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PANDA

Permanent network to strengthen expertise on infectious diseases of aquaculture species and scientific advice to EU policy

Coordination Action

Scientific support to policies

Work Package 2
Risk analysis of exotic, emerging and re-emerging disease hazards

Annex 8: Delphi Technique Workshop

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Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Table of Contents

Annex 8 - Delphi Technique Workshop

1. Workshop

It was originally envisaged that certain specific workshops would be held in order to help with compiling the necessary data required by the work package and for disseminating information related to the concepts used in the exercise. Identified workshop themes included:

i) Capacity and awareness building for the IRA concept

ii) Optimal strategies related to the necessities for conducting RAs

iii) Awareness of hazards and the disease situation for candidate EU countries

iv) The use of expert opinion to support risk factor identification.

Nevertheless, it was only possible to organise a single workshop concerning the application of the Delphi technique as a means for collating scientific opinion for areas where data is lacking. The practical workshop was held in conjunction with the 12th EAFP International Conference on Diseases of Fish and Shellfish (Copenhagen, September 2005) in order to take advantage of an already programmed event and gain the maximum benefit from attending participants.

2. Aims

The main aim of the workshop was to demonstrate the use of expert opinion for eliciting additional information on the risk of introducing pathogens, and three fish viruses were used as an example.

3. Method

The workshop used a structured method that required the formation of an expert panel, which was comprised of invited members that could provide expertise and opinion at any level on three selected fish viral pathogens. The format used included:

i) An anonymous questionnaire circulated and completed prior to the workshop,

ii) The provision of explanatory background to the exercise and its use with regard to risk assessment,

iii) Presentation of the results of the anonymous questionnaire and demonstration of the use of the hazard scoring method developed by the project for ranking purposes,

iv) Facilitated discussion on the results with input from the expert panel,

v) Consideration of the most likely pathogen entry and dissemination routes, as well as the factors impacting on establishment.

The fish viral pathogens initially considered in a closed session by the panel of sixteen experts and three facilitators were EHNV, ISAV and KHV. This was follwed by an open session including an audience comprised of conference participants.

The questionnaires for each pathogen are detailed in below in sections 8.1 (EHNV), 8.2 (ISAV) and 8.3 (KHV). The topics covered for EHNV and ISAV, as exotic diseases, included: the most important routes of introduction, the most likely country for introduction and establishment, establishment, the most effective control measures for preventing entry, consequences, interaction between wild and aquacultured species, the probability of introduction and establishment in the next 5-10 years, the likelihood of eradication, identification, and training and current expertise. The topics covered for KHV, as an emerging disease, included: the most likely route of historical and continued introduction, the factors associated with spread, spread and impact, the most effective control measures for preventing spread, the likelihood of eradication, and interaction between wild and aquacultured species.

4. Outcome

The technique was used to draw consensus from differing (expert) opinions and Dr Rowena Kosmider from the Veterinary Laboratories Agency (UK) was enrolled as an expert moderator and the facilitators were members of the work package task force (C. Rodgers, E. Peeler and L. Paisley). Attendance was not as high as was originally hoped due to a clash with an unscheduled extension to a KHV workshop. As a consequence only limited results were obtained for EHNV and ISAV. Despite this, a generic publication from the workshop is planned in order to discuss the application of the technique to fish diseases and using some of the results as examples. The analysis of this data will take place outside the scope of the project, since it was additional work unrelated to any deliverable.

5. Questionnaires

5.1 Epizootic Haematopoietic Necrosis Virus – EHNV

(exotic to Europe)

Background

For the purposes of this questionnaire, epizootic haematopoietic necrosis (EHN) means infection with EHN virus (EHNV) in the genus *Ranavirus* of the family Iridoviridae, as defined in the *OIE Aquatic Code*.

<u>Susceptible host species:</u>

Redfin perch (*Perca fluviatilis*) and rainbow trout (*Oncorhynchus mykiss*). EHNV causes high morbidity and high mortality in redfin perch but low mortality and high mortality in rainbow trout. [N.B. Other species are considered experimentally susceptible to EHNV. These species include Macquarie perch *Macquaria australasica*, Murray cod *Maccullochella peeli,* mosquito fish *Gambussia affinis*, silver perch *Bidyanus bidyanus* and mountain galaxias *Galaxias olidus*.]

