CENTRE FOR ENVIRONMENT, FISHERIES AND
AQUACULTURE SCIENCE

SHELLFISH NEWS

Number 21
Spring 2006

Cefas

defra
Department for Environment
Food and Rural Affairs

Cefas is an Executive Agency of the Department for Environment, Food and Rural Affairs (Defra)

- 'Shellfish News' is produced and edited by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) on behalf of the Department for Environment, Food and Rural Affairs (Defra).

- It is published twice yearly (Spring and Autumn) as a service to the British shellfish farming and harvesting industry.

- Copies are available free, on request to the editor. Recent back copies can also be viewed and/or downloaded as .pdf files from the Cefas web site (http://www.cefas.co.uk/Publications/shellfishnews/default.htm).

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Printed in the UK, on material that contains a minimum of 75% recycled fibre.

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CRYOPRESERVATION OF SHELLFISH SPERM, EGGS AND LARVAE

Serean Adams, Cawthron Institute, Nelson, New Zealand

Introduction

For many people, the word "cryopreservation" probably conjures up images of movies such as Austin Powers, but cryopreservation is not just a bit of science fiction: it is the storage of live material at ultra-low temperatures (-196°C). This technique is routinely used as an assisted reproductive technology in human IVF programmes and livestock breeding. Now cryopreservation is being developed and applied in shellfish aquaculture.

In New Zealand, the main shellfish species cultivated are the Pacific oyster (*Crassostrea gigas*) and the Greenshell™ mussel (*Perna canaliculus*). The industry primarily on-grows wild-caught spat but in recent years there has been a move toward using hatchery-produced spat. The Cawthron Institute began selective breeding programmes for Pacific oyster and Greenshell™ mussel in 1998. At the same time, Cawthron initiated a cryopreservation programme, with a view to develop robust cryopreservation methods for sperm, eggs and larvae of these species and others; the main purpose being to provide a powerful tool for selective breeding. Cryopreservation enables breeders to cross parents on demand, any place, any time, even beyond the lifespan of the parent. The costs of having to maintain a large number of family lines over long periods in selective breeding can be reduced through the use of cryopreservation. There are several other advantages that cryopreservation offers to hatchery spat production. For example, it can provide a year-round supply of juveniles, avoiding the unpredictability and costs of conditioning broodstock. It can also be used to maintain genetic diversity or preserve particular strains, and allows transport without risk of spawning and with reduced disease/biosecurity issues.

Success with eggs

Cawthron teamed up with AgResearch and the University of Otago as partners in the cryopreservation programme. The combination of both cryopreservation and shellfish experts proved to be highly successful. The group has developed and published a method for Pacific oyster sperm cryopreservation, and its work on mussel and abalone sperm is also well advanced. In a major breakthrough, the group achieved success with cryopreservation of oyster eggs and published this work last year. Successful egg cryopreservation has never before been achieved for any fish or shellfish species, and is not routinely carried out for any terrestrial species either. The numbers of eggs surviving cryopreservation is high enough for most females that the method is of use for selective breeding. Already, Cawthron's cryopreservation techniques are being integrated into its selective breeding programmes, and a patent application has been filed for the egg freezing technique in the US, New Zealand and Australia.

Developing successful cryopreservation protocols

The tricky part of cryopreservation is not getting cells to survive storage at -196°C, it is getting them through an intermediate temperature range along the way, where processes occurring during cooling and warming can be damaging or lethal to cells. The procedures for cryopreserving any type of cell generally involve five steps: mixing the cells with a cryoprotective agent (chemicals which help cells survive freezing, such as dimethyl sulphoxide and ethylene glycol), cooling to subzero temperatures, storage in liquid nitrogen, and then, when ready for use, thawing and removal of cryoprotective agent. The optimal procedure varies considerably between species and cell types. In general, sperm are regarded as being much easier to freeze than bigger cells such as eggs because they are much smaller and contain less lipid. Because of this, they are also able to tolerate a wider range of freezing conditions.

The method developed by Cawthron for freezing shellfish sperm involves the use of large volume cryovials and simple freezing techniques such as plunging the vials into a bath of methanol and dry ice (~-75°C) for 10 minutes before transferring them to liquid nitrogen. The fertility of frozen sperm is reduced 10 to 100-fold relative to fresh sperm but this is also typical of what has been observed for mammalian species (Figure 1).

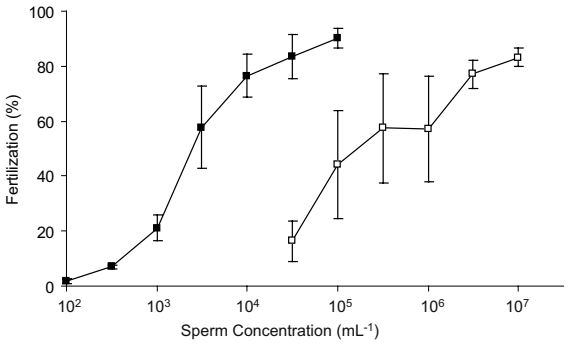
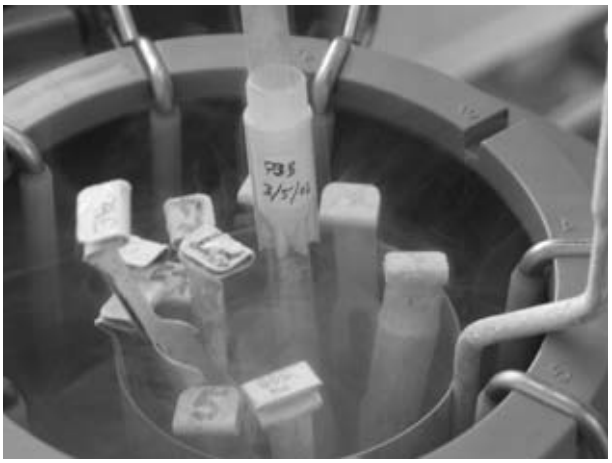


Figure 1. Fertility of fresh (closed squares) and frozen (open squares) Pacific oyster sperm (modified from Adams et al., 2004)



Cryovials are used to store sperm

For egg freezing, the conditions of cooling must be much more controlled. Freezing is carried out in plastic straws, and special programmable freezers are used. Cawthron has moved away from trying to develop methods for larvae because it sees egg freezing as more useful, however, the group has found that this is also a possibility for shellfish species.

Future Work

The cryopreservation programme at Cawthron is on-going. Further research is being carried out to refine cryopreservation techniques for mussel and abalone sperm and to reduce post-thaw variability between Pacific oyster females. Mussel eggs are proving to be more challenging with a high proportion surviving freezing but failing to fertilize and/or develop normally. Research is underway to diagnose the causes of this abnormal development so that further work can target these areas for protection during freezing.

Programmable freezers are used to control cooling in egg cryopreservation

Colour coded straws are used to store eggs

Cawthron is also developing and testing methods to cryopreserve micro-algae including the feed species for shellfish larvae such as *Chaetoceros calcitrans*, *Isochrysis galbana* and *Pavlova lutheri*. Methods have developed for these species and the algae are now being banked to provide a back-up to stock cultures should they become contaminated, crash or change their physical and biochemical characteristics.

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DEVELOPMENT OF AN OPTIMAL BROODSTOCK HOLDING AND CONDITIONING SYSTEM FOR HATCHERY PRODUCTION OF THE RAZOR CLAM, *ENSIS SILIQUA*.

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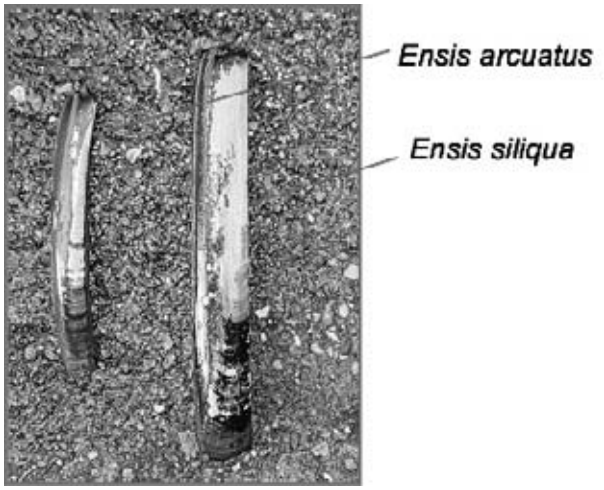
Introduction

The recent decline in wild fisheries for razor clams represents a reduction in an important economic activity in more remote regions of the Atlantic coasts of Europe. Concerns exist regarding the environmental impacts of some of the harvesting techniques currently practised in razor clam fisheries, which may result in the classic boom/bust scenario. The SHARE (Sustainable Harvesting of *Ensis*) project is investigating the environmental impacts of current harvesting/fishing techniques for razor clams and is developing technical measures for sustainable production by cultivation and stock enhancement and recommendations for more sustainable fishing practices.



Ensis species collected from Strangford Lough

Three species of *Ensis* are native within British and Irish waters, *Ensis ensis*, *Ensis arcuatus*, and *Ensis siliqua*. The two main commercial species are *E. arcuatus* and *E. siliqua* (the largest of the three). In 2003 the UK exported razor clams with a value of approximately €20million. Current fishing techniques range from dredging, to diving, to inter-tidal collection. This is presently an unmanaged fishery and as such, if harvesting continues at its current rate, its future is uncertain.

Ensis siliqua holding trials

In March 2005 researchers from C-Mar began collecting monthly samples of 15 to 20 *E. siliqua* from the inter-tidal zone at Ballywhite Bay, Strangford Lough. Each individual was weighed, measured and a section of the gonad removed for subsequent histological examination, thus enabling the reproductive cycle of this species within Strangford Lough to be determined.
In February 2006 broodstock holding trials commenced with the aim of developing broodstock holding and conditioning systems for *Ensis* species which facilitate optimal survival and gonad development. Two holding systems were investigated; sand, (which mimics natural conditions), and plastic rods (to which the *Ensis* are attached via elastic bands and suspended around the outside of the holding tank).

Twenty *E. siliqua* were placed randomly into each of four tanks, two of which contained sand and two of which utilised the plastic rod system. All tanks were aerated, supplied with constantly flowing seawater and drip-fed a mixed diet of *Tetraselmis suecica*, *Isochrysis galbana* and *Skeletonema costatum* (ration of 4% of the mean dry meat weight of the adults per day). At this time a further twenty individuals were retained for gametogenic staging. Survival rates were monitored and after a period of 33 days (to coincide with the time of collection of wild samples) a number of individuals were removed from each tank for gametogenic analysis.

Ensis siliqua holding tanks (top) showing the plastic rod system on the left and sand on the right; close up view of the plastic rod holding system (lower)

Initial findings

Preliminary results indicate that sand is the preferable holding system for broodstock razor clams due to low survival rates observed within *E. siliqua* in the plastic rod system (30% survival after 33 days compared with 85% survival within the sand system – Figure 1).

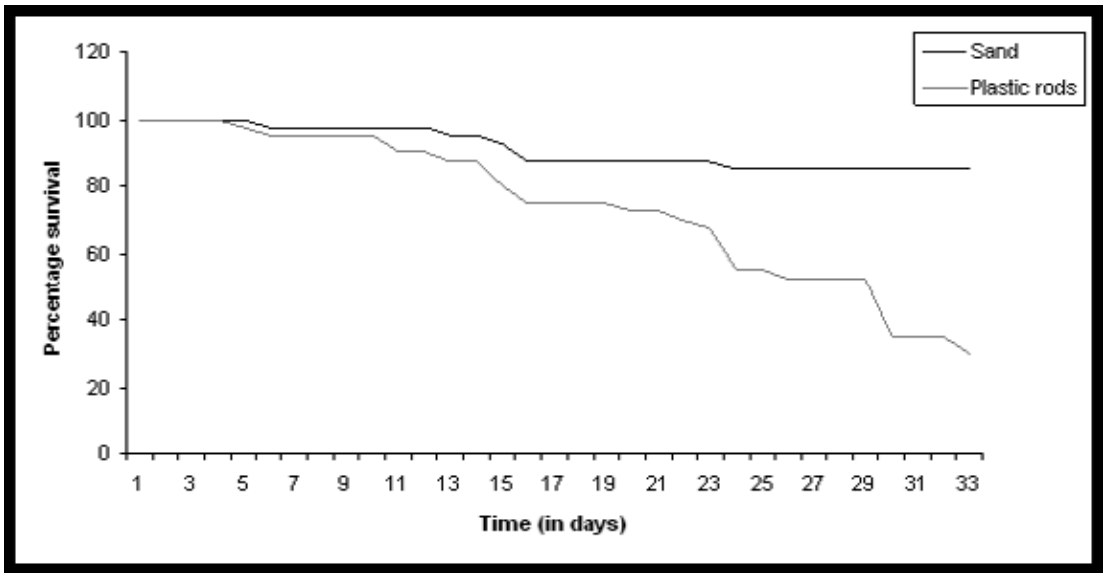
Samples, collected after 33 days will be staged gametogenically and comparisons made between the two systems. Further samples for gametogenic analysis will be collected (both from the wild and from the sand holding system) at the beginning of April 2006 (approximately 60 days from the start of the experiment).

Once we have established the optimal holding system for gonad development and adult survival, we hope to commence spawning and larval rearing experiments, with the aim of rearing juveniles for restocking of natural beds.

Acknowledgements

The SHARE project is funded by the EU under the Interreg IIIB Atlantic Area Programme and is comprised of five partners, C-Mar (Northern Ireland), CIMA (Northern Spain), the University of La Coruna (Northern Spain), IPIMAR (Portugal) and BIM (Ireland).

Figure 1. Survival rates of *E. siliqua* after 33 days in either the sand or plastic rod holding systems



AUSTRALIAN SHELLFISH SYSTEMS IN THE UK

Peter Hoare

Introduction

In the past couple of years, oyster growers in the UK and Ireland (and France) may have noticed a couple of Antipodean companies touting their plastic mesh oyster grow-out systems, namely BST and AQUAPURSE. There is a third Australian player, SEAPA but they have not marketed here seriously as yet. Previously to this, I suspect, little was known over here about the methods used by the oyster industry 'Down Under'.

A couple of years ago I wrote, in Shellfish News, about the Tasmanian Pacific Oyster industry. These new systems have been developed from the basket system used in Tasmania and the tarred sticks used by the Sydney Rock oyster industry in New South Wales, out of necessity to grow oysters in more variable conditions, in exposed waters such as found in South Australia.

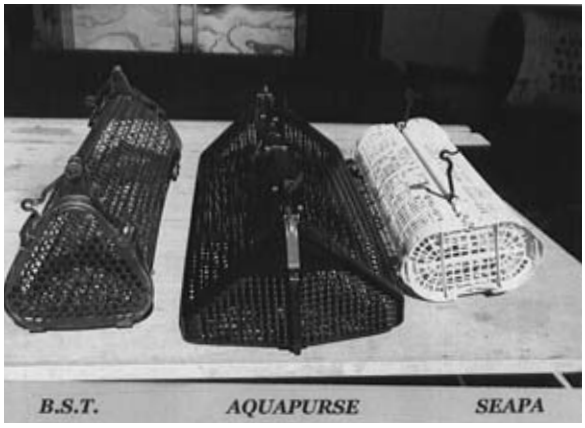
In its infancy the Tasmanian Pacific oyster industry first tried the NSW 'stick' method – used by the Sydney Rock growers. But several consecutive poor spatfalls knocked that on the head and a hatchery was built to produce single seed. The Poche and Trestle system, as used by the French and here in the British Isles, was tried but dismissed almost immediately. It was regarded as being too labour intensive and did not produce a good product.

After several false starts in design, the open mouthed basket was developed. This is now the principle inter-tidal system in Tasmania.

Basket sets at a Tasmanian Oyster Company site at Pipeclay Lagoon

New systems

The success of the Tasmanian industry upset the South Australians. So they started their own industry on sites in The Great Australian Bight, using the Tasmanian basket systems and buying Tasmanian seed. The sites were rather close to the Roaring Forties. The open baskets couldn't handle such exposed seas and in heavy weather the oysters were constantly washed out. A basket with a lid was tried but was difficult to make by hand on site. So evolved the manufactured SEAPA, BST and Aquapurse systems.



Aquapurse, BST, and SEAPA mesh baskets

TOOLTECH of Brisbane were already making Aquatrays for NSW growers of Sydney Rocks and for subsurface systems growing Pacific oysters in Tasmania. The Aquapurse was a logical extension of their technology for inter-tidal farms. Differing sizes of mesh are available with all three systems for juveniles and for grow-out to market sizes.

A better oyster

The main advantage of these systems is, like the baskets, the 'hollow' shape. This gives the oysters space to move. Without this freedom, oysters cannot feed completely around their mantle. The shell shape, which is the 'packaging', forms to where they can eat. If feeding is unimpeded, the natural shell shape is oval but if an oyster is wedged static in a 'poche', with others, it often grows into grotesque shapes. This compounds, as they grow bigger.

Polydora (mudworm) appears to be prevalent in oysters in UK and France. This is unacceptable for the Australian and Asian markets and harvests would be rejected by buyers if, when opening an order, more than two or three were found in the first fifty. Because of the freedom to move in Aquapurse, the worm gets washed off before it can get a grip into the oyster's shell. It is rare to find mudworm in oysters grown in these systems. The saving on labour is also considerable with no 'TURNING' necessary!

A versatile system

Methods of suspension vary and can be adapted to suit the conditions.

For very exposed inter-tidal sites as found in South Australia, Bayco wire is strung from vertical treated wooden posts. Provision can be made to hang the wire at variable heights as required. The Aquapurse (also BST and SEAPA) hang from the wire and are free to swing absorbing a great deal of the destructive energy of a wave. Tailor made suspension clips are provided for this.

In more sheltered inter-tidal sites Aquapurse can be 'rubbered' down to a rail with sticks thru' sacrificial holes. Other methods can be invented to suit the site (they can even be attached to a trestle!).

The down side with this equipment is the initial cost of setting up a farm. The iron trestle is tried and trusted by the French. It can be used on a 'hard' seabed where you can't drive in wooden posts and the 'poche' is dead cheap. But that's all it has going for it! Trestles in mud and sand sink overtime until they are unworkable. The nearer they get to the bottom the more chance of Polydora getting in. They also rust to bits! Treated timber posts can be driven quite easily into the mud/sand bottom. Rails are then nailed on. Systems can be suspended as shown. The treated timber will last a good deal longer than the iron in seawater.

In the Fleet lagoon

The photo shows 50 metre timber rows built by the author – single-handed – in the Fleet at Weymouth. With 2 persons - a 100 metre row can be built in an afternoon! With a floating template, mechanical post drivers fitted to the back end of an oyster barge and 4 men, half a kilometre in two or three tides is possible. It may be of interest to note some of the larger farms in Tasmania have in excess of 15 kilometres of rows.

Some examples of a versatile system – Aquatrays inter-tidal on rails (top), sub-tidal under bouys / longlines (centre) and Aquapurses inter-tidal on single or double (as shown) longlines (bottom)

New post and rail row replacing derelict iron trestles (top), fitted with Aquapurse and Aquatray (lower)

Eventually the site at Ferry Bridge will be completely cleared of the derelict trestles and replaced by timber rows. Aquapurse, Aquatray and baskets will house stock at various stages of production.

The diverse ways of suspending Aquapurse/ 'Tray on the rails is evident in the photo. The ubiquitous cutup inner tube is all that is needed to attach them!

TOOLTECH, the makers of Aquapurse and Aquatray in Brisbane, has sold them to many big oyster producers in the USA and Canada, as well as to the domestic and New Zealand market. The recent foray into Europe is now gathering apace especially in France where initial scepticism and prejudice is disappearing after early trials by some adventurous farmers and where EU grants and subsidies have proved their worth.

BST and SEAPA are both South Australian companies. BST now has a UK partner. Both are used extensively by their domestic industry in SA and BST are making ground in France and Ireland.

The innovative Australian Pacific oyster industry, much of which is now automated for bulk handling, is some 20 odd years ahead of UK and France, especially in selective breeding, but that is another story!

Further information

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RESEARCH INTO PSEUDO-NITZSCHIA DYNAMICS IN SCOTTISH WATERS.

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ASP

Marine planktonic diatoms of the genus *Pseudo-nitzschia* Peragallo (Figure 1) have been responsible for amnesic shellfish poisoning (ASP) events worldwide through their production of the neurotoxin domoic acid (DA). DA can be accumulated by filter feeding shellfish. Consumption of these shellfish by humans or animals can result in amnesic shellfish poisoning (ASP). This has led to illness and death of animals and humans in various regions worldwide.

In Scottish waters, elevated DA concentrations have been recorded since 1998. However, there have been no recorded illnesses from ASP in the UK with large quantities of shellfish being eaten safely. This is due to an active monitoring program of phytoplankton and shellfish toxicity in various locations around the country. When monitoring has indicated elevated shellfish toxin levels, closures of the Scottish West Coast scallop fishery have been necessary. This peaked in 1999 with the largest closure ever seen worldwide (an areas of 49,000km^2), causing a

severe economic impact on the industry and the region's economy as a whole.

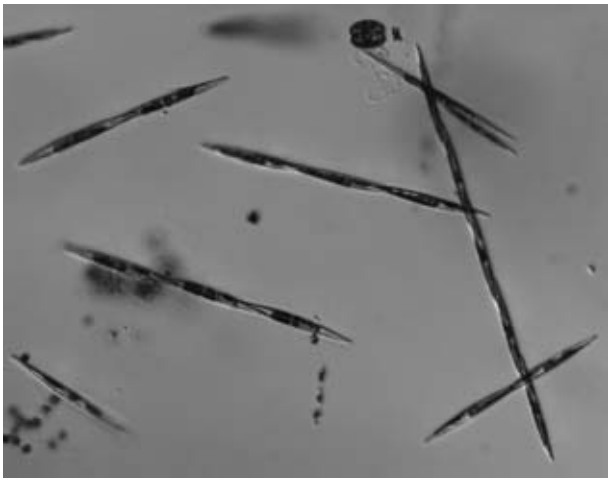

Figure 1. *Pseudo-nitzschia sp.*

Research programmes

Recent phytoplankton studies at SAMS have been conducted to gain better understanding of the factors that govern the appearance and toxicity of *Pseudo-nitzschia* spp. in Scottish waters with the aim of minimizing future fishery closures while maintaining public safety. This work has involved the combination of a field-sampling program together with physiological and molecular laboratory studies of isolated *Pseudo-nitzschia* cells.

Little is yet known of the temporal appearance and succession of *Pseudo-nitzschia* species in UK waters and how this may relate to environmental forcing. To begin to address this problem a three year monitoring program was established at a coastal station in the Firth of Lorne (Figure 2), near Oban, in Western Scottish waters to study the diversity and seasonal variation of *Pseudo-nitzschia* species in relation to physical and chemical parameters of the water column. Samples were collected with a high temporal resolution, weekly in the spring, summer and autumn and fortnightly in winter.

During the study annually repeatable seasonal patterns of *Pseudo-nitzschia* abundance were evident. *Pseudo-nitzschia* cells were categorised by shape and size into two groups, the smaller sized "delicatissima-group" and the larger sized "seriata-group". Analysis demonstrated the different dynamics and potential for toxin production of the two *Pseudo-nitzschia* groups. The delicatissima-group was most prevalent in spring and at this time was dominated by non-toxic *P. delicatissima*, while the seriata-group occurred mainly during the summer months. Summer to autumn blooms of both groups were composed of several species, including toxic *P. australis* and *P. seriata* and potentially toxic *P. pseudo-delicatissima*. Statistical analysis indicated that a significant fraction of the variance in the abundance of the *Pseudo-nitzschia* groups could be explained by the measured environmental variables. This combined with the repeatable annual nature of the blooms suggests that deterministic forecasting and modelling of the timing of future toxic *Pseudo-nitzschia* events may be an achievable goal.

Toxicity by species

During the field sampling campaign, phytoplankton cells were isolated from plankton net samples. Clonal cultures of a variety of *Pseudo-nitzschia* species were established in the laboratory and the identity and toxicity of the different species present investigated. Previously one species, *Pseudo-nitzschia australis*, isolated at the time of the 1999 ASP event, had been

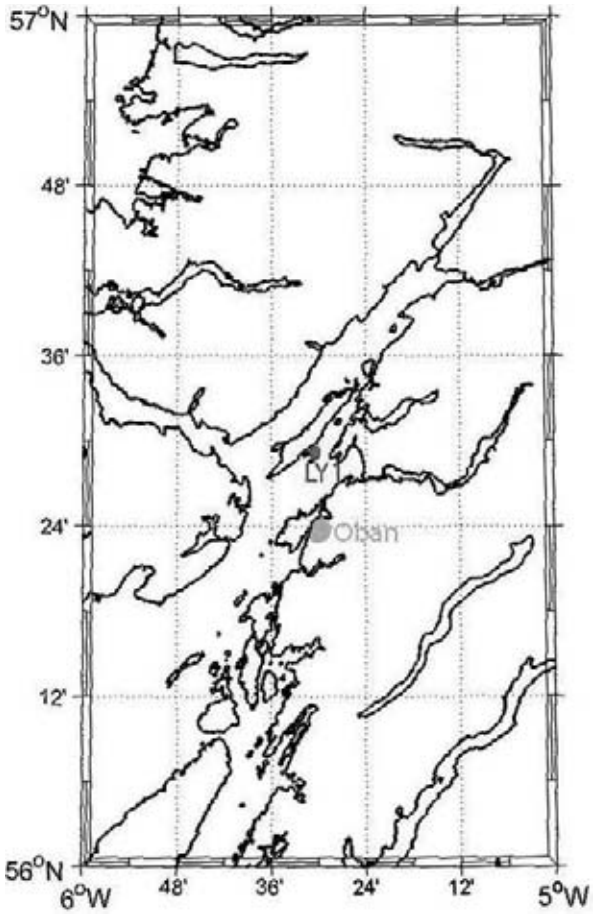

Figure 2. Sampling site LY1 in the Firth of Lorne

shown to produce DA toxin in Scottish waters. Our study confirmed the toxicity of *P. australis* but also identified *Pseudo-nitzschia seriata* as a DA producer in Scottish waters.

As discrimination between *P. australis* and *P. seriata* is more problematic than for others from the genus *Pseudo-nitzschia*, care had to be taken in the identification of the isolated cultures. Light microscopy has insufficient resolution to discriminate between these two species. Higher resolution transmission electron microscopy (TEM) gives considerably more detail (Figure 3) but was also ambiguous on its own, as important differences in morphological fine structure existed in our cells compared to other published records. However, by using molecular methods to amplify the internal transcribed spacer (ITS)1, 5.8S and ITS2 and partial large subunit (LSU) of the rDNA operon, we were able to identify strains of both *P. australis* and *P. seriata* from our isolates. Two strains of *P. seriata* isolated in successive years were found to have sequences identical to one another and also to the ITS and partial LSU rDNA sequences of other published *P. seriata* strains.

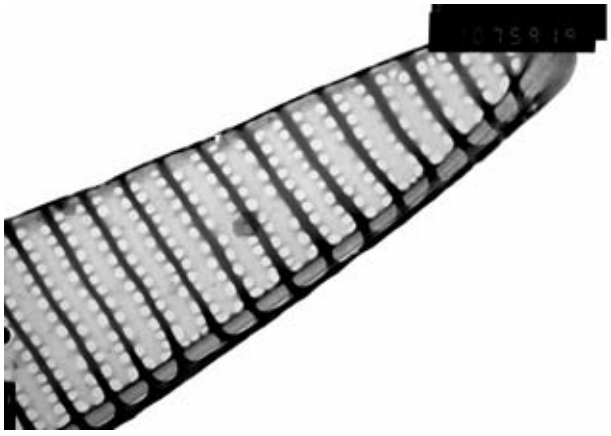

Figure 3: Transmission electron micrograph of *Pseudo-nitzschia australis*

Nutrients

The stress imposed on *Pseudo-nitzschia* cells following exhaustion of a "limiting" nutrient has been implicated in DA toxin production. Not all *Pseudo-nitzschia* species produce DA, and for those that do, the factors that govern the amount produced and the rate of production remains poorly understood. We conducted controlled laboratory nutrient manipulation experiments on our isolated cultures. As DA is an amino acid, N limitation does not result in toxin production. However, we found that in Scottish waters, in common with species from elsewhere in the world, that a lack of dissolved inorganic phosphorus or silicon lead to enhanced toxin production. Moreover, for our Scottish *P. seriata* strain, we found silicon stress generated significantly higher toxicity (Figure 4), indicating that the delicate balance of these inorganic nutrients in our coastal seas is potentially critical to ASP events.

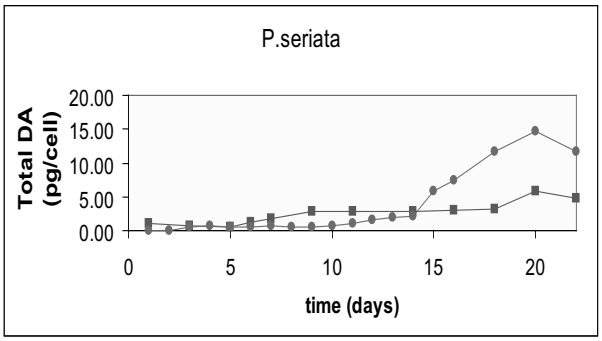

Figure 4: Toxin production by *Pseudo-nitzschia* seriata in laboratory culture normalised to cell number. Circles are silicon limited and squares are phosphorous limited cultures. The results indicate higher toxicity when the cells are silicon deficient

Photoperiod

Our medium term aim is to produce a mathematical model of the growth and toxin production of *Pseudo-nitzschia*. It is therefore necessary to determine how environmental factors other than nutrient stress influence these properties. Initial laboratory experiments have identified the importance of the duration of the period of daylight, one of the major factors in determining the seasons in high latitudes such as Scotland. We found that photoperiod influenced cell growth of both toxic and non-toxic *Pseudo-nitzschia* species. For *P. seriata* total toxin and toxin per cell were also influenced by photoperiod, suggesting that this parameter is a major factor governing the appearance of different *Pseudo-nitzschia* species throughout the year. Such results also suggest that prediction of blooms and their toxicity based on environmental conditions may indeed be possible.

Future research

While the above work provides a basis for research into Scottish *Pseudo-nitzschia* and its toxicity, further study will be required before a predictive strategy for HAB development becomes a reality. To this end researchers at SAMS, IFREMER (France), and National University

Galway (Ireland) have recently been fortunate in receiving approval of funding for harmful algal research from the EU through the INTERREG IIIB North West Europe Programme that provides support to transnational cooperation projects in the North West Europe area.

The project "**F**orcasting the **IN**itiation of blooms of Toxic **AL**gae" (FINAL) seeks to improve our understanding of the factors that govern the blooms of those potentially harmful phytoplankton species that have the capacity to contaminate commercially harvested shellfish. It will allow us to extend our work in *Pseudo-nitzschia* and will also focus on species from the genus *Alexandrium* that is responsible for paralytic shellfish poisoning.

BIVALVE CULTIVATION IN CHINA

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World leader

China now contributes 70% of world aquaculture production, and has been the world leader since 1989 in terms of production volume. Total Chinese mariculture production was 13.17 million tonnes (mt) in 2004, and freshwater aquaculture production was 16.94 mt. Most Chinese people favour seafood, and mariculture species usually enjoy a higher market price in China, compared with freshwater species. China is a huge market for fish products; for the total fisheries production of 49 mt in 2004, 95% was consumed domestically; while only 2.1 mt were exported to the world market.

