



**Seed mussel (*Mytilus edulis*) off the Ards Peninsula, Northern Ireland (Photograph by Dr Nuala McQuaid)**



**Native oysters (*Ostrea edulis*) in Strangford Lough, Northern Ireland (Photograph by Dr. Dai Roberts)**

## Native oyster restoration

Another study (funded in 2003 from the same source) is currently contributing to native oyster (*Ostrea edulis*) restoration in Strangford Lough. Following on from previous restocking programmes in the late 1990's, this project involves continued monitoring of distribution and recruitment of native oysters in the Lough. Also included is a genetic analysis of stocks of natives from within the Lough and further restocking with seed produced both at a commercial hatchery and C-Mar's hatchery at Portaferry, Co. Down. The project is being carried out in conjunction with the Strangford Lough Shellfishermen's Co-op.

## Razor clam harvesting

A three-year project entitled, "Sustainable Harvesting of *Ensis* (Razor clams)" or "SHARE" has just been awarded funding of €0.86m by the Interreg IIIB Atlantic Area Programme. Lead by C-Mar, the project

has partners in Spain (University of La Coruna and CIMA), Portugal (IPIMAR) and the Republic of Ireland (BIM). The project aims to take a "seed to market" approach to the development of sustainable production of razor clams (*Ensis siliqua* and *Ensis arcuatus*) in the Atlantic Area. The project partners hope to achieve this by developing protocols and recommendations for hatchery rearing, nursery production, ranching and reduced-impact harvesting. BIM will examine product development, quality indices, and optimal criteria for holding and transport to market.

## Further information

Updates on the results of the above research will be submitted to future editions of Shellfish News. In the meantime, further information on these and the rest of C-Mar's projects can be obtained by contacting C-Mar at +44 28 42729648 or logging on to our website at [www.qub.ac.uk/bb/cmar](http://www.qub.ac.uk/bb/cmar).

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## A VIRUS INFECTION IN EUROPEAN BROWN SHRIMPS (*CRANGON CRANGON*)

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### The brown shrimp

*Crangon crangon* supports an important fishery in Europe, with catches amounting to over 25,000 tonnes per annum (with a first sale value of more than 80 M Euro). The largest fishery for this species is located in the Wadden Sea (a nursery area for this species). Fishing fleets from Germany, the Netherlands, Denmark and France are responsible for the majority of landings. Due to its occurrence in large populations and its role as a predator and a prey organism, it is a key

species involved in cycling of the benthic habitat. In this fishery, it has been stated that in addition to fishing mortality, environmental factors (such as salinity, depth and predator density) can affect the natural mortality rate. Recent studies on UK estuarine populations of *C. crangon* carried out in our laboratory have led to the discovery of a highly prevalent virus infection in the hepatopancreas. As such, due to the apparent pathogenic nature of this virus, we propose that this disease may also play a role in modulating populations of this important species.

