MORTALITY INVESTIGATIONS
Working Together

Cefas

Environment Agency

Cefas Fish Health Inspectorate and the Environment Agency

Mortality Investigations - Working Together

Contents

1. INTRODUCTION

This is an internal working document between the Fish Health Inspectorate (FHI) and the Environment Agency.

As government Agencies, with responsibility to protect the aquatic environment - both natural and managed - it is inevitable that there will be occasions where the work of the FHI and the Environment Agency overlap. The most notable area of overlap between the FHI and the Environment Agency is in the investigation of mortalities in fisheries. Regulatory authorities should endeavour to work together in a cost effective and efficient manner whenever this is required, in keeping with Hampton Principles. This ensures minimal burden to the industry sectors we serve.

The FHI, as the competent authority in England and Wales, has responsibility for the control of notifiable and emerging disease in aquatic animals, fish, molluscs and crustacea. The Environment Agency has a remit to maintain, improve and develop fisheries, including migratory fisheries up to 6 nautical miles from the coast, and give guidance to focus on clear environmental outcomes. Improved joint working on fish mortality investigations ensures the best and most appropriate advice is given to affected fisheries, aiding their rapid recovery. Additionally this will reduce the economic impact of aquatic animal mortalities.

To assist the process of a 'joined up government', this document serves to outline the areas of responsibility falling to each Agency when working together to investigate mortality incidents in fisheries. It ensures relevant skills existing within each Agency are applied as appropriate to the situation.

Notification of a fishery mortality incident may come to either Agency in the first instance. This document defines the actions that will be taken dependent upon which Agency receives the initial notification and initiates the resulting investigation.

This document is supplementary to, and not in place of, standard operating procedures or working policies that exist within each organisation. It has been written to assist the investigation of mortality incidents at fisheries where notifiable or emerging disease is suspected or confirmed, or unexplained mortalities are reported.

Mortality incidents in natural/unmanaged inland waters, estuaries and marine waters, and mortalities affecting bivalve molluscs and crustacea have not been detailed in this outline. However the same principles of Agency collaboration would apply. In all such cases either Agency should notify the other and where a notifiable disease is suspected, or the mortality cannot be explained by environmental factors, a plan of action should be drawn up between the Environment Agency and the FHI.

2. MORTALITY INVESTIGATION INITIATED BY THE ENVIRONMENT AGENCY

Where the Environment Agency initiates the fish mortality investigation the following steps will be taken:

- Local Environment Agency Area Officers will initiate the investigation according to set Operational Instructions (OI) outlining Environment Agency procedures and to timescales set by the Environment Agency common incident classification scheme. Advice will be obtained from the local Area Fisheries, Recreation and Biodiversity Officers, if they are not already involved with the investigation.

The local Environment Agency Area Officer undertaking the mortality investigation will:

- Immediately inform the National Fisheries Technical Team (NFTT) at Brampton of the mortality and consult with them to co-ordinate their next action.
- Notify the FHI immediately where clinical signs consistent with a notifiable fish disease are present, or where the pattern and scale of the mortality may indicate a notifiable disease as the cause. In such situations immediate notification to the FHI should be given whether the fish have been seen/ sampled by the local Environment Agency or not* (The NFTT may also notify the FHI on behalf of the local Environment Agency Area Officer).
- Complete a Mortality Questionnaire and if required, submit a sample of fish to the NFTT at Brampton for examination*. Sample submissions to the NFTT will be collected in line with the guidance given in Appendix 2.
- Inform the NFTT under their OI, where permission is not given by a fishery owner for samples to be taken or where the owner does not report known mortalities.

The NFTT will:

- Notify the FHI immediately if on examination of the fish there is suspicion of a notifiable disease, or where there are no signs or environmental factors to explain the mortality.
- Provide the FHI with full details for the affected site (location, contacts) and a contact for the local Environment Agency Area Officer at the time of notification on suspicion.

It is a statutory requirement to notify the FHI where a notifiable disease is suspected, notification to the FHI can come from any member of the Environment Agency and should be made immediately on suspicion*.

* Where a notifiable disease is suspected it is vital that a sample is obtained from the affected water and this should be collected adhering to standard operating procedures and applying the guidance given in Appendix 2, Sampling Best Practice. Either the FHI or the Environment Agency can obtain the sample. Where necessary the Agencies should work together to ensure a sample is collected as soon as possible and as a matter of urgency.

