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NATIVE OYSTER (*OSTREA EDULIS*) FISHERY ENHANCEMENT IN STRANGFORD LOUGH, NORTHERN IRELAND

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Introduction

Stocking strategically located sites with oyster broodstock is seen as an important component of attempts to regenerate stocks of *Ostrea edulis*. Between 1997-99 an EU funded project led by fishermen was started to re-establish a sustainable native oyster fishery in Strangford Lough. This involved cultch deposition and the addition of seed and broodstock oysters. As a result of these efforts, there was a dramatic increase in inter-tidal populations of *O. edulis* in Strangford Lough. The current project continued the work initiated in 1997. Between October 2002 and April 2005 surveys for oysters were conducted at 55 inter-tidal sites (including a number of island sites) (Figure 1) and 120 sub-tidal sites. These represent the most comprehensive surveys of *O. edulis* ever carried out in Strangford Lough. During the inter-tidal surveys hand gathering of oysters was recorded at a number of sites.

This brief update summarises data for inter-tidal oyster surveys and estimates of the scale of unregulated harvesting. The final report will be completed in 2006.

Results and Discussion

During the surveys, live oysters were found at 27 out

of 55 inter-tidal sites in densities ranging from 0.01 to 2 per square metre. Densities less than 6 per square metre are considered low on commercially viable *O. edulis* beds. The major features of the comparative surveys are: the high numbers of oysters found in the north sector in all surveys, the increase by two orders of magnitude in oyster numbers between 1998 and 2002 to a peak of over 1 million oysters in 2003 and a decline thereafter (Table 1). Size frequency data recorded during the 2002-2005 surveys identified the major population decline in the 50 mm-90 mm size classes (Figure 2). Increases in the densities and range of native oysters in Strangford Lough between 1998 and 2003 can probably be attributed to a combination of over-summering of commercial oysters, hydrographical conditions in the northern basin and the deposition of cultch, oyster seed and broodstock and is unlikely to be due to recruitment from wild stock as no dense wild stocks are known.

The decline in oyster numbers demonstrated by repeat surveys in 2004 and 2005 is probably attributable to unregulated harvesting as no significant numbers of empty shells were found at any of the survey sites (empty shells would indicate mortalities due to predation or other causes). Declines between 2003-2004 and 2004-2005 exceed 20 tonnes with estimated values

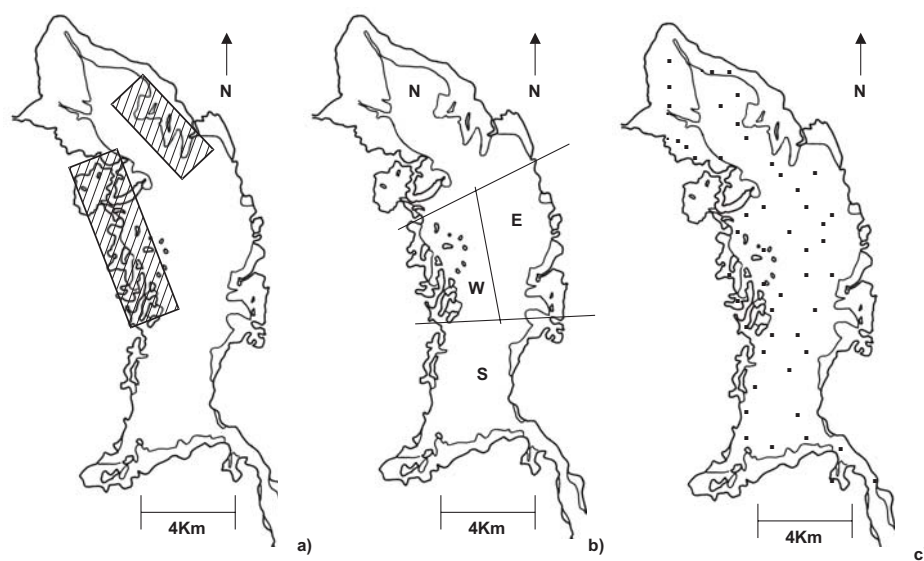


Figure 1. *Ostrea edulis* in Strangford Lough Northern Ireland.
a) Historical distribution, b) Areas used for stock assessment,
c) Inter-tidal and island sites sampled in present survey, shown as dots (55 sites)

Table 1. Estimates of standing stocks of oysters in geographical sectors of Strangford Lough (1998-2005).

	Inter-tidal area Km ²	Area suitable for settlement Km ²	Standing stock of oysters (x10 ³) [tonnes]				
			1998	2002	2003	2004	2005
North	19.644	11.000	101.7	1,017	1,242	964.0	650.8
South	4.701	0.089	0	0	0.3	0	0
East	4.509	1.064	0	0.6	0.2	0.1	0
West	5.438	0.146	8.1	2.8	1.2	0.5	0
Total	34.292	12.299	101.8	1021	1243.7	965	650.8
			[8.4]	[85]	[103]	[80]	[54]
Decline/removal tonnes (estimated value STG @ £2000/tonne)						23	26
						(46)	(52)

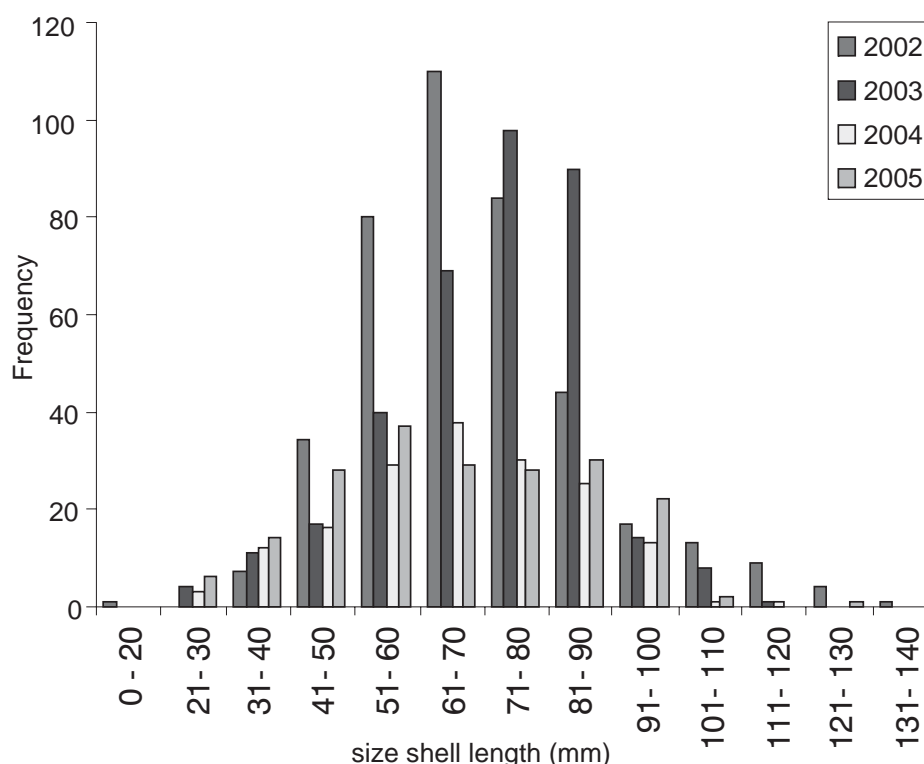


Figure 2. Size frequency distributions of inter-tidal oyster population samples 2002-2005. Based on pooled data of fixed time (20 mins) sampling intervals for all inter-tidal sites

>£40,000. The increase in standing stocks of oysters since 1998 has resulted in the first significant harvests of *O. edulis* from Strangford Lough for over 100 years. However, harvesting is unregulated and has resulted in the removal of a large proportion of the total inter-tidal oyster population so that many sites have been picked clean, and oyster numbers are probably at levels below those at which the fishery collapsed in the 19th century. This unregulated harvesting is highly likely to have a detrimental impact on the regeneration of native oysters in Strangford Lough by reducing the spawning-stock biomass.

The re-establishment of *O. edulis* assemblages also has the potential to increase biodiversity within Strangford Lough, an aspiration of the UK Biodiversity Action

Plan, which lists *Ostrea edulis* as a species that should be maintained and expanded.

However, until the issue of unregulated harvesting is resolved, the very promising recovery of oysters in Strangford Lough with the tangible potential to reconcile ecological and harvest goals of restoration will not be realised.

Acknowledgements

The present project is funded under the Northern Ireland Programme for Building Sustainable Prosperity. The authors would like to acknowledge the support and encouragement provided by Dr Jasper Parsons and the Strangford Lough Shellfishermen's Co-op.

RETURN OF THE NATIVE – IS EUROPEAN OYSTER (*OSTREA EDULIS*) STOCK RESTORATION FEASIBLE?

Ian Laing

Cefas Weymouth Laboratory

Background

Native oysters (*Ostrea edulis*) were once plentiful in British waters, but the twentieth century saw a long, near-continuous decline. This dramatic reduction in stock abundance is attributed mainly to over-exploitation. The species is rapidly fished out because it is relatively long-lived and reproduces sporadically. Other factors, including pests, disease and declining water quality have also had a detrimental impact.

Feasibility study

In order to address and potentially to reverse this situation *Ostrea edulis* was designated as a named species in the UK Biodiversity Action Plan as part of a national commitment to the International Convention on Biodiversity. Amongst other review and research initiatives, which are summarised in the final report, a feasibility study was carried out to evaluate all the factors, including an economic assessment, relevant to a programme of stock restoration.



The author inspecting a native oyster

Ian Laing and Peter Walker of Cefas carried out this study, with the assistance of Francisco Areal, an economist at CSL, York. Defra and Seafish funded the work (Defra project code FC1016). The final report was published in late May of this year, and may be accessed online at: <http://www.defra.gov.uk/research/project_data/Default.asp> (type in the project code FC1016 into the search engine). The study included biological, technical and economic aspects as well as examining the legislative framework and lessons learnt from other attempts at restoration elsewhere.

A brief summary of findings

There is a considerable body of knowledge on the biology of the native oyster and its environmental requirements, so selection of sites for restoration should not be a problem. Areas free of disease and major pests offer the best opportunities.

Restoration might use either wild, including half-grown, stocks from other areas or cultivated juveniles. The technical procedures for hatchery rearing are standard, although there can be problems here. Alternative methods, particularly breeding ponds, are available and can be used successfully. Genetically, it is generally agreed that wild European native oyster populations are basically similar; so that where stocks from other areas are introduced the source is not critical. The relaying of cultch is an essential component of a successful oyster restoration programme, and the use of sanctuaries is generally seen as beneficial.

Native oyster beds form a biotope, with many associated epifaunal and infaunal species. Loss of this habitat has resulted in a major decline in species



A feasibility study of native oyster (*Ostrea edulis*) stock regeneration in the United Kingdom

CARD Project FC1016
Native Oyster Stock Regeneration -
A Review of Biological, Technical and Economic Feasibility

for
Defra and Seafish



richness in the coastal environment. The native oyster is one of over 380 Biodiversity Action Plan species in the UK and the regulatory framework for habitat and wildlife conservation is sufficient to provide a platform for restoration programmes for habitat protection.

Restoration efforts and associated studies elsewhere have shown the potential for success. One of the more comprehensive and useful studies is the work carried out by Dai Roberts and his team on restoration in Strangford Lough, Northern Ireland. This was described in a previous issue of Shellfish News (Number 12, November 2001) and more recent studies here are summarised in the preceding article in this issue. The feasibility study also draws on experience elsewhere, mainly throughout Europe but also considers stock restoration efforts with species native to other parts of the world, including Chesapeake Bay in the USA.

Non-marketable costs and benefits were estimated. They provide an idea of the high value that may be placed on biodiversity aspects. Nevertheless, this study also shows that stock restoration can be commercially viable if fishery prices and yields are sufficiently high, although sustaining a fishery at the historical harvest level is unrealistic.

The future?

The study has shown that it is feasible to restore native oyster stocks, and discusses the various issues associated with this, some of which are mentioned in this article. The next step should perhaps be a pilot project. To have any chance of success there needs to be a local management plan involving all stakeholders and, of course, the funding.

OBITUARY: GWION DAVIES

A tribute by Peter Dare

Gwion Davies, who died in North Wales in June 2005 aged 87, will be remembered by shellfish scientists and growers for his dedicated research into the development of mussel cultivation in this country. But, before he started a long career in this field, at the MAFF Fisheries Experiment Station in Conwy, he had made significant contributions to 1940s government expeditions to the

Antarctic Ocean, partly to search for much-needed new protein sources for a war-torn British population. Even his closest colleagues at Conwy had only an inkling of this earlier phase of Gwion's life; for his modest and self-effacing nature inhibited him from telling us little more than humorous yarns about his adventures 'Down South'. However, an obituary published in the 'Daily Telegraph' fully revealed his involvement in these Antarctic expeditions. These clearly were formative years for Gwion that now help to explain his passionate advocacy of mussel farming to provide a new protein resource for this and other countries.

Service in the Antarctic

At an early age, Gwion evidently desired to experience the hard life of mariners under sail. Later, he would admit to us his admiration for the first Welsh seamen who had taken slate to South America. During Cambridge University vacations he worked aboard a Danish ketch and a square-rigged British schooner. After graduating in zoology in 1939, he became a whaling labourer on the Marr Antarctic expedition to find ways of preserving whale-meat for human consumption; and then worked aboard a Norwegian commercial whaler. In 1943 he was invited by Marr to join a top-secret 3-year voyage (*Operation Tabarin*) to safeguard British sovereignty in Antarctica. There, Gwion played a vital role for among varied duties, including dog training, he helped to man-haul equipment on sledges over hundreds of miles to establish new bases. In the next year, he was a member of a 4-man survey team that covered 500 miles in a remarkable 51 days. For these services, he was awarded the Polar Medal with Antarctic Clasp in 1953, and was



Gwion examining and weighing a mussel rope

commemorated in the name of a topographic feature - Davies Dome - on James Ross Island, Graham Land.

Early research interests

On returning to the UK, Gwion first worked at Rothampstead experimental farm, Harpenden, and then began an agricultural science course at Bangor, before joining the DAFS Marine Laboratory at Aberdeen. In the late 1950s, he moved back to his native North Wales to work with R.H. (Dick) Baird on a new MAFF programme at Conwy to tackle problems of mussel farming; work that would become his life's interest. When Baird departed to start a commercial mussel farm in the Menai Strait, Gwion himself undertook (for some 8 years) pioneering research on mussel biology, resource assessment and cultivation trials both in North Wales and the Wash.

Pioneering studies on mussel cultivation

The fieldwork in the Menai Strait, in support of a fledgling industry, often involved night-time visits to potentially treacherous mudflats in all kinds of weather. There were no H&S regulations in those days! Although of slight build Gwion's physical endurance (honed in the Antarctic) became almost legendary among colleagues. He devised 'mud skis' for traversing the flats and a sledge for carrying his homemade survey equipment. Using this gear he would map natural inter-tidal mussel beds, estimate stock abundance and availability for farming, and also locate and assess suitable grounds for cultivation by the (then new) method of relaying dredged small mussels. He also devised methods for evaluating sub-littoral beds and relaying grounds in the Menai Strait, made trials with Dutch roller dredges to control starfish predators, and studied mussel growth rates and meat yields under different tidal conditions. Later, he conducted similar (and still highly regarded) work in the Wash, with the Eastern Sea Fisheries Committee,

and did much to establish the principles of large-scale mussel cultivation there.

Gwion calculated that mussel farming should yield annually several times more protein (dry) per unit area than any livestock farm, given regular seed supplies and control of predators. He demonstrated the benefits of protecting seed from shore-crab predation by using crab-proof enclosures. After Brian Bayne, at nearby Bangor University, had discovered that mussel spat attach first to filamentous algae before eventually settling onto mussel beds, Gwion found that a synthetic filamentous material (rubberised horse hair as used for filling cushions!) proved ideal for catching spat and thus could be used as a standard tool for monitoring spat abundance in the sea – an idea that became widely adopted. He found that spat were usually present in Menai Strait waters all year round, and seasonally in great abundance, yet virtually none settled onto local mussel grounds. The problem was how best to harvest this floating resource.

After the formation in 1968 of a 3-man mussel team at Conwy to pursue these findings, Gwion played key roles in assessing mussel resources at Morecambe Bay and demonstrating how spat caught there on ground ropes could be utilised to restock the Menai Strait grounds after a nursery phase either within enclosures or on a raft; both structures being designed by him. His advice was widely sought by Sea Fisheries committees in England and Wales, and he was invited to Ireland to assist with setting up floating mussel culture. He was an avid correspondent, especially with workers in India and New Zealand, and many visited him from abroad.

All at the Conwy laboratory regarded Gwion with much respect and affection. He retired in 1980 but continued to maintain an active interest in his field right up to the end. He is survived by his wife Joscelyn and by two daughters.



Gwion (waving, right) from the mussel raft in the Menai Strait

OYSTER SEED GROWING SYSTEM PROVES A SUCCESS FOR OTHNIEL SHELLFISH

Gary Wordsworth, Othniel Shellfish Ltd

Seafish trials

Trials carried out by Othniel Shellfish Ltd to evaluate the effectiveness of a mechanised rack system for the production of Pacific oyster seed could result in impressive production levels for the company. Othniel was awarded a Seafish grant to help pay for a researcher from Southampton University, Mr Craig Grove. His job was to monitor the trials and provide scientific analysis of the optimal stocking densities for the seed. He also analysed density verses depth and drew comparisons between the use of plastic boxes and the bag system.



Part loaded box system

Othniel

Othniel has previously been involved in growing and marketing clams and cockles but now mainly concentrates on the production of oysters for sale to other growers and wholesalers. The company is well known for developing new strategies to improve the efficiency of their operation in Poole Harbour: it has



Washing large seed onto ground for on-growing

developed and now markets a novel harvesting barge for use in shallow water environments. The harvesting barge uses pressurised water jets to blow the shellfish onto a stainless steel conveyor belt, which transports them into the barge. The environmental impact of this method is minimal and the damage to the shellfish virtually nil.

This barge, which is equipped with a HIAB crane, enables Othniel to handle impressive quantities of shellfish with little effort or manpower and it has opened up the potential for low cost, large-scale oyster production.

Othniel have tried out various methods of rearing small oyster seed through the nursery phase in order to produce sufficient seed of a large enough size to lay on the sea bed for on-growing. Most methods have worked to some extent, but have proved to be expensive or labour intensive. The trialling of a mechanised bag and rack system, which Othniel originally developed some years ago for clam seed, proved to be the answer.

Results

Results of the trials, carried out in the summer of 2004, have allowed Othniel to establish the optimum economic stocking density for oyster seed production. The trial showed that whilst the boxes gave a slightly



Craning stack into water

higher growth rate, the initial higher cost and the amount of labour required meant that the bags were still the best choice from a commercial standpoint. The results of these trials will enable Othniel to fully exploit the capability of the production system in the future.

Further information

For information about the experimental system and methods of production and harvesting employed by Othniel Shellfish Ltd, contact Gary Wordsworth via email on othniel@othniel.com.

SCALLOP CULTIVATION IN NORWAY – FROM REPRODUCTION TO RANCHING

Gyda Christophersen

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Cultivation history

The great scallop, *Pecten maximus*, was first considered as a possible species for aquaculture in Norway in the 1980s. The development of suitable cultivation methods started in Bergen, on the southwestern coast of Norway (Figure 1). A pilot hatchery was established in Øygarden west of Bergen in 1987. From 1996 the hatchery, Scalpro, has been a private limited company (AS), and it is presently the only commercial bivalve hatchery in Norway in operation. During the time of the Norwegian Scallop Programme, which started in 1994, the development of a scallop industry was accelerated. The programme involved about 40 partners from the industry together with the counties, management and research organisations located on the western coast. Farmers were trained to grow scallops and extensively tested sites in intermediate and bottom growth trials. Later, large scale grow-out trials were carried out and two, no longer operative, large-scale nurseries were established. In 2003 one of the companies, Helland Skjell AS in Hordaland, had proved that it was feasible to grow cultivated spat to a market size of more than 10 cm shell-height.



Figure 1. Map of Norway showing the locations where *Pecten maximus* are cultivated and broodstock are collected

Cultivation strategy

Scallop spat available to farmers in Norway comes from hatchery production, and the full production cycle takes 5 years, on average. Broodstock scallops from wild populations are brought to the hatchery for conditioning, and they may be induced to spawn on a year-round basis (Figure 2). Larvae and post-larvae are reared intensively until 2 mm shell-height, before transfer to a nursery for growth to 15-20 mm. The usual strategy is intermediate suspension culture in trays or nets to 40-60 mm before the scallops are seeded onto the seabed for final grow-out. Seabed culture or sea-ranching is regarded as being more economically viable than intermediate culture in enclosures, and the scallop farmers aim to shorten the intermediate growth period by releasing younger scallops. A major problem is crab predation on the scallops. The crab *Cancer pagurus* tends to prefer smaller to larger scallops and cultured to wild ones, but by fencing in the growth areas survival of 70-80% is achievable. According to the bottom topography the growers use either a solid aluminium fence mounted on a base of concrete (Helland Skjell AS) or a flexible PVC fence held up by buoyancy (produced by PLA-NY AS, used by Kvitsøy Edelskjell AS and Norskjell AS). The market-sized scallops are selectively hand-harvested by divers, which is a labour intensive method. A more efficient method using an air-suction pump has successfully been adapted for harvesting sea-ranched scallops in a project recently carried out at Helland Skjell AS.

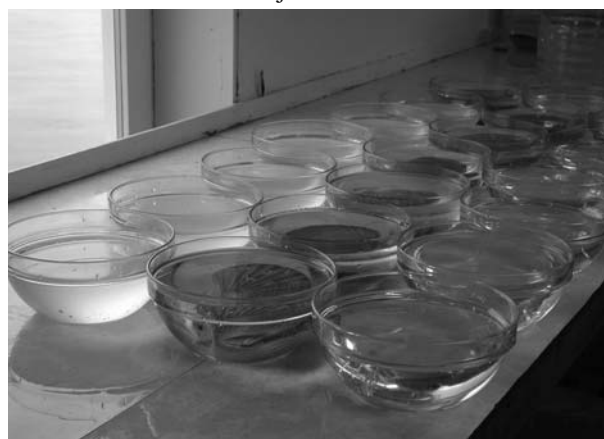


Figure 2: Spawning the scallops.
Photo by G. Christophersen

Present activities

The production of cultivated scallops is still marginal, and the yearly production of 500 tonnes comes mainly from harvest of wild populations. Scallop farming is carried out along the western coast of Norway from Kvitsøy (59°N) in the south to Brønnøysund (65°N) in the north (Figure 1). Wild scallops are mainly harvested in the “Trondheim region” while culture activities are primarily taking place in the western “Bergen region”. Bergen houses several organisations that play important roles in the development of a scallop industry in Norway. The administration of Hordaland County is located in Bergen and has over the years supported the scallop growers network as part of their Regional Development Programme, and now develop tools to identify suitable areas for scallop culture which can be used in coastal zone planning. A new network-project embracing the western region started this year with the goal to further develop the scallop sea-ranching industry. Research work is carried out at the University of Bergen (UoB), Institute of Marine Research (IMR) and The National Institute of Nutrition and Seafood Research (NIFES), while IMR, the Norwegian Food Safety Authorities, the National Veterinary Institute and the Directorate of Fisheries take care of health and management issues. Although more than a hundred licences are issued, only about 20 farmers are using their licences for growing scallops in intermediate or bottom culture at present. Only a few are farming scallops on a large scale.

Sea-ranching

The scallop bottom culture is regulated through the Sea Ranching Act, which was passed by Parliament in December 2000. The purpose of the act is to contribute to the balanced and sustainable development of a sea-ranching industry and its development as a profitable and viable regional industry, and with the scope to release and recapture crustaceans, molluscs and echinoderms for commercial purposes. The regulations to the act did not come into force before 2003, which has been a constraint to the progress of a sea-ranching industry. It was another year before the first licences were approved according to the Sea Ranching Act, in December 2004. By September 2005 nine growers had been granted bottom areas for sea-ranching scallops within a defined area and with exclusive harvesting rights. An operation is considered commercially viable by holding about one million scallops per year class. The scallops may be kept at a density of 10 scallops or more per square metre, requiring an area of 30-50 ha per company. Areas approved are from 0.5 to 200 ha each. IMR together with the industry, carry out research related to disease control and ecological effects of sea-ranching. No licence is issued if a risk of adverse effects on the environment due to the sea-ranching activity exists, and monitoring the environmental status and impact on the site is

an absolute condition. Another condition is that deployment must be with animals of local origin.

Broodstock populations

Broodstock animals are collected from wild local populations. Since Scalpro AS is the only hatchery in Norway, it is the only spat source available to scallop farmers. It also means that cultivation of *P. maximus* in Norway requires several transportation steps between different sites, an issue of concern to the health authorities. A genetic north-south variation has been suggested for scallop populations along the Norwegian coast as scallops from Trøndelag and Hordaland/Sogn express different timing of events in the reproductive cycle. Broodstock from both places have therefore traditionally been conditioned and spawned at the hatchery in order to obtain spat at different times of the year and supply farmers with spat from their own region. In an ongoing industrial research project between Scalpro AS and the UoB, conditioning regimes are being developed for three additional broodstocks to meet the demand of spat coming from different localities. However, it still remains to be demonstrated that Norwegian scallop populations from different geographical areas represent separate stocks. Genetic studies on the Norwegian scallops are few, but the development of advanced molecular tools is expected to characterize genetic differences, if any, for use in future studies on wild and sea-ranched stocks.

Spat production

A predictable spat supply is a key-factor in the development of a scallop sea-ranching industry. The commercial spat production at Scalpro AS has recently been about 6 million of 2 mm and 2-3 million of 15 mm spat. The production capacity is several times greater, but has not yet been used because of the delay for potential buyers to get licences to do full scale sea-ranching. Large variations in growth and survival are experienced during the larval and nursery growth phase. Ongoing research projects at Scalpro AS, the UoB and IMR focus on improving the rearing environment and enhancing the larval and spat yield. Both the commercial production and the research trials of larvae takes place in 3-4,000 litres flow-through tanks continuously fed a mix of cultured algae. The use of such systems has resulted in an antibiotic-free production, but work related to bacterial contamination and water quality is still in progress. The scallops are currently grown to 1-2 mm shell-height in a down-welling settlement system with partial reuse of the water before transfer to a land-based raceway nursery (Figure 3) for growth in plastic trays to 5-10 mm. The use of an intermediate nursery step between the hatchery and the sea has been proven cost-effective for spat grown in down-wellers and trays (Figure 4). Additional studies are needed to improve the spat settlement on collector bags for it to be as efficient as the traditional tray



Figure 3. The land-based raceway nursery at Scalpro AS. Photo by G. Christophersen

method. Final growth to 15-20 mm is in the sea, but the timing of deployment regarding size and season has been shown in earlier studies to be critical.

Prospects

The further development of the scallop industry in Norway still relies on research and development activities. Framework conditions that support a growing industry must exist to get potential growers interested, and it is necessary for future success that the different participants from the industry, research and management organisations continue to pull together. Critical success factors are availability of spat and space, optimal husbandry practice, efficient methods,



Figure 4 Successful spat production. Photo by G. Christophersen

good water quality, analyses costs, legislation, long term investment, market demand and marketing. At present toxic algae is not considered a problem to scallop cultivation, but PSP, DSP and ASP levels are continuously monitored. The active farmers are experienced, and if a controlled scaling up of the industry is accepted, the prospect of a vibrant scallop industry should be good.

Further information

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WHAT'S IN YOUR ESTUARY?

Tim Robbins, Devon Sea Fisheries Committee

Crab tiles

In the estuaries of Devon, fishermen have for years placed tiles to aid the collection of shore crab (*Carcinus maenas*). The tiles are placed in the inter-tidal area and are used to provide an artificial habitat for shore crabs, which have shed their shell and need protection whilst it hardens. The crabs in this soft state are sought after as bait for anglers, who target mainly bass. Surveys of Devon's estuaries have shown that there are around 74,000 tiles.

River Exe

The Exe estuary has approximately 27,000 tiles. The Exe is a Special Protection Area. Over the past few years there have been moves to try and restrict the amount of tiles on the estuaries and also to stop any increase in the area tiled. The first part of this strategy was to agree a voluntary code of conduct that now covers all the Devon estuaries. As the Exe is an SPA, English Nature was keen to prevent any increase in the

area being tiled, and with this in mind, in 2003 Devon Sea Fisheries Committee brought in Byelaw 24. This prevented the spread of tiles beyond two lines drawn across the estuary to the north and south.

Illegal tiles

Following the introduction of the byelaw, tiles were placed in the prohibited area above Starcross Yacht Club. As the owner of the tiles could not be traced it was down to the Devon Sea Fisheries Committee to remove them. Five officers spent two days on the estuary removing all the tiles from the site. The tiles were placed in dumpy bags for transport to the docks on a mussel chalon owned by Exe Mussels. The bags were then placed in skips for removal to a waste site.

Asbestos

It was then that the matter became a bit more serious. It was discovered that a third of the tiles were in fact asbestos roof tiles and could therefore not be removed



Bagging up the tiles

to a public tip. The Hazardous Waste Regulations 2005 came into force on the 16th July and have specific requirements for the removal of asbestos.

Firstly the site has to be registered under the Regulations. This proved to be interesting as there is a requirement to list a site with a postcode whereas a whole river is slightly more problematic, so a postcode adjacent to the river was chosen. There are several ways

to register the site either on-line, by phone or by post. Once registered a site number can be attached to the asbestos ready for removal. The asbestos has then to be double wrapped in plastic in 25kg bundles and stacked into a skip.

Once all the paperwork has been completed, the asbestos can be sent to the County Hazardous Waste reception site for onward transport to an approved disposal site. The reception site workers will not handle the asbestos and so it is the Committee Officers responsibility to unload the skip again.

The irony is that if the asbestos tiles had been left on the river the EA consider them to be safe as they are kept wet and therefore do not present a problem, but once they were removed they became a real problem to the Committee.

The exact cost of the clear up is not yet known, but it can now be regarded as a major issue on estuaries in the southwest. What can be done about the problem and who would fund the clean up is a different question.