Sanggou Bay is an intensively cultivated area in Shandong Province, which contributes around 30% of Chinese mariculture production and produced 2.65 mt of bivalves in 2004

Species and production

The ranking of major mariculture species, in terms of production volume, are bivalves, seaweeds, crustacea, and finfish. In 2004, China produced more than 10 mt of bivalves, which accounts for more than 80% of total Chinese mariculture production, and 60% of the world total bivalve production.

In terms of production volume, oysters are the most important of all the cultivated bivalves, accounting for nearly 30% of total wet weigh. Other species produced are clams (19%), scallops (8%), mussels (5.5%), and razor clam (5.2%). Productivity of these species is widely different, as reflected by cultivation area and production of bivalves in Shandong Province, which is one of the major mariculture provinces in China.

Bivalve production in Shandong Province, 2004

Type	Area (ha)	Production (t)	Productivity (t/ha)
Clams	71,100	1,013,000	38.26
Oysters	14,900	570,000	2.35
Scallops	52,800	550,000	16.19
Mussels	17,000	344,000	7.52
Razor clam	13,300	108,000	20.24
Whelks	4,200	68,000	10.42
Ark shell	2,300	17,300	14.25
Abalone	2,000	4,700	8.12
Other shellfish	29,280	34,300	1.17

Three of the nine provinces with mariculture (Shandong, Guangodong and Fujian) account for over 78% of the total mariculture production.

Three major oyster species are currently cultivated in China, *Crassostrea gigas*, *C. ariakensis*, and *C. plicatula*. There are at least ten species of cultivated clams in China, such as Manila clam *Ruditapes phillipinarum*, Chinese clam *Mactra chinensis*, *Meretrix meretrix*, black clam *Cyclina sinensis* and mud clam *Tegillarca granosa*, The Razor clam (*Sinonovacula constricta*) is also a major species cultivated widely in southern China. Five species of scallops are currently cultivated, including Chinese scallop *Chlamys farreri*, bay scallop *Argopecten irradians*, Japanese scallop *Pactinopecten yessoensis*, *Chlamys nobilis*, and *Argopecten irradians concentricus*. The bay scallop is the most widely distributed and contributes 80% of total scallop production in China. The three species of mussels cultivated in China are blue mussel *Mytilus edulis*, green Mussel *Perna viridis*, and thick shell mussel *Mytilus coruscus*; blue mussels accounts for more than 60% of the total mussel production.

Among all bivalves, oyster are distributed the most widely and are cultured in most of the coastal provinces. For abalone, 97% is produced in Shandong, Guandong, Liaoning and Fujian province. Major producers of clams are Liaoning, Shandong and Jiangsu province, while Liaoning, Shandong and Hebei are major producer of scallops. More bivalve species are cultured in Guandong than in any of the other provinces.

Cultivation methods

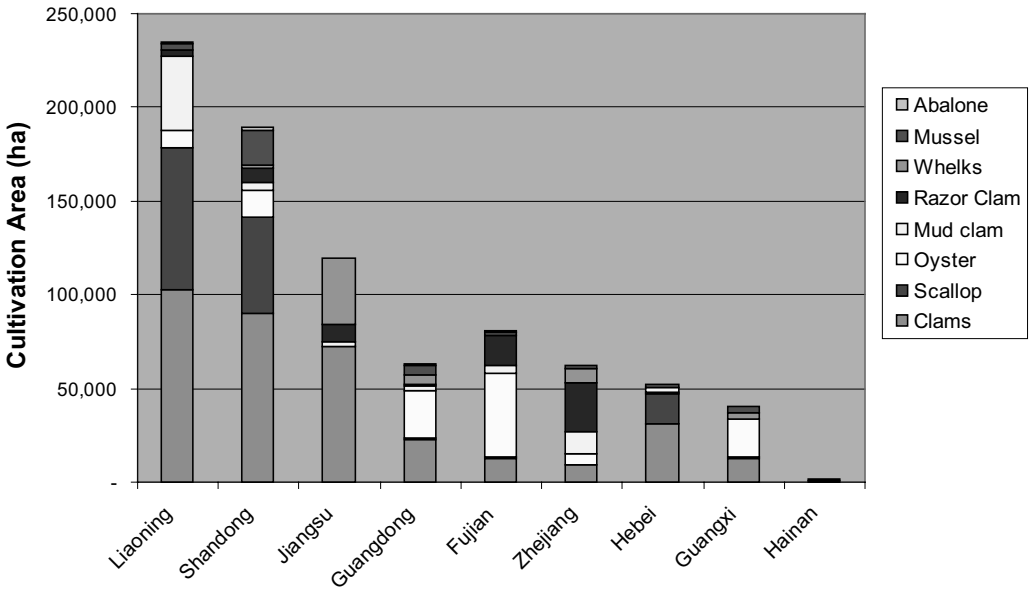
1. Traditional hatchery methods

Academician of Chinese Academy of Engineering, Dr. Zhang Fu Sui is one of the Chinese pioneers in bivalve cultivation. He was involved in research on natural spat collection and artificial seedling production of mussels in the early 1970's, and the introduction of bay scallop from America in 1982, which soon became a dominant species for long-line culture.

Dr Zhang FS working on hatchery bivalve reproduction in 1970's

Methods for bivalve reproduction in most Chinese hatcheries are much the same since Dr Zhang's time. Large land-based cement tanks of several to tens of cubic metres are used for broodstock conditioning, microalgae production,

Bivalve cultivation area of major mariculture provinces in 2003



larvae culture and early juvenile nursery. The ratio of tank areas for microalgae production and larvae culture is about 1:2 in order to produce enough live feed for the animals.

Microalgae species for bivalve hatcheries in China include *Dicrateria zhanjiangensis*, *Isochrysis galbana*, *Nitszchia* sp., *Phaeodactylum tricornutum* and *Platymonas* sp. Three-step inoculation of microalgae from smaller containers (1,000ml) into larger containers (100L and 10-20m^2) is to guarantee for enough stock solution and to prevent contamination. Batch culture method is used for which nutrients are added once into the medium, and harvest is done during the exponential growth phase. Nutrients include nitrogen ($NaNO_3$ 40ppm), phosphorous (KH_2PO_4 10ppm) and ferric salt (ferric citrate or ferric ammonium citrate 1ppm).

As most of the bivalves reproduce in summer or autumn, it is necessary to precondition the animals for early spawning so as to obtain larger seeds in the first year. Sufficient feed and controlled temperature increase are two important measures to enhance gonad maturity. Broodstock are induced to spawn by temporary exposure to the air (2-12h) only, or followed by rapid water flow and temperature increase stimulation (0.5-3h), or by chemical stimulation (soaked in 0.5M NH_4 (OH) solution for 5-10min).

Larvae are maintained in static water with gentle aeration. Microalgae are added into the tanks 4-6 times per day, at a daily ration of 2,000-10,000cell/ml. The water exchange rate is 50-100% per day.

Sediments are provided during metamorphosis, which is polyethylene mesh for attached (or temporarily attached) species such as oyster, mussel and scallop, or fine sand for burrowing species such as clams. Optimum density and sufficient feed are important for good juvenile survival, and flow though of seawater at much higher daily exchange rate is applied after settlement. Limited by space, juveniles are usually moved into shrimp ponds for further nursery cultivation at 0.3-0.5cm shell length.

Large land based cement tanks are used for broodstock conditioning, microalgae production, larvae culture and early juvenile nursery

2. Extensive larvae culture of burrowing species in land based ponds

Mature broodstock are induced to spawn in shrimp ponds (about 0.3ha), and larvae are kept in the ponds through metamorphosis and early juvenile nursery. Nutrients are added into the ponds before and during larvae culture in order to enhance microalgae production. Inoculation of microalgae is carried out when necessary and zooplankton are controlled by inlet filtration. Small (0.5-0.7cm shell length) juveniles are harvested manually for further nursery cultivation or grow out on the seabed.

3. Wild spat collection

This is also called half-artificial seeding collection. Special collection instruments are placed at settling grounds when large numbers of bivalve larvae appear. Monitoring of larval activity is important to determine where and when to put out the spat collection instruments. Restricted by natural conditions, the amount of spat collected may vary from year to year. Coir rope is widely used as spat collection substrate, as well as straw rope, plastic rope, flax rope and ropes woven by thin bamboo strips. Rocks, mollusc shells, broken tiles, bamboo baskets, bamboo curtains, rubber nets and old tires can also be used. Spat are separated for grow out by methods such as rope-binding, thinning, sandwiching and wrapping.

4. Raft-culture

This is the most widely used method for oyster, mussel and scallop cultivation. Selection of sea area is important for the success of this method. Water quality and physical characteristic such as wind, wave and water depth should all be considered. Instruments for raft-culture include: the main rope made of polyethylene at 30-60m length and 9-14mm thickness; anchors made of tree trunks, iron (or steel) cement and sand; anchor ropes made of polyethylene at the same or slightly less thickness as the long-line rope; glass balls used as floats; and hanging ropes made of polyethylene at 4-5mm thickness and 60-100cm length. Seeding rope made of coir, grass, bamboo-strip or old tyre is used to keep mussels, while lantern-nets are used to maintain scallops and oysters.

5. Inter-tidal table or stake-culture

Wooden stakes, stone slabs and frames are set up near or 1-2m below the low tide line, on which oyster spat are collected and mussels are wrapped or hung for grow out. This method is notable for its resilience to strong winds.

6. Seabed-sowing or bottom culture

Sediments such as sand, rocks and shells are usually placed onto the seabed along with the spat. Depth of the seabed for cultivation varies according to species involved, e.g. Manila clam are seeded at 0.5-6m, while Japanese scallop may require a depth of 4-40m.

The future for Chinese bivalve cultivation

Environmental pollution and over-exploitation of coastal waters are the major challenges for the Chinese bivalve cultivation industry. Initiated and driven by scientists, all stakeholders and parties concerned have begun to integrate their efforts to solve these problems. Meanwhile, Chinese scientists have been working on research topics such as culture techniques for new species, polyculture (or integrated aquaculture), environmental impacts and carrying capacity, selective breeding and genetic enhancement of cultivated bivalves; all these benefited and will continually help the industry.

The future development of Chinese bivalve cultivation may not necessarily embody a fast increase in production, but will surely be reflected by improved quality and more variety of cultivated species.

Further information

Hui Liu, Marie Curie Fellow of 6th European Framework Programme, Associate Professor of Yellow Sea Fisheries Research Institute (YSFRI). For further information, contact Hui Liu by email: LiuHui@ysfri.ac.cn

D-DAY III FOR MUSSEL FARMERS!

Martin Syvret,
Seafish Inshore Team

Mussel identification

Following on from the success of the previous mussel larvae identification courses held in the South West of England and on the West coast of Scotland, BIM, the Irish Marine Institute and Seafish, in association with C-BAIT, are again collaborating on a further session of these workshops. Due to demand by industry the location this time is in Northern Ireland with the C-MAR Laboratory at Portaferry providing the venue. The workshops were to be held on the 11th and 12th April to focus not only on the rope mussel producers in the area but also on recent developments in the collection of mussel seed for use in bottom culture.

The course is about identifying the D-stage of mussel larvae development and was originally developed by Susan Steele (Aquaculture Training Officer for BIM) and Tara Chamberlain (Irish Marine Institute) to help growers optimise the timing of the deployment of their seed collection ropes and is regularly updated to reflect new developments with respect to seed collection practises in Ireland.

The last course was run in Oban in October 2005 and was timed to coincide with the ASSG conference. Those participating ranged from growers who had been involved in the industry for 20 years+ through to new entrants who were just coming into the industry. The course itself consists of a range of information about mussel larvae reproduction, identification and assessment of larval numbers in seawater samples. Practical training in using microscopes for analysing samples for mussel larvae and also the larval stages of other 'pest' species such as starfish and sea squirts (or pissers, as they are known in Ireland) backs up these theoretical sessions.

Feedback on all the previous workshops has been very positive and there have been several 'conversions' to the art of larval identification. Further requests for this course have also been received from Shetland, Orkney as well as Denmark, Norway and Chile!

Further information

Martin Syvret, Seafish inshore advisor, on 01392 202043 or email m_syvret@seafish.co.uk. Further information can also be obtained by contacting Susan Steele on 00 353 027 71106 or steele@bim.ie

Tara Chamberlain (standing) of the Marine Institute helps with the finer points of mussel larvae identification. Photo taken at the Plymouth venue

Susan Steele (using the microscope) helps with identifying the different larvae. Photo taken in Oban

SEAFOOD VIBRIO STUDY

Sariqa Wagley
Cefas Weymouth Laboratory

Background

The consumption of seafood, especially raw oysters, contaminated with pathogenic *Vibrio* species such as *V. parahaemolyticus*, can lead to human illness. Certain *V. parahaemolyticus* strains are pathogenic and can cause acute, self-limiting gastro-enteritis. In the U.S.A. the Centers for Disease Control and Prevention (CDC) statistics report around 2,800 individual cases of *V. parahaemolyticus* food poisoning per year. In South East Asia, a pandemic serotype of *V. parahaemolyticus* (O3:K6) is responsible for an estimated 40% of all seafood-associated illness.

V. parahaemolyticus is a halophilic bacterium that can cause gastroenteritis in humans when ingested with raw or undercooked seafood

V. parahaemolyticus in Europe

In Europe, reports of cases of *V. parahaemolyticus* infection are rare and where they occur are mainly travel related or as a result of inadequate post harvest hygiene standards.

The organism has not been included in the European Network for Epidemiological Surveillance and Control of Communicable Diseases (9118/98/CE) or the Microbiologic Surveillance System for Infectious Gastroenteritis, despite the recommendations of the Scientific Committee on Veterinary Measures relating to Public Health (2001). Equally, *V. parahaemolyticus* does not appear in European legislation on microbiological requirements for shellfish-harvesting areas or ready-to-eat seafood. The incidence of disease and prevalence in European seafood is therefore uncertain.

However, several outbreaks have recently been reported in Europe associated with indigenously produced seafood. In 2004, 76 cases of O3:K6, *V. parahaemolyticus*-associated gastroenteritis were reported in Spain. Epidemiological investigation strongly indicated the major risk factor in this outbreak was the consumption of edible crabs (*Cancer pagurus*) that originated from the U.K. It was suggested that improper post harvest handling was the cause of contamination. Molecular characterisation of isolates collected from patients during this outbreak demonstrated the emergence of the O3:K6 pandemic strain in Europe.

This article summarises the major issues connected with *V. parahaemolyticus* contamination of seafood in Europe and describes Cefas research undertaken to clarify the extent of the problem.

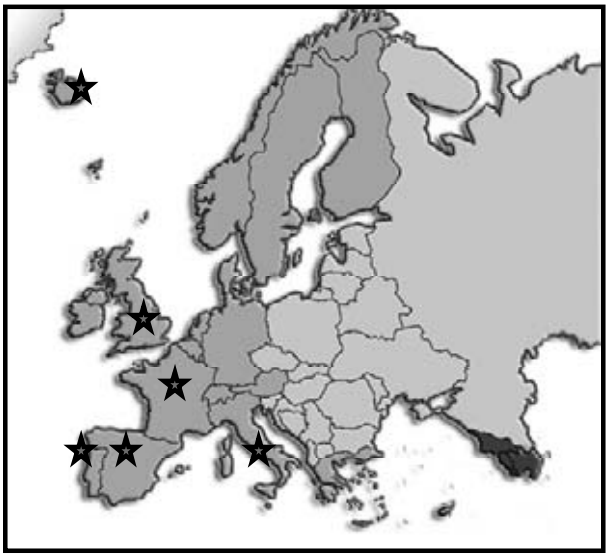
EU Research Programme

The EU 6th Research Framework Programme has been funding a 28M€ project dedicated to developing 'Quality seafood for improved consumer health and well-being'. This project, called SEAFOODplus, involves 20 smaller projects and includes the SEABAC (Seafood: Enhanced Assessment of Bacteriological Associated Contamination) project. Part of the SEABAC project research is being carried out at Cefas to assess the prevalence and to characterise *V. parahaemolyticus* and other *Vibrio* species in European seafood.

SEABAC

The SEABAC project includes six collaborative partners from research institutes and universities in Spain, Portugal, Italy, Iceland, France and the U.K. (see map). To date, over 90 strains of *Vibrio* species originating from patients, various seafoods and marine waters have been deposited into a culture collection at Cefas. A primary objective of the SEABAC project is to develop rapid, reliable techniques to detect and characterise potentially pathogenic *Vibrio* species. Frequently, existing classical detection

methods detect all vibrios and therefore do not enable assessment of the numbers and significance of the pathogenic sub-set in the population. SEABAC research will facilitate future assessment of health risks presented to European consumers by these organisms. The project includes the development of real-time PCR methods for the detection of pathogenic *Vibrio* species directly in seafood and a Pulse Field Gel Electrophoresis (PFGE) method to characterise *Vibrio* species using DNA fingerprinting techniques. The latter research using PFGE is being carried out by Cefas in Weymouth.



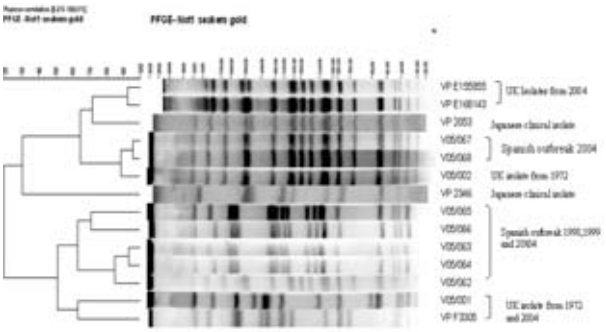
The countries marked with a star are part of the SEABAC project. They include the United Kingdom (Cefas), Italy (Instituto Superiore di Sanita), France (IFREMER), Spain (University of Santiago), Portugal (IPIMAR) and Iceland (Icelandic Fisheries Laboratories)

PGFE and O3:K6

Pulse Field Gel Electrophoresis is a molecular typing method enabling differentiation of strains and the monitoring of their spread through the community. The development of a PFGE method for *Vibrio* species will assess the significance of these bacteria in U.K. waters and investigate the clonal relationships between isolates from the U.K. and isolates of clinical significance, such as the O3:K6 pandemic strains.

Results so far suggest that *V. parahaemolyticus* strains are present in approximately 30% of seafood samples tested. PFGE fingerprint patterns from these isolates have shown that strains are closely related to each other but show scant relationship to the pandemic clone O3:K6.

However, clinical strains of *V. parahaemolyticus* isolated from 3 U.K. patients during 2004 show significant homology with the pandemic O3: K6 clone seen in recent outbreaks in Spain and Japan. Although it is not known how these individuals contracted *V. parahaemolyticus* associated illness, the data indicates that the O3:K6 pandemic clone has been responsible for isolated cases in the U.K. O3:K6 has not yet been isolated from seafood harvested from the UK coastal environment. Further studies are however under way to establish the homology between U.K. and Irish isolates with other clinically significant European clones.



Dendrogram portraying heterogeneity among clinical isolates of *V. parahaemolyticus* obtained from UK, Spain and Asia. The dendrogram is based on PFGE isolates obtained with NotI-digested *V. parahaemolyticus* DNA

This data highlights the importance of the development of standardised classical and molecular methods for the detection, enumeration and characterisation of *Vibrio* species in seafood across the EU. The integration and harmonisation of these methods on a Pan European level will advance the knowledge base within the EU and provide important information on future decisions on controls. The outcomes of the SEABAC project will help to reduce the potential human health hazards presented by the ingestion of *Vibrio* species and thus promote consumer confidence and economic trade of seafood markets.

Further information

Sariqa.Wagley@cefas.co.uk

SEAFISH EVALUATE SODIUM METABISULPHITE ALTERNATIVES

Seafish Media Release

Prawn residues

Sodium metabisulphite has been used by the UK fishing industry for many years to control the effects of melanotic blackening in Nephrops. Following recent court cases relating to high levels of residue present on prawns and new requirements for allergen labelling, there is now significant interest within the industry to source an alternative treatment. Further motivation has come from the highly corrosive nature of sodium metabisulphite, leading to high maintenance costs of both vessels and processing machinery and hazardous conditions during operation.

Sodium metabisulphite

Sodium metabisulphite is currently listed as an authorised food additive with maximum permitted residues in crustacean products of 150ppm. Sodium metabisulphite is regarded as one cause of asthma attacks and can trigger allergic reactions in vulnerable individuals. In response to this, EU Directive (2003/89/EC), which came into force on 25 November 2005, will make allergen labelling a requirement for all metabisulphite treated foods. These regulations will require that foods treated with metabisulphite are clearly displayed as such on the final packaging.

Seafish trials

Seafish has conducted trials to identify alternative treatments for maintaining shelf life in prawns. The various treatments used are outlined in the table and were applied at sea using standard dipping procedures before being stored on ice. Samples were assessed ashore by processors who undertook standard checks for appearance, odour, texture and taste over a full shelf life. Further samples were sent to a laboratory for microbial and sulphite residue analysis, and information was collected on treatment cost and supplier.

Results

As can be seen from the table (over leaf), a number of treatments appeared to perform competitively with sodium metabisulphite for inhibiting melanotic blackening.

Selected alternatives provide comparable shelf life to high concentrations of sodium metabisulphite. However, prawns treated with 5% metabisulphite lose some visual qualities through bleaching and attain high sulphite residues, often above the permitted 150ppm. Neither of these qualities are evident with alternative treatments. Furthermore, prawns with high sulphite residues, through treatment with high concentration sodium metabisulphite, were found to have poor flavour.

Trials have also identified non-sulphite based treatments that yield similar shelf life benefits to metabisulphite but, significantly, are excluded from allergen labelling. These treatments will be of particular interest for suppliers marketing prawns free from all additive labelling. The downside to these alternative treatments is that they are generally more expensive than sodium metabisulphite.

Spoiling

No treatment will prevent melanotic blackening in prawns. This is an inevitable part of the spoiling process although good handling practice and strict temperature control are undoubtedly the first steps to maintaining a quality product. The result of these trials has shown that alternative treatments are effective for shelf life extension and are less hazardous to use than sodium metabisulphite. The table provides details for all treatments.

Further information

Seafish have published a Key Features document that summarises this project – http://www.seafish.org/upload/file/legislation/Key%20feature%20-%20Soduim%20Meta.pdf

For more information, telephone Seafish Technology on 01482 327837 or email fishtech@seafish.co.uk

Product	Legislation	Subject to allergen labelling?	Price	Cost to treat 100kg prawns	Dilution	Dip time (mins)	Performance	Supplier
Sodium metabisulphite	Permitted food additive in UK. Annex III Part B Directive 95/2/EC.	Yes	£12.93 for 25kg (52p per kg)	52p	5.0%	10	Prevention of blackspot to 7 days. Visually some bleaching effect. Taste often tainted.	Various
Hasenosa HA-5502 Freskor (Spanish)	Permitted in UK Directive 95/2/EC	Yes	£29 for 25kg bag (£1.16 per kg)	£2.32	2%	5	Good visual qualities to 8 days. Effective melanosis control.	Scotprime Seafood Ltd. 11 Whitfield Drive, Heathfield Industrial Estate, Ayr, Strathclyde. Tel: 01292 611942
Pluscolor Fish 3425	Permitted in UK Directive 95/2/EC	Yes	£1.20 per kg	£1.60	1.3%	1	Prawns good bright appearance, blackspot prevention to 8 days. Effective treatment.	Peterhead Net Company 7 Wilson Street, Peterhead. Tel: (01779) 821830 & 07802 510225
Melacide SC-20	Permitted in UK Directive 95/2/EC	Yes	£1.75 per kg	73p	3%	10	Good visual qualities to 8 days. Effective melanosis control.	Malahide Filter Services, Peterhead. Tel: 01779 480908 Norkem, Knutsford, Cheshire. Tel: 01565 755550. www. norkem.com
Xyrex Prawnfresh	Processing aid as defined by Directive 89/107/EEC	No	0.5L @ £30. 5L @£250	£2.50-£3	1:1000	15	Good blackspot prevention and best eating qualities. Max. blackspot prevention to 9 days.	Xyrex, Willowburn Road, Willowyard Industrial Estate, Beith Ayrshire, KA15 1LN. Scotland. Tel: (0870) 1610103
Everfresh	Included in amenments package for Directive 95/2/EC. Expected formal adoption early 2006	No	$6 USD (£3.45) per 200g pouch.	£1.38	200g : 125L	2	Overall performance good - comparable to sulphite based treatments.	SunOpta food ingredients, 25 Wiggins Ave, Bedford, Ma 01730 Tel. 781 276 5176
Aquabon SD / 14W	GRAS additives listed in Annex II of Directive 95/2/EC	No			2%	5	Some blackspot prevention to 5 days. Good flavour.	Scotmas Limited, Spylaw Road, Kelso. TD5 8DL. Scotland. Tel: 01387 880779
Soft acid Aqua E		Yes	1/3L : 100L water (0.3% trialled)			10	No control of blackspot	Borregaard LignoTech, Norway Tel: +47 69118000
Citric acid	Permitted in UK	No	£163 for 25kg		3%		Poor prevention of blackspot, performance worse than no treatment	Trial samples from Plater chemicals, UK.
Ascorbic acid	Permitted in UK	No	£273 for 25kg		1%			

Table of treatments tested

BIO-MOS® IMPROVES GROWTH AND SURVIVAL OF CULTURED LOBSTERS

C. Daniels, D. Boothroyd, Dr. S. Davies (University of Plymouth), R. Pryor, D. Taylor and C. Wells
The National Lobster Hatchery, South Quay, Padstow, Cornwall,PL28 8BL, UK

Introduction

In agricultural studies, Bio-Mos®, the carbohydrate Mannan Oligosaccharide, from Altech Ltd, has been shown to enhance the growth and survival of domestic livestock. Bio-Mos® does this by increasing the efficiency of the digestive tract, so improving food breakdown and nutrient uptake. Bio-Mos® is a prebiotic, that is, a non-digestible food ingredient which benefits the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improve host health. Prebiotics such as Bio-Mos® have been shown to possess immunostimulation properties. It has been reported to augment and arouse the natural immune system of organism to which it has been fed. Bio-Mos® will also bind specifically with pathogenic growth-inhibiting microbes, preventing their attachment to cells within the gut, whilst leaving beneficial bacteria unharmed. The ability to aid the development of a healthy immune system is crucial to increasing success during vulnerable stages of development. Such knowledge is valuable for agriculture and aquaculture where increasing survival during the infant stages is very important to the success of livestock output. This is especially important in lobster culture as crustaceans lack a specific immune response, so therefore rely on non-specific defences during their vulnerable life stage, where highest mortality occurs.

Objective

The objective of this trial was to evaluate the use of Bio-Mos® as a dietary immuno-stimulant for improving European lobster (*Homarus gammarus*) culture. The two main aims were:

1. Determine the effect of Bio-Mos® on the survival of larvae.
2. Determine the effect of feeding Bio-Mos® at the larval stage on the growth and survival during subsequent juvenile stages.

Materials and Methods

Multiple berried (egg bearing) adult female lobsters are regularly received from local fishermen during the summer months. These females release larvae, which are collected daily from the broodstock tanks and then placed into 60L kreisel cones. Three feeding regimes, plus a control were tested, each replicated in plankton kreisel cones. These tanks are circular, with a laminar flow to keep the larvae separated in suspension (see photo). Between 800-1000 larval lobsters, from mixed origin, were held in each of the 12 kreisel cones used.

Researcher Carly Daniels holding a berried female

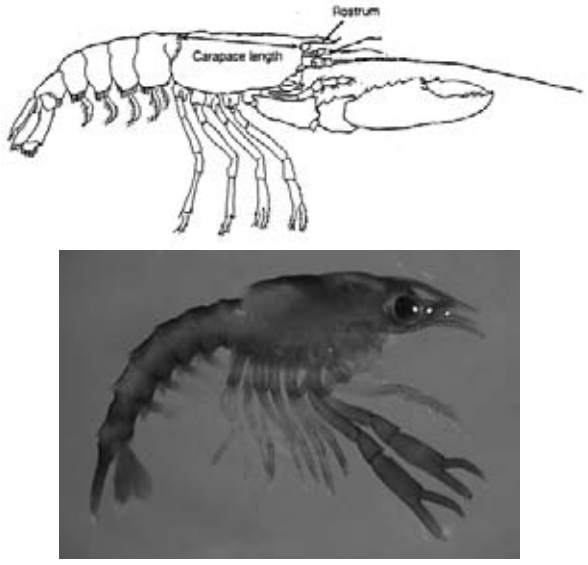
Three cones were fed daily with *Artemia nauplii* enriched purely with A1 DHA Selco™ (INVE Aquaculture), while nine other cones were fed upon *Artemia nauplii* enriched with a mixture of A1 DHA Selco™ and Bio-Mos® supplemented at three differing concentrations; 2ppt, 20ppt and 200ppt. The diets compositions are shown in the table below.

Artemia enrichment composition, of larval lobster diets

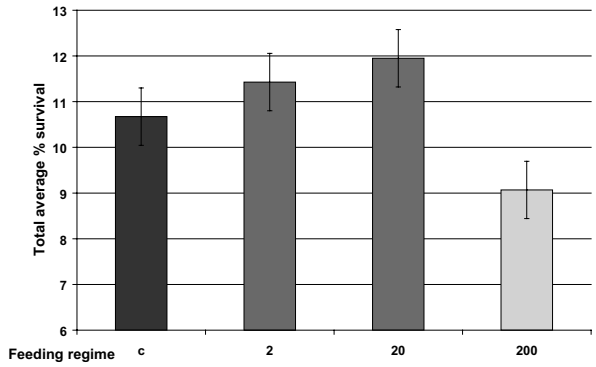
Feeding regime	Components (g)		
	Selco™	Bio-Mos®	Water
Control	6	0	3
2ppt	6	0.0072	3
20ppt	6	0.072	3
200ppt	6	0.72	3

Juvenile lobsters were fed once daily on Selco™ only enriched Artemia supplemented with frozen adult brine shrimp.

Twelve Kreisel cone recirculation system were used to rear larvae from hatching through to stage IV.



Measured morphological aspects of the European lobster, *H. gammarus*, juveniles. (top, Modified from MAFF, 1991) Photo ready for morphological analysis (lower).



Total percent survival of lobster larvae to stage IV of growth. The columns represent the four larvae feeding regimes. Standard errors are depicted by the vertical bars.

Photos of juvenile lobsters were taken at various stages and analysed using Image J software to investigate different morphological aspects for differences in development.

Several parameters were measures during this trial, these included: Survival to stage IV, mortality to stage V and VIII, developmental growth to stage V and VIII and bacterial conditions in the *Artemia* culture medium.

Results and Discussion

Immunostimulants show positive and negative effects.

Results clearly indicate that the addition of Bio-Mos® at 20ppt to A1 DHA Selco™ improved the survivorship of lobster larvae to their first juvenile stage (IV) of growth.

It was also discovered that the addition of Bio-Mos® at 20ppt to larval feed improves their later survival and growth during juvenile stages of development.

However negative effects were revealed with the inclusion of Bio-Mos® at higher concentrations (200ppt), increased mortality to early juvenile stages and decreased morphological development to stage VIII of growth were shown. For example, the average carapace length of stage VIII juveniles pre-fed a diet containing Bio-Mos® at 200ppt was between 0.4 and 0.6mm shorter than those pre-fed on all other diets.

