), J. Montes(2), S. Prado(3), G.C. López-Jimeno(3) and J. Barja(3).

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ABSTRAC

In this work we present the results obtained in the early ongrowing of oyster spat from hatchery, working at usual densities but with enhanced management practices (including different storage systems). Under these conditions, the rates of growth in weight and size are high and the cumulative mortality is less than 25% during the nursery period.

INTRODUCTION

The culture of flat oyster (*Ostrea edulis*) in Galicia (NW Spain) depends mainly at present on the importation of juveniles from foreign natural beds. The best solution is the hatchery production of autochthonous exemplars, but the early ongrowing of spat from this source is a critical point for this culture.

The spat from hatchery suffers high mortalities in the early ongrowing due to poor quality management practices (De Cos *et al.* 2003, 2005), including cleaning and duplication, regardless of the high metabolism rate of the oyster in this phase. These facts prevent the sector to use exemplars from hatchery.

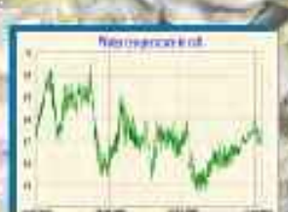
RESULTS AND DISCUSSION

The main objective of the present work was to assay new methodologies in order to minimize the mortality rates in the ongrowing of flat oyster spat. As observed in Table 1, the survival in oyster-baskets (OB) and special-boxes (SB) at densities ≤ 200 g per basket/box was higher than 90%. Mortalities higher than 25% were reached only in plastic-boxes (PB) when the frequency of duplications was reduced. Again, the best results in terms of growth (size and weight) were attained in oyster-baskets and special-boxes, with differences respect to plastic-boxes around 70-80% in weight and 20-30% in size.

The monthly ongrowing rates (Gm30) ranged between initial values of 300 until 100 in the final steps.

The seawater temperature in rafts (datalogger TIDBIT) was comprised from 20-22°C on July-August until 18°C in the following months. The initial values can be considered dangerous for oyster spat in early stages, when the metabolism rate is very high and the oxygen saturation decreases, and justify the necessity for more frequent duplications.

The results are promising to complete the ongrowing phase in rafts with low mortality rates and therefore to sustain the flat oyster aquaculture as a profitable activity.



CONCLUSION

Nursery flat oyster spat, common practice unfold up to 2500 and decrease of lower densities to 2500 g/m², favor their rapid growth and significantly increase survival rates.

Spat less than 20mm, the unfolding must be made for periods not exceeding 7 / 9 days.

MATERIALS AND METHODS

Three culture systems were used in the experiences developed in raft (Ría de Arousa, Spain):

1) Oyster-baskets (OB) with four inner compartments (4 mm mesh), in vertical parts of 6 units. The assayed densities were 100, 200 and 300 g per basket, increased in three steps along culture time.

2) Special-boxes (SB), designed from oyster-bags, disposed on iron cages used for clam ongrowing. The densities were 100 and 200 g per box, increased in two steps.

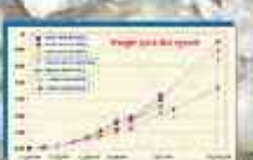
3) Plastic-boxes (PB), used for the imported spat (5 mm mesh), stacked in four columns of 14 steps into iron cages. The densities were 300 and 600 g per box.

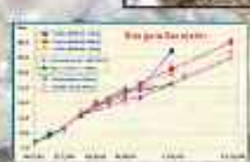
The different weights in each container correspond to equivalent densities: 1250, 2500 and 3750 g/m².

The experiments were begun on July, with duplications every 7 days. With the increase of spat size and the subsequent decrease of growth rate, every 15 and further 21 days.

In the moment of duplications, samples were taken for estimation of weight, size and survival.

The temperature was monitored along the experience with a Datalogger TIDBIT StowAway Hobo (ONSET).





This work was supported by the Program INCITE of Xunta de Galicia

Autoría: Villalba, A.; Pardo, B.G.; Cao, A.; Fernández, S.; Vilas, R.; Martínez, P.

Título: Analysis of the genetic variability of *Perkinsus olseni* (Protozoan parasite of clams) through the Spanish coast using microsatellites

Evento: 102nd National Shellfisheries Association Annual Meeting

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Ano: 2010

ANALYSIS OF THE GENETIC VARIABILITY OF *Perkinsus olseni* (PROTOZOAN PARASITE OF CLAMS) THROUGH THE SPANISH COAST USING MICROSATELLITES

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Perkinsus olseni is a protozoan parasite that has been blamed for high mortalities of venerid clams in Portugal, Spain and Korea. The species was originally described parasitizing abalones (*Haliotis rufes*). The parasite has been reported in a broad geographic range, including Oceania (Australia and New Zealand), East Asia (Korea, Japan, China, Thailand), South America (Uruguay) and Europe (Portugal, Spain, France, Italy). The host range includes various species of clams, oysters and abalones. Likely, *P. olseni* originated in the Pacific Ocean and was introduced into Europe and South America with Manila clam *Ruditapes philippinarum* transfers. The occurrence of the parasite in Italy, Portugal and Spain was first reported in the 1990s.

A study was performed to analyse the genetic variability of *P. olseni* through the Spanish coast using microsatellite loci. This is the first study about population genetic structure of *P. olseni* by using microsatellites. Markers were isolated and characterized following two approaches: (1) we developed an enriched genomic library of DNA using FIASCO (Zane et al. 2002); and (2) we screened the GenoBank EST resources to look for repetitive motifs. The microsatellite search was conducted using the programme Sputnik (Abajian, 1994). All sequences were clustered to avoid redundancy using CAP3 with default parameters. Five infected carpet shell clams *Ruditapes decussatus* from Ría de Arousa, 4 from Ría de Pontevedra (both bays in Galicia, NW Spain), and 5 from Río Carreras (Huelva, SW Spain), and 5 infected Manila clams *R. philippinarum* from Delta de l'Ebre (Catalonia, NE Spain) were used as source of parasites (Fig. 1). Isolated parasites proliferated *in vitro* and clonal cultures were produced to check for multiple infections in the same individual host. Five clonal cultures per host were used, thus giving a total of 125 clonal cultures. Additionally, 6 *P. olseni* clonal cultures each deriving from 3 infected clams *R. philippinarum* collected in Japan and from 3 clams *Austrovenus stutchbury*i from New Zealand, respectively, were analyzed.

Twelve microsatellite loci of *P. olseni* genome were obtained as a tool to evaluate the genetic variability of the parasite. The analysis of the sequences for those 12 loci in the 125 clones disclosed a remarkably low polymorphism considering that microsatellites are hypervariable loci (Table 1). Only four of these loci showed substantial polymorphism. In general, populations of *P. olseni* from Spain showed low levels of genetic variability and were characterized by significant heterozygote deficits (Tables 1 and 2). However, the proportion of different multilocus genotypes was relatively high. Differences between clones deriving from the same individual hosts were detected, demonstrating multiple infection of a single host. Statistically significant deviations from the Hardy-Weinberg equilibrium were common and always toward a deficiency of heterozygotes.

Table 1. Estimates of genetic diversity of *P. olseni* populations at 12 microsatellite loci.

	N	H_o	H_e	A	P_{95}	MLG	MLG/N
Arousa	25	0.044	0.150	1.67	33	15	0.62
Pontevedra	20	0.025	0.069	1.50	25	9	0.45
Huelva	32	0.006	0.067	1.42	16.7	3	0.09
Catalonia	40	0.021	0.160	1.91	27.3	-	-
Japan	3	-	-	1.54	36.4	3	1.0
N. Zealand	3	-	-	1.50	50	2	0.67

N, sample size; H_o, observed heterozygosity; H_e, expected heterozygosity; A, average number of alleles; P_{95}, percentage of polymorphism (95% criterion); MLG, number of different multilocus genotypes.

Fig. 1. Map of the Iberian Peninsula showing the location of the Spanish areas where infected clams were collected.

Results suggest predominant sexual reproduction and strong inbreeding within populations. However, the observed heterozygote deficiencies could also be explained by a Wahlund effect. The results are not concordant with clonal population structure for this parasite and suggest an important effect of sexual reproduction. Low genetic variability, particularly the low number of alleles detected, could be caused by relatively low effective population size. It is likely that the low polymorphism detected is due to a **founder effect**, which is consistent with the hypothesis of a single or a very reduced number of introduction events into Spain from the autochthonous *P. olseni* geographic area. Remarkable genetic differences were observed between Spanish coast populations and both putative Pacific sources. The divergence was higher in the New Zealand *P. olseni* clones than in the Japanese ones when compared to the Spanish clones (Fig. 2). Although sample size of both Pacific populations is very low, the number of alleles and multilocus genotypes, two values very sensitive to the population size, were high, which is consistent with the hypothesis of the founder effect.

Table 2. Inbreeding coefficient (F_{IS}) values, corresponding to the most polymorphic microsatellite loci, for *P. olseni* populations. * ($p < 0.004$)

	Pol20	*Pol18*	*Pol8*	*Pol11*	**Average**
Arousa	+1.00	-0.200	0.853*	0.801*	0.616
Pontevedra	0.820*	-0.027	0.655	-	0.482
Huelva	0.940*	-	+1*	-	0.970
Catalonia	0.830*	-	0.832*	0.940*	0.876

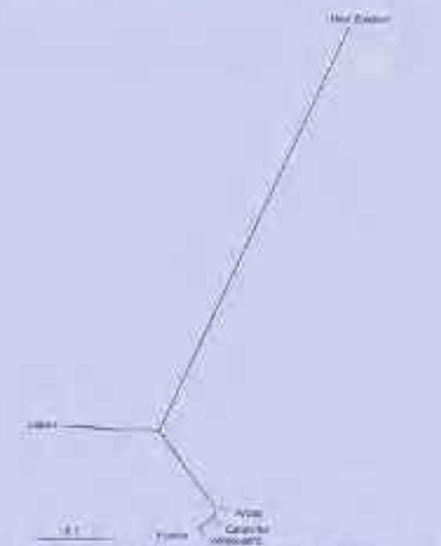

Fig. 2. Dendrogram of Nei's genetic distances (Da) among the six populations studied.

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Autoría: Besada, M.; Búa, I.; Otero, M.; Guerra, A.

Título: Reproducción de la navaja (*Ensis arcuatus*) en las Rías Bajas (Galicia, España)

Evento: XIII Foro dos Recursos Mariños e da Acuicultura da Rías Galegas.

Lugar: O Grove - Galicia (España)

Ano: 2010

XUNTA DE GALICIA
CONSELLERÍA DO MAR

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Reproducción de la navaja (*Ensis arcuatus*) en las Rías Bajas (Galicia, España)

Besada, M., Búa, I., Otero, M. y Guerra, A.
Centro de Investigacións Mariñas (CIMA). Vilanova de Arousa (Pontevedra)

Resumen

A efectos de regular y mejorar la gestión de las poblaciones de la navaja (*Ensis arcuatus*), se aporta información sobre el ciclo reproductivo de esta especie. Obtenida a partir de muestras de bancos naturales de las Rías de Arousa y Vigo. La actividad reproductiva se analiza a través de índices de condición de la gónada entre los años 1998 y 2010, la cual ocurre entre febrero y julio, con excepciones que indican emisiones parciales. Entre julio y noviembre la actividad es inapreciable y la gónada permanece vacía de productos gonadales.

Material y métodos

Las muestras proceden de bancos naturales y se obtienen por profesionales del sector usando los métodos habituales de cosecha, según la ubicación del banco natural (intermareal o sumergido). Las muestras, compuestas por lotes de un mínimo de 20 unidades, mayoritariamente de talla comercial (**Figura 1**), son procesadas en el laboratorio para disección. Mediante observación microscópica de frotis obtenidos de biopsias de la gónada, se determina la sex-ratio y el desarrollo de la gónada.

Los parámetros biométricos analizados han sido: Longitud (mm), Peso (g) y el Índice de Condición de la Gónada (ICG) determinado a partir de la relación peso gónada/peso vivo, basados en el cálculo del 60% cuerpo entero.

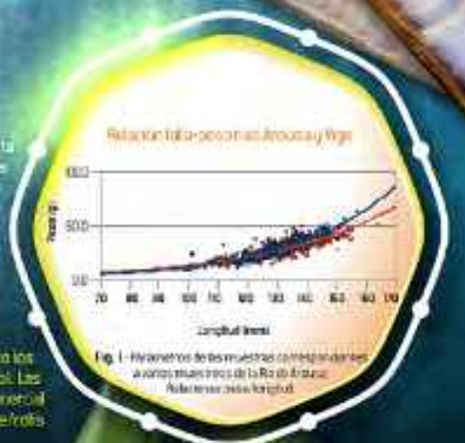

Fig. 1 - Parámetros de las muestras comerciales de navaja analizadas en los muestreos de la Ría de Arousa. Relación peso-talla (longitud).

Resultados

a Parámetros biométricos

La **Figura 1** recoge las relaciones biométricas de peso/longitud de los individuos de las muestras procesadas durante los años 2007-2010 de las rías de Arousa y Vigo, que mayoritariamente superan la talla comercial (>80 mm).

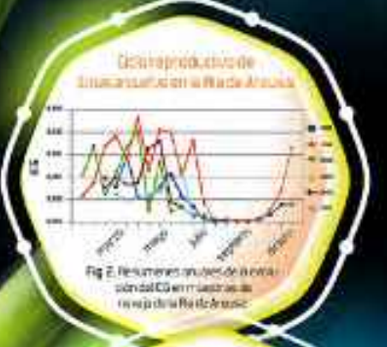

Fig 2. Resumen anual de la evolución del ICG en muestras de navaja de la Ría de Arousa.

b Índice de Condición de la Gónada (ICG)

En la **Figura 2** se recogen estos valores en la Ría de Arousa. Seleccionando como ejemplo los de 2009. Durante los años 1998, 1999 y 2000, junto con los datos inéditos en este trabajo (2008, 2009 y 2010). En la **Figura 3** se comparan los valores medios obtenidos simultáneamente de muestras procedentes de Ría de Arousa y Vigo. La elevada desviación estándar en los periodos de alto ICG sugiere una heterogeneidad en el desarrollo gonadal, con diferentes estadios de madurez.

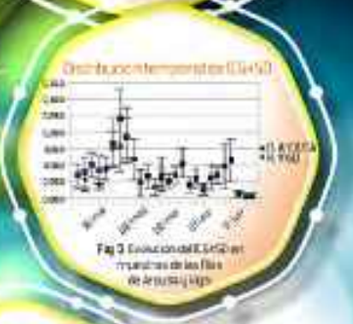

Fig 3. Evolución del ICG (%) en muestras de las Rías de Arousa y Vigo.

c Sex-ratio

Distribución de machos (M) y hembras (H) en poblaciones de la Ría de Arousa y Vigo. En muestras obtenidas en periodos de actividad reproductiva, sin diferencias significativas.

Ría de Arousa: 492 individuos analizados: **M: 49,6%, H: 50,6%**
Ría de Vigo: 117 analizados: **M: 49,6%, H: 50,6%**

Fig. 4. Sex-ratio en muestras de las Rías de Arousa y Vigo.

Conclusiones

El periodo de la actividad reproductiva se repite, con ligeras variaciones a lo largo de los años. La actividad es creciente a partir de enero hasta junio. No se aprecian diferencias importantes en cuanto al periodo de actividad en las muestras de ambas rías.

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Título: Tratamiento de efluentes de granjas de rodaballo (*Psetta maxima*) en Galicia (España)

Evento: III Foro Iberoamericano de los Recursos Marinos y la Acuicultura (III FIRMA)

Lugar: Hermosillo (México)

Ano: 2010

TRATAMIENTO DE EFLUENTES DE GRANJAS DE RODABALLO *(Psetta maxima)*, EN GALICIA (ESPAÑA)

XUNTA DE GALICIA
CONSELLERÍA DO MAR

Guerra, A.*; Marcel, P.**; Otero, M.***; Fernández, J.***; & González, S.**

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Introducción

En Galicia (N.O. de España) se producen unas 7.500 TM/año (2009) de rodaballo en piscifactorías en tierra. El 100% de estas granjas se ubican en zonas de aguas estuáricas. La misma granja estudiada produciendo 6.000 Tm y vendo 4g de pienso por su 1Tm/ha. El agua de mar entra con unos 3 ppm de sólidos en suspensión y sale de la piscifactoría con 8 ppm. Tenga cuenta que el 50% de esa materia orgánica procede del mar y el resto lo aportan los restos de piensos. De este pienso el 50% lo forman proteínas. Los residuos de particulado fino (< 100 micras) que salen por el efluente son muy ricos en fracciones de partículas gruesas.

Con este proyecto se pretende, a) el tratamiento y reconversión de los particulados finos del residuo en materia biológica aprovechable para la regeneración de tierras empobrecidas, en animal en el presente caso en enriquecimiento de sustratos de cultivo y almacén de carbono y b) Valorar el tratamiento y conversión de los sólidos más gruesos del efluente como materia orgánica aprovechable para su compostaje y uso en cultivos agrícolas y forestales. c) Valorar el impacto medio-ambiental de todo el sistema en el entorno marinero.

Materiales y métodos

A Preengorde de semilla en semillero (nursery).

Los experimentos de preengorde de la semilla se realizan en la granja de rodaballo de INSUÑA, S.L. en la Ría de Arousa. La semilla procede de criadero (REMGRO SA), de tres orígenes comerciales: dorada japonesa (*Crassostrea gigas*), almeja japonesa (*Tapes philippinarum*) y almeja bastarda (*Venerupis pullastra*). Las tallas iniciales se indican en la Tabla 1. Los experimentos se realizan en paralelo y se trata semillas en un semillero suficiente suministrado con floculación de biofiltro natural y en un semillero ubicado en la rasca portuaria. La experiencia se desarrolló durante cuatro meses hasta que la semilla alcanzó la talla adecuada para su cultivo normalizado, en bolsa (almeja) o en substrato en parque (de cultivo definitivo).

Las tasas de crecimiento en longitud (L) y peso (W) se calculan mediante la fórmula: $G = (\ln W_2 - \ln W_1)/(t_2 - t_1) \times 100$

B Lodos con residuos gruesos

Los residuos gruesos compactados, procedentes de los lodos del efluente de semillero, se mezclan con restos de compostaje en la empresa de compostaje ECOCELTA, con dos lotes de mezcla compuestos de restos vegetales con serrín de *Pinus pinaster*, y con lodos con restos de trufa, serrín y estiércol de granja de pollo. Se estudia la evolución de las propiedades químicas del suelo en función de los distintos tratamientos y usos de compost. También se evalúa la calidad microbiológica con los indicadores tradicionales coliformes.

Resultados y conclusiones

A De ensayos de preengorde de semilla de bivalvos.

En la Tabla se indican los resultados del preengorde de semillas bastardas y en la siguiente las de la ostra.

Especie	INICIO		FINAL								
			TRATAMIENTO								
			Semillero en efluente de granja bastarda			Semillero con aporte de fitoplancton			Semillero exterior en rasca portuaria		
	L (mm)	P(mg)	L (Mm)	G SEL	G SEW	L (mm)	G SEL	G SEW	L (mm)	G SEL	G SEW
Ostra japonesa	3,7 ± 0,0	26,0 ± 8,4	8,7 ± 2,6	0,58	0,87	8,6 ± 0,5	0,57	1,17	14,5 ± 2,0	0,57	1,58
Almeja japonesa	5,5 ± 0,7	46,7 ± 15,7	9,6 ± 1,4	0,33	1,00	10,2 ± 2,1	0,34	1,28	15,1 ± 1,0	0,35	1,51
Almeja bastarda	7,2 ± 0,0	150,3 ± 0,0	9,4 ± 0,8	0,21	1,30	9,6 ± 0,9	0,06	1,37	15,3 ± 1,7	0,51	1,68

La almeja bastarda y en menor medida la ostra japonesa son especies con capacidad de crecimiento rentable para el cultivo en bateas flotantes, frente a los sistemas tradicionales de engorde.

B De tratamiento de lodos para usos agrícolas y forestales.

El proceso de compostaje y vermicompostaje de lodos permite recuperar la calidad del suelo frente a la degradación, la salinización/alcalinización y la contaminación química y microbiológica. La aplicación con vermicompost al suelo ha producido:

a) Un incremento del contenido de materia orgánica, lo que supone un primer paso en la recuperación de su calidad.
b) Un incremento del contenido de fósforo en forma disponible.
c) Un incremento en el nivel de patógenos ambientales y patógenos en el suelo.
d) Valores elevados de humificación/CEC, lo que contribuye a mejorar la estructura del suelo.
e) Una baja salinidad en el vermicompost, lo que hace que los suelos tratados con el mismo no sufran problemas de salinización, ni de procesos de sodificación, lo que supone un beneficio en el uso de aguas de riego de mala calidad.

Los resultados de los bioensayos realizados con el vermicompost de lodos muestran que es un material orgánico estable y maduro, apto para ser utilizado como enmienda orgánica en suelos degradados.

Agradecimientos

Este proyecto está financiado por el programa sectorial de investigación aplicada Peme I+D e I+D Suma del Plan Gallego de Investigación, Desenvolvemento e Innovación Tecnolóxica (PGIDITE).

Autoría: Carballal, M.J.; Díaz, S.; Iglesias, D.; Villalba, A.

Título: Significance of disseminated neoplasia and infection by *Bonamia exitiosa* for oyster *Ostrea edulis* culture in Galicia (NW Spain)

Evento: Aquaculture Europe 2010: Seafarming Tomorrow. European Aquaculture Society.

Lugar: Porto (Portugal)

Año: 2010

Significance of disseminated neoplasia and infection by *Bonamia exitiosa* for oyster *Ostrea edulis* culture in Galicia (NW Spain)

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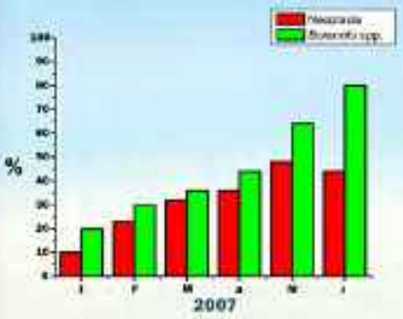
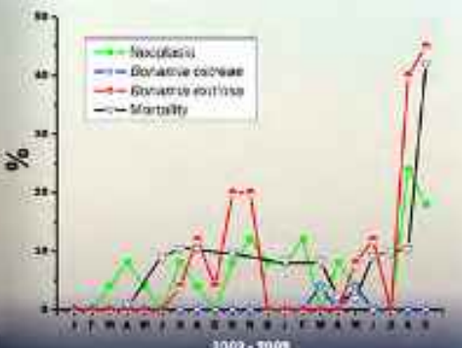
Introduction

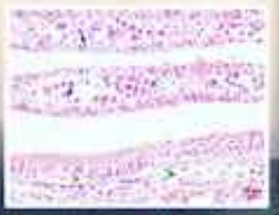
Results Experiment 1

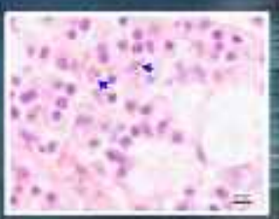


Material and Methods

Results Experiment 2







Discussion and conclusions

References

Abollo, E., A. Ramilo, S. M. Lopez, P. Gestal Mendez, A. Cao, M. J. Carballal, A. Villalba, 2008. First detection of the parasite *Bonamia ostreae* in the flat oyster *Ostrea edulis* grown in Galician waters, Aquaculture 274: 201–207.

de Casa-Vieja, G., J. Portela, A. Villalba, 2006. Growth, mortality and condition seasonality of cupped oysters cultured in two Galician bays subjected to different degrees of eutrophication, Aquaculture 254: 337–354.

de Gyves Tur, J., J. Ibarra, A. Villalba, 2000. Differences in gametic production among stocks of the flat oyster, *Ostrea edulis*, and a Pacific cupped oyster, *Crassostrea gigas*, cultured in Galicia (NW Spain). J. Shellfish Res. 19: 289–295.

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Histological techniques were performed by [illegible]
Clara Ponte.

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Autoría: Rodríguez, R.; Iglesias, D.; Ruíz, M.; López, C.

Título: Histological survey of symbionts and other conditions in razor clam *Solen marginatus* (Pennánt, 1777) from three natural beds of the Rías Altas in Galicia (NW Spain)

Evento: Aquaculture Europe 10 – Annual Meeting of the European Aquaculture Society)

Lugar: Porto (Portugal)

Ano: 2010

HISTOLOGICAL SURVEY OF SYMBIONTS AND OTHER CONDITIONS IN RAZOR CLAM *Solen marginatus* (PENNANT, 1777) FROM THREE NATURAL BEDS OF THE RÍAS ALTAS IN GALICIA (NW SPAIN)

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I Introduction

Natural populations of the razor clam *Solen marginatus* are a resource for shellfisheries in Galicia (NW Spain), especially when the catches of other razor clams were valued become low. Few pathological aspects of this species have been studied until now (Lauckner, 1983; López and Darriba, 2006; López et al. 2008). A pathological survey is being performed in the exploited beds of this species to assist in sanitary studies.

M Material and methods

Samples of 20 adults of *Solen marginatus* (>100mm in length) were collected, during the spring and fall of 2008, from three intertidal natural beds: Rhodes, Pur and Ortigueira in the North of Galicia. Samples were processed using standard techniques for histology. Davidson's solution and Harris' hematoxylin and eosin were used (Howard and Smith, 1983).

Overall prevalence for the whole study period and 95% confidence interval were performed using Epicalc 2000 software Version 1.02 (Gilman and Myatt, 1998).

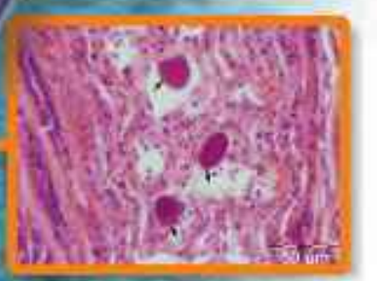
R Results and conclusion

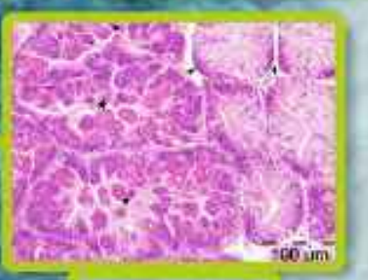
Histological examination revealed the presence of various symbionts affecting *S. marginatus*. In Table 1 we highlight the organisms with high prevalence and other organisms with low prevalence but with pathogenic potential, like it is the case of *Marteilia* sp.

In the case of beds with high prevalence and moderated intensity of protozoic extracellular cyst (Rhodes and Ortigueira), inflammatory reaction and damage on the host were not detected. Nevertheless, it is remarkable the inflammatory reaction observed in the case of the presence of metazoans as in Ortigueira.
In conclusion, the *S. marginatus* natural bed of Ortigueira presents the highest prevalence of symbionts, and it is the only with presence of *Marteilia* sp.

Table 1. Prevalence (%) and intensity of symbionts found in *Solen marginatus* from Galicia (NW Spain).

Symbionts		Prevalence (%) Spring (n=20)	Prevalence (%) Fall (n=20)	Global prevalence (%) (n=40)	95% Confidence interval
Protozoans	Extracellular cysts (+ g)	F	35	5	20.00	9.85 - 35.83
		I	10	10	10.00	4.95 - 20.20
		O	40	15	27.50	14.93 - 43.58
	Intracellular cysts (+ g)	F	10	0	5	1.39 - 16.91
		I	10	0	5.00	1.39 - 16.91
		O	15	0	10.00	3.87 - 24.04
	Extracellular cysts (++ g)	F	80	100	90	68.30 - 98.77
		I	0	0	0	0.00 - 10.59
		O	80	100	90.00	68.30 - 98.77
Nematoda	Worldwide	F	0	0	0	0.00 - 10.59
		I	0	0	0	0.00 - 10.59
		O	0	0	0.00	0.00 - 10.59
	Cilliates	F	45	20	32.50	18.07 - 49.24
		I	5	0	2.50	0.31 - 16.21
		O	45	20	32.50	18.07 - 49.24
	Non-encapsulated	F	0	0	0	0.00 - 10.59
		I	10	0	5.00	1.39 - 16.91
		O	0	10	5.00	1.39 - 16.91
Mollusca	Turbellarian Paramphistomum	F	35	15	25.00	12.34 - 41.53
		I	0	0	0	0.00 - 10.59
		O	45	20	32.50	18.07 - 49.24
	Copepodes (+ g)	F	0	0	0	0.00 - 10.59
		I	0	0	0	0.00 - 10.59
		O	0	15	7.50	1.90 - 21.48
	Trematode metacercariae	F	0	0	0	0.00 - 10.59
		I	0	0	0	0.00 - 10.59
		O	0	5	2.50	0.31 - 16.21
		O	80	90	85.00	70.80 - 93.94





R References

Gilman, J., Myatt, M., 1998. EpiCalc 2000. Version 1.02. Brixton Books. <http://www.brixtonbooks.com/epicalc.html>

Howard, G.W., Smith, C.S., 1983. Histological techniques for marine bivalve mollusks (NOAA Technical Memorandum NMFS-F/NEC-25). Woods Hole.

Lauckner, G., 1983. Diseases of Mollusca: Bivalvia. In: Kinne, O. (Ed.), Diseases of Marine Animals, Vol. II. Biologische Anstalt Helgoland, Hamburg, 477-961.

López, C., Darriba, S., 2006. Presence of *Marteilia* sp. (Paramyxea) in the razor clam *Solen marginatus* (Pennant, 1777) in Galicia (NW Spain). J. Invertebr. Pathol. 92, 109-111.

López, C., Darriba, S., Iglesias, D., 2008. Estudios sobre moluscos bivalvos cultivables y explotables sobre fondos intermareales: biología, ecología y cultivo. Eds. Guerra, A. and Ibáñez, C. Xunta de Galicia, pp. 143-183.

Autoría: Linares, F.; Olmedo, M.; Álvarez-Blázquez, B.; Pazos-Sieira, G.; Pérez-Rial, E.; Peleteiro, J.B.

Título: Ongrowing of blackspot sea bream, *Pagellus bogaraveo*, in cages with feed of different biochemical composition

Evento: Aquaculture Europe 10 – Annual Meeting of the European Aquaculture Society

Lugar: Porto (Portugal)

Ano: 2010

ONGROWING OF BLACKSPOT SEA BREAM, *PAGELLUS BOGARAVEO*, IN CAGES WITH FEED OF DIFFERENT BIOCHEMICAL COMPOSITION

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Introduction

One of the fundamental lines in the development of marine aquaculture is species diversification. Blackspot sea bream (*Pagellus bogaraveo*) is considered to be one of the target species due to its high economic value, its biological characteristics and the good lack of fish on the markets. It has been demonstrated that this species, at the ongrowing stage, presents no pathological problems and that its adaptation to culture in cages is excellent. In first experiments conducted previously (Limares et al., 2004; Olmedo et al., 2007; 2009), it was noted that the fatty content of feeds has not a clear influence on the growth of blackspot sea bream during the ongrowing stage.

The aim of this work is to check the effect on growth and the biochemical composition of blackspot sea bream of feed with two feeds of a different protein/fat content and with different sizes of feeding.

Material and methods

Commercial feeds (Skretting).
Protein/fat: composition:
(Feed T1) (Feed T2)
Four batches of 400 fishes.
Initial average weight and size: 103.60±12.13 g | 14.60±0.80 cm
Cages of 5 x 5 x 5 m (125 m3) of the Regional Government of Galicia Sea Department.
Cages control and feed supply (s) were made by Aquaculture Association "Ría de Santa", Bueu (Pontevedra).
Sampled monthly during 3 months (weight and size).
Biochemical analyses of proteins, total lipids and fatty acids of muscle and liver were done in triplicate at the start and end of the experiment.

Results and discussion

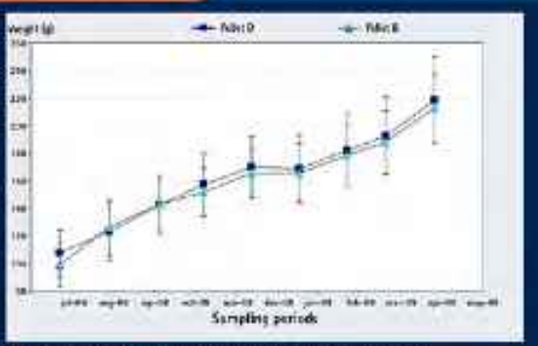

Figure 1. Growth of blackspot sea bream fed with different feeds (mean ±sd).

The values attained in weight and size after 3 months (Exp. 1) were 211.90±32.08g and 19.03±1.08cm in Group D, and 212.80±45.04g and 18.87±2.03cm for Group B. No significant differences were noted between the groups fed with the different feeds.

	Muscle			Liver		
	D	B		D	B	
	Start	End	End	Start	End	End
Proteins (% dw)	77.08	77.31	77.60	39.01	39.65	39.29
Lipids (% dw)	6.98	11.48	13.93	38.90	37.45	42.31
Fatty acids (% total)						
PUFA	30.16	30.35	30.09	18.04	25.91	21.13
SAFA	27.89	28.07	27.25	37.75	28.55	29.74
MUFA	42.00	38.58	42.66	47.63	44.01	47.88
Σ n-3	14.78	16.72	17.01	6.08	14.37	14.67
Σ n-6	15.38	13.63	13.08	9.72	10.12	10.35

Table 1. Biochemical composition of Muscle and liver proteins (%) with two feeds.

No significant differences were noted in proteins and lipids at the end of the experiment with the two feeds tested, neither in the muscle nor in the liver.

Protein content in the individuals at the end of the experiment is similar to that previously obtained in this species (Olmedo et al., 2007; 2009; Silva et al., 2006), demonstrating with smaller sized individuals that feeding with feeds with 45% protein would be sufficient for feeding this species. Feeds used in the experiment (current industrial protein content (48%) and 54%).

Significant differences in the PUFA were noted in the liver of the individuals fed with the two feeds (18.04% group D; 25.91% group B). This is due to the fact that the PUFA in fish are higher in the liver and muscle of the individuals fed with 10% fat feed. No differences were noted in the content in PUFA (n-3) in the muscle as fish with the two feeds tested.

Conclusion

The results obtained indicate that the use of different quality feeds with a protein range of 48-52% and a fat range of 12-14% has no significant effect on growth during the ongrowing stage of blackspot sea bream nor on its composition in proteins, lipids and PUFA (n-3) in liver and muscle.

References

Limares, F., M. Olmedo and M. Alvarez, 2004. Influence of feeding with feeds having a different fat content on the growth and biochemical composition of blackspot sea bream (*Pagellus bogaraveo*) juveniles. Cah. Options Méditerr., 63: 401-405.

Olmedo, M.F., Limares, F. Silva and G. Pazos, 2007. Comercial feeds and growth of juveniles of blackspot sea bream (*Pagellus bogaraveo*, Brunnich, 1768) reared in floating cages. Proceedings of the Fifth Meeting of the Southern Subcommittee of the General Fisheries Commission for the Mediterranean. Rome, FAO. 2007. FAO Fisheries Proceedings. No. 6. 2007. 1-7 pp.

Olmedo, M., Limares, F. Silva and G. Pazos, 2009. Effect of two different quality feeds on the growth and biochemical composition of juvenile blackspot sea bream (*Pagellus bogaraveo*, Brunnich, 1768) reared in floating cages. Aquaculture Research, 40: 1-8.

Silva, F., G. Pazos, M. Olmedo, F. Limares and J.L. Gallardo, 2006. Effect of protein growth rate on amino acid composition of juvenile blackspot seabream (*Pagellus bogaraveo*). Aquaculture Research, 37: 1021-1028.

Aknowledgements

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Plan Nacional (MCYMAM).
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aquaculture europe 10

Autoría: Rossignoli, A.E.; Fernández, D.; Acosta, C.P.; Blanco, J.

Título: Microencapsulation of okadaic acid as tool for the study of the accumulation of DSP toxins in bivalves

Congreso: 14th International Conference on Harmful Algae

Lugar: Hersonissos - Creta (Grecia)

Ano: 2010

MICROENCAPSULATION OF OKADAIC ACID AS A TOOL FOR THE STUDY OF THE ACCUMULATION OF DSP TOXINS IN BIVALVES

Aracell E. Rosegnoli, David Fernández, Carmen P. Acosta, Juan Blanco

ABSTRACT

INTRODUCTION

OBJECTIVE

MATERIAL AND METHODS

RESULTS

Fig. 2- Accumulated percentage of the OA in microcapsules leached in seawater.

	Type of Toxin	Toxin in Day 0 (TO) (ng)	Toxin Day 4 (T1) (ng)	Toxin increase (ng)
Mussels	OA	0.4759	0.7860	0.3057
	DTI-OA	1.8013	2.9545	1.1532
Feces	OA	Not sampled	0.1663	-
	DTI-OA	Not sampled	1.5706	-

Table 1. Content of okadaic acid (OA) and their conjugates found (OA) in the digestive gland of mussels and feces at the beginning and the end of the experiment. DO = digestive gland, day 0 = the day that the mussels were fed, Day 4 = the day later last sampling.

CONCLUSIONS

REFERENCES

Blanco, J., Moroño, Á., Fernández, M. L., (2002). Toxic episodes in shellfish, produced by dinoflagellate proliferations. An overview. Revista Galega de Recursos Mariños (Monog. 1): 1-20.

Bravo, I., Fraga, S., Figueroa, R.I., (2006). Toxic dinoflagellates associated with shellfish in Galicia (Northwest of the Iberian Peninsula): Proliferation events, geographical spread, and the possible influence of human activities. Harmful Algae 5 (6): 729-739.

Bresnan, E., Cembella, A., Fernández, J., (2009). Identification of okadaic acid and its fatty acid conjugates in the toxic dinoflagellate Prorocentrum lima. Harmful Algae 8 (3): 418-423.

Burkholder, J.M., Glibert, P.M., Skelton, H.M., (2008). Mixotrophy, a major mode of nutrition for harmful algal species in eutrophic waters. Harmful Algae 8 (1): 77-93.

Cembella, A.D., Lewis, N.I., Quilliam, M.A., (2000). The marine dinoflagellate Alexandrium ostenfeldii (Dinophyceae) as the causative organism of spirolide shellfish toxins. Phycologia 39 (1): 67-74.

Cembella, A.D., Quilliam, M.A., Lewis, N.I., Bidigare, R.R., Exon, J.H., Arsenault, G., Bird, C.J., (2002). The toxigenic marine dinoflagellate Protoceratium reticulatum and associated shellfish toxins in the Magdalen Islands, Eastern Canada. Journal of Plankton Research 24 (12): 1309-1331.

Dickey, R.W., Plakas, S.M., (2010). Ciguatera: a dynamic regional perspective. Journal of Environmental Monitoring 12 (12): 2308-2324.

Fernández, M.L., Reguera, B., González-Gil, S., Míguez, A., Pazos, Y., (1996). Okadaic acid production and cell cycle of Prorocentrum hoffmannianum Faust in culture. Journal of Plankton Research 18 (8): 1355-1365.

Fernández, M.L., Reguera, B., González-Gil, S., Míguez, A., Pazos, Y., (1996). Okadaic acid production and cell cycle of Prorocentrum hoffmannianum Faust in culture. Journal of Plankton Research 18 (8): 1355-1365.

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Fernández, M.L., Reguera, B., González-Gil, S., Míguez, A., Pazos, Y., (1996). Okadaic acid production and cell cycle of Prorocentrum hoffmannianum Faust in culture. Journal of Plankton Research 18 (8): 1355-1365.

Autoría: Martin-Gómez, L.; Carballal, M.J.; Villalba, A.; Abollo, E.

Título: Genes expressed in flat oyster (*Ostrea edulis*) affected by disseminated neoplasia

Evento: Aquaculture Europe 10 – Annual Meeting of the European Aquaculture Society

Lugar: Porto (Portugal)

Ano: 2010

GENES EXPRESSED IN FLAT OYSTER (*Ostrea edulis*) AFFECTED BY DISSEMINATED NEOPLASIA

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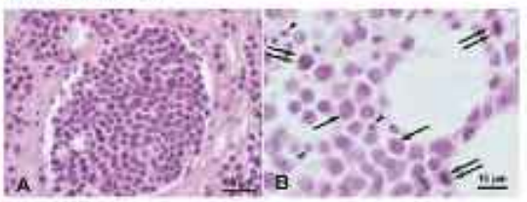
INTRODUCTION

Disseminated neoplasia, an oyster disease resembling leukaemia, has been reported in a high number of species of marine bivalves. This disease is characterized by a proliferation of abnormal circulating cells of unknown origin that leads to a rapid and invasive progression of a high number of these circulating cells in various tissues in the diseased individuals. Neoplastic haemocytes show impaired defence activities, as well as a lack of adhesion, spreading and phagocytic behaviour. Genes regulating cancer proliferations are highly conserved throughout the animal kingdom, both structure and function, which suggests that homologous genes may be activated in bivalve tumours. Some cytoskeletal associated molecules like actin, as well as myc, p53 and its homologues, Jun or ras, were reported to address tumourigenic basis of neoplasia induction and development in the mollusc *Ostrea edulis*.

MATERIALS AND METHODS

Different batches of oysters were collected during two years period from a commercial area (Ría de Arousa, Galicia NW Spain) [illegible] with neoplasia disease. Haemolymph of each individual was collected, RNA extracted using TRIzol reagent (Invitrogen) and diagnosis done using histological techniques (Mix 1960). The subsequent use of the Suppression Subtractive Hybridization (SSH) technique (Clontech) allowed us to identify differentially expressed genes during neoplastic progression. ESTs annotation with known genes were performed using BLAST and the functional classification of known genes was done according to GO GO database. Real-time PCR (Bio-Rad iQ5) was used to analyse the expression profiles of some selected genes during neoplasia progression. Data were analysed using the Bio-Rad iQ5 system software and quantification was performed using the Livak Method. Differences in mRNA levels were analysed using ANOVA or non-parametric tests depending on the data. The significance level $P<0.05$.



Picture 1. Histological sections of cultivated juvenile oyster *Ostrea edulis* affected by disseminated neoplasia. A: Haemolymph smear infiltrated by masses of neoplastic cells. B: Detail of the normal tissue showing basophilic cells (arrows), normal haemocytes (eosinophilic) and mitotic figures (double arrows).

RESULTS

Two ESTs libraries were obtained, one with those transcripts upregulated during neoplastic processes and another with downregulated transcripts. We ended up with roughly 200 ESTs (Expressed sequence tags) whose expression seems to change in neoplastic processes. The average size of the sequences was around 360 base pairs (pb) excluding the adaptor and cDNA libraries was only around 20%. BLAST analysis showed that a high percentage (80%) of the sequences characterized in this work are new ESTs with unknown functions, and that 18% of the obtained ESTs have been previously identified as oyster ESTs (mainly of *Crassostrea virginica*, *C. gigas* and *Ostrea edulis*). 17% of the clones were identified as known genes, but some of the newly identified genes have unknown functions in oysters. Genes that encoded known genes (E value 10^{-5}) were clustered in several categories with their corresponding subcategories (Figures 1 and 2). Attending to their possible implication during the transforming processes that leads to cancer, some genes were chosen for studying its expression at several stages of the disease. Real time studies were done using PCR primers for around 20 genes with possible functions characterized in oysters (Figure 3) and we ended up with 9 genes that could be good markers of the neoplastic process as it is not possible to do an early diagnosis with histological techniques.

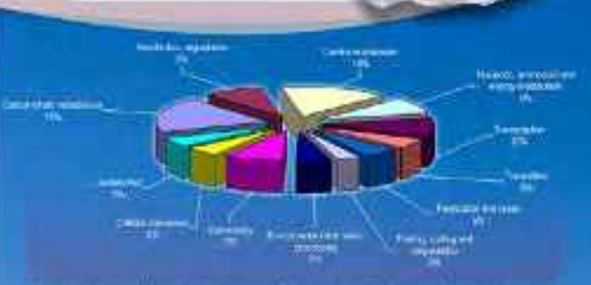


Figure 1. Functional classification of up-regulated genes in oyster during disseminated neoplasia disease.

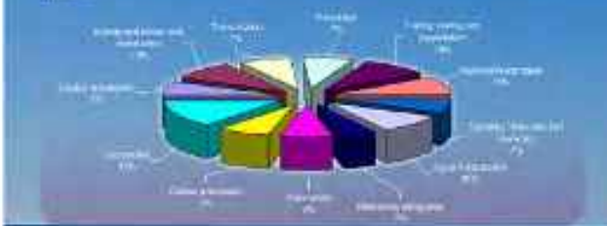
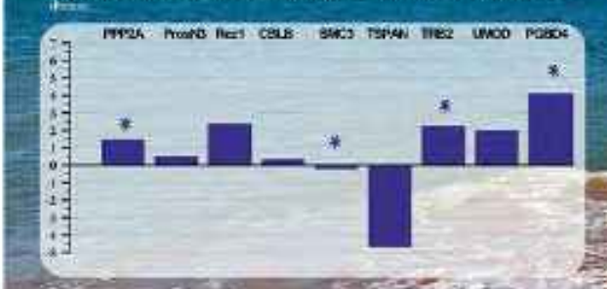


Figure 2. Functional classification of down-regulated genes in oyster during disseminated neoplasia disease.



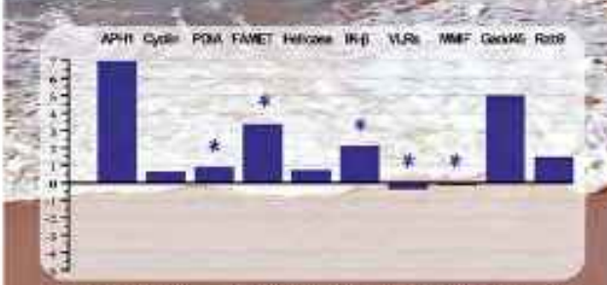


Figure 3. Messenger RNA expression levels of selected ESTs in neoplastic affected oysters compared to healthy ones. Bars in the graphic indicate log Ratio values.

$LOG_{10}Ratio\ LOG_{10}(2^{-\Delta\Delta Ct})$ Down-regulated $LOG_{10}(2^{-\Delta\Delta Ct})$ Up-regulated

where relative expression is expressed as the difference between the normalized target gene threshold cycle (Ct) and the normalized reference gene Ct for the sample minus the difference between the normalized target gene Ct and the normalized reference gene Ct for the calibrator. The symbol * above the columns indicates significant ($P<0.05$) differences between neoplasia affected oysters and healthy ones. The official symbols for each gene were used to designate each column: APH1: Anterior pharynx-defective 1 homolog (*C. elegans*); CBLB: E3 ubiquitin-protein ligase CBL-B; FAMET: Ferritin, middle subunit; GadAS: Glutamate decarboxylase; HELZ: Helicase with zinc finger domain; IRAP: Type 1 inositol 1,4,5-trisphosphate receptor-interacting protein; MMF: Macrophage migration inhibitory factor; PDIA: Protein disulfide isomerase A; PPP2A: Protein phosphatase 2A; Rab9: Ras-related protein Rab-9; SMC3: Structural maintenance of chromosomes 3; TSPAN: Tetraspanin; TRB2: Tribbles homolog 2; VLRs: Variable lymphocyte receptors; PGBD4: PiggyBac transposable element-derived protein 4; PROSB: Proteasome subunit beta type-8; RAC1: Ras-related C3 botulinum toxin substrate 1; UMOD: Uromodulin precursor.

DISCUSSION

Changes in the transcriptome of molecular oysters in response to disseminated neoplasia allow us to understand some of the mechanisms acting in tumour processes. Molecular markers identified in oyster neoplasia are in agreement with the typical characteristics of a neoplastic process. We found up-regulated genes correlated with DNA replication and repair. There is usually a high number of transcripts with function role for basal metabolism and with stress processes (membrane degradation plus folding sorting and degradation of proteins). Moreover, there is a small number of transcripts which function is involved in cellular processes as cell growth and death. Those genes that could be good markers were studied by real-time expression at different intensity levels of the disease. One of them, ferritin, is involved in cellular response to iron overload and could be employed as a molecular diagnostic tool to help state the diagnosis of the disease.

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Autoría: Ruiz, M.; Darriba, S.; Iglesias, D.; Rodríguez, R.; López, C.

Título: Viral basophilic inclusions in digestive gland of razor clam *Ensis arcuatus* (Jeffreys, 1865) (Pharidae) in Galicia (NW Spain)

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Lugar: Porto (Portugal)

Ano: 2010

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Viral basophilic inclusions in digestive gland of razor clam *Ensis arcuatus* (Jeffreys, 1865) (Pharidae) in Galicia (NW Spain)

M. Ruiz[1*], S. Darriba[2], D. Iglesias[1], R. Rodriguez[1], and C. López[1]

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Introduction

Viruses infecting bivalve molluscs were reviewed (Elston, 1997; Renault and Novoa, 2004). A viral gametocytic hypertrophy associated to the presence of intranuclear basophilic inclusions were detected in oysters (Farley, 1976; Winstead and Courtney, 2003; Choi et al., 2004; Garcia et al., 2006; Chesnel et al., 2009 and Meyers et al., 2009). Similar basophilic inclusions were observed in epithelium cells of the digestive gland in *Ensis arcuatus* (Darriba et al., 2010). In this work we continue with the study of basophilic inclusions in *E. arcuatus* by transmission electron microscopy (TEM).

Materials and methods

Samples of 15-20 adults of *E. arcuatus* (>100mm in length) were collected by diving, every two months, between January 2003 and June 2004, from three natural beds of Galicia (NW of Spain) and processed by histological standard techniques for analysis with a light microscope.

A sample showing high basophilic inclusion bodies in epithelium cells of the digestive gland were selected to ultrastructural analysis. The portion of tissue containing the inclusions was removed with a scalpel from the paraffin block. Paraffin was removed by several rinses in xylene with agitation. Tissue was placed in 2.5% glutaraldehyde, postfixed in 2% $CaCO_3$, and embedded in Epon. Ultra-thin sections were stained with uranyl acetate and lead citrate and examined with a transmission electron microscope at 80 kV.

Results and conclusion

The analyses of histological slides revealed the presence of unidentified basophilic inclusion bodies in the epithelial cells of the digestive gland (Fig. 1) of some specimens from all beds studied. The shape was oval to spherical. Mean of the longest axis was 37.70±0.40µm (n=15). Some inclusion bodies had dense staining margins. In general, intensity of infection was low and host inflammatory response was not observed (data included in Darriba et al., 2010).

TEM examination showed round to polygonal viral particles (suggesting an icosahedral symmetry) and about 38nm in diameter, inside nucleus of infected cells (Fig. 2 and 3). Both empty and full capsids could be observed. The chromophilic margins viewed by light microscopy were identified as peripherally displaced chromatin.

This is the first record of viral particles in *E. arcuatus*. Based on ultrastructural morphological characteristics, we cannot determine with certainty what type of virus was found. The lack of bivalve cell lines makes difficult virus isolation from molluscs, although development of molecular techniques could be an alternative to the virus isolation methods.

Fig.1: Basophilic inclusion body (arrow) in epithelial cells of the digestive gland H&E staining

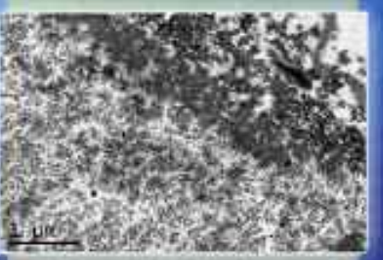

Fig. 2: Transmission electron micrograph of an inclusion body, showing intranuclear viral particles (asterisk) in an epithelial cell of the digestive gland of *Ensis arcuatus* with a normal nuclear membrane (nm, white arrow) and chromatin mass (c).

Fig. 3: Transmission electron micrograph of viral particles.

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References

Chesnel et al. 2009. Dis. Aquat. Org. 83: 181-185.
Choi et al. 2004. Dis. Aquat. Org. 59: 205-209.
Darriba et al. 2010. J. Invertebr. Pathol. 104: 23-30.
Elston. 1997. World Journal of Microbiology and Biotechnology 13: 393-403.
Farley. 1976. Prog. Exp. Tumor Res. 20: 283-294.
Garcia et al. 2006. Dis. Aquat. Org. 70: 193-199.
Meyers et al. 2009. Dis. Aquat. Org. 88: 1-12.
Renault & Novoa. 2004. Aquat. Living Resour. 17: 397-400.
Winstead & Courtney. 2003. Dis. Aquat. Org. 53: 89-90.

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Ano: 2010

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USE AND TREATMENTS OF ORGANIC MATTER OF TURBOT HATCHERIES EFFLUENTS IN GALICIA (NW SPAIN)

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Introduction

Initiatives of integrated culture fish-bivalve mollusc, put into practice on the grow-out of clam seeds obtained in hatchery, are an alternative in order to achieve the fact that seed farms can work together with fish producers. This would make possible the reduction of organic doses of effluent and its charge, when they acting as biofilters in clam biomass. Previous studies show the incidence and amounts for the scaling obtained with this practice. Residuary mud that comes from the turbot hatchery underwent two correlative processes: compost and worm compost. Therefore, this mud compost is a suitable organic source for its disposal, and it won't be an economic and health problem anymore if we give them a use and a destination.

Materials and methods

A) Tests were carried out in a turbot farm located in O Grove, Ría of Arousa (Insuiña S.L.), which is the oldest one that produces this species in Galicia. It generates 150 t per year and a effluent volume between 1,000 and 1,500 m³/h, of which around 60 m³/h are preferred to a rotary filter (200 m cross and diverted to longitudinal pools (7x1x0.5m).

Seed grow-out tests were carried out with seeds obtained in hatchery. The starting size range between 2 and 4 mm of the following species: flat oyster (*Ostrea edulis*), japanese oyster (*Crassostrea gigas*), pullet carpet shell (*Venerupis pullastra*) and manila clam (*Ruditapes philippinarum*).

B) The physical effects of compost were determined using germination blocks with Lolium perenne, in which were introduced 10 g of C1, C2, C3, C4 and C5 (commercial vermicompost) in Petri plates and 10 seeds of Lolium perenne were placed on filter paper of each plate (five replicates).

Selected waste mixtures – pine sawdust:pig slurry (3:1) [C1], compost 1): pine sawdust: fruit waste sludge (1:2:1) (C2, compost 2); poultry litter sludge (1:2) (C3, compost 3); and wood shaving: wet algae sludge (2:1:1, v:v:v) (C4, compost 4); were composted during four months. At the end of this process, worms of type *Eisenia andrei* and *Eisenia foetida* were added to C1 and C2 to initiate vermicomposting during a further two months (VC1 and VC2). Compost and vermicompost samples was passed through a 2mm sieve and dried.

Results

A Fine particles of organic matter for the growout of clams and oysters seeds.

Table 1. The growth of juvenile oysters and clams on different nursery systems.

Bivalve mollusc species	INITIAL		FINAL (56 days nursery cycle)					
			TREATMENTS (nurseries)					
			Turbot hatchery effluent		Outdoor nursery (outdoor microalgal cultures)		Estuarine (floating structures)	
	Length±SD (mm)	Weight±SD (mg)	Length (mean)	Weight (g)	Length (mean)	Weight (g)	Length (mean)	Weight (g)
Crassostrea gigas	5.2 ± 0.7	25.5±9.3	8.7±2.3	71.1 ± 60.8	9.5±2.8	208 ± 4.1±2.7	11.5±2.5	757.8 ± 371.8
Ostrea edulis	5.2 ± 0.8	30.7±13.7	8.8±1.8	80.8 ± 35.2	8.1 ± 2.2	127.4 ± 0.4	11.5±3.0	596.3 ± 173.2
Ruditapes philippinarum	6.0 ± 0.0	41.7±15.7	9.8±1.2	233.0 ± 78.0	12.2±2.0	450.7 ± 208.	15.1±1.0	1094.7 ± 169.0
Venerupis pullastra	6.2 ± 0.2	10.9±0.0	9.4±0.6	153.3 ± 38.6	9.8 ± 0.9	187.0 ± 51.5	13.3 ± 1.0	480.6 ± 169.2

B Thick particles. Mud for compost and farming uses.

Figure 2. Sulfur dipenne, germination percentage in compost (C) and vermicompost (CV).

Figure 1. Seed trays in turbot hatchery effluent

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XUNTA DE GALICIA
CONSELLERÍA DO MAR

Molecular identification of *Perkinsus* species (Protozoa) infecting commercial bivalves in mediterranean waters

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ABSTRACT

Parasites of the genus *Perkinsus* infect different species of molluscs around the world, causing mass mortal ties. In this work, we identified *Perkinsus* species infecting bivalve molluscs from different localities in Mediterranean waters, expanding its host and geographic ranges. Thus, *P. mediterraneus* was found in Greece, Italy and in Senegal, and *P. olseni* from the Balearic Island of Menorca (Spain). This study also revealed for the first time the co-infection of *P. olseni* and *P. mediterraneus* in the same host, *Venerupis*.

INTRODUCTION

Protozoan parasites of the genus *Perkinsus* have caused important mortalities in different species around the world. Five species of *Perkinsus* have been identified and described but only seven are considered "valid" based on molecular studies (Villalba et al. 2004; Dungan and Reece, 2006; Moss et al. 2008). Currently, two species have been recorded in Mediterranean waters: *P. olseni* infecting the clam *Ruditapes philippinarum* (Villalba et al. 2004; Arzul et al., 2006) and *P. mediterraneus* found in the flat oyster *Ostrea edulis* (Casas et al. 2008). Diagnostic techniques for the detection of *Perkinsus* species are grouped into two categories: (1) microscopic techniques, including methods based on Ray's fluid thioglycollate medium (Ray, 1966), histology and electron microscopy, and (2) molecular techniques based on PCR assays (Marsh et al., 1995; Casas et al., 2007; Arzul et al., 2001). In this study, we applied molecular methods for the identification of *Perkinsus* species infecting bivalve molluscs from different locations in Mediterranean waters.

MATERIAL AND METHODS

Samples were collected during autumn 2007 at three Mediterranean locations: Menorca (Balearic Islands, Spain), Catalonia (Catalonia, NE Spain) and Sicily (Sicilian Lagoons, Italy). European flat oysters (*Ostrea edulis*, n=30) and warty venus clams (*Venus verrucosa*) (n=30) were obtained from Menorca; striped venus clams (*Chamelea gallina*) were collected from Catalonia; and Sicilian carpet shells (*Ruditapes decussatus*) (n=2) and carpet shells (*Ruditapes philippinarum*) (n=1) were obtained from lagoons. Additionally, we analyzed a paraffin block of an European flat oyster infected by *Perkinsus* sp. collected from Gulf of Mar Piccolo (Puglia, Italy) (Fig. 2).

Samples from Menorca and Catalonia were randomly collected, whereas all the analyzed specimens from Sicily had been found to be infected by a *Perkinsus*-like organism through the "Ray's fluid thioglycollate medium" assay.

Figure 1. Geographic origin of the different species of bivalves collected in the Mediterranean Sea.

DNA extractions and PCR assays were performed using the genetic primers Per5/ITS3-Per6/ITS4 (Casas et al., 2002). Species identification were carried out by RFLP-PCR (Kleeman et al., 1994) (see Fig. 2) or cloning and further sequencing depending on DNA concentration in PCR products.

Species	Restriction enzyme	Restriction fragments (bp)
P. olseni	*Hae* III	~ 360 bp ~ 180 - 190 bp
P. mediterraneus	*Hae* III	~ 350 - 370 bp ~ 310 - 340 bp
P. olseni / *P. mediterraneus*	*Hae* III	~ 360 bp ~ 350 - 370 bp ~ 180 - 190 / 310 - 340 bp

Table 1. Restriction key used for digestion with *Hae* III restriction enzyme for discrimination of *P. olseni* and *P. mediterraneus*.

RESULTS

Results provided by PCR-screening revealed that *Perkinsus* spp. infected all analyzed host species. Positive PCR results were obtained for 23/30 *O. edulis* and 21/30 *V. verrucosa* from Menorca; 3/5 *R. decussatus* and 4/10 *R. philippinarum* from Catalonia; 5/5 *R. decussatus*, 1/2 *C. gallina* and 2/2 *V. aurea* from Sardinia. Specific identification revealed that *P. olseni* infects the bivalves from Catalonia and Sardinia, and *P. mediterraneus* parasitizes the flat oyster from Menorca and Gulf of Mar Piccolo (Italy). Moreover, both *Perkinsus* species were identified in *V. verrucosa* from Menorca. A total of 2 (10.53 %) warty venus were infected by *P. olseni*, 3 (15.79 %) by *P. mediterraneus* and 14 (73.68 %) were co-infected by both species (Table 2 and fig. 2).

Location	Host species	N	Positive PCR	Detected species
Menorca	*Ostrea edulis*	30	23	*P. mediterraneus* (N = 23)
	Venus verrucosa	57	21	*P. olseni* (N=2) *P. mediterraneus* (N=3) *P. olseni*/*P. mediterraneus* (N=14)
Catalonia	*Ruditapes decussatus*	5	5	*P. olseni* (N=5)
	Ruditapes philippinarum	10	4	*P. olseni* (N=4)
Sardinia	*Ruditapes decussatus*	5	5	*P. olseni* (N=5)
	Venerupis aurea	2	2	*P. olseni* (N=2)
	Chamelea gallina	2	2	*P. olseni* (N=2)
Puglia	*Ostrea edulis*	1	1	*P. mediterraneus* (N=1)

Table 2. Species identification carried out by PCR-RFLP.

Figure 2. RFLP patterns of PCR products from *Perkinsus* isolates from Mar Piccolo (Puglia, Italy). Lanes: 1, *P. olseni* from infected *R. decussatus*; 2, *P. mediterraneus* from infected *O. edulis*; 3, Co-infection of *P. olseni* and *P. mediterraneus* detected in *V. verrucosa*; M, 50 bp molecular ladder.

DISCUSSION AND CONCLUSIONS

The Office International des Epizooties (OIE) has included *P. olseni* and *P. marinus* in the list of notifiable diseases to avoid the spread of the parasites. In spite of the epidemiological importance of an accurate identification of *Perkinsus* species, still there are many records of wrong host and geographical ranges due to inappropriate tools. As an example, *Perkinsus* spp. have been reported in *R. decussatus*, *V. verrucosa*, *Crassostrea angulata*, *Cerastoderma edule*, *Callista chione*, *Arctica islandica*, *Glycymeris glycymeris*, *Donax trunculus*, *Donax vittatus*, *Mytilus galloprovincialis*, *Ostrea stentina*, *Crassostrea gigas*, *V. verrucosa*, *Chamelea gallina* and also some molecular tools could misidentify species (Arzul et al., 2001; Carnegie and Burreson, 2009).

This work provides specific identification of *Perkinsus* species in the Mediterranean waters, expanding its host and geographical ranges. This is the case of *P. mediterraneus* in *O. edulis* from Italy and in *V. verrucosa* from Menorca. Remarkably, the results obtained in this work also revealed by first time the co-infection of *P. olseni* and *P. mediterraneus* in the same host, *V. verrucosa*.

REFERENCES

Arzul, I., Corre, S.M., Gerard, A., Villalba, A. (2006). Different distributions of *Perkinsus* species in populations of cockles in Europe and the Mediterranean sea. Diseases of Aquatic Organisms 69: 213-221.
Arzul, I., Renault, T., Lupo, I., Kerambrun, P. (2001). Contrasting mortalities of *Ruditapes philippinarum* and *Ruditapes decussatus* in southern France: role of pathogens *Perkinsus atlanticus* and *Vibrio tapetis*. Diseases of Aquatic Organisms 46: 29-37.
Casas, S.M., Villalba, A., Reece, K.S. (2002). Study of geographical variation in the European flat oyster, *Ostrea edulis*, and resistance to the parasite *Perkinsus atlanticus*. I. Meristic and morphometric characters. Journal of Shellfish Research 21: 1-23.
Casas, S.M., Villalba, A., Reece, K.S., Duperret, A.K., Carnegie, R.B., Bushek, D. (2008). *Perkinsus mediterraneus* n. sp., a protistan parasite causing mortality in the European flat oyster, *Ostrea edulis*, in the Mediterranean Sea. Journal of Invertebrate Pathology 98: 331-347.
Ray, S.M. (1966). A review of the culture method for detecting *Dermocystidium marinum* with suggested modifications and precautions. Proc. Natl. Shellfish Assoc. 54: 55-69.
Villalba, A., Reece, K.S., Ordás, M.C., Casas, S.M., Figueras, A. (2004). Perkinsosis in molluscs: a review. Aquatic Living Resources 17: 411-432.

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Autoría: Díaz, S.; Cao, A.; Villalba, A.; Carballal, M.J.

Título: Expression of p53 family proteins in cockles affected by disseminated neoplasia

Evento: 102nd National Shellfisheries Association Annual Meeting

Lugar: San Diego - California (EE. UU.)

Ano: 2010

EXPRESSION OF p53 FAMILY PROTEINS IN COCKLES AFFECTED BY DISSEMINATED NEOPLASIA

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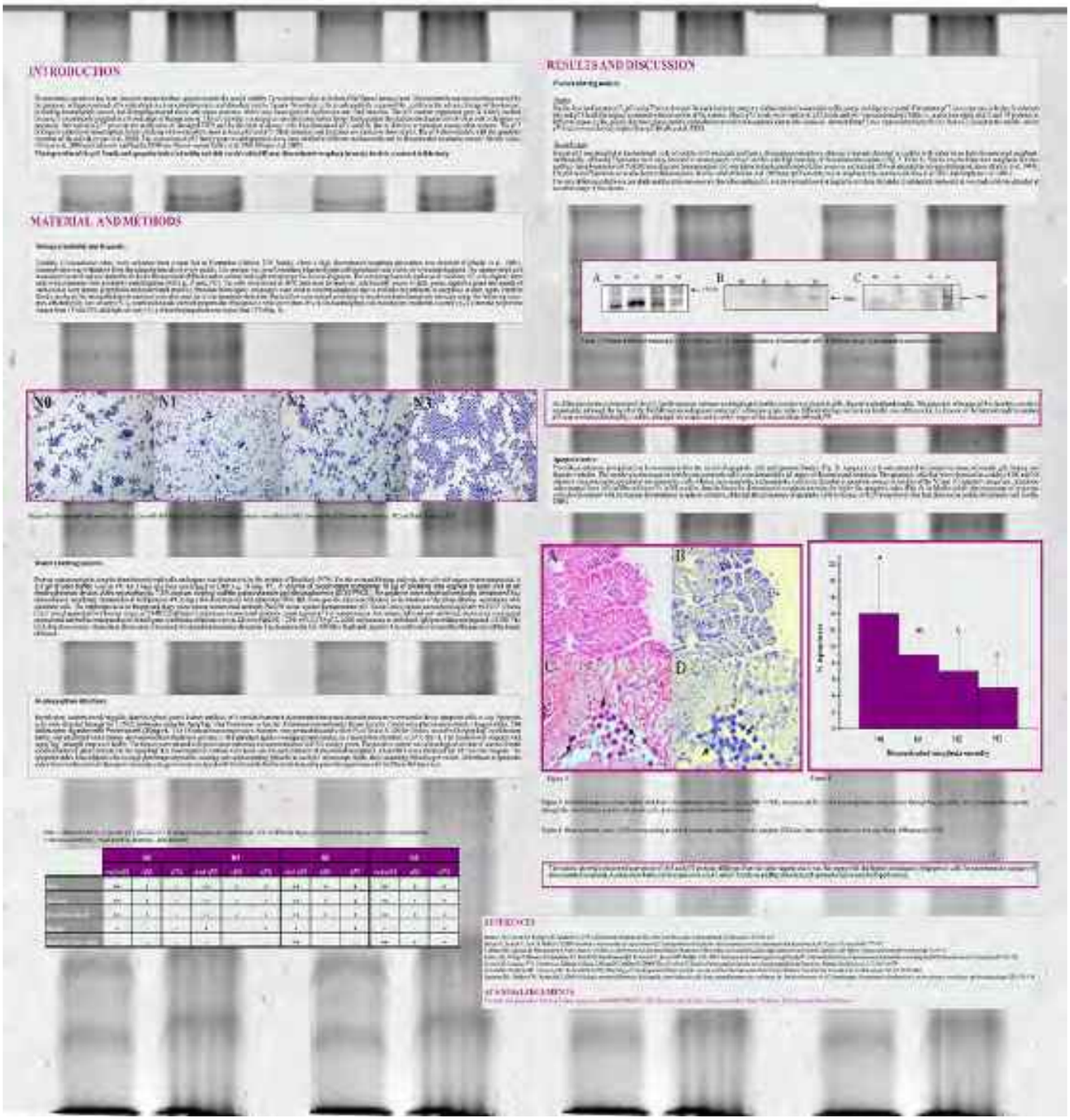

Autoría: Rodríguez-González, L. M.; Gómez-Gesteira, J. L.; Iglesias-Estepa, D.; Montes-Pérez, J.

Título: Is technically feasible the Pacific oyster *Crassostrea gigas* culture in a northern galician estuary?

Evento: Aquaculture Europe 2010. Seafarming Tomorrow. European Aquaculture Society

Lugar: Porto (Portugal)

Ano: 2010

Is technically feasible the Pacific oyster *Crassostrea gigas* culture in a northern galician estuary?

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INTRODUCTION

The Pacific oyster *Crassostrea gigas* (Thunberg, 1793) is a handy species native to the Japan/Korea region that has been introduced to a number of countries worldwide and has become the leading species in world shellfish culture. In many countries have been reported unexpected naturalized populations of *C. gigas* exhibiting an invasive pattern and it has been considered as a pest (Mousec et al., 2009). Moreover, once introduced, Pacific oysters are impossible to eradicate. In Galicia (NW Spain), an important naturalized *C. gigas* population has been reported in the Ría de O Barqueiro, being considered a problem by local fishermen.

The aim of the present study was to assess the technical feasibility of fueling some profit of this situation by the development of an aquaculture activity based on spot collection of this species and juvenile rearing up to commercial size.

Map showing the location of the study region.

MATERIALS AND METHODS

In July 2007, a total of 2.440 "Chinese hat" collectors were placed in the inner zone of the Ría de O Barqueiro. The hats were mounted in stacks of 44 and they were deployed in the intertidal zone over metal tables. In June 2008, a total of 1400 hat collectors were deployed again in the same localities. After losing the collectors out of the water in February 2008 and 2009 respectively, spat was removed, counted and weighed.

In the intertidal zone of Miñedos beach (inner zone of Ría de O Barqueiro) two batches of Pacific oysters were cultivated using culture bags placed onto low tables. Oysters from the first batch, named as "settlement Barqueiro"(SB), come from the settlement experiments performed in the Ría de O Barqueiro and were deployed in Miñedos in February 2008. Oysters from the second batch, named as "French batch"(FB), came from Marennes-Oleron (France) natural spatfall. They were deployed in March 2008. Both batches were reared at a density of 200 oysters per bag. The progression of oyster modalities in each batch was followed by means of field observations performed every two months in triplicate culture bags. From each batch 30 oysters were randomly sampled monthly and carried to the lab for further analysis. In the lab oysters were cleaned and individual whole weight was registered to the nearest 0.01g. Shell length (L), width (w), and thickness (T) were measured to the nearest 0.1mm using vernier calipers.

Each oyster was then opened and the meat was weighed after being retained for 5min in absorbent tissue paper (WWM, wet meat weight). Weight von Bertalanffy growth model was estimated fitting the observed data by non-linear least squares method. Quality of oysters was assessed in terms of their "fullness" and shape. A meat index (MI) was calculated as: MI=(WWM/100)/WW. MI allows the classification of oysters into two categories: "special" (MI>7.0) "fine"= 6.5<MI<7.0 (BIM, 1996). A shape index (SI) was calculated as: SI= (L+T)/w, allowing the classification of oysters into three categories: "good shape", SI<3; "average shape", SI=3; "poor shape", SI>3 (BIM, 1996). Spat weight and meat indices of different batches were statistically compared using Mann-Whitney non-parametric tests.

RESULTS AND DISCUSSION

In February 2008, a total of 2.149 oysters were surveyed from collectors, that is a mean number of 0.8 oysters per hat (34.0 oyster.m-2), with a mean weight of 4.97 ± 0.31g (mean ± SE). In February 2009 a total number of 14.781 oysters were removed from collectors, mean number of 11.9 oysters per hat (351.3 oyster.m-2), with a mean weight of 0.99 ± 0.13g. French repooled spat had a mean weight of 0.84 ± 0.04g. Oysters collected in 2007 were significantly heavier than oysters collected in 2008 and French spat ($F= 0.000$). There were not statistically differences in weight between oysters collected in 2008 and French spat ($F= 0.847$).

The density of oyster collection was very low compared with France, where regularly collect more than 100.000 oyster.m-2 (Alby & Mourec, 2004). SB oysters reach commercial size in November 2008, after 8.5 months of rearing. FB batch needed more than 14 months (Jun 09) to reach the same size (Fig. 1). SB had an extraordinary growth, greater than previous reported experiences in Galicia (Iglesias et al., 2003). Cumulative mortality was low, 4% for SB and 6.5% for FB. Regarding the quality of the rearing oysters, FB oysters had significantly higher MI than SB oysters ($F= 0.030$) but both batches were classified as "special" oysters (Fig. 2). All the oysters had good shape (Fig. 3) because SI<3.

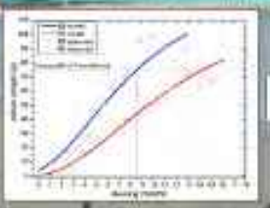

Figure 1: von bertalanffy growth model SB, Settlement Barqueiro; FB, French Batch.

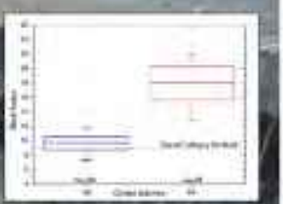

Figure 2: Box chart showing oysters distribution regarding their meat index.

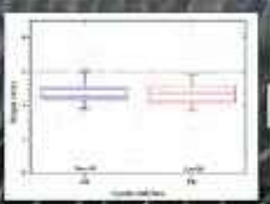

Figure 3: Box chart showing oysters distribution regarding their shape index.

CONCLUSIONS

Preliminary results suggest that growing of *C. gigas* is technically possible in the Ría de O Barqueiro since both batches presented good growth, high quality and low mortalities. Spat collection could be a bottle-neck to the development of a self-sustainable aquaculture activity because of the low spat density of collection registered in our experiments. Carrying capacity of the estuary and cost benefit economical studies would be also performed previously to start any serious commercial aquaculture project in this zone.

REFERENCES

Alby, J. and Mourec, R. 2004. Etude des techniques de captage naturel et contrôlé de l'huître creuse *Crassostrea gigas* (Thunberg, 1795). Gestion des stocks. Produit semi-fini: protocoles de test. Cycles (Deuxième année). Rapport final. IFREMER, BNI, 116p.
Iglesias, D., L. Rodríguez, L. Muiños, A.F. Carballo, J.L. Pérez, M. Fernández y E. Álvarez. 2003. Ad-libitum vs restricted ration rearing strategy in Japanese oyster (*Crassostrea gigas*) Cv. Early Hatchery Stock: growth, biochemical composition and reproductive conditioning. Journal of Shellfish Research, 22 (1): 215-225.
Mousec, L., Le Gall, P., Le Gall, S., Lapegue, S., Thomas, Y., Boudry, P. 2009. Natural spatfall and colonization patterns of the Pacific oyster, *Crassostrea gigas*, in the Bay of Brest. Aquatic Living Resources, 22, 193-202.
Research Report No. 211, 46 pp.

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Evento: Aquaculture Europe 10 – Annual Meeting of the European Aquaculture Society

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SPORES AND GAMETES OF GREEN SEAWEEDS AS FOOD FOR BIVALVES IN INTEGRATED MULTI-TROPHIC AQUACULTURE SYSTEMS

[redacted]

P-598

Introduction

Because of their small size, microalgae are the only algae that may readily form part of the diet of bivalve filter feeders while macroalgae have been used for this purpose only through the production of SCB (Peteiro Cancho et al., 2007). Here, we tested whether the spores of cultivated macroalgae which are important candidates for integrated multi-trophic aquaculture systems (IMTA) (Neori et al., 2004) could also serve as a food supplement for the filter-feeding molluscs of the IMTA through the production of gametes and/or spores. In this experiment, the growth and survival of Japanese oyster seed (*Crassostrea gigas*) maintained in a closed circuit culture with green seaweeds (*Ulva* spp.) were recorded and compared with growth rates and survival observed in starved seed. Our aim was to obtain information for the further development of more diverse and efficient IMTA.

Life cycle of *Ulva* spp.

Materials & methods

starve

Japanese oyster seed was placed in six 500 l tank using a 710µm mesh sieve. Each tank operated in a closed circuit and was equipped with an airlift system for water renewal. Water and algae were renewed weekly and temperature, pH and chlorophyll a abundance was measured three times a day (at 9, 12 and 14h). Three tanks served as a control (starved seed) while macroalgae (*Ulva* sp.) were added to the other three at a density of 2 kg m^{-2}. The experiment lasted for ten weeks (8-Jul-10/16-Sep-10). The weight of the oyster seed was measured in each tank on a weekly basis, to avoid pseudoreplication, the oyster seed from the three tanks under the same treatment was pooled together and retracted in three new aliquots. Every two weeks the average weight of the oyster seed (n=30) was measured in each treatment as well as in oyster seed kept in a commercial hatchery. The content of the hepatopancreas of some individuals was examined at the end of the experiment.

with Ulva

Results

Temperature ranged between 17.5 and 23 °C and not significant differences were observed between tanks with or without algae. However, the presence of algae significantly increased pH and chlorophyll concentration. The increase in pH resulted from the photosynthetic activity of algae while chlorophyll changes were due to the release of spores or gametes.

The presence of algae significantly increased the growth of oyster seed and decreased its mortality. After ten weeks, average weight in control tanks was mostly similar to the values recorded at the beginning of the experiment. By contrast, weight clearly increased for oyster seed maintained with *Ulva* sp. The differences between the two treatments were statistically significant after six weeks of culture (23-Aug). At the end of experiment mortality rate in control tanks was c. 30%, but increased to negligible values in the presence of *Ulva*.

At the end of the experiment, content analyses of the hepatopancreas of oyster collected with *Ulva* sp. revealed the presence of large granular cells as well as many smaller, golden or mainly colorless cells, probably gametes/spores in different degrees of digestion. No particulate matter was observed in the hepatopancreas of starved oyster.

starve vs. Ulva

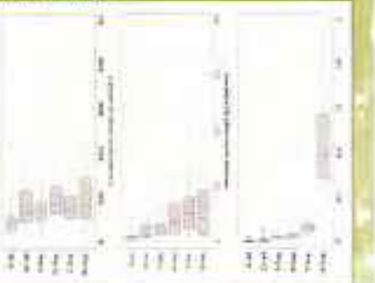
Mean oyster weight (g/oyster)

code	treatment	n	F (df) and p-value	p-value
23-Jul	starve	30	40.61 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
27-Jul	starve	30	36.39 (1, 58)	0.0001
	with Ulva	30	204.7 (1, 58)	
30-Jul	starve	30	44.61 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
3-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
6-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
10-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
13-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
16-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
20-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
23-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
27-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
30-Aug	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
3-Sep	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
6-Sep	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	
10-Sep	starve	30	57.04 (1, 58)	0.0001
	with Ulva	30	213.51 (1, 58)	

Although the spores/gametes of *Ulva* seem to serve as food for oyster seed growth was much higher in the seed kept in the hatchery of origin. This difference may indicate that the spores/gametes of *Ulva* are a less desirable food than diet provided in the hatchery or that the amount of food available in tanks with *Ulva* was insufficient. The latter hypothesis may also explain the slowdown in growth observed during the last two weeks of the experiment for oyster seed maintained with *Ulva*.

starve vs. Ulva vs. hatchery

Mean oyster weight (g/ind.)



Conclusions

The results of this and others previous experiments support the conclusion that the presence of macroalgae has a positive impact on the growth and survival of bivalve seed. This beneficial effect seems to be due to the fact that the spores or gametes released by these algae serve as a suitable food source for these filter-feeding organisms. It thus seems feasible to optimize a land-based IMTA with fish/shellfish/macroalgae by including species of seaweeds capable of releasing spores or gametes, and by placing the seaweeds before the molluscs in the circuit. In doing so, the macroalgae may serve as a roughly continuous source of live food.

Acknowledgements

References

[redacted]

Autoría: Rossignoli, A.E.; Fernández, D.; Regueiro, J.; Martín, H.; Mariño, C.; Blanco, J.

Título: Absorción del ácido okadaico por las células de la glándula digestiva del mejillón *Mytilus galloprovincialis*

Evento: XI Reunión Ibérica sobre Microalgas Nocivas y Biotoxinas

Lugar: Bilbao - Euskadi (España)

Ano: 2011

Absorción del ácido okadaico por las células de la glándula digestiva del mejillón *Mytilus galloprovincialis*

A.E. Rossignoli, D. Fernández, J. Regueiro, H. Martín, C. Mariño, J. **Blanco**
Centro de Investigacións Mariñas (CIMA). Vilanova de Arousa. Pontevedra

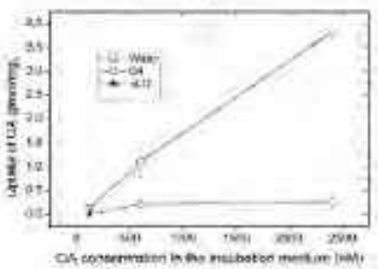
Objetivo: Determinar la vía de entrada del ácido okadaico a las células de la glándula digestiva

Aproximación general: adiciones a cultivos primarios de células de glándula digestiva

Experimento 1.

-¿Disuelto o particulado? + dependencia de concentración

Aporte de AO disuelto en agua y en gotas de aceite (con albúmina como emulgente)



Resultados:

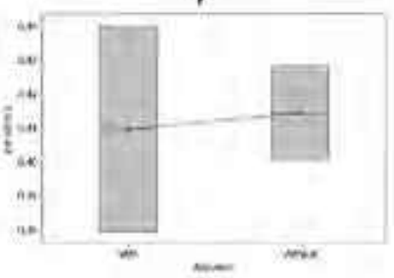
1.- Absorción muy mayoritaria de disuelto

2.- Ligera tendencia a la saturación

Experimento 2.

-¿Afecta el emulgente a la absorción de AO?

Aporte de AO en gotas lipídicas con y sin albúmina



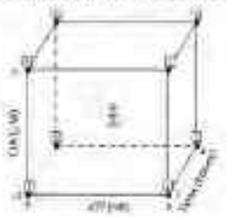
Resultados:

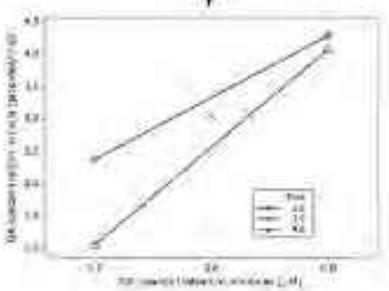
3.- Sin efecto significativo de emulgente

Experimento 3.

-Características generales de la absorción ¿es un proceso activo? ¿es dependiente de laconcentración?.

Experimento factorial con ATP, concentración y tiempo de exposición como factores.





Resultados:

4.- Sin efecto de ATP

5.- Menor diferencia en AO absorbido en 4h que en 1h. Sugiere saturación.

Conclusiones:

1.- La mayor parte del ácido okadaico parece absorberse de la fase disuelta

2.- La absorción no es un proceso activo ya que no se ve afectado por la presencia o ausencia de ATP

3.- La absorción parece presentar una ligera saturación, lo que sugiere la presencia de un transportador o la implicación de dímeros o agregados de moléculas de ácido okadaico

Material y métodos:

1.- Mejillones obtenidos de las rías gallegas (cedidos por INTECMAR)

2.- Disección de las glándulas digestivas

3.- Disgregación de células de la glándula en tampón CMFS (20 mM HEPES, 600 mM NaCl, 12,5 mM KCl, pH 7,3, 1100 mOsm) con gentamicina

4.- Lavado y resuspensión en medio L15 (Faucet et al 2004) - cultivo primario

5.- Viabilidad comprobada con azul de tripán

6.- Disolución de AO en agua y dispersión en aceite de oliva con sonicación (Branson 450) 10 min

7.- Desarrollo de los experimentos

8.- Lavado con tampón CMFS -Extracción con metanol+clarificación

9.- Análisis mediante HPLC-ESI-MS con HPLC Thermo Accela (bomba y autosampler), espectrómetro de masas de triple cuadrupolo Thermo Quantum Access Max, con interfase electrospray. Método cromatográfico con fases alcalinas (Regueiro et al 2011).

10.- Análisis estadístico con Minitab 15

-Faucet, J., Maurice, M., Gagnaire, B., Renault, T., Burgeot, T. 2004. Isolation and primary culture of gill and digestive gland cells from the sector of mussel Mytilus chilis. Mem. Cell Biol. 25: 177-184
-Regueiro, J. et al. Automated on-line solid-phase extraction coupled to liquid chromatography-tandem mass spectrometry for determination of lipophilic marine toxins in shellfish. Food Chemistry. In Press. Accepted Manuscript. Available at: http://www.sciencedirect.com/science/article/pii/S0308814611006300

Autoría: Martín-Morales, E.; Regueiro, J.; Blanco, J.

Título: Degradación enzimática de ácido domoico en la glándula digestiva de mexillón (*Mytilus galloprovincialis*)

Evento: XI Reunión Ibérica sobre Microalgas Nocivas y Biotoxinas,

Lugar: Bilbao - Euskadi (España)

Ano: 2011

Degradación enzimática de ácido domoico en la glándula digestiva del mejillón (*Mytilus galloprovincialis*)

EPITOX

incite

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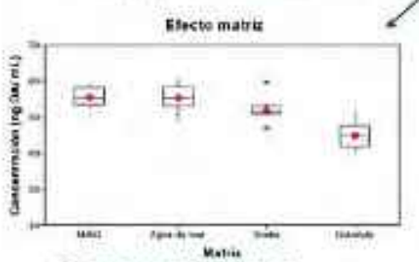
CIMA
CENTRO DE INVESTIGACIÓNS MARIÑAS

INTRODUCCIÓN

- La principal vía de entrada de ácido domoico en moluscos bivalvos es través de la ingesta, el principal órgano de acumulación a través de esta vía es la glándula digestiva.
- El mejillón (*Mytilus galloprovincialis*) es una especie que depura el ácido domoico rápidamente. Debido a su capacidad de acumulación y actividad enzimática, es posible que la glándula digestiva desempeñe un papel importante en los procesos de depuración.
- En el presente trabajo se estudió la degradación de ácido domoico en la glándula digestiva del mejillón (*Mytilus galloprovincialis*) y en el agua de mar.

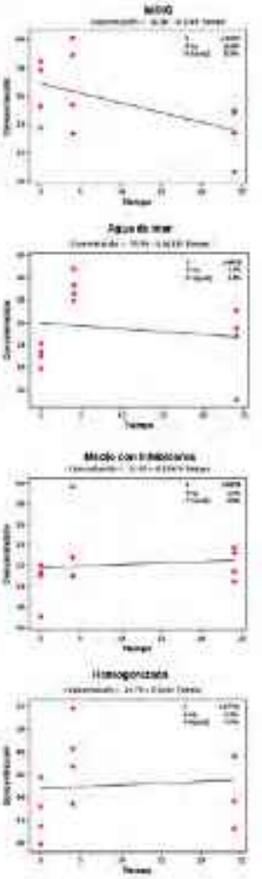
OBJETIVOS

- Saber si existe degradación del ácido domoico en la glándula digestiva.
- Saber si existe degradación del ácido domoico en agua de mar.



RESULTADOS

- No hay una disminución significativa de toxina en las muestras de agua de mar ni glándula digestiva.
- No existe reducción de concentración ácido domoico a lo largo del tiempo en ninguna de las matrices estudiadas.
- Hay una reducción no significativa en el contenido de toxina en glándula digestiva; posiblemente originada por una extracción incompleta del pellet.



CONCLUSIONES

- No parece que haya degradación el ácido domoico en la glándula digestiva.
- No se encuentra degradación significativa de ácido domoico en agua de mar.

MATERIAL Y METODOS

Bibliografía

Agradecimientos

XUNTA DE GALICIA
CONSELLERÍA DO MAR

XUNTA DE GALICIA
CONSELLERÍA DE ECONOMÍA E INDUSTRIA

Autoría: Díaz, S.; Madinabeitia, I.; Villalba, A.; Carballal, M.J.

Título: Presencia y efectos histopatológicos del copépodo (*Hermannella rostrata* Canu, 1891) en berberechos (*Cerastoderma edule* Linnaeus, 1758) de Galicia (NW España)

Evento: Foro Iberoamericano de los Recursos Marinos y la Acuicultura (IV FIRMA)

Lugar: Viana do Castelo (Portugal)

Ano: 2011

Presencia y efectos histopatológicos del copépodo (*Herrmannella rostrata* Canu, 1891) en berberechos (*Cerastoderma edule* Linnaeus, 1758) de Galicia (NW España)

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Resultados y Discusión

Conclusiones

Autoría: Linares, F.; Peleteiro, J.B.; Olmedo, M.; Álvarez-Blázquez, B.; Pazos-Sieira, G.; Pérez-Rial, E.; Rodriguez, J.L.; Valente, L.

Título: Sustainable diets for blackspot sea bream (*Pagellus bogaraveo*)

Evento: Aquaculture Europe 2011 the Annual Meeting of the European Aquaculture Society

Lugar: Rodas (Grecia)

Ano: 2011

Sustainable diets for BLACKSPOT SEA BREAM

(*Pagellus bogaraveo*)

Liñares, F.[1]*; Peleteiro, J.B.[2]; Olmedo ,M.[2]; Alvárez-Blázquez, B.[2]; Pazos Sieira, G.[1], Pérez Rial, E.[2]; Rodriguez , J.L.[3] & Valente, L.[4]

Introduction

Species diversification is one of the strategies to ensure a continuous expansion of the aquaculture industry. Blackspot sea bream (*Pagellus bogaraveo*) is considered to be one of the target species due to its high commercial value, its biological characteristics and the great lack of this fish on the markets. Considering the high dietary protein requirements of carnivorous species, fish meal (FM) replacement by alternative plant proteins is fundamental to achieve a sustainable aquaculture economically and environmentally.

The aim of this work is to evaluate the growth performance and the biochemical composition of seawater blackspot sea bream (*Pagellus bogaraveo*) fed with diets in which the marine-derived protein was replaced by plant protein ingredients.

Materials and Methods

This experiment was conducted in triplicate, in the IGAFA facilities of the Regional Government of Galicia, Spain, with 6 batches of fishes, born in captivity, with an average body weight of 136,08 ±7,96g and 18,06±0,80cm of length. Two different extruded diets (Spain Lda.) were prepared: Marine fish meal diet, and PP with a 57 % replacement fish meal by plant sources, supplemented with lysine and methionine. The chemical composition of the diets (Table I) was similar: 45% Crude protein (Cp) and 18% Crude lipid (Cl). Fish and weight were registered on a monthly basis. Analyses were made of proximal, total lipids and fatty acids in the liver and muscle of both fish, in triplicate, at the start and end of the experiment. Growth curves were compared by means of a t-Student test and biochemical comparisons with a one-way ANOVA and non-parametric test ($P<0.05$).

Results and discussion

Diets composition are shown (Table I).

As fed basis		
Theoretical composition	FM	PP
Crude protein	44,56	44,83
Digestible protein	41,38	41,71
Crude fat	18,38	18,29
Fiber	2,11	2,07
Starch	13,68	13,92
Gross Energy	18,03	18,22
Arg	2,84	2,83
His	1,18	1,07
Ile	1,93	1,97
Leu	3,44	3,47
Lys	3,53	3,37
Met	1,27	1,27
Phe	2,07	2,04
Met + Cys	1,63	1,70
Phe + Tyr	4,59	4,54
Ava Phosphorus	1,28	1,28

	FM	PP	% change
FBW/fish	417,0	393,8	-5,5
Muscle protein	13,3	14,4	+8
% of total protein	70,4	75,6	+8

Figure 1 shows the growth curves for the two groups of fish. After 18 months the weight and size of the fish were 382,09±13,39g and 22,37±0,33cm in juveniles fed with FM, and 379,89±13,34g and 23,13±0,40cm in juveniles fed with PP.

No significant differences were noted between the groups fed with the different feeds.

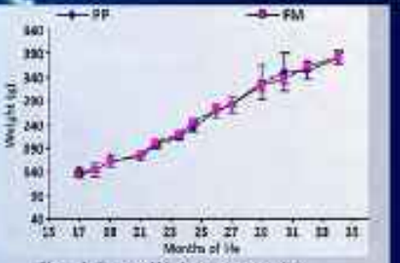

Figure 1. Growth of blackspot sea bream fed with different protein sources (mean ±s.d.)

Table II. Biochemical composition of blackspot sea bream juveniles fed with two diets

	Muscle			Liver		
	Start	FM	PP	Start	FM	PP
Proximate analysis						
Crude protein	75,42±1,03	78,51±0,76	79,08±1,04	27,37±1,06	28,04±1,20	29,53±0,94
Crude lipid	12,67±2,71	10,27±2,19	10,66±2,08	41,76±1,81	40,04±6,55	41,41±7,90
Fatty acids (%)						
PUFA	29,58±0,35	31,84±0,58	30,18±0,31	31,77±0,58	29,11±0,31	27,86±0,55
n-3	22,66±1,29	23,61±0,54	21,18±0,35	21,09±1,32	21,67±0,61	20,89±0,76
n-6	6,92±0,30	8,23±0,22	8,98±0,23	10,24±0,55	8,45±0,34	6,97±0,31
n-3/n-6	3,28±0,16	2,87±0,11	2,36±0,11	2,06±0,15	2,56±0,11	2,98±0,11
DHA	7,94±1,79	9,25±0,19	10,45±0,43	9,68±1,34	9,07±0,38	8,53±0,33

At the end of the experiment, no significant differences were noted in proteins and lipids with the two feeds tested, neither in the muscle nor in the liver (Table II). The optimal level of dietary crude protein for blackspot sea bream juveniles was estimated about 450 g/kg-1 dry matter (Shiau et al. 2005) and in other experiments was noted that the fat percent of feeds had not a great influence on the growth potential of blackspot sea bream during the ongrowing stage (Linares et al., 2004; Olmedo et al., 2007, 2009).

There were not significant differences in the fatty acid content in muscle and liver of the juveniles fed with the two diets, except in the n-6 PUFA (Table II). The percentage of n-6 fatty acids was higher in the muscle and liver of juveniles fed with PP diet (10,35 and 10,61% respectively), than in those fed with FM diet (8,35 and 8,12% respectively). The same results were previously obtained by Rguibi-Idrissi Sharon et al. (2006a), but they obtained also a decrease in EPA/% of the muscle of the alevines fed with PP diet. The differences could be due to the diets formulation and/or to the juveniles fish.

Conclusion

Results indicate that a diet based in fish meal could be partially replaced by plant-proteins diets, during the growth out phase of blackspot sea bream, without any adverse effect on growth or on tissue biochemical composition.

References

Fajardo-Silva A.C. G.Gomez, P.Borges & L.A.P. Lanna (2004). Desempenho e rendimento de filé em juvenis de pirarucu (*Arapaima gigas*) alimentados com diferentes níveis de proteína bruta. Revista Brasileira de Zootecnia 33 (1): 1-7.

Linares, F., M. Olmedo et al. (2004). Influence of feeding with different protein and lipid levels on growth and body composition of juvenile blackspot seabream (*Pagellus bogaraveo*). Aquaculture Nutrition 10: 417-423.

Olmedo, M., F. Linares, E. Pérez-Rial, G. Pazos et al. (2007). Comparative evaluation of two diets for blackspot seabream (*Pagellus bogaraveo*) juveniles reared in a marine cage. Aquaculture International 15: 181-188.

Rguibi-Idrissi H., A. Linares, B. Alvarez-Blazquez, G. Pazos et al. (2006). Liquid or dry diet, a question of taste? Effect on the growth and biochemical composition of juvenile blackspot seabream (*Pagellus bogaraveo*). Actas Workshop Nacional de Acuicultura: 54-58.

Shiau, F.C.C. Hwang, W.M.J.S. Tsorbas, E. Kuria, and M.P. Lutes (2005). Dietary protein, growth, and nitrogen excretion relationships and the partial protein budget of juvenile blackspot seabream, *Mylio macrocephalus* (Basilewsky). Aquaculture Research 36: 1-8.

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Autoría: Montes, J.; Iglesias, D.; Guerra, A.

Título: Viabilidad del cultivo de ostra plana *Ostrea edulis* en Galicia en zonas afectadas por bonamiosis

Evento: IV Foro Iberoamericano de los Recursos Marinos y la Acuicultura

Lugar: Viana do Castelo (Portugal)

Ano: 2011

VIABILIDAD DEL CULTIVO DE OSTRA PLANA *Ostrea edulis* EN GALICIA EN ZONAS AFECTADAS POR BONAMIOSIS

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XUNTA DE GALICIA
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INTRODUCCION

La bonamiosis es una enfermedad infecciosa originada por parásitos protozoos del género *Bonamia* (Fig. 1). En Galicia causa mortalidades masivas de ostra plana durante el segundo año de cultivo (Montes et al., 1992). Como consecuencia, la industria ostrícola se ha visto obligada a modificar su actividad productiva hacia una estrategia de supervivencia basada en la reducción de los tiempos de cultivo mediante la introducción de semilla de tamaño comercial procedente de otros países (Montes et al., 2003). Esta modalidad entraña graves riesgos desde el punto de vista patológico pero parece actualmente la única viable económicamente y más rápida.

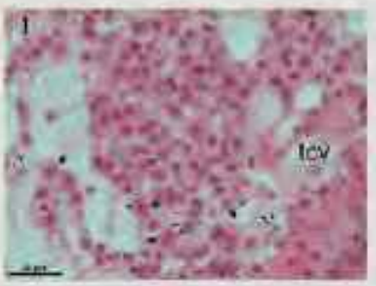
Con el fin de optimizar el resultado de los cultivos se propone realizar la información epidemiológica entre los sectores implicados para la toma de decisiones. Se intenta, en definitiva, desarrollar estrategias de cultivo fundamentadas en el análisis del riesgo patológico asociado a la bonamiosis. En este sentido se plantea el trabajo que se presenta en el cual se aportan la evolución de la prevalencia de la bonamiosis en los ciclos de cultivo controlados a cabo por un ostricultor profesional en la Ría de Arousa durante 2009 y 2010, con el fin de determinar los niveles de enfermedad asociados a la máxima mortalidad económicamente soportable en un cultivo comercial.

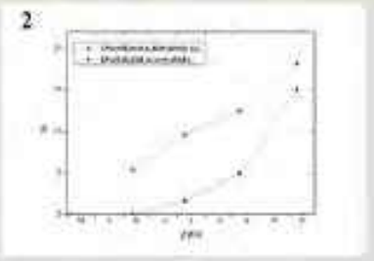
MATERIAL Y MÉTODOS

Se desarrollaron dos experiencias en relación con el seguimiento patológico de dos cultivos comerciales llevados a cabo por un ostricultor gallego en una batea situada en el polígono Cruz-Ardá de la Ría de Arousa. La primera experiencia se inició en marzo de 2009 y finalizó en noviembre del mismo año. La segunda fue más corta, introducciones las ostras en febrero de 2010 y concluyó para su venta tres meses de cultivo. De manera previa a la introducción de las ostras, se realizó un análisis histológico sobre 60 individuos de cada lote con el fin de comprobar que estaban libres de *Bonamia* spp. y de otras patologías infecciosas. Con periodicidad bimestral se realizaron muestreos de seguimiento de la mortalidad y de la prevalencia de la enfermedad en las ostras cultivadas.

RESULTADOS

El seguimiento patológico del cultivo desarrollado en 2009 incluyó el análisis histológico de 270 ostras. No se detectaron parásitos del género *Bonamia* ni en el ejemplar inicial ni en el primer muestreo de seguimiento, encontrando sólo en baja prevalencia en los siguientes muestreos, hasta alcanzar una prevalencia máxima del 15,6% a la finalización del cultivo. La mortalidad total, en tanto no se detectaron infecciones por *Bonamia* sp., fue de ostras el 5,0 %. A partir de la detección de la enfermedad, la mortalidad acusó un progresivo incremento hasta alcanzar valores de 18,2 % de mortalidad acumulada a la finalización del cultivo (**Fig. 2**). En el ciclo de cultivo desarrollado en 2010 se mantuvo por debajo la mortalidad anual de 2,0 ostras. A pesar de la experiencia anterior, no se detectó *Bonamia* sp. en el control inicial ni en el primer control de seguimiento, detectándose con una prevalencia del 1,3% a los 4 meses y alcanzando el 4,3% al finalizar el cultivo. La mortalidad siguió una evolución similar a la de la experiencia de 2009, incrementando progresivamente desde el momento de detección de la enfermedad y alcanzando valores de mortalidad acumulada del 14,7% al final de la experiencia (**Fig. 3**).





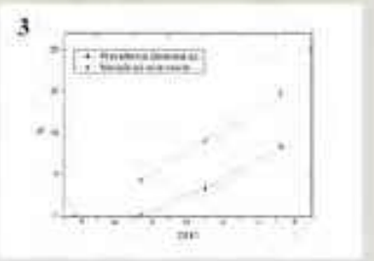


Fig. 1: Parásitos *Bonamia* sp. (puntas de flecha) en el interior de hemocitos (flechas) y libres en tejido conjuntivo conectivo (lcv) de ostra plana *Ostrea edulis*.
Fig. 2: Evolución de la prevalencia de la bonamiosis y de la mortalidad finita acumulada de las ostras (*Ostrea edulis*) en el ciclo de cultivo desarrollado en 2009.
Fig. 3: Evolución de la prevalencia de la bonamiosis y de la mortalidad finita acumulada de las ostras (*Ostrea edulis*) en el ciclo de cultivo desarrollado en 2010.

CONCLUSIONES

Tras la introducción, la bonamiosis suele comenzar a detectarse por histología en torno a los 4 meses de cultivo. A partir del momento de la detección del parásito las prevalencias aumentan progresivamente al igual que la mortalidad. La virulencia del agente es muy elevada, alcanzando valores significativos en todos los casos en los que no se controla los niveles de mortalidad. Actualmente, en Galicia el cultivo de ostra plana puede ser rentable si se parte de una semilla en la que no se detecte la enfermedad en el momento de su introducción, con el que se consiga alcanzar la comercialización del cultivo de entre 6 y 8 meses de duración. La clave del éxito reside en la información aportada por el diagnóstico inicial de las partidas introducidas y en el desarrollo de un seguimiento epidemiológico posterior del cultivo con el fin de proporcionar información útil para la toma de decisiones fundamentada en el análisis de riesgo. Este trabajo constituye una primera aproximación a esta idea, al libre, la asociación entre prevalencia y mortalidad vista estacionalidad por otros factores, comprendidos en la triada epidemiológica de interacción entre hospedador, parásito y ambiente. Es necesario contar con estudios de diferentes puntos para obtener los datos necesarios que permitan la definición de escenarios de riesgo realistas y útiles para los responsables de decisiones.

BIBLIOGRAFÍA

Montes, J., Cuchillal, M.J., López, M.C., Meixeiro, S.G. 1992. Incidence of bonamiasis in flat oyster, *Ostrea edulis* L., cultured in Galicia (N.W. Spain). *Aquaculture* 107: 169-182.

Montes, J., Perez-Sanz, S., Corchas, S.F., Guerra, A. 2003. Determining risk factors in relation to population dynamics of flat oyster, *Ostrea edulis*, affected by bonamiasis. *Aquaculture* 220: 175-182.

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Autoría: Vidal, A.; Ruiz, Y.; Suárez, P.; Alonso, A.; Rossignoli, A.E.; Blanco, J.; García, O.; San Juan, F.

Título: Accumulation of okadaic acid and detoxifing enzymatic activities in gland digestive from *Mytilus galloprovincialis* during exposure to DSP episodies

Evento: 8th International Conference on Molluscan Shellfish Safety

Lugar: Charlottetown - Prince Edward Island (Canadá)

Ano: 2011

Accumulation of okadaic acid and detoxifing enzymatic activities in gland digestive from Mytilus galloprovincialis during exposure to DSP episodies

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Introduction

Diarrhetic Shellfish Poisoning (DSP) is a gastrointestinal disease caused by ingestion of shellfish contaminated by okadaic acid (OA) and/or dinophysistoxins (DTX's). The organisms producing these toxins are marine dinoflagellates from genera *Dinophysis* and *Prorocentrum* (Yasumoto and Murata 1993). Little is known about toxins metabolism of filter feeding organisms, although involvement of detoxifying and antioxidant enzymes has been suggested, since induction of some of them has been observed in shellfish exposed to those compounds (Campa-Cordoba et al. 2009). In this study we analyse, the activity of cytochrome P450 reductase (CPR), which plays an essential role in the transformation of liposoluble xenobiotics, the activity of some antioxidant enzymes (glutathione reductase (GR), glutathione peroxidase (GPX-tot), glutathione-s-transferase (GST), catalase (CAT) and other detoxificant enzymes as those of glyoxalase system (GLO I), involved in detoxification of reactive o-keto aldehides generated in cellular oxidative processes. The variation of these enzymatic activities, were analysed in relation to OA accumulation during three different toxic blooms of *Dinophysis acuminata* and *D. acuta* in the Ria de Vigo.

Material and methods

Mussels were fortnightly sampled from the Vigo estuary (NW-Spain) since June 2001 until August 2002. In each sampling, 80 adult individuals were randomly collected. Digestive glands of 30 mussels were dissected, pooled and frozen at -80°C until the enzymatic assays. A section of mantle tissue was also dissected and histologically processed for sex determination. Digestive glands were pooled in each sample by sex and homogenized in 20 mM Tris-HCl buffer (1:4, w/v). CPR, GR, GPx and CAT activities were assayed in post-mitochondrial fractions by spectrofotometric methods.

The soft tissues of the other subsample (50 mussels) were pooled, homogenized, lyophilized and stored for drying until toxin analysis. Toxin extraction was carried out in 90% MeOH (1:4 w/v) and analysed by LC/MS according to Gerssen et al. (2009). OA was quantified in relation to reference materials from NRC-CRM, Canada.

Results and discussion

Three toxic episodes caused by *D. acuminata* and *D. acuta* was registered between June 18, 2001 and August 6, 2002 (INTECMAR, www.intecmar.org), in wich OA was acumulated in mussels (Fig.1). DTXs were not detected in any samples.

Our results show a significant increase of CPR activity in relation to OA accumulation, mainly in males (Fig. 1A). GST and GR shows a different behavior; in males we observe an activity activation at the start of intoxication which return to reference values when OA is accumulated, in females there are not notable differences, however results shows an activity inactivation at the start of episode, (Fig. 1B-C). GLO I and GPX-tot activity increases too, (Fig. 1D-E). CAT activities seem to be inhibited in both sexes, mainly when increase OA acumulated (Fig. 1F).

The results (T Student) indicate sexual differences in CPR, GR, GPX-tot and CAT activities, as well as a relation between OA and CPR, GR, and GLO I activities in males which should indicate the activation/induction of these enzymes by OA (Table 1). In females we observed a negative relation between OA and GR, GPx-tot activities, which should indicate an inhibition by OA (Table 1).

High correlations between GST activity and CPR, GR, CAT, GPX-tot and GLO I were also observed in males which should indicate induction of antioxidant enzymes (Table 1).

In females high correlations between CPR activity and GST, GPX-tot and GLO I were observed. CPR activity produces reactive oxygen species, which can induce antioxidant enzymes in order to combat the oxidative stress generated (Table 1).

These results suggest the possible involvement of these enzymes in OA detoxification in *Mytilus galloprovincialis*, as well as sexual differences in detoxification metabolism, although more studies should be performed to confirm it.

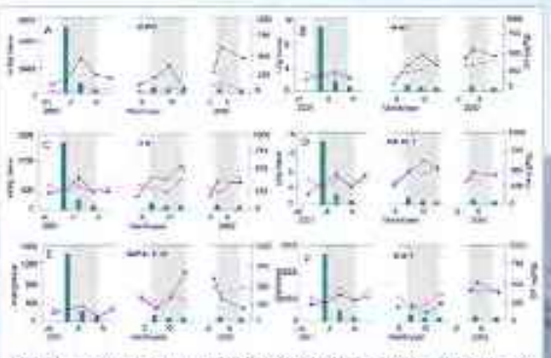

Fig. 1. OA accumulation and variation of CPR, GST, GR, GPX, CAT and GLO I from *M. galloprovincialis* digestive gland during three toxic episodes. (—) Toxic episode by *D. acuminata*. (—) Concentration of OA accumulated in mussel soft tissues. Enzymatic activities in females (—) and in males (—).