Further information

Tim Robbins, Devon Sea Fisheries Committee, Office No 9 Fish Market, The Quay, Brixham, Devon, TQ5 8AW. Tel: 01803 854648; Email: dsfc@aol.com

CLASSIFICATION OF SHELLFISH (LIVE BIVALVE MOLLUSC) PRODUCTION AREAS IN ENGLAND AND WALES: 1 SEPTEMBER 2005 - 31 AUGUST 2006

Selwyn Runacres

Fish and Shellfish Hygiene, Primary Production Division, Food Standards Agency

The annual classification of shellfish harvesting areas in England and Wales for the period 1 September 2005 to 31 August 2006 has been agreed and published by the FSA. Full details can be found on the FSA website at: <http://www.food.gov.uk/foodindustry/shellfish/shellharvestareas/shellclasseng2006>

At the time of publication, there were 371 classified beds, of which 13 achieved Class A status, 321 class B and 30 class C. A comparison of these results with the previous year shows a slight decrease in the number of A class beds and also a decrease in number of class C. Overall there has been a general increase in the quality of shellfish waters with 86% now achieving Class B status. This year's classification is illustrated on the Figure opposite.

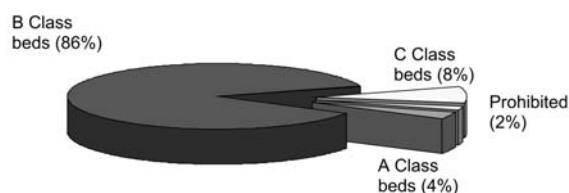
Background

Council Directive 91/492 requires all Member States

(MS) in the European Union (EU) to have in place a programme for monitoring and classifying shellfish harvesting sites. The conditions for production areas under this requirement are laid down in Chapter 1 of its Annex. These requirements have been transposed for England and Wales by The Food Safety (Fishery Products and Live Shellfish) (Hygiene) Regulations 1998 (S.I No.994).

The Food Standards Agency (FSA) is the designated Competent Authority for the UK and is responsible for arranging and approving classification of shellfish

Classification of shellfish beds for England and Wales



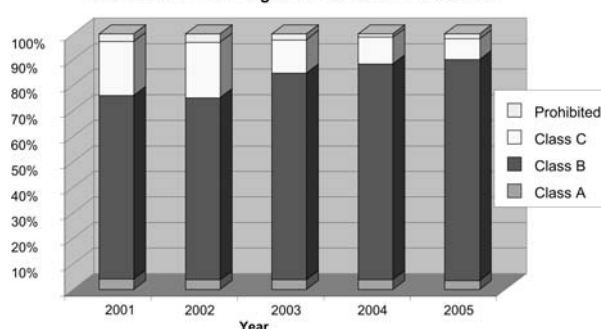
harvesting areas where commercial gathering is undertaken and shellfish are subsequently placed on the market.

In agreement with the FSA the Centre for Environment, Fisheries, Aquaculture & Science (Cefas) has been tasked with the management and co-ordination of the classification monitoring programme for England and Wales. On an annual basis they undertake a review of the classifications of all shellfish beds, submitting their recommendations to the FSA for assessment and approval before publication. Within-year recommendations ('interim updates') may also be made as and when the need arises for new beds or beds showing an improvement or deterioration in results.

Production areas are classified according to the microbiological criteria, which is based on counts of *E.coli* bacteria in shellfish flesh as set out in the Council Directive 91/492. The *E.coli* test results over a period of time determine the classification of a shellfish bed, which will fall into one of four categories; Class A, B, C or prohibited.

- Category A is awarded to an area in which there is consistently less than 230 *E. coli* per 100g of flesh;
- Category B is given to an area where 90% of samples show less than 4,600 *E. coli* per 100g of flesh;
- Category C is given to an area where the requirements for class A or B are not met but where less than 46,000 *E. coli* per 100g of flesh have been found

Classifications for England and Wales - 2001 to 2005



- Prohibited areas are those areas not meeting the requirements of any of the above categories and where molluscs must not be harvested.

The classification of a production area determines the treatment of molluscs prior to being marketed. All shellfish must meet the end product standards where the presence of *E.coli* must be less than 230 per 100g of flesh. Shellfish from B and C class beds will require further processing, described in the legislation, in order to ensure that they are fit for placing on the market.

Over the last five years there has been an increase in the percentage of B class beds and a steady reduction in C class beds. This can be seen in the figure above.

Further information

Further information can be found at: <http://www.food.gov.uk/foodindustry/shellfish/shellharvestareas/>

UK NATIONAL REFERENCE LABORATORY FOR BACTERIOLOGICAL AND VIRAL MONITORING OF LIVE BIVALVE MOLLUSCS

Ron Lee, Cefas Weymouth Laboratory

Background

In the late 1990s, a number of large outbreaks of viral gastroenteritis associated with bivalve molluscan shellfish occurred in Scandinavia and neighbouring countries. The shellfish implicated in these outbreaks originated from other parts of the EU. Council Decision 1999/313/EC was published in order to provide more consistency in approach to the application of present controls on microbiological quality of bivalve molluscs and to establish the basis for the development and future application of viral standards. The Decision designated a Community Reference Laboratory (CRL) and obliged competent authorities in Member States to each designate a National Reference Laboratory (NRL). The competent authority for the UK, the

Food Standards Agency (FSA), designated the Cefas Weymouth Laboratory as the UK NRL in 1999.

The work of the UK NRL is divided into 3 areas:

- Scientific co-ordination and representation
- Laboratory activities - bacteriology
- Laboratory activities - virology

Scientific co-ordination and representation

The NRL holds periodic meetings of a representative committee of official laboratories entitled the

**The National Reference
Laboratory, Cefas
Weymouth Laboratory**



UK Shellfish Microbiology Group. This includes representatives from the NRL, FSA, FSA Scotland, the Health Protection Agency, Hospital Trust Laboratories in England, National Public Health Service for Wales, the FRS Marine Laboratory Aberdeen and the Northern Ireland Public Health Laboratory. The Group currently meets on an annual basis with additional ad-hoc meetings held if required. Every two years more general meetings are held which are open to all British laboratories (both official and private) undertaking microbiological testing of shellfish. A website (www.nrlcefas.org) is used to disseminate information to laboratories and resolutions passed at the meetings of the UK Shellfish Microbiology Group are also posted on the site. The NRL provides advice on microbiological test methods for shellfish UK official laboratories and provides help to other laboratories as resources allow.

Laboratory activities - bacteriology

The NRL is accredited by the United Kingdom Accreditation Service (UKAS) for the enumeration of *Echerichia coli* and the detection of *Salmonella* in shellfish and also undertakes testing for human pathogenic vibrios. The methods are used for reference testing of bivalve molluscs, primarily in relation to outbreak material. Validation and characterisation studies are undertaken on laboratory methods used in the UK. The NRL also contributes to collaborative European programmes and the development of new ISO and CEN methods. Laboratory work is undertaken in support of UK protocols for the sampling and sample transport in relation to monitoring for official control purposes. The NRL organizes UK-wide ring trials for *E. coli* and *Salmonella* for official testing laboratories and participates in European ring trials.

Laboratory activities – virology

The NRL uses both conventional and real-time PCR methods for testing for Norovirus and Hepatitis A virus in bivalve molluscs. It works to standardized protocols

for these methods and participates in EU-wide ring-trials. The methods are primarily used for the testing of bivalve molluscs associated with outbreaks of illness. The NRL is also undertaking development work on the real-time method in support of a CEN technical group on the standardisation of methods for viruses in foods.

Other NRL activities

The NRL provides scientific advice to the FSA and local authorities in relation to outbreaks of shellfish-related illness. It also provides scientific and technical advice to the FSA (both in London and the devolved administrations) and local authorities on:

- Sanitary surveys
- Sample plans
- Sampling
- Sample transport
- Laboratory requirements
- Test methods
- Result interpretation
- Depuration system approval

and contributes to training courses for local food authority officers.

The NRL takes an active part in annual workshops of the European Reference Laboratory network and relevant EU working groups.

Further information

Consult the web-site (www.nrlcefas.org) or contact:
Dr Ron Lee 01035 206656 (r.j.lee@cefas.co.uk) or
Dr Rachel Rangdale 01305 2066707
(r.e.rangdale@cefas.co.uk).

ANNOUNCEMENTS



The Marine Fisheries Agency was established in 2005 as an Executive Agency of the Department for Environment, Food & Rural Affairs to bring together for the first time in one organisation the service delivery, inspection and enforcement activities provided by the Government to the fishing industry and other marine stakeholders in England and Wales. Defra has retained responsibility for the formulation of UK fisheries policy. The Marine Fisheries Agency incorporates the Sea Fisheries Inspectorate formerly of Defra and takes the responsibility for certain other delivery functions, including grants, fishing vessel licensing and quota management.

The Marine Fisheries Agency aims to serve as a trusted and effective manager of sea fisheries and the marine environment. Our main objectives are set out opposite:

- To be a key partner in the management of marine fisheries;
- To enforce fisheries regulations professionally, consistently and fairly;
- To contribute to the sustainable use of the marine environment;
- To provide specialist information and advice that facilitates the development of effective policy and helps customers to abide by it;
- To promote an open, diverse and fair culture in which staff are encouraged to reach their full potential.

Marine Fisheries Agency Headquarters and Coastal Fisheries Offices:

Headquarters	020 7270 8328	info@mfa.gsi.gov.uk
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Western District		
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RESOLUTIONS OF THE 4TH WORKSHOP OF MICROBIOLOGICAL NATIONAL REFERENCE LABORATORIES

Introduction

A workshop of the European National Reference Laboratories (NRLs) for monitoring bacteriological and viral contamination of bivalve molluscs was held by the CRL (Cefas) at the IFREMER laboratories in Nantes, France, between the 15th and 17th March 2005. Attendees comprised representatives from the CRL and NRLs from Austria, Belgium & Luxembourg, Czech Republic, Denmark, Estonia, Finland, France, Greece, Iceland, Ireland, Italy, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Turkey and the United Kingdom. Further details can be accessed through the website of the Community Reference Laboratory (www.crlcef.org)

The next meeting will be held at the Community Reference Laboratory, Cefas Weymouth, U.K. between the 7th and 9th March 2006.

Proficiency testing

1. NRLs agreed to maintain commitment to the CRL/HPA EQA as the primary means of proficiency testing for *E.coli* and *Salmonella* spp. amongst the NRL network.
2. NRLs reaffirmed commitment (by 5th Workshop) to establishing proficiency testing for statutory determinants (*E.coli* and *Salmonella* spp.) amongst national laboratories conducting testing for classification of production areas.
3. The workshop agreed that the CRL would conduct a *V. parahaemolyticus* ring trial for detection, enumeration and determination of pathogenicity principles using the methods of the laboratories own choice. The CRL will invite expressions of interest for one distribution planned for autumn 2005.
4. The workshop agreed that the CRL should organise further ring trials for detection of NoV/HAV and that this should include shellfish analyses. The CRL will invite expressions of interest for two distributions the first focusing on analysis of NoV/HAV in faecal samples/tissue culture material in September 2005 and the second comprising whole shellfish in winter 2005/6.

Risk assessment

5. The workshop identified the difficulty of interpretation of PCR positive results in shellfish. The CRL agreed to make proposals at the next workshop on the design of studies to progress a risk assessment for

viruses in shellfish in consultation with relevant risk assessment experts.

Commercial practices

6. The workshop identified that trade practices relating to trans-shipment of B and C shellfish for final processing in other Member States lacked clarity with regard to the controls actually applied and acknowledged that this could have consumer health implications. NRLs agreed to investigate this issue and the CRL would circulate a protocol for an audit with the results to be reported at the next workshop.
7. The workshop discussed the remit of NRLs in relation to industry "own-checks" and identified that the EU legislation was not precise on this point. The CRL agreed to seek clarification from the Commission and feedback to the network with a view to further discussion at the next workshop.
8. The workshop discussed the need for establishment of a minimum specified duration for the commercial depuration process in order to ensure compliance with statutory bacteriological standards. The workshop resolved to inform the Commission via the CRL of their agreement on this need and for a working group to determine the minimum period and the optimum physiological conditions for each species in order to define best practice with regard to commercial depuration as it effects bacterial contamination.

Monitoring of harvesting areas

9. NRLs endorsed the draft output of the microbiological monitoring of bivalve mollusc harvesting areas working group and noted the timetable for comment on the review document of 25th March 2005. The draft good practice guide is scheduled for distribution to NRLs for comment in June 2005.
10. In order to finalise the Microbiological Monitoring Good Practice Guide the WG requested clarification of the need to monitor *Salmonella* and *Listeria* in class A production areas as part of official control surveillance programmes. The CRL agreed to seek clarification from the Commission and to report back to NRLs.

Human health

11. The workshop acknowledged the importance of sharing information relating to bivalve mollusc related human health incidents and resolved to share information on this, and related epidemiological information, in a dedicated session at the annual workshop.

UK MICROBIOLOGICAL LABORATORIES UNDERTAKING SHELLFISH TESTING

Resolutions of Ninth Meeting: July 5th 2005

A periodic meeting of laboratories undertaking microbiological testing of bivalve shellfish was held at the Cefas Weymouth Laboratory on July 5th 2005. The group comprises representatives from Cefas Weymouth (the National Reference Laboratory), Food Standards Agency, Food Standards Agency Scotland, the Health Protection Agency, Hospital Trust Laboratories in England, National Public Health Service for Wales, the FRS Marine Laboratory Aberdeen, the Northern Ireland Public Health Laboratory.

The remit of the group is:

1. To provide, with reference to Council Decision 1999/313, a UK technical forum for discussion of issues relating to microbiological testing of shellfish.
2. To agree, where possible, common methods and approaches relating to shellfish testing for use throughout the UK and their quality assurance.
3. To advise the central UK competent authority, and the devolved administrations, of the views of testing laboratories as outlined above.
4. To enable Cefas Weymouth, as the UK National Reference Laboratory (NRL), to represent the views of UK testing laboratories in the European laboratory framework specified in Council Decision 1999/313 and to co-ordinate with UK laboratories initiatives arising at the European level.

The group agreed the following resolutions:

1. The group agreed that the development work undertaken with respect to sampling and transport protocols should be extended with the aim of publication in the scientific literature.
2. The group agreed that ISO 6887-3 was in need of revision with regard to shellfish and that this should include consideration of diluent and minimum weight of shellfish to be homogenised.
3. The group agreed that the proposed wording with respect to MPN tube combinations in the draft revision of ISO 7218 10.4 3.2c dealing with usable dilutions was not practical and that the NRL should propose replacement with the text used in 16649-3.
4. The group supported the development of standard method for viruses in food and that the UK NRL should contribute to validation of the proposed method.
5. The group agreed that it should be known as the UK Shellfish Microbiology Group.

FRESHWATER PEARL MUSSELS

In a joint operation, the Scottish police force and Scottish Natural Heritage (SNH) aim to halt the illegal trade in endangered freshwater mussels. About half of the world population of the mussels are in Scotland and while most have no pearls they are targeted by thieves hoping to find the pearls. Jewellery shop checks last year showed the illegal pearl trade still exists.

There are now only 61 known breeding sites left in Scotland and it is against the law to intentionally or recklessly kill, injure, take or disturb the mussels, or their habitat.

It is also illegal to sell or advertise pearl mussels for sale without a licence from the Scottish Executive.

During the crackdown on the black market, which is part of the Partnership for Action Against Wildlife Crime, police and river workers will be provided with information on the hot spots where pearl theft continues.

SNH licensing officer John Ralston said: "There are now so few sites of pearl mussels left in the country that we are in danger of losing this special creature altogether.

"By launching the operation, we hope to spread the word amongst anyone that might notice this illegal activity and report anything suspicious to their local wildlife crime officer."

IS THE LEATHERY SEA SQUIRT A PEST IN THE UK?

Christine Wood, Marine Biological Association, Plymouth PL1 2PB

In Issue 14 (Nov 2002) of Shellfish News Doug McLeod of the ASSG reported on the fouling problems Canadian mussel growers were experiencing with *Styela clava*, the leathery sea-squirt (also known as the clubbed tunicate).

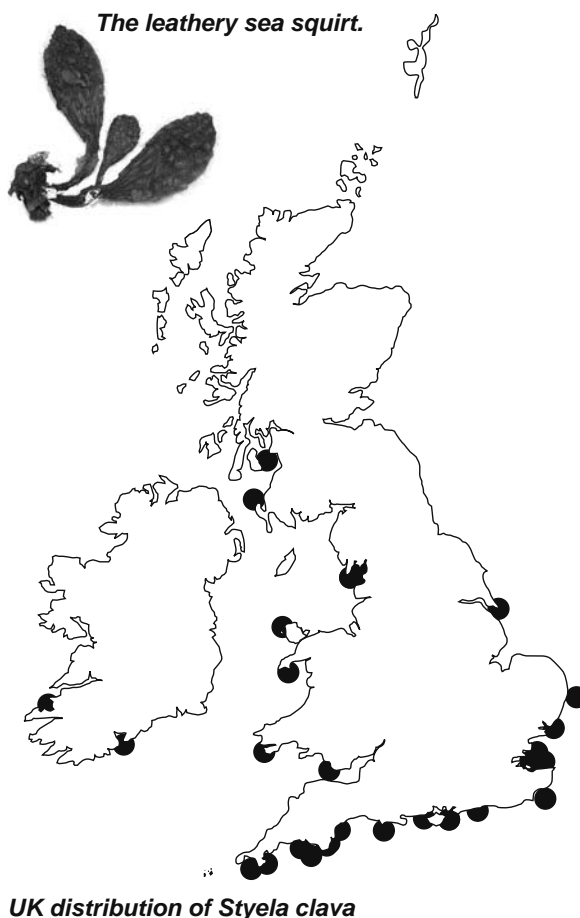
At the MBA in Plymouth we are researching the introduction of this alien species from its native Korea and Japan to the UK and Northern Europe. It is believed it originally arrived with warships returning to Plymouth naval bases at the end of the Korean War, and then spread rapidly around the coast.

We would like to hear from any shellfish growers who are having problems with fouling of their long lines or shellfish beds by this invader. It is easily identified as no other sea-squirt in our waters has a stalk, see picture. Each individual can be up to 20cm in length.

The current known UK distribution is shown on the map. The only recorded sightings in Scotland are in the Ardrossan area. If anyone has spotted it elsewhere in Scotland we would be glad to hear from you.

Further information

Chris Wood, email: cwo@mba.ac.uk; Tel: 01752 633251



NEWS FROM LANTRA

Aquaculture and Fisheries research project

At the Welsh Development Agency's Aquaculture and Fisheries Strategy Group, which was held on the 26th May 2005, Philippa Davies, Lantra's Regional Partnership Manager presented the findings and recommendations of a research project undertaken by Lantra Wales and funded by the Welsh Development Agency (WDA). The production of this report will enable the Welsh Development Agency and partners to shape and develop future work in the aquaculture and fisheries industries within Wales. For more information email philippa.davies@lantra.co.uk

e-bulletins

For the latest issue of Lantra's e-bulletin please go to <http://www.lantra.co.uk/news/documents/E-bulletin-OctoberissueFINAL.pdf>

Past issues of the e-bulletin can be accessed on the Lantra website www.lantra.co.uk/news

For further information on the Sector Skills Agreement for the environmental and land-based sector please go to <http://www.lantra.co.uk/documents/SSAbriefingnote3.pdf>

COMMISSION PROPOSES NEW RULES ON THE HEALTH OF FARMED FISH AND SHELLFISH

The Commission has proposed new EU legislation on the health of farmed fish and shellfish (molluscs) and the control of certain diseases in the aquaculture sector. The proposed legislation aims to simplify and upgrade existing legislation, in order to improve the general aquaculture health situation across Europe. It also aims to better facilitate safe trade in aquaculture animals and products, and to boost the competitiveness of this important sector for the EU. A central aspect of the proposal is a shift in focus to preventing disease occurrence at each point in the production chain rather than dealing with it only when an outbreak occurs.

Markos Kyprianou, Commissioner for Health and Consumer Protection, said: “Having healthy animals is fundamental to Europe’s aquaculture sector, which generates millions of euros annually. Disease outbreaks undermine consumers’ confidence in the safety and wholesomeness of farmed fish and shellfish. They can also devastate the stocks of farms affected by them. Prevention is the best cure, and that is what our legislation aims at.”

Aquaculture is an important sector in the EU, with a production value of around € 580 million. The proposed Directive responds to the need to update current animal health legislation for aquatic animals, taking into account the developments in aquaculture, as well as international experience and scientific knowledge. A major focus of the proposal is on the prevention of disease by applying better controls throughout the production chain. This approach should

reduce the economic losses caused by diseases and restrictions on trade. Measures are also laid down to protect disease-free farms from the introduction of pathogens and to prevent exotic diseases from entering the EU.

Flexibility is given so that local or regional approaches can be taken for the prevention and containment of diseases, while Member States will be responsible for ensuring proper implementation and controls. The proposed Directive states that national authorities should also draw up control and eradication programmes and contingency plans for outbreaks of emerging or exotic diseases. In cases where compulsory measures to eradicate exotic diseases (e.g. culling stock) need to be taken, or where Member States implement programmes to eradicate non-exotic diseases, the proposals foresee that compensation should be provided from the European Fisheries Fund.

A key objective of this proposal is to simplify and modernise existing legislation and procedures on aquatic animal health. The proposed Directive brings the rules for placing aquaculture animals and products on the market in line with the standards of the World Organisation for Animal Health (OIE). It aims to both improve intra-Community trade and make it easier for third countries to trade with the EU by providing harmonised, clear cut rules on aquaculture. In drawing up this proposal, the Commission held thorough stakeholder consultations and carried out a detailed impact assessment of the Directive.

TEN NEW AREAS DESIGNATED FOR SHELLFISH FARMING IN SCOTLAND

In July, the Scottish Executive announced that ten new areas are to be designated as shellfish waters to ensure protection of their water quality. The ten areas are: Askinish Bay, Argyll and Bute; Basta Voe, Yell, Shetland; Clift Sound, Shetland; Dales Voe, Shetland; Dornoch Firth, Highland; Isle of Ulva, Mull (Loch Tuath), Argyll and Bute; Loch An Eisg-Brachaidh, Enard Bay, Highland; Loch Crinan, Argyll and Bute; Loch Eil, Highland; and, Mid Yell Voe, Shetland.

The designations increase the number of protected shellfish waters from 104, indicating the increased importance of the industry.

Rhona Brankin, the recently appointed deputy minister for Environment and Rural Development said: “The shellfish industry in Scotland is a good example of sustainable development, providing jobs in some of the country’s most remote locations. Having good marine water quality gives Scotland a competitive edge when marketing mussels, oysters and scallops to the rest of the world.

“Designating these ten additional sites will protect both the shellfish that grow in these areas, and the other flora and fauna, which depend on the water environment.”

MULTI MILLION BOOST FOR SHELLFISH FARMERS

A major boost for shellfish farmers along the West Coast of Scotland and the Northern Isles was announced in June by the Scottish Shellfish Marketing Group (SSMG). The group, which represents Scottish shellfish farmers, has just secured a multi-million pound deal with Britain's largest retailer, Tesco to supply fresh mussels to all their stores across the UK.

The Tesco deal, worth over £1 million a year to mussel farmers, makes SSMG the biggest supplier of live mussels to all leading UK supermarkets. They already supply mussels to most household name supermarkets in Britain. The deal was clinched because Tesco were convinced that SSMG can supply the best quality and consistency of supply of Scottish rope grown mussels, as well as extending availability throughout the year.

Donny Gillies, Sales Director of SSMG says, "This is excellent news for the Scottish seafood industry as well

as for all our SSMG members. It emphasises what we have always known, that fresh Scottish seafood is the best in the world."

A spokesperson for Tesco added, "Tesco are pleased to be supporting the Scottish Shellfish Marketing Group in delivering Live Scottish Mussels to its stores. Through our partnership with the Scottish Shellfish Marketing Group we can now offer customers high quality live mussels continuously throughout the year".

Scottish shellfish farmers are joining SSMG at a greater rate than ever before, as the market experiences a mini-boom. The group's turnover has grown by 20% in the last year and SSMG are actively seeking new members. To join, or for further information, farmers can phone on 01698 844 221 or visit www.scottishshellfish.co.uk.

BONAMIA IN LOUGH FOYLE

It was confirmed in June that samples of wild native oysters taken from an oyster bed in Lough Foyle had tested positive for the oyster parasite *Bonamia ostreae*. Consequently Lough Foyle has lost its approved zone status for Bonamia.

The Marine Institute, as the National Reference Laboratory for Shellfish Diseases, will be working with the relevant authorities in Northern Ireland to carry out an epidemiological study to assess the spread and extent of the Bonamia and if possible, to ascertain how the parasite may have entered Lough Foyle.

Bonamia ostreae is a microscopic single-celled parasite that affects flat oysters (*Ostrea edulis*) and has no impact either on other Irish shellfish or on human health. While it does not affect the taste or edibility of the oyster in any way and poses no health risk to oyster consumers, it can result in significant mortalities in the affected oyster stocks.

This is the first definite isolation of the parasite in Lough Foyle. It was initially identified through the Marine Institute's routine monitoring programme when 13 out of 30 oysters sampled were identified as suspect positive for the parasite. Slides were then sent to the Community Reference Laboratory (CRL) in France, who confirmed the presence of a suspect organism.

Bonamia ostreae was first isolated in Ireland in Cork Harbour in 1987 and since then it has been isolated in a number of oyster beds around the coast. Currently there are six Irish beds identified as positive. It is transmitted through proximity and there is currently no known treatment. In order to prevent infected stocks being mixed with healthy stock, movement of shellfish species susceptible to Bonamia from affected bays to areas that are free from the parasite is prohibited.

CHAMPION OYSTER SHUCKER

Sam Tamsanguan of Wiltons Restaurant, Jermyn Street, London won first prize in the Tabasco® British Oyster Opening Championship 2005 held at Bibendum Oyster Bar in September. In competition with eleven others, Sam opened 30 native oysters in 3 minutes 35 seconds to claim the title of British Champion for the fifth time.

Competition was fierce, with Fredrik Lindfors from Franco's Restaurant, Jermyn Street taking second place

by opening 30 oysters in 3 minutes 43 seconds - just 8 seconds behind Sam. Armando Lema from Coastline Galicia Fishmongers (Abbey Road, London) took third place with a time of 4 minutes 8 seconds.

Tabasco sponsors the championships and this is the thirteenth year that they have been held.

NEWS FROM SEAFISH



Seafish produces simple Guidelines for Buyers And Sellers of First Sale Fish

Seafish has produced simple guidelines to help businesses understand new regulations introduced by the UK fisheries departments on first sale fish and shellfish.

The new fisheries department's regulations aim to improve the monitoring and control of fish and shellfish entering the supply chain in the UK. They are in line with European Regulations that support conservation and sustainable fishing.

Peter Wilson, Seafish legislation manager says: "The new regulations state that both those who sell fish and shellfish at auction and those who buy fish and shellfish other than at auction need to be registered. This will even apply to restaurants and pubs if they buy directly from a fishing vessel but will not apply to private consumption.

"For many people this will be new and difficult to understand. So Seafish has produced guidance to help businesses understand how the requirements will apply to them."

Fish auction markets also need to register with fisheries departments and the guidance will be useful to them too.

Since 1 September 2005, all fish markets and buyers and sellers of first sale fish and shellfish in the UK should have registered with the fishery department of the country they operate in. Buyers and sellers must now keep accurate records and send sales notes for their purchases to the fishery departments. Separate guidance is available from fishery departments on the submission of sales notes. There are some variances which are discussed in the guidance and businesses can seek further information from their local fishery office, fishery department or related website.

The Seafish guidance can be accessed on the Seafish web at www.seafish.org/land/legislation.asp

New Seafish aquaculture leaflets

The Seafish Inshore Group has produced a range of informative leaflets covering various areas of aquaculture production.

The seven leaflets are designed to provide summaries of the methods used in aquaculture operations around the UK. The topics covered include the cultivation of clams, native and pacific oysters, scallops and mussels. There is also a leaflet on lobster hatcheries.

Should you need more detailed information, Seafish also makes available a *Hyperbook* series including economic models and technical information for various species and the latest Seafish/BIM CD-ROM entitled *A Guide to Commercial Bivalve Molluscs*.

Copies of the leaflets and other publications can be obtained by contacting Deborah Dalton on 01482 327837 or emailing d_dalton@seafish.co.uk.

New environmental post to aid sustainable fishing practices

A new post to help the UK seafood industry develop a co-ordinated approach to responsible fishing, the environment and sustainability has been created by Seafish.

Phil MacMullen, formerly fisheries development manager at Seafish, has been appointed to the new role as Head of Environmental Responsibility in a move designed to put the industry at the forefront of sustainable fishing practices and policies.



Phil MacMullen, Head of Environmental Responsibility

With a broad remit, Phil's role will involve working closely with the seafood industry, government and other relevant organisations such as WWF to find ways of helping commercial fisheries meet current and future conservation and marine management needs.

“We are committed to supporting the development of conservation initiatives throughout the seafood industry,” says Phil.

“New regulations from Europe and our national governments will challenge industry to address environmental impacts and adopt more sustainable fishing practices. The UK fishing industry has already initiated a number of very positive schemes to promote more responsible fishing efforts, for example an integrated fishing strategy which has been developed for the Clyde fishery involving fishermen, environmentalists, government and others in the supply chain.

“However, we still need to listen and take into account the views of others, such as environmental scientists and conservation groups. My new role is about ensuring best practice, good science and good communications amongst all the relevant stakeholders and, ultimately, the industry’s long term future.”

The new post was created in recognition of the increasing number of stakeholders involved in marine management – including angling and leisure, oil, gas and renewable energy operations – and the importance of ensuring that the seafood industry maintains its key role in the development of new management policies.

New inshore post at Seafish

A new post to assist the inshore fishing and aquaculture industries meet new environmental guidelines has been created by the Sea Fish Industry Authority (Seafish).

Mark Gray has been appointed as Environmental Impact Assessment Officer in a wide-ranging role that will include developing guidelines for the industry in meeting new Environmental Impact Assessment legislation.

Mark’s role will involve setting up the appropriate protocols and procedures whenever an appropriate assessment is required for an aquaculture or inshore fishing business that is considering setting up or



Mark Gray, Environmental Impact Assessment Officer

changing working practices in locations designated as Special Areas of Conservation or Special Protected Areas.

In these areas, members of the fishing and aquaculture industries need to demonstrate that their activities are sustainable and not having an adverse impact on the marine environment.

The legislation is complex and Mark’s brief will include developing guidelines in an easy-to-understand format that seafood businesses, whether large or small, can draw upon. It is envisaged that this will provide a benchmark for the format of impact assessments, reducing costs to the industry and improving efficiency by standardising the process.

Mark has a good level of experience of nature conservation and the marine environment and for the last three years has worked with the Countryside Council for Wales as a Sea Fisheries Liaison Officer. Dr Sue Utting, who leads Seafish’s Inshore Group said: “This project will help the inshore industry by providing it with a better understanding of environmental requirements and guidelines to ensure these requirements are met.”