Bio-Mos® also appeared to reduce bacterial abundance (number of *Vibrio spp.* colonies per ml of water) in the *Artemia* culture medium and so in larval food supply.

Conclusions

Bio-Mos® added at 20ppt to lobster larval feed from hatching through to stage IV, significantly decreased mortality, giving a higher success rate to stage IV, V and VIII of growth. Whereas, the dietary addition of Bio-Mos® at 200ppt during larval stages appears to have negative effects on the growth and survival of lobsters to stage IV, V and VIII of growth. Bio-Mos® also shows the potential to reduce pathogenic bacteria abundant in feed thus producing a higher quality feed less likely to impare survival during early vulnerable lifestages.

The causes of mortality were not analyzed in detail. However, reduced mortality does suggest enhanced disease resistance with Bio-Mos® at 20ppt. This could be due to improvements in the immune response with Bio-Mos®, which has been shown in other aquacultural and agricultural studies.

Adverse effects on survival shown at 200ppt appear contrary to this theory, however, may be due to negative effects to the nutritional value of Artemia rather than harmful effects on the lobsters themselves. Therefore, Bio-Mos®, in this case, is not having a detrimental effect on the survival of lobster larvae but merely slows development by some means. This theory is supported by a reduction in mortality numbers between stages V-VIII of growth for those lobsters pre-fed a diet including Bio-Mos® at 200ppt and also significantly reduced growth rates to stage VIII. Such suppressed development could potentially be attributed to a lack in essential nutrients caused by high Bio-Mos® supplementation.

Further research

The use of functional diets may be new in aquaculture but shows the potential to produce diets which satisfy not only basic nutritional requirements but also extend beyond this to improve disease resistance. Prospectively, producing a diet with both the correct balance of key nutrients and immuno-stimulation properties, which could be species specific or for widespread use.

Further information

The National Lobster Hatchery South Quay, Padstow, Cornwall, PL28 8BL.
Tel: +44 (0)1841533877;
email: lobsters@hatchery.freeserve.co.uk;
web www.nationallobsterhatchery.co.uk

NEWS FROM DEFRA

Managing shellfish beds

In March Defra hosted a meeting at which a number of key shellfish stakeholders were able to discuss whether improvements should be made to the legislation supporting Several and Regulating Orders (SROs), used for the protection and management of shellfisheries. Should changes be recommended Defra would look to deliver these through the Marine Bill.

We would welcome your views on how the process of granting, amending and revoking SROs can be improved and these can be emailed to annabel.stockwin@defra.gsi.gov.uk or sent in writing to Annabel at Defra Marine and Fisheries Directorate, Area 7E, 3-8 Whitehall Place, London SW1A 2HH.

If changes are proposed we will, of course, carry out more formal consultation.

The National Shellfish Strategy

The Seafish Industry Authority is leading work on the National Shellfish Strategy for England and their consultant Dr Colin Bannister, formally of Cefas, reported good progress at the meeting of the Inshore Fisheries Working Group in March. The Strategy is due to be completed this summer and will highlight the significant value of shellfisheries in England and discuss their management and development for the future.

SAVING SCOTTISH OYSTERS

A new information campaign to save Scotland's threatened native oysters was launched just prior to last Christmas in Argyll by Scottish Natural Heritage (SNH), Strathclyde Police, Argyll and Bute Council and The Crown Estate. Leaflets and posters were distributed throughout the West coast of Scotland to urge people to watch out for oyster poachers in the run-up to the festive period, which is a peak season for oyster consumption.

Christmas is in fact one of three peak times for oyster consumption in Scotland, as well as Valentines Day and the start of the season in September. A further press release to promote the campaign was issued on 14th February. During these times consumption is up to three times greater than at other times of the year.

Although the bulk of these sales are for farmed oysters, unlawful gathering of native oysters undoubtedly supplies these markets.

The native oyster once supported a prolific fishery in several parts of Scotland, the most famous being in the Firth of Forth, but there are now only a few dwindling and isolated populations left on the West coast.

In the 13th century the Firth of Forth native oyster fishery covered over 129km^2 and was one of the most commercially important in Scotland. At peak production the fishery produced 30 million oysters per year and the superior reputation of the oysters was so widespread that they were sold throughout Scotland, and exported to England and the continent. Extreme pressure from harvesting together with illegal poaching caused the fishery to collapse by the 1870s and eventually stopped entirely by 1920. Surveys of the Firth of Forth in 1957 reported that the species was not only commercially extinct but biologically extinct, as not a single living oyster was found.

In the past over harvesting, diseases and chemical pollution were all factors in the native oyster's decline, while today, the biggest threat to their recovery is unlawful harvesting from sea lochs. Collection of native oysters is unlawful without consent from The Crown Estate.

In an ironic twist of fate for the famed aphrodisiac, populations have become so small and isolated that they have difficulty in synchronising spawning times, which means few eggs are fertilised.

This information campaign aims to raise awareness about the problem and encourage people to help by reporting any unlawful collection or other threats to the native oyster, as well as helping to monitor populations by reporting any sightings.
David Philip, Stewardship and Renewables Manager at The Crown Estate said: "We are pleased to be involved in this awareness raising programme with our partners Argyll and Bute Council, SNH, Association of Scottish Shellfish Growers and Strathclyde Police. We see the scheme as vital in ensuring the long-term future of Scotland's native oysters. The wide distribution and dissemination of information on this UK Biodiversity Action Species should ensure its protection and hopefully restoration on the west coast."

Superintendent Raymond Park, Argyll & Bute Sub-Division of Strathclyde Police said: "Strathclyde Police is pleased to have the opportunity of co-operating with SNH and the other partner agencies involved in this campaign, with a view to reducing the threat to the Native Oyster population in West Argyll. For the campaign to be successful, it is important that those outwith the immediate natural heritage community should understand the issues. That is why we will be making the campaign literature available at the public counters of many of our police stations. We hope that the increased public awareness of the plight of the Native Oyster and of the very restricted circumstances in which it can lawfully be taken from its habitat will reduce losses of the species and increase incident reporting by members of the public."

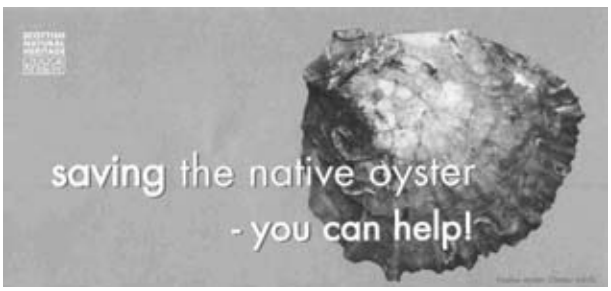
Marina Curran-Colthart- Local Biodiversity Officer for Argyll and Bute said: "Argyll & Bute is renowned for having some of the best examples of biodiversity in Britain. The native oyster is just one of the many species under threat here and this campaign will help people understand its plight and become more perceptive when it comes to enjoying them."

The new leaflet and poster alerts people to the decline of the native oyster and provides three key opportunities for the public to help:

- Report collection of native oysters to the Police

- Take care not to use anti-fouling paints that contain the chemical tributyl tin (TBT) and contact SEPA if you are concerned that the paint is being used

- Report sightings of native oysters to your local SNH office



CONSENSUS

With the increasing demand for seafood in Europe and the declining return from wild fisheries, aquaculture is seen as the industry that will meet this gap in the future. CONSENSUS – a multi-stakeholder platform for sustainable aquaculture in Europe – is an EU Sixth Framework initiative funded under the Key Action of Food Quality and Safety. It is driven by major European stakeholders representing consumer interests, aquaculture producers, aquatic feed suppliers, environmental, animal heath and welfare groups as well as from various levels of legislative bodies in both the EU and Member States.

An inaugural meeting was organized in Oostende, Belgium late last year that allowed stakeholders from 16 countries to present and discuss their views on seafood consumption and sustainable aquaculture development – a first for any European food production sector. A common goal is to promote excellence in aquaculture for the benefit of the European consumer.

The main aim of CONSENSUS is to ensure that sustainability becomes normal practice in the aquaculture industry in terms of the environment, social contribution and economic success into the future.

The production of EU aquaculture continues to rise steadily, representing more than 1.3 million tons of fish and shellfish, worth more than €3 billion in 2004. Production is expected to outstrip wild fisheries production within twenty years. The contribution of aquaculture to the European consumer, in the face of declining fisheries landings, is increasingly important and it also provides a valuable contribution to rural and coastal economies throughout Europe. The European Commission set out a Strategy for the Sustainable Development of European Aquaculture in 2002 and, as a complement to this, the CONSENSUS project has, as one of its key goals, to define clearly the indices for sustainable aquaculture in Europe

Another major role of CONSENSUS is to demonstrate to consumers the health benefits of eating fish and shellfish grown in sustainable conditions.

Participants at the inaugural CONSENSUS meeting in Oostende

The participants at the meeting heard from consumer groups and representatives of the "Seafood Plus" Project [see Shellfish News 17, May 2004 for more about this project] on the nutritional aspects of seafood and the quality of aquaculture products. The conclusions of the meeting highlighted the beneficial effects of PUFA (polyunsaturated fatty acids), trace elements and vitamins contained in seafood against heart disease and other cardio-vascular complaints, as well as a wide range of other medical conditions.

"New information from wide-ranging European surveys shows that consumer perception of the safety and quality of farmed fish is now equal to that of fish caught in the wild" said Alistair Lane, Executive Director of the European Aquaculture Society (EAS), which is coordinating CONSENSUS.

The next step of CONSENSUS is to take the Workshop's conclusions forward for consultation with the different elements of the aquaculture profession, through the representative professional Federations; these are the Federation of European Aquaculture Producers (FEAP), the European Mollusc Producers' Association (EMPA) and the Federation of European Feed Manufacturers (FEFAC). The goal of this part of the project is to define clearly the identifiable and measurable standards of sustainable aquaculture.

"There is a very clear will on the part of the European Aquaculture sector to move towards new standards of excellence that will be of evident benefit to the European consumer" summarised John Godfrey of the European Consumers' Organisation (BEUC) who chairs the Steering Committee of CONSENSUS.

FISH AND SHELLFISH SURVEYS PUBLISHED

Surveys of the levels of various contaminants in fish, shellfish and fish oils have been published by the Food Standards Agency.

The levels have been found to be low and the Agency continues to advise that as part of a healthy balanced diet the majority of people should eat more fish. FSA advice is that people should eat at least two portions of fish a week, one of which should be oily. Fish and shellfish are rich in protein and minerals, and oily fish is rich in long-chain omega 3 fatty acids, which reduce the risk of death from heart disease.

The surveys, which were carried out as part of routine monitoring, show that, where comparisons are possible, levels of contaminants are similar to or have decreased since they were previously measured.

Fish and shellfish were collected or harvested from a range of locations around the UK and retail samples were also taken. A range of contaminants were analysed, including lead, mercury and cadmium, organotins, which are present in sea water from marine paints, and polycyclic aromatic hydrocarbons (PAHs), which come from oil and combustion processes. Some of these substances can occur naturally at low levels, while others are present as a result of environmental pollution.

Scientific experts from the Food and Agriculture Organization/World Health Organization Joint Expert Committee on Food Additives and the European Food Safety Authority have considered these contaminants and set guidelines (for all except PAHs) as to how much can be consumed without posing a risk to consumer health. In addition, the European Commission has set legal limits for some contaminants in food that take into account safety and other considerations, such as measures that should be taken by industry to reduce the levels. Occasional consumption of products that slightly exceed these limits would not be a concern for health.

The results of the surveys have been considered by the Agency, alongside data about consumption levels, to estimate consumer exposure. A summary of some of the major findings is as follows:

Survey of cadmium, lead and mercury in shellfish: Lead, mercury and cadmium can be present at naturally low levels. They can also be found at higher levels as a result of pollution from industrial processes. Samples in the survey included mussels, cockles, oysters, clams, whelks, winkles, scallops and razor shells. Out of the 125 samples in the survey, three mussel

samples exceeded the legal limit for lead and two scallop samples for cadmium. The samples that exceeded the legal limit do not present a health concern because even people who eat well above average amounts of shellfish would still be below the safety guidelines taking into account the rest of the diet.

Survey of organotins in shellfish: Organotins can be present in seawater mainly from previous use in marine paints and can be taken up by fish and shellfish. Samples included in the survey were mussels, cockles, oysters, clams, winkles, scallops and razor shells. Organotins were detected in 50 shellfish out of 155 samples. In 48 of these, this would contribute less than 7% of the safety guideline for average consumers. One sample of mussel and one of oyster contained higher levels of organotins, but exposure would still be less than half of the safety guideline for average consumers.

Survey of arsenic in fish and shellfish: Arsenic is present in the environment from natural sources, such as rocks and sediments, and as a result of human activities such as coal burning and copper smelting. A range of shellfish, such as oysters, mussels and clams, were analysed. All samples had detectable levels of total arsenic. Inorganic arsenic, which has the potential to cause cancer, was detected in 68% of bulk fish and shellfish samples and 100% of individual shellfish samples. There is no regulatory limit for arsenic in fish and shellfish. People's estimated maximum intake of inorganic arsenic would be below 5% of the safety guideline set previously by the World Health Organization, although the guideline is due to be reviewed.

Survey of polycyclic aromatic hydrocarbons (PAHs) in shellfish: PAHs come from oil and combustion processes and only occur in raw shellfish as a result of environmental pollution. Samples of cockles, mussels, oysters, scallops and one clam were included in the survey. Out of 72 samples, all contained detectable levels of benzo(a)pyrene and other PAHs. Mean levels of PAHs are lower by between 40 and 80% since a survey in 1995-6, although the sampling locations are not identical. Some PAHs have the potential to cause cancer and experts advise that it is not possible to set a level that would pose no risk. However, at the levels detected the estimated intake of PAHs from the consumption of shellfish and the rest of the diet is at a level the World Health Organization considered to be of low concern for human health.

SLOW FOOD FACT-FINDING MISSION ON RIVER FAL

Fishermen working on the historic River Fal oyster fishery met representatives of the Slow Food movement in January as part of a fact-finding mission to learn why this historic and traditional fishery needs to be preserved.

Fiona Richmond, executive director of the recently set up Slow Food UK, Silvia Monasterolo, Slow Food's European praesidium and Terre Madre co-ordinator, spent a day gaining a first-hand insight into how the oysters are harvested by traditional oyster sailing boats.

After spending some time on the water fishing with Tim Vinnicombe, whose family have worked these oyster beds for five generations, they were taken up the river by oyster bailiff Paul Ferris to watch the other harvesting method, using haul-tow punts, at Turnaware Bar.

Clare Leverton, who runs the Port of Truro Oyster Fishery Management Group on behalf of the fishermen, said the visit would help to raise awareness of the issues affecting the fishery and the importance of this unique product. "A partnership with Slow Food will raise the international profile of the wonderful oysters caught using traditional sailing and rowing boats," she said. "The fishermen wasted no time in showing Fiona and Silvia some of the issues facing the fishery, such as the slipper limpet, which is a pest affecting the oysters and needs to be eradicated."

Fishing was followed by a visit to oyster merchants Falmouth Bay Oysters, where the visitors saw the special care taken to prepare and present this top quality delicacy for customers across England and the rest of Europe.

Fiona Richmond said: "The Fal oyster is an exceptional product in terms of its taste, quality, and environmentally sound methods of

production, history and traditional links with local culture. This is exactly the type of product the Slow Food movement would like to protect and support, and we look forward to working with all the stakeholders to learn more and take this forward."

For further information please contact Clare Leverton on 01872 270333 or email: admin@swpesca.co.uk.

EUROPEANS PREFER SEAFOOD THAT IS ENVIRONMENTALLY RESPONSIBLE

In the first-ever poll of European consumers, supermarkets, chefs and restaurateurs on attitudes toward seafood and the ocean, 79% said that the environmental impact of seafood is an important factor in their purchasing decisions.

The study, commissioned by the Seafood Choices Alliance in partnership with Greenpeace, the Marine Conservation Society, WWF and the North Sea Foundation, reveals that 86% of consumers would prefer to buy seafood that is labelled as environmentally responsible. Consumers say that reassurance is more important than price, and 40% are willing to pay 5-10% more for seafood identified as eco-friendly, the study from the non-profit trade association shows.

Conducted in the UK, Germany and Spain, the study also found an emerging activism for protecting the ocean through the choices that seafood buyers make: 95% of consumers and 85% of seafood professionals say they want more information about how to buy sustainable seafood.

"These findings are very encouraging because they show that when retailers and consumers are given adequate information, they are quite willing to alter their purchases in favour of sustainable seafood," said Bernadette Clarke, Fisheries Officer at the Marine Conservation Society.

"Consumers have the power to tell the fish suppliers what they want – and this study shows that they want nothing less than sustainable seafood," said Katherine Short, Fisheries Officer for WWF's Global Marine Programme.

"This research shows that European consumers, chefs and retailers want tools available to them in order to make better seafood choices," says Esther Luiten, project leader for sustainable seafood at the North Sea Foundation.

STARFISH SLIME

Starfish slime may seem an unlikely raw product for a high growth company, but whilst most new biotech companies have a long period of research and development before they are ready to market, the active component of this mucus is already proving a secure income stream for GlycoMar Ltd.

Dr Charlie Bavington, managing director of GlycoMar explained: "As unprepossessing as this substance might sound, we collect it from the animals in order to extract the patented compounds it contains.

"The resulting product is then supplied under licence to Rhinopharma Ltd, a Canadian company that is developing drugs to combat respiratory diseases and allergies such as hay fever. It's not quite liquid gold, but having a quick and clear sales path has been crucial to GlycoMar's formation and early development."

GlycoMar Ltd is based at the European Centre for Marine Biotechnology (ECMB) near Oban, Argyll, which is a subsidiary of the Scottish Association for Marine Science. ECMB provided the initial capital and support for GlycoMar.

GlycoMar, which means 'sweet sea', was specifically formed in February of this year to exploit the potential of sugars derived from marine invertebrates. Such carbohydrates – which are common to all animals, and collectively studied within the field of

glycobiology – are fundamental to how cells recognise each other and interact. They are known to play a central role in many diseases including cancer, inflammation and infection. GlycoMar's niche is perceived to be early stage drug discovery and replacement of a number of health products that are currently supplied from mammals.

The company received a business start-up grant of £4,500 and a development grant of £17,900 from Argyll and the Islands Enterprise (AIE).

THE CROWN ESTATE REVIEW FISH FARM RENTS

The Crown Estate has initiated a review of the way it charges fish and shellfish farmers around the coast of Scotland, in a move welcomed by industry representatives.

The Crown Estate owns the seabed out to the 12 nautical mile limit and charges fish and shellfish farmers who want to anchor their cages, long lines or other equipment in the UK's coastal waters, just as a landowner charges a farmer rent for the use of their fields.

But the current system for charging, based on future projections of production levels, is undoubtedly complex and hard-to-follow. Now The Crown Estate is to use the opportunity presented by a planned review in 2008 to find a simpler and more transparent charging system.

The Deputy Minister for Environment and Rural Development Rhona Brankin MSP said: "I welcome this Crown Estate initiative. It is sensible to simplify this complex system through a full review, especially given the commitment by the Crown Estate of no rental increase for 3 years."

The review will be conducted by a team of independent experts, and has been welcomed by a cross-section of industry representatives. David Sandison of Shetland Aquaculture said: "The industry has campaigned long and hard to the Crown Estate Commissioners for a review of charging methods and rent levels, so we welcome a truly independent panel being established to conduct a top to bottom review.

"We also appreciate the recognition and commitment by The Crown Estate to work towards a long term solution to one of the issues affecting the future competitiveness of the sector. It is essential that we can retain a viable and sustainable future for an industry that is central to many of the more remote and peripheral areas of Scotland."

Alan Anderson of Western Isles Aquaculture Association welcomed the initiative too, saying: "I hope that all the other regulators will follow The Crown Estate by taking a similar approach to reduce the regulative and legislative burden on the Scottish aquaculture industry. Such actions are essential if the Scottish industry is to be competitive within the global marketplace."

Backing for the initiative has come from the shellfish sector. There is a growing Scottish shellfish industry, worth an estimated £10m annually. The Association of Scottish Shellfish Growers supports the move. "Although the regular rent review for the shellfish sector is not due until 2010, the ASSG welcomes this early re-assessment of the system and the level of rental charges. Recognition of the need to make adjustments to rents, in order to support the long term economic sustainability of the shellfish cultivation industry in these times of rapidly rising costs, is to be commended", observed Doug McLeod, Chairman of the ASSG.

Ruth Henderson, chief executive of Seafood Shetland, incorporating Shetland Fish Processors and Shellfish growers, said: "Shetland's shellfish farmers operate entirely in rural locations. Shellfish production in the area is providing long-term employment; sustainable, high-quality food production, and support for local ancillary industries, in areas where the local economy is often fragile. Shellfish farmers in Shetland welcome the decision to review the charges levied upon them by the Crown Estate."

Frank Parrish, The Crown Estate's Marine Estate Director added: "We want to do everything we can to help the aquaculture industry in Scotland grow and prosper."

The team of independent experts has been appointed. The group includes former Marine Harvest Scotland boss David Windmill, Stephen Pollock, Head of Valuation at chartered surveyors James Barr and Alan Christie of Ernst and Young.

As Frank Parrish explained: "Aquaculture has changed significantly over the years and we hope the expert panel will find a simple and understandable method for charging.

"We have worked with the industry to select an impressive group of people at the top of their field. Over the coming months they will be looking at past and current economics and prospects for the future in order to develop alternative charging systems. I am confident they will produce a solution that better meets modern needs."

SOLWAY COCKLE FISHERY

The Scottish side of the Solway cockle fishery re-opened in March for the first time in four years to more than 100 fishermen who hold licenses.

A new management system overseen by the Solway Shellfish Management Association (SSMA) is now in place.

Fisheries Minister Ross Finnie urged fishermen to act responsibly in working with enforcement agencies in the area:

"The healthy cockle beds are an important asset for fishermen and local communities but they must be managed in a sustainable and safe manner. I believe that the Solway Regulating Order is the best way of doing this.

"There should however be no doubt that the Solway Cockle Fishery is only open to those who have obtained a licence from the SSMA. All enforcement agencies involved will work to ensure that anyone found fishing illegally is prosecuted.

"The Solway Firth Regulating Order would not be in place were it not for the efforts and support of the SSMA. I am grateful for their efforts and those of partners in Scottish Enterprise Dumfries and Galloway, Dumfries and Galloway Council, Dumfries and Galloway Constabulary and the Health and Safety Executive"

The Solway Firth Regulated Fishery (Scotland) Order 2006 (SI 2206 No 57) (the Solway Regulating Order) and the Inshore Fishing (Prohibition of Fishing for Cockles) (Scotland) Order 2006, which effectively lifted the restrictions which were in place to allow those with a Regulating Order licence to fish, came into force on 13 March 2006.
Under the Regulating Order 100 licences have been issued to hand gatherers, six licences have been issued for vessel fishing and one tractor dredging licence has been issued on a trial basis.

PUBLIC INQUIRY ON INSHORE FISHERIES PROPOSALS

An independent inquiry to examine proposals for the management of shellfish fisheries in the Highlands was announced last November.

The inquiry will consider objections to the proposed Highland Regulating Order.

Fisheries Minister Ross Finnie said: "I know that plans for a Highland Regulating Order have prompted considerable debate, both in the Highlands and beyond.

"I am keen to resolve the question of whether the proposals are the best way to manage and develop this vital element of the Highlands' environment and economy.

"A number of relevant objections to the scheme have been received and, as required by the Sea Fisheries (Shellfish) Act 1967, I will be appointing an inspector to make an inquiry into the subject matter of the proposed Order".

Regulating Orders are made by Scottish Ministers under the Sea Fisheries (Shellfish) Act 1967 and permit a grantee to maintain and regulate a fishery in the designated area. The applicant follows a statutory process, which includes a period for objections to be raised. Should objections be received that are "neither frivolous nor irrelevant", Ministers are required under Schedule 1 of the Act "to appoint some fit person to act as inspector to make an inquiry concerning the proposed order".

The Highland Shellfish Management Organisation's (HSMO) proposed Highland Regulating Order aims to improve management of a variety of shellfish - including scallops, crabs and lobsters - around the area's coastline. Shellfisheries play an important role in the Highlands economy, for example by providing employment for around 1500 fishermen.

The Highland Shellfish Management Organisation is promoting the proposed Order, consultation on which took place during late 2004.

EXOTIC CRAB POISED FOR WIDESPREAD UK INVASION

The Chinese mitten crab, brought to Britain during the last century in ships' ballast water, is spreading at an alarming rate and could cause devastating environmental problems if populations are not monitored and controlled, a new study shows.

The study details how the UK colonisation of mitten crabs has increased on a large scale in recent years. Scientists from the University of Newcastle upon Tyne carried out the first comprehensive modelling of the crab's migration through Europe and the UK. They compared the two and found the pattern of the crabs' ongoing invasion of the UK is similar to the population expansion in Europe earlier in the last century when the Continent experienced a major outbreak.

The study authors predict that the mitten crab - so called because its claws are coated with small clumps of dark brown fur, or mittens - has the potential to establish itself in all major UK estuaries in several years time.

Mitten crabs are unwelcome because they prey on protected UK native species such as the white-clawed crayfish and salmon eggs and fry. They also settle in river banks, burrowing into them and riddling them with bore holes up to half a metre long, which may eventually cause the bank to collapse.

The Newcastle University study, published in the academic journal Biological Invasions, recommends that a nationwide monitoring and trapping system for the crab should be

The Chinese Mitten Crab

introduced before it is too late to control the population.

Chinese mitten crabs are already present in some of our waterways, including the Thames, Humber and Tyne rivers and parts of the North Sea and Channel coasts. Recently it has been spreading at a very fast rate. From 1997-1999 the spread along the coast was 448km per year - nearly six times the average spread of 78km per year from 1976-1999. In rivers, the increased spread from 1995-1998 was 49km per year, around three times the average spread of 16km per year from 1973-1998.

The UK spread was most marked along the east coast northwards to the River Tyne and on the south coast westwards to the River Teign.
Dr Matt Bentley, one of the research team, said: "The pattern of the spread in the UK since the 1970s mirrors the spread in mainland Europe and in the Baltic region which experienced a major outbreak. This is a fairly good indication that the UK is set for a similar situation."

Mitten crabs can be found in the sea or rivers because they are catadromous - meaning they mainly live in freshwater but must migrate to the sea to breed. Their potential for widespread colonisation is increased by the fact they can cross dry land and can migrate up to 1,000km while growing to adult size.

A decrease in river pollution and a prolonged period of drought in the late 1980s - which together improved habitat conditions for mitten crabs - are potential reasons for the recent population rise.

Dr Bentley, of Newcastle University's School of Marine Science and Technology added: "This study demonstrates the importance of a monitoring programme for the mitten crab, even if its appearance is just a rare occurrence in an estuary. Records demonstrate the crab's ability to rapidly expand once the local population reaches a critical density and or conditions become favourable.

"With most invasive species, such as the grey squirrel, the problem is not recognised until it is too late to do anything and you can not eliminate it without taking drastic environmental measures.

"This study shows there is a need for a monitoring system for the mitten crab which could help manage the spread at an early stage. Low cost options could include a public awareness campaign where anglers and other users of rivers and the coastline are encouraged to report sightings of crabs. Measures which are currently used to monitor fish in our rivers, such as the electrical fish counters, could also be adapted to include monitoring of mitten crabs."

The research team also included Professor Tony Clare and Dr Steve Rushton at Newcastle University and Dr Leif-Matthias Herborg, formerly of Newcastle University and now at the University of Windsor (Ontario, Canada).

M &S HONOURED FOR CONTRIBUTION TO UK AQUACULTURE INDUSTRY

UK retailer Marks and Spencer was honoured for its contribution to the aquaculture industry at a prestigious awards ceremony in March of this year.

The company was presented with the inaugural Fish Farmer magazine 'Fit for the Future' award at the Aquaculture Today 2006 gala dinner, held at the Sheraton Grand Hotel in Edinburgh. The award, which recognises outstanding achievement and innovation in aquaculture, was judged by a panel of industry experts including Bob Kennedy, Senior Editor of Fish Farmer magazine.

Commenting on the award, Mr Kennedy said: "The winners' shortlist demonstrates the diverse and innovative nature of today's industry. Marks & Spencer have made a tremendous contribution to the UK aquaculture industry, and have in fact worked closely with several of our nominees, and it was only right and fitting that they be the first recipient of this award."

The winners' shortlist consisted of (in no particular order):

- Karol Rzepkowski and Laurent Viguie of Johnson Seafarms for pioneering development

- Walter Speirs of the Scottish Shellfish Marketing Group for helping to promote growth of the mussel industry
- The SMILE project for addressing environmentally sustainable aquaculture by using an integrated ecosystem approach
- Stirling Institute of Aquaculture for RAFOA - Research Into Alternatives To Fish Oils In Aquaculture
- Marks & Spencer for co-operation with the aquaculture industry in research & development covering a number of farmed species
- Young's Bluecrest Seafood Ltd for commercial commitment to the future of seafood and raising the profile of aquaculture produce through effective promotion
- National Lobster Hatchery, Padstow, for its innovative re-stocking project, funded through various initiatives
- Loch Fyne Oysters for promoting consumption of luxury aquaculture products.

The National Lobster Hatchery had previously been presented with a Seafish 'Pride in Seafood' award for its "outstanding" contribution to the UK seafood industry.

ENVIRONMENT AGENCY ADVICE ONLINE

The Environment Agency are highlighting how small and medium enterprises (SMEs) can gain economically as well as increase their environmental awareness through following guidance offered by the NetRegs website. NetRegs is an online information resource that provides SMEs with clear and concise information on how to comply with green regulations and provides advice on good environmental practice. The NetRegs website is free to use and there is no obligation to register - visitors can remain completely anonymous.

Small businesses that do register can receive free email updates about environmental issues affecting them and links to further information and advice. The e-alerts can be personalised to provide information relating to the food and drink sector, such as changes to the rules on hazardous waste or adjustments to the Animal By-Products Regulations, as well as more general environmental updates on subjects including water and air emissions.

By ensuring they comply with environmental legislation, smaller manufacturers can avoid the risk of prosecution and reap significant commercial benefits in terms of cost savings and improved customer relations. To register for the e-alert service or for more information on the environmental legislation affecting the seafood sector, visit www.netregs.gov.uk.

NEWS FROM LANTRA

Experience counts for mature learners!

A new initiative that aims to help mature workers develop and improve their employability skills has been launched in Scotland. 'Experience Counts' has been set up in partnership with the Skills for Business Network in Scotland and recognises the increasingly significant role that people aged over 50 play in the country's workforce. Learners are being offered free training in areas such as communication, information technology, team working and customer care. Lantra were one of three Sector Skills Councils who successfully piloted the scheme and now look forward to further recruitment. Workers from the Aquaculture industry who are age 50+ are urged to contact Lantra Scotland to take advantage of this great opportunity. Call today on 01738 553311 or e-mail lantra.scotland@lantra.co.uk

New Industry Partnership Manager for Aquaculture

Liz Paul is the new Industry Partnership Manager for Aquaculture. Liz has been showcasing the Sector Skills Agreement Stages 1-3 consultation document (see below) to employers and other key stakeholders from the aquaculture industry and has enjoyed a good response: "Reactions to the SSA so far have been very positive and encouraging. Lantra's relationship with the industry is vital to our work." Said Liz, who is also the Regional Partnership Manager

for Highlands and Islands area, where her development work has been highly commended. Contact Liz on 01738 553311 or e-mail liz.paul@lantra.co.uk

Raising skills... growing businesses

Stages 1 to 3 of the environmental and land based Sector Skills Agreement (SSA) are now complete. The consultation document for the Aquaculture industry is available for comment and feedback on Lantra's website at http://www.lantra.co.uk/SSAreports.asp.