Male	CPR	GR	GST	CAT	GPX-tot	Female	CPR	GR	GST	CAT	GPX-tot	GLO I
GR						GR						
GST	[illegible]	[illegible]				GST	[illegible]					
GPX	[illegible]		[illegible]			GPX						
GPX-tot			[illegible]			GPX-tot	[illegible]		[illegible]	[illegible]		
GLO I		[illegible]	[illegible]		[illegible]	GLO I	[illegible]	[illegible]	[illegible]		[illegible]	
OA	[illegible]	[illegible]				OA		[illegible]			[illegible]	

Table 1. [illegible]

References

Campa-Cordoba et al. 2001. Cent. Biochem. Physiol. C: 149, 312-322.
Gerssen et al. 2009. J. Chromatogr. A: 1216,1421-1430.
Yasumoto & Murata 1993. Chem. Rev. 93:1897-1909.

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Título: Are the enzymes related to metabolism of xenobiotics involved in detoxification of okadaic acid in mussels?

Evento: Second joint Symposium and AOAC trask force meeting

Lugar: Baiona - Galicia (España)

Ano: 2011

ARE THE ENZYMES RELATED TO METABOLISM OF XENOBIOTICS INVOLVED IN DETOXIFICATION OF OKADAIC ACID IN MUSSELS ?

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Introduction

Okadaic acid (OA) is the main compound causing episodes of DSP (Diarrhetic Shellfish Poisoning) in Galician Rias. Filter-feeding shellfishes, such as bivalve molluscs, can accumulate OA and dinophysistoxins (DTXs) in high concentrations during toxic algal blooms, mainly in the digestive gland (Blanco et al. 2007).

There are few studies about metabolism of marine toxins, although some authors have suggested involvement of detoxification enzymes (Kodama and Sato, 2002, FRS Marine Laboratory, 2004) and described induction of some antioxidant enzymes in crustaceans and scallops in presence of toxic dinoflagellates (Campa-Cordova et al. 2009).

This work is a preliminary study about the metabolism of okadaic acid (OA) in *Mytilus galloprovincialis*.

Material and Methods

Mussels (*Mytilus galloprovincialis*) were kept for two weeks in laboratory. After six days of conditioning, individuals were separated into two groups. One was treated with microencapsulated purified OA and another, which served as a control, with empty microcapsules. Samples were collected every two days and sex were determined histologically. Digestive glands of male and female were halved, pooled and frozen at -80 °C for enzymatic and chemical analysis.

For enzymatic assays, samples were homogenized in 20 mM Tris-HCl buffer (1:4, w:v). Cytochrome P450 reductase (CPR), Glutathione-S-transferase (GST), Glutathione reductase (GR), Glyoxalase I (GLO I), Glutathione peroxidase total (GPx-tot) and Catalase (CAT) activities were assayed in post-mithocondrial fractions by spectrofotometric methods.

Toxins extraction were performed in 100% MeOH (1:4 w:v) and their analyses were carried out by LC/MS according to Gerssen et al. 2009. OA was quantified in relation to reference materials from NRC-CRM, Canada.

Results and Discussion

The main detoxifying enzymes in eukaryotic cells are cytochrome P450-denpendent monooxigenases, which transform liposoluble toxins in more polar compounds easily eliminated. These enzymatic activities are determined by electron donation to cytochrome P450, mediated by the NADPH-cytochrome P450 reductase. Products of monooxygenases are not easily eliminated and often are more toxic than initial compounds. To increase their polarity, be transported and eliminated, they can be conjugated with endogenous metabolites such as reduced glutathione. This conjugation is catalyzed by glutathione S-transferase (GST), which in turn depends on generation of reduced glutathione by glutathione reductase. Moreover, cytochrome P450-dependent monooxygenases generate large amounts of highly toxic free radicals such as reactive O_2 species and o-ketoaldehyds (2-oxoaldehyds). Detoxification of these reactive species is carried out by antioxidant enzymes such as glutathione peroxidase and glyoxalase, respectively, which are also dependent of GSH generation by glutathione reductase.

Our results show a significant increase of CPR activity in relation to OA accumulation, mainly in females (Fig. 1A). GST activity decreases at the beginning of treatment in both sexes, but in males increases with increasing OA accumulation, while in females decreases significantly (Fig. 1B). GR shows a different behavior: in males there are not significant differences, however, in females we observe an activity activation at the start of treatment, which return to reference values when OA is accumulated (Fig. 1C). GLO I activity increases too, but not significantly, at the start of treatment, mainly in females (Fig. 1D). GPx and CAT activities seem to be inhibited in both sexes, mainly in males (Fig. 1 E-F).

These results indicate sexual differences in all activities analyzed, as well as a significant enzymatic induction, mainly of CPR in relation to the AO accumulated and suggest the possible involvement of these enzymes in OA detoxification in *Mytilus galloprovincialis*, although more studies should be performed to confirm these results.

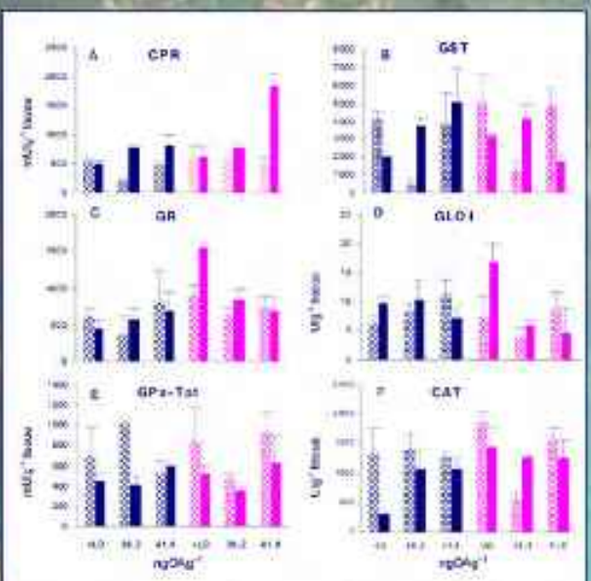

Fig. 1. Enzyme activity variation during treatment with OA in *M. galloprovincialis* digestive gland. control males; treated males; control females; treated females. * Significant differences (p<0.05) between control and OA treatment (T Student).

References

- Blanco et al. 2007. Toxicon 50, 1011-1016.
- Campa-Córdoba et al. 2005. Com. Biochem. Physiol. C, 1[illegible]
- FRS Marine Laboratory. 2004. Marine Biology. Fisheries Research Services. Report AE 14/08. Aberdeen, U.K.
- Gerssen et al. 2009. J. Chromatogr. A, 1210 [illegible]
- Kodama and Sato. 2002. International Conference [illegible] NTSCD [illegible] UNU-Nuoto.

Autoría: Blanco, J.; Arévalo, F.; Correa, J.; Goicoechea, M.; Pérez, B.; Longa, A.

Título: Comparison of mouse bioassay, HPLC-MS and a phosphatase inhibition test for quantifying DSP toxicity in mussels

Congreso: Marine and Freshwater Toxins Analysis. Second Joint Symposium and AOAC Task Force Meeting

Lugar: Baiona - Galicia (España)

Ano: 2011

COMPARISON OF MOUSE BIOASSAY, HPLC-MS AND A PHOSPHATASE INHIBITION TEST FOR QUANTIFYING DSP TOXICITY IN MUSSELS

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ABSTRACT

The differences of three techniques of quantification of DSP toxicity (mouse bioassay and phosphatase inhibition) and toxin concentration (HPLC-MS) have been studied in a set of samples from different locations and at different states of the outbreak. The use of the two techniques alternative to mouse bioassay would lead to a similar number of "false negative" and "false positive" tests but they did not coincide in the samples with these results. When several levels of toxicity are considered in sight of the average survival time of the mussels, HPLC-MS shows less "false negative" results that phosphatase inhibition for the samples with high toxicity (time to death < 5h). If the positivity levels of the two alternative levels are adjusted in order to eliminate the "false negative" results, levels of ca. Lower than 160 have to be used, but in such cases the number of "false positive" results increases. The okadaic acid concentration estimated by HPLC-MS and phosphatase inhibition assay were not bonary related, even if only the data below the saturation of the phosphatase assay were considered. Transforming the data logarithmically linearized the relationship substantially suggesting that the enzymatic kinetics used in the phosphatase assay to estimate the toxin concentration or the interactions with the biological matrix should be reviewed.

MATERIAL AND METHODS

Biological material: 133 samples of raft mussels from Galician rias. Diverse procedence, diverse outbreaks and diverse phases of each outbreak.
Bioassay: DSP procedure of Yasumoto et al. 1984
Phosphatase inhibition test and HPLC-MS:
Extraction: Whole body extraction with 100% methanol (1g/4mL)
Clarification: Centrifugation 20000 x g
Hydrolysis: Aqueous NaOH 75°C 40 min (phosphatase) or Methanolic NaOH 80°C 10 min (HPLC-MS)
Prepurification: SPE Strata-X (HPLC-MS)
Quantification: EGU Immunotec. Method for detection of diarrhoeic shellfish toxins in edible molluscs. ED-SOP-Tuxtlex-DSP-001Rev12. With fluorescence microplate reader.
HPLC-ESI-MS: Thermo Surveyor + Ciron XPplus ion trap MS. RCS-Hypersil C3 50x3.1, 3 micron. Quillam 2003. Negative ionization. Hydrolysed and not hydrolysed extracts were quantified. (HPLC-MS)
Statistics:
Minitab 15, Type II regression (major axis) (Peltzer 2007)

RESULTS

Sample representativity: Samples obtained covered a wide range of toxicities and phases of the outbreak.

Agreement of the three techniques about closure decision: Neither HPLC-MS nor Phosphatase inhibition assay gave the same results than mouse bioassay. The three techniques agreed in 77.8% (70.4-84% with 95% confidence) of the samples.

"False negative" results: With both techniques ca. 10% of the samples whose toxin concentration was estimated to be below the legal threshold (negative result) were estimated to be above it (positive result) by mouse bioassay (false negative results if MBA is used as reference).

"False positive" results: HPLC-MS produced slightly more false positive results than the Phosphatase inhibition assay.

"High risk" results: Phosphatase inhibition test gave more negative results (8) than HPLC-MS (3) in samples that were found to be very toxic for mice (time to death less than 5 h).

Reference levels to avoid/reduce "False negatives": In general, slightly higher levels for Phosphatase assay. "False positives" increase substantially when reference levels are reduced.

Phosphatase vs. HPLC-MS relationship:
Nonlinear. Log-log response (curved, triangle-shaped residual distribution)
Slope smaller than 1, offset larger than 0.
Poor explained variance (15% and 30% for raw and log-transformed data)

Fig. 1. Frequency distribution of the three toxicity estimates obtained in the sight of Crude Mine (Galician rias). [illegible]

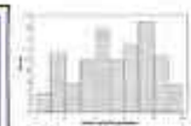

Fig. 2. Distribution of the samples studied in [illegible]

Table 1. Agreement and disagreement of the current techniques [illegible]

Each Technique vs Standard Assessment Agreement

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Assessment Disagreement

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Between Techniques Assessment Agreement

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 2. Negative and positive results by HPLC-MS and Phosphatase inhibition in relation to the toxicity estimated by time to death in mice.

MBA					
Negative	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Positive	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MBA					
Negative	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Positive	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

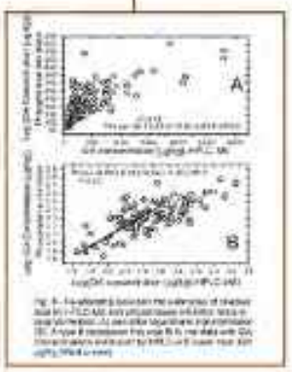

Fig. 4. [illegible]

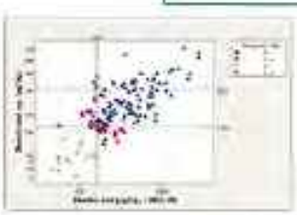

Fig. 5. [illegible]

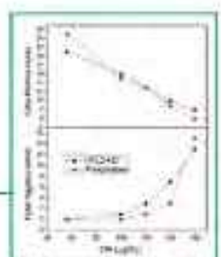

Fig. 3. "False negative" and "False positive" results in relationship to the reference levels of [illegible] and Phosphatase inhibition assay, as a function of the reference level [illegible]

ACKNOWLEDGMENTS

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REFERENCES

Peltzer, E. 2007. MATLAB® shell-scripts for linear regression analyses. Lsqfitma.m. [Online]. http://www.mbari.org/staff/etp3/regress/lsqfitma.m. (accessed) May 2008.

Quilliam, M. A. (2003). Chemical method for lipophilic shellfish toxins. In G. M. Hallegraeff, D. M. Anderson, & A. D. Cembella (Eds.), Manual on Harmful Marine Microalgae (pp. 211245). Paris: UNESCO Publishing.

Yasumoto, T., Murata, M., Oshima, Y., Clardy, G.K., 1984. Diarrhoeic shellfish poisoning. In Ragelis, X.P. (Ed.), Seafood Toxins. American Chemical Society, Washington DC, pp. 209-214.

Autoría: Vidal, A.; Suárez, P.; Rossignoli, A.E.; Ruiz, Y.; Alonso, A.; García, O.; Blanco, J.; San Juan, F.

Título: Inducción de la actividad de enzimas relacionadas con el metabolismo de xenobióticos por Ácido Okadaico en la glándula digestiva de *Mytilus galloprovincialis*

Evento: XI Reunión Ibérica sobre Microalgas Nocivas y Biotoxinas

Lugar: Bilbao - Euskadi (España)

Ano: 2011

Inducción de la actividad de enzimas relacionadas con el metabolismo de xenobióticos por Ácido Okadaico en la glándula digestiva de *Mytilus galloprovincialis*.

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EPITOX

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Introducción

El ácido okadaico (AO) es el principal compuesto causante de episodios tóxicos de DSP (Diarrheic Shellfish Poisoning) en las rías Gallegas. Durante estos episodios, organismos filtradores, como los moluscos bivalvos pueden acumular AO en grandes cantidades, principalmente en la glándula digestiva (Blanco et al. 2007). Hasta el momento existen muy pocos estudios sobre el metabolismo de toxinas marinas, aunque algunos autores han sugerido la participación de enzimas de detoxificación (Kodama and Sato, 2002; FRS Marine Laboratory, 2004) y han descrito la inducción de algunas enzimas antioxidantes en crustáceos y pectínidos en presencia de dinoflagelados tóxicos (Campo Córdoba et al. 2009). Las principales enzimas implicadas en la desintoxicación de las células eucariotas son monooxigenasas dependientes del citocromo P450 (transforman compuestos tóxicos liposolubles en compuestos polares fácilmente eliminados). Estas actividades enzimáticas están determinadas por la donación de electrones al citocromo P450, mediada por la Citocromo reductasa P450-NADPH (CPR). Los productos de las monooxigenasas son difíciles de eliminar, y con frecuencia son más tóxicos que los compuestos iniciales. Para aumentar su polaridad, y así ser transportados y eliminados, se pueden conjugar con metabolitos endógenos como el glutatión reducido. Esta conjugación es catalizada por la glutatión S-transferasa (GST), que a su vez depende de la generación de glutatión reducido por la glutatión reductasa (GR). Por otra parte, las monooxigenasas dependientes del citocromo P450 generan grandes cantidades de radicales libres muy tóxicos (especies reactivas del O2 y α-octoaldehidos). La desintoxicación de estas especies reactivas se lleva a cabo por enzimas antioxidantes como la glutatión peroxidasa (GPX-tot) y glioxalasa (GLO), respectivamente, que también dependen de la generación de GSH por la GR.

El presente trabajo constituye un estudio preliminar sobre el metabolismo del AO en *Mytilus galloprovincialis*.

Material y métodos

Se realizó el acondicionamiento de los mejillones a las condiciones del laboratorio durante seis días. Posteriormente se separaron en dos grupos. El primer grupo fue tratado con OA contenido en microcapsulas purificadas y el otro, que sirvió como control, con microcapsulas vacías. Se recogieron muestras cada 2 días: la glándula digestiva fue diseccionada y congelada a -80ºC para su posterior análisis enzimático y de ácido okadaico; una sección central de uno de los hemimantos fue también diseccionada para la determinación del sexo de cada individuo por métodos histológicos convencionales.

Para los ensayos enzimáticos, las muestras se homogeneizaron en 20 mM Tris HCl (1:4 w v-1). Las actividades de la CPR, GST, GR, GLO I, GPx-tot y catalasa (CAT) fueron analizadas en la fracción post-mitocondrial por métodos espectrofotométricos.

La extracción de los toxinas se realizaron en 100% MeOH (1:4 w:v) y su análisis se llevó a cabo por LC / MS siguiendo el método desarrollado por Gerssen et al. 2009. El AO se cuantificó por comparación con los materiales de referencia de la NRC-CRM, Canadá.

Resultados y discusión

Los resultados obtenidos muestran un aumento significativo de la actividad de la CPR con la acumulación de AO, principalmente en hembras (fig. 1A). Sin embargo la actividad de la GST disminuye al inicio del tratamiento en ambos sexos, para en machos aumentar a medida que se produce la acumulación de AO, mientras que en hembras disminuye significativamente (Fig. 1B). La GR presenta un comportamiento diferente en machos no hay diferencias significativas, para en hembras se observa una activación de la actividad al comienzo del tratamiento, volviendo a los niveles de referencia con la acumulación de AO (Fig. 1C). La actividad de la GLO I aumenta pero no significativamente al inicio del tratamiento, principalmente en hembras (Fig. 1D). Las actividades de la GPx y la CAT parece que son inhibida en ambos sexos, cerciorándose más en machos (Fig. 1 E-F).

Estos resultados indican diferencias sexuales en las actividades enzimáticas estudiadas, así como una inducción enzimática significativa con la acumulación de AO, sobre todo de la CPR sugiriendo la posible participación de estas enzimas en la desintoxicación de AO en *Mytilus galloprovincialis*, aunque deben hacerse más estudios para confirmar estos resultados.

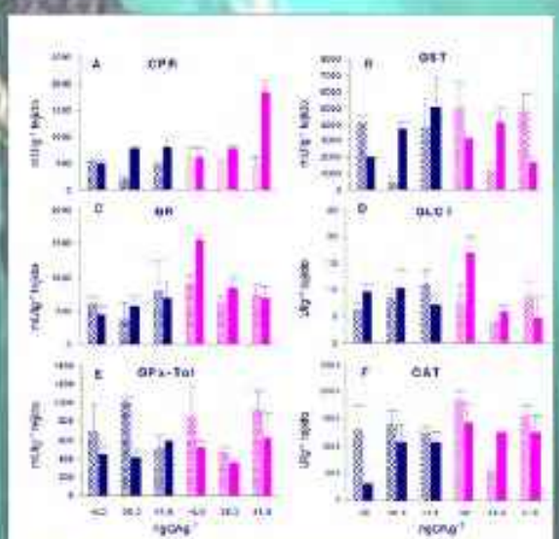

Fig. 1. Variación de la actividad enzimática durante el tratamiento con AO en glándula digestiva de *M. galloprovincialis*. (□Machos control ■machos tratados; ▨Hembras control ■hembras tratadas). * Diferencias significativas (p<0.05) entre individuos control y tratados con AO (T Student).

- Blanco et al. 2007. J. Shellfish Res. 26:1-7.
- Campa-Córdoba et al. 2009. Com. Biochem. Physiol. C 149: 317-322.
- FRS Marine Laboratory. 2004. Marine Biotoxins. Fisheries Research Services. Report AE 1468. Aberdeen. 83 p.
- Gerssen et al. 2009. J. Chromatogr. A. 1216:1421-1430.
- Kodama and Sato. 2002. International Conference. UNESCO, Joint UNU-IwaTa.

Autoría: Guerra-Díaz, A.; Lodeiros-Seijo, C.; Gaspar, M.B.; da Costa-González, F.

Título: Razor clams: biology, aquaculture and fisheries

Evento: XIV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2011

Razor clams: biology, aquaculture and fisheries

Guerra Díaz, A. [1]; Lodeiros Seijo, C. [2]; Gaspar, M.B. [3] y da Costa González, F. [4] (eds.)

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Several reasons have driven us to publish a second edition of "Navajas y longueirones: ecología, pesquerías y cultivo" published in Spanish in 2008. In the first place, we felt the need to incorporate newly acquired knowledge about razor clam species (Pharidae and Solenidae families), together with information contributed from countries with fisheries for these species; and secondly, we felt it was necessary to publish in English. The result is a more mature and more universal work than the first. Forty-four contributors and 23 international reviewers have participated in this English edition.

The book is divided into 3 main sections. The first describes various aspects of the biology of the species in the following chapters: taxonomy and distribution, anatomy, physiology, reproduction, genetics and pathology, with preferential information about the three species that appear on the Spanish coasts and particularly in Galicia (sword razor shell, *Ensis arcuatus*; cod razor shell, *Ensis siliqua*; and grooved razor shell, *Solen marginatus*). The second section of the book focuses on the fishing practices in different habitats and countries and the impact they have on the environment, as well as the latest advances made in the aquaculture of these species. The third section gathers together information concerning the current status of the resource worldwide, mainly from European countries (Spain, Portugal, Italy, Ireland, United Kingdom and Greece), but without forgetting others where razor clam fishing has been and still is important (Chile, Peru, Argentina, Canada, USA, Thailand, Tunisia, etc.).

Section I: Biology

Chapter 1: Systematics and distribution

Chapter 2: Anatomy

Chapter 3: Reproduction

Chapter 4: Selection and retention of particles in the diet of *Solen sp.*

Chapter 5: Molecular and cytogenetic features of razor clams

Chapter 6: Pathologies in cod razor clam (*Ensis siliqua*)

Chapter 7: Ecology of sword razor shell (*Ensis arcuatus*) and pod razor shell (*Solen marginatus*)

Chapter 8: Advances in our knowledge of microbiota of hatchery-cultured bivalves

Section II: Aquaculture and harvesting methods

Chapter 9: Razor clam culture in Galicia (NW Spain)

Chapter 10: Razor clam (*Ensis macha*) culture in Chile

Chapter 11: Environmental impacts of razor clam fisheries

Section III: Razor clam fisheries

Chapter 14: Spain

Chapter 13: Ireland

Chapter 12: United Kingdom

Chapter 16: Italy

Chapter 15: Portugal

Chapter 17: Greece

Chapter 19: Canada and USA

Chapter 18: Tunisia

Chapter 20: Peru

Chapter 21: Chile

Chapter 22: Argentina

Chapter 23: Thailand

Autoría: Guerrero, S.; Cremades, J.; Domínguez, J.; Muñíz, V.; Ancosmede, C.; Cores, A.

Título: Poliquetos en el efluente de una pisicfactoría de peces planos

Evento: XIV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2011

POLIQUETOS EN EL EFLUENTE DE UNA PISCIFACTORÍA DE PECES PLANOS

GUERRERO[1], S.; CREMADES[2], J.; DOMÍNGUEZ[1], J.; MUÑÍZ[1], V.; ANCOSMEDE[1], C. y CORES, A.[1]

[1] Centro de Investigacións Mariñas (CIMA), Xunta de Galicia, 36620 Vilanova de Arousa, Pontevedra. E-mail: salvadorg@cimacoron.org

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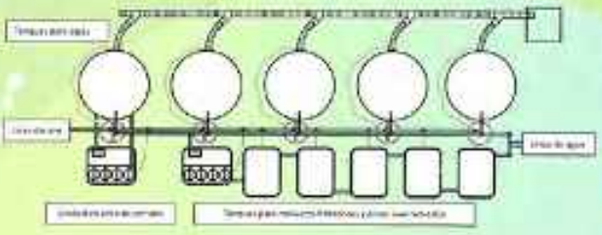
XUNTA DE GALICIA CONSELLERÍA DO MAR · CIMA · UNIVERSIDADE DA CORUÑA · JACUMAR

INTRODUCCIÓN

EXPERIENCIAS EN EL CIMA

EXPERIENCIAS EN AQUACRIA



Autoría: Acosta, C.P.; Cerviño-Eiroa, A.

Título: Eficiencia de sistemas para el preengorde de volandeira cultivada en batea

Evento: XIV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2011

Eficiencia de sistemas para el engorde de volandeira cultivada en batea

C. F. Alcalde y A. Carreño Sanz
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OBJETIVOS

Los estudios realizados hasta la fecha demuestran que a nivel comercial la volandeira (*Aequipecten opercularis* L.) es la especie de pectínidos mas adecuada para su cultivo en suspensión debido a su rápido crecimiento y a la posibilidad de abastecimiento de semilla por captación natural. El objetivo de este trabajo fue determinar la eficacia de tres sistemas para el cultivo en suspensión de volandeira: los tradicionales cestos ostrícolas, y dos tipos de linternas, de piso rígido (platillos sistema SERVIMAR) y de piso flexible (lantern net o linternas).

MATERIAL Y METODOS

El experimento fue llevado a cabo en una batea situada en la ría de Vigo con semilla de volandeira de talla inicial 26 mm de altura estabulada en tres sistemas: cestos ostrícolas, linternas de monofilamento de piso flexible (linternas) y linternas de monofilamento de piso rígido (platillos). Con una densidad inicial del 40% de cobertura (753 indiv/m^2). Los experimentos fueron realizados por triplicado. Cada tres meses aproximadamente 100 individuos de cada sistema eran medidos en la batea para determinar el crecimiento en talla (altura de la concha en mm) y una muestra de 30 individuos, eran llevados al laboratorio para analizar el crecimiento en peso. Coincidiendo con la recogida de muestras, se realizaban las limpiezas mediante el cambio a estructuras limpias y se ajustaba la densidad (100, 60 y 40 semillas/piso en cestos y platillos y 150, 120 y 88 semillas/piso en linternas)

RESULTADOS Y DISCUSION

La semilla de talla inicial 26 mm (altura de la concha) presentó un incremento de talla de 102.4% en el cultivo en linternas, 107.3% en platillos y 109.7% en cestos (Fig.1). Los incrementos en peso fueron de 1278.9% en cestos, 1559.5% en platillos y 1475.2% en linternas. (Tabla I).

Un ANOVA de una vía mostró diferencias significativas en el crecimiento entre los distintos sistemas, tanto en talla ($F=11.20$, $P=0.000$) como en peso ($F=5.94$, $P=0.004$) siendo en los cestos donde se obtuvieron los peores resultados. El crecimiento entre ambas linternas no presentó diferencias significativas (L=P>C).

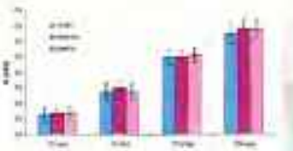


Figura 1. Crecimiento en talla en los tres sistemas. H es la altura de la concha

El Indice de condición (Fig.2), presenta una evolucion similar en todos los sistemas, excepto al final del estudio que desciende en la semilla cultivada en cestos de 21 a 19.11, a diferencia de los otros sistemas que aumenta ligeramente hasta alcanzar 23,10 y 22.56 en linternas y platillos, coincidiendo con la abundancia de epibiontes en los cestos, fundamentalmente fijaciones de mejillón, que disminuye el paso del agua al interior de los mismos, a diferencia de las linternas con abundancia de ascidias.

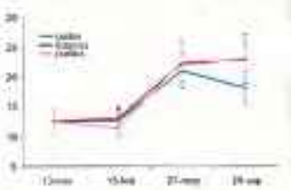


Figura 2. Indice de condición

El rendimiento obtenido fue, 9.6 kg/m^2 de biomasa (equivalente a 4.8 kg de carne/m^2) en los platillos, 7.4 kg/m^2 (3.6 kg de carne/m^2) en linternas y por último 5.8 kg /m^2 en cestos (equivalente a 2.7 kg de carne/m^2) (Tabla II)

La estimación de costes en euros por línea (precios 2008) de cada sistema de cultivo, se calculó trabajando lantern-nets de 10 pisos por cuerda, linternas (SERVIMAR) compuestos de 8 platillos (7 de cultivo y 1 utilizado como contrapeso) y líneas de 8 cestos (7 de cultivo y uno de tapa) por cuerda (Tabla II)

Los costes por inversión del material necesario para el cultivo, calculado en euros por metro cuadrado útiles fue de 55.96 € para el sistema de cestos, 33.79 € para los platillos y 19.45 € para las linternas.

Tabla I. Datos de crecimiento en talla (H: altura de la concha y peso (PT: peso medio). Condiciones experimentales

sistema	n^o/cuerda	n^o indiv/m^2		PT (g)		H (mm)	
		Inicial	Final	Inicial	Final	Inicial	Final
CESTO	0,0799	753	324	1,47	20,64	26	57,67
PLATILLO	0,0799	753	324	1,47	27,73	26	58,9
LINTERNA	0,053	753	469	1,47	24,17	26	54,91

Tabla II. Datos de producción y costes estimados (en euros) de cada sistema

sistema	Biomasa m²/kg		Producción/kg		Rendimiento/kg		Coste
	Inicial	Final	Inicial	Final	Inicial	Final	
CESTO	0,126	7,33	0,97	2,44	1,71	6,45	55
PLATILLO	0,126	9,78	1,31	3,78	2,17	7,76	34
LINTERNA	0,126	10,71	1,31	4,76	3,81	13,86	19

Desde el punto de vista productivo, la inversión de materiales por kilogramo de volandeira producida conlleva unos costes para el cultivador de 1.71 € haciendo el cultivo con linternas, 4.16 € en el caso de los platillos y por último 7.85€ si el sistema utilizado es el de los cestos. Estos datos ponen de manifiesto que en las condiciones de este trabajo, el sistema más eficiente fue el de lantern net.

Este trabajo ha sido financiado por la acción de investigación PGIDIT-CIMA03/04 a través de la Dirección Xeral de Desenvolvemento Pesqueiro da Consellería do Mar da Xunta de Galicia

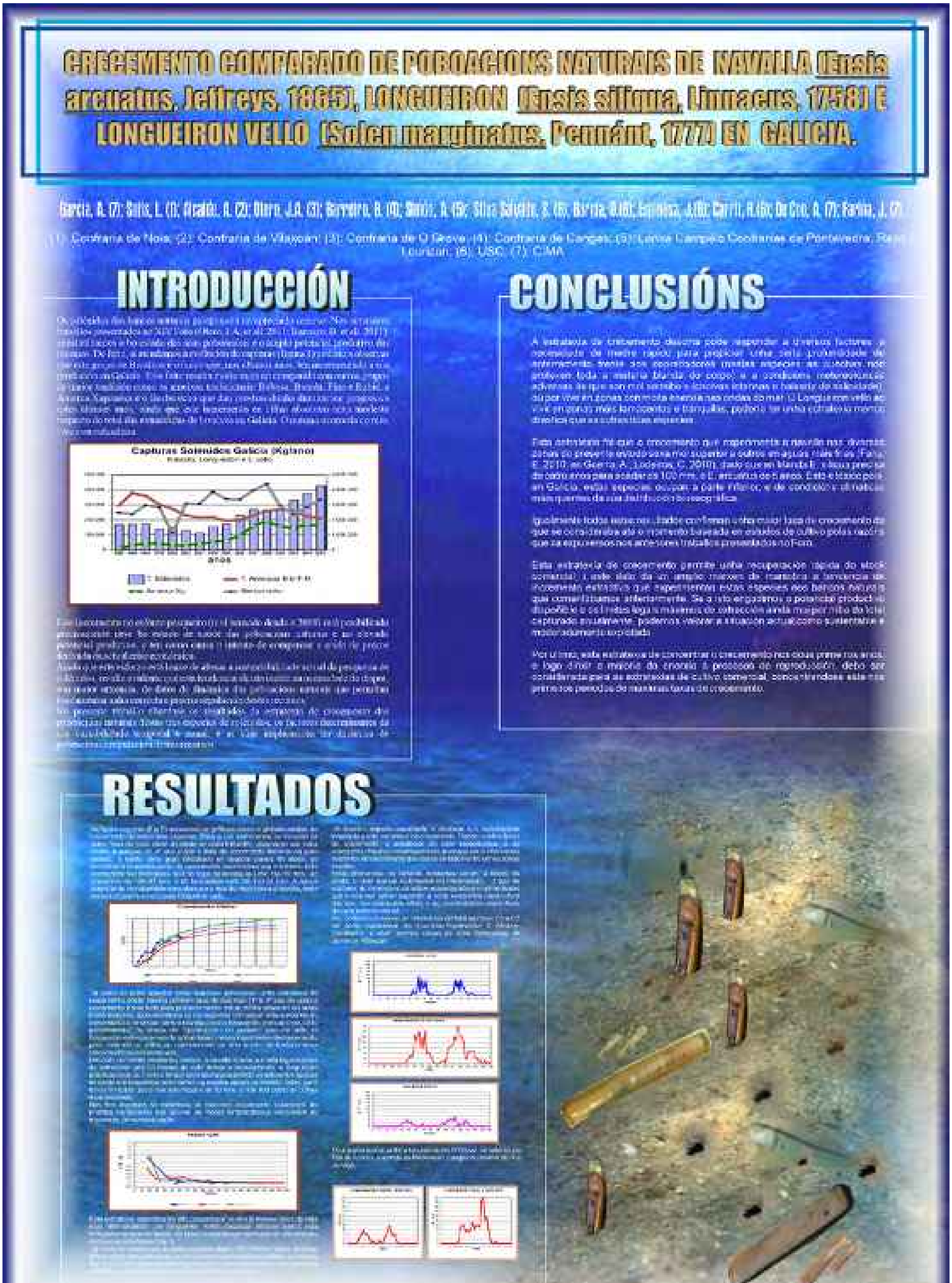
Autoría: García, A.; Solis, L.; Alcalde, A.; Otero, J.A.; Barreiro, B.; Simón, A.; Silva-Salvado, S.; García, O.; Espinosa, J.; de Coo, A.: Fariña, J.

Título: Crecemento comparado de poboacións naturais de navalla (*Ensis arcuatus*, Jeffreys, 1865), longueirón (*Ensis siliqua*, Linnaeus, 1758) e longueirón vello (*Solen marginatus*, Pennánt, 1777) en Galicia

Evento: XV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2012


CRECEMENTO COMPARADO DE POBOACIONS NATURAIS DE NAVALLA (Ensis arcuatus, Jeffreys, 1865), LONGUEIRON (Ensis siliqua, Linnaeus, 1758) E LONGUEIRON VELLO (Solen marginatus, Pennánt, 1777) EN GALICIA.
(1): Confraría de Noia; (2): Confraría de Vilaxoán; (3): Confraría de O Grove; (4): Confraría de Cangas; (5): Lonxa Campelo; (6): USC; (7): CIMA
INTRODUCCIÓN
Capturas Solénidos Galicia (Kg/ano)
CONCLUSIÓNS
RESULTADOS

Autoría: Silva-Salvado, S.; García-Martín, O.; Espinosa, J.; García, A.; Otero, J.A.

Título: Ciclo reprodutivo y talla de maduración de la primera gónada en solénidos en Galicia

Evento: XV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2012

Ciclo reproductivo y talla de maduración de la primera gónada en Solénidos en Galicia

Silva Salvado, S. (6); García Martín, O.(6); Espinosa, J.(6); Carril, R.(6); García, A. (2); Otero, J.A.(3)

USC; (1); CIMA (2); Confraría de O Grove (3)

INTRODUCCIÓN

RESULTADOS

Ciclos reproductivos

Ciclos reproductivos

Talla de Primera Maduración

DISCUSIÓN-CONCLUSIONES

Autoría: Guerrero, S.; Santos I.

Título: Importancia de la temperatura en la supervivencia en laboratorio del poliqueto *Diopatra neapolitana*: resultados preliminares

Evento: XV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2012

XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL E DO MAR
CIMA
Importancia de la temperatura en la supervivencia en laboratorio del poliqueto Diopatra neapolitana
Resultados preliminares
Guerrero[1], S.; Santos[1], I.
Introducción y objetivos
Material y métodos
Importancia económica en Galicia
Resultados
Discusión y conclusiones
Agradecimientos
2012
ForoAcui

Autoría: Ramilo, A.; Iglesias, D.; Darriba, S.; Abollo, E.; Villalba, A.

Título: First detection of the parasite *Mikrocytos mackini* in Europe, infecting the Manila clam *Ruditapes philippinarum*

Evento: Physiomar 12 International Meeting

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2012

First detection of the parasite *Mikrocytos mackini* in Europe, infecting the Manila clam *Ruditapes philippinarum*

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INTRODUCTION

Mikrocytos mackini is an intracellular parasite blamed for severe mortalities of oysters *Crassostrea gigas* in British Columbia (Canada) and Washington (USA) (Bower 2008, Abbott et al. 2012), its morphology under light microscopy resembles that of other microcell parasites of molluscs, the protozoan parasites of the genus *Bonamia*. Due to its small size (2-4 µm), but its taxonomical position is uncertain. Experimental infections performed to evaluate the susceptibility of various commercial molluscan species showed that the oysters *C. gigas*, *Crassostrea virginica*, *Ostrea edulis* and *Ostrea lurida* became infected with *M. mackini* whereas the clams *Panopea abrupta* and *Ruditapes philippinarum* were not (Meyer et al. 2008), thus suggesting those clams were resistant to *M. mackini*. However, in late 2011, a parasite closely related to *Mikrocytos*, although different from *M. mackini*, was reported infecting clams, *Donax trunculus* from French beds affected by high mortality (Garcia et al. 2012).

MATERIALS AND METHODS

Samples of *R. philippinarum* were collected in late 2007 and early 2008 in four beds located in Galicia (NW Spain) (Fig 1). Two subsamples of each bed, consisted of buried and unburied clams, were examined by histological techniques and macroscopically to detect anomalies. Attempts to identify the microcells observed in histology sections were performed by PCR.

Fig. 1. Map of Galicia showing the location of sampled beds: 1. Vilanova; 2. Noia-Muros; 3. Arousa-Ulla; 4. Corcubión.

The primer pairs 9D/18A5 (Cochennec et al. 2000) and the set of primers HAP-F1/F2/R1/R2/R3 (Renault et al. 2000), designed to identify *Bonamia* and *Haplosporidium* parasites, respectively, were used in 2008. Recently, in early 2012, the primer pair MIKROCYTOS-F/MIKROCYTOS-R primers (Carnegie et al. 2003) has been used. PCR amplification products were cloned and sequenced. Additionally, an *in situ* hybridization (ISH) assay has been carried out to confirm the identity of the microcells on clam tissues, using a digoxigenin (DIG)-labelled probe obtained by PCR with MIKROCYTOS-F/ MIKROCYTOS-R primers.

RESULTS

1) Macroscopic observation

The macroscopic observation of the shell valves allowed to detect Brown Ring Disease (BRD) in both buried and unburied clams collected in the four clam beds. BRD reached high levels of prevalence and of intensity according to the scale of Pollard and Mann (1994) (Fig. 2a, b), in every bed except in that of Espasante, both prevalence and intensity were higher for unburied clams than for those buried.

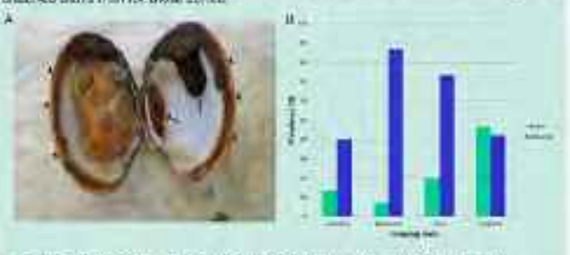

Fig. 2. A. Brown ring disease (BRD) observed as a ring on the inner shell of a clam affected by carnation. B. Values of prevalence of BRD.

DISCUSSION

This is the first report of *M. mackini* in Europe and the first report of this parasite infecting the cosmopolitan clam *R. philippinarum*. Brown ring disease and infection by *M. mackini* have been blamed for high mortality in their respective type-hosts, *R. philippinarum* and *C. gigas*. Thus, both diseases could have contributed to the high clam mortality claimed by clam farmers (not officially confirmed), in the study beds because both showed high prevalences which was higher in unburied clams than in buried clams.

M. mackini was found by histology and ISH assays in the connective tissue of different organs of *R. philippinarum* mostly in foot and adductor muscle, causing host haemocyte infiltration, which is consistent with reports of other authors for *Mikrocytos* in *C. gigas* (Mackin et al. 1950; Carnegie et al. 2003) and *O. lurida* (Elston et al. 2012). *M. mackini* had never been detected in Europe but Garcia et al. (2012) reported *Mikrocytos*-like parasites in the clam *D. trunculus*, associated with digestive metaplasia in three natural beds from the French Atlantic coast during summer and autumn of 2010.

Other *Mikrocytos*-like parasites have been described in *O. lurida* from California (USA), *O. edulis* from Nova Scotia (Canada) and *C. gigas* from China and Canada. The European animal health regulation includes *M. mackini* in the list of exotic diseases that must be under surveillance. Microcell parasites had been observed in histological sections of Manila clams *R. philippinarum* collected in late 2007 and early 2008 from four beds located in Galicia (NW Spain), where high mortality had been claimed by clam farmers, although the high mortality was not officially confirmed. Attempts performed in 2008 to establish the identity of those microcells were restricted to evaluate by PCR if they corresponded to *Bonamia* parasites, since the host species seemed to be non-susceptible to *M. mackini* (Meyer et al. 2008). However, the recent detection of *Mikrocytos*-like parasites in clams *D. trunculus* from France (Garcia et al. 2012) has made advisable to re-examine the stored materials, thus leading to the identification of *M. mackini* for the first time in Europe, infecting the cosmopolitan Manila clam *R. philippinarum*.

RESULTS (cont)

2) Histopathology

Histological analysis showed the occurrence of uninucleated microcells of 2-3 µm of diameter, with a basophilic central nucleus of approximately 1 µm of diameter in clams from the four beds. Microcells were seen in the connective tissue of different organs, mostly in adductor muscle, foot, mantle lobes and siphon but also in gills and visceral mass. They mostly appeared within haemocytes, associated with focal haemocytic infiltration, although sometimes they were extracellular (Fig. 3a, b). The prevalence of these microcells is shown in Fig. 3c. Additionally, parasitization by prokaryotic, protozoan and metazoan symbionts was detected in clams from the four beds.

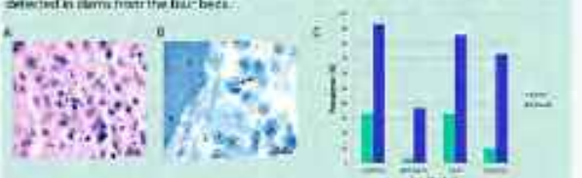

Fig. 3. Histopathology of clams R. philippinarum naturally infected with MSC cells. A. Histological section showing the connective tissue of foot. Haemocytes and cysts of MSC (arrowhead) infiltrating the parasite (arrow) can be observed at the cytoplasm of haemocytes. Scale bar: 10 µm. B. Detail of parasitized microcells.

3) Molecular analysis for identification of microcells

PCR assays with the primer pairs 9D/18A5 and HAP-F1/F2/R1/R2/R3 did not yield any amplification. However, when the *Mikrocytos*-specific PCR assay was carried out with MIKROCYTOS-F/R primers, products of the expected size for *M. mackini* (544 bp) were obtained (Fig. 4a). The obtained sequences showed 99-100% homology with the SSU rDNA sequence of *M. mackini* of *C. gigas* from British Columbia (Canada) available in GenBank (accession number HM563060).

The MIKROCYTOS F/R digoxigenin probe was found to hybridize with microcells present in histological sections of clams from the four study beds (Fig. 4b).

Fig. 4. a) Agarose gel electrophoresis showing the PCR products obtained with MIKROCYTOS-F/R primer pair. Lanes 1 to 3: DNA of *R. philippinarum* collected in Galicia and not *M. mackini*. *M. mackini* DNA from *M. mackini* in experimentally infected clams from BC, Canada. M: 100 bp molecular marker. N: no DNA. Positive samples were also MIKROCYTOS-F/R clam probe. b) Histological section through the digestive gland of a clam, the blue coloration corresponds to hybridization with *M. mackini* probe.

DISCUSSION

Prevalence values of *Mikrocytos* sp. in *D. trunculus* were high as in the case of microcells in Manila clams in Galicia. The Instituto Tecnolóxico para o Control do Medio Mariño de Galicia (INTECMAR) develops a surveillance programme on molluscan health involving sampling, once each year, the most productive Galician clam beds and histopathological analysis. Only 2 out of around 500 clams analysed in 2009 showed microcells, but with low intensity. Since then, microcells have not been detected in Galician clams by histology. In the absence of microcells, the occurrence of *M. mackini* in Galician clams cannot be officially confirmed by authorized reference laboratories.

The Manila clam is one of the major cultured species of molluscs in the world, reaching big production in China, European countries (Italy, France or Spain), and USA. Thus, attention should be paid to avoid *M. mackini* transmission with Manila clam cultures.

Abbott et al. 2012. Dis. Aquat. Org. 97:241-251.
Bower 2008.
Carnegie et al. 2003. Dis. Aquat. Org. 55:219-227.
Cochennec et al. 2000. J. Invertebr. Pathol. 75, 73-82.
Garcia et al. 2012. J. Invertebr. Pathol. 109, 275-279.
Mackin et al. 1950. J. Invertebr. Pathol. 1(1):1-37.
Pollard and Mann. 1994. Dis. Aquat. Org. 19:133-139.
Renault et al. 2000. Dis. Aquat. Org. 42:207-214.

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New molecular species-specific procedures to diagnose *Bonamia exitiosa* and *Bonamia ostreae*

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INTRODUCTION

Bonamiosis causes serious mortalities of different species of oysters around the world. Two species of the genus *Bonamia*, *B. ostreae* and *B. exitiosa*, are highly pathogenic and widely spread in the Northern and Southern Hemisphere, respectively. *B. exitiosa* has been recently detected in the Northern Hemisphere, in Iberian (Ría of Vigo), and subsequently in other European countries as well as in northern Africa. The World Organisation for Animal Health (OIE) has included both species on the list of notifiable diseases. The European regulation on animal health considers both species as requiring surveillance, allocating *B. exitiosa* in the list of exotic diseases and *B. ostreae* in the non-exotic ones. However, difficulties exist for diagnosis for both species, here certain limitations. Histological methods do not allow a clear identification of both species and the near-universal PCR procedures are genus-specific, thus species-specific diagnosis requires further DNA sequencing or RFLP assay.
The aim of this study was to develop sensitive and species-molecular tools for diagnosis of *B. exitiosa* and *B. ostreae*.

MATERIALS AND METHODS

PCR assays

Two primer pairs have been designed, based on the 18s rRNA gene and on the first internal transcribed spacer (ITS1) sequences of *B. exitiosa* and *B. ostreae*, to specifically identify each parasite: the primer pair BOSTRE-F / BOSTRE-R for the former and BEXIT-F / BEXIT-R for the latter.

Analytical specificity and sensitivity of the PCR assays

The analytical specificity of the primers was evaluated in the specific qPCR assay using genomic DNA from oysters infected with *B. exitiosa*, with *B. ostreae* and co-infected with both species, as well as genomic DNA from mollusc species not cohabiting with these parasites. Likewise, to test the analytical sensitivity of the cPCR assays, DNA of oysters with different levels of infection by *B. exitiosa* and *B. ostreae* and DNA of non-infected oysters were used. PCR amplicons obtained were monitored by measuring the fluorescence, obtaining a Ct value for each sample and subsequently a melt curve was performed to determine the specificity of the amplified products. Specific temperature melting (Tm) values for each species were estimated in both assays.
In order to establish the analytical sensitivity of qPCR and nPCR assays, serial dilutions of plasmid DNA containing the specific PCR amplification products were used, as well as, the same dilutions in presence of DNA of non-infected oysters.

Validation of the new PCR-based species specific procedures

The new PCR-based diagnostic tests were compared with two OIE-listed assays: standard histology and the PCR-RFLP assay described by Cochennec-Laureau et al. (2003). Comparisons were performed at 3 times, corresponding to three oyster collections: (1) a total of 137 oysters from 5 geographic origins, in this case post-gill prints were involved in the molecular assays. (2) Ninety oysters from 3 areas in the case gonad post-gill prints were involved in molecular tests to evaluate if diagnosis improved. (3) Thirty oysters collected from a Bonamia-free area were added to the study to assess if false positive diagnoses are produced by any diagnostic test: gonad post-gill prints were involved in molecular tests. The modified Ray's fluid thioglycollate culture medium (RFTM) described in Cochennec-Laureau et al. (2003) and the new ISH assay described here (both tests were conducted).

RESULTS

PCR assays

Analytical specificity

The primer pair BOSTRE-F/R gave a specific product of PCR of 200 bp only in samples with *B. ostreae* DNA (Fig. 1A-lanes 3 and 5). Similarly the primer pair BEXIT-F/R gave a 581 bp product of PCR only in samples with *B. exitiosa* DNA (Fig. 1B- lanes 3 and 5). In fact clearly, no amplification was observed in samples with DNA of other parasites (data not shown). When the primers were tested by mPCR, BEXIT-F/R produced a specific melting peak at 78.25 °C ± 0.23 (mean ± SD) (Fig. 2A) in samples with *B. exitiosa*, while BOST-F/R gave rise to a specific melting peak at 74.75 °C ± 0.35 (Fig. 2B) in samples with *B. ostreae*.

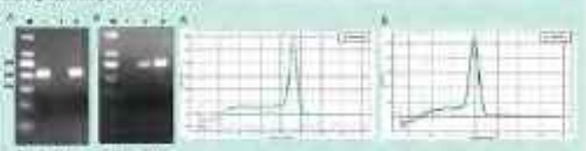

Fig. 1. Agarose gel electrophoresis of PCR products with primer pair B. ostreae-F/R (A) and B. exitiosa-F/R (B). Lanes 1 to 5: B. exitiosa, B. ostreae, B. exitiosa + B. ostreae, Bonamia-free oyster, M: 50 bp molecular marker

Fig. 2. Melting peaks obtained from mPCR assays for *B. ostreae* (A) and *B. exitiosa* (B)

Analytical sensitivity

The species-specific qPCR assays for *B. ostreae* and *B. exitiosa* allowed to detect 1 fg of plasmid DNA of the respective parasite both in samples with parasite plasmid DNA alone and with DNA of non-infected oyster. Regarding nPCR, the detection limits were 1 fg for *B. ostreae* and 0.1 fg for *B. exitiosa*. Lower DNA concentration values gave 0% values but of less than one affecting reproducibility. The highest Ct values in these results range were 31 and 30.76 for *B. ostreae* and *B. exitiosa*, respectively.

RESULTS (cont)

Comparison of both types

The prevalence of positive cases of *B. exitiosa* and *B. ostreae* was higher with the new qPCR or nPCR than with the new OIE-listed methods (Table 1). The sensitivity values of histology and PCR-RFLP for either parasite were below 0.50 for both parasites, while overall, twelve were false negative diagnostics, while the values of the new tests were between 0.91 and 1.00 for both parasites (Table 2). Like the sensitivity values for histology and PCR-RFLP were between 0.90 and 1.00 while those of cPCR and nPCR were mostly below 0.50, which would involve some false positive diagnostic. However, when the three oyster collections (oysters from a non-infected area) was analysed, the final diagnostic value of tested negative reacts for either parasite.

Table 1. Number of oysters with positive diagnosis of *Bonamia ostreae* and *Bonamia exitiosa*. The percentages of oysters with positive diagnosis are shown in brackets.

	Negative diagnosis	Histology	RFLP-PCR	Real-time qPCR (Ct ± SD)	Nested qPCR (Ct ± SD)
B. exitiosa (137 oysters)	0 oysters	49 (36%)	54 (39%)	137 (100%)	137 (100%)
	6 oysters	88 (64%)	83 (61%)	0 (0%)	0 (0%)
B. ostreae (90 oysters)	0 oysters	57 (63%)	71 (79%)	90 (100%)	
	9 oysters	33 (37%)	19 (21%)	0 (0%)	

Table 2. Values corresponding to PCR assays using the primer pair BOSTRE-F/R for diagnosis of *B. ostreae* and BEXIT-F/R for diagnosis of *B. exitiosa*.

		Histology	RFLP-PCR	Real-time qPCR	Nested qPCR
B. exitiosa	Sensitivity	0.36	0.39	1.00	1.00
	Specificity	1.00	1.00	0.96	0.96
	Efficiency	0.64	0.61	0.98	0.98
B. ostreae	Sensitivity	0.63	0.79	1.00	
	Specificity	1.00	1.00	0.97	
	Efficiency	0.90	0.96	0.97	

Species-specific ISH for *B. exitiosa*

BEX ITS probe was found to hybridize with *B. exitiosa* in *O. edulis* stations (Fig. 3C). Cell hybridization signal was neither detected in the absence of probe (negative control, Fig. 3A), nor in oysters infected with *B. ostreae* (Fig. 3D). It is other cells not hybridized with the other assayed parasites (data not shown). *B. exitiosa* was detected by ISH in 12 out of 15 oysters found infected by PCR-RFLP. Moreover ISH showed infection in two oysters that were negative by PCR-RFLP. Positive ISH tests were observed mainly in connective tissue of gonad, vesicular and digestive gland. ISH confirmed that the infection by *B. exitiosa* is limited to gonad tissue or other organs (gills or labial).

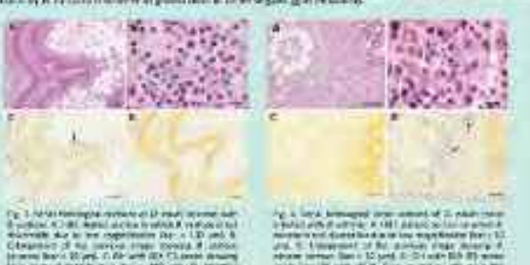

Fig. 3. Serial histological sections of *O. edulis* stations infected with *B. exitiosa*. A (-ve) Apical section of stomach and digestive gland (negative control for ISH). B Adjacent section to A showing *B. exitiosa* (arrows) in connective tissue cells. C (+ve) Apical section of stomach and digestive gland showing *B. exitiosa* (arrows) by ISH. D Adjacent section to C showing absence of *B. exitiosa* by ISH. Bars = 50 µm.

Fig. 4. Serial histological sections of *O. edulis* naturally infected with *B. exitiosa*. A (-ve) Apical section of stomach and digestive gland showing no reaction by ISH. B Adjacent section to A showing *B. exitiosa* (arrows) by ISH. C (+ve) Apical section of stomach and digestive gland showing *B. exitiosa* (arrows) by ISH. D Adjacent section to C showing absence of *B. exitiosa* by ISH. Bars = 50 µm.

DISCUSSION

New species-specific qPCR and nPCR procedures for detection of *B. ostreae* and the first species-specific qPCR and nPCR methods for *B. exitiosa* are described in this poster. Their analytical specificity was proved. The species-specific qPCR and nPCR are both capable of detecting very low quantities of DNA from *B. ostreae* and *B. exitiosa*, even in the presence of DNA of non-infected oyster. These new procedures showed high sensitivity, higher than that of standard histology and PCR-RFLP. Because of the big diagnostic differences between these tests, the application of statistics to estimate sensitivity and specificity will be other than there were some false positives perceived by the new molecular methods and false negatives by the OIE-listed ones, which is a matter of likelihood but not of certainty. Possible causes for false positives (if any) could be cross-contamination and occurrence of cryptic DNA without true infection. A minimum of 10 value limit for positive diagnostics should be considered for qPCR assay. Considering the analytical specificity of the new primers, the fact of positive cases in the samples from the Bay of Vigo and would strengthen the critical level of false positives from a Bonamia-free area. Differences in sensitivity between the tests with the new primers and the OIE-listed ones increased by the addition of gonad with regard to visual gill. Thus, the choice of organs for diagnosis of these parasites is crucial.
The BEX ITS1 is the first probe allowing specific detection of *B. exitiosa* in histological sections.

References

Cochennec-Laureau, N., Renault, T., Berthe, F. and Reece, K. (2003) Real-time quantitative diagnostic tools for the genus *Bonamia* (Protozoa) and detection of *Bonamia ostreae* in *Ostrea edulis*.

Hine, M., Gorton, S. and Gardner, I.A. (2002) "PCR", a comparison for the detection of *Bonamia* in the absence of a gold standard. Preventive Veterinary Medicine 53, 73-90.

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Título: Cloning, characterization and analysis of the expression of genes TNF, AIF, Dermatopontin and VAMP associated with immune response in *Ostrea edulis*

Evento: Physiomar 12 International Meeting

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2012

Cloning, characterization and analysis of the expression of genes TNF, AIF, Dermatopontin and VAMP associated with immune response in *Ostrea edulis.*

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INTRODUCTION

The immune system of mollusks is endowed with an innate immune system, which involves cellular and humoral components. Cellular responses are mediated by haemocytes through phagocytosis and various cytotoxic reactions; haemolymph serum contains humoral defence factors, such as soluble lectins, hydrolytic enzymes and antimicrobial peptides. A few molecular studies have identified sequences of genes with a potential role in the immune response of bivalve mollusks. The genus *Bonamia* (Protozoa, Haplosporidia) includes parasites that proliferate within oyster haemocytes. The parasite, once phagocytosed within the haemocyte, appears to have some counter mechanism that turns off the haemocyte's metabolic destructive capacity, so that the parasite survives and multiplies within the host cell. In this study, we isolated and characterized the full-length of various immune genes expressed in the haemocytes of the flat oyster, *Ostrea edulis*, in response to bonamiosis. In addition, differential expression of these genes due to disseminated neoplasia (DN) was studied. DN is an oyster disease resembling leukemia.

MATERIALS AND METHODS

SSH technique (PCR Select cDNA subtraction kit, Clontech) was used to characterize genes involved in the flat oyster's immune response against bonamiosis. A SSH library was produced with the haemolymph of naturally infected oysters with *Bonamia ostrea* and *Bonamia exitiosa* comparing the cDNA with that of non-infected (control) individuals. For each EST (Expressed Sequence Tag) library, the up-regulated transcripts in response to infection and the down-regulated transcripts were obtained. Four selected genes were cloned using the Rapid Amplification of cDNAs ends kit (Clontech). The mRNA expression for each gene at different intensity levels of infection was determined by real-time PCR using the Bio-Rad IQ5 detection system. Data were analyzed using the Bio-Rad IQ5 system software and quantification was performed using the Look Method (2$^{-\Delta\Delta}$). Differences in mRNA level were analyzed using ANOVA or non-parametric sum depending on the data. Phylogenetic trees were constructed based on the deduced amino acid sequences of known homologues of several taxa using the Maximum Evolution (ME) algorithm within MEGA version 4.1. The trees were constructed using the Bonamia-corrected stalkmark point were validated by 10000 bootstrap repetitions.

RESULTS AND DISCUSSION

The following four genes were found to be involved in the immune response of the genus *Ostrea edulis*: TNF (Tumour necrosis factor) and AIF (Allograft inflammatory factor), VAMP (Vesicle-associated membrane protein) and Dermatopontin. TNF and AIF are soluble cytokine-like molecules with immunomodulatory activity in response to exogenous stimulation, as infections or neoplastic processes. TNF was over expressed in the haemocytes of oysters suffering heavy bonamiosis (Fig. 1). AIF was highly expressed in haemolymph cells of oysters with heavy bonamiosis, in DN-affected oysters as well as in oysters suffering both diseases (Fig. 2 and 3). Dermatopontin is a protein involved in the extracellular acidic properties, that was down regulated in oysters with bonamiosis (Fig. 1). VAMP is a protein involved in endocytosis which appeared to be up-regulated in haemolymph cells of DN-affected oysters (Fig. 2), in heavy bonamiosis (Fig. 1) and in oysters suffering both diseases (Fig. 3). A phylogenetic profile was obtained for TNF and AIF genes showing the relationship with related sequences (Fig. 4). Discovery of these genes will support more detailed investigation into the immunological and inflammatory responses of invertebrate animals.

Acknowledgments: This work was supported by Xunta de Galicia under the projects PGIDIT03MAR10101 and PGIDIT03MAR10108. LMG was supported by a fellowship from the Xunta de Galicia (PGIDIT 2000-2010).

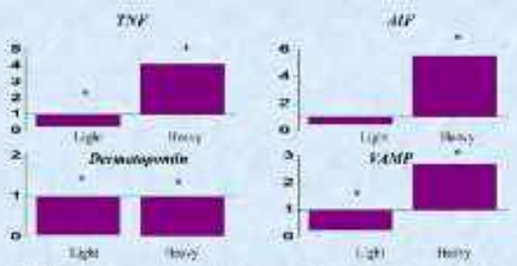

Fig. 1. RT-PCR analysis of gene expression in haemolymph cells of flat oysters affected by bonamiosis. Level 1 corresponds to expression in non-infected oysters and has height corresponds to the expression level in lightly or heavily infected oysters. * Statistically significant differences with regard to non-infected oysters. (P< 0.05).

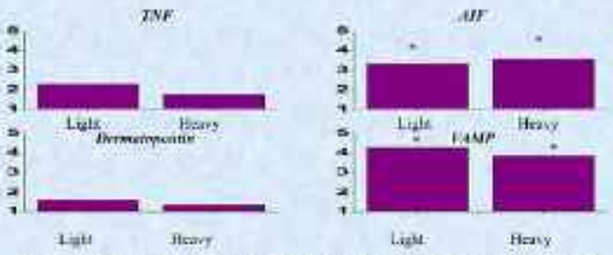

Fig. 2. RT-PCR analysis of gene expression in haemolymph cells of flat oysters affected by disseminated neoplasia. Level 1 corresponds to expression in non-affected oysters and has height corresponds to the expression level in lightly or heavily DN-affected oysters. * Statistically significant differences with regard to non-affected oysters. (P< 0.05).

Fig. 3. RT-PCR analysis of gene expression in haemocytes of flat oysters affected by both diseases. * Statistically significant differences with regard to non-affected oysters. (P< 0.05).

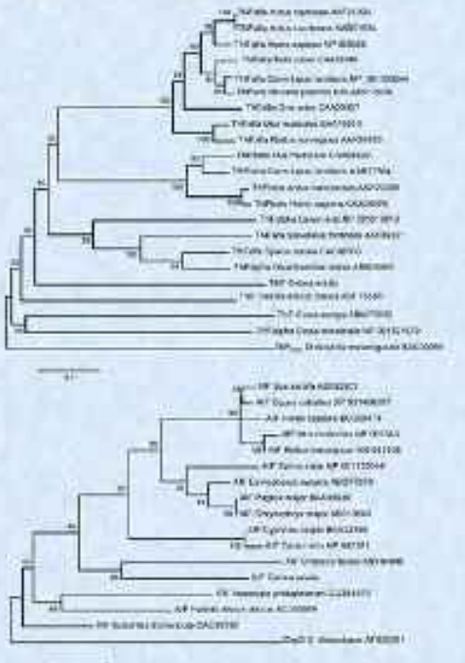

Fig. 4. Phylogenetic relationships among TNF (top) and AIF (bottom) deduced amino acid sequences of mammals, fish and invertebrates.

Autoría: Fernández, S.; Villalba, A.; Cao, A.

Título: Evaluation of variability of *Perkinsus olseni* population using analysis of protein expression by 2D-PAGE and mass spectrometry

Evento: III Jornadas Bienales de Jóvenes Investigadores en Proteómica

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2012

Evaluation of variability of *Perkinsus olseni* populations using analysis of protein expression by 2D-PAGE and mass spectrometry.

Sergio Fernández, Antonio Villalba, Asunción Cao

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INTRODUCTION

The protozoan *Perkinsus olseni* is a parasite infecting a wide variety of molluscs around the world and has been associated with severe mortalities and important economic losses [1]. In fact, it is considered in the World Organization for Animal Health (OIE) list of notifiable diseases. Little is known on the interactions between host and parasite at the protein level and on parasite populations parameters, such as genetic variability or population structure [2,3].

The genetic variability and the population genetic structure of *P. olseni* through the Spanish coast were analysed using microsatellite markers [4]. In this context, the panzootic map of parasites deriving from four different geographic areas (populations), were compared using 5 microsatellite loci polymorphisms. Parasites of *in vitro* cultured cells and those of their extracellular products released to the culture medium were analysed in this analysis. Some of the *in vitro* cultured populations were used as initial points. Conclusions of such studies were published.

MATERIAL AND METHODS

1. *In vitro* cultures.

Perkinsus olseni parasites were isolated and propagated *in vitro* from a clonal multispecies population from each of the following areas, via de Arousa, Ría de Pontevedra and Mundaka, and 4 clonal multispecies cell populations from Catalonia (Fig.1). One *P. olseni* clonal culture was developed from each area and the resulting 36 clonal cultures were involved in the comparisons. These *in vitro* clonal cultures were established as described by Coss & La Peyre (2003) [5].

Fig.1. Map of Spain showing the location of the areas where clones infected with *P. olseni* were collected

2. Sample collection and determination of protein concentration.

A total of 150 x 10⁶ parasite cells of each clonal culture were used for cytosolic protein analysis and 350 mL of their culture medium after 3 months since starting culture were used for extracellular protein analysis. Cells and culture media samples were processed as 1 and 8 mL of lysis solution, respectively. Proteins were solubilized for 1.5 h at 4°C and centrifuged at 12000 x g for 20 min. The supernatant was purified (10 kDa cut off) and resuspended in rehydration solution. Protein concentration was measured according to Bradford's method (RC/DC Protein Assay kit-Bio-Rad).

3. 2D electrophoresis and gel image analysis.

For the isoelectric focusing (IEF), 100 µg of protein were applied onto IPG strips (17cm, pH 5-8, NonLinear) with a rehydration buffer. Before the second dimension, the strips were equilibrated in two steps of 20 min each, in equilibration buffer; 20 mg/ml DTT were used in the first step to reduce proteins and 25 mg/ml iodoacetamide were used in the second step to alkylate proteins. The equilibrated IPG strips were transferred onto 12.5% acrylamide gels for the second dimension (SDS-PAGE). The SDS-PAGE gels were then silver stained and the protein patterns were analysed using 1D Quest 1.1.0 software (Bio-Rad). Three gels of each clonal culture were involved in the analysis. In all 12 gels were used to produce a synthesis of each geographic area that included the spots common to the 12 gels. The patterns of spots were averaged for arriving at an reference map with the common cytosolic proteins of all the areas and another map with the consensus secreted proteins were produced.

4. Mass spectrometry and protein identification.

A number of common, well-defined spots common for all the areas and spots exclusive of each area were selected for further characterization. Selected spots were excised manually from gels and sent to the Proteomics Laboratory of University Pablo de Olavide (LP-UPO/UAB) for identification. Because limitations restricted the number of selected spots, extracted peptides were analysed by matrix assisted laser desorption ionization time of flight mass spectrometry (MALDI TOF MS, Ultraflex III TOF/TOF instruments, Applied Biosystems, Foster City CA, USA), to confirm protein digestion, and sequenced using nLC-ESI MS/MS (Ultimate LCD II mass spectrometer, PrincetonSurface, Dionex WAT, San José, CA, USA).

All sequence tags obtained from "de novo" sequencing were manually confirmed and were submitted to homology search using the uBLAST algorithm (NCBI, USA). Data were compared against all public (non redundant) NCBI (National Center for Biotechnology Information, Maryland, USA) databases.

RESULTS

A reference map of *P. olseni* cytosolic proteins and another of common proteins were built (Fig. 2). An average of 200 spots were detected from parasite cells and 75 spots from culture medium. For products released to the culture medium, the number of detected spots to be common to all the populations were 161 cytosolic and 63 secreted proteins while 175 and 68, respectively, were exclusive of each particular areas (Table 1). A total of 400 spots were excised, from each 12 were successfully sequenced and 32 of them identified.

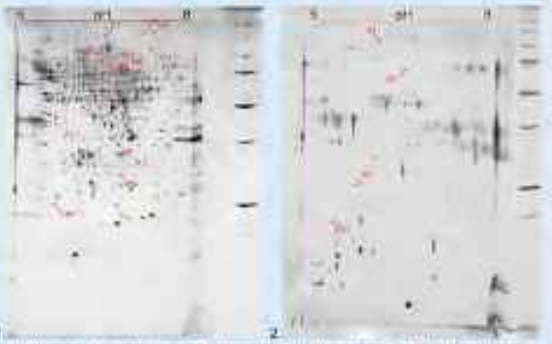

Fig.2. Bi-dimensional electrophoretic maps of cytosolic proteins (1) and secreted proteins (2) of *P. olseni*. The spots studied are marked with numbers.

Table 1. Number of spots found to be common to all populations and those specific of each population and number of excised, characterized and identified spots, corresponding to cytosolic and secreted *P. olseni* proteins.

	Common to all populations	Arousa exclusive	Pontevedra exclusive	Mundaka exclusive	Catalonia exclusive
Cytosolic proteins	161	175	68	63	32
Excised	19	7	13	8	5
Characterized	15	5	7	7	3
Identified	12	3	6	7	3
Secreted proteins	63	68	32	34	21
Excised	15	5	7	5	10
Characterized	13	4	5	4	7
Identified	9	3	3	4	5

A first impression after reviewing all the gels was that there was a high similitude among populations. For comparison purposes between areas of origin of the isolates, Mundaka and Pontevedra were closer between them than Catalonia with each other (Table 2).

Sixteen cytosolic proteins were identified, 12 of them were present in all the populations and 4 were exclusive of some area. Most identified proteins were involved with glycolysis and carbohydrate reductase processes, identified cytosolic proteins involved in stress response and signal transduction were a minority group (Table 3). Just 5 secreted proteins were identified, 2 of them were present in all populations and 4 of them in the Arousa population. The secreted proteins were clustered into signal transduction group, proteolysis, metabolism, stress response and transferase activity.

Table 2. Matrix of genetic identity between pairs of populations (1-4) based on shared spots.

	Arousa	Pontevedra	Mundaka	Catalonia
Arousa	1			
Pontevedra	0.81	1		
Mundaka	0.68	0.83	1	
Catalonia	0.53	0.61	0.72	1

Table 3. Identified spots (they reference), assigned protein and % value, and number of the isolates and sequences used identified proteins, distributed into the clusters or sort, classified cellular process.

COMMON CELLULAR PROTEIN

CODE		Mw / pI	E. coli(s)	P. olseni GI
C1	Enolase, putative, *Perkinsus marinus*	48 / 5.05	6.0E-161	Enolase
C2	Glyceraldehyde-3-phosphate dehydrogenase, putative, *Perkinsus marinus*	44/5.33	1.0E-106	Glycolysis
C3	Glyceraldehyde-3-phosphate dehydrogenase, putative, *Perkinsus marinus*	38 / 7.03	1.0E-000	Glycolysis
C4	Enolase 1, putative, *Perkinsus marinus*	46 / 5.5	6.0E-161	Glycolysis
C5	Enolase 1, putative, *Perkinsus marinus*	46/5.3	6.0E-161	Glycolysis
C6	Phosphoglycerate kinase 1, putative, *Perkinsus marinus*	44 / 6.5	9.0E-161	Glycolysis
C7	Aldose reductase-like, putative, *Perkinsus marinus*	37 / 6.05	1.0E-000	Glycolysis
C8	Elongation factor 2, putative, *Perkinsus marinus*	92 / 7.05	1.0E-000	Translation elongation factor
C9	Ferredoxin-dependent glutamate synthase, putative, *Perkinsus marinus*	175 / 6.3	1.0E-000	Oxidation-reduction process
C10	Ferredoxin-dependent glutamate synthase, *Perkinsus marinus*	175 / 6.35	1.0E-000	Oxidation-reduction process
C11	Ferredoxin-dependent glutamate synthase, *Perkinsus marinus*	56 / 5.33	1.0E-000	Beta-1,4-glucanase
C12	Glutamine synthetase, putative, *Perkinsus marinus*	52 / 5.45	6.0E-000	Metabolism

SPECIFIC CELLULAR PROTEIN

AROLVA	Cytochrome C peroxidase, *Perkinsus marinus*	35.5 / 5.55	1.0E-161	Cytolysis
CATALONIA	Actin, putative, *Perkinsus marinus*	45 / 5.4	4.0E-000	Cytolysis
MUNDRA	Phosphoglycerate kinase, putative, *Perkinsus marinus*	50 / 5.03	1.0E-000	Stress response
	Glutathione peroxidase, putative, *Perkinsus marinus*	41 / 6.1	1.0E-000	Metabolism

COMMON SECRETED PROTEIN

CODE		Mw / pI	E. coli(s)	P. olseni GI
S1	Cathepsin L, putative, *Perkinsus marinus*	40 / 6.3	6.0E-0.06	Proteolysis
S2	Thiol-dependent protease, putative, *Perkinsus marinus*	46 / 5.23	1.0	Signal transduction

SPECIFIC SECRETED PROTEIN

AROLVA	Beta-thiol protein 68, putative, *Perkinsus marinus*	68.75 / 5.35	1.0E-000	Stress response
	Phosphoserine aminotransferase, putative, *Perkinsus marinus*	52 / 5.63	1.0E-000	Metabolism
	Protein disulfide-isomerase, putative, *Perkinsus marinus*	57 / 5.08	0.0	Signal transduction
	Phosphatidylserine synthase, putative, *Perkinsus marinus*	58.55 / 5.53	0.0	Transferase activity

DISCUSSION

This poster reports a first stage of the study of *P. olseni* proteome. The four studied *P. olseni* populations were found similar with the proteomic approach. These results agreed with the study by Villa et al. 2011 [4], who found very low genetic variability among the same *P. olseni* populations, using microsatellite markers, and suggested founder effects in the recent evolutionary history of the parasite in the Spanish coast, coincident with the introduction of the parasite through the importation of clams from the Pacific area.

Twenty two proteins were identified and classified in only two of the categories. An intracellular cytosolic distribution was identified, suggesting a high constitutive expression of this protein even in optimum culture conditions. Proteins that have been selected as antiparasitic drug targets of human pathogenic parasites, such as an Aldehyde dehydrogenase [6], Glyceraldehyde-3-phosphate [7] and Glycerol-kinase [8-9] [10], were identified in *P. olseni*, which could open ways of fight against shellfish parasites. Protein Cathepsin L was the only protease activity identified among secreted proteins, the peptidases could be involved in digestion of host tissues. Hsp90 and Hsp70 were identified in both the populations of Arousa, which could suggest a more acclimation of the parasite from the area to the culture medium conditions with less changes in water and temperature ranges shown by parasites of this geographic area [11].

The low number of sequences corresponding to proteins in databases, in spite of the recent completion of the *Perkinsus marinus* genome sequence [12], was due to the low infection of the selected portions of *P. olseni*.

REFERENCES

1. Villalba A. et al. 2004. Journal of Shellfish Research 23: 411-432.
2. Reece, K. S. et al. 2004. Parasitology 129: 385-396.
3. Villalba, A. et al. 2005. Bulletin of the European Association of Fish Pathologists 25: 127-134.
4. Villalba, A. et al. 2011. Diseases of Aquatic Organisms 93: 207-222.
5. Coss, A. & La Peyre, J. F. 2003. Journal of Shellfish Research 22: 111-115.
6. Kapatral, V. et al. 1999. Molecular and Biochemical Parasitology 101: 1-13.
7. Navarro, J. 2000. International Journal of Parasitology 30: 1-11.
8. Pereira, C. et al. 2000. Molecular and Biochemical Parasitology 110: 195-206.
9. Liu, Y. and Zhou, 2007. Advanced chemistry of the human parasite and role as an anti-helminth. Advances in Cell and Molecular Biology 8: 1-17.
10. Li, et al. 2007. BMC Structural Biology 7: 28-38.

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Título: *Perkinsus spp*. in clams *Ruditapes decussatus*, *Ruditapes philippinarum*, V*enerupis senegalensis* and *Tapes rhomboides* in Galicia (NW Spain). First detection of *Perkinsus chesapeaki*-like parasite by DGGE technique

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Perkinsus spp. in clams *Ruditapes decussatus, Ruditapes philippinarum, Venerupis senegalensis and Tapes rhomboides* in Galicia (NW Spain). First detection of a *Perkinsus chesapeaki*-like parasite by DGGE technique

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Introduction

Perkinsosis is a disease affecting numerous mollusk species around the world, causing important mortalities and mass episodes. Nowadays, seven *Perkinsus* species are considered valid: *P. marinus*, *P. olseni*, *P. atlanticus*, *P. chesapeaki*, *P. mediterraneus* sp. n. (Villalba et al. 2005) and *P. beihaiensis* (Yan et al. 2007).
Two of these species, *P. olseni* and *P. mediterraneus*, have been reported in Europe. Recently Arzul et al. (2011) have detected the presence of a *Perkinsus* sp. closed to *P. chesapeaki*, a endemic species from East North America, infecting the carpet clam *R. decussatus* in Leucate lagoon (France).
Differentiation among species of the genus *Perkinsus* is usually performed through PCR or PCR-RFLP assays.

This poster reports a new PCR-DGGE assay developed to serve as a screening tool among *Perkinsus* spp. DGGE is a molecular technique used to separate DNA fragments of the same length but with different sequences. This method has a high power of discrimination, detecting even a single base variations in DNA. This technique was applied to perform a survey on the *Perkinsus* spp. occurring through Galician (NW Spain) coast, involving four clam species with high market value. In the course of the survey a *Perkinsus chesapeaki*-like parasite was found for the first time in Spain, infecting a new host, the Manila clam *R. philippinarum*.

Materials and methods

Samples involving four clam species (*Ruditapes decussatus*, *Ruditapes philippinarum*, *Venerupis senegalensis* and *Tapes rhomboides*) were collected between April 2010 and June 2011 from 15 beds scattered along the Galician coast (Fig. 1).

Thirty clams from each sampling site were processed for molecular analysis. To evaluate the prevalence of *Perkinsus* species, PCR assays were performed using the general primers Per4PS1S3-Per4PS1S1 (Casal et al. 2008).
A species-specific primer pair, Per4JSU-F and Per4JSU-R, was designed based on the LSU rDNA gene sequence of *Perkinsus* spp. to perform DGGE assay. One hundred nanograms of each PCR amplified product were loaded onto 8% (w/v) polyacrylamide gels (37.5:1) with 30 to 60 % gradient urea formamide (100% corresponded to 7M urea and 40% (v/v) formamide) increasing in the direction of electrophoresis. Gels were run in a buffer tank at 60 °C for 10 min at 20 V and for 17 h at 100V, stained with ethidium bromide for 15 min and rinsed for 30 min in distilled water. PCR products derived from *in vitro* cultured cells of *P. olseni*, *P. chesapeaki*, *P. marinus* and *P. mediterraneus* were included in all gels as reference of each species.
Gels obtained were scanned and observed to identify the *Perkinsus* species. Furthermore, every band was cut out, cleaned, re-amplified and sequenced. Additionally, for the two DNA samples that showed a *P. chesapeaki*-like pattern, the internal transcribed spacer 1 (ITS1) region was amplified and sequenced.
Phylogenetic analysis was carried out with MEGA software using a neighbor-joining analysis. Bootstrap values were calculated over 10000 replicates and cut-values for considered tree was of 50%.
Finally, with the aim of confirming the presence of *Perkinsus chesapeaki* in *R. philippinarum* tissues, an assay was carried out using the species specific hybridization probe Per4ISU-435-DIG (Casal et al. 2008).

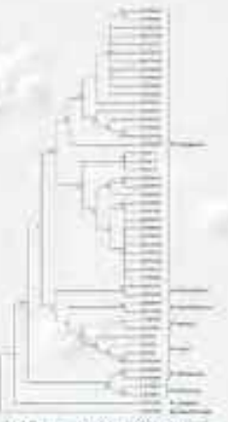
Results

Spatial distribution of perkinsosis through Galician coast. Results provided by PCR using genus-specific primers revealed that the highest prevalence of perkinsosis corresponded to *R. decussatus* and *V. senegalensis* beds, where lower values were detected in *R. philippinarum*, as *T. rhomboides* was found positive (Fig. 1).

Identification of *Perkinsus* species by PCR-DGGE technique. DGGE assay allowed discrimination among species of *Perkinsus* species obtaining a different pattern of bands for cultured cells of *P. olseni*, *P. marinus*, *P. mediterraneus* and *P. chesapeaki* used as references. Every DNA sample that had been found positive for *Perkinsus* sp., showed a strong band by DGGE that matched that obtained for *P. olseni* cultured cells. Additionally, two Manila clams from Arcade showed an upper band that matched that of *P. olseni* and another lower one that matched that of *P. chesapeaki* cultured cells (Fig. 2).

DNA sequencing and phylogenetic analysis. The results of DNA sequencing confirmed the species identity of each band obtained. All the DGGE bands corresponding to the *P. olseni* pattern showed a sequence highly similar (99-100%) to *P. olseni* rDNA gene sequences of *P. olseni* included in GenBank. Similarly, the bands corresponding to *P. chesapeaki* pattern, deriving from two Manila clams, showed 100% similarity to its rDNA gene sequences of *P. chesapeaki*. However, the analysis of ITS region deriving from these two Manila clams showed 97% similarity to ITS sequences of *P. chesapeaki* deposited in GenBank. The phylogenetic analysis of ITS region revealed a close relationship to other sequences of *P. chesapeaki* with bootstrap values of 100% (Fig. 3, clones 1, 2 and 3).

In situ hybridization. ISH assay using the *P. chesapeaki*-specific probe Per4ISU-435-DIG confirmed the presence of the parasite in histological sections of *R. philippinarum* (Fig. 4).



Discussion

The results showed that PCR-DGGE is a reliable technique to identify *Perkinsus* species, as both the four species involved in this study, *P. olseni* (the most representative *Perkinsus* sp. in Galicia), were found in 9 out of 15 beds and all three clam species but *R. philippinarum* tested. Only *P. chesapeaki* was not found in the beds of *R. decussatus* and targeted host. Two Manila clams from Arcade showed co-infection with *P. olseni* and a *P. chesapeaki*-like parasite. Analysing longer ITS sequences of a other loci would be required to confirm the species identity of this parasite as *P. chesapeaki*. This is the first report of a *Perkinsus chesapeaki*-like parasite occurring in Spain and the first time in the endangered clam species *R. philippinarum*.

References

Arzul et al. 2011. Mar. Ecol. Prog. Ser. 441:65.
Casal et al. 2008. J. Eukaryot. Microbiol. 55:65-75.
Villalba et al. 2004. Dis. Aquat. Org. 61:127-143.

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Título: Effects of infection with the protozoan parasite *Perkinsus olseni* on protein expression of Manila clam *Ruditapes philippinarum* haemocytes and plasma

Evento: Physiomar 12 International Meeting

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2012

Effects of infection with the protozoan parasite *Perkinsus olseni* on the protein expression of Manila clam *Ruditapes philippinarum* haemocytes and plasma.

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INTRODUCTION

MATERIAL AND METHODS

RESULTS & DISCUSSION

REFERENCES

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Lugar: Santiago de Compostela - Galicia (España)

Ano: 2012

COMPARISON OF PROTEIN EXPRESSION AMONG DIFFERENT LARVAL STAGES OF THE MUSSEL *MYTILUS GALLOPROVINCIALIS*

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INTRODUCTION

Settlement and metamorphosis are two crucial processes in the life cycle of many marine invertebrates. In mussels, these processes are important factors for structuring rocky-shore populations and, in those species with commercial interest, for the regulation and management of the strategies for seed supplying, from both the wild and hatcheries. Settlement has been defined as the process whereby pelagic swimming larvae come in contact with the substratum to explore it and, eventually, to undergo metamorphosis (Rodriguez et al., 1993). Metamorphosis is a radical change in the shape of the larvae that involves physiological and metabolic adaptations to the new benthic life. It is known that mussel larvae undergo settlement and metamorphosis in response to a wide variety of stimuli, such as neuroactive compounds (Garcia-Lavandeira et al., 2005; Young et al., 2011; Sánchez-Lazo and Martínez-Pita, 2012), algal chemical cues (Alfaro et al., 2006), bacterial biofilms (Bao et al., 2007), biofilm exudates (Aldredge et al., 2012) and bacterial cell suspensions (Swanson et al., 2012). To be able to respond to all these stimuli, mussel larvae have to reach the final part of the developmental stage, called competence, that has been described as the capacity to undergo metamorphosis as a reaction to a set of endogenous and exogenous cues. However, competence is a functional stage of the early life history of marine organisms still not fully understood. In mussels, both the appearance of the eye-spot and the activity of the first tissue have been used as proxies to recognise this stage. Therefore, more direct tags of larval competence, as for example molecular markers or proteins involved in signal transduction or hormone binding, are required to identify this important larval stage. In this poster we present preliminary data of a comparative proteomic analysis carried out with *Mytilus galloprovincialis* larvae from different developmental stages.

MATERIALS AND METHODS

Obtaining the larvae

Adult mussels to be used as brood stocks were obtained from a culture population in the Ría de Arousa (NW of Spain) and transported to the hatchery for spawning induction by thermal shock. Oocytes from 12 females were mixed in a single 5 L plastic container and fertilised with 20 mL of a sperm suspension from 11 males. After adding the sperm, the mixture was shaken, left undisturbed during approximately 20 minutes and then transferred to a 300 L larval rearing tank filled with 1 µm filtered and UV-treated seawater. After a 72 hours period without food and only with a gentle aeration, seawater in the tank was cleaned and the D-shape mussel larvae retained in a screen of 40 µm. Then, the total number of larvae in the tank was determined and 4 samples, of approximately 250000 D-shape larvae each, were taken. Rearing of the rest of the larvae was carried on in the same 300 L tank with a continuous supply of a mixture of several microalgae. After 10 and 21 days of rearing, 4 samples of 50000 veliger larvae and 7 samples of 50000 eyed-pediveliger larvae were taken, respectively. After each sampling event, larvae were frozen to -80ºC, lyophilized and frozen again to -80ºC until protein extraction.

Protein extraction

A total of 250000 3-days-old D-shape larvae (Figure 1), 50000 10-days-old veliger larvae (Figure 2) and 21-days-old eyed-pediveliger larvae (Figure 3) were resuspended in 1 mL and 4 mL of lysis solution, respectively. After centrifugation for 30 min at 16000g, the pellet was discarded and the protein containing supernatant was stored at -80ºC until electrophoresis. The protein content was determined by RC DC Protein Assay kit (Bio-Rad), based on the Lowry protocol (Lowry et al. 1951).

Two-dimensional gel electrophoresis and analysis of spot patterns in gels

The samples were solubilized in rehydration and 400µl containing 500 µg protein was applied to 17cm IPG strips (Bio-Rad), pH 5-8. After Isoelectric Focusing (IEF), the IPG strips were equilibrated for two intervals of 20min in equilibration buffer. For the first equilibration step, dithiothreitol 1% (wV) was added to reduce the proteins, thereafter the proteins were carbamidomethylated with 2.5% (wV) iodoacetamide. The equilibrated IPG strips were transferred for the second dimension (SDS-PAGE) onto 12.5% gels. The SDS-PAGE gels were then coomassie stained and the protein patterns were analyzed using PDQuest 7.4.0 software (Bio-Rad). Four gels of each larval stages were created in the analysis.

Fig 1.- 3-days-old D-shape mussel larvae (400)

Fig 2.- 10-days-old veliger mussel larvae (200)

Fig 3.- 21-days-old eyed-pediveliger mussel larvae (200)

RESULTS AND DISCUSSION

Figure 4 shows a representative map of each larvae stage of the mussel *Mytilus galloprovincialis*. A mean of 350 spots were detected in the gels of D-shape larvae, 1200 in veliger larvae and 2300 in eyed-pediveliger larvae. The number of spots resolved is much higher than the spots resolved in *Bolinus brandaris* and *Buccinum undatum* (Thyagarajan and Qubre 2008; Thyagarajan et al., 2008), *Pseudopolydora vexillosa* (Mok et al. 2004) or *M. galloprovincialis* (Lopez et al. 2008), possibly due to the mobility of the proteins can be affected by their own structure and subunits or the occasional smears of proteins fragments can complicate the molecular weight interpretation (Westermeier et al. 2003).

The synthetic gels corresponding to each developmental stage included 197 spots in D-shape larvae, 644 in veliger larvae and 475 in eyed-pediveliger larvae (Fig 5). The reduction in spots number from gel to synthetic map was due to a conservative approach for the analysis of the gels, counting only clearly defined spots and not considering outermost and confusing areas.

The comparison among different larval stages of the mussel *M. galloprovincialis* disclosed 94 spots exclusive to the eyed-pediveliger larvae, 106 spots shared by veliger larvae and eyed-pediveliger larvae and 235 common to D-shape larvae, veliger larvae and eyed-pediveliger larvae (Fig 6). Some of this 94 spots could help us to identify the proteins responsible for larval competence and understand the regulatory mechanisms that control the larval division to metamorphose. Signal transduction proteins (adenylate cyclase and calreticulin) and juvenile hormone binding proteins were identified in swimming cysts of *B. amphitrite* (Thyagarajan and Qubre 2008). Mok et al. (2006) identified in proteome of competent *P. vexillosa* a molecular chaperon (calreticulin), a signal transduction regulator (tyrosin activation protein) and a tissue-remodeling enzyme (metalloproteinase). These findings provide promising initial steps towards the development of a proteomic database for marine invertebrate metamorphosis and would help to explain the biochemical mechanisms that are involved in this process.

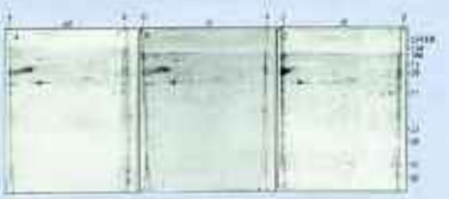

Fig 4.- Representative 2-DE gel image showing the proteomes of (A) D-shape larvae, (B) veliger larvae and (C) eyed-pediveliger larvae of *Mytilus galloprovincialis*. The 1st dimension was performed on pH 5-8 linear IPG strips; the second dimension was run on 12.5% polyacrylamide gels. Gels were stained with Coomassie. The protein load per gel was about 500µg.

Fig 5.- Two dimensional gel reconstructions by Melle-maps of (A) D-shape larvae, (B) veliger larvae and (C) eyed-pediveliger larvae of *Mytilus galloprovincialis*

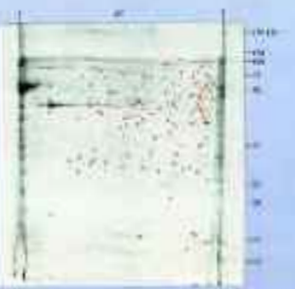

Fig 6.- Two-dimensional co-detection that allows get rid of non-homologous zones of *Mytilus galloprovincialis*. Protein spots marked with a circle depict the 94 spots that belong exclusively to eyed-pediveliger larvae.

REFERENCES

Alfaro, A.C., Jeffs, A.G., Hooker, M.H., Kelly and S., Jeffs, A.G. (2006) Chemical cues promote settlement in larvae of the green-lipped mussel, *Perna canaliculus*. Aquaculture International 14: 405-413.

Bao, W.-Y., Satuito, C.G., Yang, J.-L. and Kitamura, H. (2007) Larval settlement and metamorphosis of the mussel *Mytilus galloprovincialis* in response to biofilms. Mar. Biol. 150: 565-574.

Swanson, R.M., Rhyne, A.C., Rhodes, J.D. and Wiggins, C.M. (2012). The role of bacterial biofilms and exudates on the settlement of mussel (*Perna canaliculus*) larvae. Aquaculture 356: 339-345.

Swanson, R.M., Rhyne, A.C., Higgins, C.M. and Brooks, J.D. (2012). The effects of bacterial cell suspensions on mussel (*Perna canaliculus*) larval settlement. Aquaculture 334-337: 113-118.

García-Lavandeira, M., Silva, A., Abad, M., Pazos, A.J., Sánchez, J.L. and Pérez-Parallé, M.L. (2005). Effect of GABA and epinephrine on the settlement and metamorphosis of the larvae of four species of bivalve molluscs. J. Exp. Mar. Biol. Ecol. 326: 146–159.

López, J.L., Alfaro, S.L. and Fuentes, J. (2007). Proteomic approach to assess the larval ontogeny of the mussel *Mytilus galloprovincialis*. Marine Biotechnology 9: 599-608.

Mok, F., Thyagarajan, V. and Qubre, P.Y. (2006). Proteomic analysis during larval development and metamorphosis of the sabellid polychaete *Pseudopolydora vexillosa*. Proteomic Science 2: 44.

Rodríguez, S.R., Ojeda, F.P. and Inestrosa, N.C. (1993). Settlement of benthic marine invertebrates. Mar. Ecol. Prog. Ser. 97: 193-207.

Sánchez-Lazo, C. and Martínez-Pita, I. (2012). Influence of settlement of larvae of the mussel *Mytilus galloprovincialis* using neuroactive compounds. Aquaculture 344-349: 76-81.

Thyagarajan, V., Wong, T. and Qubre, P.Y. (2008). 2D-gel based proteomic and phosphoproteome reference library using larval environments of two phylum member, tubeworm *H. elegans* and bryozoan *B. neritina*. Proteome Sci. 6: 27.

Thyagarajan, V. and Qubre, P.Y. (2008). Proteomic analysis of larvae during development, attachment, and metamorphosis in the barnacle *Balanus amphitrite*. Proteome Sci. 6: 3.

Vanhaute, E., Smolders, A., Baggerman, G., Van der Ven, K., De Leeb, S. and Blust, R. (2002). Proteomics in Daphnids: implications for 2D database of toxicant-homozygote proteins. Environ. Toxicol. Pharmacol. 12: 247-255.

Young, T., Alfaro, A.C. and Robertson, J. (2011). Effect of neuroactive compounds on the settlement of mussel *Perna canaliculus* larvae. Aquaculture 313: 27-32.

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Título: Ongrowing and lipid composition of senegalese sole (*Solea senegalensis*) fed with commercial and plant-based diets

Evento: Aquaculture Europe 12

Lugar: Praga (República Checa)

Ano: 2012

Ongrowing and lipid composition of senegalese sole (*Solea senegalensis*) fed with commercial and plant-based diets

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INTRODUCTION

Senegalese sole (*Solea senegalensis*, Kaup 1858) is a species of high commercial value and wide market in Southern Europe, being considered as a promising flatfish species for Mediterranean aquaculture. A great effort to develop specific diets for this species was recently made (Borges et al., 2009; Rubio et al., 2009; Valente L.M.P.2011). Plant protein sources have successfully replaced fish meal in Senegalese sole diets (Silva et al., 2010; Linares et al., 2011).

The present work shows the growth performance and flesh quality of Senegalese sole (*Solea senegalensis*) fed two practical diets, in which 78% of marine-derived protein was replaced by plant protein ingredients (PP), and it was compared with those fed a commercial diet (control) from Sorgetting (52% protein, 18% lipids; dry matter basis). All tested diets were isonitrogenous, but PP diets contained two lipid levels: 9% (PP-9) and 18% (PP-18). PP diets were produced by Sparos S.L.

Fig.1 Growth of Senegalese sole fed with different diets

Diets			
	Control	PP-9	PP-18
Whole Body	9.1±0.1	6.0±0.4*	12.4±0.6*
Muscle	2.0±0.0	1.4±0.0*	1.9±0.0*
Liver	6.4±1.5	5.1±0.5	25.3±3.5*

Table I. Total lipids (% wet weight) in whole body, muscle and liver of Senegalese sole (mean±ssd).

MATERIAL & METHODS

The experiment was conducted in a closed circuit system at the experimental facilities of IGAFA (heated seawater: 19±1°C;30 ‰). Triplicate groups of 30 pit-tagged fish, born in captivity, with an average weight of 64,09±0,3g and size16,42±0,75cm, were distributed by 9 tanks of 1m³ and fed the experimental diets during 5 months. Analyses of total lipids were carried out. The results were compared by a Student's t-test and one-way ANOVA.

RESULTS & DISCUSSION

By the end of the trial the growth performance of the fish varied significantly among dietary treatments. Fish fed with PP-9 grew better than those fed PP-18, having a final body weight similar to that obtained with the commercial diet (Fig.1).

Whole body lipid composition of the fish differed among treatments (Table I). Plant protein diets induced a significantly lower whole body lipid deposition (2 wet ww) than those fed the control (9% ww). This was reflected in lipid distribution among tissues. Lipid levels in the muscle of the fish fed with control diet are significantly higher than in those fed with PP-9. In contrast, the liver lipid content was significantly increased when plant-protein diets were used compared to fish fed the control, confirming previous observation in the pre-fattening phase of sole (Linares et al. (IAS2011). Sensory analyses showed that fish from all the tested treatments shared similar texture, odour and taste characteristics.

CONCLUSION

The present results confirm that with low fat diets it is quite feasible to use plant protein sources without affecting the growth performance or the organoleptic quality of Senegalese sole. Nevertheless, the impact of the increased lipid deposition in liver induced by vegetable sources warrants further studies.

REFERENCES

Borges P., B. Oliveira, S. Casal, I. Dias, S. Conceição, and L.M.P. Valente. 2009. Dietary lipid level affects growth performance and lipoprotein oxidation of Senegalese sole (*Solea senegalensis*) juveniles. Comparative Biochemical Nutrition 145: 1004-1014.

Linares F., Pereira I.B., Otero M., Alvarez-Blázquez B., Pozo Sierra G., Pérez Ruiz E., Rodríguez I., A. Valente L. 2011. Sustainable diets for Senegalese sole (*Solea senegalensis*) juveniles. Actas Iberoam Aquacultura 2011.

Rubio V.C., Infante Navarro D., Madrid J.A., Sánchez Vázquez F.J., 2009. Macronutrient self-selection in sole (*Solea senegalensis*) fed macronutrient diets and challenged with dietary protein dilution. Aquaculture 291:95-100.

Silva I.M.G., M. Pires, L.T.C. Conceição, J. Dias, B. Cassus and L.M.P. Valente. 2010. Feed intake and growth performance of Senegalese sole (*Solea senegalensis*, Kaup 1858) fed diets with partial replacement of fishmeal with plant protein. Aquaculture Research 41:e650-e662.

Valente L.M.P., Linares F., Villanueva E.J., A. Silva I.M.G., P.P.G.M. Rosenlund, E. Pires M.A., Saavedra M.J., Borges B., Morais F., Alvarez-Blázquez B., Fonseca. 2011. Dietary protein source in young fish: Animal meal impact on growth performance, nutrient utilization in Sea bass (*Dicentrarchus labrax*) and Senegalese sole (*Solea senegalensis*). Aquaculture 318: 109-117.

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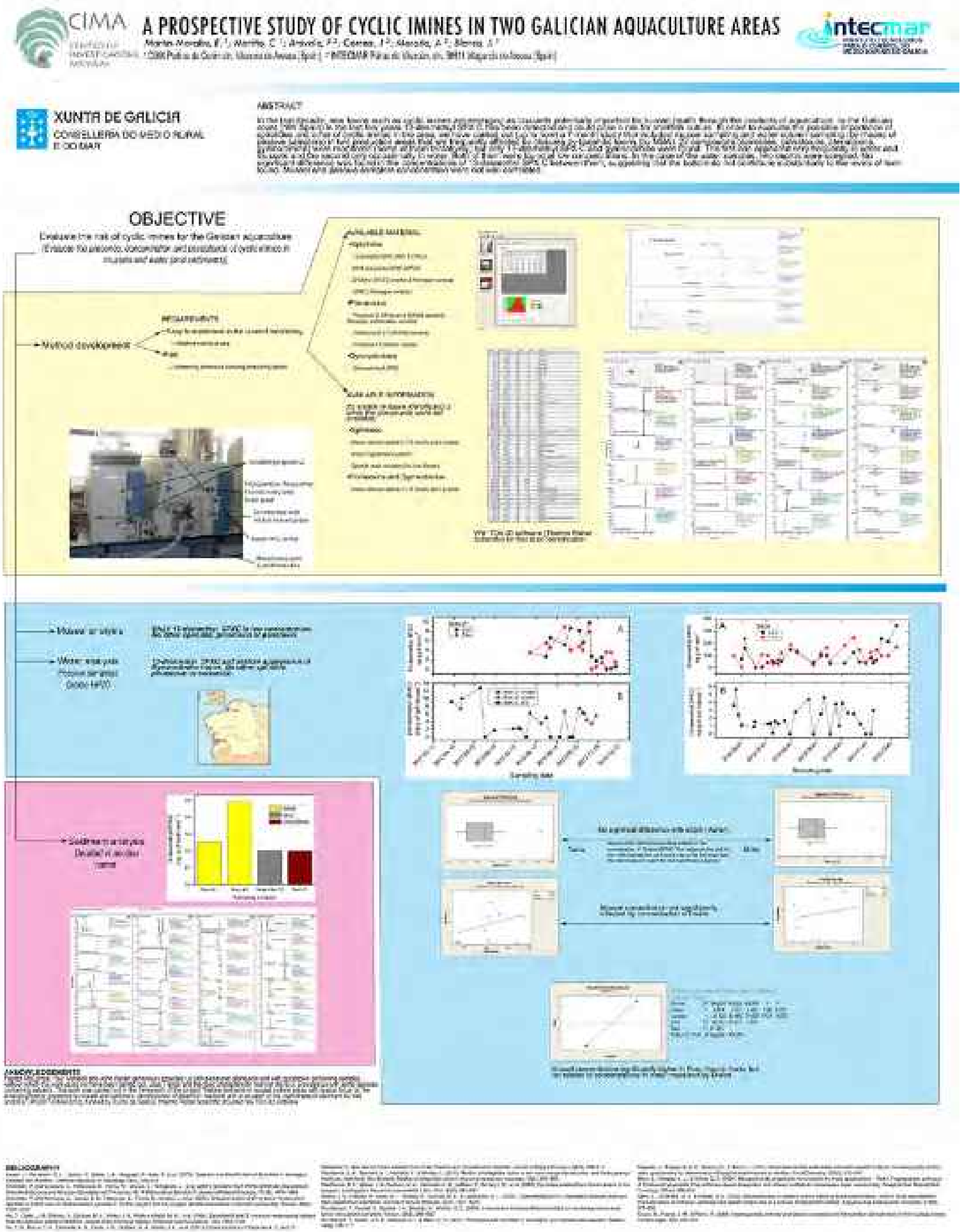
Autoría: Martín-Morales, E.; Mariño, C.; Arévalo, F.; Correa, J.; Moroño, A.; Blanco, J.

Título: A prospective study of cyclic imines in two Galician aquaculture areas

Evento: Marine and Freshwater Toxins Analysis. Fourth Joint Symposium and AOAC Task Force Meeting

Lugar: Baiona - Galicia (España)

Ano: 2013


CIMA
A PROSPECTIVE STUDY OF CYCLIC IMINES IN TWO GALICIAN AQUACULTURE AREAS
intecmar
XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL
E DO MAR
ABSTRACT
OBJECTIVE
Evaluate the risk of cyclic imines for the Galician aquaculture
Method development
Sediment analysis
ACKNOWLEDGEMENTS
BIBLIOGRAPHY

Autoría: Santos, I.; Toca, F.; Mariño, J.C.; Fernández, M.; Guerrero, S.

Título: Supervivencia de la almeja japonesa *Ruditapes philippinarum* (Adams et Reeves, 1850) en tres tipos de sustrato: fango, conchilla de mejillón y mixto al 50% en el banco intermareal del Sarrido, Cambados (Pontevedra)

Evento: XVI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2013

Supervivencia de la almeja japonesa *Ruditapes philippinarum* (Adams et Reeves, 1850) en tres tipos de sustrato: fango, conchilla de mejillón y mixto al 50% en el banco intermareal de O Sarrido, Cambados (Pontevedra)

XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL E DO MAR

CIMA

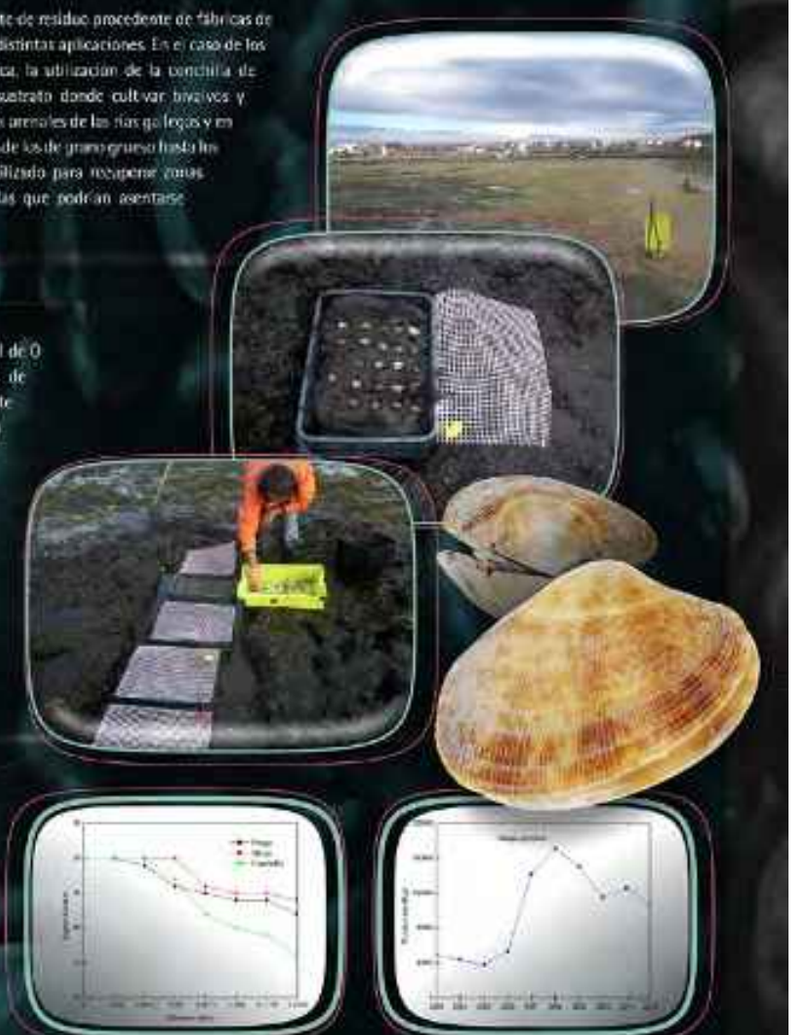
Ignacio Santos
Federico Taca
Juan Carlos Mariño
Mercedes Fernández
Salvador Guerrero

Introducción

En Galicia la concha de mejillón supone una cantidad importante de residuo procedente de fábricas de conserva y cocederos de moluscos al que se le están buscando distintas aplicaciones. En el caso de los arenales mariqueros con abundante fango y materia orgánica, la utilización de la conchilla de mejillón puede ser una práctica adecuada para mejorar el sustrato donde cultivar bivalvos y especialmente la almeja japonesa que esta presente en todos los arenales de las rías gallegas y en una gran variedad de sustratos de diferentes granulometrías, desde los de grano grueso hasta los muy finos. Aunque la arena es el material que más se ha utilizado para recuperar zonas intermareales improductivas colmatadas por el fango y en las que podrían asentarse poblaciones naturales de berberecho y almejas.

Material y métodos

El experimento ha sido realizado en la zona fangosa del arenal de O Sarrido en Cambados (Pontevedra), empleando seis cajas de confinamiento donde se han mantenido almejas adultas durante 203 días, utilizando tres tipos de sustrato: fango, conchilla triturada de mejillón y mixto al 50% de conchilla con fango, depositando en cada una de las cajas 25 individuos adultos de almeja japonesa. La talla media inicial de las almejas fue 42,45 1,77 mm y el peso medio 20,95 2,54 g. Las cajas se cubrieron con una rejilla de 0,4 milímetros de luz para permitir la circulación del agua y evitar la salida de los individuos y la entrada de depredadores. Con periodicidad mensual, entre octubre de 2012 y junio de 2013 se realizaron muestreos para contabilizar el número de supervivientes, manipulando el sustrato hasta el fondo de las cajas para localizar todas las almejas supervivientes.



Resultados

La producción de almeja japonesa en Cambados alcanzó un promedio de 98.889 kilos en los últimos diez años. La tasa de mortalidad en fango resultó igual a −0,174; en sustrato mixto de fango con conchilla triturada de mejillón ha sido −0,128 y en conchilla −0,328, resultando el promedio −0,210. Al nivel de confianza del 95% solamente se encontraron diferencias significativas entre los sustratos Mixto y Conchilla ($P<0.05$). En este apartado colocar todas las gráficas y las tablas con sus títulos correspondientes debajo de ellas.

Conclusiones

Después de 203 días, la supervivencia de la almeja japonesa en las cajas con mezcla de fango y conchilla triturada de mejillón alcanzo el 88%.

Agradecimientos

A José Manuel Cousido por su ayuda y el aporte de los materiales para la experiencia.

Autoría: Guerrero, S.; Toca, F.; Mariño, J.C.; Fernández, M.; Otero, X.; Santos, I.