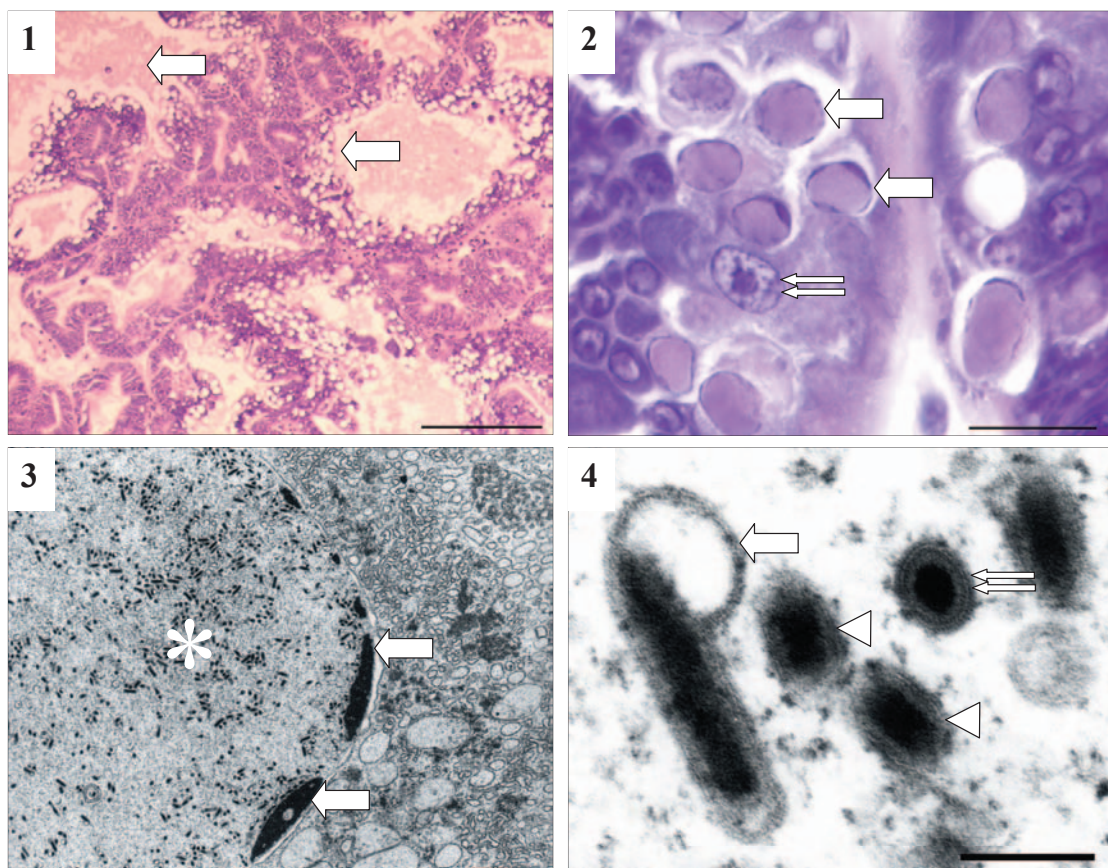
## A strange pathology in the hepatopancreas

*C. crangon* collected from sites in the Clyde, Mersey, Thames and Alde estuaries during sampling exercises arranged under the National Marine Monitoring Program (NMMP) were processed for histology and electron microscopy using standard methods.

Whilst there were no obvious signs of external disease in any of the shrimp collected, histological analysis revealed a characteristic pathology in 98% of the shrimp from the Clyde estuary and 95%, 72% and 70% of the shrimp from the Mersey, Alde and Thames estuaries respectively. Affected shrimp showed degeneration of the hepatopancreatic tubules, causing a loss of histological structure in the organ (Figure 1). At higher magnification, significant changes were seen in the nuclei of epithelial cells lining the hepatopancreatic tubules and of the epithelial cells lining the midgut (Figure 2). Cells containing such nuclei appeared singly or in clusters and the cytoplasm of intact affected cells appeared denser than unaffected cells, with an apparent loss of lipid storage inclusions. The percentage of

hepatopancreatic epithelial cells containing aberrant nuclei and the relative degree of pathology differed between individual shrimps, suggesting that the condition had a progressive nature, leading eventually to the degeneration of the hepatopancreas.

Higher power views of affected cells, obtained using a transmission electron microscope revealed that the nuclei of these aberrant hepatopancreatic epithelial cells contained large numbers of rod-shaped, cylindrical, envelope-bound particles (Figure 3). The mean length of these particles was approximately 280 nm, with a mean diameter of 72 nm. The envelope surrounding each particle was approximately 5 nm in width (Figure 4). The structural nature of these particles is in accordance with previous virus infections described in invertebrates. They most closely resemble the intranuclear bacilliform virus (IBVs) described infecting other crab, crayfish and shrimp populations from around the world. This is the first report of an IBV in the Crangonidae family of shrimps and as such, we have termed this virus *Crangon crangon* bacilliform virus (CcBV).