3. MORTALITY INVESTIGATION INITIATED BY THE FHI

Where the FHI initiates the fish mortality investigation the following steps will be taken:

- The FHI will notify the NFTT who will contact a local Environment Agency Area Officer to advise them of the mortality at a fishery in their area.
- The FHI will undertake a site inspection and where a notifiable disease is suspected, or the mortality cannot be explained due to environmental factors or other signs, will endeavour to collect a sample at the time of inspection. In cases where it is difficult to obtain a sample from the site, the FHI will liaise with local Environment Agency working together to collect fish for sampling. This must be done as a matter of urgency where a notifiable disease is suspected.
- The NFTT will liaise with the local Environment Agency Area Officer to ensure a mortality questionnaire is completed for the site. If this is not possible then a copy of the visit memo from the FHI will be provided on request.

4. COMMUNICATIONS BETWEEN THE FHI AND THE ENVIRONMENT AGENCY

On suspicion or confirmation of a notifiable disease or in cases of unexplained mortality, communications between the FHI and the Environment Agency will proceed as follows:

- The FHI are responsible for the placing and lifting of statutory controls on the affected site and will notify the NFTT when these controls have been placed.
- Where the Environment Agency has initiated an investigation, the NFTT will submit copies of the mortality investigation reports and the mortality questionnaire to the FHI as soon as this information becomes available*. In addition contact information for the site owner/ manager will also be submitted to the FHI.
- With the permission of the fishery owner/ manager, the FHI will copy the NFTT in on all written correspondence relating to the investigation between the FHI and the affected site. This includes all diagnostic test results whether positive or negative.
- With the permission of the fishery owner/ manager, the Environment Agency will copy the FHI in on all written correspondence relating to the investigation between the Environment Agency and the affected site.
- For samples submitted to the FHI from the Environment Agency - the FHI will report in writing all diagnostic test results relating to the investigation to the NFTT as soon as the tests are completed according to standard operating procedures.
- For samples collected by the FHI – the FHI will report in writing all diagnostic test results relating to the investigation directly to the site owner and, with the permission of the site owner/manager, will copy all letters to the NFTT.
- On confirmation of a notifiable disease the FHI will telephone the site owner/ manager to notify them immediately, and will e-mail or telephone the NFTT. This will ensure that all parties are notified as a matter of urgency.

* For mortality investigations undertaken by the NFTT, the mortality questionnaire will be available on submission of the fish to the NFTT. The initial mortality report, detailing the findings of the post-mortem examination will be available within 48hrs of the examination.

5. JOINT ATTENDANCE

In the event of joint Environment Agency/FHI attendance at a mortality event, and where notifiable disease is suspected, priority in terms of samples for diagnostic testing will be accorded to the FHI. Where sufficient numbers of fish exhibiting clinical disease are available, fish may be submitted for examination and diagnostic testing by both Agencies. This is in order to increase the speed with which information is available to fishery owners in the event of the cause being related to fisheries management problems.

6. ADDITIONAL ACTIONS ON CONFIRMATION OF A NOTIFIABLE DISEASE

The FHI will advise the owner/manager of the affected site of their options for eradication or management of the disease. With the owner or manager's permission all written advice will be copied to the NFTT.

When it has not been possible to clear and disinfect the site to eradicate the disease, the FHI will proceed to place a confirmed designation on the site. In some cases the area for designation may be large, complex and involve several angling clubs, syndicates or owners. In such cases it will be necessary for the FHI to enlist the help of the local Environment Agency office to map the area for designation and obtain contacts for all waters affected by the control measures.

Where an initial or confirmed designation has been placed on a site, strict conditions will apply to live fish movements, disposal of dead fish and, in some cases, to the movement of equipment and transport vehicles into, out of or within the designated area. Consents given under the designation conditions can only be made by the FHI, in writing, to the responsible person at the designated site. The FHI will copy all such written permissions to the NFTT at Brampton who will have the responsibility to relay this information to the appropriate teams at the relevant Environment Agency Area Office. It is the responsibility of the Environment Agency to ensure appropriate FHI permission has been granted before considering any live fish movement applications. Should the Environment Agency have any concern/ queries regarding movement applications or any other potential breach of designation conditions, the FHI must be notified immediately.