Título: Crecimiento y supervivencia de semilla de almeja babosa *Venerupis pullastra* (Montagu, 1803) colocada en bolsas en dos zonas intermareales de la Ría de Arousa (Pontevedra, España)

Evento: XVI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2013

XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL E DO MAR

CIMA

Crecimiento y supervivencia de semilla de almeja babosa *Venerupis pullastra* (Montagu, 1803) colocada en bolsas en dos zonas intermareales de la Ría de Arousa (Pontevedra, España)

Salvador Guerrero
Federico Toca
José Carlos Mariño
Mercedes Fernández
Xurxo Otero
Ignacio Santos.

Resumen

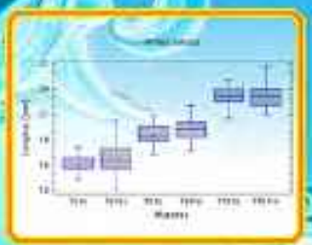
La productividad de las zonas intermareales gallegas se ha visto incrementada en los últimos años con el aporte de semilla procedente de criaderos, estableciéndose en ellas y fomentando en los cultivos de bivalvos suspensívoros de interés de forma notable al ahorrar un tiempo que suponía volver a los depredadores. En esta experiencia se ha evaluado a lo largo de 60 días el efecto de la protección de bandejas recubiertas por malla de 1x1 mm para cultivar semilla de almeja babosa *Venerupis pullastra* (Montagu, 1803) de tres tamaños iniciales: T6, T8 y T10 (milímetros de anchura).

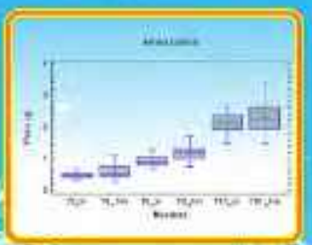
Material y métodos

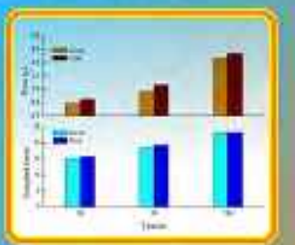
Los tratados ensayados contaban con densidades de 435 y 484 g/m² respectivamente y se colocaron en el Banco del Sarrido, y la más pequeña con densidad inicial de 1100 g/m², se depositó en la zona permanentemente sumergida del Parque de cultivo de Carril. La experiencia se inició a finales

Resultados

Respecto al crecimiento en longitud, en todos los casos hubo diferencias significativas, excepto entre la semilla T10 que no registró incremento significativo. La tasa de crecimiento diario de la semilla T6 fue 11,39 micras/día (rango: 12 a 78,11, 36 micras día⁻¹) y para T10 de 1,93 micras día⁻¹. Las tasas de crecimiento SGR estuvieron comprendidas en el rango 4,6–12,3 % superior en la talla de la registrada en la semilla más pequeña (97,1%) y después en la grande (95,1%), existiendo diferencia significativa entre la T6 y la T10 (P<0,01).







Conclusiones

Después de 60 días la semilla T6 puesta en el parque de cultivo registró un incremento medio de 0,68 milímetros y una supervivencia del 97,1%.

Agradecimientos

A Rosario Morales por cedernos una parcela en el Parque de cultivo. Al cofradre de Cabo de Cruz por cedernos los sacos de polietileno. A la Cofradía de Carril por las facilidades dadas en el Sarrido. A María del Carmen Andrés por la preparación de la semilla.

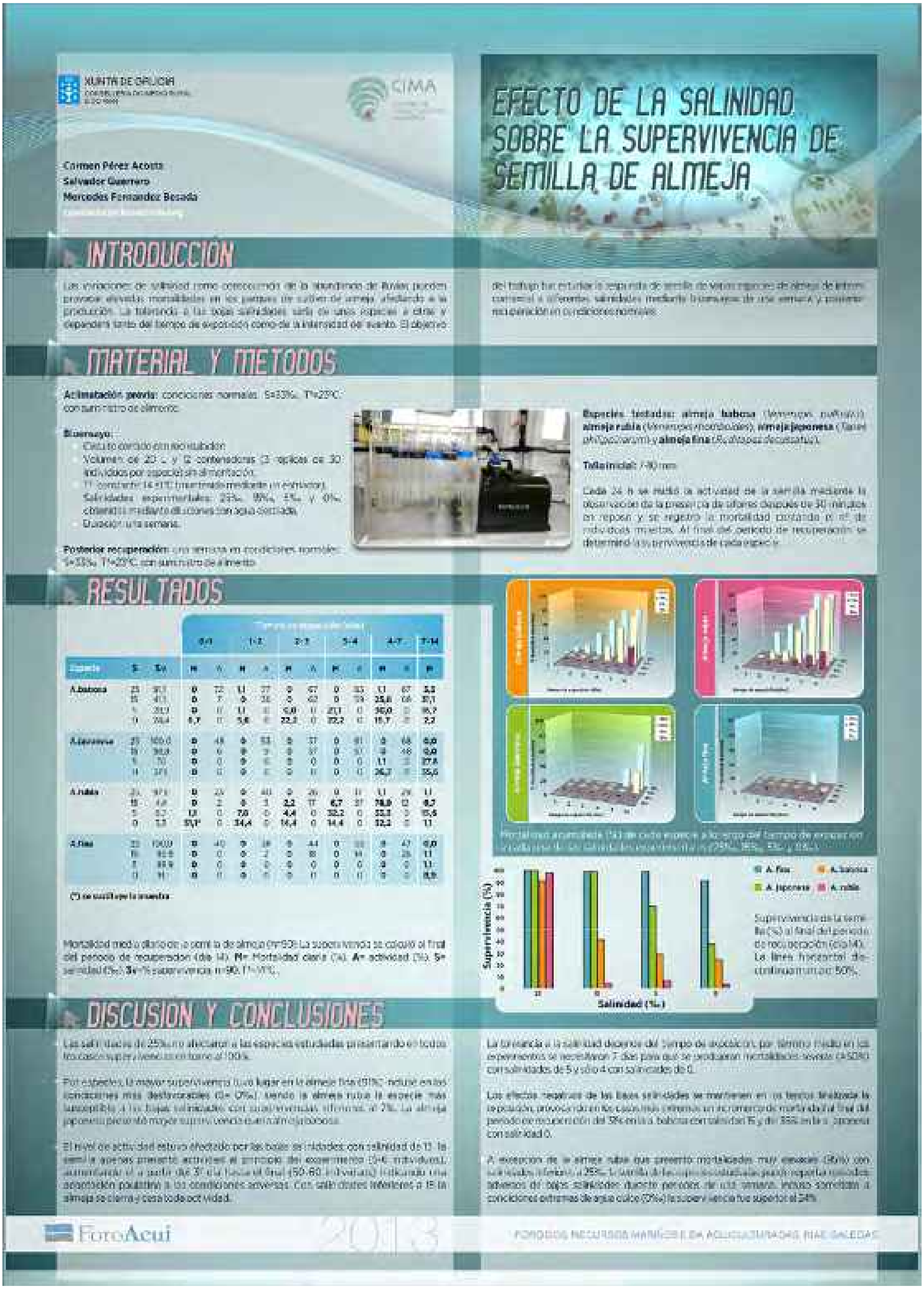
Autoría: Pérez-Acosta, C.; Guerrero, S.; Fenández-Besada, M.

Título: Efecto de la salinidad sobre la supervivencia de semilla de almeja

Evento: XVI Foro de Recursos Marinos e Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2013


XUNTA DE GALICIA
CIMA
EFECTO DE LA SALINIDAD SOBRE LA SUPERVIVENCIA DE SEMILLA DE ALMEJA
Carmen Pérez Acosta
Salvador Guerrero
Mercedes Fernandez Besada
INTRODUCCION
MATERIAL Y METODOS
Aclimatación previa:
Bioensayo:
Duración: una semana.
Posterior recuperación:
Especies testadas:
Talla inicial:
RESULTADOS
A.babosa
A.japonesa
A.rubia
A.fina
A.fina
A.babosa
A.japonesa
A.rubia
Supervivencia (%)
Salinidad (‰)
DISCUSION Y CONCLUSIONES
ForoAcui
2013
FORO DOS RECURSOS MARIÑOS E DA ACUICULTURA DAS RIAS GALEGAS

Autoría: de la Ballina, N.R.; Ramilo, A.; Villalba, A.; Cao, A.

Título: Proteomic approach to identify bonamiosis-resistance markers in the flat oyster *Ostrea edulis* haemolymph

Evento: 1st International Conference of Fish and Shellfish Inmunology

Lugar: Vigo - Galicia (España)

Ano: 2013

PROTEOMIC APPROACH TO IDENTIFY BONAMIOSIS- RESISTANCE MARKERS IN THE FLAT OYSTER *OSTREA EDULIS* HAEMOLYMPH

Nuria R. DE LA BALLINA, Andrea RAMILO, Antonio VILLALBA, Asunción CAO

Centro de Investigacións Mariñas (CIMA), Consellería do Medio Rural e do Mar, Xunta de Galicia. Apdo 13. 36620 Vilanova de Arousa, Spain.

1 INTRODUCTION

European flat oyster *Ostrea edulis* populations have suffered extensive mortalities caused by Bonamiosis. Two protozoan parasites, *Bonamia ostreae* and *Bonamia exitiosa* are responsible for this disease in Europe. Both are intracellular parasites able to survive and proliferate within haemocytes, the main cellular effectors of the immune system of molluscs. Both parasites are included in the list of notifiable diseases of the World Organization for Animal Health. The most promising fighting strategy against bonamiosis involves producing resistant oyster strains.

A proteomic approach was used to compare the protein expression in haemolymph between bonamiosis-affected and non-affected oysters *O. edulis* from 3 stocks with different susceptibility to this disease. The aim was to find protein markers of resistance to bonamiosis, that could be used in successive breeding programmes to produce resistant oyster strains.

2 MATERIALS AND METHODS

Oysters

Three stocks of European flat oysters *Ostrea edulis* with different susceptibility to bonamiosis were used in this study. Two of them consisted of hatchery-produced spat (coming from two brood stocks: (1) oysters of the third generation of a selective breeding programme for bonamiosis-resistance performed with Galician oysters (**Galician selected stock, GSS**) (da Silva et al., 2005; Villalba et al., 2007); and (2) oysters taken from a bonamiosis-affected natural bed in Ría de Pontevedra (Galicia NW Spain), (**Galician non-selected stock, GNSS**). The spat of both stocks was produced simultaneously in the hatchery facilities of CIMA; then the spat of both stocks was transferred to a raft in Ría de Arousa (Galicia) for on-growing. The third stock consisted of oysters produced within an inter-tidal selective breeding programme for bonamiosis-resistance performed by Atlantic Shellfish (S.L., that were transferred to our laboratory (**Rosmaire stock, RS**) (Culloty et al., 2001, 2004).

One hundred oysters from each stock were carried to the laboratory, where they were kept in tanks with running seawater during one week for acclimation. Then, haemolymph was withdrawn from the adductor muscle (Fig. 1). Contaminated haemolymph was discarded and clean haemolymph was frozen, lyophilized and stored at -80° C.

Fig. 1. Collection of haemolymph from the adductor muscle of an oyster *Ostrea edulis* using a needle and syringe.

Diagnosis of *Bonamia* spp. infections was performed by PCR. After diagnosis, haemolymph samples were clustered in two different pools: positive and negative for *Bonamia* spp. Each pool was made-up with haemolymph from 7 different oysters.

Protein extraction

Lyophilized samples were solubilized in lysis buffer with sonication application for 2'30 min at 4° C. After centrifugation for 30 min at 10000g, the remaining supernatants were collected and the protein content was determined by RC DC Protein Assay (Bio-Rad) based on the Lowry protocol (Lowry et al., 1951). Samples were purified by readyprep 2-D Cleanup (Bio-Rad).

2D electrophoresis and gel (image) analysis

For the isoelectric Focusing (IEF), 500 µg of whole haemolymph protein were loaded onto IPG strips (17cm, pH 3-8, Bio-Rad) with a rehydration buffer. Before the second dimension, strips were equilibrated for 20 min in equilibration buffer containing 1% DTT and then equilibrated for 20 min in the same buffer containing 2.5% iodoacetamide. To start the second dimension (SDS-PAGE), the equilibrated IPG strips were transferred onto the top of 12.5% SDS polyacrilamide gel, and running in a DODECACELL system (Bio-Rad), where is possible to carry out SDS PAGE in 12 gels simultaneously keeping same conditions in all of them. Protein spots in gels were visualized by silver staining compatible with mass spectrometry and digitized using a Bio-Rad GS-800 calibrated densitometer. Protein patterns were analysed using PD Quest 8.0.1 software (Bio-Rad), to identify common spots to various haemolymph pools and exclusive spots (unexpected) up to sixth pool. Five gels of each condition were considered for the analysis.

3 RESULTS AND DISCUSSION

Protein expression profiles obtained for whole haemolymph of infected oysters differed from non-infected ones, suggesting that the pattern of protein expression changed due to *Bonamia* infection.

The analysis of the gels is summarised in Table 1. The comparison of the gels from **GSS**, considering all the spots that were common in various treatments and the spots exclusive of each treatment, allowed detecting 43 spots exclusive of *Bonamia*-negative oysters and 8 spots exclusive of *Bonamia*-positive selected oysters. We got three different haemolymph pools from **GNSS**, *Bonamia*-negative oysters, with 10 exclusive spots, *B. ostreae*-positive oysters, with 22 exclusive spots, and *Bonamia exitiosa*-positive ones, with 13 exclusive spots. In the case of **RS**, 2 spots exclusive of *B. ostreae*-negative oysters, 4 spots exclusive of oysters with *B. ostreae* intense positive signal and 16 spots exclusive of oysters with *B. ostreae* light positive signal were detected.

We excised the exclusive spots of the selected stocks (GSS and RS) (Fig. 2), which have an especial interest as possible key proteins in the resistance to the bonamiosis. Mass spectrometry analysis of the excised spots is being performed to identify the proteins. That should increase the knowledge in the host-parasite interactions, which hopefully will provide key information to recover the European flat oyster production through best resistant oyster farming.

Fig. 2. Digitized images of silver-stained gels produced by 2D-ELECTROPHORESIS of haemolymph proteins of *Ostrea edulis* obtained from control and bonamia-challenged oysters for bonamiosis resistance. (A) *Bonamia*-negative haemolymph from GSS oysters; (B) *Bonamia*-positive haemolymph from GSS oysters; (C) *Bonamia*-negative haemolymph from RS oysters; and (D) RS oysters with *B. ostreae* light positive signal. Spots marked with red circles are those exclusive of each pool of oysters tested. Molecular mass (kDa) and pI.

Stock	Haemolymph pools	Average no. spots within 4 replicate gels	No. common spots to the 4 replicate gels of each pool	Comparison negative vs positive pools: Common spots	Exclusive spots
GSS	Negative	464	435	392	43
	Positive to *B. ostreae*	707	681		8
GNSS	Negative	414	378	368	10
	Positive to *B. ostreae*	505	458		22
	Positive to *B. exitiosa*	510	497		13
RS	Negative	401	368	349	2
	Light positive signal for *B. ostreae*	403	385		16
	Intense positive signal for *B. ostreae*	368	349		4

Table 1. Statistical analysis of the 2D gels, including the average number of spots in the gels of each sample class, the number of common spots of the 4 replicates of each class, and the number of common and exclusive spots in the comparisons between PCR-negative and positive pools.

4 REFERENCES

- Cao, A., Fuentes, J., Fernández, T., Casas, S.M., & Villalba, A. (2004). Transferencia genética y resistencia a la bonamiosis en ostra plana (*Ostrea edulis*) mediante selección. *Aquatic Living Resources*, 17(3), 249–256.
- Culloty, S.C., Cronin, M.A., Mulcahy, M.F. 2001. An investigation into the relationship between the prevalence of *Bonamia ostreae* and *B. exitiosa* and mortalities in populations of the European flat oyster *Ostrea edulis* in Ireland. *Aquaculture* 199, 25–41.
- Culloty, S.C., Cronin, M.A., Mulcahy, M.F., 2004. Potential resistance of European flat oysters (*Ostrea edulis*) to infection by *Bonamia ostreae*. *Aquaculture* 237, 41–58.
- da Silva, P.M., Fuentes, J., Villalba, A., 2005. Growth, survival and cross-selection of resistance to *Bonamia ostreae* between two populations of European flat oyster *Ostrea edulis* affected by bonamiosis. *Journal of Shellfish Research* 24, 1–8.
- Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randall, R.J. 1951. Protein measurement with the Folin Phenol Reagent. *J. Biol. Chem.* 193, 265–275.
- Villalba, A., da Silva, P.M., Fuentes, J. 2007. La producción de ostras de criadero como herramienta para la conservación y explotación sostenible de bancos naturales: propuestas al cultivo de la ostra plana europea. *Boletín del Instituto Español de Oceanografía* 23(1–4), 1–15.

Autoría: Ramilo, A.; Villalba, A.; Carballal, M.J.; Iglesias, D.; Abollo, E.

Título: Sequences of SSU rDNA, ITS AND IGS regions of *Marteilia sp*. (Cercozoa: Paramyxidae) infecting cockles *Cerastoderma edule* from Galicia (NW Spain), and a specific PCR assay for its diagnosis

Evento: XVIth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish"

Lugar: Tampere (Finlandia)

Ano: 2013

Sequences of SSU rDNA, ITS and IGS region of *Marteilia sp.* (Cercozoa: Paramyxidae) infecting cockles *Cerastoderma edule* from Galicia (NW Spain), and a specific PCR assay for its diagnosis

A. Ramilo[1], A. Villalba[1*], M. J. Carballal[1], D. Iglesias[1] and E. Abollo[2]

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Introduction

The genus *Marteilia* includes protozoa parasites of marine molluscs. Morphological, host and tissue tropism of *Marteilia* species in Europe and infecting other molluscs besides cockles, including mussels and clams. *Marteilia refringens* is responsible for QX disease of *Ostrea edulis* and *Crassostrea gigas* oysters in Australia, in the case of cockles, *Marteilia* sp. was reported infecting wedge cockles *Donax trunculus* in the south of France (Comps et al. 1975). More recently, a parasite referred as *Marteilia* sp. type C was associated with cockle mortality in Catalonia (NE Spain) (Carrasco et al. 2012). In spring 2012, northwestern coastal cockle fishery collapse in the Ría de Arousa, the ría where cockle production used to be the highest in Galicia (NW Spain). Molecular characterization, involving sequencing of SSU rDNA, ITS and IGS regions of the etiological agent of marteiliosis in Galician cockles has been performed to state its taxonomic position. Additionally, a PCR diagnostic assay has been designed to discriminately this parasite from *M. refringens*, the agent of marteiliosis of mussels *Mytilus galloprovincialis* in the Galician rías.

Materials and methods

Molecular characterization. DNA was extracted from digestive glands of cockles collected from Lourizán (Ría de Vigo) and O Sarridal (Ría de Pontevedra) in June 2013 (Fig. 1). Previously published primers (Berthe et al. 2000; Le Roux et al. 2001; López-Flores et al. 2004) and primers designed in this study were used to amplify the 18S, ITS-1 and 18S regions of the rDNA gene complex of the etiological agent of marteiliosis of Galician cockles (Fig. 2). The PCR products were cloned and sequenced and all the sequences were checked for similarity using BLAST (Basic Local Alignment Search Tool). Also were aligned using the Clustal W multiple alignment of MEGA program to exclude the homologous regions and produce the entire 18S-18S-ITS1 sequences.

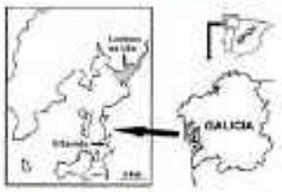

Fig. 1. Map of the Ría de Vigo (Spain) showing the location of the shellfish bed Lourizán (Ría de Vigo) and Sarridal, in the mouth of Ría Pontevedra, and Ría de O Sarridal

Phylogenetic analysis of ITS-1 and 18S sequences of the etiological agent of marteiliosis of Galician cockles was carried out with MEGA software using neighbour-joining (NJ) analysis. Bootstrap values were calculated over 10000 replicates and an value for condensed tree was of 50%. Pairwise distances among the available ITS-1 sequences of *Marteilia cochillia*, *M. refringens*, *M. sydneyi* and *Marteilia* sp. infecting cockles were calculated.

Design of a specific PCR-diagnostic assay for the etiological agent of cockle marteiliosis. Two specific primers, MfaumF and MfaumR, have been designed based on the ITS-1 region of the *Marteilia* parasite infecting Galician cockles. The analytical specificity of the primers was evaluated using genomic DNA extracted from Galician cockles affected by marteiliosis, DNA from no-cockle and oysters infected with *M. refringens*, and DNA from non-infected cockles.

Discussion

Molecular characterization of the ribosomal gene of the etiological agent of marteiliosis of cockle from Galicia supports the inclusion the genus *Marteilia*, which is consistent with observations with light and transmission electron microscopy (Villalba et al., *in prep.*). Furthermore, the sequences corresponding to ITS-1 and IGS and phylogenetic analysis suggest that the etiological agent of Galician cockles is a different species from *M. refringens* and *M. sydneyi*, while it is similar to the *Marteilia* sp. type C infecting cockles from Catalonia (Spain). Molecular and morphological characters of the parasite of Galician cockles support that it corresponds to a new species within the genus *Marteilia*.

Results

Analysis of rDNA sequences. The molecular characterization allowed obtaining a consensus sequence of 4,455 bp of *Marteilia* sp. of cockles, containing a 2307 bp section of the IGS region, the whole 18S rRNA gene of 1,799 bp, and a 449 bp section of the ITS-1 region (Fig. 2). A big insertion of 328 nucleotides was detected in the IGS region of the *Marteilia* parasite infecting Galician cockles with regard to *M. refringens*.

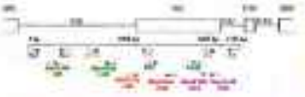

Fig. 2. Schematic representation of the nuclear ribosomal DNA of the etiological agent of marteiliosis affecting *Cerastoderma edule* from Galicia and location of all the primers used for the molecular characterization. Primers newly designed are showed in bold.

Table 1. Pairwise distances between the *Marteilia* genome of Galician cockles, *M. refringens* and *M. sydneyi*.

	M. refringens	*M. sydneyi*
Marteilia sp. of Galician cockles	0.015	0.059
M. sydneyi	0.054	–

rDNA region	Marteilia isolate	Accession number	Nucleotide identity	Query cover
18S	*Marteilia* sp. type C from cockle (Catalonia)	JX515581	99%	97%
	M. refringens	AJ250870	99%	100%
	Perkinsus sp. from *Ostrea edulis* (Ireland)	DQ218181	82%	97%
	Marteilia refringens from *Mytilus galloprovincialis* (Galicia)	EU135145	79%	58%
ITS-1	*Marteilia* sp. type C from cockle (Catalonia)	JX515582	100%	54%
	M. refringens	AJ277737	99%	54%
IGS	*Marteilia* sp. type C from cockle (Catalonia)	JX515583	99%	100%
	M. refringens	AJ250871	95%	100%

Table 2. Percentage of homology of the etiological agent of marteiliosis of Galician cockles with other Paramyxida species.

Phylogenetic analysis

Fig. 3. The sequence alignments used in phylogenetic analysis consisted of 384 bp for 18S region. 18S tree showed two clades, containing a branch with the sequences of *Marteilia* sp., infecting cockles from Galicia and Catalonia, with high bootstrap values (100%) and another branch with *M. refringens* sequences.

Fig. 4. The sequence alignments used in phylogenetic analysis consisted of 382 bp for ITS-1 region. ITS-1 tree showed a similar topology, with two clades: *Marteilia* sp., infecting cockles from Galicia clustered in a clade with *Marteilia* sp. type C from Catalonia, with bootstrap value of 100%, and another clade was formed with *M. refringens* infecting all known hosts.

Specific PCR-diagnostic assay for the etiological agent of cockle marteiliosis. MfaumF/MfaumR primers yield a PCR product of 320 bp which was observed only in samples of Galician cockles infected with *Marteilia* sp., whereas no amplification was observed in *M. galloprovincialis* and *O. edulis* infected with *M. refringens*, and DNA from non-infected cockles (Fig. 5). PCR products were sequenced and showed 100% homology with *Marteilia* sp. type C (JX515583) infecting cockles from Catalonia.

Fig. 5. Images of agarose gel electrophoresis after diagnostic PCR assay performed to assess analytical specificity of primers MfaumF/MfaumR. Lanes 1 and 2: Galician *Cerastoderma edule* infected with *Marteilia* sp.; lane 3: *C. edule* co-infected with *Marteilia* sp.; lane 4: *Mytilus galloprovincialis* infected with *Marteilia refringens*; lane 5: *Donax vittatus* infected with *M. refringens*; lane 6: negative control; lane M: 50 bp molecular marker.

References

Villalba et al., *this proceedings*. Dall'Ara, Conf. 2013
Comps et al. 1975. *J. Invertebr. Pathol.* 26:203–209
Carrasco et al. 2012. *Aquaculture* 358–359:26–34

Berthe et al. 2000. *J. Eukaryot. Microbiol.* 47:358–370
Le Roux et al. 2001. *J. Eukaryot. Microbiol.* 48:604–608
López-Flores et al. 2004. *Parasitology* 129:611–617

Autoría: Carballal, M.J.; Ramilo, A.; Abollo, E.; Villalba, A.

Título: First detection of *Minchinia* sp. (Haplosporidia) infecting cockles *Cerastoderma edule* from Galicia (NW Spain)

Evento: First Internacional Conference Fish and Shellfish Immunology

Lugar: Vigo - Galicia (España)

Ano: 2013

First detection of *Minchinia* sp. (Haplosporidia) infecting cockles *Cerastoderma edule* from Galicia (NW Spain)

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Introduction

The genus of Haplosporidia includes parasitic parasites or hyperparasites of marine invertebrates, mostly molluscs, grouped in four genera: *Arcachonia*, *Bonamia*, *Haplosporidium* and *Urosporidium*. Some of them are responsible for mass mortalities of commercially important molluscs worldwide. The genus *Minchinia* includes the following species: *M. nelsoni*, *M. teredinis*, *M. costalis*, *M. chitonis* and *M. roscovitensis*. Only three haplosporidians have been reported infecting cockles *Cerastoderma edule* thus far: *Haplosporidium edule* from Galicia (NW Spain; Abollo et al. 2001) and from The Netherlands and *M. nelsoni* and *M. roscovitensis* from The Netherlands and U.K (Langdon and Mulcahy 2012). A haplosporidian-like parasite was detected in cockles *C. edule* collected in a bed near Carnoustie (Ría de Arousa, NW Spain), within a routine health surveillance programme. The poster reports on morphological (histology) and molecular characterization of the SSU rDNA of this haplosporidian-like parasite.

Materials and methods

A total of 180 cockles were collected in a fished bed located in Carnoustie (Fig.1), from March to December 2012. Haemolymph samples were taken from the adductor muscle of each cockle; then a piece of tissues containing several mantle, foot, gills and rectum, was excised and processed for histopathological analysis.

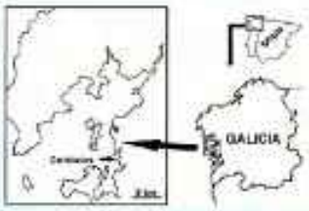

Fig. 1. Map of the Ría de Arousa (Harmon) showing the location of the cockle bed in Carnoustie.

DNA was extracted from paraffin blocks and from haemolymph samples and PCR assays were performed with primers described by Renault et al. (2000) for haplosporidian parasites: HAP-F1/HAP-R1, HAP-F1/HAP-R2, HAP-F1/HAP-R3, HAP-F2/HAP-R1, HAP-F2/HAP-R2 and HAP-F2/HAP-R3. Subsequently, two pair of primers 18S-A/18S-B (Medlin et al. 1988) and Nem-Bot1/Bot1-1112r (White 2009) were used to characterize the SSU rDNA gene of the parasite. PCR amplification products were cloned and sequenced.

All sequences were searched for similarity using BLAST (Basic Local Alignment Search Tool) and then aligned using the ClustalW multiple alignment of MEGA programme to include the homologous regions of the two products of PCR obtained and to produce the entire 18S sequence. Phylogenetic analysis of the parasite infecting cockles (*Minchinia* sp.) was carried out with Mrbayes software using Maximum Likelihood analysis. Bootstrap values were calculated over 10000 replicates and the cut-off for considered tree was of 50%. Additionally, an in situ hybridization (ISH) assay was performed to confirm the identity of the haplosporidian parasite on cockle tissues. Using a digoxigen (DIG) labelled probe obtained by PCR with HAP-F1/HAP-R1 primers.

Discussion

The molecular results support the detection of the haplosporidian-like parasite within the genus *Minchinia*. This parasite showed a high homology with *M. roscovitensis* (98%), however parasite spores were not found in the infected cockles, which presented an heavy haemocytic infiltration because of the haemocytic response of some invertebrates. Langdon and Mulcahy (2012) suggested that *M. nelsoni* and *M. roscovitensis* could be the cause of the large foci of heavy haemocytic infiltration observed in cockles in adults from the Netherlands, United Kingdom and Spain. The infection described in this study was not associated with large haemocytic foci but with heavy haemocytic infiltration of the connective tissue. Plasmodia as those described in the present study have been observed in the large foci of heavy haemocytic infiltration described previously in Galician cockles (Villalba et al. 2001), thus haplosporidian etiology is unlikely. The severity of the lesions observed with histological analysis suggests that the *Minchinia* sp.-infecting Galician cockles has high pathogenicity, while such an association with high cockle mortality was not detected, probably because of the low prevalence of the parasite.

References

Abollo et al. 2001. Eur J Protistol 36: 151-157
Medlin et al. 1988. Gene 71: 491-499
Langdon and Mulcahy. 2012. J Mar Biol Ass U K 92: 1-13
Renault et al. 2000. Dis Aquat Org 42: 207-214
Villalba et al. 2001. Bull Eur Ass Fish Pathol 21: 179-183
White. 2009. PhD Thesis. College of William and Mary, Williamsburg, VA. USA.

Results

Histological analysis. Uninucleated, binucleated cells and plasmodia of a haplosporidian like parasite were observed in histological sections of 6.4% the cockles, moderate to heavy infection involving abundant plasmodia, was found in 3% of the cockles. The parasites were observed free throughout the non-reactive tissue, mainly in the digestive gland, gills and gland areas (Fig. 2A). Uninucleated and binucleated stages ranged from 2 µm to 5 µm in diameter and averaged 4.5 ± 0.6 (SD) µm (N=30). Uninucleated and binucleated stages ranged from 2 µm to 5 µm in diameter and averaged 4.5 ± 0.6 (SD) µm (N=30). Nuclei ranged from 1.5 to 2 µm in diameter and averaged 1.8 ± 0.2 (SD) µm (N=30). The infection was associated with heavy haemocytic infiltration of the connective tissue and necrosis in some areas, especially in the digestive gland. Abundant multinucleate plasmodia and also uninucleated and binucleated cells were seen in the haemolymph of one cockle (Fig.2C).

Fig. 2. Light microscopic view from a cockle *Cerastoderma edule* infected with a haplosporidian like parasite. A: Histological section showing the digestive gland (*Hp*) and plasmodia sections (*p*) in the connective tissue (H&E staining). B: Histological section showing phagocytosed haplosporidian like plasmodia (*p*) (methanol/H&E staining). C: Haemocytic sample showing uninucleated haplosporidian like plasmodia (*p*) (methanol/Giemsa's stain) (from Villalba et al. 2001).

Molecular analysis. The PCR assays performed with primers HAP yielded an amplicon of expected size in all cases, except those carried out with HAP-F2/HAP-R1. The sequences obtained comprised between 350-500 bp and showed 90-99% homology with *M. roscovitensis* SSU rDNA gene. The molecular characterization of the *Minchinia* sp. cockle allowed us to keep the DNA sequences of three strains of 1706 bp each one.

Table 1. Percentage of homology data (%) of the sequences (SSU) programmed.

Description of GenBank	Accession number	Maximum identity	Query coverage
Minchinia sp.			
Bonamiidae			

Description of GenBank	Accession number	Maximum identity	Query coverage
Minchinia sp.			

Near 18S rDNA gene sequence a general used in the phylogenetic analysis consisted of 767 bp including gaps and missing data. The tree constructed with ML known model (HKY) (Fig. 3) supported the monophyly of the genus *Minchinia* with bootstrap values of 99%. The sequences obtained clustered together (Bayesian: 1.0 and ML: 99%) and were placed together with published *M. roscovitensis* with bootstrap values of 1.00% that access showed that the HAP-F1/HAP-R1 oligotypic probe hybridized with *Minchinia* sp. parasites present in histological sections of cockles from Galicia (Fig. 4).

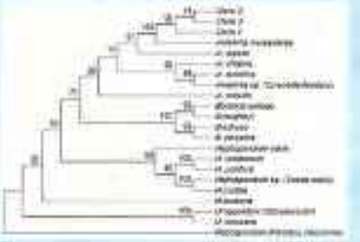

Fig. 3. Bayesian inference analysis showing the taxonomic position of *Minchinia* sp. infecting *Cerastoderma edule* from Galicia.

Fig. 4. In situ hybridization with the HAP-F1/HAP-R1 DIG probe as a biological control through the gills of a mantle. The tissue sections were counted by hematoxylin and Eosin (H.E.).

Autoría: Linares, F.; Peleteiro, J.B.; Álvarez-Blázquez, B.; Pazos, G.; Valente, L.M.P.; Rodríguez J.L.

Título: Dietary inclusion of 10% seaweeds in senegalese sole (*Solea senegalensis*) juveniles

Evento: Aquaculture Europe 14

Lugar: San Sebastián - Euskadi (España)

Ano: 2014

Dietary inclusion of 10% seaweeds in Senegalese sole (*Solea senegalensis*) juveniles

F. Linares, J.B. Peleteiro, B. Álvarez-Blázquez, G. Pazos, L.M.P Valente and J.L. Rodríguez.

Introduction

Senegalese sole (*Solea senegalensis*, Kaup 1858) is considered a promising flatfish species for Mediterranean aquaculture. Low energy diets seem to be suitable for Senegalese sole production (Borges *et al.*, 2009; Valente *et al.*, 2011) and fishmeal could be replaced up to 25% by a mixture of plant protein diets (Cabral *et al.*, 2011; 2012). Seaweeds are regarded as important nutritional sources in aquafeeds due to its content in proteins, lipids, pigments, vitamins and minerals. But they were never tested in sole. The present work evaluated the inclusion of 10% *Ulva rigida* and 10% *Gracilaria cornea* in Senegalese sole juveniles.

Material and Methods

The experiment was conducted in a closed circuit system at the experimental facilities of IGAFA (seawater, 35±1‰, 16 h L). Triplicate groups of 77 fish, born in captivity, with an average weight of 22.8±0.1g were distributed by 9 tanks of 100 L and fed three isonitrogenous (55% of proteins) and isoenergetic (8% of lipids) diets (CTRL, Ulva and Gracilaria). By the end of the trial, growth performance and chemical composition of fish and tissues were evaluated. The results were compared by a one-way ANOVA followed by the Student's t-test.

Results and Discussion

By the end of the feeding trial, the growth performance of the fish did not differ significantly among dietary treatments (Figure 1). The final body weight of fish fed with Ulva and Gracilaria (≈62g) was similar to that obtained in fish fed the control diet (62g) (Figure 1). Feed conversion ratios were also similar among the three tested diets, varying between 1.4 and 1.5.

Whole body composition of Senegalese sole fed the different seaweeds did not differ significantly from those fed the control diet. Similarly, muscle protein (18-21%) and lipid (2%) content did not differ among the three diets (Table 1). However, as the liver the inclusion of 10% seaweeds led to a significant reduction of both protein (≈ 10% vs 13%) and lipid content (≈ 7% vs 8%).

This study demonstrate for the first time that Senegalese sole can be fed with diets containing 10% seaweeds (Ulva and Gracilaria) without affecting the growth performance of the fish and its flesh quality. Further studies should be carried out to evaluate the long-term effects of these seaweeds on fish well being.

Table 1
Whole body and tissue composition (% wet weight) of Senegalese sole juveniles.

Dietary treatments

	CTRL	Ulva	Gracilaria
Whole Body Composition (% fw)			
Dry matter	27.0±0.3	27.1±0.6	26.6±0.8
Protein	16.2±0.2	16.1±0.2	16.0±0.2
Lipids	6.6±0.7	6.9±0.4	6.7±0.3
Energy (KJ g⁻¹)	6.8±0.02	6.9±0.2	6.7±0.2
Muscle Composition (% fw)			
Protein	18.7±0.2	18±0.4	17.9±1.4
Lipids	2.1±0.8	2.1±0.8	2.2±0.3
Liver Composition (% fw)			
Protein	13.3±0.3[a]	12±0.8[b]	11.6±1.0[b]
Lipids	8.4±0.5[a]	6.7±0.0[b]	6.4±0.2[b]

References

Borges, P., Oliveira, B., Casal, S., Dias, J., Conceição, L., Valente, L.M.P., 2009. Dietary lipid levels affects growth performance and nutrient utilization of Senegalese sole (*Solea senegalensis*) juveniles. Br. J. Nutr. 102, 1007–1016.

Cabral, E.M., Batista, S., Bandarra, N., Custódio, M., Quental-Ferreira, H., Moura, P., Ribeiro, N., Peres, H., Oliva-Teles, A., Valente, L.M.P., 2017. Effects of different fishmeal and fish oil replacement by plant ingredients diets on European seabass (*Dicentrarchus labrax*) juveniles' performance and flesh quality. Aquaculture 473, 539–547.

Cabral, E.M., Fernandes, T.J.R., Custódio, M., Quental-Ferreira, H., Moura, P., Ribeiro, N., Peres, H., Oliva-Teles, A., Batista, S., Valente, L.M.P., 2013. Replacement of fishmeal and fish oil in European seabass (*Dicentrarchus labrax*) diets by processed animal protein blends and plant ingredients. Br. J. Nutr. 109, 1990–2002.

Valente, L.M.P., Linares, F., Moutinho, S., Rito, J., Dias, J., Rodrigues, P., Ribeiro, L., Peres, H., Oliva-Teles, A., Rema, P., Pereira, R., Álvarez-Blázquez, B., Peleteiro, J.B., 2013. Dietary protein source and origin (marine vs plant) affect growth performance, nutrient utilization and quality traits of fillets of gilthead seabream (*Sparus aurata*) juveniles. Aquaculture 414–415, 141–150.

Acknowledgements

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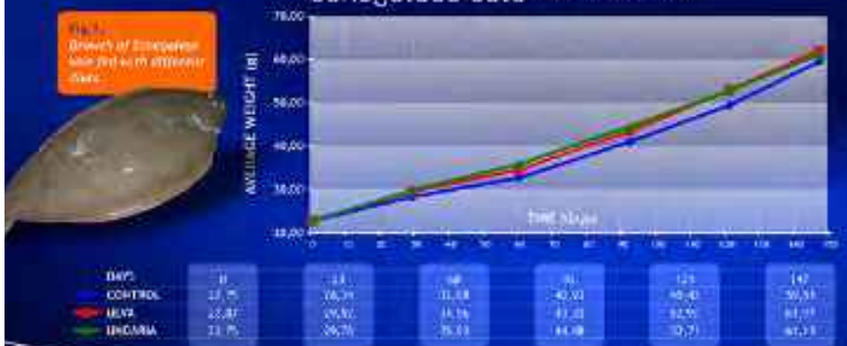
Senegalese sole (*Solea senegalensis*)

Fig.1.
Growth of Senegalese sole fed with different diets.



aquaculture europe 14

Autoría: Rodríguez, J.L.; Peleteiro, J.B.; Linares, F.

Título: Growth of the wreckfish *Polyprion americanus* in Galicia (Spain)

Evento: Aquaculture Europe 14

Lugar: San Sebastián - Euskadi (España)

Ano: 2014

Growth of the
Wreckfish
(Polyprion americanus)
in Galicia (Spain)
IGAFA
Introduction
Material and Methods
Results
Discussion
References
Acknowledgements
Table 1. Results obtained
Fig1. Growth of wreckfish in IGaFA facilities
Average weight
Average lenght
Average weight (g)
Average lenght (cm)
Time (Days)
aquaculture europe 14

Autoría: Martín-Morales, E.; Mariño, C.; Martín, H.; Blanco, J.

Título: A preliminary study of lipophilic toxins in Galician sediments

Evento: ICES Annual Science Conference

Lugar: A Coruña - Galicia (España)

Ano: 2014

A PRELIMINARY STUDY OF LIPOPHILIC TOXINS IN GALICIAN SEDIMENTS

Martín-Morales, Eva; Mariño, Carmen; Martín, Helena; Blanco, Juan

ICES CIEM

CIMA XUNTA DE GALICIA

ABSTRACT

For decades, okadaic acid has been broadly recorded in Galician Rías causing frequent bans of shellfish harvesting. In addition, the presence of 13-desmethyl SPX C has been commonly recorded in seawater and shellfish from the same area since LC-MS/MS started to used routinely to check the presence of lipophilic toxins. This work tryes to elucidate if sediment profiles could be an useful tool to study the incidence of harmful events in the past. For that reason, sediment samples from different locations of the Galician coast (Ría de Ares-Betanzos, Arousa, Muros and Pontevedra) were analyzed by LC-MS/MS in order to evaluate the presence of lipophilic toxins in sediments. The method includes the following toxins: yessotoxin, okadaic acid, DTX-1; PTX-2; 13-desmethyl SPX C; 13, 19 didesmethyl SPX C; Pinnatoxin F and Pinnatoxin G, Gymnodimine, azaspiracids 1-3, and the tentative identification of other toxins. 13 desmethyl SPX C, okadaic acid and PTX-2 were often detected above the LOQ of the LC-MS/MS method in all the studied Rías. Levels of 13 desmethyl SPX C are slightly higher than those of PTX-2. Okadaic acid is the toxin that reaches the highest concentrationin some samples maximum concentration was found in subsurficial sediments (Arousa, Muros and Pontevedra Rías).

OBJECTIVE

Evaluate the concentration and persistence of marine biotoxins in Galician sediments to assess the influence of toxic events in the past.

METHODS

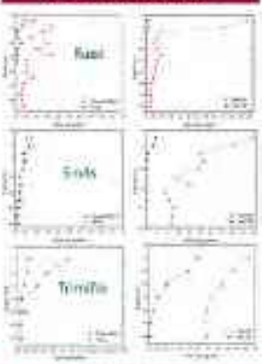
Cores in mussel culture areas (rafts) → around 40-120 years

Raw Extracts:
1g sed. → MeOH 100% (1/4 p:v) → 1100rpm 3' → Centrifuge (4800g 15') → 0.2 um filter → LC-ESI-MS/MS (MRM method).

Hydrolysis: 1mL of raw extract + 125 µL NaOH 2.5M → 76ºC 40' → +125µL HCl 2.5M.

RESULTS

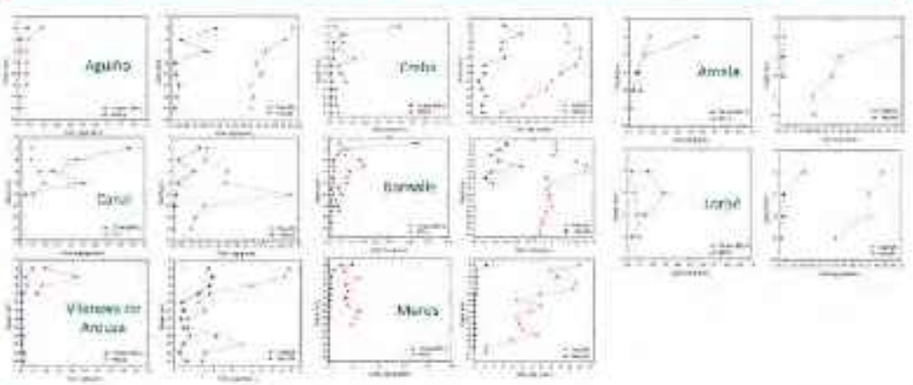
Ría de Pontevedra



CONCLUSIONS

- The most common toxins in Galician sediments are 13 dsm SPX C, OA and PTX-2.
- Okadaic acid in sediments is mainly found in conjugated form.
- The highest OA concentrations were found at superficial sediments → probably increasing of harmful event during last decades.
- Some subsuperficial maxima of 13 dsm SPX C were found in some areas suggesting that some in some places it could had have more importance that at present.
- PTX-2 and 13 dsm SPX C are present in low concentrations at sediments probably because degradation.
- PTX-2 and OA total concentration are related as it could be expected from the development of Dinophysis populations.

Ría de Arousa | Ría de Muros | Ría de Ares



Mackinnon, S. A., Sidwell, R. J., McNabb, P. & Hay, B. Methyl-spirolide toxins in two new temperate shellfish species and Protoperidinium moreheadi (Dinophyceae) from northern New Zealand. Harmful Algae 10, 553–564 (2011).

Nicholas, R. S. et al. New perspectives on Dinoflagellate detection in the Hauraki Gulf, New Zealand arising from the discovery of Gymnodinium. Harmful Algae 18, 84–93 (2013).

Autoría: Fernández-Boo S. Villalba A, Cao A

Título: Changes of the plasma protein composition of the manila clam *Ruditapes philippinarum* due to infection with *Perkinsus olseni*

Evento: 106th Annual Meeting of National Shellfisheries Association

Lugar: Jacksonville - Florida (EE. UU.)

Ano: 2014

CHANGES OF THE PLASMA PROTEIN COMPOSITION OF THE MANILA CLAM *RUDITAPES PHILIPPINARUM* DUE TO INFECTION WITH *PERKINSUS OLSENI*

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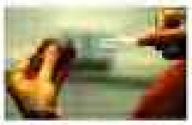
INTRODUCTION

The protozoan parasite *Perkinsus olseni* is responsible for Manila clam *Ruditapes philippinarum* mortality in various continents. Knowledge of the interaction between this parasite and the clam immune system could contribute to find strategies to minimise the losses caused by perkinsosis in clam fishery and aquaculture. The immune system of bivalve molluscs involves humoral factors and cell-mediated mechanisms. Both the cellular (haemocytes) and acellular (plasma) fractions of the mollusc haemolymph have important immune roles. Plasma includes immune humoral factors released by haemocytes and other cells, such as lectins, antimicrobial peptides, lysozyme, lysosomal enzymes, and anti-protease activity. A proteomic approach was implemented to identify differentially expressed plasma proteins linked to *P. olseni* infection. Early changes of the plasma protein composition of Manila clam due to infection were analysed by comparing clams from a *Perkinsus*-free area that were challenged in the laboratory with parasite zoospores versus control [illegible] clams. Additionally, effects of longer term infection were assessed by comparing heavily-infected clams with non-infected ones, both collected from a *P. olseni*-affected bed.

MATERIALS AND METHODS

Experimental challenge: Forty clams were individually challenged, each with 10^6 *P. olseni* zoospores in 250 ml of filtered sea water for 24 h, with aeration; control involved 42 clams maintained without zoospores.

Field infection: Two hundred clams were collected and diagnosed with Ray's fluid thioglycollate method; 42 non-infected clams and 42 heavily-infected clams were selected for comparison.



Haemolymph was collected, its plasma fraction was separated and then pooled. Pools from 20 clams in experimental challenge (2 replicates per treatment) and from 14 clams in field infection (3 replicates per treatment) were prepared.

2D electrophoresis and gel (image) analysis: Proteins were extracted from plasma; 500 µg of plasma protein (triplicate) were applied onto IPG strips for isoelectric focusing. Equilibrated IPG strips were transferred onto acrylamide gels for the second dimension separation. The gels were silver stained, digitised, and the spot patterns were analysed using PD Quest 8.0.0 software. Spots exclusive of each treatment and the ten common ones identified.

Spot excision. Thirty exclusive and distinct spots were identified; new gels were performed as described previously, which were Sypro-Ruby stained. The exclusive spots were excised and sent for protein identification.

Protein identification. Peptides extracted from the spots were analysed by MALDI-TOF/MS – MALDI-TOF/TOF and de Novo sequencing. Peptide mass fingerprinting and peptide fragmentation spectra data of each spot were combined through the GPS Explorer Software v3.6 using Mascot software v2.1 to search for protein identification against a Mollusca database (NCBInr [illegible]).

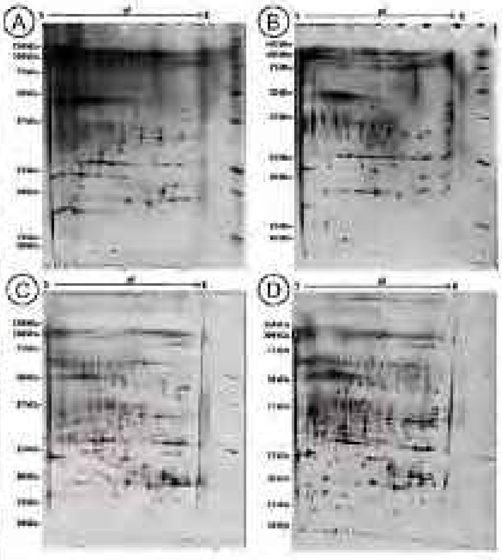
RESULTS

Table 1. [illegible]

		Average number of spots (3 replicates)	No. shared spots	No. exclusive spots
Experimental challenge	Control	428	105	24
	Challenged clams	330		20
Field infection	Non-infected clams	199	48	6
	Heavily-infected clams	160		6

Table 2. [illegible]

CODE	MW (exp)/ MW (theo)	pI (exp)/ pI (theo)	MASCOT SCORE	MATCHES (COV%)	SCORE	E-VALUE	SEQUENCE	PROTEIN ID
C1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C2	[illegible]	[illegible]					[illegible]	No identification
C3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C10	[illegible]	[illegible]					[illegible]	No identification
C11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



Representative Sypro-Ruby images of silver-stained gels produced by 2D SDS-PAGE [illegible]

DISCUSSION

The lower number of expressed proteins (spots in gels) in the plasma of experimentally challenged clams and heavily-infected clams with regard to control and non-infected clams, respectively, suggests that *P. olseni* infection causes a reduction of the number of proteins in the haemolymph plasma of Manila clams. La Peyre et al. (1995) did not find a significant change of protein concentration in the plasma of *Crassostrea virginica* after challenge with *Perkinsus marinus*, while *C. gigas* showed a significant increase.

More than double number of spots occurred in gels deriving from experimental challenge compared to that from field infection. The different environmental conditions plus differences between early innate response with regard to chronic, heavy infection could contribute to the difference.

Results suggest that *P. olseni* infection provoked disappearance of proteins encoded C1 - C15 from clam plasma but induced the occurrence of I1 - I10. Regarding the "disappearing" proteins, nicotinate-nucleotide pyrophosphorylase (NNP) is involved in de novo NAD biosynthesis, which plays roles in anti-oxidative activity, calcium homeostasis, gene expression and apoptosis. Three lectins were included in the group of identified proteins, lactadherin, sialic acid binding lectin and ficolin-2. Lectins are involved in carbohydrate recognition within the immune system. Various lectins whose expression in haemocytes is modulated by *P. olseni* and bacterial infections have been characterised in Manila clams (Kang et al. 2006, Kim et al. 2008, Adhya et al. 2010). The expression of the gene of the sialic acid binding lectin in haemocytes of the Manila clam was down-regulated in the first 24 h after challenge with *Vibrio anguillarum* and then up-regulated (Li et al. 2011), thus temporal variation in the modulation of lectin gene expression after challenge with microbial pathogens occurs.

Regarding the proteins appearing in plasma after challenge, Hsf2 interacting protein I1 is involved in telomerase regulation and chromosome segregation in mitosis (Yuan et al. 2005). Lysine specific demethylase is involved in changes of chromatin structure and regulates cellular growth and differentiation (Al-Shaheen et al. 2011). The sarcoplasmic binding protein is involved in regulation of calcium concentration and can act as stress biomarker (Tassakajon et al. 2013). Lysozymes play a key role in defense against bacterial infection; lysozymes of a wide range of molluscs have been identified (Takeshita et al. 2004, Itoh et al. 2007, Xue et al. 2010). The appearance of lysozyme in clam plasma after challenge with *P. olseni* zoospores was consistent with the anti-*P. marinus* activity of lysozyme from *Crassostrea virginica* reported by La Peyre et al. (2004).

LITERATURE CITED

Adhya et al. (2010) Journal of Fish Diseases 2010, 33, 889-899

Bob et al. (2002) Fish & Shellfish Immunology [illegible]

Kang et al. (2006) Developmental & Comparative Immunology [illegible]

Kim et al. (2008) Fish & Shellfish Immunology 25, [illegible]

La Peyre et al. (1995) Fish & Shellfish Immunology 5, [illegible]

La Peyre et al. (2004) 75th Meeting of the American Society of Parasitologists. Philadelphia, PA, 2004 [illegible]

Li et al. (2011) Fish & Shellfish Immunology 30, [illegible]

Al-Shaheen et al. (2011) Peptides [illegible]

Takeshita et al. (2004) Protein Expression and Purification 36, 254-262

Tassakajon et al. (2013) Fish & Shellfish Immunology [illegible]

Xue et al. (2010) BMC Evolutionary Biology [illegible]

Yuan et al. (2005) Journal of Biological Chemistry [illegible]

Autoría: Acosta, C.P.; Guerrero, S.; Linares, F.; Cerviño-Eiroa, A.; Carballal, M.J.; Fernández-Besada, M.; Rodríguez-Villanueva, J.L.; Andrés, C.; Lastres, M.; Salinas, J.M.; Cremades, J.

Título: Multitrophic action: A pilot experience to growing together fish, shellfish and edible seaweeds in Galician Rías (NW Spain)

Evento: Aquaculture Europe 14

Lugar: San Sebastián - Euskadi (España)

Ano: 2014

"MULTI-TROPHIC ACTION": A PILOT EXPERIENCE TO GROWING TOGETHER FISH, SHELLFISH AND EDIBLE SEAWEEDS IN GALICIAN "RÍAS" (NW SPAIN)

E.P. Acosta[1]*, S. Guerrero[2], E. Linares[3], A. Cerviño Lema[2], M.J. Carballal[3], M. Fernandez Besada[2], J.L. Rodriguez Villanueva[2], C. Andrés[2], M. Lastres[2], J.M. Salleas[3] and J. Cremades[2]

INTRODUCTION

Integrated multi-trophic aquaculture (IMTA) includes species from different trophic levels in the same system by creating a sustainable mini-ecosystem. Ideally, the biological and chemical processes are balanced by an adequate selection of the different species that will provide different functions to the integrated system (Neori et al., 2004). The experience presented here, still in progress, aims primarily to develop a pilot scale IMTA system in Arousa estuary (Pontevedra, Spain), using facilities for fish farming. The species chosen were red sea bream (*Pagellus pagorosus*), mussels (*Mytilus galloprovincialis*), clams (*Venerosis pullastra*) and the edible seaweed "sugar kombu" (*Saccharina latissima*).

The experience began in October 2012 and takes place in a floating cage for culture of red sea bream. The ropes seeded with mussels and seaweeds were hanged on the sides of the fish cage and a metal cage with clam seed was deposed between the fish.

To estimate the potential benefits of integration were also placed the same species in the same way in a mussel raft about 100m away fish cage. The benefits of integration are evaluated by comparing productivity, chemical composition (carbohydrates, protein, total lipid, omega 3 fatty acids, nitrogen isotopic forms, etc.) and incidence of parasitisms in the different species in both locations.

DISCUSION AND CONCLUSIONS

- The results obtained so far indicate that mollusk-fish integration is broadly positive, especially during the winter and early spring, months of lower natural concentration of seston.
- These differences are not very pronounced in this experience due no doubt to that the fish system load is moderate, so it can be deduced that if it is carried out similar experiences in an area where the fish biomass was more high, the results could be different and perhaps even more favorable.
- In any case, as other authors have already pointed out (Nisam et al., 2013) this study demonstrates that the presence of a nearby fish biomass in areas where current practices of shellfish farming already exist at least is not detrimental to them.
- Although no significantly, nutritional values were also slightly higher in fish cage and no significant differences were found between the parasites present in mussels and clams from both sources.
- Integration of fish and shellfish with seaweeds is highly positive both for its contents in proteins as for its ability to improve water quality.

REFERENCES

[illegible]

XUNTA DE GALICIA
CONSELLERIA DO MEDIO RURAL E DO MAR
UNIVERSIDADE DA CORUÑA

Este proyecto está financiado por la acción de investigación "Multitrophic-IMTA" PGIMT-CIMA 13/05 a través de la Dirección Xeral de Desenvolvimento Pesqueiro, Consellería do Medio Rural e do Mar, Xunta de Galicia

Autoría: Blanco, J.; Moroño, A.; Correa, J.; Porro, M.C., Cabado, A.G.; Vieites, J.M.; Arévalo, F.

Título: Effect of canning on okadaic acid and DTX2 content and concentration in mussels *Mytilus galloprovincialis*

Evento: Marine and Freshwater Toxins Analysis. 5th Joint Symposium and AOAC Task Force Meeting

Lugar: Baiona - Galicia (España)

Ano: 2015

Effect of canning on okadaic acid and DTX2 content and concentration in mussels *Mytilus galloprovincialis*

[illegible]

INTRODUCTION

- Since the implementation of LC-MS/MS, as reference technique for the analysis of lipophilic toxins, the mussel processing companies (steaming and canning companies) as their own checks, have observed a substantial increase in the number of mussel batches that, being the raw samples on-line the limiting threshold, after the usual steaming process increased the concentration over the legal limit, without any known risk above the legal limit.

- In comparison work (Blanco et al.2015) we have found that during the first part of the canning process –industrial steaming– apart from the expected increase of toxin concentration due to dehydration, in some cases an additional and important increase of the apparent toxin content happens (data not shown).

- The effect of the second part of the canning process, involving cooking (2 stages) in presence of brine (water, oil, vinegar, paprika and other minor components, is unknown.

MATERIAL AND METHODS

- 4 batches of incoming fresh mussel (different, random origin, location and size fractions). OA/DTX2 proportion: 100 mussels/batch distributed into four samples of forty mussels each.

- Intensely washed

- Typical canning (120g conc):
  - Retorted 70g mussel meat, 50 mL of the sauce (oil, vinegar, paprika and minor components)

- Sealing
- Oil processing 115°C, 40 min

- Extraction
  - Mussels: Homogenizing sample. Ideal MeOH 1:1 (v:w) + two serial extractions
  - Sauce: sauce/MeOH 1:3 (v:v) + two serial extractions. Dilution 1/5
- Hydrolysis
  - Aliquots: 1 mL extract, 0.125 mL 2.5N NaOH, 80°C, 40 min; neutralization 0.125mL 2.5N HCl
  - Sauce: 1 mL sauce, same proportion as mussels, (extraction: all plus 1ml)
- Analysis (LC-MS/MS)
  - Mussels: Waters Xquity + Xevo TQ MS triple quadrupole
  - Sauce: Thermo Accela+ Quantum Access Max triple quadrupole (Two pieces as 2013 slightly modif.)
- Statistical analysis: Minitab 16

OBJECTIVE

To evaluate the effect of the canning/retorting process on toxin concentration and content by comparing the final canned mussels with steamed ones.

RESULTS

1.- Drained mussel total weight (20-33%)

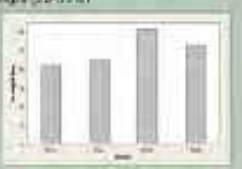


Fig.1. Weight loss of the drained meat (the two external pairs) in the study

2.- OA concentration increased slightly (change from 1 unit that of DTX2 decreased

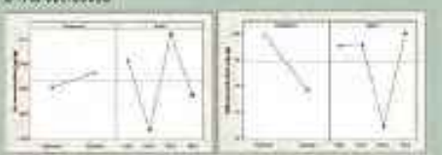


Fig.2. Effects of canning (treatment) over them on OA and DTX2 concentration (in mussels) estimated by two way ANOVA

3.- Both, OA and DTX2 content of mussels decreased

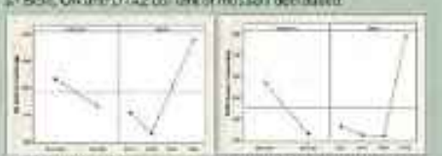


Fig.3 Effects of canning (treatment) over them on OA and DTX2 content of mussels estimated by two way ANOVA

4.- The estimated toxicity decreased slightly

Fig.4. Effects of canning (treatment) over them on the toxicity of mussels estimated by two way ANOVA

5.- The decrease of free forms of both toxins was higher than that of the esterified forms

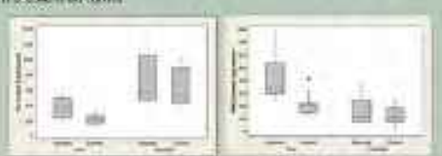


Fig.5. Decrease of free and esterified forms of OA and DTX2 in steamed and canned mussels

6.- In general, less than 10% of the toxins were released to the sauce, mostly in free form

Fig.6. Toxicity of free and esterified forms of OA and DTX2 in steamed and canned mussels

ABSTRACT

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DISCUSSION

Canning/retorting increases the weight of the mussel meat additionally to absorbing the previous loss in the last steps of canning process). This is in concordance with the existing evidence on about thermal processing.

Shrinkage did not significantly increase neither did it correlate with the estimated toxicity, indicating that loss of the processing juices can seem to contribute to the toxin increase of the estimated toxicity during the second process and this means that evaporating is the main cause of the toxicity increase (by concentration) as previous papers (Lee et al. 2015).

Both, OA and DTX2 are lost in close proportion during the canning/retorting process. DTX2 was lost in a higher proportion than OA as could be expected from their different polarities (Hess et al. 2005, McCarron et al. 2008, Reboreda et al. 2010). Only a part of this loss from the mussels was due to the transfer to the sauce, most was due to thermal degradation.

The estimated toxicity was slightly reduced. This reduction was mostly due to the reduction of DTX2 content, consequently, it cannot be expected to take place when OA is the only toxin present in the mussels.

Sauce contributes more to the weight (approx 40%) than to the toxin content.

The free forms of both toxins decreased in amounts more than the esterified ones. Only a part of this decrease can be due to losses to sauce.

ACKNOWLEDGEMENTS

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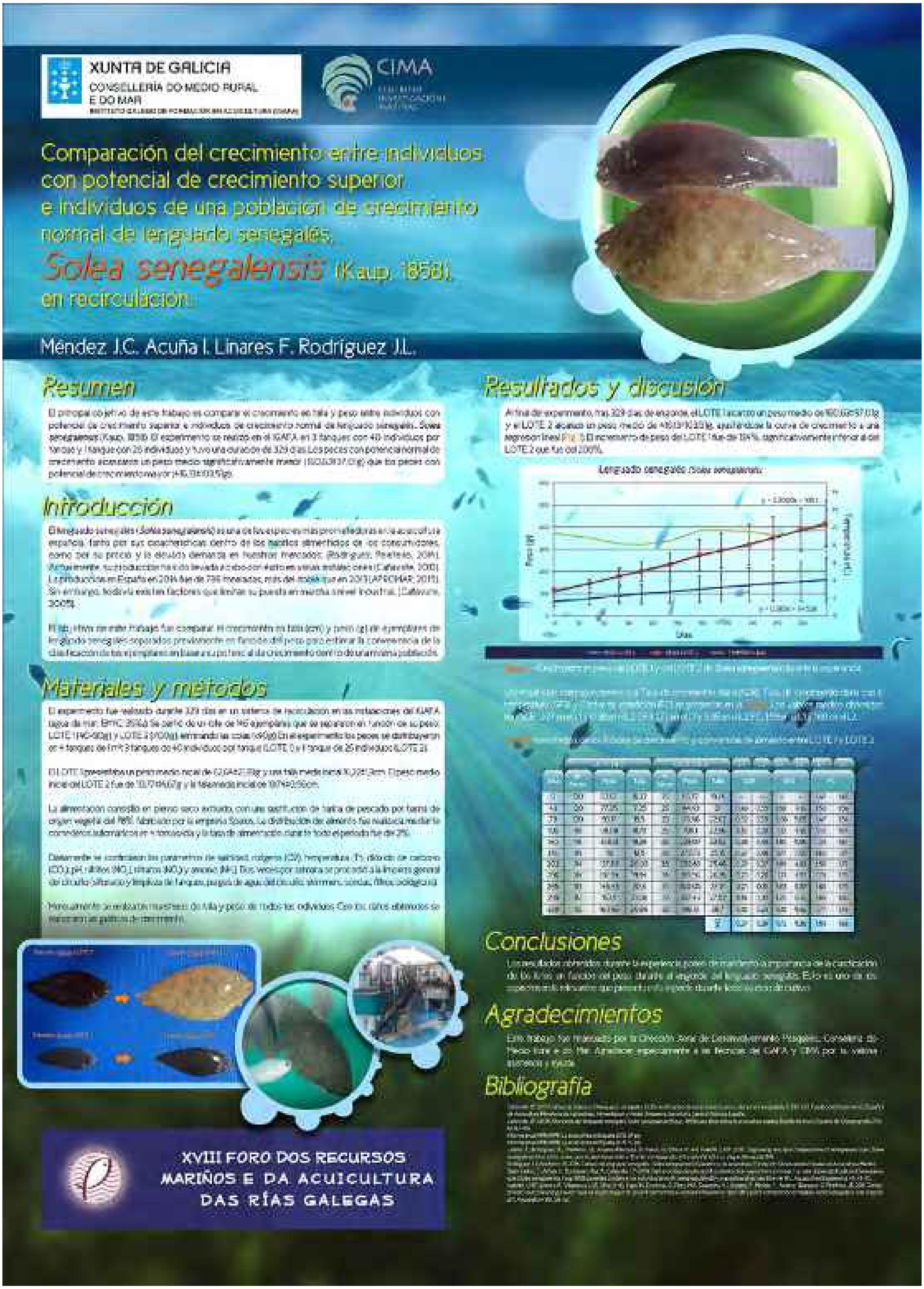
Autoría: Méndez, J.C.; Acuña, I.; Linares, F.; Rodríguez J.L.

Título: Comparación del crecimiento entre individuos con potencial de crecimiento superior e individuos de una población de crecimiento normal de lenguado senegalés, *Solea senegalensis* (Kaup, 1858) en recirculación

Evento: XVIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2015


XUNTA DE GALICIA
CONSELLERÍA DO MEDIO RURAL
E DO MAR
CIMA
Comparación del crecimiento entre individuos
con potencial de crecimiento superior
e individuos de una población de crecimiento
normal de lenguado senegalés,
Solea senegalensis (Kaup, 1858),
en recirculación.
Méndez J.C. Acuña I. Linares F. Rodríguez J.L.
Resumen
Introducción
Materiales y métodos
Resultados y discusión
Conclusiones
Agradecimientos
Bibliografía
XVIII FORO DOS RECURSOS
MARIÑOS E DA ACUICULTURA
DAS RÍAS GALEGAS

Autoría: Acosta, C.P.; Fernández-Besada, M.; Andrés, C.; Rodríguez-Villanueva, J.L.; Cremades, J.

Título: Experiencia piloto de cultivos multitróficos: análisis de la integración peces-moluscos mediante isótopos estables

Evento: XVIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2015

Experiencia piloto de cultivos multitróficos: análisis de la integración peces-moluscos mediante isotopos estables

C.P. Acosta[1], M. Fernández Besada[1], C. Andrés[1], J.L. Rodríguez Villanueva[1] y J. Cremades[1]

XUNTA DE GALICIA

CIMA

Instalaciones del IEcoFa donde se realizó la experiencia.

Introducción

La acuicultura multitrófica integrada (AMTI) consiste en el cultivo en proximidad de especies pertenecientes a distintos niveles tróficos y tiene por objeto fomentar las funciones ecosistémicas complementarias, de modo que el exceso de nutrientes de una especie es aprovechado total o parcialmente por los organismos del siguiente nivel trófico, propiciando así los sinergismos entre especies (Chopin et al., 2012).

El nitrógeno orgánico en forma de material particulado procedente de los granjas de peces (restos de pienso o heces) puede ser ingerido por los animales filtradores o bien tras ser remediados e inmovilizado en sus tejidos. La identificación del nitrógeno de esta procedencia puede ser estimada atendiendo a la distinta relación isotópica ($\delta^{15}N$) presente tanto en la fuente de alimentación (pienso) como en el medio natural y los tejidos de los organismos del sistema integrado (Costanzo et al. 2001; McClelland et al. 1997; Vose and Unruh 1997).

Material y métodos

La experiencia piloto que aquí se presenta, desarrollada en las instalaciones del IEcoFa, consiste en el estudio de la integración peces-moluscos. Esta experiencia fue iniciada en 2004 y tuvo lugar en la ría de Arousa, en una jaula utilizada para el cultivo de lenguado (*Platichthys flesus luscus*), con una carga de 800 kg de peces alimentados con 15 kg de pienso/día.

Como organismo filtrador fue utilizado el mejillón (*Mytilus galloprovincialis*). Las cuerdas de mejillón eran de 3 m de longitud y fueron sembradas a la manera tradicional con una densidad aproximada de 700 mejillones/cuerda. Para estimar los posibles beneficios de la integración se colgaron dos conjuntos de cuerdas: 3 en el lateral de la jaula y otras 3 en una balsa próxima a la jaula pero a la vez lo suficientemente alejada como para minimizar la influencia de la jaula de peces (300 m de distancia).

- Las biometrías para los estudios de crecimiento se realizaron con muestras de 20 mejillones/cuerda.
- Los análisis de isotopos se realizaron con muestras de 5 mejillones/cuerda, envueltos y sin hepatopáncreas, analizados mediante combustión en un analizador elemental EA1108 unido a un espectrómetro de masas de relaciones isotópicas MAT253. Se utilizó Acetanilida como estándar para la cuantificación del nitrógeno. Paralelamente se analizó una muestra del pienso utilizado como alimento de los peces.
- El contenido en proteínas (C) fue calculado posteriormente multiplicando el porcentaje de nitrógeno x 6,25.

Resultados y discusión

Tabla I. Resultados del ANOVA de una vía para el contenido de nitrógeno (%N) y $\delta^{15}N$ (UR ‰) de los mejillones cultivados en ambos emplazamientos.

Factor	GL	SC	MC	F	P
%N	1	0,059	0,059	0,51	0,482 ns
$\delta^{15}N$	1	0,322	0,322	9,20	0,006 **

ns= no significativo

** = P<0,01; prueba paramétrica de Tukey-Kramer

- Al final del periodo de estudio la longitud fue similar (L=71 mm) en ambas ubicaciones. Respecto al peso, hubo ligeras diferencias que no fueron estadísticamente significativas ($p>0,05$), el contenido en carne fue ligeramente mayor en la jaula, tanto en peso fresco como en peso seco, aunque el ratio diferencias en el peso de las valvas fue mayor en la balsa ($p<0,001$).
- Sin embargo tanto el IC como el rendimiento en carne fue claramente mayor en los mejillones cultivados en la jaula de peces ($P<0,001$) sugiriendo un beneficio del sistema AMTI (Tabla I).
- Los bajos valores de la relación isotópica $\delta^{15}N$ de la muestra de pienso (6,75‰) inferiores a los [illegible] proteína es de origen vegetal, mientras que las fuentes de nitrógeno de [illegible] claramente superiores a 5,48±1,18 (Tabla II), *vista de referencia para* [illegible] proceden parcialmente de la eutrofización de origen [illegible]
- Los valores significativamente menores [illegible] la jaula ($\delta^{15}N$= 5,79±0,3 ‰) [illegible] la balsa), indica que han asimilado parcialmente [illegible] (Fig.1 y tabla II).
- Se apreció también que el contenido en proteínas [illegible] y 8,7% de N respectivamente, si bien estas diferencias no fueron significativas.

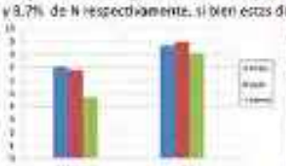


Figura 1. Valores de la relación isotópica $\delta^{15}N$ y contenido en N de los mejillones cultivados en balsa.

Conclusiones

Podemos concluir que la integración de peces y mejillones en jaulones en todos los sentidos y que, de alguna manera, los mejillones están retirando del medio parte de los restos de los peces de peces en su propio beneficio. A pesar de ello, en [illegible] que en el escenario estudiado no existieran diferencias significativas en cuanto a la riqueza en proteínas y distintas variables biométricas de los mejillones viene a indicar que en todo momento no ha habido limitaciones de alimento natural, pero en un escenario de menor riqueza fitoplanctónica esta integración habría sido más positiva, o bien que esta misma abre la vía al desarrollo de la mitilicultura integrada con la producción de peces en zonas de menor riqueza fitoplanctónica, lo que en algunos casos podría ser una ventaja frente a episodios de mareas rojas.

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Autoría: Linares, F.; Rodríguez, J.L.; Peleteiro, J.B.; Cal, R.; Pazos, G.; Álvarez-Blázquez, B.

Título: Biochemical composition of wild wreckfish (*Polyprion americanus*)

Evento: Aquaculture Europe 15

Lugar: Rotterdam (Países Bajos)

Ano: 2015

XUNTA DE GALICIA
IGAFA
BIOCHEMICAL COMPOSITION OF
WILD WRECKFISH
(Polyprion americanus)
Introduction
Material and methods
Results and Discussion
Conclusion
References
Aknowledgements
Funded by the Seventh Framework Programme of the European Union
DIVERSIFY

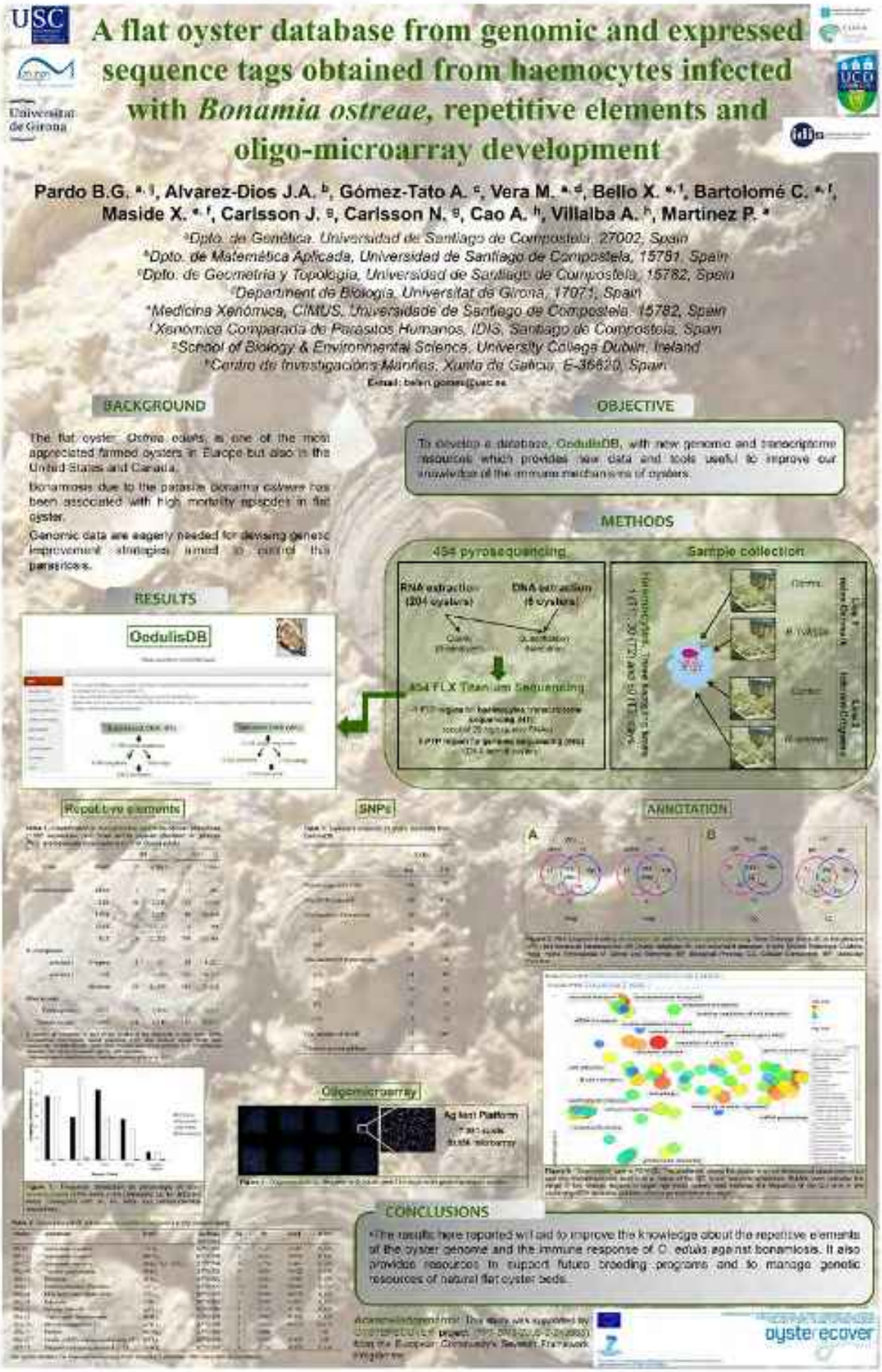
Autoría: Pardo, B.G.; Álvarez-Dios, J.A.; Gómez-Tato, A.; Vera, M.; Bello, X; Bartolomé, C.; Maside, X.; Carlsson, J.; Carlsson, N.; Cao, A.; Villalba, A.; Martínez, P.

Título: A flat oyster database from genomic and expressed sequence tags obtained from haemocytes infected with *Bonamia ostreae*, repetitive elements and oligo-microarray development

Evento: International Symposium on genetics in aquaculture XII

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2015


A flat oyster database from genomic and expressed sequence tags obtained from haemocytes infected with Bonamia ostreae, repetitive elements and oligo-microarray development
Pardo B.G. [a, 1], Alvarez-Dios J.A. [b], Gómez-Tato A. [c], Vera M. [a, d], Bello X. [e, 1], Bartolomé C. [e, f], Maside X. [e, f], Carlsson J. [g], Carlsson N. [g], Cao A. [h], Villalba A. [h], Martinez P. [a]
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BACKGROUND
The flat oyster, Ostrea edulis, is one of the most appreciated farmed oysters in Europe but also in the United States and Canada.
Bonamiosis due to the parasite bonamia ostreae has been associated with high mortality episodes in flat oyster.
Genomic data are eagerly needed for devising genetic improvement strategies aimed to control this parasitosis.
OBJECTIVE
To develop a database, OodulisDB, with new genomic and transcriptome resources which provides new data and tools useful to improve our knowledge of the immune mechanisms of oysters.
METHODS
454 pyrosequencing
Sample collection
RNA extraction (204 oysters)
DNA extraction (6 oysters)
454 FLX Titanium Sequencing
RESULTS
OodulisDB
Repetitive elements
SNPs
ANNOTATION
A
B
Oligomicroarray
Agilent Platform
CONCLUSIONS
•The results here reported will aid to improve the knowledge about the repetitive elements of the oyster genome and the immune response of O. edulis against bonamiosis. It also provides resources to support future breeding programs and to manage genetic resources of natural flat oyster beds.
oyster ecover

Autoría: Hasanuzzaman, A.F.M.; Robledo, D.; Gómez-Tato, A.; Álvarez-Dios, J.A.; Harrison, P.; Fernández-Boo, S.; Cao, A.; Villalba, A.; Pardo, B.G.; Martínez, P.

Título: Differentially expressed genes in in vitro stimulated *Ruditapes philippinarum*-haemocyte and *Perkinsus olseni*- trophozoite: unveiling host-parasite interaction in perkinsosis

Evento: International Symposium on genetics in aquaculture XII

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2015

Differentially Expressed Genes in *In Vitro* Stimulated *Ruditapes philippinarum*-Haemocyte and *Perkinsus olseni*-Trophozoite: UNVEILING HOST-PARASITE INTERACTION in PERKINSOSIS

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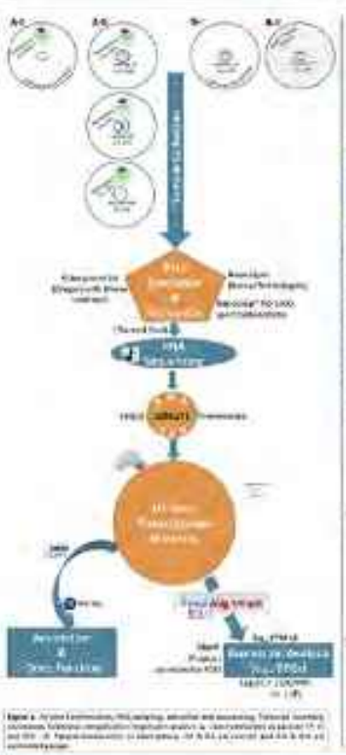
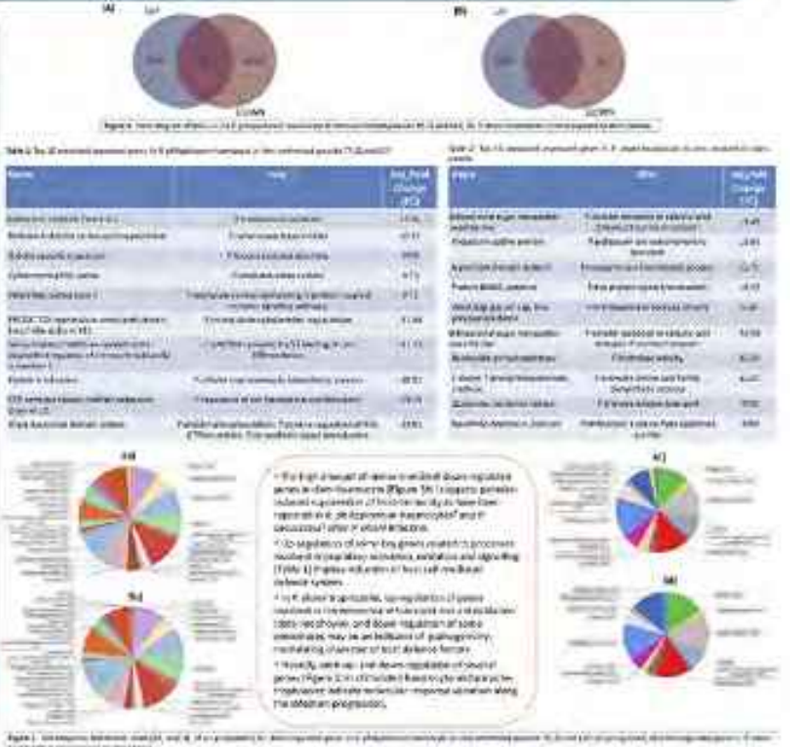
ABSTRACT

Background: Perkinsosis[1], caused by intracellular protozoan parasite *Perkinsus olseni*, is deadly hindering the production of Manila clam (*Ruditapes philippinarum*). Understanding the molecular mechanisms involved in *R. philippinarum*-*P. olseni* genetic interaction through transcriptomic analysis would aid to develop strategies for controlling this parasitosis. The present study has dealt with transcriptional expression in both host defence cell (haemocyte) and parasite infectious cell (trophozoite). **Materials and Methods:** We collected RNA samples from *R. philippinarum*-haemocytes and *P. olseni*-trophozoites in vitro stimulated by molecular signals from trophozoites (TP), zoospores (ZS) and extracellular products (ECP) of the parasite, and by plasma of Manila clam, respectively, and from the corresponding controls. A RNA-seq (Illumina) approach was used to characterize their respective transcriptomic profiles, and RNA-seq reads were first *de novo* assembled by Trinity and further mega-assembled using CAP3. **Results:** a total of 33,182 and 47,998 unigene transcripts were identified in the clam-haemocyte and *P. olseni*, respectively. The RNA-seq analysis provided a preliminary information of differentially expressed genes (DEGs) in the host defence cell and the parasite. Among clam-haemocyte associated genes, we detected 687 up regulated genes (e.g. cathepsin, kazal-type serine protease inhibitor domain-containing protein, NF-κB) and 2,688 down regulated genes (e.g. lectin, complement, interferon, and cytokine). Regarding *P. olseni* trophozoite, we detected 682 up regulated (e.g. glutathione peroxidase, cell wall associated hydrolase, ATP dependent protease) and 478 down regulated (e.g. cysteine protease, serine carboxypeptidase) protease genes. **Conclusion:** Such simultaneous analysis on gene expression in clam-haemocyte and parasite-trophozoite provides valuable information for further in vitro and in vivo study to understand the genetic basis of *R. philippinarum*-*P. olseni* interaction during Perkinsosis.

Materials and Methods



Results and Discussion



References

[1] Villalba, A., Reece, K. S., Ordás, M. C., Casas, S. M., Figueras, A., 2004. Perkinsosis in molluscs: a review. Aquatic Living Res. 17, 411–432.
[2] Hasanuzzaman, A. F. M. et al., in submission. Transcriptomic analysis of gene expression in haemocytes of Manila clam (*Ruditapes philippinarum*) after a challenge with *Perkinsus olseni* trophozoites. Fish & Shellfish Immunology, 51, 473–486.
[3] Canesi, L., Balbi, T., Fabbri, R., Salerno, G., Gallo, G., Marchi, B., Faggio, C., 2012. Influence of natural and anthropogenic stressors on gene modulation and biological responses in hemocytes of marine bivalves. Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology, 155, 135–148.

Future Directions

- Development of oligo-microarray tool for gene expression analysis in host and parasite.
- Further *in vitro* and *in vivo* study on characterizing role of *R. philippinarum* haemocyte and *P. olseni* trophozoite at different infection stages in Perkinsosis.

ACKNOWLEDGMENTS

Autoría: Iglesias, D.; Villalba, A.; No, E.; Darriba, S.;Mariño, C.; Fernández, J.; Carballal, M.J.

Título: Cockle *Cerastoderma edule* marteiliosis first detected in Ría de Arousa (Galicia, NW Spain) has spread to other Galician rías causing mass mortality

Evento: 17th International Conference of the European Association of Fish Pathologists

Lugar: Las Palmas de Gran Canaria - (España)

Ano: 2015

Cockle *Cerastoderma edule* marteiliosis first detected in Ría de Arousa (Galicia, NW Spain) has spread to other Galician rias causing mass mortality

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INTRODUCTION

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MATERIAL AND METHODS

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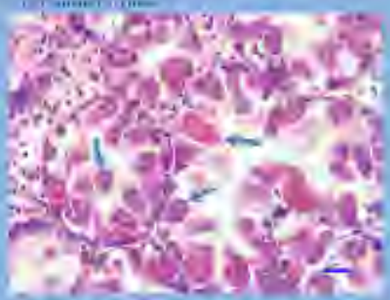
Figure 1 [illegible]



RESULTS AND DISCUSSION

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Figure 2 [illegible]

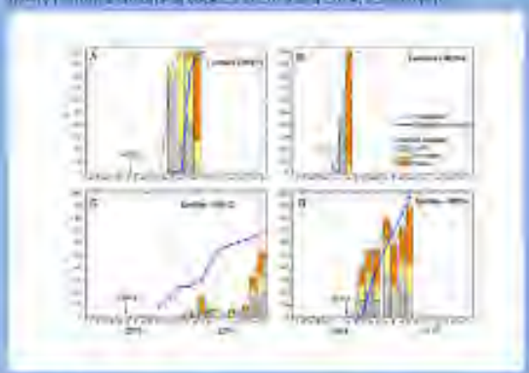
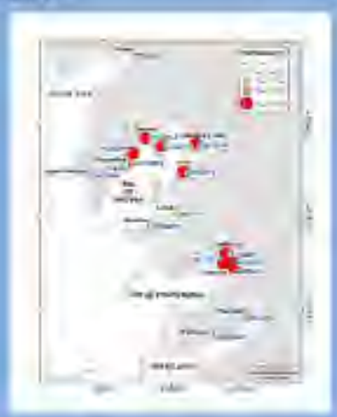


Figure [illegible]



REFERENCES

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Autoría: Porro, M.C.; Vieites, J.M.; Blanco, J.; Arévalo, F.; Moroño, A.; Correa, J.; Cabado, A.G.

Título: Comparison of LC-MS/MS method and the colorimetric phosphatase inhibition assay for quantification of Okadaic Acid-toxins group

Evento: Marine and Freshwater Toxins Analysis. 5th Joint Symposium and AOAC Task Force Meeting

Lugar: Baiona - Galicia (España)

Ano: 2015

COMPARISON OF LC-MS/MS METHOD AND THE COLORIMETRIC PHOSPHATASE INHIBITION ASSAY FOR QUANTIFICATION OF OKADAIC ACID-TOXINS GROUP

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ABSTRACT

Presence of okadaic acid (OA) toxins in bivalve molluscs creates a worldwide problem of both public health and food safety. The occurrence of toxic episodes during recent years, together with the replacement of mouse bioassay by LC-MS/MS as EU reference technique, favoured the implementation of quantitative alternative methods, such as the phosphatase inhibition test method, which has the advantage that it does not require sophisticated equipment, so it is an interesting tool for own checks made by food business operators. Moreover, it may be used as alternative or supplementary method to the EU-RL LC-MS/MS one, according to Commission Regulation (EU) No 15/2011. Concerning to that, LC-MS/MS and colorimetric phosphatase inhibition test method (OKATEST™) were compared for determination of OA toxins group in raw, steamed and canned mussels. Both methods showed a good linear correlation, although concentration with OKATEST™ was higher than that achieved with the reference method. All treatments share the same slope of the regression line (close to 1) but differ in elevation, that is always positive.

INTRODUCTION

Toxic episodes in Galicia (NW of Spain), affecting shellfish production areas, are mainly caused by some lipophilic toxins, such as okadaic acid (OA), its analogues and esterified derivatives. The most prevalent of molluscs can produce increases in lipophilic toxins concentration (Fux et al., 2012; EFSA, 2009; Blanco et al., 2015). The mussel industries can find that in some raw samples, containing toxins levels below the legal limit, the concentration of lipophilic toxins after the steaming process is higher than those found in fresh mussels. The fact produces that some processed mussel batches must be recalled and, as a consequence, important economic losses are generated and stresses the need of an easy to use technique to quantify lipophilic toxins. LC-MS/MS (following the EU harmonised Standard Operating Procedure,SOP) is the reference method for the detection of these toxins, but any other recognised method, different from the LC-MS/MS, can be applied for the detection of lipophilic toxins, provided that it fulfils the method performance criteria. In this context, the phosphatase inhibition assay can be used as alternative or supplementary to the LC-MS/MS method (European Commission 2011).

MATERIAL AND METHODS

Sampling

Samples of fresh mussels, 16 in total: 8 from Ría de Arousa and 8 from Ría de Pontevedra, were collected between January 22nd and January 29th 2014, at the final step of a series of three long-lasting toxic episodes.

Samples were cleaned and individualized in order to prepare adequately randomized samples. Each sample was divided into 5 groups of 40 mussels of uniform size, intended for analysis in 3 steps of canning processing: fresh, cooked (steamed) and canned (mussels in pickled sauce).

The samples corresponding to the steaming treatment were heated at 110 ºC for 30 seconds in a continuous industrial steamer. Canned samples were steamed as above, and sterilized at 115ºC, 40 minutes in an industrial (scale) autoclave.

LC-MS/MS analysis

Reagents and standards

Okadaic acid and DTX2 certificate solutions were obtained from NRC, Canada (NRC CRM-OA-c, NRC-CRM-DTX2) and from Laboratorio CIFGA, Spain (CRM-OD-CIF, 10 DTX2). Acetonitrile (ACN) was obtained from Ashburn (Waltham, Scotland). Methanol was purchased from VWR (Barcelona, Spain) and trimethylamine hydroxide from Merck (Darmstadt, Germany). Ultrapure water was obtained from a Milli-Q A 10 (Millipore Iberica, Madrid, Spain).

LC-MS/MS vs OKATEST

LC- MS/MS method

The method used in this study was optimized and validated in Intecmar following the guidelines provided by the Standardized Operating Procedure of the EU-RL for the determination of marine biopolls in toxins on molluscs by LC-MS/MS Version 4, and based on Gu-Lean et al (2008) and Reguera et al (2011). The method is accredited to fulfil the norm UNE-EN ISO/IEC 17025 (Acreditación Nº 265/LE 894).

Method consists on an extraction in MeOH, an alkaline hydrolysis (as in OKATEST method) and separation in a column Acquity UPLC BEH C18 (2.1x100mm, 1.7 µm), at 45 ºC, with a binary gradient of the mobile phase.

Toxins were detected by means of a triple quadrupole mass spectrometer Xevo TCMS (Waters, Barcelona, Spain) with an ESI interface, which was operated in negative mode. The following parameters were used for detection: 3 kV capillary voltage, 350ºC desolvation temperature, 850 L/h N2 flow, 50L/h cone gas flow and 30 V cone voltage. Two transitions were used: m/z 803.5>255.2 (collision energy = 46 eV) for quantification and m/z 803.5>113 (collision energy = 96 eV) for confirmation.

OKATEST method

Methanolic extracts from LC-MS/MS analysis were subjected to an alkaline hydrolysis with NaOH, during 40 min, 76 ºC to detect all forms of OA and DTX2. All samples were analyzed by duplicate. Absorbance of samples and standards were read at 405 nm in a microplate Spectrafluor MT (Tecnos Diem Ibérica SL).

Statistical method

Model comparison and group comparisons were carried out by standard major axis regression with the lmodel2 package (R).

RESULTS AND DISCUSSION

When all data are used, a good linear correlation was obtained between both methods (r^2=0.92), although, in general, toxicity levels estimated with Okatest were higher than those obtained with LC-MS/MS.

Nevertheless, when the regression lines were estimated for each treatment, the slopes were significant, close to 1 (1.08) and not significantly different between them. In such a case, the regression lines only differ in elevation (Fig 1). This indicates that, steaming has a systematic positive effect (mostly independent of the toxicity level) on the response of OKATEST or an equivalent negative effect on LC-MS/MS.

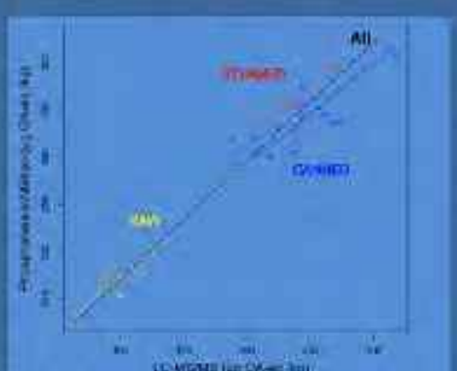


Figure 1. Linear regressions of estimated toxicities by LC-MS/MS and OKATEST

Table 1. Parameters of the linear regressions of toxicities estimated by LC-MS/MS and OKATEST for all the measurements and for each step of the canning process

Treatment	Elevation	Slope	R-squared
Raw	64.12	1.08	0.87
Steamed	102.94	1.08	0.46
Canned	74.78	1.08	0.86
All	45.46	1.26	0.93

Table 2. Statistical significance of the differences of regression line between treatments

Treatment	Raw	Steamed	Canned
Raw	-	[illegible]	>0.1
Steamed	[illegible]	-	<0.01
Canned	>0.1	<0.01	-

REFERENCES

COMMISSION REGULATION (EU) No 15/2011 of 10 January 2011amending Regulation (EC) No 2074/2005 as regards recognised testing methods for detecting marine biotoxins in live bivalve molluscs.

EFSA Panel on Contaminants in the Food Chain (2009). Statement of the Panel on Co-occurrence in the Food Chain on a request from the European Commission on the influence of processing on the levels of lipophilic marine biotoxins in bivalve molluscs. The EFSA Journal, 1016, 7-11.

Gerssen, A., Mulder, P. P. J., McElhinney, M. A., & de Boer, J. (2009). Liquid chromatography-tandem mass spectrometry method for the detection of marine lipophilic toxins in bivalve shellfish. J Chroma, 1216, 1421-1430.

Picot, C., Dewar, G., Durand, G., Wendelin, M., Pavan-Meurin, D., & C. Bouzan, A. (2012). Okadaic Acid, Okadaic Acid and Scientific Interspecies Variability in Concentration and Cooking Effects. Food and Public Health, 2(1), 50-57.

Reguera, J., Rodríguez, V. E., Alvarez, V., & Martín, J. (2011). Automated on-line solid phase extraction coupled to liquid chromatography tandem mass spectrometry for determination of okadaic acid in shellfish. Food Chemistry, 126(2), 540-548.

EU-harmonised SOP for determination of lipophilic marine biotoxins in molluscs by LC-MS/MS/MS.

J Blanco, P Arévalo, C Porro, MC Porro, AG Cabado, JM Vieites, A Moroño. Effect of the industrial steaming on the toxicity estimated in LC-MS/MS, of mussels exposed for a long time to diarrhetic shellfish poisoning (DSP) toxins. Food Chemistry 177 (2015) 243-249.

Acknowledgments

This work was supported by Intecmar (Consellería do Medio Rural e do Mar, Xunta de Galicia), the Ministry of Economy and Competitiveness of Spain AGL2012-40185-C02-02 (Tools in this project) and INDITI (INTERCONECTA Galicia 2013 Stellax project ITC-20133012).

Autoría: Otero, J.; Bañón, R.; Filgueira, F.J.; Juncal, L.; Ribo, J.R.; Iglesias, R.A.; Fernández, J.; Otero, X.; Cerdeira, J.D.; Teijeiro, O.E.; Rodríguez. L.M.; Febrero, F.; Alcalde, A.; Solís, L., Barreiro, B.; Simón, A.; Conde, L., Gómez, D.; Abella, E.; Poza, G.; Guimarey, S.; Pereira, S.; Mariño, C.; López, M.C.; Fernández, A.; Fariña, J.A.; Penas, E.; Briones, M.; Meléndez, M.I.; García, A.; de Coo, A.

Título: A presencia e a súas posibles repercusións da especie exótica marina *Rapana venosa* (Valenciennes, 1846) na Ría de Arousa

Evento: XVIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2015

ESPECIES-MARIÑAS-EXÓTICAS-INVASORAS-GALICIA

INTRODUCCIÓN

Rapana venosa é un gasterópodo pertencente à familia Muricidae, e provinte do Oceano Pacífico oeste: Mar de Xapón, Mar Amarelo e Mar da China.
Nembargantes, extendeuse primeiramente polo Mar Negro en 1947 e despois polo Mar Mediterráneo oriental, e posteriormente por diversas zonas do Oceano Atlántico como a Bretaña Francesa (1997), Mar do Norte (2005), e Costas de EEUU (1998), Arxentina e Uruguai (1999).
R. venosa é unha especie cunha alta capacidade colonizadora, e o impacto ecolóxico sobre poboacións nativas de bivalvos pode ser moi elevado, podendo incluso causar a desaparición de poboacións locais enteiras (Zolotarev, 1996).

ACTIVIDADES

As tarefas fundamentais en relación a este depredador exótico se centraron en:

1.-RECOLLIDA DOS EXEMPLARES SUMINISTRADOS POLO SECTOR E ASISTENCIAS TÉCNICAS. PARA FACILITAR ESTA CONCIENCIACIÓN SE EDITARON CARTEIS E SE MANTIVERON REUNIÓNS CON DIVERSAS CONFRARÍAS E ORGANIZACIÓNS.

2.- REVISIÓN DOS DOCUMENTOS E BIBLIOGRAFIA SOBRE A PERIGOSIDADE E EFECTOS NEGATIVOS DESTA ESPECIE.

A presencia e a suas posibles repercusións da especie exotica marina Rapana venosa (Valenciennes, 1846) na Ria de Arousa

Otero, J.(3), Bañón, R. (1), Filgueira, F.J.(1), Juncal, L.(1), Ribs, J.R.(1), Iglesias, R.A.(2), Fernandez, J.(2), Otero, X.(2), Cordeira, J.D.(2), Teixeiro, O.E. (2), Rodriguez, L.M.(2), Febrero, F.(2), Ana Alcalde, A.(3), Solís, I. (3), (3), Barreiro, B.(3), Simón, A.(3), Conde, I. (3), Gómez D.(3), Abella, E. (3), Poza, G.(3), Guzmarey, E.(3), Pereira, S.(3), Mariño, C.(3), Lopez, M°.C.(4), Fernández, A.(4), Fariña, J.A.(4), Penas, E.(4), Briones, M.(4), Isabel Melendez, M.I.(4), García, A. (4), De Cos, A. (4)
1-UTPB, 2-Biolog@ de Zona, 3-Asistencias técnicas Confrarias, 4-CIMA

RESULTADOS

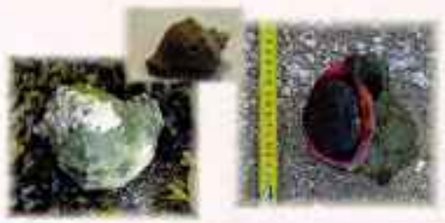
Ata o momento rexistráronse 6 individuos adultos vivos e a cuncha dun individuo xuvenil, todos na Ría de Arousa. A primeiro achado existente é do ano 2003 (Bañón & Otero, 2014): dous individuos adultos en posición de cópula. Observacións por orde cronolóxica:

CAPTURAS XA DOCUMENTADAS :

- 2003: dous individuos adultos en actitude de cópula (Bañón R. & Otero J., 2014)
- 2005 Un individuo adulto (Trigo & Vieites, 2013)
- 2007: Un individuo en unha corda dunha batea mexilloeira (Rolán & Bañón, 2007)

CAPTURAS NOVAS :

- 2013. Un individuo capturado con trasmallos nas Illas Malveiras- Parque Nacional Illas Atlanticas-Cortegada
- 2015: Un individuo capturado con Trasmallos (Otero J.). Permanece nas instalación do CIMA para o estudio do deu comportamento.
- 2015: unha cuncha dun xuvenil recollida nunha praia marisqueira intermareal de O Grove (Otero J.)



CONCLUSIÓNS

Estamos diante dun depredador moi importante e cunha gran capacidade expansiva ver mapa de expansión en Mar Negro e cartels da Facultade de Ciencias de Uruguai e o Indep de Buenos Aires, pola expansión desta especie no Mar del Plata.

Esta situación perigosa vese reforzada por 3 aspectos :
- Aseguir individuos adultos a xuvenil que implica posibilidade de crecimento en nosas augas
- Individuos adultos en postura de copula e as suas implicacións na posible reprodución
- Localización en varias zonas da ría de Arousa expedindo unha expansión real e varias vías de entrada.

Todo iso, obrigaría á realización dun programa específico de investigación e estratégias de control dunha especie tan perigosa.

Autoría: de Coo, A. *et al*

Título: Estudo das especies exóticas nas augas costeiras e rías de Galicia: avaliación da súa distribución e abundancia, das súas repercusións ambientais e socioeconómicas, e medidas de prevención e protección

Evento: XVIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2015

ESPECIES MARINAS EXOTICAS INVASORAS GALICIA

INTRODUCCIÓN

OBXETIVOS

ESTUDIO DAS ESPECIES EXÓTICAS PRESENTES NAS AUGAS COSTEIRAS E RÍAS DE GALICIA: AVALIACIÓN DA SÚA DISTRIBUCIÓN E ABUNDANCIA, DAS SÚAS REPERCUSIÓNS AMBIENTAIS E SOCIOECONÓMICAS E MEDIDAS DE PREVENCIÓN E PROTECCIÓN

PERSOAL PARTICIPANTE

RESULTADOS ACTUAIS

Autoría: García, A.; Bañón, R.; Filgueira, F.J.; Juncal, L.; Ribó, J.R.; Fernández, J.; Iglesias, R.A.; Otero, X.; Cerdeira, J.D.; Teijeiro, O.E.; Rodríguez, L.M.; Febrero, F.; Alcalde, A.; Solís, L.; Otero, J.; Barreiro, B.; Simón, A.; Conde, L.; Gómez, D.; Abella, E.; Poza, G.; Guimarey, S.; Pereira, S.; Mariño, C.; Lopez, M.C.; Fernández, A.; Fariña, J.A.; Penas, E.; Briones, M.; Meléndez, M.I.; de Coo, A.

Título: Últimos datos de *Bolinus brandaris* (L., 1758) i *Hexaples trunculus* (L., 1758) e a súas repercusións ambientais e produtivas en Galicia

Evento: XVIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Año: 2015

ESPECIES-MARIÑAS-EXÓTICAS-INVASORAS-GALICIA

INTRODUCCIÓN

Hexaplex trunculus (Linnaeus, 1758) e Bolinus brandaris (Linnaeus, 1758), son dous especies orixinarias do Mediterráneo e Atlántico norte, desde Marrocos (Tánger) ata o sur de Portugal (Cascais) (Ocuart, 2001). Introducido en Galicia probablemente nos anos 80, con poboacions estables polo menos desde o 2007, posiblemente antes (Bañón et al., 2009).

Dada a importancia do seu asentamento en augas da Ensenada do Grove o pasado ano 2014 expusemos neste Foro, Bañón, R.(1), Otero, J.(3) e De Coo, A. et all, diversos aspectos destas especies e a gravidade coxunta dos impactos que pode provocar, así como unhas primeiras ideas que permitiran o seu control e reducción/erradicación en augas de Galicia.

Na presente comunicación, pasamos a mostrar algúns datos e iniciativas desenvolvidas ao redor das mencionadas especies este ano en curso.

ACTIVIDADES

As actividades desenvolvidas este ano centráronse en:

- Un mellor coñecemento das súas costumes alimentarias, mediante diversas experiencias nos acuarios do Cima.
- Elaboración das mostraxes da UTPB para concretar zonas onde se esta expandindo en Galicia
- Distribución xeográfica e número de postas na enseada do Grove
- Primeira avaliación dunha pequena experiencia de Control/Redución/Erradicación destas especies na enseada do Grove.
- Revisión parámetros poboacionais

Ultimos datos de Bolinus brandaris (L., 1758) i Hexaples trunculus (L., 1758) e a suas repercusions ambientais e productivas en Galicia.

García, A.(1), Bañón, R. (1), Filgueira, F.J.(1), Janzal, L.(1), Ribo, I.R.(1), Fernández, L.(2), Iglesias, R.A.(2), Otero, X. (2), Cerdeira, J.D.(2), Tejeiro, O.E. (2), Rodríguez, L.M.(2), Febrero, F.(2), Ana Alcalde, A.(3), Solís, I. (3), Otero, J.(3), Barreiro, B.(3), Simón, A.(3), Conde, J. (3), Gómez D.(3), Abella, E. (3), Paes, G.(3), Guimaraes, S.(3), Pereira, S.(3), Murillo, C.(3), Lopez, Mª.C.(4), Fernandez, A.(4), Furiña, J.A.(4), Penas, F.(4), Brierton, M.(4), Isabel Melendez, M.I.(4), De Coo, A. (4)

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RESULTADOS

As especies de mariscos aquí estudadas aceptan unha gran variedade de presas : bivalves, cefalopodos, peixes e crustaceos. Tañen estratexias definidas para extraer os bivalves.

Dos datos disponibles pódese decir que estas especies estan expandindose a outras rias: Vigo e Pontevedra e dentro da ría de Arousa.

Das mostraxes realizadas (Mapa anexo) concluíse que estas dúas especies teran (de forma coxunta) varias postas en toda a enseada do Grove

A proba extractiva de erradicación acordada entre a Cofradía do Grove, Consellería do Medio Rural e do Mar e empresa SEAGA, desenvolvense (ver dibuxo seguinte) nun total de 15 días, estraíndo unhas 300 postas e sobre 100.000 exemplares de Hexaplex e Bolinus.

Dos diversas publicacións e os resultados parciais nosos, Hexaplex e Bolinus presentan un crecemento bastante rápido e unha mortalidade reducida.

CONCLUSIÓNS

En primeiro lugar apuntar o perigo destas especies exóticas tanto polo amplo abanico de presas ás que poden acceder como polo seu relativo rápido crecemento, mortalidade baixa e estratexia reprodutiva. Neste mesmo terreo é necesario valorar esa expansión detectada noutras rias e zonas.

Ainda que (na parte positiva) da experiencia actual parece que a súa distribución xeográfica e o seu asentamento esta limitada por tres factores : (1) presenza de ceba: zoostera mariña, (2) ausencia de forte ondada e reclusión a zonas protexidas e (3) non existencia de fortes caudais de auga doce.

De todo o anterior, dado o seu forte impacto ambiental, cabería planificar o traballo dos seguintes anos en delimitar mellor esas zonas de posible asentamento e o nivel de desenvolvemento poboacional en cada unha delas.

Por outra banda, comprobouse que realizar plans de extracción de postas e os individuos maduros que se agrupan nas mesmas é factible e de elevados resultados. Sería pois necesario realizar unha planificación detallada dos próximos traballos desta extracción a fin de alcanzar un maior efecto sobre estas poboacións de especies invasoras

Autoría: Linares, F.; Rodríguez, J.L.; Peleteiro, J.B.; Cal, R.; Martínez, J.M.; Pazos, G.; Álvarez-Blázquez, B.

