

Theme Session D

New trends in diseases of marine organisms: causes and effects

Co-Convenors: Sharon MacLean (USA), Thomas Lang (Germany), and Sharon McGladdery (Canada)

Background

There is considerable scientific and public interest in ICES Member Countries related to diseases and parasites of wild and farmed marine fish and shellfish, both in the context of ecosystem health monitoring and assessment, and in the context of the expansion of mariculture as an important source of food protein to meet growing demographics. Furthermore, efforts initiated for an assessment of the health status of marine mammals have increased over the past years.

The Theme Session focus was to gather scientists from ICES Member Countries contributing paper and poster presentations on the following and other relevant aspects:

- causes and effects of emerging diseases (incl. parasites) in wild fish, shellfish and other marine organisms;
- causes and effects of new diseases (incl. parasites) in farmed fish and shellfish;
- the use of diseases and parasites of wild marine organisms as indicators in integrated ecosystem health monitoring and assessment;
- new trends in the disease interactions between wild and farmed fish and shellfish;
- effects of introduced species on the health status of native fish and shellfish stocks;
- new methodologies related to disease diagnosis and control.

Because of both the venue (Canada is a leading country in research on diseases of marine organisms) and the generally increasing interest in the topic, it was anticipated that the Theme Session would attract many contributions from various ICES Member Countries.

Presentations

S. MacLean, the Chair of the ICES Working Group on Pathology and Diseases of Marine Organisms (WGPDMO), opened the session held on Tuesday, 23 September, 16:00–18:00 hrs and on Wednesday, 24 September, 09:00–13:00 hrs. She welcomed the participants (between 20 to 40 depending on the presentation) and outlined the scope of the Theme Session. 14 oral presentations were given and two posters were displayed at the Poster Session on Tuesday.

The majority of contributions focused on diseases and parasites of wild fish. Issues addressed included a new robust and easy-to-communicate method (Fish Disease Index) to quantify and assess the health status of wild fish species in the context of marine environmental monitoring and assessment programmes (e.g., the OSPAR CEMP)(D:01), and spatial and temporal patterns in hyperpigmentation, a phenomenon of unknown etiology increasingly affecting North Sea dab (*Limanda limanda*) (D:02). These presentations illustrate the value of long-term monitoring in detecting trends in disease conditions and in providing a basis for retrospective and prospective evaluation of environmental conditions. Additional presentations included: the detection of antibody against Infectious Salmon Anaemia (ISA) Virus in archived sera (1995–2002) from wild Atlantic salmon (*Salmo salar*) in Maine and Massachusetts, USA (D:03); the infection of wild caught Atlantic sturgeon (*Acipenser oxyrinchus*) from the New York Bight and Hudson River, USA, with the copepod *Dichelesthium oblongum*, causing ulcerative lesions on the fins and increased concentrations of serum ions (ion loading) (D:12) ; an overview of endemic mycobacteriosis in the Chesapeake Bay (D:13), affecting striped bass (*Morone saxatilis*) since the late 1990s at high

prevalences (> 75 %) with indication of disease-induced mortality; improved diagnostic methodologies (virus isolation on cell lines, RT-PCR and *in situ* hybridisation) for the detection of betanodavirus infections in Atlantic cod (*Gadus morhua*) (D:15); and the red vent syndrome, a new disease caused by parasitic nematodes (*Anisakis simplex*) penetrating the tissue in the vent region and leading to significant inflammatory reactions in Atlantic salmon returning to rivers in England, Wales and Scotland, UK, in 2006 and 2007 (Poster D:22).

Diseases affecting both farmed and wild fish were addressed in two presentations, both describing a new emerging infectious disease caused by non-motile, Gram-negative, aerobic and facultative intracellular bacteria belonging to the genus *Francisella* (D:07, D:14).