7. FUTURE IMPROVEMENTS

It is planned that samples collected from fishery sites will be flagged electronically on the Fish Health Database to allow the NFTT to view the visit record and have direct access to the laboratory diagnostic testing results relevant to the sample.

APPENDIX 1. CONTACT INFORMATION

Fish Health Inspectorate

Core hours Monday to Thursday, 8.30 am to 5 pm, Friday, 8.30 am to 4.30 pm:

Telephone: (01305) 206700
Fax: (01305) 206602
Email: fhi@cefas.co.uk

Outside of core hours contact defra duty office and request a page to the Fish Health Inspectorate:

Telephone: 0207 2708080

Environment Agency

National Fisheries Technical Team, Brampton
Core Hours Monday to Friday: 8.30am to 5pm

Telephone: (01480) 483802
E-mail: fish.health@environment-agency.gov.uk

Environment Agency National Call Centre:
Core Hours Monday to Friday: 8.30am to 5pm

Telephone: 0870 8506506

Environment Agency Emergency number: 24 hours

Telephone: 0800 80 70 60

APPENDIX 2. SAMPLING BEST PRACTICE

The following guidelines are applied to mortality investigations by the FHI in conjunction with Standard Operating Procedures (SOP's) for the sampling of fish for diagnostic testing. The FHI work to accredited procedures and will ensure colleagues at the NFTT are provided with up to date copies of their fish sampling SOP for reference.

Where a notifiable disease is suspected it is of vital importance that a sample is taken from the fishery, however, in many cases this can prove difficult to achieve. The following considerations will greatly increase the chance of obtaining a viable sample for diagnostic virology testing:

- Wherever possible always try to select live moribund or clinically affected fish for sample
- Until a sample has been obtained advise the fishery owner/ manager to freeze 'freshly dead' (not decomposing) morts – frozen fish can be defrosted and sampled for virology diagnostic testing in cases where it is proving difficult to obtain live fish for sample.
- Sample at the time of the mortality – not after the event
- In the absence of live clinically affected/moribund fish, it is acceptable to take virology sample material from freshly dead* (but not decomposing) animals. The condition of the fish should be clearly noted on the paperwork submitted with the sample.

*NB Material from dead fish (prior to sample) is not suitable for bacteriology or histology diagnostics.

APPENDIX 3. UK NOTIFIABLE DISEASES (NON-EXOTIC TO EU) SPECIES SUSCEPTIBILITY AND CLINICAL SIGNS

Disease	Susceptible species	Temp Range	Key Clinical Signs
Koi Herpesvirus (KHV) Disease	All varieties of *Cyprinus carpio*	16°C - 28°C	Sloughing mucous Dry, skin patches Sunken eyes Gill necrosis
Spring Viraemia of Carp (SVC)	Bighead carp (*Aristichthys nobilis*), goldfish (*Carassius auratus*), crucian carp (*C. carassius*), grass carp (*Ctenopharyngodon idellus*), common carp and all varieties (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*), sheatfish (*Siluris glanis*), tench (*Tinca tinca*)	5°C - 18°C Must be rising if temp between 5 and 10°C	Swollen abdomen/dropsy Protruding vent Trailing fecal casts Haemorrhage at base of fins & vent Exophthalmia Darker colouration Pale gills
Viral Haemorrhagic Septicaemia (VHS)	Herring (*Clupea spp*), whitefish (*Coregonus spp*), pike (*Esox lucius*), haddock (*Gadus aeglefinus*), Pacific cod (*G. macrocephalus*), Atlantic cod (*G. morhua*), Pacific salmon (*Oncorhynchus spp*), rainbow trout (*O. mykiss*), rockling (*Onos mustelus*), brown trout (*Salmo trutta*), turbot (*Scophthalmus maximus*), sprat (*Sprattus sprattus*), grayling (*Thymallus thymallus*)	≤ 14°C	Petechial haemorrhage Exophthalmia Anaemia Spiralling swimming behaviour
Infectious Haematopoietic Necrosis (IHN)	Chum salmon (*Oncorhynchus keta*), coho salmon (*O. kisutch*), Masou salmon (*O. masou*), rainbow or steelhead trout (*O. mykiss*), sockeye salmon (*O. nerka*), pink salmon (*O. rhodurus*), Chinook salmon (*O. tshawytscha*), and Atlantic salmon (*Salmo salar*)	≤ 18°C	Erratic swimming Swollen abdomen/dropsy Protruding vent Trailing fecal casts Haemorrhage at base of fins & vent Exophthalmia Darker colouration Pale gills
Infectious Salmon Anaemia (ISA)	Rainbow trout (*Oncorhynchus mykiss*), Atlantic salmon (*Salmo salar*), brown and sea trout (*S. trutta*)	-	Anaemia – pale gills Exophthalmia Haemorrhage in anterior eye chamber Dark spleen Dark or pale/ yellow liver Petechiae in visceral fat Ascites
Bacterial Kidney Disease (BKD)	Family: Salmonidae	-	Dark coloration Exophthalmia Distended abdomen Haemorrhage at base of fins/ vent Enlarged kidney Granuloma in kidney, spleen, liver Ascites
Gyrodactylus salaris (G.s.)	Atlantic salmon (*Salmo salar*) rainbow trout (*Oncorhynchus mykiss*), Arctic char (*Salvelinus alpinus*), North American brook trout (*S. fontinalis*), grayling (*Thymallus thymallus*), North American lake trout (*Salvelinus namaycush*) and brown trout (*Salmo trutta*). Other species of fish on sites where any of the above species are present shall also be considered as susceptible species.	-	Heavy infection: increased mucus, thickening of fins Inactivity