<u>Geographical distribution:</u>

Australia

<u>Transmission:</u>

The natural route of transmission is unknown but EHNV is readily spread in water and oral transmission probably also occurs. Infection can be transferred between aquaculture establishments with movements of fish. Fomites (e.g. fishing gear, inanimate objects) and piscivorous birds are other potential routes of transmission.

The carrier status in susceptible species or other teleosts, as well as vertical transmission, is uncertain. However, it is possible that reservoirs of infection could exist outside fish populations (e.g. amphibians).

<u>Occurrence:</u>

The incubation period for EHNV infection is 3-10 days at water temperatures of 19-32ºC and up to 32 days at 8-10ºC. On first appearance natural outbreaks (e.g. in redfin perch) involve all age classes, whereas subsequent annual epizootics occur mainly in juveniles. Poor water quality and concurrent diseases may be a factor in rainbow trout infection.

<u>Survival:</u>

EHNV is highly resistant to drying and can remain infective for more than 97 days in water and at least 113 days in dried fish tissue (cell culture). It may also survive >300 days in cell cultures at 4ºC and for 2 years in fish tissues stored at –20ºC.

EHNV is inactivated at 60ºC for 15 mins or 40ºC for 24 hrs; pH 4 for 1 hr and pH 12 for 1 hr; 200 mg/l sodium hypochlorite for 2 hr; 70% ethanol for 2 hr.

Prevention and control:

There is no treatment or vaccine for EHN. Quarantine measures and movement controls are necessary for prevention of spread. Site clearance (e.g. destruction of infected stock), disinfection and restocking with fish of known health status would also be required.

Questionnaire for EHNV

A. The most important routes of introduction

1. What do you consider would be the most important routes of introduction of EHNV into the European Union (EU)? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary.

Route	Rank	Specify (where indicated only)
Live fish		Species:
Ova importation		
Fish commodity/product importation		Commodity:
Illegal movements or illegal importation of fish		
Waste (incl. water) and disposal from processing centres		
Other route(s)		Specify route:

B. The most likely country for introduction and establishment

2. What is the probability of EHNV being introduced into specific European geographic regions (i.e. country groups)?

For information, the country groups are the following:

Balkans	Eastern Europe	"Islands"
Albania Bosnia Bulgaria Croatia Cyprus Greece Macedonia FYRO Slovenia Yugoslavia FR	Czech Republic Estonia Hungary Latvia Lithuania Poland Romania Slovak Republic	Faeroes Iceland Ireland United Kingdom

Scandinavia	Southern Europe	Western Europe
Finland Norway Sweden	Italy Malta Portugal Spain	Austria Belgium Denmark France Germany Luxembourg Netherlands Switzerland

Now mark the probability of EHNV being introduced into each European group:

European groups	High	Medium	Low	Negligible	None
Balkans					
Eastern Europe					
"Islands"					
Scandinavia					
Southern Europe					
Western Europe					

Now identify the individual highest risk countries for EHNV introduction using only the European groups marked with a high or medium probability in the previous table:

Individual country
1.
2.
3.
4.
5.

C. Establishment

3. What is the probability that EHNV would establish in the EU following its introduction into the geographic regions?

European groups	High	Medium	Low	Negligible	None
Balkans					
Eastern Europe					
"Islands"					
Scandinavia					
Southern Europe					
Western Europe					

D. The most effective control measures for preventing entry

4. What do you consider the most effective control measures are for preventing entry of EHNV into Europe? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary.

Control measure	Rank	Specify (where indicated only)
Make notifiable		
Import controls (e.g. live fish, specified entry points, specified product type, etc.)		Specify type of control:
Improved surveillance (e.g. active)		Specify:
Pre-import certification		
Other control measure(s)		Specify measure:

E. Consequences

5. How severe do you think the impact of EHNV would be on farmed rainbow trout production in the EU?

Very severe	Severe	Moderate	Low	Negligible	None

6. How severe do you think the impact of EHNV would be on wild fish populations (e.g. perch) in the EU?

Very severe	Severe	Moderate	Low	Negligible	None

F. Interaction between wild and aquacultured species

7. Given that EHNV becomes established within aquacultured fish species, what is the probability of the virus establishing within wild fish? Please provide a minimum, maximum and most likely percentage value (e.g. 25, 50, 75, 95%).