NEWS FROM THE TRADE ASSOCIATIONS

ASSOCIATION OF SCOTTISH SHELLFISH GROWERS (ASSG)

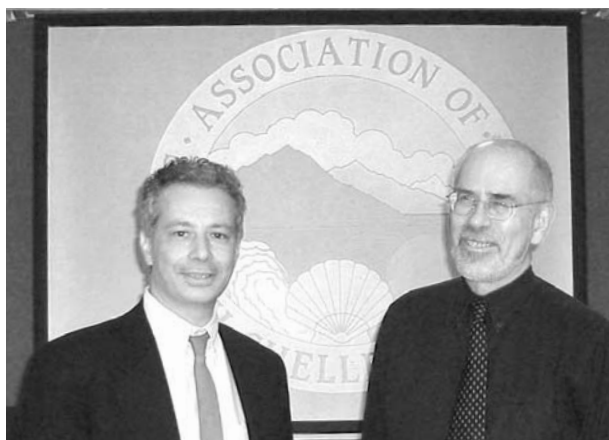
VIEWS FROM THE ASSG

AGM

The AGM at Dunstaffnage last May was what I feel is fairly typical of ASSG events – laid back, somewhat chaotic, but full of good ‘stuff’ – information, data, networking opportunities – and running over time limits because everything is so interesting!! And I trust that those members who made the journey to listen to the presentations from Alessandro Piccioli on future EC funding opportunities, the scientists leading research projects of potential great interest to our future businesses, the FRS Aberdeen Marine Lab presentation on last year’s production and ‘state of the industry’ report – oh, and the status of the Association’s Balance Sheet and P&L Account – felt that it was a worthwhile investment of time and energy.

I guess the fact that it over-ran, but people were still standing around discussing issues at half past five indicates that the afternoon had proved a useful meeting. And to those whom I failed to spend any/sufficient time with, my apologies; to those who couldn’t make it, I’m sorry that you missed some quality shellfish time!

One of the issues I addressed in my Report was the launch, that day, of the ASSG website (www.assg.co.uk) - the site is still ‘under construction’, and we hope to have elements like the press room and position papers completed in the near future, but I can recommend a visit to all interested parties.



Alessandro Piccioli and Doug McLeod at the ASSG AGM

A screenshot of the ASSG website homepage. At the top is the ASSG logo and navigation links: HOME, MANAGEMENT COMMITTEE, SHELLFISH AQUACULTURE, SHELLFISH SPECIES, ENVIRONMENTAL SUSTAINABILITY, INDUSTRY SUPPLIES, PRESS ROOM, MEMBERSHIP, LINKS. Below the logo is a 'Welcome to the ASSG' section with a brief description of the association. To the left is a 'Members Login' section with fields for 'USER:' and 'PASS:', and a 'Login' button. To the right is a photo of a 'Long line mussel farm on Loch Etive' with a caption. Below that is a 'NOTICE' section about the 'ASSG International Conference 2005: The Sustainability of the Shellfish Sector' held at McTavish's, Oban, on 27th & 28th October. At the bottom is contact information for Mr Douglas McLeod, Ardvasar, Isle of Skye, Scotland IV45 8RU, including Tel/Fax and Mobile numbers, and an email address.

Home page of www.assg.co.uk

Water quality

The legitimate member worries on water quality and classification procedures debated at the AGM have continued to absorb a significant amount of time and effort, with meetings between Association representatives and SEPA and FSAS, the two ‘competent authorities’ most concerned with this issue. And the process of debate continues, including a review of options for the classification process, which lies at the heart of these problems.

As many of the downgrades of Harvesting Area classifications have been in areas designated under EU Directive 79/923 (on the quality of growing waters), we believe we have a potential ‘case’ with the European Commission against the UK government (the UK being the member state). At the same time, the Commission has finally decided to address a letter of formal notice to the UK government on the complaint lodged in 2002 by the SAGB, that it was failing to take measures to achieve guideline values of faecal coliforms (parameter 10 of 79/923). So there may well be a ‘fast track’ vehicle by which our complaints about the inadequacy of protection of our shellfish waters can be moved to the Brussels stage, ie we may be able to add our evidence

of failure to the SAGB dossier in the event of failing to gain satisfaction through the 'negotiation route' with our Scottish Competent Authorities.

SSMG agreement

Nevertheless, its not all downbeat news – in mid-June the SSMG announced the agreement of a “multi-million pound deal with Britain’s largest retailer, Tesco to supply fresh mussels to all their stores across the UK”. This must be taken as a positive stamp of approval for Scottish farmed shellfish – I look forward to more nation-wide deals, as production continues to grow steadily, and producers actively market their product, maintaining quality and prices.

Biotoxins

Meanwhile, changes are afoot on the biotoxin front, with the FSAS phytoplankton monitoring programme being awarded to SAMS at Dunstaffnage, and ‘Integrin’ gaining responsibility for toxin sample collection and ASP testing. These developments are of a piece with the groundswell of sentiment against the mouse bioassay and in favour of chemical testing for toxins. And coincidentally, for the first time in 50 years, a new analytical method for a biotoxin has been officially approved (the ‘Lawrence LC Method’) – let’s hope that the industrial, regulatory, scientific communities can continue to move forward towards appropriate and accurate testing methodologies, to safeguard both the industry and consumer health.

Unfortunately, in recent months (September/October), DG Sanco appear to be retreating from their previous straightforward position of endorsing a move to chemical testing methods, with a statement that the mouse test would have to remain ‘for the time being’ as there was a lack of Certified Reference Materials, and a letter to the New Zealand authorities requiring a return to a bioassay if they wished to continue exporting to the EU. Under the umbrella of the European Association (EMPA – AEPM), the ASSG will pursue this issue with the Commission over the next month or so.

WAVE project

The WAVE project (assessing the competences for aquaculture across the EU) continues to progress – and “many thanks” to those of you who participated in the interviews carried out by Julia Purkis. Without such involvement from industry professionals we would otherwise inevitably end up with proposals from non-industry representatives, whether for qualifications or industry practices, which would fail to reflect the realities of shellfish farming ‘on the water’.

ASP

The summer ‘toxin season’ has not been too apocalyptic this year, although with background levels of ASP in scallops continuing to register above the Action Level for whole animal tests, the overwhelming majority of Scottish waters have remained ‘subject to shucking advice’ for King Scallops. The FSA is implementing a series of new measures for the biotoxin testing programme under the new Food Hygiene Regulation (effective 1 January 2006), although it appears that there will be only limited changes for most ‘aquaculture’ operators. However, details of the new arrangements, and potential changes to the microbiological testing scheme for the Harvesting Area classification scheme, will be further outlined during the October Conference.

Downgrades

Discussions with SEPA and Scottish Water continue over the critical issue of *E. coli* levels in many of our growing areas, which do not appear to be receiving the protection that they deserve under Directive 79/923 (Shellfish Growing Waters). These concerns have been growing since the release of the draft Classifications last February, with 47% of Scottish sites suffering downgrades, and the Association has no intention of letting them be ignored.

This issue has every sign that it will run and run, and the ultimate end phase could well be the reporting to the European Commission of the failure of the Scottish Executive and the Competent Authority to fulfil their obligations under Directive 79/923. Not that we wish it to reach such a situation – I personally would rather that Scottish Water, along with its sponsors, the Scottish Executive, and SEPA (the Competent Authority) agreed a comprehensive sewerage treatment programme, with tertiary treatment for all new/ upgraded facilities accepted as an established minimum requirement.

It ain’t rocket science - it just requires political will, an acceptance that investment in these treatment plants is required (by law), and that it will create expansion in a wealth/job creating industry eminently suited to the Scottish coastal zone.

I took part in an international Workshop discussing these and related issues in Alabama in mid-August. There was a stunned disbelief in the American audience when I described the lack of reaction from our regulators, sewerage authorities, health officials and politicians from the 47% downgrades experienced by Scottish shellfish sites Harvesting Area classifications last February. And equal astonishment at the lack of ‘sanitary survey’ knowledge with our ‘competent authorities’ (a coastal survey of all potential pollution



Wrestling with wreckage from a previous oyster growing trial on the Solway

sources, which will become a requirement from January 2006). The sympathy for our plight was so intense that the US EPA has offered to supply high resolution satellite images of Scottish lochs to allow the identification of pollution sources – so, from now on, rather than suffer from the lack of response from Scottish Water executives to e-mail requests for information, and obfuscation from local SEPA offices, I'll be seeking anti-pollution information and assistance from Atlanta, Georgia!!

The Workshop in Alabama also considered methods of tackling vibrios and viruses, both monitoring for presence and technologies for removal. Cefas were impressive in the presentation of progress with Real Time PCR as a direct virus monitoring method (Dr. Rachel Rangdale (Weymouth) whom you may remember from ASSG Conference 2003, and a presentation on Bacteriophage), and post-harvest processing (PHP) with IQF, Ultra High Pressure and low temperature pasteurisation as methods to reduce public health risk. One of the US speakers on PHP has been invited to this year's Conference.

Other issues

Responses have also been drafted and filed on issues such as the extension of planning controls to marine fish farming, the Kilmelford sewerage system (SEPA), biotoxin priorities for research funding (AOAC), shellfish research funding priorities in the UK (CARD) and project proposal (Loch Etive microbiology) assessment (SARF) – all in all, quite a busy summer!!

Solway Firth

Meanwhile, in the Solway Firth, the team from 'South Solway Shellfisheries Ltd' (SSSL) have been working towards developing a sustainable shellfish cultivation operation since the turn of the Millennium, diligently following the regulatory requirements relating to planning consents, conservation consultations, etc. They have also followed standard industry advice – always start with a pilot project before investing in



Six walkers returning to the quad bikes, an illustration of the scale of the Solway 'Frontier'

a full-blown operation. However, gaining the required consent from English Nature (EN) for the pilot project, using innovative Australian technology (the BST longline system with Boddington baskets – for oysters) and introducing the traditional French 'bouchot' system (for mussels) to the UK, has proved difficult.

As a result, SSSL appealed against the EN constraints, and I attended the hearing in Carlisle in late September. The outcome of such events will inevitably represent a balancing act between ultimate conservation interests ('no disturbance is acceptable') and commercial interests ('economic development must prevail'). I believe that shellfish cultivation activities have, in general, minimal impact upon wildlife, and the EN concerns in this example are focused on bird disturbance, where Scottish growers are able to confirm that avian resilience to disturbance and habituation to cultivation operations is extremely robust.

The Inspector is still considering his decision at this point, but I hope he decides in favour of this limited scale pilot project for our sector, which will barely be detectable on the amazingly massive mudflats of the Solway. Standing on the sands there at low tide, surrounded by acres of emptiness, there was a palpable sense of a potentially major economic engine, which could contribute significantly to the regeneration of the area with minimal environmental impact. The Solway probably represents the last great 'frontier' in Europe for the creation of a major shellfish production development – this is an asset that should be utilised for the benefit of local and national economics, and assessment of this potential, which would not, in my opinion, measurably impact negatively on the bird populations, should be fully supported by the Inspector.

Further information

Association of Scottish Shellfish Growers,
'Mountview', Ardvassar, Isle of Skye, IV45 8RU. Tel/
Fax : 01471-844-324; Mobile : 07831-383-826;
email: DouglasMcLeod@aol.com

SHELLFISH ASSOCIATION OF GREAT BRITAIN (SAGB)

SHELLFISH IN A HEALTHY DIET

Since the Association began to highlight the important role of shellfish as part of a healthy diet last year, the question has been raised internationally and the potential benefits are even wider than was first appreciated. Interest in the issue at a European level was stimulated by a conference in Bordeaux last September, at which a number of French speakers gave presentations on health benefits from shellfish consumption. The Shellfish Association of Great Britain followed this up this year in its Annual Conference, with a special session devoted to health benefits. This was sponsored by SEAFISH and BIM in Ireland provided excellent promotional material. That included a superb booklet called Nutritional Aspects of Fish, which also included shellfish. It was compiled by Sarah Keogh, a Consultant Dietician based in Dublin.

Long chain fatty acids

This year the food and farming organisation Sustain produced a widely publicised report on fish and shellfish, which are both sustainable and healthy. In this they highlighted mussels as being high in beneficial omega-3 fatty acids, as well as being sustainable and free from contamination from dioxins and PCBs.

Many of the health benefits linked to shellfish come from the high concentration of the long-chain omega-3 fatty acids EPA and DHA. These are produced by marine plankton and they cannot be synthesised in the body. They are vital for brain and nerve development and function but they also have anti-inflammatory benefits and can help prevent plaque formation in arteries, one cause of thrombosis and strokes. Although some plants such as linseed produce omega-3 fatty acids, these are only short chain ones which do not have the same benefits as EPA and DHA, which are only provided by fish and shellfish in the diet.

Whilst the oily fish story has received good publicity, the benefits of shellfish have been largely ignored until recently. Many people immediately think of cholesterol and the widely held view that crustaceans are high in this. More recent research has clarified that many of the sterols found in crustaceans, which were originally reported as cholesterol, are actually beneficial sterols akin to those in cholesterol-lowering plant oils. Taken together with the fact that n-3 fats lower both cholesterol and triglycerides when they replace saturated fatty acids in the diet, it appears that older advice to avoid crustaceans because of high cholesterol content is misplaced.

When the Shellfish Association was seeking speakers for its annual conference it soon became clear that there were very few people in Britain with knowledge of the dietary benefits of shellfish. Dr. Elizabeth Smith from

the FRS Marine Lab in Aberdeen had measured EPA and DHA in mussels and so was well placed to speak on this and to show it is not just oily fish but bivalve shellfish as well that contain these beneficial fatty acids. One of the failings in modern diets in the West is an imbalance in fatty acids, with too much omega-6 present. On the day she also presented a surprising twist on the shellfish toxin story, showing that low levels of the ASP toxin domoic acid can be beneficial in protecting the brain against higher concentrations which can be toxic.

Minerals and Vitamins

Barbara Demeneix, who works at the French Natural History Museum in Paris, showed that shellfish are an excellent source of iodine and that they provide a balanced supply of selenium, which is necessary for the body to metabolise iodine. Mussels, lobster and shrimp are particularly good sources of both. Fish and shellfish contain more iodine than any other food in a normal diet. Surprisingly sea salt is extremely low in iodine, so people should not think they are getting added iodine from their salt, especially as very little table salt has added iodine these days.

Other minerals, especially zinc, are better met by including shellfish in the diet than any other food item. Bivalve shellfish such as oysters are also very high in vitamin A and shellfish generally are high in vitamin E.

Seafood plus

The potential health benefits of including shellfish in the everyday diet now appear spectacular and may well be one of the reasons for low heart attack rates and longevity in France; not just the red wine alone. The Shellfish Association is involved with some of its members and Cefas in the European REDRISK project, aimed at reducing viral risks from bivalve shellfish, but that project is itself part of a bigger EU-wide study called Seafood plus, which includes studies on health benefits.

A further conference is being held on this in Washington DC in December and an EU Taskforce will be looking at the health benefits of fish and shellfish consumption, so the topic now very much on the international food agenda. It is expected to be a driving force for increased shellfish consumption, a trend already being seen by UK retailers, as shellfish is now their fastest growing sector.

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)

SHELLFISH PRODUCTION

SHELLFISH PRODUCTION IN THE UK IN 2004

The figures available are presented in three categories. Readers should be aware that there is some overlap in the statistics. For example, figures for farmed production of some species may or may not also be included in the Fishery Order figures. This is indicated where information is available. The data are nevertheless valuable for giving an overall impression of activity within and value of the industry, and for comparisons between years. More detailed analyses of the figures may be obtained from the sources quoted.

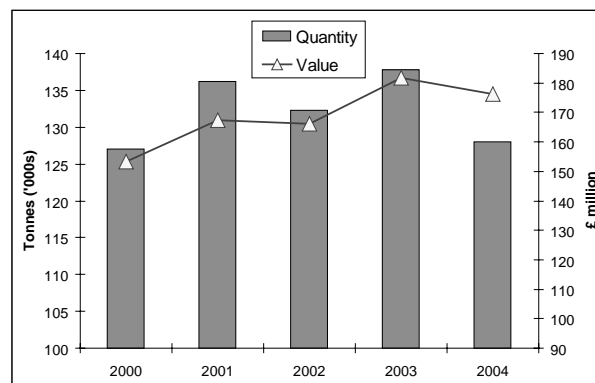
1. Shellfish landings

Source: Defra, *UK Sea Fisheries Statistics 2004*, HMSO, London.

Web: <http://statistics.defra.gov.uk/esg/publications/fishstat/default.asp>

In 2004, the UK fleet, including the Channel Islands and Isle of Man vessels, landed in the UK and abroad 654 thousand tonnes of sea fish (including shellfish) with a value of £513 million. Compared with 2003, this represents a 2 per cent increase in quantity and a 3 per cent decrease in value.

Landings by the UK fleet into the UK have remained around 460 thousand tonnes over the last five years. Shellfish accounted for 27 per cent of landings by quantity and 43 per cent by value. In comparison, Demersal fish species represented 34 per cent of total landings in terms of quantity and 41 per cent in terms of value and Pelagic fish species accounted for 39 per cent of landings by quantity but only 16 per cent by value.



Weight and value of shellfish landings in the UK (2000 – 2004)

Just over 128,000 tonnes of shellfish were landed in the UK in 2004, representing a decrease of just over 7% compared with the previous year. Shellfish landings were worth over £176 million in 2004, which is a 3% decrease, compared with 2003. Weight and value of shellfish landings in the UK over the last 5 years are shown on the figure.

A detailed species breakdown of shellfish landings in the UK can be found in the Table. The two main species (by weight) of shellfish landed by the UK fleet into the UK and abroad are crabs and *Nephrops*. In 2004, *Nephrops* accounted for 23 per cent of shellfish landings and crabs accounted for 19 per cent. Landings of crabs and *Nephrops* have remained relatively stable over the last five years. These two species accounted for 54 per cent of the total shellfish value.

Total Shellfish landings in the UK in 2004.

Type	Tonnes	Value (£'millions)	Unit Value (£ per tonne)
Cockles	12,891	10.1	781
Crabs	22,019	23.9	1,087
Lobsters	1,358	12.6	9,308
Mussels	12,074	2.0	167
<i>Nephrops</i>	30,516	70.5	2,310
Periwinkles	58	0.1	1,235
Queen Scallops	5,151	1.9	371
Scallops	22,356	34.0	1,521
Shrimps	528	0.7	1,300
Squid	2,891	7.9	2,717
Other Shellfish	18,203	12.5	
Total Shellfish	128,049	176.2	

Of the 25,000 tonnes of crabs landed by the UK fleet into the UK and abroad in 2004, 27% (7,000 tonnes) were caught in the West of Scotland, 21% (5,250 tonnes) were caught in the English Channel and 19% (4,750 tonnes) were caught in the Central North Sea. Of the 31,000 tonnes of Nephrops landed by the UK fleet in 2004, 10,000 tonnes were caught in both the Northern North Sea and the West Of Scotland.

Cockle landings dropped substantially, from the peak value in 2003 of 31,357 tonnes, to 12,891 tonnes. This latter figure is similar to the landings in 1998. The total value of these landings increased slightly over the 2003 figure, as at £781 per tonne the unit value is more than double that in 1998.

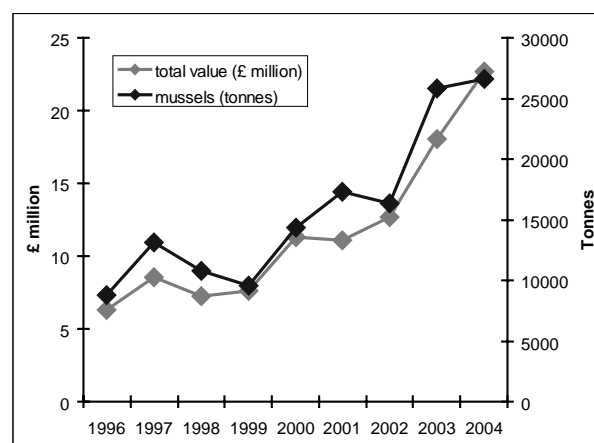
Scallops are an important species. They accounted for 17.5% of the total shellfish catch and 19.3% of the total value in 2004, an increase of around 2% over 2003 for both figures.

Lobsters were once again the most valuable species on a per weight basis, although the price per tonne fell again in 2004 so that at £9,300 per tonne it was slightly less than the average value for the previous 10 years.

The 'Other Shellfish' category in the table includes oysters and clams, as well as some high value species, for example, Crawfish, English Prawns, Razor Fish and Squat Lobsters, for which there is no separate information available.

2. Farmed Shellfish Production

A summary table of farmed shellfish production in the UK in 2004 is given below. The total value of the shellfish produced for the table was an estimated £22.7 million, from over 27,800 tonnes. The table does not include production or value of native oysters from the Solent Several and Regulated grounds. These appear in the Fishery Order table in Section 3, below. These oysters are 'cultivated' in the sense that the grounds are managed, including the relaying of cultch. The figures also do not include hatchery/nursery seed production, for on-growing, much of which is exported.



Estimated total value (all shellfish) and mussel production in the UK (1996-2004)

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 estimated value of production in 2004 increased by about 26% compared with 2003. The figure shows the estimated total value of all cultivated shellfish in the UK over the previous nine years and how this is a reflection of production of mussels as the dominant species by weight.

A. England and Wales

P. Dunn and I. Laing, Cefas Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset, DT4 8UB.

The accompanying tables show the statistics collected by the Cefas Fish Health Inspectorate during their disease inspection visits to shellfish farms and the summary is presented in the context of previous years to demonstrate trends.

In 2004 there were 118 registered farm sites in England, a net decrease of 7 on the previous year. These sites belonged to 96 businesses, a decrease of 2 businesses, there were 8 new businesses registered, while 10 ceased

Production (tonnes) of farmed shellfish in the UK in 2004.

	Scotland	England	Wales	Northern Ireland	UK Total
Pacific oyster	287	432	22	278	1,019
Native (flat) oyster	8	106	-	4	118
Scallops	10	0	-	-	10
Queens	45	-	-	-	45
Mussels	4,223	3,263	14,814	4,311	26,611
Clams	-	7	-	11	18
Cockles	-	10	-	-	10
Estimated Value (£ million)	6.0	3.3	10.4	3.0	22.70

Farmed shellfish (table) production in England and Wales 1999-2004 (in tonnes)

	Native oysters	Pacific oysters	Mussels	Manila clams	Hard clams	Palourdes	Cockles
1999	93	386	8,009	17	0	12	43
2000	115	313	11,224	25	0	3	147
2001	127	225	13,367	29	4	1	105
2002	116	392	12,386	37	4	1	147
2003	114	471	17,919	35	2	6	24
2004	106	454	18,077	6	1	0	10

trading. The equivalent figures for Wales are 10 farms belonging to 9 businesses. The English Shellfish farm businesses employed 260 people (169 Full time, 85 Part time and 6 Casual) in 2004. The Welsh Employment total was 28 (21 Full time and 7 Part time workers).

Farmed production of native oysters was broadly similar to that in 2003. Most (72%) native oyster farming is carried out at sites in East Anglia, although the total amount is small compared with oyster production from the managed fisheries in the south and southwest of England (see Fishery Order production, below).

Pacific oyster production remained similar to the amount farmed in 2003. About 57% of this production takes place in the South West of England, with a further 29% from farm sites in East Anglia.

Total shellfish production, by weight, continues to be dominated by mussels. There was a very small increase in production of mussels in 2004 over the previous year. While the vast majority of these mussels are produced at farm sites on Fishery Orders in Wales there is increasing production from some other farms sites in the South West of England.

Hatchery seed production of all species in 2004 was very similar to that in 2003. Small quantities of native oysters were produced, some of which were in support of studies associated with the Native Oyster Species Action Plan (NOSAP).

The National Lobster Hatchery in Padstow, Cornwall released over 2,200 juvenile lobsters in 2004, as a means of enhancing wild stocks.

B. Scotland

Source: "Scottish Shellfish Farm Production Survey 2004" (ISBN : 1363-5867), available from Fisheries Research Services, Marine Laboratory, PO Box 101, Victoria Road, Aberdeen, AB9 8DB (Editors D.J. Pendrey & D.I. Fraser).

Web: http://www.marlab.ac.uk/Delivery/Information_resources/information_resources.aspx

Introduction

This report is based on the returns of an annual survey questionnaire sent to all registered Scottish shellfish farming companies. The cooperation of the shellfish farming industry is gratefully acknowledged.

Movement and production forms were sent to 175 companies registered as active before the survey. All returns were received. One 'wild' mussel fishery registered as a shellfish farm has been excluded from this report. During 2004, 15 new companies registered; ten de-registered.

Activity

The survey shows that 110 companies (63%) produced shellfish for sale, both for the table and for on-growing. The remaining 65 continued in operation, but had no sales during 2004. The number of active companies continued to decrease from a peak of 229 in 1990, to 175 at the end of 2004. These companies farmed 309 active sites, of which 152 (49%), placed shellfish on the market.

Farmed juvenile (seed) shellfish production in England and Wales 1999 -2004 in thousands (1000's)

	Native oysters	Pacific oysters	Manila clams	Palourdes	Hard Clams
1999	2,270	125,500	20,000	4,000	0
2000	2,000	63,230	19,200	2,100	0
2001	600	318,211	50,000	30,000	62,000
2002	0	178,142	163,000	0	0
2003	132	316,130	342,000	0	0
2004	125	329,000	340,000	0	0

The industry employed 149 full-time and 253 part-time and casual workers during 2004, an overall increase of 10% on the previous year. This reflects the on-going trend in the development of new sites and businesses particularly for mussel production.

The number of companies registered as active has decreased by 2% since 2003, and the number of active sites has increased by 2% over the same period. This trend reflects the development of new sites, particularly for mussel production. Many unproductive sites held stock not yet ready for market, others were fallow, and some were positioned in remote areas where the cost-effective production and marketing of shellfish proved difficult.

Historically, production data have been collected by company. However, since 2002, data have been collected by both company and site, enabling us to provide more accurate site information. One hundred and fifty-two sites were shown to have produced shellfish for sale, an increase of 8% since 2003.

Many companies cultivate more than one species on site; a practice made possible by similar cultivation techniques. For example, scallops are grown together with queens; Pacific oysters with native oysters and mussels with Pacific oysters.

The number of companies producing more than 100 tonnes of mussels decreased from 13 to 11 since 2003. Those 11 companies produced 60% of the total mussel production in Scotland. However, the number of companies producing mussels has increased by 15% since 2003. The number of companies producing Pacific oysters did not alter significantly in 2004, although their scale of production has increased by 4% since 2003. The 13 companies producing over 100,000 Pacific oysters shells produced 95% of the Scottish total.

Production

Total production was dominated by mussels (4,223 tonnes) and Pacific oysters (3.6 million shells, 287 tonnes). Small volumes of queens (45 tonnes), scallops (10 tonnes) and native oysters (8 tonnes) were also produced. There continued to be an upward trend in the production of mussels and Pacific oysters. There was little change in the production of queens and scale of production remained low. Production of both scallops and native oysters decreased and scale of production remained low. Mussel production increased by 16%, as markets were developed, and prices remained high. The greatest increase in regional production was in Shetland, by 41% to 2,188 tonnes. Strathclyde produced 1,193 tonnes, which, combined with the amount for Shetland accounted for 80% of the Scottish total. Pacific oyster production increased by 3%, whilst markets were maintained and demand remained high.

Almost 79% of Pacific oysters were produced in the Strathclyde region, where the scale of production amongst larger companies decreased. Queen production decreased by less than 1% through annual variation in natural settlement. Native oyster production decreased by 35%. This accounts for a small percentage of total oyster production, targeting a niche market. Production of farmed scallops decreased by almost 53%, and production was again affected by environmental influences causing area closures, which prevented sales for human consumption.

Ten Several Orders have been granted for scallop fisheries, nine for commercial companies and one for research and development. Eight are in Highland region, one in Strathclyde and one in Shetland. Reports from industry indicated a strong market for scallops and queens throughout the year.

Prices of farmed shellfish fluctuated throughout the year; however, the value at first sale of the species cultivated was estimated. The price of Pacific oysters varied between 15 and 25 pence per shell; native oysters 35 pence per shell; scallops and queens 50-60 and five pence per shell respectively; and mussels between £800-£1,300 per tonne.

Environmental and Health issues

Approved Zone status for the notifiable diseases *Bonamia* and *Marteilia* was maintained in 2004 (in accordance with EC Directive 91/67) after testing confirmed the absence of these diseases in Scottish waters. Samples were taken from seven sites holding native oysters, a species known to be susceptible to these shellfish diseases. Approved Zone status continued to protect the health of both wild and farmed native oyster stocks in Scottish waters. EC Council Directive 95/70 maintains that minimum Community measures for the control of certain diseases affecting bivalve molluscs are in place. A third of all shellfish sites are visited annually by the Fisheries Research Services (FRS) Fish Health Inspectorate in accordance with the requirements of the Directive. On these visits facilities, stock health, movement records and registration details are checked. It is the responsibility of farmers to inform FRS of any abnormal or unexplained shellfish mortality on their sites.

Mortalities were reported to be the result of predation by eider ducks, crabs, starfish and oystercatchers. Losses were also reported due to storm damage, warm weather and mechanical grading. Tubeworm infestation caused marketing difficulties for one company.

Summary

The 2003 survey has shown:

- Mussels and Pacific oysters are the main species produced in terms of value and tonnage, both species continued an upward trend in increased production;
- There has been little change in the production of queens and scale of production remained low;
- There has been a substantial decrease in the production of scallops, whilst scale of production remained low;
- There has been a decrease in the production of native oysters, whilst scale of production remained low;
- There was little change in the number of active and producing companies;
- Employment increased by 5%;
- Environmental influences affected scallop sales during the year;
- Approved Zone status for the diseases *Bonamia* and *Marteilia* was maintained during the year;
- For shellfish health purposes, at least a third of all shellfish sites were inspected by FRS Fish Health Inspectorate during 2004;
- The industry continued to be dominated by small producers, although there was a continued trend toward large companies contributing significantly to the annual production of all species.

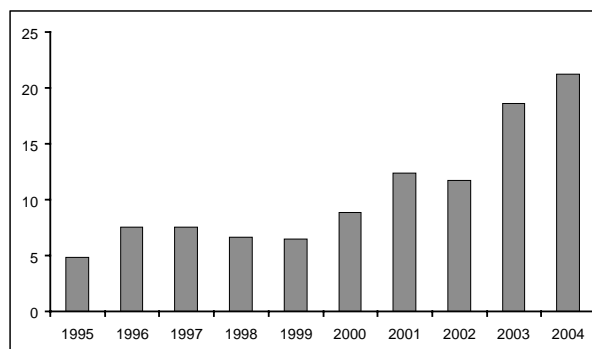
The market for all species was buoyant and prices remained stable throughout the year. It is predicted that annual production of all species will continue to increase steadily.

