Project no. SSP-2004-006598

Project acronym:
DIPNET – Disease Interaction and Pathogen Exchange NETwork

Project title:
Disease interactions and pathogen exchange between farmed and wild aquatic animal populations
- A European network

Instrument: Coordination Action

Thematic Priority 8 Scientific Support to Policy

D 5.6: Publishable final activity report

Due date of deliverable: November 14, 2006
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Start date of project: October 1 2004 Duration: 24 months

Organisation name of lead contractor for this deliverable: IFREMER

Revision : Definitive

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	x
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Project execution

DIPNET (full title: "Disease interactions and pathogen exchange between farmed and wild aquatic animal populations – a European network") is a coordination action funded under priority 8 of the 6th EU framework programme for research. Its principal objectives are to strengthen the current scientific knowledge on transfer of pathogens and diseases between wild and cultured aquatic animal populations, to provide knowledge based scientific advice to policy development, to build networks among interested parties and to disseminate current knowledge towards knowledge users, other stakeholders and the wider European public.

The project was carried out from October 1, 2004 through September 30, 2006. The work was organized in five work packages, each headed by one of the contractors:

WP 1: Scientific review of disease interaction and pathogen exchange (FRS Marine Laboratory Aberdeen, UK; Dr. Rob Raynard)
WP 2: Risk assessment and modeling of pathogen exchange (CEFAS Weymouth Laboratory England; Dr. Edmund Peeler, Dr. Mark Thrush)
WP 3: Epidemiology of infectious fish and shellfish diseases (Universidad de Zaragoza, Facultad de Veterinaria, Spain; Dr. Ignacio de Blas)
WP 4 Network building and knowledge dissemination (VESO, Oslo, Norway; Dr. Paul J. Midtlyng, Ms. Aase Helen Garseth)
WP 5: Scientific coordination and project management (IFREMER La Tremblade; Dr. Laurence Miossec)

IFREMER has been the scientific coordinator of the project, while VESO has been carrying out the economic and administrative project management. Agreements have been signed with 6 non-contracting institutions, and more than 100 scientists from 26 European countries have participated in various DIPNET activities and contributed to the work.

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Scientific work

After an initial kick-off workshop with more than 40 invited scientists, working subgroups were established to draft various parts of the scientific review report (WP1) and to carry out the work plan relating to risk assessment and modelling (WP2) and epidemiology (WP3).

A scientific review of current activities and methods in epidemiology and surveillance of infectious diseases in farmed and wild fish and shellfish (WP3) was completed during the first year of the project.

During the second project year, an open workshop with close to 100 invited participants from 26 European countries was held in Prague to present the draft and to obtain further input to the draft WP1 document that was subsequently completed. In WP2, a review of risk assessment and predictive modelling in aquatic animal health (D2.1) and further scientific deliverables

were produced during year 2 (see below). Based on the materials collected, an introductory risk assessment seminar specifically targeted at potential users was held in Weymouth late May 2006.

In WP3, the review on methods in epidemiology and surveillance of several scientific deliverables was revised (D3.1) and a position paper on priorities in epidemiological research and surveillance of diseases in wild aquatic animal populations (D3.3) was completed. Moreover an additional report on epidemiological basis demonstrating causality was provided (D 3.4). A user seminar on fish disease epidemiology and surveillance was held in Zaragoza on May 30-June 1, 2006.

List of DIPNET scientific reports

- D1.5 Review of disease interactions and pathogen exchange between farmed and wild finfish and shellfish in Europe
- D2.1 Review of risk assessments and disease modeling in aquatic animal health
- D2.2 Position paper on consequence assessment in aquatic animal health risk assessments
- D2.4 Position paper on research priorities in aquatic animal health risk assessments
- D3.1 Review of current fish disease monitoring and surveillance activities in Europe
- D3.3 Position paper on priorities in epidemiological research and surveillance of wild aquatic animal populations
- D 3.4 Transfer of pathogens between farmed and wild aquatic animals – epidemiological basis for demonstrating causality (additional deliverable)

All of these documents will be made publicly available for stakeholders and interested parties.

Dissemination and use

A project website including a scientific bibliography and information about the project and its work was rapidly established. An E-mail group for active dissemination of newsletters was also initiated and proved very successful, reaching more than 150 subscribers within 3 months and more than 350 subscribers within 1 year. At the end of the project, this newsgroup comprised more than 530 recipients, and continues to grow. Forty six newsletters with relevant information on the subject of study were disseminated through this channel during the 2-year project period.

More than 10 scientific poster and oral contributions pertaining to the DIPNET work have been presented by project participants at various scientific conferences. A non-technical summary of the WP1 report (in English) has been completed and printed for dissemination among the interested public. With the help of the DIPNET network of scientists, translations of the text into the main European languages have been initiated to support further dissemination. The collection of newsletters, the published information materials, and project reports will be kept available at the project website until November 2008.

A specific deliverable summarizing a number of proposed policy actions (D5.5: Policy Implementation Plan) has been prepared and submitted to the policy customer, DG Fisheries and Aquaculture. Access to this deliverable is restricted and further distribution and use of the document is to the discretion of the Commission Services.