Minimum	Maximum	Most likely

8. Given that EHNV becomes established within wild fish species, what is the probability of the virus establishing within aquacultured fish? Please provide a minimum, maximum and most likely percentage value (e.g. 25, 50, 75, 95%).

Minimum	Maximum	Most likely

G. Probability of EHNV introduction and establishment in the next 5-10 years.

9. What is the percentage probability of EHNV being introduced into Europe in the next 5-10 years? (e.g. 25, 50, 75, 95%)

5 years		10 years	

10. What is the percentage probability of EHNV becoming established in Europe following introduction in the next 5-10 years? (e.g. 25, 50, 75, 95%)

5 years		10 years	

H. Likelihood of EHNV eradication

11. Upon entry of EHNV, how feasible or technically possible do you consider eradication would be from a single fish farm?

Very Possible	Possible	Not possible

12. Upon entry of EHNV, how feasible or technically possible do you consider eradication would be in a wild population?

Very Possible	Possible	Not possible

I. Identification of EHNV

13. Would all relevant diagnostic laboratories of the EU Competent Authorities be able to identify EHNV?

Definitely	Possibly	No

J. Training and expertise

14. Do the diagnostic laboratories of the EU Competent Authorities require more training and expertise for EHNV identification?

Definitely	Possibly	No

5.2 Infectious Salmon Anaemia Virus – ISAV

(exotic to Europe)

Background

For the purposes of this questionnaire, infectious salmon anaemia (ISA) means infection with ISA virus (ISAV) in the genus *Isavirus* of the family *Orthomyxoviridae*, as defined in the *OIE Aquatic Code*.

Susceptible host species:

Atlantic salmon (*Salmo salar*), brown and sea trout (*S. trutta*), pollock (*Pollachius virens*) and cod (*Gadus morhua*). [N.B. Other species are considered experimentally susceptible to ISAV. These species include rainbow trout (*Oncorhynchus mykiss*) and Atlantic herring (*Clupea harengus*).

Geographical distribution:

Canada (New Brunswick and Nova Scotia), Chile, the Faeroe Islands, Norway and USA (Maine).

Transmission:

The natural route of transmission is water-borne and direct fish to fish contact, whereas vertical transmission has been suspected but not confirmed. A biological vector (e.g. sea lice) may also play a role in transmission. Infection can be transferred between aquaculture establishments with movements of fish and/or well boats. Fomites (e.g. fishing gear, inanimate objects), waste water from processing plants and piscivorous birds are other potential routes of transmission.

The natural reservoir for the virus is unknown.

Occurrence:

ISA can be characterised by persistent daily low level mortalities (0.05-1%) but can cause total mortalities from 15-100%. The appearance of disease signs can occur 2-4 weeks after experimental infection.

Survival:

ISAV can survive for at least 14 days at 4ºC in sea water and 48 hr at 10ºC, up to 6 days in fish tissue on ice.

ISAV is inactivated at 56ºC for 1-5 mins; pH <5 for more than 24 hr and pH 12 for less than 24 hr; it is inactivated by ether and chloroform; >5 mg/l sodium hypochlorite for 15 mins (tissue homogenate); UV light and ozone.

Prevention and control:

There is no treatment or vaccine for ISAV. Quarantine measures, movement controls and processing plant waste disinfection are necessary for prevention of spread. Site clearance (e.g. destruction of infected stock), disinfection and restocking with fish of known health status would also be required.

<u>**Questionnaire for ISAV**</u>

A. The most important routes of introduction

1. What do you consider would be the most important routes of introduction of ISAV into the European Union (EU)? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary.