C. Northern Ireland

Mr David Martin

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Shellfish production statistics for Northern Ireland in 2004 are included in the summary table, above. The industry currently employs 76 full time and 60 part time personnel. This represents a drop in total employment by 8% compared with 2003, although the number of full time employees increased from 63 in 2003. Overall, production was similar to that in 2003.



Value of shellfish production (£ million) from Fishery Orders (1995-2004)

3. Shellfish Production from Several and Regulated Fisheries

Source: Annual Returns

In England and Wales there are currently 18 Several Fisheries, 7 Regulated Fisheries and 2 Hybrid Order Fisheries. Hybrid Orders are Regulating Orders where the grantee has the power to assign Several plots within the fishery. Scotland has 9 Several Fisheries, primarily for scallops and one Regulated Fishery, covering most shellfish species, around the Shetland Islands. Farmed shellfish production from the Scottish sites is included in the report above.

For England and Wales, information was obtained from all of the Fishery Orders, and is included in the table. There was shellfish production at all but three of the Several Fishery sites. Of these, one is affected by adverse hygiene classification and another has seed mussels on the ground but no production yet. There was also production at six of the Regulated Fisheries and both of the Hybrid Order Fisheries. The other Regulated Fishery is operated for supplying significant quantities of seed mussels. Various levels of other cultivation activity took place at many of the productive sites, for example relaying of cultch and or stock. The table shows an estimated total value of production from the Fishery Orders in 2004 of just under £21.3 million. This is a significant (18%) increase on the estimated value for 2003 (£18 million), and follows year on year increases in which the total value of production from Fishery Orders is almost 3.3 times that of five years ago (see figure).

Production / Landings (tonnes) of shellfish from Fishery Orders in England and Wales in 2004

Type	Several	Regulated	Hybrid	Total	Estimated Value (£,000s)
Pacific oyster	21	2	95	118	164
Native (flat) oyster	39	628	8	675	1,870
Clams	-	3	406	409	1,024
Mussels	14,885	252	1,728	16,865	10,450
Cockles	-	11,749	2,710	14,459	7,788

Mussel production was 16.9 thousand tonnes, which is slightly lower than the record of 18 thousand tonnes in 2003. The weight of mussel landings exceeded that for cockles for the third year running. Mussel production contributed almost 49% of the total estimated value of production from Fishery Orders. Welsh Fisheries continue to make up the majority of mussel production, contributing almost 88% of Fishery Order production in 2004. All of the mussel production from Fishery Orders is also recorded as coming from registered farms, with the majority of mussel farming taking place within Fishery Order areas.

Almost all cockle production is from managed fisheries. Production of cockles was down compared to that in 2003. Production fell by almost 17%, although this was more than compensated for by an increase in estimated value of more than 8%. A record value of almost £7.8 million was achieved through a further significant increase in the unit price for cockles, from £412/tonne in 2003 to £711/tonne in 2004.

Production and value of clams from Fishery Orders was similar to that in 2003. Almost all clam production is from managed fisheries.

There was a 40% decrease in production of flat oysters compared with 2003. Care must be taken in interpreting year on year differences in production, however, as

the figures are invariably estimated from incomplete information. Despite the drop in production the estimated total value of these oysters increased slightly compared to that in 2003.

The level of production of Pacific oysters from Fishery Orders in 2004 was substantially less than that in the previous year. Production dropped by 58%, from 282 tonnes to 118 tonnes in this period. All Pacific oyster production in England and Wales is from registered shellfish farms (and is included in the farmed production figures). About 26% of the total Pacific oyster production in England and Wales came from Fishery Orders in 2004.



A plate of oysters

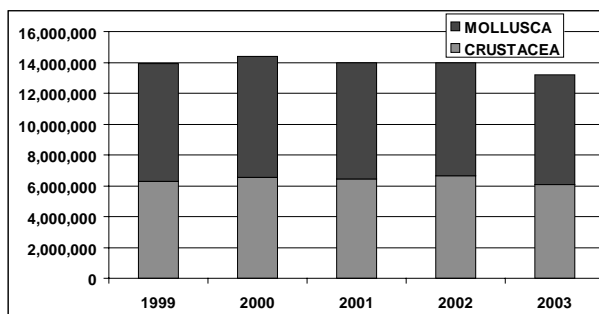
WORLD SHELLFISH PRODUCTION

Overview

Each year, the Food and Agriculture Organisation of the United Nations (FAO) publishes data on the status of global fisheries and aquaculture. The figures for 2003 are now available.

Landings

Total world landings of shellfish fell to 13.2 million (metric) tonnes in 2003, from 14 million tonnes in 2002 (see figure). Landings of crustaceans dropped by 8.5% and molluscs by just over 3%. In comparison, total finfish landings are about 76.4 million tonnes, a total that fell from 78.5 million tonnes in 2002.



World shellfish landings (metric tonnes)

Cultivation

In contrast to declining capture production, world shellfish aquaculture production continues to grow, with the annual year on year increase of about 6% being maintained in 2003. Molluscs account for over 85% of the total world marine or brackish water shellfish production of 14.4 million metric tonnes. Although molluscs dominate shellfish production by weight, the greater unit value of crustaceans gives them nearly equal value. In 2003, the reported figures were 10.5 and 11.5 billion US dollars for crustaceans and molluscs respectively. The total is a 13% increase over the value for 2002. European shellfish production is worth just over 0.9 billion US dollars, or 4.4% of the world total.

Around 87% of all shellfish production is from Asia, although Europe is the second largest producer, by region, contributing about 5.3% (by weight) of total world mollusc production.

The Pacific oyster (*Crassostrea gigas*) is by far the most important individual species. Production of this species exceeds 4.3 million metric tonnes globally, and has increased by 18% in the last five years. It accounts for over 36% of total mollusc production and for 97% of the

total oyster production. Only 2.8% of this production is in Europe, with France by far the major producer. Almost 96% of Pacific oyster production is from Asia.

Manila clams are the second most important individual mollusc species, contributing a further 21% of the total world aquaculture production of molluscs. Globally, production of this species has increased by 40% over the last five years. In Europe, production takes place predominately in Italy, although here the reported production fell to 25,000 tonnes in 2003, representing less than half the production of two years previously. Mussels, at 1.6 million tonnes, make up about 13% of total world mollusc production. The European species

account for 39% of this amount. Spain produced almost 250,000 tonnes of mussels in 2002, a yield that has been fairly constant over the last five years. This is about 40% of all cultivated mussels in Europe. Other major European producers are Italy (16%, 100,000 tonnes) and France (11%, 68,000 tonnes). Production in the UK, at a reported 19,222 tonnes, is 3.1% of the European total.

Following three years of slightly increased production, cultivation of European oysters fell from 7,169 tonnes in 2002 to 5,226 tonnes in 2003. This was mainly due to a reported drop in production in Spain from 4,500 tonnes in 2002 to 2,300 tonnes in 2003.

SHELLFISH PRODUCTION IN JERSEY IN 2004

*Source: Fisheries Section Annual report 2004
Fisheries and Marine Resources, Department of
Environment & Public Services, Howard Davis Farm,
Trinity, Jersey JE4 8UF. Tel 01534 866226, Fax 01534
866201*

The table below shows the areas farmed and the production of shellfish from 2000-2004. There has been a steady increase in shellfish production over the last 5 years. In 2004 there was a 12% increase in production compared with the previous year. This follows a 17% increase in that year and a 16% increase the previous year.

The fish-farming sector of the industry continues to develop and now represents a significant part of the whole fishing industry. Production of Pacific oyster is up significantly to 720 tons, an increase of 28%. The UK total in 2004 was just over 1,000 tons.

While the mussel landings maintained it should be noted that a large proportion of the landings were stock that was imported part grown then held and on grown locally. About 25% of the total production was grown from spat to market size in Jersey. Several applications for new concessions and renewals of existing concessions were applied for in 2004. The Committee

granted two new concessions, one inter-tidal and one sub-tidal, and the renewal of an existing concession. One serious concern highlighted by the fish farmers during 2004 was the difficulties experienced with freighting products to France. Farmers had experienced difficulties with respect to timetabling and arranging freight around busy times e.g. at Easter. The issue was addressed at a meeting with the fish farmers, freight operators and the President of Harbours and Airports. Fish merchants were also represented as they too had issues to discuss.



Oyster farming in Jersey

Farmed shellfish areas and production in Jersey, C.I.

	2000	2001	2002	2003	2004
Inter-tidal area (hectares)	46.6	53.6	54.5	54.5	54.5
Sub-tidal areas(hectares)	166	166	100	100	100
Pacific Oysters (tonnes)	240.7	389.8	475.6	560.2	720.8
Scallops (tonnes)	1.95	1.91	1.54	1.35	3.57
Mussels (tonnes)	57.5	78.0	96.4	108.3	25.0
Total (tonnes)	300.14	469.69	573.56	669.85	749.34

UK SHELLFISH IMPORTS AND EXPORTS IN 2004

Source: HM Customs and Excise. Data prepared by Trade Statistics, Food Chain Analysis 3, Defra.

The UK is a net exporter of shellfish, with just less than 100,000 tonnes leaving the country in 2004, compared with imports of just over 61,000 tonnes. The figures show an overall level of trade similar to that in the previous year.

The vast majority (over 97%) of shellfish exports are to other EU member states, whereas over 70% of imports are from outside the EU. About 65% of mollusc exports are of a live or chilled product, whereas only 16% of the imports arrive in this condition, with 63% of these from elsewhere in Europe.

Trade in selected shellfish species, together with the totals for crustaceans and molluscs are shown in the table.

UK trade in selected shellfish in 2004 (tonnes)

	Exports	Imports
Crabs	7,808	1,029
Lobsters	1,416	1,633
Shrimps and Prawns	22,290	43,113
Crustaceans Total	53,338	47,904
Mussels	20,178	4,507
Oysters	896	395
Scallops	8,898	1,163
Cuttlefish	5,304	742
Squid	1,483	4,130
Molluscs Total	46,632	13,406

Crustaceans account for the majority of trade, making up 53% of total exports and 78% of the imports, although both these proportions are slightly lower than in 2003. Much of the export trade recorded as shrimps and prawns will be of Nephrops, together with some brown shrimp. Imported shrimps and prawns are predominantly frozen product, with over half the total coming from India, Bangladesh and Indonesia. Most of the crabs exported from the UK go to Spain and France, with further significant quantities going to Portugal. These three countries are also the main consumers of exported lobsters. Virtually all imported lobsters are live animals, coming from Canada (79%) and the USA (20%).

Over 77% of mussel exports are of a live or chilled product, whereas only 17% of imported mussels arrive in this condition, as opposed to a frozen or otherwise preserved product. The Netherlands is the major importer of live UK mussels, taking over 11.5 thousand tonnes in 2004, and accounting for over 75% of the total. Exports to France and Ireland accounted for a further 20% and 6% respectively. The proportion of mussels arriving as a frozen product increased from about 75% in 2003 to 82% in 2004, with over 1,000 tonnes coming from New Zealand. Over 94% of UK oyster exports are sent to France (452 tonnes), Spain (262 tonnes) and the Irish Republic (130 tonnes). Most (56%, 223 tonnes) of UK oyster imports come from Ireland. About 60% of the scallops exported are as a frozen, or otherwise preserved product, with 86% of these going to Italy, Spain and France. France is by far the major importer of UK live/fresh or chilled scallops, taking 2,586 tonnes, or 72% of the total. Spain is the major importer of UK squid, taking 75% of the total exports of this species. Over 87% of cuttlefish exports are as a live product, with Italy taking 50% of these, the remainder going to The Netherlands, Spain and France.

RESEARCH NEWS

Research News includes abstracts of recent work that may be of interest to the shellfish industries. These abstracts can be taken both from papers published in international scientific journals and from project work undertaken by students at Universities and Research Laboratories. Results from the latter are usually not widely available and supervisors of student projects are encouraged to submit abstracts to Shellfish News as a means of publishing this information.

1. Pacific oyster broodstock management

The effect of providing algal food to female Pacific oyster broodstock sampled at a time of year when condition is naturally high was investigated using indices of oocyte quality and subsequent larval and post-larval performances.

Broodstock were collected in the Aber Benoit estuary (Brittany, France) at the end of April 2002 and were divided into two groups, a starved control and a fed group (provided *ad libitum* with an algal mixture of *Isochrysis galbana* clone T-Iso and *Chaetoceros calcitrans*). Oysters were maintained under these conditions for six weeks prior to spawning.

Two batches of larvae and post-larvae were reared from two females in each treatment. Quality criteria were defined in terms of predictors (oocyte lipid content, mature oocyte diameter, ovarian maturity and presence/absence of atresia) and validators (larval growth, algal consumption, time to settlement and post-larval growth).

In both conditions, a surplus of oocytes was produced. No effect of the conditioning treatment was detected either on oocyte quality predictors or on subsequent validators. It is likely that winter reserve accumulation is more important than conditioning for successful gametogenesis in the productive Aber Benoit environment. Given the considerable cost of abundant feeding during the conditioning of broodstock collected at the end of winter and destined for gamete stripping (the prevalent practice in France) we suggest that minimal or no feeding is required when condition index is high.

Reference

Cannuel, R., Beninger, P.G. (Peter.Beninger@univ-nantes.fr), 2005. Is oyster broodstock feeding always necessary? A study using oocyte quality predictors and validators in *Crassostrea gigas*. Aquatic Living Resources, Vol 18, pp 35-43.

2. Effect of PAHs on Pacific oyster fecundity

To investigate the polycyclic aromatic hydrocarbon (PAH) effect on fertilization of Pacific oysters we exposed the adult brood stocks to PAHs (200 ppb) for 30 days, with a non-exposed group as the control. In addition, each subset of the gametes from both groups was further exposed to graded level of PAHs (0, 50, 100, and 200 ppb).

The result suggests that fertilization capability and larval development are adversely affected by parental exposure whereas sperm movement was more vulnerable to larval exposure. In the brood stock contaminated by PAHs, larval development was also vulnerable to larval exposure to PAHs.

Reference

Jeong, W.G., Cho, S.M. (s_gigas@gaechuk.gsnu.ac.kr), 2005. The effects of polycyclic aromatic hydrocarbon exposure on the fertilization and larval development of the Pacific oyster, *Crassostrea gigas*. Journal of Shellfish Research, Vol 24, pp 209-213.

3. Oyster selection gives faster growth

The progeny of four 4th generation Sydney rock oyster breeding lines that were selected for fast growth were compared in a 3-year farming experiment. Oysters of the most improved breeding line (line 2) reached market size (≥ 50 -g whole weight) 15 months earlier than non-selected control oysters (3 years and 5 months). The average reduction in time to market size for oysters of all four breeding lines was 12.5 months.

Reference

Nell, J.A. (john.nell@fisheries.nsw.gov.au), Perkins, B., 2005. Evaluation of progeny of fourth generation Sydney rock oyster *Saccostrea glomerata* (Gould, 1850) breeding lines. Aquaculture Research, Vol 36, pp 753-757.

4. Tetraploid Pacific oysters

A new method to produce tetraploid Pacific oysters by cytochalasin B inhibition of Polar body 2 expulsion in diploid females crossed with tetraploid males is

described. This offers a means of direct introgression of genetic characters from selected diploid to tetraploid lines, avoiding a triploid step.

Offspring larval ploidy shifted over time and depended on size, with tetraploids more frequent among the smaller larvae and triploids among the large. Viable tetraploids were found at 4 and 6 months, indicating that the technique was successful. The possibility that gynogenesis occurred was tested by microsatellite analysis to confirm the presence of paternally inherited alleles. These were present in all animals of the $2n \times 4n + CB$ (female first) cross. However, a $4n \times 2n + CB$ cross produced triploids, including some gynogens. Our method illustrates for the first time that diploid *C. gigas* eggs, if selected for large size, can give viable tetraploid offspring.

Reference

McCombie, H. (hmccombi@ifremer.fr), Ledu, C., Phelipot, P., Lapegue, S., Boudry, P., Gerard, A., 2005. A complementary method for production of tetraploid *Crassostrea gigas* using crosses between diploids and tetraploids with cytochalasin B treatments. Marine Biotechnology, Vol 7, pp 318-330.

5. GABA and bivalve settlement

Competent larvae of different marine bivalve species were treated with GABA and epinephrine at different concentrations and times of exposure to test the ability of the drugs to induce settlement and metamorphosis.

GABA induced both settlement and metamorphosis in the mussel *Mytilus galloprovincialis*, the clams *Venerupis pullastra* and *Ruditapes philippinarum* and the oyster *Ostrea edulis*.

Maximum induction of settlement (> 39%) was achieved after exposure of *V. pullastra* larvae to 10^{-4} M GABA. This concentration of GABA induced the highest percentages of metamorphosis in all four species studied. Epinephrine was identified as an active inducer of settlement and metamorphosis in bivalve molluscs. Exposure to 10^{-5} M epinephrine induced significant levels of settlement in *Mytilus*, *Venerupis* and *Ostrea*. In contrast, epinephrine failed to induce settlement behaviour in *Ruditapes*. Maximum induction of metamorphosis was produced by 10^{-5} M epinephrine in mussels, clams and oysters; *Ruditapes* showed the highest percentage of metamorphosis (> 78%).

Reference

Garcia-Lavandeira, M., Silva, A., Abad, M., Pazos, A.J., Sanchez, J.L., Perez-Paralle, M.L. (bnmalu@usc.es), 2005. Effects of GABA and epinephrine on the settlement and metamorphosis of the larvae of four species of bivalve molluscs. Journal of Experimental Marine Biology and Ecology, Vol 316, pp 149-156.

6. Selecting cryoprotectants

Cryopreservation is a valuable tool for aquaculture by providing the possibility of continuous seed production at any time of year. This study aimed to select the least toxic among the cryoprotectants dimethyl sulfoxide, propylene glycol, and methanol based on their toxicological effects on *Crassostrea rhizophorae* gametes and trochophores.

Animals were exposed for 10, 20, and 30 min to a range of concentrations of those cryoprotectants. The end-point was EC15-24h (effective concentration which causes abnormalities in 15% of the population exposed to the cryoprotectants for 24h), recently determined as the chronic value (the concentration at which chronic effects are first observed) for *C. rhizophorae* embryonic phases.

There were no significant differences among the exposure times in dimethyl sulfoxide toxic effects to either gametes or trochophores. For methanol the increase in exposure time resulted in higher toxicity for gametes, but not for trochophores, while for propylene glycol there was a significant increase in toxicity with the increase of exposure for trochophores and spermatozoa, but not for oocytes. So, for gametes, methanol was the most toxic among the cryoprotectants, while propylene glycol was the most toxic for trochophores.

Reference

Nascimento, I.A. (iracema@ftc.br), Leite, M.B.N.L., de Araujo, M.M.S., Sansone, G., Pereira, S.A., Santo, M.D., 2005. Selection of cryoprotectants based on their toxic effects on oyster gametes and embryos. Cryobiology, Vol 51, pp 113-117.

7. Anti-viral activity in Pacific oysters

Innate, non-specific resistance mechanisms to pathogens are important, particularly for delaying virus replication at the onset of infection. Innate immunity constitutes the first line of defence in vertebrates and is the only one in invertebrates. Little is known about possible antiviral substances in invertebrates. The present work concerns a study of antiviral substances in the hemolymph from adult Pacific oysters. An antiviral substance was detected. Fresh filtered hemolymph was capable of inhibiting the replication of herpes simplex virus type I *in vitro* at an EC50 of 425 µg/ml (total proteins) and the replication of infections pancreatic necrosis virus in EPC and RTG-2 cells at 217 and 156 µg/ml (total proteins), respectively.

Reference

Olicard, C., Renault, T., Torhy, C., Benmansour, A., Bourgougnon, N. (nathalie.bourgougnon@univ-ubs.fr), 2005. Putative antiviral activity in hemolymph from adult

8. Summer mortality in Pacific oysters (1)

Summer mortality has been reported in the Pacific oyster for many years in different parts of the world. The causes of this phenomenon are complex. The multidisciplinary program "MOREST", coordinated by IFREMER, was initiated to understand the causes of summer mortality of Pacific oyster juveniles in France and to reduce its impact on oyster production. Within this program, three successive groups of bi-parental families were bred in a hatchery in 2001 and placed in the field during the summer in three sites (Ronce, Riviere d'Auray, and Baie des Veys).

This paper reports the relative importance of family, site and field placement timing for three characters of major importance for oyster production: survival, growth, and yield. At the end of the summer period, significant differences for the three characters were observed among sites and families for each group. Family effect was the largest variance component for survival, representing 46% of the total. Variance component analysis revealed that variation in yield among families depended either on survival or on growth according to the site. Significant family x environment interactions were observed for yield and survival but not for growth. No difference in survival was found among groups in the three sites at the end of the experiment, but a critical period of mortality was identified from late July until early September. The influence of environmental conditions, notably on reproductive allocation and its relationship with the studied traits, is discussed.

Reference

Degremont, L., Bedier, E., Soletchnik, P., Ropert, M., Huvet, A., Moal, J., Samain, J.F., Boudry, P. (pierre.boudry@ifremer.fr), 2005. Relative importance of family, site, and field placement timing on survival, growth, and yield of hatchery-produced Pacific oyster spat (*Crassostrea gigas*). Aquaculture, Vol 249, pp 213-229.

9. Summer mortality in Pacific oysters (2)

The purpose of this study was to investigate summer mortality in Pacific oysters in relation to culture practices in the traditional oyster production region of Marennes-Oleron (France).

Four oyster rearing conditions, varying culture location ("on-" or "off-bottom"), and site depth (65 - 80% daily immersion ("deep") or 45 - 65%, ("shallow")) were studied to compare performance and maturation status

of oysters, in relation to sediment and water column parameters.

The most severe mortality occurred in June to July in "on-bottom" reared oysters (25%), as compared with 10% mortality in "off-bottom" cultured oysters. Oysters (shell and meat) grew significantly better when reared "off-bottom" than "on-bottom." Reproductive effort was almost double in "off-bottom" reared oysters, compared with those "on-bottom"; thus, reproduction cannot be directly related to mortality in this summer mortality event. Low glycogen content recorded for both "on" and "off-bottom" reared oysters in summer, confirmed the probable lack of food and/or the overstocking in the Marennes-Oleron Bay. Whatever the immersion depth ("deep" or "shallow" conditions), "on-bottom" cultured oysters were adversely affected in growth, reproductive effort, and survival suggesting a direct effect of the mud on performance of oysters cultured on the bottom. Data from monitoring of sediment redox potential, organic content, and ammonium release did not support hypotheses that these parameters were alone responsible for the observed differences in mortality events.

Reference

Soletchnik, P. (patrick.soletchnik@ifremer.fr), Lambert, C., Costil, K., 2005. Summer mortality of *Crassostrea gigas* (Thunberg) in relation to environmental rearing conditions. Journal of Shellfish Research, Vol 24, pp 197-207.

10. Juvenile oyster disease in USA

An organism has been identified that is believed to be the causative agent of juvenile oyster disease in the USA. Since its first isolation in 1997, this bacterium has been recovered as the numerically dominant species from affected animals throughout the north-eastern United States (Maine, New York and Massachusetts). Colonies are usually beige to pinkish-beige, although the majority of isolates recovered in 2003 from an epizootic in Martha's Vineyard, Massachusetts, produce colonies with a greenish-yellow appearance. The cells are Gram-negative, aerobic, strictly marine and rod or ovoid in appearance. They are actively motile by one or two flagella. Phylogenetic analyses and comparisons with other known species support the assignment of this bacterium to a novel species. The name *Roseovarius crassostreae* sp. nov. is proposed.

Reference

Boettcher, K.J. (boettche@maine.edu), Geaghan, K.K., Maloy, A.P., Barber, B.J., 2005. *Roseovarius crassostreae* sp nov., a member of the Roseobacter clade and the apparent cause of juvenile oyster disease (JOD) in cultured Eastern oysters. International Journal of Systematic and Evolutionary Microbiology, Vol 55, pp 1531-1537.

11. Natural recruitment of Pacific oysters in the Wadden Sea

Among the increasing number of species introduced to coastal regions by man, only a few are able to establish themselves and spread in their new environments. The Pacific oyster took 17 years before a large population of several million oysters became established on natural mussel beds in the vicinity of an oyster farm near the island of Sylt (northern Wadden Sea, eastern North Sea). The first oyster, which had dispersed as a larva and settled on a mussel bed, was discovered 5 years after oyster farming had commenced. Data on abundance and size-frequency distribution of oysters on inter-tidal mussel beds around the island indicate that recruitment was patchy and occurred only in 6 out of 18 years. Significant proportions of these cohorts survived for at least 5 years. The population slowly expanded its range from inter-tidal to sub-tidal locations as well as north- and southwards from Sylt along the coastline. Abundances of more than 300 oysters per square metre on mussel beds were observed in 2003, after two consecutive spatfalls in 2001 and 2002. Analyses of mean monthly water temperatures indicate that recruitment coincided with above-average temperatures in July and August when spawning and planktonic dispersal occurs. We conclude that the further invasion of Pacific oysters in the northern Wadden Sea will depend on high late-summer water temperatures.

Reference

Diederich, S. (sdiederich@awi-bremerhaven.de), Nehls, G., van Beusekom, J.E.E., Reise, K., 2005. Introduced Pacific oysters (*Crassostrea gigas*) in the northern Wadden Sea: invasion accelerated by warm summers? Helgoland Marine Research, Vol 59, pp 97-106.

12. Competition between mussels and Pacific oysters

Pacific oysters have been introduced into the Wadden Sea (North Sea), where they settle on native mussel beds, the only extensive insular hard substrata in this soft-sediment environment. As oyster abundance increased, some mussel beds became increasingly overgrown with oysters, whereas others did not.

Field experiments revealed that recruitment of oysters was higher in the lower inter-tidal than in the upper sub-tidal zone, that it was higher on other oysters than on mussels, and that it was not affected by barnacle epigrowth, except when settling on mussels.

Mussel recruitment is known from inter- and sub-tidal zones. It occurred equally on oyster and mussel shells but showed a clear preference for barnacle epigrowth over clean shells.

Assuming that settlement and recruitment are key processes for species abundances on the North Sea coast, it is predicted that the positive feedback in oyster settlement will lead to rapid reef formation of this invader at the expense of mussel beds. Mussels, however, may escape competitive exclusion by settling between or on the larger oysters especially when barnacles are abundant.

Experimental patches with mussels were more often covered by furoid algae than patches with oysters, and oyster recruitment was poor underneath such algal canopies. Thus, fucoids may provide the native mussels with a refuge from the invading oysters and the two bivalves may coexist, provided food is not limiting.

Reference

Diederich, S. (sdiederich@awi-bremerhaven.de), 2005.

Differential recruitment of introduced Pacific oysters and native mussels at the North Sea coast: coexistence possible? Journal of Sea Research, Vol 53, pp 269-281.

13. Identifying bivalve larvae

A major obstacle in the quantification of planktonic larval distributions is the identification of sampled larvae. Identification is difficult due to the uniform morphology of many larval species. We evaluated the morphology of bivalve larvae reared in our laboratory (*Crassostrea gigas*, *Cerastoderma edule*, *Macoma balthica*, *Mytilus edulis*) and literature data on larvae from the 1960s, using image analysis techniques. We used this dataset to compile species-specific dimensions (length-width of the larval shell) and shape parameters (contour of the larval shell).

The first method yielded different slopes when length and width were plotted against each other, but regression lines overlapped, which rendered the technique impractical for field identification. Multidimensional scaling of larval shape within one species showed shape development of the larvae during ontogeny. Analysis on larger individuals (length > 150 µm) was relatively successful for those species of which sufficient individuals were available. The identity of up to 74% of the large larvae could be predicted correctly.

Reference

Hendriks, I.E. (iris.hendriks@uib.es), van Duren, L.A., Herman, P.M.J., 2005. Image analysis techniques: A tool for the identification of bivalve larvae? Journal of Sea Research, Vol 54, pp 151-162.

14. Spawning of blue and Mediterranean mussels

The blue mussel, *Mytilus edulis* has been reared along the Normandy coast since the 1960s. The gonadal

cycle of this mussel species shows a sharp decrease in meat quality during the winter period after spawning. This decline in meat quality is so severe that sales have to be suspended from December to July. Another species of mussel, *Mytilus galloprovincialis*, which is reared in the lagoons along the French shore of the Mediterranean Sea, has a different spawning cycle. An experiment was undertaken to study the meat quality of *M. galloprovincialis* throughout the year after the spat were transferred from the Mediterranean Sea to the Normandy coast. However, this species showed an immediate adaptation to the gonadal cycle of *M. edulis* and so there is no interest to make further transfers of *M. galloprovincialis* in the future.

Reference

Kopp, J. (jkopp@ifremer.fr), Cornette, F., Simonne, C., 2005. A comparison of growth and biochemical composition of *Mytilus galloprovincialis* (Lmk.) and *Mytilus edulis* (L.) on the West coast of Cotentin, Normandy, France 1999-2000. Aquaculture International, Vol 13, pp 327-340.

15. DNA damage to polluted mussels

Damage to DNA detected by use of the single-cell gel electrophoresis (comet) assay was monitored in blue mussels, *Mytilus edulis*, sampled from coastal waters in Denmark. Mussels from five locations in Koge Bay, an area receiving wastewater from many industries and municipalities, were collected five times during 1999 and six times in 2001. In 1999, both gill cells and haemolymph cells were examined, and sediments were sampled on three dates from the same five locations. In the autumn of 1999, mussels were also collected at six reference sites without known pollution.

Results showed a significantly higher level of DNA damage in gill cells compared with haemolymph cells. Because of this, only gill cells were sampled for the monitoring in 2001. Levels of DNA damage, expressed as tail moments, were significantly higher for the mussels in Koge Bay when compared with levels of DNA damage in mussels from the non-polluted coastal areas. No clear seasonal variation was demonstrated. Analysis of the correlation between chromium, nickel, cadmium and mercury in sediments and tail moments in haemolymph and gill cells from the five sites showed a statistically significant positive correlation between tail moments and chromium, nickel and cadmium.

Reference

Rank, J., Jensen, K., Jespersen, P.H., 2005. Monitoring DNA damage in indigenous blue mussels (*Mytilus edulis*) sampled from coastal sites in Denmark. Mutation Research-Genetic Toxicology and Environmental Mutagenesis, Vol 585, pp 33-42.