Koi Herpesvirus (KHV) Disease – Guidelines for Diagnosis on Suspicion

Small white patches of necrosis may be evident during early stages of KHV

Key clinical signs of KHV disease

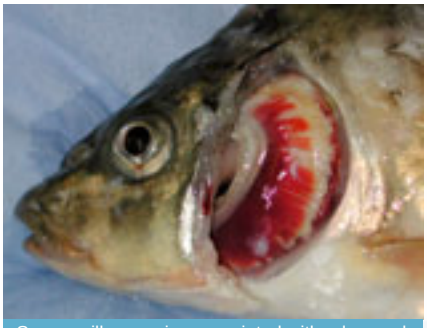
Gills are the most frequently affected tissue.

Look for clinical signs in the gills ranging from pale/ white patches in the early stages and advancing to necrotic patches as the disease progresses.

Additional clinical signs

In addition to gill pathology, clinical signs of KHV disease may also include:

> Sunken eyes
> Loss of mucous resulting in dry rough patches
> Sloughing Mucous
> Heavy mucous in gills



Severe gill necrosis asssociated with advanced stages of KHV

Additional Considerations

The following factors should also be considered:

Species affected - KHV disease only affects *Cyprinus carpio* varieties.

Water temperature - KHV disease outbreaks are most likely to occur between 15ºC and 28ºC

If you suspect KHV

On suspicion of Koi Herpesvirus Disease, please notify the Fish Health Inspectorate (FHI) at Cefas immediately. The FHI will validate the suspicion and if necessary place a temporary movement restriction on the site (a thirty-day notice) while the cause of the mortality is investigated further and samples taken. Please also provide contact details for the affected water and send the mortality investigation report and questionnaire to the FHI as soon as possible.

KHV infected (left) and uninfected (right) koi carp.

On suspicion of KHV disease please call:

Tel: +44 (0) 1305 206700
Outside Office Hours: 02072 708080
(Defra duty office)

APPENDIX 5. DISEASE LEAFLETS

Bacterial Kidney Disease (BKD)

Bacterial disease affecting salmonid species around the world.

- **External Signs:** lethargy, skin darkening, protruding eyes and blood-filled blisters on the flanks
- **Affects:** principally farmed and wild salmonids
- **Mortality:** chronic losses over an extended period
- **Treatment:** no treatment

Overview

Bacterial kidney disease (BKD) is a chronic disease caused by the bacterium *Renibacterium salmoninarum*. It occurs worldwide where salmonid fish are found. It is known to cause up to 80% mortality in Pacific salmon and 40% in Atlantic salmon.

Disease causing agent: *Renibacterium salmoninarum* of the Corynebacteriaceae family

BKD has no implications for human health.

Geographical Distribution

BKD was first described in 1933, following a mortality of wild salmon in the River Dee, Scotland. Since then, BKD has been reported worldwide where salmonid aquaculture takes place, including North America, South America, Europe, Japan and Iceland. Although the disease is still exotic to Australia.