**Figures 1-4. CcBV-infected hepatopancreatic epithelium. (1) Low power light micrograph of tubular degeneration in mid-late infection (arrows). (2) Higher power light micrograph of infected cells showing aberrant nuclei (arrows). An apparently uninfected nucleus is also highlighted (double arrows). (3) Electron micrograph of infected cell showing periphery of nucleus containing masses of virions (asterisk). Note the margination of host genetic material (arrows). (4) High power electron micrograph of virions in lateral section (arrow), transverse section (double arrow) and elliptical section (arrow heads). Scale bar = 100 nm**

## Significance to brown shrimp stocks

Description of this highly prevalent and apparently pathologic IBV in *C. crangon* is particularly important due to the relative lack of information on such infections in wild (non-cultured) crustacean species and the importance of *C. crangon* as a fishery resource. Although pathogenesis trials have not yet been carried out, it is suggested that the pathology associated with CcBV infection is serious enough to lead to dysfunction of the hepatopancreas and ultimately to death of the host.

Since *C. crangon* supports an important fishery in Europe and due to its key position in many benthic habitats, it is recommended that further studies are carried out on the prevalence of this infection in important fisheries sites. If significant infection prevalence is detected on such fishing grounds, it is likely to create an additional loading on natural mortality in *C. crangon* stocks. In addition, since *C. crangon* is also regarded as cannibalistic (accounting for between 2 and 42% of mortalities in these fisheries) and that it is presumed that CcBV is transmitted horizontally (as for other IBVs), it is tempting to suggest that cannibalism may also lead to the very

high prevalence of CcBV infection in *C. crangon* populations. However, the pathological manifestation of CcBV would also lead to liberation of infective stages (as loose virions and sloughed epithelial cells) in the faeces. In this way, transmission may occur by coprophagy and benthic scavenging by *C. crangon*. Further studies are required to assess whether CcBV has the ability to affect recruitment in *C. crangon* fisheries and to whether this virus is specific to *C. crangon* or can infect other benthic crustacean species inhabiting these environments.

## Acknowledgements

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## Reference

STENTIFORD, G.D., BATEMAN, K., FEIST, S.W. Pathology and ultrastructure of an intranuclear bacilliform virus (IBV) infecting brown shrimp *Crangon crangon* (Decapoda: Crangonidae). *Diseases of Aquatic Organisms* 58, 89-97.

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## TOOTHPASTE FROM SHRIMP SHELLS

It is reported that crab fishermen have healthy teeth, because they often chew on freshly cooked crabs.

A year ago a student in Germany told his father of a project in his school studying shrimp shells. The shell is made of chitin, from which chitosan can be obtained. Chitosan has antibacterial qualities and it was found that it could cover teeth with a fine film that protects them from bacteria.

The father of the student was the head of the company "B&F-Elektro" and together with the college, The Institute for Environmental Technology (Eutec), this gave him the idea to develop a toothpaste made from shrimp shells. The product, named "Chitodent", was introduced, with much publicity, to the German market on 1<sup>st</sup> March this year.

Initially the tubes are being filled manually at a small establishment, located next to the college, with production of only 2,000 tubes per month. Negotiations with companies that can produce greater amounts at a more competitive price are in progress. At the moment, this natural dental paste can be only acquired via the Internet (see <http://www.chitodent.de/en/index.html>), but the distributors are also already negotiating with some supermarket chains. Each tube of "Chitodent"



costs 6.48 euro. Despite this high cost orders are arriving at the rate of 10,000 per month, from all over Germany.

The toothpaste does not smell or taste of shrimp as chitosan is odourless and at the high degree of purity used is also non-allergenic. The bitter flavour from the additional products used to create the foam is disguised with mint, which is common to many types of toothpaste.

The main problem at present is in obtaining sufficient raw material necessary for the production of "Chitodent". Most of the shrimps fished locally are exported whole to Morocco, but the manufacturers hope to buy in chitin in a pulverized state, possibly from China.