16. Immunocompetence in mussels

This study shows a partial recovery of the haemocyte responses in mussels originating from an industrialized site and transferred to an unindustrialized environment.

We measured the haemocyte responses of the blue mussels, *Mytilus edulis* (L.), transferred from a contaminated site (Pictou, NS, Canada) to a relatively clean site (Richibucto, NB, Canada) to assess the capacity of recovery of haemocytes. Mussels from each site were caged in Richibucto. Haemocyte count, phagocytic capacity, mortality and mitotic activity were measured 1, 4 and 9 days after caging. At the end of the 9-day exposure, 15 mussels from each site were evaluated for their capacity to clear bacteria, 36 h after having been injected with *Listonella anguillarum*.

Before caging, mussels native to Pictou had higher haemocyte counts and mitotic capacity and lower phagocytic capacity than mussels native to Richibucto. However, after the mussels had been caged and transferred from Pictou to Richibucto and as the exposure progressed, phagocytic capacity slowly rose to the level measured at Richibucto, the haemocyte count lowered and haemocyte mortality and mitotic activity rose. At the end of the experiment, bacteria-clearing was still more efficient in mussels originating from Richibucto than in those transferred from Pictou.

Reference

Mayrand, E. (elise@umcs.ca), St-Jean, S.D., Courtenay, S.C., 2005. Haemocyte responses of blue mussels (*Mytilus edulis* L.) transferred from a contaminated site to a reference site: can the immune system recuperate? Aquaculture Research, Vol 36, pp 962-971.

17. Mussel heart rate and salinity

The heart rate of specimens of *Mytilus edulis* both from the sub-littoral and littoral zones exposed to normal and altered salinity was investigated in a long-term experiment. The heart rate was monitored by a non-invasive method for nine days. The heart rate of sub-littoral mussels was higher than that of littoral ones. This suggests a higher level of metabolic activity in sub-littoral mussels. When exposed to moderate hypo salinity *M. edulis* from both zones showed a significant decrease in the heart rate with respect to the control salinity. The heartbeat quickly accelerated in all organisms when they were returned to the control salinity medium. Throughout the experiment, heart contractions halted with distinct periodicity in all mussels.

Reference

Bakhmet, I.N. (bakmet@bio.krc.karelia.ru), Berger, V.J., Khalaman, V.V., 2005. The effect of salinity change on

the heart rate of *Mytilus edulis* specimens from different ecological zones. Journal of Experimental Marine Biology and Ecology, Vol 318, pp 121-126.

18. Water flow, food and mussel beds

This is a report of a study of the role of hydrodynamics in controlling the food supply in the Menai Strait, which is tidally energetic with a pronounced residual flow. A comparison between the cycle of chlorophyll concentrations in water above an extensive, commercially-exploited, mussel bed and the corresponding cycle over a control site showed clear evidence of the influence of horizontal tidal advection on food supply. Consumption of phytoplankton by filtration over the mussel bed reduced concentrations and resulted in a pronounced horizontal gradient. Losses to filtration appeared to be compensated through transport of plankton-rich water into the Strait by the large residual flow while advection of the gradient by the tidal current resulted in large oscillations in chlorophyll concentration, with an amplitude of 50% of the mean. An analytical model of advection and consumption reproduced these features. The strong tidal flow maintained a high level of turbulence, so that the water column was generally well mixed vertically. Depletion of phytoplankton in the bottom boundary layer was, therefore, not present for most of the tidal cycle but on two occasions, when the observed Reynolds stress was close to zero at slack water, we did observe significant depletion at 1 m above the bed. This depletion is interpreted as the effect of mussel feeding briefly out-competing the supply of phytoplankton by vertical diffusion for the period of low turbulence. Assuming a steady state, we estimated the total supply of phytoplankton imported into the Menai Strait of 9.0 t C per d and the amount consumed by filter feeders in the area of the mussel bed of 4.5 t C per d.

Reference

Tweddle, J.F., Simpson, J.H. (j.h.simpson@bangor.ac.uk), Janzen, C.D., 2005. Physical controls of food supply to benthic filter feeders in the Menai Strait, UK. Marine Ecology-Progress Series, Vol 289, pp 79-88.

19. Estimating mussel biomass

The aim of this investigation was to develop appropriate methods for quantitative assessment of blue mussel beds. Combined methods of remote sensing, ground truth investigation and sampling in the field were applied to mature and young inter-tidal mussel beds. Three variables were measured to obtain reliable quantitative estimates of biomass and abundance: the total area covered by a bed; the cover, i.e. the area of mussel-covered patches in relation to the total mussel bed area; and the proportion, i.e. the area covered by

mussels within the patches in relation to the total area of mussel patches. Cover and proportion of inter-tidal blue mussel beds were measured in the field by use of transects. Aerial photographs enabled the total area of the beds to be determined and large-scale surveys of mussel beds to be carried out synchronously. By examining large-scale aerial photographs it was possible also to determine the cover by remote sensing.

It was found that the proportion could not be derived from aerial photographs, even from pictures at the largest scale tested during this investigation (scale 1:2500). It was estimated that 12 sub-samples (each covering 177 square cm) from mature beds, and 12 sub-samples (each covering 38 square cm) from young beds are needed to obtain reliable data on biomass and abundance.

Reference

Herlyn, M. (marc.herlyn@nlwkn-ny.niedersachsen.de), 2005. Quantitative assessment of intertidal blue mussel (*Mytilus edulis* L.) stocks: combined methods of remote sensing, field investigation and sampling. Journal of Sea Research, Vol 53, pp 243-253.

20. Slipper limpets and mussels

The American slipper limpet *Crepidula fornicata* (L.) was unintentionally introduced to Europe in the 1870s with oysters imported for farming. Since *C. fornicata* is a filter feeder, trophic competition and associated negative effects when epizootic on bivalves have been assumed. This study is the first to experimentally test in the field effects of the epizootic *C. fornicata* on survival and growth of the blue mussel.

In two field experiments of 12 weeks each, epigrowth by *C. fornicata* resulted in a 4- to 8-fold reduction in survival of mussels, equivalent to a mortality of 28% and 30%, respectively. Shell growth in surviving mussels with attached *C. fornicata* was 3 to 5 times lower compared to un-fouled mussels, but similar to that with artificial limpets. As a causative agent, interference competition in the form of changes in small-scale hydrodynamics due to stacks of *C. fornicata* is suggested. This may result in additional energy expenditure for byssus production by the mussels. Competition for food does not seem to be relevant. However, the generality of this assumption has to be verified by investigating associations of *C. fornicata* with other organisms on which it settles. This stresses the need for a species-by-species approach under diverse environmental settings in assessing impacts of introduced species. In the case of mussels, this study shows that *C. fornicata* has the potential to act as an important mortality factor.

Reference

Thieltges, D.W. (dthieltges@awi-bremerhaven.de), 2005. Impact of an invader: epizootic American slipper limpet

21. Using mussels to improve water quality

In the eastern Skagerrak, reductions in eutrophication are planned through reduction of nitrogen inputs, but it is unclear how this can be achieved. One possible method is the cultivation of filter-feeding organisms, such as blue mussels, which remove nitrogen while generating seafood, fodder and agricultural fertilizer, thus recycling nutrients from sea to land. The expected effect of mussel farming on nitrogen cycling was modelled for the Gullmar Fjord on the Swedish west coast and it is shown that the net transport of nitrogen (sum of dissolved and particulate) at the fjord mouth was reduced by 20%. Existing commercial mussel farms already perform this service for free, but the benefits to society could be far greater. We suggest that rather than paying mussel farmers for their work, nutrient trading systems are introduced to improve coastal waters. In this context an alternative of mussel farming to nitrogen reduction in the sewage treatment plant in the Lysekil community is presented. Accumulation of bio-toxins has been identified as the largest impediment to further expansion of commercial mussel farming in Sweden, but the problem seems to be manageable through new techniques and management strategies.

Reference

Lindahl, O. (odd.lindahl@kmf.gu.se), Hart, R., Hernroth, B., Kollberg, S., Loo, L.O., Olrog, L., Rehnstam-Holm, A.S., Svensson, J., Svensson, S., Syversen, U., 2005. Improving marine water quality by mussel farming: A profitable solution for Swedish society. *Ambio*, Vol 34, pp 131-138.

22. Offshore mussel farming

Offshore production offers a new perspective for mussel aquaculture in the German Bight as no expansion is possible in the inter-tidal and sub-tidal zone of the Wadden Sea, because of restrictions on the number of licenses. The development of offshore wind farms offers a unique opportunity because of the associated infrastructure. Service platforms, as well as the pylons themselves, offer perfect structures for mooring long-lines and other culture units. One of the advantages of offshore culture may be a lower parasite load in offshore mussels compared with mussels produced under traditional inshore bottom culture. By sampling mussel spat from suspended buoys offshore or collectors, we simulated an offshore culture situation and compared parasite infestation rates with those in mussel spat obtained from various inshore sites.

Mussels from offshore sites were free of trematodes and shellboring polychaetes. Parasitic copepods only occurred at a single offshore site, on a 20-year-old research platform, but not on buoys or collectors exposed for shorter time periods. All three monitored parasite taxa were present at all other inshore sites. The highest prevalence was found for trematodes in inshore benthic inter-tidal mussels (78.7 +/- 6.4%) and locally reached 100%. Through a variety of detrimental effects, trematodes, parasitic copepods and shell-boring polychaetes are known to affect growth performance and product quality. We therefore propose that offshore mussel production could be a promising culture procedure because it seems to result in lower parasite burden than at traditional culture sites. Whether offshore production also results in better survival and growth, compared with inshore mussel culture on a commercial scale, needs to be investigated further.

Reference

Buck, B.H., Thielges, D.W. (dthielges@awi-bremerhaven.de), Walter, U., Nehls, G., Rosenthal, H., 2005. Inshore-offshore comparison of parasite infestation in *Mytilus edulis*: implications for open ocean aquaculture. *Journal of Applied Ichthyology*, Vol 21, pp 107-113.

23. *Giardia* in Spanish mussels

This is the first work that describes the presence of *Giardia* cysts in mussels (*Mytilus galloprovincialis*) destined for human consumption.

Between January and June 2004, a total of 200 non-depurated mussel samples from the Galician coast (northwest Spain) were examined for *Giardia* cysts with a direct immunofluorescence antibody test. *Giardia* cysts were found in mussels from all of the estuaries studied, with an overall rate of contamination of 41.5%. There was a relationship between the presence of *Giardia* cysts, the microbiological contamination (expressed as most probable number of *Escherichia coli*) detected in the samples, and the harvesting area.

Reference

Gomez-Couso, H., Mendez-Hermida, F., Castro-Hermida, J.A., Ares-Mazas, E. (mpeares@usc.es), 2005. Occurrence of *Giardia* cysts in mussels (*Mytilus galloprovincialis*) destined for human consumption. *Journal of Food Protection*, Vol 68, pp 1702-1705.

24. An algal infestation in mussels

During summer 2001, blue mussels with abnormal shell growth were observed near Kragero, southern Norway. Samples were collected and examined.

The mussels had green spots in their mantle and in

the adductor muscle. Mussels from four sites had a prevalence of green spots varying from 2 to 71% that correlated well with shell deformities. Histological examination revealed the presence of round or ovoid algae, of a size 0.9-1.5 x 1.2-2.4 µm, free within haemocytes and in the lesions, characterised by an inflammatory response and the presence of cellular debris. The algae contain a relatively large nucleus, 1 chloroplast and 1 mitochondrion. Size and morphology suggest that the alga might be a picoeucaryot green alga.

Infection of mussel tissues appears to start in the posterior mantle edge, near the siphons, and spread anterior-ventrally in the mantle connective and storage tissues. Occasionally spots were also found in the gonad follicles. Large infected areas were also observed in sinuses within the adductor muscle. Only mussels that were 3 yr old or more were infected. Deformations apparently resulted from years of continuous shell formation by a contracted, partly deformed mantle. Most deformed mussels had eroded shells; allowing some light penetration through the exposed, thin nacre. Young, thin-shelled mussels were not infected. The present work suggests that the alga has, at least partially, a parasitic relationship with the mussels, and is associated with pathological alterations in mussel tissues.

Reference

Mortensen, S. (stein.mortensen@imr.no), Harkestad, L.S., Stene, R.O., Renault, T., 2005. Picoeucaryot alga infecting blue mussel *Mytilus edulis* in southern Norway. Diseases of Aquatic Organisms, Vol 63, pp 25-32.

25. Food availability and algae toxins in long-line mussel farms

Seawater velocity, meat content, food availability, and algae toxins were measured in a commercial long-line mussel farm in Lysefjorden, in southern Norway.

The mean current speed decreased rapidly within the farm area. The current speed 30 m inside the farm was reduced to less than 30% compared with the current speed outside the farm. The reduction was a consequence of friction from the mussels and farm structures. More than 50% of the incoming phytoplankton biomass (chlorophyll a) was depleted within the first 30 m in the mid section of the farm. After this decrease the chlorophyll a concentrations stabilized throughout the farm. The reduction in current speed led to food depletion and lower meat content within the farm. The concentration of diarrhetic shellfish toxins (DST) was inversely related to the meat content of the mussels. This relationship can be used to optimize monitoring programs for shellfish toxins. The range of DST in mussels varied from 0.40 to 1.60 mg per kg steamed meat within the farm. It is suggested that depuration of DST was faster in areas with high food availability.

Reference

Strohmeier, T. (tore.strohmeier@imr.no), Aure, J., Duinker, A., Castberg, T., Svardal, A., Strand, O., 2005. Flow reduction, seston depletion, meat content and distribution of diarrhetic shellfish toxins in a long-line blue mussel (*Mytilus edulis*) farm. Journal of Shellfish Research, Vol 24, pp 15-23.

26. *Marteilia* in mussels and oysters

The aim of this work was to determine whether the two previously described *Marteilia* molecular types ('O' (*Marteilia* from oyster or *Marteilia refringens*) and 'M' (*Marteilia* from mussels or *Marteilia maurini*)) exist in the Iberian Peninsula, and the strictness of the association with their bivalve host species.

The sequence variability in the internal transcribed spacer-1 (ITS-1) gene of *Marteilia* species was studied in mussels, *Mytilus galloprovincialis*, and flat oysters, *Ostrea edulis*, from different geographical locations in Spain, to establish the existence and the distribution of different species or molecular types. Although there were two distinct evolutionary lineages that corresponded more or less strictly with the 'M' and 'O' types, it was evident from the estimated phylogeny that some 'O' types have switched to 'M' type, and vice versa. Moreover, 'O' types were found in mussels and 'M' types were found in oysters, which suggests that there have been several cross-species transmissions of *Marteilia* between mussels and oysters.

Reference

Novoa, B., Posada, D., Figueras, A. (patol@iim.csic.es), 2005. Polymorphisms in the sequences of *Marteilia* internal transcribed spacer region of the ribosomal RNA genes (ITS-1) in Spain: genetic types are not related with bivalve hosts. Journal of Fish Diseases, Vol 28, pp 331-338.

27. Detecting *Marteilia*

An in situ hybridisation technique has been developed for the detection of infection in oysters with *Marteilia refringens*, with particular emphasis on light infections and on confirmation of suspected cases following examination by histology.

Although validation of new diagnostic methods is usually achieved by comparison with standard techniques, the sensitivity and specificity of the standard (histology) method for *Marteilia refringens* had never been established. Surveillance and monitoring frequently target populations displaying different levels of prevalence under different field conditions. The objective of our study was to evaluate the sensitivity and specificity values of in situ hybridisation and histology for the detection of *M. refringens*, based on three populations of flat oysters, one free of the disease

and two with mild and high levels of prevalence. A blind assay of 200 individuals from each population was performed using both techniques. Results were analysed by various approaches.

The most realistic estimate shows a link between the level of prevalence and the sensitivity of the techniques. Values of sensitivity and specificity for histology were 0.7 and 0.99 respectively, and 0.9 and 0.99 respectively in the case of in situ hybridisation. Some uncertainty remains regarding these values because the study does not take into account the severity of infection or the developmental stages of the parasite actually present in each individual. This work provides valuable information with regard to the choice and potential use of those two diagnostic methods as currently recommended by international standards.

Reference

Thebault, A., Bergman, S., Pouillot, R., Le Roux, F., Berthe, F.C.J. (fberthe@upei.ca), 2005. Validation of in situ hybridisation and histology assays for the detection of the oyster parasite *Marteilia refringens*. *Diseases of Aquatic Organisms*, Vol 65, pp 9-16.

28. Manila clam parasites

Recently, natural stocks of the Manila clam have declined drastically in Japan. To clarify the reason for this, clams were sampled monthly from Yamaguchi and processed for histological observations, during which three protozoan parasites were discovered.

Transmission electron microscopy revealed that these parasites were an unidentified haplosporidian in the connective tissues, *Marteilia* sp. in the digestive gland and *Marteilioides* sp. in the oocytes. Histopathological observations suggest that *Marteilia* sp. and *Marteilioides* sp. were not pathogenic to the host. However, infection with a haplosporidian may have a negative impact on the clams. The prevalence of these parasites was low and further investigations need to be undertaken to clarify their taxonomic status and establish any pathogenicity.

Reference

Itoh, N., Momoyama, K., Ogawa, K. (aogawak@mail.ecc.u-tokyo.ac.jp), 2005. First report of three protozoan parasites (a haplosporidian, *Martelia* sp and *Martelioides* sp.) from the Manila clam, *Venerupis* (= *Ruditapes*) *philippinarum* in Japan. *Journal of Invertebrate Pathology*, Vol 88, pp 201-206

29. Detecting *Mikrocytos*

The protistan parasite *Mikrocytos mackini*, causative agent of Denman Island disease (Mikrocytosis), induces mortality and reduces marketability in the

Pacific oyster in British Columbia, Canada. This parasite is a pathogen of international concern because it infects a range of oyster species, and because its life cycle and mode of transmission are unknown.

A digoxigenin-labelled DNA probe in situ hybridisation technique (DIG-ISH) was developed, and its detection sensitivity was compared to standard histological sections stained with haematoxylin and eosin. In stained preparations, the detection of *M. mackini* was certain only when the parasite occurred within the vesicular connective tissue of adult oysters. However, the DIG-ISH technique clearly demonstrated the presence of infection in all other host tissues as well as in juvenile oysters with poorly developed vesicular connective tissue. The probe hybridised strongly to *M. mackini*, did not hybridise to oyster tissues or with the other shellfish parasites tested, and was more sensitive for detecting infections when compared to histology.

Reference

Meyer, G.R., Bower, S.M. (bowers@dfo-mpo.gc.ca), Carnegie, R.B., 2005. Sensitivity of a digoxigenin-labelled DNA probe in detecting *Mikrocytos mackini*, causative agent of Denman Island disease (Mikrocytosis), in oysters. *Journal of Invertebrate Pathology*, Vol 88, pp 89-94.

30. Genetics of native oysters

Samples of *Ostrea edulis* were collected during 1999 and 2000 from five sites in Scotland, and from one site each in Northern Ireland, Ireland, France, The Netherlands and Norway. Samples were scored at four microsatellite loci. Mean numbers of alleles per locus varied from 12.6 to 16.6 and observed heterozygosity per locus ranged from 0.801 to 0.845. Samples derived originally from hatchery seed showed significantly fewer alleles per locus and significantly reduced expected heterozygosity compared with wild populations. However, observed heterozygosity did not differ significantly between the two groups. Significant deficiencies of heterozygotes were present at one or more loci in four of the ten populations sampled and a significant excess of heterozygotes was present at one locus in a hatchery-sourced Scottish population. Genetic distance indices revealed that the Norway population was the most distinct from all others and that hatchery-sourced populations were also relatively distinct from other wild populations. However, genetic subdivision was generally low implying high historical 'migration' rates for these populations.

Reference

Sobolewska, H., Beaumont, A.R. (a.r.beaumont@bangor.ac.uk), 2005. Genetic variation at microsatellite loci in northern populations of the European flat oyster (*Ostrea edulis*). *Journal of the Marine Biological Association of the United Kingdom*, Vol 85, pp 955-960.

31. Bonamia-resistant oysters

Infection by *Bonamia ostreae* has caused extensive mortalities of oysters *Ostrea edulis* through European and United States coasts for at least 25 years. The development of a bonamiosis-resistant strain seems a promising strategy to fight against the disease. The results from this study suggest that the profitability of oyster farming in Galicia could improve, even under bonamiosis pressure, by using oyster spat from the appropriate source.

Evaluation of variability in productive traits and disease susceptibility of European populations was performed to identify favourable oyster populations with which to start selective breeding in Galicia (NW Spain). Oysters taken from Greece, Ireland, Ortigueira (Galicia) and Coroso (Galicia) were used as brood stock, and 19 seed families were produced (4-5 families from each origin). The oyster families were used to assess variability after on-growing in an area of the Ria de Arousa heavily affected by bonamiosis.

Results showed significant differences in growth, mortality and susceptibility to bonamiosis and other diseases, both between origins and between families under origins. Bonamiosis was associated with mortality in the late stage of oyster on-growing. Indications were found of natural selection of oysters of the Ortigueira population. These were less susceptible to bonamiosis due to their long exposure to the disease.

Reference

da Silva, P., Fuentes, J., Villalba, A. (villalba@cimacoron.org), 2005. Growth, mortality and disease susceptibility of oyster *Ostrea edulis* families obtained from brood stocks of different geographical origins, through on-growing in the Ria de Arousa (Galicia, NW Spain). Marine Biology, Vol 147, pp 965-977.

32. Treating for polychaete worms

Hyposaline treatment is recommended as a simple and cost-effective method for the control of shell infestation by the polydorid polychaete, *Boccardia acus* in the farmed Chilean oyster, *Tiostrea chilensis*.

Attempts to commercially farm the Chilean oyster in New Zealand are hampered by high levels of shell infestation by *Boccardia acus*. Wild stock in the warmer, northern waters of New Zealand typically present a mean of 8.6 +/-0.7 worms per right upper valve from an early stage of development (similar to 17 mm shell height). Both hypersaline and freshwater treatments were effective in reducing worm numbers, but freshwater treatment for 180-300 min was most effective and resulted in > 98% worm mortality without producing any obvious harmful effects on the oyster.

Reference

Dunphy, B.J. (b.dunphy@auckland.ac.nz), Wells, R.M.G., Jeffs, A.G., 2005. Polydorid infestation in the flat oyster, *Tiostrea chilensis*: hyposaline treatment for an aquaculture candidate. Aquaculture International, Vol 13, pp 351-358.

33. Vibrio indicators in mussels

The uptake of *Escherichia coli*, *Vibrio cholerae* non-O1 and *Enterococcus durans* by mussels (*Mytilus galloprovincialis*) and the times for depuration were investigated in order to determine the most useful indicator of *Vibrio* contamination.

The mussels were maintained in tanks of static seawater contaminated with bacteria at 5 log (base 10) CFU/ml for bioaccumulation. Each organism was presented alone and with others to mussels, at temperatures of 14 and 21 degrees C.

In water contaminated with either single or mixed organisms the bacteria accumulated rapidly in the mussels reaching high concentrations after 1 h. With both single and mixed organisms, the maximum numbers of *E. coli* in mussels were 6.6 log (base 10) CFU/g at 14 degrees C and 5.4 log (base 10) CFU/g at 21 degrees C. Both *V. cholerae* non-O1 and *E. durans* alone and with other organisms reached a number ranging from 6.5 to 7 log (base 10) CFU/g at both temperatures.

During depuration, in re-circulating seawater, the numbers of all the organisms slowly decreased, with *E. coli* alone, numbers ranged from 2.8 to 2 log (base 10) CFU/g after 72 h at both 14 and 21 degrees C, and the organisms were undetectable after 144 h. With mixed organisms at 14 degrees C *E. coli* became undetectable after 168 h but at 21 degrees C no *E. coli* were recovered after 72 h. At 14 degrees C *V. cholerae* non-O1 alone was also undetectable after 168 h, but at 21 degrees C and with mixed organisms at both temperatures. *V. cholerae* was recovered after 168 h at numbers of about 1 log (base 10) CFU/g. After 168 h numbers of *E. durans* alone ranged from 2.6 log (base 10) CFU/g at 14 degrees C to 1.5 log (base 10) CFU/g at 21 degrees C, and with mixed organisms the numbers ranged from 2.3 to 2.0 log (base 10) CFU/g at both temperatures.

In summary, of the three bacteria of faecal origin, *E. durans* is quickly acquired by mussels and released more slowly than the others, while *E. coli* quickly becomes undetectable. The results suggest that, for this kind of seafood, enterococci may be a more appropriate indicator than *E. coli* of risks to consumers from vibrios.

Reference

Marino, A. (marmo@pharma.unime.it), Lombardo, L., Fiorentino, C., Orlandella, B., Monticelli, L., Nostro, A.,

Alonzo, V., 2005. Uptake of *Escherichia coli*, *Vibrio cholerae* non-O1 and *Enterococcus durans* by, and depuration of mussels (*Mytilus galloprovincialis*). International Journal of Food Microbiology, Vol 99, pp 281-286.

34. Post harvest treatment for Vibrios

Vibrio vulnificus produces serious illnesses that are commonly associated with shellfish consumption, particularly raw oysters. Therefore, post-harvest treatments to reduce vibrio levels in oysters have been recommended. In this study, rapid chilling by immersion of unwashed whole oysters in ice for 3 h was assessed as a post-harvest treatment for reduction of *V. vulnificus*. Treated oysters were subsequently refrigerated at 7.2 degrees C, whereas control oysters were not iced but were maintained refrigerated throughout the study.

Numbers of *V. vulnificus* generally declined in treated samples compared with controls; however, increases in total heterotrophic bacteria and faecal coliforms were also observed in treated samples. Because of the relatively small declines in *V. vulnificus* numbers and the possibility of concomitant increases in faecal coliform and total bacterial contamination this study does not support the use of ice immersion as a post-harvest method.

Reference

Quevedo, A.C., Smith, J.G., Rodrick, G.E., Wright, A.C. (acwright@ifas.ufl.edu), 2005. Ice immersion as a post-harvest treatment of oysters for the reduction of *Vibrio vulnificus*. Journal of Food Protection, Vol 68, pp 1192-1197.

35. Detecting Noroviruses

Noroviruses are the most important cause of outbreaks of acute gastroenteritis worldwide and are commonly found in shellfish grown in polluted waters. In the present study, we developed broadly reactive one-step TaqMan reverse transcription (RT)-PCR assays for the detection of genogroup I (GI) and GII Noroviruses in faecal samples, as well as shellfish samples. The specificity and sensitivity of all steps of the assays were systematically evaluated. In the final format, the monoplex assays were validated by using RNA extracted from a panel of 84 stool specimens, which included Norovirus strains representing 19 different genotypes (7 GI, 11 GII, and 1 GIV strains). The assays were further validated with 38 shellfish cDNA extracts previously tested by nested PCR. Comparison with a recently described real-time assay showed that our assay had significantly higher sensitivity and was at least as sensitive as the nested PCR. For stool specimens, a one-step duplex TaqMan RT-PCR assay performed as well as individual genogroup-

specific monoplex assays. All other enteric viruses examined were negative, and no cross-reaction between genogroups was observed. These TaqMan RT-PCR assays provide rapid (less than 90 min), sensitive, and reliable detection of Noroviruses and should prove to be useful for routine monitoring of both clinical and shellfish samples.

Reference

Jothikumar, N., Lowther, J.A., Henshilwood, K., Lees, D.N., Hill, V.R., Vinje, J. (janvinje@email.unc.edu), 2005. Rapid and sensitive detection of noroviruses by using TaqMan-based one-step reverse transcription-PCR assays and application to naturally contaminated shellfish samples. Applied and Environmental Microbiology, Vol 71, pp 1870-1875.

36. Toxic algae and climate change

In temperate seas such as the North Sea harmful (toxic) algal blooms will probably increase as a result of climate change. This conclusion was reached after investigating the projected effect of climate change for the year 2100 in Dutch coastal waters of a 4 degrees C temperature rise and increased water column stratification on the growth rates of six harmful and two non-harmful phytoplankton species.

Two species with estimated doubled growth rates in 2100, *F. japonica* and *C. antiqua*, both entered Europe via ship's ballast water or shellfish imports. This stresses the need to legally regulate such invasion routes in order to prevent the import of novel species.

Reference

Peperzak, L. (L.Peperzak@rikz.rws.minvenw.nl), 2005. Future increase in harmful algal blooms in the North Sea due to climate change. Water Science and Technology, Vol 51, pp 31-36.

37. Measuring yessotoxins

This study shows that ELISA is a reliable method for estimating the total level of yessotoxins (YTXs) in mussels. We propose the use of ELISA as a screening tool with a cut-off limit at 4 mg/kg for negative samples, whereas samples above this limit would be re-analyzed by LC-MS.

Blue mussels (*Mytilus edulis*) collected from Flodevigen Bay, Norway, in 2001 and 2002 and were analysed for yessotoxins (YTXs) by ELISA and yessotoxin (YTX), 45-hydroxyYTX, and carboxyYTX by LC-MS. Results from the two methods were compared to evaluate the ELISA. The response in the ELISA was 3-13 times higher than LC-MS, probably due to the antibodies binding to other YTX analogues not included in the LC-MS analysis. Nevertheless, the

correlation between ELISA and LC-MS was good. YTX was a minor component in the blue mussels at all times compared to 45-hydroxyYTX and especially carboxyYTX, except when a bloom of *P. reticulatum* occurred. The results also indicate the presence of significant amounts of YTX analogues in addition to those measured by LC-MS. All samples below 4 mg/kg by ELISA were below the current EU regulatory limit of 1 mg/kg by LC-MS.

Reference

Samdal, I.A. (ingunn.samdal@vetinst.no), Aasen, J.A.B., Briggs, L.R., Dahl, E., Miles, C.O., 2005. Comparison of ELISA and LC-MS analyses for yessotoxins in blue mussels (*Mytilus edulis*). *Toxicon*, Vol 46, pp 7-15.

38. Toxic algae alter bird-feeding behaviour

We demonstrate how harmful algal bloom (HAB) toxins can change the strength of consumer-prey interactions by altering the foraging behaviour of avian predators on rocky and sandy shores.

Changes in the foraging behaviour and diet of 5 common northern California shorebirds (black oystercatchers, godwits, sanderlings, whimbrels, and willets) correlated with the predicted seasonal variation in paralytic shellfish poisoning toxin (PSPT) concentrations in their two major invertebrate prey species, sea mussels and sand crabs, at two locations along the California coast.