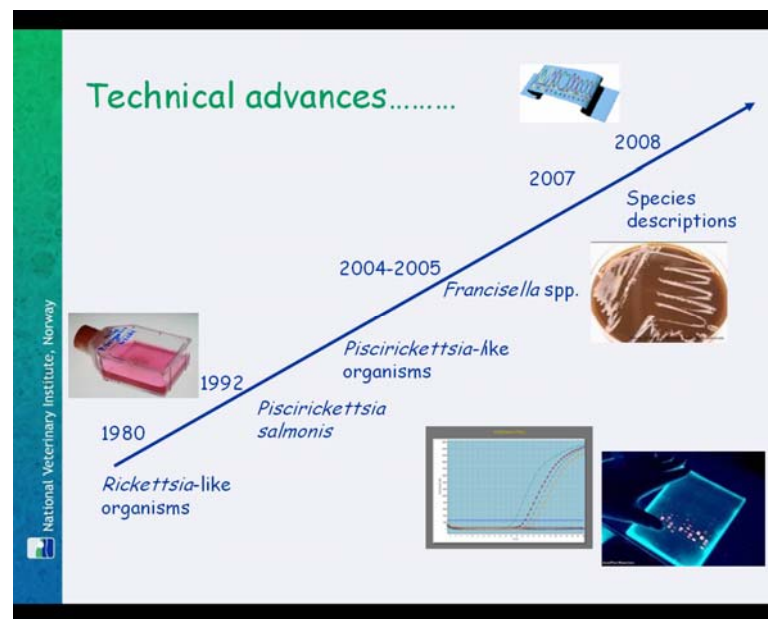


Figure: ICES CM 2008/D:07 *Francisella* spp. infections in farmed and wild fish. Duncan J. Colquhoun, Adam Zerihun, and Jarle Mikalsen

This genus is widespread and has been reported to affect mammals (including humans) and a number of wild and farmed marine and freshwater fish species on a global scale. In fish, *Francisella* sp. causes a conspicuous granulomatous disease, primarily affecting spleen, kidney and liver, termed 'visceral granulomatosis'. By applying new immunohistochemical and real-time PCR techniques to stored histological blocks, it has been confirmed that this disease was previously incorrectly diagnosed as 'presumptive mycobacteriosis' in wild cod. The disease has been found to affect both farmed and wild cod in Norwegian and Swedish waters at high prevalence since 2004. There is some indication that the spread of *Francisella* sp. may be linked to increased water temperature. From experiments, there is no evidence that the infection can be transferred from fish to humans.

The studies of *Francisella* in cod (D:07, D:14) and of antibodies to the ISA virus in archived sera of Atlantic salmon (D:3) demonstrated the presence of these pathogens in wild cod and salmon many years before culture of these species began in the respective regions. New diagnostic techniques and pathogen detection methods applied to archived samples allow for such retrospective analysis which in turn provides greater epidemiological data toward understanding wild and farmed fish interactions. Further, detection of pathogens in wild stocks prior to farming may alter classification of diseases (e.g., enzootic or exotic) and have implications for regulatory purposes.

Information on disease problems in shellfish were provided in three presentations. Presentation D:04 addressed the emergence of bitter crab disease as an international health issue. The fatal disease is caused by a parasitic dinoflagellate of the genus *Haematodinium* and has been reported from approximately 30 wild decapod crustaceans both from the North Atlantic and Pacific oceans. Because affected crabs are partly non-marketable due to their bitter flavour, the disease causes economic losses. Both this paper and D:13 (mycobacteriosis in striped bass) reported on multidisciplinary studies that point to the importance of population dynamics and modelling expertise in assessing the impacts of disease on wild stocks. Presentation D:23 provided information on crustacean health problems in relation to the new EC Fish Health Directive (2006/88/EC) which now includes regulations directed at crustacean diseases. In this context, results of experimental trials on the susceptibility of European lobster (*Homarus gammarus*) to the viral agent causing the white spot syndrome were detailed. Presentation D:10 provided information on a new hard clam (*Mercenaria mercenaria*) parasite found in Virginia, USA, belonging to the Haplosporidia, a group known to cause lethal oyster diseases. Through electron microscopy and SSU rRNA sequencing, the hard clam parasite was designated as a new species of the genus *Minchinia* and is closely related to *M. tapetis* that infects carpet shell clams in Europe. The presentation critically addressed the question of suitable methods for the detection of an infection, e.g., molecular assays vs. histology, particularly for organisms not easily seen microscopically.

A considerable number of presentations focused on diseases in marine mammals. A molecular

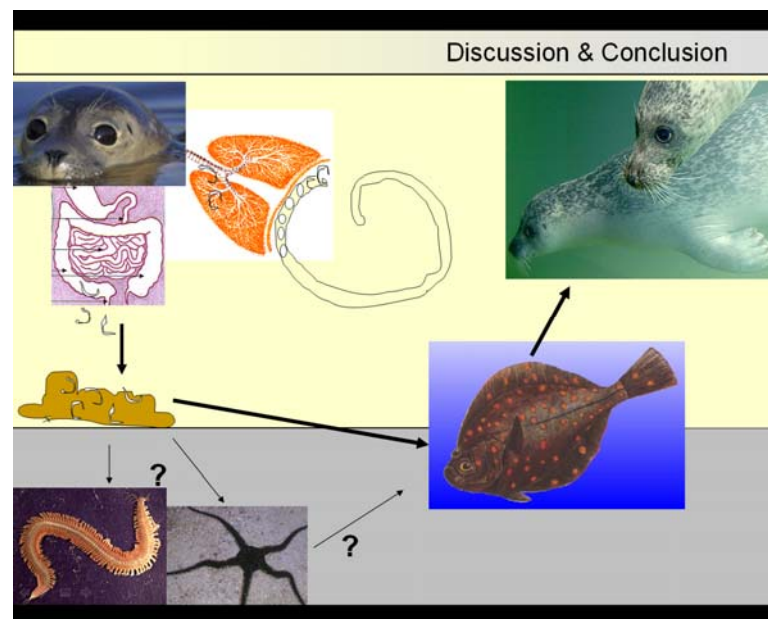


Figure: ICES CM 2008/D:06 Lungworm transmission in porpoises and seals: molecular tools determine fish intermediate hosts. Kristina Lehnert, Georg von Samson-Himmelstjerna, Peter Wohlsein, Dirk Schaudien, and Ursula Siebert