Route	Rank	**Specify** (where indicated only)
Live fish		Species:
Ova importation		
Fish commodity/product importation		Commodity:
Transport transfer (e.g. well boats)		
Illegal movements or illegal importation of fish		
Natural reservoir transfer		
Waste (incl. water) and disposal from processing centres		
Other route(s)		Specify route:

B. The most likely country for introduction and establishment

2. What do you consider are the individual high risk countries for ISAV introduction? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary.

Country	Rank
Denmark	
Finland	
France	
Iceland	
Ireland	
Poland	
Spain	
Sweden	
UK	
Other (specify):	

C. Establishment

3. What is the probability that ISAV would establish in the EU following its introduction?

High	Medium	Low	Negligible	None

D. The most effective control measures for preventing entry

4. What do you consider the most effective control measures are for preventing entry of ISAV into Europe? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary.

Control measure	**Rank**	**Specify** (where indicated only)
Import controls (e.g. live fish, specified entry points, specified product type, etc.)		Specify type of control:
Improved surveillance (e.g. active)		Specify:
Improved epidemiological data		
Pre-import certification		
Other control measure(s)		Specify measure:

E. Consequences

5. How severe do you think the impact of ISAV would be on farmed Atlantic salmon production in the EU?

Very severe	Severe	Moderate	Low	Negligible	None

6. How severe do you think the impact of ISAV would be on wild marine fish populations (e.g. cod, herring or pollack) in the EU?

Very severe	Severe	Moderate	Low	Negligible	None

F. Interaction between wild and aquacultured species

7. Given that ISAV becomes established within aquacultured fish species, what is the probability of the virus establishing within wild fish? Please provide a minimum, maximum and most likely percentage value (e.g. 25, 50, 75, 95%).

Minimum	Maximum	Most likely

8. Given that ISAV becomes established within wild fish species, what is the probability of the virus establishing within aquacultured fish? Please provide a minimum, maximum and most likely percentage value (e.g. 25, 50, 75, 95%).

Minimum	Maximum	Most likely

G. Probability of ISAV introduction and establishment in the next 5-10 years.

9. What is the percentage probability of ISAV being introduced into Europe in the next 5-10 years? (e.g. 25, 50, 75, 95%)

5 years		10 years	

10. What is the percentage probability of ISAV becoming established in Europe following introduction in the next 5-10 years? (e.g. 25, 50, 75, 95%)

5 years		10 years	

H. Likelihood of ISAV eradication

11. Upon entry of ISAV, how feasible or technically possible do you consider eradication would be from a single fish farm?

Very Possible	Possible	Not possible

12. Upon entry of ISAV, how feasible or technically possible do you consider eradication would be in a wild population?

Very Possible	Possible	Not possible

I. Identification of ISAV

13. Would all relevant diagnostic laboratories of the EU Competent Authorities be able to identify ISAV?

Definitely	Possibly	No

J. Training and expertise

14. Do the diagnostic laboratories of the EU Competent Authorities require more training and expertise for ISAV identification?

Definitely	Possibly	No

5.3 Koi herpesvirus – KHV

(not exotic to Europe but emerging)

Background

For the purposes of this questionnaire, koi herpesvirus disease means infection with koi herpesvirus (KHV) in the genus *Herpesviridae*. However, the exact taxonomic status of KHV is still under study but recently it has been suggested that it may represent a third cyprinid herpesvirus (CyHV-3). [N.B. A similar virus has also been referred to as carp interstitial nephritis and gill necrosis virus (CNGV)].

Susceptible host species:

Carp *Cyprinus carpio* and its variants.

Geographical distribution:

Europe (Austria, Belgium, Denmark, Germany, Netherlands, Switzerland, UK)*, Indonesia, Israel, Japan and the USA. [*N.B. Some outbreaks may not be officially notified or be based on virus isolation].

Transmission:

The natural route of transmission is probably horizontal (fish to fish) as well as mechanical. The disease is not notifiable and infection can be transferred between aquaculture establishments with movements of fish. Fomites (e.g. aquaculture equipment, inanimate objects) are other potential routes of transmission.

The carrier status in susceptible species is possible.

Occurrence:

The disease can occur at water temperatures between 18ºC and 25ºC (or possibly 28ºC) but the virus can replicate between 10ºC and 30ºC under laboratory conditions.