In the UK, BKD has been found in both fresh and seawater locations in Scotland, England and Wales. Northern Ireland is free from BKD.

BKD is not restricted to cultivated fish. The condition has been found in naturally spawning salmonid populations.

Characteristics & clinical signs

BKD may be transmitted horizontally, through contact with infected fish or water, and vertically, from infected broodstock eggs. It is thought infected fish shed bacteria in faeces. Experimental evidence shows viable bacteria can persist for several weeks in fish faeces and in sediment.

BKD is a systemic infection in affected fish. Due to the slow-growing nature of the bacteria it may take several months before disease signs appear.

Infected fish display a wide range of clinical signs, however some are asymptomatic with no signs of disease. Clinical signs include; lethargy, skin darkening, protruding eyes (exophthalmia), anaemia, distended abdomens, blood-filled blisters on the flanks and bruising (haemorrhaging) around the vent.

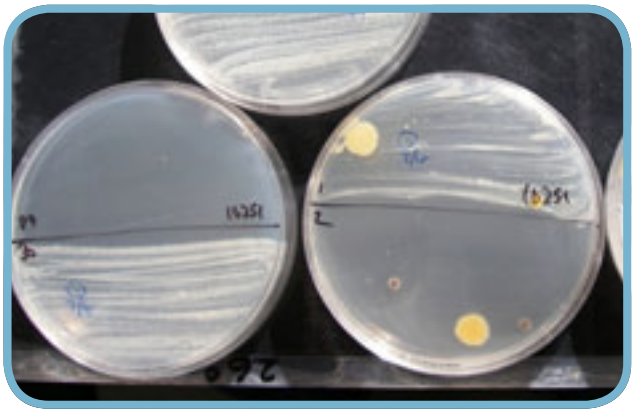
Internal signs include presence of fluid in the abdominal cavity, swollen kidneys sometimes with white/grey lesions and diffuse white membranes over the internal organs. Microscopically bacteria are often seen in granulomatus lesions in the kidney and also in the white blood cells (macrophages), within which they appear able to survive and multiply.

Susceptible species

BKD causes significant mortalities in wild Pacific salmon Other salmonids have varying degrees of susceptibility. In Great Britain the disease has been found in Atlantic salmon, brown trout, rainbow trout and grayling.

Diagnosis

In England and Wales salmonids are screened for BKD by ELISA (Enzyme Linked Immunosorbant Assay), and PCR (polymerase chain reaction) tests. Growth in culture is carried out by inoculating kidney swabs onto SKDM (selective kidney disease medium), with bacterial colonies confirmed by serological tests and PCR.



Treatment and control

Despite research, there is no effective treatment for BKD. Good biosecurity and avoidance of infection are the effective means of controlling the disease.

The chronic nature of BKD and the presence of asymptomatic fish in the early stages of infection can be problematic when adopting control measures. Effective health monitoring of farmed stocks and attention to biosecurity systems may help avoid BKD.

If BKD was found on a UK farm, movement restrictions would be applied. All contact sites are investigated for evidence of the disease source and spread.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of BKD in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of BKD.

Cefas

Email: fhi@cefas.co.uk
Web: www.efishbusiness.co.uk

Fish Health Inspectorate (FHI)
Centre for Environment, Fisheries & Aquaculture Science
Barrack Road
The Nothe
Weymouth
Dorset
DT4 8UB

Tel: +44 (0) 1305 206700
Fax: +44 (0) 1305 206602

Epizootic Haematopoietic Necrosis (EHN)

Serious systemic viral disease infecting fish.

- **External Signs:** abdominal distension, darkening of the body, reddening fin bases and skin ulcers
- **Affects:** rainbow trout and perch are known to be susceptible
- **Mortality:** up to 100% mortality in perch, lower mortality in rainbow trout
- **Treatment:** no treatment and the virus is resistant to disinfection

Overview

Epizootic haematopoietic necrosis (EHN) is a systemic viral disease of rainbow trout, *Oncorhynchus mykiss*, and the European or red-fin perch, *Perca fluviatilis*. EHN related viruses infect wels catfish, ictalurid catfish, and turbot. Additionally similar viruses have been found in healthy and diseased amphibia and reptiles.