Stages 1-3 involved research into current and future issues affecting Aquaculture businesses. The research, a combination of focus groups, one to one interviews, desk research and telephone interviews, assessed the current and future skills (and training) needs of businesses. Current provision of training and education was also thoroughly investigated in order to determine whether or not it meets the real needs of employers. The SSA is made between businesses and governments, funding agencies and partners. It will give employers more influence on skills policies and funding to ensure a sustainable workforce for the future. Throughout the first half of 2006, Lantra will be negotiating with governments and partners to secure commitment to making the changes needed, as well as gaining further support from employers working in land-based and environmental industries. To contribute your views or for additional information, please e-mail ssa@lantra.co.uk or telephone 02476 858 411.

"The Sector Skills Agreement provides a vital opportunity for the industry to have its views acknowledged - leading to a better understanding of the industry and optimising business success," said Doug McLeod, Chair of the Aquaculture Industry Group.

NEW ONLINE COASTAL ATLAS

A new online atlas was launched at the Coastal Futures 2006 conference in January. The 'Coastal and Marine Resource Atlas' will replace outdated hard copy maps of the UK's coastline with constantly updated marine data intended as a one stop shop for planning how the UK protects the environment in cases of oil spills at sea.

The atlas contains environmental and other resource datasets covering the Great Britain coastline and marine areas of the UK Continental Shelf. It is designed as a living web-based tool providing greater access to a wide range of information on coastal and marine resources and will aid both government and industry to better manage coastal resources and the seas around the UK coast.

The atlas is the result of a two year project funded by UK private and public sector organisations led by the Maritime and Coastguard Agency (MCA) and Defra along with other government agencies. The atlas is hosted by MAGIC, a web-based interactive mapping site, which draws together information on key environmental schemes and designations in one place.

This will be an important tool for improving how the UK plans to manage the precious natural coastal and marine resources in times of marine emergencies but in the event of actual spills expert advice will always be sought. The project has been undertaken using both private and public sector funding working together and sharing information.

For further information: www.magic.gov.uk/camra.html.

OYSTER BONANZA AT CHRISTMAS

Last Christmas brought an oyster bonanza to Scotland's shellfish farmers. Sales of oysters normally run at around six tonnes a month, but during December, Scottish Shellfish Marketing Group (SSMG) farmers received orders for 24 tonnes of oysters to be shucked and slurped at Christmas parties throughout the UK and, surprisingly, Switzerland. All of SSMG's oyster output goes to supermarkets and wholesalers in the UK, and one supermarket chain in Switzerland.

Scottish oysters have one major advantage over their overseas competition – they are always in season. The Pacific Oyster spat is grown in waters along the West Coast of Scotland that never rise above 18 degrees Celsius - ensuring constant fresh growing conditions all year round.

Says SSMG Managing Director Donny Gillies: "Oyster farming at Christmas is like a military operation. Unlike turkeys, which can be prepared weeks in advance and kept chilled, Scottish Oysters have to be extremely fresh – and everyone wants to eat them on December 25th! We' were working flat out to supply Britain and Switzerland with the Christmas treat that is festive food with real luxury – superb Scottish oysters."

Composting whelk waste

Due to increasing environmental controls and restrictions on the disposal of animal by-products, the seafood industry is in urgent need of alternative ways of disposing of their seafood waste.

Trials in 2003 showed that composting is one suitable process for treating different types of seafood waste and since then, Seafish has carried out a number of commercial-scale trials with composting companies.

One recent set of trials, commissioned in 2005 in north-west England, assessed the suitability of commercial-scale composting for the disposal of cooked whelk waste. AM Seafoods of Fleetwood provided the cooked whelk waste and TEG Environmental carried out the composting, using their commercial facility near Preston.

The compost was analysed to see whether it was safe and suitable to use in land-based applications. The whelk compost was found to be a good material for use as a fertiliser or soil improver although the compost was not suitable for direct use as a growing medium as the nutrient levels were too high.

Seafood businesses that want to send their waste for treatment at a site will have to pay a gate fee. This fee varies according to the type, quantity and difficulty of the waste and it is estimated at around £40-60 per tonne.

Alternatively, companies can establish a composting facility themselves or in partnership with other businesses. The economics and viability of composting vary significantly depending on factors such as plant size and gate fees for receiving other materials. Therefore, costs will vary depending on the nature of the operation.

For further information contact Seafish fish technologist, Michaela Archer on 01482 327 837 or email web_fish_waste@seafish.co.uk

Crustacea datasheets

The Seafish Inshore Group and Seafood Scotland are producing helpful guidance for the seafood industry on storing and handling live crustacea to help businesses comply with the law and achieve high standards of operation.

The guide encourages practices that ensure product quality and efficient use of resources for crabs, lobster and shrimps. Arranged into three parts, the first section describes legislation, for example food safety and animal health and welfare, that businesses need to be aware of when handling live product.

SEAFISH

10 GOLDEN RULES

to look after your crustacea stock:

1. Cool the stock (4-8°C) and keep it cool.
2. Keep them in the dark.
3. Keep them in fresh, good quality seawater and exchange it regularly.
4. If you cannot put the crustacea into seawater, keep them cool and damp.
5. Handle gently; do not throw or drop them. Do not damage the shell.
6. Grade carefully - remove undersized, weak, diseased or injured specimens.
7. Keep the stock free from contamination.
8. Prepare the stock for onward transport; stop feeding them and cool them.
9. Return poor quality specimens to the sea - do not try to sell them.
10. Beware of the 'domino effect' - one mistake, one excessive stress, one death in a packed container and the survival rate falls away.

EUROPEAN COMMUNITY
Financial Instrument for Fisheries Guidance

Crustacea need careful handling

The other two sections provide information on ensuring high quality of product. These detail how to look after live crustacea to maintain quality and minimise mortality. The first of these two sections General guidance gives advice that applies to all species of crustacea.

The other section Species in detail complements the general guidance in that it provides advice specific to the following species; Brown crab, Spider crab, Velvet crab, Lobster and Crayfish, Nephrops, Squat lobsters and Common prawn.

Seafish are making the guide available in three formats – waterproof single sided data sheets that are suitable for fishing vessels and commercial environments, a large manual that is mainly for reference and offers more detail than the sheets, and a CD. The CD will contain all the detailed information and the summary sheets.

Presently, two datasheets are available. The Ten Golden Rules, describes the main principles or rules for handling live crustacea, and the General crustacea guidance, which provides additional information on legislation and water quality.

For more information contact: Marcus Jacklin, inshore advisor with the Inshore Group Tel: 01482 327837 email: m_jacklin@seafish.co.uk

Scotland Nehprops survey

Seafish is currently conducting a detailed survey of the west of Scotland Nephrops sector. The survey is being carried out not only to assess fishermen's views on the various issues affecting the west of Scotland Nephrops industry, but to gauge the scale, nature and impact of these issues, and to present a summary of fishermen's ideas for possible solutions.

Robert Stevenson, chief executive of the West of Scotland Fish Producers' Organisation, said: "It is extremely important that fishermen involved in the Nephrops sector in the west coast of Scotland take part in this study. Without their input it will be much harder to resolve the issues faced by the industry. I would encourage all fishermen to take part in this important study"

This study will look at management objectives for the fishery, the sustainability of the fishery, how to maximise catch value, and local fisheries management measures. This work will provide valuable information to fishermen's associations and other representative bodies, such as the West of Four Fisheries Management Group (WOFFMG), and the proposed network of Inshore Fisheries Groups (IFG's) currently being established in Scotland. Improving the quality of information available to such groups will assist in developing future inshore fishery management recommendations.

The study will target all vessel owners/skippers fishing Nephrops in the area from Duncansby Head in the north, to the Mull of Galloway in the south (including Orkney and the Western Isles).

The Economics Team at Seafish, who are conducting the study, are contracted by the WOFFMG, with funding provided by Highland Marine Resources & Communities Scheme (HiMaRCS), The Scottish Executive and Seafish.

The success of this survey depends on as many Nephrops vessel owners taking part as possible. Seafish acknowledges that the data collected on the survey form is confidential in nature and may constitute commercially sensitive information. The data collected will be used for Seafish's own economic research and assessment purposes and will not be revealed or disclosed to any third party. However, this data may be analysed and published along with other data from the same survey, but will be anonymous.

Seafish Inshore Group host Shellfisheries workshop

A workshop covering a wide range of issues relevant to shellfisheries along the east coast of England took place in Bridington recently.

Hosted by Seafish, and attended by up to to 40 shellfish industry representatives, the workshop included presentations on environmental issues and responsible fishing, fuel efficiency and vessel design. Attendees also had the opportunity to discuss their individual needs with Seafish staff.

Industry representatives played a major part in setting the agenda for the workshop by working closely with Group Training Associations and Regional Development Agencies to give their views on what they would like covered in the workshop, ensuring its relevance and benefit to industry.
Plans are in place to hold more events in other parts of the country over the next few months. For more information, please contact Marcus Jacklin, Seafish inshore advisor on 01482 327837 or email: m_jacklin@seafish.co.uk.

Seafood Awards

Following the success of the first ever Seafood Awards in March 2005, Seafish is delighted to announce it will once again be playing a central role in encouraging enterprise and innovation across all sectors of the seafood industry in the UK by hosting the Seafood Awards 2007 next March.

Set up to raise industry standards and to reward and recognise best practice, the awards are aimed at bringing together different sectors of industry. There are award categories covering all sectors of the industry, from catching to processing, foodservice to retail, and nomination brochures will be available later this year. To find out more, contact Anne Kennedy on 0131 524 8658 (a_kennedy@seafish.co.uk)

SHELLFISH ASSOCIATION OF GREAT BRITAIN (SAGB)

Shellfish Association Cautions Members on Depuration

In early February this year the Shellfish Association became concerned by widespread reports in the press of large outbreaks of the 'winter vomiting' bug in many schools and hospitals across the country. It was also a period of cold weather, when water temperatures had dropped lower than they have been for many years.

The outbreaks, caused by norovirus, were not related to shellfish, but had potential to infect shellfish and if this happened, to spread infection by this route. The weather up to early February had been dry, so it was expected that few storm overflows would have been operating, but there was concern that any sudden change to wet conditions could have risked contamination of shellfish beds.

The Association wrote to its members who operate purification tanks advising them to prolong depuration time as long as practical beyond the statutory 42 hours and to raise the temperature of the water a few degrees above the minimum, suggesting 12°C for most species and 10°C for mussels.

Whilst there is little experimental evidence that 2 days depuration will remove anything more than a fraction of norovirus loading from bivalves, the Association believes the epidemiological evidence is that when done properly at temperatures that permit the shellfish to be active without being stressed, it is effective in minimising viral risks.

Evidence for this view came a few years ago when norovirus outbreaks, instead of being a predominantly winter problem, actually peaked during a summer. Again, this was not related to shellfish. Following those events, there was no suggestion from reported outbreak data that shellfish had begun to cause problems, so it appeared that during summer time at least, the combination of treatments now in place to prevent contaminated shellfish reaching the market are effective. The main shellfish producing estuaries have now benefited from big improvements in sewage treatment works and with effective universal depuration in place (SAGB advises all operators to purify their shellfish, irrespective of A or B classification) it appears that the risks have been greatly reduced.

It is acknowledged that minor ailments such as norovirus are frequently not recorded when they affect small numbers of people and it is the large outbreaks, often in institutions that do get reported. In the USA, John Painter of the Centers for Disease Control and Prevention reported in December that they estimate that for each case reported there are 38 people infected in the population at large. Experimental data so far does not confirm the view that standard depuration will greatly reduce viral risks, though the original aim of two day depuration was to allow some time beyond that needed for bacterial depuration in order to deal with light viral loading.

On the Continent, depuration is usually much shorter, from 5 to 24 hours, aimed specifically at meeting the bacterial end-product standard criteria and there is no doubt that such shellfish do from time to time cause problems from norovirus. The European Commission is eager to take steps to improve the viral safety of molluscan shellfish. SAGB believes that it is vital that the evidence from UK practice is recognised and that in practice the UK system does already largely overcome virus problems. There is a need for more research on water temperatures, as the current minima may be too low.

Getting the message of the effectiveness of UK practice to the Commission will not be easy, as 42 hour depuration is likely to be resisted in Europe because it will be difficult for many large operators, but SAGB believes that the UK's success in largely defeating viral health risks must be recognised and put into wider practice. Shellfish are an important part of a healthy diet and it is essential that the public have full confidence in consuming them.

Further information

The Shellfish Association of Great Britain, Fishmonger's Hall, London Bridge, London, EC4R 9EL (Tel. 020 7283 8305) (Fax. 020 7929 1389) (email: SAGB@shellfish.org.uk)

ASSOCIATION OF SCOTTISH SHELLFISH GROWERS (ASSG)

Water quality

Since the 2005 draft Harvesting Area classifications, characterised by a swingeing downgrading of almost 50% of Scottish sites, the ASSG, supported and endorsed by others, such as The Crown Estate, Seafish and HIE, has been working steadily to raise the profile of the water quality issue with the Scottish Executive (Ministers and officials), MSPs, SEPA, FRS, Scottish Water and the Local Authorities. I believe that we are achieving a measure of success in pressing the issue through the deep undergrowth of bureaucracy, which will lead to improved progress on minimisation of pollution of our growing waters.

A brace of research projects on water quality issues have been funded to investigate the perceived decline in west coast water quality, seeking an explanation for some poor E.coli results, while representations to SEERAD, SEPA and SW appear to be making some progress in recognition of the need to upgrade water treatment capabilities. However, there is every sign that this is an issue that will continue to haunt us for a long time to come, and continued pressure on the 'Competent Authority' (SEPA in this case) will be essential.

However these discussions and representations take time, and it must be accepted that this is a never-ending process of fighting our corner – in addition, the ASSG is involved in all the on-going debates concerning implementation of EU Directives (Water Framework, new Food Hygiene, Strategic Environmental Assessment, etc, etc), all of which are long term processes of representation. There is no doubt that patience and tenacity are major requirements for anyone involved in aquaculture representation activities!!

Biotoxins

Biotoxin issues continued to concern members during 2005, and indeed shellfish growers elsewhere in the EU – Galician scallop and mussel producers have been largely closed for much of 2005 due to biotoxins, and it was a bad year for Irish growers too. In the opening months of 2006 there appears to be some credible movement in the process of weaning regulators away from the mouse bioassay (MBA) and onto chemical testing methods, including a proposal to recognise the recently approved (by the AOAC) HPLC-based 'Lawrence Method' for PSP as the Reference Method alongside the MBA. This proposal is under active debate within Europe, and potentially could be implemented by mid-2007. So after 50 years, some positive action on this front!

On the other hand, there are some negatives, with rumblings from DG Sanco about halving the regulatory limit for DSP (OA, DTX and PTX) from 160 ug/Kg OA equivalent to 80 ug/Kg, while the UK Committee on Toxicity has concluded that the PSP limit should be reduced from 800ug/Kg to 200 ug/Kg. The ASSG will oppose such moves, claiming no justification on a risk assessed basis, and press for extensive consultation before any downward move in regulatory limits.

The impact of the new food hygiene legislation concerning biotoxins, implemented from 1 January 2006, will be largely felt by the scallop capture sector (especially divers and dredgers), while it will generally continue as 'Business As Usual' for aquaculture sites, albeit with a greater emphasis on producer responsibility – so more End Product Tests please!

Annual Conference and Code of Good Practice

The ASSG Annual International Conference in October 2005, themed on 'Sustainability', appears to have continued the 'trend' to 'better', as evidenced by growers' positive reactions, both verbally and written. The speakers focussed on issues close to growers' interests, from Kevin Voisin detailing post-harvesting processing (taking time off from recuperating from Hurricane Katrina's impact on the family business in New Orleans), to Bruce Samson giving insights into the development of the New Zealand mussel cultivation sector). And many, many more!! An impressive event, which I think rewarded – in some fashion – everyone who attended.

One particularly significant element of the Conference was the launch of the 'ASSG Code of Good Practice', a document (hard copy and

electronic) which was distributed to all attendees and will be distributed to all ASSG members. This is an effort to maintain our 'environmentally benign' credentials, and keep us up to date with aquaculture industry developments – if we wish to be taken seriously as a sector, and as a representative trade association, then we have to have policies and documents such as these.

The next question is whether we take this 'Code of Good Practice' platform as a basis for some form of quality audit, some form of branding for our shellfish products – for those who sign up to its precepts and principles. This year's AGM will continue to focus on these issues, when the costs and benefits associated with the possible implementation of a quality audit/ branding exercise based on the 'ASSG Code of Good Practice' will be addressed.

Environmental aspects

The latest possible threat for our activities is seen by some as the move by the Scottish Executive, via SNH, to create a 'Coastal and Marine National Park'. An instinctive reaction is to see such a development as a threat to shellfish cultivation, as we, like other 'normal' coastal activities, are likely to be perceived as having a significant environmental impact, an impact not desirable in a 'National Park'. I trust that we will be able to ensure that any constraints resulting from the emergence of a Marine National Park will be minimised for shellfish cultivation, another area of activity for your Association during 2006!

Historically the parameters of restrictions on our activities have generally been recognised as having rational drivers, originally based in public health, rather than conservation issues, so the political driver for the CMNP is a new playing field for us. Indeed, the usual drivers for policies on shellfish related matters are science-based, reflecting scientific issues relating to public health, the environment or the impact of our activities on the sea, the coast or our neighbours (or the impact of our neighbours on us!). This relationship is acknowledged in the fact that the major theme of this year's ASSG International Conference (diary date - 26th & 27th October 2006) will be the interaction between science and regulation of the shellfish cultivation industry (microbiology, biotoxins and emerging issues such as ballast water transfers, vibrio and chemical contamination). Such scientific drivers can be rationally debated, in contrast to emotive, subjective, political and personality driven agendas which we appear to facing increasingly as we enter the 21st Century.

The ASSG is always striving to ensure that the views of the Scottish shellfish cultivation sector enjoy an input at the wider arena and one dimension that we are actively participating in at the moment is via an EC funded project named 'CONSENSUS', which aims to identify and promote improvements in sustainable aquacultural practices (including commercial sustainability, see Announcements, in this issue of Shellfish News, for more information on Consensus).

Another theme that continues to grind away in the background is the issue of certification of cultivated shellfish as 'organic'. I personally continue to fail to perceive any specific positives for our industry from such certification, and instead identify a number of 'downsides'. Instead, I believe that quality branding on the basis of sustainability would be more positive for improving consumer perceptions and raising the market profile of the environmentally benign characteristics of shellfish cultivation. Similarly our colleagues in France believe that improving the market profile of shellfish should not be based on the concept of 'organic', but rather on the promotion of a 'natural' image for shellfish.

Chinese visit

In March we hosted a visit from a small delegation from the 'Seafish Industry Authority' of China, who were visiting Scotland to observe best practice in production through processing and science (see photos) - my thanks are extended to all those who assisted in welcoming the group, including SSMG, Loch Fyne Oysters, Kames Fish Farming, Muckairn Mussels, SAMS and Integrin. In an analogous fashion to my wish to negotiate agreements with competing interest groups in the coastal zone, I believe we have to establish positive relations with the largest producer of cultivated shellfish on the planet, ie China. I am convinced that by being 'ahead of the pack' in building relationships with Chinese organisations, Scotland can establish a mutually beneficial and positive relationship with our Asian competitor/potential collaborator.

Delegates from the Chinese Seafish Industry Authority on a recent visit to Scotland.

I believe it is issues like sustainability, agreed protocols over micro-biology and biotoxin testing with regulators, resolution of disagreements and achievement of consensus with competing coastal zone interest, whilst maintaining commercial reality, that will both define 2006 and establish the parameters for the next decade of successful shellfish cultivation. The ASSG plans to be a central player in this process, but it requires support from the membership – and the greater our membership the stronger our position. So if you know shellfish growers who have neglected to join this Spring, please encourage them to 'come inside the tent'!

Further information

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THE UK *BONAMIA* & *MARTEILIA* SAMPLING PROGRAMME 2005

Ian Laing
CEFAS Weymouth Laboratory

Introduction

The two most serious diseases of native oysters in Europe are Marteiliosis and Bonamiasis. In 2002 the UK achieved Approved Zone status in respect of these two diseases (Commission Decision 2002/300/EC). Approved Zone status recognises that it has been demonstrated, by regular and targeted sampling and testing, that the oysters in the specified areas are free from the causative organisms of these diseases. For *Marteilia refringens*, the whole coastline is approved and for *Bonamia ostreae* the whole coastline, except for three restricted areas, where the disease is found, is approved. These three areas are (1) from the Lizard to Start Point; (2) from Portland Bill to Selsey Bill and (3) from Shoeburyness to Felixstowe.

Approved zone status enables us to operate import controls aimed at preventing the introduction of these diseases from elsewhere in the EU, where they are known to occur, or where no sampling and testing is carried out. Movements within the UK are also controlled according to the health status of these areas. Anyone wishing to deposit or relay any molluscan shellfish taken from the controlled (restricted) areas listed above must apply for permission to the Fish Health Inspectorate at the Cefas Weymouth Laboratory (for England and Wales) or the Fisheries Research Services at the Marine Laboratory, Aberdeen (in Scotland). Addresses are at the back of this issue of Shellfish News.

Sampling results for England and Wales in 2005

For Bonamia, Table 1 gives a summary of the results for all sites from which samples of native oysters (*Ostrea edulis*) were taken in autumn 2005. The usual sample size at each site was 30 oysters. Sites in the unrestricted areas (i.e. those free from *Bonamia* and *Marteilia*) were also sampled in spring 2005. No cases of *Bonamia* were detected in these samples.

All samples were also examined for *Marteilia*. This was not detected in any samples.

In Table 1 the results for 2005 are compared with those for the previous four years. The level of *Bonamia* infection in 2005 appeared to be slightly higher in farms but slightly lower in fisheries than in previous years.

The average for all the sampled farm sites was 16.12% of oysters infected, compared with 13.15% the previous year and a ten-year average of 16.6%. There was no evidence that higher than usual mortalities at some farm sites in Essex were as a result of disease. Adverse water quality is a suspected cause of this problem.

The average for all the fishery sites sampled was 4.46%, compared with 5.19% the previous year and a ten-year average of 4.23%. *Bonamia* was not detected in any of the samples taken from the Fal wild fishery for the first time ever, although the disease organism will still be present in this area.

Table 1: Summary of results of native oyster sampling in England and Wales for Bonamia (2001-2005)

	Restricted Area 1 The Lizard to Start Point		Restricted Area 2 Portland Bill to Selsey Bill		Restricted Area 3 Shoeburyness to Landguard Point		Unrestricted Areas	
Year	Sites	% infected (range)	Sites	% infected (range)	Sites	% infected (range)	Sites	% infected (range)
2001	11	0-30	22	0-26	15	0-60	5	0
2002	11	0-10	23	0-29	12	0-46	6	0
2003	11	0-25	23	0-33	15	0-62	6	0
2004	6	0-7	24	0-30	20	0-50	7	0
2005	4	0	23	0-30	17	0-37	4	0

The disease has not spread outside of the restricted areas in which it has been recorded in previous years.

Sampling results for Scotland in 2005

Approved Zone status for the notifiable diseases Bonamiasis and Marteiliosis was maintained in 2005. Testing confirmed the absence of these diseases in samples taken from all six farm sites holding native oysters in Scotland. Two tests (spring and autumn) were carried out, with a sample of 30 oysters examined in each case.

Sampling results for Northern Ireland in 2005

Bonamia ostreae was detected for the first time in flat oysters collected in Lough Foyle in 2005. This Lough lies between Northern Ireland (UK) and the Republic of Ireland (RoI). The initial positive results were found for samples collected on the RoI side of the Lough and tested by the Marine Institute in spring 2005. Following this positive result, two further rounds of testing were performed in collaboration with RoI. Three sets of 150 oysters were sampled from the RoI side, the NI side and the middle of the Lough, with each lab testing the shellfish from their own side and half of the shellfish from the middle. This was repeated again late in 2005. Testing was conducted in NI by histological examination and also by PCR. No positive samples were found by histology. However 6 samples, collected during summer 2005 were found positive by PCR and (for some) confirmed by sequencing.

Lough Foyle previously enjoyed Approved Zone status for *Bonamia* and this has been suspended, with the appropriate controls on shellfish movements put in place. Samples from other parts of the Approved Zone, in Strangford Lough and Larne Lough, continue to test negative. Samples from all NI Loughs tested negative for Marteilia, maintaining Approved Zone status for this disease.

Further information

Shellfish farmers should note that if they have a mortality problem with their stock then they are legally obliged to report it to the appropriate Fish Health Inspectorate (Weymouth, Aberdeen or Belfast (DARDNI)) for investigation. The Inspectorate will then identify the causes and where appropriate take any action to limit the spread of disease and minimise economic losses to the industry.

ADDENDUM

1. Green oysters and blue light

The marine diatom *Haslea ostrearia* Simonsen produces a blue pigment, marennine, which is used for greening oysters. This microalga is cultured industrially indoors with artificial light. The influence of light quality on marennine production by cultures of *H. ostrearia* was investigated in the laboratory and at a semi-pilot scale (300 L tanks).

In the first series of experiments in the laboratory, a clone of *H. ostrearia* was cultured under light of different colours (white, blue, green, yellow, and red) and at two irradiances ('low' and 'high'). Compared to the white light controls, growth was increased in blue light at the 'low', but not at the 'high' irradiance, and marennine production at the end of the exponential phase was the highest in cells grown under blue light, regardless of the light quality or intensity during growth. Increased marennine production during growth was also observed, whichever colour of light (blue or white) was used during the acclimation phase. In a second series of experiments, marennine production in seven clones differing with regard to their mean cell size was compared. The total marennine, expressed as either per cell or per culture volume, was higher in blue light for all the clones. Complementary experiments carried out under semi-industrial conditions confirmed this effect of blue light.

Mouget, J.L. (jean-luc.mouget@univ-lemans.fr), Rosa, P., Vachoux, C., Tremblin, G. (2005). Enhancement of marennine production by blue light in the diatom *Haslea ostrearia. Journal of Applied Phycology,* 17: 437-445.

2. Pacific oyster broodstock maintenance

This work examined the role of temperature and photoperiod in the regulation of Pacific oyster reproduction. Broodstock were maintained in natural, accelerated and perpetual winter conditions of temperature and photoperiod, with feeding *ad libitum*.

Each experimental treatment led to different strategies for growth and resource allocation. The gametogenic cycle, appeared entirely modulated, accelerated or delayed, by coupled temperature/photoperiod parameters.

Temperature played a key role. Gonia proliferation was set off and sustained by winter temperature (8-11 degrees C) whatever the physiological state of oysters. Maturation of germ cells appeared to be a function of temperature and could proceed at low temperature, while ripe oysters were obtained at 8 degrees C in winter conditioning. The three conditioning methods used in this study allowed the production of gametes throughout the year, including in the autumnal resting period. Moreover, stocks of ripe oysters could be maintained at low temperature for several months to produce spat when desired for aquaculture production.

Fabioux, C. (Caroline.Fabioux@iftemer.fr), Huvet, A., Le Souchu, P., Le Pennec, M., Pouvreau, S. (2005). Temperature and photoperiod drive *Crassostrea gigas* reproductive internal clock. *Aquaculture*, 250: 458-470.

3. Cryopreservation of oyster sperm

In this study, the effects of cooling rate, single or combined cryoprotectants at various concentrations, equilibration time (exposure to cryoprotectant), straw size, and cooling method were evaluated in order to develop a protocol for shipping sperm samples from diploid oysters.

Evaluation of cooling rates revealed an optimal rate of 5 degrees C/min to -30 degrees C followed by cooling at 45 degrees C/min to -80 degrees C before plunging into liquid nitrogen. Screening of single or combined cryoprotectants at various concentrations suggested that a low concentration (2%) of polyethylene glycol (FW 200) was effective in retaining post-thaw motility and fertilizing capability when combined with permeating cryoprotetcants such as dimethyl sulfoxide (DMSO), methanol (MeOH), and propylene glycol (P-glycol). However, polyethylene glycol alone was not as effective as MeOH, DMSO, and P-glycol when using the same methods. The highest post-thaw motility (70%) and percent fertilization (98%) were obtained for samples cryopreserved with 6% MeOH. However, this does not exclude other cryoprotectants such as DMSO or P-glycol identified as effective agents in other studies. There was no significant difference in post-thaw motility between straw sizes of 0.25 and 0.5 ml. Equilibration time (exposure to cryoprotectant) of 60 min could be beneficial when the cryoprotectant concentration is low

and solution is added in a step-wise fashion at low temperature. Differences in post-thaw sperm quality (e.g., motility or percent fertilization) among individual males were evident in this research. As a consequence, a generalized classification, describing males with different tolerances (broad, intermediate, and narrow) to cryopreservation was developed. This classification could be applied to strain or species differences in tolerances to the cryopreservation process. The present study demonstrated that oyster sperm could be collected and shipped chilled to another facility for cryopreservation, and that it could be shipped back to the hatchery for fertilization performed at a production scale yielding live larvae with > 90% fertilization. Given the existence of facilities for commercial-scale cryopreservation of dairy bull sperm, the methods developed in the present study for oysters provide a template for the potential commercialization of cryopreserved sperm in aquatic species.

Dong, Q.X., Huang, C.J., Eudeline, B., Tiersch, T.R. (ttiersch@agetr.lsu.edu) (2005). Systematic factor optimization for cryopreservation of shipped sperm samples of diploid Pacific Oysters, *Crassostrea gigas*. *Cryobiology*, 51: 176-197.

4. Molecular methods for oyster species identification

A specific multiplex polymerase chain reaction (PCR) was developed for the identification of *Crassostrea angulata*, *C. gigas, Ostrea edulis*, and *O. stentina* oyster species.

Universal primers were used for the amplification of complete repetition units of 5S rDNA in each of the 4 species. The alignment of the obtained sequences was the basis for the specific design of species-specific primers (ED1, ED2, ST1, ST2, CR1, and CR2) located in the non-transcribed spacer regions. The different sizes of the species-specific amplicons, separated by agarose gel electrophoresis, allowed identification of *Crassostrea* and *Ostrea* species. A multiplex PCR with a set of the 6 designed primers showed that they did not interfere with each other and bound specifically to the DNA target. This genetic marker can be very useful for traceability of the species, application in the management of oyster cultures, and conservation of the genetic resources of the species.

Cross, I., Rebordinos, L. (laureana.rebordinos@uca.es), Diaz, E. (2006). Species identification of *Crassostrea* and *Ostrea* oysters by polymerase chain reaction amplification of the 5S rRNA gene. Journal of *AOAC International*, 89: 144-148.

5. Identification of bivalve larvae by molecular methods

Two molecular protocols for the identification of mussel and scallop have been developed using specific primers targeting the mitochondrial 16S ribosomal DNA gene and the nuclear 18S ribosomal DNA gene.