Cumulative mortality can be 100% and temperature is an important factor to the onset of mortality. Secondary infections (e.g. in gills) can be associated with KHV infection. The disease has occurred in fingerling, juvenile and adult common and koi carp.

Survival:

KHV may survive in water for 8-20 hr although it can persist for much longer in sediment. It has been reported to also survive for up to 50 days in tissue culture supernatant at 4ºC, 30 days at 10ºC, 12 days at 25ºC and 5 days at 30ºC. Infectivity may be lost after 2 days at 35ºC.

KHV is inactivated at 60ºC for 30 mins; pH <3 and pH >11; it is sensitive to chloroform.

Prevention and control:

There is no treatment or licenced vaccine for KHV, although attenuated vaccines have been used. Quarantine measures and movement controls are probably necessary for prevention of spread. Site clearance (e.g. destruction of infected stock), disinfection and restocking with fish of known health status would also be required.

<u>**Questionnaire for KHV**</u>

A. Most likely route of historical and continued introduction

1. What do you consider are the most important routes of introduction of KHV into the European Union (EU) from the following list? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary. Add other routes, if necessary.

Route	**Rank**	**Specify** (where indicated only)
Importation of live fish		Species:
Natural spread		
Ova importation		
Processed fish commodity/product importation		Commodity:
Waste water and disposal from processing centres		
Other route(s)		Specify route:

2. What is the percentage probability that KHV will continue to be introduced into Europe from the following list of routes? (e.g. 25, 50, 75, 95%).

Route	**Probability**
Importation of live fish	
Natural spread	
Ova importation	
Processed fish commodity/product importation	
Waste water and disposal from processing centres	
Other route(s)	

B. Factors associated with KHV spread

3. Given that KHV is established within Europe, what do you consider are the most important factors associated with its spread? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary.

Factor	**Rank**
Natural spread	
Illegal movement of live fish	
Legal movement of live fish	
Transport contamination	
Processing waste and disposal	
Scavengers/fish eating birds	
Other factor (specify):	

C. Spread and impact

4. Do you think that KHV is currently undetected in more EU countries than already known?

Yes	No

5. If yes (question 4), how many more countries in the EU do you think have currently undetected KHV?

1-3	3-5	>5

6. What is the percentage probability of KHV spreading further in Europe in the next 5-10 years? (e.g. 25, 50, 75, 95%)

5 years		10 years	

7. What do you consider will be the most important impacts of the presence of KHV in the EU over the next 5 years? Mark with a rank score (e.g. 1, 2, 3, etc.).

Impacts	Rank
Negative impact on wild fish populations (e.g. native species)	
Negative impact on aquaculture	
Negative impact on coarse fisheries	
Negative impact on hobbyists	
Negative impact on trade in ornamental fish	
Other (specify):	

D. The most effective control measures for preventing spread

8. What do you consider the most effective control measures are for preventing the spread of KHV within Europe? Mark with a rank score (e.g. 1, 2, 3, etc.) and specify where necessary.

Control measure	Rank	**Specify** (where indicated only)
Make notifiable		
Import controls (e.g. live fish, specified product, etc.)		Specify type of control:
Pre-export certification		
Movement restrictions		Specify:
Improved surveillance (e.g. active)		Specify:
Improved diagnostic methods		Specify required method:
Stamping out/eradication		

Creation of approved KHV free territories/zones		
Other control measure(s)		Specify measure:

E. Likelihood of KHV eradication

9. How feasible or technically possible do you consider eradication of KHV is from a single fish farm?

Very Possible	Possible	Not possible

10. How feasible or technically possible do you consider eradication of KHV would be in a wild population?

Very Possible	Possible	Not possible

F. Interaction between wild and aquacultured species

11. What is the probability of KHV being transmitted from wild fish to aquacultured species? Please provide a minimum, maximum and most likely percentage value (e.g. 25, 50, 75, 95%).

Minimum	Maximum	Most likely

12. What is the probability of KHV being transmitted from aquacultured species to wild fish? Please provide a minimum, maximum and most likely percentage value (e.g. 25, 50, 75, 95%).

Minimum	Maximum	Most likely