Título: Influence of broodstock nutrition of wreckfish (*Polyprion americanus*) on the oocytes fatty acid composition

Evento: Aquaculture Europe 16

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Ano: 2016

INFLUENCE OF BROODSTOCK NUTRITION OF WRECKFISH *(Polyprion americanus)* ON THE OOCYTES FATTY ACID COMPOSITION

F. Linares* | J. L. Rodriguez | J. B. Poleteiro | R. Cal | J.M. Martinez | G. Pazos | B. Alvarez-Blazquez

Introduction

Nutritional requirements of wreckfish are unknow so far and there are only a few references related to feeding behavior from commercial caught (Erick Peres & Holmes, 2003) and feeding rates in captivity (Papaconstantinou et al., 2004). Recently some studies were done about composition of wild wreckfish (Bernardi et al., 2011; Linares et al., 2013). The optimum development of broodstock diets for wreckfish will be essential for the future of the aquaculture of this species. Dietary lipids and specially fatty acids play a critical role in the successful production of high-quality gametes and eggs of marine fish (Izquierdo et al., 2000; Sargent et al., 2002).

The aim of this work is providing information about the influence of the feeding of wreckfish broodstock on oocytes composition with the aim of knowing the relationship of broodstock feeding on fecundity and oocyte quality.

Material and methods

From December 2012 to December 2013, two different diets, Semi-moist diet and a "new dry food" were supplied to two different batches of the Instituto Español de Oceanografía (IEO) wreckfish broodstock and tested. 11 (6 wreckfish (3 females and 2 males) feeding with commercial diet; 52 (4 wreckfish (3 females, 1 male and 2 undetermined) feeding with the "new dry food".

The semi-moisture diet was a mixture of 14,8% white fish, 14,8% oily fish, 13% mussels, 17,0% squid and 34,8% fishmeal. The "new dry food" formulated by Skretting SL, and University of Las Palmas of Gran Canaria has 50% of fish meal, 12,5% of squid meal and 6% of krill meal. Samples of oocytes were taken out from two different females of broodstock fed with commercial diet (S1) and new dry feed (S2). Total lipids and fatty acids of commercials diet and dry feed were carried out. Fatty acid analysis of oocytes from females fed with the two diets were performed. All the analyses were done in triplicate and values are reported as mean ± std. (Tables 1 and 2).

Lipids (%DW) / Fatty acids (%)	Semi-moist diet 52	Dry feed 17,3±0,33
ΣSFAs	29,96±1,18[a]	24,68±0,22[b]
ΣMUFAs	41,81±0,71	31,83±0,71
ARA	1,25±0,26[a]	9,06±0,05[b]
EPA	4,50±0,63[a]	6,61±0,21[b]
DHA	15,81±1,16	16,57±0,32
ΣPUFAs	28,23±2,05[a]	44,72±0,37[b]
Σn-3	25,40±1,57	27,91±0,43
Σn-6	2,56±0,56[a]	16,82±0,07[b]
n-3/n-6	9,97±0,24[a]	1,66±0,03[b]

Table 1. Lipid and fatty acid composition (%DW) of semi-moist diet and dry feed

Fatty acids (%)	Oocytes S2	Oocytes S1
ΣSFAs	23,12±0,88[a]	25,09±0,79[b]
ΣMUFAs	32,43±0,86	31,69±0,46
ARA	3,75±0,17[a]	3,72±0,23[a]
EPA	7,60±0,03[a]	6,91±0,31[b]
DHA	26,33±1,07	27,92±1,06
ΣPUFAs	44,45±1,62[a]	42,22±1,34[b]
Σn-3	38,62±1,51[a]	39,18±1,36
Σn-6	5,83±0,23[a]	2,86±0,59[b]
n-3/n-6	6,86±0,32[a]	13,81±0,44[b]

Table 2. Oocytes fatty acid composition from two females fed with commercial diet and dry feed

Results and Discussion

Both diets (Table 1, semi-moisture and dry diet, have 17% of lipids (%DW). Semi-moisture diet has 28,3% of PUFA (%total fatty acids), 30% of SFA, 41,8% of MUFA, 6,8% EPA, 16% of DHA and 1,2% of ARA. The fatty acid profile of dry feed showed 44,7% of PUFA, 24,6% of SAFA and 30,8% of MUFA. EPA, DHA and ARA represent 6,6%, 16,7% and 9% of the total fatty acids, respectively. Fatty acid profiles of oocytes from two different females fed with commercial diet (S1) and dry food (S2) are shown in Table II.

Some significant differences were observed among oocytes fatty acid content from S1 and S2 females. SFAs are higher in oocytes S1 than in oocytes S2 while PUFA content has higher values (47% of total fatty acids) in S2 than in oocytes S1 (44%) due to the high amount of n-6 PUFA found in oocytes S2. In the main fatty acids is noticeable the differences observed in ARA content which is significantly higher in oocytes S2 (3,7%) than in oocytes S1 (2,8%).

Conclusion

Data shown in this paper contribute to characterize the fatty acid profile of oocytes from wreckfish females and to know the relationship between broodstock nutrition and oocytes composition showing there is a clear relationship between the fatty acid profile of the broodstock feeding and the fatty acid composition of oocytes from females fed the new diet and semi-moist feed.

Sampling of oocytes

References

Linares F., J.L Rodriguez, J. B Poleteiro, R. Cal, G. Pazos and B. Alvarez-Blazquez. Biochemical composition of wild wreckfish (Polyprion americanus) (2013).

Aknowledgements

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Título: Gene expression in *Ruditapes philippinarum* haemocyte in response to natural infection with *Perkinsus olseni*

Evento: 4th International Symposium in Aquaculture GIA

Lugar: Atenas (Grecia)

Ano: 2016

Gene Expression in *Ruditapes philippinarum* Haemocyte in Response to Natural Infection with *Perkinsus olseni*

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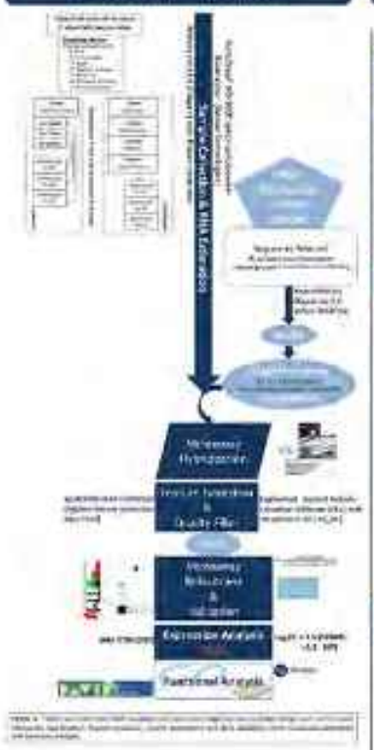
ABSTRACT

Manila clam (*Ruditapes philippinarum*) production is hindered by perkinsosis, a disease caused by the protistan parasite *Perkinsus olseni*. We carried out a gene expression analysis of haemocytes, the specialized immune defence cells, in response to this parasitosis to understand the molecular mechanisms underlying host-parasite interaction. A Manila clam oligo-microarray (Agilent Technologies) was designed using an integrated haemocyte transcriptome from our own data and previous reports. This microarray comprised of 14,621 probes representing 11,052 transcripts, most of them annotated to NCBI nr protein database (10,813; 97.8%). Haemocyte RNA was extracted from three pools, each one constituted with mixed haemocytes of naturally *P. olseni*-infected clams at different degree of infection (low, medium and high). These biological replicates were used for hybridizations. SAM (Significance Analysis of Microarray) identified 32 significant (false discovery rate, FDR 5%; fold change (FC) ≥ 1.5 and ≤ -1.5) differentially expressed genes (DEGs) of which 19 were up-regulated and 2 (e.g. defensin, apoptosis) in 13 down-regulated. Most DEGs (56%) were associated with GO terms related to metabolic and binding processes. There was up-regulation of DEGs linked to cytoskeleton organization and microtubule-based process (e.g. actin, tubulin), stress response (e.g. heat shock cognate 71 kDa, ubiquitin 8) and immune response (e.g. cathepsin, alpha-2-macroglobulin, serine-type enzyme, inhibitor of nuclear factor kappa-B protein, interferon regulatory factor 2). Results suggest that clams undertook predominantly regulation of metabolism related genes to compensate energy required for cellular homeostasis and survival after infection with *P. olseni*. This information will aid to formulate effective strategies to control perkinsosis in Manila clam.

Materials and Methods



Results and Discussion

- The greatest amount of up-regulated genes, mainly related to membrane proteins and cytoskeleton organization (Table 1, Table 2) as reported in *P. olseni* infected *R. decussatus*[1], suggests that the clams were active toward cellular homeostasis and survival processes after infection with *P. olseni*.
- Dysregulation of genes such as cytochrome P450 oxidoreductase, 7-dehydrocholesterol reductase, cytochrome P450, which response to Reactive Oxygen Species (ROS) and cell oxidation, indicating an oxidative mechanism of *P. olseni* pressure against the parasite *P. olseni*.
- Down regulation of apolipoprotein involved in lipid metabolism is likely a response to inhibit *P. olseni* proliferation by reducing level of lipid, a requirement for growth, development, and life cycle completion of Perkinsus spp. within the host cells.
- Down regulation of gene defensin may be linked to compromise immunity in the host, which is to be further elucidated. Modulation of defensin is an immediate response to invading microorganisms, and early over-expression of this gene has been reported in infected *R. philippinarum*[2], but decreased expression of defensin in this study likely reflect the chronic and latency of the parasite in the host.

Future Direction

- Functional characterization gene expression profiling of different organs such as gill, mantle, digestive gland of Manila clam *R. philippinarum* by *P. olseni* will be helpful for enriching the understanding of the present study.
- An integrative gene expression analysis of Manila clam in vivo and in vitro exposed to different infective forms (e.g. trophozoites, zoospores, zoite cells) at each step of the parasite *P. olseni* cell life cycle (PLC) will help to shed light on the molecular mechanisms of host-parasite interactions as well as clarify the host range of the parasite *P. olseni* in the habitat.

References

1. Villalba, A., Reece, K. S., Ordás, M. C., Casas, S. M., & Figueras, A. (2004). Perkinsosis in molluscs: a review. Aquatic Living Resources, 17(4), 411.
2. Allam, B., Paillard, C., Auffret, M., Ford, S. E., Lacoste, A., Choquet, G., Moreau, K., Moreau, P., Maguire, C., Reinisch, C., & Nicolas, J. L. (2006). Transcriptomic approaches and molecular characterization of the Manila clam, *Ruditapes philippinarum*, immune cells. Fish & Shellfish Immunology, 20(4), 496–511. https://doi.org/10.1016/j.fsi.2005.06.007
3. Costa, M.M., Allam, B., Magalhães, L., Lima, M.R., Ramos, C., Vieira, R., Figueras, A. (2012). Transcriptional characterization of immune-related genes in the Manila clam *Ruditapes philippinarum* challenged with *Perkinsus olseni*. Fish & Shellfish Immunology, 33(3), 578–587. https://doi.org/10.1016/j.fsi.2012.06.008
4. Moreira, R., Balseiro, P., Planas, J. V., Fuste, B., Beiras, R., Fernández-Tajes, J., Gomez-Tato, A. (2015). Dual-species transcriptome analysis reveals multiple variants of host immune response and gene expression plasticity in the Manila clam infected with *Perkinsus olseni*. PLOS ONE, 10(3), e0120624. https://doi.org/10.1371/journal.pone.0120624
5. Tirado-Garcia, M., Insua, D., Garcia, R., Figueras, A. (2008). Infection and transmission cycle of Perkinsus olseni (Perkinsozoa: Perkinsida) in the Manila clam *Ruditapes philippinarum* (Bivalvia: Veneridae). Parasitology Research, 103(1), 1–9. https://doi.org/10.1007/s00436-008-0918-6
6. Moreira, R., Fernández, B., Martín, R., Arias, M., Azevedo, C., Pardo, B. G., Martínez, P. (2012). An analysis of novel expressed sequence tags in gonad tissue of the Manila clam *Ruditapes philippinarum*. Animal Genetics, 43(6), 744–748. https://doi.org/10.1111/j.1365-2052.2012.02332.x

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Título: Infection with a haplosporidan-like protist detected in the main production area of *Cerastoderma edule* in Galicia (NW Spain)

Evento: 18th International Conference of the European Association of Fish Pathologists.

Lugar: Belfast (Reino Unido)

Ano: 2017

XUNTA DE GALICIA
CONSELLERÍA DO MAR

Infection with a haplosporidan-like protist detected in the main production area of *Cerastoderma edule* in Galicia (NW Spain)

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Introduction

The common cockle (*Cerastoderma edule*) was the main commercial bivalve species harvested by Galician shellfishers, in terms of quantity, until the incursion of *Marteilia cochilia* in 2012 causing a lethal disease that collapsed the production in some rias. Nowadays, the most productive Galician area is the Ria of Noia, where no marteiliosis outbreak has been recorded and, thus, zoosanitary surveillance has been strengthened.

Material and methods

Since 2012, samples of common cockles were collected from Ria of Noia (Galicia – NW Spain) once a year for the monitoring programme of the INTECMAR and bimonthly for the research programme of the CIMA. A flesh portion including digestive gland, gills, gonad, kidney and mantle was excised and processed for histopathological analysis. Histological sections were examined for the detection of parasites and pathological conditions.

Results

Prokaryote-like colonies, renal coccidians, gregarines, ciliates, turbellaria, and some copepod were observed without causing host damage. Trematode larvae were also observed – metacercariae and digenean sporocysts containing cercariae - causing host damage, especially the sporocysts, but without serious consequences at population level due to low prevalence. Disseminated neoplasia and granulomatosis were also observed at low prevalence.

The most relevant pathology was the **heavy haemocytic infiltration** observed in digestive gland associated with **haplosporidan-like stages** found in the connective tissue. Uni and bi-nucleated cells (around 5 µm in length) were the most frequent stages, although elongated plasmodia with few nuclei (3-4) were also observed. Sporogonic stages were not detected and abnormal high cockle mortality was not claimed by shellfishers.

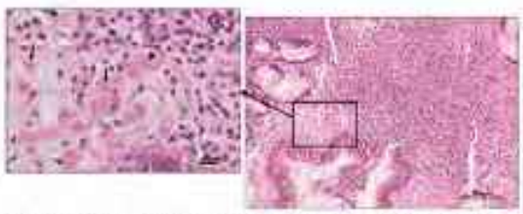

Figure 1.- Heavy haemocytic infiltration in digestive gland of *C. edule* associated with haplosporidan-like stages and detail of uni and bi-nucleated cells (arrows) and plasmodia with three nuclei (arrow head).

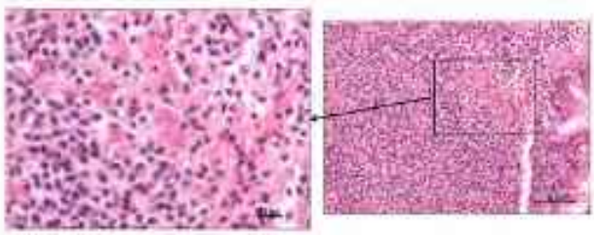

Figure 2.- Heavy haemocytic infiltration in digestive gland of *C. edule* associated with haplosporidan-like stages

These plasmodia were smaller than those of the two haplosporidan species reported in *C. edule* in Galicia thus far, *Haplosporidium edule* and a *Minchinia mercenariae*-like parasite, and they were only observed in the connective tissue of the digestive gland.

The intensity of the haemocytic reaction associated with the haplosporidan-like infection was variable, being heavy in some individuals of various samples (Figs. 1 &2). The infection prevalence was also variable, ranging from 0 to 100%; the highest value was recorded in the last sample, November 2016 (Fig. 3).

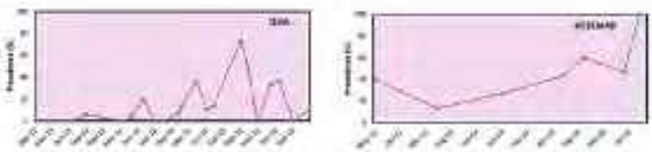

Figure 3.- Prevalence of the haplosporidan-like parasite in the samples analysed in CIMA and in INTECMAR

Conclusions

The most important area of common cockle production in Galicia, Ria of Noia, is not affected by marteiliosis outbreaks but the infection with a haplosporidan-like protist, causing evident host damage, could be considered a threat.
Further studies are needed to identify the parasite and to evaluate its effects at individual and population levels.

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Título: Parásitos y enfermedades de *Nassarius reticulatus* y su rol como trasmisores de enfermedades a los bivalvos comerciales

Evento: XVI Congreso Nacional de Acuicultura

Lugar: Zaragoza - Aragón (España)

Ano: 2017

XUNTA DE GALICIA
CONSELLERÍA DO MAR

CIMA

Parásitos de *Nassarius reticulatus* y su rol como transmisores de enfermedades a los bivalvos comerciales

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Introducción

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Material y métodos

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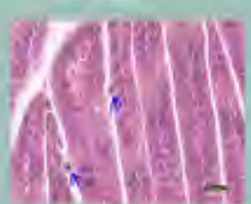

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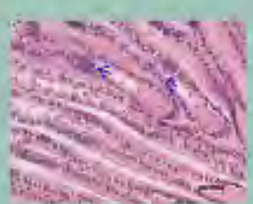

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Resultados y conclusiones

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Bibliografía

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Agradecimientos

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Autoría: Blanco, J.; Arévalo, F.; Moroño, A.; Corre, J.; Muñiz, S.; Mariños, C.; Martín, H.

Título: Presence of azaspiracids in bivalve molluscs from Northerm Spain

Evento: Marine and Freshwater Toxins Analysis. 6th International Symposium

Lugar: Baiona - Galicia (España)

Ano: 2017

Presence of azaspiracids in bivalve molluscs from Northern Spain

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Abstract

Low concentrations of azaspiracids have been found in bivalve molluscs all over the Northern and Northwestern coast of the Iberian Peninsula. The detections started in June 2016 and lasted until March 2017. The observed toxin profile was dominated by AZA2, followed by AZA1 and some other AZAs that were detected only in some samples. Some compounds producing fragments characteristics of AZAs but that do not fit with any of the known ones were also found. The causative agent has not been identified but, in sight of the toxin profile in the bivalves, it seems that it should be a new species or strain. The detections of AZAs in bivalves in the Northern Coast was linked to downwelling or upwelling in relation and, in the Galician Rías, took place (with only a few exceptions) in the outer (more oceanic) part, suggesting that the responsible species develops at the open sea and that the populations are advected to the shore.

Introduction

- In the Iberian peninsula AZA presence was reported in 2003 after analyzing a single mussel sample obtained from the Ría de Vigo (Galicia, NW Spain). Toxin profile, very close to that from Ireland and Norway, dominated by AZA1.
- Up to the end of 2016 (data in this study) no Azaspiracid was detected in bivalves or seawater.
- In 2006, after being monitored since 2002, AZA1-3 were found in bivalves from the Portuguese coast. Toxin profile dominated by AZA2, instead of AZA1. AZA concentrations very low, 6 to 0.1 µg kg^{-1}.
- Also in 2006, azaspiracids were found in several bivalves from the coast of Huelva (SW Spain). Toxin a profile characterized by the dominance of AZA2. *Angelicoma longusta* was found to be the AZA producer species in that epizootic and a new azaspiracid, AZA 43, which is isobaric with AZA2 and has a very similar chromatographic retention time, was found.
- In this work, a number of detections of azaspiracids in samples from the official monitoring programme of bivalve production areas (areas with natural beds or shoe for the cultivation) of the Atlantic and Cantabrian coast of Spain, from Portugal to France are described.

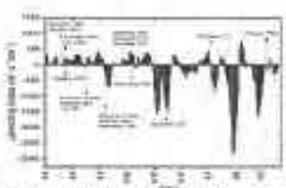
Material and methods

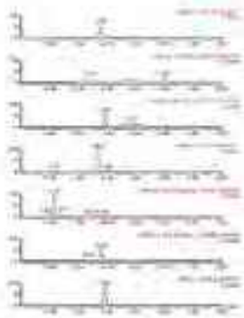
Samples

Results

- June 2016 AZA2 detected in *Mytilus galloprovincialis* from the Basque Country (Mutriku) and Galicia (Ribadeo and Foz).
- Since then to March 28th 2017, AZA2 detected in the Galician, Cantabrian and Basque coast.
- AZA2 detected from different locations and bivalves, initially from the Cantabrian sea and after 13 weeks from the Atlantic coast.

- AZA2 was the most abundant AZA of the three AZAs monitored (AZA1-3).
- Its concentration was always very low (maximum around 3 µg kg^{-1}).
- In routine analysis only solidum, traces of AZA1 were detected.
- In the samples used to screen the presence of other AZAs, peaks corresponding to the transitions of AZA2 and AZA37 were found in all cases. A number of other AZAs could also be present in sight of the transitions monitored, some of them could correspond to dialfish metabolites (AZA6) but others to AZAs of phytoplanktonic origin (AZA 1, 11, 43) (Fig. 2).
- The analysis of the concentrated samples confirmed the presence of AZA2 in all samples, AZA1 in most of them, AZA3 in the mussel samples and also trace amounts of AZA 43, AZA3 and AZA43 in some cases.
- Two peaks corresponding to AZA43 and other two to AZA3 were also found, one of them (for each compound) with the expected retention time but the others eluting significantly earlier. The products of five specific transitions for each of them were detected (Fig. 3).
- The detection of azaspiracids in the Cantabrian Sea took place mostly during periods of upwelling relaxation or downwelling (Fig. 4). In the Rías Baixas this was not always the case and approximately the same amount of detections were made during upwelling and downwelling periods. In the Rías, azaspiracids were mostly detected in their outer part (Fig. 5).





Conclusions

It seems that in the North and Northwestern coast of the Iberian Peninsula the risk of azaspiracid poisoning is not negligible. The AZA-producing species in the area was not identified but the toxin profile in bivalves did not fit any of the known species/strains, thus suggesting that the agent is a new one (species or strain). Additional efforts should be carried out in order to identify the producer of these toxins in the studied area and to confirm the presence of new toxins of the group.

The development of the causative species seems to take place offshore and consequently the maximum risk takes place during upwelling relaxation or downwelling, especially in the Northern coast.

Acknowledgements

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References

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XUNTA DE GALICIA
CONSELLERÍA DO MAR

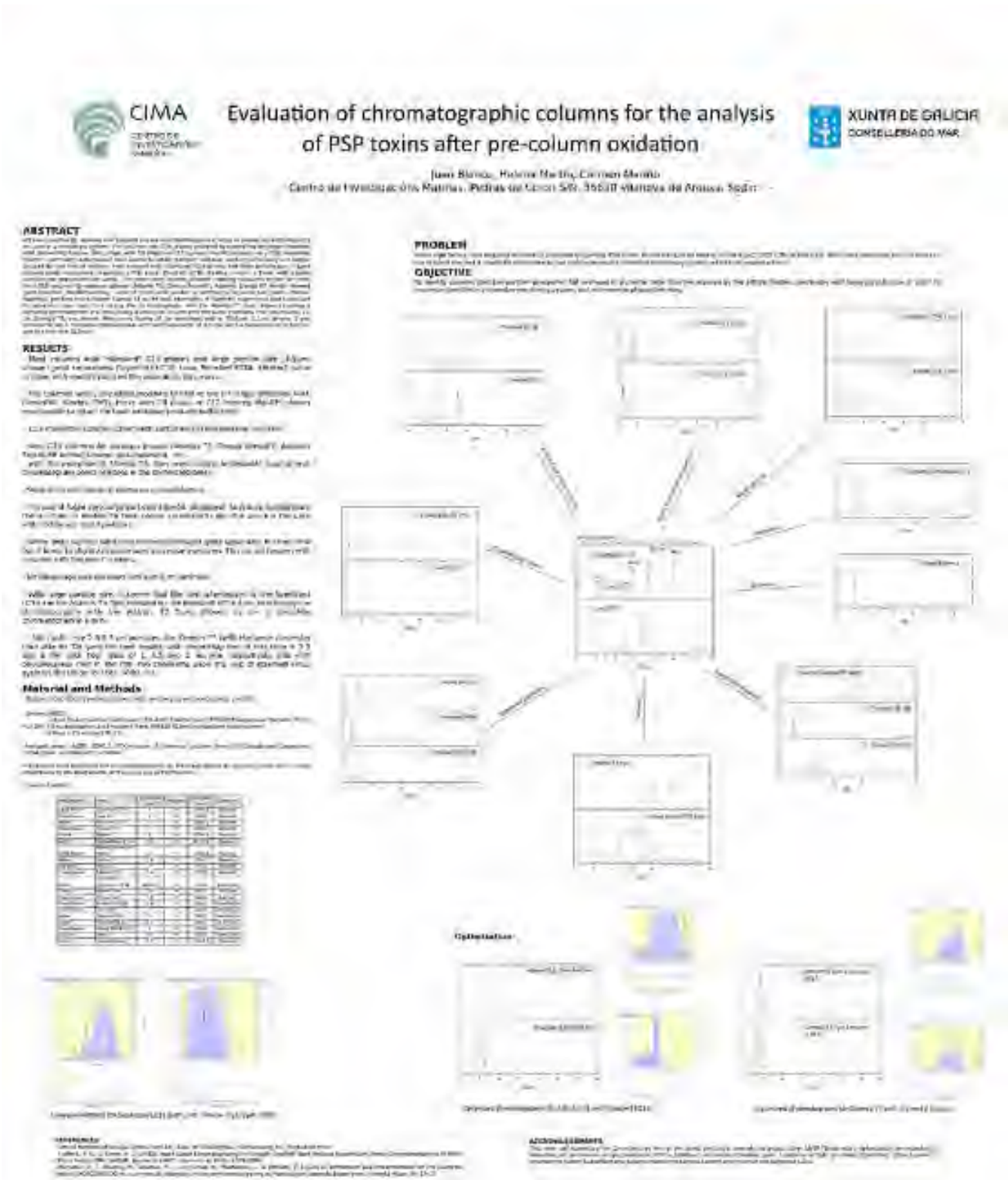
Autoría: Blanco, J.; Martín, H.; Mariño, C.

Título: Evaluation of chromatographic columns for the analysis of PSP toxins after pre-column oxidation

Evento: 11th International Conference on Molluscan Shellfish Safety 2017 (ICMSS)

Lugar: Galway (Irlanda)

Ano: 2017


CIMA
Evaluation of chromatographic columns for the analysis of PSP toxins after pre-column oxidation
XUNTA DE GALICIA
CONSELLERIA DO MAR
ABSTRACT
RESULTS
Material and Methods
PROBLEM
OBJECTIVE
Optimization
REFERENCES
ACKNOWLEDGEMENTS

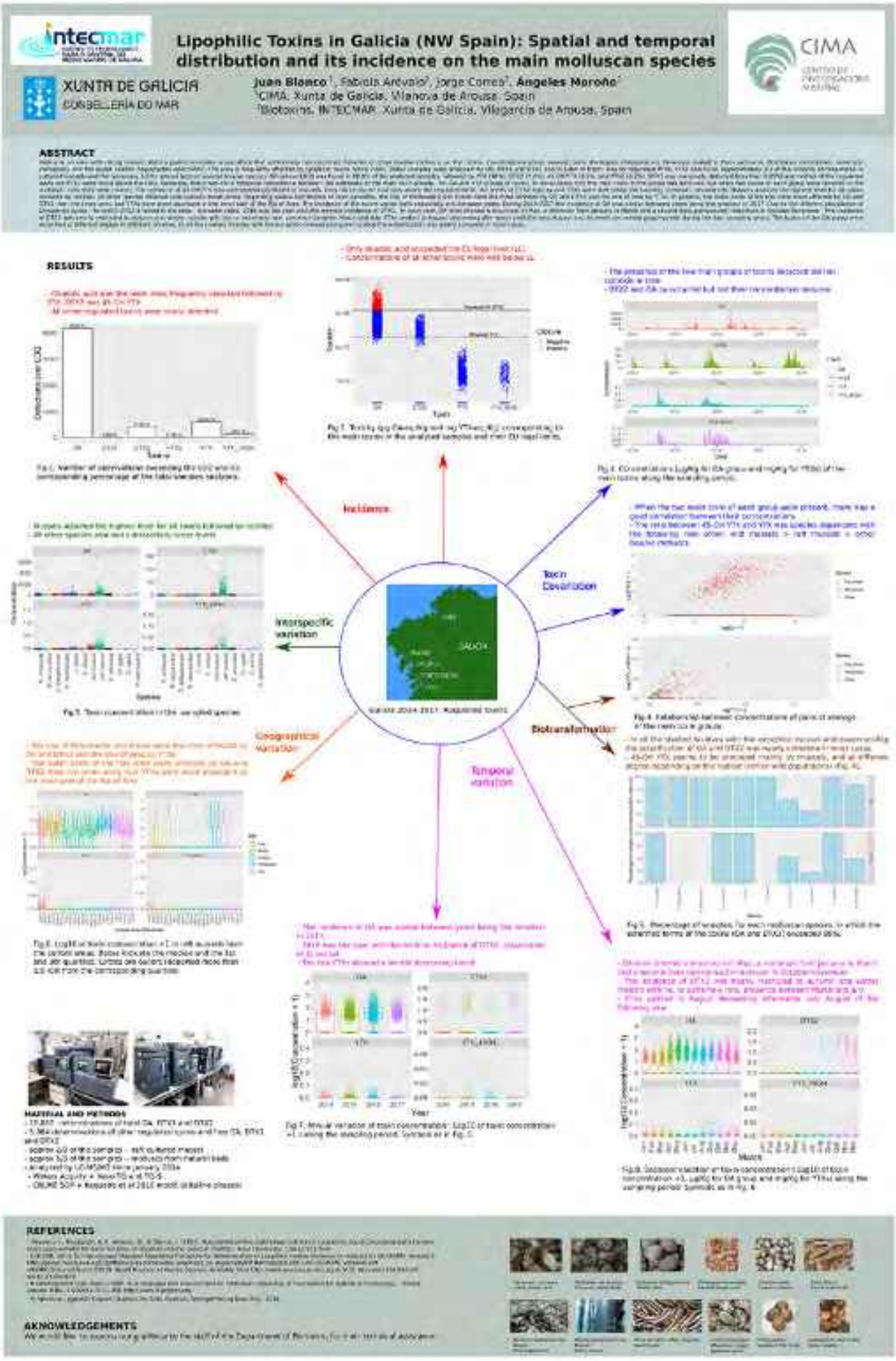
Autoría: Blanco, J.; Arévalo, F.; Correa, J.; Moroño, A.

Título: Lipophilic toxins in Galicia (NW Spain): Spatial and temporal distribution and its incidence on the main molluscan species

Evento: 8th International Conference on Harmful Algae

Lugar: Nantes (Francia)

Ano: 2018


Lipophilic Toxins in Galicia (NW Spain): Spatial and temporal distribution and its incidence on the main molluscan species
XUNTA DE GALICIA
CONSELLERÍA DO MAR
Juan Blanco, Fabiola Arévalo, Jorge Correa, Ángeles Moroño
CIMA, Xunta de Galicia, Vilanova de Arousa, Spain
Biotoxins, INTECMAR, Xunta de Galicia, Vilagarcía de Arousa, Spain
ABSTRACT
RESULTS
Incidence
Toxin Devaliation
Interspecific variation
Biotransformation
Geographical variation
Temporal variation
MATERIAL AND METHODS
REFERENCES
AKNOWLEDGEMENTS

Autoría: Linares, F.; Rodríguez, J.L.; Pazos, G.; Pérez, E.; Alvarez–Blázquez, B.

Título: Fatty acid compositon of oocytes and eggs from wreckfish (*Polyprion americanus*) females fed with different diets

Evento: 18º International Symposium on Fish Nutrition and Feeding

Lugar: Las Palmas de Gran Canaria (España)

Ano: 2018

FATTY ACID COMPOSITON OF OOCYTES AND EGGS FROM WRECKFISH (*Polyprion americanus*) FEMALES FED WITH DIFFERENT DIETS.

III International Symposium on Fish Nutrition and Feeding
Las Palmas de Gran Canaria, Spain
June 3rd - 7th, 2018

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Introduction

The optimum development of broodstock diets for wreckfish will be essential for the future of the aquaculture of this species. Dietary lipids and specially fatty acids play a critical role in the successful production of high quality gametes and eggs of marine fish (Izquierdo et al., 2001; Sargent et al., 1999). Recently some studies were done about composition of wild wreckfish tissues (Roncarati et al., 2014; Linares et al., 2018).

The aim of this work is to know the influence of wreckfish broodstock diets composition on the fatty acid composition of oocytes and eggs

Material and methods

Three broodstock diets were used: semi-moist and dry food supplied as two batches of the IEO wreckfish broodstock and hake/squid (half and half) to the IGAFA broodstock. The semi-moist diet was a mixture of sea-white fish (~40% of fish, semi-mussels, mantle squid and 3% oil). farmed. The dry food has 50% of fish meal (rich of squid meal and 10% of krill meal). Proteins, total lipids and fatty acids of the diets were carried out. Samples of oocytes and eggs were taken out by cesarean of the females. Fatty acid analyses of oocytes and eggs from females fed with the three diets were performed.

Results and Discussion

All the diets have a high amount of proteins, higher than 50%, and the lipid content is low in semi-moist diet, ca. 20% in dry food and 40% in hake/squid (Table I). Hake/squid has the highest level of polyunsaturated (PUFA), 30% of total fatty acids (TFA), while dry food has the highest level of n-6 (20%) and ARA (9%) (Table II). The semi-moist has a high level of n-3 PUFA (24% and 40% in oocytes and eggs respectively) which hake/squid was rich as well and in the case of n-3 LC-PUFA the highest values were found (>20% and >30% TFA) in oocytes and eggs from females fed with dry food (Tables III and IV).

Table I. Protein and lipid composition (%DM) of diets

	Protein	Lipid
Semi-moist diet	66.86	17.38 ± 3.45
Dry feed	56.2	3.93 ± 0.39
Hake/Squid	62.93 ± 2.3	7.89 ± 4.23

Table II. Fatty acid composition of diets (% TFA)

	Semi-moist diet	Dry feed	Hake/Squid
SaFA's	29.78 ± 1.19	27.1 ± 0.21	31.12 ± 0.43
MUFA's	38.33 ± 0.37	36.17 ± 0.11	18.26 ± 0.38
PUFA's	30.49 ± 1.53	46.09 ± 0.3	34.63 ± 0.81
Σn-3	24.40 ± 1.37	20.21 ± 0.14	19.44 ± 1.03
Σn-6	5.25 ± 0.35	16.23 ± 0.05	5.56 ± 0.01
n-3/n-6	5.35 ± 0.23	1.87 ± 0.01	13.81 ± 0.31
DHA	15.61 ± 1.15	17.84 ± 0.05	12.59 ± 1.10
EPA	6.84 ± 0.48	2.19 ± 0.1	4.37 ± 0.33
ARA	1.25 ± 0.26	5.8 ± 0.12	2.73 ± 0.01
EPA/ARA	5.43 ± 0.59	0.39 ± 0.02	2.09 ± 0.09
DHA/EPA	1.66 ± 0.25	1.15 ± 0.04	3.32 ± 0.17

SaFA's (Saturated fatty acids), MUFA's (Monounsaturated fatty acids), PUFA's (Polyunsaturated fatty acids), DHA as n-3 (Docosahexaenoic acid), EPA as n-3 (Eicosapentaenoic acid), ARA as n-6 (Arachidonic acid)

Oocytes from wreckfish females

Average 1.13 ± 0.11 mm

Eggs from wreckfish females

Average 2.00 ± 0.03 mm

Table III. Fatty acid composition of oocytes (%TFA) from females fed with different diets (n=3)

	Semi-moist diet	Dry feed	Hake/Squid
SaFA's	22.47 ± 0.61	22.17 ± 2.07	21.22 ± 1.18
MUFA's	25.96 ± 1.39	38.11 ± 4.55	33.33 ± 3.61
PUFA's	45.46 ± 1.34	45.92 ± 4.70	45.42 ± 2.29
Σn-3	36.49 ± 1.98b	31.55 ± 3.36b	41.36 ± 2.19a
Σn-6	6.34 ± 0.64b	12.32 ± 1.31a	4.06 ± 0.30b
n-3/n-6	5.90 ± 0.93b	2.55 ± 0.20c	9.65 ± 0.90a
DHA	24.80 ± 1.93ab	21.52 ± 1.99b	28.48 ± 1.84a
EPA	7.37 ± 0.94b	5.49 ± 0.35c	10.72 ± 1.13a
ARA	1.66 ± 0.36b	5.74 ± 1.31a	1.84 ± 0.06b
EPA/ARA	5.36 ± 0.18b	0.91 ± 0.20c	5.80 ± 0.46a
DHA/EPA	4.16 ± 0.69b	6.66 ± 0.10a	2.71 ± 0.36b

Table IV. Fatty acid composition of eggs (%TFA) from females fed with different diets (n=3)

	Semi-moist diet	Dry feed	Hake/Squid
SaFA's	33.28 ± 0.96b	31.65 ± 1.34b	39.39 ± 0.66a
MUFA's	24.93 ± 1.96b	44.10 ± 5.44a	28.11 ± 0.76b
PUFA's	41.79 ± 2.56b	45.02 ± 5.64a	48.50 ± 0.72a
Σn-3	36.29 ± 2.16b	32.46 ± 1.62c	42.64 ± 0.83a
Σn-6	5.32 ± 0.43b	9.79 ± 0.96a	5.34 ± 0.10b
n-3/n-6	6.93 ± 1.26b	3.56 ± 0.39c	7.75 ± 0.21a
DHA	25.76 ± 2.16b	22.75 ± 1.33b	30.17 ± 0.93a
EPA	7.21 ± 0.76b	5.74 ± 0.34c	9.22 ± 0.10a
ARA	1.46 ± 0.30b	5.12 ± 0.47a	1.41 ± 0.06b
EPA/ARA	5.26 ± 0.65b	1.14 ± 0.16c	6.64 ± 0.39a
DHA/EPA	4.92 ± 0.23b	3.98 ± 0.06c	7.99 ± 0.39a

Conclusion

There is a clear relationship between the main fatty acids composition of diets, oocytes and eggs and the ratio EPA/ARA in oocytes and eggs reflected the diet and was negatively correlated to dietary ARA content.

References

Lindero, F., J. L. Rodriguez, E. Peleteiro, R. Coll, G. Pazos and B. Alvarez-Blázquez. Biochemical composition of wild wreckfish (Polyprion americanus). EASEA.

Izquierdo, M. S., Fernández-Palacios, H. Tacon, A. G. J. 2001. Effect of broodstock nutrition on reproductive performance of fish. Aquaculture 197: 25-42.

Roncarati, A., Coppola, R., Melotti, P., Stecchi, L., Meluzzi, A. 2014. Wreckfish, Polyprion americanus (Bloch and Schneider, 1801), a promising species for aquaculture: Proximate composition, fatty acid profile and cholesterol content of wild Mediterranean specimens. Journal of Food Composition and Analysis 34: 1-6.

Sargent, J. R., Tocher, D. R., Bell, J. G. 2002. The lipids. In: Halver J. E., Hardy R. W. (Eds), Fish nutrition, 3rd ed. Elsevier USA, pp. 1-61.

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Autoría: Rossignoli, A.E.; Tudó; A.; Cañete, E.; Diogène, J.; Figueroa, R.; Bravo, I.; Ramilo, I.; Blanco, J.; Riobó P.

Título: Citotoxity of different species of the genus *Gambierdiscus* isolates in the Canary Islands

Evento: XIII Reunión Ibérica de Algas tóxicas y biotoxinas marinas

Lugar: Vigo - Galicia (España)

Ano: 2018

CITOTOXICITY OF DIFFERENT SPECIES OF THE GENUS *GAMBIERDISCUS* ISOLATED IN THE CANARY ISLANDS

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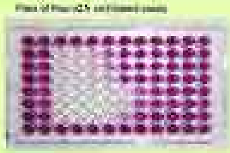
INTRODUCTION

Gambierdiscus genus include species responsible for the ciguatera syndrome, an endemic food poisoning of some tropical and subtropical zones that is acquired by the consumption of fish contaminated with ciguatoxins, which have accumulated through food webs (Parsons et al., 2012). In recent years, the tropicalization caused by climate change is causing a possible distribution of *Gambierdiscus* towards higher latitudes and may constitute an emerging problem in the Canary Islands where more than 100 cases of ciguatera have been registered in the last decade (Rodríguez et al., 2017; Bravo et al., 2015).



MATERIAL AND METHODS

Strains of five *Gambierdiscus* (*G. australes*, *G. caribaeus*, *G. carolinianus*, *G. excentricus* and *G. silvae*) species obtained from the Canary Islands have been cultured in order to estimate their toxicity.

Cells culture: In flasks of different volumes of K medium without silicates made with seawater from Ría de Vigo and salinity adjusted to 35; incubated at 25ºC and at a 12:12h L:D photoperiod.

Toxins extraction and CTXs/MTXs partition: Caillaud et al., 2010

Neuro-2a cell based assay (CBA-Neuro2A): Caillaud et al., 2012

Mouse bioassay (MBA): Banner et al., 1960 and Yasumoto et al., 1984

Solid phase extraction: Strata FL-PR Florisil (170 µm, 80 Å) cartridges 500 mg/6mL. Eluate collected with Acetone:methanol (7:3), dried under N2 gas and redissolved in methanol.

LC-MS/MS: Acquity BEH C18 (2.1x100mm, 1.7µm) column. Gradient as Yogi et al. 2014. Flow rate 0.4 µL/min. TSQ Quantum, Positive ion mode using SRM with Na+ adduct.

Strain	Specie	Origin	Ciguatoxin Concentration
VGO1366	G. silvae	La Gomera (Valle del Rey-Ch. Condesa)	17.10 ± 1.87 fg/cell eq
VGO1367	G. silvae	La Gomera (Valle del Rey-Ch. Condesa)	31.95 ± 2.87 fg/cell eq
VGO1368	G. silvae	La Gomera (Valle del Rey-Ch. Condesa)	32.10 ± 0.24 fg/cell eq
VGO1367	G. caribaeus	La Gomera (San Sebastián-Pl. La Cueva)	It is not possible to quantify (100% mortality without ouabain/veratridine)
VGO1368	G. caribaeus	La Graciosa (Pto. Pl. Santiago)	Negative (LOD < 1.70 fg/cell eq)
VGO1166	G. australes	Los Abrigos, Tenerife	It is not possible to quantify (100% mortality without ouabain/veratridine)
VGO1369	G. australes	La Gomera (Valle Rey-Ch. Condesa)	It is not possible to quantify (100% mortality without ouabain/veratridine)
VGO1350	G. excentricus	La Gomera (Valle Rey-Ch. Condesa)	It is not possible to quantify (100% mortality without ouabain/veratridine)
VGO1351	G. excentricus	La Gomera (Valle Rey-Ch. Condesa)	It is not possible to quantify (100% mortality without ouabain/veratridine)
VGO1190	G. carolinianus	Abadá, Tenerife	It is not possible to quantify (100% mortality without ouabain/veratridine)

Table 1. [illegible] by CBA-Neuro2A.

Strain	Specie	Origin	CTXs/MTXs partition	Qualitative data CBA-Neuro2A	Death time MBA			Main observations
VGO1181	G. excentricus	Pta. Hidalgo, Tenerife	MTXs	MTX +	[illegible]	[illegible]	[illegible]	Typical symptoms neurotoxic compound
VGO1181			CTXs	MTX +	[illegible]	[illegible]	[illegible]	Typical symptoms neurotoxic compound
VGO1186	G. australes	Los Abrigos, Tenerife	MTXs	MTX +	[illegible]	[illegible]	[illegible]	Typical symptoms neurotoxic compound
VGO1186			CTXs	MTX +	[illegible]	[illegible]	[illegible]	[illegible]
VGO1197	G. caribaeus	La Palma, El Hierro	MTXs		Alive 48h	Alive 48h	Alive 48h	[illegible]
VGO1197			CTXs		Alive 48h	Alive 48h	Alive 48h	[illegible]
VGO1181	G. silvae	Pta. Hidalgo, Tenerife	MTXs	CTX +	Alive 48h	Alive 48h	Alive 48h	[illegible]
VGO1181			CTXs	CTX +	Alive 48h	Alive 48h	Alive 48h	[illegible]
VGO1180	G. silvae	Pta. Hidalgo, Tenerife	MTXs	CTX +	[illegible]	[illegible]	[illegible]	[illegible]
VGO1180			CTXs	CTX +	[illegible]	[illegible]	[illegible]	[illegible]

Table 2. [illegible]

RESULTS before CTX:MTX partition

-Strains with the presence of MTX had 100% mortality before the addition of ouabain/veratridine. It is not possible to quantify them by CBA-Neuro2A without a previously dichloromethane: methanol partition.

-Strains of *G. silvae* were the only ones in which could be quantified, without interferences, the concentration of CTX.

RESULTS after CTX:MTX partition

-The distribution of CTX and MTX between the two fractions was not pure appearing MTX in the CTX fraction which is possible that mask, if it exist, the CTX effect in some species.

-*G. silvae*, is the unique specie with a profile only of CTX although mixed between the two fractions.

- Death of mice are more quickly and more violent when MTXs are presents in the extracts.

RESULTS LC-MS/MS

-Toxicity observed by biological assays in the three *G. silvae* strains could be attribute to a compound with m/z [M+Na]+ 1163.6, the same m/z as C-CTX-1 and C-CTX2 ciguatoxins.

-Another peak present in some chromatograms with m/z [M+Na]+ of 1117.6, could be corresponding with 52-epi-54deoxyCTX1B, 54-deoxyCTX1B or PCTX2 ciguatoxins.

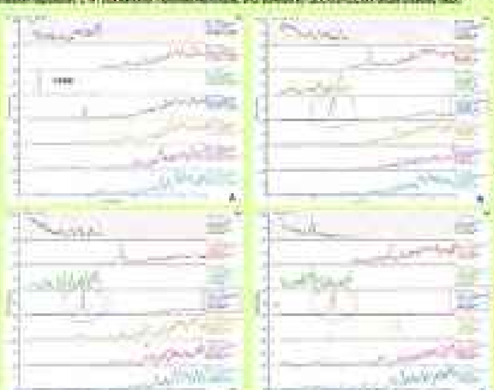


Figure 1. Chromatograms obtained by LC-MS/MS. A: CTX1B standard; B: G. silvae VGO1180; C: G. silvae VGO1181; D: G. silvae VGO1368

CONCLUSIONS

1. Variations have been observed in the toxicity of the different species attributed to the different proportions found between MTX and CTX.
2. *G. silvae* is the least toxic by MBA, however this strain is the one with the highest potential risk of ciguatera in Canary Islands because it contains only CTXs.
3. Even though MTX present in the other species analysed is more toxic than CTX by MBA, it does not pose any risk since, being water soluble, it does not accumulate in fish and is quickly eliminated by organisms.
4. Taking into account the origin of the samples, the presence of Caribbean CTXs is more than likely.
5. *G. silvae*, because it seems to be the unique specie with only CTXs, this could be used as a very useful tool for the optimization of the method to separate the fractions of CTX and MTX, in order to improve their detection method.

REFERENCES

[illegible]

[illegible]

Autoría: Acosta, C.P.; García, A.; Fernández-Besada, M.; de Coo, A.

Título: Incidencia da depredación de xuvenís de cangrexo (*Carcinus maenas*) sobre as primeiras fases do recrutamento de bivalvos

Evento: XXII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2019

INCIDENCIA DA DEPREDACIÓN DE XUVENÍS DE CANGREXO *(CARCINUS MAENAS)* SOBRE AS PRIMEIRAS FASES DO RECRUTAMENTO DE BIVALVOS

PEREZ ACOSTA, C. ; GARCÍA, A. ; FERNÁNDEZ BESADA, M. ; DE COO, A.

OBXECTIVOS PRINCIPAIS

Este póster describe os primeiros resultados da acción de investigación: *"INCIDENCIA DA DEPREDACIÓN POR CANGREXOS, CON ESPECIAL REFERENCIA AO DESENVOLVEMENTO ACTUAL NAS PRIMEIRAS FASES DA SEMENTEIRA NATURAL DE BIVALVOS EN ZONAS DE MAREA BAIXA"*, xestionado pola Consellería do Mar, en diferentes etapas:

1.- Estimar a taxa de mortalidade que experimentan as primeiras fases (talla 1-5 mm) de berberecho (*C. Edule*) e ameixas (*V. Decussata, V. pullastra* e *R. Philippinarum*) durante o inicio do seu recrutamento na praia.

2.-Avaliar e documentar a actividade depredadora-alimentacia de xuvenís de cangrexo (*Carcinus maenas*) sobre a súa abundancia e actividade nas praias, na actualidade.

3.-Determinar as épocas de maior actividade e abundancia de xuvenís de cangrexos no medio natural, e unha primeira estimación da importancia que esta actividade depredadora ortxina na mortalidade total no recrutamento de bivalvos.

4.- Realizar unha primeira estimación, na medida do posible, da acción doutros posibles depredadores (Gasterópodos, peixes e aves) en probas limitadas.

5.- Avaliación de sistemas de protección e prevención para mellorar a supervivencia do recrutamento nestas primeiras fases e realizar unha análisise ecolóxica e de sustentabilidade adecuada.

TRABALLO REALIZADO

O recrutamento de *Carcinus maenas* iníciase no mes de abril-maio de 2018, acadando valores máis importantes. As primeiras tallas (L<10 mm) sitúanse no nivel marcal superior, baixando polo intermareal a medida que medra esta talla (gráfica inferior)

Realizáronse un total 19 ensaios en acuarios de 8 a 14 L situados no interior dun acuario maior de 100 L con T8 controlada a 16 ºC o que se lles engadiu semente de bivalvos viva.

- Tallas de cría do cangrexos ensaiados: 5 a 16 mm.
- Tallas dos bivalvos presa:
  Berberecho: 2,1 a 4,2 mm
  A. Babosa: 2,6 a 4,77 mm
  A. xaponica: 2,8 mm

As crías de *C. maenas* recén mudadas presentan un alto nivel de depredación. ***C. maenas* de talla 11 mm chegan a consumir 36,5 sementes de berberecho de 3 mm por día.**

Existe preferencia entre especies e o tamaño das mesmas, sendo a especie preferida o berberecho e a talla máis consumida 3,2 mm, que representa a terceira parte da lonxitude do cangrexo depredador.

METODOLOXÍA

- Mostraxes periódicos en praia para determinar a estructura de tallas-idade de *C. maenas* e das súas potenciais presas : recrutamento de berberecho e ameixas.

- Ensaios de alimentación en acuarios a distintas temperaturas e cangrexos de talla pequena en fases pre-postmuda para avaliar tallas e cantidades de cepredacion.

-Observación en praia e documentación en vídeo e cuantificación da actividade depredadora dos cangrexos de talla pequena.

-Ensaiar sistemas de extracción dos cangrexos máis pequenos en praia para previr os seus efectos nas épocas de recrutamento da semente de bivalvos.

CONCLUSIÓNS PROVISIONAIS

C. maenas presenta un recrutamento sincronizado coa fixación nas praias dos xuvenís bivalvos de pequeno tamaño das súas principais **especies-presa.**

Unindo o elevado número de reclutas de *C. maenas* e a alta tasa de depredación sobre bivalvos xuvenís, parece evidente unha forte influencia do recrutamento de este cangrexo na mortalidade natural das primeiras fases do recrutamento de bivalvos en praia.

XXII Foro de los Recursos Marinos y Acuicultura de las Rías Gallegas · 2019

Autoría: Carballal, M.J.; Iglesias, D.; Abollo, E.; Cao, A.; García, L.; Ramilo, A.; González, A.I.; González, A.F.; Pascual, S.; Villalba, A.

Título: Looking for hosts of *Marteilia cochillia* in the zooplankton

Evento: IMMR'19 | International Conference on Diseases of Fish and Shellfish

Lugar: Porto (Portugal)

Ano: 2019

Looking for hosts of *Marteilia cochillia* in the zooplankton

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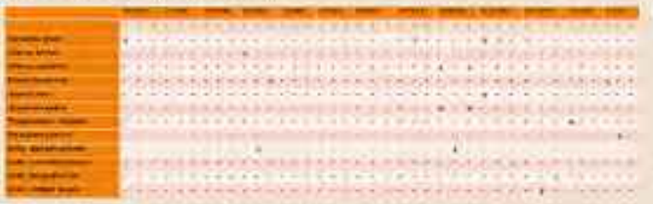
Introduction

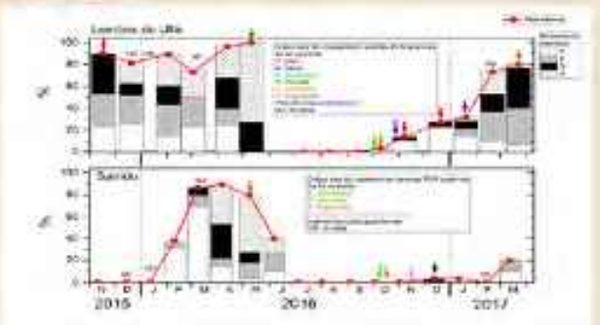
The protozoan *Marteilia cochillia* infects cockles *Cerastoderma edule* on the ría of Arousa, Pontevedra and Vigo (Galicia, NW Spain). Outbreaks of this parasite are detected every year since 2012, affecting newly recruited cockles and causing high mortality. Direct transmission of the parasite from infected to healthy cockles has been discarded through cohabitation experiments, while the involvement of zooplankton species as intermediate hosts of other *Marteilia* spp. has been proposed. The aim of this study was to look for zooplankton species candidates to act as intermediate hosts of *M. cochillia*.

Methodology

Zooplankton was sampled periodically above three shellfish beds of the ría of Arousa: Lombo do Ulla, Corón and O Sarrido, from November 2015 to March 2017 (Figure 1). Two samples were collected using a bongo net with a 200 µm mesh towed for 20 min at an average speed of 2 knots. One sample was fixed in 96% ethanol and used for DNA extraction and the other sample was fixed in formalin to count and identify zooplankton species. PCR assays were used to detect *M. cochillia* in the zooplankton (Royo-Flores et al., 2004; Carrasco et al., 2012); positives samples were sequenced to confirm the presence of parasite DNA. *In situ* hybridization was carried out to detect the parasite in *Paracentrotus gravi*, *Tomopteris longicornis* and *Oikopleura* infective stages. ISH was performed as described by Le Roux et al. (1999) with slight modifications.

Monthly samples of cockles collected from shellfish beds Lombo do Ulla and O Sarrido were processed by histology to diagnose *M. cochillia*. The intensity of infection with *M. cochillia* in the cockles was ranked using the following scale: 0, no parasite was detected; 1, light infection; 2, moderate infection; 3, heavy infection; 4, post heavy infection with intense haemocytic response.





Results and discussion

Molecular analyses showed the presence of *M. cochillia* DNA in zooplankton organisms above shellfish beds with cockles infected with this protozoan. Parasite DNA was mainly detected in copepods and appendicularians and less frequently in larvae of crustaceans and echinoderms. Five PCR positive pools were recorded in the copepod *Paracentrotus gravi* and two positive ones in the copepods *Oithona plumifera*, *Temora longicornis* and *Acartia discaudata* and in appendicularians (*Fritillaria* sp.). *Paracentrotus gravi* was identified by ISH in the zooplankton samples thus far.

Regarding a putative annual cycle, *M. cochillia* DNA was first recorded in zooplankton in spring (May 2016, Lombo do Ulla and O Sarrido), when sporulation stages of the parasite were occurring in cockles, which suggested transmission of spores from cockles to zooplankton. Most PCR positives in zooplankton were detected in autumn-early winter in both beds when the infection prevalence in cockles was low or null and most infected cockles showed pre-sporulation stages (Figure 2), suggesting that transmission of the parasite from zooplankton to cockles could occur in that period. Laboratory experiments demonstrated the transmission of *Marteilia* spp. from infected oysters and mussels (with abundant parasite sporulation stages) to non-infected copepods *Paracentrotus gravi* but transmission assays from copepods to healthy cockles (Audemard et al., 2002; Carrasco et al., 2014).

Paracentrotus gravi was more abundant and showed more PCR positive pools in Lombo do Ulla, where infection was more prevalent and intense, than in the other two shellfish beds. Remarkably, *P. gravi* has been proposed as intermediate host of other *Marteilia* spp.

In conclusion, DNA of *M. cochillia* was detected in zooplankton organisms, mainly in copepods. Among them, *P. gravi* is a solid candidate to act as intermediate host of *M. cochillia* which has to be confirmed with *in situ* hybridization assays and transmission experiments.

References

- Audemard, C., Le Roux, F., Reinhardt, A., Collins, C., Sunila, I., Suárez, P. G., De Mercado-Pozo, E., Casulli, C., Combes, C., Berthe, F. 2002. Marteilia in a nonstock: involvement of the copepod *Paracartia grani* in the life cycle of the oyster pathogen *Marteilia refringens*. Parasitol 84(2): 223-240
- Carrasco, N., Arzul, I., Chollet, B., Robert, M., Joly, J.-P., Lupo, C., Perkins, F. O., Berthe, F. C. J. 2012. Comparative experimental infection of the copepod *Paracartia grani* in the laboratory with *Marteilia refringens* and *M. pararefringens*. J. Fish. Dis. 35: 897-908
- Carrasco, N., Andree, K. B., Lacuesta, B., Rueda, A., Furones, M. D. 2012. Molecular characterization of the Marteilia parasite infecting the common edible cockle *Cerastoderma edule* in the Spanish Mediterranean coast. A new Marteilia species affecting bivalves in Europe?. Aquaculture, 324-325: 20-26
- Le Roux, F., Audemard, C., Barnaud, A., Berthe, F. 1999. DNA probes as scientific tools for the detection of *Marteilia refringens*. Mol. Marine Biol. 8, 264-267.
- Royo-Flores, I., De La Herran, R., Garrote-Ramos, M. A., Navas, J. I., Ruiz-Rejón, C., Ruiz-Rejón, M. 2004. The nuclear 18S-rRNA gene sequence as a tool for the diagnosis of *Marteilia refringens* and differentiation between *Marteilia* species infecting oysters and mussels based on the ITS1 sequence. Parasitol. 129: 401-413

Autoría: de la Ballina, N.R.; Villalba, A.; Cao, A.

Título: Proteomic comparison of *Ostrea edulis* granulocytes and hyalinocytes after *in vitro* stimulation with immune response inducers

Evento: IMMR'19 | International Conference on Diseases of Fish and Shellfish

Lugar: Porto (Portugal)

Ano: 2019

PROTEOMIC COMPARISON OF *OSTREA EDULIS* GRANULOCYTES AND HYALINOCYTES AFTER *IN VITRO* STIMULATION WITH IMMUNE RESPONSE INDUCERS

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INTRODUCTION

Most European flat oyster *Ostrea edulis* populations are exhausted due to overfishing and diseases. Recovery and maintenance of wild populations is a priority for marine ecosystem health. Understanding oyster immune system would contribute to design effective strategies to fight oyster diseases. Haemocytes play a crucial role in oyster immune response. There are two basic cell types of bivalve haemocytes: hyalinocytes and granulocytes, which are morphologically distinguishable, although their functional differences and specific abilities are poorly understood. This study aims to enlighten the differences in immune capacity among the haemocytic types of *O. edulis*, analysing the proteomes of granulocytes and hyalinocytes after *in vitro* stimulation with various inducers of immune response, namely lipopolysaccharide (LPS), polyinosinic-polycytidylic acid (Poly I:C) and Zymosan A, to simulate the confrontation with bacteria, viruses and fungi, respectively.

MATERIALS AND METHODS

Both oyster haemocyte types were separated by Percoll density gradient centrifugation of oyster hemolymph (Fig 1). Granulocytes and hyalinocytes were separately stimulated with LPS, Poly I:C and Zymosan A for different incubation times (Fig 2). Then, cell proteins were separated by 2D-PAGE and the protein profiles of granulocytes and hyalinocytes were analysed and compared with PD Quest software (Fig 3). The protein spots exclusive for each haemocyte type and treatment were excised from gels and analysed by MALDI-TOF/TOF with a combination of mass spectrometry (MS) and MS/MS for sequencing and protein identification.

Fig 1. Overview of the protocol for the separation of haemocyte types from the hemolymph of *Ostrea edulis* using Percoll gradients.

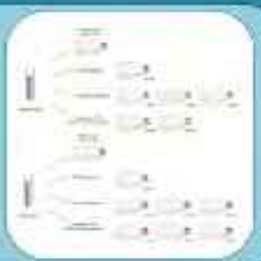

Fig 2. Diagram representation of the haemocyte incubations with various inducers of the immune response, indicating the concentration of the inducer and the incubation period of each.

RESULTS

For each inducer, non-stimulated (control) cells were compared with the stimulated cells for each duration (Fig 2). The gels in which some exclusive spots were identified after comparisons between treatments are included in Fig 3. A total of 12 proteins were identified, 6 exclusive of granulocytes stimulated with LPS and Poly I:C and 6 exclusive of hyalinocytes stimulated with Poly I:C and Zymosan A (Table 1). The identified proteins are involved in important biological processes for the preservation of organism integrity, such as signal transduction, defence, functions related with cytoskeleton and protein biosynthesis.

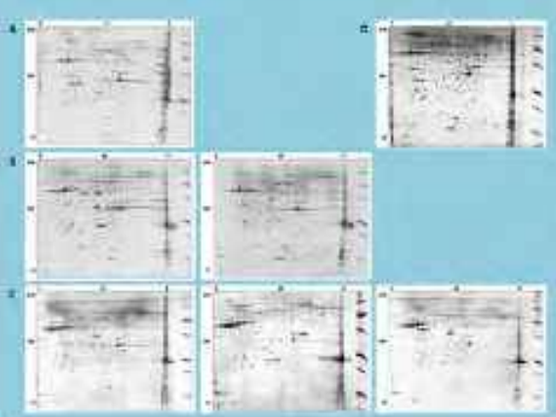

Fig 3. Digitized images of silver-stained 2D-GE (pH 4-7) gels showing proteins from *Ostrea edulis* haemocytes. (A) Granulocytes without inducer. An exclusive spot of this group when compared with granulocytes incubated with LPS is highlighted. (B) Hyalinocytes stimulated with Poly I:C. Exclusive spots were identified in the 12 h native (left) gel, and 12 minutes (right gel) treatments. (C) Hyalinocytes stimulated with Poly I:C. Exclusive spots were identified in the 12 h native (middle gel) and 12 minutes (right gel) treatments. (D) Hyalinocytes exposed to Zymosan A. The highlighted spot was present in groups stimulated with Zymosan A at every period length and absent in the control group. The codes corresponds to those of the proteins included in Table 1. (L) Markers (pdb). M: apparent molecular mass in kilodaltons.

Table 1. Protein identification by proteomic MS and multivariate [PCA and Cluster analysis] *in vitro* stimulated with inducers of immune response: LPS, Poly I:C and Zymosan A.

Code	Accession number	Protein identification	Molecular function
MLC901	[illegible]	[illegible]	[illegible]
MP1	Poly I:C (12 min)	[illegible]	[illegible]
MP2	Poly I:C (12 min)	[illegible]	[illegible]
MP3	Poly I:C (12 min)	[illegible]	[illegible]
MP4	Poly I:C (12 min)	[illegible]	[illegible]
MP5	Poly I:C (12 min)	[illegible]	[illegible]
MP6	Poly I:C (12 min)	[illegible]	[illegible]
MP7	Poly I:C (12 min)	[illegible]	[illegible]
MP8	Poly I:C (12 min)	[illegible]	[illegible]
MP9	Poly I:C (12 min)	[illegible]	[illegible]
MP10	Poly I:C (12 min)	[illegible]	[illegible]
MP11	Poly I:C (12 min)	[illegible]	[illegible]
MP12	Poly I:C (12 min)	[illegible]	[illegible]
MP13	Poly I:C (12 min)	[illegible]	[illegible]
MP14	Poly I:C (12 min)	[illegible]	[illegible]
MP15	Poly I:C (12 min)	[illegible]	[illegible]
HZn4	Zymosan A (12 h and 12 min)	[illegible]	[illegible]

DISCUSSION

Our results showed differential modification of the proteome between granulocytes and hyalinocytes of *O. edulis* upon exposition to various immune response inducers. The identification of differential roles for each haemocyte type will contribute to better understand the immune mechanisms of the oyster, which should be useful to design effective strategies to recover European flat oyster populations.

Autoría: Rodríguez J.L.; Araujo, A.; Fuentes, N.; Alvarez-Blázquez, B.; Pérez, E.; Vilar, A.; Linares, F.

Título: Experiments of wreckfish (*Polyprion americanus*) larval culture in Galicia (Spain)

Evento: Aquaculture Europe 2019 (EAS 2019)

Lugar: Berlín (Alemania)

Ano: 2019

CIMA
IGAFA
EXPERIMENTS OF
WRECKFISH
(Polyprion americanus)
LARVAL CULTURE IN GALICIA (SPAIN)
Introduction
Materials and Methods
Results
Discussion and Conclusion
References
1 DAYS
5 DAYS
9 DAYS
15 DAYS
28 DAYS
31 DAYS
36 DAYS
42 DAYS
45 DAYS
47 DAYS
56 DAYS
72 DAYS
98 DAYS
INSTITUTO ESPAÑOL DE OCEANOGRAFÍA
aquaculture europe 19

Autoría: Parada, J.M.

Título: Data collection procedure for the inference of stocks of bivalve molluscs populations in shellfish exploitation

Evento: I Simposio Ibérico de Modelado y Evaluación de Recursos Pesqueros

Lugar: Vigo - Galicia (España)

Ano: 2021

Data collection procedure for the inference of stocks of bivalve molluscs populations in shellfish exploitation.

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Iberian Symposium on Modeling and Assessment of Fishery Resources (SIMERPE). Vigo, octubre 19-22, 2021.

The capture of clams and cockles constitutes one of the main resources of artisanal shellfish gathering. In Galicia, about 5,700 t were extracted, reaching a first-sale value of 60 million euros in 2020 (https://pescadegalicia.gal. Anuario de pesca 2020).

Although decree Decree 153/2018, which regulates the exploitation and management of shellfish resources in Galicia, does not focus on estimating the volume of the stock of exploited species, the evaluation of the populations and the inference of their evolution continues to be of great importance for the diagnosis of their status and advice on the management of their exploitation.

This document shows a procedure used to monitor different exploited shellfish banks to obtain mortality and growth values, as well as recruitment rates to feed a virtual population model (**Figure 1**). For this we used data from the daily monitoring of the catches and their size structure, obtained at a control point established in the shellfish bank (**Figure 2**); biannual assessments of the population stock (**Figure 3**); and, optionally, monthly monitoring of mortality and growth from confined individuals (**Figure 4**).

This compilation of data on the populations of bivalve molluscs and their exploitation allows diagnosing their status and inferring their evolution in the short term (**Figure 5**). When applying this procedure to the carpet-shell clam population (*Venerupis corrugata* (Gmelin, 1791)) from As Pias shellfish bank (ria of Ferrol) we have obtained an index of agreement d_{ij} = 0.97 and Nash-Sutcliffe (N-SI) = 0.84 with respect to the observed values.

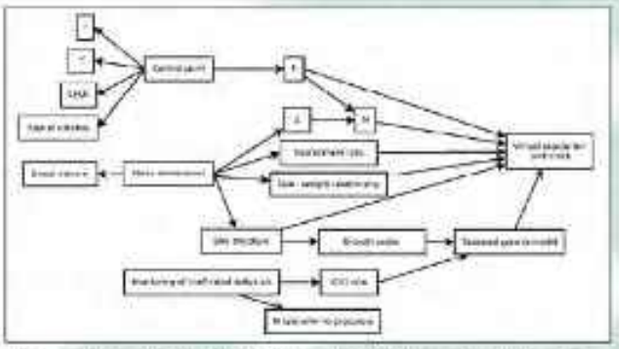


Figure 1.- Procedure data flow, f, fishing effort (number of shellfishers and boats), Y yield, F, fishing mortality, Z, total mortality from cohorts identified in the size structures obtained in the samples of biannual population.

Figure 2.- Control point. The vessels participating in the shellfish bank management plan must pass through the control point before starting the task and once it is finished. At the control point, data from the time spent (CPUE in terms of catches per person and hour) and the catches are obtained, and a control of the sizes of the captured specimens is carried out.

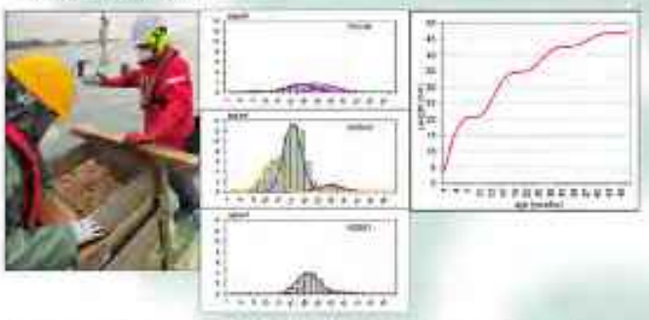


Figure 3.- Semestral stock evaluations. In spring and autumn, stock assessments are carried out with quantitative sampling using vertical insertion dredges or manual trawling gear such as the shellfish cacques. Stock assessments include estimates of stock volume and size structure. The identification of cohorts in these stock assessments allows the calculation of the total mortality rate, the recruitment rate and the parameters of the von Bertalanffy growth model.

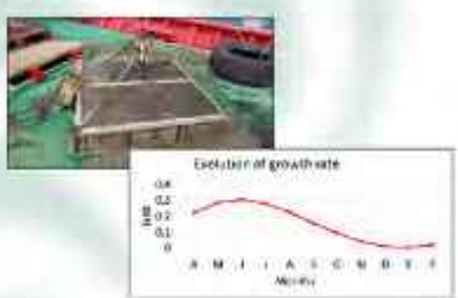


Figure 4.- Monthly monitoring of confined individuals. Six batches of individuals are arranged in 40 x 60 cm confinement boxes with sand and protected from predators. Batches can be juvenile specimens (100 individuals per batch) and kept without substitution or semi-adult specimens (25 individuals per batch) and replaced every month. With monthly frequency the individuals are counted and measured to determine the mortality in the absence of predators and the G30 growth rate. This growth rate is used to improve the fit of the von Bertalanffy seasonal growth model.

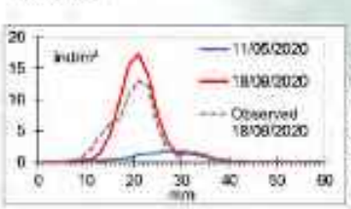


Figure 5.- Application of the model and validation for *Venerupis corrugata* in As Pias shellfish bank.
Variables:
Growth equation: t0 = 0, L_{∞} = 52 mm, K = 0.6 years, C = 0.45, WP = 1.81
Mortality: M = 2, F = 0.5, First catch size= 35 mm
Recruitment rates G.22, Recruitment starts June, Standard deviation of recruits cohort = 3.4; L50 = 35 mm
Size - weight relationship: log(weight) = 3.044 - log(size) - 3.862
Validation agreement:
Index of agreement(d_{ij})= 0.97
Nash-Sutcliffe index (N-SI) = 0.84

Autoría: Cao, A.; Iglesias, D.; Carballal, M.J.; Villalba, A.

Título: Looking for cockle *Cerastoderma edule* protein markers of resistance against marteiliosis

Evento: 20th International Conference on Diseases of Fish and Shellfish

Lugar: Conferencia virtual

Ano: 2021

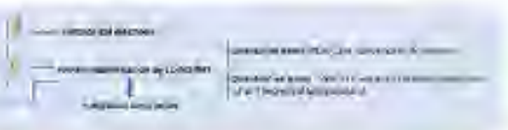
LOOKING FOR COCKLE *CERASTODERMA EDULE* PROTEIN MARKERS OF RESISTANCE AGAINST MARTEILIOSIS

Asunción Cao, David Iglesias, María J. Carballal, Antonio Villalba

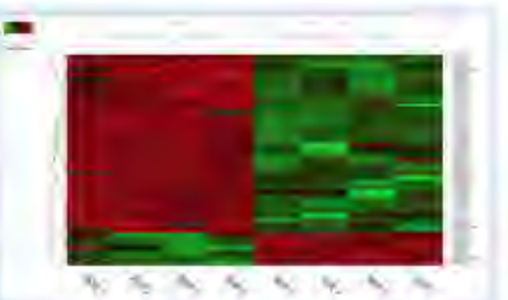
Centro de Investigacións Mariñas (CIMA). Consellería do Mar-Xunta de Galicia. Ministerio de Asuntos Exteriores

INTRODUCTION

MATERIALS AND METHODS



RESULTS



DISCUSSION

Autoría: Moroño, A.; Blanco, J.; Arévalo, F.; Correa, J.; Salgado, C.; Rossignoli, A.E.

Título: Twenty five years of domoic acid monitoring in Galicia (NW Spain)

Evento: 19th International Conference on Harmful Algae

Lugar: La Paz (México)

Ano: 2021

Twenty five years of domoic acid monitoring in Galicia (NW Spain)

Angeles Morales[1], Juan Blanco[1], Yolanda Arévalo[1], Jorge Lamas[1], Lourdenga Salgado[1], Antonio L. Navagrete[2]
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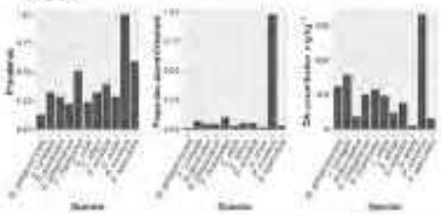
POSTER NUMBER

Objective

To evaluate the spatial, temporal, and interspecific variations of domoic acid in bivalves, in the last 25 years in Galicia.

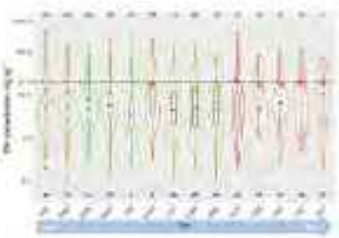
Results

Prevalence: 14.3 and 13.9 % (with and without P. multiplex)
Incidence (Effect-Hit): 2.4 and 1.3% (with and without P. multiplex)
Maximum level: 6659 and 306 mg kg⁻¹ (with and without P. multiplex)
By species:



Spatial variation between Rías

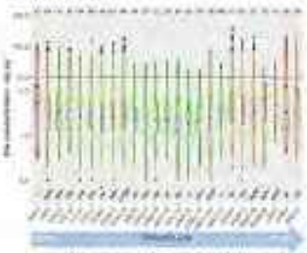
Maximum domoic acid concentration in the northernmost Rías (Ferrol/Codeira-Vivero) (*P. maximus* and *M. galloprovincialis* excluded)



Domoic acid concentration in the main rivers (areas) with the exception of the Galician Rías and recorded during the past 25 years in the Galician Rías.

Spatial variation between mussel production areas

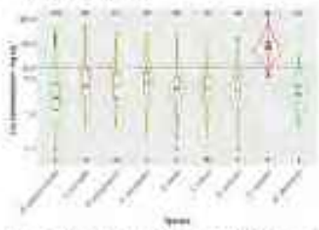
Maximum domoic acid concentration in the northernmost and southernmost mussel production areas. Minimum in the areas in the Ría de Arousa.



Domoic acid concentration in rift mussels, tested for 11 m species in the Galician Rías.

Interspecific variation

Maximum average concentrations in *Pecten maximus* followed, with much lower levels, by some clams (*Polyhyges rhomboides* and *Venerupis rhomboides*)

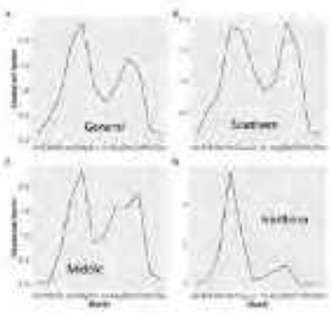


Domoic acid concentration during the 11 m species in the main areas of the Galician Rías. M. Mariño, V. Vasconcelos, R. Rodrigues, P. Rodrigues, C. Cristóbal, F. Pérez, P. Pérez, A. Arquimedes.

Seasonal variation

Two DA maxima: spring and autumn

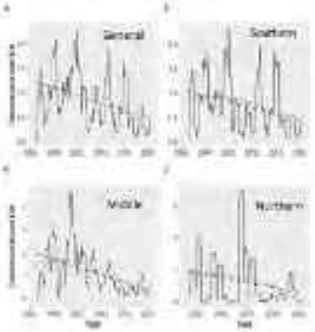
Importance of the autumn maximum decreasing to the North



Seasonal pattern, obtained by time series analysis, of the average domoic acid concentration between 1995 and 2015 in the Galician Rías.

General trend

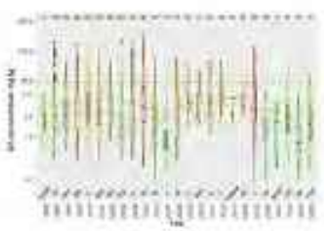
General decreasing trend but not strictly linear



Concentration average domoic acid concentration corresponding to Rías. The shared and the dotted lines are the linear and quadratic trend respectively, fitted by regression.

Cycles

11-year and 4-year cycles in mussel rafts



Domoic acid concentration in the species along the sampling period in all mussels. The dotted line is the result of fitting the concentration of a linear sinusoid and two sinusoids with periods of 4 and 11 years.

Methods

Domoic acid analysis: Extraction with HCl 0.1 M. Reverse phase chromatography with Waters Sunfire Cl18. Detection with UV absorption at 242 nm.
Statistical methods: All tests were performed with R.
- Anova/Tukey HSD test: packages base, Stat, and multicomp.
- Regression: base, and Stat.
- Time series analysis: base, stat, forecast, and forecast.

Autoría: de Santiago-Meijide. J.A.; Gregorio, M.V.; Rodríguez, O.; Rodríguez, S.; Gabín-Sánchez, C.

Título: Fijación de post-larvas de mejillón (*Mytilus galloprovincialis* Lamarck, 1819) en textiles vegetales biodegradables

Evento: XXIV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2022

Fixación de post-larvas de mexillón (*Mytilus galloprovincialis* Lamarck, 1819) en téxtiles vexetais biodegradables.

Autores: de Santiago, J.A.; Gregorio, M.V.; Rodríguez, O.; Rodríguez, S.; Gabín-Sánchez, C.

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OBXECTIVOS.

1. Atopar substratos axeitados para fixar post-larvas de mexillón.

- De fabricación estandarizada.
- Materiais vexetais, biodegradables, sen achegas de microplásticos.
- Fáciles de manexar en criadeiro.
- Que permitan altas taxas de fixación.
- Que non modifiquen a sistemática de cultivo en batea.

2. Axustar os protocolos de traballo no criadeiro.

Fig. 1: Substratos téxtiles inseridos en bastidores

Fig. 2: Post - larvas en fixación

Fig. 3: Post - larvas fixadas en téxtil vexetal.

Fig. 4: Post - larvas en tanque vertical.

Fig. 5: Encordado manual en batea. Tamaño 500 um

Fig. 6: Semente despois de 60 días no mar

MATERIAL E MÉTODO DE TRABALLO.

- Bagaxe experimental en produción de semente de mexillón (proxecto **Blue Seed**. 6º Framework UE).
- Aproveitamento da época natural de posta (Marzo-Xullo).
- Recepción do lote de reprodutores. Limpeza e revisión do estado gonadal (80 - 120 exemplares).
- Indución ao desove por choque térmico.

PROCESO DE FIXACIÓN.

- Tambor de fixación con malla de 150 mm, 34 cm diámetro, circulación "top-down" por "air-lift".
- Tiras de téxtil cunha superficie total de 280 cm² inseridas en bastidores.
- Se introducen larvas, retidas en 200 - 265 mm, durante 3 -5 días.
- As post-larvas fixadas ao textil colgánse en vertical en circuito aberto e alimentación en contínuo.

RESULTADOS:

1. Alta fixación nos substratos téxtiles empregados.
2. Bo crecemento da semente na batea.
3. Biodegradación axeitada destes téxtiles no medio mariño.
4. Superficie compatible coas técnicas comúns de encordado.
5. Fácil manexo no criadeiro

XUNTA DE GALICIA | CONSELLERÍA DO MAR

CIMA

Xacobeo 21·22

Autoría: Parada, J.M.; Fernández-Pérez, A.; Fernández-Besada, M.; Méndez-Pérez, B.

Título: Contribución a la ecología trófica de *Tritia neritea* (L., 1758) Gastropoda, Nassariidae en bancos marisqueros

Evento: XXIV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

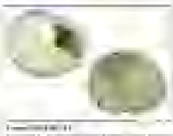
Lugar: O Grove - Galicia (España)

Ano: 2022

Contribución a la ecología trófica de *Tritia neritea* (L., 1758) Gastropoda, Nassariidae en bancos marisqueros.

XUNTA DE GALICIA

Acui XXIV. O Grove.



Autoría: Cerviño-Otero, A.; Pérez, E.; González-Fontela, A.; Ortega, M.; Iglesias, D.; Villaba, A.; Gabín-Sánchez, C.

Título: Pilot Project for the restoration of native flat oyster beds in San Simón inlet (Galicia, NW Spain)

Evento: 5ª Conferencia anual da Native Oyster Restoration Alliance (NORA)

Lugar: Middelburg (Países Bajos)

Ano: 2023

Pilot project for the restoration of native flat oyster beds in San Simón inlet (Galicia, NW Spain)

Cerviño-Otero A.[1], Pérez E.[2], González-Fontela A.[1], Iglesias D.[1], Villalba A.[1], Ortega M.[1] and Gabín-Sánchez C.[1]

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INTRODUCTION

Natural beds of flat oyster (*Ostrea edulis*, Linnaeus 1758) began to disappear from Galician (NW Spain) rias (local name for estuaries) in the middle of the last century due to overfishing, which was heightened by introduced diseases. Bonamiosis caused catastrophic mortalities, contributing to the decline of this species since 1980s, as it occurred throughout the Atlantic European coast.

Location of the San Simón inlet (NW of Spain)

Structure and oysters in 2023

In 2019, the oyster producers began an intuitive restoration trial, by which they introduced some adult oysters in a homemade system. These oysters were not monitored due to COVID and also they suffered from severe floods during 2021. Surprisingly, numerous oysters are still alive.

Promising previous results + Interest of shellfishers + Funding opportunities from research agencies

FEASIBILITY STUDY (June-November 2023)

OBJECTIVES

To acquire knowledge about the state of the natural oyster beds: location and health/demographic condition.
To reinforce the oyster broodstock by introducing adult oysters, which are deployed in manageable structures.
To disseminate information on the project among shellfish harvesters to involve them in the restoration activities.

ACTIVITIES

A survey searching for information on oyster bed location involved 30 shellfishers. The area was visited several times to assess oyster occurrence.

No natural oyster beds were found and only those harvesters with more than 5 years of activity remember any oysters in the area.

Histological and molecular (PCR) analyses were performed in a sample of the oyster batch introduced in 2019. *Bonamia ostrea* was detected in 25% of the oysters, by both diagnostic techniques.

Oysters produced in the IGAFA

Oysters in the baskets

An intertidal system with a capacity to suspend 200 baskets from a longline was installed. 1500 adult oysters produced in the Galician Aquaculture Training Institute (IGAFA, Ría de Arousa) were set in the baskets as a first trial to test the validity of the structure. A new deployment of 5000 oysters will be performed soon.

Longline system

Shellfish harvesters working with the oysters

Natural beds information + Broodstock maintaining system + Encouraging and involving shellfishers in the project + Funding from research agencies

PILOT PROJECT DESIGNING (3 years, 2024-2026)

Fondos Europeos · XUNTA DE GALICIA · CIMA · REDEMAR

Cofunded by the EMFF in a 75%. Spanish P.O. 2014ES14MFOP001 (Priority 1 – OE1 e) – measure1.5.2.). MIB: D.X. Desenvolvemento Pesqueiro"

Autoría: Abella, E.; Parada, J.M.

Título: Caracterización dos bancos marisqueiros intermareais de Vilanova de Arousa a partir das especies acompañantes sen interese comercial

Evento: I Simposio de Técnicos de Marisqueo

Lugar: Santiago de Compostela - Galicia (España)

Año: 2023

Caracterización dos bancos marisqueiros intermareais de Vilanova de Arousa a partir das especies acompañantes sen interese comercial

Emilio Abella

José Manuel Paroda

E habitual que nos achegueimos aos bancos marisqueiros Galiadores nun limitado número de especies con interese comercial. Pero non debemos perder de vista que as poboacións desenvolvense no seu de sistemas ecológicos máis complexos e forman parte das comunidades asentadas nestes fondos. O conocemento das comunidades que se asentan nunha zona produtiva achega unha dimensión integrada das condicións ambientais desta. Isto pode aportar un conocemento directo do estado da biodiversidade no litoral de Galicia sometido a explotación marisqueira, e da sua evolución no tempo.

Material e métodos

[illegible]

Resultados e discusión

[illegible]

Conclusiónes

[illegible]

SiTeM Sistema de Tecnologia de Marisqueiro

XUNTA DE GALICIA

REDEMAR

Autoría: Carracedo-Parga, C.; Abella-Rey, E.; Fuentes-Padín, T.; García-Cardesín, E.; Cremades, J.; Barreiro-Ríos, B.; García-Moroño, C.; Prieto-Sierra, D.; Traveso-Lago, A.

Título: Trazado da distribución potencial de *Himantalia elongata, Sargassum muticum* e *Undaria pinnatifida* a partir de tres fontes de información

Evento: XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2023

Trazado da distribución potencial de *Himanthalia elongata* , *Sargassum muticum* e *Undaria pinnatifida* a partir de tres fontes de información

C. Carracedo Parga[1], E. Abella Rey[2], T. Fuentes Padín[2], E. García-Cardesín[2], J. Cremades[2], B. Barreiro Ríos[3], C. García Moroño[4], D. Prieto Sierra[5] & A. Traveso Lago[6]

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ANTECEDENTES E OBXECTIVOS

O proxecto **HISARUM [DOCUMAR]** propuxose abordar un seguimento das poboacións de macroalgas *Himanthalia elongata*, *Sargassum muticum* e *Undaria pinnatifida*, coa finalidade de establecer boas prácticas de explotación para recuperar o impacto da praga no medio mariño, protexer e recuperar a biodiversidade no medio mariño e, polo tanto, a sustentabilidade das poboacións.

É habitual comunicar os resultados sobre a distribución das especies a partir de información recollida por uns mesmos, cando podemos recorrer a fontes que poden servir para ampliar a información preliminar con carácter exploratorio, susceptible de continuar en fases posteriores do estudio, coa información obtida de xeito directo.

METODOLOXÍA

A información cartográfica provén de tres fontes principais de información, e foron recompiladas en catro escalas diferentes:

1.- Información dos indicadores *NEMP*, asociados aos Plans de Xestión, e recollida e transmitida, na súa meirande parte, por os técnicos de confrarías. Foi representada para o conxunto do litoral de Galicia.

2.- Información procedente do herbario da USC (SANT), que no caso da *Himanthalia elongata* foi completada pola información de "Global Biodiversity Information Facility (GBIF)". Foi representada para o conxunto do litoral de Galicia.

3.- Información transmitida por coñecedores do litoral a unha escala máis local, como recolectores de recursos ou técnicos de confrarías. Nesta comunicación presentamos soamente información referente á Ría de Arousa (OPP 20). Foi representada para o ámbito territorial da entidade.

RESULTADOS

mapas derivados indicadores NEMP

mapas derivados de datos herbario SANT, e outras zonas GBIF

CONCLUSIÓNS

Os indicadores *NEMP* aportan información interesante pero especialmente parcial. Constitúen unha fonte clara de vulnerabilidade a hora de recoller datos de estado ambiental das zonas produtivas. Unha aproximación máis coordinada á hora de recollida pode mellorar a calidade dos resultados.

A información aportada polo herbario da USC é moito máis completa e abrangue a practica totalidade do litoral de Galicia, e ao que acumula mostras dun longo período de tempo, permite facernos unha idea da evolución temporal da distribución das especies.

A información aportada por produtores e técnicos de confrarías permite coñecer a distribución a grandes rasgos de cada unha das tres especies dentro de ámbito territorial de cada entidade, sendo menos as zonas de presenza exclusiva de cada especie, e as áreas onde se solapan as distribucións. Un mapeado secuencial pode detectar variacións temporais na distribución espacial das especies.

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Actuación cofinanciada polo FEMP, en virtude do artigo 39 do Regulamento (UE) nº 508/2014 do Parlamento Europeo

PROYECTO HISARUM · FEDERACIÓN GALEGA CONFRARÍAS de PESCADORES · OPP20 · XUNTA DE GALICIA · UNIÓN EUROPEA FONDO EUROPEO MARÍTIMO Y DE PESCA (FEMP) · REDEMAR · CIMA · UNIVERSIDADE DA CORUÑA

Autoría: Cuiñas, P.; No-Couto, E.; Fernández, D.; Suárez, J.M; Lago, J.; Senande, M.

Título: Explotación de datos AIS (Automatic Identification System) en combinación con rexistros de capturas para xerar información de interese na xestión dos recursos marisqueiros. Exemplo no plan de xestión conxunto de ourizo de mar (*Paracentrotus lividus*) mediante mergullo da zona V

Evento: I Simposio de Técnicos de Marisqueo

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2023

Explotación de datos AIS (Automatic Identification System) en combinación con rexistros de capturas para xerar información de interese na xestión dos recursos marisqueiros

Exemplo no plan de xestión conxunto de ourizo de mar (*Paracentrotus lividus*) mediante mergullo da zona V

Pedro Cuiñas

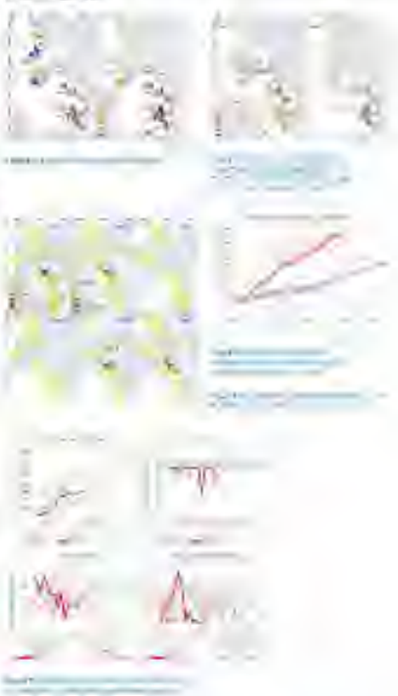
José María Suárez

Edgardo Costa

Jennifer Lago

Diana Fernández

María Sanande



SiTeM

Sistema de Técnicas de Marisqueo

Junta de Galicia

REDEMAR

Autoría: Fernández-Pérez, A.; Parada, J.M.; Méndez-Pérez, B.; Fernández-Besada, M; Varela-Baños, P.

Título: Efecto da presenza de biofilm e algas filamentosas sobre o comportamiento trófico de *Tritia neritea* como especie preeira

Evento: I Simposio de Técnicos de Marisqueo

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2023

Efecto da presenza de biofilm e algas filamentosas sobre o comportamento trófico de *Tritia neritea* como especie preeira

Alejandro Fernández Pérez

M. Fernández Besada

José Manuel Parada

Paolo Varela Baños

Beatriz Méndez Pérez

Co obxectivo de coñecer a influencia da alimentación alternativa de *T. neritea* como devoradora sobre a súa función como eliminadora de presa de media, neste traballo está, cómo o efecto da presenza de algas e biofilm sobre unha posible reducción no consumo de presa por parte de *Tritia neritea*.

Materiais e métodos

[illegible]

Resultados

[illegible]

SiTeM Simposio de Recursos de Montaquen

XUNTA DE GALICIA

REDEMAR

Autoría: Fuentes-Padín, T.; García-Cardesín, E.; Abella-Rey, E.; No-Couto, E.; Cremades, J.

Título: Optimización del cultivo de lechuga de mar (*Ulva ohnoi*, Ulvales, Chlorophyta) como productor primario en sistemas IMTA-RAS

Evento: XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2023

Optimización del cultivo de lechuga de mar (*Ulva ohnoi*, Ulvales, Chlorophyta) como productor primario en sistemas IMTA-RAS

Fuentes Padín, T.[1], E. García-Cardesín[1], E. Abella Rey[2], E. No-Couto[2] & J. Cremades[1,*]

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ANTECEDENTES Y OBJETIVOS

- Dentro del Programa Complementario de Ciencias Marinas de Galicia (PCOMG) en el paquete de trabajo 5 (PT5) de "Diversificación sostenible de la Acuicultura" se contempla la implementación de un sistema de cultivo integrado pasivo mediante IMTA en recirculación de agua (RAS).
- Con el objetivo de asegurar el suministro de biomasa de alga que permita el inicio del cultivo integrado, y subsanar cualquier necesidad del cultivo principal, se decide mantener un cultivo auxiliar que además proporcionase datos sobre los parámetros de cultivo con vistas a una modulación del mismo.

METODOLOGÍA

- La instalación de cultivo está formada por 6 tanques cilíndricos de base cónica y una capacidad de 50 litros, que reciben aireación desde la base de los mismos, y están iluminados con focos LED de 100 W (10000 lM, 6000 K) y activa regulable.
- La composición del medio de cultivo con altas cargas de nitrógeno y fosfatos, pretende simular las condiciones del efluente de una planta de cultivo de peces.
- Se realizaron ciclos de cultivo de duración semanal con fotoperiodo 12:12, replicando las condiciones de cultivo en grupos de tres tanques, de forma que en cada ciclo se puedan enviudar dos biomasas iniciales diferentes con iguales condiciones de luz.
- Se recogieron muestras de agua en cada tanque al inicio y al cierre cada ciclo de cultivo para cuantificar la concentración de nutrientes.
- Se recogieron muestras de materia seca de cada uno de los tanques al final de cada ciclo de cultivo para un posterior análisis de su composición.

RESULTADOS

- Se completaron 15 ciclos de cultivo de una semana de duración, todos con similares condiciones de luz (fuente de luz a 47 cm de la superficie del agua del tanque), en los que se fue incrementando progresivamente la biomasa inicial.
- La temperatura del agua se mantuvo entre 19,2 y 21,3ºC. En la figura 2 se presentan las temperaturas medidas dentro de tanque 3, cada 15 minutos, entre el 23 y el 26 de septiembre. La salinidad se mantuvo entre 33,8 y 34,9. En cuanto a los niveles de luz, se registraron valores entre 338 y 451 µmol m^{-2} s^{-1}.
- La figura 3 muestra las producciones obtenidas para cada grupo de tres tanques con igual densidad de partida. La curva de producción en función de la densidad inicial parece estar estabilizándose, pero debemos completar ciclos con biomasas iniciales antes de asegurarlo.

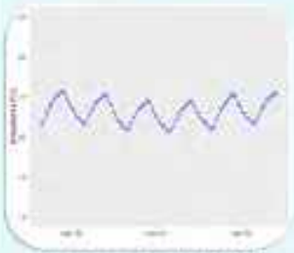

Fig. 2. Temperatura registrada cada 15 minutos en el tanque 3 entre el 23 y el 26 de septiembre.

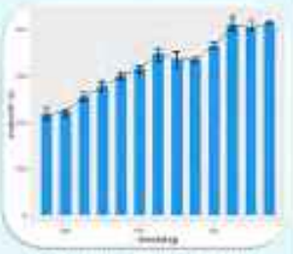

Fig. 3. Producciones obtenidas en cada grupo de tres tanques con igual biomasa de inicio de cultivo.

Fig. 4. a) Vista general de la instalación de cultivo. b) Vista superior de un tanque donde se puede apreciar el efecto de la aireación. c) Vista de un tubo iluminado y una pareja de tanques. d) Muestras de alga recién extraída para su secado y posterior almacenamiento.

REFERENCIAS

Cruz Fuentes, T. (2018). Desarrollo de sistema de Cría Integral Multitrófica para cultivo en tanques de agua [Trabajo Fin de Fin de Grado]. Universidade da Coruña.

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CONSELLERÍA DE CULTURA, EDUCACIÓN E ORDENACIÓN UNIVERSITARIA · MINISTERIO DE CIENCIA E INNOVACIÓN · Plan de Recuperación, Transformación y Resiliencia · XUNTA DE GALICIA

Autoría: Monteagudo, A.B.; Parada, J.M.; Rodríguez, I.

Título: Mellora da calidade do sedimento en zonas infralitorais mediante o emprego dun aparello de remoción hidráulica

Evento: I Simposio de Técnicos de Marisqueo

Lugar: Santiago de Compostela - Galicia (España)

Año: 2023

Mellora da calidade do sedimento en zonas infralitorais mediante o emprego dun aparello de remoción hidráulica

Ana Belén Monteagudo

José Manuel Parada

Ismael Rodríguez

Co obxectivo de pór en marcha unha actuación de remoción de substratos de longa duración que permita diminuír a acumulación de lamas, deseñouse un artefacto de remoción hidráulica, moito máis lixeiro que os rastros mecánicos convencionais, e operable desde unha embarcación lixeira para permitir o seu emprego en bancos infralitorais.

Material e métodos

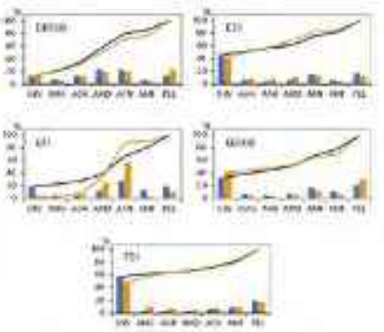
O deseño para a construción do artefacto baseouse nos aparos hidráulicos manuais empregados nos polbeiros do cultivo de mexillón da Ría (Pluguedey, 2001).

Para poder a proba o artefacto e comprobar a súa efectividade seleccionouse unha zona ao sur da illa de Cortegada –Ría de Arousa– na que a principios de xaneiro de 2008 se viña dando unha anomalía de mortalidade nos bivalvos. Para a elección final desta, o único requisito foi que existise un alto grado de sedimentación nas zonas de interese e as menores velocidades de propagación nos canais de navegación (Figura 4). Para avaliar a efectividade dos traballos, estableceuse unha estación de seguimento na área de actuación (Figura 4), na que se tomaron mostras do sedimento antes e despois dos traballos para o seu estudo granulométrico mediante a ferramenta de aplicación *GRADISTAT* (Blott e Pye, 2001). Ademais, tomáronse imaxes da superficie na zona de actuación, co obxectivo de contar cunha mostra de aspecto visual do sedimento antes e despois dos traballos.

Tendo nos dezoito acadados nas praias de pedra e parte de area da illa, tamén se realizaron tarefas de remoción nunha zona na que se realizara a adición de ostras en 2000-2001 (Figura 4). Para o seguimento tomáronse mostras da zona antes e despois da realización de traballos de remoción durante unha semana.

Resultados e discusión

A comparación dos texturas granulométricas obtidas antes e despois dos traballos de remoción revelou unha redución no contido en partículas entre tres e seis veces superior na estación de seguimento (Figura 5). A moda permaneceu estable en todos os estadios, situada no límite de 0,063 mm, o que é indicativo de que a fracción de partículas derivou no período da moda das areas medias as areas finas.



Os resultados obtidos non só determinan a idoneidade do emprego de técnicas de remoción hidráulica para promover cambios no sedimento na zona de actuación (Peterson, 1999), senón que confirman a efectividade do aparello deseñado para o seu uso en illeiro lonxa. Por outra banda, constátase a efectividade dos traballos de remoción tanto en zonas onde o proceso de enfanga-lo é máis recente, como é o caso da zona de adición de ostras en 2000-2001, como en zonas nas que o nivel de enfangado está máis avanzado. Isto indícanos que a remoción hidráulica é unha técnica efectiva tanto para a recuperación de zonas sobre para o mantemento das zonas nas que se realizou a adición de substrato, evitando que a dinámica de lamas remate a cobrir de novo as condicións previas á adición de areas realizada.

SiTeM Simposio de Técnicas de Medio Litoral

XUNTA DE GALICIA

REDEMAR

Autoría: No-Couto, E.; Cuiñas, P.; Fernández, D.; Suárez, J.M.; Lago, J.; Senande, M.

Título: Achegamento ao uso de AIS (Automatic Identification System) como ferramenta de apoio na xestión das explotacións marisqueiras. Exemplo no plan de xestión conxunto de ourizo de mar (*Paracentrotus lividus*) mediante mergullo da zona V

Evento: I Simposio de Técnicos de Marisqueo.

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2023

Achegamento ao uso de *AIS (Automatic Identification System)* como ferramenta de apoio na xestión das explotacións marisqueiras

Exemplo no plan de xestión conxunto de ourizo de mar (*Paracentrotus lividus*) mediante mergullo da zona V

Edgar No-Couto

Pedro Cuiñas

Diana Fernández

José María Suárez

Jennifer Lago

María Senande

O AIS (*Automatic Identification System*) é un equipo de axuda á navegación que envía datos de posición, velocidade e rumbo da barco través de antas de radio VHF. Dende o ano 2016 as embarcacións que pretenden facer na Reserva Mariña de Interese Pesqueiro (REMIP) de Os Miñarzos (Lira-Carnota), están obrigadas a portar AIS activado.

A parte de tratarse dun sistema AIS pensado especialmente para a seguridade marítima, que almacena as súas bases de datos estatísticas, a día de hoxe a información dixitalizada e espacialmente explícita que xera supón unha fonte de información moi valiosa para a xestión pesqueira. Neste traballo analízase a información recollida polos AIS das embarcacións participantes no plan de xestión conxunto de ourizo mediante o mergullo da zona V (Lira-Carnota, Porto do Carballiño e Ría de Muros e Noia), durante os anos 2016 e 2017 (un total de 1.151 días).

Material e métodos

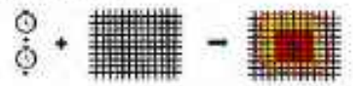
Durante estes anos os mariscadores a pé desembarcaron en cada unha das zonas mencionadas anteriormente entre as 8:00 e as 17:00 h (UTC+1) e 2:00 h (UTC+2) (horario de verán), é dicir, as embarcacións estiveron traballando maioritariamente durante a pleamar. A diferencia de traballos anteriores, onde para calcular o esforzo de extracción asignábase a primeira pegada GPS do mariscador, neste traballo empregouse a información proporcionada polos AIS para calcular o esforzo de extracción a partir da velocidade das embarcacións.

Caracterización anual das zonas de explotación

Para cada unha das zonas de explotación, definidas polos mariscadores, calculouse a densidade de esforzo de extracción en cada ano de estudio. Para isto, o polígono que delimita cada zona foi dividido en celdas hexagonais de 0,1 km².

Definición e caracterización espacial do esforzo

Para definir a área de distribución do esforzo de extracción, empregouse o método de Kernel, que permite estimar a densidade de probabilidade de ocorrencia dun evento a partir dunha mostra de localizacións. Neste caso, empregouse o método de Kernel adaptativo, que ten en conta a densidade local de puntos para axustar o ancho de banda, de forma que as áreas con maior concentración de datos teñen un ancho de banda menor, mentres que as áreas con menor densidade teñen un ancho de banda maior. Isto permite unha representación máis precisa da distribución espacial do esforzo, evitando sobresuavizar as áreas de alta intensidade e subestimar as de baixa intensidade.



Finalmente, para cada zona de estudio, calculouse a área ocupada polo esforzo de extracción (en km²) como a suma das áreas das celdas hexagonais que conteñen polo menos un punto de esforzo. Para evitar que valores atípicos ou puntos illados distorsionen a estimación da área ocupada, empregouse un percentil de corte, de forma que só se inclúen as celdas que acumulan un determinado porcentaxe do esforzo total. Neste traballo utilizouse o percentil 95, é dicir, excluíronse as celdas que conteñen o 5% do esforzo menos intenso.

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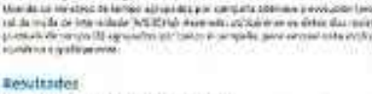

Finalmente, para cada zona de estudio, calculouse a área ocupada polo esforzo de extracción (en km²) como a suma das áreas das celdas hexagonais que conteñen polo menos un punto de esforzo. Para evitar que valores atípicos ou puntos illados distorsionen a estimación da área ocupada, empregouse un percentil de corte, de forma que só se inclúen as celdas que acumulan un determinado porcentaxe do esforzo total. Neste traballo utilizouse o percentil 95, é dicir, excluíronse as celdas que conteñen o 5% do esforzo menos intenso.

Evolución temporal e temporal do esforzo

Para cada unha das zonas de estudio, calculouse a evolución temporal da área de distribución do esforzo de extracción (en km²) como a suma das áreas das celdas hexagonais que conteñen polo menos un punto de esforzo. Para evitar que valores atípicos ou puntos illados distorsionen a estimación da área ocupada, empregouse un percentil de corte, de forma que só se inclúen as celdas que acumulan un determinado porcentaxe do esforzo total. Neste traballo utilizouse o percentil 95, é dicir, excluíronse as celdas que conteñen o 5% do esforzo menos intenso.

Resultados

Caracterización anual das zonas de explotación

Dos 2.555 barcos rexistrados no AIS durante o período de estudio, o 98% realizou o seu traballo nun único día, mentres que o 0,46% traballou en dous días distintos. Só un barco traballou en tres días distintos. Estes datos suxiren que a maioría dos mariscadores a pé participantes no plan de xestión conxunto de ourizo mediante mergullo da zona V (Lira-Carnota, Porto do Carballiño e Ría de Muros e Noia) traballou durante un único día por semana, probablemente o sábado, que é o día de apertura da zona.

Definición e caracterización espacial do esforzo

Identificáronse un total de 90 bancos (1.098 ha), dos cales só 40 (**Figura 1**) foron explotados durante o período de estudio. Os bancos que acumulan máis horas de traballo foron O Carballo de Fisteira (460 h) e Punta Vaca (418 h) (**Figura 3A**), o mesmo ocorre coa área de esforzo, que foi máis elevada en Punta Vaca (0,2 km²) e O Carballo (0,18 km²) (**Figura 3B**).

Conclusións

A información derivada dos AIS pode supoñer por si mesma un importante apoio na avaliación e seguimento da explotación de marisqueiro a pé. A partir destes datos pode coñecerse a densidade de ocupación dos bancos, determinar as áreas de explotación e a evolución temporal do esforzo, así como as características das embarcacións e dos mariscadores.

SiTeM Simposio de Técnicos de Mariscadeo

XUNTA DE GALICIA

REDEMAR

Autoría: Parada, J.M.; Fernández Pérez, A.; Méndez Pérez, B.; Fernández Besada, M.

Título: ¿Pueden los gasterópodos nassáridos *Tritia reticulata* (L., 1758) y *Tritia neritea* (L., 1758) actuar como depredadores de moluscos bivalvos?

Evento: XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2023

¿Pueden los gasterópodos nassáridos *Tritia reticulata* (L., 1758) y *Tritia neritea* (L., 1758) actuar como depredadores de moluscos bivalvos?

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RESUMEN

A pesar de que *Tritia reticulata* (L. 1758) y *Tritia neritea* (L., 1758) son considerados carroñeros y/o carnívoros en la literatura científica, los moluscólogos y cultivadores de bivalvos emplean esfuerzo y recursos en retirar sistemáticamente de los bancos marisqueros estas especies porque los consideran depredadores. En este trabajo hemos examinado ejemplares de estas especies en contacto con ambientes [Crassostrea gigas (Thunberg, 1793)] ostrícolas y no se registran episodios de depredación, lo [illegible] que se pone en cuestión la justificación de los trabajos de retirada de estas especies de los bancos marisqueros.

MATERIALES Y MÉTODOS

- Seis botes de 30 l de Adhara de *T. reticulata* y seis de *T. neritea* en [illegible] cada bote.
- Caja con sedimento y flujo constante de agua. De [illegible] 213 ind/m².
- Seis botes de 30 l enterrados a [illegible] en la arena.
- Tres de los botes cebados con aproximadamente 3-5 bivalvos abiertos (entre 2 y 4 cm) cada día.
- Tres cajas sin cebo.
- Duración: 13 días.
- Diariamente se anotaba el consumo de *T. reticulata* o *T. neritea* encontrados [consumo directo] y el número de ejemplares consumidos en las cajas cebadas. El recuento duraba 10 minutos después de su renovación.