study on the transmission of lungworm species (Nematoda) that are associated with pneumonia in porpoises and seals showed that the flatfish species dab, plaice (*Pleuronectes platessa*) and turbot (*Psetta maxima*) may act as intermediate hosts of juvenile parasites in the North Sea (D:06). D:08 presented an overview on the most prevalent infectious diseases (nematode infections, bacterial [incl. the zoonotic pathogen *Brucella* sp.] and viral infections) in marine mammals from the North Sea and Baltic Sea. Results of a long-term study on the causes of death in harbour porpoises (*Phocoena phocoena*) stranded along the coastline of the southern North Sea in the period 1990 to 2007 were presented in contribution D:09. The results revealed that the number of strandings has increased (possibly either due to increased

fishing effort or to a southward shift of the population associated with an increase in population density) and that the majority of fatal cases could be attributed to mortality associated with bycatch and to infectious diseases. Poster D:20 presented results of an integrated study carried out in bottlenose dolphins (*Tursiops truncatus*) from South Carolina and Florida, USA, investigating the link between the health status of the dolphins and their chemical body burdens with respect to anthropogenic hazardous substances such as brominated flame retardants, PCB, DDT and trace metals. In particular the dolphins from the sampling site in South Carolina (Charleston) were characterised by high contaminant levels - some of the highest ever measured in marine mammals. Dolphins classified as 'diseased' had significantly higher concentration of polybrominated diphenyl ethers (PBDE) than specimens classified as 'normal' or 'possibly diseased'.

Paper D:05 constituted a specific contribution to the Theme Session in that it focused on the anticipated transfer of infectious diseases (rabies, morbillivirus, adenovirus, parasites) from terrestrial to marine mammals due to the reduction of sea ice in the Arctic and resultant increased proximity of previously separated marine and terrestrial mammal populations. The presentation highlighted the potential effects on marine mammal populations and on the subsistence harvest of marine mammals by Native communities.

Final considerations and conclusions

The contributions to the Theme Session clearly demonstrated the large variety of diseases affecting wild and farmed marine organisms as well as the sophisticated research carried out in relevant laboratories of ICES Member Countries. The co-convenors were pleased with the high quality of the contributions, which was also reflected by the two ICES Awards given to two contributors to the Theme Session: Kristina Lehnert (D:06) as best ICES ASC 2008 newcomer and Duncan Colquhoun (D:07) for the best ICES 2008 ASC paper presentation.

Some of the diseases described have been well known for a long time, while others appear to be newly emerging problems. While the majority of presentations focused on wild fish and marine mammals, there were relatively few contributions addressing disease issues relevant for farmed fish and, unfortunately, none for farmed shellfish. However, from the information highlighted in the presentations, there is evidence that a number of areas are emerging that require further dedicated research and monitoring:

The use of diseases of wild marine fish, shellfish and mammals as indicators in integrated assessments of ecosystem health in relation to the impacts of anthropogenic pressures (e.g., hazardous substances, climate change, transport, offshore industries),

- improved methodologies for estimating population effects of diseases in wild stocks,
- the transmission of diseases from wild to farmed marine fish and shellfish and *vice versa*,
- human risks associated with potentially zoonotic diseases affecting marine organisms,
- disease risks to wild and farmed indigenous species due to introduction of new species or to global product trade,
- the effects of climate change on the ecology of infectious diseases in marine organisms, including range extension of marine animal diseases associated with alteration in host species range and pathogen introduction to potential new host species,
- improvement of diagnostic tools for the identification of disease infections and pathogens involved, including validation assessment for the use of molecular tools in regulatory decision-making.

The need for the continuation of funding of wild fish disease monitoring programmes by ICES Member Countries has repeatedly been stressed by the ICES Working Group on Pathology and Diseases of Marine Organisms (WGPDMO) and a letter requesting ICES Member Countries to take part in such programmes was sent out by the ICES General Secretary to the ICES Delegates in September 2008. The rationale for this is based on the need to detect environmental trends affecting wild resource productivity as well as the need to understand health dynamics in the environment we are increasingly relying upon for farming fish and shellfish species. Without this information, management of mariculture (open water) health is easily compromised, as is our ability to risk assess locations for farming of species susceptible to specific diseases and parasites.