Disease causing agent: Epizootic haematopoietic necrosis virus of the genus Ranavirus of the family Iridoviridae.

EHN has no implication to human health.

Geographical Distribution

EHN is endemic in southeastern Australia. Infections in perch in the wild are thought to be widespread. Disease outbreaks occur on rainbow trout farms, often connected to waters holding perch.

Characteristics and clinical signs

The first signs of EHN infected perch are large-scale mortalities of the population. The most seriously affected are fingerling and juvenile fish. However the disease occurs in fish of all ages.

Internally an enlarged spleen and kidney often accompany pinpoint bruising (petechial haemorrhaging) in the internal organs.

The disease has more chronic presentation in rainbow trout. It mainly affects fingerlings. Clinical signs include; abdominal distension, darkening of the body surface, loss of appetite, flared gill covers (opercula) and reddening at the fin bases, loss of equilibrium and skin ulcers. Total mortality is usually low to moderate.

EHN outbreaks are associated with water temperatures between 11°C and 17°C and poor water quality. Outbreaks generally occur in summer, and result in dramatic population declines of wild perch.

Susceptible Species

In the wild EHN has been reported in European perch and rainbow trout. However under experimental conditions EHN was demonstrated to be pathogenic in a number of other species of fish including silver perch, mosquito fish, and Macquarie perch.

Diagnosis

The virus is isolated in cell culture from internal organs of affected fish and identification confirmed by PCR (Polymerase Chain Reaction).

Treatment and control

There is no treatment for EHN.

Due to viruses in the EHN group being resistant to inactivation, they are presumed to persist for months or even years on infected farms in water, pond sediment, plants and equipment. EHN is highly resistant to drying and disinfection.

If EHN was found in the UK, movement restrictions would be applied to affected farms and measures taken to eradicate the disease. All contact sites would be investigated for evidence of the virus source and spread.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of EHN in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of EHN.

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Epizootic Ulcerative Syndrome (EUS)

Serious disease of farmed and wild fish in fresh and brackish waters.

- **External Signs:** red spots, blackish burn-like marks, deep ulcers at the base of fins and over the body
- **Affects:** a wide range of species are susceptible
- **Mortalities:** up to 80%
- **Treatment:** no treatment

Overview

Epizootic ulcerative syndrome (EUS) is a disease of wild and farmed, fresh and brackish water fish. For over three decades it has caused major fish losses in many countries. EUS has a complex aetiology characterised by the presence of the fungal infection, *Aphanomyces invadans,* and necrotising ulcerative lesions. Over 100 species of freshwater fish are reported as EUS susceptible.

Disease causing agent: The fungus *Aphanomyces invadans* is widely acknowledged to be the causative agent of EUS.

EUS has no impact on human health.

Geographical Distribution

EUS is endemic in south-east and south Asia, Australia and Japan. It has spread rapidly in recent years and recently been reported in Africa.

To date there have been no reported EUS cases in the UK or European Union.

Characteristics and Clinical Signs

The disease is transmitted horizontally through contact with infected fish or water. Epidemics can develop rapidly.

EUS is characterised by large bruises or necrotic (dead) ulcerative lesions on the base of fins and other body parts. Later these become larger inflamed areas with acute degeneration of skin (epidermal) tissues. This includes; red spots, blackish burn-like marks or deep ulcers with red centres and red rims, with some ulcers eroding to expose the spine, brain and internal organs. The fungus may invade internal organs such as the kidney and liver. Mortality of up to 80% of stock is associated with an EUS outbreak.

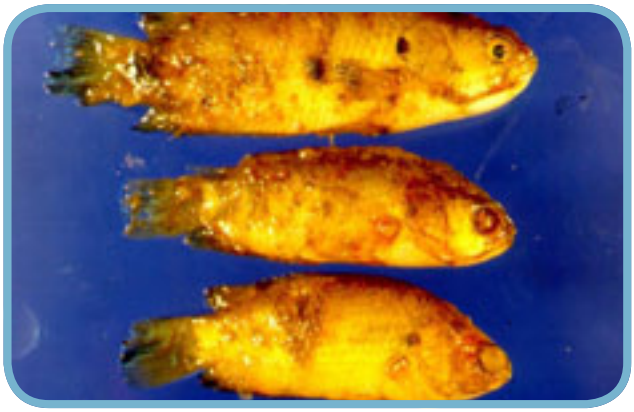
EUS is thought to be triggered by rapid changes to pH, extreme weather events, such as heavy rainfall resulting in flooding, and variations in salinity and water temperature.