RESULTADOS

- *T. reticulata* se desenterraba para consumir dentro cuanto se tenía comida disponible y en presencia de carroña se encontraba bastante de comer ($Chi^2 = 6.5436$; $p = 0.010$). *T. reticulata* se encontraba cerquita de carroña y con ausencia de ella permanecía igualmente enterrada ($Chi^2 = 0.022$; $p = 0.8831$). Fig. 1.
- Aquí la misma ejemplares de *T. reticulata* que de *T. neritea* y consumen carroña ($Chi^2 = 25.77$; $p < 0.001$) (Fig. 2).
- En ninguna de las réplicas de la experiencia fueron depredadas las [illegible] cebadas, salvo en ausencia de carroña.

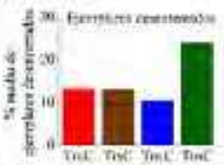

Figura 1: Porcentaje medio de ejemplares de *T. reticulata* (Trt) y *T. neritea* (Trn) consumidos en el conjunto de las tres réplicas de cajas con cebo (cC) y sin cebo (sC).

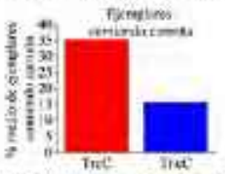

Figura 2. Porcentaje medio de ejemplares de *T. reticulata* (Trt) y *T. neritea* (Trn) consumidos en el conjunto de las tres réplicas de cajas con cebo (cC).

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DISCUSIÓN

T. reticulata no puede ser considerada especialmente una carroñera atraída como alimento con Davenport y Moore (2003), los ejemplares de *T. neritea* consumen carroña cuando la ofrecen a su disposición, aunque en menor medida que *T. reticulata* (Fig. 2) probablemente porque carroña [illegible] alimento no [illegible] como carroña depredadora, sino [illegible] y carroñera facultativa (Fig. 1) (Davenport y Moore (2003); Chase et al. (2018)) o, como sugiere Morton (1967) para *Tutufa rubeta* (Martyn, 1871), como oportunista.

La concepción de estas especies como depredadoras por los cultivadores y recolectores probablemente se deba a la [illegible] con ejemplares dañados o muertos, presentes en los lotes sembrados. Si algunas almejas sembradas estuvieran en contacto con ejemplares muertos del mismo sitio durante la fase de recolección por los cultivadores y durante la cuarentena posterior comenzar el ciclo que sitúe a los carroñeros (Davenport y Moore, 2003).

La extracción sistemática de *T. reticulata* y por extensión de *T. neritea*, que se realiza en algunas áreas de explotación de bivalvos, no se justifica por su carácter depredador y podría ser contraproducente debido a su papel como carroñeros en el ecosistema marino:

* Reducen la exposición de enfermedades al eliminar animales muertos o enfermos (Bernardini et al., 2014).

* Dispersan a predadores carroñeros facultativos, y reducen su efecto sobre la población viva (Herrera et al., 2014).

* Reciclan la materia de los cementerios (Garcia H et al., 2003).

* Contribuyen a reducir el exceso de materia orgánica evitando alteraciones en la comunidad bentónica (Crabbe et al., 2016).

* Actúan como reguladores de la población (Miranda et al., 2016).

* Compartir depredadores comunes con los bivalvos, como los [illegible] Decapoda ocasionales [illegible] o [illegible] (Aguiar [illegible], 1758) (Ferrer et al., 2016). En esta fábrica, se propondría [illegible] reducir la mortalidad de los bivalvos de producción por "causa".

CONCLUSIONES

- *T. reticulata* y *T. neritea* no son especies depredadoras y su actitud alimenticia de los lotes [illegible] ejemplares puede ser oportunista.

BIBLIOGRAFÍA

- Aranguren G. et al. 2016. *Oceanography*, 154: 658-666.
- Crowley A. et al. 2016. *Sci. Rep.* Elsevier., 568–610: 674–907.
- Davenport J. y Moore H.B. 2003. *J. Mar. Biolog. Assoc. U.K.*, 83: 287–969.
- Depestele J. *et al.* 2023. (Eds.). *The European Seabed Ecological Raising Diversity in Complex Multi-Jurisdictional Fisheries*. Springer International Publishing, Cham, pp. 125–167.
- Dirk J. S. et al. 2003. *Mar.*, 110: 225–234.
- Marron B. 2001. *Ambiente Res.*, 71: 239–249.
- Otto T.F. et al. (Eds.). 2019. *Corrie Ecology and Management*. Wildlife Research Monographs. Springer International Publ., Cham, 281 pp.
- Pena D., et al. 2016. *Cybium: international journal of Ichthyology*, 40: 233–234.

Autoría: Parada, J.M.; Monteagudo, A.B.; Méndez-Pérez, B.; Fernández-Besada, M.; Fernández-Pérez, A.; Rodríguez, I.

Título: Emprego de vídeo remolcado para a avaliación de stock de fauna epibionte en substratos brandos

Evento: I Simposio de Técnicos de Marisqueo

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2023

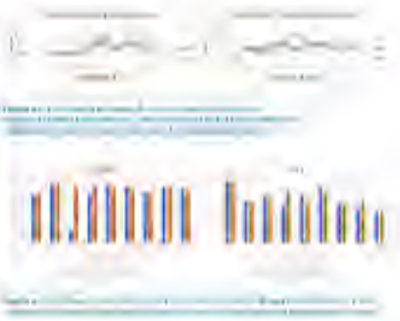
Emprego de video remolcado para a avaliación de stock de fauna epibionte en substratos brandos

José Manuel Parada
Mercedes Fernández Bescós
Ana Monteagudo
Alejandro Fernández Pérez
Ismael Méndez Ferro
Ismael Rodríguez

No plan de xestión do banco marisqueiro intermareal das Pías (Ría de Ferrol) é necesaria a técnica de vídeo remolcado para realizar un seguimento temporal da presenza de estrelas de mar, no programa de control de depredadores. Neste traballo proponse un procedemento para o emprego de vídeo remolcado e analízase a utilidade desta técnica na avaliación do stock de estrelas de mar. Unha vez a presenza dun stock de vieira no mesmo banco, os vídeos obtidos foron empregados para estudar as dificultades para a aplicación desta técnica na avaliación de stock de vieira.

Material e métodos

Resultados



Conclusións

SiTeM
Xunta de Galicia
REDEMAR

Autoría: Parada, J.M.; No-Couto, E.; Santiago, J.A.

Título: Proposta de metodoloxía para o estudo da diversidade en substratos duros intermareais afectados pola explotación dos recursos marisqueiros. Estudo preliminar

Evento: I Simposio de Técnicos de Marisqueo

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2023

Proposta de metodoloxía para o estudo da diversidade en substratos duros intermareais afectados pola explotación dos recursos marisqueiros. Estudo preliminar

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Neste traballo se realiza un estudo previo para analizar a viabilidade da aplicación da medida da diversidade baseada en grupos funcionais como indicador de obxectivos ecolóxicos dos plans de explotación. Este indicador podería ser de utilidade para o estudo dos efectos dos raspados, o seguimento da recuperación de substratos rochosos sometidos a extracción de recursos que requiren o raspado e a avaliación dos resultados da aplicación de boas prácticas durante a extracción destes recursos.

Material e métodos

Foi calculada a diversidade de grupos funcionais na illa Localidade de Salgueiras, na ría de Baiona (Figura 1), área sen constancia a raspado (para a comunidade de mexillón en 2020), nen estivo sometida durante os tres anos seguintes. Tomáronse, en cada, unha fotografía a cor (marco de 50 x 32 cm de superficie con período de abril anual entre 2020 e 2023 na zona intermareal media correspondente coa cinguta ecotadal de mexillón (Figura 1). As outras fotografías obtidas foron tratadas co software PhotoQuad (Trygonis et al., 2013) para o cálculo da cobertura dos diferentes grupos funcionais.

Os grupos funcionais foron definidos tendo en conta a súa función específica dentro da nutrición ou o seu papel como conformadores de hábitat (Padilla et al., 2010; Coppard et al., 2020; Mieszkowska et al., 2006) nas comunidades rochosas intermareais.

Figura 2. Fotografías de substratos duros intermareais [illegible]

Os datos de cobertura foron empregados para calcular o índice de diversidade de Simpson (1-D) no que cada grupo funcional foi tratado como se fose unha especie. Por outra banda, foi tido en conta a riqueza de grupos funcionais obtidos cada ano nos baldeiros raspados para explorar a súa capacidade descritiva da trayectoria da recuperación dos substratos rochosos, sendo estes grupos considerados como análogos das especies nos cálculos de riqueza dada. Sen embargo, os baldeiros mortos, a pesar de ser un grupo de interese, foi considerado no cálculo da diversidade ao ser derivado da colonización e conformación de hábitat dos baldeiros (Harley et al., 2002) e, polo tanto, dependente do seu proceso de recuperación, obtendo así unha estrutura relevante para raspado.

Resultados

A [illegible] fotografías dos catro anos mostraron un total de 17 grupos funcionais (Figura 2). Tralo raspado inicial da roche en grupos predominantes foron os de rocha con biofilme, presentes en algas coralinas articuladas, pteriomorfos rapadores, algas filamentosas e baláns (Figura 3). Un ano despois do raspado (2021) os colonos dominaban e localizáronse consecuencia de invasión da dominancia da rocha con biofilme, na cobertura. O segundo ano (2022) adquiriron máis importancia as algas coralinas articuladas, e mesmo as algas oportunistas. Tres anos despois as algas recuperaron a cobertura dos baldeiros, antes [illegible] semellanza a das rochas articuladas e rizoides, e a parede cingata a unha cobertura do 6%. En paralelo, a diversidade evolucionou de xeito contrastado, dende un valor inferior a 0,500 a un valor de 0,850 (Figura 3).

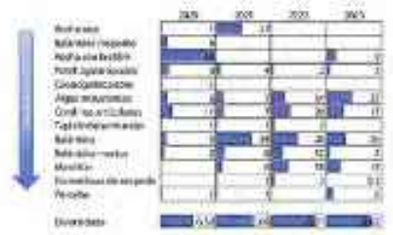

Figura 3. [illegible]

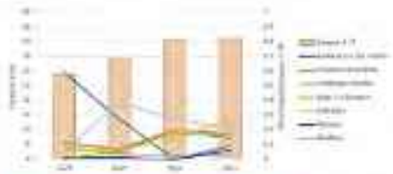

Figura 4. [illegible]

Conclusións e recomendacións de mellora

A cobertura e diversidade de grupos funcionais en substratos rochosos permite avaliar a alteración da biocenose e a evolución da diversidade con menos esforzo e máis rapidez que o estudo a nivel de especie. Sen embargo na aplicación destas metodoloxía cuspídanse certas dificultades como o seguimento durante tres cuadrais das mostras en especial cando o mantemento da verticalidade no emisario para recoller a distribución dos lados do mesmo, ou a empraga de gaiolas para a illamento de bivalvos que evitan a entrada de [illegible] que poden dificultar a asignación de grupos funcionais.

Esta metodoloxía pode ser de utilidade para o seguimento da diversidade e os axustes dos obxectivos ecolóxicos dos plans de xestión. Sen embargo, para a súa aplicación definitiva requírese ampliar o seu estudo en tempo [illegible] para determinar a [illegible] e [illegible] grupos funcionais que poidan servir como indicadores da saúde do ecosistema.

SiTeM Simposio de Tesouros de Mariscos

XUNTA DE GALICIA

REDEMAR

Autoría: Pérez-González, A.; García-Cardesín, É.; Cremades, J.; Abella-Rey, E.; Fuentes-Padín,T.; Carracedo-Parga, C.; García-Moroño, C.; Barreiro-Ríos, B.; Prieto Sierra, D.; Traveso Lago, A.

Título: Repoblación del alga parda alimentaria *Himanthalia elongata* (Fucales, Ochrophyta) con el fin de su conservación

Evento: XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2023

Repoblación del Alga Parda Alimentaria *Himanthalia elongata* (Fucales, Ochrophyta) con el Fin de su Conservación

Pérez-González[1], A., García-Cardesín[1], E., Cremades, J.[1]*, Abella Rey, E.[2], Fuentes Padín, T.[2], Carracedo Parga, C.[2], García Moroño, C.[3], Barreiro Ríos, B.[4], Prieto Sierra, D.[5] & Traveso Lago, A.[6]

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RESUMEN GRÁFICO

ANTECEDENTES Y OBJETIVOS

- *Himanthalia elongata* (correa, espagueti o judía de mar) es uno de los recursos autóctonos de macroalgas marinas alimentarias más importantes de Galicia.
- Por diversas causas (cambio global, depredación, explotación no adecuada a su peculiar biología, entre otras) en los últimos años se está empobreciendo en nuestras costas.
- El proyecto **HISARUM**, nacido en el marco de **REDEMAR** (Red entre el sector pesquero y organismos científicos en la Comunidad Autónoma de Galicia) tiene como uno de sus principales objetivos contribuir a la sostenibilidad de la explotación de este importante y peculiar recurso.

METODOLOGÍA

- Estudio previo del estado de las poblaciones de *H. elongata* en las tres Cofradías participantes en el proyecto: A Illa de Arousa, Cangas y Ribadeo.
- Recolección de reproductores de ambos sexos para evaluar su estado de madurez y, en su momento, la obtención de embriones en el laboratorio.
- Selección y acondicionamiento de las zonas del intermareal idóneas para la repoblación de los embriones obtenidos en el laboratorio y el seguimiento de su posible fijación.
- Realización de la siembra en las zonas idóneas de A Illa de Arousa y Cangas con dos suspensiones de embriones de *H. elongata* de distinta talla.

RESULTADOS

- En el ámbito de la Cofradía de Ribadeo este recurso ya no está presente, seguramente por procesos de mediterranización de la costa. Por esta razón no se planteó realizar de momento este tipo de experiencias en esta Cofradía.
- En A Illa de Arousa y Cangas la siembra de embriones obtenidos en laboratorio (a partir de reproductores de la propia zona o fértiles) se realizó con éxito en las mareas equinocciales de septiembre (concretamente el 23 y 30 del mes).
- Para empezar a estimar la mejor estrategia de siembra en el futuro, se utilizaron dos tipos de embriones: unos muy juveniles, de unos 10 días de edad, y otros más diferenciados, de unos 30 días.

CONCLUSIONES

- **El estudio de la evolución de las poblaciones de *Himanthalia elongata* en las cofradías implicadas en este proyecto hace visible su palmaria disminución en los últimos años.**
- **Pero los avances obtenidos en estos estudios facilitan el desarrollo de nuevas técnicas de siembra y recuperación de la misma.**
- **Por lo que estamos ante una gran oportunidad para conservar y potenciar este recurso.**

Actuación cofinanciada por los Fondos FEAMP en el marco del PO ... y del Real Decreto ... de ... Caladero Nacional Pesquero

Autoría: Varela Baños, P.; Parada, J.M.

Título: Análise da dinámica de crecemento do berberecho no banco marisqueiro de Lombos do Ulla

Evento: I Simposio de Técnicos de Marisqueo

Lugar: Santiago de Compostela - Galicia (España)

Ano: 2023

Análise da dinámica de crecemento do berberecho no banco marisqueiro de Lombos do Ulla

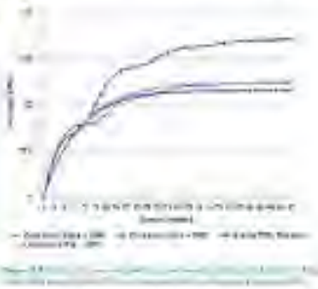
Pablo Varela Baños

José Manuel Parada

Cerastoderma edule é unha das especies comerciais máis importantes na Ría de Arousa. Dentro da ría unha das zonas máis importantes historicamente a nivel produción de berberecho é o banco de Lombos de Ulla (Figura 1). Con campañas de explotación que xeralmente comezan en outubro e rematan a marzo, a produción media entre 2001 e 2011 foi de 472 t, o que supón un 29 % da produción anual na ría de Arousa para ese mesmo período.

Material e métodos

Resultados e discusión



SiTeM

XUNTA DE GALICIA

REDEMAR

Autoría: Cerviño-Otero, A.; Pérez, E.; González-Fontela, A.; Ortega, M.; Iglesias, D.; Villalba, A.; Gabín-Sánchez, C.

Título: Estudo preliminar para a execución dun proxecto de restauración de ostra plana na enseada de San Simón

Evento: XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2023

Estudo preliminar para a execución dun proxecto de restauración de ostra plana na enseada de San Simón

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INTRODUCIÓN

Os bancos naturais de ostra plana (*Ostrea edulis*, Linnaeus 1758) das rías galegas amosaron sinais alarmantes de esgotamento xa dende mediados do século pasado. A causa principal foi a sobreexplotación, pero tamén contribuíron as enfermidades introducidas, como a bonamiose, que provocou mortalidades catastróficas, como ocorreu en toda a costa atlántica europea. Co fin de recuperar os bancos naturais de ostra plana da enseada de San Simón, unha das zonas con maior producción de ostra plana de Galicia no pasado, iniciouse un proxecto de restauración que ten como obxectivo final recuperar a cultura sostible de ostra plana nesta zona e fortalecer os beneficios para o ecosistema que brinda esta especie.

OBXECTIVOS

- Localizar e delimitar en mapas da zona os bancos naturais existentes ou históricos
- Verificar a existencia ou non de captación natural en colectores que foran instalados previamente
- Localizar e delimitar a zona máis adecuada para a instalación dun sistema de estabulación de reprodutores

MATERIAIS E MÉTODOS

Realizáronse 30 enquisas entre as persoas do sector pesqueiro da zona para a recollida de información sobre os bancos naturais de ostra plana (Fig. 1).

Para determinar a mellor zona para a instalación do sistema de estabulación de reprodutores realizouse unha saída de campo onde se tomaron os principais parámetros fisicoquímicos en varios puntos dos bancos naturais da enseada de San Simón. Ademais, recolléronse 30 exemplares xuvenís de ostra de antigos colectores co fin de caracterizar a especie con técnicas moleculares (Fig. 2). A amplificación de secuencias específicas para cada unha das especies levouse a cabo mediante PCR múltiplex. Neste ensaio utilizáronse tres pares de primers deseñados por Cross et al., (2006). O seu uso conxunto nunha única PCR permite a amplificación específica dunha secuencia de 800 pb de *O. edulis*, dunha de 400 bp de ostra rizada *Magallana gigas* e doutra de 596 pb da ostra anana ou morrucho *Ostrea stentina*.

Fig. 1: Enquisa.

Fig. 2: Colectores.

RESULTADOS E CONCLUSIÓNS

Os datos recollidos nas enquisas amosan que só as persoas con máis de 5 de anos de experiencia lembran observar algún exemplar de ostra plana nos bancos marisqueiros da confraría de Arcade. De acordo con esta información, as zonas onde foi vista algún exemplar indícanse con "X" na figura 3. Esta información terase en conta en futuras actuacións nas que se leve a cabo a instalación de colectores.

Mediante PCR con primers específicos das especies *O. edulis*, *O. stentina* e *M. gigas*, comprobouse que o 100% dos individuos recollidos nos antigos colectores pertencían á especie *O. stentina* (Fig. 4).

Fig. 3: Localización da zona de estabulación de reprodutores (frecha amarela). Zonas nas que se observaron exemplares de ostra plana no pasado (X)

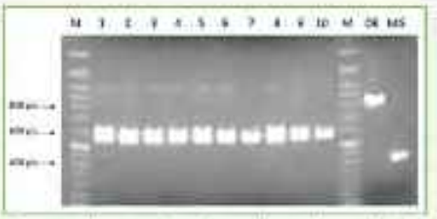

*Fig. 4: Análise por electroforese dos produtos obtidos da amplificación do ADN dos ostras illadas nos colectores na enseada de San Simón mediante PCR múltiplex. Liña M: Marcador de peso molecular; Liñas 1-10 produtos da amplificación das mostras. Liña OE: produto da amplificación do ADN de *O. edulis* utilizado como control positivo. Liña MG produto da amplificación de ADN de *M. gigas* utilizado como control positivo.*

Tendo en conta os resultados da saída de campo, así como os coñecementos da zona proporcionados pola asistencia técnica da confraría e polo persoal técnico da Consellería, decidiuse que a zona de estabulación de reprodutores será na bóia Río Alvedosas VIII72 (Fig. 5).

BIBLIOGRAFÍA

Cross, I., Kelleher, K., & Diaz, E. (2006). Species identification of Crassostrea and Ostrea Ostrea by Polymerase Chain Reaction Amplification of the 5S rRNA Gene. J. AOAC Int. Vol 89, Nº 1, 144-149.

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Actuación cofinanciada pola FEAMP no 75% PO español 2014ES14MFOP002 (Enxeñaría 2. OE1.el - medida 1.3.2/ OE: 0. X. Desenvolvemento Pesqueiro

Autoría: de Santiago-Meijide. J.A.; Cerviño-Otero, A.; Gregorio, M.V.; Rodríguez, O.; Rodríguez, S.; Gabín-Sánchez, C.

Título: Resultados preliminares del crecimiento de la mejilla (*Mytilus galloprovincialis* Lamarck, 1819) producida en criadero y fijada den textiles biodegradables

Evento: XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2023

Resultados preliminares del crecimiento de la mejilla (*Mytilus galloprovincialis* Lamarck, 1819) producida en criadero y fijada en textiles vegetales biodegradables.

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OBJETIVOS.

1. Verificar si han crecido de forma similar en todas las áreas de cultivo.
2. Verificar si han crecido igual dentro del mismo polígono.
3. Confirmar si hay diferencias en longitud y biomasa, según la profundidad.

Fig. 1: Mejillá fijadas en textil vegetal.

MATERIAL Y MÉTODO DE TRABAJO.

-Entre el 6 de marzo y 10 de agosto, salen > 9.100.000 unidades de mejilla, con una talla promedio de 515 µm.

-Se reparten entre 11 productores. Ría Arousa (8); Ría de Pontevedra (2); Río de Sada (1).

-Se toman 10 centrimetros de muestras a 1 y 5 metros en caso de estar la cuerda chicoteada y a 1, 6 y 12 si no lo están.

-Se toma la biomasa total y número de individuos por muestra; de ellas se toman 30 individuos de los cuales, se miden las dimensiones dorso-ventral y antero-porterior, así como el peso individual.

-Se calcula la tasa de crecimiento G30 (Wimberg, G.G,1971), para obtener una variable homogénea de crecimiento, para muestras con diferentes días en cultivo.

-Se utiliza el análisis de la varianza (ANOVA), para comprobar si dos o más grupos son o no estadísticamente iguales entre sí.

-Para verificar si hay una diferencia estadísticas significativa entre las medias de dos muestras diferentes, se utiliza la *prueba t de Student*, para varianzas iguales o distintas, según el caso.

Fig. 2: Encordado manual en la batea. Tamaño 515 µm.

Diferencia en la tasa de crecimiento		
	Polígonos cercanos (misma ría)	Polígonos alejados (distinta ría)
Mismo lote de mejilla	5,47%	23,07%

Diferencia en la tasa de crecimiento		
	Dentro de la misma batea	Bateas distintas
Mismo polígono (Villagarcía-A)	0,16%	3,27%

Fig. 3: Diferencias en la tasa de crecimiento de la mejilla, según la ubicación de la misma.

Fig. 4: Diferencias en longitud y biomasa de la mejilla, según la profundidad en la cuerda.

RESULTADOS.

1. Hay diferencias significativas en la tasa de crecimiento entre todas las cuerdas muestreadas.
2. No se han encontrado diferencias significativas en la talla (dorso-ventral), dentro de la misma batea. Si hay diferencias significativas entre rias e incluso dentro de un mismo polígono (Figura 3).
3. La profundidad marca diferencias significativas en la talla promedio (dorso-ventral) y en la biomasa, sobre todo a partir de los 5-6 metros de profunidad; estas diferencias se hacen más evidentes, si se comparan entre 1 y 12 metros (-11,01 % en longitud; -61,78 % en biomasa). Figura 4.

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Expediente subvencionado por la Unión Europea FEMP Eje. 1 Desarrollo sostenible de la acuicultura. Artículo 51 Aumento el potencial de las zonas de producción acuícola.
Porcentaje de cofinanciamiento medida: 75% FEMP y 25% Estado miembro

Autoría: Fernández, B.; Brianes, M.J.; Vázquez, M.; Cabaleiro, S.; Gabín-Sánchez, C.

Título: Experiencia de adaptación a la cautividad del salmonete de roca (*Mullus surmuletus* Linnaeus, 1758) aplicando técnicas de enriquecimiento ambiental

Evento: XXVI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2024

Primeiro premio ao mellor cartel científico

Adaptación a la cautividad del salmonete de roca (*Mullus surmuletus* Linnaeus, 1758) aplicando técnicas de enriquecimiento ambiental

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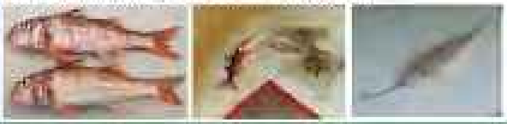
Introducción

En mayo de 2024 fue aprobada por la Dirección Xeral de Desenvolvemento Pesqueiro de la Consellería do Mar (Xunta de Galicia) la acción de investigación **CIMA 24/01 (SALROC)** con la que se pretende contribuir a la diversificación de la piscicultura marina mediante la optimización de las técnicas de cultivo del **salmonete de roca** (*Mullus surmuletus* Linnaeus, 1758). Una de las primeras acciones que se contemplan en dicho proyecto es la adaptación a la cautividad de juveniles y/o adultos de salmonetes de roca capturados en el medio natural para, posteriormente, poder iniciar pruebas de engorde y reproducción. Como prueba preliminar, se capturaron varios ejemplares salvajes y se introdujeron en tanques de cultivo del Centro de Investigacións Mariñas (CIMA-Corón) y del Centro Tecnológico del Clúster de la Acuicultura (CETGA) para intentar establecer y/o mejorar futuros protocolos de captura, transporte y adaptación a la cautividad. A los tanques se les añadieron diferentes elementos de **Enriquecimiento Ambiental (EA)** con la intención de observar su efecto en el comportamiento de los peces.

Este trabajo es el primer estudio en el que se aborda la aplicación de estrategias de enriquecimiento ambiental para el cultivo del salmonete de roca.



Materiales y métodos

Códigos QR-1 y QR-2 para acceder a dos VÍDEOS donde se pueden observar algunas de las instalaciones del CIMA-Corón utilizadas en esta experiencia (tanque 1 con salmonetes de roca y los elementos de EA).

Captura en el medio natural.
Los salmonetes fueron capturados en las rías de Arousa y Pontevedra (Galicia, España). Para intentar minimizar los daños a la hora de capturar y manejar los salmonetes vivos, se utilizó como arte de pesca el bolinche y se usaron salabres con red de caucho (Fig. 1).

Transporte.
Para transportar los peces vivos a las instalaciones del CIMA se acondicionó la parte trasera de una furgoneta con un depósito de agua de 200 litros, un sistema de aireación y un sistema de oxigenación (Fig. 2).

Figura 1: Ejemplar capturado siendo manejado con un salabre de red de caucho.
Figura 2: Furgoneta del CIMA con el sistema de transporte de peces vivos.

Instalaciones e instrumental.
Los tanques de cultivo empleados en el CIMA son de 1 m^2 de superficie y 500 litros de volumen y el circuito de agua es abierto. Se midieron diariamente temperatura, salinidad y oxígeno utilizando un oxímetro [illegible] y un salinómetro digital [illegible].

Enriquecimiento ambiental (EA).
En el CIMA, como elementos de EA (Fig. 3), se colocaron refugios de fondo (enriquecimiento físico estructural) y una bandeja con arena (enriquecimiento físico de substrato). Los refugios de fondo del CIMA se construyeron a partir de los denominados "cuarterones" (utilizados en los cestos ostrícolas para el engorde de moluscos en batea).
En el CETGA se utilizaron refugios de fondo (generados a partir de tubos de PVC) y un fondo arenoso. A lo largo de dos meses se observó el comportamiento de los salmonetes y su interacción con los diferentes elementos de EA.

Alimento.
El principal alimento utilizado en la experiencia fueron poliquetos vivos y congelados. En el CIMA, para mantener vivos a los poliquetos durante varios días, se ideó un sistema de estabulación de poliquetos utilizando un climatizador portátil [illegible] (Fig. 4).

Figura 3: Tanque del CIMA con salmonetes de roca y elementos de EA (refugios de fondo y bandeja con arena).
Figura 4: Sistema de estabulación de poliquetos del CIMA (con climatizador portátil [illegible]).

Resultados y Discusión

Durante los meses de julio y agosto de 2024 se capturaron vivos un total de 78 ejemplares de salmonete de roca (se espera incrementar este número con sucesivas capturas). Ocho de los ejemplares fueron estabulados en un tanque del CIMA y el resto en las instalaciones del CETGA. En ambos centros, durante los tres primeros días de estabulación, se observó una mortalidad próxima al 30%, probablemente debida al estrés de la captura y a las erosiones que presentaban algunos ejemplares. Con los ejemplares supervivientes de las capturas, y ya adaptados a la cautividad, se realizarán en el futuro diversas pruebas de engorde y reproducción.

El alimento no empezó a ser ingerido por los peces hasta transcurridos 5-10 días. Actualmente se está realizando el proceso de adaptación de los animales a piensos semi-húmedos y secos.

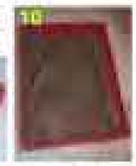
Las observaciones sobre la **adaptación a la cautividad** de los salmonetes fueron muy similares en ambos centros. Los primeros días tras la captura se observó que los animales tenían un comportamiento asustadizo, agrupados y sin apenas movimiento ni actividad de inspección del espacio (Fig. 5).

Los **refugios de fondo** ("cuarterones" modificados en el CIMA y tubos de PVC en el CETGA) tuvieron rápidamente aceptación por los peces ya que a las pocas horas de colocarlos ya estaban ocupados (Fig. 6). A partir de ese momento estos refugios estuvieron ocupados prácticamente todo el tiempo y, a veces, cada refugio era ocupado por varios individuos (Fig. 7 y Fig. 8). El manejo (movimiento, afloramiento de la parte superior, limpieza y desinfección periódica) de ambos sistemas de refugio fue bastante sencillo por lo que, a la vista de los resultados, serán utilizados en futuros procesos de adaptación a la cautividad.

El empleo de arena como elemento de EA se estudió desde dos perspectivas. En el CIMA, se colocó una bandeja con arena en el fondo del tanque mientras que en el CETGA se cubrió todo el fondo de un tanque con una capa de 2 cm de arena. En el CIMA, transcurridas 24 h de la colocación de la bandeja, ya empezó a ser utilizada por los salmonetes para descanso y búsqueda activa de alimento con sus barbillones (Fig. 9 y Fig. 10). Sin embargo, en el tanque del CETGA, la presencia de arena en todo el fondo del tanque no supuso ninguna mejora evidente de aclimatación pero sí supuso un problema del mantenimiento de las condiciones higiénicas.

El hecho de utilizar una bandeja de arena en vez de un fondo totalmente recubierto de arena disminuye los inconvenientes de un fondo arenoso a la hora de gestionar su limpieza por lo que utilizaremos la bandeja con arena como elemento de EA en las futuras adaptaciones a la cautividad de esta especie.

Figura 5: Salmonetes sin elementos de EA, próximos al desagüe.
Figura 6: Salmonetes del CIMA en un elemento de EA (refugio de fondo).



Figuras 9 y 10: Salmonetes del CIMA en la bandeja con arena, ver vídeo de la foto 9 a través del código QR-3.

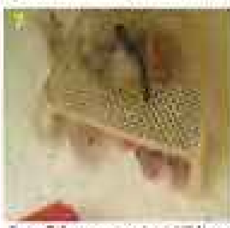
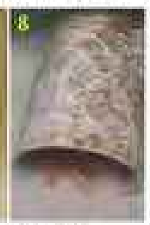



Figura 7: Cuatro salmonetes del CIMA en un refugio de fondo.
Figura 8: Cuatro salmonetes del CETGA en un refugio de fondo.

Códigos QR-4 y QR-5 para acceder a dos VÍDEOS donde se pueden observar algunos comportamientos de los salmonetes con los refugios de fondo y el alimento (poliquetos).

Conclusiones

Con esta experiencia preliminar se concluye que la introducción de elementos sencillos de EA puede modificar el comportamiento de los salmonetes al sentirse atraídos a interaccionar con ellos ya sea como refugio, lugar de descanso o búsqueda de alimento. Consideramos que la utilización, como elementos de EA, de estructuras físicas sencillas puede ser una herramienta válida para intentar mejorar el bienestar de los salmonetes y su adaptación a la cautividad. Se necesitan más estudios para cuantificar los posibles beneficios e incrementarlos y para diseñar estructuras que se adapten de la forma más óptima posible al comportamiento de esta especie.

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Bibliografía

- APROMAR (Asociación Empresarial de Acuicultura de España). 2022. Guía sobre el bienestar de los peces en la acuicultura española. Volumen 1: Conceptos y Generalidades. Coordinador: Pablo Arechavala López. 94 pp.
- Arechavala López, P. 2020. Enriquecimiento ambiental: estrategia para mejorar la producción y el bienestar de los peces. Libro de actas del XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas, pp. 93-100.
- Arechavala López, P., Caballero Froilán, J.C., Jiménez García, M., Capó, X., Tejada, S., Saraiva, J.L., Sureda, A. y Moranta, D. 2023. Enriched environments enhance cognition, exploratory behaviour and brain physiological functions of *Sparus aurata*. Scientific Reports, 13(1): 11252. 14 pp.
- Arechavala López, P., Cabrera-Álvarez, M.J., Maia, C.M., Saraiva, J.L. 2021. Environmental enrichment in fish aquaculture: A review of fundamental and practical aspects. Reviews in Aquaculture, Vol. 14, pp. 704-728. 25 pp.

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XXVI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove, 9 e 10 de outubro de 2024 · XXVI ForoAcui

Autoría: Fernández, B.; Brianes, M.J.

Título: Cultivo de peixes planos en tanques de moluscos aplicando técnicas de enriquecemento ambiental

Evento: XXVI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2024

Cultivo de peixes planos en tanques de moluscos aplicando técnicas de enriquecemento ambiental

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Introducción

A finais de febreiro de 2024 iniciouse no CIMA (Centro de Investigacións Mariñas-Corón) unha experiencia, que duraría aproximadamente seis ou oito meses, na que se pretendía coñecer se os tanques que había no devandito centro, habitualmente utilizados para o cultivo de moluscos, podían ser adecuados tamén para o cultivo de peixes planos ou bentónicos, en concreto para o mantemento e/ou engorde de linguado salvaxe (*Solea solea* (Linnaeus, 1758)) e de rodaballo (*Scophthalmus maximus* (Linnaeus, 1758)), con vistas á súa posible utilización futura para realizar experiencias de cultivo con peixe con carácter bentónico como é o salmonete de roca (*Mullus surmuletus* Linnaeus, 1758). Aos devanditos tanques engadíronselles diversos elementos estruturais de **enriquecemento ambiental (EA)** de tipo físico (pedras, refuxios de fondo e tubos) coa intención de incrementar a heteroxeneidade espacial no interior dos tanques, comprobar como interactuaban os peixes cos devanditos elementos estruturais e tentar incrementar así o benestar dos peixes.

Este traballo é o primeiro estudo publicado no que se aborda, de forma práctica, a aplicación de estratexias de enriquecemento ambiental de tipo estrutural para o cultivo de peixes planos.

Materiais e Métodos

Código QR-1 para acceder a un **VÍDEO** onde se poden observar algunhas das **instalacións** do CIMA utilizadas nesta experiencia (tanques **T1** e **T2**).

Para esta experiencia utilizáronse dous tanques de cultivo circulares (inicialmente deseñados para o cultivo de moluscos) de 1 m² de superficie e 500 litros de volume de auga que se atopaban nas instalacións do CIMA-Corón. Nun dos tanques (tanque T1) incluíuse o engorde de **linguado** e no outro tanque (tanque T2) o engorde de **rodaballo** (ver **VÍDEO-1**. **Código QR-1**). O circuito de auga era aberto e a caudal do tanque estableceuse en 10 renovacións/día.

Medíronse diariamente a temperatura (ºC), a salinidade (Unidades Prácticas de Salinidade, UPS) e o osíxeno disolto en auga (ppm), utilizando un osímetro Oxyguard Handy Polaris 2 e un salinómetro Hanna HI98312.

Os peixes utilizados na experiencia (30 linguados e 20 rodaballos) foron cedidos polo IGAFA (Instituto Galego de Formación en Acuicultura).

A subministración de pensu seco realizouse mediante comedeiros automáticos e complementáronse con tomas manuais.

Periodicamente (aproximadamente cada mes) realizáronse mostraxes de peso e talla. Cos resultados realizáronse as curvas de crecemento de peso e talla e calculáronse diversos índices de crecemento: factor de condición (FC), taxa diaria de crecemento específico (G), eficiencia de crecemento (EC) e eficiencia de crecemento á curta (ECA* d/día).

Considerando ao enriquecemento ambiental (EA) como unha importante ferramenta para intentar mellorar o benestar dos peixes de acuicultura (Arechavala, 2022, Arechavala et al., 2020, Arechavala et al., 2021 e APROMAR, 2022 e Calli et al., 2015) engadíronse aos tanques diversas estruturas de EA para comprobar o seu efecto no comportamento dos peixes. Así, ao tanque de linguados (**Fig. 1**) engadíronse pedras e refuxios de fondo (realizados a partir dos denominados "cuarteróns" dos cestillos ostrícolas) e, ao tanque de rodaballos (**Fig. 2**), pedras no fondo e unha estrutura tubular disposta obliquamente na columna de auga. Esta estrutura cilíndrica inicialmente foi unha cesta común ou cartucho para, tras degradarse a cesta, reforzouse por un tubo de PVC.

Figura 1: Tanque T1 con **linguados** e elementos de EA estrutural de fondo (refuxios e pedras).

Figura 2: Tanque T2 con **rodaballos** e elementos de EA estrutural de fondo (pedras) e un elemento de EA estrutural (dúbrase tubo de PVC).

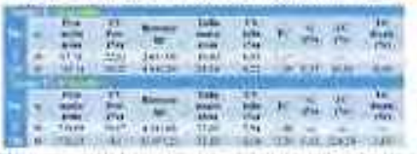
Resultados e Discusión

Os 30 linguados mantivéronse nos tanques de cultivo durante 181 días e os 20 rodaballos durante 190 días. Durante ese tempo non houbo ningunha mortalidade excepto o caso dun rodaballo morto accidentalmente tras desbordarse a auga do tanque ao quedar taponada a saída da auga por unha folla de árbore arrastrada polo vento uns días antes de colocar unha lona tapadeira nos tanques.

Con respecto aos parámetros da auga de cultivo, a temperatura da auga fluctuou entre un valor medio mensual de 12,6ºC en febreiro e 18,9ºC en agosto, a salinidade media mensual entre 29,1 UPS en marzo e 35,6 UPS en agosto. O nivel de osíxeno medio mensual non baixou de 6,6 ppm, con valor diario mínimo de 5,1 ppm o 5 de agosto.

Cos datos obtidos nas mostraxes elaboráronse curvas de crecemento (**Fig. 3** e **Fig. 4**) e calculáronse varios índices de crecemento (**Táboa I**). Observouse o comportamento dos peixes ante os diferentes elementos de EA e comprobouse que os refuxios de fondo cos linguados estiveron ocupados practicamente todo o tempo e que os rodaballos interactuaban frecuentemente co EA obtendo con una actitude que poderíamos definir de certa "curiosidade" (ver **VÍDEO**, código **QR-2**)

Figura 3 e **Figura 4**. Gráficas coas **curvas de crecemento** (en peso e talla) do linguado e rodaballo.



Táboa I. Valores medios de peso e talla e índices de crecemento (medios ou poboacionais) obtidos entre o principio (día 0) e final (día 181 para linguados e día 190 para rodaballos). CV: coeficiente de variación; FC: factor de condición; G: taxa diaria de crecemento específico; EC: eficiencia de crecemento; e ECA: eficiencia de crecemento á curta. Os valores en negrita de crecemento acadados, consideramos que son os máis axeitados para unha experiencia de duración de 6 meses, tendo en conta que a duración principal dos ciclos de cultivo máis habituais no engorde dos seres bentónicos.

Código QR-2 para acceder a un **VÍDEO** onde se pode observar o comportamento dos **rodaballos** ante o elemento de EA estrutural inicial (cesta ou cartucho).

Conclusións

Con esta experiencia confírmase que é posible manter e/ou engordar peixes planos (linguado e rodaballo) utilizando tanques inicialmente deseñados para o cultivo de moluscos, polo menos a pequena escala. Como se demostrará nunha experiencia posterior, estes tanques tamén son adecuados para o cultivo doutros peixes bentónicos, como é o caso do salmonete de roca.

A introdución de elementos sinxelos de enriquecemento ambiental parece mellorar o benestar dos peixes ao sentirse atraídos e interaccionar con eles dun xeito positivo. Non está dentro dos obxectivos deste traballo analizar indicadores do benestar dos peixes que permitan avaliar cuantitativamente a posible melloría do benestar dos peixes grazas ao enriquecemento ambiental pero si se pretende estimular ao produtor de acuicultura, así como aos estudantes e técnicos do sector pesqueiro, a valorar esta posibilidade, considerando que a posible pequena melloría no benestar dos peixes poderíase, por unha banda, traducir nunha mellor consideración social da acuicultura por parte da opinión pública e, por outra banda, supoñer un valor engadido á hora de certificar ou vender o produto.

Agradecementos

Ao Instituto Galego de Formación en Acuicultura (IGAFA) pola cesión dos exemplares de linguado e rodaballo utilizados nesta experiencia.

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Bibliografía

- APROMAR (Asociación Empresarial de Acuicultura de España). 2022. La acuicultura en España 2022. Retos para el crecimiento. Edición 2022. Tendencias y Retos Mundiales. Consolidación. Retos Específicos. Edipex. 58 pp.
- Arechavala-López, P. 2022. Enriquecimiento ambiental: ecología para mejorar la producción y el bienestar de los peces. Curso de verano de UPV. Nuevos Retos Científicos en la Acuicultura del Siglo XXI. Edipex. pp 75-108.
- Arechavala-López, P., Caballero-Huertas, J.C., Jiménez-Castillo, Tapia, M.R., Peralta, S., Saraiva, J.L., Sanllida, A. y Moranta, D. 2020. Structural environmental enrichment supports anti-predator behaviour and decreases stress responses in juvenile European seabass (*Dicentrarchus labrax*). Scientific Reports. 10:21112 (12p). Nature.
- Arechavala-López, P., Cabrera-Álvarez, M.J., Maia, C.M., Saraiva, J.L. 2021. Environmental enrichment in fish subjected to different husbandry conditions: Effects on growth performance, physiological responses, and welfare indicators in meagre (*Argyrosomus regius*). Aquaculture. vol 533, pp 736-755. 20 pp.
- Calli, L., Vadstein, O.J., Hamre, K. (2015). The effect of rearvolume on the performance of Atlantic cod (*Gadus morhua*) reared in recirculating aquaculture systems. Aquacultural Engineering, 68, 58-65. [also journal of Aquaculture Engineering, vol 68, 1 pp.]

XUNTA DE GALICIA | CONSELLERIA DO MAR | CIMA

Autoría: Pampín, A.; Villalba, A.; Iglesias, D.; Ortega, M.; de Santiago, J.A.; Abella, E.; Cao, A.; Blanco, A.; Martínez, P.

Título: Genetic resiliencie in the common cockle (*Cerastoderma edule*): Contrasting natural selection and selective breeding for marteiliosis resistance

Evento: 7th International Symposium in Aquaculture (GIA)

Lugar: Tessaloniki (Grecia)

Ano: 2024

GENETIC RESILIENCE IN THE COMMON COCKLE (*CERASTODERMA EDULE*): CONTRASTING NATURAL SELECTION AND SELECTIVE BREEDING FOR *MARTEILIOSIS* RESISTANCE

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INTRODUCTION

The emergence of mortalities caused by multiple interacting factors has been reported in the common cockle *Cerastoderma edule* (Linnaeus, 1758) in many regions around the world. In the Galician coast (NW Spain), in 2013 these mortalities led to the total closure of the fishery, damaging the economy of numerous artisanal shellfish gatherers and shellfish processors. The first annual outbreak was reported in the Arousa estuary in 2012 (Villalba et al. 2014) and, subsequently, spread to southern estuaries along the Galician coast in the following years, resulting in nearly 100% mortality and massive economic losses for the fishery production.

In 2015, Iglesias et al. (2020) recorded a reduction in prevalence and mortality rates, ranging between 40% and 50%, furthermore, it was observed that newly recruited cockles were able to reach maturity, suggesting the presence of a resistant mechanism in individuals attributable to natural selection.

Understanding the mechanisms of selection, resistance and development of effective strategies for disease management are imperative for safeguarding shellfish populations and aquaculture production. Several molecular approaches are currently used in aquaculture to manage shellfish production, one of which involves obtaining resistant strains. In 2020, a common garden experiment conducted by Villalba et al. (2020) evaluated the response of a wild resistant strain to mortalities, confirming its resistance and validating an easy to implement polymorphic DNA (SNP) identified by Pampín et al. (2021), which could differentiate resistant cockles from a long-term affected estuary from a naive and highly susceptible strain.

This study aims to assess the resilience of third-generation hatchery-bred cockles selected for mortalities disease resistance and compare them to wild cockles selected under a long-term affected shellfish area, the Ría de Arousa. Furthermore, we evaluated the performance of 47 SNPs associated with mortalities outcomes including 27 of the previous common garden experiment by Villalba et al. (2020).

MATERIALS and METHODS

Sampling location of the three broodstock in Ría de Arousa estuary, NW Spain

EXPERIMENTAL DESIGN

Collection Breeders 3 STRAINS:
- 462 inds. Halvey Nets (HN)
- 278 inds Wild bag nets affected resistant strain, Villanova Arousa (VA)
- 340 inds. Putative resistant from F2 hatchery controlled breeding crossing

Conditioning area spawning (NO, Resistant WT, F2), seed collection and growth seed until 1,8 cm (Marine Research Center)

Pregrowth stage – Lotrins (strains NO, VA F2)

Challenge 4 box per strain – 2 shellfish beds (Arillo and Samil)

Sampling

Prevalence and Mortality
Genotype 47 SNPs
- Diversity
- Allelle frecuencies
- Ne

Sampling
NO (November 2021)
F2 (May 2022)
VA (May 2022)

RESULTS

- Prevalence and mortality increased rapidly in NO samples, reaching approximately 50% by early May, while VA and F2 samples showed significantly lower prevalence and mortality rates, remaining below 20% throughout the same period.
- Genetic diversity (He) varied between 0.288 to 0.327. Higher in challenged samples. Lowest in wild samples previous to challenge.
- VA and F2 samples have similar prevalence and mortality rates across all selection levels (p>0.05) (Table 1).
- 47 markers showed no possible differences between resistant (post-challenge and after the challenge) (p>0.05). Seven markers initially exhibiting significant differences before the challenge showed similar genotype distributions post-challenge (CE2, CE3, CE26, CE42, CE45, CE52, CE53), suggesting a temporary effect of resistant selection due to Marteilia exposure (Fig 1).
- Significant differences between resistant (VA, F2) and Wild/Hatchery samples (NO).

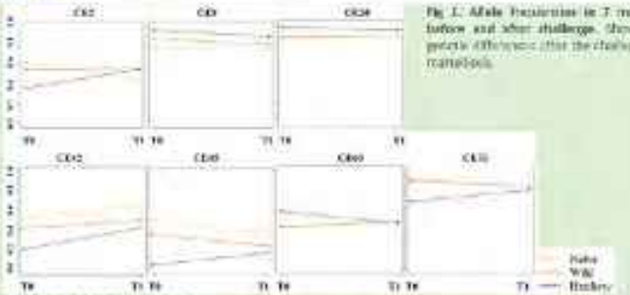

Fig 1. Allele frequencies in 7 markers before and after challenge. Shown no genetic differences after the challenge the mortalities.

Table 1. Sampled Samples and levels of marteiliosis

				M. cochillia Infection level						
	Date	Sample	N	0	1	2	3	4	Prevalence
Control	Jan-21	CNO	34	34	0	0	0	0	0.0%
	Jun-21	CNO	33	33	0	0	0	0	0.0%
	Jun-21	CVA	34	34	0	0	0	0	0.0%
Naive	Nov-21	NOAri	35	10	7	13	1	4	71.4%
	Nov-21	NOSar	47	14	5	5	11	12	70.2%
Wild	May-22	VAAri	49	42	3	3	0	1	14.0%
	May-22	VASar	50	43	3	3	1	0	10.0%
Hatchery	May-22	F2Ari	46	40	3	1	0	0	10.0%
	May-22	F2Sar	49	42	3	0	0	0	14.0%

CONCLUSIONS

- No significant differences regarding prevalence and mortality between resistant strains (hatchery vs wild). Resistance was assumed in hatchery cockles compared to naive ones after the challenge.
- Validation of a SNPs set of 47 used in the analyses that resulted the genetic differentiation between naive and resistant before them.

REFERENCES

Villalba, A., Iglesias, D., Ortega, M., de Santiago, J.A., Abalia, E. (2014). Source of Marteilia cochillia infection in the Ría de Arousa and its role in the management of cockle fisheries. Journal of Shellfish Research 33(1): 1-16. doi: 10.2983/035.033.0102

Pampín, M., Blanco, A., Martínez, P., Villalba, A., Iglesias, D., Ortega, M., de Santiago, J.A., Abalia, E., Cao, A. (2021). Genetic markers associated with resistance to Marteilia cochillia in common cockle (Cerastoderma edule) using a combined genome-wide and candidate gene approach. Evolutionary Applications 14: 2019-2034. doi: 10.1111/eva.13260

Iglesias, D., Villalba, A., Ortega, M., de Santiago, J.A., Abalia, E., Cao, A., Blanco, A., Martínez, P., Pampín, M. (2020). A common garden experiment suggests a genetic component underlying the recovery of European cockle (Cerastoderma edule) populations affected by mortalities. Aquaculture 528: 735509. doi: 10.1016/j.aquaculture.2020.735509

Villalba, A., Iglesias, D., Ortega, M., de Santiago, J.A., Abalia, E., Cao, A., Blanco, A., Martínez, P., Pampín, M. (2020). Resistance to Marteilia cochillia infection in cockles Cerastoderma edule: Response to selection and heritability. Aquaculture 528: 735509. doi: 10.1016/j.aquaculture.2020.735509

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Título: Efecto da presenza de *Gracilaria vermiculophylla* na distribución e comportamento de *Carcinus maenas*

Evento: XXVI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

Ano: 2024

XUNTA DE GALICIA | CONSELLERÍA DO MAR | CIMA | REDEMAR | ForoAcui XXVI O Grove 2024

Efecto da presenza de *Gracilaria vermiculophylla* na distribución e comportamento de *Carcinus maenas*

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INTRODUCIÓN

As preferencias de hábitat do cangrexo *Carcinus maenas* poden verse modificadas pola presenza de matas vexetais. Analízase o impacto da alga *Gracilaria vermiculophylla* sobre a ecoloxía e etoloxía co *C. maenas*. Os obxectivos son:

(1) Avaliar posibles diferenzas no número de cangrexos entre as zonas con algas (CA) e sen elas (SA).

(2) Se existen diferenzas, determinar se a distribución dos cangrexos depende da influencia de diferentes biomasas de algas.

(3) Estimar se existen diferenzas no número de cangrexos enterrados en función da presenza ou ausencia de algas así como de sua biomasa.

MATERIAL E MÉTODOS

Empregáronse tres piscinas, cada unha considerada unha réplica independente. Nun primeiro ensaio depositouse nunha das metades de cada piscina 2 kg de *G. vermiculophylla* (5.57 kg/m²), no segundo ensaio 1 kg (1.79 kg/m²) e por último 0,5 kg (0.89 kg/m²) (Fig. 1). Cada ensaio tivo unha duración de 3 días.

Figura 1. Piscina con 2 kg (3.57kg/m²) de *G. vermiculophylla* (zona de alga) e sen ningún (zona SA) e 0,5 kg (0.89 kg/m²) (zona CA).

En cada unha das tres piscinas depositáronse 10 individuos de *C. maenas*. A maña anterior ao inicio de cada ensaio liberábanse os cangrexos no centro da piscina e a maña seguinte se observaba o comportamento dos cangrexos, logo eran recollidos e voltos a liberar no centro da piscina nada máis dos dous días restantes.

Para diferenciar as seguintes variables:

Número de cangrexos localizados dentro da alga.

Número de cangrexos enterrados no substrato na zona con algas (CA).

Número de cangrexos fóra da mata de algas.

Número de cangrexos enterrados ou refugiados nos bordos da piscina na zona sen algas (SA).

Para a análise das matas actuou a proba Chi-cadrado de Pearson.

RESULTADOS E DISCUSIÓN

Os resultados mostraron diferenzas moi significativas entre a porcentaxe de cangrexos situados na zona CA e na zona SA. O 53% ata o 84% dos cangrexos situáronse na zona CA dos tres ensaios (con 2 kg, 1 kg e 0,5 kg de algas respectivamente) (Taboa 1, Fig. 2).

Este resultado reforza o uso desta alga como refuxio (Kelly, 2020). Ademais, a probable alta complexidade destas matas de algas, como microhábitat para o mantemento, ao que se engadiría a presenza de individuos dentro da mata de algas na busca de crustáceos e pequenos invertebrados.

Inda que se esperaba que unha maior porcentaxe dos cangrexos da zona SA se enterraran no substrato en busca de refuxio, non se atoparon diferenzas significativas para esta variable nas zonas CA e SA con 1 kg e 0,5 kg de algas, pero si con 2 kg (Taboa II). É dicir, cando a biomasa de algas era baixa, os individuos enterrábanse case por igual en ambas zonas, mentres que con maior biomasa (2 kg), enterráronse menos individuos. Isto podería indicar que a complexidade do hábitat xerada pola mata vexetal ofrece suficiente refuxio aos cangrexos fronte aos seus propios depredadores, sen necesidade de enterrase (Tummon Flynn *et al.*, 2020).

Taboa I. Porcentaxe de cangrexos atopados nas zonas con algas (CA) e sen algas (SA) para os tres ensaios de biomasas de algas (2 kg, 1 kg e 0,5 kg) para cada unha das réplicas ao comezo e medio dos tres.

	Biomasa de algas	2 kg		1 kg		0,5 kg	
	Presenza de algas	CA	SA	CA	SA	CA	SA
Réplica 1	% cangrexos	100	0	87	13	76	24
	Chi² (p)	26,01 (< 10⁻⁶ ***)		61,29 (< 10⁻¹⁴ ***)		26,01 (< 10⁻⁶ ***)	
Réplica 2	% cangrexos	83	17	93	7	67	33
	Chi² (p)	42,25 (< 10⁻¹⁰ ***)		72,25 (< 10⁻¹⁷ ***)		61,29 (< 10⁻¹⁴ ***)	
Réplica 3	% cangrexos	93	8	93	7	93	93
	Chi² (p)	69,49 (< 10⁻¹⁶ ***)		72,25 (< 10⁻¹⁷ ***)		62,41 (< 10⁻¹⁵ ***)	
Medio	% cangrexos	93	7	91	9	84	16
	Chi² (p)	72,25 (< 10⁻¹⁷ ***)		83,01 (< 10⁻¹⁹ ***)		44,8 (< 10⁻¹¹ ***)	

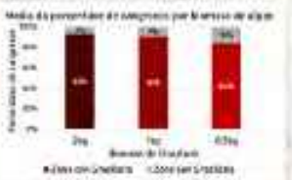

Figura 2. Porcentaxe media de cangrexos nas zonas CA e SA en función da biomasa de macrovexetal.

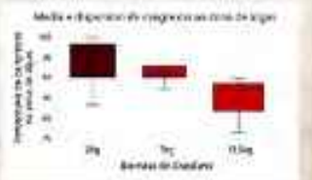

Figura 3. Media e dispersión da porcentaxe de cangrexos na zona CA en función da biomasa de mata vexetal.

Taboa II. Porcentaxe de cangrexos enterrados nas zonas CA e SA para os tres ensaios en cada réplica (1 a 3) medio (x̄) e media (x̃). Non significativo (n.s.), moi significativo (***), significativo (*) e non realizado (-).

	Biomasa de algas	2 kg		1 kg		0,5 kg	
	Presenza de algas	CA	SA	CA	SA	CA	SA
Réplica 1	% cangrexos enterrados	10	0	7	13	24	21
	Chi² (p)	8,1 (0,004 **)		1,29 (0,26 n.s.)		0,69 (0,77 n.s.)	
Réplica 2	% cangrexos enterrados	10	7	3	7	0	13
	Chi² (p)	0,29 (0,59 n.s.)		1,8 (0,18 n.s.)		5,1 (0,024 *)	
Réplica 3	% cangrexos enterrados	10	0	17	7	10	10
	Chi² (p)	8,1 (0,004 **)		3,57 (0,17 n.s.)		0,154 (0,774 n.s.)	
Medio	% cangrexos enterrados	10	2	9	9	11	14
	Chi² (p)	4,667 (0,04 *)		0,002 (0,81 n.s.)		0,014 (0,86 n.s.)	

Destácase a importancia das labores nas estructivas de conservación incluídos no marisqueo en Galicia. A retirada destas matas de algas, pode contribuír á expansión de depredadores como o cangrexo deste estudo.

CONCLUSIÓNS

A distribución espacial do *C. maenas* dentro da piscina depende da presenza da mata de *G. vermiculophylla* e a maioría dos individuos atopáronse na zona CA, actuando esta zona como un hábitat de alta complexidade estrutural, onde refuxiarse e probablemente buscar alimento. Cando a biomasa descía algún pouco, os individuos enterrábanse case por igual na zona CA que na zona SA pero cando a mata elevada a porcentaxe de cangrexos enterrados na zona SA é menor, probablemente debido á protección das algas. A retirada de macroalgas invasivas, pode diminuír a presenza de cangrexos depredadores.

BIBLIOGRAFÍA

Kelly, J. (2020). Dissertations, Theses, and Masters Projects. https://doi.org/10.25773/v5-nzcc-9x44

Tummon Flynn, P., McConnell, K., Lang, T., and Quijón, P. 2020. PeerJ 8: e10548.

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Título: Reforzo das poboacións de *Himantalia elongata* (Fucales, Ochrophyta) na Illa de Arousa (Pontevedra, Galicia)

Congreso: XXVI Foro dos Recursos Mariños de da Acuicultura da Rías Galegas

Lugar: O Grove - Pontevedra (España)

Ano: 2024

Reforzo de poboacións de *Himanthalia elongata* (Fucales, Ochrophyta) na Illa de Arousa (Pontevedra, Galicia)

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Antecedentes e obxectivos

Himanthalia elongata (correa, xudía ou espagueti de mar) é un dos recursos autóctonos de macroalgas mariñas alimentarias máis importantes de Galicia.

Debido ao cambio global, depredación e unha explotación inadecuada, dada a súa bioloxía e a súa crecente interese nos últimos anos, esta especie está sufrindo un alarmante declive nas nosas costas.

Por isto, xurdiu o proxecto HISARUM, nacido no marco de REDEMAR no 2023, co fin de contribuír á sustentabilidade da explotación deste recurso.

Neste traballo recóllense parte dos protocolos obtidos no proxecto máis os seguimentos posteriores ao mesmo.

Material e métodos

Recolléronse exemplares fértiles de *H. elongata* na zona do Coxiño do Corvo (Illa de Arousa, Pontevedra, Galicia), leváronse ao laboratorio e conseguíronse embrións.

Desenvolveuse un deseño experimental de maneira que houbo 4 tratamentos distintos e 2 controis, xa que se realizaron dúas sementeiras ao mar (Fig. 1) en setembro e outubro de 2023. (C) correspóndese ao control, (1A) á primeira sementeira con embrións de 5 días en alxinato sódico e quelato de ferro, (1B) á primeira sementeira con embrións de 30 días tamén en solución de alxinato sódico e quelato de ferro, (2A) á segunda sementeira con embrións de 10 días en auga de mar e (2B) á segunda sementeira con embrións de 10 días en alxinato sódico e quelato de ferro. Antes das sementeiras, retiráronse os exemplares de *H. elongata* das rochas para asegurar que os resultados obtidos eran exclusivamente das sementeiras.

Fig. 1. Disposición dos tratamentos de repoboación de *H. elongata* na Illa de Arousa. (1) Primeira sementeira, (C) Control, (2) Segunda sementeira.

Leváronse a cabo dous seguimentos tralas sementeiras, un en maio de 2024 e outro en setembro de 2024, nos que se contabilizaron o número de talos vexetativos nunha superficie tratada de 6m², con cuadrantes de 50cm².

Os datos obtidos analizáronse mediante un ANOVA dun só factor e un Test de Tukey ao 95% de confianza.

Resultados e discusión

Os resultados obtidos recóllense na Tab. 1. Vese que a sementeira máis axeitada é a nomeada 2B (Fig. 2), con embrións de 10 días embebidos nunha solución de alxinato e quelato de ferro, formando este tratamento un grupo significativamente diferente ao resto tralo ANOVA e o Test de Tukey ao 95%.

Tab. 1. Abundancia de talos vexetativos de *H. elongata* na zona repoboada en función do tratamento.

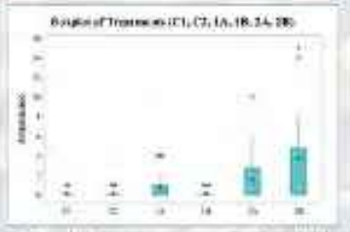

Fig. 2. Gráfico de caixas para os tratamentos en base á abundancia.

Tralos seguimentos pódese apreciar (Fig. 3) que os talos vexetativos procedentes destas sementeiras comezan a desenvolver receptáculos (cintas), evidenciando a viabilidade do protocolo de repoboación desenvolvido no proxecto.

Fig. 3. Desenvolvemento de receptáculos nos talos vexetativos de *H. elongata* procedentes das sementeiras realizadas no proxecto HISARUM 2023.

Conclusións

Os seguimentos das experiencias de repoboación reflexan uns resultados positivos, principalmente para o tratamento con embrións de 10 días de idade na solución de alxinato sódico e quelato de ferro.

A pesar da súa vulnerabilidade, a bioloxía de *H. elongata* permite o desenvolvemento de estratexias encamiñadas para a súa conservación.

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Título: Diferencias anatómicas y fisológicas de mejilla (*Mytilus galloprovincialis* Lamarck, 1819), encordadas en dos bateas con características hidrodinámicas opuestas

Evento: XXVI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas

Lugar: O Grove - Galicia (España)

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Diferencias anatómicas y fisiológicas de mejilla (*Mytilus galloprovincialis* Lamarck, 1819), encordadas en dos bateas con características hidrodinámicas opuestas.

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INTRODUCCIÓN.

La Acción de Investigación ADESMEBAT, tiene como objetivo discriminar si existen diferencias anatómicas, fisiológicas y proteómicas en el mejillón, entre zonas de alta y baja tasa de desprendimiento, encordando mejilla de criadero de la misma puesta, en ambas ubicaciones al mismo tiempo.

Aquí se presentan los primeros datos obtenidos, tras los muestreos iniciales.

OBJETIVOS.

Confirmar diferencias entre ambas zonas:

1. De crecimiento.
2. En el índice de condición (I.C).
3. Del número de filamentos del biso

MATERIAL Y MÉTODOS.

-El 31 de mayo se encuerda mejilla procedente del criadero del CIMA, de la misma puesta, con una talla promedio de 551 µm, en dos bateas con características hidrodinámicas e históricos de desprendimiento opuestos.

-Una batea situada en el polígono Caramiñal E (bajo hidrodinamismo/Alto Desprendimiento "AD"); otra batea en el Caramiñal H (alto hidrodinamismo/Bajo Desprendimiento "BD").

-Tras 95 días de cultivo, se toman 10 centrímetros de muestra en cada una de las bateas, a 1 m de profundidad.

-Se toma la biomasa total y número de individuos que componen cada muestra.

- Hay tres subprocesos que contribuyen a este poster: anatómico, cálculo del I.C y proteómica. Para cada uno de ellos se toman 30 individuos de cada ubicación, de los cuales, se miden las dimensiones antero-porterior y dorso-ventral, así como el peso individual.

- Subproceso anatómico: se extrae el biso de cada individuo, se contabilizan en número de filamentos y el diámetro basal del mismo.

-Subproceso de cálculo del I.C: mediante la expresión I.C (%)= (Peso Vianda/PesoTotal)*100.

-Subproceso proteómico: Extracción del pie, filamentos y placas de 30 individuos de cada ubicación.

Fig. 1. Fotografías de biso de mejillón procesado

	LONGITUD (mm)	PESO (g)	I.C (%)	Nº FILAMENTOS BISO	RELACION P.CARNE/P.VALVAS
CARAMIÑAL-E (AD)	27,76	2,15	31,47	12,83	0,913
CARAMIÑAL-H (BD)	24,17	1,09	30,12	18,2	0,606
T.Variación AD vs BD (%)	12,99	49,30	4,29	-41,86	11,72

Fig. 2. Tabla de resultados, entre mejilla cultivada en zonas de alto desprendimiento (AD) y de bajo desprendimiento (BD).

RESULTADOS.

1. Hay diferencias de longitud (antero-posterior), de biomasa, de I.C y relación Peso carne/ Peso valvas, a favor de la cultivada en zonas de bajo hidrodinamismo (AD).
2. La mejilla cultivada en zona de alto hidrodinamismo (BD), tienen un 41,86 % más filamentos en el biso, respecto a la cultivada en zona AD.
3. La mejilla cultivada en zonas con alto hidrodinamismo, probablemente destine parte de sus recursos energéticos a generar un biso que lo sustente con más consistencia, lo que podría repercutir en su crecimiento e I.C.

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Actividade científica

1. Presentacións en congresos

1979

I Simposio Ibérico de estudios de Bentos Marino. San Sebastián – Euskadi (España)

Romarís, X.M.; Fernández, F.; Cerviño, A.; Pazó, J.P. (1979, abril 9-11) *Evolución del sustrato que sustituyó a una pradera de Zostera marina L. y dinámica de la población de Cerastoderma edule L. asentada sobre este*

Landín, A.; Cerviño, A.; Alonso, J.L. (1979, abril 9-11) *Notas sobre el banco natural de moluscos de Placeres (ría de Pontevedra) afectado por los vertidos de un complejo industrial (Pasta kraft-cloro)*

1981

II Simposio Ibérico de estudios de Bentos Marino. Barcelona – Catalunya (España)

Pazó, J.M.; Romaris, X.M.; Fernández, F. (1981, marzo 19-22) *Fijación de ostra plana (Ostrea edulis L.) sobre colectores de celulosa en la bahía de Baiona (ría de Vigo) en el año 1979*

Cerviño, A.; Alonso, J.L.; Landín, A. (1981, marzo 19-22) *Estudio del sedimento de la desembocadura del ría Lérez (Pontevedra) y delimitación del banco natural de moluscos que se asienta sobre él*

1982

III Simposio Ibérico de estudios de Bentos Marino. Pontevedra – Galicia (España)

García, A., Otero, J.; de Coo, A.; López, M.C.; Carballal, M.J.; Otero-González, J. (1982, outubro 4-7) *Contribución al estudio del berberecho (Cerastoderma edule L) en la ría de Arosa*

Otero, J.; de Coo, A.; García, A.; Cerviño, A. (1982, outubro 4-7) *Estudio de selectividad, efectos biológicos y efectos mecánicos de las artes marisqueras denominadas "Rastro de Vara", "Raño" y "Horquilla", sobre poblaciones de Cerastoderma edule y Venerupis pullastra en la ría de Arosa*

de Coo, A.; Otero, J.; García, A.; López, M.C.; Carballal, M.J.; Otero-González, J. (1982, outubro 4-7) *Crecimiento de una población de almeja babosa (Venerupis pullastra M.) en la playa de Cabodeiro, Isla de Arosa (ría de Arosa)*

1984

IV Simposio Ibérico de estudios de Bentos Marino. Lisboa (Portugal)

Pazó, J.P.; Fernández-Cortes, F.; Romaris, X.M.; Moscoso, E.R. (1984, maio 21-25) *Fijación de ostra plana (Ostrea edulis L) sobre colectores de celulosa en la bahía de Baiona (ría de Vigo) en el año 1980*

de Coo, A.; Otero, J.R.; López, M.C.; García, A.; Lorenzo, J.; Garrido, S. (1984, maio 21-25) *Estudio comparativo de tres diseños de muestreo: aleatorio estratificado, sistemático y conglomerado en dos etapas, aplicados a bancos sumergidos de moluscos bivalvos*

Guerra, A. (1984, maio 21-25) *Estudio de captación natural de semilla de ostra plana O. edulis por medio de colectores en la ría de Ortigueira (N.W, España)*

López, M.C.; de Coo, A.; Otero, J.R.; García, A.; Lorenzo, J.; Garrido, S. (1984, maio 21-25) *Evolución del estado de condición y reproductivo del banco natural de Cerastoderma edule en la desembocadura del ría Ulla (ría de Arosa) Galicia*

Pereira, J.R.; Arnaiz, R.; Linares, F.; González; V. (1984, maio 21-25) *Variación estacional del crecimiento, índice de condición, composición bioquímica y contenido energético de la población de Cerastoderma edule L. situada en el banco natural del Lombo del Ulla (ría de Arousa) Galicia*

Otero, J.R.; de Coo, A.; García, A.; López, M.C.; Lorenzo, J.; Garrido, S. (1984, maio 21-25) *Estudio biométrico comparado de una población de Cerastoderma edule y Cerastoderma glaucum en la ría de Arosa (Galicia)*

Pereira, J.R.; Carou, F.; Arnaiz, R.; de Coo, A.; Cores, M.J. (1984, maio 21-25) *Variación del crecimiento, índice de condición y composición bioquímica de poblaciones de Ostrea edulis L. sometidas a diferentes condiciones y procedimientos de cultivo*

Fernández-Cortes, F.; Romaris, X.M.; Pazó, J.P.; Moscoso, E.R. (1984, maio 21-25) *Distribución de las poblaciones de bivalvos en la ensenada de San Simón (ría de Vigo)*

García, A.; López, M.C.; de Coo, A.; Otero, J.R.; Lorenzo, J.; Garrido, S. (1984, maio 21-25) *Contribución al conocimiento de la distribución geográfica y mortalidad de Cerastoderma edule en la ría de Arosa*

Arnaiz, R.; Pereira, J.R. (1984, maio 21-25) *Estudio del crecimiento, índice de condición, composición bioquímica y contenido energético de una población de Venerupis decussata L. procedente de la costa tunecina y sembrada en la ría de Arousa (N.O. España)*

Otero, J.R.; García, A.; López, M.C.; de Coo, A.; Lorenzo, J.; Garrido, S. (1984,maio 21-25) *Contribución al estudio del crecimiento de Cerastoderma edule en la ría de Arosa (Galicia)*

Catoira, J.L.; Martínez, D. (1984, maio 21-25) *Contribución al estudio del crecimiento del berberecho (Cerastoderma edule L) en las Rías Altas gallegas*

1985

I Congreso Nacional de Acuicultura. O Grove - Galicia (España)

Guerra, A.; Otero, M. (1985, outubro 8-11) *Estudio sobre la captación natural de semilla de ostra (Ostrea edulis L.) en la ría de Ortigueira (NW de España) II*

Pereira, J.R.; Arnaiz, R.; de Coo, A.; García, A. (1985, outubro 8-11) *Efecto del nivel protéico, lipídico, glúcido y energético de la dieta sobre el crecimiento y composición bioquímica de la lubina (Dicentrarchus labrax L.)*

Pardellas de Blas, X.X. (1985, outubro 8-11) *La propiedad cooperativa y las economías de escala en viveros flotantes*

Fernández-Prieto, A. (1985, outubro 8-11) *Aportaciones en extensión para o desenvolvemento da acuicultura en Galicia*

García, A; de Coo, A.; López, C.; Martinez, D. (1985, outubro 8-11) *Dinámica de poboacións C. edule nas rías galegas: Síntese e variacións anuais, poboacionais e interrías do crecemento, índice de condición, mortalidade e reclutamento*

de Coo, A.; López, C.; Martinez, D.; García, A. (1985, outubro 8-11) *Limitacións da aplicación de modelos matemáticos a especies de moluscos bivalvos en relación ca súa extratexia de supervivencia e as condición medioambientais das rías galegas*

Pereira, J.R.; de Coo, A.; Arnaiz, R.; García, A. (1985, outubro 8-11) *Efecto de la alimentación sobre el crecimiento y composición bioquímica del salmón atlántico (Salmo salar L.) en agua de mar*

Lodeiros, C.; Pérez, C.; López, A.; Alves, E.; Guerrero, S.; Bernardez, I. (1985, outubro 8-11) *Estudio cuantitativo y cualitativo de la flora bacteriana en hatchery de Ostrea edulis y su relación con la posible patogenidad larvaria*

Saavedra, C.; Malvido, G.; Santos, M.; Zapata, C.; Guerra, A.; Alvarez, G. (1985, outubro 8-11) *Métodos electroforeticos para la detección de la variabilidad genética molecular en la ostra plana (Ostrea edulis L.)*

Landín, A. (1985, outubro 8-11) *Salinidades y temperaturas de la ría de Arosa (NW España) a lo largo de un año*

1987

II Congreso Nacional de Acuicultura. Santiago de Compostela - Galicia (España)

Solórzano, M.; Linares, F.; Arnaiz, R.; de Coo, A. (1987, decembro 1-4) *Supervivencia y crecimiento del cultivo larvario de lubina, Dicentrarchus labrax (Linnaeus, 1978)*

Arnaiz, R.; Solórzano, M.R.; Linares, F.; Rosell, J.M.; Outon, M.J.; López, M.C.; de Coo, A. (1987, decembro 1-4) *Influencia de la puesta, calidad de presa y densidad de cultivo en la supervivencia y crecimiento de las fases larvarias del rodaballo, Psetta maxima (L. 1758)*

Ramonell, R.; Bermudez, R.; Landín, A. (1987, decembro 1-4) *Maduración de los huevos de Palaemon serratus (Pennant) e influencia de la temperatura en el tiempo de incubación*

Guerra, A.; Acosta, C.; Espinos, F. (1987, decembro 1-4) *Primeras experiencias de cultivo de almeja japonesa (Tapes semidecussatus) y ostra japonesa (Crassostrea gigas) en la ria de Ribadeo (NW de España)*

Rodríguez-Moscoso, E.; Fernández-Cortés, F.; Romaris, X.M; Pazo, J.P. (1987, decembro 1-4) *Valoración de la técnica de semicultivo: limpieza de algas clorofíceas en la ensenada de San Simón*

Román, G.; Fernández-Cortés, F.; Acosta, C.P.; Rodríguez-Moscoso, E. (1987, decembro 1-4) *Primeras experiencias con colectores de pectínidos en las rías de Arosa y Aldán*

López, C.; de Coo, A.; García, A. (1987, decembro 1-4) *Ciclo sexual do Cerastoderma edule L. na ría de Arousa*

Guerra, A.; Pazó, J.; Acosta, C. (1987, decembro 1-4) *Índices de condición en ostra plana (Ostrea edulis L.) cultivada en dos rias gallegas: Ortigueira y Arosa (NW de España)*

Figueras, A.J.; Montes, J. (1987, decembro 1-4) *Parásitos y enfermedades del mejillón cultivado en batea en Galicia*

Montes, J.; Figueras, A.J. (1987, decembro 1-4) *Bonamia ostreae en una población de ostra plana (Ostrea edulis L.) cultivada en tres diferentes áreas de la costa gallega*

Montes, J. (1987, decembro 1-4) *Situación epidemiológica de Bonamia Ostreae en diferentes stocks de ostra plana (Ostrea edulis L.) en Galicia*

Sanz, C. (1987, decembro 1-4) *Distribución espacial y temporal de carbono orgánico disuelto en la ría de Arosa*

Carballal, M.J.; Fariña, J.A. (1987, decembro 1-4) *Situación de las condiciones de oxidación-reducción en sedimentos colonizados por Zostera spp. en la ensenada de San Simón, entre mayo y octubre de 1986*

1988

VI Simposio Ibérico de estudios de Bentos Marino. Palma de Mallorca - Baleares (España)

Guerra, A., Gabín, C. (1988, setembro 19-22) *Nuevas aportaciones al estudio de captación natural de ostra plana (Ostrea edulis L) en la ría de Ortigueira. (N.W de España)*

Carballal, M.J.; Cerviño, A. (1988, setembro 19-22) *Evolución de parámetros del sedimento en tres zonas diferenciadas de la ensenada de San Simón (Ría de Vigo)*

1989

Seminario Internacional do Mexillón. O Grove – Galicia (España)

Pérez-Camacho, A.; González, R.; Fuentes, J.M. (1989, novembro 6-10) *O cultivo do mexillón en Galicia*

Fuentes, J.M.; Reyero, M.; Zapata, C.; Álvarez, G. (1989, novembro 6-10) *Evaluación de caracteres genéticos de producción en poblaciones naturales de mejillón Mytilus galloprovicialis del NW de España*

Montes, J.; Villalba, A.; Mourelle, S.G.; Carballlal, M.J.; López, M.C. (1989, novembro 6-10) *Parásitos y alteraciones patológicas detectadas en el mejillón cultivado en las rías gallegas*

Villalba, A.; Montes, J.; López, M.C.; Mourelle, S.G.; Carballlal, M.J. (1989, novembro 6-10) *Alteraciones de tipo neoplásico y otras patologías asociadas a procesos de reacción hemocitaria en mejillón cultivado en las rías gallegas*

Villalba, A.; Montes, J.; Carballlal, M.J.; López, M.C.; Mourelle, S.G. (1989, novembro 6-10) *Epizotiología de la marteiliosis del mejillón cultivado en la rías gallegas*

1990

III Congreso Nacional de Acuicultura. Santiago de Compostela – Galicia (España)

Bellver, P.; Linares, F.; Corcobado, F.; Benavente, G.P. (1990, setembro 24-27) *Estudio de la evolución del peso seco individual y de la composición en ácidos grasos de rodaballo (Psetta maxima L.) durante el desarrollo embrionario*

Arnaiz, R.; de Coo, A.; Corcobado, F.; Rodríguez, E.; Bellver, P.; Linares, F.; Teijeiro, M.C. (1990, setembro 24-27) *El periodo crítico de las larvas de rodaballo (Psetta maxima L.). Desarrollo de las branquias y niveles de ácido graso 22:6w3*

Arnaiz, R.; de Coo, A.; Linares, F.; Corcobado, F.; Bellver, P.; Fariña, T.; Sanjurjo, B. (1990, setembro 24-27) *Evolución de niveles de ácidos grasos en larvas de rodaballo, (Psetta maxima L.) en cultivo intensivo. El periodo crítico*

Corcobado, F.; de Coo, A.; Arnaiz, R.; Benavente, G.P. (1990, setembro 24-27) *Factores intrínsecos que afectan la estima del crecimiento de la población de larvas de rodaballo (Psetta maxima) en cultivo intensivo*

de Coo, A.; Corcobado, F.; Arnaiz, R.; Rúa, N.; Teijeiro, M.C.; Bellver, P. (1990, setembro 24-27) *Crecimiento de las larvas de rodaballo (Psetta máxima) en cultivo intensivo. Dosificación de alimento*

de Coo, A.; Corcobado, F.; Arnaiz, R.; Fariña, T. ; Linares, F. (1990, setembro 24-27) *Análisis de mortalidad de las larvas de rodaballo (Psseta máxima) en cultivo intensivo*

Guerrero, S.; Allen, S. (1990, setembro 24-27) *Ploidy estimation of triploid (Crassostrea virginica) larvae in relation to growth and survival*

Ramonell, R.; Román, G.; Acosta, C.P.; Malvar, M. (1990, setembro 24-27) *Captación de semillas de pectinidos en colectores: Resultados de la campaña de prospección en Bueu (Ría de Pontevedra, Galicia) en 1988*

Román, G.; Acosta, C.P. (1990, setembro 24-27) *Cultivo de vieira en batea. II: Reproducción*

Reyero, I.; Fuentes, J.; Zapata, C.; Álvarez, G. (1990, setembro 24-27) *Importancia de la procedencia de la semilla en el cultivo del mejillón en Galicia*

Abalde, J.; Andrés, M.C.; Rodríguez, C.; Guerra, A. (1990, setembro 24-27) *Estudio de la variación en la composición bioquímica de una población de semilla de ostra plana (Ostrea edulis) cultivada en dos rias gallegas*

Gabín, C.; Guerra, A.; Fernández, J.; Ramón, M.L. (1990, setembro 24-27) *Estrategias para la mejora del rendimiento de semilla de ostra plana (O. edulis L) obtenida en el medio natural*

Abalde, J.; Andrés, M.C.; Cid, A.; Guerra, A. (1990, setembro 24-27) *Crecimiento de una población de semilla de ostra plana (Ostrea edulis) en tres estaciones de la costa gallega*

Cancelo, M.; Fernández, A.; Gabín, C.; Guerra, A. (1990,setembro 24-27) *Análisis de crecimiento de semilla de zamburiña (Chlamys varia L.) cultivada en batea*

Martínez, D.; Mosquera, G.; Ruiz, C.S.; Sánchez, J.L.; Abad, M. (1990, setembro 24-27) *Relaciones entre el alimento disponible, índice de condición y desarrollo gametogénico de Ostrea edulis L*.

Ruiz, C.S.; Martínez, D.; Mosquera, G.; Abad, M.; Sánchez, J.L. (1990, setembro 24-27) *Variación estacional en la composición bioquímica de ostra plana, (Ostrea edulis, L.) en San Cibrán (Lugo)*

Acosta, C.P.; Román, G.; Álvarez, M.J. (1990, setembro 24-27) *Cultivo de zamburiña (Chlamys varia L) II. Preengorde en batea*

Román, G.; Acosta, C.P. (1990,setembro 24-27) *Cultivo de vieira en batea. I: Crecimiento*

Fernández, J.; Ramón, M.L.; Gabín, C.; Cancelo, M. (1990, setembro 24-27) *Cultivo en batea de almeja japonesa (Venerupis semidecussata) en la ria de Ares-Betanzos*

Guerra, A.; Ramón, M.L.; Cancelo, M.; Fernández, J. (1990, setembro 24-27) *Análisis de crecimiento y producción de almeja japonesa (Venerupis semidecussata) cultivada en diferentes sistemas y áreas de las rias altas (NW. España)*

Linares, F.; Bellver, P.; Teijeiro, M.C.; Pérez, G.; Amoedo, F. (1990, setembro 24-27) *Influencia de la utilización de enriquecimiento en ácidos grasos sobre la composición de rotifero (Brachionus plicatilis) y (Artemia sp) y suevolución en condiciones de ayuno*

Fariña, T.; Linares, F.; Bellver, P.; de Coo, A.; Arnaiz, R.; Corcobado, F. (1990,setembro 24-27) *Utilización de copépodos harpacticoides en el cultivo larvario del rodaballo (Psetta maxima L.) supervivencia: Resultados preliminares*

Montes, J.; Mourelle, S.G.; Meléndez, M.I. (1990, setembro 24-27) *Bonamiasis en poblaciones de ostra plana (Ostrea edulis L) de diferentes orígenes cultivada en Galicia*

1991

VII Simposio Ibérico de estudios de Bentos Marino. La Manga del Mar Menor - Murcia (España)

Guerra, A.; Montes, J. (1991, outubro 1-4) *Desarrollo gametogénico en una población de ostra plana (Ostrea edulis L.) reclutada en el medio natural y cultivada en dos estaciones de la ría de Ortigueira (N.O. España)*

1993

IV Congreso Nacional de Acuicultura. A Illa de Arousa – Galicia (España)

Corcobado, F.; de Coo, A.; Arnaiz, R.; Rúa, N.; Amoedo, F. (1993, setembro 21-24) *Peso talla y composición en ácidos grasos de huevos de rodaballo (Psetta maxima, Linneo, 1758). Relación con la calidad de puesta y ciclo ovulatorio*

Arnaiz, R.; de Coo, A.; Corcobado, F.; Rúa, N.; Amoedo, F. (1993, setembro 21-24) *Una hipótesis nutricional de la mortalidad asociada al periodo crítico. Órganos y desarrollo larvario de rodaballo (Scophthalmus máximus) y dorada (Sparus aurata). Necesidades de DHA*

de Coo, A.; Moscoso, E.; Arnaiz, R.; Corcobado, F.; Rúa, N.; Varela, J.A.; López, M. (1993, setembro 21-24) *Estudio histológico de crecimiento, mortalidad y desarrollo de aparato digestivo, branquial e hígado en larvas de rodaballo sometidas a ayuno y diferentes niveles de deficiencias en hufas w3*

Urcera, M.J.; Arnaiz, R.; Rúa, N.; de Coo, A. (1993, setembro 21-24) *Cultivo de la centolla (Maja squinado): Influencia de la dieta en el desarrollo larvario*

Guerra, A., Montes, J. (1993, setembro 21-24) *Desarrollo gametogénico en una población de ostra plana (Ostrea edulis L.) cultivada en dos zonas de la ria de Ortigueira (NW, España) con diferente grado de parasitación por Bonamia ostreae*

Pazos, A.J.; Román, G.; Acosta, C.P.; Abad. M.; Sánchez, J.L. (1993, setembro 21-24) *Ciclo gametogénico de la vieira (Pecten máximus) L., en el cultivo suspendido en la ria de Arousa*

Acosta, C.P.; Román, G.; Mosquera, M.; Campos, M.J.; Cerviño, A. (1993, setembro 21-24) *Crecimiento y reproducción en una población de Pecten maximus. Implicaciones en su explotación comercial y cultivo*

Parada, J.M.; Cancelo, M.J.; Fernández, A.; Guerra, A.V. (1993, setembro 21-24) *Comportamiento reproductivo de la zamburiña (Chlamys varia L) cultivada en batea en Galicia (N.O de España)*

Villalba, A. (1993, setembro 21-24) *Estrategias reproductoras del mejillón (Mytilus galloprovincialis) cultivado en las rías de Vigo, Arosa, Muros y Ares-Betanzos (Galicia, N.O. de España)*

Rodríguez, E.; Arnaiz, R.; de Coo, A.; Martínez, D.; Silva, A.; Varela, J.A. (1993, setembro 21-24) *Proceso de maduración y acondicionamiento de Tapes decussatus (Linné 1787) fuera de época natural I. Histoquímica, histología y composición bioquímica*

Villalba, A.; Carballal, M.J.; López, M.C. (1993, setembro 21-24) *Estudio del ciclo gonadal de tres especies de almeja, Ruditapes decussatus, Venerupis pullastra y Venerupis rhomboides de las rías gallegas*

Martínez, D.; Rodríguez, M.E.; Arnaiz, R.; Alonso, J.L.; Camino, J.M.; Álvarez, J.M.; Loureiro, J.M.; López, M.F. (1993, 24 setembro) *Ciclo reproductor de coquina (Donax trunculus), relaciones con su contenido en proteínas, glucógeno, lípidos y ácidos grasos polinsaturados*

Rosique, M.J.; Riera, V.; Guerra, A.; García, B. (1993, 24 setembro) *Crecimiento y mortalidad de la semilla de ostra plana (Ostrea eduis) del mar menor (Murcia) en el Atlántico (rías de Arosa y Ortigueira) y Mediterráneo (Delta del Ebro y Murcia)*

Cerviño, A.; Landín, A.; de Coo, A.; Moscos, E. (1993, 24 setembro) *Crecimiento y mortalidad de la almeja fina (Venerupis decussata) y almeja babosa (V. pullastra) cultivada en parque intermareal en la ria de Arousa (Galicia, España). Presencia de Perkinsus asociado a alta mortalidad*

Abad, M.; Ruíz, C.; Sedano, F.J.; Mosquera, G.; Martínez, D. (1993, 24 setembro) *Estudio de las variaciones estacionales de la composición lipídica y ácidos grasos de una población de Ostrea edulis en el medio natural en San Cibrán, Lugo*

Carballal, M.J.; López, M.C.; Villalba, A. (1993, 24 setembro) *Mecanismos de defensa celular del mejillón, (Mytilus galloprovincialis), cultivado en Galicia*

López, M.C.; Carballal, M.J.; Villalba, A.; Corral, L.; Azevedo, C. (1993, 24 setembro) *Estudio de los tipos hemocitarios y de su dotación enzimática en la almeja (Ruditapes decussatus) de Galicia*

Sanmamed, A. (1993, 24 setembro) *Viabilidad técnica del transporte de ostras en barco vivero, como alternativa a otros sistemas*

Guerra, A.V., Parada, J.M.; Lama, A.; Saavedra, J.; Montes, J. (1993, 24 setembro) *Estudios y perspectivas de la evolución del cultivo de la ostra plana (Ostrea edulis) en Galicia (NW de España)*

Montes, J.; Lama, A,; Anadón, R. (1993, 24 setembro) *Fase proliferativa en el ciclo de vida de Bonamia Ostreae*

Lama, A.; Montes, J. (1993, 24 setembro) *Influencia del método de cultivo en el desarrollo de la Bonamiasis en la ostra plana*

Guerra, A.; Rosique, M.J.; Riera, V.; Montes, J. (1993, 24 setembro) *Presencia de Marteilia refringens en ostra plana (Ostrea edulis L.) cultivada en la costa mediterránea española*

Villalba, A.; López, M.C.; Carballal, M.J. (1993, 24 setembro) *Parásitos y alteraciones patológicas de tres especies de almeja, Ruditapes decussatus, Venerupis pullastra y Venerupis rhomboides, en las rías gallegas*

Lama, A.; Montes, J. (1993, 24 setembro) *Situación de la Bonamiasis en el litoral español*

Guerrero, S.; Porta, F.; Otero, X., Mosteiro, M.J.; de Santiago, J.A. (1993, 24 setembro) *Comentarios sobre producción, depuración y control de mejillón en España*

Álvarez, M.J.; Campillo, M.J.; Reyero, I.; Blanco, J. (1993, 24 setembro) *Comparación de sistemas de esterilización y conservación del agua de mar*

1995

V Congreso Nacional de Acuicultura. Tarragona - Catalunya (España)

Montes, J. (1997, maio 9-13) *Principales enfermedades asociadas al cultivo de moluscos en Galicia*

Linares, F.; Ortega, A.; Fernández, M.J.; Labarta, U. (1997, maio 9-13) *Incidencia del estado poblacional y la temperatura en la composición química del rotifero, (Brachionus plicatilis)*

Pazos, A.J.; Román, G.; Acosta, C.P.; Abad, M.; Sáncjez, J.L. (1997, maio 9-13) *Variaciones estacionales de composición de ácidos grasos de la gonada femenina de Pecten maximus L. en el cultivo suspendido en la ría de Arousa*

Montes, J.; Lama, A.; Longa, M.A. (1997, maio 9-13) *Estudio sobre la incidencia Bonamia ostreae en Galicia: Perspectiva histórica, situación actual y problemática*

Guerra, A.; Mosquera, G.; Álvarez, M.J.; Montes, J. (1997, maio 9-13) *Crecimiento de semilla de ostra japonesa (Crassostrea gigas) hasta talla comercial, cultivada en suspendido en diferentes zonas de Galicia (N.O de España)*

1996

IX Simposio Ibérico de estudios de Bentos Marino. Alcalá de Henares - Madrid (España)

Guerra, A.; Seoane, I.; Rodríguez, V.; Fernández, A.; Martinez, D.; Lastres, M. (1996, febreiro 19-23) *Estudios sobre la alimentación de la oreja de mar (Haliotis tuberculata L.) en Galicia (N.O España)*

1997

VI Congreso Nacional de Acuicultura. Cartagena - Murcia (España)

Nóvoa, S.; Martínez, D.; Miranda, A.; Ojea, J.; Rodríguez, J.L. (1997, xullo 9-11) *Calidad nutricional del alga marina (Chaetoceros gracilis). Evolución de la composición en ácidos grasos durante su ciclo del cultivo*

Guerra, A.; López-Piyon, M.J.; Lastres, M.; Montes, J. (1997, xullo 9-11) *Estudio de la reproducción de la oreja de mar (Haliotis tuberculata L) en la ría de Arousa (N.O. de España)*

Martínez, D.; Rodríguez, E.; Arnaiz, R.; Nóvoa, S.; Ojea, J. (1997, xullo 9-11) *Gametogénesis y composición bioquímica en una población de Ensis siliquia (Linné,1758) en la ría del Barquero (N. Galicia)*

Seoane, I.; Rodríguez, V.; Guerra, A. (1997, xullo 9-11) *Posibles relaciones entre acondicionamiento de progenitores y viabilidad larvaria de ostra plana (Ostrea edulis) en criadero*

Martínez, M.; Cerviño, A.; de Coo, A.; García, A.; Martínez, D.; Nóvoa, S.; Ojea, J.; Sebe, M.P.; Casal, A.; Fariña, J.; Mosquera, P.; Rodríguez, R. (1997, xullo 9-11) *Preengorde de almeja fina (Ruditapes decussata) en sistemas sobreelevados*

Martínez, M.; Cerviño, A.; de Coo, A.; García, A.; Rodríguez, V.; Sebe, M.P.; Seoane, I.; Casal, A.; Fariña, J.; Mosquera, P.; Rodríguez, R. (1997, xullo 9-11) *Cultivo de ostra plana (Ostrea edulis) en sistemas sobreelevados*

Viñas, J.; Barciela, P.; Viñas, L.; de Coo, A. (1997, xullo 9-11) *Cultivo sobreelevado de ostra plana (Ostrea edulis) en la zona intermareal de las lagunas de Baldaio (Galicia)*

Viñas, J.; Barciela, P.; Viñas, L.; de Coo, A. (1997, xullo 9-11) *Preengorde de semilla de almeja fina (Venerupis decussatus) y almeja babosa (Venerupis pullastra) en cultivo sobreelevado en la zona intermareal de las lagunas de Baldaio (Galicia)*

Cabada, A.; Martínez, M.; Sebe, M.P. (1997, xullo 9-11) *Evolución de los parámetros poblacionales de la ostra plana (Ostrea edulis) en el banco natural de Coroso, en Riveira, ría de Arousa (Galicia)*

Viñas, J.; Barciela, P.; Viñas, L.; de Coo, A. (1997, 11 xullo) *Crecimiento y produción de la población de bígaro (Littorina littorea) en el estuario del río Anllóns (Galicia)*

Rodríguez, J.L.; Ruíz, N.; Ortega, A.; Linares, F. (1997, xullo 9-11) *Cultivo larvario de rodaballo (Psetta máxima L) a baja densidad*

Olmedo, M.; Linares, F.; Ruíz, N.; Álvarez-Blázquez, B.; Peleteiro, J.B.; Ortega, A.; Rodríguez, J.L. (1997, xullo 9-11) *Preengorde de alevines de besugo (Pagellus bogaraveo B.) nacidos en cautividad*

Ortega, A.; Linares, F.; Rodríguez, J.L.; Ruíz, N.; Figueiro, R. (1997, xullo 9-11) *Experiencias de engorde de rodaballo (Psetta máxima L.) en jaulas*

11th international Pectinid Workshop. La Paz – Baja California (México)

Acosta, C.P.; Román, G.; Cano, J.; Campos, M.J.; Román, G.; Lowe, E. (1997, abril 10-15) *Effect of depth on reproductive cycles and reserves in suspension cultures of Aequiecten opercularis*

Román, G.; Acosta, C.P.; Cano, J.; Campos, M.J.; Lowe, E. (1997, abril 10-15) *Reproductive and reserve storage cycles in Aequiecten opercularis*

Campos, M.J.; Román, G.; Lowe, E.; Acosta, C.P.; Cano, J. (1997, abril 10-15) *The reproductive cycle of Aequiecten opercularis*

Cano, J.; Campos, M.J.; Román, G.; Lowe, E.; Acosta, C.P. (1997, abril 10-15) *Growth of the queen scallop (Aequiecten opercularis) in suspended culture: influence of density and depth*

1999

VII Congreso Nacional de Acuicultura. As Palmas de Gran Canaria - Canarias (España)

Martínez, D.; Rodríguez, E.; Ojea, J.; Nóvoa S.; Rodríguez, J.L. (1999, maio 19-21) *Evolución da composición de ácidos graxos das familias de lípidos neutros e polares, na gónada e masa visceral, das especies de Solénidos: Solen marginatus (Pennant, 1777) e Ensis siliqua (Linné, 1758), ó longo do ciclo gametoxénico*

Nóvoa, S.; Martínez, D.; Ojea, J.; Blanco, J. Buján, M.; Rodríguez, J. L. (1999, maio 19-21) *Fabricación de microcápsulas a partir de aceites naturais (atún, xarda, sardiña) para o seu emprego como suplemento lipídico nutricional nos cultivos larvarios de ameixa*

Ojea, J.; Nóvoa, S.; Martínez, D.; Rodríguez, J. L. *Avaliación da calidade nutritiva do fitoplancto en tres sistemas de cultivo empregados en criadeiros de moluscos*

Guerrero, S.; Fernández de Landa, J. L.; Álvarez, R.; Arnaiz, R.; Rodríguez, E. (1999, maio 19-21) *Fixación de mexillón en long-line nas rías galegas: primeiros resultados*

Rodríguez, V.; Seoane, M. I.; Guerra, A. (1999, maio 19-21) *Comparación do rendemento de dous tipos de colectores na fase de fixación de ostra plana (Ostrea edulis) en criadeiro*

Brezmes, C.; Estévez, A.; Rodríguez, V.; Seoane, M. I. (1999, maio 19-21) *Ensaios de laboratorio para a obtención de microcápsulas destinadas á alimentación de moluscos bivalvos en criadeiro*

Seoane, M. I.; Rodríguez, V. (1999, maio 19-21) *Avaliación da supervivencia larvaria de ostra plana (Ostrea edulis L) en cultivos tratados con cloranfenicol*

Linares, F.; Olmedo, M.; Ortega, A.; Peleteiro, J. B. (1999, maio 19-21) *Experiencias de engorde de ollomol, Pagellus bogaraveo, (Brunnich, 1768) en gaiolas e tanques de cultivo*

Cerviño, A.; García, A.; Sebe, P.; Cabada, A. (1999, maio 19-21) *Primeiros datos sobre o recrutamento e o crecemento das poboacións naturais de ameixa bicuda (Venerupis aurea Gmelin, 1750) na Ría de Arousa, Galicia*

Cerviño, A.; de Coo, A. (1999, maio 19-21) *Evolución dos parámetros de temperatura, salinidade, e fluorescencia nos anos 1996 a 1998 na ría de Arousa*

Cabada, A.; de Coo, A.; Cerviño, A. (1999, maio 19-21) *Evolución dos prezos de primeira venda e a oferta dos moluscos bivalvos nas rías galegas no período 1994-1998*

de Coo, A.; Cerviño, A.; Sebe, P. (1999, maio 19-21) *Evolución productiva, económica e organizativa do marisqueo tradicional na ría de Arousa. 1994-1998*

García, A.; Cerviño, A.; Martínez, A.; Sebe, P. (1999, maio 19-21) *Efecto das artes de pesca tradicionais do marisqueo a pé "sacho" e " ganchelo" sobre o recrutamento nos moluscos bivalvos*

Sebe, P.; Cabada, A.; Cerviño, A.; de Coo, A.; Martínez, M. (1999, maio 19-21) *Acondicionamento e recuperación da zona submareal da praia de Borreiros-Vilaxoán, mediante a achega de áridos procedentes de canteira. Ría de Arousa. Galicia*

de Coo, A.; Abella, E.; Alcalde, A.; García, A.; Parada, J. M. (1999, maio 19-21) *Primeiros datos sobre o recrutamento e o crecemento das poboacións naturais de ameixa xaponesa Ruditapes philippinarum (Adams & Reeve 1850) na zona de Vilaxoán, ría de Arousa, Galicia*

Martínez, M.; de Coo, A.; Sebe, M. P. (1999, maio 19-21) *A formación de biso como indicador de calidade na semente de moluscos bivalvos. Primeira experiencia con ameixa fina, Tapes decussatus (L.)*

Sebe, P.; Cabada, A.; de Coo, A.; Martínez, M. (1999, maio 19-21) *Primeiros datos sobre os parámetros poboacionais da ameixa rubia, Venerupis rhomboideus (Pennant, 1777) na ría de Arousa. Galicia*

Guerra, A.; Montes, J.; Lomba, A.; Darriba, S. (1999, maio 19-21) *Cultivo en batea de semente de ostra plana (Ostrea edulis L.). Actuais perspectivas do cultivo en Galicia*

Darriba, S.; Guerra, A.; San Juan, F.; Montes, J. (1999, maio 19-21) *Estudio do ciclo reproductivo da navalla (Ensis ensis) nas illas Cíes (ría de Vigo, NO de España)*

8th International Conference on Applied Algology. Montecatini - Terme (Italia)

Martínez, D.; Novoa, S.; Ojea, J.; López-Alcalá; López-Ruiz, J. L. (1999, setembro 20-26) *Uses of two products of zeolitic nature on four microalgae culture*

12th International Carotenoid Symposium. Cairns (Australia)

Zapata, M.; Wright, S. W.; Garrido, J. L.; Jeffrey, S. W. (1999, xullo 18-23) *Aplication of algal carotenoids to the study of ocean processes*

Zapata, M.; Wright, S. W.; Garrido, J. L.; Jeffrey, S. W. (1999, xullo 18-23) *New HPLC techniques for analysis of chlorophylls and caratenoids from marine microalgae*

Egeland, E.S, Garrido, J. L.; Zapata, M.; Maestro, M. A.; Liaen-Jensen, S. (1999, xullo 18-23) *4-keto-19 – hexanohyloxyfucoxanthi with a novel carotenoid end group from the microalga Emiliainia huxleyi (Pymnesiophyceae)*

VI Reunión Ibérica sobre fitoplancto tóxico e biotoxinas. Sevilla – Andalucía (España)

Rodríguez, F.; Pazos, E.; Moroño, A.; Maneiro, J.; Blanco, J. (1999, maio 5-7) *Variación na relación entre a fluorescencia "in vivo" e a clorofila "a" asociada á dinámica oceanográfica*

Blanco, J.; Pazos, E.; Arévalo, F.; Salgado, C.; Bermúdez de la Puente, M.; Maneiro, J.; Moroño, A. (1999, maio 5-7) *Contido de ácido okadaico das células de Dinophysis responsables de varios episodios tóxicos nas rías galegas*

Lion, M.; Blanco, J. (1999, maio 5-7) *Contido en toxinas en cultivos continuos de Alexandrium minutum*

9th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish". Rodas (Grecia)

Villalba, A. & Casas, S. M. (1999, setembro 19-24) *Effect of perkinsosis on the energetic physiology of the carpet-shell clam, Ruditapes decussatus*

Villalba, A.; Carballal, M. J.; López, C. & Casas, S. M. (1999, setembro 19-24) *Temporal patterns of perkinsosis in carpet-shell clam, Ruditapes decussatus, from the ría de Arousa (Galicia, NW Spain)*

Carballal, M. J.; Villalba, C.; López, C. & Casas, S. M. (1999, setembro 19-24) *Defence reactions of clam Ruditapes decussatus, induced by Perkinsus atlanticus*

Casas, S.; Villalba, A.; López, C. e Carballal, M. J. (1999, setembro 19-24) *In vitro study of temperature and salinity effects on viability and longevity of free stages of the life cycle of Perkinsus atlanticus, a parasite of carpet-shell clam, Ruditapes decussatus*

Montes, J.; Ferro-Soto, B.e J. Santamarina. (1999, setembro 19-24) *Pathological problems in the culture of flat oyster from Galicia (NW Spain)*

Almeida, M, Gonzalves, P, Soares, F.; Montes, J. (1999, setembro 19-24) *Preliminary study on pathology from ria de Formosa (Algarve, Portugal)*

Prado, S.; Núñez, S, Toranzo, A.; Montes, J. (1999, setembro 19-24) *New attemps to optimization of production of flat oyster (Ostrea edulis L.) spat*

I Xornadas de Patoloxía en Acuicultura. Vigo – Galicia (España)

Montes, J.; Santamarina, J.; Ferro, J.; Guerra, A. (1999, outubro 21) *Problemática patolóxica do cultivo de ostra plana*

Villalba, A.; Carballal, M. J.; López,C.; Casas, S.; Iglesias, D. (1999, outubro 21) *Obxectivos xerais da investigación do equipo nos últimos anos*

XXXIV Reunião Anual da Sociedade Portuguesa de Microscopia Electrónica e Biologia Celular. Lisboa (Portugal)

Azevedo, C.; Corral, L.; Montes, J. (1999) *A ultraestrutura dos filamentos dos esporos como carácter taxonómico dos géneros Haplosporidium e Minchinia*

Seminar on Mediterranean Marine Aquaculture Fish Species. TECAM. Zaragoza – Aragón (España)

Olmedo, M.; Peleteiro, J.B.; Linares, F.; Álvarez-Blázquez, B.; Gómez, C.; Ortega, A. (1999, maio) 24-28 *Experience with ongrowing juvenile blackspot sea bream (Pagellus bogaraveo) born in captivity, in tanks at diferents temperatures*

Xornadas Técnicas sobre o Sector Pesqueiro e as Industrias Transformadoras. EXPO-BARBANZA. Ribeira - Galicia (España)

de Coo – Martín; A. (1999) *Unha avaliación do marisqueo en Galicia, 1994-1999. Causas do subdesenvolvemento, evolución actual. Alternativas de modernización*

II Foro do Recursos Mariños e da Acuicultura da Rías Galegas. O Grove – Galicia (España)

de Coo – Martín; A. (1999, outubro 6-8) *Resultados económicos e produtivos do "Plan Galicia" do marisqueo a pé*

de Coo – Martín; A. (1999, outubro 6-8) *A defensa do recursos e a reducción das capturas na Rías Galegas ¿un discurso político con base científica?*

2000

3rd International Conference on Molluscan Shellfish Safety. Southampton - New York (Estados Unidos)

Carballal, M. J.; Iglesias, D.; Santamarina, J.; Ferro, B.; Villalba, A. (2000, xuño 19-24) *Parasites and pathological conditions of the populations of cockle Cerastoderma edule from Galician estuaries*

Santamarina, J., Ferro-Soto, B., Iglesias, D., Carballal, M. J., Otero, X., Villalba, A. (2000, xuño 19-24) *Mortality of cockle Cerastoderma edule associated with a protistan parasite (CPX) in the estuary of the Ulla river (Galicia, NW Spain)*

Blanco, J.; Bermúdez, M.; Arévalo, F.; Salgado, C.; Moroño, A. (2000, xuño 19-24) *Domoic acid depuration in the mussel Mytilus galloprovincialis: effects of size, temperature and salinity*

Saavedra, Y.; Blanco, J.; Carro, N.; Maneiro, J.; Fernández, P. (2000, xuño 19-24) *The effect of size on trace metal levels in raft mussels*

Moroño, A.; Arévalo, F.; Fernández, M. L.; Maneiro, J.; Salgado, C.; Blanco, J. (2000, xuño 19-24) *Following the intoxication and detoxification process caused by a Dinophysis acuminata bloom in Mytilus galloprovincialis Lmk*

Guerrero, S.; Alonso, J. L. (2000, xuño 19-24) *Settlement of the blue mussel Mytilus galloprovincialis on long-line systems in two estuaries of Galicia, Spain*

Prado, S.; Osorio, C. R.; Barja, J. L.; Montes, J. (2000, xuño 19-24) *Studies on the bacteria causing mortalities in cultures of oysters and clams larvae and the probiotic straims used for their control*

Montes, J.; Santamarina, J.; Ferro-Soto, B.; Prado, S.; Guerra, A. (2000, xuño 19-24) *Recent evolution of the pathology of flat oyster Ostrea edulis L. in Galicia (NW Spain)*

92nd Annual Meeting of the National Shellfisheries Association. Seattle (Estados Unidos)

Villalba, A.; Casas, S.; Carballal, M. J.; López, C. (2000, marzo 19-23) *Effects of perkinsosis on the clam Ruditapes decussatus industry of Galicia (NW Spain)*

International Conference and Exhibition. Aqua 2000. Niza (Francia)

Linares, F.; Olmedo, M.; Peleteiro, J. B.; Gianzo, C. (2000, maio 2-6) *Biochemical composition of blackspot seabream larvae, Pagellus bogaraveo, throughout larval development. Initial results*

Martínez D.; Nóvoa, S.; Ojea, J.; Álvarez, L. M. (2000, maio 2-6) *Larval rearing of razor clams Solen marginatus (Pennant, 1777), Ensis siliqua (Linné, 1758)*

Darriba, S.; Guerra, A. (2000, maio 2-6) *Somatic condition indexes of the razor clam (Ensis ensis): relation with de amount of phytoplankton*

V Congreso de Ciencias del Mar, Marcuba 2000. La Habana (Cuba)