Primers for the mitochondrial 16S ribosomal DNA gene in multiplex polymerase chain reaction (PCR) protocols yielded diagnostic DNA fragments for the mussels *Mytilus edulis*, *Mytilus galloprovincialis*, and the hybrid *Mytilus edulis/galloprovincialis* (335 bp), the king scallop *Pecten maximus* (382 bp) and the black scallop *Mimachlamys varia* (398 bp). DNA from the queen scallop *Aequipecten opercularis* showed no consistent PCR amplification of the 16S rDNA gene. Primers for the nuclear 18S rDNA gene in standard PCR protocols yielded similar-sized, diagnostic DNA fragments (approx. 190 bp) for the mussels *Mytilus edulis*, *Mytilus galloprovincialis*, and the hybrid *Mytilus edulis/galloprovincialis*, the king scallop *Pecten maximus*, the black scallop *Mimachlamys varia*, and the queen scallop *Aequipecten opercularis*. Both protocols have been tested with *Mytilus* spp., *P. maximus*, and 6 other bivalve species from a wide range of locations in Irish and European waters. Cross-reaction of the specific primers with DNA template from any of the 6 other bivalve species was not observed. Rapid DNA extraction using FTA Card technology and the16S rDNA primers allowed for the detection of at least 10 mussel larvae in a sub-sample of natural plankton.

Bendezu, I.F. (ivan.bendezu@lyit.ie), Slater, J.W., Carney, B.F. (2005). Identification of *Mytilus* spp. and *Pecten maximus* in Irish waters by standard PCR of the 18S rDNA gene and multiplex PCR of the 16S rDNA gene. *Marine Biotechnology*, 7: 687-696.

6. Mussel larvae identification

Monoclonal antibodies (mAbs) were generated against 2-day-old mussel larvae in an attempt to develop a rapid and rigorous method for the identification of mussel larvae in field plankton samples.

To assess the possibility of using these mAbs in routine assays for measuring the abundance of mussel larvae in plankton, studies on cultured mussel larvae, at different stages of development, and tests on bivalve larvae from plankton samples were carried out. Initially, to see whether the two mAbs also recognise other mussel larval stages, they were tested against mussel larvae of different ages obtained from monospecific cultures. The results indicate that both antibodies stain all the stages tested, even 1-month-old postlarvae. In addition, we also demonstrate that these mAbs also recognise other forms of *Mytilus*. Both antibodies bind to *M. galloprovincialis* larvae from the Mediterranean Sea and *M. edulis* larvae. Finally, and more significantly, studies on field plankton samples were performed to confirm if both mAbs are really mussel-specific, and do not cross-react with larvae of any other bivalve species existing in the plankton. The results presented here clearly indicate that our two monoclonal antibodies specifically recognise the mussel larvae in field plankton samples from different geographical regions, but not the larvae of any other bivalve species. Thus, these monoclonal antibodies could be used for routine monitoring of mussel larvae in plankton samples from different sources.

Lorenzo-Abalde, S. (silvi@uvigo.es), Gonzalez-Fernandez, A., Villegas, E.D., Fuentes, J. (2005). Two monoclonal antibodies for the recognition of *Mytilus* spp. larvae: studies on cultured larvae and tests on plankton samples. *Aquaculture*, 250: 736-747.

7. Sources of Vibrios in hatcheries

Results of a 1-year intensive monitoring of Vibrio bacteria in a mollusc hatchery are presented in this paper.

Surface seawater, well seawater (including pasteurized well seawater), tap water from a freshwater well, f/2 medium, starter cultures of eight micro algal species, mass-produced microalgae and compressed air were studied as possible sources of Vibrio. Additionally, a recently collected broodstock of the scallop *Argopecten ventricosus* was also investigated for a possible role in discharging *Vibrio* during spawning. Efficiency of a cartridge-ultraviolet (UV)-filtration system and of a steam gun employed for sterilizing tanks, hoses and utensils was also determined.

Results indicated that *Vibrio* were present in surface seawater throughout the year. In well seawater these bacteria were only found during the first 5 months after construction of the well and before commencement of continuous operations, but not after this period. *Vibrio* was never detected in pasteurized well seawater, f/2 medium, starter cultures of microalgae and compressed air. However, mass-produced microalgae contained *Vibrio*, possibly as a result of the use of contaminated tap water for washing and rinsing the fibreglass culture tanks. Scallop broodstock was found to be an important source of *Vibrio* in the hatchery. Biopsy on female gonads of live organisms demonstrated higher numbers of colony-forming units than male gonads. At spawning, *Vibrio* was released into water, producing bacterial blooms in tanks after 24 h. The cartridge-UV-filtration system was not sufficient to eliminate the bacteria from seawater, but the steam gun proved to be a good tool to eliminate *Vibrio* biofilms on tank walls or equipment used in the hatchery.

Sainz-Hernandez, J.C., Maeda-Martinez, A.N. (amaeda04@cibnor.mx) (2005). Sources of *Vibrio* bacteria in mollusc hatcheries and control methods: a case study. *Aquaculture Research*, 36: 1611-1618.

8. Bacterial infection in a scallop hatchery

A bacteriological study was carried out at a scallop (*Pecten maximus*) hatchery near Bergen, western Norway following a severe increase in mortality rates during the larval stages of the scallops. No larvae survived to settling, except for those in groups treated prophylactically with chloramphenicol. In order to identify pathogenic strains of bacteria, we performed a challenge test on 10- to 16-day-old larvae using isolated bacterial strains from the hatchery. Infection with six of these strains produced mortalities that were not statistically different from that resulting from infection with the known pathogen *Vibrio pectenicida*. However, about 5% of the strains tested in the challenge experiment produced higher motility rates than found in the unchallenged control group, indicating a possible probiotic effect of these strains. On the basis of 16S rDNA analysis, the phylogenetic tree indicated two groups of apparent pathogens: (1) one strain, LT13, grouped together with *Alteromonas/*

Pseudoalteromonas; (2) a cluster of strains grouped together with *Vibrio splendidus* (LT06, LT21, LT73, PMV18 and PMV19). Strain LT13 was isolated from cultures of the microalga *Chaetoceros calcitrans* used for feed, while the other strains were isolated from larval cultures. Transmission electron microscopy showed intracellular bacteria that resembled bacteria in the groups Chlamydiaceae and Rickettsiaceae.

Torkildsen, L., Lambert, C., Nylund, A., Magnesen, T., Bergh, O. (oivind.bergh@imr.no).(2005). Bacteria associated with early life stages of the great scallop, *Pecten maximus*: impact on larval survival. *Aquaculture International*, 13: 575-592.

9. Bacterial infection in a native oyster hatchery

Three disease outbreaks were investigated in different Galician hatcheries in order to establish the relationship between microbiota and mortalities. Isolates were obtained from various parts of the hatcheries. Experimental tests for pathogenicity were carried out using selected strains of *Ostrea edulis* larvae. The pathogenicity of one strain from each outbreak was demonstrated and shown to cause high mortalities (ranging from 98.5 to 100 %) in 72 to 96 h after inoculation of larval cultures. All three strains belonged to the genus *Vibrio*. One of the strains was identified as *Vibrio neptunius* and is the first description of this species as a molluscan pathogen. The other two strains showed low similarity with known *Vibrio* species and may constitute new species within this genus.

Prado, S. (sprado@usc.es), Romalde, J.L., Montes, J., 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: 209-215.

10. Bacterial infection of Pacific oysters

Effects of the extracellular products (ECPs) of *Vibrio aestuarianus* strain 01/32, a strain known to be toxic to Pacific oysters, were studied. The ECPs were lethal to oysters, with a LD50 value of 3.3 mu g/g body weight. To determine the oyster cellular immune responses, in vitro effects on *C. gigas* haemocytes, using flow cytometric-based haemocyte assays, were investigated. Treatment of haemolymph with ECPs caused a significant inhibition of haemocyte phagocytosis and adhesive capabilities. Exposure of haemocytes to live bacteria induced no changes in haemocyte parameters. Together, these results suggest that *V. aestuarianus* strain 01/32 secretes one or more factors that may play an important role in the pathogenicity of this microorganism.

Labreuche, Y., Soudant, P. (philippe.soudant@univ-brest.fr), Goncalves, M., Lambert, C., Nicolas, J.L. (2006). Effects of extracellular products from the pathogenic *Vibrio aestuarianus* strain 01/32 on lethality and cellular immune responses of the oyster *Crassostrea gigas*. *Developmental and Comparative Immunology*, 30: 367-379.

11. Summer mortality of oysters in France

Mortality and biological performance of half-grown Pacific oysters were studied from spring 2000 to autumn 2001 at six stations located in two areas of the Bay of Veys (Normandy).

The data set, including monthly mean temperatures and data provided by examination of 2,837 oysters, were analysed by Principal Component Analysis and a Hierarchical Ascending Clustering. This resulted in the formation of four clusters. The highest station on the shoreline belonged to a cluster characterized notably by low total weight due to a short immersion/feeding period, whereas all other stations belonged to another single cluster. Nevertheless, various biological differences were found between these stations. For example, the reproductive cycle was generally synchronized throughout the bay but some differences relative to spawning occurrence were observed. In 2000, oyster mortality was higher at the more marine area. In 2001, oyster mortalities were significantly higher overall and all stations were strongly affected.

Costil, K. (katherine.costil@unicaen.fr), Royer, J., Ropert, M., Soletchnik, P., Mathieu, M. (2005). Spatio-temporal variations in biological performances and summer mortality of the Pacific oyster *Crassostrea gigas* in Normandy (France). *Helgoland Marine Research*, 59: 286-300.

12. Polyploidy losses in Pacific oysters

Alterations of chromosome number have been observed in the somatic tissue of Pacific oyster diploids and artificial polyploids. Tetraploid oysters with abnormal chromosome numbers (aneuploidy) in some or all of their tissue are

considered undesirable as parents either for triploids (produced via a cross with diploids and of aquacultural interest) or for tetraploid breeding. Aneuploid tetraploid oysters may confer the tendency to lose chromosomes and to revert to lower ploidy levels to their offspring. More directly, their offspring could have a lower ploidy because of potential links between somatic and gametic chromosome loss.

This study evaluated the phenomenon in six bi-parental tetraploid families bred from parents of differing somatic ploidy quality. The offspring were assessed over a year using chromosome counts. Chromosome loss occurred at high frequency in all families and families differed in their composition of ploidy types. Triploidy was observed in four out of the six families. Comparison of data collected at 4 months and I year showed no further deterioration over this time-scale. The incidence of chromosome loss among families suggests a genetic basis to the phenomenon, although a direct relationship between the ploidy quality of the parents and that of the offspring was not observed.

McCombie, H., Lapegue, S., Cornette, F., Ledu, C., Boudry, P. (pboudry@ifremer.fr) (2005). Chromosome loss in bi-parental progenies of tetraploid Pacific oyster *Crassostrea gigas*. *Aquaculture*, 247: 97-105.

13. Response of oysters to pollution

The shellfish industry is often situated in estuarine zones subject to anthropogenic pollution. The species cultured are sedentary and filter-feeding, which favours bioaccumulation of pollutants in their tissues. The harmful effects of pollutants on these species are not well known.

In this study, effects of pollutants on haemocyte functions were monitored in the Pacific oyster. Haemocytes were exposed *in vitro* to selected pollutants. Twenty-three pollutants were tested and eight of them showed significant modulation of haemocyte activities. PAHs and PCB 77 induced a decrease of haemocyte activity after an incubation periods of 4 h at 200 mu mol/L. Three pesticides (2,4D, paraoxon, and chlorothalonil) also modulated haemocyte activities. A mixture of eight pesticides decreased phagocytotic activity.

Gagnaire, B., Thomas-Guyon, H., Burgeot, T., Renault, T. (trenault@ifremer.fr) (2006). Pollutant effects on Pacific oyster, *Crassostrea gigas* (Thunberg), haemocytes: Screening of 23 molecules using flow cytometry. *Cell Biology and Toxicology*, 22: 1-14.

14. TBT toxicity

The toxicity of TBT was determined using a suite of biomarkers designed to detect cytotoxic, immunotoxic and genotoxic effects.

Exposure of adult mussels, *Mytilus edulis*, to environmentally realistic concentrations of TBT for 7 days resulted in a statistically significant decrease in cell viability at concentrations of 0.5 mu g/l and above. TBT had no effect on phagocytic activity or antioxidant capacity. There was a statistically significant increase in DNA damage detected between the controls and 0.5, 1 and 5 mu g/l of TBT. Possible mechanisms by which TBT could damage DNA either directly or indirectly are discussed including the possibility that TBT is genotoxic due to its ability to disrupt calcium homeostasis.

Hagger, J.A. (jhagger@plymouth.ac.uk), Depledge, M.H., Galloway, T.S. (2005). Toxicity of tributyltin in the marine mollusc *Mytilus edulis*. Marine Pollution Bulletin, 51: 811-816.

15. Climate change and bivalve growth

It has been proposed that emission of anthropogenic carbon dioxide to the atmosphere will lead to increased concentrations of CO_2 in seawater, corresponding to a decrease of pH of several tenths of pH units. These experiments showed that this could reduce the growth of *M. edulis*.

The experiments to test the effects of increased seawater concentrations of CO_2 on shell growth of the blue mussel *Mytilus edulis* were performed in aquaria continuously flushed with seawater spiked with CO_2 to provide five different levels of pH between 6.7 and control seawater (pH = 8.1). The shell length of the mussels was measured at the start and end of the 44 days experimental period. No mortality was observed during the first 23 days of the experiment. The growth increment was much larger for small mussels than for large mussels, but relative growth profile as function of pH was more similar in the two size groups; observed differences might be random variation between samples. There was a strong and statistically significant decrease in growth at the lowest pH

values, with virtually no growth at pH = 6.7 and reduced growth at pH = 7.1. The effect seems to set in between pH 7.4 and 7.1; at mean pH levels 7.4 and 7.6 the growth increments were not significantly different from growth at normal pH 8.1.

Berge, J.A. (john.berge@niva.no), Bjerkeng, B., Pettersen, O., Schaanning, M.T., Oxnevad, S. (2006). Effects of increased sea water concentrations of $_{CO}2$ on growth of the bivalve *Mytilus edulis* L. *Chemosphere*, 62: 681-687.

16. Mussel filtration and temperature

The filtration rate of *Mytilus edulis* as a function of acute change in temperature was measured by means of the clearance method in a group of mussels seasonally acclimated to 18 degrees C. This was done by stepwise changes in temperature in order to both determine the temperature-tolerance interval within which the mussels were fully open, and to ensure that the acute effects were reversible. The filtration rate (F, ml per min per individual) as a function of temperature (T, degrees C) could be expressed by a regression line with the equation: F = 3.27 T + 38.2 in the temperature-tolerance interval between 8.3 and 20 degrees C. A reduction in temperature to below 8.3 degrees C initiated valve closure, and at 6.1 degrees C all mussels were completely closed.

The same group of mussels was then acclimated to 11 degrees C over a period of 5 days before the measurements were repeated, and the filtration rate as a function of temperature was subsequently found to be: F = 3.27 T + 38.1 in the temperature-tolerance interval, which had extended down to 4.1.degrees C. Next, a group of mussels seasonally acclimated to about 15 degrees C was split up into 3 subgroups which were exposed to 10.2, 15.6 and 20.3 degrees C over the following 23 days. During the acclimation period, the filtration rate of fully open mussels was measured every 3 to 4 days in the 3 groups. Because none of the slopes of the 3 regression lines appreciably differed, it is concluded that the acute effect of a change in temperature is not modified in *M. edulis* over a 3 week acclimation period. That is, there is no evidence for temperature compensation.

Kittner, C. (kittner@biology.sdu.dk), Riisgard, H.U. (2005). Effect of temperature on filtration rate in the mussel *Mytilus edulis*: no evidence for temperature compensation. *Marine Ecology-Progress Series*, 305: 147-152.

17. Mussel filtration at low temperature

When contaminated, most molluscs destined for human consumption require a depuration regime lasting 48 h at a minimum temperature of 5 degrees C to ensure elimination of coliforms. However, this regime is unsatisfactory in northern temperate regions, where temperatures are frequently below 5 degrees C. A series of tests were undertaken to determine the filtration activity of mussels (*Mytilus* spp.) under low temperatures. We used physiological measures rather than the more traditional method of bacterial analysis to evaluate mussel acclimation to cold temperatures. Mussels were acclimated for 4 weeks at three different temperatures (8, 4, and -1 degrees C) and their scope for growth was evaluated each week to determine the level of acclimation. Mussels were then exposed to a thermal shock and clearance rates were measured after 2 h and 72 h. We observed a clearance rate of 2.45 l per h per g dry wt for the 8 degrees C control group. Thus, within a 48-h depuration period, *Mytilus* spp. could filter a standard volume of 117.47 l. We found that thermal shock had an important effect on the volume filtered by a mussel in 48 h. For example, at 4 degrees C mussels acclimated at 8 degrees C were able to filter the standard volume of 117.47 l in an average of 75 h, whereas those acclimated at 4 degrees C and transferred to 8 degrees C required only 23 h on average.

Cusson, M., Tremblay, R. (rejean_tremblay@uqar.qc.ca), Daigle, G., Roussy, M. (2005). Modeling the depuration potential of blue mussels (*Mytilus* spp.) in response to thermal shock. *Aquaculture*, 250: 183-193.

18. Pacific oyster recruitment in the Wadden Sea

Pacific oysters were introduced to the northern Wadden Sea (North Sea, Germany) by aquaculture in 1986. Although at first recruitment success was rare, three consecutive warm summers led to a massive increase in oyster abundance and to the overgrowth of native mussel beds. These mussels constitute biogenic reefs on the sand and mud flats in this area. It was found that high survival and growth rates of the oysters may compensate for years with low recruitment, and may therefore allow a rapid population increase. This may lead to restrictions on habitat use by native mussels in the Wadden Sea.

Survival and growth of the invading oysters were investigated and compared with the native mussels in order to predict the further development of the oyster population and the scope for coexistence of both species. Field experiments revealed high survival of juvenile oysters (approximately 70%) during the first three months after settlement. Survival during the first winter varied between > 90% during a mild and about 25% during a cold winter and was independent of substrate (i.e., mussels or oysters) and tide level. Within their first year oysters reached a mean length of 35-53 mm, and within two years they grew to 68-82 mm, which is about twice the size native mussels would attain during that time. Growth of juvenile oysters was not affected by substrate (i.e., sand, mussels, and other oysters), barnacle epibionts and tide level, but was facilitated by fucoid algae. By contrast, growth of juvenile mussels was significantly higher on sand flats than on mussel or oyster beds and higher in the sub-tidal compared to inter-tidal locations. Cover with fucoid algae increased mussel growth but decreased their condition (expressed as dry flesh weight versus shell weight).

Diederich, S. (sdiederich@awi-bremerhaven.de) (2006). High survival and growth rates of introduced Pacific oysters may cause restrictions on habitat use by native mussels in the Wadden Sea. *Journal of Experimental Marine Biology and Ecology*, 328: 211-227.

19. Heat treatment to control Pacific oysters

Pacific oysters, *Crassostrea gigas* are traditionally considered shellfish of great fishery and aquaculture value. Recently there has been increasing reports about the prevalence of *C. gigas* as biofouling organism in cooling water systems. In the absence of relevant data on the susceptibility of oysters to commonly employed antifouling techniques such as heat treatment, it was presumed that treatment programmes directed against other major fouling organisms would control oysters. The present study was carried out to test the above hypothesis, and results showed that *C. gigas* has an upper temperature tolerance that is much higher than other major marine fouling animals including blue mussel *Mytilus edulis*. Apparently, temperature regimes presently used in heat treatment of cooling water systems fouled by mussels need to be increased, if *C. gigas* are to be controlled effectively. Our results also indicate that previous exposure of *C. gigas* to sub lethal high temperatures could make them more resistant to subsequent thermal treatment, an aspect that should be taken into account when heat treatment is used to control oyster fouling.

Rajagopal, S. (S.Rajagopal@science.ru.nl), van der Velde, G., Jansen, J., van der Gaag, M., Atsma, G., Janssen-Mommen, J.P.M., Polman, H., Jenner, H.A. (2005). Thermal tolerance of the invasive oyster *Crassostrea gigas*: Feasibility of heat treatment as an antifouling option. *Water Research*, 39: 4335-4342.

20. Oyster recruitment in Strangford Lough

Ostrea edulis was extremely rare in the wild in Strangford Lough from the early 1900s until renewed spatfall was observed at a number of sites in the 1990s. A monitoring programme was undertaken to investigate the presence and distribution of planktonic oyster larvae at nine sites around the Lough between June and September in 1997 and 1998 as a precursor to studies of spatfall patterns.

Larval densities at sites in the northern basin of the Lough were significantly higher than those in the southern basin where larvae were lacking or in low numbers. Densities and sizes of oyster larvae showed significant temporal variation suggesting pulsed larval release. Larval densities also showed significant spatial variation with higher densities at sites closer to commercial stocks pointing to these as the main source of oyster larvae. This hypothesis was supported during a larval flux study over a complete tidal cycle, which indicated a 90% net tidal movement of *O. edulis* larvae from the entrance of the bay where commercial stocks were held to the main body of the Lough. Thus the maintenance of dense commercial stocks of flat oysters may provide the key to the redevelopment of native oyster beds in Strangford Lough and elsewhere by providing an initial broodstock nucleus froth which larvae can be exported.

Kennedy, R.J., Roberts, D. (d.roberts@qub.ac.uk) (2006). Commercial oyster stocks as a potential source of larvae in the regeneration of *Ostrea edulis* in Strangford Lough, Northern Ireland. *Journal of the Marine Biological Association of the United Kingdom*, 86: 153-159.

21. Closed areas and scallop fisheries

Despite the current interest in using closed areas for fisheries management, few studies have actually examined the benefits for invertebrate fisheries such as scallops. This study details the dynamics of a population of great scallops *Pecten maximus* (L.), within a closed area and an adjacent fished area off the Isle of Man, over a 14 yr period (1989 to 2003).

Scallop densities were very low in both areas when the closed area was set up, but increased at an accelerated rate over time within the closed area. Scallop densities also increased on the adjacent fishing ground, but not to the same extent. Consequently, the density of scallops above the minimum legal landing size (110 mm SL) was more than 7 times higher in the closed area than in the fished area by 2003. There was also a shift towards much older and larger scallops in the closed area and, correspondingly, lower estimates of total mortality. Experimental dredging of 2 plots within the closed area confirmed that fishing drove these differences in population dynamics and structure. These patterns of scallop density, age and size structure resulted in the exploitable biomass (adductor muscle and gonad) of scallops being nearly 11 times higher in the closed area than in the fished area by 2003, and the reproductive biomass was 12.5 times higher. This is significant for fisheries management because the build up of high densities of large *P. maximus* individuals enhanced local reproductive potential and therefore the likelihood of export of larvae to the surrounding fishing grounds. Along with these direct benefits of closed area protection, juvenile scallops had higher survival and individual growth rates in the closed area, apparently in response to reduced fishing disturbance. Although juvenile scallops are not subject to direct removal by fishing, protection during this critical phase therefore appeared to assist the recovery of the closed area population. In summary, this study joins a growing number indicating that the use of closed areas offers a range of benefits over more traditional methods of managing fisheries. Fisheries for relatively sedentary and long-lived species such as *P. maximus* appear to be particularly suitable for this type of management.

Beukers-Stewart, B.D. (brycebs@liverpool.ac.uk), Vause, B.J., Mosley, M.W.J., Rossetti, H.L., Brand, A.R. (2005). Benefits of closed area protection for a population of scallops. *Marine Ecology-Progress Series*, 298: 189-204.

22. Scallop shell strength

Shell strength, shell height and shell thickness were determined in scallops of age groups 2-5 years from wild stocks and from suspended cultures. There was a strong divergence in shell strength development between wild and cultured scallops in animals older than age group 3. This was not reflected in the concurrent development of shell height and thickness, indicating that factors other than shell height and shell thickness explain the differences in observed shell strength. In wild scallops, shell height, shell thickness and age accounted for about 65% of the variation in shell strength, while the same variables accounted for about 30% in cultured scallops. Wild scallops had stronger shells than the cultured scallops of the same size (53-68 mm shell height) grown at the same site, suggesting that factors related to suspended culture could explain the weak shells in cultured scallops. The results indicate that conditions related to suspended culture can have a negative impact on shell strength development in *P. maximus*. As the shell is the primary protection against predation in scallops, a better understanding of what affects the shell strength is important.

Grefsrud, E.S. (ellen.sofie.grefsrud@imr.no), Strand, O. (2006). Comparison of shell strength in wild and cultured scallops (*Pecten maximus*). *Aquaculture*, 251: 306-313.

23. Manila clams affect sediment stability

The aim of this study was to examine the impact of bioturbation by the Manila clam on sediment stability. A laboratory benthic annular flume system was deployed to evaluate the relationship between sediment stability of a sub-tidal mudflat and density of the clams at different current velocities.

There was a significant correlation between mean sediment erosion rate and current velocities in all treatments with clams. There was also a significant correlation between mean erosion rate and clam density, reflecting bioturbation-enhanced sediment erosion. The effects of clam density on how easily the sediment was eroded were more marked at the lower current velocities. In the control,

the critical erosion velocity was about 32 cm per second. With increasing clam density this decreased down to the minimum value of about 20 cm per second at a density of 206 clams per m^2. This study demonstrated that the burrowing activity of Manila clams reduces sediment stability, particularly at relatively low current velocities and at densities below those found in the clam cultivation areas studied (within the Sacca di Goro lagoon).

Sgro, L., Mistri, M. (m.mistri@unife.it), Widdows, J. (2005). Impact of the infaunal Manila clam, *Ruditapes philippinarum*, on sediment stability. *Hydrobiologia*, 550: 175-182.

24. Effect of seed size and density on mussels

In suspended aquaculture, the size of mussel seed and the density at which these mussels are placed in socks are two important factors affecting mussel production. However, the effect of these two factors has yet to be examined simultaneously. We conducted two large-scale field experiments to assess the effect of seed size and initial density on growth, tissue-to-shell ratio and survival of blue mussels (*Mytilus edulis*) grown on longlines.

Experimental mussel sites were set up during the autumn of two consecutive years in two bays on the north shore of Prince Edward Island, Canada. At each site, socks containing combinations of three seed sizes (small, medium and large) at two initial densities (low and high) were deployed and monitored over time. Small seed grew faster than large seed and often reached commercial size in the same time period. Furthermore, initial density generally did not affect shell growth. During the pre-spawning period following the autumn deployment, seed at low initial density had a higher tissue-to-shell ratio than seed at high initial density, especially for large seed. This effect of initial density disappeared in early summer. Early in the experiments (< about 10 months), mussel survival on socks was affected by seed size only: small seed generally had lower survival rates than larger seed. Late in the experiments (> 10 months), there appeared to be an interaction between seed size and initial density on mussel survival: survival of small seed generally decreased with increasing initial density, while survival of large seed was not affected by initial density. Since large seed tended to be packed at lower initial density than small seed, lack of crowding was likely responsible for the absence of density-dependent loss. Our study thus assessed different seeding strategies, and results were generally consistent across years and sites.

Lauzon-Guay, J.S. (js.lauzon@unb.ca), Dionne, M., Barbeau, M.A., Hamilton, D.J. (2005). Effects of seed size and density on growth, tissue-to-shell ratio and survival of cultivated mussels (*Mytilus edulis*) in Prince Edward Island, Canada. *Aquaculture*, 250: 652-665.

25. Effects of suspended mussel cultivation 1

The benthic environment in a typical mussel farm from eastern Canada was examined in relation to husbandry practices.

The results did not show any particular spatial patterns. A total of 31 species were identified. Diversity indices were small throughout the study site. The number of years of operation for a given site varied between 0 (control sites) and 16 years while mussel culture densities ranged between 0 (control sites) and 0.70 kg m^{-2}. Overall, no strong relationship was underlined between benthic parameters and studied husbandry practices. BIOENV analyses showed that culture density explained a small proportion of the variation in the assemblage of benthic organisms underneath mussel lines. Similar analyses showed that water depth better explained the variability observed under mussel lines when using the macro invertebrate presence/absence data set. The absence of a strong relationship between husbandry practices and the studied benthic parameters might be related to the oceanographic characteristics and land-based activities associated with the water system rather than direct and cumulative effects of mussel culture.

Miron, G. (mirong@umoncton.ca), Landry, T., Archambault, P., Frenette, B. (2005). Effects of mussel culture husbandry practices on various benthic characteristics. *Aquaculture*, 250: 138-154.

26. Effects of suspended mussel cultivation 2

Mussel farming in two areas of the Sacca di Goro lagoon induced intense biodeposition of organic matter to the underlying sediments,

which stimulated sediment oxygen demand, and inorganic nitrogen and phosphorus regeneration rates compared to the nearby control station. Overall benthic fluxes at the mussel farm are amongst the highest ever recorded for an aquaculture impacted area and question the belief that farming of filter-feeding bivalves has inherently lower effects than finfish farming.

In situ incubation of intact mussel ropes demonstrated that the mussel rope community was an enormous sink for oxygen and particulate organic matter, and an equally large source of dissolved inorganic nitrogen and phosphate to the water column. Overall, a one meter square area of mussel farm (mussel ropes and underlying sediment) was estimated to have an oxygen demand of 46.8 mmol in 2 h and to regenerate inorganic nitrogen and phosphorus at rates of 8.5 and 0.3 mmol in 2 h, with the mussel ropes accounting for between 70 and more than 90% of the overall oxygen and nutrient fluxes. Even taking into account that within the farmed area there are 15-20 m^2 of open water for each one covered with mussel ropes, the mussel ropes would account for a large and often dominant part of overall oxygen and nutrient fluxes. These results demonstrate that it is essential to take into account the activity of the cultivated organisms and their epiphytic community when assessing the impacts of shellfish farming. Overall, whilst grazing by the mussel rope community could act as a top-down control on the phytoplankton, most of the ingested organic matter is rapidly recycled to the water column as inorganic nutrients, which would be expected to stimulate phytoplankton growth. Consequently, the net effect of the mussel farming may be to increase phytoplankton turnover and overall production, rather than to limit phytoplankton biomass.

Nizzoli, D. (dnizzoli@nemo.unipr.it), Welsh, D.T., Bartoli, M., Viaroli, P. (2005). Impacts of mussel (*Mytilus galloprovincialis*) farming on oxygen consumption and nutrient recycling in a eutrophic coastal lagoon. *Hydrobiologia*, 550: 183-198.

27. Beneficial effect of slipper limpets

The American slipper limpet *Crepidula fornicata* is now widespread along the Atlantic coast of Europe. Negative effects such as competition for food and space have been reported. In the Wadden Sea, attached limpets reduce survival and growth of mussels. However, a laboratory experiment also showed sea star (*Asterias rubens*) predation on mussels with limpet epigrowth to be three times lower than in clean mussels. Hence, although negatively affected by *C. fornicata* in one way, this epigrowth is beneficial for fouled mussels in another.

Thieltges, D.W. (dthieltges@awi-bremerhaven.de) (2005). Benefit from an invader: American slipper limpet *Crepidula fornicata* reduces starfish predation on basibiont European mussels. *Hydrobiologia*, 541: 241-244.