In rocky habitats, when mussel PSPT concentrations exceeded 150 ug saxitoxin (STX) equivalents per 100 g, oystercatchers increased their consumption of smaller, non-PSPT-accumulating prey (limpets), as well as their discard rate of captured mussel tissue. In sandy habitats, when sand crab PSPT concentrations exceeded 150 to 200 ug saxitoxin (STX) equivalents per 100 g, shorebird abundance decreased, while their rejection rate of sand crab prey increased.

These results confirm the prediction that shorebirds are able to detect and avoid consumption of lethal amounts of PSPT, and that the movement of HAB toxins through the marine food web can alter upper-level trophic interactions.

Reference

Kvitek, R., Bretz, C. (carrie_bretz@csumb.edu), 2005. Shorebird foraging behaviour, diet, and abundance vary with harmful algal bloom toxin concentrations in invertebrate prey. *Marine Ecology-Progress Series*, Vol 293, pp 303-309.

39. Long days favour ASP species

Marine planktonic diatoms of the genus *Pseudo-nitzschia* have been responsible for amnesic shellfish poisoning (ASP) events worldwide through the production of the neurotoxin domoic acid. The appearance and toxicity of *Pseudo-nitzschia* species is variable throughout the year and potentially linked to changes in environmental parameters; many ASP events occur in relatively high latitudes where day length is particularly variable with season. In UK waters, shellfish monitoring has prevented any impact on human health but has led to long-term closures of fisheries, with severe economic consequences.

Laboratory experiments on two *Pseudo-nitzschia* species typically found in Scottish West Coast waters during spring (short photoperiod) and summer (long photoperiod) conditions were conducted to determine the influence of photoperiod on their growth and toxicity.

Results indicated that non-toxic *P. delicatissima* achieved a greater cell density under Short Photoperiod (9-h light: 15-h dark (L:D) cycle). For toxin-producing *P. seriata*, a Long Photoperiod (18-h L:6-h D cycle) resulted in an enhanced growth rate, cell yield and total toxin production.

Reference

Fehling, J. (jf510@york.ac.uk), Davidson, K., Bates, S.S., 2005. Growth dynamics of non-toxic *Pseudo-nitzschia delicatissima* and toxic *P. seriata* (Bacillariophyceae) under simulated spring and summer photoperiods. *Harmful Algae*, Vol 4, pp 763-769.

40. A review of *Prorocentrum*

Prorocentrum minimum (Pavillard) Schiller, a common bloom-forming dinoflagellate, is the cause of harmful blooms in many estuarine and coastal environments. Blooms appear to be undergoing a geographical expansion and a relationship appears to exist between blooms of this species and increasing coastal eutrophication.

Although shellfish toxicity with associated human impacts has been attributed to *P. minimum* blooms from a variety of coastal environments (Japan; France; Norway; Netherlands; New York, USA), only clones isolated from the Mediterranean coast of France, and shellfish exposed to *P. minimum* blooms in this area, have been shown to contain a water-soluble neurotoxic component that killed mice. Detrimental ecosystem effects associated with blooms range from fish and zoobenthic mortalities to shellfish aquaculture mortalities, attributable to both indirect biomass effects (e.g., low dissolved oxygen) and toxic effects. *P. minimum* blooms generally occur under conditions

of high temperatures and incident irradiances and low to moderate salinities in coastal and estuarine environments, although they have been found under widely varying salinities and temperatures if other factors are conducive for growth. The physiological flexibility of *P. minimum* in response to changing environmental parameters (e.g., light, temperature, salinity) as well as its ability to utilize both inorganic and organic nitrogen, phosphorus, and carbon nutrient sources, suggest that increasing blooms of this species are a response to increasing coastal eutrophication.

Reference

Heil, C.A. (Cindy.Heil@fwc.state.fl.us), Glibert, P.M., Fan, C.L., 2005. *Prorocentrum minimum* (Pavillard) Schiller - A review of a harmful algal bloom species of growing worldwide importance. *Harmful Algae*, Vol 4, pp 449-470.

41. Juvenile lobster behaviour

The behaviour of juvenile European lobsters (*Homarus gammarus*) in the wild is little understood. A laboratory system was designed with a maze-like environment to simulate a field study.

Juvenile lobsters of total length 68 to 115 mm were studied. The lobsters were mainly nocturnal. They established home shelters in which they spent the day and covered distances of 1,200 to 1,600 m during the night. On average, the lobsters performed 136 excursions from their shelters, of which 10% led only to the immediate surroundings of the shelters. Of all the excursions 90% were shorter than 16 m. In some exceptional cases distances of several hundred meters were covered in the maze between shelter visits. Excursions of less than 16 m lasted on average less than 5 min. The frequencies of shelter visits during the dark phase were highest in small lobsters (300 visits) and lowest in larger lobsters (50 visits). The time spent within shelters decreased from 10% to less than 2% with lobster size. A distinct change in behaviour was obvious at a body length of 75 to 80 mm. Smaller lobsters behaved defensively and relied on shelter protection. Larger lobsters were less dependent on shelter protection and thus were able to explore and utilize their environment more intensively.

Reference

Mehrtens, F., Stolpmann, M., Buchholz, F. (fbuchholz@awi-bremerhaven.de), Hagen, W., Saborowski, R., 2005. Locomotory activity and exploration behaviour of juvenile European lobsters (*Homarus gammarus*) in the laboratory. *Marine and Freshwater Behaviour and Physiology*, Vol 38, pp 105-116.

42. Effects of fishing on *Nephrops* discards and escapees

The Norway Lobster *Nephrops norvegicus* (L.) was captured by trawling at depths of 120 to 150 m off the West Coast of Scotland using commercial fishing gears. Discarded animals (normally < 25-35 mm carapace length) were sampled immediately after capture, and following emersion (exposure to air) on deck for 1 or 2 h. Their recovery from, and survival of, the stresses of being fished were examined in separate groups of animals transferred by SCUBA divers to underwater cages on the seabed at a mean depth of 24 m. "Escaped" *N. norvegicus* were collected in a small-meshed (40 mm) "cover" around the cod-end and sampled without emersion. It was assumed that the physiological state of these animals would be similar to those passing through the cod-end meshes directly back into the surrounding sea during normal fishing operations. Groups of escaped animals were also transferred to underwater cages for recovery and survival studies. Control animals (creel-caught from the same fishing grounds) were sampled after recovery in underwater cages.

Discarded animals showed significant reductions in total body water content compared to controls but recovered after 24 h. Controls that had been damaged by puncturing also showed a reduction in water content. Escaped animals showed significantly higher mean water content compared to discards. Haemolymph volumes were also reduced in discarded animals suggesting that significant blood loss occurs during capture. There was also evidence of a shift of fluid from haemolymph to tissues in discarded animals. Pericardial (haemolymph) pressures were much reduced in discards compared to undisturbed control animals but showed significant recovery in surviving animals. Pressure reduction was less in escapes but was seen in control animals that had been exercised to exhaustion.

Reference

Harris, R.R. (rrh@leicester.ac.uk), Andrews, M.B., 2005. Physiological changes in the Norway lobster *Nephrops norvegicus* (L.) escaping and discarded from commercial trawls on the West Coast of Scotland - I. Body fluid volumes and haemolymph composition after capture and during recovery. *Journal of Experimental Marine Biology and Ecology*, Vol 320, pp 179-193.

43. Fishing disturbance of Manila clams

The present study is a first attempt at evaluating the effects of repeated disturbance, such as that caused by mechanical fishing systems, on Manila clams. Under-sized clams were subjected to experimental shaking in the laboratory, and detrimental effects were investigated by applying the biomarker approach.

Changes in physiological, biochemical and behavioural responses were evaluated by determining scope for growth, adenylate energy charge, survival time in air, re-burrowing response and shell damage. Responses highlighted general worsening in clam condition as mechanical stress increased. Among the various measurements, survival time in air and re-burrowing response appeared particularly suitable as indices, their responsiveness and applicability suggesting their use in assessing mechanical stress due to dredging in field conditions.

Reference

Marin, M.G. (mgmar@civ.bio.unipd.it), Moschino, V., Meneghetti, F., Da Ros, L., 2005. Effects of mechanical stress in under-sized clams, *Tapes philippinarum*: a laboratory approach. *Aquaculture International*, Vol 13, pp 75-88.

44. Scallop swimming behaviour

Queen scallops, *Aequipecten opercularis*, caught in different seasons demonstrated marked differences in swimming performance. When stimulated to swim at natural ranges of temperature, Winter (cold acclimatised), animals accelerated faster than autumn collected animals swimming at the same temperature and attained higher velocities during jetting. The effects of acclimatisation were confined to the jetting phase and may be a mechanism for the maintenance of acceleration during escape from predators.

Reference

Bailey, D.M. (d4bailey@ucsd.edu), Johnston, I.A., 2005. Temperature acclimatisation of swimming performance in the European Queen Scallop. *Journal of Thermal Biology*, Vol 30, pp 119-124.

45. Nursery cultivation of great scallops

A technique for growing small great scallop spat in suspension culture from rafts is described.

Hatchery produced spat of initial size 3.0 mm and 4.3 mm shell height were transferred to a sea-based primary nursery system in May. Scallop spat (3.0 mm) grew to 16.8 mm in 85 days. Survival was 70.0 %, except for in 33.4% of the sampling units with predators, where survival was between 0 and 37.4%. Important predators were crabs and starfish (*Asterias rubens*). A significant negative correlation was found between starfish arm length and survival of scallops. Initial shell height affected growth and survival significantly whereas stocking density (50-400 spat per quarter and initial coverage of 1% to 17%) had a significant effect on growth only. Spat of 4.3 mm

initial size were significantly bigger than the spat of 3.0 mm after 34 and 57 days, whereas survival was 96 % versus 71% after 37 days. No mortality occurred during the second sampling period, but growth was then negatively correlated to increased density of spat.

Reference

Louro, A., Christophersen, G., Magnesen, T., Roman, G. (guillermo.roman@co.ieo.es), 2005. Suspension culture of the great scallop *Pecten maximus* in Galicia, NW Spain - Intermediate primary culture of hatchery produced spat. *Journal of Shellfish Research*, Vol 24, pp 61-68.

46. Chitosan preserves strawberries

Strawberries are highly perishable and characterized by a short shelf life. Chitosan has been found to be an ideal preservative coating material for fresh berries due to its antifungal and film-forming properties. However, acid-dissolved chitosan solutions develop bitterness and astringency tastes, making chitosan-coated foods less practical on the real market.

Three 1% chitosan-based solutions were developed for coating strawberries: chitosan in 0.6% acetic acid solution, in 0.6% lactic acid solution, and in 0.6% lactic acid solution plus 0.2% vitamin E. Coated strawberries were packed in clam-shell boxes and stored at 2 degrees C and approximately 88% to 89% relative humidity for 1 wk, at which time they were evaluated by consumers for "liking" or acceptance attributes and by trained panel for describing the appearance, texture, and flavour of the strawberries.

Results from consumer testing at 1 d and 1 wk after coating indicated that chitosan coatings increased the appearance acceptance of the strawberries, but coatings containing vitamin E decreased acceptable appearance of strawberries. Chitosan coatings did not change consumer acceptability of flavour, sweetness, or firmness of the samples. Trained panel results after 1 wk of storage showed that chitosan-coated strawberries have similar sensory descriptors as those of fresh berries, whereas coatings containing vitamin E developed the waxy-and-white surface of the samples. The trained panel did not detect astringency difference among all samples, indicating that 1% chitosan coating did not change astringency of strawberries.

Reference

Han, C.R., Lederer, C., McDaniel, M., Zhao, Y.Y. (Yanyun.zhao@oregonstate.edu), 2005. Sensory evaluation of fresh strawberries (*Fragaria ananassa*) coated with chitosan-based edible coatings. *Journal of Food Science*, Vol 70, pp S172-178.

Shellfish in the Press

Massive mussel increase

BOTH VOLUME and price of fresh prepared, pre-packed mussels is on the rise in France.

Volume shot up by 69%, and prices by 11.5% between 2002 and 2003, with supermarkets responsible for 99.3% of sales, according to figures from the Comité National de la Conchyliculture.

Volume sales of Mediterranean and other French mussels were down 17.2% and 16.1%, respectively, while volume sales of Dutch mussels went up 77.3%, and mussels from other countries rose 44.2%.

Volume sales of all Pacific oysters declined 2.8% during the same period while the average price rose 5.1%.

Volume sales of size 4 and 5 Pacific oysters rose 13.6%, and their price rose 12.4%, while volume sales of No1 and 2 oysters dropped 20.2%, but saw average prices rise 9.6%.

Fish Farming International, May 2005

Nephrops leads the way

With annual landings of 20,000 tonnes valued at £52m, the latest official landing statistics (2003) show that in terms of value nephrops is the single most important species caught by Scottish fishermen.

It is ahead of mackerel £41m (99,000 tonnes), haddock £25m (38,000 tonnes), scallops £16m (10,000 tonnes), monkfish £15m (7000 tonnes), cod £14m (9000 tonnes) brown crab £11m (9000 tonnes) and herring £6.5m (52,000 tonnes).

With the exception of Peterhead, Scrabster and Kinlochbervie, prawns form the backbone of landings from former seine net/white fish at ports such as Eyemouth and Pittenweem in south east Scotland, and at Fraserburgh, Buckie,



Sincere V enters Pittenweem harbour ahead of Sea Spray II. Prawns form the backbone of landings at the Fife port.

Stornoway, Lochinver, Ullapool, Mallalag and Oban round Scotland to Tarbert, Campbeltown, Carradale, Troon and Gfivan in the Clyde.

Higher prices have seen skippers and crews of creel boats tubing live prawns for direct sale to outlets in Spain for several years now.

More recently, several smaller west coast trawlers have changed their way of

working to benefit from this specialist market. Trawlers that previously towed for four hours now heave up after only two hours, in order to keep prawn in optimum condition.

With some boats trawling down to 100 fathoms, this is the equivalent to losing a tow a day, and therefore of marginal benefit to all but the smaller class of boat.

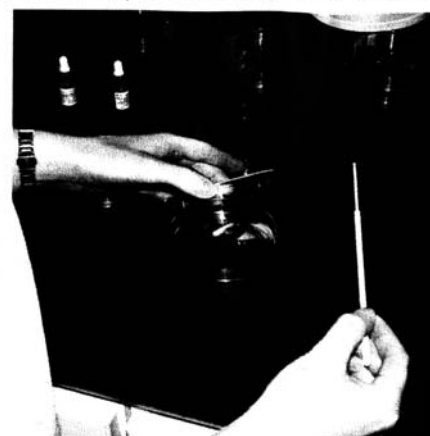
Fishing News, 20 May 2005

Boost for Scottish aquaculture research

THE UK fish farming sector is set to receive a significant boost from the Scottish Aquaculture Research Forum (SARF) following its backing for two new major research projects. SARF, an independent charity established last year to promote, encourage, and support research and development in the farming of fish and shellfish, has announced a call for two research proposals – both based around waste assimilation from fish farms and the regulation of water quality.

The first project, 'The development of modelling techniques to improve predictions of assimilative capacity of water bodies utilised for marine caged fish farming (Phase 1)', will investigate various modelling techniques leading to the development of predictive tools on the capacity of the environment to assimilate waste.

From the general perspective of minimising the risk of pollution, or the particular perspective of ensuring compliance with Environmental Quality Standards (EQS),



SARF was established in 2004 to promote aquaculture research

such predictive tools will be useful for regulatory agencies in matching scales of development to the assimilative capacity of the environment.

The project, which it is estimated will last up to 36 months, will attract a maximum contribution from SARF of £120,000.

The second project, 'Review

of Environmental Quality Standards for use in assimilative capacity model development', is a desktop review examining the suitability of existing EQS for use in assimilative capacity models and to ensure they contribute to the maintenance and integrity of habitats and species in marine and freshwater Special Areas of Conservation (SAC).

This project has an estimated duration of 12 months, with a maximum contribution from SARF of £25,000.

Fish Farming Today, April 2005

New FAO 'gateway' page for aquaculture

FAO has developed an internet information site for worldwide aquaculture as part of the Fisheries Global Information System (FIRIS). The Aquaculture gateway page is accessible through the FIGIS website at the following internet address: <http://www.fao.org/figis/servelet/static?dom=root&ml=aquaculture/index.xml>.

Information can be navigated across FIGIS for a multifaceted view to address the needs of a diverse audience – from policy-makers, fishery managers and NGOs to biologists, statisticians and industry leaders.

The Aquaculture gateway page contains:

- Fact Sheets including specific subject information and profiles supported by graphics (GIS maps and images, etc.). The Fact Sheets contain a synthesis of information tailored to illustrate the various characteristics of each broad aquaculture subject.

- The National Aquaculture Sector Overview (NASO) gives a general overview of the aquaculture and culture

based fisheries aspects at the national level.

- The National Aquaculture Legislation Overviews (NALO), a series of comparative national overviews of aquaculture laws and regulations relevant to the top 40 aquaculture producing countries, are being prepared in collaboration with the FAO Development Law Service. NALOs reflect the multi-disciplinary character of aquaculture, the complex issues involved and the various regulations under a wide range of legislation governing the sector.

- The Cultured Species Fact Sheet, directed at those wishing to gain an understanding of the steps that should be followed to start to raise aquatic species and learn about current techniques, provides a general overview of various production systems, diseases and control measures for the most important species in aquaculture.

Further details can be obtained by writing to Mr Valerio Crespi (Fishery Resources Officer) at FAO/HQ - E-mail: valerio.crespi@fao.org.

Fish Farming International, April 2005

Growth in Scottish shellfish industry

NEW figures released at the Aquaculture Today conference in Edinburgh show that Scotland's shellfish industry expanded last year by almost 15 per cent.

In the keynote address to around 170 delegates on the opening day of the conference, Deputy Environment and Rural Development Minister Lewis Macdonald said: "The Scottish Executive has made the sustainable development of the aquaculture industry one of its key priorities."

"The survey I am publishing today gives evidence of the continuing growth of the shellfish industry. The market for this small but vibrant industry is buoyant and it is predicted that annual production of all shellfish species will continue to increase steadily in the long-term."

The key points from the survey are:

- Overall production increased by almost 15% from 3,991 tonnes in 2003 to 4,578 tonnes in 2004. The continuing upward trend in production is almost

entirely due to strong growth in the mussel sector;

- The greatest increase in regional mussel production was in Shetland, by more than 41% in the last year to 2,193 tonnes;

- Employment increased by 12%. This reflects the ongoing trend in the development of new sites, and businesses particularly for mussel production;

- The industry continues to be dominated by small producers although there is a continued trend toward large companies contributing significantly to the annual production of all species; 11 companies have produced 60 per cent of the mussels;

- The market for all species was buoyant and prices remained stable throughout the year. It is predicted that annual production of all species will continue to increase steadily in the long-term.

The 2004 Scottish Shellfish Farming Production Survey can be found at <http://www.frscotland.gov.uk>.

Marina mud dumping puts mussel fishery at risk

MUSSEL fishermen at Conwy, north Wales, are fighting a proposal to pump mud from the local marina into the estuary near to cultivated mussel beds that provide a livelihood each winter for 15 men.

Owners of the Conwy marina wish to change from dumping the silt offshore in the Irish Sea as stipulated by a FEPA licence and save money by just pumping it directly into the estuary.

At a meeting in April the Conwy Mussel Development Group, chaired by Dr Eric Edwards – a former director of the Shellfish Association – agreed to oppose this plan until more information was available on the content of the silt.

DEFRA has agreed that a one-month

trial can go ahead, but the Conwy Borough Council and the North West Wales Sea Fisheries Committee are supporting the fishermen and the trial has been postponed until more information is available on the environmental impact of the discharge.

Conwy councillor Tony Tobin said: "We do not know where this silt from the marina will land and if it is on the mussels they will be smothered. There is a massive risk and it could be a big price to pay if it goes wrong and so the marina's mud should go to the designated dumping site in the Irish Sea".

Trevor Jones from the Conwy Mussel Company told *FN*: "We have managed to get the trial delayed for three months

while the mussels are spawning."

"The Conwy mussel beds are designated as an EU 'shellfish growing water' and it is essential that a proper risk assessment is made before this trial discharge proposal is given the go-ahead."

Conwy's historic mussel fishery has been revitalised by funds from the Welsh Office that are used successfully by the development group for annual reseedling and cultivation projects.

This work has increased the yield and sustainability of the stocks. Dredging is banned and the licensed fishermen use their traditional long-handled rakes to harvest an annual crop of some 200 tonnes of top quality mussels.

Fish Farmer, May/June 2005

Fishing News, 24 June 2005



SAGB officers, left to right: Dr Peter Hunt, Maldwin Drummond and Norman Young.

Shellfishermen seek more control of stocks

NATIONAL conservation of the UK's inshore shellfish stocks is a priority and equal access by other EU member states is not an option, according to Dr Peter Hunt, director of the Shellfish Association of Great Britain (SAGB).

In a report to the association's AGM at Fishmongers' Hall, London, Dr Hunt told members that

a wide variety of shellfish dominate the commercial fishery within 12 miles of the coast and total landings in 2004 were 130,000 tonnes with a final sale estimated at £550m.

He said: "The SAGB's aspiration is clear: we must have national conservation of shellfish in the UK's 12-mile zone to ensure optimum and sustained

exploitation and the maintenance of coastal communities."

He reported that most shellfish stocks appear stable, but there is concern that poor catch data and a lack of understanding of the dynamics of some species, such as of lobster and crab, might be insufficient to cope with the increasing fishing pressures.

He cited the increase in bivalve cultivation, saying that mussels grown on the seabed and by rope culture were a valuable sector.

A major spatfall of native oysters had occurred in the summer of 2004 providing extra recruitment to the fisheries in the Solent, Thames Estuary, Fal and elsewhere, he said.

Fishing News, 10 June 2005

Innovation aids Maldon Oysters

AN INNOVATIVE approach to oyster farming in the Blackwater Estuary, Essex, south-east England, was given at the SAGB conference by David Coward-Talbot, director of the Maldon Oyster and Seafood Company.

Coward-Talbot first described how Essex's historic flat oyster (*Ostrea edulis*) industry had been in decline since the 1900s due to over fishing, disease and a neglect of the spawning beds. The remaining stocks were decimated by a combination of the severe winter of 1962/63 and the effects of the toxic biocide TBT used in antifouling paints.

In 1988, Coward-Talbot and the late Clarrie Devall turned to growing the introduced Pacific oyster (*Crassostrea gigas*), using hatchery seed reared by John Bayes of Seasalter, Whitstable. This paid off and the trials showed that the Pacifics grew to a saleable size of 100g in about 24 months, and their quality was good.

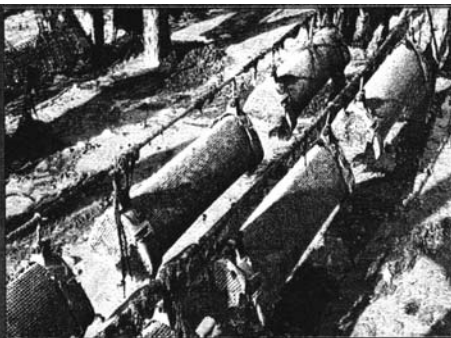
Today, the Maldon Oyster and Seafood Company produces an annual



crop of about two million oysters, most of them sold in south-east England.

Backed by his new partner Richard Emans – a mechanical engineer with marketing skills – Coward-Talbot has introduced a number of innovative ideas that have increased production and made his company one of the largest shellfish farmers in the UK.

A typical innovation is the use of the BST Oyster Supplies long line system for growing the seed/juveniles in plastic containers off the seabed, and then using mesh bags and trestles to grow them to market size.



Maldon grows the seed/juveniles in plastic containers off the seabed, and then uses mesh bags and trestles to grow them to market size

Far left: David Coward-Talbot, director of the Maldon Oyster and Seafood Company

In a two-year trial, this combined method showed faster growth and better-shaped oysters, Coward-Talbot explained. More systems are being constructed on the lower shore in a move to increasing production.

Maldon Oyster has also built a modern packing and depuration unit, where more innovation is evident – including a temperature-controlled depuration system that can purify oysters, mussels, clams and cockles; a heavy-duty washer and a modern grading system that speeds up packing.

The premises also have cold stores and a smoke house facility.

Innovation is also evident in the marketing. Although most of its oysters go to Billingsgate Fish Market in London, they also supply hotels, restaurants and local markets with fresh oysters, mussels, scallops and other shellfish.

David Coward-Talbot told the conference that publicity on TV and in the local press had boosted sales and his aim is to sell 50,000 oysters a week. Further details on the SAGB and its conference, email Lorraine Andrews at the SAGB: Lorraine@shellfish.org.uk

*From 'On the Shellfish Scene' by Dr Eric Edwards OBE
Fish Farming International, June 2005*

Special feed for king crabs



Scientists can now measure the meat content of crabs by blood-test

A NEW purpose-designed feed for red king crabs is currently being tested by scientists from research institute Fiskeriforskning in Norway. Fiskeriforskning has collaborated over the last year with the company ContRace AS on red king crab farming and scientists in its feed centre developed the feed based on the institute's long experience of growing new species. The institute has previously fed wild caught king crabs, but farming of king crab

from the larvae stage is completely new and there is still a lot to be learned in this area.

Sten Siikavuopio, project leader at Fiskeriforskning, said everything is going to plan, adding: "So far the trials are looking promising."

Siikavuopio says that the feed requires special qualities, such as long durability underwater. It must also be easy for the crab to get hold of. The new dry feed is being tested on both wild caught and farmed king crab.

Simultaneously with testing the new feed, the scientists are also trying out a new method to measure the meat content of crabs. By taking one simple blood test from a king crab, they can discover how much meat it has on its body. The meat content is crucial for the selling price of the king crab. The trials are taking place at the ContRace AS farm. The company is in the world to establish commercial farming of red king crab.

Fish Farming Today, June 2005

Stressed-out scampi lose their flavour

HEALTH checks have been ordered for scampi after scientists discovered that the stress of being landed by trawlers was affecting the taste of the crustaceans.

Marine biologists at Glasgow University claim that scampi (peeled langoustine tail in breadcrumbs) lose their sweet flavour if they are trawled in nets for long periods of time.

They found that the shellfish suffer high levels of anxiety when they are caught, and the worry causes them to burn up their sugar reserves.

Seafood firm Young's, which supplies many UK supermarkets with frozen scampi, has asked the scientists to hold regular clinics, where blood samples are taken from the prawns to test for signs of stress.

The samples are analysed to measure stress hormones and lactates to try to establish whether different catching methods result in more relaxed and tastier scampi.

"Nephrops that are stressed lose their sweetness and the product is less tasty," said Douglas Neil of Glasgow University's Institute of Biomedical and Life Sciences. "There are issues here both for the wellbeing of the animal and for seafood quality."

Professor Geoff Moore, who is based at the University Marine Biological Station on the island of Cumbrae, said it was a misconception that shellfish do not suffer when they are being landed.

"You pull in a scampi that has been trawled for hours over the seabed, along with others all



"As soon as they come aboard a wee splash of whisky relaxes them wonderfully and really improves the taste."

jumbled together, and it is going to be stressed, and that has an effect on the biochemistry," he said.

Chris Solloway of Young's said: "If you speak to people at an abattoir, they will tell you that if the animals get stressed, then the quality of the meat goes right down, and it's a similar thing that happens with scampi."

"The idea is that you have to keep them nice and relaxed when you've caught them and then the quality doesn't decline when they get to be processed."

Shirley Spear, head chef at the award-winning Three Chimneys restaurant on the Isle of Skye, serves up langoustines in the shell from nearby Loch Dunvegan.

"Langoustines caught in trawler nets and dragged along with other animals suffer more stress, and I believe that may well have an adverse effect on the taste," she said.

"We only use fresh langoustines that are caught by local fishermen using creels, which we feel are more humane."

But master fishmonger Ken Watmough, whose Aberdeen shop has two royal warrants, was more sceptical.

"Like too many of these university reports, I think they may have gone a bit too far," he said. "Creeled langoustine come at a premium and, realistically, we will always have to rely on produce that is trawled."

Fishing News, 29 July 2005

Seafish future hangs in balance

GOVERNMENT ministers have asked the UK's fishing industry to help decide the fate of the Sea Fish Industry Authority (Seafish), in the wake of growing criticism for the public body's lack of evolution since being established under the Fisheries Act 1981, reports **Jason Holland**.

A consultation on the future of the authority was launched last Wednesday (20 July) by a team from the Department for Transport after being invited to do so by the four UK fisheries ministers.

Comprising two – Priscilla Russell of DEFRA's in-house policy consultancy and John Martin, a former Scottish Executive senior civil servant – the team wants to hear views on the roles, responsibilities and funding of Seafish. They also want suggestions about the future or possible closure of the organisation.

The review focuses on three main issues:

■ Does Seafish still have a

role, what is it, and what should it be doing to fulfil that role in the years ahead?

■ Is the levy still the right way to finance the authority? Are there ways in which its administration might be improved? How far should Seafish look to other sources of finance, such as charges and government grants?

■ Who should appoint board members, and to whom should they be accountable? Does Seafish do enough to report back to its stakeholders, and to keep in close touch with the industry?

The reviewers say these issues are not intended to be exclusive, but the team's remit does not extend to questions about the authority's internal management. They would, however, like to hear about other issues that are of interest or concern to stakeholders.

There are a number of reasons why stakeholders might take the view that the powers decided in 1981 need updating to take account of the

circumstances that apply today, concedes the review team.

"The structure of the fishing and seafood industry in the UK has changed dramatically over 25 years. Official statistics show a 40% decline in the tonnage of fish landed by the UK fleet in the UK between 1981 and 2003," it said.

Demersal and pelagic sector landings are both markedly down over the period, to 35% and 64% respectively of what they were in 1981. Whereas shellfish landings have doubled over the same period, and now account for 30% of total landings.

In addition, the number of jobs in the catching sector has halved from 24,000 in 1981 to 12,000 in 2003.

There have also been "important changes to the institutional context in which Seafish operates", and most fisheries management responsibilities have been transferred to the devolved administrations under the devolution legislation of 1998, added the reviewers.

An extreme view is that the industry and its environment have changed so fundamentally that there is no longer any role for a UK-wide authority representing the industry as a whole.

Review work started in late May and the response deadline is 23 September. The reviewers expect to deliver their report to fisheries ministers in early November.

The review is part of a programme of periodic reviews of non-departmental public bodies undertaken under cabinet office guidelines.

Based in Edinburgh and Hull, Seafish has an annual turnover of £11.5m and 117 staff.

The full consultation document is available on the DEFRA website.