Linares, F.; Olmedo, M; Peleteiro, J. B.; Ortega, A. (2000, decembro 4-8) *Composición lipídica del besugo (Pagellus bogaraveo) procedente del medio natural y de cultivo intensivo. Resultados preliminares*

Darriba, S.; Martínez, D.; Guerra, A. (2000, decembro 4-8) *Estudio del crecimiento de la navaja (Ensis arcuatus, Jeffreys, 1865) en Galicia (NO de España).*

XI Simposio Ibérico de Estudios del Bentos Marino. Torremolinos – Andalucía (España)

Molares, J.; Macho, G.; Vázquez, E.; Gregorio, V.; Giráldez, R. (2000, febreiro 22-25) *Períodos de puesta, abundancia larvaria y reclutamiento del percebe Pollicipes pollicipes Gmelin en la costa batida del sur de Galicia (NO España)*

Molares, J.; Macho, G.; Gregorio, V.; Giráldez, R.; Fuentes, J. (2000, febreiro 22-25) *Períodos de puesta, abundancia larvaria y reclutamiento del cirrípedo intermareal Elminius modestus Darwin en la ría de Arousa (NO España)*

Macho, G.; Molares, J.; Giráldez, R.; Gregorio, V.; Vázquez, E. (2000, febreiro 22-25) *Períodos de puesta, abundancia larvaria y reclutamiento de los cirrípedos intermareales Balanus perforatus Bruguière y Chthamalus montagui Southward en la costa batida del sur de Galicia (NO España)*

Darriba, S.; Guerra, A. (2000, febreiro 22-25) *Índice de condición gonadal de la navaja (Ensis ensis): relación con el índice de condición somático y abundancia de fitoplancton*

Guerrero, S.; Alonso, J. L. (2000, febreiro 22-25) *Relación entre la temperatura del agua y presencia de poslarvas de mejillón (Mytilus galloprovincialis Linnaeus,1750) en colectores long-line en las rías gallegas*

4th International Larval Biology Meeting. Santa Cruz – California (Estados Unidos)

Vázquez, E.; Molares, J.; Macho, G.; Giráldez, R.; Gregorio, V. (2000, xuño 24-28) *Reproduction, larval abundance and recruitment of barnacles from exposed coast of Galicia (NW Spain)*

Macho, G.; Molares, J.; Gregorio, V.; Giráldez, R.; Fuentes, J. (2000, xuño 24-28) *Spatial and seasonal species composition of barnacle larvae in estuarine waters (ría de Arousa, NW Spain)*

Molares, J.; Macho, G.; Gregorio, V.; Giráldez, R.; Fuentes, J. (2000, xuño 24-28) *Breeding period, larval abundance and recruitment of the barnacle Elminius modestus Darwin in the ría de Arousa (NW Spain)*

Workshop on New Species for Aquaculture. University of Algarve. Faro (Portugal)

Guerra, A.; Darriba, S.; Martínez, D.; Catoira, J. L.; Montes, J. (2000, novembro 20-21) *Commercial razor clams in Galicia (NW of Spain): The new candidates for the shellfish-culture*

Peleteiro, J.B.; Olmedo, M.; Linares, F. (2000, novembro 20-21) *Recent advances in the cultivation techniques for blackspot seabream (Pagellus bogaraveo B.): perspectives for industrial cultivation*

9th International Conference on Harmful Algal Blooms. Hobart – Tasmania (Australia)

Zapata M.; Rodríguez F.; Fraga S. (2000, febreiro 7-11) *Pigment patterns of toxic and non-toxic Pseudo-nitzschia species (Bacillariophyceae)*

Rodríguez, F.; Pázos, Y.; Maneiro, J.; Fraga, S.; Zapata, M. (2000, febreiro 7-11) *HPLC pigment composition of phytoplankton populations during the development of Pseudo-nitzschia spp. Proliferation*

Chlorophyll Workshop, QUASIM EM E-BEQUALM. Büsum (Alemania)

Zapata, M. (2000) *Advances in HPLC methods for the analysis of chlorophylls from seawater samples*

Rodríguez, F.; Pazos, Y.; Moroño, A.; Maneiro, J.; Blanco, J.; Zapata, M. (2000) *Relationship between in vivo fluorescence and chlorophyll a in a coastal station in the Ría de Pontevedra (Galicia, NW Spain)*

Aquatic Science Meeting ASLO. Copenhague (Dinamarca)

Zapata, M.; Wright, S. W.; Garrido, J. L.; Rodríguez, F. (2000, xuño 5-9) *Phytoplankton pigment diversity: How to make use of pigment diversity in oceanographic research?*

Wright, S. W.; Zapata, M.; Garrido, J. L.; Jeffrey, S. W. (2000, xuño 5-9) *Recent advances in HPLC separation of phytoplankton pigments*

Garrido, J. L.; Otero, J.; Maestro, M.; Rodríguez, F.; Zapata, M. (2000, xuño 5-9) *Non polar chlorophyll c-like pigments from some marine haptophytes*

Cortes, M. A.; Zapata, M.; Rodríguez, F.; Garrido, J. L. (2000, xuño 5-9) *Liquid chromatography-electrospray mass spectrometry of chlorophyll c compounds*

Van Lenning, K.; Zapata, M.; Wright, S.W.; Garrido, J. L.; Rodríguez, F.; Probert, I. (2000, xuño 5-9) *Pigment patterns of the bloom-forming haptophyte Emiliania huxleyi*

Rodríguez, F.; Van Lenning, K.; Zapata, M. (2000, xuño 5-9) *Divinyl chlorophyll a and b in ocean and coastal waters: Two or three pigment patterns?*

Southern Ocean-JGOFS Symposium. Brest (Francia)

Rodríguez, F.; Zapata, M. (2000, xullo 6-13) *Pigment signatures in the Gerlache Strait (Antarctic Peninsula) as determined by HPLC analysis using a C8 column and a pyridine-contai-ning mobile phase*

2001

VIII Congreso Nacional de Acuicultura. Santander – Cantabria (España)

Cerviño, A.; Bao, M.; de Coo, A.; García, A.; Domínguez, M. (2001, maio 22-25) *El aprovechamiento de energías alternativas en la acuicultura. Energía eólica en una batea*

Darriba, S.; Fernández, J.; González-Tizón, A.; Martínez-Lage, A.; Méndez, J.; Guerra, A. (2001, maio 22-25) *Características biométricas de dos especies de solénidos comerciales: navaja (Ensis arcuatus) y longueirón (Ensis siliqua)*

Fernández, J.; González-Tizón, A.; Martínez-Lage, A.; Darriba, S.; Guerra, A.; Méndez, J. (2001, maio 22-25) *Contenido en ADN y determinación de los cariotipos de dos especies de solénidos comerciales: navaja (Ensis arcuatus) y longueirón (Ensis siliqua)*

Fuentes, J. M.; Gregorio, M. V.; Álvarez-Ossorio, M. T.; Molares, J. (2001, maio 22-25) *Distribución espacio-temporal de las larvas del mejillón, Mytilus galloprovincialis, en la ría de Arousa*

García, A.; de Coo, A.; Cerviño, A.; Bao, M.; Domínguez, M. (2001, maio 22-25) *Primeros resultados de crecimiento de semilla de moluscos en batea con circulación de agua por sistema forzado en la ría de Arousa. Galicia. España.*

Olmedo, M.; Linares, F.; Peleteiro, J. B. (2001, maio 22-25) *Engorde de besugo, Pagellus bogaraveo, (Brünnich, 1768) entre 30 y 200 g en tanques y jaulas*

Martínez, D.; Nóvoa, S.; Ojea, J. (2001, maio 22-25) *Cultivos larvarios y poslarvarios de almeja fina (Ruditapes decussata) y almeja babosa (Tapes pullastra) en criadero*

Nóvoa, S.; Martínez, D.; Ojea, J.; Samain, J. F.; Soudant, P.; Rodríguez, J. L. (2001, maio 22-25) *Asimilación de microcápsulas de gelatina-acacia incorporando ácido araquidónico deuterado en aceite de oliva por larvas de almeja babosa (Tapes pullastra)*

Ojea, J.; Martínez, D.; Nóvoa, S. (2001, maio 22-25) *Ciclo gametogénico de una población de almeja fina (Ruditapes decussata) y relación con su contenido en glicógeno*

Rodríguez-Moscoso, E.; Espinosa, J.; García, O.; Arnaiz, R.; Martínez, D. (2001, maio 22-25) *Incidencia del protozoo Perkinsus sp sobre el crecimiento de una población de cultivo de almeja fina Ruditapes decussatus (Linné, 1758) en la ría de Arousa*

IV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Búa, I.; Graña, I.; Graña, L.; García, L.; Muñiz, V.; Guerra, A. (2001, outubro 9-10) *Desarrollo de un modelo piloto de criaderos de moluscos bivalvos bajo cubierta ligera*

Conchas, R. F.; Ferro-Soto, B.; Santamarina, J.; Lama, A.; Longa, M. A.; Montes, J. (2001, outubro 9-10) *Evolución de la bonamiasis en Galicia*

Molares, J. (2001, outubro 9-10) *Planes de Explotación de Recursos Específicos: Diseño y seguimiento*

3rd Fish and Shellfish Larviculture Symposium Larvi 2001. Gante (Bélgica)

Linares, F.; Olmedo, M.; Peleteiro, J. B.; Arán Echabe, J. (2001, setembro 3-6) *Ongrowing and biochemical composition of blackspot sexa bream (Pagellus bogaraveo) juvenís fed with different dry food*

VII Congreso Ibérico de Parasitología. Porto (Portugal)

Conchas, R. F.; Darriba, S.; Montes, J.; Ferro-Soto, B.; Guerra, A. (2001, setembro 18-21) *Descripción de los principales problemas patológicos en navaja (Ensis arquatus, J.) y longueirón (Ensis siliqua, L.) de Galicia*

Darriba, S.; Conchas, R. F.; Guerra, A.; Montes, J. (2001, setembro 18-21) *Presencia de Nemaptosis y Trematodos en dos especies de Solenaceae: Ensis arquatus (Jeffreys, 1865) e Ensis siliqua (Linneo, 1758)*

Montes, J.; Guerra, A.; Ferro-Soto, B.; Conchas, R. F. (2001, setembro 18-21) *Estrategias de cultivo de la ostra plana (Ostrea edulis L.) en relación con la incidencia de la bonamiasis*

10th International Conference of the European Assocciation of Fish Pathology "Diseases of Fish and Shellfish". Dublín (Irlanda)

Carballal, M. J.; Iglesias, D.; Villalba, A. (2001, setembro 17) *Temporal variation of disseminated neoplasia in two intertidal beds of the cockle Cerastoderma edule from Galicia (NW Spain)*

Conchas, R. F.; Ferro-Soto, B.; Montes, J. (2001, setembro 17) *Pathological monitoring of bivalve molluscs from Galicia (NW Spain)*

Iglesias, D.; Carballal, M. J.; Villalba, A. (2001, setembro 17) *Influence of neoplastic disorders in the cockle Cerastoderma edule from an intertidal bed in the Ría de Noia (NW Spain): age and sex susceptibility and effects on the condition*

Prado, S.; Montes, J.; Toranzo, A. E.; Barja, J. L. (2001, setembro 17) *Biotechnological potential of a probiotic marine bacterium for the improvement of oyster larvae production*

Aquaculture 2001-The Annual International Meeting of World Aquaculture Society, Orlando - Florida (Estados Unidos)

Apakupakul, K.; Villalba, A.; Casas, S. M.; Reece, K. M. (2011, xaneiro 21-25) *Molecular analysis of a Perkinsus species in the European flat oyster Ostrea edulis*

Villalba, A.; Casas, S. M. (2011, xaneiro 21-25) *Effect of perkinsose on the energetic physiology of the clam Ruditapes decussatus*

VII Reunión Ibérica de Fitoplancton y Biotoxinas. Alicante – València (España)

Blanco, J.; Acosta, C. P.; Bermúdez da Puente, M.; Salgado, C. (2001, maio 16-18) *Depuración y distribución anatómica del ácido domoico en la vieira Pecten maximus*

Blanco, J.; Reyero, M. I.; Franco J. M. (2001, maio 16-18) *Cinética de acumulación y transformación de toxinas de tipo paralítico (PSP) en el mejillón Mytilus galloprovincialis*

Iniesta, R.; Blanco, J. (2001, maio 16-18) *Efecto del tamaño corporal en la eliminación de toxinas de tipo PSP en el mejillón Mytilus galloprovincialis*

Gómez, A.; Blanco, J. (2001, maio 16-18) *Efecto de la concentración de metales, pH y de un complejo vitamínico sobre el dinoflagelado Dinophysis acuminata*

Moroño, A.; Arévalo, F.; Lion, M.; Maneiro, J.; Pazos, E.; Salgado, C.; Blanco, J. (2001, maio 16-18) *Proliferación de Alexandrium minutum Halim en la ría de Pontevedra*

Pazos, E.; Gómez, A.; Moroño, A.; Blanco, J.; Maneiro, J.; Reguera, B. (2001, maio 16-18) *Condiciones ambientales asociadas a la aparición de células pequeñas de Dinophysis*

Pazos, E., Blanco, J., Moroño, A., Maneiro, J. (2001, maio 16-18) *Floraciones de Pseudo-nitzschia en las rías gallegas: condiciones oceanográficas asociadas*

Pazos, E.; Moroño, A.; Roset, J.; Maneiro, J.; Blanco, J. (2001, maio 16-18) *Marea roja de Peridinium polonicum Woloszynska en el río Tajo*

Seminario Proteómica: técnicas y aplicaciones. Santiago de Compostela – Galicia (España)

Álvarez, G.; Fuentes, J. López, J. L. (2001, outubro 19) *Genética de mejillones: una aproximación desde la proteómica*

III Congreso de la Sociedad Española de Genética. Sevilla – Andalucía (España)

López; J. L.; Mosquera, E.; Fuentes, J.; Mariña, A.; Vázquez, J.; Álvarez, G. (2001, setembro 19-21) *Electroforesis bidimensional de Mytilus galloprovincialis: diferencias en la expresión proteica entre mejillones intermareales y mejillones de cultivo*

Congreso Internacional de Ciencia y Tecnología Marina: Océanos III Milenio. Pontevedra – Galicia (España)

Molares, J.; Fernández, A.; Santos, I.; Cerdeira, J. D.; Menéndez, R. J.; Ramonel, R.; Malvar, M.; César, J. (2001, abril 24-27) *Desarrollo de un Sistema de Información Geográfica orientado a la ordenación de la pesquería de los recursos específicos (percebe, erizo, longueirón y navaja) en Galicia*

Workshop High Performance Computing and Networking 2001. Santiago de Compostela – Galicia (España)

Molares Vila. J. (2001) *Sistemas de Información Geográfica aplicados a estudios de dinámica y gestión de poblaciones de invertebrados marinos con interés económico. A Coruña.*

Life Histories, Assessment and Management of Crustacean Fisheries. A Coruña – Galicia (España)

Molares, J.; Freire, J. (2011, outubro 8-11) *Fisheries and Management Perspectives of the Goose Barnacle Pollicipes pollicipes of Galicia (NW Spain)*

29th Annual Marine Benthic Ecology Meetings. New Hampshire (Estados Unidos)

Macho, G.; Molares, J.; Vázquez, E.; Giráldez, R.; Gregorio, V. (2001, marzo 17) *Biological and physical factors affecting barnacle recruitment in an exposed coast of Galicia (NW Spain)*

Gordon Research Conferences, Polar Marine Sciences. Ventura – California (Estados Unidos)

Zapata, M.; Rodríguez, F. (2001, marzo 11-16) *How useful are phyto-plankton pigments to infer phytoplankton community structure?. A case study: Gerlache and Bransfield Straits (Antarctic Peninsula)*

12th International Congress of Photosynthesis. Brisbane (Australia)

Zapata, M.; Garrido, J. L.; Jeffrey, S.W.; Wright, S. W.; Rodríguez, F.; Clementson, L. (2001, 23 agosto) *Nine chlorophyll c pigments from marine haptophyte microalgae*

9th Congress European Society for Photobiology. Lillehammer (Noruega)

Garrido, J. L.; Zapata, M. (2001, agosto 18-23) *Isolation and analysis of new pigments from marine microalgae*

VI International Conference of the Aquatic Ecosystem Health and Management Society (AEHMS). Amsterdam (Netherlands)

Iniesta, R.; Blanco, J. (2001, n ovembro 4-7) *Effect of body size on detoxification and biotransformation of PSP toxins in the mussel Mytilus galloprovincialis*

2002

V Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (Pontevedra)

Darriba, S.; Martínez, D.; Sanjuán, F.; Guerra, A. (2002, outubro 10-11) *Estudio integral da navalla do banco natural das Illas Cíes (ría de Vigo)*

Olmedo, M.; Linares, F.; Peleteiro J.B. (2002, outubro 10-11) *Selección de pósters que recompilan o avanzado no cultivo de ollomol en reproducción, cultivo larvario e engorde*

Miguens, J. L.; Molares, J.; Pavón, R.; Laza, R. (2002, outubro 10-11) *Xestión do marisqueo mediante a aplicación informática SIGREMAR 2002.*

Aquaculture Europe 2002. Seafarming Today and Tomorrow. European Aquaculture Society. Trieste (Italia)

Darriba S.; Martínez, D.; Guerra, A. (2002, outubro 16-19) *The razor clam Ensis arcuatus: perspectives for hatchery outgrowing culture*

Linares, F.; Olmedo, M.; Peleteiro, J. B. (2002, outubro 16-19) *Biochemical composition of blackspot seabream larvae, Pagellus bogaraveo, fed with rotifer enriched with three different microalgae*

Martínez, D.; Nóvoa, S.; Ojea, J.; Rodríguez J. L. (2002, outubro 16-19) *The relation between the oocytes quality of four species of bivalve molluscs and their rates on larval growth*

Peleteiro, J.B.; Olmedo, M.; Alvarez-Blázquez, B.; Linares, F. (2002, outubro 16-19) *Reproduction control of blackspot seabream, Pagellus bogaraveo B., in captivity*

Silva, A.; Nóvoa, S.; Sordo, A.; Abad, M.; Sánchez, J. L. (2002, outubro 16-19) *The influence of photoperiod on hatchery conditioning of broodstock of the clam Ruditapes decussatus*

II Congreso Internacional das Sociedades Malacolóxicas Europeas. Vigo - Galicia (España)

Darriba, S.; Guerra, A. (2002, setembro 9-13) *A navalla da ría de Vigo (España): ¿Ensis ensis ou Ensis arcuatus?*

Lorenzo, S.; González-Fernández, A.; López, J. L.; Fuentes, J. (2002, setembro 9-13) *Identificación de larvas de Mytilus galloprovincialis mediante métodos inmunolóxicos*

94th National Shellfisheries Association Annual Meeting. Mystic - Connecticut (Estados Unidos)

Casas, S. M.; Villalba, A.; La Peyre, J. F.; Reece, K. S.; Azevedo, C. (2002, abril 14-18) *Continuous in vitro culture of Perkinsus atlanticus, parasite of the carpet shell clam Tapes decussatus*

La Peyre, J. F.; Nickens, A. D.; Casas, S. M.; Villalba, A. (2002, abril 14-18) *Viability and growth of Perkinsus marinus and Perkinsus atlanticus at three temperatures.*

IVth International Symposium on Aquatic Animal Health. New Orleans - Louisiana (Estados Unidos)

Casas, S. M.; La Peyre, J. F.; Villalba, A. (2002, setembro 2-6) *Enzymatic activities in the extracellular products of in vitro cultures of Perkinsus atlanticus and comparison with Perkinsus marinus*

III Encuentro Latinoamericano de Patologistas de Organismos Acuáticos (EBRAPOA). Foz de Iguazu (Brasil)

Conchas, R. F.; Ferro, B.; Santamarina, J.; Montes, J. (2002) *Incidencia da marteiliase en Galicia, N.O. España*

V Larval Biology Meeting. Vigo – Galicia (España)

Macho, G.; Molares, J.; Giráldez, R.; Vázquez, E. (2002, setembro 15-20) *Timing of barnacle larval release and cyprid arrival in an exposed coast of Galicia (NW Spain)*

4th International Conference on Molluscan Shellfish Safety. Santiago de Compostela – Galicia (España)

Blanco, J.; Fuentes, J. (2002, xuño 4-8) *Accumulation of paralytic shellfish toxins from Alexandrium minutum by genetically different mussel stocks*

Blanco, J.; Iniesta, R. (2002, xuño 4-8) *Accumulation of paralytic shellfish toxins by Mytilus galloprovincialis: dependence on the toxin concentration in food*

Blanco, J.; Salgado, C.; Arévalo, F.; Correa, J.; Acosta, C. P.; Moroño, A.; Iniesta, R.; Maneiro, J. (2002, xuño 4-8) *Effect of the environmental conditions on the domoic acid (amnesic shellfish poisoning toxin) depuration of the king scallop Pecten maximus*

Iniesta, R.; Blanco, J. (2002, xuño 4-8) *Paralytic shellfish toxins depuration of different Tapes decussatus organs*

Iniesta, R.; Blanco, J. (2002, xuño 4-8) *A method to quantify metabolic faecal losses in mussels (Mytilus galloprovincialis), scallop (Pecten maximus) and cockle (Cerastoderma edule)*

Saavedra, Y.; González, A.; Fernández, P.; Fernández, R.; Blanco, J. (2002, xuño 4-8) *Interspecific variation of metal concentrations in three bivalve mollusc from Galicia*

Saavedra, Y.; González, A.; Fernández, P.; Fernández, R.; Blanco, J. (2002, xuño 4-8) *Content in nine heavy metals of the organs of the scallop Pecten maximus*

37th European Marine Biology Symposium. University of Iceland and Marine Research Institute. Reykjavik (Islandia)

Macho, G.; Molares, J.; Giráldez, R.; Vázquez, E. (2002, agosto 5-9) *A 4 years barnacle recruitment study: biological and physical factors*

2003

VI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (Pontevedra)

da Costa, F.; Martínez, D.; Novoa, S.; Ojea, J.; Darriba, S.; Guerra, A. (2003, outubro 9-10) *Cultivo de 3 especies comerciais de solénidos de interese comercial en Galicia*

Guerra, A.; Miranda, M. (2003, outubro 9-10) *O Centro de Investigacións Mariñas (CIMA) Resumo de cinco anos de actividade*

IX Congreso Nacional de Acuicultura. Cádiz – Andalucía (España)

Cerviño, A.; García, A.; De Coo, A.; Bao, M.; Domínguez, M. (2003, maio 12-16) *Mejoras tecnológicas en el preengorde de moluscos bivalvos. Aplicaciones en el cultivo en batea en las rías bajas gallegas. Galicia. España*

Cerviño, A.; García, A; De Coo, A.; Bao, M.; Domínguez, M. (2003, maio 12-16) *El preengorde de moluscos bivalvos en medio natural. Sus ventajas comparativas respecto de los semilleros en tierra y su aplicación a las rías bajas de Galicia. Algunas líneas de mejora*

Conchas, R. F.; Alonso, B.; Montes, J. (2003, maio 12-16) *Patologías asociadas a los Solénidos: Ensis arcuatus (navaja) y Ensis siliqua (longueirón) en Galicia*

Darriba, S.; San Juan, F.; Guerra, A. (2003, maio 12-16) *Metabolismo reproductivo de la navaja (Ensis arcuatus, Jefreys, 1865): acumulación y movilización de lípidos de reserva durante el ciclo gametogénico*

de Coo, A.; Cerviño, A.; García, A; Bao, M.; Domínguez, M. (2003, maio 12-16) *Tasa de crecimiento, formación de colas y mortalidad en el preengorde la ostra plana (Ostrea edulis), Linné 1758, en batea en las rías bajas de Galicia. Su relación con las densidades de cultivo y las operaciones de manejo*

García, A.; Cerviño, A.; De Coo, A.; Bao, M.; Domínguez, M. (2003, maio 12-16) *Tasa de crecimiento y mortalidad en el preengorde de la almeja fina, Ruditapes decussatus (Linné, 1758), la almeja babosa, Venerupis pullastra (Montagu, 1803) y la almeja japonesa, Ruditapes philippinarum (Adams & Reeve, 1850)*

Linares, F.; Olmedo, M.; Peleteiro, J. B. (2003, 16 maio) *Crecimiento y composición bioquímica de larvas de besugo, Pagellus bogaraveo (Brünnich, 1768), alimentadas con Artemia enriquecida con tres microalgas diferentes*

Martínez, D.; Nóvoa, S.; Ojea, J.; Rodríguez, E. (2003, maio 12-16) *Determinación de la talla de primera maduración sexual de la coquina, Donax trunculus (Linné, 1758), en un banco natural de la Ría del Barquero (NO Galicia)*

Nóvoa, S.; Martínez, D.; Ojea, J.; Rodríguez, J. L. (2003, maio 12-16) *Composición en ácidos grasos de larvas D de almeja fina (Ruditapes decussatus) Linné 1787, obtenidas a partir de progenitores acondicionados en distintos regímenes de temperatura y progenitores del medio natural*

Ojea, J.; Martínez, D.; Nóvoa, S.; Pazos, A. J.; Abad, M. (2003, maio 12-16) *Efecto del régimen de temperatura durante el proceso de acondicionamiento de almeja fina (Ruditapes decussatus) Linné, 1787*

Olmedo, M.; Peleteiro, J. B.; Cal, R.; Linares, F. (2003, maio 12-16) *Crecimiento de juveniles de lenguado (Solea senegalensis, Kaup, 1858) en Galicia*

Rodríguez, E.; Ojea, J.; Martínez, D.; Arnaiz, R.; Nóvoa, S. (2003, maio 12-16) *Ciclo de reproducción y estado de condición de una población de berberecho rabioso (Glycymeris glycymeris) en la ría de Arosa (NW Galicia, 2001-2002)*

14th International Pectinid Workshop. Florida (Estados Unidos)

Acosta, C. P.; Blanco, J. (2003, abril 23-29) *Clearance rate of Pecten maximus. I: Effect of flow and food concentration*

Acosta, C. P.; Blanco, J. (2003, abril 23-29) *Clearance rate of Pecten maximus. II: Optimal food concentration*

Acosta, C. P.; Blanco, J. (2003, abril 23-29) *Clearance rate of Pecten maximus. III: Inter-individual variability*

Acosta, C. P.; Blanco, J. (2003, abril 23-29) *Clearance rate of Pecten maximus. IV: Effect of the acclimation and food concentration*

Acosta, C. P.; Blanco, J. (2003, abril 23-29) *Clearance rate of Pecten maximus. V: Effect of oxygen supply, size and food concentration*

VIII Reunión Ibérica de Fitoplancton Tóxico y Biotoxinas. La Laguna – Islas Canarias (España)

Acosta, C. P.; Mariño, C.; Blanco, J. (2003, novembro 3-5) *El efecto del desove en la distribución de ASP en Pecten maximus*

Acosta, C. P.; Blanco, J. (2003, novembro 3-5) *Efecto de Gymnodinium catenatum sobre la tasa de aclaramiento en Pecten maximus*

García, A.; Campos, M. J.; Cano, J.; Mariño, C.; Gómez, M. J.; Blanco, J. (2003, novembro 3-5) *Evolución de las toxinas ASP en la glándula digestiva de la vieira Pecten maximus cultivada en Andalucía*

Moroño, A.; Pazos, Y.; García, A.; Mariño, C.; Maneiro, J.; Blanco, J. (2003, novembro 3-5) *Contenido en toxinas asociado a especies de Alexandrium detectadas en el Sistema de Control de las Rías Gallegas*

Moroño, A.; Pazos, Y.; Arévalo, F.; Salgado, C.; Maneiro, J.; Blanco, J. (2003, novembro 3-5) *Estudio comparativo del perfil de toxinas en agua durante los episodios de Dinophysis acuminata y D. Acuta*

Pazos, Y.; Moroño, A.; Doval, M.; Pérez-Bello, J. L.; Fernández, F.; Zapata, M.; Maneiro, J. (2003, novembro 3-5) *Mortalidad de peces en el Río Ulla (Arousa), asociado a una proliferación masiva de Glenodinium foliaceum*

26th AMOP Technical Seminar. Victoria (Canadá)

Montero, P.; Blanco, J. et al. (2003, xuño 10-12) *Oil spill monitoring and forecasting on the Prestige-Nassau accident*

Colloquium Spectroscopicum Internationale XXXIII. Granada – Andalucía (España)

Saavedra, Y.; González, A.; Fernández, P.; Blanco, J. (2003, 12 setembro) *A simple microwave digestion method to multielement monitoring in mussel samples*

11th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish". St. Julian's Bay (Malta)

Carballal, M. J.; Villalba, A.; Iglesias, D. (2003, setembro 21-25) *Virus-like particles associated with large foci of heavy hemocy-tic infiltration in cockles Cerastoderma edule from Galicia (NW Spain)*

Casas, S. M.; Grau, A.; Reece, K. S.; Apakupakul, K.; Azevedo, C.; Villalba, A. (2003, setembro 21-25) *Description of a Perkinsus-like protistan parasite of the European flat oyster Ostrea edulis (L.) from the coast of Balearic Islands, Mediterranean sea*

da Silva, P. M.; Villalba, A. (2003, setembro 21-25) *Comparison of different histological techniques for the detection of Bonamia ostreae in flat oyster Ostrea edulis and estimation of infection intensity*

da Silva, P. M.; Fuentes, J.; Carballal, M.J.; Villalba, A. (2003, setembro 21-25) *Looking for genetically based differences in disease susceptibility among oyster Ostrea edulis populations from different European areas to perform a selective breeding program for disease resistance*

Iglesias, D.; Carballal, M. J.; Villalba, A. (2003, setembro 21-25) *Digenean parasites of the cockle Cerastoderma edule populations from Galicia (NW Spain)*

Villalba, A.; Reece, K. S.; Ordás, M. C.; Casas, S. M.; Figueras, A. (2003, setembro 21-25) *Perkinsosis in molluscs – a review*

Jornadas sobre proteómica UCO-2003. Córdoba - Andalucía (España)

Lorenzo, S.; Fuentes, J.; López, J. L. (2003, febreiro) *Application of the proteomics for the search of specific proteins of larvae of the mussel Mytilus galloprovincialis*

II Plankton Symposium. Vigo – Galicia (España)

Lorenzo, S.; Gregorio, M. V.; Andrade, M.; Pérez, A.; González-Fernández, A.; Fuentes, J. (2003, outubro 16-19) *Monoclonal antibodies: A new tool for mussel larvae identification*

Fernandez-Tejedor, M.; Garcés, E.; Camp, J.; Penna, A.; Zapata , M. (2003, outubro 16-19) *Karlodinium micrum (=Gyrodinium galatheanum) an ichthyotoxic dinoflagellate in Alfacs Bay*

Seminario Científico Internacional. Efectos económicos, sociais e ambientais da marea negra do "Prestige". Santiago de Compostela – Galicia (España)

Molares, J. (2003, marzo 8) *Efectos del fuel vertido por el Prestige sobre las poblaciones de percebe en el litoral gallego*

II Coloquio Nacional de Malacología. IPIMAR. Lisboa (Portugal)

Azevedo, C.; Cochas, R. F.; Corral, L.; Montes, J. (2003, maio 16-17) *Novo parasita do berbigao Cerastoderma edule: ultrastructura e ciclo de vida*

2004

Fifth International Conference on Molluscan Shellfish Safety. Galway (Irlanda)

Blanco, J. (2004, xuño 14-18) *Modelling phycotoxins accumulation in bivalves: a review*

Blanco, J. ; García, A.; Vázquez, M. C.; Mariño, M. C.; Gómez, M. J.; Cano, J.; Campos, M. J. (2004, xuño 14-18) *Kinetics and anatomical distribution of Paralytic Shellfish Poisoning (PSP) toxins in the king scallop Pecten maximus*

García-Muñoz, A.; Campos, M. J.; Cano, J.; Mariño, C.; Gómez, M. J.; Blanco, J. (2004, xuño 14-18) *Anatomical distribution of amnesic shellfish poisoning (ASP) toxins in the king scallop Pecten maximus throughout the culture cycle*

Saavedra, Y.; González, A.; Fernández, P.; Blanco, J. (2004, xuño 14-18) *The influence of sex and spawning on metal concentration and content of Mytilus galloprovincialis*

XI International Conference on Harmful Algal Blooms. Ciudad del Cabo (Sudáfrica)

Moroño, A.; Pazos, Y.; García, A.; Mariño, C.; Maneiro, J.; Blanco, J. (2004, novembro 15-19) *1998-2004 study of Alexandrium minutum toxin content in a Galician Ría (NW, Spain)*

Moroño, A.; Arévalo, F.; Correa, J.; Maneiro, J.; Pazos, Y.; Salgado, C.; Blanco, J. (2004, novembro 15-19) *Toxin profile in sea-water during two toxic episodes: Dinophysis acuminata versus D. acuta predominance*

Pazos, Y.; Maneiro, J.; Moroño, A.; Doval, J.; Blanco, J. (2004, novembro 15-19) *Time Series Análisis (1992-2003) of Alexandrium minutum Halim and its Oceanographic Conditions in Galicia (NW Spain)*

Seminario Aquacultura e Novas Espécies. Funchal - Madeira (Portugal)

Olmedo, M.; Linares, F.; Peleteiro, J. B. (2004) *Últimos avances en el cultivo de besugo (Pagellus bogaraveo) en aguas de Galicia (NW de España)*

Aquaculture Europe 2004. Biotechnologies for quality. Barcelona – Catalunya (España)

Conchas, R. F.; Balseiro, P.; Novoa, B.; Montes, J.; Alonso, B.; González, G.; Figueras, A. (2004, outubro 20-23) *Validation of the technique of PCR for diagnosis of parasite Bonamia ostreae in flat oyster Ostrea edulis, L*

da Costa, F.; Darriba, S.; Martínez, D.; Guerra, A. (2004, outubro 20-23) *Conditioning broodstock of the commercial razor clam Solen marginatus (Pennánt, 1777)*

da Costa, F.; Nóvoa, S.; Martínez, D.; Guerra, A. (2004, outubro 20-23) *Seed culture of the razor clam Solen marginatus*

da Silva, P. M.; Fuentes, J.; Villalba, A. (2004, outubro 20-23) *Selective breeding programme for oyster disease resistance. Influence of sex in the susceptibility of Ostrea edulis to bonamiosis*

Darriba, S.; Miranda, M.; da Costa, F.; Guerra, A. (2004, outubro 20-23) *Reproductive study of the razor clam Ensis siliqua (Linnaeus, 1758) in Galicia (NW Spain)*

Fuentes, J. (2004, outubro 20-23) *Selective breeding programme for oyster disease resitance. Influence of sex in the susceptibility of Ostrea edulis to bonamiosis*

Iglesias, D.; Carballal, M. J.; Villalba, A. (2004, outubro 20-23) *Gonadal cycle of the cockle Cerastoderma edule of Galicia (NW Spain)*

Linares, F.; Olmedo, M.; Peleteiro, J. B. (2004, outubro 20-23) *Influence of feeding with feeds having a different fat content on the growth and composition of blackspot sea bream (Pagellus bogaraveo) juveniles*

VII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Darriba, S.; Miranda, M.; da Costa, F.; Guerra, A. (2004, outubro 7-8) *Estudios para la gestión de la explotación de solénidos*

Guerrero, S. (2004, outubro 7-8) *Gestión de los residuos procedentes de la acuicultura en Galicia*

2004 ICES Annual Science Conference. Vigo – Galicia (España)

Kroeck, M.A.; Arzul, I.; Montes, J.; Conchas, R.F.; Chollet, B.; Morsan, E.M.; Berthe, F. (2002, setembro 20-25) *Presence of Bonamia-like microcells in flat oyster, Ostrea puelchana (d´Orbigny, 1842) from San Matías Gulf (NW Patagonia, Arxentina)*

Lorenzo, S.; González, A.; Fuentes, J. M. (2002, setembro 20-25) *Identification of mussel larvae from plankton samples by monoclonal antibodies*

IX European Multicolloquium of Parasitology (EMOP IX). València - (España)

Conchas, R.F.; Montes, J. (2004, xullo 18-23) *Bonamiosis control in Galicia (NW Spain)*

Conchas, R. F.; Montes, J.; López, C.; Darriba, S.; Iglesias, D. (2004, xullo 18-23) *Bucephalidae trematode affecting razor clam, Ensis arcuatus, from the coast of Galicia (NW Spain)*

Gordon Research Conference on Marine Microbes. Roscoff (Francia)

Zapata, M. (2004, xuño 6-10) *Recent advances in pigment analysis as applied to picoplankton*

Seminario Moluscicultura no litoral sul-atlântico - Diversificação. Faro (Portugal)

Darriba, S.; Guerra, A. (2004, 20 febreiro) *Estado del conocimiento e investigaciones realizadas en Galicia sobre los solénidos comerciales*

ESCPB 23rd Annual Conference. Cesenatico (Italia)

Ojea, J.; Martínez, D.; Nóvoa, S.; Cerviño, A. (2004, setembro 23-26) *Gonadal cycle of a population of the japanese clam (Tapes philippinarum) and its relation with glycogen content*

2005

VIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Cerviño-Eiroa, A.; García-Fernández, A.; de Coo-Martín, A. (2005, outubro 6-7) *Sistema de bolsas para preengorde de ameixas en batea*

Cerviño-Otero, A.; Ojea, J.; Nóvoa, S.; Martínez, D. (2005, outubro 6-7) *Ciclo reprodutivo da ameixa babosa Venerupis pullastra (Montagu, 1803)*

Darriba, S.; Miranda, M. (2005, outubro 6-7) *Impacto do descenso da salinidade na reprodución da navalla (Ensis arcuatus)*

Guerreiro, S.; Santos, I.; Outón, M.J. (2005, outubro 6-7) *Caracterización e cuantificación dos residuos procedentes da acuicultura en Galicia*

Miranda, M.; Santamaría, I.; Casal, J.; Ruiz, A.; Guerra, A. (2005, outubro 6-7) *Aproveitamento de augas residuais dunha piscifactoría de rodaballo en Galicia para o engorde de moluscos bivalvos*

Rodríguez, L.; Iglesias, D.; Escudeiro, A.; Montes, J.; Conchas, R.F.; Pérez, J.L.; Fernández, M.; Guerra, A. (2005, outubro 6-7) *Impulso do cultivo da ostra rizada (Crassostrea gigas) en diferentes rías galegas*

I Seminario de Xestión e Tratamento de Residuos na Acuicultura. Vigo – Galicia (España)

Guerrero Valero, S. (2005) *Residuos na acuicultura en Galicia*

X Congreso Nacional de Acuicultura. Gandía – València (España)

Cerviño-Eiroa, A.; García-Fernández, A.; de Coo-Martín, A. (2005, outubro 17-21) *O preengorde da ameixa xaponesa, Ruditapes philippinarum (Adams & Reeve, 1850), en diversos sistemas de cultivo nas Rías Baixas e litoral de Galicia*

Cerviño-Eiroa, A.; García-Fernández, A.; de Coo-Martín, A. (2005, outubro 17-21) *Resultados de preengorde da ameixa fina, Ruditapes decussatus (Linné, 1758), en diversos sistemas nas Rías Baixas de Galicia*

Cerviño-Otero, A.; Ojea, J.; Nóvoa, S.; da Costa, F.; Martínez, D. (2005, outubro 17-21) *Estudo do ciclo reprodutivo da ameixa babosa Venerupis pullastra (Montagu, 1803), en dúas poboacións distintas da costa galega: Camariñas (NO de Galicia) e O Grove (SO de Galicia)*

Cerviño-Otero, A.; Martínez, D.; Nóvoa, S.; Ojea, J.; García-Martínez, M.; Abad, M. (2005, outubro 17-21) *Variación estacional no índice de condición e composición bioquímica da gónada da ameixa babosa, Venerupis pullastra (Montagu, 1803) en dúas poboacións distintas da costa galega*

Cerviño-Otero, A.; Carballal, M.J.; Martínez, D.; García-Fernández, A.; Cerviño-Eiroa, A. (2005, outubro 17-21) *Efectos dos procesos de 1ª maduración reprodutiva no preengorde da ameixa fina, Ruditapes decussatus (Linné, 1758), a ameixa babosa, Venerupis pullastra (Montagu, 1803) e a ameixa xaponesa, Ruditapes philippinarum (Adams & Reeve, 1850)*

Cerviño-Otero, A.; Carballal, M.J.; Martínez, D.; Cerviño-Eiroa, A.; García-Fernández, A.(2005, outubro 17-21) *O crecemento diferencial entre machos e femias na ameixa babosa, Venerupis pullastra (Montagu, 1803) e as súas consecuencias das prácticas de criadeiros e centros de preengorde*

Chereguini, O.; Garcia de la Banda, I.; Lobo, C.; Linares, F. (2005, outubro 17-21) *Coalimentación larvaria e destete de Solea senegalensis (Kaup, 1958) a ambientes de diferente salinidade*

da Costa, F.; Darriba, S.; Martínez, D. (2005, outubro 17-21) *Desenvolvemento embrionario e larvario de Ensis arcuatus (Jeffreys, 1865) ao microscopio electrónico de varrido*

Darriba, S.; Miranda, M.; Guerra, A. (2005, outubro 17-21) *Estudo reprodutivo dos bivalvos Ensis arcuatus e Ensis siliqua en distintos bancos naturais de Galicia (NO España)*

de Coo, A.; Cerviño-Eiroa, A.; García-Fernández, A. (2005, outubro 17-21) *O período crítico de mortalidade no preengorde da ostra plana Ostrea edulis (Linné, 1758) en batea, nas rías baixas de Galicia. A súa relación coas densidades de cultivo e as operacións de manexo*

García-Fernández, A.; Cerviño-Eiroa, A.; de Coo-Martín, A. (2005, outubro 17-21) *Potencial de crecemento e resultados de mortalidade no preengorde a ameixa babosa, Venerupis pullastra (Montagu, 1803), en diversos sistemas nas rías Baixas de Galicia, con especial atención aos factores que interactuan na súa evolución*

Guerra, A. (2005, outubro 17-21) *Logros no estudo de solénidos comerciais en Galicia, a través do Plan Nacional JACUMAR*

Guerrero, S.; Santos, I.; Outón, M.J. (2005, outubro 17-21) *Uso de subprodutos procedentes de conchas de bivalvos en Galicia*

López, C.; Darriba, S.; Miranda, M.; Álvarez, C. (2005, outubro 17-21) *Depuración de Ensis arcuatus e Ensis siliqua (Solenacea)*

Miranda, M.; Santamaría, I.; Casal, J.; Ruiz, A.; Guerra, A. (2005, outubro 17-21) *Preengorde de semente de ameixas en efluentes de piscifactorías mariñas en terra*

Mariño-Balsa, J.C.;Linares, F.; Rodríguez, J.L. (2005, outubro 17-21) *Deseño dun plan de repoboación de rodaballo en Galicia*

Olmedo, M.; Linares, F.; Álvarez-Blázquez, B.; Peleteiro, J.B. (2005, outubro 17-21) *Estado actual do ollomol, Pagellus bogaraveo*

Prado, S.; Ojea, J.; Martínez, D.; Montes, J.; Barja, J. (2005, outubro 17-21) *Selección de bacterias mariñas como probióticos en acuicultura. Actividade da cepa*

Rodríguez, L.; Iglesias, D.; Montes, J.; Conchas, R.F.; Pérez, J.L.; Fernández, M.; Guerra, A. (2005, outubro 17-21) *Estudo de valoración do cultivo de ostra rizada (Crassostrea gigas) en diferentes rías galegas. Primeiros resultados*

Santos, I.; Guerrero, S.; Outón, M.J. (2005, outubro 17-21) *Residuos do cultivo de rodaballo (Psetta maxima) en Galicia*

IX Congreso Ibérico de Parasitoloxía. Coimbra (Portugal)

Conchas, R.F.; Pérez, J.L.; González, G.; Montes, J. (2005, outubro 25-28) *Optimización do cultivo de ostra plana en Galicia mediante o control do parasito Bonamia ostreae con técnicas de diagnóstico rápido*

López, C.; Darriba, S.; Conchas, R.F. (2005, outubro 25-28) *Presenza de Marteilia sp. en Solen marginatus (Pennántt, 1777) en Galicia (NO España)*

40 EMBS: European Marine Biology Symposium. Viena (Austria)

Sánchez Mata, A. (2005, agosto 21-25) *Macrobenthic biomass gradient over a range of exposed sandy beaches at the northern atlantic coast of Spain*

Sánchez Mata, A. (2005, 21-25) *Patterns of zonation in Antarctic intertidal benthos: the effects of glacial melting on diversity and abundance*

Larvi 2005. 4th Fish & Shellfish Larviculture Symposium. Gent (Bélgica)

Laura Ribeiro, L; Couto, A.; Olmedo, M.; Álvarez-Blázquez B.; Linares, F.; Valente, L. (2005, setembro 5-8) *Digestive enzymes activity during black spot seabream (Pagellus bogaraveo) larvae and post-larvae development*

Marine and Freshwater Toxins Analysis. First Joint Symposium and AOAC Task Force Meeting. Baiona - Galicia (España)

Blanco, J.; Mariño, M.C.; Martín, H.; Acosta, C.P. (2005, abril 11-14) *Anatomical distribution of DSP in the mussel Mytilus galloprovincialis during the depuration process*

World Aquaculture 2005. Bali (Indonesia)

Chereguini, O.; García de a Banda, I.; Díez, J.; Lobo, C.; Linares, F. (2005, maio 9-13) *Effect of different regimes on senegal sole Solea senegalensis (Kaup 1858) larval culture in Cantabria (Northern Spain)*

García de la Banda, I.; Chereguini, O.; Lobo, C.; Díez, J.; Linares, F.; Arce, F. (2005, maio 9-13) *Ongrowing of senegal sole Solea senegalensis (Kaup 1858) fries using two different commercial diets in Cantabria (Northern Spain)*

EAS Aquaculture Europe 2005. Trondheim (Noruega)

Guerrero, S.; Santos, I.; Outón, M.J. (2005, agosto 5-9) *Mussel and white shell by-products in Galicia, Spain*

Santos, I.; Guerrero, S.; Outón, M.J. (2005, agosto 5-9) *Turbot Farms waste in Galicia, Spain*

12th International Conference of the European Association of Fish Patholoxists "Diseases of Fish and Shellfish". Copenhagen (Dinamarca)

Conchas, R.F.; Balseiro, P.; Novoa, B.; Montes, J.; Figueras, A. (2005, setembro 11-16) *Validation of nested PCR for dioagnose of parasite Perkinsus olseniatlanticus in culture clams.*

Carballal, M.J.; Díaz, S.; Villalba, A. (2005, setembro 11-16) *Urosporidium sp. hyperparasite of the turbellarian Paravortex cardii in the cockle Cerastoderma edule*

Díaz, S.; Soudant, P.; da Silva, P.M.; Carballal, M.J.; Lambert, C.; Villalba, A. (2005, setembro 11-16) *Flow cytometric DNA content analysis of normal haemocytes and neoplastic cells in the haemolymph of the cockle Cerastoderma edule*

III Congreso Internacional de Ciencia e Tecnoloxía Mariña "Océanos III Milenio". Porto Real (Cádiz)

Díaz, S.; Carballal, M.J.; Villalba, A. (2005) *Alteracións patolóxicas do berberecho, Cerastoderma edule, dun banco natural do NO de España*

Molares, J.; Fernández, A.; Santos, I.; Cerdeira, J.D.; Menéndez, R.J.; Ramonel, R.; Malvar, M.; César, J. (2005) *Desarrollo de un sistema de información geográfica oreintado a la ordenación de la pesquería de recursos específicos (percebe, erizo, longueirón y navaja) en Galicia*

97th National Shellfisheries Association Annual Meeting. Philadelphia (Estados Unidos)

da Silva, P. M.; Fuentes, J.; Villalba, A. (2005, abril 10-14) *Disseminated neoplasia in oysters Ostrea edulis cultured in Galicia (NW Spain)*

da Silva, P. M.; Villalba, A.; Sunila, I. (2005, abril 10-14) *Branchial lesions associated with abundant apoptotic cells in oysters Ostrea edulis of Galicia (NW Spain)*

A Peyre, J.; Casas, S.M.; Reece, K.S.; Villalba, A. (2005, abril 10-14) *In vitro propagation of Perkinsus mediterraneus a parasite of the edíbel oyster Ostrea edulis*

Romalde, J. L.; Rodríguez, J.M.; Beaz, R.; Vilariño, M.L.; Carballal, M.J.; Díaz, S.; Villalba, A. (2005,abril 10-14) *Evidences for retroviral etiology of the disseminated neoplasia in cockles (Cerastoderma edule)*

Workshop Internacional de Cultivo de Moluscos sobre: Estado actual de la bioloxía y cultivo de bivalvos enterradores. Concepción (Chile)

Guerra, A.; Darrriba, S. (2005, abril 19-20) *Novas especies na acuicultura de moluscos bivalvos: estudos dos solénidos en Galicia (España)*

Guerra, A. (2005, abril 19-20) *Os minicriadeiros: desenvolvemento e transferencia dun modelo de instalación para a obtención de semente de moluscos bivalvos comerciais*

2006

IX Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez, D. (2006, outubro 10-11) *Viabilidad del cultivo intensivo de 3 especies de solénidos comerciales: navaja, longueirón y longueirón vello*

Darriba, S.; Guerra, A. (2006, outubro 10-11) *Estudio de dos poblaciones de oreja de mar (Haliotis tuberculata) en Galicia (NO de España)*

Díaz, S. M.; Carballal M. J.; Villalba A. (2006, outubro 10-11) *Diferencias de alteraciones patológicas entre berberechos enterrados y desenterrados*

Guerrero, S.; Alonso-Fernández de Landa, J.L.; Otero, M. (2006, outubro 10-11) *Generación de residuos de la acuicultura en Galicia*

Molares, J. (2006, outubro 10-11) *Xestión marisqueira en zonas de libre marisqueo: Os Lombos do Ulla e o Bohído (Ría de Arousa). Pontevedra*

Sánchez-Mata, A.; Molares, J.; Sánchez-Mata, A.G.; Chapela, A.; Giráldez, R. (2006, outubro 10-11) *Estructura y distribución de los bancos naturales de vieira (Pecten maximus L. 1758) de las Rías de Ares, Arousa y Vigo*

XIV Simposio Ibérico de Estudios de Biología Marina. Barcelona – Catalunya (España)

Sánchez-Mata, A.G.; Sánchez-Mata, A.; Lastra, M. (2006, setembro 12-15) *The effects of a PSP episode on mortality of king scallop (Pecten maximus L., 1758) in Ría de Vigo, Galicia, NW Spain*

Sánchez-Mata, A.; Molares, J.; Parada, J.M.; Martínez, G. (2006, 2006, setembro 12-15) *Changes in salinity and current speed induce cockle (Cerastoderma edule, L.) transport in Lombos do Ulla Estuary*

IV Symposium on Sandy Beaches. Vigo – Galicia (España)

Sánchez-Mata, A.G.; Sánchez-Mata, A.; Lastra, M. (2006, outubro 9-13) *Long-term biodiversity gradients in macrobenthic communities of northern Spain exposed sandy beaches*

Sánchez-Mata, A.; Molares, J.; Rodal, M.; Carreira, P.; Varela, M.T. (2006, outubro 9-13) *A mesoscale study on the recruitment, growth and mortality of the grooved car-pet-shell (Ruditapes decussatus, L. 1758) in two galician sandy beaches*

VII Simposio Español de Estudios Polares. Granada – Andalucía (España)

Sánchez-Mata, A.; Lastra, M.; Mora, J.; García, M. (2006, setembro 18-20) *Efecto de las variaciones térmicas del substrato en la distribución de la biodiversidad bentónica intermareal a lo largo de un gradiente espacial en Isla Decepción (Islas Shetland del Sur)*

EAS Aqua 2006 - Linking Tradition & Technology. Florencia (Italia)

Carballal, M. J.; Cerviño, A.; Martínez, D. (2006, maio 9-13) *Pathological analysis of seed clam Ruditapes decussatus, Venerupis pullastra and Ruditapes philippinarum pre-fattening in the Ría de Arousa (Spain)*

da Costa, F.; Martínez, D.; Guerra, A. (2006, maio 9-13) *Conditioning effects of the razor clam Solen marginatus upon larval and postlarval culture*

da Costa, F.; Ojea, J.; Martínez, D. (2006, maio 9-13) *Effects of diets upon larval culture in the razor clam Ensis arcuatus (Jeffreys, 1865)*

da Costa, F.; Nóvoa, S.; Martínez, D. (2006, maio 9-13) *Effects of temperature upon larval culture in the razor clam Ensis arcuatus (Jeffreys, 1865)*

da Costa, F. (2006, maio 9-13) *Culture of 3 commercial razor clam species in Galicia (NW Spain)*

Darriba, S. (2006, maio 9-13) *Razor clams and aquaculture: studies in Galicia (NW Spain)*

Guerrero, S.; Pascual, C.; Barja, J. L.; Romalde, J.L.; Brea, M.D.; Prado, S.; Rodríguez, C.J.; Alonso-Fernández de Landa, J.L. (2006, maio 9-13) *Preliminary results on the silage of residues from marine and freshwater aquaculture*

López, C.; Darriba, S.; Cutrín, J. M.; Conchas, R. (2006, maio 9-13) *Presence and characterization of Marteilia sp. in razor clams, Solen marginatus (Pennántt, 1777) in Galicia (NW Spain)*

5th International Symposium on Aquatic Animal Health. San Francisco - California (Estados Unidos)

Abollo, E.; Comesaña, P.; Casas, S.M.; Cao, A.; Villalba, A. (2006, setembro 2-6) *Co-infection of two Bonamia species in the European oyster Ostrea edulis from Galician coast (NW Spain)*

Abollo, E.; Casas, S.M.; Ceschia, G.; Villalba, A. (2006, setembro 2-6) *Differential diagnosis of Perkinsus species by polymerase chain reaction-restrition fragment length polymorphism assay*

López, C.; Darriba, S.; Iglesias, D.; Harshbarger, J. C. (2006, setembro 2-6) *Presence of germinoma in razor clam Ensis arcuatus (Jeffreys, 1865) in Galicia (NW Spain)*

López, C.; Beaz, R.; Balboa, S.; Romalde, J. (2006, setembro 2-6) *Histopathological and bacteriological study of cultured clams (Ruditapes decussatus and Ruditapes philippinarum) from two different location in Galicia (NW of Spain)*

98th National Shellfisheries Association Annual Meeting. Monterrey - California (Estados Unidos)

Villalba, A. (2006, marzo 26-30) *Different types of neoplasia in Crassostrea gigas, Venus verrucosa and Mytilus galloprovincialis from the Spanish coast*

Villalba, A.; Comesaña, P.; Casas, S.M.; Cao, A. (2006, marzo 26-30) *Comparison of immune parameters between oyster stocks and species with different susceptibility to infection by Bonamia ostreae*

MarCuba 2006 – VII Congreso de Ciencias del Mar. La Habana (Cuba)

Guerrero, S.; Pascual, C.; Barja, J. L.; Romalde, J.L.; Alonso Fernández de Landa, J.L.; Brea, M.D.; Prado, S.; Rodríguez, C.J. (2006, outubro 4-8) *Tratamiento de residuos de la acuicultura de rodaballo en Galicia mediante ensilados*

IX Congreso de Ibérico de Parasitología. Lisboa. (Portugal)

Azevedo, C.; Casal, G.; Montes, J. (2006, decembro) *Detalhes ultrastruturais do ciclo de vida de Haplosporidium montforti (Phylum Haplosporidia), parasita de Haliotis tuberculata (Gastropoda, Bivalvia)*

1st International Workshop of Physiological Aspects of Reproduction and Nutrition in Mollusks. La Paz (México)

Darriba, S.; Guerra, A. (2006, novembro 6-9) *Reprodution of the razor clam Ensis arcuatus (Solenacea) in three natural beds in Galicia (NW Spain)*

VI Internacional Abalone Symposium. Puerto Mont (Chile)

Lastres-Couto, M.A.; Andrés-Rivas, M.C.; Guerra-Díaz, A. (2006, maio 5) *Preliminary growth-out experiment with spat of Haliotis tuberculata, L. in the Ría de Vigo (NW Spain)*

Workshop of experts for updating SCOR UNESCO monograph from SCOR WG 78 "Phytoplankton Pigments in Oceano-graphy". Mónaco

Garrido, J.L.; Rodríguez, F.; Zapata, M. (2006, abril) *New HPLC and mass spectrometry methods unveil "new" pigments in "old" species*

Garrido, J.L.; Rodríguez, F.; Zapata, M. (2006, abril) *Mass spectrometry studies of new pigments in Karenia and Tetraselmis species*

Rodríguez, F.; Garrido, J.L.; Zapata, M. (2006, abril) *Chlorophylls -not only carotenoids- as markers of phytoplankton groups in field studies*

12th International Conference on Harmful Algae. Copenhague (Dinamarca)

Blanco, J.; Mariño, C.; P. Acosta, C.; Martín, H. (2006, setembro 4-8) *The use of biopsies to quantify domoic acid concentration in the king scallop Pecten maximus*

Garcés, E.; Fernández, M.; Penna, A.; Van Lenning, K.; Gutiérrez, A.; Zapata, M. (2006, 8setembro 4-8) *Characterization of NW Mediterranean Karlodinium spp. (Dinophyceae) strains using morphological, molecular, chemical, and physiological methodologies*

Mariño, C.; Martín, H.; P. Acosta, C.; Blanco, J. (2006, setembro 4-8) *Effect of emersion on diarrhetic shellfish toxins depuration from the blue mussel Mytilus galloprovincialis*

P. Acosta, C.; Mariño, C.; Martín, H.; Blanco, J. (2006, setembro 4-8) *Lack of effect of temperature on the depuration of domoic acid from the king scallop Pecten maximus*

41th European Marine Biology Symposium. Cork. (Irlanda)

Sánchez-Mata, A.G.; Sánchez-Mata, A.; Lastra, M. (2006, setembro 4-8) *Prestige oil spill effects on the macrobenthic community over a range of Galician sandy beaches (NW Spain)*

Sánchez-Mata, A.; Sánchez Mata, A.G.; Chapela, A.; Giráldez, R.; Molares, J. (2006, setembro 4-8) *King scallop (Pecten maximus) stock assessment and fishery avaliation in Ría de Arousa (Galicia, NW Spain)*

2007

XI Congreso Nacional de Acuicultura. Vigo – Galicia (España)

Andrés, M.C.; Lastres, M.A.; Santamaría, I.; Ruiz, M.; Guerra, A. (2007, 28 setembro) *Desarrollo reproductivo y acondicionamiento de la oreja de mar (Haliotis tuberculata, Linnaeus, 1758), en Galicia (NO de España)*

Brea, M.D.; Prado, S.; Rodríguez, C.J.; Doce, A.; Guerrero, S.; Fernández de Landa, J.L.A.; Leiro, J.; Arranz, J.; Toranzo, A.E.; Romalde, J. L.; Barja, J.L.; Pascual, C. (2007, 28 setembro) *Ensilados de pescado: composición química y microbiota asociada*

Carballal, M.J.; Louzán, A.; Martínez-Patiño, D. (2007, 28 setembro) *Primeros resultados de un estudio histopatológico de la coquina Donax trunculus en Galicia*

Cerviño-Otero, A.; Ojea, J.; Nóvoa, S.; Martínez, D. (2007, 28 setembro) *Comparativa de la evolución del Ciclo Gametogénico entre una población submareal y otra intermareal de almeja babosa Venerupis pullastra (Montagu, 1803) de O Grove (SO de Galicia)*

Cerviño-Otero, A.; Nóvoa, S.; Ojea, J.; Martínez, D. (2007, 28 setembro) *Composición bioquímica de dos poblaciones naturales de almeja babosa Venerupis pullastra (Montagu, 1803) de O Grove (SO de Galicia). Diferencias entre el intermareal y submareal*

Cerviño-Otero, A.; Carballal, M.J.; Martínez-Patiño, D. (2007, 28 setembro) *Estudio patológico de tres poblaciones naturales de almeja babosa Venerupis pullastra*

da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2007, 28 setembro) *Evolución de la composición bioquímica a lo largo del desarrollo larvario de Solen marginatus*

da Costa, F.; Martínez-Patiño, D.; Nóvoa, S.; Ojea, J. (2007, 28 setembro) *Crecimiento y viabilidad larvaria en relación a la composición bioquímica y de ácidos grasos en los ovocitos de 3 especies de solénidos: Ensis arcuatus (Jeffreys, 1865), Ensis siliqua (Linné, 1758) Solen marginatus (Pennánt, 1777)*

da Costa, F.; Rial, D.; Nóvoa, S.; Ojea, J.; Martínez, D. (2007, 28 setembro) *Crecimiento de semilla de longueirón vello (Solen marginatus Pennánt, 1777) en el medio natural*

de Santiago J.A.; Andrés, M.C. ; Guerra, A. (2007, 28 setembro) *Preengorde de almeja babosa Venerupis pullastra (Montagu, 1803), mediante un sistema de flujo invertido forzado por "air lift", en la Ría de Camariñas (A Coruña)*

Díaz, S.; Villalba, A.; Carballal, M.J. (2007, 28 setembro) *Transmisión de neoplasia diseminada entre berberechos Cerastoderma edule*.

Fernández-Tajes, J.; Fernández Moreno, M.; Martínez Patiño, D.; da Costa, F.; Gaspar, M.; Constantino, R.; Cromie, A.; McDonough, N.; Roberts, D.; Méndez, J. (2007, 28 setembro) *Estudios genéticos aplicados al desarrollo de la acuicultura de navajas y longueirones*

García de la Banda, I.; Lobo, C.; Recalde, L.; León-Rubio, J.M.; Moriñigo, M.A.; Arijo, S.; Chabrillón, M.; Díaz-Rosales, P.; Balebona, M.C.; Martínez-Manzanares, E.; Arce, F.; Nicolás, M.; Lucas, M.L.;Pazos, G.; Linares, F. (2007, 28 setembro) *Influencia de la adición del probiótico pdp11 en el engorde del lenguado senegalés Solea senegalensis (Kaup 1858)*

García Fernández, A.; Cerviño Eiroa, A. (2007, 28 setembro) *Nuevos avances y resultados de crecimiento y mortalidad en el preengorde de almejas, en diversos sistemas en las Rías Bajas de Galicia*

Gaspar, M.; Carvalho, S.; Constantino, R.; Martínez Patiño, D.; da Costa, F.; Fernández Tajes, J.; Méndez, J.; Cromie, A.; McDonough, N.; Roberts, D. (2007, 28 setembro) *Impacto de la pesca como motor para el desarrollo de la acuicultura de navajas y longueirones*

Guerra, A.; Nóvoa, S.; Besada, M.; Búa, I.; Lastres, M.; Fernández, J.; Asela, R. (2007, 28 setembro) *Crecimiento y composición bioquímica de semilla de almeja japonesa (Tapes philippinarum) y almeja babosa (Venerupis pullastra), obtenida en criadero y cultivada en diferentes sistemas de preengorde y en parque de cultivo*

Iglesias, D.; Rodríguez, L.; Montes, J. (2007, 28 setembro) *Estudio histopatológico de Crassostrea gigas (Thunberg, 1793) cultivada en las rías gallegas*

Martínez Patiño, D.; Nóvoa, S.; Ojea, J.; Rodríguez, J.L. (2007, 28 setembro) *Efecto de la cantidad de alimento suministrado a los cultivos en el crecimiento y composición en ácidos grasos de las larvas de almeja babosa, Venerupis pullastra (Montagu, 1803)*

Martínez Patiño, D.; da Costa, F.; Cromie, A.; Nóvoa, S.; Ojea, J.; Werner, A.; Browne, L.; Fernández-Tajes, J.; Méndez, M.; Gaspar, M.; Constantino, R.; Roberts, D.; McDonough, N. (2007, 28 setembro) *Desarrollo de la acuicultura de navajas y longueirones: cultivo en criadero*

Molares, J. (2007, 28 setembro) *El marisqueo: razones para la supervivencia de una actividad artesanal*

Molares, J.; Parada, J.M.; Sánchez-Mata, A.; Martínez, G.; Darriba, C.; Rodal, M.; Carreira, P.; Varela, T.; Crego, A.; Mariño, J. (2007, 28 setembro) *Gestión del banco marisquero de "Lombos do Ulla" (Ría de Arousa, NO de España) desde 2002 hasta 2007*

Nóvoa, S.; Ojea, J.; Martínez Patiño, D.; Rodríguez, J.L. (2007, 28 setembro) *Calidad ovocitaria de la almeja babosa, Venerupis pullastra (Montagu, 1803), relacionada con su contenido en ácidos grasos ω3 y ω6*

Ojea, J.; Silva, A.; Martínez, D.; Nóvoa, S.; García-Martínez, P.; Abad, M. (2007, 28 setembro) *Condiciones óptimas para el acondicionamiento de la almeja fina, Ruditapes decussatus (Linnaeus, 1758) en criadero*.

Olmedo, M.; Linares, F.; Álvarez-Blázquez, B.; Pazos, G.; Valente, L. (2007, 28 setembro) *Crecimiento y composición corporal de juveniles de besugo, Pagellus bogaraveo, alimentados con diferentes niveles de proteína y carbohidratos*

Olmedo, M.; Peleteiro, J.B.; Cal, R.; Álvarez-Blázquez, B.; Gómez, C.; Linares, F. (2007, 28 setembro) *Reproducción y cultivo larvario de lenguado, Solea senegalensis, en el Centro Oceanográfico de Vigo*

Parada, J.M. (2007, 28 setembro) *Engorde a escala industrial de almeja babosa (Venerupis senegalensis) y almeja fina (Tapes decussatus) en batea hasta talla comercial*

Parada, J.M. (2007, 28 setembro) *Asesoramiento técnico a las organizaciones de mariscadores para el manejo de los recursos marinos*

Parada, J.M.; Molares, J.; Otero, X. (2007, 28 setembro) *Episodios de mortalidad en el banco marisquero "Lombos do Ulla" (Ría de Arousa – NO de España) deducidos a partir de datos meteorológicos de los últimos 45 años*

Pérez, D.; González Fdez., A.; Fuentes, J.M. (2007, 28 setembro) *Aplicación de los anticuerpos monoclonales M22.8 y M36.5 en la evaluación de la abundancia de larvas de mejillón en las rías gallegas*

Rasines, I.; Cherenguini, O.; Rodríguez, C. ; Linares, F.; Pazos, G.; Martín, I. (2007, 28 setembro) *Composición bioquímica de las puestas de lenguado senegalés (Solea senegalensis) en cautividad: variación estacional*

Rey Méndez, M.; Quinteiro, J. ; Tourón, N.; Rodríguez Castro, J.; Herrero, A.; Girard, D.; González, N.; de la Uz Díaz, S.; Rodríguez, C.; Carrasco, J.F.; Rial, D.; Martínez, D.; Ojea, J.; Catoira, J.L. (2007, 28 setembro) *Cultivo y gestión del erizo de mar (Paracentrotus lividus Lamarck, 1816)*

Rodríguez Moscoso, E.; Ojea, J.; Arnaiz, R.; Martínez, D.; Nóvoa, S. (2007, 28 setembro) *Estrategia de reproducción del rabioso (Glycymeris glycymeris) (Linnaeus, 1758)*

Sánchez-Mata, A.; Molares, J.; Rodal, M.; Carreira, P.; Varela, T.; Crego, A.; Parada, J.M.; Martínez, G.; Darriba, C.; Mariño, J. (2007, 28 setembro) *Gestión del banco marisquero O Bohído (Ría de Arousa) en el periodo 2006-2007: Análisis de las poblaciones de bivalvos comerciales*

Villalba, A.; da Silva, P.M.; Fuentes, J. (2007, 28 setembro) *La producción de estirpes de Ostrea edulis tolerantes a la bonamiosis como solución para el engorde de la ostra plana en Galicia*

X Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

de Coo Martín, A. (2007, 11 outubro) *Revisión a dez anos de marisqueo*

de Coo Martín, A. (2007, 11 outubro) *As especies depredadoras asociadas a bancos naturais e parques de cultivo de moluscos bivalvos. A opinión do sector extractivo e cultivador galego*

Guerra, A.; Gabín, C. (2007, 11 outubro) *Los solénidos comerciales en Galicia*

Lastres, M.A.; Andrés, M,C.; Santamaría, I.; Rubirosa, M.J.; Ancosmede, C.; Pérez, N.; Guerra, A. (2007, 11 outubro) *Cultivo y gestión de la oreja de mar: Haliotis tuberculata spp*

López, C.; González, A.; Quintáns, J.M.; Rodríguez, J.L. (2007, 11 outubro) *Datos preliminares del control de parámetros físico-químicos y bacteriológicos en circuíto cerrado de peces planos*

Louzán, A.; Cerviño-Otero, A.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2007, 11 outubro) *Seguimiento del ciclo reproductor y desarrollo larvario de una población de coquina Donax trunculus (Linné, 1758)*

Macías, C.; Aguado, F.; Henríquez, N.; Guerrero, S.; Estévez, A.; Valencia, J.M.; Cremades, J. (2007, 11 outubro) *Acuicultura Integrada: desarrollo de experiencias de cultivos multitróficos en la costa española*

Ojea, J.; Martínez-Patiño, D.; Nóvoa, S.; Catoira, J.L. (2007, 11 outubro) *Datos biométricos e índices de condición del erizo de mar (Paracentrotus lividus, Lamarck 1816) en cuatro localidades de Galicia*

CoastGIS'07. Santander – Cantabria (España)

Navarrete-Taito, C.; Freire, J.; Molares, J.; González-Ronda, A. (2007, 10 outubro) *A GIS prototype as a support tool for management of the goose barnacle (Pollicipes pollicipes) fisheries in Galicia (NW Spain)*

Parada, J.M.; Molares, J. (2007, 10 outubro) *Modelling salinity in Ulla estuary using GIS technology in runoff calculation*

Seminario do proxecto EUROCIPS. Vigo - Galicia (España)

Molares, J. (2007, 28 setembro) *Coastal inventory and sensitivity mapping*

IX Reunión Ibérica de Fitoplancton Tóxico y Biotoxinas. Cartagena – Murcia (España)

Blanco, J. (2007, 10 maio) *Acción estratégica de la CA de Galicia para la mitigación de los efectos de los episodios tóxicos*

Escudeiro, A.; Martín, H.; Blanco, J. (2007, 10 maio) *Distribución celular del ácido okadaico en la glándula digestiva de Mytilus galloprovincialis*

Mauriz, A.; Blanco, J. (2007, 10 maio) *Estudio de la distribución intracelular y ligamiento de la toxina ASP en la glándula digestiva de Pecten maximus*

Aquaculture Europe 2007. Estambul (Turquía)

Carballal, M.J.; Cerviño, A.; Martínez, D. (2007, 27 outubro) *Parasites and gonad development in clams prefattened in three different systems*

da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2007, 27 outubro) *Fatty acid composition of the razor clam Ensis siliqua during larval development*

da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2007, 27 outubro) *Biochemical study of larval development in the razor clam Ensis siliqua*

López, C.; Darriba, S.; Iglesias, D. (2007, 27 outubro) *Parasites and pathological condition of two natural beds razor clam Ensis arcuatus (Jeffrees, 1865) (Pharidae) in Galicia (NW Spain)*

9th Annual Aquaculture Workshop. Portaferry (Northern Ireland)

Da Costa, F.; Martínez-Patiño, D. (2007, 15 setembro) *Culture potential of 3 commercial razor clam species in Galicia (NW Spain)*

XII COLACMAR. Florianópolis (Brasil)

Guerrero Valero, S.; Otero, M.; Alonso, J.L. (2007, 19 abril) *Cuantificación del impacto ambiental generado por los residuos de la acuicultura en Galicia*

XIIIth International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish". Grado (Italia)

Abollo, E.; Ramilo, A.; Cao, A.; Comesaña, P.; Villalba, A. (2007, 21 setembro) *Natural and experimental transmission of the protozoan parasite Bonamia ostreae to the Pacific oyster Crassostrea gigas*

Díaz, S.; Carballal, M.J.; Villalba, A.; Cao, A. (2007, 21 setembro) *Expression of the mutant protein p53, Hsp70 and Hsp90 chaperons in haemolymph of neoplastic cockles, Cerastoderma edule*

Iglesias, D.; Carballal, M.J.; Villalba, A. (2007, 21 setembro) *An epizootic disorder detected in a natural population of the clam Venerupis aurea in Galicia (NW Spain)*

Villalba, A.; Abollo, E. (2007, 21 setembro) *Cases of marteiliosis and gonadal neoplasia in a population of the invasive black-pygmy mussel Xenostrobus securis in the Ría de Vigo (Galicia, NW Spain)*

10th Internacional Conference on Shellfish Restoration (ICSR). Vlissingen (Netherlands)

Domínguez Pérez, L.; Villalba García, A.; Fuentes González, J.M. (2007, 16 novembro) *Effects of photoperiod and length of conditioning on gametogenesis and spawning of the mussel Mytilus galloprovincialis*

Fuentes González, J.M.; Villalba García, A. (2007, 16 novembro) *Selective breeding programme for bonamiosis tolerance of the European flat oyster Ostrea edulis in Galicia: preliminary results*

Workshop for the Analisys of the Impact of Perkinsosis to the European Shellfish Industry. CETMAR. Vigo – Galicia (España)

Villalba García, A. (2007, 14 setembro) *Perkinsosis in molluscs: epizootiological aspects*

International Symposium on Algal Toxins. Trieste (Italia)

Arévalo, F.; Iniesta, R.; Vidal, A.; Goicoechea, M.; Correa, J.; Muñiz, S.; Blanco, J. (2007, 28 maio) *Comparison of pre-column HPLC, post-column HPLC and mouse bioassay methods for the quantification of PSP toxicity in mussels and their implications in monitoring systems*

Diogene, J.; Fernández, M.; Cañete, E.; Caillaud, A.; Mallat, E.; de la Iglesia, P.; Elandaloussi, L.; Furones, D.; Blanco, J.; Sampedro, N.; Vila, M.; Franco, J. (2007, 28 maio) *Complementary techniques and approaches implemented to support official methodologies used within the monitoring programme for harmful algal blooms in shellfish production areas in Catalonia*

2008

XI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

López, M.; Rodríguez,C.; Carrasco, J.F.; Brea, Mª.D.; Pais, R.; Rodríguez, C.J.; Guerrero, S. (2008, outubro 9-10) *Experiencias de engorde de xuvenís de polbo (Octopus vulgaris) con distintos tipos de cebos*

Guerrero, S.; Cremades, J.; Salinas, J.M.; Ocaña, S.; Fuertes, C.; Sanmartín, J.J.; Devesa, S.; Muiños, A.; Pallarés, A. (2008, outubro 9-10) *Desarrollo de experiencias de cultivo multitrófico integrado aplicables a la acuicultura marina gallega*

Cerviño-Otero, A.; da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2008, outubro 9-10) *Desenvolvemento embrionario e larvario de tres especies de bivalvos: navalla (Ensis arcuatus), longuerión (Ensis siliqua) e ameixa babosa (Venerupis pullastra)*

da Costa, F.; Martínez-Patiño, D.; Álvarez, F.; Nóvoa, S.; Ojea, J. (2008, outubro 9-10) *Talle de primeira maduración do longueirón vello Solen marginatus (Pennánt, 1777)*

Louzán, A.; Nóvoa, S.; Ojea, J.; Martínez, D. (2008, outubro 9-10) *Evolución do contido en carbohidratos ao longo do ciclo gametoxénico de Donax trunculus (Linné, 1758)*

Ojea, J.; Martínez, D.; Nóvoa, S.; Catoira, J.L. (2008, outubro 9-10) *Reprodución do ourizo de mar, Paracentrotus lividus (Lamarck, 1816) en dúas poboacións naturais: Mar Cantábrico (Cedeira) e Océano Atlántico (Aguiño)*

Santamaría, I.; Otero, M., Fernández, M.; Guerra. A. (2008, outubro 9-10) *Engorde de ameixa babosa, Venerupis pullastra (Montagu, 1803) nos parques do Carril (Vilagarcía de Arousa, Pontevedra)*

García, A.; Solís, L.; Alcalde, A.; Conde, Mª. L.; de Coo, A.; Fariña, J.; García, J.; Poza, G.; Santos, I.; Crespo, J.A.; Fernández, D. (2008, outubro 9-10) *Primeiros resultados da actividade depredadora sobre moluscos bivalvos comerciais, por peixes, crustáceos, equinodermos e gasterópodos mariños en Galicia; mecanismos de actuación*

de Santiago, J. A.; Pouso O.; Graña, L.; Lampon V.; Pombal, M.; Guerra, A. (2008, outubro 9-10) *Sistema de bandexas en fluxo invertido para preengorde no exterior de ameixa babosa (Venerupis pullastra)*

Fernández, A.; de Santiago, J.A.; Martín, F.; Otero, M.; Guerra, A. (2008, outubro 9-10) *Preengorde de semente de ameixa e ostra en sistema de fluxo invertido no exterior.*

Marcet, P.; Otero, M.; Asela, F.; Guerra, A. (2008, outubro 9-10) *Valorización de residuos de efluente de piscifactoría*

Andrés M.C.; Lastres M.A.; Varela, M.; Santamaría, I.; Guerra, A. (2008, outubro 9-10) *Crecemento de semente de Haliotis tuberculata L. utilizando dous tipos de dieta*

Solís, L.; Alcalde, A.; Conde, Mª.L.; de Coo, A.; Fariña, J.; García, A.; García, J.; Poza, G.; Santos, I. (2008, outubro 9-10) *Potencial de afectación das especies depredadoras de moluscos bivalvos comerciais en Galicia. Primeiras mostraxes de poboacións e conclusións preliminares*

García, J.; Solis, L.; Alcalde, A.; Conde, Mª. L.; de Coo, A.; Fariña, J.; García, A.; Poza, G.; Santos, I. (2008, outubro 9-10) *Unha visión actual dos depredadores de moluscos bivalvos comerciais en Galicia*

de Coo A. (2008, outubro 9-10) *Marisqueo de bivalvos e crise económica en Galicia*

Alcalde, A.; Conde, Mª.L.; de Coo, A.; Crespo, J.A.; Fariña, J.; Fernández, D.; García, A.; García, J.; Poza, G.; Santos, I. (2008, outubro 9-10) *As especies depredadoras asociadas a bancos naturais e parques de cultivo de moluscos bivalvos. A opinión do sector extractivo e cultivador galego*

II Foro Iberoamericano dos recursos mariños e a acuicultura. FIRMA 2008. Cumaná (Venezuela)

Martínez, D.; Cerviño-Otero, A.; Louzán, A.; Da Costa, F.; Ojea, J.; Nóvoa, S. (2008, novembro 5-8) *Produción de especies de interese marisqueiro na Planta de Cultivos Mariños de Ribadeo (CIMA)*

Nóvoa, S.; Ojea, J.; Martínez, D.; Louzán, A. (2008, novembro 5-8) *Variación do contido lipídico nos distintos estadios do ciclo gametoxénico de Donax trunculus (Linné, 1758)*

Lastres, M.; Andrés, C.; Santamaría, B.; Guerra, A. (2008, novembro 5-8) *Proxecto formativo para técnicos de acuicultura no desenvolvemento de criadeiro de moluscos*

VII Reunión de Microbioloxía do Medio Acuático 2008. Bilbao – Euskadi (España)

Doce, A.; López, C.; Diéguez, A.L.; González, A.; Balboa, S. e Romalde, J.L. (2008, setembro 25-27) *Estudo histopatolóxico e bacteriolóxico de ameixas cultivadas (Ruditapes decussatus e Ruditapes philippinarum) en Galicia*

IV Sole Workshop. CCMAR. Universidade do Algarve. Faro (Portugal)

García de la Banda, I.; Lobo C.; Martín I.; Moriñigo, M.A.; Arijo, S.; León-Rubio, J.M.; Tapia-Paniauga, S.; Chabrillón, M.; Pazos, G.; Linares, F.; Moreno-Ventas, X.; Canteras J.C. (2008, novembro 13) *Pbp11 probiotic use on Solea senegalensis (Kaup) larval and postlarval culture*

Aquaculture Europe 2008. Cracovia (Polonia)

Carballal M.J.; Díaz S.; Louzán A.; Martínez D. (2008, setembro 15-18) *Parasites and cells of the internal defence system of the bivalve Donax trunculus*

López, C., Rodríguez-Díaz, R.; Darriba-Couñago, S. (2008, setembro 15-18) *Parasites and pathological condition of two natural beds of razor clam, Solen marginatus (Pennánt, 1777), in Galicia (NW Spain)*

Cerviño-Otero, A.; da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2008, setembro 15-18) *Embryonic, larval and post-larval development in the pullet carpet shell, Venerupis pullastra (Montagu, 1803)*

da Costa, F.; Ojea, J. Nóvoa, S.; Martínez-Patiño, D. (2008, setembro 15-18) *Biochemical study of larval development in the razor clam Ensis arcuatus*

da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2008, setembro 15-18) *Fatty acid composition of the razor clam Solen marginatus during larval development*

XX International Congress of Genetics. Berlín (Alemania)

Martín-Gómez, L.; Villalba, A.; Abollo, E. (2008, xullo 12-17) *Molecular identification of differentially regulated xenes of the European flat oyster (Ostrea edulis) in response to experimental infection by Bonamia ostreae (Haplosporidia)*

X European Multicolloquium of Parasitology (EMOP X). París (Francia)

Abollo, E., Ramilo, A.; Villalba, A. (2008, agosto 24-29) *DNA probes as tools for the specific diagnosis of Bonamia exitiosa (Haplosporidia)*

Pascual, S.; Abollo, E. (2008, agosto 24-29) *Myxosporean infection in frozen blocks of Patagonian hakes*

Pollicipes International Conference. Sines (Portugal)

Molares Vila, J. (2008, 27 setembro) *Effect of oil spill from tanker "Prestige" upon goose barnacle populations in Galicia (NW Spain)*

Molares Vila, J. (2008, 27 setembro) *Xestión do percebe en Galicia*

100th National Shellfisheries Association Annual Meeting. Providence (Estados Unidos)

Martin-Gómez L.; Abollo, E.; Villalba A. (2008, abril 6-10) *Identification of differentially expressed genes in the European flat oyster (Ostrea edulis) in response to infection by the haplosporidian Bonamia ostreae*

Pardo, B.G.; Castro, J.; López, A.; Pino-Querido, A.; Bouza, C.; Fuentes, J.; Villalba, A.; Martínez, P. (2008, abril 6-10) *Identifying familiar relationships in cohorts of Ostrea edulis using microsatellite loci*

Cao A., Abollo E.; Pardo, B.G.; Martínez, P.; Villalba, A. (2008, abril 6-10) *Identification of the Perkinsus spp., occurring in the Spanish coast and evaluation of their intraspecific variability*

2009

XII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Aranda, J.A.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2009, outubro 7-8) *Primeiros datos da calidade das postas, en relación ao estado dos reprodutores de dúas especies de ameixas: Ruditapes decussatus e Ruditapes philippinarum*

Cerviño-Otero, A.; Ferreiro, J.L.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2009, outubro 7-8) *Cultivo da ameixa babosa Venerupis pullastra (Montagu, 1803): criadeiro, preengorde e engorde*

de Santiago J.A.; Graña, L.; Lampón, V.; Pombal, M.; Pouso, O.; Guerra, A. (2009, outubro 7-8) *Rendemento do embarcadoiro de preengorde, con fluxo de auga invertido e forzado por "air lift", no Porto de Camariñas*

da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2009, outubro 7-8) *Efecto do substrato no crecemento e supervivencia de semente da navalla (Ensis arcuatus) e o longueirón vello (Solen marginatus)*

Mariño-Balsa, J.C.; Graña-Pereira, M.I.; Cid-González, E.; Fernández-Franco, B.; Pérez-Benavente, G. (2009, outubro 7-8) *Seguimento anual do rodaballo (Scophthalmus maximus) liberado nas praias de Mexilloeira e O Carreiro*

Louzán, A.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2009, outubro 7-8) *Adaptación de semente de coquina Donax trunculus (Linné, 1758) ao medio natural*

Ojea, J.; Martínez-Patiño, D.; Nóvoa, S.; Catoira, J.L. (2009, outubro 7-8) *Índice de condición, ciclo gametoxénico e composición bioquímica de gónadas do ourizo de mar en catro poboacións naturais de Galicia*.

Otero, M.; Bua, I.; Guerra, A. (2009, outubro 7-8) *Crecemento en substrato de semente de tres especies de ameixas cultivadas en diferentes sistemas de preengorde*

Gómez, J.L.; Iglesias, D.; González, D.; do Río, G.; Frire, A.; González, G.; Fernández, R.; Montes, J. (2009, outubro 7-8) *Fixación da ostra xaponesa (Crassostrea gigas) na Ría do Barqueiro*

Guerra, A. (2009, outubro 7-8) *Os minicriadeiros e sementeiros de moluscos bivalvos*

Guerrero, S.; Cremades, J.; Salinas, J.M.; Ancosmede, C.; Ocaña, S.; Andrade, M. (2009, outubro 7-8) *Interacción dos gametos das algas verdes Codium spp., e Ulva sp., no crecemento e supervivencia de semente de ameixa babosa (Venerupis pullastra), ameixa xaponesa (Ruditapes philippinarum) e ostra rizada (Crassostrea gigas)*

Guerrero, S.; Cremades, J.; Salinas, J.M.; Ancosmede, C.; Andrade, M.; Ocaña, S.; Doval, M.D.; Pazos, Y. (2009, outubro 7-8) *Variación de nutrientes e clorofila "a" dentro dun sistema de acuicultura multitrófica integrada (AMTI)*

Marcet, P.; Guerra, A.; Otero, Mª; González, S. (2009, outubro 7-8) *Compostaxe de lodos residuais procedentes do cultivo de rodaballo: aplicación nun solo degradado*

Prado, S.; Dubert, J.; Cerviño-Otero, A.; Louzán, A.; Nóvoa, S.; Barja, J.L. (2009, outubro 7-8) *Seguimento da calidade microbiolóxica do fitoplancto en criadeiros de moluscos*

Prado, S.; Dubert, J.; Ojea, J.; da Costa, F.; Aranda, J.A.; Martínez-Patiño, D. (2009, outubro 7-8) *Establecimento dos puntos críticos no circuíto de auga dun criadeiro de moluscos*

Rey-Méndez, M.; Quinteiro, J.; Rodríguez-Castro, J.; Tourón, N.; Rama-Villar, A.; Fernández-Silva, I.; González, N.; Martínez, D.; Ojea, J.; Catoira, J.L. (2009, outubro 7-8) *Evolución do crecemento do ourizo de mar (Paracentrotus lividus Lamarck, 1816) procedente de criadeiro*

Santamaría, I.; Fernández, M.; Otero, M.; Guerra, A. (2009, outubro 7-8) *Relacións biométricas na orella de mar (Haliotis tuberculata) en zonas de produción natural da Ría de Vigo (España)*

XII Congreso Nacional de Acuicultura. Madrid (España)

Aranda, J.A.; Louzán, A.; da Costa, F.; Cerviño-Otero, A.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2009, novembro 24-26) *Desenvolvemento embrionario e larvario de dúas especies de moluscos bivalvos: Donax trunculus (Linné, 1758) e Ruditapes decussatus (Linné, 1758)*

Cerviño-Otero, A.; da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2009, novembro 24-26) *Desenvolvemento embrionario e larvario da ameixa babosa Venerupis pullastra (Montagu, 1803) ao microscopio electrónico de barrido*

Cremades, J.; Andrade, M.; Ocaña, S.; Guerrero, S.; Ancosmede, C.; Salinas, J.M. (2009, novembro 24-26) *Experiencia de cultivo integrado de macroalgas en gaiolas de peixes na Ría de Muros e Noia (A Coruña)*

da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2009, novembro 24-26) *Efecto do estadio gametoxénico inicial no acondicionamento de tres especies de solénidos: Ensis arcuatus, E. siliqua e Solen marginatus*

da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2009, novembro 24-26) *É necesario alimentar as larvas de Solen marginatus?*

Dubert, J.; Louzán, A.; Prado, S.; Balsa, S.; Nóvoa, S.; Montes, J.; Barja J.L. (2009, novembro 24-26) *Estudo da evolución da carga bacteriana asociada a reprodutores de coquina (Donax trunculus) durante o acondicionamento en criadeiro*

García, S.; Domíngues, P.; Garrido, D.; Rodríguez, C.J.; Pascual, C. (2009, novembro 24-26) *Efecto de dietas artificiais, con e sen atraente, sobre o crecemento do polbo común, Octopus vulgaris*

García da Banda, I.; Lobo, C.; Rodríguez, C.; Linares, F.; Pazos, G.; Moreno-Ventas, X. (2009, novembro 24-26) *Optimización do protocolo de cultivo larvario e destete do linguado senegalés Solea senegalensis (Kaup, 1858)*

Louzán, A.; da Costa, F.; Nóvoa, S.; Ojea, J.; Martí-nez-Patiño, D. (2009, novembro 24-26) *Estudo do desenvolvemento larvario dunha poboación de coquina Donax trunculus (Linné, 1758)*

Mariño, J.C.; Pérez, G; Rodríguez, J.L.; Cid, E.; Fernández, B.; Graña, M.I. (2009, novembro 24-26) *Repoboación de rodaballo (Psetta maxima) na Costa de Galicia*

Ojea, J.; Martínez-Patiño, D.; Nóvoa, S.; Catoira, J.L. (2009, novembro 24-26) *Cultivo de ourizo de mar en criadeiro: desovas e desenvolvementos larvarios*

Olmedo, M.; Linares, F.; Álvarez-Blázquez, B.; Pazos, G.; Peleteiro, J.B. (2009, novembro 24-26) *Engorde do ollomol, Paguellus bogaraveo, en gaiolas con diferentes taxas de alimentación*

Parada, J.M.; Molares, J. (2009, novembro 24-26) *Unha aplicación en visual Basic para a avaliación de stocks de bancos marisqueiros*

Prado, S.; Louzán, A.; Balsa, S.; Dubert, J.; Nóvoa, S.; Montes, J.; Barja, J.L. (2009, novembro 24-26) *Estudo da evolución da carga bacteriana asociada a reprodutores de coquina (Donax trunculus) durante o acondicionamento en criadeiro*

Prado, S.; da Costa, F.; Dubert, J.; Martínez-Patiño,D.; Barja, J.L. (2009, novembro 24-26) *Microbiota de cultivos larvarios de longueirón vello (Solen marginatus)*

Prado, S.; Dubert, J.; Ojea, J.; Cerviño-Otero, A.; Toranzo, A.E. (2009, novembro 24-26) *Influencia do uso de antibiótico en diferentes desenvolvementos larvarios de ameixa xaponesa (Ruditapes philippinarum)*

Salinas, J.M.; Fuertes, C.; Cremades, J.; Guerrero, S. (2009, novembro 24-26) *Fitotoxicidade inducida por formaldehído, amonio cuaternario e peróxido de hidróxeno sobre a macroalga mariña Saccharina latissima (Laminariales, Phaeophyta)*

Aquaculture Europe 2009. Thronheim (Noruega)

da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2009, agosto 14-17) *Investigating the effect of feeding regimens on gametogenesis of broodstock of razor clam Ensis siliqua under hatchery conditions*

da Costa, F.; Cerviño-Otero, A.; Louzán, A.; Ojea, J.; Nóvoa, S. (2009, agosto 14-17) *Effects of substratum and stocking density on the performance of juveniles of Ensis arcuatus in intermediate cultivation trials*

XIII Congreso Latinoamericano de Ciencias do Mar. VIII Congreso de Ciencias do Mar (COLACMAR). La Habana (Cuba)

Guerrero, S.; Ancosmede, C.; Cremades, J.; Andrade, M.; Ocaña, S.; Salinas, J.M.; Doval, M.D.; Pazos, Y. (2009, outubro 26-30) *Modelo terrestre de Acuicultura Multitrófica Integrada (AMI) baseado no cultivo combinado de rodaballo, ameixa, laminaria e anémona*

Annual Meeting and Technical Workshop of the National Reference Laboratories for Mollusc Diseases. La Tremblade (Francia)

Abollo, E.; Ramilo, A.; Carballal, M.J.; Iglesias, D.; Villalba, A. (2009, marzo 16-19) *Bonamia exitiosa parasitizing the flat oyster Ostrea edulis in Galicia (NW Spain)*

II Internacional Symposium in Marine Sciences. Vigo – Galicia (España)

Darriba, S.; Iglesias, D.; Rodríguez, L.M. (2009, abril 27-30) *Estudo histolóxico de seguimento da Arola (Dosinia exoleta) (Mollusca, Bivalvia) na Ría de Arousa: Resultados preliminares*

17th International Pectinid Workshop. Santiago de Compostela – Galicia (España)

Blanco, J.; Mauríz, A.; Acosta, C.P. (2009, abril 22-28) *Accumulation of ASP Toxins in the King Scallop Pecten maximus: Kinetics and Mechanisms*

Vidal, A.; Arévalo, F.; Blanco, J. (2009, abril 22-28) *Effects of baking on domoic acid concentration in King Scallops (Pecten maximus)*

7th International Conference on Molluscan Shellfish Safety. Nantes (Francia)

Álvarez, G.; Uribe, E.; Vidal, A.; Ávalos, P.; González, F.; Mariño, C.; Blanco, J. (2009, xuño 14-19) *Paralytic Shellfish Poisoning from the subtropical zone of the Southeastern Pacific Ocean: First report and toxin profiles*

Blanco, J.; Arévalo, F.; Correa, J.; Goicoechea, M.; Pérez, B.; Longa, A. (2009, xuño 14-19) *Comparison of mouse bioassay, HPLC-MS and a phosphatase inhibition test for quantifying DSP toxicity in mussels*

Vidal, A.; Correa, J.; Blanco, J. (2009, xuño 14-19) *The effect of some habitual cooking processes on the domoic acid concentration in the cockle (Cerastoderma edule) and Manila clam (Ruditapes philippinarum)*

Álvarez, G.; Uribe, E.; Ávalos, P.; Mariño, C.; Blanco, J. (2009, 19 xuño) *First identification of azaspiracids and spirolides in two shellfish species from Northern Chile*

XI Congresso Ibérico de Parasitoloxía. Lisboa (Portugal)

Montes, J. (2010, setembro 19) *Principales parasitoloxías en moluscos*

Conchas, R.F.; Montes, J.; González, G. (2010, setembro 19) *Control da bonamiose con técnicas de diagnóstico rápido.*

X Reunión Ibérica de Fitoplancto Tóxico e Biotoxinas. Lisboa (Portugal)

Blanco, J.; Arévalo, F.; Correa, J. (2009, maio 12-15) *Comparación da seguridade ofrecida polo control de ácido domoico no corpo enteiro da vieira e o control por órganos*

Rossignoli, A.E.; Blanco, J. (2009, maio 12-15) *Distribución subcelular do ácido okadaico na glándula dixestiva de Mytilus galloprovincialis: Primeiras evidencias de unión do ácido okadaico a unha lipoproteína*

14th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish". Praga (Chequia)

Díaz, S.; Renault, T.; Villalba, A.; Carballal, M.J. (2009, setembro 14-19) *Comparison of immune parameters between healthy and disseminated neoplasia affected-cockles*

Cao, A.; Fernández, S.; Hermida, M.; Casa, A.; Villalba, A. (2009, setembro 14-19) *Comparative analysis of in vitro cell proliferation rate among several isolates from three Perkinsus species (P. marinus, P. chesapeaki and P. olseni)*

Rodgers, C.; Roque, A.; Aranguren, R.; Carrasco, L.; Elandaloussi, A.; Figueras, C.; Navas, C.; Rodriguez, C.; Rodríguez, A.; Furones, D. (2009, setembro 14-19) *Definition of a list of shellfish diseases to aid health management in Spain*

Rodríguez, R.; Iglesias, D.; Ruíz, M.; López, C. (2009, setembro 14-19) *Digenean trematodes affecting razor clam Solen marginatus populations from Galicia (NW Spain) natural beds*

Ruiz, M.; Darriba, S.; Rodríguez, R.; Harshbarger, J.C.; López, C. (2009, setembro 14-19) *Presence of germinoma in razor clam Ensis siliqua (Linnaeus, 1758) in Galicia (NW Spain)*

5th International Symposium on Sandy Beaches. Rabat (Marruecos)

Lastra, M.; Mora, J.; Sánchez-Mata, A.; García-Gallego, M.A. (2009, outubro 19-23) *Patterns of macrofaunal community in intertidal sedimentary shores in South Shetland Islands, Antarctica*

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XIII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Acosta, C.P.; Cerviño-Eiroa, A. (2010, outubro 7-8) *Cultivo de volandeira Aequipecten opercularis: Comparación de sistemas*

Besada, M.; Búa, I.; Otero, M.; Guerra, A. (2010, outubro 7-8) *Reproducción de la navaja (Ensis arcuatus) en las Rías Bajas (Galicia, España)*

Cerviño-Otero, A.; da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez Patiño, D. (2010, outubro 7-8) *Influencia de la época del año y procedencia de los reproductores de almeja babosa Venerupis pullastra (Montagu, 1803) en la obtención de desoves y en el cultivo larvario*

Guerrero, S.; Cremades, J.; Ancosmede, C.; Muñíz, V.; Domínguez, J. (2010, outubro 7-8) *Aproximación a la utilización de anémonas y poliquetos como sedimentívoros dentro de un cultivo multitrófico integrado (AMTI)*

Guerrero, S.; Cremades, J; Ancosmede, C. (2010, outubro 7-8) *Preengorde en parque de cultivo de semilla de almeja fina y japonesa procedente de semillero multitrófico*

Guerrero S.; Cremades, J.; Ancosmede, C.; Andrade, M. (2010, outubro 7-8) *Test de resistencia al estrés por transporte de semilla de moluscos bivalvos procedente de criadero*

Louzán, A.; da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2010, outubro 7-8) *Efecto de dos tipos de dietas en el desarrollo larvario de la coquina Donax trunculus (Linné, 1758)*

Martínez-Patiño, D.; Cerviño-Otero, A.; Aranda, J.A.; Montes, J.; Ojea, J. (2010, outubro 7-8) *Primeros resultados del proyecto: Desarrollo del cultivo en criadero de la almeja rubia Venerupis rhomboides*

Sánchez-Mata, A.R.; Sánchez Mata A.G.; Varela Sóñora, M.T. (2010, outubro 7-8) *Evolución del proceso de detoxificación de Pecten maximus L. (1758) en viveros experimentales de la Ría de Vigo*

Sánchez-Mata, A.R.; Sánchez Mata A.G.; Varela Sóñora, M.T. (2010, outubro 7-8) *Seguimiento del estado reproductivo y crecimiento de Pecten maximus L. (1758) en el banco natural de Cangas, Ría de Vigo*

Encuentro sobre criaderos y semilleros. Santiago de Compostela – Galicia (España)

Cerviño, A. (2010) *Preengorde de semilla de almeja*

de Coo, A. (2010) *Importancia de los depredadores en los bivalvos comerciales. Sistemas de prevención y protección*

Guerra, A. (2010) *Proyecto demostración de criaderos y semilleros en recintos de alta productividad*

Guerrero-Valero, S. (2010) *Breve historia de los criaderos gallegos*

No Couto, E. (2010) *Minicriaderos: valoración e características de preengorde e sementeiras*

Aquaculture Europe 10 – the Annual Meeting of the European Aquaculture Society. Porto (Portugal)

Aranda Burgos, J.A.; da Costa, F.; Nóvoa, S.; Ojea, J.; Cerviño-Otero, A.; Louzán, A.; Fernández Pardo, A.; Martínez Patiño, D. (2010, outubro 5-8) *Embryonic and larval development of the grooved carpet sell (Ruditapes decussatus): A scanning electron microscopy study*

Carballal, M.J.; Díaz, S.; Iglesias, D.; Villalba, A. (2010, outubro 5-8) *Significance of disseminated neoplasia and infection by Bonamia exitiosa for oyster Ostrea edulis culture in Galicia (NW Spain)*

Cerviño, A.; Blanco, E.; Montes, J.; Prado, S.; López-Jimeno, G.C.; Barja, J. (2010, outubro 5-8) *Survival and growth of flat oyster (Ostrea edulis) spat in floating rafts using three culture systems*

da Costa, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2010, outubro 5-8) *Effects of diets on growth and biochemical composition of spat of the razor clam Ensis arcuatus (Jeffreys, 1865)*

da Costa, F.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2010, outubro 5-8) *The effect of microalgal diets on growth and biochemical composition of the razor clam Solen mar-ginatus spat*

Darriba, S.; Ramilo, A.; Abollo, E.; Villalba, A. (2010, outubro 5-8) *Detection of Perkinsus olseni infecting the cockle Cerastoderma edule in Galicia (NW Spain)*

Dubert, J.; Prado, S.; Blanco, E.; Montes, J.; Cerviño, A.; Barja, J.L. (2010, outubro 5-8) *Primary approach to study the microbiota associated to flat oyster (Ostrea edulis) cultures in a commercial hatchery*

Dubert, J.; Prado, S.; da Costa, F.; Fernández Pardo, A.; Balsa, S.; Montes, J.; Toranzo, A.E. (2010, outubro 5-8) *Vibrio associated to the gonad of razor clam (Solen marginatus) broodstock during the conditioning in hatchery*

Dubert, J.; Prado, S.; Louro, M.; Aranda, J.A.; Cerviño-Otero, A.; Ojea, J. ; Toranzo, A.E. (2010, outubro 5-8) *Infrequent profiles of Vibrio strains isolated from carpet-shell clam (Ruditapes decussatus) reared in hatchery*

Guerra, A.; Marcet, P.; Otero, M.; Fernández-González, S. (2010, outubro 5-8) *Use and treatments of organic matter of turbot hatcheries effluents in Galicia (NW Spain)*

Guerrero, S.; Cremades, J.; Ancosmede, C.; Salinas, J.M. (2010, outubro 5-8) *Spores and gametes of green seaweeds as food for bivalves in integrated multitrophic aquaculture systems*

Linares, F.; Olmedo, M.; Alvárez-Blázquez, B.; Pazos-Sieira, G.; Pérez-Rial, E.; Peleteiro, J.B. (2010, outubro 5-8) *Ongrowing of blackspot sea bream, Pagellus bogaraveo, in cages with feed of different biochemical composition*

Martin-Gómez, L.; Carballal, M.J.; Villalba, A.; Abollo, E. (2010, outubro 5-8) *Genes expressed in flat oyster (Ostrea edulis) affected by disseminated neoplasia*

Parada, J.M.; Molares, J. (2010, outubro 5-8) *A visual basic software for the estimation and management of stocks of bivalve molluscs in extensive cultivation*

Peleteiro, J.B.; Rodríguez-Villanueva, J.L.; Crespo, J.; Alvárez-Blázquez, B.; Mariño, C.; Linares, F.; Hernández-Urcera, J. (2010,outubro 5-8) *First experiences with wreckfish culture (Polyprion americanus) in Galicia. Behaviour and ongrowing*

Peleteiro, J.B.; Rodríguez-Villanueva, J.L.; Escorcio, C.; Alvárez-Blázquez, B.; Bacelar, M.; Linares, F.; Saavedra, M.J.; Cal, R.M.; Magadán, S.; Valente, L.M.P. (2010, outubro 5-8) *Is recirculation the system for Senegal sole (Solea senegalensis) culture?. Comparison of two culture systems using a control diet and a plant-based diet until market size*

Prado, S.; Dubert, J.; da Costa, F.; Martínez-Patiño, D.; Barja, J.L. (2010, outubro 5-8) *Bacteria associated to Solen marginatus mortalities in hatchery*

Prado, S.; Dubert, J.; Méndez, J.C.; Louzán, A.; Nóvoa, S.; Barja, J.L. (2010, outubro 5-8) *Comparison of the fermentative bacteria in different larval cultures of wedge shell clam (Donax trunculus) in hatchery*

Ramilo, A.; Villalba, A.; Ceschia, G.; Abollo, E. (2010, outubro 5-8) *Molecular identification of Perkinsus species (protozoa) infecting commercial bivalves in Mediterranean waters*

Rodríguez-González, L.M.; Gómez-Gesteira, J.L.; Iglesias-Estepa, D.; Montes-Pérez, J. (2010, outubro 5-8) *Is technically feasible the Pacific oyster Crassostrea gigas culture in a northern Galician estuary?*

Rodríguez, R.; Iglesias, D.; Ruíz, M.; López, C. (2010, outubro 5-8) *Histological survey of symbionts and other conditions in razor clam Solen marginatus (Pennánt, 1777) from three natural beds of the Rías Altas (N Galicia, NW Spain)*

Rodríguez J.L.; Linares, F.; Pazos, G.; Soto, N. (2010, outubro 5-8) *Larval culture of senegal sole, Solea senegalensis, in closed and open circuit*

Ruiz, M.; Darriba, S.; Iglesias, D.; Rodríguez, R.; López, C. (2010, outubro 5-8) *Viral basophilic inclusions in digestive gland of razor clam Ensis arcuatus (Jeffreys, 1865) (Pharidae) in Galicia (NW Spain)*

Sánchez, F.J.; Fuentes, L.; Otero, J.J.; Lago, M.J.; Linares, F.; Pazos, G.; Iglesias, J. (2010, outubro 5-8) *Effect of tank volume on the growth and survival of reared Octopus vulgaris paralarvae*

Valente, L.M.P.; Linares F.; Villanueva, J.L.R.; Escorcio, C.; Borges, B.P.; Alvárez-Blázquez. B.; Silva, J.M.G.; Espe, M.; Medale, F.; Cal, R.M.; Peleteiro, J.B. (2010, outubro 5-8) *Dietary protein source or energy levels have no major impact on growth performance or nutrient utilization of ongrowing senegalese sole*

Villalba, A.; Ramilo, A.; Abollo, E.; Fuentes, J. (2010, outubro 5-8) *Mass mortality of European flat oyster Ostrea edulis spat associated with a viral infection in Galicia (NW Spain).*

RAMIRAN 2010. Treatment and use of organic residues in agriculture: challenges and opportunities towards sustainable management. Lisboa (Portugal)

Marcet, P.; Guerra, A.; González, S.; Otero, M.; Eiroa, J. (2010, setembro 13-15) *Effects of fish manure vermicompost on a soil affected by wildfire*

Marcet, P.; Guerra, A.; González, S.; Otero, M.; Eiroa, J. (2010, setembro 13-15) *Composting and vermicomposting of settleable solid fish waste (manure) from commercial turbot farm*

III Foro Iberoamericano de los Recursos Marinos y la Acuicultura. Hermosillo (México)

Guerra, A.; Marcet, P.; Otero, M.; Fernández, J.; González, S. (2010, novembro 10-12) *Tratamiento de efluentes de granjas de rodaballo (Pesetta maxima) en Galicia (España)*

Lastres, M.A.; Andrés, C.; Santamaría, I.; Guerra, A. (2010, novembro 10-12) *Resultados de la aplicación de técnicas de cultivo de moluscos bivalvos en criaderos bajo el modelo de empresa tutelada*

102nd National Shellfisheries Association Annual Meeting. San Diego – California (Estados Unidos)

Díaz, S.; Cao, A.; Villalba, A.; Carballal, M.J. (2010, marzo 2-5) *Expression of p53 family proteins in cockles affected by disseminated neoplasia*

Fernández, S.; Cao, A.; Chicano, E.; Alhama, J.; Barea, J.L.; Villalba, A. (2010, marzo 2-5) *Comparison of protein expression among three Perkinsus spp., protozoan parasites of molluscs, throught 2D electrophoresis and mass spectrometry*

Villalba, A.; Pardo, G.B.; Cao, A.; Fernández, S.; Vilas, R.; Martínez, P. (2010, marzo 2-5) *Analysis of the genetic variability of Perkinsus olseni (Protozoan parasite of clams) through the Spanish coast using microsatellites*

27th ESCPB new. Biological effects of climatic changes and pollution: from biomarkers to system biology. Alessandría (Italia)

Ruiz, P.; Díaz, S.; Orbea, A.; Carballal, M.J.; Villalba, A.; Cajaraville, M. (2010, setembro 5-9) *Biomarkers and transcription level of cancer related genes in cockles Cerastoderma edule from Galicia (NW Spain) with disseminated neoplasia*

Aquaculture 2010, The Annual International Meeting of World Aquaculture Society. San Diego – California (Estados Unidos)

Díaz, S.; Cao, A.; Villalba, A.; Carballal, M.J. (2010, marzo 1-5) *Expression of p53 family proteins in cockles affected by disseminated neoplasia*

Fernández, S.; Cao, A.; Chicano, E.; Alhama, J.; Barea, J.L.; Villalba, A. (2010, marzo 1-5) *Comparision of protein expression among three Perkinsus spp., protozoan parasites of molluscs, through 2D electrophoresis and mass spectrometry*

Villalba, A.; Pardo, B.G.; Cao, A.; Fernández, S.; Vilas, R.; Martínez, P. (2010, marzo 1-5) *Analysis of the genetic variability of Perkinsus olseni (protozoan parasite of clams) through the Spanish coast using microsatellites*

7th International Conference on Innate Immunity. Rhodes (Grecia)

Martín-Gómez, L.; Villalba, A.; Abollo, E. (2010, xullo 4-9) *Identification of genes implicated in the immune response to bonamiosis of the flat oyster.*

14th International Conference on Harmful Algae. Hersonissos – Creta (Grecia)

Escudeiro-Rossignoli, A.; Fernández, D.; Pérez-Acosta, C.; Blanco, J. (2010, novembro 1-5) *Microencapsulation of okadaic acid as a tool for the study of the accumulation of DSP toxins in bivalves*

Moroño, A.; Arévalo, F.; Correa, J.; Sánchez, A. G.; Sánchez Mata, A.R. (2010, novembro 1-5) *Migration of domoic acid between tissues during freezing/thawing of scallops*

Riobó, P.; Franco, J.M.; Blanco, J.; Arévalo, F.; Correa, J.; Muñiz, S.; Cacho, E.; Ocaña, M.A.; Gordillo, M. (2010, novembro 1-5) *Comparison of the influence of different extraction procedures and analytical methods on the qualitative and quantitative results for PSP toxins determination*

2011

XIV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Acosta, C.P.; Cerviño-Eiroa, A. (2011, outubro 6-7) *Eficiencia de sistemas para o engorde de volandeira cultivada en batea*

Bicada, M.; Guerra, A. (2011, outubro 6-7) *Reprodución da navalla (Ensis arcuatus), con especial referencia á ría de Arousa (Pontevedra) e á xestión do recurso pesqueiro*

Fernández- Pardo, A.; Aranda-Burgos, J.A.; Cerviño, A.; Ojea, J.; Martínez-Patiño, D.; Nóvoa, S. (2011, outubro 6-7) *Efecto da adición de vitaminas na composición bioquímica do fitoplancto cultivado en sistema continuo*

Guerra A. (2011, outubro 6-7) *Razor clams: bilology, aquaculture and fisheries*

Guerreiro, S.; Cremades, J.; Ancosmede, C.; Domínguez, J.C.; Cores, A. (2011, outubro 6-7) *Poliquetos no efluente dunha piscifactoría de peixes planos*

Marcet P.; Guerra, A. (2011, outubro 6-7) *Efecto do vermicompost de lodo residual procedente de granxa de rodaballo sobre o desenvolvemento de Eucalyptus nitens*

IV FIRMA, Foro Iberoamericano dos Recursos Mariños e a Acuicultura. Braga (Portugal)

Díaz, S.; Villalba, A.; Carballal, M.J. (2011, outubro 27-29) *Presenza e efectos histopatolóxicos do copépodo Hermannella rostrata Canu 1891 en berberechos Cerastoderma edule (Linnaeus 1758) de Galicia (NW España)*

González, A.; García, L. (2011, outubro 27-29) *Ensaios de reprodución de Hippocampus reidi (Ginsburg, 1933)*

Guerra, A.; Lastres, M.; Rivas, M.C.; Ancosmede, C.; De Santiago, J.A. (2011, outubro 27-29) *Preengorde no medio natural de semente de ameixa babosa (Venerupis pullastra) e coquina (Donax trunculus) en sistemas de fluxo forzado investido e fluxo lineal*

Guerreiro, S.; Domínguez, J.C.; Cremades, J.; Ancosmede, C. (2011, outubro 27-29) *Crecemento de anémona no efluente dunha piscifactoría*

Montes, J.; Iglesias, D.; Guerra, A. (2011, outubro 27-29) *Viabilidade do cultivo de ostra plana Ostrea edulis en Galicia en zonas afectadas por bonamiose*

Congreso Aquaculture Europe 2011 the Annual Meeting of the European Aquaculture Society. Rhodes (Grecia)

da Costa, F.; Ojea, J.; Nóvoa, S.; Louzán, A.; Fernández-Pardo, A.; Aranda-Burgos, J.A.; Martínez-Patiño, D. (2011, outubro 18-21) *Effect of different systems for nursery culture of the razor clam Solen marginatus (Solenidae: Bivalvia)*

da Costa, F.; Cerviño-Otero, A.; Aranda-Burgos, J.A.; Louzán, A.; Martínez-Patiño, D. (2011, outubro 18-21) *Effects of substratum and stocking density on the performance of xuvenís of the razor clam Ensis siliqua on an intermediate cultivation system*

Linares C., F.; Peleteiro, J.B.; Olmedo, M.; Alvá-rez-Blázquez, B.; Pazos Sieira, G.; Pérez Rial, E.; Rodriguez, J.L.; Valente, L. (2011, outubro 18-21) *Sustainable diets for blackspot sexa bream*

Louzán, A.; da Costa, F.; Cerviño-Otero, A.; Fernández-Pardo, A.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2011, outubro 18-21) *Embryonic and larval development of the wedge shell clam Donax trunculus (Linné, 1758) with scanning electron microscopy*

Peleteiro, J.B.; Rodríguez-Villanueva, J.L.; Pérez-Rial, E.; Soares, E.C.; Mañanós, E.; Sarasquete, M.C.; Álvarez-Blázquez, B.; Mariño, C.; Linares, F. (2011, outubro 18-21) *Study on the reproductive behavior and sexual steroids levels in wreckfish (Polyprion americanus) in captivity during the gonadal maturation period*

Rodríguez-Villanueva, J.L.; Peleteiro, J.B.; Pérez-Rial, E.; Soares, E.C.; Álvarez-Blázquez, B.; Mariño, C.; Linares, F.; Mañanós, E. (2011, outubro 18-21) *Growth of wreckfish (Polyprion americanus) in Galicia, Spain*

Valente, L.M.P.; Linares, F.; Villanueva, J.L.R.; Escórcio, C.; Borges, P.; Alvárez-Blázquez, B.; Silva, J.M.G.; Espe, M.; Medale, F.; Cal, R.M.; Peleteiro, J.B. (2011, outubro 18-21) *Dietary protein source or energy levels have non major impact on growth performance or nutrient utilization of ongrowing Senegalese sole*

XIII Congreso Nacional de Acuicultura. Castelldefels – Catalunya (España)

Aranda-Burgos, J.A.; da Costa, F.; Cerviño-Otero, A.; Louzán, A.; Fernández-Pardo, A.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D. (2011, novembro 21-24) *Efecto de diferentes dietas en crecemento, supervivencia e composición bioquímica de larvas de ameixa fina, Ruditapes de-cussatus, (Linné, 1758)*

Carrasco, N.; Villalba, A.; Andree, K. B.; Lacuesta, B.; Ramilo, A.; Gairin, I.; Furones, M.D. (2011, novembro 21-24) *Primeira detección de parasitos do xénero Bonamia en Cataluña e o Mediterráneo español, en ostra plana, O. edulis, cultivada no Delta do Ebro.*

Cremades, J.; Ao-Amrousi, A.; Da Cruz Freitas Junior, J.; Salinas, J.M.; Guerreiro, S. (2011, novembro 21-24) *Cultivo en suspensión da macroalga Saccharina latissima (Laminariales, Phaeophyta) no efluente dunha piscifactoría*

da Costa, F.; Aranda-Burgos, J.A.; Cerviño-Otero, A.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2011, novembro 21-24) *Desenvolvemento embrionario de Ensis siliqua con microscopía electrónica de varrido e transmisión: estudo da formación da cuncha*

da Costa, F.; Fernández-Pardo, A.; Louzán, A.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2011, novembro 21-24) *Efecto do substrato e da densidade nun sistema de preengorde de Solen marginatus*

Dubert, J.; Blanco, E.; Cerviño, A.; Montes, J.; Barja, J.L.; Prado, S. (2011, novembro 21-24) *Bacterias oxidativas asociadas ao cultivo de Ostrea edulis en criadeiro*

Fernández-Pardo, A.; da Costa, F.; Martínez-Patiño, D.; Ojea, J.; Nóvoa, S. (2011, novembro 21-24) *Cultivo de fitoplancto en sistema continuo. Avaliación de distintos parámetros*

Louzán-Pérez, A.; Fernández-Pardo, A.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D. (2011, 2 novembro 21-24) *Efecto da temperatura no acondicionamento de coquina Donax trunculus (Linné, 1758) en criadeiro*

Martínez-Patiño, D.; Nóvoa, S.; Ojea, J.; Louzán, A.; Cerviño-Otero, A. (2011, novembro 21-24) *Variación estacional no Índice de Condición e composición bioquímica da ameixa loura, Venerupis rhomboides (Pennant, 1777), nunha poboación da costa galega.*

Villalba, A. (2011, novembro 21-24) *Implicación da Biotecnoloxía na selección de estirpes de ostra plana tolerantes á bonamiose*

XI Reunión Ibérica de Fitoplancto Tóxico e Biotoxinas. Bilbao - Euskadi (España)

Blanco, J. (2011, maio 30 – xuño 2) *Desenvolvemento actual da Acción Estratéxica de Investigación da Xunta de Galicia sobre Episodios Tóxicos de Orixe Fitoplanctónica EPITOX*

Lozano, V.; Martínez-Escauriaza, R.; Pérez-Parallé, M.L.; Regueiro, J.; Blanco, J.; Pazos, A.J.; Sánchez, J.L. (2011, maio 30 – xuño 2) *Expresión de dous xenes que codifican para proteínas MRP no mexillón (Mytilus galloprovincialis) durante un episodio tóxico debido a toxinas DSP*

Martín-Morais, E.; Regueiro, J.; Blanco, J. (2011, maio 30 – xuño 2) *Degradación enzimática de ácido domoico na glándula dixestiva de mexillón (Mytilus galloprovincialis)*

Martínez-Escauriaza, R.; Lozano, V.; Pérez-Parallé, M.L.; Blanco, J.; Regueiro, J.; Sánchez, J.L.; Pazos, A.J. (2011, maio 30 – xuño 2) *Participación de proteínas de tipo MDR en procesos de desintoxicación do mexillón (Mytilus galloprovincialis) fronte a toxinas DSP*

Riobó, P.; Franco, J.M.; Blanco, J.; Mariño, C.; Martín, H.; Arévalo, F.; Correa, J.; Muñiz, S.; Cacho, E.; Ocaña, M.A.; Gordillo, M. (2011, maio 30 – xuño 2) *Comparación da influencia de diferentes procedementos de extracción e limpeza de mostras na determinación de toxinas PSP*

Rossignoli, A.E.; Fernández, D.; Regueiro, J.; Martín, H.; Mariño, C.; Blanco, J. (2011, maio 30 – xuño 2) *Absorción do ácido okadaico polas células da glándula dixestiva do mexillón Mytilus galloprovincialis*

Vidal, A.; Suárez, P.; Rossignoli, A.E.; Ruiz, E.; Alonso, A.; García, Ou.; Blanco, J.; San Juan, F. (2011, maio 30 – xuño 2) *Indución da actividade de encimas relacionadas co metabolismo de xenobióticos por ácido okadaico na glándula dixestiva de Mytilus galloprovincialis*

Marine and Freshwater Toxins Analysis. Second Joint Symposium and AOAC Task Force Meeting. Baiona. (Francia)

Regueiro, J.; Rossignoli, A.E.; Álvarez, G.; Blanco, J. (2011, maio 1-5) *Automated on-line SPE coupled to liquid LC/ MS for determination of lipophilic marine toxins in shellfish*

XV EAFP International Conference 2011. Split (Croacia)

Darriba, S.; Ruiz, M.; López, C. (2011, setembro 12-16) *Phage particles infecting intracellular prokaryotic organisms in bivalve from Galicia (NW Spain)*

2012

XV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España) Pontevedra

de Coo-Martín, A.; García-Fernández, A. (2012, outubro 10-11) *Crecemento comparado de poboacións naturais de navalla (Ensis arcuatus, Jeffreys, 1865), longueirón (Ensis siliqua, Linnaeus, 1758) e longueirón vello (Solen marginatus, Pennánt, 1777) en Galicia*

de Coo-Martín, A.; García-Fernández, A. (2012, outubro 10-11) *Ciclo reprodutivo y talla de maduración de la primeira gónada en solénidos*

Guerrero, S.; Santos I. (2012, outubro 10-11) *Importancia de la temperatura en la supervivencia en laboratorio del poliqueto Diopatra neapolitana: resultados preliminares*

Martínez-Patiño, D. (2012, outubro 10-11) *Balance de las nuevas especies aportadas a la diverisficación de la acuicultura y el marisqueo*

García, A.; Solis, L.; Alcalde, A.; Otero, J.A.; Barreiro, B.; Simón, A.; Silva-Salvado, S.; García, O.; Espinosa, J.; de Coo, A.; Fariña J. (2012, outubro 10-11) *Crecemento comparado de poboacións naturais de navalla (Ensis arcuatus, Jeffreys, 1865), longueirón (Ensis siliqua, Linnaeus, 1758) e longueirón vello (Solen marginatus, Pennánt, 1777) en Galicia*

da Costa, F.; Ríos, B.; Ojea, J.; Nóvoa, S.; Aranda-Burgos, J.A.; Martínez-Patiño, D. (2012, outubro 10-11) *Efecto de la densidad en el preengorde en batea de la navaja Ensis arcuatus*

Louzán, A.; Nóvoa, S.; Ojea, J.; Nantón, A.; Méndez, J.; Martínez-Patiño, D. (2012, outubro 10-11) *Ensayo de diferentes estructuras de preengorde de coquina Donax trunculus (Linnaeus 1758) en el medio natural*

Nantón, A.; Freire, R.; Arias, A.; Nóvoa, S.; Louzán, A.; Martínez-Patiño D.; Méndez, J. (2012, outubro 10-11) *Identificación de la coquina Donax vittatus en las costas gallegas mediante el uso de marcadores moleculares*

Ojea, J.; Martínez-Patiño D.; Nóvoa, S.; Catoira, J.L. (2012, outubro 10-11) *Primeras experiencias del cultivo en criadero del erizo comestible europeo, Echinus esculentus (Linnaeus 1758)*

Catoira, J.L.; Ojea, J.; Martínez-Patiño D.; Nóvoa, S.; Rey-Méndez, M. (2012, outubro 10-11) *Primeras experiencias de mantenimiento y mejora gonadal en batea del erizo de mar común o erizo comestible europeo Echinus esculentus (Linnaeus 1758)*

Cerviño-Otero, A.; Martínez-Patiño, D.; Nóvoa, S.; Ojea, J.; Cerviño-Eiroa, A. (2012, outubro 10-11) *Primeras experiencias de preengorde de almeja rubia Venerupis rhomboides (Pennant 1777) en Galicia*

V FIRMA, Foro Iberoamericano de los Recursos Marinos y la Acuicultura. Cádiz – Andalucía (España)

Guerra, A. (2012, novembro 26-29) *El papel de los criaderos en el desarrollo de la acuicultura de moluscos*

Domíngues, P.; Sánchez, F.J.; Iglesias, J.; Otero, J.J.; Pazos, G.; Linares, F. (2012, novembro 26-29) *Variaciones en peso, lípidos y proteínas totales de paralarvas recién eclosionadas de Octopus vulgaris (Cuvier, 1797) durante la puesta*

III Jornadas Bienales de Jóvenes Investigadores en Proteómica. Santiago de Compostela - Galicia (España)

Fernández, S.; Villalba, A.; Cao A. (2012, febreiro 9-10) *Evaluación de la variabilidad de la expresión proteica en poblaciones de Perkinsus olseni, protozoo parásito de moluscos marinos, mediante electroforesis bidimensional y espectrometría de masas*.