28. PCR detection of PSP algae

A real-time polymerase chain reaction (PCR) assay was designed and evaluated for rapid detection and quantification of the toxic dinoflagellates *Alexandrium catenella* and *A. tamarense*, which cause paralytic shellfish poisoning. Two sets of PCR primers and fluorogenic probes targeting these two species were derived from the sequence of 28S ribosomal DNA. PCR specificity was examined in closely related *Alexandrium* spp. and many other microalgae. *A. catenella*-specific primers and probe detected the PCR amplification from *A. catenella* strains only (nonspecific signals were not detected from any microalgae). Also, *A. tamarense*-specific primers and probe also detected the targeted species, suggesting the strict species specificity of each PCR. This assay could detect one cell of each species, showing its high sensitivity. Moreover, using the developed standard curves, *A. tamarense* and *A. catenella* could be quantified in agreement with counting by optical microscopy. This method is therefore applicable to the monitoring of toxic *A. tamarense* and *A. catenella.*

Hosoi-Tanabe, S. (syonatsu@ses.usp.ac.jp), Sako, Y. (2005). Species-specific detection and quantification of toxic marine dinoflagellates *Alexandrium tamarense* and *A. catenella* by real-time PCR assay. *Marine Biotechnology*, 7: 506-514.

29. Detecting DSP producing species

Planktonic *Dinophysis* spp. and the epiphytic *Prorocentrum lima* (Ehrenberg) Dodge are known dinoflagellate producers of DSP toxins. Underestimation of toxic dinoflagellates associated with a toxic event may be due to the lack of sampling of species with epiphytic and epibenthic strategies, such as *P lima*. As *Dinophysis* spp. is not found in the Fleet Lagoon,

Dorset, but previous DSP events have closed the Pacific oyster farm here, *P. lima* is the most likely causative organism.

A field assay for separating microalgal epiphytes and concentrating wild cells on to filters was successfully applied to sub-samples of a variety of macroalgae and macrophytes (seagrass) collected from the Fleet during summer 2002. *P. lima* was present in increasing cell densities on most substratum species, over the sampling period. LC-MS analysis detected OA and DTX-1 in extracts of wild *P. lima* cells, in ratios characteristic of P. *lima* strains previously isolated from the Fleet. No toxins, however, were detected in oyster flesh during this time.

Foden, J. (j.m.foden@cefas.co.uk), Purdie, D.A., Morris, S., Nascimento, S. (2005). Epiphytic abundance and toxicity of Prorocentrum lima populations in the Fleet Lagoon, UK. *Harmful Algae*, 4: 1063-1074.

30. A new DSP test

Jellett Rapid Testing Ltd. has developed a rapid field test kit to screen for diarrhetic shellfish poisoning (DSP) toxins. The new test provides a qualitative (positive/negative) indication of the presence of okadaic acid (OA) and some of its analogues in about 30 min. It is designed as a screening method for regulatory labs to eliminate negative samples, thereby leaving a smaller number of positive samples to be tested with more sophisticated and time-consuming quantitative methods. Due to its simplicity and speed, the Rapid Test for DSP may eventually be used in other applications such as shellfish harvest management and toxin research. The test is based on easy-to-use lateral flow immuno-chromatographic (LFI) test strips, which operate the same way as Jellett Rapid Testing's Rapid Tests for paralytic shellfish poisoning (PSP) toxins and amnesic shellfish poisoning (ASP) toxins. The sensitivity of the antibodies to some of the analogues of the DSP family of toxins was investigated using pure compounds from the National Research Council of Canada. In the Rapid Test format, okadaic acid, dinophysistoxin 1 (DTX1) and dinophysistoxin 2 (DTX2) were detected similarly with 50% reduction in test line colour intensity at 5 nM for the solutions applied to test strips. One of the DTX-3 esters eliminated the test line at 500 nM, indicating low cross-reactivity, whereas no effect was observed with one of the brevetoxins (PbTx-3), yessotoxin, gymnodimine, spirolide and pectenotoxins PTX2, PTX11, at concentrations up to 1000 nM.

Laycock, M.V., Jellett, J.F. (jjellett@jellett.ca), Easy, D.J., Donovan, M.A. (2006). First report of a new rapid assay for diarrhetic shellfish poisoning toxins. *Harmful Algae*, 5: 74-78.

31. PSP testing in the USA

In January 2004, in response to the summary of actions from the 2003 Interstate Shellfish Sanitation Conference, the U.S. Food and Drug Administration concurred that the Jellett Rapid PSP test (JRPT) may be used for screening acidified shellfish tissues for saxitoxins. A parallel study of the JRPT and the mouse bioassay (MBA) was conducted from January 21 to April 13, 2004. Thereafter, the JRPT was implemented as a PSP screen for the remainder of 2004. A negative JRPT test represented a final result. When the JRPT was positive or indeterminate, the MBA was conducted. From January 21 to December 23, 2004 a total of 940 JRPT were completed; the testing yielded 478 negative, 147 positive, 259 false positive, 20 indeterminate and 6 invalid results. Animal usage was decreased and analyst time was conserved when a negative screen was obtained. The study confirmed the JRPT could be used for PSP surveillance in California on a year-round basis without a negative impact on public health.

Oshiro, M., Pham, L., Csuti, D., Dodd, M., Inami, G.B., Brenden, R.A. (rbrenden@dhs.ca.gov) (2006). Paralytic shellfish poisoning surveillance in California using the Jellett Rapid PSP test. *Harmful Algae*, 5: 69-73.

32. ASP in scallop samples

Since 1998, king scallops (*Pecten maximus*) obtained from Scottish offshore sites have been monitored for domoic acid (DA) and epi-domoic acid (epi-DA), the principal toxic compounds associated with amnesic shellfish poisoning (ASP). The presence of these toxins in king scallops harvested from Scottish waters at concentrations exceeding the current regulatory limit is a recurrent event. However, little information was available to determine the effects that different storage conditions experienced during sample transportation to the monitoring laboratory may have on toxin concentrations. Furthermore, the stability of DA and epi-DA in the solvents routinely used for their extraction from shellfish has not previously been assessed.

Results from this study demonstrate that when king scallop samples were stored for 2-3 days at 12 degrees C, a significantly higher toxin concentration was detected in the gonad than when samples were stored at 4 degrees C and analysed within 48 h. This implies that monitoring programmes must consider transport and storage conditions between harvest and analysis. Stability studies showed rapid decomposition of DA and epi-DA in aqueous methanol extracts while DA and epi-DA seem acceptably stable when stored refrigerated in citrate buffer.

Stobo, L.A., Gallacher, S., Shanks, A.M. (2006). Effect of storage on amnesic shellfish poisoning (ASP) toxins in king scallops (*Pecten maximus*). *Harmful Algae*, 5: 9-19.

33. ASP in Ireland

In December 1999, domoic acid (DA) a potent neurotoxin, responsible for the syndrome Amnesic Shellfish Poisoning (ASP) was detected for the first time in shellfish harvested in Ireland. Two liquid chromatography (LC) methods were applied to quantify DA in shellfish. DA was identified in four species of bivalve shellfish collected along the west and south coastal regions of the Republic of Ireland. The amount of DA that was present in three species (*Mytilus edulis*, *Crassostrea gigas*, *Ensis siliqua*) was within EU guideline limits for sale of shellfish. However, king scallops (*Pecten maximus*) posed a significant human health hazard with levels up to 240 mu g DA/g total tissues. Most scallop samples (55%) contained DA at levels greater than the regulatory limit. The DA levels in the digestive glands of some samples of scallops were among the highest that have ever been recorded (2,820 mu g DA/g).

James, K.J. (kjames@cit.ie), Gillman, M., Amandi, M.F., Lopez-Rivera, A., Puente, P.F., Lehane, M., Mitrovic, S., Furey, A. (2005). Amnesic shellfish poisoning toxins in bivalve molluscs in Ireland. *Toxicon*, 46: 852-858.

34. Microbial contamination episodes

Shellfish harvesting waters exhibit transitory non-compliance with microbiological standards after rainfall episodes despite significant expenditures on control of sewage derived pollutant loadings. This paper demonstrates the role of wave propagation in the entrainment of Faecal Indicator Organisms from river channel beds as a contributor to episodes of poor microbial water quality.

High flows and rapid changes in river flow, driven by releases of bacterially pure reservoir water, resulted in elevated Faecal Indicator Organisms concentrations and transient peaks in concentration. New interpretation of data suggest three modes of entrainment: (1) immediate wave-front disturbance, (2) wave propagation lift and post-wave transport at mean flow velocity, and (3) stochastic erosional mechanisms that maintain elevated bacterial concentrations under steady high flow conditions. This is a significant advance on the previously proposed mechanisms. The processes highlighted have relevance for the protection of shellfish nurseries, drinking water supply intakes and episodes of poor bathing water quality, and associated health risks.

Wilkinson, J., Kay, D. (dvk@aber.ac.uk), Wyer, M., Jenkins, A. (2006). Processes driving the episodic flux of faecal indicator organisms in streams impacting on recreational and shellfish harvesting waters. *Water Research*, 40: 153-161.

35. Viral contamination of Dutch oysters

Consumption of virus-contaminated shellfish has caused numerous outbreaks of gastroenteritis and hepatitis worldwide. In The Netherlands, oysters are cultured and imported both for consumption and export. The presence of noroviruses, rotaviruses, astroviruses, hepatitis A viruses, and enteroviruses was determined in 64 commercial and non-commercial oyster samples.

Oysters were collected monthly for 13 months from four different harvesting areas in the Oosterschelde Delta. Oyster samples were classified by determining *Escherichia coli* levels. Two of 36 commercial and 2 of 28 non-commercial oyster samples were B-classified and therefore not ready for consumption. All other oyster samples were A-classified. Enterovirus RNA was detected in 14 of 64 oyster samples, of which 4 were from non-commercial oyster harvesting areas and 10 were from commercial harvesting areas. None of the other human pathogenic viruses were detected. The levels of somatic coliphages and F-specific phages were also determined in all 64 oyster samples, with some samples containing high phage levels, but with most samples containing low phage levels. However, independent of these high

or low phage levels, enterovirus RNA could be detected. Thus, commercial oysters can be contaminated with pathogenic viruses, and monitoring only faecal indicators might not sufficiently protect human health.

Lodder-Verschoor, F., Husman, A.M.R. (am.de.roda.husman@rivm.nl), van den Berg, H.H.J.L., Stein, A., van Pelt-Heerschap, H.M.L., van der Poel, W.H.M. (2005). Year-round screening of non-commercial and commercial oysters for the presence of human pathogenic viruses. *Journal of Food Protection,* 68: 1853-1859.

36. Natural treatments to reduce faecal contamination

'Natural' treatment systems such as wetlands and reed beds have been proposed as sustainable means of reducing fluxes of faecal indicator organisms (FIOs) to recreational and shellfish harvesting waters.

This study was primarily undertaken to investigate the relative sources of FIOs to the popular bathing waters around Clacton, UK. In this predominantly arable (mainly cereal cropping) farming area, the principal land use predictor, explaining 76% of the variance in *Escherichia coli* concentration at sub-catchment outlets during the bathing season, was the proportion of built-up (i.e. urbanised) land in each sub-catchment. This finding contrasts with earlier studies in livestock farming regions where the proportion of improved grassland has proven to be the strongest predictor of microbial concentration.

Also novel in this investigation, a flood defence wall has been built creating a wetland area which discharges every tidal cycle. The wetland gives over a 97% reduction in the flux and concentrations of FIOs to the marine recreational waters. Also, FIO concentrations in water draining through the wetland to the sea were similar to concentrations measured in six UK sewage treatment plant effluents subject to secondary (biological) treatment followed by UV disinfection.

Kay, D. (dvk@aber.ac.uk), Wyer, M.D., Crowther, J., Wilkinson, J., Stapleton, C., Glass, P. (2005). Sustainable reduction in the flux of microbial compliance parameters from urban and arable land use to coastal bathing waters by a wetland ecosystem produced by a marine flood defence structure. *Water Research*, 39: 3320-3332.

37. Shellfish microbiological testing

The variability in Escherichia coli enumeration data and detection of *Salmonella* spp. for LENTICULE discs and freeze-dried samples for the Health Protection Agency's External Quality Assessment (EQA) scheme for shellfish microbiology was compared. The results provide validation data for the replacement of freeze-dried samples by LENTICULE discs for the Shellfish EQA Scheme.

Four samples of known but undisclosed microbiological content were dispatched in both freeze-dried and LENTICULE disc formats to 57 participating laboratories in 20 countries. Participants examined samples using their routine methods for the most probable number (MPN) of *E. coli* per 100 g and the presence/absence of *Salmonella* spp.

There was no significant difference between the Food and Environmental Proficiency Testing Unit and participating laboratories for *E. coli* and *Salmonella* spp. results. There were significantly fewer outlying results using the LENTICULE discs than freeze-dried sample format and equivalent or less variance for the former for *E. coli* MPN. There was no significant difference between LENTICULE discs and freeze-dried samples for the presence/absence of *Salmonella* spp. Overall the results indicated that LENTICULE discs are a homogenous and stable matrix for EQA samples.

Prior, Z. (foodeqa@hpa.org.uk), Andrews, N., Russell, J.E. (2005). LENTICULE discs provide a homogenous format for external quality assessment samples: a comparison with freeze-dried samples for shellfish microbiology. Letters in *Applied Microbiology*, 41: 334-340.

38. Destruction of Hepatitis A by cooking

Hepatitis A is a worldwide infectious disease. Shellfish consumption has always been one of the major risk factors for hepatitis A infection, especially when these products are eaten raw or slightly cooked.

The aim of the present study was to evaluate hepatitis A virus (HAV) stability in experimentally contaminated mussels, subjected to domestic cooking. Three different domestic preparations (mussel hors d'oevre, mussel au gratin, mussels with tomato sauce) were performed according

to traditional Italian cookery methods using different time and temperature conditions. The infectious virus was completely inactivated only in "mussels in tomato sauce", while it was still present, even if not quantitatively determinable, in the other preparations. The study confirmed that certain factors could influence the sensitivity of HAV to thermal inactivation, preventing a complete decontamination of the product.

Croci, L. (luciana.croci@iss.it), De Medici, D., Di Pasquale, S., Toti, L. (2005). Resistance of hepatitis A virus in mussels subjected to different domestic cookings. *International Journal of Food Microbiology*, 105: 139-144.

39. Effects of aerial exposure on Nephrops

A range of biochemical, endocrinological, immunological, microbiological and pathological measures of condition of trawl-caught *Nephrops norvegicus* destined for the live transport market was studied.

During prolonged periods of aerial exposure *N. norvegicus* experience large disruptions to the carbohydrate profile, with increases in haemolymph L-lactate and crustacean hyperglycaemic hormone concentrations, and corresponding fluctuations in haemolymph pH. The severity of this disruption increases with the temperature of aerial exposure. This in turn impacts on the immune competence of the lobsters, with significant reductions in the number of circulating haemocytes and phenoloxidase levels observed as well as increases in the degree of bacteraemia of the haemolymph.

Utilising evidence obtained during histological and other studies, possible causes of the immuno-suppression and subsequent meat spoilage are discussed. The information obtained should help to identify critical periods in the post-capture period that promote poor stock condition and mortality. Such data may be used to generate an internationally accepted Code of Practice for the capture, handling and transport of commercially exploited decapod crustaceans.

Ridgway, I.D., Taylor, A.C., Atkinson, R., Stentiford, G.D., Chang, E.S., Chang, S.A., Neil, D.M. (D.Neil@bio-gla.ac.uk) (2006). Morbidity and mortality in Norway lobsters, *Nephrops norvegicus*: physiological, immunological and pathological effects of aerial exposure. *Journal of Experimental Marine Biology and Ecology*, 328: 251-264.

40. Wild v cultured lobster broodstock

Stock enhancement experiments of European lobsters have been carried out around the Kvitsoy Islands in southwestern Norway since 1990. In addition to releases of coded wire tagged lobster juveniles and subsequent monitoring of the commercial fishery, a lobster hatchery was established in 1997. Several experiments were made on the communal-rearing approach where the performance of mixed larval groups (families) was evaluated under identical conditions. Berried females of wild and cultured origin and their respective fertilised eggs were screened by using micro-satellite DNA profiling involving a multiplex set of six lobster specific primers, thereby allowing determination of both parental genotypes. Each female was kept separately during hatching, and the offspring were later mixed and raised in a communal rearing system. The early-larval survival was estimated at stage IV (bottom stage), and the survivors were identified to family and group by micro-satellite profiling. Five different communal experiments were conducted, representing offspring from 65 berried females. Offspring of cultured females displayed a relative fitness of 60% in comparison to offspring from wild females. Large variation in survival was also observed among families within the "wild" and "cultured" groups, suggesting a genetic component for these traits and a potential for selective breeding.

Jorstad, K.E. (knut.joerstad@imr.no), Prodohl, P.A., Kristiansen, T.S., Hughes, M., Farestveit, E., Taggart, J.B., Agnalt, AL., Ferguson, A. (2005). Communal larval rearing of European lobster (*Homarus gammarus*): Family identification by microsatellite DNA profiling and offspring fitness comparisons. *Aquaculture*, 247: 275-285.

Shellfish in the Press

Crackdown on Dee estuary cocklers

ENVIRONMENT Agency Wales started a month-long public consultation last Friday (13 January) on the future management of Dee cocklebeds as it attempts to establish a sustainable fishery that operates for six months of the year.

The agency has applied to DEFRA and the National Assembly for Wales for a regulating order, which will allow for better controls for regulating and funding the fishery.

Alan Winstone, the agency's environment manager for the north Wales coast commented: "A regulating order is long overdue for the Dee estuary and we look forward to working with fishermen to ensure a profitable and sustainable future for the estuary.

"A properly managed fishery where the beneficiaries fund the regulatory costs and cockling is carried out by professionals with full consideration for safety and the environment is essential."

Main changes to current legislation will include an extension to the close season, an annual allocation of 50 licences based on evidence of previous participation in the fishery, a licence fee of £992, cold weather restriction on opening, daily quotas and access from designated points around the estuary. It is estimated that the fishery can support a total annual catch of 500-2500 tonnes, generating an average gross income of between £250,000 and £1.25m a year and supporting up to 50 licensees.

The Dee is one of five major cockle fisheries within the UK. It has had partial regulation since bylaws introduced a permitting system in 1995. These bylaws do not enable the agency to restrict the number of fishermen or to recover the costs required in regulating the fishery.

Currently, every applicant must be granted a permit, and monitoring, administration and enforcement costs are high and are currently funded by the taxpayer.

The absence of adequate controls has resulted in a highly volatile fishery with large numbers of inexperienced casual labourers descending on the estuary.

In the first week of 2006 there were two separate incidents of illegal cocklers being caught in the Dee Estuary, revealed the agency.

The offenders are to appear in court soon.

■ Consultation documents are available at www.environmentagency.wales.gov.uk

Fishing News, 20 January 2006

SSMG to introduce new mussel packaging

THE traditional sight of fresh mussels in net bags will soon be a thing of the past, the Scottish Shellfish Marketing Group (SSMG) has announced.

SSMG has introduced revolutionary new packaging for its products which it claims will ensure that their freshness and quality is better than ever previously achieved.

Instead of traditional net bags of fresh mussels, shoppers will soon be able to choose SSMG's Modified Atmosphere Packaging (MAP), which SSMG says will deliver fresh Scottish mussels in peak condition having been sealed in an atmosphere scientifically designed to exactly match that of the seashore where they were harvested.

SSMG newly appointed managing director Donny Gillies said: "Because our fresh mussels in MAP packaging are not exposed to the air, as happens when they are bought in nets, they remain fresh, moist and plump to a degree previously impossible to attain. The packaging is also a lot stronger, giving greater protection to the mussels themselves."

SSMG aims to eventually supply all its live mussels in MAP packaging. The new packaging also ensures an additional three to four days of product life is achieved for consumers. The new machinery is currently installed at SSMG's European Food Safety Inspection Service (EFSIS) approved facility in Bellshill.

The new MAP packaging is part of a recent £400,000 investment which is aimed at ensuring that all of SSMG's products reach their customers in the freshest possible condition, and has allowed the development of a range of new shellfish ready meals for supermarkets across Britain.

The technology to replicate the seashore atmosphere was developed by Dutch firm PRINS & DINGEMANSE. SSMG has linked its scientific breakthrough with new packaging technology from Norwegian experts POLIMOON to provide UK customers with "the world's first high-tech" fresh mussel packaging. As well as delivering fresh mussels, SSMG will also be supplying fresh oysters using MAP packaging. SSMG currently produces 10.5 tonnes of mussels per day.

SSMG says the new packaging will deliver a better product.

Fish Farming, November 2005

Oyster farmers battle for world record

A shellfish farmer in North Wales is claiming a new British record for the largest oyster at a recent competition for a place in the *Guinness Book of Records*.

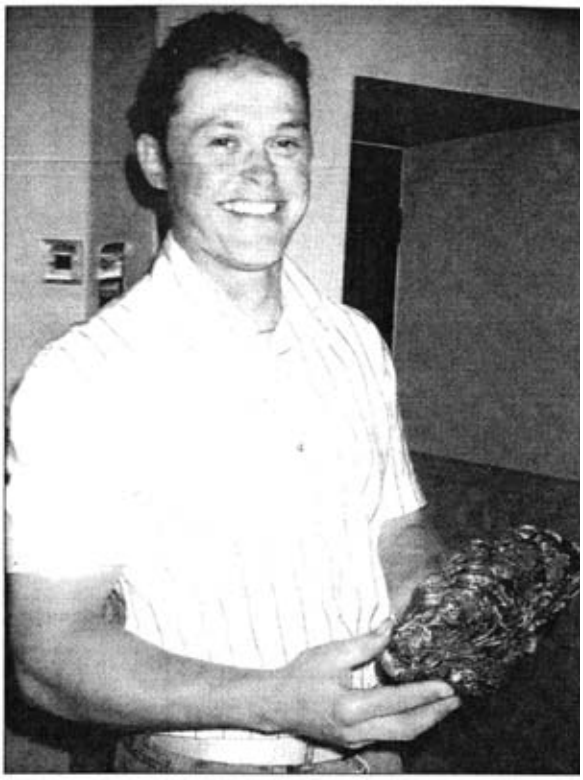
Shaun Krynen of Menai Oysters won the competition on September 28 at the Anglesey Arms Hotel, Menai Bridge, Wales. And, as one of the judges, I was pleased to present him with a cheque for £250 ($430) and a certificate from the Sea Fish Industry Authority, which organised this fun event.

However, Mr Krynen's Pacific oyster (*Crassostrea gigas*), which weighed 1. 48kg (3lb. 4oz), failed to beat the American world record of 3.7kg (8.1 lb), but he is claiming it as a new British record.

The Welsh oyster beat challengers from Essex and Cornwall and attracted a lot of media and press attention. As a result, Shaun and his winning oyster appeared on several TV news programmes and even hit the national press.

Shaun is a marine science graduate from the University of Wales and he is using his expertise to run a shellfish farm in the Menai Strait, North Wales that produces about 70,000 Pacific oysters and around 150 tonnes of bottom-cultivated mussels annually.

He told the press "As far as I am concerned my oyster is a new British record because I don't think one has ever existed. I am sure there are bigger oysters than my three-pounder somewhere and I am issuing a come and beat me challenge to other shellfish producers".



Shaun Krynen of Menai Oysters holding his British record. Although only just slightly smalle in size than the US world record-setter, it weights less than half o the American giant

ON THE SHELLFISH SCENE

by Dr Eric Edwards

The Guinness Book of Records lists the largest oyster in the world as a 'native oyster (*Ostrea edulis*) taken from Chesapeake Bay in 1999 that measured 30.5 cm (12 inches) long and 14 cm (5.5 inches) wide and weighing 3.7kg (8.1 lb).

This record seems rather odd to me as I thought that it was the American oyster (*Crassostrea virginica*) that inhabited this part of the eastern seaboard of the USA Furthermore, the Welsh oyster was only a couple of centimetres smaller in length, but only half the weight of the current world champion.

The Guinness Book of Records people take these challenges seriously and with my fellow judge, Dr Steven Lockwood, I had to make careful measurements under the scrutiny of the press. I can only suggest that efforts are now taken to beat this suspect American record and I repeat Shaun Krynen's challenge to try to find an oyster over 4kg or 8.5 lbs.

Fish Farming International, November 2005

Sales executive wins oyster-eating competition

AN Edinburgh bar marked the first day of Seafood Week by hosting an oyster-eating competition. *Tonic* invited couples to participate in a race to devour a plateful of oysters as quickly as they could. However, before feeding them to each other, competitors first had to suck the oysters using a straw.

The overall winners were oyster lovers Lou Lanos (24) and Axel Laval (24) who were presented with a bottle of champagne after sucking and munching their way through an impressive eight oysters each. Originally from Paris, Lou is an advertising sales executive with our sister publication, *European Fish Trader*.

Speaking after the event, Lou said she was delighted to have the opportunity to represent France in the shellfish-eating contest.

"I love oysters but I've never had to suck them and eat them so quickly before!" she said.

"I'm thrilled to have won, especially knowing that I was competing against Scottish people."

Following the competition, Australian-born chef Dario Pacifici demonstrated his oyster shucking technique. Glasgow-based company, The Fish People supplied 100 oysters for the event.

Fish Farming Today, November 2005

Scottish aquaculture receives £600,000 boost

MORE than £600,000 worth of grants have been awarded to Scottish aquaculture companies in the latest round of the European Financial Instrument for Fisheries Guidance (FIFG) awards.

In the Highlands and Islands the awards were as follows: Johnson Seafarms Ltd, based in Vidlin, Shetland, was awarded £208,200 towards the expansion of its cod farming facility; Balta Island Seafare Ltd, based in Unst, Shetland, was awarded £27,180 to develop its organic salmon farming site; Loch Fyne Oysters Ltd, based in Ardkinglas, Argyll, was awarded £20,000 towards the expansion of its oyster and mussel farm; Shetland-based East Voe Shellfish was awarded £18,225 towards the expansion of its existing mussel farm, and Shetland Mussels Ltd was granted £30,752 for the purchase and installation of mussel culture equipment.

Elsewhere in Scotland, the awards were: £11,333 to Dunbar Trout Farmers, based at Langholm and Stow, for the installation of drum filters; £10,570 to Yarrow Fishery, Selkirk, towards a micro screening plant for inlet water supply, and £285,750 to Scot Trout Farming Ltd for the expansion of facilities to enable production increases.

The aquaculture companies are among 67 businesses set to benefit from the latest FIFG grant awards. The £6.5 million funding boost is expected to create 100 new jobs in Scotland's fisheries and aquaculture sectors.

Announcing the awards, Fisheries Minister Ross Finnie said they are a further substantial commitment to the future of Scotland's fisheries and aquaculture industries on top of £30 million invested over the last five years.

"The scheme in the Highlands and Islands has been regularly oversubscribed with high quality bids and for that reason I have topped up the available EU FIFG aid with Executive funds to benefit a larger number of projects across Scotland," Mr Finnie said.

"I am particularly delighted to announce support of improvements to facilities at Mallaig and Carradale harbours and the further expansion of cod farming facilities on Shetland.

"I am committed to a profitable and sustainable fisheries sector and see grant support as contributing to achieving this objective."

This is the ninth round of FIFG awards which were introduced in 2000 and will run until the end of 2006. Over the period of the FIFG programme, £55 million has been made available to Scotland (£17 million for the Highlands and Islands area and £38 million for the rest of Scotland).

Fish Farming International, November 2005

Sustainable exploitation on agenda at French shellfish conference

THE 8th International Conference on Shellfish Restoration (ICSR '05), held in France in October, provided an opportunity for scientists, government officials, resource managers, industry figures and members of the public to exchange information about the biology, ecology and sustainable exploitation of shellfish resources.

Approaches to restore coastal shellfish ecosystems through management, enhancement, and restoration efforts were discussed, and innovative management, ecological, and social approaches towards the restoration of degraded shellfish habitat and the improvement of coastal ecosystem health were shared.

Shellfish restoration was on the agenda at ICSR conference

The conference focused on a number of themes relating to shellfish restoration including the importance of hatcheries and aquaculture, genetic considerations, shellfish fitness considerations, exotics/invasive/introduced species considerations, shellfish-ecosystem linkages, environmental quality monitoring and improvements, socio-economic, policy, outreach and education aspects, and fisheries and aquaculture management.

Presentations given included: Hatchery technology to support shellfish restoration and recent research on New Zealand abalone stock enhancement; protection of bivalve larval rearing by beneficial marine bacteria; settled mesh trials of the scallop *Pecten maximus* in South West Ireland; disinfectants used in mollusc hatcheries and nurseries, and population dynamics and status of the stock of oyster (*Crassostrea madrasensis*) and green mussel (*Perna viridis*) in the Cox's Bazar coast of Bangladesh.

The ICSR was held in Brest, France, from October 2-5. Recommendations put forward at the conference were presented at the 9th Interviews on Science and Ethics, held in Brest on October 7 and 8.

Fish Farmer, November/December 2005

Traps target illegal Manx scallop fishing

SEABED traps are to be set up off the Isle of Man to deter illegal fishing, the government has announced.

Eight 2m 'tank traps', designed to tangle fishing equipment towed across the seabed, are being laid down off Port Erin, according to *BBC News*.

Specialist divers from Port Erin Marine Laboratory are being called in to install the traps.

Peter Karran MHK, member for fisheries, said the area has an 'extremely valuable' population of scallops and the fisheries department is determined to protect the area.

"The closed area enjoys widespread support from the fishing industry and could be responsible for ensuring the sustainability of some Manx scallop beds."

The Department of Agriculture, Fisheries and Forestry is urging anyone who sees illegal fishing to report it to them.

Fishing News, 9 December 2005

NFFO looks at shellfish strategy

DEVELOPMENT of a strategy for the English shellfish sector was at the top of the agenda at a meeting of the NFFO shellfish committee in Derby on Thursday last week.

Dr Colin Bannister, one of two consultants appointed to work with Seafish to work on the strategy, was present at the meeting. One of the NFFO's aims is to develop views to feed into a meeting later this month of a government working group that is examining the strategy.

Issues discussed included marketing, the expansion of the shellfish sector, the supply chain and managing the resource.

Doug Beveridge of the NFFO said the shellfish sector was more valuable than the bare statistics suggested, particularly to small ports.

"There has been a lot of growth in the shellfish sector and it has to be managed. This is especially important against the backdrop of the forthcoming Marine Bill and the spatial planning that will be involved and that is bound to affect fishing. It's important that we get the views of the shellfish sector and indeed the under-10m sector on the table."

Fishing News, 9 December 2005

Ifremer studies mollusc feed

IFREMER, the French research body, has been studying new strains of microalgae for feeding mollusc larvae and investigating nutritional needs of the Pacific oyster (*Crassostrea gigas*) that have never been fully explored, writes **BERNADETTE TOURNAY.**

"Up to now, microalgae as feed for molluscs has been considered a 'given' and therefore no progress in the way they are cultivated was necessary," explains Dr René Robert, head of the research at Ifremer's experimental hatchery at Argenton.

"However with molluscs it is essential because, as opposed to fish and prawns, there are no other nutritional steps."

Relatively few microalgae strains and flagellate species are currently used as feed for mollusc larvae and this can limit hatchery production and create feeding problems if losses occur.

Two species of flagellates, *Isochrysis affinis galbana* and/or its clone *Tahiti iso* and *Pavlova lutheri* are most commonly used as mollusc larvae feed in addition to five different species of micro algae, also known as diatoms.