■ Stakeholders can send their responses to Priscilla Russell, SFIA Review, In House Policy Consultancy, Department for Transport, 4/12 Great Minster House, 76 Marsham St, London SW1P 4DR or email Daniel.Barrett@dfi.gsi.gov.uk

Fishing News, 29 July 2005

UK cockles benefit from conservation

MORE cockles are landed in the UK than any other mollusc, and since 2000 landings have remained steady at about 20,000 tonnes as stocks benefit from tight conservation measures.

The common cockle, *Cerastoderma edulis*, has been exploited by generations of coastal inhabitants, mainly for local sales or home consumption. Today, cockles is big business, and there is a huge demand for the cooked meats in The Netherlands and Spain.

As a result, the UK's main cockle fisheries must be strictly controlled to ensure the stocks are not over-exploited. Efforts to 'farm' cockles on a small scale, by thinning out dense beds of spat and relaying them elsewhere, are also beginning to show good results.

Recently I visited Leigh on Sea in south-east England, where most of the cockles caught in the Thames estuary are landed and processed. The season has just opened, and 14 licenced vessels fitted with hydraulic suction are fishing the stocks.

As with several other cockle fisheries in England and Wales, the Thames cockle fishery is managed by the local Sea Fisheries Committee under a Regulating Order, which gives powers to implement detailed



Unloading cockles from a Thames suction dredger

Left: Joss Wiggins, head fishery officer for Essex, checks cockles

controls and byelaws aimed at conserving stocks.

The measures include limiting the length of the season, closing certain beds, varying the legal landing size, limiting damage rates, and setting a total allowable catch (TAC).

In addition, each boat must have an annual licence, costing £2000 (\$3600); no vessel longer than 14 metres can suction-dredge for cockles; and fishing is restricted to a daily catch of 12 tonnes a boat for two days each week.

It all seems very restrictive, but the fishermen accept the rules, realising it is in their interest to conserve stocks. As a result, the Kent and Essex Sea Fisheries Committee can claim that its management policy during the past 30 years has resulted in a sustained fishery.

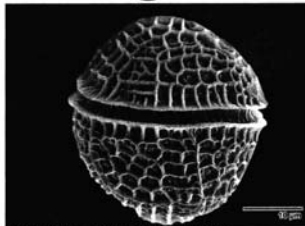
Credit must go to Joss Wiggins, Essex's head fishery officer, and his staff who have worked hard to gain the fishermen's trust. The Thames cockle fishery is an example to the world of how a positive approach to shellfish management can be made to work.

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

New method for algal toxin testing

UNTIL recently, testing on mice has been the only accepted method for identifying whether mussels are contaminated by yessotoxins (YTX). However a new method tested by a Norwegian scientist in her doctorate thesis could revolutionise this procedure.

Yessotoxins are toxic compounds produced by the marine alga *Protoceratium reticulatum* which accumulate in mussel flesh. They were included in the diarrhetic shellfish poison group but are now considered to be a separate group of phycotoxins. In 2002 the European Commission implemented a maximum permitted level of 1 mg YTX equivalents/kg in shellfish intended



The marine alga *Protoceratium reticulatum*

for human consumption, discovering if mussels are poisonous or not.

Research student, Ingunn Anita Samdal has developed a method for identifying yessotoxin, using an ELISA based test kit.

The result is a relatively cheap and simple alternative for mass-screening of mussels. The work has already been developed by Biosense Laboratories AS in Bergen, Norway in collaboration with AgResearch, New Zealand into a 'pre-release' test kit. Biosense say that the YTX ELISA

based test offers advantages in speed and accessibility over current methods and is a suitable tool for routine monitoring and HACCP implementation.

Fish Farming Today, July 2005

Durable shellfish processing machinery

M L Supplies based in Falmouth, Cornwall has just started importing shellfish processing machinery from France including oyster washers oyster graders, bagging and weighting machines both new and used all made in 316 grade stainless steel.

M L Supplies has been supplying shellfish purification tanks for 14 years and has hundreds of satisfied customers, "We have tanks that were supplied 14 years ago that have been used non-stop for 8 month of the year, and the only thing on the tank that has been replaced is the UV Bulb's which is a requirement of the EU directive" says Martin Laity, owner of M L Supplies.

For more information on tanks and machines call Martin on 01326 374748.



M L Supplies machines are all made in 316 grade stainless steel

Fish Farmer, July/August 2005

Humane killing method developed for shellfish

A REVOLUTIONARY electronic stunner has been developed which offers a humane method of killing shellfish prior to cooking. The British invention was launched in Paignton, Devon at the Blue Sea Food company.

The 'Crustastun' is the result of a two-year funded research programme carried out by the Department of Food Animal Science at the University of Bristol and the Silsoe Research Institute in Bedford. It combines clear economic and operational advantages with a humane solution to all shellfish processors.

The Crustacean Stunner has been invented, developed and patented by Simon Buckhaven of Studham Technologies and is manufactured to order by CMP (Charlottetown Metal Products) of Canada – a long established and well known manufacturer of shellfish processing plant and equipment.

Live product is placed on a conveyor-belt which passes through a water tank. Electrode plates deliver an instant stun which initially anaesthetises and within seconds kills the shellfish.

The system can be sized to accommodate volume throughput, and runs at the speed required by the processor. Leg and claw loss are greatly reduced, ensuring less wastage and better quality product.

The Blue Sea Food company prides itself on state-of-the-art production facilities and its expertise in producing cooked shellfish from a local and sustainable source. As a



Left: Single unit for restaurants and fishmongers.

Right: Shellfish can be slaughtered humanely prior to cooking

result, its products are sold around the world into some of the highest quality restaurants.

Richard Chatfield, director of the Blue Sea Food company says: "The new crustacean stunner has really enhanced the quality of our products and also increased the speed of our production. This method of stunning shellfish before they are cooked is not only more ethical but means that the meat quality is of a noticeably higher standard, because the crab hasn't experienced the level of pain or distress associated with traditional methods of killing."

For more information visit www.crustastun.com.

Fish Farmer, July/August 2005

Multi million boost for shellfish farmers

A MAJOR boost for Scotland's shellfish farmers has been announced by the Scottish Shellfish Marketing Group (SSMG). The group which represents shellfish farmers along the West Coast and Northern Isles of Scotland, have just secured a multi-million pound deal with Britain's largest retailer, Tesco to supply fresh mussels to all their stores across the UK.

The Tesco deal, worth over £1 million a year to mussel farmers, makes SSMG the biggest supplier of live mussels to all leading UK supermarkets. They already supply mussels to most household name supermarkets in Britain.

The deal was clinched because Tesco were convinced that SSMG can supply the best quality and consistency of supply of Scottish rope grown mussels, as well as extending availability throughout the year.

Donny Gillies, Sales Director of SSMG says: "This is excellent news for the Scottish seafood industry as well as for all our SSMG members. It emphasises what we have always known, that fresh Scottish seafood is the best in the world."

A spokesperson for Tesco added: "Tesco are pleased to be supporting the Scottish Shellfish Marketing Group in delivering Live Scottish Mussels to its stores. Through our partnership with the Scottish Shellfish Marketing Group we can now offer customers high quality live mussels continuously throughout the year."

Scottish shellfish farmers are joining SSMG at a greater

rate than ever before, as the market experiences a mini-boom. The group's turnover has grown by 20% in the last year and SSMG are actively seeking new members.



Tesco will sell mussels from Scotland

Fish Farmer, July/August 2005

Lundy lobsters are bouncing back

THE UK'S first no-take zone (NTZ) for marine nature conservation is producing promising results, with lobsters showing a large increase in numbers after just two years, scientists have revealed.

Dr Miles Hoskin, the lead scientist of the monitoring programme for Lundy NTZ, said: "Our results show a very clear signal that lobsters in the NTZ are recovering from the effects of fishing."

"After only 18 months we found three times more lobsters of landable size in the NTZ compared to fished areas. This difference was highly significant. At the time, some argued that this was just a flash in the pan – but we found the same result again this year, which strongly suggests that this is not the case."

Research collaborator Professor Ross Coleman added: "We're also monitoring sponges and soft corals that may have been indirectly affected by fishing but more



A large lobster from Lundy's no-take zone.

Picture: Holly Sheldon/English Nature

patience will be required to see how they respond."

Lundy's NTZ – an area to the east of Lundy Island, 12 miles off the north Devon coast – was set up in 2003 to enhance conservation of marine wildlife.

In the area the removal of any living creature, including lobsters, crabs, scallops and fish, is permanently banned by law.

English Nature maritime conservation officer Chris Davis said: "For the second year now the results look very promising. This adds to our

knowledge of what no-take zones in the UK can achieve.

"It's exciting for us because, although we will have to wait several years to see the whole picture, the results have exceeded expectations."

Marine and fisheries minister Ben Bradshaw applauded the NTZ's success, adding: "My view has always been that closed areas can play an important part in the future of our marine environment management. We shall continue to explore the environment and fish stock benefits of creating a network of similar areas."

Fishing News, 5 August 2005



A researcher shows how Ritchey-ID tags are being used to help monitor cultured seaweed

Tough tags keep track of seaweed

TAGS originally designed for use on livestock are being used by the Scottish Association for Marine Science (SAMS) to keep track of seaweed cultures, urchins and shellfish in the coastal waters around Scotland.

The robust polyurethane identification tags from tagging specialist Ritchey-ID, part of Ritchey plc, have a 30 year track record in the ears of livestock – and are now set to demonstrate their indestructibility underwater, claims the company.

Ritchey ID tags were used in saltwater last year, being used to identify the fragile timbers of a medieval ship last year. The Mary Rose Trust foundation found the tags proved indestructible, even when submerged in the corrosive

saline and chemical solution necessary to protect the timbers from the atmosphere.

Established to improve understanding and stewardship of the marine environment, through research, education and technology transfer, SAMS promotes, delivers and supports high-quality independent research and education in marine science. The core science programme investigates past and present changes in Northern Seas necessitating keeping track of marine communities for environmental monitoring purposes.

Comments research scientist Craig Sanderson: "The tags are invaluable for tagging items which go into the marine environment for extended periods of time as they

are highly visible, resistant to salt water and over-growth by marine organisms and withstand erosion by wave action. We also use them to relocate areas underwater for monitoring purposes."

Marine science joins an increasingly diverse list of industries using Ritchey-ID tags for identification purposes, HSE/LOLER legislative and insurance requirements. The hard-wearing tags are used by a range of sectors including: forestry, horticulture, oil and petroleum industries, the fishing industry, hospitals, construction and manufacturing.

Ritchey-ID tags are unaffected by grease, grime or solvents. They can be either printed or supplied plain with a special marking pen. ■ www.ritchey-id.com

Fish Farming International, August 2005

Lobster hatchery protects islands' catching future

Orkney lobster catches – the most valuable shellfish landed to the islands – increased from 88 tonnes in 2000 to 112 tonnes last year, selling for more than £1.2m.

There is little doubt among the local fishing industry that this improvement is a direct result of the stock enhancement programme, run by the Orkney Fishermen's Association.

This association took over the Orkney lobster hatchery at Lamb Holm, established by North Isles Shellfish in 1996. Last year it collected 500,000 larvae last year and released 55,000 juvenile lobsters into the sea around the islands.

The hatchery borrows berried lobsters from O-Fish-Shell for storage in a new 72-box hen incubation room, commissioned last year to accommodate 400 female lobsters.

Up to 30,000 larvae can accumulate in storage tanks overnight so each morning some of the larvae are transferred into the conical room and aerated seawater water (held at 22°C), while the remainder are released into the sea.

The lobster larvae quickly develop through four moults, before free swimming

juvenile lobsters, by now carrying their claws in front, are individually scooped out for individual storage.

During the main summer season, hatchery manager Dawson Shearer, Cherry Young and Lari Scott typically select 1000 stage-4 lobsters for placement in one of 13,000 individual cell trays for two weeks, from where they are released as stage 5/6 lobsters.

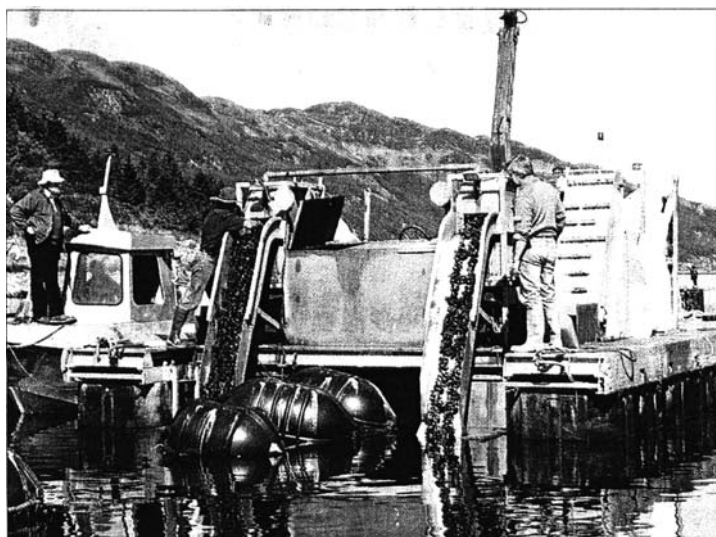
Juvenile lobsters are usually released in 3-10 fathoms of water around Orkney, including Westray, Stronsay, Sanday, Hoy, Burray, South Ronaldsay, Scapa Flow and all parts of the mainland.

The hatchery has released 250,000 juvenile lobsters into local waters since 1998.

Last year it sold 1500 juvenile lobsters for release off the coast of Northern Ireland, while a group of fishermen from Ireland recently visited Orkney with a view to purchasing considerably larger quantities to supplement catch rates in years to come.

The hatchery receives financial support from Orkney Islands Council, Orkney Enterprise, the SFF Fishermen's Trust and the EU.

Fishing News, 19 August 2005



Ladder-maker proves system by taking over farm

JIM McLACHLAN and colleagues from farm equipment maker Xplora Ltd work on a very successful harvest at the mussel farm in Loch Striven, west of Scotland's Clyde estuary – a farm he has taken over to prove that his patented

rope 'ladder' growing system. And prove it he has. Although he is waiting until next year for the best results, in this partial harvest McLachlan tells *FFI* that, working from 6am until around 2.30pm one day, his team filled no fewer

than eight, 1.25-tonne bags with prime mussels. He says that the farm, formerly a 50-tonnes-a-year farm, is now a 300-tonnes-a-year farm, thanks to the ladder system – and he expects to eventually harvest 500 tonnes at the site, increasing the harvest

tenfold by using his system. Xplora has also modified the harvesting barge that is designed to harvest while re-laying the same single line of rope ladders. ■ *FFI* will report on this innovative system in a future issue

Fish Farming International, August 2005

Prizes for Yorks lobsters info

HUMBER fishermen are being asked to support a lobster monitoring study by logging any tagged lobsters they catch so the animals' growth, movement and population density can be tracked.

As part of the programme, being conducted in the Easington area, North Eastern Sea Fisheries Committee has launched a lobster tagging competition in conjunction with Metoc, environmental consultants for the Langeled Project.

Fishermen who catch any tagged lobsters have the chance to win up to £200 for monitoring what they catch and where.

The committee took the opportunity to tag a number

of lobsters in May, when fishermen were prevented from catching lobsters in and around the Langeled Pipeline.

Yellow tags are inserted on the underside of the tail (ventrally). A six-digit serial number is printed on each tag.

Tagging was carried out on lobsters that are above and below minimum landing size. Additionally, animals above 87mm have been V-notched. If a tagged lobster is caught fishermen are asked to make a note of the serial number, the position (latitude and longitude or bearing and distance from a landmark) of recapture, and the date.

They are asked not to remove the tag, unless they intend to land the lobster.

Fishermen are also asked, if possible, to calculate the carapace length in millimetres, and estimate of the total number of lobsters that were caught on that string and the number of pots on the string.

Send this information by 15 December to Giles Bartlett, environmental officer, Town Hall, Bridlington, East Riding of Yorkshire YO14 4LP, or Giles.Bartlett@eastriding.gov.uk.

Fishermen can also submit data to any of the committee's shore-based officers.

For each submission, a draw ticket will be given. At the end of the year all draw tickets will go into a hat for a chance to win one of 15 cash prizes, ranging from £10 to £200.

Fishing News, 26 August 2005

Guide to seafood hygiene

A GUIDE to assist companies implement seafood hygiene management has been published by Eurofish.

Other organisations involved in the publication are: SIPPO/Norwegian Ministry of Fisheries and Coastal Affairs/HIFF:

A Guide to Seafood Hygiene Management has been written by Prof. Hans Henrik Huss; Dr. Mike Dillon and Dr. Simon Derrick, Humber Institute of Food & Fisheries, Grimsby, UK, and is priced at €30.

This practical guide offers:

- Examples of hygiene requirements during processing
 - Information on standards and legal requirements
 - Principles of management control and monitoring
- "Safe production of seafood is vital in order to sell to an international market. Management of all components in the production chain is, therefore, important to achieve the required level of food safety," says Eurofish.

■ www.eurofish.dk

Fish Farming International, August 2005

Scarer keeps ducks away

NORWEGIAN mollusc production systems specialist Smart Farm has developed a self-powered duck-scarer with a range of 200 metres to help keep the waterfowl away from mussels.

Based on Lofitech's proven animal deterrent technology, the scarer is delivered complete with underwater probe, digitised eagle scream above water, wind generator, solar panel, charger, batteries, instrument rig and raft.

■ www.smartfarm.no



Fish Farming International, August 2005

Crown Estate announces annual figures

THE Crown Estate in Scotland has announced an 18% increase in net revenue surplus to £11.8 million for 2004/05, representing 6.4% of The Crown Estate's UK total. All of this money is paid to the Treasury for the benefit of the taxpayer.

The Scottish marine estate, which includes over half of the foreshore and almost all the seabed out to the 12 nautical mile territorial limit, represented over a fifth of the Scottish capital value (£38.2 million) and more than a third of the overall Scottish revenue (£5.5 million), including £2.7 million from the aquaculture industry.

The aquaculture income includes income from shellfish farming and the farming of emerging species, such as halibut and cod, but is largely made up of rental charges relating to salmon farms, which amounted to £17.12 per tonne harvested for mainland Scotland and inner isles growers, and £15.41 per tonne harvested for growers in the Western and Northern Isles.

During the course of the year, The Crown Estate's marine estate re-invested more than £500,000 in marine stewardship in Scotland, including £100,000 to the Scottish Aquaculture Research Forum (SARF), a similar amount to other aquaculture-related research projects, £200,000 on salmon industry development measures and £110,000 on marine-related local, community-led projects.

Ian Grant, chairman of The Crown Estate, said: "These are excellent results and not only reflect improved market conditions, but

also the continued improvements in the efficiency of our operations. Increased efficiency has been coupled with greater focus on improved customer service to ensure our desire to be regarded as 'the landlord of choice' is not merely an ambition, but becomes the accepted norm."

Roger Bright, chief executive of The Crown Estate, said: "We have delivered excellent results this year. We have done this by managing our business activities to protect revenue

generation through lease restructuring, and creating capital value by active asset management, developing and improving existing properties, and enhancing the quality of our portfolio through acquisitions and disposals."

Commenting on the figures Alistair Carmichael, MP for Orkney and Shetland said: "In the opening line of their annual report the Crown Estate management state, 'There is no



Ian Grant

organisation in the world quite like The Crown Estate'. They are not wrong there.

"Aquaculture in other countries does not have to pay additional taxes to their governments in this way. This hampers the ability of our industry to compete on a level playing field with international competitors. It is another burden that our industry has to bear.

"The government has the power to limit harmful Crown Estate charges on our salmon and shellfish farmers and to reduce rents on piers and marinas. However, while the Estate keeps making record profits every year they appear quite happy to sit back and let the money roll in."

Fish Farming Today, August 2005

All-in-one mussel machine

SPANISH shellfish equipment specialist Talleres Aguin reports that mussel farmers are taking to its latest all-in-one processing machine, the LP2. The LP2 brings together the functions of de-clumping, selection and clearing of

product, as well as grading and weighing.

Until now, says Talleres Aguin, all these tasks were performed by individual machinery – themselves replacing often back-breaking manual labour.

"The LP2 project has been designed to satisfy the needs of the mussel farming industry," says the Pontevedra-based company.

"Mussel farmers are demanding equipment that simplifies the tasks not only at the moment of commercialisation but also in previous stages of production like attaching the seeds and re-tubing."

It says that with existing equipment the product itself suffers during handling, and can reach the market in "sub-optimal conditions" making it impossible to reach the levels of quality producers and sellers would like to achieve.

"The objective of this new machine is to maximise its output, reducing the cost of production as a result of the reduction in time used in the farming process – at the same time guaranteeing an optimum quality of the final product," says Talleres Aguin.

The company says that special emphasis has been



Talleres Aguin's new eight tonnes an hour LP2

put on trying to avoid the inconveniences of existing machinery that fundamentally affect the quality of the mussel.

"Handling with the present machinery means that the product suffers irreversible damages to the shell, which provokes the partial loss of water that is in the mussel shell, thus considerably reducing the product's longevity out of the sea," it says.

"With the LP2 we have used elements like nylon brushes and PVC belts that avoid friction with metal parts.

"Also there are no violent vibrations so the machine does not damage the product at all.

Not only that, Talleres Aguin claims that the LP2 can reach a production capacity of eight tonnes per hour, "a much higher result than with the existing machines".

Talleres Aguin adds: "The first machines built have been a total success among the producers, as well as the mussel purification plants, exceeding their expectations."

So popular is the LP2 that Talleres Aguin says it is struggling to meet demand. "In view of this we are looking to expand our manufacturing facilities to cater for this demand," adds the company.

'Benign' algae proves toxic

AN ALGAE formerly believed to be benign and found only off the western coast of Ireland is now known to be another cause of mussel poisoning and has been confirmed throughout the western coastline of Europe, according to Science News Online.

Azspiracid poisoning is brought about by consuming mussels which had fed on a planktonic alga, *Protophormidium crassipes*. Luckily, the toxin does not appear to be fatal unlike those caused by other algae.

The discovery of P cras-

sipes came about after 12 people on the small Irish island of Arranmore started to suffer from severe nausea, vomiting, cramps, headaches and diarrhoea.

Although pollutants were first suspected, their illness was traced to the community's first commercial crop of mussels from an aquaculture project.

According to Kevin James of the Cork Institute of Technology, who was among the scientists who solved the mystery, there is no test for the poison's presence in people, so researchers have based

their findings on P crassipes and mussels in the area.

He suspects, then, that much azspiracid poisoning goes undetected, and mistaken for those of more common food poisoning causes.

Besides mussels, azspiracids have been found in scallops, clams cockles and oysters, in shellfish taken from Norway, England, Spain and France. Testing for azspiracids has to be frequent, using highly specific and sensitive methods involving liquid chromatography-mass spectrometry.

■ kjames@cit.ie

Fish Farming International, August 2005

Fish Farming International, August 2005

Ten new areas designated for shellfish farming

THE Scottish Executive has announced that ten new areas are to be designated as shellfish waters to ensure protection of their water quality. The ten areas are: Askinish Bay, Argyll and Bute; Basta Voe, Yell, Shetland; Clift Sound, Shetland; Dales Voe, Shetland; Dornoch Firth, Highland; Isle of Ulva, Mull (Loch Tuath), Argyll and Bute; Loch An Eisg-Brachaidh, Enard Bay, High-

land; Loch Crinan, Argyll and Bute; Loch Eil, Highland; and, Mid Yell Voe, Shetland.

The designations increase the number of protected shellfish waters from 104, indicating the increased importance of the industry.

Rhona Brankin, the recently appointed deputy minister for Environment and Rural Development said: "The shellfish industry in Scotland is a good example of sustainable



Rhona Brankin, the new Scottish 'aquaculture minister'

development, providing jobs in some of the country's most remote locations. Having good marine water quality gives Scotland a competitive edge when marketing mussels, oysters and scallops to the rest of the world.

"Designating these ten additional sites will protect both the shellfish that grow in these areas, and the other flora and fauna, which depend on the water environment."

Fish Farming Today, August 2005

Shetland sea urchin objection dismissed

A SEA URCHIN project in Shetland has been given the go-ahead to resume after the Scottish Executive dismissed an appeal against its works licence that had threatened the experimental farm.

UK Scallops Ltd, run by Ben Wilcock, was given the green light for the experimental project in the Bay of Hillswick, last November, granting permission to switch a small site from scallop to sea urchin farming, which would involve mooring two 10 metre cages in the bay.

However, local residents Jan and Pete Bevington said the development was interfering with their investment

However in dismissing the appeal, reporter William Patterson said that council officers should have considered more thoroughly their own set of rules when it comes to the possible impact of fishing farming development on what is deemed 'other interests', including potential conservation sites.

"I have to conclude that the appellants' fears about the consequences of two 10m diameter fish cages in the bay at Hillswick are much more emphatic than is justified."

"The effect on the setting of listed buildings and a potential conservation area would be extremely modest; and it seems improbable that visitors to Hillswick would be deterred in advance by knowledge of the cages' presence, would turn around after seeing them, or would stay less time and spend less money locally than if they were not there."

Ben Wilcock said he was pleased with the decision, as it allows him to start his experiments to develop a sea urchin farming industry in Shetland.

"The young sea urchins are a by-catch when I am working with scallops and oysters," he says.

"It seemed to be a waste to just dump them, and that's how I started thinking about farming sea urchins. It became a natural thing to develop sea urchin farming, particularly when the young ones come free of charge."

"There appears to be some potential in the sushi markets. However, first of all I need to concentrate on learning how to farm them. It might not work and then I will remove the cages again after a couple of years."



Ben Wilcock is now allowed to go ahead with his sea urchin project

in Shetland's only vegetarian restaurant, at the Hillswick Wildlife Sanctuary.

Their home, the 300 year old Booth, a former Hanseatic trading post overlooking the bay, is also the focal point of a potential conservation area.

But last month Scottish ministers dismissed the Bevingtons' appeal and confirmed the original decision to grant a works licence for an interim period of three years.

Fish Farming International, August 2005

New investment for shellfish group

THE Scottish Shellfish Marketing Group is to invest £400,000 in developing new products and introducing new equipment.

New modified atmosphere packaging is to be introduced replacing traditional net bags with sealed containers.

Donny Gillies, SSMG's sales director, 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 investment was supported by a Regional Selective Assistance Scotland grant and Financial Instrument for Fisheries Guidance, through the Lowland Scotland Processing and Marketing Grant Scheme.

Up to 20 new jobs will be created and processing stepped up by 50 per cent. The SSMG currently packages 10 tonnes of fresh mussels each day and produces ready-meals using five tonnes of mussels. This latter figure will now increase by 50% to seven-and-a-half tonnes a day.

Fish Farming Today, August 2005

Ireland building the best shellfish safety system

THE Marine Institute hosted a meeting in Galway of scientists, seafood producers and industry regulators from 12 organisations around Ireland, Norway, the Netherlands, France, Belgium and Italy. The EU funded project, called BIOTOX, aims to develop and validate new methods of testing for marine biotoxins in shellfish, and to develop cost-effective risk management tools and traceability systems.

"Ireland has set the target of building the best shellfish safety system in the north-



The Biotox project will develop and validate new methods of testing for marine biotoxins in shellfish

ern hemisphere", said Dr. Peter Heffernan, CEO of the Marine Institute. "This has strengthened consumer

safety and has been a key factor in the expansion of the Irish shellfish sector in recent years. We are committed to continuously building and improving on our shellfish safety system and have been successful in securing funding for this €5.5 million project based on Ireland's significant marine research capacity and competitiveness."

The Galway meeting marked the beginning of the implementation phase of the three-year project which kicked-off in the Netherlands in January 2005.

Fish Farming Today, August 2005

Shetland Mussels: A growing industry

STATISTICS recently released by Seafood Shetland demonstrate that mussel production, which already supplies 50 per cent of Scotland's farmed mussels, will continue to steadily increase over the next three years, with a predicted increase of around 16 per cent in the next year (to 3,920 tonnes from the 2005 level of 3,394 tonnes).

This growing industry forms an integral part of Shetland's aquaculture sector, and its value to the local economy is significant. This year, UK sales were worth £3.3 million and the industry provided employment for 100 people in full, part-time and casual positions.

Commenting on the increase in mussel production, chief executive of Seafood Shetland, Ruth Henderson, said: "The increased mussel production has been planned to meet market demands. Shetland mussels are well respected and have a very good reputation in the marketplace.

"For the future, shellfish growers will undertake sustainable and planned growth while exploring new species and adding value to the product. Other developments include producing a code of best practice and obtaining Protected Designation of Origin (PDO) status for Shetland mussels."

Demlane Mussels from Walls is an example of a company that has led the way in successfully developing its rope-grown mussels, which results in a thin-shelled product with exceptionally high meat content.

In a recent move, the company has been acquired by Oban-based Isle of Shuna Shellfish Ltd, which will continue to grow the company and develop Demlane Mussels' established reputation for delivering a consistently high quality and fully traceable product.

Olnafirth Sea Farm Ltd, based in Voe, also farms mussels. Farmer Keith Robertson previously farmed salmon for twelve years and diversified into mussels seven years ago.

Commenting on the growth of the industry, he said: "Last year we produced 95 tonnes of mussels and this year the volume has increased to 120 tonnes. We do have scope to gradually increase tonnage year on year to a maximum level of 200 tonnes.

"The mussels are grown on a sinkable rope supplied by a company in Spain. We are the only farm in Shetland using this method, which is very easy to install as you don't need to spend time pegging it or running weights.

"Our mussels are marketed to wholesale markets and supermarkets through the Scottish Shellfish Marketing Group (SSMG), which is run by a co-operative of member farms. Shetland mussel farmers currently supply around half of SSMG's production.

"SSMG has now expanded into the value added market, producing a cooked product in a variety of sauces. Most of my clean shelled mussel is used in the production of this new range, which is then supplied direct to supermarkets."



Shetland mussel production set to increase according to statistics. Insert: Ruth Henderson

Fish Farming Today, September 2005

More than 4000 settled lobster juveniles produced in Galicia

A CO-OPERATIVE project between regions of Spain, Norway and Ireland which has focused on the production of lobster juveniles has started to yield positive results. The AquaReg lobster sub-project aims to produce cost-effective production of lobster juveniles. In autumn 2004 it was extremely difficult even to obtain egg-bearing females in Galicia as broodstock for this project.

Releases of artificially raised lobster juveniles would be an alternative, however, there was no effective methodology for production of juveniles. The purpose of the AquaReg project "A regional development strategy for stock enhancement of clawed lobsters" is to exchange knowledge and transfer technology between the regions to develop an improved methodology for producing viable lobsters juveniles for release into the sea.