104th National Shellfisheries Association Annual Meeting. Seattle - Washington (Estados Unidos)

Da Silva, P.M.; Vianna, R.T.; Sabry, R.C.; Magalhães, A.R.M.; Boehs, G.; Scardua, M.P.; Guertler, C.; Ferreira, L.P.; Brãndao, R.P.; Santana, L.N.; Villalba, A.; Fernández, S.; Ramilo, A.; Cao, A.; Reece, K.; Dungan, C.; Barracco, M.A. (2012, marzo 24-29) *Status of Perkinsus spp. in oysters Crassostrea rhizophorae and C. brasiliana from Brazil: First report of P. marinus*

Fernández, S.; Villalba, A.; Cao, A. (2012, marzo 24-29) *Evaluation of variability in Perkinsus olseni population using analysis of protein expression by 2D- PAGE and mass spectrometry.*

Martín-Gómez, L.; Villalba, A.; Carballal, M. J.; Abollo, E. (2012, marzo 24-29) *Relevant cancer related-genes in the flat oyster Ostrea edulis affected by disseminated neoplasia: identification and characterization*

Martín-Gómez, L.; Villalba, A.; Carballal, M. J.; Abollo, E. (2012, marzo 24-29) *Cloning, Characterization and analysis of the expresion of genes TNF, AIF, dermatopontin and VAMP associated with immune response in Ostrea edulis*

Ramilo, A.; González, M.; Carballal, M.J.; Darriba, S.; Abollo, E.; Villalba, A. (2012,marzo 24-29) *Spatial distribution of the oyster Ostrea edulis parasites Bonamia ostreae and Bonamia exitiosa in Galicia (NW Spain) and infection dynamics through oyster growing*

Ramilo, A.; Navas, J.I.; Villalba, A.; Abollo, E. (2012, marzo 24-29) *New PCR-based species specific procedures to diagnose Bonamia exitiosa and Bonamia ostreae, protozoan parasites of oysters*

Ramilo, A.; Pintado, J.; Darriba, S.; Ruiz, P.; Villalba, A.; Abollo, E. (2012, marzo 24-29) *Perkinsus spp. in clams Ruditapes decussatus, Ruditapes philippinarum, Venerupis senegalensis and Tapes rhomboides in Galicia (NW Spain). First detection of Perkinsus chesapeaki in Spain by DGGE*

Physiomar 12 International Meeting. Santiago de Compostela - Galicia (España)

Cao. A.; Fuentes, J. (2012, setembro 4-8) *Comparison of protein expression among different larval stages of the mussel Mytilus galloprovincialis*

Fernández, S.; Villalba, A.; Cao A. (2012, setembro 4-8) *Effects of infection with the protozoan parasite Perkinsus olseni on the protein expression of Manila clam Ruditapes philippinarum haemocytes and plasma*

Honrubia, R.; Castro, C.; Calvo, E.; Vera, M.; Álvarez-Dios, J.A.; Pardo, B.; Cao, A.; Villalba, A.; Martínez, P.; Sánchez, L. (2012, setembro 4-8) *Genomic characterization of microsatellite motifs in flat oyster (Ostrea edulis)*

Martín-Gómez, L.; Villalba, A.; Carballal, M.J.; Abollo, E. (2012, setembro 4-8) *Cloning, characterization and analysis of the expression of genes TNF, AIF, Dermatopontin and VAMP associated with immune response in Ostrea edulis*

Martín-Gómez, L.; Villalba, A.; Carballal, M.J.; Abollo, E. (2012, setembro 4-8) *Relevant cancer related-genes in the flat oyster Ostrea edulis affected by disseminated neoplasia: identification and characterization*

Ramilo, A.; Iglesias, D.; Darriba, S.; Abollo, E.; Villalba, A. (2012, setembro 4-8) *First detection of the parasite Mikrocytos mackini in Europe, infecting the Manila clam Ruditapes philippinarum.*

Congreso Europeo de Acuicultura. EAS 2012. Praga (República Checa)

Iglesias, J.; Pazos, G.; Fernández, J.; Sánchez, F.J.; Otero, J.J.; Domingues, P.; Lago, M.J.; Linares, F. (2012, setembro 1-5) *The use of crab zoeae on growth and biochemical composition of Octopus vulgaris paralarvae*

Linares, F.; Rodríguez, J.L.; Peleteiro, J.B.; Alvarez–Blázquez, B.; Pazos, G.; Otero, M.; Valente, L.M.P. (2012, setembro 1-5) *Ongrowing and lipid composition of Senegalese sole Solea senegalensis fed with commercial and plant-based diets*

5th Meeting of the Microcell Working Group. Central Veterinary Institute. Lelystad (Paises Bajos)

Carrasco, N.; Villalba, A.; Andree, K. B.; Engelsma, M.Y.; Lacuesta, B.; Ramilo, A.; Gairin, I.; Furones, M.D. (2012, febreiro) *Bonamia exitiosa (Haplosporidia) is infecting the European flat oyster Ostrea edulis cultured on the Spanish Mediterranean coast*

Ramilo, A.; Navas, J.I.; Villalba, A.; Abollo, E. (2012, febreiro) *New PCR-based species specific procedures to diagnose Bonamia exitiosa and Bonamia ostreae*

Ramilo, A.; González, M.; Carballal, M.J.; Darriba, S.; Abollo, E.; Villalba, A. (2012, febreiro) *Bonamia ostreae and Bonamia exitiosa coexist in Galician Bays: spatial distribution and temporal infection pattern through oyster on growing*

VI Jornadas de Acuicultura en el Litoral Suratlántico, Cartaya – Andalucía (España)

Villalba, A. (2012, 10 maio) *Estrategias de lucha frente a enfermedades de moluscos*

2013

First Internacional Conference Fish and Shellfish Immunology. Vigo – Galicia (España)

de la Ballina, N.R.; Ramilo, A.; Villalba, A.; Cao, A. (2013, xuño 25-28) *Proteomic approach to identify markers of resistence to bonamiosis in the proteins of the oyster Ostrea edulis haemolymph*

Martín-Gómez, L.; Villalba, A.; Carballal, M.J.; Abollo, E. (2013, xuño 25-28) *Molecular characterisation of TNF, AIF, dermatopontin and VAMP genes of the flat oyster Ostrea edulis and analysis of their modulation by diseases*

Pardo, B.G.; Millán, A.; Fernández, C.; Alvarez-Dios, J.A.; Gómez-Tato, A.; Cao, A.; Ramilo, A.; Carballal, M.J.; Villalba, A.; Martínez, A. (2013, xuño 25-28) *Identification of candidates genes involved in responses of Ostrea edulis to bonamiosis based on oligo-microarray analysis*

16th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish". Tampere (Finlandia)

Villalba, A. (2013, setembro 2-6) *Collapse of the cockle Cerastoderma edule fishery in Ría de Arousa (Galicia, NW Spain) due to marteiliosis*

Villalba, A. (2013, setembro 2-6) Evaluation of the impact of the infection with ostreid herpesvirus-1 (OsHV-1) *µvar in the on-growing of pacific oysters Crassostrea gigas in Galicia (NW Spain)*

Carballal, M.J.; Ramilo, A.; Abollo, E.; Villalba, A. (2013, setembro 2-6) *First detection of Minchinia sp. (Haplosporida) infecting cockles Cerastoderma edule from Galicia (NW Spain)*

Ramilo, A.; Villalba, A.; Carballal, M.J.; Iglesias, D.; Abollo, E. (2013, setembro 2-6) *Sequences of SSU rDNA, ITS AND IGS regions of Marteilia sp. (Cercozoa: Paramyxidae) infecting cockles Cerastoderma edule from Galicia (NW Spain), and a specific PCR assay for its diagnosis*

Villalba, A.; Iglesias, D.; Darriba, S.; Parada, J.M.; No, E.; Ramilo, A.; Abollo, E.; Carballal, M.J. (2013, setembro 2-6) *Collapse of the cockle Cerastoderma edule fishery in Ría de Arousa (Galicia, NW Spain) due to marteiliosis*

Villalba, A.; Ramilo, A.; Abollo, E. (2013, setembro 2-6) *Evaluation of the impact of the infection with ostreid herpesvirus-1 (OsHV-1) µvar in the on-growing of pacific oysters Crassostrea gigas in Galicia (NW Spain)*

Aquaculture 2013. Las Palmas - Islas Canarias (España)

Matias, A.M.; Díaz, S.; Sousa, J.; Villalba, A.; Carballal, M.J.; Leitão, A. (2013, novembro 3-7) *Variation of the karyotype of neoplastic cells associated to severity of disseminated Neoplasia in cockles Cerastoderma edule*

XVI Foro de Recursos Marinos e Acuicultura das Rías Galegas. O Grove - Galicia (España)

Fernández-Otero, R.; Villalba-García, A. (2013, outubro 10-11) *OYSTERECOVER: Abrindo o camiño para a recuperación da ostra plana en Europa*

Martínez-Patiño, D. (2013, outubro 10-11) *Incorporación de nuevas especies al cultivo industrial en criadero*

Aranda, J.A.; Cerviño-Otero, A.; da Costa, F.; Fernández-Pardo, A.; Louzán, A.; Nóvoa, -S.; Ojea, J.; Martínez, D. (2013, outubro 10-11) *Desarrollo embrionario y larvario de especies de moluscos bivalvos de interés comercial*

Guerrero, S.; Mariño, J.C.; Fernández, M.; Otero, X.; Santos, I. (2013, outubro 10-11) *Crecimiento y supervivencia de semilla de almeja babosa Venerupis pullastra (Montagu, 1803) colocada en bolsas en dos zonas submareales de la Ría de Arousa (Pontevedra, España)*

Nantón, A.; Freire, R.; Arias, A.; Nóvoa, S.; Louzán, A.; Martínez-Patiño, D.; Méndez, J. (2013, outubro 10-11) *Estudio preliminar de una región de control del genoma mitocondrial de la coquina Donax trunculus*

Ojea, J.; Martínez-Patiño, D.; Nóvoa, S.; Rodríguez, N.; Ferreiro, L.; Barceló, E.; Gómez, D.; García, M.; Catoira, J.L. (2013, outubro 10-11) *Proyecto de regeneración del erizo de mar, Paracentrotus lividus, en las Rías Altas. (Ribadeo, San Cosme, Burela, San Cibrao, Celeiro, O Vicedo y Espasante)*

Pérez-Acosta, C.; Guerrero, S.; Fernánde-Besada, M. (2013, outubro 10-11) *Efecto de la salinidad sobre la supervivencia de semilla de almeja*

Santos, I.; Toca, F.A.; Mariño, J.C.; Fernández, M.; Guerrero, S. (2013, outubro 10-11) *Supervivencia de la almeja japonesa Ruditapes philippinarum (Adams et Reeves, 1850) en tres tipos de sustrato: Fango, Conchilla de mejillón y Mixto al 50% en el banco intermareal del Sarrido, Cambados (Pontevedra)*

XIV Congreso Nacional de Acuicultura. Gijón – Asturias (España)

Castro, N.; Magariños, B.; Bandín, I.; Rodríguez, J.L.; Linares, F.; Toranzo, A.E. (2013, setembro 23-25) *Influencia de macroalgas en la resistencia del lenguado a enfermedades microbianas*

Fernández-Pardo, A.; Murado, M.; Rial, D.; Martínez-Patiño, D.; Nóvoa, S. (2013, setembro 23-25) *Optimización del cultivo larvario de Venerupis pullastra mediante una aproximación factorial de segundo orden*

Medina, A.; Fernández-Pardo, A.; Martínez, D.; Ojea, J.; Nóvoa, S. (2013, setembro 23-25) *Estudio de la Tasa de Aclaramiento y de Ingestión de tres especies de almeja: fina (Ruditapes decussatus), japónica (Ruditapes philippinarum) y rubia (Venerupis rhomboides)*

Medina, A.; Aranda, J.A.; Cerviño, A.; Nóvoa, S.; Ojea, J.; Martínez, D. (2013, setembro 23-25) *Evaluación de dos sistemas de preengorde de especies de almeja: fina (Ruditapes decussatus), japónica (Ruditapes philippinarum) y rubia (Venerupis rhomboides)*

Villalba, A.; Ramilo, A.; Abollo, E. (2013, setembro 23-25) *Impacto de la infección por virus herpes de ostreidos tipo 1 en el engorde de ostra rizada Crassostrea gigas en Galicia*

Fourth Joint Symposium and AOAC Task Force Meeting. Baiona – Galicia (España)

Martín Morales, E.; Mariño, C.; Arévalo, F.; Moroño, A.; Correa, J.; Blanco, J. (2013, maio 5-9) *A prospective study of cyclic imines in two Galician aquaculture areas*

Martín Morales, E.; Mariño, C.; Blanco Pérez, J. (2013, maio 5-9) *The origin of persistent low levels of 13-desmethyl SPX C in Galician waters: Stability in seawater and sediments*

2014

XVII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

de Coo, A. et al. (2014, outubro 9-10) *Estudo das especies exóticas nas augas costeiras e rías de Galiza: avaliación da súa distribución e abundancia, das súas repercusións ambientais e socioeconómicas, e medidas de prevención e protección*

Nantón, A.; Catoira, J.L.; Teijeiro, O.E.; Cerdeira, J.D.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D.; Méndez, J. (2014, outubro 9-10) *Análisis genético en coquina (D. trunculus) de dos localidades gallegas mediante marcadores microsatélite*

Guerrero-Valero, S. (2014, outubro 9-10) *Experiencia piloto para el cultivo conjunto de peces, moluscos, crustáceos y macroalgas en las rías gallegas*

106th National Shellfisheries Association Annual Meeting. Jacksonville – Florida (Estados Unidos)

Fernández-Boo, S.; Villalba, A.; Cao, A. (2014, marzo 29-abril 2) *Modulation of the protein expression of the haemocytes of the Manila clam Ruditapes philippinarum by infection with Perkinsus olseni*

International Meeting on Marine Research 2014, Peniche (Portugal)

Hasanuzzaman, A.F.; Sanchez, D.R.; Harrison, P.; Tato, A.G.; Alvarez Dios, J.A.; Fernández-Boo, S.; Cao, A.; Villalba, A.; Pardo, B.G.; Martínez, P. (2014, xullo 10-11) *De novo assembly of Manila clam (Ruditapes philippinarum) and protozoan parasite (Perkinsus olseni) transcriptome from RNA-Seq data*

Fernández-Boo, S.; Villalba, A.; Cao, A. (2014, xullo 10-11) *Changes of the plasma protein composition of the Manila clam Ruditapes philippinarum due to infection with Perkinsus olseni*

Aquaculture Europe 2014. San Sebastián – Euskadi (España)

Acosta, C.P.; Guerrero, S.; Linares, F.; Cerviño Eiroa, A.; Carballal, M.J.; Fernández Besada, M.; Rodríguez Villanueva, J.L.; Andrés, C.; Lastres, M.; Salinas, J.M.; Cremades, J. (2014, outubro 14-17) *Multitrophic action: A pilot experience to growing togetherfish, shellfish and edible seaweeds in Galician Rías (NW Spain)*

Linares, F.; Peleteiro, J.B.; Álvarez–Blázquez, B.; Pazos, G.; Valente, L.M.P.; Rodríguez, J.L. (2014, outubro 14-17) *Dietary inclusion of 10% seaweeds in Senegalese sole Solea senegalensis juveniles*

Rodríguez, J.L.; Peleteiro, J.B.; Linares, F. (2014, outubro 14-17) *Growth of the wreckfish Polyprion americanus in Galicia (Spain)*

Álvarez-Blázquez, B.; Seixas, P.; Cal, R.; Domingues, P.; Lluch, N.; Pazos, G.; Lago, M.J.; Gómez, C.; Linares, F. (2014, outubro 14-17) *Larvae quality of blackspot seabream (Pagellus bogaraveo) fed rotifers enriched with marine microalgae (t-iso) produced in two different systems: bags and photobioreactors (pbrs)*

ICES Annual Science Conference 2014. A Coruña – Galicia (España)

Martín-Morales, E.; Mariño, C.; Martín, H.; Blanco, J. A (2014, setembro 15-19) *Preliminary study of lipophilic toxins in Galician sediments*

Pino-Querido, A.; Álvarez-Castro, J.; Vera, M.; Pardo, B.G.; Toro, M.A.; Regueiro, J.; Fuentes, J.; Blanco, J.; Martínez, P. (2014, setembro 15-19) *Phenotypic and genetic correlations for several potentially interacting traits related to DSP toxin accumulation in the Mediterranean mussel (Mytilus galloprovincialis)*

Pino-Querido, A.; Álvarez-Castro, J.M.; Guerra-Varela, J.; Toro, M.A.; Vera, M.; Pardo, B.G.; Fuentes, J.; Blanco, J.; Martínez, P. (2014, setembro 15-19) *Heritability analysis for several potentially interacting traits in Mediterranean mussel (Mytilus galloprovincialis)*

Blanco, J. (2014, setembro 15-19) *Accumulation, biotransformation, ways of excretion and depuration kinetics of DSP toxins in bivalves*

Martín-Morales, E.; Mariño, C.; Martín, H.; Blanco, J. (2014, setembro 15-19) *Estability of okadaic acid, 13-desmethyl SPX and Gymnodimine in Galician coast waters*

Moroño, A.; Arévalo, F.; Correa, J.; Corina Porro, M.; Cabado, A.G.; Vieites, J.M.; Blanco, J. (2014, setembro 15-19) *Effect of industrial process for canning on okadaic acid toxins detection/quantification by different techniques*

Physiomar-14. La Serena (Chile)

R. de la Ballina, N.; Ramilo, A.; Villalba, A.; Cao, A. (2014, novembro 3-6) *Identification of oyster Ostrea edulis haemolymph proteins involved in the interaction with Bonamia spp. (Protistan parasites)*

VI Simposio Internacional de Sanidad e Inocuidad Acuícola. Ensenada (México)

Villalba, A. (2014, setembro 17-18) *Estatus de la perkinsosis en Europa y su impacto en la producción*.

2015

Fifth Joint Symposium and AOAC Task Force Meeting Marine & Freshwater Toxins Analysis. Baiona – Galicia (España)

Blanco, J.; Moroño, A.; Correa, J.; Corina Porro, M.; Cabado, A.G.; Vieites, J.M.; Arévalo, F. (2015, xuño 14-17) *Effect of canning on okadaic acid and DTX2 content and concentration in mussels*

Corina Porro, M.; Vieites, J.M.; Cabado, A.G.; Arévalo, F.; Moroño, A.; Correa, J.; Blanco, J. (2015, xuño 14-17) *Comparison of LC-MS/MS method and the colorimetric phosphatase inhibition assay for quantification of Okadaic Acid-toxins group*

International Symposium on Genetics in Aquaculture XII (ISGA XII). Santiago de Compostela – Galicia (España)

Ventoso, P.; Martínez-Escauriaza, R.; Sánchez, J.L.; Pérez-Parallé, M.L.; Blanco, J.; Triviño, J.C.; Pazos, A.J. (2015, xuño 21-27) *Sequencing and de novo assembly of the digestive gland transcriptome in Mytilus galloprovincialis and analysis of differentially expressed genes in response to domoic acid*

17th International Conference on Diseases of Fish and Shellfish. Las Palmas – Isla Canarias (España)

Iglesias, D.; Villalba, A.; No, E.; Darriba, S.; Mariño, C.; Fernández, J.; Carballal M.J. (2015, setembro 7-11) *Cockle Cerastoderma edule Marteiliosis first detected in Ria de Arousa (Galicia, NW Spain) has spread to other rias causing mass mortality*

XVII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Acosta, C.P.; Fernández Besada, M.; Andrés, C. Rodríguez Villanueva, J.L.; Cremades, J. (2015, outubro 8-9) *Experiencia piloto de cultivos multitróficos: análisis de la integración peces-moluscos mediante isótopos estables*

Fernández, J.; Bañón, R.; Filgueira, F.J.; Juncal, L.; Ribo, J.R.; Iglesias, R.A.; Otero, X.; Cerdeira, J.D.; Teijeiro, O.E.; Rodríguez, L.M.; Febrero, F.; Alcalde, A.; Solís, l.; Otero, J.; Barreiro, B.; Simón, A.; Conde, l.; Gómez, D.; Abella, E.; Poza, G.; Guimarey, S.; Pereira, S.; Mariño, C.; López, M.C.; Fernández, A.; Fariña, J.A.; Penas, E.; Briones, M.; Meléndez, M.I.; García, A.; de Coo, A. (2015, outubro 8-9) *Datos sobre as características poboacionais con distribución, avance e as posibles repercusións da especie exótica mariña Crepipatella dilatata (Lamarck, 1822) na banda sur da ría de Arousa*

Fernández-Pérez, J.; Nantón, A.; Rodríguez, L.; Febrero, F.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D.; Méndez, J. (2015, outubro 8-9) *Evaluación genética de la coquina Donax trunculus en tres localidades gallegas mediante el marcador mitocondrial 16S*

García, A.; Bañón, R.; Filgueira, F.J.; Juncal, L.; Ribó, J.R.; Fernández, J.; Iglesias, R.A.; Otero, X.; Cerdeira, J.D.; Teijeiro, O.E.; Rodríguez, L.M.; Febrero, F.; Alcalde, A.; Solís, l.; Otero, J.; Barreiro, B.; Simón, A.; Conde, l.; Gómez, D.; Abella, E.; Poza, G.; Guimarey, S.; Pereira, S.; Mariño, C.; Lopez, M.C.; Fernández, A.; Fariña, J.A.; Penas, E.; Briones, M.; Meléndez, M.I.; de Coo, A. (2015, outubro 8-9) *Últimos datos de Bolinus brandaris (Linnaeus, 1758) i Hexaples trunculus (Linnaeus, 1758) e a súas repercusións ambientais e produtivas en Galici*

Méndez, J.C.; Acuña, I.; Linares, F.; Rodríguez J.L. (2015, outubro 8-9) *Comparación del crecimiento entre individuos con potencial de crecimiento superior e individuos de una población de crecimiento normal de lenguado senegalés (Solea senegalensis) Kaup, 1858 en recirculación*

Otero, J.; Bañón, R.; Filgueira, F.J.; Juncal, L.; Ribo, J.R.; Iglesias, R.A.; Fernández, J.; Otero, X.; Cerdeira, J.D.; Teijeiro, O.E.; Rodríguez. L.M.; Febrero, F.; Alcalde, A.; Solís, l.; Barreiro, B.; Simón, A.; Conde, l.; Gómez, D.; Abella, E.; Poza, G.; Guimarey, S.; Pereira, S.; Mariño, C.; López, M.C.; Fernández, A.; Fariña, J.A.; Penas, E.; Briones, M.; Meléndez, M.I.; García, A.; de Coo, A. (2015, outubro 8-9) *A presencia e a suas posibles repercusións da especie exotica marina Rapana venosa (Valenciennes, 1846) na ría de Arousa*

Linares-Cuerpo F. (2015, outubro 8-9) *Presentación del proyecto de la UE: Diversificación y potencial de cultivo de especies emergentes en la acuicultura europea: caso de la cherna. DIVERSIFY*

No-Couto, E. (2015, outubro 8-9) *Os Lombos do Ulla. Factores humanos e naturais que inciden na explotación*

Martínez-Patiño, D. (2015, outubro 8-9) *Ensayos en criadero para encontrar las condiciones óptimas de supervivencia de la especie Donax trunculus*

Aquaculture Europe 2015. Rotterdam (Netherlands)

Álvarez-Blázquez, B.; Linares, F.; Cal, R.M.; Rodríguez, J.L.; Martínez, J.M.; Sánchez, M.; Lluch, N.; Pérez, E.; Domingues, P.; Peleteiro, J.B. (2015, outubro 20-23) *Biometric parameters of wild wreckfish (Polyprion americanus)*

Linares, F.; Rodríguez, J.L.; Peleteiro, J.B.; Cal, R.; Pazos, G.; Álvarez-Blázquez, B. (2015, outubro 20-23) *Biochemical composition of wild wreckfish (Polyprion americanus)*

Peleteiro, J.B.; Linares, F.; Vilar, A.; Fauvel, C,H.; Duncan, V.; Rodríguez, C.; Izquierdo, M.; Mylonas, C. (2015, outubro 20-23) *Diversify; results from the first year of wreckfish (Polyprion americanus) culture*

XV Congreso Nacional y I Congreso Ibérico de Acuicultura. Huelva – Andalucía (España)

Barja, J.L.; Montes, J.; Prado, S.; Olveira, J.G.; Dubert, J.; Rodríguez, L.; Febrero, F.; Martínez-Patiño, D. (2015, outubro 13-16) *Inestabilidad de los bancos de coquina (Donax sp.) en la costa de Galicia. Aspectos microbiológicos y parasitológicos*

Fernández-Pérez, J.; Nantón, A.; Piñeiro, S.; Prego-Faraldo, M.V.; Nóvoa, S.; Martínez-Patiño, D.; Méndez, J. (2015, outubro 13-16) *Estudio de la diversidad genética y diferenciación poblacional en la coquina Donax trunculus mediante el marcador mitocondrial 16S*

Ferré, J.; Nóvoa, S.; Ojea, J.; Suárez-Costa, I.; Martínez, D. (2015, outubro 13-16) *Estudio comparativo de cuatro medios nutritivos analizando la composición de ácidos grasos en Isochrysis galbana y Chaetoceros neogracile*

Ferré López, J.G.; Nóvoa Vázquez, S.; Martínez Patiño, D.; Ojea Martínez, J.; Suárez Costa, I. (2015, outubro 13-16) *Diferencias en la tasa de crecimiento de Isochrysis galbana, Diacronema lutheri y Chaetoceros neogracile al aplicar cuatro medios nutritivos en dos sistemas de cultivo*

Martínez, J.M.; Peleteiro, T.; Lluch, N.; Sánchez, M.; Linares, F.; Rodríguez, J.L.; Vilar, A.; Cal, R.; Álvarez-Blázquez, B. (2015, outubro 13-16) *Maduración sexual de tres stocks de cherna (Polyprion americanus) en Galicia*

Martínez-Patiño, D.; Ojea-Martínez, J.; González, R.; Cascallar, M.; Nóvoa-Vázquez, S. (2015, outubro 13-16) *Ensayos en criadero para encontrar las condiciones óptimas de supervivencia de la especie Donax trunculus*

Fuentes, J.M.; Gregorio, M.V.; Giráldez, R.; Villalba, A. (2015, outubro 13-16) *Acondicionamiento en criadero de dos especies del género Cerastoderma de Galicia*

Villalba, A.; Rodríguez, A.I.; Cao, A. (2015, outubro 13-16) *Luchando en Galicia contra la infección de la ostra rizada Crassostrea gigas por la microvariante del virus herpes de ostreidos tipo 1*

Villalba, A.; Iglesias, D.; Darriba, S.; Molares, J.; Parada, J.M.; No, E.; Ramilo, A.; Abollo, E.; Mariño, C.; Fernández, J.; Carballal, M.J. (2015, outubro 13-16) *La producción de berberecho de Galicia asolada por Marteilia cochillia*

Seminario proxecto RAIA. Porto (Portugal)

No Couto, E. (2015) *Apoyo a la gestión marisquera desde la oceanografía operacional*

1st Paramyxean working group meeting. Sant Carles de la Ràpita – Catalunya (España)

Villalba, A.; Iglesias, Darriba, S.; Parada, J.M.; No, E.; D.; Ramilo, A.;Abollo, E.; Mariño, C.; Fernández, J.; Carballal, M.J. (2015, 26 de febreiro) *Impact of the infection with Marteilia cochillia on the cockle Cerastoderma edule fishery in Galicia (NW Spain)*

Annual Meeting and Technical Workshop of the National Reference Laboratories for Mollusc Diseases. Saintes & La Tremblade (Francia)

Ramilo, A.; Iglesias, D.; Abollo, E.; González, M.; Darriba, S.; Villalba, A. (2015, 16 marzo) *Mikrocytos in Manila clams of Galicia (NW Spain): a past short story*

Cold Spring Harbor Labs Retrovirus Meeting 2015. New York (Estados Unidos)

Metzger, M.J.; Reinisch, C.; Sherry, J.; Carballal, M.J.; Iglesias, D.; Villalba, A.; Goff, S.P. (2015, 23 maio) *Amplification of LTR-Retrotransposons in Contagious Cancers of Bivalves*

International Symposium: Effects of the Long-Term Climatic Changes on Marine Environment and the Marine Invertebrate Animals. Jeju (Corea del Sur)

Villalba, A. (2014) *Review of perkinsosis in Spain*

17th International Conference of the European Association of Fish Pathologists "Diseases of Fish and Shellfish". Las Palmas de Gran Canaria – Islas Canarias (España)

Villalba, A. (2015, 11 setembro) *What's new in bivalve mollusc pathology? – Overview of articles published in the last two years*

2016

18th International Conference of the European Association of Fish Pathologists «Diseases of Fish and Shellfish». Belfast (Reino Unido)

Iglesias, D.; Villalba, A.; No E.; Darriba, S.; Cao, A.; Mariño, J. C.; Fernández, J.; Carballal, M. J. (2017, setembro 4-8) *Epidemiological patterns of marteiliose affecting the common cockle Cerastoderma edule in Galicia (NW Spain)*

108th Annual Meeting National Shellfisheries Association. Las Vegas (Estados Unidos)

Villalba, A.; Metzger, M.J.; Iglesias, D.; Carballal, M.J.; Goff, S.P. (2016, febreiro 22-26) *At least two contagious cancer cell lineages can transmit disseminated neoplasia in cockles Cerastoderma edule*

I International Symposium "Advances in Marine Mussel Research". Vigo – Galicia (España)

Villalba, A.; Iglesias, D.; Carballal, M.J. (2016, outubro 26-27) *Transmission of independent cancer lineages within bivalve molluscs in Galicia*

XIX Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Lastres, M.; Carragal, R.; González, P.; López, A.; Potel, I.; Figueira, I.; Cid, E.; Andrés, C.; Casais, E; da Costa, F.; Nóvoa, S.; Martínez-Patiño, D. (2016, outubro 6-7) *Comparativa de luz L.E.D. versus luz fluorescente en el cultivo de microalgas. Evaluación del coste energético por célula producida*

Nóvoa, S.; Ojea, J.; Martínez, D. (2016, outubro 6-7) *Protocolo de cultivo de la navaja Ensis magnus (Schumacher, 1817) en criadero*

Catoira, J.L.; Seoane, P.; Martínez, D.; Ojea, J.; Méndez, J.; No, E. (2016, outubro 6-7) *Caracterización de una población de coquina (Donax trunculus, L. 1758) en la playa de Bastiagueiro, A Coruña*

Seoane, P.; Catoira, J.L.; Martínez, D.; Ojea, J. (2016, outubro 6-7) *Ensayos de crecimiento de coquina (Donax trunculus Linnaeus, 1758) en sistemas de cultivo en el medio natural*

4th International Symposium on Genomics in Aquaculture. Atenas (Grecia)

Hasanuzzaman, A.F.Md.; Gómez-Tato, A.; Alvarez-Dios, J.A.; Rubiolo, J.A.; Robledo, D.; Cao, A.; Fernández-Boo, S.; Villalba, A.; Pardo, B.G.; Martínez, P. (2016, abril 20-22*) Gene Expression in Ruditapes philippinarum Haemocyte in Response to Natural Infection with Perkinsus olseni*

Aquaculture Europe 2016. Edinburgh – Reino Unido

Álvarez-Blázquez, B.; Vilar, A.; Papandroulakis, N.; Linares, F.; Cal, R.; Rodríguez, J.L.; Martínez, J.M.; Lluch, N.; Gómez, C.; Peleteiro, J.B. (2016, setembro 20-23) *First experiences of wreckfish (Polyprion americanus) larval husbandry in NW Atlantic and East Mediterranean*

Linares, F.; Rodríguez, J.L.; Peleteiro, J.B.; Cal, R.; Martínez, J.M.; Pazos, G.; Álvarez-Blázquez, B. (2016, setembro 20-23) *Influence of broodstock nutrition of wreckfish (Polyprion americanus) on the oocytes fatty acid composition*

Martínez-Vázquez, J.M.; Pérez-Rial, E.; Peleteiro, J.B.; Linares, F.; Rodríguez, J.L.; Vilar, A.; Cal, R.; Álvarez-Blázquez, B. (2016, setembro 20-23) *Description of the wreckfish (Polyprion americanus) reproductive cycle in captivity*

2017

18th International Conference of the European Association of Fish Pathologists «Diseases of Fish and Shellfish». Belfast (Reino Unido)

Iglesias, D.; Villalba, A.; No E.; Darriba, S.; Cao, A.; Mariño, J. C.; Fernández, J.; Carballal, M. J. (2017, setembro 4-8) *Epidemiological patterns of marteiliose affecting the common cockle Cerastoderma edule in Galicia (NW Spain)*

Villalba, A.; Cao, A. (2017, setembro 4-8) *Assessing procedures to reduce mortality of hatchery-produced Pacific oyster spat due to OsHV1-µvar during growing out in Galicia (NW Spain)*

Darriba, S.; Iglesias, D.; Villalba, A.; Carballal, M. J. (2017, setembro 4-8) *Infection with a haplosporidan-like protist detected in the main production area of Cerastoderma edule in Galicia (NW Spain)*

Lopez, C.; Darriba, S. (2017, setembro 4-8) *Survey of the Rickettsiales-like colonies associated with a mortality event in Tapes virgineus in Galicia (NW Spain)*

Evolution 2017. Portland - Oregon (Estados Unidos)

Metzger, M.; Villalba, A.; Carballal, M.; Iglesias, D.; Sherry, J.; Reinisch, C.; Muttray,.A.; Baldwin, S.; Goff, S. (2017, xuño 23-27) *Contagious Clam Cancer: Evolution at the intersection of cancer and infectious disease*

2nd International Symposium on Advances in Mussel Research. Sète (Francia)

Bernard, I.; Allain, G.; Charles, M.; Villalba, A.; Burioli, E.; Houssin, M.; Deydier, Y. (2017, setembro 7-8) *Investigation on blue mussel high mortality in France: a phenomenon with high spatio-temporal variability but no conclusive cause*

Jornada de presentación de la Red Gallega de Investigación y Transferencia en Acuicultura INMUNOGENOM. Santiago de Compostela – Galicia (España)

Villalba, A. (2017, 15 decembro) *Transmisión horizontal de cáncer en berberechos*

Villalba, A. (2017, 15 decembro) *Grupo de Patología de Moluscos del CIMA (GPM-CIMA).*

Aquaculture Europe 2017. Dubrovnik (Croacia)

Papadaki, M.; Peleteiro, J. B.; Álvarez-Blázquez, B.; Rodríguez, J. L.; Linares, F.; Vilar, A.; Pérez Rial, E.; Lluch, N.; Fakriadis, I.; Mylonas, C. (2017, outubro 17-20) *Description of the endocrine reproductive cycle of the wreckfish Polyprion americanus in captivity*

Álvarez-Blázquez, B.; Rodríguez, J. L.; Vilar, A.; Mylonas, C.; Papandroulakis, N.; Pérez Rial, E.; Lluch, N.; Pazos, G.; Linares, F. (2017, outubro 17-20) *Progress in the wreckfish intensive culture. New candidate species for aquaculture*

Martínez-Escauriaza, R.; Ventoso, P.; Sánchez, J. L.; Pérez-Parallé, M. L.; Blanco, J.; Triviño, J. C.; Pazos, A. J. (2017, outubro 17-20) *Differentially expressed genes in the digestive gland of Aequipecten opercularis (L.) in response to domoic acid accumulation*

Rodriguez, J. L.; Álvarez-Blázquez, B.; Pérez, E.; Martínez, J. M.; Méndez, J. C.; Acuña, I.; Linares, F. (2017, outubro 17-20) *Evaluation of wreckfish (Polyprion americanus) growth in Galicia (Spain)*

7th Congress of European Microbiologists (FEMS). València – València (España)

Rodríguez, S.; Balboa, S.; Oliveira, G.; Montes, J.; Moreno, D.; Barrajón, A.; Barja, J. (2017, xullo 9-13) *First report of mass mortalities in natural population of Pinna nobilis. A microbial perspective*

XVI Congreso Nacional de Acuicultura. Zaragoza - Aragón (España)

Carballall, M. J.; Iglesias, D. (2017, outubro 3-5) *Parásitos y enfermedades de Nassarius reticulatus y su rol como trasmisores de enfermedades a los bivalvos comerciales*

Costa, D. P.; Nóvoa, S.; Ojea, J.; Martínez, D. (2017, outubro 3-5) *Desarrollo larvario en criadero de almeja bicuda Polititapes aureus (Gmelin, 1791)*

Nóvoa, S.; Pérez-Parallé, M. L.; Ojea, J.; Sánchez, J. L.; Martínez, D. (2017, outubro 3-5) *Inducción de la fijación de larvas de almeja japonesa Ruditapes philippinarum (Adams & Reeve, 1850) utilizando diferentes compuestos neuroactivos*

Prado, S.; Nóvoa, S.; Martínez-Patiño, D.; Barja, J. L. (2017, outubro 3-5) *Interacción microalgas-bacterias en criadero de bivalvos: Supervivencia en el fitoplancton de vibrios patógenos de larvas*

21st International Pectinid Workshop. Portland, Maine (Estados Unidos)

Ventoso, P.; Martínez-Escauriaza, R.; Sánchez, J. L.; Pérez-Parallé, M. L.; Blanco, J.; Triviño, J. C.; Pazos, A. J. (2017, abril 19-25) *RNA-seq analysis of differential gene expression in response to domoic acid-producing Pseudo-nitzschia in the digestive gland of Aequipecten opercularis (L.)*

11th International Conference on Molluscan Shellfish Safety. Galway (Irlanda)

Blanco, J.; Martín, H.; Mariño, C. (2017, maio 14-18) *Evaluation of chromatographic columns for the analysis of PSP toxins after pre-column oxidation*

Álvarez, G.; Godoy, M.; Araya, M.; Ganuza, I.; Pino, R.; Rengel, J.; Uribe, E.; Blanco, J. (2017, maio 14-18) *Effects of Harmful Algal Bloom of Alexandrium catenella in the mass mortality of the surf clam Mesodesma donacium in Chiloé Island, Chile*

Álvarez, G.; Rengel, J.; Uribe, E.; Blanco, J. (2017, maio 14-18) *Anatomical distribution of cadmium in Argopecten purpuratus: effects of evisceration on industrial processes to reduce the metal concentration in scallops used for human consumption.*

XX Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Nóvoa, S.; Ojea, J.; Castilla, S.; Granjel, E.; Martínez, D. (2017, outubro 10-11) *Estado reproductivo de una población de coquina Donax trunculus (Linnaeus, 1758) de la playa de Vilarrube (Galicia)*

Catoira, J. L.; Seoane, P.; Martínez, D.; Ojea. J. (2017, outubro 10-11) *Relaciones biométricas y crecimiento de coquina (Bivalvia: Donacidae) en sistemas de cultivo en el medio natural*

2018

IMMR'18 | International Meeting on Marine Research. Peniche (Portugal)

de la Ballina, N. R.; Villalba, A.; Cao, A. (2018, xullo 5-6) *Shotgun analysis to look for differences in immune ability between granulocytes and hyalinocytes of the European flat oyster.*

VI International Symposium on Marine Sciences ISC. Vigo – Galicia (España)

de la Ballina, N. R.; Villalba, A.; Cao, A. (2018, xuño 20-22) *Differential proteomic profiles between granulocytes and hyalinocytes from Ostrea edulis.*

VI International Symposium on Marine Sciences. XIII Reunión Ibérica de Fitoplancton Tóxico. Vigo – Galicia (España)

Blanco, J. (2018, xuño 20-22) *Atypical okadaic acid derivatives in cockle*

Wreckfish workshop. Vigo – Galicia (España)

Linares, F. (2018, 20 xullo) *Wreckfish broodstock nutrition*

Mass Mortality event of the pen shell Pinna nobilis and emergency response

Grau, A.; Valencia, J.M.; Catanese, G, Villalba, A. (2018) *The agent of the mass mortality of the fan mussel in the Mediterranean Sea.*

18th International Conference on Harmful Algae. Nantes (Francia)

Blanco, J. (2018, outubro 21-26) *Prorocentrum lima, a new diarrhetic shellfish toxins producer in northern Chile.*

Blanco, J. (2018, outubro 21-26) *Depuration and anatomical distribution of domoic acid in the scallop Argopecten purpuratus.*

Blanco, J. (2018, outubro 21-26) *First detection of domoic acid produced by Pseudo-nitzschia multistriata in Peruvian waters.*

Blanco, J. (2018, outubro 21-26) *Association of Alexandrium ostenfeldii with spirolide accumulation in cultured mussels (Mytilus galloprovincialis) from northwest Mexico.*

Xornada COCKLES. Vigo - Galicia (España)

Villalba, A. (2018, 10 abril) *Ameazas máis destacadas que afectan aos bancos de berberecho con énfase nos seus patóxenos.*

Villalba, A. (2018, 10 abril) *The scientific approach of COCKLES to stakeholders issues.*

Business2Sea 2018: Desafios do Mar – 2030. Porto (Portugal)

Villalba, A.; Magalhães, L. (2018, novembro 15 -16) *Cockles project: Cooperation for restoring cockle shellfisheries and its ecosystem services in the Atlantic Area*

VII Jornades del Medi Ambient de les Illes Ballears. Illes Balears (España)

Grau, A.; Valencia, J.M.; Villalba, A.; López-Sanmartín, M.; Navas, J.I.; Catanese, G. (2018, novembro) *Comprenent l'etiologia de l'esdeveniment de mortalitat massiva de la nacra (Pinna nobilis) a la Mediterrània*

XXI Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Lastres, M.; Andrés, M.C.; Abilleira, S.; Cid, E.; Méndez, J.C.; Sánchez, J.J.; Rivadeneira, G.; Nóvoa. S.; Ojea, J.; Martínez-Patiño, D. (2018, outubro 10-11) *Comparación de sistemas suspendidos de flujo pasivo y flujo forzado para el preengorde de semilla de almeja babosa Venerupis corrugata (Gmelin, 1971), en la Ría de Arousa*

Martínez-Patiño, D.; Nóvoa. S.; Ojea, J.; Nombela, M.A.; Alejo, I.; Álvarez, M.J.; Álvarez, X.A.; Otero, J.; Teijeiro, O.; Cerdeira, J.D.; Liñán, I.M.; Brezmes, C.; Febrero, F.; Rodríguez, L.M. (2018, outubro 10-11) *Determinación de las causas de la disminución de los bancos de coquina (Donax sp.) en Galicia. Banco de Vilarrube*

Prado, S.; Castilla, S.; Martínez-Patiño, D.; Nóvoa. S.; Barja, J.L. (2018, outubro 10-11) *Interacciones fitoplancton-patógenos larvarios en criadero de bivalvos. Tetraselmis suecica-Vibrio*

2019

XXII Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Acosta, C. P.; García A.; Fernández-Besada, M.; de Coo, A. (2019, outubro 10-11) *Incidencia de la depredación de juveniles de cangrejo sobre las primeras fases del reclutamiento de moluscos*

Ojea, J.; Fontán, N.; Nóvoa, S.; Viñas, B.; Martínez, D. (2019, outubro 10-11) *Cultivo intensivo de almeja japonesa, Ruditapes philippinarum (Adams y Reeve, 1850) en las instalaciones del CIMA de Ribadeo*

Congreso europeo de Acuicultura (EAS 2019). Berlín (Alemania)

Rodríguez, J.L.; Araujo, A.; Fuentes, N.; Alvarez-Blázquez, B.; Pérez, E.; Vilar,A.; Linares F. (2019, outubro 7-10) *Experiments of wreckfish (Polyprion americanus) larval culture in Galicia (Spain)*

Pérez, M.; Martínez-Vázquez, J.M.; Alvarez-Blázquez, B.; Linares F.; Rodríguez, J.L.; Vilar, A. (2019, outubro 7-10) *Suitability of FoxL2 gene as sexual marker in wreckfish (Polyprion americanus) broodstocks*

Prado, S.; Ojea, J.; Nóvoa, S.; Martínez-Patiño, D.; Barja J.L. (2019, outubro 7-10) *Vibrio europaeus: Opportunistic pathogen for a wide range of bivalve species in hatchery. A case report*

Nantón, A.; Fernández-Pérez, J.; Manso, M.J.; Nóvoa, S.; Martínez-Patiño, D.; Méndeza, J. (2019, outubro 7-10) *Parentage assignment in the wedge clam Donax trunculus using microsatellites*

XVII Congreso Nacional de Acuicultura. Cartagena – Murcia (España)

Martínez-Vázquez, J.M.; Alvarez-Blázquez, B.; Linares F.; Rodríguez, J.L.; Vilar, A.; Pérez., M. (2019, maio 7-10) *Validación del gen Foxl2 como marcador sexual en la cherna (Polyprion americanus). Ventajas e inconvenientes*

Alvarez-Blázquez, B.; Peleteiro, J.B.; Rodríguez-Villanueva, J.L.; Vilar, A.; Pérez-Rial, E.; Mylonas, C.C.; Papadakis, I.; Papadaki, M.; Fakriadis, I.; Lluch, N.; Pazos. G.; Linares, F. (2019, maio 7-10) *El cultivo de la cherna (Polyprion americanus). Avances bajo el proyecto DIVERSIFY (Exploring the biological and socio-economic potential of new/ emerging candidate fish species for the expansion of the European aquaculture industry, KBBE.2013.1.2-09).*

Prado, S.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D.; Barja, J.L. (2019, maio 7-10) *Formación de biopelículas de vibrios patógenos en criaderos de bivalvos*

Prado, S.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D.; Barja, J.L. (2019, maio 7-10) *El fitoplancton como vía de entrada de patógenos a los cultivos larva rios de bivalvos en criadero: Caso práctico*

I Congreso da Xuventude Investigadora en Produción Primaria Sostible e Calidade e Seguridade Alimentaria - JIPAS 2019. Lugo – Galicia (España)

Lorenzo-Abalde S.; Cao A.; Carballal M.J.; Iglesias D.; Villalba A. (2019, novembro 28-29) *Characterisation of the haemocyte types of the cockle Cerastoderma edule and in sight on factors in fluencing their density*

52nd Annual Meeting of the Society for Invertebrate Pathology. València – València (España)

Ilze, S.; Bass D.; Villalba-García, A.; Carballal-Durán, M.; Cao-Hermida, A.; Iglesias-Estepa, D.; Macarie, A.; Shaw, P.; Feist, S.; Hooper, Ch.; Kerr, R.; Ironside, J. (2019, xullo 28 – agosto 1) *Discovery of Marteilia parasites in UK common cockle (Cerastoderma edule) fisheries and comparison with Marteilia cochillia*

19th International Conference on Diseases of Fish and Shellfish. Porto (Portugal)

Iglesias, D.; Villalba, A.; Cao, A.; Carballal M.J. (2019, setembro 8-12) *Is natural selection enhancing resistant against marteiliosis in cockles recruited in the inner side of the ría of Arousa?*

Prado-Álvarez, M.; Carlsson, J.; Cao, A.; Gestal, C.; Sarah, C.; Villalba, A.; Carlsson J. T.(2019, setembro 8-12) *Transcriptomic profile and targeted genotyping on OSHV-1 resistant and susceptible Crassostrea gigas*

de a Ballina, N.R.; Villalba, A.; Cao, A. (2019, setembro 8-12) *Proteomic comparison of Ostrea edulis granulocytes and hyalinocytes after in vitro stimulation with immune response inducers*

Carballal, M.J.; Iglesias, D.; Abollo, E.; Cao, A.; García, L.; Ramilo, A.; González, A.I.; González, A.; Pascual del Hierro, S.; Villalba, A. (2019, setembro 8-12) *Looking for hosts of Marteilia cochillia in the zooplankton*

Prado-Álvarez, M.; García-Fernández, P.; Cao, A.; Villalba, A.; Moran, P.; Gestal, C. (2019, setembro 8-12) *DNA methylation profiling on Crassostrea gigas families with different susceptibility to OsHV-1*

Annual Meeting and Technical Workshop of the National Reference Laboratories for Mollusc Diseases, and of the COCKLES project. Arcachon (Francia)

Villalba, A.; Iglesias, D.; Cao, A.; Carballal M.J. (2019, marzo 19-21) *Overview on the infection of cockles with Marteilia cochillia in Galicia (NW Spain)*

Villalba, A.; Iglesias, D.; Cao, A.; Carballal M.J. (2019, marzo 19-21) *Neoplasia in cockles*

2021

International Union for the Conservation of Nature (IUCN): Mass Mortality event of the pen shell Pinna nobilis and Emergency response.

Grau, A.; Catanese, G.; Villalba, A. (2021, 9 marzo) *Haplosporidium pinnae is the main pathogen involved in the mass mortality of the noble pen-shell Pinna nobilis*.

Congreso Europeo de Acuicultura (EAS 2020). Online

Sánchez, J.L.; Pazos, A.J.; Nóvoa, S.; Martínez-Patiño, D.; Ojea, J.; Pérez-Parallé, M.L. (2021, abril 12-15) *Effects of several neuroactive compounds on the induction of the metamorphosis process in the larvae of the manila clam, Ruditapes philippinarum (Adams and Reeve, 1850)*

Pérez-Parallé, M.L.; Sánchez, J.L.; Martínez-Patiño, D.; Nóvoa, S.; Ojea, J.; Pazos, A.J. (2021, abril 12-15) *Serotonin and acetylcholine induce metamorphosis in the larvae of the manila clam, Ruditapes philippinarum (Adams and Reeve, 1850)*

Pazos, A.J.; Pérez-Parallé, M.L.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D.; Sánchez, J.L. (2021, abril 12-15) *De novo transcriptome assembly and analysis of transcriptomic profiles during larval development of the manila clam, Ruditapes philippinarum (Adams and Reeve, 1850)*

XXIII Foro do Recursos Mariños e da Acuicutlura da Rías Galegas O Grove – Galicia (España)

Lastres, M.; Andrés, M.C.; Nóvoa, S.; Ojea, J.; Martínez-Patiño, D.; Barja, J.L.; Prado, S.; Montes, J.; Cid, E.; Marchena, M.; Buceta, H.; Catro, Y.; Dios, L.; González, M. (2021, outubro 7-8) *Evaluación del rendimiento comerical y de la capacidad productiva de una instalación tipo minicriadero dedicada a la produciónde almeja babosa (Venerupis corrugata Gmelin, 1791), almeja japonesa (Ruditapes phiplippinarum Adams & Reeve, 1850), almeja fina (Ruditapes decussatus Linnaeus, 1758) y ostra plana (Ostrea edulis Linnaeus, 1758)*

Simposio Ibérico de Modelado y Evaluación de Recursos Pesqueros. Vigo – Galicia (España)

Parada, J.M. (2021, outubro 19-22) *Data collection procedure for the inference of stocks of bivalve molluscs populations ins shellfish exploitation*

2022

XXIV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Gabín-Sánchez, C. (2022, outubro 6-7) *A viaxe desde o parque experimental de ostricultura (1965) ata o Centro de Investigacións Mariñas (2022)*

Nóvoa-Vázquez, S. (2022, outubro 6-7) *Centro de cultivos marinos de Ribadeo. Más de 40 años investigando la producción de moluscos bivalvos en criadero*

Villalba, A. (2022, outubro 6-7) *Conociendo y afrontando las enfermedades de los bivalvos marinos*

Blanco, J. (2022, outubro 6-7) *La investigación sobre la presencia y acumulación de toxinas en organismos marinos de las Rías Gallegas*

de Santiago-Meijide, J.A.; Gregorio, M.V.; Rodríguez, O.; Rodríguez, S.; Gabín-Sánchez, C. (2022, outubro 6-7) *Fijación de post-larvas de mejillón (Mytilus galloprovincialis Lamarck, 1819) en textiles vegetales biodegradables*

Parada-Encisa, J. M.; Fernández-Pérez, A.; Fernández-Besada, M.; Méndez-Pérez, B. (2022, outubro 6-7) *Contribución a la ecología trófica de Tritia neritea (Linnaeus, 1758) Gastropoda, Nassariidae en bancos marisqueros*

2023

20th International Conference on Harmful Algae. Hiroshima (Xapón)

Blanco Pérez, J. (2023, novembro 5-10) *Screening of lipophilic toxins in marine invertebrates from NW Iberian Peninsula (Spain). Are mussels good toxicity indicators?*

Blanco Pérez, J. (2023, novembro 5-10) *Screening of paralytic shellfish toxins in non-traditional vectors in NW Iberian Peninsula (Spain)*

XXV Foro dos Recursos Mariños e da Acuicultura das Rías Galegas. O Grove – Galicia (España)

Cerviño-Otero, A.; González-Fontela, A.; Ortega, M.; Iglesias, D.; Villalba, A.; Gabín-Sánchez, C.; Pérez, E. (2023, outubro 5-6) *Estudo preliminar para a execución dun proxecto de restauración de ostra plana na enseada de San Simón*

Parada-Encisa, J. M. (2023, outubro 5-6) *25 anos de apoio científico–técnico á xestión dos recursos marisqueiros en Galicia*

Nóvoa-Vázquez, S.; Ojea-Martínez, J.; Piñeiro-Martínez, A.; Villada-Pillado, A.; Sánchez, J. L.; Pazos, A. J.; Pérez-Parallé, M. L.; Llamazares, D. (2023, outubro 5-6) *Influencia do fotoperiodo e da temperatura no desenvolvemento gametoxénico de ameixa fina (Ruditapes decussatus, Linnaeus, 1758). Estudo preliminar en criadeiro*

Villada-Pillado, A ; Ojea-Martínez, J. ; Piñeiro-Martínez, A. ; Nóvoa-Vázquez, S. (2023, outubro 5-6) *Seguimento do preengorde de ameixa babosa (Venerupis corrugata, Gmelin, 1791) en batea con sistemas de fluxo forzado en dúas localizacións da mariña lucense*

Piñeiro-Martínez, A.; Nóvoa-Vázquez, S.; Ojea-Martínez, J.; Villada-Pillado, A (2023, outubro 5-6) *Estudos preliminares de marcaxe de semente de ameixa babosa (Venerupis corrugata, Gmelin, 1791) en condicións controladas durante a fase de preengorde na planta de cultivo*

Nóvoa-Vázquez, S.; Ojea-Martínez, J.; Piñeiro-Martínez, A.; Villada-Pillado, A; Lastres, M.; Cid, E.; Fernández, I.; Bermúdez, I.; Conde, B.; González, S.; Rogel, I.; Pazos, A. J.; Pérez-Parallé, M. L. (2023, (2023, outubro 5-6) *Papel de catecolaminas e neurotransmisores na indución da metamorfose na ameixa babosa (Venerupis corrugata, Gmelin, 1791)*

Ojea-Martínez, J.; Nóvoa-Vázquez, S.; Piñeiro-Martínez, A.; Villada-Pillado, A. Llamazares, D. (2023, outubro 5-6) *Seguimento dos cambios morfolóxicos dos sifóns de ameixa fina (Ruditapes decussatus, Linnaeus, 1758) e xaponesa (Ruditapes philippinarum, A. Adams & Reeve, 1850) ao longo do desenvolvemento larvario e postlarvario*

Quinteiro, J.; Cuíñas, P.; González, N.; Quinteiro, L.; Ojea, J.; Gabín-Sánchez, C.; González, M.; Traveso, A.; Prieto, D.; Portilla, G.; Seoane, P.; Vidal, C. M.; Senande, M.; Paisal, J. M.; Costas, A.; Barreiro, M. B.; Alfaya, J.; Santiago, J. A.; Outeiral, R.; Buján, M.; Asorey, B.; Fernández, D.; Rey-Méndez, M. (2023, outubro 5-6) *Diversidade xenética do ourizo de mar galego e a súa aplicación na conservación*

Parada, J. M.; Fernández, A.; Fernández, M.; Méndez, B. (2023, outubro 5-6) *Contribución a la ecología trófica de Tritia neritea (Linnaeus, 1758) Gastropoda, Nassariidae en bancos marisqueros.*

Native Oyster Restoration Alliance. 5th Conference 2023. Scaling-up European Oyster Reef Restoration. Middelburg (Países Baixos)

Cerviño-Otero, A.; González-Fontela, A.; Iglesias, D.; Villalba, A.; Ortega, M.; Gabín-Sánchez, C.; Pérez, E. (2023, novembro 6-8) *Pilot project for the restoration of native flat oyster beds in San Simón inlet (Galicia, NW Spain)*

Wokshop MyCOAST: Ferramentas para afrontar os riscos costeiros nos observatorios costeiros. Santiago de Compostela – Galicia (España)

Parada-Encisa, J. M. (2023, marzo 1) *Ferramentas para a acuicultura costeira*

2º Taller de pesquerías artesanales. Santander – Cantabria (España)

Parada Encisa, J. M. (2023, maio 11) *Grupo de recursos mariños. Centro de Investigacións Mariñas (Cima). Consellería do Mar. Principales tareas en seguimiento de bancos marisqueros*

Grupo de traballo: Situación dos recursos marisqueiros na costa: Golfo Ártabro-Ría de Ferrol. Ferrol – Galicia (España)

Parada-Encisa, J. M. (2023, xuño 12) *Evolución das poboacións de bivalvos de interese marisqueiro no banco marisqueiro das Pías (Ría de Ferrol). Posibles variables relacionadas*

Simposio de Técnicos de Marisqueo. Santiago de Compostela – Galicia (España)

Parada-Encisa, J. M.; Fernández - Pérez, A.; Méndez-Pérez, B.; Fernández-Besada, M.; Varela-Baños, P. (2023, xuño 22) *Efecto da presenza de biofilm e algas filamentosas sobre o comportamento trófico de Tritia neritea como carroñeira*

Parada-Encisa, J. M.; Monteagudo, A. B.; Rodríguez, I. (2023, 22 xuño) *Mellora da calidade do sedimento en zonas infralitorais mediante o emprego dun aparello de remoción hidráulica*

Parada-Encisa, J. M.; No-Couto, E.; de Santiago-Meijide, J. A. (2023, xuño 22) *Proposta de metodoloxía para o estudo da diversidade en substratos duros intermareais afectados pola explotación dos recursos marisqueiros. Estudo preliminar*

Parada-Encisa, J. M.; Méndez-Pérez, B.; Fernández-Besada, M.; Fernández-Pérez, A.; Rodríguez, I.; Monteagudo, A. B. (2023, xuño 22) *Emprego de vídeo remolcado para a avaliación de stock de fauna epibionte en substratos brandos*

Parada-Encisa, J. M.; Varela-Baños, P. (2023, xuño 22) *Análise da dinámica de crecemento do berberecho no banco marisqueiro dos Lombos do Ulla*

Aquaculture Europe 2023. Viena (Austria)

Nóvoa-Vázquez, S.; Piñeiro-Martínez, A.; Ojea-Martínez, J.; Villada-Pillado, A.; Barja, J. L.; Prado, S. (2023, setembro 18-21) *Marine bacteria from hatchery phytoplankton cultures: first approach to the population in the high temperature season*

Nóvoa-Vázquez, S.; Ojea-Martínez, J.; Martínez-Patiño, D.; Barja, J. L.; Prado, S. (2023, setembro 18-21) *Biofilm formation by pathogenic vibrios on hatchery surfaces*

Nóvoa-Vázquez, S.; Ojea-Martínez, J.; Villada-Pillado, A.; Piñeiro-Martínez, A. Lastres, M. A.; Cid, E.; Prado, S.; Barja, J. L. (2023, setembro 18-21) *Is climate change driving the re-emergence of the pathogen Vibrio ostreicida in seawater? Risk of its entry in aquaculture systems*

Nóvoa-Vázquez, S.; Ojea-Martínez, J.; Piñeiro-Martínez, A.; Villada-Pillado. A.; Prado, S.; Barja, J. L. (2023, setembro 18-21) *Microbiota associated to vibrio infections in bivalve hatchery: cooccurrence of antibiotic-producing bacteria (Pseudoalteromonas citreaaurantia and/or Phaeobacter inhibens-gallaeciensis)*

2024

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Fernández, B.; Brianes, M.J.; Vázquez, M.; Cabaleiro, S; Gabín, C. (2024, outubro 9-10) *Adaptación a la cautividad del salmonete de roca (Mullus surmuletus Linnaeus, 1758) aplicando técnicas de enriquecimiento ambiental*

Fernández, B.; Brianes, M.J. (2024, outubro 9-10) *Cultivo de peixes planos en tanques de moluscos aplicando técnicas de enriquecemento ambiental*

de Santiago-Meijide, J.A.; Cao Hermida, A.; Gregorio, M.V.; Rodríguez, O.; Brianes, M.J.; Rúa, P.; Bértolo, A.; Gabín-Sánchez C. (2024, outubro 9-10) *Diferencias anatómicas y fisiológicas de mejilla (Mytilus galloprovinciales Lammarck, 1819), encordadas en dos bateas de características hidrodinámicas opuestas*

Pérez-González, A.; García-Cardesí, E.; Abella, E.; Cremades J. (2024, outubro 9-10) *Reforzo de poboacións de Himanthalia elongata (Fucales, Ochrophyta) na Illa de Arousa (Pontevedra, Galicia)*

González-Vidal, N.; Fernández-Besada, M.; Méndez-Pérez, B.; Parada, J.J. (2024, outubro 9-10) *Efecto da presenza de Gracialaria vermiculophylla na distribución e comportamento de Carcinus maenas*

7th International Symposium in Aquaculture (GIA). Tessaloniki (Grecia)

Pampín, M.; Villalba, A.; Iglesias, D.; Ortega, M.; de Santiago, J.A.; Abella, E.; Cao, A.; Blanco, A.; Martínez, P. (2024, maio 22-24) *Genetic resiliencia in the common cockle (Cerastoderma edule): Contrasting natural selection and selective breeding for marteiliosis resistance*

Actividade científica

2. Artigos en publicacións

1990

Blanco, J. (1990) Cyst germination of two dinoflagellate species from Galicia (NW Spain). Scientia marina. 54 (3), 287-291.

1991

Azevedo, C. and Villalba, A. (1991) Extracellular giant rickettsiae associated with bacteria in the gill of *Crassostrea gigas* (Mollusca, Bivalvia). *Journal of Invertebrate Pathology* 58 (1), 75-81. http://dx.doi.org/10.1016/0022-2011(91)90164-L

Camacho, A. P., Gonzalez, R. and Fuentes, J. (1991) Mussel culture in Galicia (N.W. Spain). *Aquaculture* 94 (2-3), 263-278. http://dx.doi.org/10.1016/0044-8486(91)90122-N

Linares, F. and Henderson, R. J. (1991) Incorporation of ^{14}C-labelled polyunsaturated fatty acids by juvenile turbot, *Scophthalmus maximus* (L.) *in vivo*. *Journal of Fish Biology* 38 (3), 335-347. http://dx.doi.org/10.1111/j.1095-8649.1991.tb03124.x

Montes, J. (1991) Lag time for the infestation of flat oyster (*Ostrea edulis* L.) by *Bonamia ostreae* in estuaries of Galicia (N.W. Spain). *Aquaculture* 93 (3), 235-239. http://dx.doi.org/10.1016/0044-8486(91)90235-y

Montes, J., Villalba, A., López, M. C., Carballal, M. J. and Mourelle, S. G. (1991) Bonamiasis in native flat oysters (*Ostrea edulis* L.) from two intertidal beds of the Ortigueira estuary (Galicia, N.W. Spain) with different histories of oyster culture. *Aquaculture* 93 (3), 213-224. http://dx.doi.org/10.1016/0044-8486(91)90233-w

1992

Flynn, K. J., Garrido, J. L., Zapata, M., Öpik, H. and Hipkin, C. R. (1992) Changes in fatty acids, amino acids and carbon/nitrogen biomass during nitrogen starvation of ammonium- and nitrate-grown *Isochrysis galbana*. *Journal of Applied Phycology* 4 (2), 95-104. http://dx.doi.org/10.1007/BF02442457

Fuentes, J., Reyero, I., Zapata, C. and Alvarez, G. (1992) Influence of stock and culture site on growth rate and mortality of mussels (*Mytilus galloprovincialis* Lmk.) in Galicia, Spain. *Aquaculture* 105 (2), 131-142. http://dx.doi.org/10.1016/0044-8486(92)90125-5

Kraay, G. W., Zapata, M. and Veldhuis, M. J. W. (1992) Separation of chlorophylls c_1, c_2, and c_3 of marine phytoplankton by reversed-phase-C18-high-performance liquid chromatography. *Journal of Phycology* 28 (5), 708-712. http://dx.doi.org/10.1111/j.0022-3646.1992.00708.x

Montes, J., Carballal, M. J., Lopez, M. C. and Mourelle, S. G. (1992) Incidence of bonamiasis in flat oyster, *Ostrea edulis* L., cultured in Galicia (N.W. Spain). *Aquaculture* 107 (2-3), 189-192. http://dx.doi.org/10.1016/0044-8486(92)90066-T

Ruiz, C., Martinez, D., Mosquera, G., Abad, M. and Sanchez, J. L. (1992) Seasonal variations in condition, reproductive activity and biochemical composition of the flat oyster, *Ostrea edulis*, from San Cibran (Galicia, Spain). *Marine Biology* 112 (1), 67-74. http://dx.doi.org/10.1007/BF00349729

1993

Flynn, K. J., Zapata, M., Garrido, J. L., Öpik, H. and Hipkin, C. R. (1993) Changes in carbon and nitrogen physiology during ammonium and nitrate nutrition and nitrogen starvation in *Isochrysis galbana*. *European Journal of Phycology* 28 (1), 47-52. http://dx.doi.org/10.1080/09670269300650071

Garrido, J. L. and Zapata, M. (1993) High performance liquid chromatographic separation of polar and non-polar chlorophyll pigments from algae using a wide pore polymeric octadecylsilica column. *Hrc-Journal of High Resolution Chromatography* 16 (4), 229-233. http://dx.doi.org/10.1002/jhrc.1240160405

Garrido, J. L. and Zapata, M. (1993) High performance liquid chromatography of chlorophylls c_3, c_1, c_2 and a and of carotenoids of chromophyte algae on a polymeric octadecyl silica column. *Chromatographia* 35 (9-12), 543-547. http://dx.doi.org/10.1007/BF02267914

Saavedra, C., Zapata, C., Guerra, A. and Alvarez, G. (1993) Allozyme variation in European populations of the oyster *Ostrea edulis*. *Marine Biology* 115 (1), 85-95. http://dx.doi.org/10.1007/BF00349389

Villalba, A., Azevedo, C. and Rodriguez, C. (1993) Occurrence of Multiple Hyperplastic Growths on the Gills of Pacific Oyster, *Crassostrea gigas*, and Their Relationship with Associated Pathologic Conditions. *Journal of Invertebrate Pathology* 61 (3), 296-302. http://dx.doi.org/10.1006/jipa.1993.1054

Villalba, A., Mourelle, S. G., Carballal, M. J. and Lopez, M. C. (1993) Effects of infection by the protistan parasite *Marteilia relringens* on the reproduction of cultured mussels *Mytilus galloprovincialis* in Galicia (NW Spain). *Diseases of Aquatic Organisms* 17 (3), 205-213. http://dx.doi.org/10.3354/dao017205

Villalba, A., Mourelle, S. G., Lopez, M. C., Carballal, M. J. and Azevedo, C. (1993) Marteiliasis affecting cultured mussels *Mytilus galloprovincialis* of Galicia (NW Span). I. Etiology, phases of the infection, and temporal and spatial variability in prevalence. *Diseases of Aquatic Organisms* 16 (1), 61-72. http://dx.doi.org/10.3354/dao016061

1994

Flynn, K., Franco, J. M., Fernandez, P., Reguera, B., Zapata, M., Wood, G. and Flynn, K. J. (1994) Changes in toxin content, biomass and pigments of the dinoflagellate *Alexandrium minutum* during nitrogen refeeding and growth into nitrogen or phosphorus stress. *Marine Ecology-Progress Series* 111 (1-2), 99-109. http://dx.doi.org/10.3354/meps111099

Fuentes, J. and Molares, J. (1994) Settlement of the mussel *Mytilus galloprovincialis* on collectors suspended from rafts in the Ría de Arousa (NW of Spain): annual pattern and spatial variability. *Aquaculture* 122 (1), 55-62. http://dx.doi.org/10.1016/0044-8486(94)90333-6

Fuentes, J., Reyero, I., Zapata, C. and Alvarez, G. (1994) Production traits of the mussel *Mytilus galloprovincialis* cultured in Galicia (NW of Spain): relative effects of source of seed and growing environment. *Aquaculture* 122 (1), 19-31. http://dx.doi.org/10.1016/0044-8486(94)90330-1

López, C., Villalba, A. and Bachére, E. (1994) Absence of generation of active oxygen radicals coupled with phagocytosis by the hemocytes of the clam, *Ruditapes decussatus* (Mollusca: Bivalvia). *Journal of Invertebrate Pathology* 64 (3), 188-192. http://dx.doi.org/10.1016/s0022-2011(94)90125-2

Medina, I., Linares, F. and Garrido, J. L. (1994) Use of a packed programmed-temperature vaporizer injector in the solvent elimination mode for the determination of fatty acid methyl esters by gas chromatography. *Journal of Chromatography A* 659 (2), 472-476. http://dx.doi.org/10.1016/0021-9673(94)85089-5

Molares, J., Tilves, F. and Pascual, C. (1994) Larval development of the pedunculate barnacle *Pollicipes cornucopia* (Cirripedia: Scalpellomorpha) reared in the laboratory. *Marine Biology* 120 (2), 261-264. http://dx.doi.org/10.1007/bf00349686

Molares, J., Tilves, F., Quintana, R., Rodriguez, S. and Pascual, C. (1994) Gametogenesis of *Pollicipes cornucopia* (Cirripedia: Scalpellomorpha) in north-west Spain. *Marine Biology* 120 (4), 553-560. http://dx.doi.org/10.1007/bf00350075

Montes, J., Anadon, R. and Azevedo, C. (1994) A Possible Life Cycle for *Bonamia ostreae* on the Basis of Electron Microscopy Studies. *Journal of Invertebrate Pathology* 63 (1), 1-6. http://dx.doi.org/10.1006/jipa.1994.1001

1995

Abad, M., Ruiz, C., Martinez, D., Mosquera, G. and Sánchez, J. (1995) Seasonal variations of lipid classes and fatty acids in flat oyster, *Ostrea edulis*, from San Cibran (Galicia, Spain). *Comparative Biochemistry and Physiology C-Pharmacology Toxicology & Endocrinology* 110 (2), 109-118. http://dx.doi.org/10.1016/0742-8413(95)00006-A

Blanco, J. (1995) The distribution of dinoflagellate cysts along the Galician (NW Spain) coast. *Journal of Plankton Research* 17 (2), 283-302. http://dx.doi.org/10.1093/plankt/17.2.283

Blanco, J. (1995) Cyst production in four species of neritic dinoflagellates. *Journal of Plankton Research* 17 (1), 165-182. http://dx.doi.org/10.1093/plankt/17.1.165

Egeland, E. S., Eikrem, W., Throndsen, J., Wilhelm, C., Zapata, M. and LiaaenJensen, S. (1995) Carotenoids from further prasinophytes. *Biochemical Systematics and Ecology* 23 (7-8), 747-755. http://dx.doi.org/10.1016/0305-1978(95)00075-5

Fraga, S., Bravo, I., Delgado, M., Franco, J. M. and Zapata, M. (1995) Gyrodinium impudicum sp nov (Dinophyceae), a non toxic, chain-forming, red tide dinoflagellate. *Phycologia* 34 (6), 514-521. http://dx.doi.org/10.2216/i0031-8884-34-6-514.1

Fuentes, J., Villalba, A., Zapata, C. and Alvarez, G. (1995) Effects of stock and culture environment on infections by *Marteilia refringens* and *Mytilicola intestinalis* in the mussel *Mytilus galloprovincialis* cultured in Galicia (NW Spain). *Diseases of Aquatic Organisms* 21 (3), 221-226. http://dx.doi.org/10.3354/dao021221

Garrido, J. L., Zapata, M. and Muñiz, S. (1995) Spectral Characterization of New Chlorophyllcpigments Isolated From *emiliania Huxleyi* (Prymnesiophyceae) by High-Performance Liquid Chromatography1. *Journal of Phycology* 31 (5), 761-768. http://dx.doi.org/10.1111/j.0022-3646.1995.00761.x

Molares, J. and Fuentes, J. (1995) Recruitment of the mussel *Mytilus galloprovincialis* on collectors situated on the intertidal zone in the Ria de Arousa (NW Spain). *Aquaculture* 138 (1-4), 131-137. http://dx.doi.org/10.1016/0044-8486(95)01085-8

Shioi, Y., Watanabe, K., Takamiya, K. I., Garrido, J. L. and Zapata, M. (1995) Separation of mono- and divinyl chlorophyll species by high-performance liquid chromatography using an octadecyl polyvinyl alcohol polymer column. *Analytical Biochemistry* 231 (1), 225-229. http://dx.doi.org/10.1006/abio.1995.1524

Vanlenning, K., Garrido, J. L., Aristegui, J. and Zapata, M. (1995) Temperature-programmed high performance liquid chromatography separation of mono- and divinyl chlorophyll forms from marine phytoplankton. *Chromatographia* 41 (9-10), 539-543. http://dx.doi.org/10.1007/BF02688083

Villalba, A. (1995) Gametogenic cycle of cultured mussel, *Mytilus galloprovincialis*, in the bays of Galicia (N.W. Spain). *Aquaculture* 130 (2-3), 269-277. http://dx.doi.org/10.1016/0044-8486(94)00213-8

Villalba, A., Peters, E. C., Lopez, M. C. and Caraballal, M. J. (1995) Disseminated Sarcoma in the Clam *Ruditapes decussatus* in Galicia (NW Spain). *Journal of Invertebrate Pathology* 65 (1), 76-78. http://dx.doi.org/10.1006/jipa.1995.1012

1996

Arbones, B., Figueiras, F. G. and Zapata, M. (1996) Determination of phytoplankton absorption coefficient in natural seawater samples: Evidence of a unique equation to correct the pathlength amplification on glass fiber filters. *Marine Ecology Progress Series* 137 (1-3), 293-304. http://dx.doi.org/10.3354/meps137293

Blanco, J., Zapata, M. and Morono, A. (1996) Some aspects of the water flow through mussel rafts. *Scientia Marina* 60 (2-3), 275-282. http://hdl.handle.net/10261/25085

Garrido, J. L. and Zapata, M. (1996) Ion-pair reversed-phase high-performance liquid chromatography of algal chlorophylls. *Journal of Chromatography A* 738 (2), 285-289. http://dx.doi.org/10.1016/0021-9673(96)00106-9

Pazos, A. J., Roman, G., Acosta, C. P., Abad, M. and Sanchez, J. L. (1996) Stereological studies on the gametogenic cycle of the scallop, *Pecten maximus*, in suspended culture in Ria de Arousa (Galicia, NW Spain). *Aquaculture* 142 (1-2), 119-135. http://dx.doi.org/10.1016/0044-8486(95)01247-8

Pazos, A. J., Roman, G., Acosta, C. P., Abad, M. and Sanchez, J. L. (1996) Influence of the gametogenic cycle on the biochemical composition of the ovary of the great scallop. *Aquaculture International* 4 (3), 201-213. http://dx.doi.org/10.1007/bf00117382

Roman, G., Campos, M. J. and Acosta, C. P. (1996) Relationships among environment, spawning and settlement of Queen scallop in the Ria de Arosa (Galicia, NW Spain). *Aquaculture International* 4 (3), 225-236. http://dx.doi.org/10.1007/bf00117384

Saavedra, C. and Guerra, A. (1996) Allozyme heterozygosity, founder effect and fitness traits in a cultivated population of the European oyster, *Ostrea edulis*. *Aquaculture* 139 (3-4), 203-224. http://dx.doi.org/10.1016/0044-8486(95)01127-7

1997

Blanco, J., Morono, A., Franco, J. and Reyero, M. I. (1997) PSP detoxification kinetics in the mussel *Mytilus galloprovincialis*. One- and two-compartment models and the effect of some environmental variables. *Marine Ecology Progress Series* 158, 165-175. http://dx.doi.org/10.3354/meps158165

Carballal, M. J., Lopez, C., Azevedo, C. and Villalba, A. (1997) Enzymes involved in defense functions of hemocytes of mussel *Mytilus galloprovincialis*. *Journal of Invertebrate Pathology* 70 (2), 96-105. http://dx.doi.org/10.1006/jipa.1997.4670

Carballal, M. J., Lopez, C., Azevedo, C. and Villalba, A. (1997) *In vitro* study of phagocytic ability of *Mytilus galloprovincialis* Lmk haemocytes. *Fish & Shellfish Immunology* 7 (6), 403-416. http://dx.doi.org/10.1006/fsim.1997.0094

Carballal, M. J., Lopez, M. C., Azevedo, C. and Villalba, A. (1997) Hemolymph cell types of the mussel *Mytilus galloprovincialis*. *Diseases of Aquatic Organisms* 29 (2), 127-135. http://dx.doi.org/10.3354/dao029127

Garrido, J. L. and Zapata, M. (1997) Reversed-phase high-performance liquid chromatographic separation of mono- and divinyl chlorophyll forms using pyridine-containing mobile phases and a polymeric octadecylsilica column. *Chromatographia* 44 (1-2), 43-49. http://dx.doi.org/10.1007/bf02466514

Lopez, C., Carballal, M. J., Azevedo, C. and Villalba, A. (1997) Enzyme characterisation of the circulating haemocytes of the carpet shell clam, *Ruditapes decussatus* (Mollusca : bivalvia). *Fish & Shellfish Immunology* 7 (8), 595-608. http://dx.doi.org/10.1006/fsim.1997.0112

Lopez, C., Carballal, M. J., Azevedo, C. and Villalba, A. (1997) Differential phagocytic ability of the circulating haemocyte types of the carpet shell clam *Ruditapes decussatus* (Mollusca: Bivalvia). *Diseases of Aquatic Organisms* 30 (3), 209-215. http://dx.doi.org/10.3354/dao030209

Lopez, C., Carballal, M. J., Azevedo, C. and Villalba, A. (1997) Morphological characterization of the hemocytes of the clam, *Ruditapes decussatus* (Mollusca: Bivalvia). *Journal of Invertebrate Pathology* 69 (1), 51-57. http://dx.doi.org/10.1006/jipa.1996.4639

Pazos, A. J., Roman, G., Acosta, C. P., Abad, M. and Sanchez, J. L. (1997) Seasonal changes in condition and biochemical composition of the scallop *Pecten maximus* L from suspended culture in the Ria de Arousa (Galicia, NW Spain) in relation to environmental conditions. *Journal of Experimental Marine Biology and Ecology* 211 (2), 169-193. http://dx.doi.org/10.1016/s0022-0981(96)02724-4

Pazos, A. J., Roman, G., Acosta, C. P., Sanchez, J. L. and Abad, M. (1997) Lipid classes and fatty acid composition in the female gonad of *Pecten maximus* in relation to reproductive cycle and environmental variables. *Comparative Biochemistry and Physiology B-Biochemistry & Molecular Biology* 117 (3), 393-402. http://dx.doi.org/10.1016/s0305-0491(97)00135-1

Pérez Camacho, A., Villalba, A., Beiras, R. and Labarta, U. (1997) Absorption efficiency and condition of cultured mussels (*Mytilus edulis galloprovincialis* Linnaeus) of Galicia (NW Spain) infected by parasites *Marteilia refringens* Grizel et al. and *Mytilicola intestinalis* Steuer. *Journal of Shellfish Research* 16 (1), 77-82. http://hdl.handle.net/10261/312662

Villalba, A., Mourelle, S. G., Carballal, M. J. and Lopez, C. (1997) Symbionts and diseases of farmed mussels *Mytilus galloprovincialis* throughout the culture process in the Rias of Galicia (NW Spain). *Diseases of Aquatic Organisms* 31 (2), 127-139. http://dx.doi.org/10.3354/dao031127

Zapata, M. and Garrido, J. L. (1997) Occurrence of phytylated chlorophyll c in *Isochrysis galbana* and *Isochrysis* sp. (Clone T-ISO) (Prymnesiophyceae). *Journal of Phycology* 33 (2), 209-214. http://dx.doi.org/10.1111/j.0022-3646.1997.00209.x

1998

Carballal, M. J., Villalba, A. and Lopez, C. (1998) Seasonal variation and effects of age, food availability, size, gonadal development, and parasitism on the hemogram of *Mytilus galloprovincialis*. *Journal of Invertebrate Pathology* 72 (3), 304-312. http://dx.doi.org/10.1006/jipa.1998.4779

Estevez, A., McEvoy, L. A., Bell, J. G. and Sargent, J. R. (1998) Effects of temperature and starvation time on the pattern and rate of loss of essential fatty acids in *Artemia* nauplii previously enriched using arachidonic acid and eicosapentaenoic acid-rich emulsions. *Aquaculture* 165 (3-4), 295-311. http://dx.doi.org/10.1016/s0044-8486(98)00260-9

Fuentes, J., Molares, J. and Villalba, A. (1998) Growth, mortality and parasitization of mussels cultivated in the Ria de Arousa (NW Spain) from two sources of seed: intertidal rocky shore vs. collector ropes. *Aquaculture* 162 (3-4), 231-240. http://dx.doi.org/10.1016/s0044-8486(98)00214-2

Garrido, J. L. and Zapata, M. (1998) Detection of new pigments from *Emiliania huxleyi* (Prymnesiophyceae) by high-performance liquid chromatography, liquid chromatography-mass spectrometry, visible spectroscopy, and fast atom bombardment mass spectrometry. *Journal of Phycology* 34 (1), 70-78. http://dx.doi.org/10.1046/j.1529-8817.1998.340070.x

Rodriguez, F., Zapata, M. and Garrido, J. L. (1998) High performance liquid chromatographic separation of chlorophyll c forms from marine phytoplankton on octylsilica bonded phases. *Chromatographia* 48 (9-10), 677-680. http://dx.doi.org/10.1007/bf02467598

Rodriguez-Moscoso, E. and Arnaiz, R. (1998) Gametogenesis and energy storage in a population of the grooved carpet-shell clam, *Tapes decussatus* (Linne, 1787), in northwest Spain. *Aquaculture* 162 (1-2), 125-139. http://dx.doi.org/10.1016/S0044-8486(98)00170-7

1999

Azevedo, C., Montes, J. and Corral, L. (1999) A revised description of *Haplosporidium armoricanum*, parasite of *Ostrea edulis* L. from Galicia, northwestern Spain, with special reference to the spore-wall filaments. *Parasitology Research* 85 (12), 977-983. http://dx.doi.org/10.1007/s004360050669

Barcia, R., Cao, A., Arbeteta, J. and Ramos-Martinez, J. I. (1999) The IL-2 Receptor in Hemocytes of the Sea Mussel *Mytilus galloprovincialis* Lmk. *IUBMB Life* 48 (4), 419-423. http://dx.doi.org/10.1080/713803540

Blanco, J., Fernandez, M. L., Miguez, A. and Morono, A. (1999) Okadaic acid depuration in the mussel *Mytilus galloprovincialis*: one- and two-compartment models and the effect of environmental conditions. *Marine Ecology Progress Series* 176, 153-163. http://dx.doi.org/10.3354/meps176153

Jeffrey, S. W., Wright, S. W. and Zapata, M. (1999) Recent advances in HPLC pigment analysis of phytoplankton. *Marine and Freshwater Research* 50 (8), 879-896. http://dx.doi.org/10.1071/mf99109

Roman, G., Campos, M. J., Acosta, C. P. and Cano, J. (1999) Growth of the queen scallop (*Aequipecten opercularis*) in suspended culture: influence of density and depth. *Aquaculture* 178 (1-2), 43-62. http://dx.doi.org/10.1016/S0044-8486(99)00105-2

Villalba, A., Carballal, M. J., Lopez, C., Cabada, A., Corral, L. and Azevedo, C. (1999) Branchial rickettsia-like infection associated with clam *Venerupis rhomboides* mortality. *Diseases of Aquatic Organisms* 36 (1), 53-60. http://dx.doi.org/10.3354/dao036053

2000

Egeland, E. S., Garrido, J. L., Zapata, M., Maestro, M. A. and Liaaen-Jensen, S. (2000) Algal carotenoids. Part 64. Structure and chemistry of 4-keto-19 '-hexanoyloxyfucoxanthin with a novel carotenoid end group. *Journal of the Chemical Society-Perkin Transactions 1* 1 (8), 1223-1230. http://dx.doi.org/10.1039/a910345g

Fuentes, J., Gregorio, V., Giraldez, R. and Molares, J. (2000) Within-raft variability of the growth rate of mussels, *Mytilus galloprovincialis*, cultivated in the Ria de Arousa (NW Spain). *Aquaculture* 189 (1-2), 39-52. http://dx.doi.org/10.1016/s0044-8486(00)00357-4

Garrido, J. L., Otero, J., Maestro, M. A. and Zapata, M. (2000) The main nonpolar chlorophyll c from *Emiliania huxleyi* (Prymnesiophyceae) is a chlorophyll c(2)-monogalactosyldiacylglyceride ester: a mass spectrometry study. *Journal of Phycology* 36 (3), 497-505. http://dx.doi.org/10.1046/j.1529-8817.2000.99135.x

Rodriguez, F., Fernandez, E., Head, R. N., Harbour, D. S., Bratbak, G., Heldal, M. and Harris, R. P. (2000) Temporal variability of viruses, bacteria, phytoplankton and zooplankton in the western English Channel off Plymouth. *Journal of the Marine Biological Association of the United Kingdom* 80 (4), 575-586. http://dx.doi.org/10.1017/S0025315400002393

Zapata, M., Rodriguez, F. and Garrido, J. L. (2000) Separation of chlorophylls and carotenoids from marine phytoplankton: a new HPLC method using a reversed phase C-8 column and pyridine-containing mobile phases. *Marine Ecology Progress Series* 195, 29-45. http://dx.doi.org/10.3354/meps195029

Ziuganov, V., San Miguel, E., Neves, R. J., Longa, A., Fernandez, C., Amaro, R., Beletsky, V., Popkovitch, E., Kaliuzhin, S. and Johnson, T. (2000) Life span variation of the freshwater pearl shell: A model species for testing longevity mechanisms in animals. *Ambio* 29 (2), 102-105. http://dx.doi.org/10.1579/0044-7447-29.2.102

2001

Carballal, M. J., Iglesias, D., Santamarina, J., Ferro-Soto, B. and Villalba, A. (2001) Parasites and pathologic conditions of the cockle *Cerastoderma edule* populations of the coast of Galicia (NW Spain). *Journal of Invertebrate Pathology* 78 (2), 87-97. http://dx.doi.org/10.1006/jipa.2001.5049

Latasa, M., van Lenning, K., Garrido, J. L., Scharek, R., Estrada, M., Rodriguez, F. and Zapata, M. (2001) Losses of chlorophylls and carotenoids in aqueous acetone and methanol extracts prepared for RPHPLC analysis of pigments. *Chromatographia* 53 (7-8), 385-391. http://dx.doi.org/10.1007/bf02491072

Lopez, J. L., Mosquera, E., Fuentes, J., Marina, A., Vazquez, J. and Alvarez, G. (2001) Two-dimensional gel electrophoresis of *Mytilus galloprovincialis*: differences in protein expression between intertidal and cultured mussels. *Marine Ecology Progress Series* 224, 149-156. http://dx.doi.org/10.3354/meps224149

Morono, A., Franco, J., Miranda, M., Reyero, M. I. and Blanco, J. (2001) The effect of mussel size, temperature, seston volume, food quality and volume-specific toxin concentration on the uptake rate of PSP toxins by mussels (*Mytilus galloprovincialis* Lmk). *Journal of Experimental Marine Biology and Ecology* 257 (1), 117-132. http://dx.doi.org/10.1016/s0022-0981(00)00336-1

Rajan, P. R., Lopez, C., Lin, J. H. Y. and Yang, H. L. (2001) Vibrio alginolyticus infection in cobia (*Rachycentron canadum*) cultured in Taiwan. *Bulletin of the European Association of Fish Pathologists* 21 (6), 228-234. https://eafp.org/download/2001-Volume21/Issue%206/21_228.pdf

Villalba, A., Carballal, M. J. and Lopez, C. (2001) Disseminated neoplasia and large foci indicating heavy haemocytic infiltration in cockles *Cerastoderma edule* from Galicia (NW Spain). *Diseases of Aquatic Organisms* 46 (3), 213-216. http://dx.doi.org/10.3354/dao046213

Zapata, M., Edvardsen, B., Rodriguez, F., Maestro, M., A. and Garrido, J., L. (2001) Chlorophyll c2 monogalactosyldiacylglyceride ester (chl c2-MGDG). A novel marker pigment for *Chrysochromulina* species (Haptophyta). *Marine Ecology Progress Series* 219, 85-98. http://dx.doi.org/10.3354/meps219085

2002

Anadón, R., Alvarez-Marqués, F., Fernández, E., Varela, M., Zapata, M., Gasol, J. M. and Vaqué, D. (2002) Vertical biogenic particle flux during Austral summer in the Antarctic Peninsula area. *Deep Sea Research Part II: Topical Studies in Oceanography* 49 (4-5), 883-901. http://dx.doi.org/10.1016/s0967-0645(01)00129-1

Blanco, J., Acosta, C. P., de la Puente, M. B. and Salgado, C. (2002) Depuration and anatomical distribution of the amnesic shellfish poisoning (ASP) toxin domoic acid in the king scallop *Pecten maximus*. *Aquatic Toxicology* 60 (1-2), 111-121. http://dx.doi.org/10.1016/s0166-445x(01)00274-0

Blanco, J., de la Puente, M. B., Arevalo, F., Salgado, C. and Morono, A. (2002) Depuration of mussels (*Mytilus galloprovincialis*) contaminated with domoic acid. *Aquatic Living Resources* 15 (1), 53-60. http://dx.doi.org/10.1016/s0990-7440(01)01139-1

Casas, S. M., La Peyre, J. F., Reece, K. S., Azevedo, C. and Villalba, A. (2002) Continuous *in vitro* culture of the carpet shell clam *Tapes decussatus* protozoan parasite *Perkinsus atlanticus*. *Diseases of Aquatic Organisms* 52 (3), 217-231. http://dx.doi.org/10.3354/dao052217

Casas, S. M., Villalba, A. and Reece, K. S. (2002) Study of perkinsosis in the carpet shell clam *Tapes decussatus* in Galicia (NW Spain). I. Identification of the aetiological agent and *in vitro* modulation of zoosporulation by temperature and salinity. *Diseases of Aquatic Organisms* 50 (1), 51-65. http://dx.doi.org/10.3354/dao050051

Fuentes, J., Lopez, J. L., Mosquera, E., Vazquez, J., Villalba, A. and Alvarez, G. (2002) Growth, mortality, pathological conditions and protein expression of *Mytilus edulis* and *M. galloprovincialis* crosses cultured in the Ria de Arousa (NW of Spain). *Aquaculture* 213 (1-4), 233-251. http://dx.doi.org/10.1016/s0044-8486(02)00046-7

Lodeiros, C., Pico, D., Prieto, A., Narvaez, N. and Guerra, A. (2002) Growth and survival of the pearl oyster *Pinctada imbricata* (Roding 1758) in supended and bottom culture in the Golfo de Cariaco, Venezuela. *Aquaculture International* 10 (4), 327-338. http://dx.doi.org/10.1023/a:1022451608405

Lopez, C., Rajan, P. R., Lin, J. H. Y., Kuo, T. Y. and Yang, H. L. (2002) Disease outbreak in seafarmed Cobia (*Rachycentron canadum*) associated with *Vibrio* Spp., *Photobacterium damselae* ssp. *piscicida*, monogenean and myxosporean parasites. *Bulletin of the European Association of Fish Pathologists* 22 (3), 206-211. https://eafp.org/download/2002-Volume22/Issue%203/22_206.pdf

Novoa, S., Martinez, D., Ojea, J., Soudant, P., Samain, J. F., Moal, J. and Rodriguez, J. L. (2002) Ingestion, digestion, and assimilation of gelatin-acacia microcapsules incorporating deuterium-labeled arachidonic acid by larvae of the clam *Venerupis pullastra*. *Journal of Shellfish Research* 21 (2), 649-658.