To give hatcheries more choice, researchers tested four microalgae species as feed for the Pacific oyster larvae – *Imantonia rotunda*, *Emiliania huxleyi*, *Pseudoisochrysis paradoxa* and *Diacronema vlakianum*.

E huxleyi and *I rotunda* led to poor growth, while *D vlakianum* and *P galbana* had promising results with the same feed value as *T iso* and superior to *Pavlova lutheri*.

In addition these species were found to grow well in hatchery conditions in large volumes and their size was perfectly adapted to be ingested by very young larvae.

Ifremer is also studying two species of microalgae taken from the natural environment, one from temperate, the other from tropical waters. Both have high feed values for Pacific oyster larvae.

However, it is not yet possible to produce them in volumes of more than 20 litres, making them unsuitable for commercial hatcheries.

Ifremer has also looked at the feeding and nutritional needs of molluscs, such as the importance of particular fatty acids. Current knowledge has been based on what is known about fish without having been validated for bivalve molluscs.

This approach, says Dr Robert, has not given researchers the information they need about mollusc larvae's essential needs.

It is important that the elements contained in microalgae used as feed cover the biochemical needs of the larvae to achieve good growth. However, the same basic feed is used for all molluscs. *P lutheri* has been used for some time, with some success on clams and flat oysters, so its use for other molluscs has never been questioned.

"We have shown that this algae has no feed value for the Pacific oyster even though it has two essential fatty acids and should produce good larval development," says Dr Robert.

"Instead it produces no growth in *C gigas*. We have studied other species of *Pavlova* with the same results."

Dr Robert believes the approach to mollusc nutrition needs to be reappraised, and that the future for mollusc feed will lie in the optimisation of phytoplankton production in hatcheries and nurseries.

This in turn will lead to a diversification of the number of species available and improve the understanding of the ecophysiological needs of larvae, as well as improve their cultivation by developing new methods such as continuous production in photo bioreactors at high density.

Fish Farming International, December 2005

Above: harvesting equipment strips the mussels from the droppers without any problems, says Demland Mussels
Left: harvesting mussels grown on droppers – lengths of netting – at the company's site in Shetland

Droppers 'could revolutionise mussel farming'

A SCOTTISH company believes that its new mussel-growing system could revolutionise mussel aquaculture following successful trials in Shetland.

Gamrie Bay Prawn Trawls of Aberdeenshire, launched its net droppers – lengths of netting – at this year's Fishing trade show in Glasgow, and has just reported good harvest results from droppers set on longlines at the Demlane Mussels site in Shetland.

Gamrie's Michael Watt lists the advantages of using the new droppers:

- No pegging of ropes no pegs needed
- Easy installation at set up
- Increased yields by up to 35%
- Allows room for growth
- Better water circulation
- Secure and even growth
- Well suited to automatic and hand harvesting methods
- No broken pegs after harvest
- Uniform feeding of mussels across droppers
- Reusable

Demlane, which set the droppers in 2003, reported average yields from each net dropper over one month's harvesting at 79.98kg, with the best day averaging 86.9kg.

"This is compared to a rope and peg average at the Demlane site of 55 to 60kg per rope and peg dropper," says Watt.

"The meat content was 39%, with sizes of 50 to 60 mussels per kilo.

"The automatic harvesting equipment stripped the mussels as normal with no problems. Only 4.03 droppers were harvested per 500kg of graded mussels, compared to 8 rope droppers.

"The netting is in excellent condition and ready to reset for next spat settlement."

Gamrie Bay Prawn Trawls held a seminar for producers to discuss these and future developments in Shetland, where the sector grew by 16% last year, producing 4000 tonnes.

"We believe the nets can revolutionise mussel aquaculture in Shetland and worldwide where sites are now limited," says Watt.

Gamrie plans to develop the system in trials on the west coast of Scotland, Ireland, and in Galicia, the heart of Spain's mussel industry.

"Trials of different styles and sizes have been undertaken, each using nets of three to four meshes across and of varying lengths weighted to one side to keep the mesh open," explains Watt.

"The droppers are attached to ropes on the water surface, which themselves are fixed to lines of plastic floats set at regular intervals."

Fish Farming International, December 2005

Women with mussels!

TWO WELSH mussel companies are finding that women have no problem doing men's work in the fishing industry, reports Eric Edwards.

At Port Pehrhyn, Bangor, Laura Carpenter (pictured, left) and Charlotte Wilson (right) have been working as deckhands on the 30m dredger *Still Ostrea*, owned by Deepdock, while Bonny Mould works handling the dredges on the 43m *Valente*, owned by Myti Mussels.

The skippers of the two vessels tell *FN* that their female crews are enthusiastic and reliable.

Mussel producers in the Menai Strait had a good 2005, with bumper harvests sent live by truck to markets in the Netherlands and France as well as Ireland.

Production during the mussel season that ends in April is expected to reach about 8000 tonnes, worth around £5m.

Fishing News, 27 January 2006

Value of UK shellfish production increases by 26%

THE estimated value of shellfish production in the UK in 2004 increased by around 26% compared with 2003. The total value of shellfish produced for the table was an estimated £22.7 million, from over 27,800 tonnes.

A report published by the Centre for Environment Fisheries and Aquaculture Science in December states that production by weight of the major species of farmed shellfish (mussels and Pacific oysters) for the table was similar to that in the previous year. For the other species, of which only small quantities are produced, there was a drop in production for both clams and scallops.

The figures show that a total of 26,611 tonnes of mussels were produced in the UK with Wales producing the largest volume (14,814 tonnes), followed by, Scotland (4,223 tonnes), Northern Ireland (4,311 tonnes), and England (3,263 tonnes). The UK total for Pacific oysters was 1,019 tonnes with England producing 432 tonnes, Scotland producing 287 tonnes, Northern Ireland producing 278 tonnes and Wales producing 22 tonnes.

One hundred and eighteen tonnes of native (flat) oysters were produced – 106 tonnes in England, 8 tonnes in Scotland and four tonnes in Northern Ireland. Scotland was the only producer of Queens, producing 45 tonnes. Eigh teen tonnes of clams were grown in Northern Ireland and England, with the countries producing 11 tonnes and seven tonnes respectively. Ten tonnes of scallops were grown in Scotland and 10 tonnes of cockles were produced in England.

A total of 1,019 tonnes of Pacific oysters were produced in the UK in 2004.

The figures do not include production or value of native oysters from the Solent Several and Regulated grounds. Nor do they include hatchery/nursery seed production for on-growing, much of which is exported.

Fish Farmer, January/February 2006

Moroccan bonamia outbreak

THE WORLD animal health organisation, the OIE, has reported an outbreak of *Bonamia ostreae* among 580 oysters in Morocco. The OIE said that the oysters were destroyed at Khnifiss lagoon, Laayoune province, in Western Sahara. The outbreak was confirmed by Morocco's National Fisheries Research Institute.

Fish Farming International, January 2006

BST International

THE BST Adjustable Longline Oyster system has been developed over 15 years by a group of Australian oyster farmers seeking an improved cultivation method suited to the challenging South Australian conditions.

The aim is to use the natural rumbling action on the suspended baskets to produce strong clean oysters with minimum labour input by letting nature do the work. By raising and lowering the lines it is possible to control growth and minimise fouling.

In European conditions the results have been remarkable, with data from the independent French research establishment S.M.I.D.A.P showing up to 40% growth increase compared to the conventional bag and trestle systems.

These growth rates suggest it will be possible to bring oysters to market size in 18 months with improved shell shape and avoiding the problems associated with polydora.

The clean shell, good shape and high meat to shell ratio have made BST cultivated oysters the preferred product in the Australian market where there are some 600 Ha under cultivation.

Systems are installed in England, Ireland, Scotland and on the Solway Firth in extremely rough conditions which survived the heavy winter storms. New installations are planned in several areas of France in the spring of 2006.

BST International
The Causeway Blackwater Trading Estate Maldon Essex CM9 4GG Tel 0044 1621 874 245 Fax0044 1621 874 299 e-mail sales@bstoysters.net www.bstoysters.net

Fish Farmer, January/February 2006

EU research on allergies

A EUROPEAN project is addressing the causes food allergies, a significant problem for the seafood sector. The EuroPrevall project will try to identify risk factors, helping pinpoint the circumstances sparking these problems.

This would allow foods to be tested for allergies without feeding foodstuffs to potentially allergic individuals, the so-called 'food challenge' test.

EuroPrevall will also try to establish the difference between food intolerance and food allergies, discovering, said the European Commission "what is causing our bodies to react, sometimes violently, to the very thing that is supposed to sustain us".

■ www.europrevall.org

Fish Farming International, January 2006

QPX disease test on clams

A NEW genetic test that can detect devastating clam disease QPX – quahog parasite unknown – has been developed by US scientists at the Woods Hole Oceanographic Institution (WHOI) in Cape Cod, Massachusetts, reports **MONICA DOBIE**.

Scientists claim the test is sensitive enough to detect the QPX organism not only in clams, but also in seawater and sediment – and can even ensure clams without visible symptoms are not carrying the disease.

QPX spreads from clam to clam by secreting a thick mucus layer to insulate itself from the clam's immune system. The disease has devastated hundreds of clam beds along the east coast of north America, from Virginia, USA, to Canadian waters.

Researchers believe QPX decomposes in seaweed, making it present in all coastal waters, but ilt becomes deadly to clams only when it reaches a critical concentration in the water.

WHOI is also investigating what circumstances enables this organisms to reach deadly concentrations.

■ www.whoi.edu

Fish Farming International, January 2006

New strategy marks start of planning system to protect Scotland's water

A NEW era in policy and practice for Scotland's water environment began in December when environmental watchdog, the Scottish Environment Protection Agency (SEPA) launched the River Basin Planning Strategy for the Scotland River Basin District.

Representing the start of the implementation of river basin planning for Scotland, the Strategy is a requirement of new legislation to protect and improve all of Scotland's waters.

SEPA's Callum Sinclair said: "At the heart of the Strategy lies SEPA's vision of river basin planning as a system that will promote sustainable water use in a manner that protects and improves the water environment. The active involvement of other interested parties will be crucial to the success of the Strategy and the new planning system. The Strategy will help inform organisations and communities on how and when they can become involved in river basin planning in the future, and to consider how their contributions will be most effective. For some, this process has already begun by attending seminars held in 2003 or by responding to the formal public consultation exercise in 2004."

The actions in the strategy focus on three strategic areas and have been developed using the views expressed in the participative and consultative exercises:

1. Establishing administrative arrangements and working principles to support the production of river basin management plans;
2. Delivering participative and consultative opportunities; and
3. Integrating and co-ordinating river basin plans with other plans and planning.

Mr Sinclair added: "River basin planning and the River Basin Management Plan it will produce will deliver a range of short, medium and long-term benefits for Scotland's water environment. This Strategy will form the basis on which SEPA and its partners can plan and prepare to deliver basin planning in order to better protect, manage and improve Scotland's waters for everyone."

The Strategy also outlines SEPA's commitment to establish a National Advisory Group and a network of eight Area Advisory Groups in 2006.

The River Basin Planning Strategy for the Scotland River Basin District and a digest of responses to the 2004 public consultation are now available at www.sepa.org.uk/wfd/rbmp.

To receive a copy of the Strategy, e-mail publications@sepa.org.uk.

New legislation will protect and improve Scotland's waters.

Fish Farming International, January/February 2006

FSAS: New shellfish harvesting area classification regime

THE classification of shellfish harvesting areas is not only a legal requirement, but one that plays a vital role in protecting public health as well as the good name of the industry in Scotland.

As of January 1 this year, the classification process is changing due to the consolidation of the hygiene regulations in Europe. The Food Standards Agency Scotland (FSAS) has been working closely with harvesters to raise awareness of the new process.

There are currently 180 designated production areas and 246 individual harvesting areas in Scotland, with around 30 outstanding classification applications for 2005/2006.

At the moment under EU directive 91/492, the FSA, as the competent UK authority, must classify and list harvesting areas according to the degree of E.Coli contamination in samples of mollusc flesh.

Once the application for a particular area is processed, six samples need to be taken in separate months over a year to retain the classification. For example, an A classification means the produce may go direct for human consumption while a B classification means depuration, heat treatment or relaying needs to take place before the shellfish can enter the food chain.

Samples from each area are analysed monthly for numbers of E.coli per 100g of flesh and intra-valvular liquid, using a validated and accredited test method, as required by law.

The draft classification document for any given year is issued in January and harvesters have six weeks to lodge an appeal. An independent panel then hears appeals in March and the final document is produced once the appeals have been heard and determined.

However, with the consolidation of the food hygiene regulations across Europe, the method of harvesting area assessment will change next year for new areas.

In time all existing areas will need to be assessed in the same way. The actual process of classification will remain the same, using the same test method, which will be stipulated as the only method acceptable for this purpose.

Under the new regulations, the FSA will have to produce a full survey of the proposed classification area. This survey will look at a number of factors, including water quality, any pollution sources and quantities as well as rainfall in the area. This survey will be compiled with the assistance of a number of parties including the Scottish Executive, the Scottish Environmental Protection Agency and local authorities. It will allow a sampling plan to be developed for each production area. Set monitoring points will be identified where samples will be taken from for the purposes of classification.

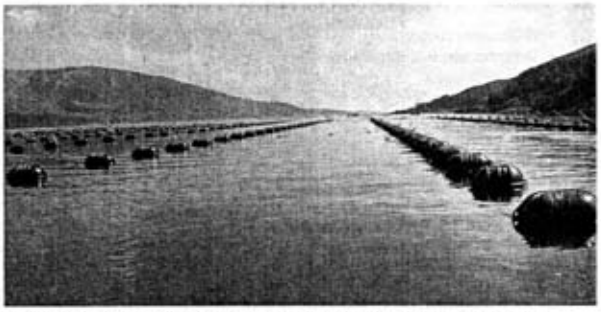
Lorna Murray, Senior Enforcement Advisor with the FSAS's Local Authority Food Law Enforcement Branch, said: "In essence this new requirement merely formalises the work already being done by the FSA with partner organisations.

"The onus on shellfish harvesters to send in monthly samples remains unchanged. Failure to submit regular samples will lead to difficulty in accurately assessing a site when awarding a classification the following year.

"We can't stress enough the importance of properly using the checks and balances which are in place, especially when you consider that it's relatively common for people to eat raw or lightly cooked shellfish and if E.coli is present then there is a possibility of people becoming very ill."

This new survey information will be reviewed on a regular basis and the final product will be the future sampling plan for the area.

This article was contributed by the Food Standards Agency Scotland. For further information about the new requirements please contact Lorna Murray on 01224 285100.



The classification process for shellfish harvesting areas is changing.

Fish Farming International, January/February 2006

Bumper Essex oyster crop

Essex oyster growers achieved record sales over the recent holiday period as the shellfish have again become fashionable in nearby London and all around the southeast of England.

Over the period, the Maldon Oyster and Seafood Company despatched some 70,000 oysters to London from its purification and packing plant.

David Coward-Talbot, who has been growing oysters for more than 20 years, tells me that his trade is getting better, and that the recent bumper harvest required eight staff to harvest, wash, grade and pack the oysters for market.

The firm supplies quality native and Pacific oysters to London's Billingsgate Fish Market and local top restaurants. It also exports oysters and other shellfish to Hong Kong and the Middle East.

Most of the business revolves around Pacific oysters grown from hatchery seed at its large oyster farm in the Blackwater Estuary. The Maldon Oyster and Seafood Company plans to buy a further six million seed oysters to ensure that it can meet the growth in sales.

■ www.maldonoysters.com

Agnes Jarosz with some of the 70,000 oysters she helped harvest for the holidays

From 'On the Shellfish Scene' by Dr Eric Edwards, Fish Farming International, February 2006

Satellite monitoring of Solway cocklers

SOMERSET firm BlueFinger has been awarded a contract by Solway Shellfish Management Association (SSMA) for the supply of a vessel monitoring system (VMS) for the Solway Firth inshore cockle fishery.

The cockle fishery was reopened recently after being closed for some years due to over exploitation, and is managed by SSMA. The deployment of a VMS was an important consideration in SSMA's decision to reopen the fishery. It will enable SSMA to monitor licensed cockle fishing vessels and tractors and avoid overexploitation in the future.

BlueFinger will supply the vessel equipment and the monitoring centre software of the VMS. The vessels will be equipped with a GPS/GPRS-based tracking unit that will provide location reports to the SSMA monitoring centre via BlueFinger's fleet management hub.

A commercial cockle fishery started in the Solway Firth in 1987 and landings were 4500 tonnes by 1991, with up to six or seven hydraulic suction dredgers working on a completely unrestricted fishery.

After several years of poor recruitment stocks began to decline, and boat dredging was banned in 1992 and tractor dredging in 1994. Hand gathering then increased on the Scottish side of the Solway and was banned in 2002.

BlueFinger has been providing tailormade asset tracking systems for over eight years, traditionally to the maritime market.

Fishing News, 13 January 2006

EU censures Spain for dirty seawater

THE EUROPEAN Court of Justice (ECJ) has censured Spain for failing to keep water sufficiently unpolluted in the key mussel production region of Galicia.

Judges agreed with the European Commission that Spain should have established a shellfish-focused water pollution prevention plan, under the terms of the EU's shellfish water directive. Spain will now have to write such a plan or could face large recurring fines of over €100,000.

The court dismissed arguments brought by Spain that it had complied with the directive regarding the waters of the Ría de Vigo gulf by creating a general sewage treatment programme.

Judges agreed with the EU that this did not fulfil the directive's "obligation to establish specific programmes in order to reduce pollution of shellfish waters".

It also threw out an argument by Spain that the shellfish water directive did not apply to the Ría de Vigo because its shellfish are not ready for instant consumption, but undergo purification or re-laying in beds.

Fish Farming International, February 2006

EU moves on organic rules

THE EUROPEAN Commission has taken its first significant step on the road to producing a unified definition of organic foods - something both producers and consumers have been clamouring for increasingly in recent times.

However, according to a proposed regulation imposing rules on aquaculture businesses seeking to market organic fish, the Commission explicitly suggests: "polyploidy animals may not be used".

Some in the industry see this as preventing salmon - a polyploid - from being marketed as organic within the EU, even if its feed is sustainable and welfare standards are high.

However, the regulation is a proposal, and as such will not come into effect without much consultation between all parties that it can potentially affect.

Polyploid organisms have more than two copies of their chromosomes and socan evolve generation to generation, a key worry for organic consumers seeking genetic purity in their foodstuffs.

Most polyploids are plants (eg, wheat), but salmon is a notable exception. Other organic production rules the Commission wants imposed across the EU include that "feed used in aquaculture shall be from sustainable fisheries or composed essentially of agricultural ingredients from organic farming and of natural nonagricultural substances".

And it suggests a broader principle: "Aquaculture production shall minimise the negative effect on the environment."

Should the regulation be approved by the EU Council of Ministers and the European Parliament, the Commission would be authorised to draft more detailed production rules for organic aquaculture products.

Meanwhile, national governments could use their own organic production standards, and would have to recognise those in other member states.

● http://europa.eu.int/eur-lex/

Fish Farming International, February 2006

New Code of Good Practice set to benefit shellfish growers

BOTH established growers and newcomers to the shellfish industry are set to benefit from a new Code of Good Practice. The Association of Scottish Shellfish Growers (ASSG) launched the document at its recent conference, held in Oban.

The ASSG Code is targeted at the overall activities of shellfish growers, including the essential requirement of making a profit margin in order to continue to operate. The ASSG hopes that, by following the practices outlined in this volume, the grower will be able to produce a superior quality product, maintain a high standard of shellfish health, more than satisfy hygiene regulations and therefore safeguard customer health, while minimising the impact of the operation on the natural environment.

Julia Purkis and Doug McLeod of the ASSG are pictured with the Code of Good Practice.

"I believe that this Code will help shellfish growers – current and potential – planners, regulators and others, to collaborate in positive efforts to optimise the future sustainable expansion of our sector, and therefore I wish to express our thanks to the funding organisations which have enthusiastically supported this initiative," said ASSG chairman Doug McLeod.

"The initial audience for the Code is the members of the Association – by formally signing up to follow the recommendations of the Code of Practice, members will be clearly expressing their commitment to respect the interests of other stakeholders in the coastal zone, including local authorities, The Crown Estate and environmental interests (such as SNH). However, there is no wish to make adherence to the Code an exclusive opportunity, and we would be happy to see the audience extend to all shellfish cultivation activities in Scottish waters. And in the longer term, we expect the Code will enter the wider international community of shellfish cultivation."

The Code is perceived as a living document, available both as hard copy and electronic version, with updates to be supplied as appropriate and as required. This applies to regulatory and research outcomes as well as developments in husbandry techniques and advice about optimal management of predators.

This shellfish industry Code of Good Practice document presents objectives and specifies shellfish farm operating practices that will ensure that activities are managed in an environmentally responsible and sustainable manner that is in harmony with the needs of other marine and shoreline users. It is designed to serve as an important reference for shellfish growers. It refers to existing guidelines and regulations, as well as addressing other pertinent issues and areas of concern. In addition, it addresses the concerns of consumers, environmental organisations, government and the general public.

Fish Farmer, January/February 2006

Success on a ladder!

ARNE BAEKGAARD (left), chairman of the Danish Shellfish Growers Association, and Jim McLachlan, managing director of shellfish equipment specialist Xplora Products, hold up 16.8kg of blue mussels showing how much a single metre of Xplora's innovative ladder production system can grow. The mussels were grown over 29 months at Xplora's test farm on Loch Striven, on the west coast of Scotland.

Fish Farming International, February 2006

Oyster man dies

HARRY Banks (right), a retired oyster merchant and one of the longest serving members of the Shellfish Association of Great Britain (SAGB), died earlier this month at the age of 92 at his home in West Mersea, Essex, writes **Eric Edwards**.

After spending a few years as a police officer in the Metropolitan Police, ill health forced him to retire and during the war he worked for the Ministry of Food.

In 1947, he joined the family's oyster firm, Banks Brothers, and when the native oysters declined he built up a busy trade importing Portuguese oysters, which were sold during the summer at shellfish bars all around the country.

Unfortunately, the Banks oyster stocks were destroyed in the severe winter of 1962. A new start was made, but in 1976, imports of oysters from Portugal were banned due to 'gill disease' and efforts by Harry Banks to grow the resilient Japanese oyster ('gigas') ailed in the late 1970s, probably due to the effects of toxic TBT antifouling paints, then used on yachts.

In the early 1980s, the parasitic disease *Bonamia* spread from Cornwall to Essex killing most of the native oysters. From then, on most of Harry Banks' depleted oyster beds were used for mooring yachts.

He joined the Shellfish Association in 1963 and until a few years ago represented Essex oyster growers on the SAGB Council and its mollusc committee. Harry Banks remained a valued member of SAGB until he died.

Richard Haward of West Mersea said: "Harry maintained his interest in oysters and their cultivation long after the end of his day to day involvement and he was always keen to pass on his extensive knowledge to younger growers."

In the last few years, the situation has improved for oyster growers at West Mersea and they can now supply top London restaurants and stores with both native and Pacific oysters.

Fishing News, 24 February 2006

A life of toil growing oysters

Paying my last respects at the recent funeral of Harry Banks, a retired oyster merchant from West Mersea in Essex, southeast England, reminded me of the problems he and other local oystermen have faced over the years.

During Harry's 92 years on earth, his father and grandfather were oystermen, and he and his brother joined them in the family business, Banks Brothers. Originally, this company depended on growing and selling native oysters (*Ostrea edulis*), but stocks declined in the early 1900s because of overfishing and increasing coastal pollution.

The author with Essex oystermen Harry Banks (seated) and Clarrie Deval

Far left: A traditional Essex oyster fishing smack

Banks Bros, desperate to supply their markets with oysters, imported American and Portuguese oysters to supplement their declining stocks of 'natives'. The trade in American oysters (*Crassostrea virginica*) started about 1876 and stopped at the start of World War II.

Unfortunately, this movement introduced the American slipper limpet and the American oyster drill into Essex, and these pests added to Harry Banks' problems.

After the war, Harry started a new trade importing Portuguese oysters – known then as 'Ports' – and a big business was developed at West Mersea supplying them to shellfish stalls at English seaside resorts during the summer, when it was illegal to sell natives.

The severe winter of 1962 killed off most of the stock in Essex, and in 1976 the UK government banned the import of 'Ports' because of a gill disease, ending this lucrative trade with Portugal for ever.

Efforts by Harry Banks to grow the resilient Japanese oyster (*C gigas*) failed in the late 1970s, probably due to the effects of toxic TBT antifouling paints. In 1982, the disease bonamia came to Essex and from then on most of the Banks' oyster beds were used for mooring yachts.

Harry was a lifelong member of the Shellfish Association of Great Britain, where his wealth of knowledge about oysters was passed on to younger growers. Things are much better for the Essex oyster trade now, but the past toils and tribulations are worth recording.

From 'On the Shellfish Scene' by Dr Eric Edwards, Fish Farming International, March 2006

What a whopper!

Ireland can this month claim to have the largest mussel dredger in the world, when the 50m (164ft) *Emerald Gratia* joins its fleet. This huge multi-purpose mussel farming vessel, built in Poland and completed at the Padmos Shipyard at Stellendam, Holland for the Emerald Mussel Company of Westport, Co Mayo, will service bottom cultivation sites in Loughs Carlingford, Belfast and Foyle.

Powered by twin 500hp Mitsubishi diesels, she can carry loads of 300 tonnes of seed mussels for relaying. She has eight high-powered dredges and a specially designed deck washer that can separate and remove stones.

Emerald Gratia is the seventh big Dutch-built vessel for Irish mussel farmers. She is also the last to be part-funded under the current EU FIFG programme.

Ireland's sea fisheries board, BIM, says this new fleet will revolutionise the process of bottom mussel farming in Ireland and make better use of its valuable seed resource.

These modern vessels will also ensure the sustainability of an industry currently producing 30,000 tonnes of mussels, worth €3.8 million.

Emerald Gratia will be officially launched at a ceremony in Dublin this month

From 'On the Shellfish Scene' by Dr Eric Edwards, Fish Farming International, March 2006

Shetland shellfish conference highlights industry developments

OVER 60 delegates, including Shetland's shellfish farmers, gathered at the NAFC Marine Centre last month to hear from a number of high quality speakers on the future of the industry.

Kick-starting the conference, Seafood Scotland's Chief Executive, Libby Woodhatch delivered an overview of the role of the organisation and a summary of the growth in the seafood sector as a whole. She also revealed findings from a new consumer attitudes survey undertaken by Seafish, which highlight the importance of promoting provenance and quality in order to increase consumer confidence in seafood, and discussed how the Scottish seafood industry should capitalise on this growth.

Commenting on the value of the conference, she said: "It was an excellent opportunity for me to be able to speak to people working in the shellfish aquaculture sector in Shetland and to hear the Scottish Shellfish Marketing Group story.

"The conference has helped to give Seafood Scotland a clear picture of developments in Shetland's shellfish industry and it was useful to hear about their plans for the future. In turn, it was a good opportunity for individual farmers to discover the marketing opportunities available for their product.

Speakers addressed over 60 delegates at the conference

"There is certainly more scope for using provenance as a selling point to develop the sector, but you need to have clear niche markets in place to sell the story and you also need to be able to guarantee quality and continuity of supply."

Waitrose fresh fish buyer, Jeremy Ryland-Langley, explained that shellfish is an increasingly important part of the company's assortment with huge opportunities for the future, particularly in the added value sector. He too emphasised the important role for sustainability and provenance, adding that Waitrose is proud of its supplier base, one of which is the Scottish Shellfish Marketing Group – a supplier for 15 years.

Managing director of the Scottish Shellfish Marketing Group (SSMG), Donny Gillies presented a flavour of SSMG's marketing strategy, including ways to raise customer awareness in the Scottish shellfish brand, while consultant Ron Ferguson, who led SSMG through considerable change and restructure, delivered a well-rounded overview of how to drive efficiencies through a business, adding that he had never seen a marketplace where there is so much potential and opportunity.

Chairman of SSMG, Walter Speirs rounded off the presentations with his impressions of the co-operative from a farmer's perspective. He explained how things have changed since its inception in 1992 and how the group has grown in terms of capacity and membership.

The conference concluded with an open forum, co-hosted by Ruth Henderson of Seafood Shetland and Peter Dryburgh of the NAFC Marine Centre, which gave Shetland shellfish producers the opportunity to share their views.

FISHupdate, March 2006

New antibiotic isolated from oyster

NORTH Carolina Sea Grant researchers have isolated a new peptide antibiotic from the American oyster that may have implications for managing many diseases in farmed oysters.

The new antimicrobial peptide AOD (American oyster defensin) may protect against bacteria in *Crassostrea virginica*, native to North Carolina and important economically to Atlantic and Gulf Coast oyster beds and fisheries.

"This peptide may be helpful in selecting disease-resistant oysters and may also allow for the development of a test to monitor oyster health," said Prof Ed Noga of North Carolina State University College of Veterinary Medicine. "In recent years, a number of pathogens, especially bacteria and parasites, have devastated American oyster populations."

Fish Farming International, March 2006

Musseling returns to Beckfoot beds

MUSSEL beds at Beckfoot Flats, near Silloth, have been reopened after being closed for several years for conservation purposes, writes **Gordon Brown.**

Cumbria Sea Fisheries Committee made the decision after consultation with English Nature, which was approached when a survey revealed 550 tonnes of good quality, clean, shelled mussels.

English Nature's assessment was that resumption of fishing was unlikely to have an adverse effect on the beds, but the committee feel that large-scale commercial harvesting may not yet be viable.

The value of mussels currently available on the beds has been put at between £150 and £300 per tonne.

Large cockles have been reported in mid-Solway between Silloth and Southerness in Scotland exceeding 35mm shell width, 10mm above the minimum size, and have been described by sea fishery officer David Dobson as "some of the finest" he has seen with a current value of between £1200 and £1300 a tonne.

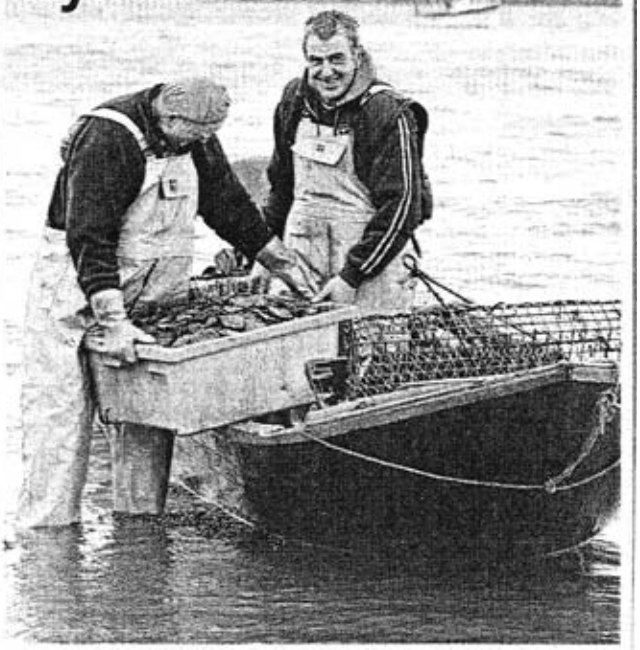
"At a time when things are tight I am pleased with the way the fishing of cockles has gone. Fishermen have worked well with us. There were reports of illegal fishing on the Scottish side but the authorities were alerted," commented Mr Dobson.

All other intertidal cockle beds in the district are closed.