For further information and published results from the project see: www.dipnet.info

Project logo

Main scientific conclusions

The project's main scientific deliverable (D1.5) is a more than 400-page scientific review. In total, this document comprises 82 disease chapters, each with a comprehensive bibliography of scientific articles. The available information is being presented and discussed in four main sections, following an ecosystems approach, each scenario representing the situation in various parts of Europe:

The North Atlantic scenario

Disease interactions between coastal net-pen aquaculture and migrating wild fish populations

There is good evidence that pathogen exchange from wild to farmed populations is fundamental to disease emergence in aquaculture. However, the large number of individuals and high biomass density of farmed populations may lead to epidemics that – when left uncontrolled – tend to become self-perpetuating within the aquaculture segment itself. In such situations, infections in aquaculture may spill over and infect wild susceptible host species. However, the conditions that promote epidemics and disease occurrence in aquaculture are rarely found in wild fish populations and there are few reports on negative population effects in the wild. The most prominent current examples of disease interactions with negative effects on wild aquatic populations in the North Atlantic scenario are infestations with the salmonid ectoparasites *Gyrodactylus salaris* and *Lepeophtheirus salmonis.* These examples, however, both demonstrate that risks can be alleviated through adequate measures such as zoo-sanitary controls on live fish movements and of release into the wild, and through co-ordinated measures to reduce the propagation of parasite population in aquaculture sites. For protection of aquaculture from disease interactions, preventing the establishment of long-term infection reservoirs (e.g infected escapee populations) in the wild aquatic fauna, and location of sites to minimise contact opportunities with potential wild fauna carriers are deemed the most important.

The continental European scenario

Disease interactions between freshwater resident wild fish populations and traditional (pond) aquaculture

From the perspective of maintaining biodiversity and the viability and strength of wild aquatic animal populations, the spread of crayfish plague stands out as a dominant issue. The main problem prohibiting the management and control of this disease, that easily eradicates native European crayfish, is the lack of adequate diagnostic methods to identify latent carriers. A second conservational issue of particular urgency is infectious haematopoietic necrosis (IHN) virus infection and its consequence to landlocked Atlantic salmon strains, that may become exposed should this infection be translocated from south and central Europe where it is endemic. There are still no data to evaluate the role of wild-farmed fish interactions in the epidemiology of koi herpesvirus (KHV), an important issue in order to develop appropriate control options for this disease in the future. The continental European review strongly advocates that all fish being released for stocking purposes should be free from certain infections so that reservoirs of infection are not established by man due to the lack of adequate controls.

The Mediterranean scenario

Disease interactions between wild marine fish populations and Mediterranean sea cage aquaculture

In comparison to other geographic regions there is a marked lack of scientific information and data relating to disease interactions and pathogen exchange between the wild fauna and Mediterranean aquaculture. The use of broodfish captured from the wild poses a specific hazard for disease interaction involving nodaviruses and for the benefit of aquaculture there is a strong need to improve diagnostic and testing systems for nodavirus infections. From the perspective of protecting wild stocks, the potential effects of isopod parasites warrant further attention. There is currently no effective treatment available to break their infective cycle and the role of disease interactions in propagation and geographical spread of these parasites in the sea is hypothesised, but has not been adequately studied as of yet.

The shellfish and crustacean scenario

Disease interactions between wild and farmed shellfish and crustaceans

Cultured and wild molluscs tend to share the same ecological habitat and there is no real distinction between farming and harvest from natural populations regarding risk of disease emergence and spread. The review of published information suggests that most diseases affecting cultured molluscs are also negatively affecting wild populations, and this is clearly different from the finfish situation. Prominent examples such as bonamiosis in flat oysters show that long-distance movement of juveniles plays a key role in disease spread among both wild and farmed molluscs. Protecting the habitats and health of wild mollusc stocks is therefore considered of major importance for both the protection of biodiversity and of future aquaculture. A further main issue is the incomplete knowledge about the life-cycle of many protozoan parasites of molluscs, which is currently hindering the assessment of risks and consequences for the emergence of exotic mollusc diseases in Europe. Regarding crustaceans there are currently no disease controls for the importation of frozen shrimp from virus endemic regions in the Americas and Asia to European states. Scientific data suggest that crustacean viruses such as white spot syndrome virus (WSSV) are adaptable to a wide range of crustacean

hosts, including those commercially exploited within the European area. The investigation of this issue should therefore be addressed as a matter of urgency

Risk assessment and modelling of disease interactions

The work performed to assess the risks for spread of *Gyrodactylus salaris* provides the best illustrations of how risk assessment can examine disease interaction between wild and farmed fish and thereby support decision making. The main application of mathematical modeling has been the epidemiology of sea lice infestations with a focus on transmission between wild and farmed salmonids. Both risk assessment and mathematical modeling can improve our understanding of disease interaction and pathogen exchange between wild and farmed populations. However, there is a need to strengthen the consequence assessment part of current risk assessments in aquatic animal health, and explicitly to include disease interaction aspects into aquatic animal health risk assessments for the future.

Epidemiology and disease surveillance

The vast majority of epidemiological information in aquatic animal health is derived from statutory surveillance programmes or targeted research projects in aquaculture. The design and conduct of epidemiological studies in wild populations pose particular challenges, and steps should be taken to capture and better utilise routine data generated during fisheries biology, biodiversity and wildlife conservation studies for epidemiological and fish health research. Quantification of the escapee ratio, as shellfish transfers during the growing process, is thereby of particular interest to further studies on disease interactions and pathogen exchange. Means to encourage the supply of disease information and samples from wild aquatic animal populations (notifiable status of certain diseases; analysis of suspect samples free of charge) should remain to improve awareness towards geographic spread and changes in disease dynamics. Because fish farms often utilise untreated inlet water from rivers or lakes, farmed populations may *de facto* be “sentinel animals” with respect to the presence or absence of certain infectious agents in the upstream area. The corresponding potential for low-cost capture of disease information on wild aquatic animal populations should be explored. It is further suggested that samples from routine stock assessment of wild aquatic populations should be utilised for disease epidemiology studies.

According to the authors of one of the WP3 reports, the weakest point in current epidemiological studies of aquatic animal diseases – including on-going surveillance programmes - is the lack of documentation about the accuracy of diagnostic tests. It is therefore suggested that test systems including the use of pooled samples should be validated for use in high-density (farmed) as well as low-density (wild) populations.