Rodriguez, F., Varela, M. and Zapata, M. (2002) Phytoplankton assemblages in the Gerlache and Bransfield Straits (Antarctic Peninsula) determined by light microscopy and CHEMTAX analysis of HPLC pigment data. *Deep-Sea Research Part Ii-Topical Studies in Oceanography* 49 (4-5), 723-747. http://dx.doi.org/10.1016/s0967-0645(01)00121-7

Roman, G., Campos, N. J., Cano, J., Acosta, C. P., Iglesias, P. and Garcia, O. (2002) Reproductive and reserve storage cycles in *Aequipecten opercularis* (L., 1758) in Galicia, NW Spain. *Journal of Shellfish Research* 21 (2), 577-584

2003

Abalde, S. L., Fuentes, J. and Gonzalez-Fernandez, A. (2003) Identification of *Mytilus galloprovincialis* larvae from the Galician rias by mouse monoclonal antibodies. *Aquaculture* 219 (1-4), 545-559. http://dx.doi.org/10.1016/s0044-8486(02)00658-0

Azevedo, C., Conchas, R. F. and Montes, J. (2003) Description of *Haplosporidium edule* n. sp (Phylum *Haplosporidia*), a parasite of *Cerastoderma edule* (Mollusca, Bivalvia) with complex spore ornamentation. *European Journal of Protistology* 39 (2), 161-167. http://dx.doi.org/10.1078/0932-4739-00905

Blanco, J., Reyero, I. and Franco, J. (2003) Kinetics of accumulation and transformation of paralytic shellfish toxins in the blue mussel *Mytilus galloprovincialis*. *Toxicon* 42 (7), 777-784. http://dx.doi.org/10.1016/j.toxicon.2003.10.007

Carballal, M. J., Villalba, A., Iglesias, D. and Hine, P. M. (2003) Virus-like particles associated with large foci of heavy hemocytic infiltration in cockles *Cerastoderma edule* from Galicia (NW Spain). *Journal of Invertebrate Pathology* 84 (3), 234-237. http://dx.doi.org/10.1016/j.jip.2003.11.002

Conchas, R. F., Santamarina, J., Lama, A., Longa, M. A. and Montes, J. (2003) Evolution of Bonamiosis in Galicia (NW Spain). *Bulletin of the European Association of Fish Pathologists* 23 (6), 265-272.

Garrido, J. L., Rodriguez, F., Campana, E. and Zapata, M. (2003) Rapid separation of chlorophylls *a* and *b* and their demetallated and dephytylated derivatives using a monolithic silica C_{18} column and a pyridine-containing mobile phase. *Journal of Chromatography A* 994 (1-2), 85-92. http://dx.doi.org/10.1016/s0021-9673(03)00486-2

Molares, J. and Freire, J. (2003) Development and perspectives for community-based management of the goose barnacle (*Pollicipes pollicipes*) fisheries in Galicia (NW Spain). *Fisheries Research* 65 (1-3), 485-492. http://dx.doi.org/10.1016/j.fishres.2003.09.034

Montes, J., Ferro-Soto, B., Conchas, R. F. and Guerra, A. (2003) Determining culture strategies in populations of the European flat oyster, *Ostrea edulis*, affected by bonamiosis. *Aquaculture* 220 (1-4), 175-182. http://dx.doi.org/10.1016/s0044-8486(02)00628-2

Morono, A., Arevalo, F., Fernandez, M. L., Maneiro, J., Pazos, Y., Salgado, C. and Blanco, J. (2003) Accumulation and transformation of DSP toxins in mussels *Mytilus galloprovincialis* during a toxic episode caused by *Dinophysis acuminata*. *Aquatic Toxicology* 62 (4), 269-280. http://dx.doi.org/10.1016/s0166-445x(02)00105-4

Rodriguez, F., Pazos, Y., Maneiro, J. and Zapata, M. (2003) Temporal variation in phytoplankton assemblages and pigment composition at a fixed station of the Ria of Pontevedra (NW Spain). *Estuarine Coastal and Shelf Science* 58 (3), 499-515. http://dx.doi.org/10.1016/s0272-7714(03)00130-6

Rodriguez, F., Varela, M., Fernandez, E. and Zapata, M. (2003) Phytoplankton and pigment distributions in an anticyclonic slope water oceanic eddy (SWODDY) in the southern Bay of Biscay. *Marine Biology* 143 (5), 995-1011. http://dx.doi.org/10.1007/s00227-003-1129-1

2004

Berthe, F. C. J., Figueras, A., Soudant, P. and Villalba, A. (2004) Perkinsosis in Europe: Current issues and research needs. *Bulletin of the European Association of Fish Pathologists* 24 (1), 52-53. https://eafp.org/download/2004-Volume24/Issue%201/24_052.pdf

Casas, S. M., Grau, A., Reece, K. S., Apakupaku, K., Azevedo, C. and Villalba, A. (2004) *Perkinsus mediterraneus* n. sp., a protistan parasite of the European flat oyster *Ostrea edulis* from the Balearic Islands, Mediterranean Sea. *Diseases of Aquatic Organisms* 58 (2-3), 231-244. http://dx.doi.org/10.3354/dao058231

da Silva, P. M. and Villalba, A. (2004) Comparison of light microscopic techniques for the diagnosis of the infection of the European flat oyster *Ostrea edulis* by the protozoan *Bonamia ostreae*. *Journal of Invertebrate Pathology* 85 (2), 97-104. http://dx.doi.org/10.1016/j.jip.2003.12.010

Darriba, S., San Juan, F. and Guerra, A. (2004) Reproductive cycle of the razor clam *Ensis arcuatus* (Jeffreys, 1865) in northwest Spain and its relation to environmental conditions. *Journal of Experimental Marine Biology and Ecology* 311 (1), 101-115. http://dx.doi.org/10.1016/j.jembe.2004.05.004

Fernandez, E., Alvarez, F., Anadon, R., Barquero, S., Bode, A., Garcia, A., Garcia-Soto, C., Gil, J., Gonzalez, N., Iriarte, A., Mourino, B., Rodriguez, F., Sanchez, R., Teira, E., Torres, S., Valdes, L., Varela, M., Varela, R. and Zapata, M. (2004) The spatial distribution of plankton communities in a Slope Water anticyclonic Oceanic eDDY (SWODDY) in the southern Bay of Biscay. *Journal of the Marine Biological Association of the United Kingdom* 84 (3), 501-517. http://dx.doi.org/10.1017/S0025315404009518h

Novas, A., Cao, A., Barcia, R. and Ramos-Martinez, J. I. (2004) Nitric oxide release by hemocytes of the mussel *Mytilus galloprovincialis* Lmk was provoked by interleukin-2 but not by lipopolysaccharide. *The International Journal of Biochemistry & Cell Biology* 36 (3), 390-394. http://dx.doi.org/10.1016/s1357-2725(03)00212-7

Ojea, J., Pazos, A. J., Martinez, D., Novoa, S., Sanchez, J. L. and Abad, M. (2004) Seasonal variation in weight and biochemical composition of the tissues of *Ruditapes decussatus* in relation to the gametogenic cycle. *Aquaculture* 238 (1-4), 451-468. http://dx.doi.org/10.1016/j.aquaculture.2004.05.022

Saavedra, Y., Gonzalez, A., Fernandez, P. and Blanco, J. (2004) Interspecific variation of metal concentrations in three bivalve mollusks from Galicia. *Archives of Environmental Contamination and Toxicology* 47 (3), 341-351. http://dx.doi.org/10.1007/s00244-004-3021-5

Saavedra, Y., Gonzalez, A., Fernandez, P. and Blanco, J. (2004) The effect of size on trace metal levels in raft cultivated mussels (*Mytilus galloprovincialis*). *Science of the Total Environment* 318 (1-3), 115-124. http://dx.doi.org/10.1016/s0048-9697(03)00402-9

Saavedra, Y., Gonzalez, A., Fernandez, P. and Blanco, J. (2004) A simple optimized microwave digestion method for multielement monitoring in mussel samples. *Spectrochimica Acta Part B-Atomic Spectroscopy* 59 (4), 533-541. http://dx.doi.org/10.1016/j.sab.2003.12.024

Villalba, A., Reece, K. S., Ordas, M. C., Casas, S. M. and Figueras, A. (2004) Perkinsosis in molluscs: A review. *Aquatic Living Resources* 17 (4), 411-432. http://dx.doi.org/10.1051/alr:2004050

Zapata, M., Jeffrey, S. W., Wright, S. W., Rodriguez, F., Garrido, J. L. and Clementson, L. (2004) Photosynthetic pigments in 37 species (65 strains) of Haptophyta: implications for oceanography and chemotaxonomy. *Marine Ecology Progress Series* 270, 83-102. http://dx.doi.org/10.3354/meps270083

2005

Abollo, E., Novoa, B. and Figueras, A. (2005) SSU rDNA analysis of *Kudoa rosenbuschi* (Myxosporea) from the Argentinean hake *Merluccius hubbsi*. *Diseases of Aquatic Organisms* 64 (2), 135-139. http://dx.doi.org/10.3354/dao064135

Abollo, E. and Pascual, S. (2005) Renal coccidiosis in the European cormorant *Phalacrocorax aristotelis aristotelis* from the Galician coast. *Journal of the Marine Biological Association of the United Kingdom* 85 (4), 1017-1019. http://dx.doi.org/10.1017/s0025315405012075

Carballal, M. J., Diaz, S. and Villalba, A. (2005) *Urosporidium* sp hyperparasite of the turbellarian *Paravortex cardii* in the cockle *Cerastoderma edule*. *Journal of Invertebrate Pathology* 90 (2), 104-107. http://dx.doi.org/10.1016/j.jip.2005.08.003

da Silva, P., Fuentes, J. and Villalba, A. (2005) Growth, mortality and disease susceptibility of oyster *Ostrea edulis* families obtained from brood stocks of different geographical origins, through on-growing in the Ria de Arousa (Galicia, NW Spain). *Marine Biology* 147 (4), 965-977. http://dx.doi.org/10.1007/s00227-005-1627-4

da Silva, P. M., Soudant, P., Carballal, M. J., Lambert, C. and Villalba, A. (2005) Flow cytometric DNA content analysis of neoplastic cells in haemolymph of the cockle *Cerastoderma edule*. *Diseases of Aquatic Organisms* 67 (1-2), 133-139. http://dx.doi.org/10.3354/dao067133

Darriba, S., Juan, F. S. and Guerra, A. (2005) Energy storage and utilization in relation to the reproductive cycle in the razor clam *Ensis arcuatus* (Jeffreys, 1865). *Ices Journal of Marine Science* 62 (5), 886-896. http://dx.doi.org/10.1016/j.icesjms.2005.02.010

Darriba, S., San Juan, F. and Guerra, A. (2005) Gametogenic cycle of *Ensis siliqua* (Linnaeus, 1758) in Ria de Corcubion, northwestern Spain. *Journal of Molluscan Studies* 71, 47-51. http://dx.doi.org/10.1093/mollus/eyi006

Kroeck, M. A. and Montes, J. (2005) Occurrence of the haemocyte parasite *Bonamia* sp in flat oysters *Ostrea puelchana* farmed in San Antonio Bay (Argentina). *Diseases of Aquatic Organisms* 63 (2-3), 231-235. http://dx.doi.org/10.3354/dao063231

Li, A. X., D'Amelio, S., Paggi, L., He, F., Gasser, R., Lun, Z. R., Abollo, E., Turchetto, M. and Zhu, X. Q. (2005) Genetic evidence for the existence of sibling species within *Contracaecum rudolphii* (Hartwich, 1964) and the validity of *Contracaecum septentrionale* (Kreis, 1955) (Nematoda : Anisakidae). *Parasitology Research* 96 (6), 361-366. http://dx.doi.org/10.1007/s00436-005-1366-y

Lopez, J. L., Abalde, S. L. and Fuentes, J. (2005) Proteomic approach to probe for larval proteins of the mussel *Mytilus galloprovincialis*. *Marine Biotechnology* 7 (4), 396-404. http://dx.doi.org/10.1007/s10126-004-4029-6

Lorenzo-Abalde, S., Gonzalez-Fernandez, A., Villegas, E. D. and Fuentes, J. (2005) Two monoclonal antibodies for the recognition of *Mytilus* spp. larvae: studies on cultured larvae and tests on plankton samples. *Aquaculture* 250 (3-4), 736-747. http://dx.doi.org/10.1016/j.aquaculture.2005.05.039

Macho, G., Molares, J. and Vazquez, E. (2005) Timing of larval release by three barnacles from the NW Iberian Peninsula. *Marine Ecology Progress Series* 298, 251-260. http://dx.doi.org/10.3354/meps298251

Pascual, S. and Abollo, E. (2005) Whaleworms as a tag to map zones of heavy-metal pollution. *Trends in Parasitology* 21 (5), 204-206. http://dx.doi.org/10.1016/j.pt.2005.03.005

Prado, S., Romalde, J. L., Montes, J. and Barja, J. L. (2005) Pathogenic bacteria isolated from disease outbreaks in shellfish hatcheries. First description of *Vibrio neptunius* as an oyster pathogen. *Diseases of Aquatic Organisms* 67 (3), 209-215. http://dx.doi.org/10.3354/dao067209

Villalba, A., Casas, S. M., Lopez, C. and Carballal, M. J. (2005) Study of perkinsosis in the carpet shell clam *Tapes decussatus* in Galicia (NW Spain). II. Temporal pattern of disease dynamics and association with clam mortality. *Diseases of Aquatic Organisms* 65 (3), 257-267. http://dx.doi.org/10.3354/dao065257

Zapata, M. (2005) Recent advances in pigment analysis as applied to picophytoplankton. *Vie Et Milieu-Life and Environment* 55 (3-4), 233-248. https://hal.sorbonne-universite.fr/hal-03219067

2006

Abollo, E., Casas, S. M., Ceschia, G. and Villalba, A. (2006) Differential diagnosis of *Perkinsus* species by polymerase chain reaction-restriction fragment length polymorphism assay. *Molecular and Cellular Probes* 20 (6), 323-329. http://dx.doi.org/10.1016/j.mcp.2006.04.001

Azevedo, C., Conchas, R. F., Tajdari, J. and Montes, J. (2006) Ultrastructural description of new Rickettsia-like organisms in the commercial abalone *Haliotis tuberculata* (Gastropoda : Haliotidae) from the NW of Spain. *Diseases of Aquatic Organisms* 71 (3), 233-237. http://dx.doi.org/10.3354/dao071233

Balseiro, P., Fernandez Conchas, R., Montes, J., Gomez-Leon, J., Novoa, B. and Figueras, A. (2006) Comparison of diagnosis techniques for the protozoan parasite *Bonamia ostreae* in flat oyster *Ostrea edulis*. *Aquaculture* 261 (4), 1135-1143. http://dx.doi.org/10.1016/j.aquaculture.2006.05.014

Blanco, J., Acosta, C. P., Marino, C., Muniz, S., Martin, H., Morono, A., Correa, J., Arevalo, F. and Salgado, C. (2006) Depuration of domoic acid from different body compartments of the king scallop *Pecten maximus* grown in raft culture and natural bed. *Aquatic Living Resources* 19 (3), 257-265. http://dx.doi.org/10.1051/alr:2006026

Blanco, J., Cano, J., Marino, M. D. C. and Campos, M. J. (2006) Effect of phytoplankton containing paralytic shellfish and amnesic shellfish toxins on the culture of the king scallop *Pecten maximus* in Malaga (SE Spain). *Aquatic Living Resources* 19 (3), 267-273. http://dx.doi.org/10.1021/alr:2006027

da Silva, P. M., Villalba, A. and Sunila, I. (2006) Branchial lesions associated with abundant apoptotic cells in oysters *Ostrea edulis* of Galicia (NW Spain). *Diseases of Aquatic Organisms* 70 (1-2), 129-137. http://dx.doi.org/10.3354/dao070129

Darriba, S., Igleslias, D., Harshbarger, J. C. and Lopez, C. (2006) Germinoma in razor clam *Ensis arcuatus* (Jeffreys, 1865) in Galicia (NW Spain). *Journal of Invertebrate Pathology* 93 (2), 140-142. http://dx.doi.org/10.1016/j.jip.2006.06.009

Garces, E., Fernandez, M., Penna, A., Van Lenning, K., Gutierrez, A., Camp, J. and Zapata, M. (2006) Characterization of NW Mediterranean *Karlodinium* spp. (Dinophyceae) strains using morphological, molecular, chemical, and physiological methodologies. *Journal of Phycology* 42 (5), 1096-1112. http://dx.doi.org/10.1111/j.1529-8817.2006.00270.x

Lodeiros, C., Buitrago, E. and Guerra, A. (2006) Evaluación del tipo de cestos de cultivo para la ostra de mangle *Crassostrea rhizophorae* suspendidas en long line y balsa = Evaluation of culture enclosures for the mangrove oyster *Crassostrea rhizophorae* suspended from raft and long-line systems. *Ciencias Marinas* 32 (2), 331-337. http://dx.doi.org/10.7773/cm.v32i21.1056

Lopez, C. and Darriba, S. (2006) Presence of *Marteilia* sp (Paramyxea) in the razor clam *Solen marginatus* (Pennantt, 1777) in Galicia (NW Spain). *Journal of Invertebrate Pathology* 92 (2), 109-111. http://dx.doi.org/10.1016/j.jip.2006.03.002

Ordas, M. C., Abollo, E., Costa, M. M., Figueras, A. and Novoa, B. (2006) Molecular cloning and expression analysis of interferon regulatory factor-1 (IRF-1) of turbot and sea bream. *Molecular Immunology* 43 (7), 882-890. http://dx.doi.org/10.1016/j.molimm.2005.06.034

Pascual, S., Abollo, E. and Azevedo, C. (2006) Host–parasite interaction of a muscle-infecting didymozoid in the Atlantic mackerel *Scomber scombrus* L. *Ices Journal of Marine Science* 63 (1), 169-175. http://dx.doi.org/10.1016/j.icesjms.2005.08.010

Rodriguez, F., Chauton, M., Johnsen, G., Andresen, K., Olsen, L. M. and Zapata, M. (2006) Photoacclimation in phytoplankton: implications for biomass estimates, pigment functionality and chemotaxonomy. *Marine Biology* 148 (5), 963-971. http://dx.doi.org/10.1007/s00227-005-0138-7

2007

Blanco, J., Alvarez, G. and Uribe, E. (2007) Identification of pectenotoxins in plankton, filter feeders, and isolated cells of a *Dinophysis acuminata* with an atypical toxin profile, from Chile. *Toxicon* 49 (5), 710-716. http://dx.doi.org/10.1016/j.toxicon.2006.11.013

Blanco, J., Marino, C., Martin, H. and Acosta, C. P. (2007) Anatomical distribution of diarrhetic shellfish poisoning (DSP) toxins in the mussel *Mytilus galloprovincialis*. *Toxicon* 50 (8), 1011-1018. http://dx.doi.org/10.1016/j.toxicon.2007.09.002

Cao, A., Novás, A., Ramos-Martínez, J. I. and Barcia, R. (2007) Seasonal variations in haemocyte response in the mussel *Mytilus galloprovincialis* Lmk. *Aquaculture* 263 (1-4), 310-319. http://dx.doi.org/10.1016/j.aquaculture.2006.11.004

Cao, A., Ramos-Martínez, J.-I. and Barcia, R. (2007) In hemocytes from *Mytilus galloprovincialis* Lmk., treatment with corticotropin or growth factors conditions catecholamine release. *International Immunopharmacology* 7 (11), 1395-1402. http://dx.doi.org/10.1016/j.intimp.2007.07.008

Fernandez-Tajes, J., Gaspar, M., Martinez-Patino, D., McDonough, N., Roberts, D., Gonzalez-Tizon, A., Martinez-Lage, A. and Mendez, J. (2007) Genetic variation of the razor clam Ensis siliqua (Jeffreys, 1875) along the European coast based on random amplified polymorphic DNA markers. *Aquaculture Research* 38 (11), 1205-1212. http://dx.doi.org/10.1111/j.1365-2109.2007.01792.x

Laza-Martinez, A., Seoane, S., Zapata, M. and Orive, E. (2007) Phytoplankton pigment patterns in a temperate estuary: from unialgal cultures to natural assemblages. *Journal of Plankton Research* 29 (11), 913-929. http://dx.doi.org/10.1093/plankt/fbm069

Not, F., Zapata, M., Pazos, Y., Campana, E., Doval, M. and Rodriguez, F. (2007) Size-fractionated phytoplankton diversity in the NW Iberian coast: a combination of microscopic, pigment and molecular analyses. *Aquatic Microbial Ecology* 49 (3), 255-265. http://dx.doi.org/10.3354/ame01144

Romalde, J. L., Vilarino, M. L., Beaz, R., Rodriguez, J. M., Diaz, S., Villalba, A. and Carballal, M. J. (2007) Evidence of retroviral etiology for disseminated neoplasia in cockles (*Cerastoderma edule*). *Journal of Invertebrate Pathology* 94 (2), 95-101. http://dx.doi.org/10.1016/j.jip.2006.09.007

2008

Abollo, E., Ramilo, A., Casas, S. M., Comesana, P., Cao, A., Carballal, M. J. and Villalba, A. (2008) First detection of the protozoan parasite *Bonamia exitiosa* (Haplosporidia) infecting flat oyster *Ostrea edulis* grown in European waters. *Aquaculture* 274 (2-4), 201-207. http://dx.doi.org/10.1016/j.aquaculture.2007.11.037

Azevedo, C., Casal, G. and Montes, J. (2008) Ultrastructural developmental cycle of *Haplosporidium montforti* (phylum Haplosporidia) in its farmed abalone host, *Haliotis tuberculata* (Gastropoda). *Journal of Parasitology* 94 (1), 137-142. http://dx.doi.org/10.1645/ge-1177.1

Casas, S. M., Reece, K. S., Li, Y., Moss, J. A., Villalba, A. and La Peyre, J. F. (2008) Continuous culture of *Perkinsus mediterraneus*, a parasite of the European flat oyster *Ostrea edulis*, and characterization of its morphology, propagation, and extracellular proteins in vitro. *Journal of Eukaryotic Microbiology* 55 (1), 34-43. http://dx.doi.org/10.1111/j.1550-7408.2008.00301.x

da Costa, F., Darriba, S. and Martinez-Patino, D. (2008) Embryonic and larval development of *Ensis arcuatus* (Jeffreys, 1865) (Bivalvia : Pharidae). *Journal of Molluscan Studies* 74, 103-109. http://dx.doi.org/10.1093/mollus/eym051

da Silva, P. M., Comesana, P., Fuentes, J. and Villalba, A. (2008) Variability of haemocyte and haemolymph parameters in European flat oyster *Ostrea edulis* families obtained from brood stocks of different geographical origins and relation with infection by the protozoan *Bonamia ostreae*. *Fish & Shellfish Immunology* 24 (5), 551-563. http://dx.doi.org/10.1016/j.fsi.2007.11.003

da Silva, P. M., Renault, T., Fuentes, J. and Villalba, A. (2008) Herpesvirus infection in European flat oysters *Ostrea edulis* obtained from brood stocks of various geographic origins and grown in Galicia (NW Spain). *Diseases of Aquatic Organisms* 78 (3), 181-188. http://dx.doi.org/10.3354/dao01874

Fernandez-Tajes, J., Martinez-Lage, A., Freire, R., Guerra, A., Mendez, J. and Gonzalez-Tlzon, A. M. (2008) Genome sizes and karyotypes in the razor clams *Ensis arcuatus* (Jeffreys, 1865) and *E. siliqua* (Linnaeus, 1758). *Cahiers De Biologie Marine* 49 (1), 79-85. http://dx.doi.org/10.21411/CBM.A.829E218F

Fraga, S., Penna, A., Bianconi, I., Paz, B. and Zapata, M. (2008) *Coolia canariensis* sp. nov. (Dinophyceae), a new nontoxic epiphytic benthic dinoflagellate from the Canary Islands. *Journal of Phycology* 44 (4), 1060-1070. http://dx.doi.org/10.1111/j.1529-8817.2008.00555.x

La Peyre, M. K., Casas, S. M., Villalba, A. and La Peyre, J. F. (2008) Determination of the effects of temperature on viability, metabolic activity and proliferation of two *Perkinsus* species, and its significance to understanding seasonal cycles of perkinsosis. *Parasitology* 135 (4), 505-519. http://dx.doi.org/10.1017/s0031182008004150

Lin, J. H. Y., Lin, H. T., Lopez, C., Chen, T. Y., Chen, M. S. and Yang, H. L. (2008) A comparison of the expression of immunity-related *rag* 1 and *ikaros* genes with histogenesis of the thymus in *Epinephelus malabaricus* (Bloch & Schneider). *Aquaculture Research* 39 (3), 252-262. http://dx.doi.org/10.1111/j.1365-2109.2007.01871.x

Lopez-Flores, I., Robles, F., Valencia, J. M., Grau, A., Villalba, A., de la Herran, R., Garrido-Ramos, M. A., Ruiz-Rejon, C., Ruiz-Rejon, M. and Navas, J. I. (2008) Detection of *Marteilia refringens* using nested PCR and *in situ* hybridisation in *Chamelea gallina* from the Balearic Islands (Spain). *Diseases of Aquatic Organisms* 82 (1), 79-87. http://dx.doi.org/10.3354/dao01966

Ojea, J., Pazos, A. J., Martinez, D., Novoa, S., Garcia-Martinez, P., Sanchez, J. L. and Abad, M. (2008) Effects of Temperature Regime on Broodstock Conditioning of *Ruditapes decussatus*. *Journal of Shellfish Research* 27 (5), 1093-1100. http://dx.doi.org/10.2983/0730-8000-27.5.1093

Parada, J. M. and Molares, J. (2008) Natural mortality of the cockle *Cerastoderma edule* (L.) from the Ria of Arousa (NW Spain) intertidal zone. *Revista De Biologia Marina Y Oceanografia* 43 (3), 501-511

Pascual, S. and Abollo, E. (2008) Myxosporean Infection in Frozen Blocks of Patagonian Hakes. *Journal of Food Protection* 71 (11), 2316-2322. http://dx.doi.org/10.4315/0362-028x-71.11.2316

Ribeiro, L., Couto, A., Olmedo, M., Alvarez-Blazquez, B., Linares, F. and Valente, L. M. P. (2008) Digestive enzyme activity at different developmental stages of blackspot seabream, *Pagellus bogaraveo* (Brunnich 1768). *Aquaculture Research* 39 (4), 339-346. http://dx.doi.org/10.1111/j.1365-2109.2007.01684.x

Rossignoli, A. E. and Blanco, J. (2008) Cellular distribution of okadaic acid in the digestive gland of *Mytilus galloprovincialis* (Lamarck, 1819). *Toxicon* 52 (8), 957-959. http://dx.doi.org/10.1016/j.toxicon.2008.09.003

Saavedra, Y., Gonzalez, A. and Blanco, J. (2008) Anatomical distribution of heavy metals in the scallop *Pecten maximus*. *Food additives & contaminants. Part A, Chemistry, analysis, control, exposure & risk assessment* 25 (11), 1339-1344. http://dx.doi.org/10.1080/02652030802163398

2009

Alvarez, G., Uribe, E., Quijano-Scheggia, S., Lopez-Rivera, A., Marino, C. and Blanco, J. (2009) Domoic acid production by *Pseudo-nitzschia australis* and *Pseudo-nitzschia calliantha* isolated from North Chile. *Harmful Algae* 8 (6), 938-945. http://dx.doi.org/10.1016/j.hal.2009.05.005

Alvarez, G., Uribe, E., Vidal, A., Avalos, P., Gonzalez, F., Marino, C. and Blanco, J. (2009) Paralytic shellfish toxins in *Argopecten purpuratus* and *Semimytilus algosus* from northern Chile. *Aquatic Living Resources* 22 (3), 341-347. http://dx.doi.org/10.1051/alr/2009028

Boehs, G., Lenz, T. M. and Villalba, A. (2009) Xenomas in *Crassostrea rhizophorae* (Ostreidae) from Camamu Bay, Bahia, Brazil. *Brazilian Journal of Biology* 69 (2), 457-458. http://dx.doi.org/10.1590/s1519-69842009000200032

Cao, A., Fuentes, J., Comesana, P., Casas, S. M. and Villalba, A. (2009) A proteomic approach envisaged to analyse the bases of oyster tolerance/resistance to bonamiosis. *Aquaculture* 295 (3-4), 149-156. http://dx.doi.org/10.1016/j.aquaculture.2009.06.044

da Costa, F. and Martinez-Patino, D. (2009) Culture potential of the razor clam *Solen marginatus* (Pennant, 1777). *Aquaculture* 288 (1-2), 57-64. http://dx.doi.org/10.1016/j.aquaculture.2008.11.001

da Silva, P. M., Fuentes, J. and Villalba, A. (2009) Differences in gametogenic cycle among strains of the European flat oyster *Ostrea edulis* and relationship between gametogenesis and bonamiosis. *Aquaculture* 287 (3-4), 253-265. http://dx.doi.org/10.1016/j.aquaculture.2008.10.055

Garrido, J. L., Rodriguez, F. and Zapata, M. (2009) Occurrence of Loroxanthin, Loroxanthin Decenoate, and Loroxanthin Dodecenoate in *Tetraselmis* Species (Prasinophyceae, Chlorophyta). *Journal of Phycology* 45 (2), 366-374. http://dx.doi.org/10.1111/j.1529-8817.2009.00660.x

Perez, D., Lorenzo-Abalde, S., Gonzalez-Fernandez, A. and Fuentes, J. (2009) Immunodetection of *Mytilus galloprovincialis* larvae using monoclonal antibodies to monitor larval abundance on the Galician coast: Optimization of the method and comparison with identification by morphological traits. *Aquaculture* 294 (1-2), 86-92. http://dx.doi.org/10.1016/j.aquaculture.2009.05.020

Prado, S., Montes, J., Romalde, J. L. and Barja, J. L. (2009) Inhibitory activity of *Phaeobacter* strains against aquaculture pathogenic bacteria. *International Microbiology* 12 (2), 107-114. http://dx.doi.org/10.2436/20.1501.01.87

Saavedra, Y., González, A. and Blanco, J. (2009) Inter-individual distribution of metal concentrations in four marine bioindicator organisms and its use for optimal sampling design of a monitoring system. *International Journal of Environmental Analytical Chemistry* 89 (8-12), 559-568. http://dx.doi.org/10.1080/03067310802553146

Vidal, A., Correa, J. and Blanco, J. (2009) Effect of some habitual cooking processes on the domoic acid concentration in the cockle (*Cerastoderma edule*) and Manila clam (*Ruditapes philippinarum*). *Food additives & contaminants. Part A, Chemistry, analysis, control, exposure & risk assessment* 26 (7), 1089-1095. http://dx.doi.org/10.1080/02652030902855422

2010

Alvarez, G., Uribe, E., Avalos, P., Marino, C. and Blanco, J. (2010) First identification of azaspiracid and spirolides in *Mesodesma donacium* and *Mulinia edulis* from Northern Chile. *Toxicon* 55 (2-3), 638-641. http://dx.doi.org/10.1016/j.toxicon.2009.07.014

Balseiro, P., Montes, J., Fernandez Conchas, R., Novoa, B. and Figueras, A. (2010) Comparison of diagnostic techniques to detect the clam pathogen *Perkinsus olseni*. *Diseases of Aquatic Organisms* 90 (2), 143-151. http://dx.doi.org/10.3354/dao02194

Boehs, G., Villalba, A., Ceuta, L. O. and Luz, J. R. (2010) Parasites of three commercially exploited bivalve mollusc species of the estuarine region of the Cachoeira river (Ilheus, Bahia, Brazil). *Journal of Invertebrate Pathology* 103 (1), 43-47. http://dx.doi.org/10.1016/j.jip.2009.10.008

Da Costa, F., Martinez-Patino, D., Ojea, J. and Novoa, S. (2010) Larval Rearing and Spat Production of the Razor Clam *Ensis siliqua* (Bivalvia: Pharidae). *Journal of Shellfish Research* 29 (2), 347-351. http://dx.doi.org/10.2983/035.029.0209

Darriba, S., Iglesias, D., Ruiz, M., Rodriguez, R. and Lopez, C. (2010) Histological survey of symbionts and other conditions in razor clam *Ensis arcuatus* (Jeffreys, 1865) (Pharidae) of the coast of Galicia (NW Spain). *Journal of Invertebrate Pathology* 104 (1), 23-30. http://dx.doi.org/10.1016/j.jip.2009.12.005

Diaz, S., Cao, A., Villalba, A. and Carballal, M. J. (2010) Expression of mutant protein p53 and Hsp70 and Hsp90 chaperones in cockles *Cerastoderma edule* affected by neoplasia. *Diseases of Aquatic Organisms* 90 (3), 215-222. http://dx.doi.org/10.3354/dao02231

Dominguez, L., Villalba, A. and Fuentes, J. (2010) Effects of photoperiod and the duration of conditioning on gametogenesis and spawning of the mussel *Mytilus galloprovincialis* (Lamarck). *Aquaculture Research* 41 (11), e807-e818. http://dx.doi.org/10.1111/j.1365-2109.2010.02601.x

Garcia de La Banda, I., Lobo, C., Leon-Rubio, J. M., Tapia-Paniagua, S., Carmen Balebona, M., Morinigo, M. A., Moreno-Ventas, X., Lucas, L. M., Linares, F., Arce, F. and Arijo, S. (2010) Influence of two closely related probiotics on juvenile Senegalese sole (*Solea senegalensis*, Kaup 1858) performance and protection against *Photobacterium damselae* subsp. piscicida. *Aquaculture* 306 (1-4), 281-288. http://dx.doi.org/10.1016/j.aquaculture.2010.05.008

Le Grand, F., Kraffe, E., de Montaudouin, X., Villalba, A., Marty, Y. and Soudant, P. (2010) Prevalence, intensity, and aneuploidy patterns of disseminated neoplasia in cockles (*Cerastoderrna edule*) from Arcachon Bay: Seasonal variation and position in sediment. *Journal of Invertebrate Pathology* 104 (2), 110-118. http://dx.doi.org/10.1016/j.jip.2010.01.011

Lynch, S. A., Abollo, E., Ramilo, A., Cao, A., Culloty, S. C. and Villalba, A. (2010) Observations raise the question if the Pacific oyster, *Crassostrea gigas*, can act as either a carrier or a reservoir for *Bonamia ostreae* or *Bonamia exitiosa*. *Parasitology* 137 (10), 1515-1526. http://dx.doi.org/10.1017/s0031182010000326

Mauriz, A. and Blanco, J. (2010) Distribution and linkage of domoic acid (amnesic shellfish poisoning toxins) in subcellular fractions of the digestive gland of the scallop *Pecten maximus*. *Toxicon* 55 (2-3), 606-611. http://dx.doi.org/10.1016/j.toxicon.2009.10.017

Pascual, S., Villalba, A., Abollo, E., Garci, M., Gonzalez, A. F., Nombela, M., Posada, D. and Guerra, A. (2010) The mussel *Xenostrobus securis*: a well-established alien invader in the Ria de Vigo (Spain, NE Atlantic). *Biological Invasions* 12 (7), 2091-2103. http://dx.doi.org/10.1007/s10530-009-9611-4

Rossignoli, A. E. and Blanco, J. (2010) Subcellular distribution of okadaic acid in the digestive gland of *Mytilus galloprovincialis*: First evidences of lipoprotein binding to okadaic acid. *Toxicon* 55 (2-3), 221-226. http://dx.doi.org/10.1016/j.toxicon.2009.07.022

Valente, L. M. P., Olmedo, M., Borges, P., Soares, S., Gomes, E. F. S., Alvarez-Blazquez, B., Pazos, G. and Linares, F. (2010) Effects of carbohydrate sources on growth, body composition and tissue lipid deposition of blackspot seabream, *Pagellus bogaraveo* (Brunnich). *Journal of Animal Physiology and Animal Nutrition* 94 (2), 212-219. http://dx.doi.org/10.1111/j.1439-0396.2008.00900.x

Vera, M., Pardo, B. G., Pino-Querido, A., Alvarez-Dios, J. A., Fuentes, J. and Martinez, P. (2010) Characterization of single-nucleotide polymorphism markers in the Mediterranean mussel, *Mytilus galloprovincialis*. *Aquaculture Research* 41 (10), e568-e575. http://dx.doi.org/10.1111/j.1365-2109.2010.02550.x

2011

Alvarez, G., Uribe, E., Diaz, R., Braun, M., Marino, C. and Blanco, J. (2011) Bloom of the Yessotoxin producing dinoflagellate *Protoceratium reticulatum* (Dinophyceae) in Northern Chile. *Journal of Sea Research* 65 (4), 427-434. http://dx.doi.org/10.1016/j.seares.2011.03.008

Casas, S. M., Comesana, P., Cao, A. and Villalba, A. (2011) Comparison of antibacterial activity in the hemolymph of marine bivalves from Galicia (NW Spain). *Journal of Invertebrate Pathology* 106 (2), 343-345. http://dx.doi.org/10.1016/j.jip.2010.11.007

da Costa, F., Darriba, S., Martinez-Patino, D. and Guerra, A. (2011) Culture possibilities of the razor clam *Ensis arcuatus* (Pharidae: Bivalvia). *Aquaculture Research* 42 (10), 1549-1557. http://dx.doi.org/10.1111/j.1365-2109.2010.02747.x

da Costa, F., Novoa, S., Ojea, J. and Martinez-Patino, D. (2011) Changes in biochemical and fatty acid composition of the razor clam *Solen marginatus* (Solenidae: Bivalvia) during larval development. *Marine Biology* 158 (8), 1829-1840. http://dx.doi.org/10.1007/s00227-011-1695-6

da Silva, P. M., Fuentes, J. and Villalba, A. (2011) Disseminated neoplasia in flat oysters *Ostrea edulis* from Galicia (NW Spain): Occurrence, ultrastructural aspects and relationship with bonamiosis. *Journal of Invertebrate Pathology* 107 (1), 50-59. http://dx.doi.org/10.1016/j.jip.2011.01.001

Diaz, S., Renault, T., Villalba, A. and Jesus Carballal, M. (2011) Disseminated neoplasia in cockles *Cerastoderma edule*: ultrastructural characterisation and effects on haemolymph cell parameters. *Diseases of Aquatic Organisms* 96 (2), 157-167. http://dx.doi.org/10.3354/dao02384

Fuentes, L., Javier Sanchez, F., Jesus Lago, M., Iglesias, J., Pazos, G. and Linares, F. (2011) Growth and survival of *Octopus vulgaris* (Cuvier 1797) paralarvae fed on three *Artemia*-based diets complemented with frozen fish flakes, crushed zooplankton and marine microalgae. *Scientia Marina* 75 (4), 771-777. http://dx.doi.org/10.3989/scimar.2011.75n4771

Pardo, B. G., Cao, A., Vilas, R., Abollo, E., Villalba, A. and Martinez, P. (2011) Microsatellite marker development in the protozoan parasite *Perkinsus olseni*. *Diseases of Aquatic Organisms* 94 (2), 161-165. http://dx.doi.org/10.3354/dao02325

Regueiro, J., Alvarez, G., Mauriz, A. and Blanco, J. (2011) High throughput analysis of amnesic shellfish poisoning toxins in bivalve molluscs by dispersive solid-phase extraction and high-performance liquid chromatography using a monolithic column. *Food Chemistry* 127 (4), 1884-1891. http://dx.doi.org/10.1016/j.foodchem.2011.02.039

Regueiro, J., Martin-Morales, E., Alvarez, G. and Blanco, J. (2011) Sensitive determination of domoic acid in shellfish by on-line coupling of weak anion exchange solid-phase extraction and liquid chromatography-diode array detection-tandem mass spectrometry. *Food Chemistry* 129 (2), 672-678. http://dx.doi.org/10.1016/j.foodchem.2011.05.004

Regueiro, J., Rossignoli, A. E., Alvarez, G. and Blanco, J. (2011) Automated on-line solid-phase extraction coupled to liquid chromatography-tandem mass spectrometry for determination of lipophilic marine toxins in shellfish. *Food Chemistry* 129 (2), 533-540. http://dx.doi.org/10.1016/j.foodchem.2011.04.054

Rossignoli, A. E., Fernandez, D., Acosta, C. P. and Blanco, J. (2011) Microencapsulation of okadaic acid as a tool for studying the accumulation of DSP toxins in mussels. *Marine Environmental Research* 71 (1), 91-93. http://dx.doi.org/10.1016/j.marenvres.2010.11.003

Rossignoli, A. E., Fernandez, D., Regueiro, J., Marino, C. and Blanco, J. (2011) Esterification of okadaic acid in the mussel *Mytilus galloprovincialis*. *Toxicon* 57 (5), 712-720. http://dx.doi.org/10.1016/j.toxicon.2011.02.003

Ruiz, M., Darriba, S., Rodriguez, R., Iglesias, D., Lee, R. and Lopez, C. (2011) Viral basophilic inclusions in the digestive gland of razor clams *Ensis arcuatus* (Pharidae) in Galicia (NW Spain). *Diseases of Aquatic Organisms* 94 (3), 239-241. http://dx.doi.org/10.3354/dao02330

Valente, L. M. P., Linares, F., Villanueva, J. L. R., Silva, J. M. G., Espe, M., Escorcio, C., Pires, M. A., Saavedra, M. J., Borges, P., Medale, F., Alvarez-Blazquez, B. and Peleteiro, J. B. (2011) Dietary protein source or energy levels have no major impact on growth performance, nutrient utilisation or flesh fatty acids composition of market-sized Senegalese sole. *Aquaculture* 318 (1-2), 128-137. http://dx.doi.org/10.1016/j.aquaculture.2011.05.026

Vilas, R., Cao, A., Pardo, B. G., Fernandez, S., Villalba, A. and Martinez, P. (2011) Very low microsatellite polymorphism and large heterozygote deficits suggest founder effects and cryptic structure in the parasite *Perkinsus olseni*. *Infection Genetics and Evolution* 11 (5), 904-911. http://dx.doi.org/10.1016/j.meegid.2011.02.015

2012

Carrasco, N., Villalba, A., Andree, K. B., Engelsma, M. Y., Lacuesta, B., Ramilo, A., Gairin, I. and Furones, M. D. (2012) *Bonamia exitiosa* (Haplosporidia) observed infecting the European flat oyster *Ostrea edulis* cultured on the Spanish Mediterranean coast. *Journal of Invertebrate Pathology* 110 (3), 307-313. http://dx.doi.org/10.1016/j.jip.2012.03.015

Comesana, P., Casas, S. M., Cao, A., Abollo, E., Arzul, I., Morga, B. and Villalba, A. (2012) Comparison of haemocytic parameters among flat oyster *Ostrea edulis* stocks with different susceptibility to bonamiosis and the Pacific oyster *Crassostrea gigas*. *Journal of Invertebrate Pathology* 109 (3), 274-286. http://dx.doi.org/10.1016/j.jip.2011.12.007

Darriba, S., Ruiz, M. and Lopez, C. (2012) Phage particles infecting branchial Rickettsiales-like organisms in banded carpet shell *Polititapes virgineus* (Bivalvia) from Galicia (NW Spain). *Diseases of Aquatic Organisms* 100 (3), 269-272. http://dx.doi.org/10.3354/dao02493

Iglesias, D., Rodriguez, L., Gomez, L., Azevedo, C. and Montes, J. (2012) Histological survey of Pacific oysters *Crassostrea gigas* (Thunberg) in Galicia (NW Spain). *Journal of Invertebrate Pathology* 111 (3), 244-251. http://dx.doi.org/10.1016/j.jip.2012.08.015

Manso, C. F., Diaz, S., Carballal, M. J., Villalba, A. and Romalde, J. L. (2012) Detection of reverse transcriptase activity in golden carpet shell clams (*Venerupis aurea*) with disseminated neoplasia. *Bulletin of the European Association of Fish Pathologists* 32 (2), 56-63. https://eafp.org/download/2012-volume32/issue_2/56-Manso.pdf

Martin-Gomez, L., Villalba, A. and Abollo, E. (2012) Identification and expression of immune genes in the flat oyster *Ostrea edulis* in response to bonamiosis. *Gene* 492 (1), 81-93. http://dx.doi.org/10.1016/j.gene.2011.11.001

Ruiz, M., Iglesias, D., Darriba, S., Rodriguez, R. and Lopez, C. (2012) Epidemiological survey of digenean trematodes affecting razor clams, *Ensis arcuatus*, from Galicia (NW Spain). *Bulletin of the European Association of Fish Pathologists* 32 (1), 3-13. https://eafp.org/download/2012-volume32/issue_1/3%20Lopez.pdf

2013

Carballal, M. J., Iglesias, D., Diaz, S. and Villalba, A. (2013) Disseminated neoplasia in clams *Venerupis aurea* from Galicia (NW Spain): Histopathology, ultrastructure and ploidy of the neoplastic cells, and comparison of diagnostic procedures. *Journal of Invertebrate Pathology* 112 (1), 16-19. http://dx.doi.org/10.1016/j.jip.2012.10.003

da Silva, P. M., Vianna, R. T., Guertler, C., Ferreira, L. P., Santana, L. N., Fernandez-Boo, S., Ramilo, A., Cao, A. and Villalba, A. (2013) First report of the protozoan parasite *Perkinsus marinus* in South America, infecting mangrove oysters *Crassostrea rhizophorae* from the Paraiba River (NE, Brazil). *Journal of Invertebrate Pathology* 113 (1), 96-103. http://dx.doi.org/10.1016/j.jip.2013.02.002

Diaz, S., Villalba, A., Insua, A., Soudant, P., Fernandez-Tajes, J., Mendez, J. and Carballal, M. J. (2013) Disseminated neoplasia causes changes in ploidy and apoptosis frequency in cockles *Cerastoderma edule*. *Journal of Invertebrate Pathology* 113 (3), 214-219. http://dx.doi.org/10.1016/j.jip.2013.03.010

Domingues, P., Sánchez, F. J., Iglesias, J., Otero, J. J., Pazos, G. and Linares, F. (2013) Variations in Weight and Proximate Composition of Newly Hatched *Octopus vulgaris* (Cuvier 1797) Paralarvae. *Journal of Applied Aquaculture* 25 (3), 219-226. http://dx.doi.org/10.1080/10454438.2013.815459

Lynch, S. A., Villalba, A., Abollo, E., Engelsma, M., Stokes, N. A. and Culloty, S. C. (2013) The occurrence of haplosporidian parasites, *Haplosporidium nelsoni* and *Haplosporidium* sp., in oysters in Ireland. *Journal of Invertebrate Pathology* 112 (3), 208-212. http://dx.doi.org/10.1016/j.jip.2012.11.013

Martin-Gomez, L., Villalba, A., Jesus Carballal, M. and Abollo, E. (2013) Identification of Relevant Cancer Related-Genes in the Flat Oyster *Ostrea edulis* Affected by Disseminated Neoplasia. *Marine Biotechnology* 15 (2), 159-174. http://dx.doi.org/10.1007/s10126-012-9472-1

Paz, B., Blanco, J. and Franco, J. M. (2013) Yessotoxins production during the culture of *Protoceratium reticulatum* strains isolated from Galician Rias Baixas (NW Spain). *Harmful Algae* 21-22, 13-19. http://dx.doi.org/10.1016/j.hal.2012.11.002

Ramilo, A., Ignacio Navas, J., Villalba, A. and Abollo, E. (2013) Species-specific diagnostic assays for *Bonamia ostreae* and *B. exitiosa* in European flat oyster Ostrea edulis: conventional, real-time and multiplex PCR. *Diseases of Aquatic Organisms* 104 (2), 149-161. http://dx.doi.org/10.3354/dao02597

Ruiz, M., Darriba, S., Rodriguez, R. and Lopez, C. (2013) Histological survey of symbionts and other conditions of pod razor clam *Ensis siliqua* (Linnaeus, 1758) in Galicia (NW Spain). *Journal of Invertebrate Pathology* 112 (1), 74-82. http://dx.doi.org/10.1016/j.jip.2012.09.003

Ruiz, P., Diaz, S., Orbea, A., Carballal, M. J., Villalba, A. and Cajaraville, M. P. (2013) Biomarkers and transcription levels of cancer-related genes in cockles *Cerastoderma edule* from Galicia (NW Spain) with disseminated neoplasia. *Aquatic Toxicology* 136, 101-111. http://dx.doi.org/10.1016/j.aquatox.2013.03.018

Sanchez, F. J., Fuentes, L., Otero, J. J., Lago, M. J., Linares, F., Pazos, G. and Iglesias, J. (2013) Effect of tank volume on the growth and survival of reared *Octopus vulgaris* paralarvae. *Aquaculture Research* 44 (4), 667-670. http://dx.doi.org/10.1111/j.1365-2109.2011.03049.x

2014

Aranda-Burgos, J. A., Da Costa, F., Novoa, S., Ojea, J. and Martinez-Patino, D. (2014) Embryonic and larval development of *Ruditapes decussatus* (Bivalvia: Veneridae): a study of the shell differentiation process. *Journal of Molluscan Studies* 80, 8-16. http://dx.doi.org/10.1093/mollus/eyt044

Aranda-Burgos, J. A., da Costa, F., Novoa, S., Ojea, J. and Martinez-Patino, D. (2014) Effects of microalgal diet on growth, survival, biochemical and fatty acid composition of *Ruditapes decussatus* larvae. *Aquaculture* 420, 38-48. http://dx.doi.org/10.1016/j.aquaculture.2013.10.032

Borrell, Y. J., Arias-Perez, A., Freire, R., Valdes, A., Sanchez, J. A., Mendez, J., Martinez, D., Lopez, J., Carleos, C., Blanco, G. and Insua, A. M. (2014) Microsatellites and multiplex PCRs for assessing aquaculture practices of the grooved carpet shell *Ruditapes decussatus* in Spain. *Aquaculture* 426, 49-59. http://dx.doi.org/10.1016/j.aquaculture.2014.01.010

Fernandez-Boo, S., Chicano-Galvez, E., Alhama, J., Barea, J. L., Villalba, A. and Cao, A. (2014) Comparison of protein expression profiles between three *Perkinsus* spp., protozoan parasites of molluscs, through 2D electrophoresis and mass spectrometry. *Journal of Invertebrate Pathology* 118, 47-58. http://dx.doi.org/10.1016/j.jip.2014.02.011

Flannery, G., Lynch, S. A., Longshaw, M., Stone, D., Martin, P., Ramilo, A., Villalba, A. and Culloty, S. C. (2014) Interlaboratory variability in screening for *Bonamia ostreae*, a protistan parasite of the European flat oyster *Ostrea edulis*. *Diseases of Aquatic Organisms* 110 (1-2), 93-99. http://dx.doi.org/10.3354/dao02717

Garcia-Mendoza, E., Sanchez-Bravo, Y. A., Turner, A., Blanco, J., O'Neil, A., Mancera-Flores, J., Perez-Brunius, P., Rivas, D., Almazan-Becerril, A. and Pena-Manjarrez, J. L. (2014) Lipophilic toxins in cultivated mussels (*Mytilus galloprovincialis*) from Baja California, Mexico. *Toxicon* 90, 111-123. http://dx.doi.org/10.1016/j.toxicon.2014.07.017

Hine, P. M., Carnegie, R. B., Kroeck, M. A., Villalba, A., Engelsma, M. Y. and Burreson, E. M. (2014) Ultrastructural comparison of *Bonamia* spp. (Haplosporidia) infecting ostreid oysters. *Diseases of Aquatic Organisms* 110 (1-2), 55-63. http://dx.doi.org/10.3354/dao02747

Iglesias, J., Pazos, G., Fernandez, J., Sanchez, F. J., Otero, J. J., Domingues, P., Lago, M. J. and Linares, F. (2014) The effects of using crab zoeae (*Maja brachydactyla*) on growth and biochemical composition of *Octopus vulgaris* (Cuvier 1797) paralarvae. *Aquaculture International* 22 (3), 1041-1051. http://dx.doi.org/10.1007/s10499-013-9725-7

Martin-Gomez, L., Villalba, A., Carballal, M. J. and Abollo, E. (2014) Cloning and characterization of neoplasia-related genes in flat oyster *Ostrea edulis*. *Infection Genetics and Evolution* 23, 138-149. http://dx.doi.org/10.1016/j.meegid.2014.02.004

Martin-Gomez, L., Villalba, A., Carballal, M. J. and Abollo, E. (2014) Molecular characterisation of TNF, AIF, dermatopontin and VAMP genes of the flat oyster *Ostrea edulis* and analysis of their modulation by diseases. *Gene* 533 (1), 208-217. http://dx.doi.org/10.1016/j.gene.2013.09.085

Martin-Gomez, L., Villalba, A., Kerkhoven, R. H. and Abollo, E. (2014) Role of microRNAs in the immunity process of the flat oyster *Ostrea edulis* against bonamiosis. *Infection Genetics and Evolution* 27, 40-50. http://dx.doi.org/10.1016/j.meegid.2014.06.026

Matias, A. M., Diaz, S., de Sousa, J. T., Villalba, A., Carballal, M. J. and Leitao, A. (2014) Karyotype variation in neoplastic cells associated to severity of disseminated neoplasia in the cockle *Cerastoderma edule*. *Aquaculture* 428, 223-225. http://dx.doi.org/10.1016/j.aquaculture.2014.03.017

Ramilo, A., Gonzalez, M., Carballal, M. J., Darriba, S., Abollo, E. and Villalba, A. (2014) Oyster parasites *Bonamia ostreae* and *B. exitiosa* co-occur in Galicia (NW Spain): spatial distribution and infection dynamics. *Diseases of Aquatic Organisms* 110 (1-2), 123-133. http://dx.doi.org/10.3354/dao02673

Ramilo, A., Iglesias, D., Abollo, E., Gonzylez, M., Darriba, S. and Villalba, A. (2014) Infection of Manila clams *Ruditapes philippinarum* from Galicia (NW Spain) with a *Mikrocytos*-like parasite. *Diseases of Aquatic Organisms* 110 (1-2), 71-79. http://dx.doi.org/10.3354/dao02737

Ramilo, A., Villalba, A. and Abollo, E. (2014) Species-specific oligonucleotide probe for detection of *Bonamia exitiosa* (Haplosporidia) using in situ hybridisation assay. *Diseases of Aquatic Organisms* 110 (1-2), 81-91. http://dx.doi.org/10.3354/dao02646

Reguera, B., Riobo, P., Rodriguez, F., Diaz, P. A., Pizarro, G., Paz, B., Franco, J. M. and Blanco, J. (2014) *Dinophysis* Toxins: Causative Organisms, Distribution and Fate in Shellfish. *Marine Drugs* 12 (1), 394-461. http://dx.doi.org/10.3390/md12010394

Villalba, A., Iglesias, D., Ramilo, A., Darriba, S., Parada, J. M., No, E., Abollo, E., Molares, J. and Carballal, M. J. (2014) Cockle *Cerastoderma edule* fishery collapse in the Ria de Arousa (Galicia, NW Spain) associated with the protistan parasite *Marteilia cochillia*. *Diseases of Aquatic Organisms* 109 (1), 55-80. http://dx.doi.org/10.3354/dao02723

2015

Alvarez, G., Uribe, E., Regueiro, J., Martin, H., Gajardo, T., Jara, L. and Blanco, J. (2015) Depuration and anatomical distribution of domoic acid in the surf clam *Mesodesma donacium*. *Toxicon* 102, 1-7. http://dx.doi.org/10.1016/j.toxicon.2015.05.011

Blanco, J., Arevalo, F., Correa, J., Porro, M. C., Cabado, A. G., Vieites, J. M. and Morono, A. (2015) Effect of the industrial steaming on the toxicity, estimated by LC-MS/MS, of mussels exposed for a long time to diarrhetic shellfish poisoning (DSP) toxins. *Food Chemistry* 177, 240-247. http://dx.doi.org/10.1016/j.foodchem.2015.01.012

Carballal, M. L., Barber, B. J., Iglesias, D. and Villalba, A. (2015) Neoplastic diseases of marine bivalves. *Journal of Invertebrate Pathology* 131, 83-106. http://dx.doi.org/10.1016/j.jip.2015.06.004

da Costa, F., Barreiro, B., Ojea, J., Novoa, S. and Martinez-Patino, D. (2015) Effects of stocking density on intermediate culture of the razor clam *Ensis arcuatus* (Pharidae: Bivalvia). *Aquaculture Research* 46 (8), 1858-1865. http://dx.doi.org/10.1111/are.12341

Dubert, J., Fernandez-Pardo, A., Novoa, S., Barja, J. L. and Prado, S. (2015) Phytoplankton production systems in a shellfish hatchery: variations of the bacterial load and diversity of vibrios. *Journal of Applied Microbiology* 118 (6), 1264-1275. http://dx.doi.org/10.1111/jam.12787

Fernandez-Boo, S., Villalba, A. and Cao, A. (2015) Variable protein profiles in extracellular products of the protistan parasite *Perkinsus olseni* among regions of the Spanish coast. *Journal of Invertebrate Pathology* 132, 233-241. http://dx.doi.org/10.1016/j.jip.2015.11.003

Fernandez-Boo, S., Villalba, A. and Cao, A. (2015) Cell proteome variability of protistan mollusc parasite *Perkinsus olseni* among regions of the Spanish coast. *Diseases of Aquatic Organisms* 113 (3), 245-256. http://dx.doi.org/10.3354/dao02835

Pino-Querido, A., Alvarez-Castro, J. M., Guerra-Varela, J., Toro, M. A., Vera, M., Pardo, B. G., Fuentes, J., Blanco, J. and Martinez, P. (2015) Heritability estimation for okadaic acid algal toxin accumulation, mantle color and growth traits in Mediterranean mussel (*Mytilus galloprovincialis*). *Aquaculture* 440, 32-39. http://dx.doi.org/10.1016/j.aquaculture.2015.01.032

Pino-Querido, A., Alvarez-Castro, J. M., Vera, M., Pardo, B. G., Fuentes, J. and Martinez, P. (2015) A molecular tool for parentage analysis in the Mediterranean mussel (*Mytilus galloprovincialis*). *Aquaculture Research* 46 (7), 1721-1735. http://dx.doi.org/10.1111/are.12329

Ramilo, A., Carrasco, N., Reece, K. S., Valencia, J. M., Grau, A., Aceituno, P., Rojas, M., Gairin, I., Furones, M. D., Abollo, E. and Villalba, A. (2015) Update of information on perkinsosis in NW Mediterranean coast: Identification of *Perkinsus* spp. (Protista) in new locations and hosts. *Journal of Invertebrate Pathology* 125, 37-41. http://dx.doi.org/10.1016/j.jip.2014.12.008

Ruiz, M., Darriba, S., Rodriguez, R. and Lopez, C. (2015) *Marteilia* sp. and other parasites and pathological conditions in *Solen marginatus* populations along the Galician coast (NW Spain). *Diseases of Aquatic Organisms* 112 (3), 177-184. http://dx.doi.org/10.3354/dao02805

2016

Alvarez, G., Uribe, E., Regueiro, J., Blanco, J. and Fraga, S. (2016) *Gonyaulax taylorii*, a new yessotoxins-producer dinoflagellate species from Chilean waters. *Harmful Algae* 58, 8-15. http://dx.doi.org/10.1016/j.hal.2016.07.006

Blanco, J., Arevalo, F., Correa, J., Corina Porro, M., Cabado, A. G., Vieites, J. M. and Morono, A. (2016) Effect of the industrial canning on the toxicity of mussels contaminated with diarrhetic shellfish poisoning (DSP) toxins. *Toxicon* 112, 1-7. http://dx.doi.org/10.1016/j.toxicon.2016.01.061

Calvo-Iglesias, J., Perez-Estevez, D., Lorenzo-Abalde, S., Sanchez-Correa, B., Isabel Quiroga, M., Fuentes, J. M. and Gonzalez-Fernandez, A. (2016) Characterization of a Monoclonal Antibody Directed against *Mytilus spp* Larvae Reveals an Antigen Involved in Shell Biomineralization. *Plos One* 11 (3), 17. http://dx.doi.org/10.1371/journal.pone.0152210

Carballal, M. J., Iglesias, D., Darriba, S., Cao, A., Mariño, J. C., Ramilo, A., No, E. and Villalba, A. (2016) Parasites, pathological conditions and resistance to *Marteilia cochillia* in lagoon cockle *Cerastoderma glaucum* from Galicia (NW Spain). *Diseases of Aquatic Organisms* 122 (2), 137-152. http://dx.doi.org/10.3354/dao03070

Diaz, S., Iglesias, D., Villalba, A. and Carballal, M. J. (2016) Long-term epidemiological study of disseminated neoplasia of cockles in Galicia (NW Spain): temporal patterns at individual and population levels, influence of environmental and cockle-based factors and lethality. *Journal of Fish Diseases* 39 (9), 1027-1042. http://dx.doi.org/10.1111/jfd.12436

Dubert, J., da Costa, F., Aranda-Burgos, J. A., Martinez-Patino, D., Prado, S. and Barja, J. L. (2016) Beneficial effects of carpet shell clam (*Ruditapes decussatus*) depuration during short periods of conditioning in shellfish hatchery: Role of the temperature and phytoplankton on reduction and diversity of vibrios. *Aquaculture* 459, 65-72. http://dx.doi.org/10.1016/j.aquaculture.2016.03.030

Fernandez-Boo, S., Villalba, A. and Cao, A. (2016) Protein expression profiling in haemocytes and plasma of the Manila clam *Ruditapes philippinarum* in response to infection with *Perkinsus olseni*. *Journal of Fish Diseases* 39 (11), 1369-1385. http://dx.doi.org/10.1111/jfd.12470

Fernandez-Pardo, A., da Costa, F., Rial, D., Novoa, S., Martinez-Patino, D. and Antonio Vazquez, J. (2016) Use of response surface methodology to determine optimum diets for *Venerupis corrugata* larvae: effects of ration and microalgal assemblages. *Aquaculture* 452, 283-290. http://dx.doi.org/10.1016/j.aquaculture.2015.11.005

Hasanuzzaman, A. F. M., Robledo, D., Gomez-Tato, A., Alvarez-Dios, J. A., Harrison, P. W., Cao, A., Fernandez-Boo, S., Villalba, A., Pardo, B. G. and Martinez, P. (2016) *De novo* transcriptome assembly of *Perkinsus olseni* trophozoite stimulated *in vitro* with Manila clam (*Ruditapes philippinarum*) plasma. *Journal of Invertebrate Pathology* 135, 22-33. http://dx.doi.org/10.1016/j.jip.2016.01.009

Metzger, M. J., Villalba, A., Carballal, M. J., Iglesias, D., Sherry, J., Reinisch, C., Muttray, A. F., Baldwin, S. A. and Goff, S. P. (2016) Widespread transmission of independent cancer lineages within multiple bivalve species. *Nature* 534 (7609), 705-709. http://dx.doi.org/10.1038/nature18599

Pardo, B. G., Antonio Alvarez-Dios, J., Cao, A., Ramilo, A., Gomez-Tato, A., Planas, J. V., Villalba, A. and Martinez, P. (2016) Construction of an *Ostrea edulis* database from genomic and expressed sequence tags (ESTs) obtained from *Bonamia ostreae* infected haemocytes: Development of an immune-enriched oligo-microarray. *Fish & Shellfish Immunology* 59, 331-344. http://dx.doi.org/10.1016/j.fsi.2016.10.047

Quijano-Scheggia, S., Barajas-Gonzalez, M., Lim, H. C., Leaw, C. P., Olivos-Ortiz, A., Gavino-Rodriguez, J., Blanco Perez, J. and Bates, S. S. (2016) The inhibitory effect of a non-yessotoxin-producing dinoflagellate, *Lingulodinium polyedrum* (Stein) Dodge, towards *Vibrio vulnificus* and *Staphylococcus aureus*. *Revista De Biologia Tropical* 64 (2), 805-816. http://dx.doi.org/10.15517/rbt.v64i2.19320

Ramilo, A., Pintado, J., Villalba, A. and Abollo, E. (2016) *Perkinsus olseni* and P. *chesapeaki* detected in a survey of perkinsosis of various clam species in Galicia (NW Spain) using PCR-DGGE as a screening tool. *Journal of Invertebrate Pathology* 133, 50-58. http://dx.doi.org/10.1016/j.jip.2015.11.012

Ruiz, M., Lopez, C., Lee, R.-S., Rodriguez, R. and Darriba, S. (2016) A novel paramyxean parasite, *Marteilia octospora* n. sp (Cercozoa) infecting the Grooved Razor Shell clam *Solen marginatus* from Galicia (NW Spain). *Journal of Invertebrate Pathology* 135, 34-42. http://dx.doi.org/10.1016/j.jip.2016.02.002

Tenorio, C., Uribe, E., Gil-Kodaka, P., Blanco, J. and Alvarez, G. (2016) Morphological and toxicological studies of *Pseudo-nitzschia* species from the central coast of Peru. *Diatom Research* 31 (4), 331-338. http://dx.doi.org/10.1080/0269249x.2016.1247018

Vera, M., Carlsson, J., El Carlsson, J., Cross, T., Lynch, S., Kamermans, P., Villalba, A., Culloty, S. and Martinez, P. (2016) Current genetic status, temporal stability and structure of the remnant wild European flat oyster populations: conservation and restoring implications. *Marine Biology* 163 (12), 17. http://dx.doi.org/10.1007/s00227-016-3012-x

Villalba, A. (2016) What's new in bivalve mollusc pathology? Overview of articles published in the last two years. *Bulletin of the European Association of Fish Pathologists* 36 (1), 24-37. https://eafp.org/download/2016-volume36/issue_1/36-1-026-villalba.pdf

2017

Afonso, C., Cardoso, C., Freire, M., Silva, I. E., Linares, F., Villanueva, J. L. R., Valente, L. M. P. and Bandarra, N. M. (2017) The impact of alternative dietary lipids on the *in vitro* bioaccessibility of sole fillets for human consumption. *Aquaculture* 474, 66-74. http://dx.doi.org/10.1016/j.aquaculture.2017.03.040

Amaro, R., Bouza, C., Pardo, B. G., Castro, J., San Miguel, E., Villalba, A., Lois, S., Outeiro, A. and Ondina, P. (2017) Identification of novel gender-associated mitochondrial haplotypes in *Margaritifera margaritifera* (Linnaeus, 1758). *Zoological Journal of the Linnean Society* 179 (4), 738-750. http://dx.doi.org/10.1111/zoj.12472

Blanco, J., Arevalo, F., Morono, A., Correa, J., Muniz, S., Marino, C. and Martin, H. (2017) Presence of azaspiracids in bivalve molluscs from Northern Spain. *Toxicon* 137, 135-143. http://dx.doi.org/10.1016/j.toxicon.2017.07.025

Blanco, J., Martin, H. and Marino, C. (2017) Reduction of diarrhetic shellfish poisoning (DSP) toxins accumulation in cultured mussels by means of rope clustering and hydrodynamic barriers. *Aquaculture* 479, 120-124. http://dx.doi.org/10.1016/j.aquaculture.2017.05.034

Diaz, S., Villalba, A. and Carballal, M. J. (2017) Assessment of transmissibility of the disseminated neoplasia affecting cockles *Cerastoderma edule* in Galicia (NW Spain). *Bulletin of the European Association of Fish Pathologists* 37 (1), 5-15. https://eafp.org/download/2017-volume37/issue_1/37-1-005-villalba.pdf

Hasanuzzaman, A. F. M., Robledo, D., Gomez-Tato, A., Alvarez Dios, J. A., Harrison, P. W., Cao, A., Fernández-Boo, S., Villalba, A., Pardo, B. G. and Martínez, P. (2017) Transcriptomic profile of Manila clam (*Ruditapes philippinarum*) haemocytes in response to *Perkinsus olseni* infection. *Aquaculture* 467, 170-181. http://dx.doi.org/10.1016/j.aquaculture.2016.06.007

Mendes, M. C. D., Nunes, J. M. C., Menezes, M., Fraga, S., Rodriguez, F., Vazquez, J. A., Blanco, J., Franco, J. M. and Riobo, P. (2017) Toxin production, growth kinetics and molecular characterization of *Ostreopsis* cf. *ovata* isolated from Todos os Santos Bay, tropical southwestern Atlantic. *Toxicon* 138, 18-30. http://dx.doi.org/10.1016/j.toxicon.2017.08.007

Nanton, A., Arias-Perez, A., Freire, R., Fernandez-Perez, J., Novoa, S. and Mendez, J. (2017) Microsatellite variation in *Donax trunculus* from the Iberian Peninsula, with particular attention to Galician estuaries (NW Spain). *Estuarine Coastal and Shelf Science* 197, 27-34. http://dx.doi.org/10.1016/j.ecss.2017.08.011

Pazos, A. J., Ventoso, P., Martinez-Escauriaza, R., Perez-Paralle, M. L., Blanco, J., Trivino, J. C. and Sanchez, J. L. (2017) Transcriptional response after exposure to domoic acid-producing *Pseudo-nitzschia* in the digestive gland of the mussel *Mytilus galloprovincialis*. *Toxicon* 140, 60-71. http://dx.doi.org/10.1016/j.toxicon.2017.10.002

Stentiford, G. D., Ramilo, A., Abollo, E., Kerr, R., Bateman, K. S., Feist, S. W., Bass, D. and Villalba, A. (2017) *Hyperspora aquatica* n.gn., n.sp (Microsporidia), hyperparasitic in *Marteilia cochillia* (Paramyxida), is closely related to crustacean-infecting microspordian taxa. *Parasitology* 144 (2), 186-199. http://dx.doi.org/10.1017/s0031182016001633

Tillmann, U., Jaen, D., Fernandez, L., Gottschling, M., Witt, M., Blanco, J. and Krock, B. (2017) *Amphidoma languida* (Amphidomatacea, Dinophyceae) with a novel azaspiracid toxin profile identified as the cause of molluscan contamination at the Atlantic coast of southern Spain. *Harmful Algae* 62, 113-126. http://dx.doi.org/10.1016/j.hal.2016.12.001

Vázquez-Luis, M., Álvarez, E., Barrajón, A., García-March, J. R., Grau, A., Hendriks, I. E., Jiménez, S., Kersting, D., Moreno, D., Pérez, M., Ruiz, J. M., Sánchez, J., Villalba, A. and Deudero, S. (2017) S.O.S. *Pinna nobilis*: A Mass Mortality Event in Western Mediterranean Sea. *Frontiers in Marine Science* 4, 6. http://dx.doi.org/10.3389/fmars.2017.00220

2018

Blanco, J. (2018) Accumulation of *Dinophysis* Toxins in Bivalve Molluscs. *Toxins* 10 (11), 27. http://dx.doi.org/10.3390/toxins10110453

Blanco, J., Alvarez, G., Rengel, J., Diaz, R., Marino, C., Martin, H. and Uribe, E. (2018) Accumulation and Biotransformation of *Dinophysis* Toxins by the Surf Clam *Mesodesma donacium*. *Toxins* 10 (8), 13. http://dx.doi.org/10.3390/toxins10080314

Blanco, J., Martin-Morales, E. and Alvarez, G. (2018) Stability of okadaic acid and 13-desmethyl spirolide C in seawater and sediment. *Marine Chemistry* 207, 21-25. http://dx.doi.org/10.1016/j.marchem.2018.10.007

Catanese, G., Grau, A., Valencia, J. M., Garcia-March, J. R., Vazquez-Luis, M., Alvarez, E., Deudero, S., Darriba, S., Carballal, M. J. and Villalba, A. (2018) *Haplosporidium pinnae* sp nov., a haplosporidan parasite associated with mass mortalities of the fan mussel, *Pinna nobilis*, in the Western Mediterranean Sea. *Journal of Invertebrate Pathology* 157, 9-24. http://dx.doi.org/10.1016/j.jip.2018.07.006

Conde-Sieira, M., Gesto, M., Batista, S., Linares, F., Villanueva, J. L. R., Miguez, J. M., Soengas, J. L. and Valente, L. M. P. (2018) Influence of vegetable diets on physiological and immune responses to thermal stress in Senegalese sole (*Solea senegalensis*). *Plos One* 13 (3), 23. http://dx.doi.org/10.1371/journal.pone.0194353

de la Ballina, N. R., Villalba, A. and Cao, A. (2018) Proteomic profile of *Ostrea edulis* haemolymph in response to bonamiosis and identification of candidate proteins as resistance markers. *Diseases of Aquatic Organisms* 128 (2), 127-145. http://dx.doi.org/10.3354/dao03220

Garcia-Portela, M., Riobo, P., Reguera, B., Garrido, J. L., Blanco, J. and Rodriguez, F. (2018) Comparative ecophysiology of *Dinophysis acuminata* and *D. acuta* (DINOPHYCEAE, DINOPHYSIALES): effect of light intensity and quality on growth, cellular toxin content, and photosynthesis. *Journal of Phycology* 54 (6), 899-917. http://dx.doi.org/10.1111/jpy.12794

Hasanuzzaman, A. F. M., Rubiolo, J. A., Robledo, D., Gomez-Tato, A., Alvarez-Dios, J. A., Fernandez-Boo, S., Cao, A., Villalba, A., Pardo, B. G. and Martinez, P. (2018) Gene expression analysis of *Ruditapes philippinarum* haemocytes after experimental *Perkinsus olseni* zoospore challenge and infection in the wild. *Fish & Shellfish Immunology* 72, 611-621. http://dx.doi.org/10.1016/j.fsi.2017.11.033

Kerr, R., Ward, G. M., Stentiford, G. D., Alfjorden, A., Mortensen, S., Bignell, J. P., Feist, S. W., Villalba, A., Carballal, M. J., Cao, A., Arzul, I., Ryder, D. and Bass, D. (2018) *Marteilia refringens* and *Marteilia pararefringens* sp. nov. are distinct parasites of bivalves and have different European distributions. *Parasitology* 145 (11), 1483-1492. http://dx.doi.org/10.1017/s003118201800063x

Moutinho, S., Linares, F., Rodriguez, J. L., Sousa, V. and Valente, L. M. P. (2018) Inclusion of 10% seaweed meal in diets for juvenile and on-growing life stages of Senegalese sole (*Solea senegalensis*). *Journal of Applied Phycology* 30 (6), 3589-3601. http://dx.doi.org/10.1007/s10811-018-1482-6

Mylonas, C. C., Rodríguez, J. L., Linares, F., Pazos, G., Pérez-Rial, E., Lluch, N., Perez, M., Álvarez-Blázquez, B., Vilar, A. and Robles, R. (2018) Breakthrough in the reproduction and larval rearing of wreckfish in the DIVERSIFY project. *Aquaculture Europe* 43 (2), 14-16. http://hdl.handle.net/10261/315707

Papadaki, M., Peleteiro, J. B., Alvarez-Blázquez, B., Villanueva, J. L. R., Linares, F., Vilar, A., Rial, E. P., Lluch, N., Fakriadis, I., Sigelaki, I. and Mylonas, C. C. (2018) Description of the Annual Reproductive Cycle of Wreckfish *Polyprion americanus* in Captivity. *Fishes* 3 (4), 43. http://dx.doi.org/10.3390/fishes3040043

Paredes-Banda, P., Garcia-Mendoza, E., Ponce-Rivas, E., Blanco, J., Almazan-Becerril, A., Galindo-Sanchez, C. and Cembella, A. (2018) Association of the Toxigenic Dinoflagellate *Alexandrium ostenfeldii* With Spirolide Accumulation in Cultured Mussels (*Mytilus galloprovincialis*) From Northwest Mexico. *Frontiers in Marine Science* 5, 14. http://dx.doi.org/10.3389/fmars.2018.00491

Pazos, G., Fernandez, J., Linares, F., Sanchez, J., Otero, J. J., Iglesias, J. and Domingues, P. (2018) The complete life cycle in captivity of the spider crab, *Maja brachydactyla*, Herbst 1788. *Aquaculture Research* 49 (7), 2440-2445. http://dx.doi.org/10.1111/are.13703

Ramilo, A., Abollo, E., Villalba, A. and Carballal, M. J. (2018) A *Minchinia mercenariae*-like parasite infects cockles *Cerastoderma edule* in Galicia (NW Spain). *Journal of Fish Diseases* 41 (1), 41-48. http://dx.doi.org/10.1111/jfd.12668

Ronza, P., Cao, A., Robledo, D., Gomez-Tato, A., Alvarez-Dios, J. A., Hasanuzzaman, A. F. M., Quiroga, M. I., Villalba, A., Pardo, B. G. and Martinez, P. (2018) Long-term affected flat oyster (*Ostrea edulis*) haemocytes show differential gene expression profiles from naive oysters in response to *Bonamia ostreae*. *Genomics* 110 (6), 390-398. http://dx.doi.org/10.1016/j.ygeno.2018.04.002

2019

Alvarez, G., Diaz, P. A., Godoy, M., Araya, M., Ganuza, I., Pino, R., Alvarez, F., Rengel, J., Hernandez, C., Uribe, E. and Blanco, J. (2019) Paralytic Shellfish Toxins in Surf Clams *Mesodesma donacium* during a Large Bloom of *Alexandrium catenella* Dinoflagellates Associated to an Intense Shellfish Mass Mortality. *Toxins* 11 (4), 18. http://dx.doi.org/10.3390/toxins11040188

Blanco, J., Arevalo, F., Correa, J. and Morono, A. (2019) Lipophilic Toxins in Galicia (NW Spain) between 2014 and 2017: Incidence on the Main Molluscan Species and Analysis of the Monitoring Efficiency. *Toxins* 11 (10), 23. http://dx.doi.org/10.3390/toxins11100612

Blanco, J., Martin, H., Marino, C. and Rossignoli, A. E. (2019) Simple Diffusion as the Mechanism of Okadaic Acid Uptake by the Mussel Digestive Gland. *Toxins* 11 (7), 11. http://dx.doi.org/10.3390/toxins11070395

Lamas, J. P., Arevalo, F., Morono, A., Correa, J., Muniz, S. and Blanco, J. (2019) Detection and Spatio-Temporal Distribution of Pinnatoxins in Shellfish from the Atlantic and Cantabrian Coasts of Spain. *Toxins* 11 (6), 11. http://dx.doi.org/10.3390/toxins11060340

Maroso, F., de Gracia, C. P., Iglesias, D., Cao, A., Diaz, S., Villalba, A., Vera, M. and Martinez, P. (2019) A Useful SNP Panel to Distinguish Two Cockle Species, *Cerastoderma edule* and *C. glaucum*, Co-Occurring in Some European Beds, and Their Putative Hybrids. *Genes* 10 (10), 10. http://dx.doi.org/10.3390/genes10100760

Pereira, R., Basto, A., Conde-Sieira, M., Linares, F., Villanueva, J. L. R., Sieira, G. P., Soengas, J. L. and Valente, L. M. P. (2019) Growth performance and nutrient utilisation of Senegalese sole fed vegetable oils in plant protein-rich diets from juvenile to market size. *Aquaculture* 511, 9. http://dx.doi.org/10.1016/j.aquaculture.2019.734229

Pérez, E., Linares, F., Rodríguez Villanueva, J., Vilar, A., Mylonas, C., Fakriadis, I., Papadaki, M., Papandroulakis, N., Papadakis, I., Robles, R., Fauvel, C., Roo, J., Peleteiro, J., Lluch, N., Pazos, G., Méndez, B., Sigelaki, I., Gómez, C., Pérez, M. and Álvarez-Blázquez, B. (2019) Wreckfish (*Polyprion americanus*). New Knowledge About Reproduction, Larval Husbandry, and Nutrition. Promise as a New Species for Aquaculture. *Fishes* 4 (1), 14. http://dx.doi.org/10.3390/fishes4010014

Roldan, C., Villalba, A. and Vieitez, J. M. (2019) A new solitary, interstitial species of Loxosomatidae (Entoprocta) from the coast of Galicia (NW Spain), *Loxosoma discoides* n. sp. *Zootaxa* 4604 (2), 388-394. http://dx.doi.org/10.11646/zootaxa.4604.2.11

Ventoso, P., Pazos, A. J., Perez-Paralle, M. L., Blanco, J., Trivino, J. C. and Sanchez, J. L. (2019) RNA-Seq Transcriptome Profiling of the Queen Scallop (*Aequipecten opercularis*) Digestive Gland after Exposure to Domoic Acid-Producing *Pseudo-nitzschia*. *Toxins* 11 (2), 26. http://dx.doi.org/10.3390/toxins11020097

Vera, M., Pardo, B. G., Cao, A., Vilas, R., Fernandez, C., Blanco, A., Gutierrez, A. P., Bean, T. P., Houston, R. D., Villalba, A. and Martinez, P. (2019) Signatures of selection for bonamiosis resistance in European flat oyster (*Ostrea edulis*): New genomic tools for breeding programs and management of natural resources. *Evolutionary Applications* 12 (9), 1781-1796. http://dx.doi.org/10.1111/eva.12832

2020

Álvarez, G., Rengel, J., Álvarez, F., Ganuza, I., Pino, R., Muñoz, P., Rosales, S., Hevia, V., Araya, M., Díaz, P. A., Rivera, A. and Blanco, J. (2020) Mass mortality of marine invertebrates associated with the presence of yesso-toxins in northern Chile. *Harmful Algae News* (64), 6-7. https://unesdoc.unesco.org/ark:/48223/pf0000373644.locale=es

Alvarez, G., Rengel, J., Araya, M., Alvarez, F., Pino, R., Uribe, E., Diaz, P. A., Rossignoli, A. E., Lopez-Rivera, A. and Blanco, J. (2020) Rapid Domoic Acid Depuration in the Scallop *Argopecten purpuratus* and Its Transfer from the Digestive Gland to Other Organs. *Toxins* 12 (11). http://dx.doi.org/10.3390/toxins12110698

Ben-Gigirey, B., Rossignoli, A. E., Riobo, P. and Rodriguez, F. (2020) First Report of Paralytic Shellfish Toxins in Marine Invertebrates and Fish in Spain. *Toxins* 12 (11). http://dx.doi.org/10.3390/toxins12110723

Blanco, J., Mauriz, A. and Alvarez, G. (2020) Distribution of Domoic Acid in the Digestive Gland of the King Scallop *Pecten maximus*. *Toxins* 12 (6), 11. http://dx.doi.org/10.3390/toxins12060371

Cano, I., Ryder, D., Webb, S. C., Jones, B. J., Brosnahan, C. L., Carrasco, N., Bodinier, B., Furones, D., Pretto, T., Carella, F., Chollet, B., Arzul, I., Cheslett, D., Collins, E., Lohrmann, K. B., Valdivia, A. L., Ward, G., Carballal, M. J., Villalba, A., Marigómez, I., Mortensen, S., Christison, K., Kevin, W. C., Bustos, E., Christie, L., Green, M. and Feist, S. W. (2020) Cosmopolitan Distribution of *Endozoicomonas*-Like Organisms and Other Intracellular Microcolonies of Bacteria Causing Infection in Marine Mollusks. *Frontiers in Microbiology* 11, 577481. http://dx.doi.org/10.3389/fmicb.2020.577481

Carballal, M. J., Cao, A., Iglesias, D., Gonzalez, A. I. and Villalba, A. (2020) Temporal dynamics of infection of cockles *Cerastoderma edule* with the protistan parasite *Minchinia tapetis* (Rhizaria: Haplosporida) in Galicia (NW Spain). *Journal of Invertebrate Pathology* 172, 107349. http://dx.doi.org/10.1016/j.jip.2020.107349

Chacon, G. M., Arias-Perez, A., Freire, R., Martinez, L., Novoa, S., Naveira, H. and Insua, A. (2020) Evidence of doubly uniparental inheritance of the mitochondrial DNA in *Polititapes rhomboides* (Bivalvia, Veneridae): Evolutionary and population genetic analysis of F and M mitotypes. *Journal of Zoological Systematics and Evolutionary Research* 58 (2), 541-560. http://dx.doi.org/10.1111/jzs.12267

Charles, M., Bernard, I., Villalba, A., Oden, E., Burioli, E. A. V., Allain, G., Trancart, S., Bouchart, V. and Houssin, M. (2020) High mortality of mussels in northern Brittany - Evaluation of the involvement of pathogens, pathological conditions and pollutants. *Journal of Invertebrate Pathology* 170, 107308. http://dx.doi.org/10.1016/j.jip.2019.107308

Charles, M., Villalba, A., Meyer, G., Trancart, S., Lagy, C., Bernard, I. and Houssin, M. (2020) First detection of *Francisella halioticida* in mussels *Mytilus* spp. experiencing mortalities in France. *Diseases of aquatic organisms* 140, 203-208. http://dx.doi.org/10.3354/dao03505

Darriba, S., Iglesias, D. and Carballal, M. J. (2020) *Marteilia cochillia* is released into seawater via cockle *Cerastoderma edule* faeces. *Journal of Invertebrate Pathology* 172, 5. http://dx.doi.org/10.1016/j.jip.2020.107364

Darriba, S., Lee, R.-S. and Lopez, C. (2020) *Mikrocytos mytilicoli* n.sp. (Cercozoa, Mikrocytida, Mikrocytiidae) infecting the copepod *Mytilicola intestinalis* (Arthropoda, Cyclopoida, Mytilicolidae), a symbiont of *Mytilus galloprovincialis* in Galicia (NW Spain). *Journal of Invertebrate Pathology* 176. http://dx.doi.org/10.1016/j.jip.2020.107460

de la Ballina, N. R., Villalba, A. and Cao, A. (2020) Differences in proteomic profile between two haemocyte types, granulocytes and hyalinocytes, of the flat oyster *Ostrea edulis*. *Fish & Shellfish Immunology* 100, 456-466. http://dx.doi.org/10.1016/j.fsi.2020.03.033

Hasanuzzaman, A. F. M., Cao, A., Ronza, P., Fernandez-Boo, S., Rubiolo, J. A., Robledo, D., Gomez-Tato, A., Antonio Alvarez-Dios, J., Pardo, B. G., Villalba, A. and Martinez, P. (2020) New insights into the Manila clam - *Perkinsus olseni* interaction based on gene expression analysis of clam hemocytes and parasite trophozoites through in vitro challenges. *International Journal for Parasitology* 50 (3), 195-208. http://dx.doi.org/10.1016/j.ijpara.2019.11.008

Sas, H., Deden, B., Kamermans, P., zu Ermgassen, P. S. E., Pogoda, B., Preston, J., Helmer, L., Holbrook, Z., Arzul, I., Have, T., Villalba, A., Colsoul, B., Lown, A., Merk, V., Zwerschke, N. and Reuchlin, E. (2020) *Bonamia* infection in native oysters (*Ostrea edulis*) in relation to European restoration projects. *Aquatic Conservation: Marine and Freshwater Ecosystems* 30 (11), 2150-2162. http://dx.doi.org/10.1002/aqc.3430

Sunesen, I., Rodriguez Hernandez, F., Aguiar Juarez, D., Tardivo Kubis, J. A., Lavigne, A. S., Rossignoli, A., Riobo, P. and Sar, E. A. (2020) Morphology, genetics and toxin profile of *Prorocentrum texanum* (Dinophyceae) from Argentinian marine coastal waters. *Phycologia* 59 (6), 634-650. http://dx.doi.org/10.1080/00318884.2020.1830552

2021

Araújo, R., Vázquez Calderón, F., Sánchez López, J., Azevedo, I. C., Bruhn, A., Fluch, S., Garcia Tasende, M., Ghaderiardakani, F., Ilmjärv, T., Laurans, M., Mac Monagail, M., Mangini, S., Peteiro, C., Rebours, C., Stefansson, T. and Ullmann, J. (2021) Current Status of the Algae Production Industry in Europe: An Emerging Sector of the Blue Bioeconomy. *Frontiers in Marine Science* 7, 24. http://dx.doi.org/10.3389/fmars.2020.626389

Blanco, J., Mariño, C., Martín, H., Álvarez, G. and Rossignoli, A. E. (2021) Characterization of the Domoic Acid Uptake Mechanism of the Mussel (*Mytilus galloprovincialis*) Digestive Gland. *Toxins* 13 (7), 11. http://dx.doi.org/10.3390/toxins13070458

Blanco, J., Morono, A., Arevalo, F., Correa, J., Salgado, C., Rossignoli, A. E. and Lamas, J. P. (2021) Twenty-Five Years of Domoic Acid Monitoring in Galicia (NW Spain): Spatial, Temporal and Interspecific Variations. *Toxins* 13 (11). http://dx.doi.org/10.3390/toxins13110756

de la Ballina, N. R., Villalba, A. and Cao, A. (2021) Shotgun analysis to identify differences in protein expression between granulocytes and hyalinocytes of the European flat oyster *Ostrea edulis*. *Fish & shellfish immunology* 119, 678-691. http://dx.doi.org/10.1016/j.fsi.2021.10.045

Hammel, M., Simon, A., Arbiol, C., Villalba, A., Burioli, E. A. V., Pepin, J. F., Lamy, J. B., Benabdelmouna, A., Bernard, I., Houssin, M., Charriere, G. M., Destoumieux-Garzon, D., Welch, J. J., Metzger, M. J. and Bierne, N. (2021) Prevalence and polymorphism of a mussel transmissible cancer in Europe. *Molecular Ecology* 31 (3), 736-751. http://dx.doi.org/10.1111/mec.16052

Lamas, J. P., Arevalo, F., Morono, A., Correa, J., Rossignoli, A. E. and Blanco, J. (2021) Gymnodimine A in mollusks from the north Atlantic Coast of Spain: Prevalence, concentration, and relationship with spirolides. *Environmental pollution* 279, 116919-116919. http://dx.doi.org/10.1016/j.envpol.2021.116919

Linares, F., Perez Rial, E., Rodriguez, J. L., Pazos, G. and Alvarez-Blazquez, B. (2021) Biometric parameters and biochemical composition of wild wreckfish (*Polyprion americanus*). *Marine Biology Research* 17 (3), 234-246. http://dx.doi.org/10.1080/17451000.2021.1923752

Martinez-Escauriaza, R., Lozano, V., Luz Perez-Paralle, M., Blanco, J., Sanchez, J. L. and Pazos, A. J. (2021) Expression Analyses of Genes Related to Multixenobiotic Resistance in *Mytilus galloprovincialis* after Exposure to Okadaic Acid-Producing *Dinophysis acuminata*. *Toxins* 13 (9). http://dx.doi.org/10.3390/toxins13090614

Patiño, D. M., Otero, J., Louzán, A., Ojea, J., Vázquez, S. N. and Álvarez-Salgado, X. A. (2021) Wedge clam (*Donax trunculus* Linnaeus, 1758) reproduction: reproductive traits and environmental influence in the NW Iberian coast and contrast across Atlantic and Mediterranean waters. *Hydrobiologia* 848 (6), 1347-1366. http://dx.doi.org/10.1007/s10750-021-04532-x

Pita, C., Roumbedakis, K., Fonseca, T., Matos, F. L., Pereira, J., Villasante, S., Pita, P., Bellido, J. M., Gonzalez, A. F., García-Tasende, M., Lefkaditou, E., Adamidou, A., Cuccu, D., Belcari, P., Moreno, A. and Pierce, G. J. (2021) Fisheries for common octopus in Europe: socioeconomic importance and management. *Fisheries Research* 235, 11. http://dx.doi.org/10.1016/j.fishres.2020.105820

Rodriguez-Cabo, T., Morono, A., Arevalo, F., Correa, J., Lamas, J. P., Rossignoli, A. E. and Blanco, J. (2021) Paralytic Shellfish Poisoning (PSP) in Mussels from the Eastern Cantabrian Sea: Toxicity, Toxin Profile, and Co-Occurrence with Cyclic Imines. *Toxins* 13 (11). http://dx.doi.org/10.3390/toxins13110761

Rodriguez-Villegas, C., Diaz, P. A., Riobo, P., Rossignoli, A. E., Rodriguez, F., Loures, P., Baldrich, A. M., Varela, D., Sandoval-Sanhueza, A. and Figueroa, R. I. (2021) Latitudinal Variation in the Toxicity and Sexual Compatibility of *Alexandrium catenella* Strains from Southern Chile. *Toxins* 13 (12), 16. http://dx.doi.org/10.3390/toxins13120900

Rossignoli, A. E., Marino, C., Martin, H. and Blanco, J. (2021) Development of a Fast Liquid Chromatography Coupled to Mass Spectrometry Method (LC-MS/MS) to Determine Fourteen Lipophilic Shellfish Toxins Based on Fused-Core Technology: In-House Validation. *Marine Drugs* 19 (11). http://dx.doi.org/10.3390/md19110603

Tenorio, C., Álvarez, G., Quijano-Scheggia, S., Perez-Alania, M., Arakaki, N., Araya, M., Álvarez, F., Blanco, J. and Uribe, E. (2021) First Report of Domoic Acid Production from *Pseudo-nitzschia multistriata* in Paracas Bay (Peru). *Toxins* 13 (6), 13. http://dx.doi.org/10.3390/toxins13060408

Ventoso, P., Pazos, A. J., Blanco, J., Perez-Paralle, M. L., Trivino, J. C. and Sanchez, J. L. (2021) Transcriptional Response in the Digestive Gland of the King Scallop (*Pecten maximus*) After the Injection of Domoic Acid. *Toxins* 13 (5). http://dx.doi.org/10.3390/toxins13050339

2022

Blanco, J., Martin, H., Marino, C. and Rossignoli, A. E. (2022) Okadaic Acid Depuration from the Cockle *Cerastoderma edule*. *Toxins* 14 (3), 9. http://dx.doi.org/10.3390/toxins14030216

Blanco, J., Morono, A., Arevalo, F., Correa, J., Salgado, C., Pazos, Y., Calvo, S. and Rossignoli, A. E. (2022) Twenty-Five Years of PSP Toxicity in Galician (NW Spain) Bivalves: Spatial, Temporal, and Interspecific Variations. *Toxins* 14 (12), 22. http://dx.doi.org/10.3390/toxins14120837

de la Ballina, N. R., Maresca, F., Cao, A. S. C. and Villalba, A. (2022) Bivalve Haemocyte Subpopulations: A Review. *Frontiers in Immunology* 13, 28. http://dx.doi.org/10.3389/fimmu.2022.826255

Des, M., Gomez-Gesteira, J. L., Decastro, M., Iglesias, D., Sousa, M. C., ElSerafy, G. and Gomez-Gesteira, M. (2022) Historical and future naturalization of *Magallana gigas* in the Galician coast in a context of climate change. *Science of the Total Environment* 838, 10. http://dx.doi.org/10.1016/j.scitotenv.2022.156437

Diaz, P. A., Alvarez, G., Pizarro, G., Blanco, J. and Reguera, B. (2022) Lipophilic Toxins in Chile: History, Producers and Impacts. *Marine Drugs* 20 (2), 30. http://dx.doi.org/10.3390/md20020122

Escobar-Ortega, D., Couceiro, L., Muino, R., No, E. and Fernandez, N. (2022) Insights into Environmental Drivers on the Reproductive Cycle of *Diopatra neapolitana* (Polychaeta: Onuphidae). *Biology-Basel* 11 (10), 14. http://dx.doi.org/10.3390/biology11101504

Grau, A., Villalba, A., Navas, J. I., Hansjosten, B., Valencia, J. M., Garcia-March, J. R., Prado, P., Follana-Berna, G., Morage, T., Vaquez-Luis, M., Alvarez, E., Katharios, P., Pavloudi, C., Nebot-Colomer, E., Tena-Medialdea, J., Lopez-Sanmartin, M., Peyran, C., Cizmek, H., Sarafidou, G., Issaris, Y., Tueney-Kizilkaya, I., Deudero, S., Planes, S. and Catanese, G. (2022) Wide-Geographic and Long-Term Analysis of the Role of Pathogens in the Decline of *Pinna nobilis* to Critically Endangered Species. *Frontiers in Marine Science* 9, 20. http://dx.doi.org/10.3389/fmars.2022.666640

Nogueira, E., Bravo, I., Montero, P., Díaz-Tapia, P., Calvo, S., Ben-Gigirey, B., Figueroa, R. I., Garrido, J. L., Ramilo, I., Lluch, N., Rossignoli, A. E., Riobó, P. and Rodríguez, F. (2022) HABs in coastal upwelling systems: Insights from an exceptional red tide of the toxigenic dinoflagellate *Alexandrium minutum*. *Ecological Indicators* 137, 108790. http://dx.doi.org/10.1016/j.ecolind.2022.108790

Rossignoli, A. E., Lamas, J. P., Marino, C., Martin, H. and Blanco, J. (2022) Enzymatic Biotransformation of *13-desmethyl Spirolide C* by Two Infaunal Mollusk Species: The Limpet *Patella vulgata* and the Cockle *Cerastoderma edule*. *Toxins* 14 (12), 9. http://dx.doi.org/10.3390/toxins14120848

Sambade, I. M., Casanova, A., Blanco, A., Gundappa, M. K., Bean, T. P., Macqueen, D. J., Houston, R. D., Villalba, A., Vera, M., Kamermans, P. and Martinez, P. (2022) A single genomic region involving a putative chromosome rearrangement in flat oyster (*Ostrea edulis*) is associated with differential host resilience to the parasite *Bonamia ostreae*. *Evolutionary Applications* 15 (9), 1408-1422. http://dx.doi.org/10.1111/eva.13446

Skujina, I., Hooper, C., Bass, D., Feist, S. W., Bateman, K. S., Villalba, A., Carballal, M. J., Iglesias, D., Cao, A. S. C., Ward, G. M., Ryder, D. R. G., Bignell, J. P., Kerr, R., Ross, S., Hazelgrove, R., Macarie, N. A., Prentice, M., King, N., Thorpe, J., Malham, S. K., McKeown, N. J. and Ironside, J. E. (2022) Discovery of the parasite *Marteilia cocosarum* sp. nov. In common cockle (*Cerastoderma edule*) fisheries in Wales, UK and its comparison with *Marteilia cochillia*. *Journal of Invertebrate Pathology* 192, 16. http://dx.doi.org/10.1016/j.jip.2022.107786

Tenorio, C., Alvarez, G., Perez-Alania, M., Blanco, J. L., Paulino, C., Blanco, J. and Uribe, E. (2022) Bloom of *Prorocentrum cordatum* in Paracas Bay, Peru. *Diversity-Basel* 14 (10), 15. http://dx.doi.org/10.3390/d14100844

Villalba, A., Skazina, M., Diaz, S., Diz, A. P. and Strelkov, P. (2022) Two branchial pathological conditions, nuclear hypertrophy and abnormal epithelial proliferation, in *Mya arenaria* from northwest Russian coasts. *Diseases of Aquatic Organisms* 152, 139-145. http://dx.doi.org/10.3354/dao03711

2023

Benito, D., Izagirre, U., Lekube, X., Zaldibar, B., Villalba, A., De Montaudouin, X., Daffe, G., Soto, M. and de Cerio, O. D. (2023) Molecular confirmation of pearl formation in arctic mussels (*Mytilus edulis*) caused by *Gymnophallus bursicola* (Odhner 1900) metacercariae. *Parasitology* 150 (11), 1015-1021. http://dx.doi.org/10.1017/s0031182023000860

Blanco, J., Arevalo, F., Morono, A., Correa, J., Rossignoli, A. E. and Lamas, J. P. (2023) Spirolides in Bivalve Mollusk of the Galician (NW Spain) Coast: Interspecific, Spatial, Temporal Variation and Presence of an Isomer of 13-Desmethyl Spirolide C. *Toxins* 15 (1), 14. http://dx.doi.org/10.3390/toxins15010013

Blanco, J., Moroño, A., Arévalo, F., Correa, J. and Lamas, J. P. (2023) Yessotoxins in Mollusks of the Galician Coast from 2014 to 2022: Variability, Biotransformation, and Resistance to Alkaline Hydrolysis. *Toxins* 15 (11), 16. http://dx.doi.org/10.3390/toxins15110661

Bruzos, A. L., Santamarina, M., García-Souto, D., Díaz, S., Rocha, S., Zamora, J., Lee, Y. A., Viña-Feás, A., Quail, M. A., Otero, I., Pequeño-Valtierra, A., Temes, J., Rodriguez-Castro, J., Aramburu, L., Vidal-Capón, A., Villanueva, A., Costas, D., Rodríguez, R., Prieto, T., Tomás, L., Alvariño, P., Alonso, J., Cao, A. S. C., Iglesias, D., Carballal, M. J., Amaral, A. M., Balseiro, P., Calado, R., El Khalfi, B., Izagirre, U., de Montaudouin, X., Pade, N. G., Probert, I., Ricardo, F., Ruiz, P., Skazina, M., Smolarz, K., Pasantes, J. J., Villalba, A., Ning, Z. M., Ju, Y. S., Posada, D., Demeulemeester, J., Baez-Ortega, A. and Tubio, J. M. C. (2023) Somatic evolution of marine transmissible leukemias in the common cockle, *Cerastoderma edule*. *Nature Cancer* 4 (11), 35. http://dx.doi.org/10.1038/s43018-023-00641-9

Iglesias, D., Cao, A. S., Carballal, M. J. and Villalba, A. (2023) Decline of *Marteilia cochillia* in Ria de Arousa may be due to increased resistance in host *Cerastoderma edule*. *Diseases of Aquatic Organisms* 156, 7-13. http://dx.doi.org/10.3354/dao03756

Iglesias, D., Villalba, A., Mariño, C., No, E. and Carballal, M. J. (2023) Long-term survey discloses a shift in the dynamics pattern of an emerging disease of cockles *Cerastoderma edule*, marteiliosis, and raises hypotheses to explain it. *Journal of Invertebrate Pathology* 201, 17. http://dx.doi.org/10.1016/j.jip.2023.108021

Kubis, J. A. T., Rodríguez, F., Rossignoli, A. E., Riobó, P., Juárez, D. A., Sar, E. A. and Sunesen, I. (2023) Morphological, molecular and toxinological analyses of *Alexandrium affine* (Dinophyceae) from marine coastal waters of Buenos Aires Province (Argentina). *Phycologia* 62 (4), 341-351. http://dx.doi.org/10.1080/00318884.2023.2223796

Lunetta, A., Albentosa, M., Nebot-Colomer, E., Pardo, B. G., Martinez, P., Villalba, A., Donato, G., Akinyemi, M. I. and Vazquez-Luis, M. (2023) Assessment of *Ostrea stentina* recruitment and performance in the Mar Menor lagoon (SE Spain). *Regional Studies in Marine Science* 58, 12. http://dx.doi.org/10.1016/j.rsma.2022.102760

Pampín, M., Casanova, A., Fernández, C., Blanco, A., Hermida, M., Vera, M., Pardo, B. G., Coimbra, R. M., Cao, A., Iglesias, D., Carballal, M. J., Villalba, A. and Martínez, P. (2023) Genetic markers associated with divergent selection against the parasite *Marteilia cochillia* in common cockle (*Cerastoderma edule*) using transcriptomics and population genomics data. *Frontiers in Marine Science* 10, 14. http://dx.doi.org/10.3389/fmars.2023.1057206

Parada, J. M. and Molares, J. (2023) Effects of environmental variability on population dynamics of golden carpet shell clam (*Polititapes aureus*). *Academia Biology*. http://dx.doi.org/10.20935/AcadBiol6127

Rossignoli, A. E., Ben-Gigirey, B., Cid, M., Mariño, C., Martín, H., Garrido, S., Rodríguez, F. and Blanco, J. (2023) Lipophilic Shellfish Poisoning Toxins in Marine Invertebrates from the Galician Coast. *Toxins* 15 (11), 15. http://dx.doi.org/10.3390/toxins15110631

Rossignoli, A. E., Mariño, C., Martín, H. and Blanco, J. (2023) First Report of Two Gymnodimines and Two Tetrodotoxin Analogues in Invertebrates from the North Atlantic Coast of Spain. *Marine Drugs* 21 (4), 13. http://dx.doi.org/10.3390/md21040232

Tardivo Kubis, J. A., Rodríguez, F., Rossignoli, A. E., Riobó, P., Sar, E. A. and Sunesen, I. (2023) Morphological, Phylogenetic and Toxinological Characterization of Potentially Harmful Algal Species from the Marine Coastal Waters of Buenos Aires Province (Argentina). *Phycology* 3 (1), 79-105. http://dx.doi.org/10.3390/phycology3010006

Uribe, E., Alvarez, G., Cárcamo, C., Díaz, P. A., Rengel, J. and Blanco, J. (2023) First report of epiphytic dinoflagellate *Coolia malayensis* (Dinophyceae) in the southeastern Pacific Ocean. *Journal of Phycology* 59 (4), 725-737. http://dx.doi.org/10.1111/jpy.13351

Vera, M., Wilmes, S. B., Maroso, F., Hermida, M., Blanco, A., Casanova, A., Iglesias, D., Cao, A., Culloty, S. C., Mahony, K., Orvain, F., Bouza, C., Robins, P. E., Malham, S. K., Lynch, S., Villalba, A. and Martinez, P. (2023) Heterogeneous microgeographic genetic structure of the common cockle (*Cerastoderma edule*) in the Northeast Atlantic Ocean: biogeographic barriers and environmental factors. *Heredity* 131 (4), 292-305. http://dx.doi.org/10.1038/s41437-023-00646-1

Villalba, A., Coimbra, R. M., Pampín, M., Iglesias, D., Costas, D., Mariño, C., Blanco, A., Vera, M., Domínguez, M., Cacabelos, E., Abella, E., Incera, M., Otero, R. F. and Martínez, P. (2023) A common garden experiment supports a genetic component underlying the increased resilience of common cockle (*Cerastoderma edule*) to the parasite *Marteilia cochillia*. *Evolutionary Applications* 16 (11), 1789-1804. http://dx.doi.org/10.1111/eva.13601

2024

Blanco, J., Lamas, J. P., Arévalo, F., Correa, J., Rodríguez-Cabo, T. and Moroño, A. (2024) Paralytic Shellfish Toxins in Mollusks from Galicia Analyzed by a Fast Refined AOAC 2005.06 Method: Toxicity, Toxin Profile, and Inter-Specific, Spatial, and Seasonal Variations. *Toxins* 16 (5), 18. http://dx.doi.org/10.3390/toxins16050230

Orgeira-Crespo, P., Gabín-Sánchez, C., Aguado-Agelet, F. and Rey-González, G. (2024) Novel Algorithm to Detect, Classify, and Count Mussel Larvae in Seawater Samples Using Computer Vision. *Applied Sciences-Basel* 14 (12), 18. http://dx.doi.org/10.3390/app14125113

Parada, J. M. (2024) An inexpensive and lightweight dynamic cone penetrometer for the characterization of shallow submerged sediments. *Aquatic Conservation-Marine and Freshwater Ecosystems* 34 (4), 10. http://dx.doi.org/10.1002/aqc.4146

Parada, J. M., Fernández Besada, M. and Méndez Pérez, B. (2024) Modelled salinity values and episodes of critical salinities over 63 years in an estuary with bivalves of commercial interest. *Discover Oceans* 1 (1), 6. http://dx.doi.org/10.1007/s44289-024-00006-9

Parada, J. M. and Nieto, B. (2024) Quantification of the fishing effort of the artisanal fleet in the Maritime-Terrestrial National Park of the Atlantic Islands of Galicia in the absence of vessel monitoring system. *Regional Studies in Marine Science* 72, 13. http://dx.doi.org/10.1016/j.rsma.2024.103435

Rodríguez, F., Escalera, L., Reguera, B., Nogueira, E., Bode, A., Ruiz-Villarreal, M., Rossignoli, A. E., Ben-Gigirey, B., Rey, V. and Fraga, S. (2024) Red tides in the Galician rías: historical overview, ecological impact, and future monitoring strategies. *Environmental Science-Processes & Impacts* 26 (1), 16-34. http://dx.doi.org/10.1039/d3em00296a

Stout, L., Daffe, G., Chambouvet, A., Correia, S., Culloty, S., Freitas, R., Iglesias, D., Jensen, K. T., Joaquim, S., Lynch, S., Magalhaes, L., Mahony, K., Malham, S. K., Matias, D., Rocroy, M., Thieltges, D. W. and de Montaudouin, X. (2024) Morphological *vs*. molecular identification of trematode species infecting the edible cockle *Cerastoderma edule* across Europe. *International Journal for Parasitology-Parasites and Wildlife* 25, 13. http://dx.doi.org/10.1016/j.ijppaw.2024.101019

2025

Blanco, J., Estévez-Calvar, N. and Martín, H. (2025) Excretion Routes of Okadaic Acid and Dinophysistoxin-2 from Mussels (*Mytilus galloprovincialis*) and Cockles (*Cerastoderma edule*). *Toxins* 17 (3), 128. http://dx.doi.org/10.3390/toxins17030128

Cao, A., Travers, M.-A., Varela, T. and Villalba, A. (2025) Infection with *Vibrio aestuarianus* limits the utility of increasing resistance of Pacific oyster *Crassostrea (Magallana) gigas* against OsHV-1 µVar. *Diseases of aquatic organisms* 161, 55-67. http://dx.doi.org/10.3354/dao03838

Parada, J. M., No-Couto, E. and Santiago, J. A. (2025) Functional groups as ecological indicators of environmental status in intertidal rocky substrates affected by shellfish resource exploitation. *Hydrobiologia*. 14. http://dx.doi.org/10.1007/s10750-025-05827-z

Rey, V., Rossignoli, A. E., Rodríguez, F., Blanco, J., Garrido, S. and Ben-Gigirey, B. (2025) Evaluation of the prevalence of Paralytic Shellfish Toxins in non-traditional vectors and potential health risks associated to their consumption. *Food Control* 176, 111351. https://doi.org/10.1016/j.foodcont.2025.111351

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