Over the last year, there has been an active knowledge and technology transfer between the Martin Ryan Institute in Ireland, the Norwegian Institute for Nature Research in Norway and IGaFA in Spain. This work has involved a workshop, practical demonstrations and intensive assistance in the design, construction and operation of a production unit for settled lobster juveniles at IGaFA, Illa de Arousa, Galicia.

On the basis of methods developed at the University of Maine in the US by Dr. Brian Beal, the lobster hatchery has been constructed in a transportable container, thus being the first mobile lobster hatchery ever been built. Under optimal conditions, the hatchery can have a capacity for producing more than 10,000 settled lobster juveniles per year.

When lobster eggs hatch, the larvae that are released are free-swimming and they drift with the seawater currents as do other planctonic organisms. During this free-swimming period of their life cycle, they moult or shed their shells three times before they metamorphose and change into juvenile lobsters

that settle on the seabed.

This spring almost 4,400 of such settled juveniles were produced for training purposes, and for studies investigating optimisation of on-growing methodology. After preliminary trials, the survival from hatching to settlement was very high, with an exceptional maximum survival at more than 90%.

Settled European lobsters are only 1.5 to 2 cm long, and are therefore extremely vulnerable to predation if they are released directly into the sea. For this reason, it is important to rear the

lobsters until they reach a length of 4-5 cm before they are released to increase their chances of survival. Currently, trials involving a variety of ways of rearing lobster juveniles are ongoing, and preliminary results indicate that survival and growth in the initial phases of the most promising on-growing methods is good. These trials are, however, in an early phase and require further refinement and optimisation based on results being obtained during this summer will take place during the coming year. It is hoped that an additional outcome to this project will be a greater appreciation for the need to effectively manage lobster stocks and thereby improve landings.

The EU-funded AquaReg Project is a co-operative venture between the regions of Galicia in Spain represented by the CETMAR Foundation, Border, Midland and Western (BMW) in Ireland represented by The Marine Institute and Trøndelag in Norway represented by joint forces of the South Trøndelag and North Trøndelag counties. The overall objective of AquaReg is to provide opportunities and design strategies for sustainable development of peripheral coastal communities by promotion of interregional co-operation in aquaculture and fisheries.

For more information about this project, see www.aquareg.com.



Co-operation has yielded positive results

Fish Farming Today, September 2005

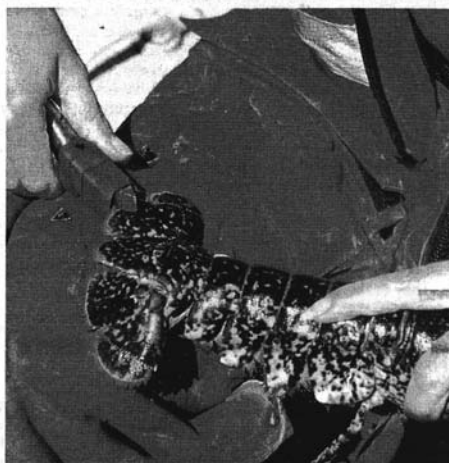
V-notch scheme success

The North Eastern Sea Fisheries Committee (NESFC) has run a successful lobster V-notching scheme that started in 1998 along the Yorkshire coast. This was one of the first major lobster conservation projects of its kind in the UK, although other SFCs have since followed with similar schemes to build up the breeding stocks.

The programme is still under way in Yorkshire and since 1998 more than 19,800 mature lobsters, mostly females, have been purchased and V-notched then released into local inshore waters as part of a conservation package.

Other lobster management measures by the NESFC include strictly enforcing the statutory minimum size of 87mm, and banning the use of parts of lobsters and crabs for bait. A permit scheme that ensures better records of the number of pots used and catch levels has also aided in monitoring the fishery.

All these measures have benefited the north east coast lobster fisheries, especially in the Bridlington area where landings have been rising for a decade. In 1980,



V-notching a lobster – the scheme is still under way in the NESFC district after starting in 1998.

Bridlington had 22 tonnes of lobsters. By 1990 this had increased to 51 tonnes and last year it reached a record 199 tonnes.

However, data for the whole of the Yorkshire coast show only a small increase in lobster production, rising from 426 tonnes in 1999 to 469 tonnes last year.

Raising the size limit for both sexes is the most likely

reason for the stable Yorkshire lobster stocks. This is despite the fact that 231 licensed vessels and 92 unlicensed boats set just over 86,000 pots for lobsters and velvet and brown crabs along this coast last year.

NESFC officers are concerned about the expansion in potting, although catch per unit effort remains constant for lobsters.

Fishing News, 2 September 2005

SW oyster processor wins equipment grant

FALMOUTH Bay Oysters has been awarded over £8500 of Objective One fisheries grant money to purchase a specialist oyster-grading machine, writes **Phil Lockley**.

The unit can quickly grade oysters into any specified weight/size category. It can also be used to grade other products, such as crabs, lobsters and scallops.

Established in 1999, Falmouth Bay processes a range of shellfish products, including the award winning Native Falmouth Bay Oyster. This is its second Objective One grant.

The firm's Jeff Childs said the purchase of the grading machine formed an integral part of a recent audit carried out on behalf of a major chain of London restaurants.

"Our company has been fully approved and as such we have been able to increase the size of our workforce."

Clare Leverton of South West Pesca, which administers the grants, said: "I am particularly pleased to see native oysters gaining a good market in the UK, especially those taken by the unique sail-powered boats working in Falmouth Bay."

Fishing News, 23 September 2005

EU says new rules needed for fish health

THE EU Commission has proposed tougher new rules for the health of farmed fish to stem the high cost of diseases in the industry.

It estimates that the financial losses due to disease (mortalities, reduced growth and reduced quality) are 20% of the production value, equivalent to €500 million within the EU.

The proposed legislation, for both finfish and shellfish, aims to simplify and upgrade existing legislation in order to improve the general aqua-

culture health situation across Europe. It also aims to better facilitate safe trade in aquaculture animals and products, and to boost the competitiveness of this important sector for the EU.

A central aspect of the proposal is a shift in focus to preventing disease occurrence at each point in the production chain rather than dealing with it only when an outbreak occurs.

Markos Kyprianou, commissioner for health and consumer protection, said:

"Disease outbreaks undermine consumers' confidence in the safety and wholesomeness of farmed fish and shellfish. They can also devastate the stocks of farms affected by them."

Prevention, he says, is the best cure and that is what the legislation aims at.

Aquaculture is an important growing sector in the EU, with a production value of around €2.6 billion a year. The proposed directive responds to the need to update current animal health

legislation for aquatic animals, taking into account the developments in aquaculture, as well as international experience and scientific knowledge.

A key objective of this proposal is to simplify and modernise existing legislation and procedures on aquatic animal health. It also aims to improve intra-Community trade and make it easier for third countries to trade with the EU by providing harmonised, clear-cut rules on aquaculture.

Fish Farming International, September 2005

Marine bill consultation

Industry, conservation groups and the public are being invited to give their views on planned legislation that aims to improve the management of Britain's seas.

The government is committed to introducing a marine bill by October 2006 that will establish an integrated system for the planning, management and protection of coastal and natural resources.

Three forums are being held with partner organisations to discuss proposals to help create clean, healthy, safe, productive and biologically diverse seas.

The first forum, at the Strand Palace Hotel in central London, will be held on 26 September and is open to all stakeholders. However, a high level of interest is

expected and places will be offered on a first come, first served basis.

The second and third forums are planned for the autumn and early next year.

Further information can be found on DEFRA's website.

■ A conference will also take place next month in London on the draft marine bill. 'Towards a marine bill – realising the opportunity', organised by company CMS, will highlight themes likely to be in the final bill and the views on them of the government and key stakeholders.

The conference is to be held on 25 October in London. Further details from Dr Bob Earll on tel/fax 01531 890415, e-mail bob.earll@coastms.co.uk or www.coastms.co.uk

Fishing News, 9 September 2005

Inshore fisheries forum proposals

Representatives of the North Sea Commission Fisheries Group from Denmark, Sweden, Norway, Scotland and Shetland briefed the European Parliament fisheries committee in Brussels on 30 August on a proposed inshore fisheries forum.

Shetland Islands Council fisheries director Peter Dryburgh says: "The inshore fisheries sector faces heavy challenges from other activities in coastal waters. There is increasingly heavy use of these waters for recreation, aquaculture, transport and power generation. There is also strong pressure for the designation of closed or managed areas for conservation purposes to protect vulnerable species and habitats."

North Sea Commission fisheries adviser Ann Bell says that the forum will:

- Promote greater participation in the management of coastal

waters by local communities and encourage more devolution of management powers.

- Bring fishers, environmental interests, leisure anglers, conservation agencies and local communities together to seek protection measures.

- Seek solutions to the conflict that often exists between the inshore sector and others fishing in coastal waters.

- Represent inshore interests on the North Sea Regional Advisory Council by seeking direct membership of the executive committee or active observer status.

- Consider the pros and cons of transferring inshore fishing rights to local fishers or local communities and seek to promote this where necessary.

- Think globally but act locally, including sharing expertise for the benefit of inshore fishers and their local communities.

Fishing News, 9 September 2005

Hunt for world's largest oyster!

OYSTER farmers around the world are being urged to take their jumbo-sized oysters to a hotel in Wales later this month in a bid to set a new world record.

Brewing company JW Lees is offering £250 for the biggest oyster on the day with another £250 if the world record is broken. The event is being endorsed by Seafish, who will provide awards for the winner and runners-up.

The world record attempt is available to all oyster farmers and growers, and both Pacific and native oysters can be entered.

Proceedings start at noon on Wednesday 28 September at the Anglesey Arms hotel, Menai Bridge, Ynys Mon, Wales. Dr Eric Edwards, vice-president of the Shellfish



Large native oysters from south Wales will be entered for the £250 prize.

Association of Great Britain, and Dr Stephen Lockwood, Seafish board member, will be judging.

The record is currently held by a native oyster (*Ostrea edulis*) from

Chesapeake Bay, Virginia, US. The 1999 oyster weighed in at 3.7kg (8.1lb) and measured 30.5cm long and 14cm wide.

■ Oyster season – page 14.

Fishing News, 16 September 2005

Crayfish tag programme launched in Co Donegal

BURTONPORT Fishermen's Co-operative and the Commercial Fisheries Research Group at the Galway-Mayo Institute of Technology are conducting a study of Donegal's crayfish stocks, writes John Rafferty.

It is widely believed that most crayfish stocks in Ireland have collapsed or are depleted, and all Irish landings of the species are exported to the Continent.

Crayfish landings have sharply fallen over the past 30 years, with only 36 tonnes recorded in 2002.

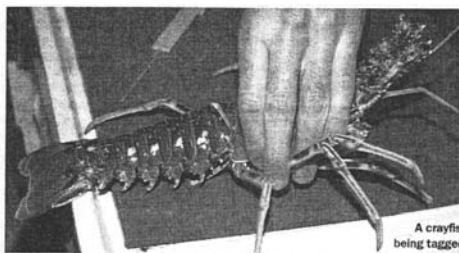
But due to the species' high unit value only a slight increase in stock could have a huge impact on the socio-economics of

the areas in which they are fished. Fishermen in some inshore areas are reliant on the fishery, particularly at the beginning and the end of the salmon season.

At present, crayfish fishermen receive €33/kg for their catches.

An EU minimum landing size (MLS) of 110mm carapace length and efforts to reduce tangle net activity are the only management measures for the fishery in Ireland.

The study will implement a tagging scheme to obtain growth and habitat information for crayfish under the MLS. It will also start a record system for all vessels fishing the species in the Donegal pilot region.



A crayfish being tagged

The Department of the Marine has granted a special licence to vessels nominated by the Galway-Mayo Institute to land under-MLS crayfish to Burtonport Co-op where they are to be kept in closed-circulation seawater systems.

Personnel from the Galway-Mayo Institute then measure, sex and tag

crayfish using coded suture tags that are not lost during moulting. Juvenile crayfish are then released back into the fishery.

Sightings of tagged crayfish should be reported to Brendan Allen at Galway-Mayo Institute of Technology, giving the tag colour, code and location.

Fishing News,
16 September 2005

Making new waves in scallops and sea urchins

SHETLAND, already renowned for its premium quality mussels, is also making new waves in other farmed shellfish products including scallops, queens and sea urchins.

Ben Wilcock established UK Scallops Ltd in 1999 and last year harvested his first batch of around 5,000 scallops and 100,000 queens.

This year marks a complete change of direction for the business. Ben has altered his farming process to grow scallops for two years only, he then sells the young shellfish onto other farmers to continue growth for a further two to three years until the scallops are ready for market.

"We are acting rather like a large hatchery," said director Ben Wilcock. "This new method of working means a very quick product turnaround for me. I'm now sup-



Scallops from Shetland are popular in France and Jersey

plying two year old scallops as far afield as France and Jersey where the product is proving very popular.

"I am extremely pleased with the operation, but it has been very hard work to get to this stage. It has been a case of learning as I go because, although there were three or four farms trialling scallop farming in Scotland, there wasn't a model in Shetland to be guided by.

"My plans for the future are to keep expanding, particularly by increasing the production of queen scallops, which grow very well in Shetland. I've also established a relationship with a processing unit on the mainland so that we can supply half shell queens and queen meat to the hotel trade in Scotland."

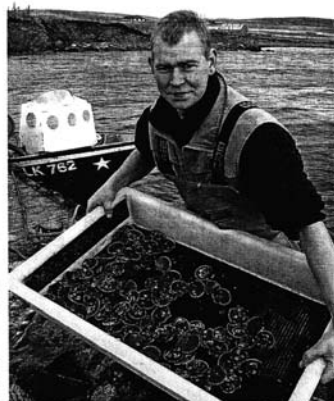
Ben has also begun a pilot project to investigate the growth potential for the small green sea urchin, which has a natural spat fall on his Shetland farms.

"Very little has been done within the UK to cultivate this species, although it seems such a natural thing for me to do. I'm still investigating the best method to farm sea urchins but, from other trials that I've done on my farms on the west coast of Scotland, I think the ideal way to guarantee any real commercial quantity would be to grow the urchins in small salmon cages.

"Other issues, such as when is the best time to harvest the roe from the urchin, still need to be addressed and I'm just learning as I go. The North Atlantic Fisheries College in Scalloway has been very helpful and are currently undertaking scientific research on my behalf as I investigate the more

commercial aspects of this new initiative.

"There is definitely a ready market for sea urchins, which, like caviar, is a highly sought after product, particularly by sushi bars. These new developments mean that the business is continually evolving and moving in new directions, ensuring that there is no reliance on the market for one particular species."



Ben Wilcock of UK Scallops with a batch

Fish Farming Today,
September 2005

Report by **Dr DAVID ROBERTS** of the School of Biological and Food sciences, Queen's University, Belfast

MORE THAN 100 people attended last month's Eighth Aquaculture Workshop organised by the Queen's University Centre for Marine Resources and Mariculture (C-Mar) at Exploris, Portlerry, Northern Ireland.

This annual event, initially targeted at industry, government and academia throughout the island of Ireland, now attracts delegates and speakers from other parts of Europe and the US.

This year's programme included sessions on scallops and on seaweed aquaculture, as well as reviews the work of the UK Sea Fish Industry Authority's Inshore Group and on the development of carrying capacity models for shellfish cultivation in Northern Ireland.

Scallops

Some stocks of the great scallop, *Pecten maximus*, which supports major fisheries throughout Europe, have been monitored over extended periods whereas other stocks have been studied only recently.

As well as addressing catches, growth, population and levels of toxic algae, surveys now routinely look at fishing impact and scallop habitats, ultimately contributing to sustainable management of the resource.

Stock decline has stimulated interest in scallop aquaculture for more than 20 years, yet seed production can be erratic and

Workshop goes from strength to strength



Delegates at last month's C-Mar workshop in Northern Ireland

continues, together with limited investment, to constrain aquaculture development.

However, increasingly successful mesocosm techniques can reduce seed-production costs and niche production systems from wild-caught seed to the table, such as those of Northwest Shellfish in Mulroy Bay.

Norway

Critical factors in the successful development of scallop aquaculture in Norway include predictable spat production, good water quality and investment. It now has large-scale hatcheries and legislation to protect sea ranching, which led to the first

seabed ranching licences being awarded this year.

Norwegian production systems include hatchery production of spat, land-based nurseries and bottom growout systems with PVC or stainless steel fences to exclude predators. All this is underpinned by clear business planning.

Inshore

The Seafish Inshore Group provided case studies of aquaculture development in south-west England and outlined a programme to develop good practice guidelines for primary producers.

It also outlined advice available

for businesses to meet increasing demands from environmental and food-hygiene legislation.

Strategies

Large-scale commercial bivalve aquaculture is ultimately limited by primary production at commercial sites. Carrying capacity models are being developed on behalf of the province's Department of Agriculture and Rural Development for the major sealoughs in Northern Ireland, to help develop management strategies for responsible development, particularly of mussels.

Macroalgae

Macroalgae have been exploited for centuries and global production is now a multi-billion dollar industry. In addition to their use in food for direct human consumption algal products have applications in the textile, paint, and biomedical industries, and as fertilisers.

More recent developments include those in aquafeeds, nutrient stripping in intensive aquaculture (integrated aquaculture) and waste-water treatment. Current R&D aims to develop culture techniques for 'new species' such as *Ulva* esculenta (BIM) and novel applications of algal products (Oilean Teo Glass (OGT)).

Fish Farming International, October 2005



Shaun Krijnen with the 3lb 4oz Pacific oyster he is claiming to be the biggest ever in the UK.

Fishing News, 7 October 2005

'Biggest British oyster' claim

SHAUN Krijnen of Menai Oysters in North Wales was claiming a new British record for the largest oyster at a competition for the *Guinness Book of Records* on 28 September.

He was presented with a cheque for £250 by brewing company J W Lees and a certificate by Seafish, which organised the event.

But Shaun's Pacific oyster, which weighed 1.48kg (3lb 4oz), failed to beat the American world record of 3.7

kg (8.1lb) and failed to earn him a place in the *Guinness Book of Records*.

However, Shaun, who sells about 70,000 Pacific oysters a year from his farm in the Menai Straits, has claimed a new British record and issued a "come and beat me" challenge to other shellfish producers.

He told *FN*: "As far as I am concerned it is a British record because I don't think one has ever existed. I am sure there are bigger

oysters somewhere, but I think mine is about 30 years old and was laid by MAFF in the early experiments with this introduced oyster."

The Welsh oyster beat challengers from Essex and the Fal River, Cornwall, at the competition, staged at the Anglesey Arms Hotel, Menai Bridge. It was billed as a curtain raiser to the 10th Annual Oyster and Welsh Produce Festival that begins today (7 October) in Anglesey.

Oyster reel protect shorelines

OYSTER farmers may be able to lobby for funding from their coastal protection authorities, if those officials read a new U.S. study concluding that oyster reefs play an important role in preventing coastal erosion.

Published in *Restoration Ecology*, scientists focused on coastal Louisiana – prior to Hurricane Katrina – and found that in normal conditions, oyster reefs proved an effective alternative to man-made protection, such as limestone breakwaters.

They concluded: "The use of small created fringing oyster shell reefs has the potential to provide a useful shoreline stabilisation tool to coastal managers under low energy environments."

Beds would therefore be useful in protecting soft coastlines such as sandstone, or marshland, where there are generally small waves.

Furthermore, reefs are self-sustaining, use native materials, have the potential for long-term growth, and contribute ecosystem stability, via water-borne chemicals stimulating oyster settlement.

Because they grow naturally, coastal protection "maintenance requirements would likely be reduced," noted the report.

Fish Farming International, October 2005

New Danish oyster company

A FARM has been 're-established' on the island of Venø in Denmark, following the liquidation of Venø Fish Farm KS in March 2005.

Using the same name, Venø Fish Farm AS now runs both the land-based and the fjord-based facilities, having taken over in the middle of the summer.

"Our strategy is to focus on the native European flat oyster (*Ostrea edulis*) while maintaining the ability to produce juvenile marine fish species should there be demand," says new managing director Henning Ramslev.

In previous years the farm produced European flounder (*Platichthys flesus*) for stock enhancement and Atlantic turbot (*Psetta maxima*) for sale to on-growing farms. Also, flat oysters from the Limfjord were purchased from local fishermen. These were cleaned, graded and purified in Venø Fish Farm's depuration unit before being



Henning Ramslev, managing director of the new Venø Fish Farm AS

sold under the brand-name 'Venøysters'. Any oysters weighing under 75g were stocked in suspended trays out in the fjord for a further growth period.

There have been unsuccessful attempts at spat production in Denmark for almost a century, although the newly established Danish Shellfish Centre in nearby Nykøbing

Mors has turned out several small batches of spat, on an experimental level. However, in the summer of 2004 Venø Fish Farm managed to raise several million flat oysters through the settling stage.

"Our first batch in mid-June was very good and then we had an even better one in July, so it wasn't just luck," says production manager David

Ommanney. "The proper preparation, husbandry and weather also played a part. Large-scale commercial production is now a reality here in Denmark."

"We are perfectly located on the Limfjord for farming native oysters," according to David Ommanney. "The fjord has a very high primary production [of microalgae] and warms up rapidly during

the spring and summer. Perhaps more importantly, the Limfjord has recently qualified for the status of an approved zone by the EU as being free of *Bonamia ostreae* and *Marteilia refringens*. This means that we can export healthy juveniles for on-growing elsewhere."

The strategy adopted by Venø Fish Farm AS is as a vertically integrated unit.

"We now have the component parts with which to achieve this," says Henning Ramslev, who owns 50% of the company.

"Our spat are fattened up in our areas in the fjord, after which we cleanse them in our depuration unit before marketing them ourselves under our established brand-name of Venøysters."

"This way we can guarantee our customers that we have a sustainable and environmentally friendly production of safe, top-quality native oysters."

Fish Farming International, October 2005

Mixed fortunes in Wash fisheries

It has been an uncertain summer in the Wash. July usually brings three or four weeks of intense activity as suction dredgers from King's Lynn and Boston scoop up the cockle TAC. But this year the dredgers have chosen to leave the stock alone.

While there were more cockles on the ground than for a long time, there was a fairly uniform mixing of mature and juvenile stock and dredging would have decimated a good year class coming through.

Lynn processor John Lake says: "We have a good setting from last year. All the cockle beds are set well but many of the cockles weren't big enough for this year."

Steven Williamson of Heiplog & Lynn agrees, saying: "There were cockles that we could have had. But they were smothered in immature stock. So we came to the unanimous decision to leave them and hope for a bumper year next year."

The situation is comparable to 1998 when a big spat-fall grew on to underpin the cockle fishery for several years. But a handraking fishery was agreed with a TAC of just 67 tonnes over the ensuing months, and with cockle supplies from other parts of the country disrupted by the tribulations of Burry Inlet and Morecambe Bay, it was hoped that it would provide an option for a handful of boats.

The problem for the rest of the 40 or so multipurpose Wash boats was how to find profitable employment until the shrimps started to come on in September. In the end, most boats turned to repair and maintenance or relaying of juvenile mussels on to the private lays.



Scooping up seed mussels to put on the lays was the only work left for most.



Cockles landed at King's Lynn – but not this year. The cockles, with a lot of immature stock, were left to grow for another year.

Fishing News, 26 August 2005

Razor fish promise a new fishery

On the brighter side, the Wash does have the prospect of a new fishery because large numbers of razor fish, the American species *Ensis directus*, have been found, particularly on the eastern side.

Directus has a tendency to live in highly mobile sand which is largely devoid of other sensitive species, so dredging would probably pass the environmental impact test.

Ground conditions suggest that that part of the Wash might be the cleanest razor dredging prospect in the UK and as a foreign species anyway, *Directus* is not a major concern of English Nature.

At 10-11cm, it is also a handy size for canning and the fishery could slot nicely into the late spring gap between mussels and cockles. CEFAS and Seafish are developing a suitable dredge and trials are due shortly.

A trial fishery could begin within months in two designated areas. Unfortunately, one of those is close to Heacham and Snettisham where beach recharging is about to start, and that patch is one of the more prolific brown shrimp grounds.

Despite the razor fish potential and signs of a decent autumn shrimp fishery – rockpools are full of young brown shrimp – the Wash waters are not getting any clearer.

Eider ducks create a Catch 22

A recent and pressing problem is a growing eider duck population which has discovered that mussel lays are easy pickings of its favourite food.

They are plundering by upending over the lays at low tide, which is more energy efficient than their normal deep diving, and more and more birds are flocking to the feast.

Number estimates are sketchy – official counting has been mostly limited to shore-based observation, out of sight of the lays – but there is no shortage of anecdotal evidence. Lynn processor John Lake has been particularly affected.

"In two visits to my lays, 3000 eider ducks were counted on one day and 2500 on another – and that's just on one lay," he says. "Eiders eat about 2.5kg a day each and they could be in the Wash for our months or more each winter. That's a lot of mussels – and at £400 per tonne."

Total Wash mussel landings last year came to 160 tonnes.

The industry and ESF want action before the birds return in the autumn and there have been meetings with English Nature, CEFAS and the bird organisations.

The discussions centred on proposals for scaring devices, which can be effective with rope culture mussels – the scarers can be placed on the pontoons and more closely directed.

But in the wide open spaces of the Wash, they will probably only move the ducks from one lay to another, and their effectiveness in terms of range has yet to be tested.

Also, there is the statutory authorisation procedure. Under the habitats legislation, any scaring proposals must undergo an 'appropriate assessment' to ensure no adverse effect on wildlife. If there are multiple applications, they must be assessed collectively.

There was a total of 22 applications from 13 fishermen and, had all been approved, the eider could have been scared away from the

lays to other areas. However, it is doubtful that they would have found enough to eat in those other areas.

"It is just not possible to show that there would not be an impact on the wildlife, not only on the birds but on the natural mussel beds," says Connel O'Donnelly of English Nature.

In which case, any shoot-to-kill policy – the logical next step – looks a non-starter. DEFRA approval for this would hinge on non-lethal means having been shown not to work, and that is difficult as non-lethal means have not been approved. Those 22 applications have therefore encountered a Catch 22 situation.

Some applicants have lodged appeals against English Nature's decision and there might yet be a public inquiry. But that would not be in time for the winter mussel season.

There is the possibility of funding for fishermen to test non-lethal measures, helping to defray losses over the coming winter.

Fishing News, 26 August 2005

Fishing News, 26 August 2005

'Blip' in mussel growth rate

The mussel sector has also been having a mixed time. A lot of juvenile stock was shifted on to lays during the spring, most going on sublittoral beds to reduce barnacle growth and increase meat ratio. It was partly because of barnacle growth that only about 300 tonnes of a TAC of 1400 tonnes was fished last winter.

But growth rates have been generally low with a number of possible factors implicated. These range from crowded stock or lower water flow from nutrient-bearing rivers reaching the Wash to

global warming with milder winters perhaps keeping the bivalves feeding longer for relatively little return. Hotter summers could be a problem in future.

"We had a blip in growth rates which might have been down to the hot weather in 2003," says Mat Mander, clerk and chief fishery officer at Eastern Sea Fisheries.

"And although meat yields have improved, they haven't really bounced back as we had expected. It is still too early to flag up warmer conditions as a major factor in the longer term but we are keeping an eye on it."

Fishing News, 26 August 2005

Razor fishery edges closer

PROSPECTS for a new razor fishery in the Wash, based on the now domiciled American species, *Ensis directus*, are looking better with the imminent trial of a new dredge, reports **John Worrall**.

CEFAS, which went out to tender for a boat to undertake the work, was expected to award the contract this week so that the trial could be completed well before the end of the month.

Dave Palmer of CEFAS said: "We expect the trial to involve about 10 days of dredging. One of the main points of interest will be the optimum depth to get the razor fish out of the ground."

"We want to go as shallow as possible while still achieving a quality catch and we will be looking at the impact of the dredge on the seabed and monitoring seabed recovery."

"We will then be doing

another appropriate assessment before we look at the possibility of opening a commercial fishery."

The dredge, which has been built in Boston, is based on a model already in use in Ireland on the larger, native, razor fish and is expected to deliver live razors. Experimental fishing a few years ago before the Wash fishery was closed showed damage rates of below 10%.

This trial concentrates on two areas on the east side of the Wash, covering a couple of square kilometres where grab sampling has already suggested a stock of around 2000 tonnes.

"This trial project is due to finish at the end of October and once the results are to hand, the interested parties will need to decide on the way ahead", said Dave Palmer.

"Ideally it would be a spring fishery."

Fishing News, 7 October 2005

INFORMATION FILE

WHERE CAN I GET HELP OR ADVICE?

Policy Matters

Department for the 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; Aquaculture, Salmon, Freshwater Fisheries and Whaling Division

Area 5E, 3-8 Whitehall Place, London SW1A 2HH (Tel. 0207 270 8227) (Fax. 0207 270 8827)

Shellfish Health; Aquaculture, Salmon, Freshwater Fisheries and Whaling 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 and Pollution, Marine Environment Consents;

Marine and Waterways Division

Area 2D, 3-8 Whitehall Place, London SW1A 2HH (Tel. 0207 270 8642) (Fax. 0207 270 1036)

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 Aquaculture 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)

You can also visit the Defra website at <http://www.defra.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 EH6 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

Food Standards Agency (England), 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.cefasc.co.uk>

Fisheries Research Services, Marine Laboratory, PO Box 101, Victoria Road, Aberdeen AB9 8DB
(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, Ardvassar, Isle of Skye, IV45 8RU
(Tel/Fax: 01471 844324)
(<http://www.assg.co.uk>)

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

Cefas

A variety of booklets and leaflets are available, including:

- A Guide to Shellfish Health Controls
- 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)

The above may be obtained from the Cefas Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, DT4 8UB, (Tel no: 01305 206600; Fax no: 01305 206601)

A catalogue of Cefas publications is available from the Cefas Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk, NR33 0HT, (Tel no: 01502 562244; Fax no: 01502 513865). Electronic copies of many of these publications can be found on the Cefas web site at <http://www.cefas.co.uk/publications/default.htm>

Back copies of issues 9-19 of Shellfish News can also be viewed and/or downloaded as .pdf files from the Cefas web site (http://www.cefas.co.uk/publications/shellfish_news.htm). Many of the illustrations are in full colour in the web edition.

Seafish

Detailed information on the technical and economic aspects of cultivation for individual shellfish species is available from Seafish. They publish a series of 'hyper-books' on CD-ROM that covers all aspects of cultivation. Economic models are also available.

For further information contact the Aquaculture Development Advisor for your area (see above for contact details, or <http://www.seafish.org/sea/aquaculture.asp> for further information).

A full list of Seafish publications can be found on the Seafish web site at <http://www.seafish.org/resources/publications.asp>



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