Susceptible Species

EUS has been reported in over 100 species of fresh and brackish water fish including; crucian carp, rudd, barramundi, wels catfish, perch, eels, mullet and rainbow trout.

Diagnosis

EUS is grown in culture by inoculating swabs taken from affected fish onto agar medium. Identification is confirmed by PCR (Polymerase Chain Reaction) on culture isolate.



Treatment and control

There is no treatment for EUS.

If EUS was found in the UK, control measures would be implemented, including disinfection of farms and fisheries. Movement restrictions would be applied and measures taken to eradicate the disease. All contact sites would be investigated for evidence of disease in order to identify the source and spread of the infection.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of EUS in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of EUS.

Cefas

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Web: www.efishbusiness.co.uk

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Gyrodactylus salaris (GS)

External parasite affecting Atlantic salmon.

- **External Signs:** fish have a white or grey appearance often with secondary fungal infections
- **Affects:** primarily affects Atlantic salmon in freshwater
- **Mortality:** high mortality levels - up to 95%
- **Treatment:** no treatment of wild fish, except eradication

Overview

Gyrodactylus salaris (GS) is an external parasite primarily affecting Atlantic salmon in freshwater. GS can occur in high densities resulting in heavy loss of salmon parr and smolts. Although not currently found in UK waters, an introduction of GS could rapidly spread across the country and dramatically reduce wild salmon stocks.

Disease causing agent: *Gyrodactylus salaris* is a monogenean parasite of the phylum Platyhelminthes.

GS has no implication on human health

Geographical Distribution

GS was first reported in Sweden and is believed to occur naturally in Russia and the Baltic regions of Finland, Latvia and Lithuania. The Baltic strain of salmon has a high level of tolerance to infection. However Atlantic salmon are highly susceptible to the parasite.

Experiments have demonstrated that salmon from UK waters are susceptible to infection. GS has also been reported in Norway, Denmark and Germany.

GS is not currently found in the UK or Ireland.

Characteristics and clinical signs

GS is a small worm like organism up to 2mm in length. It attaches to the fins, gills and skin of fish using specially modified hooks. Once attached the parasite feeds by releasing digestive enzymes on to the skin of the fish, digested material is consumed by the parasite.

Clinical signs of infection reflect the irritation that the parasite causes to fish. Behavioural changes such as flashing may be observed, with increased mucus production. Skin damage may include ulcers and small lesions, leaving the fish subject to secondary fungal infection.

The parasite can be seen under low magnification. Without magnification, heavily infected fish may have a white or grey appearance due to excess mucus production. Also fungal infections may occur.

Experience in Norway has shown when GS is introduced to a new host population, 95% of wild Atlantic salmon parr will be lost within a few years. It is possible a single GS specimen introduced into an unaffected water system would be capable of starting an epidemic. GS has the capability to reproduce and spread very rapidly.

GS can be transmitted on infected fish both alive or dead. Other fish species - such as eels, minnows and sticklebacks - can transport the parasite. It can also survive for several days in damp conditions. Therefore it can be accidentally transported on damp equipment - such as fishing tackle, nets and waders - used in infected waters.

Susceptible species

The main host of GS is the Atlantic salmon, although other salmonids are also susceptible including; rainbow trout, Arctic char, North American brook trout, grayling, North American lake trout and brown trout.

Clinical signs are generally not seen on species other than Atlantic salmon

Diagnosis

The fins of affected fish are examined microscopically. Individual parasites are removed from the fish and examined under high power magnification. Presumptive diagnosis is made by examination of the shape and size of the hooks of the attached organ, and comparing with morphological data held on other species. Identification is confirmed by PCR (Polymerase Chain Reaction) on isolated parasites.

Treatment and control

The UK is recognised as being GS free and therefore imposes controls on live fish movements from infected countries. Other potential avenues of introduction exist, such as through contaminated angling equipment.

Anglers returning from fishing excursions in countries with GS infection should thoroughly clean and disinfect all fishing equipment. This kills any parasites and prevents accidental introductions. Countries such as Iceland and Norway may require certification confirming angling equipment disinfection before permitting fishing.