Mr Dobson told the committee that the targeting of cockles by customary shrimping boats had reduced fishing effort on shrimps during the past three months.

Fishing News, 10 March 2006

Week long oyster season



A disappearing world from Ireland's west coast. Currach fishermen Tom (left) and Martin Keane land their oyster catch after a day's fishing in Blacksod Bay, Co Mayo. The North Mayo Oyster Co-opened a seven day oyster fishing season in Blacksod Bay last week.

Fishing News, 17 March 2006

Sea urchins to topple oysters as love food

THE SEX lives of jaded UK consumers are set to get a welcome lift from sea urchins, delegates to an Edinburgh conference will hear later this month.

Attendees at the Aquaculture Today 2006 conference will be told that farmed sea urchins have hidden depths, including a wide appeal for those with love on their minds.

The prickly animals are being credited with more pizzazz than other sea creatures when it comes to aphrodisiac qualities. They are already a sought-after love food in Japan, where they are eaten raw as a type of sushi.

A number of Scottish salmon farmers plan to harvest tens of thousands of urchins, which live happily alongside farmed salmon, feeding on leftovers and cleaning algae from the sides of cages.

According to research specialists at the Scottish Association for Marine Science, the UK consumer will soon be enjoying the "smoky sea" flavour of sea urchins.

Sea urchins are one of several marine farmed species going under the commercial microscope at the Aquaculture Today event, being held at the Sheraton Grand Hotel & Spa on 28-30 March.

Fishing News, 10 March 2006

Solway cockle fishery re-opens

The cockle dredger *Solway Prospector*, owned by Fruits of the Sea is one of six dredgers granted a licence for the newly opened Solway fishery. She recently completed a major refit at Leigh-on-Sea in Essex.

THE SCOTTISH side of the Solway Firth cockle fishery opened on Friday last week (17 March) for the first time in over four years.

One hundred licences have been issued to hand gatherers, six licences to fishing vessels and one tractor dredging licence has been issued on a trial basis.

The fishery will be controlled by a regulating order which will be overseen by the Solway Shellfish Management Association (SSMA), and enforcement agencies were due to hold a meeting with licence holders today (Friday 24 March) in Annan.

Fisheries Minister Ross Finnie urged fishermen to act responsibly in working with enforcement agencies in the area: "The healthy cockle beds are an important asset for fishermen and local communities but they must be managed in a sustainable and safe manner. I believe that the Solway Regulating Order is the best way of doing this.

"There should however be no doubt that the Solway cockle fishery is only open to those who have obtained a licence from the SSMA. All enforcement agencies involved will work to ensure that anyone found fishing illegally is prosecuted."

As well as the SSMA the reopening of the fishery has also involved Scottish Enterprise Dumfries & Galloway, Dumfries and Galloway Council, Dumfries and Galloway Constabulary and the Health and Safety Executive.

Fishing News, 10 March 2006

Chilean mussel growers create country's first industrial hatchery

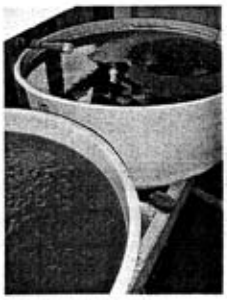
A GROUP of Chiloé Island mussel growers have united to create the country's first industrial hatchery and thus ensure a good supply of spat the whole year round, reports Peter J Neilson.

Almost two years ago a group of Chilean mussel (*Mytilus chilensis*) growers on the Island of Chiloé took notice of a problem which sooner or later would affect them. Due to the explosive growth of their industry, especially in the Tenth region, they could not rely on an adequate natural spat collection, which occurs in spring and summer and is not always successful.

After several meetings, pioneering mussel farmer Mario Cerna came forward with a revolutionary idea: the creation of the first large-scale mussel spat hatchery.

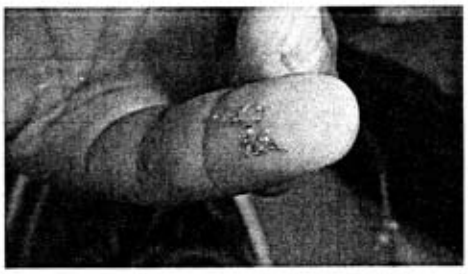
Mussel farming pioneer

Mario Cerna is quite a character, and a real-life pioneer. He just celebrated 25 years of mussel growing on Chiloé Island and is by far the person who knows most about *Mytilus chilensis* in the country. With decades of mussel farming behind him, he was able to forsee the problem which has now proven to be a reality in traditional spat collecting areas such as Putemun, Curanhue and Bahía Yaldad.



Ongrowing tanks

He summoned his colleagues – all fellow-members of the Chiloé Mussel Growers' Association – Russie Luengo, Adolfo Mohor, José Vera, Néstor Vera, Eduardo Vergara and Spanish mussel farming company Ferrando & Suárez, every one of whom harvest at least one thousand tonnes of mussels a year, and they agreed to create an associative project.



Mussel spat in Cerna Mar hatchery

Mario Cerna, owner of Cerna Mar mussel farming company, offered his own installations and property for the construction of this new hatchery and they immediately sat down to develop a working plan.

Mr Cerna told *FISHupdate*: "Many friends and businessmen – both national and foreign – have asked me how come I'm sharing my lifelong investments and creation with other persons. The answer is that without outside support I was unable to undertake this project, because what I was doing was practically an experiment.

"The idea is that hopefully this project will last long enough so that in the future other mussel growers will follow our example and develop their own spat. This is Chile's first mussel hatchery owned by a group of aquaculturists and we already have broodstock in the water for the next harvest," he commented.

"Many people have laughed at us, but if natural spat becomes scarce, we will already have half the task accomplished," said Russie Luengo, director of the Chiloé Mussel Growers Association.

FISHupdate, March 2006

Fisheries re-apply for MSC status

TWO fisheries have independently announced that they are to apply for reassessment as sustainable fisheries by the Marine Stewardship Council (MSC).

The Burry Inlet cockle fishery and South West mackerel hand line fishery already hold MSC 'eco-labels' and now want to be reassessed as sustainable and well-managed fisheries.

Moody Marine is carrying out the reassessments and, if successful, both fisheries will be licensed to continue using the MSC eco-label.

Retailers Tesco, Waitrose and Duchy Selections already offer MSC-certified seafood from these fisheries.

Both fisheries were awarded MSC certification in 2001 for five years. Since then Moody Marine has carried out annual checks to ensure it continues to meet MSC criteria. The fisheries have now applied to renew their certificates for a further five years.

"These reassessments are a strong endorsement of our programme," said MSC chief executive Rupert Howes.

"They show that fisheries see MSC as an effective solution to secure a sustainable future. The reassessment process requires continuous improvements to fishery management, guaranteeing that MSC-labelled products remain the best environmental choice in seafood."

Fishing News, 17 March 2006

Trials for new spider crab pot

A SEA Fish Industry Authority (Seafish) project to investigate the potential of using large pots to target spider crabs will shortly get underway in the south-west of England.

Spider crabs are principally caught in the south-west by tangle nets and this new project will assess the potential of using crab pots instead. If successful, these pots could also bring conservation benefits by reducing the bycatch of unwanted species.

These pots are larger than the traditional lobster pots used by the region's fishermen, featuring a 40 inch base and a cone-shaped entrance diameter of 14 inches, compared with the 10-12 inch diameter bucket-shaped cone entrance used for brown (edible) crab and lobster.

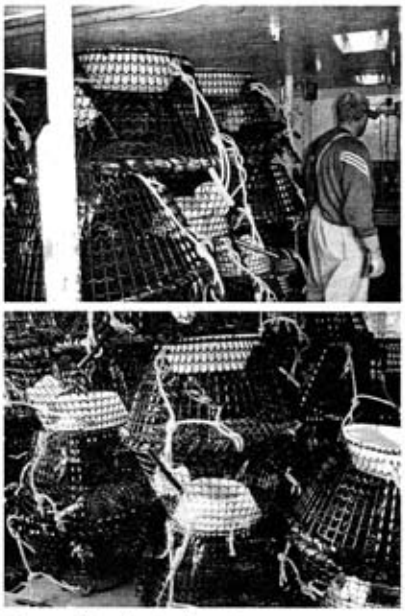
These pots were originally constructed for fishing trials for deepwater red crab, which were carried out off the west coast of Scotland last year and are based on a design used in the Canadian snow crab fishery. As a number of these redundant pots were readily available, it was recognised that they provided the perfect opportunity for low-cost trials in a different fishery.

The south-west spider crab season runs from April until August and is worked by small boats operating on inshore grounds. One of the aims of the study is to assess the practicalities of using larger pots on this class of vessel.

The market demand for spider crab varies depending on size with the price ranging from 30 pence per kilo for small crabs up to £1.40 to £1.60 per kilo for specimens above one kilo in weight. The study will investigate whether these larger diameter entrance pots have the potential for catching the more lucrative bigger crabs. The trial will commence in April and already two or three fishermen from the Mounts Bay area of Cornwall have indicated their willingness to participate.

Richard Caslake, Seafish Fisheries Technologist, said: "The trial will investigate whether this type of pot could prove a viable alternative to using tangle nets for spider crab. The larger entrance and size of the pot could make them effective catchers of spider crab."

For more information on the project contact Richard (Gus) Caslake on 01736 362625, or email r_caslake@seafish.co.uk



Pots: could replace tangle nets

FISHupdate, March 2006

Ducks ruin Wash mussel business

A LEADING mussel fisherman and processor in the Wash is being forced out of the business by eider ducks, reports **John Worrall**.

Several thousand of the ducks are feeding on the seed mussel lays and destroying them, and John Lake has been dredging up his seed mussel as quickly as possible and selling it to the Netherlands and Germany. By the end of last week he had moved about 1000 tonnes.

He told *FN*: "We are clearing the lays. We have to because the eider will eat the mussels before they are mature. We are losing money by doing this because we are not getting the growth and added value. But we have no option. We will then be out of the mussel business."

Eider ducks were hardly seen in the Wash until four or five years ago, when they discovered the huge amounts of immature mussel that are brought in to the Wash and relaid.

They can feed with minimal effort under protection from European legislation, notably the Habitats Directive, which allows only non-lethal measures to deter them.

Trials are under way with scaring devices and an interim report was due this week.

There is some evidence that the birds' behaviour has changed since the scarers were deployed in that they have moved to different lays. But one view is that rather than being scared, they have simply eaten out one location and moved to the other.

The lays will be resurveyed by Eastern Sea Fisheries Committee at the end of the month.

Doug Beveridge of the NFFO said the situation was a major blow to the local area and was very worrying in its wider implications, with a draft of the Marine Bill due later this year.

And he slammed DEFRA and English Nature for their lack of urgency in tackling the problem.

"We hear continually about sustainable development and the need for partnership, but there is little evidence in this situation of any partnership," he said.

"John Lake has been relaying seed mussel in the Wash for over 40 years, and you can't get much more sustainable than that.

"He has been warning of the dangers to the mussels from the eider duck population for two years now and the implications if nothing was done, but there is absolutely no urgency to do anything effective about it.

"English Nature and DEFRA's wildlife division must think it is more humane to let the ducks starve – which is what will happen as they eat all the mussels – and to see all the local jobs exported to the Netherlands and elsewhere."

He said the lack of action to support the fishery had worrying implications for inshore and shellfish fisheries in general, with the new Marine Bill and its spatial planning provision in process, and a national shellfish strategy being developed.

"It's very worrying how environmental legislation is so unaccountable and how powerless the fishing industry is in trying to oppose it. We hear so much about the need to work in partnership with the government and NGOs, but there is a big difference between their words and their policies.

"They have just fudged and sat on their hands for two years on this issue, and now, both the fishermen and the ducks will go hungry, because there is not enough food to sustain the huge numbers of eider ducks in the Wash."

Fishing News, 17 March 2006

Scarers fail to clear eiders

FISHERMEN in the Wash were this week finishing clearing the last of the growing stock on their mussel lays following inconclusive results from the trial of devices to scare off predatory eider ducks (*FN* 20 January), reports John Worrall.

The stock is being sold to the Netherlands and Germany.

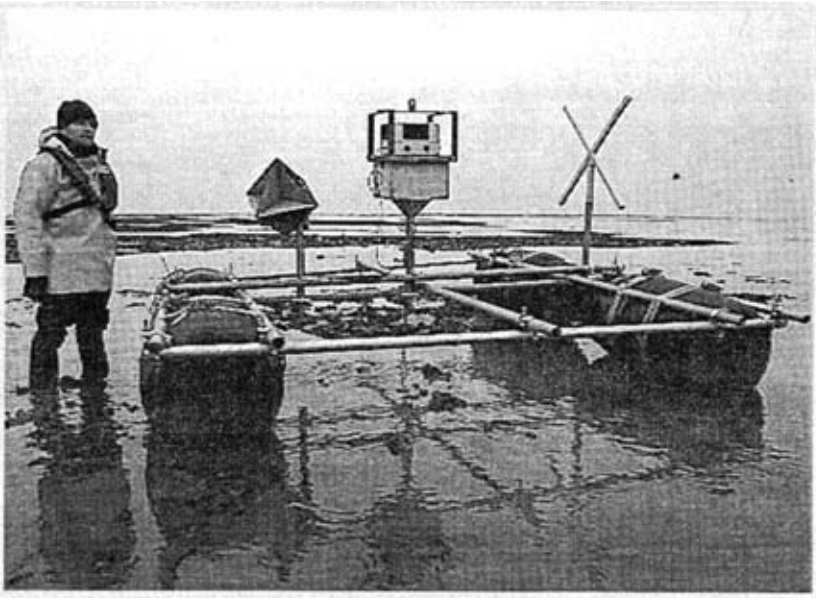
The trial, which involved pontoon-mounted scarers anchored on the lays, found that they had little overall effect on the birds' feeding habits and significant numbers of eiders were still visible on the lays.

John Lake, of John Lake Shellfish, said he had cleared one lay in January but had suspended the effort so that the scarer trials could be completed during February. However, when the birds were still prominent, he decided to clear the other lay and cut his losses. The clearance effort took eight boats about six weeks but he says there was no alternative with so many birds in the Wash.

"English Nature said there were about 3000 eider on the lays, but it only takes an eider half an hour to fill up and move off. An hour later there are probably a different 3000 there feeding.

"We have seen and videoed a flock of 10,000 or so near the North Ridge buoy. Now, work that out at 2.5kg of mussels per eider per day. After all, the Wash is only 17 or 18 miles square. There are plenty of measures to protect the birds but none to protect the fishermen."

Within the month the eiders will be flying to their breeding grounds in north-west Scotland and Scandinavia, but the issue will be aired at a four-day public inquiry in King's Lynn, starting on 25 April.



Pontoon-mounted bird scarers on the Wash mussel lays did not faze the eiders.

Fishing News, 17 March 2006

Expert leaves for Red Sea

Dylan Taylor, the successful manager of the National Lobster Hatchery at Padstow, is leaving England in November to work at an ornamental marine fish farm on the Red Sea coast.

His appointment as the Operations Manager with Issham Aquatics in Saudi Arabia will open up new opportunities for this young man, who is a dedicated marine aquarium expert.

Previously a technician at the Marine Aquarium in Plymouth, he took over as manager of the National Lobster Hatchery in 2003 and has increased the output of cultured juvenile lobsters from 2000 a year to about 20,000.

In 2005, as well as having a record breaking number of small lobsters released into the sea, Dylan with his small team of three technicians and researchers has redeveloped the visitors centre, raised its profile and increased the number of paying visitors to around 40,000.

Dylan Taylor, the successful manager of the UK National Lobster Hatchery at Padstow, is leaving to work at an ornamental marine fish farm on the Red Sea coast

This income helps with the running costs for the lobster rearing and release work, and, along with other new grants, the hatchery's financial situation is improved.

As a Trustee of the National Lobster Hatchery, I am proud to report the success of this stock enhancement venture, which is run by the Cornwall Sea Fisheries Committee. However, like most new aquaculture enterprises, this hatchery has had various problems since it opened in October 2000.

Indeed, at our regular management meetings under the chairmanship of Eddy Derriman, the Chief Fishery Officer for Cornwall, we had to cope with several technical, financial and staff problems. Large-scale larval rearing was one big difficulty with regular high mortalities.

A project with the University of Plymouth in 2004 led to the use of dietary supplements that have helped overcome these problems and a reliable system has been achieved. Carly Daniels, who did this original work as a student has now started work as a researcher at the lobster hatchery and will continue her research on probiotics.

A new Senior Technician, Colin Wells, joined the lobster team at Padstow in October. He previously worked rearing seahorses at the National Marine Aquarium in Plymouth and his skills and expertise will be used to refine and expand this lobster rearing and release programme.

From 'On the Shellfish Scene' by Dr Eric Edwards, Fish Farming International, November 2005

Padstow lobster hatchery receives national accolade

THE National Lobster Hatchery in Padstow, Cornwall has been presented with a Pride in Seafood award for its outstanding contribution to the UK seafood industry.

The hatchery was established in 2000 with the aim of enhancing lobster stocks in Cornwall, and at the heart of its work is an innovative restocking project.

Local fishermen bring "pregnant" female lobsters in to the hatchery, to give them a chance to release their offspring in captivity, where there are no predators. The young lobsters are then raised to a size where they can be released back into the sea and look after themselves.

As a result, thousands of lobsters reared at the hatchery have been released around the Cornish coastline, an initiative which has been of great benefit to the local industry.

The hatchery also hosts a visitor centre which has about 30,000 visitors per year and this winter will embark on an extensive revamp of the facility to include even more information to appeal to as wide a range of audiences as possible.

Accepting the award, general manager Dylan Taylor said: "At the hatchery we're all really proud of our contribution to a sustainable lobster fishery and we're delighted to receive this award from Seafish in recognition of our work.

"The hatchery is enjoying its most successful year in 2005. With the backing of the seafood industry, the Government and the public, the hatchery aims to continue growing both in terms of lobster production and in providing new and exciting experiences for our visitors in Padstow."

Seafish chairman Andrew Dewar-Durie, who presented the award said: "I am delighted to present Dylan with this award in recognition of his hard work and commitment. Individuals such as Dylan and the rest of the team at the hatchery work tirelessly for the good of the industry and I think that it is wonderful we can pay public tribute in this way."

The Pride in Seafood Awards were launched as part of the Pride in Seafood Campaign which is aimed at boosting the seafood industry's image as a forward-looking sector. The awards publicly recognise contributions made to the industry by outstanding individuals, companies and organisations.

After two "challenging but rewarding" years managing the hatchery, Dylan Taylor is now returning to working with ornamental marine fish. He will be based on the coast of the Red Sea and will be working on a new mariculture project which will farm various organisms including coral.

Hatchery manager Dylan Taylor (right) received the award from Seafish chairman Andrew Dewar-Durie.

Fish Farming Today, December 2005

New team joins SW lobster hatchery

DOMINIC Boothroyd has been appointed the chief of Padstow's lobster hatchery. He is joined by a new team of trained aquarists and marine biologists as the facility attempts to further increase the region's lobster stock, reports **Phil Lockley**.

Development to give the paying public a greater hands-on experience of what goes on at the hatchery will soon take place.

The outer section, where tourists see an exhibition of the life of a lobster, will have more aquariums and a section of the wall separating that from the hatchery workshop will be removed.

It will be replaced by a public viewing area, where visitors can see part of the work carried out inside the high-tech hatchery.

A new seawater cleaning and pumping system is also being installed.

The Cornish hatchery already has a new isolation section to set aside any animals that are assessed as requiring extra care, or those that are in need of a more detailed examination.

Hatchery technician Rory Pryor said that the hatchery development is hoped to be finished before the main tourist season begins.

"Already there is an increase in the number of visitors seeing the hatchery and we are expecting even more visitors than last year," he said.

Fishing News, 20 January 2006

A thinking lobster?

A RARE albino lobster, recently donated to the National Lobster Hatchery at Padstow, has sparked a debate on whether or not white lobsters use conscious thought to outwit their prey, writes Phil Lockley.

Technician and press officer Rory Pryor (pictured holding the lobster) said the lobster is one of the strangest and rarest white lobsters he has ever seen, but it may also be the "brightest" in terms of thinking.

He said: "Having watched a similar lobster placed in a large tank together with juvenile mullet, we saw the lobster crush a mussel, pass a chunk of its meat to the mouth parts, chew it further and 'blow' the cloud of small pieces amid its outstretched claws.

"The fish responded and she snapped at many – eventually one unlucky fish fell foul of her claw. We can't say that the lobster planned the fish's end, as lobsters do not have a true brain, but she seemed brighter than others."

He said that the lobster is not a true albino, but when the berried hen's eggs are hatched the brood will be closely watched to see if they too retain that quirk-of-nature shell colour.

Fishing News, 13 January 2006

New manager appointed

DOMINIC Boothroyd (pictured) has been appointed as the new general manager at the National Lobster Hatchery.

Prior to joining the hatchery, Dominic worked for The National Marine Aquarium in Plymouth but was stationed in Dubai where he was operations manager for the aquarium in the Burj Al Arab hotel – the world's only 7-star hotel.

Speaking to *Fish Farmer*, Dominic said his dream for the lobster hatchery is to increase production to a level where it is making a major contribution to the sustainability of the fishery, not just around Cornwall but around the whole of the United Kingdom.

"My other dream is for us to become a centre of excellence for everything associated with lobsters, particularly with regard to research but also with regard to technology, science, education and retail," he said.

"In short, when people think about lobsters I want them to think abou the National Lobster Hatchery."

Dominic was born and raised in th area and has a real love of the sea. H said he was delighted to be able t move back to Cornwall with his wi and young family.

New hatchery manager Dominic Boothroyd.

Fish Farmer, January/February 2006

WHERE TO GET HELP & ADVICE

Policy Matters

Department for Environment, Food and Rural Affairs, Nobel House, 17 Smith Square, London SW1P 3JR
(Switchboard tel. (0207 238 3000)
General fax. (0207 238 6591)

Several and Regulating Orders, Shellfish Farming;
Fish Industry Management Division
Area 7E, 3-8 Whitehall Place, London SW1A 2HH
(Tel. 0207 270 8210) (Fax. 0207 270 8097)

Shellfish Health;
Veterinary Exotic Diseases, Research and Official Controls Division
Area 5E, 3-8 Whitehall Place, London SW1A 2HH
(Tel. 0207 270 8826) (Fax. 0207 270 8827)

Public Shellfisheries, excluding Regulating Orders;
Sea Fisheries Conservation Division
Area 6A, 3-8 Whitehall Place, London SW1A 2HH
(Tel. 0207 270 8256) (Fax. 0207 270 8310)

Shellfish Licensing Scheme;
Fish Industry Management Division
Area 7E, 3-8 Whitehall Place, London SW1A 2HH
(Tel. 0207 270 8128) (Fax. 0207 270 8146)

Grant Aid;
Marine Fisheries Agency
Area 6D, 3-8 Whitehall Place, London SW1A 2HH
(Tel. 0207 270 8041) (Fax. 0207 270 8019)

Marine Environment Protection, Marine Pollution Incidents and Marine Consents;
Marine Environment Division,
Area 2D, 3-8 Whitehall Place, London SW1A 2HH
(Tel. 0207 270 8642) (Fax. 0207 270 8709)

You can also visit the Defra website at http://www.defra.gov.uk

Monitoring of Fishing Activities, Licensing;
Marine Fisheries Agency
Area 6D, 3-8 Whitehall Place, London SW1A 2HH
(Tel. 0207 270 8778/8657)
(Fax. 0207 270 8146)

Research and Development Programmes;
Dr Neil Auchterlonie, Fish Health and Shellfish health R&D Programme Manager
Area 6C, 3-8 Whitehall Place, London SW1A 2HH
(Tel: 0207 270 8770) (Fax: 0207 270 8020)
(e-mail: neil.auchterlonie@defra.gsi.gov.uk)

Welsh Assembly Government, Agricultural and Rural Affairs Department, New Crown Buildings, Cathays Park, Cardiff CF1 3NQ (Tel. 029 2082 3567) (Fax. 029 2082 3562) (http://www.wales.gov.uk)

Scottish Executive Environment and Rural Affairs Department, Pentland House, 47 Robbs Loan, Edinburgh EHG14 1TW
(Tel. 0131 244 6224) (Fax. 0131 244 6313)
(http://www.scotland.gov.uk/who/dept_rural.asp)

Department of Agriculture and Rural Development for Northern Ireland, Fisheries Division, Annexe 5, Castle Grounds, Stormont, Belfast, BT4 3PW
(Tel. 028 9052 3431) (Fax. 028 9052 2394)
(http://www.dardni.gov.uk)

Shellfish Hygiene

England - Food Standards Agency Aviation House, 125 Kingsway, London, WC2B 6NH
(Tel. 020 7276 8000) (http://www.food.gov.uk)

Food Standards Agency (Scotland), St Magnus House, 25 Guild Street, Aberdeen AB11 6NJ
(Tel 01224 285100);

Food Standards Agency (Wales), Southgate House, Wood Street, Cardiff CF10 1EW
(Tel 029 20 678918);

Food Standards Agency (Northern Ireland), 10C Clarendon Road, Belfast BT1 3BG
(Tel 02890 417711)

Scientific and technical advice

Cefas Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB
(Tel 01305 206600) (Fax 01305 206601)
- Cultivation techniques; health regulations; disease control; shellfish hygiene classifications and purification plant approvals; shellfish water quality and effluent discharges (microbiology) (England & Wales)

Cefas Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk, NR33 0HT
(Tel 01502 562244) (Fax 01502 513865)
- Shellfish stocks (England & Wales)

Cefas Burnham Laboratory, Cefas Laboratory, Remembrance Avenue, Burnham-On-Crouch, Essex, CMO 8HA
(Tel. 01621-787200) (Fax 01621 784989)
- Pollutants (contaminants) and their effects

You can also visit the Cefas website at http://www.cefas.co.uk

Fisheries Research Services, Marine Laboratory, PO Box 101, Victoria Road, Aberdeen AB11 9DB
(Tel. 01224 876544) (Fax. 01224 295511)
(http://www.marlab.ac.uk)- Shellfish stocks, cultivation, hygiene, and disease control (Scotland)

SEAFISH – Inshore Group, Aquaculture Development Advisors:

For Scotland and Northern Ireland: Craig Burton, PO Box 3, Acharacle, Argyll. PH36 4YF
(Tel/Fax: 01967 431 573;
Mobile: 078 760 35771)
(email: c_burton@seafish.co.uk)

For England and Wales: Martin Syvret, 40 Toronto Road, Mount Pleasant, Exeter, Devon, EX4 6LF
(Tel/Fax. 01392 202043; Mobile: 078 760 35746)
(e-mail: m_syvret@seafish.co.uk)

SEAFISH Technology, Seafish House, St. Andrew's Dock, Hull, HU3 4QE
(Tel 01482 327837) (Fax 01482 223310)

You can also visit the SEAFISH website at http://www.seafish.org

Advice on commercial activities

The Shellfish Association of Great Britain, Fishmonger's Hall, London Bridge, London, EC4R 9EL (Tel. 020 7283 8305) (Fax. 020 7929 1389)
(http://www.shellfish.org.uk)

The Association of Scottish Shellfish Growers, Mountview, Ardvasar, Isle of Skye, IV45 8RU
(Tel/Fax: 01471 844324)

Wildlife conservation and status of on-growing sites

Joint Nature Conservation Committee, Monkstone House, City Road, Peterborough PE1 1JY (Tel. 01733 562626) (Fax. 01733 555948)
(http://www.jncc.gov.uk)

English Nature, Northminster House, Peterborough, PE1 1UA
(Tel. 01733 455000) (Fax. 01733 568834)
(http://www.english-nature.org.uk)

Countryside Council for Wales, Ffordd Penrhos, Bangor, LL57 2LQ
(Tel. 01248 385500) (Fax. 01248 355782)
(http://www.ccw.gov.uk)

Scottish Natural Heritage, 12 Hope Terrace, Edinburgh, Scotland, EH9 2AS
(Tel. 0131 447 4784) (Fax. 0131 446 2277)
(http://www.snh.org.uk)

Other Useful Numbers

Crown Estate Commissioners, Crown Estate Office, Marine Estates Division, 16 Carlton House Terrace, London SW1Y 5AH
(Tel. 020 7210 4322, Dr Tony Murray)
(Fax. 020 7839 7847)
(http://www.crownestates.co.uk)

Central contact for local Sea Fisheries Committees - The Association of Sea Fisheries Committees of England and Wales,
6, Ashmeadow Road, Arnside, Via Carnforth, Lancashire, LA5 0AE
(Telephone and Fax: 01524 761616;
email: asfc.office@btopenworld.com).

Co-ordinator for Defra - CARD R&D – Dr. Mark James, Fisheries Resource Management Ltd., Coillie Bhrochain, Bonskeid, Pitlochry, Perthshire, PH16 5NP.
(Tel./Fax: 01796 474473).
(http://www.frmltd.com).

USEFUL PUBLICATIONS

Readers of Shellfish News may be interested in the publications listed below. These are available by contacting the relevant Department/Agency or via the websites (see contact details in Where to get Help and Advice). Full lists of publications are available on the respective websites.

Defra
- A Guide to Shellfish Health Controls
- Several and Regulating Orders: Notes for Guidance
- Several and Regulating Order Management Plan

Cefas
- The Fish Health Inspectorate and You - Service Standards and Code of Practice for Enforcement
- Bivalve cultivation: criteria for selecting a site
- Scallop cultivation in the UK: a guide to site selection
- Storage and care of live lobsters
- Research on Shellfish Cultivation (1990-2003)

SEERAD Fisheries Research Services
- Fish Health Inspectorate Service Charter
- Scottish shellfish farm production survey
- The classification of shellfish production areas using E. coli
- Marine biotoxins
- Ensuring the quality of fish and shellfish
- Supporting new aquaculture species in Scotland
- Bonamiasis
- Marteiliasis
- Aquaculture and Aquatic Animal Health Programme

Seafish
- The oyster hyperbook
- The suspended mussel hyberbook
- The seabed cultivated mussel hyperbook
- The scallop hyperbook
- The clam hyperbook
- Introduction to HACCP for Bivalve Purification and Dispatch Centres

ADDENDUM to Shellfish News Number 21 (Spring 2006)

BONAMIA IN WALES

Since this issue of Shellfish News went to Press, the native oyster parasite *Bonamia ostreae* has been detected in a natural bed of flat oysters (*Ostrea edulis*) in the River Cleddau in Wales.

Examination of a routine sample of 30 *Ostrea edulis* collected in late March from Burton Beach in the River Cleddau led to the suspicion that this disease had spread into the river. Examination of further samples from the river by molecular biological techniques has confirmed the identification of the *Bonamia ostreae* parasite. This is the first appearance of this disease in Wales.

Controls have been put in place to prohibit relaying or re-immersion in another farm or in the aquatic environment where there is an Approved Zone for Bonamia, in order to prevent the disease spreading further. To ensure maximum protection, these controls extend to the whole of the River Cleddau, Milford Haven and the adjacent coast from Skomer Island to St. Govan's Head. It is not expected that these controls will interfere with current commercial activity, as native oysters from this area are fished only for consumption.

We will be monitoring the extent and effect of the disease in this area and attempting to find out how it was introduced. If anyone has any information that may help with this investigation they can contact the Fish Health Inspectorate at the Cefas Weymouth laboratory in the strictest confidence.

Further information on the disease and its status elsewhere in the UK can be found in the monitoring report on Page 46 of this issue of Shellfish News.

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