Norway has tried to eradicate GS from infected river systems by chemical means. Chemical treatment is costly, environmentally damaging, only possible under favourable conditions, and has had varying degrees of success. GS cannot survive full strength sea-water, therefore migratory fish will not reintroduce the parasite.

The most effective control on GS is to prevent its introduction into the UK. If GS was found in the UK, control measures would be implemented, including disinfection of farms and fisheries. Movement restrictions would be applied and measures taken to eradicate the disease. All contact sites would be investigated for evidence of disease in order to identify the source and spread of the infection.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of GS in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of GS.

Cefas

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Web: www.efishbusiness.co.uk

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Infectious Haematopoietic Necrosis (IHN)

Serious viral disease affecting salmon and trout.

- **External Signs:** lethargy with period of frenzy, darkening of skin, pale gills, distended abdomen and protruding eyes
- **Affects:** salmonid species
- **Mortality:** up to 100% mortality in juvenile rainbow trout
- **Treatment:** no known treatment

Overview

Infectious haematopoietic necrosis (IHN) is a viral disease affecting a range of salmonid fish species. IHN can occur on farms rearing fry or juvenile rainbow trout in freshwater, where acute outbreaks result in high mortality. Mortality rates can be acute or chronic and depend on factors such as species, water temperature and husbandry conditions. Mortality of up to 95% is common.

Disease causing agent: Infectious haematopoietic necrosis virus of the genus novirhabdovirus and family Rhabdoviridae.

IHN has no implications for human health.

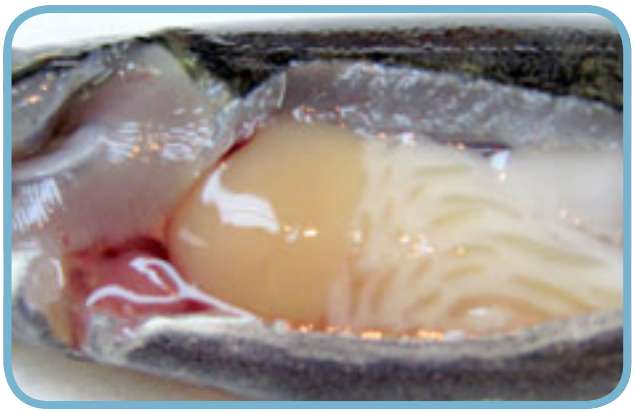
Geographical Distribution

Historically IHN was geographically limited to the western part of North America. However the disease has spread to continental Europe and Asia through movement of infected fish and eggs. Once IHN is introduced to farmed stock or wild fish, the disease may become persistent in carrier fish.

Characteristics and clinical signs

IHN is typically characterised by lethargy interspersed with periods of frenzied, abnormal activity. Clinical signs include darkening of the skin, pale gills, fluid in the abdomen (ascites), distended abdomen, protruding eyes (exophthalmia), and pinpoint bruising (petechial haemorrhaging). Fish appear anaemic and lack food in the gut. The liver, kidney and spleen are often pale.

The disease may be transmitted horizontally, through contact with infected fish or water, and vertically, from infected broodstock eggs.



Water temperature is the most important factor in IHN outbreak progression, typically causing highest mortality between temperatures of 8°C and 15°C.

Outbreaks are most severe in fingerling and juvenile fish. In aquaculture older rainbow trout are reported to be chronically affected. Wild fish act as an important reservoir of infection where the disease is endemic. Carrier fish are thought to release large amounts of virus resulting in widespread and persistent infection in affected catchments.

Susceptible Species

Species that have been shown to be susceptible to IHN include; rainbow or steelhead trout, Atlantic salmon. Pacific salmon including chinook, sockeye, chum, yamame, amago, and coho.

Diagnosis

The virus is isolated in cell culture from internal organs of affected fish and identification is confirmed by IFAT (Immunofluorescent Antibody Technique) and PCR (Polymerase Chain Reaction).

Treatment and control

There is no treatment for IHN.

If IHN was found on a UK farm, eradication and disinfection programmes would be implemented. Movement restrictions would be applied to contact sites and all farms on the same river catchment. Attempts would be made to eradicate IHN and all contact sites would be investigated to identify the virus source and spread. Any approved status would be suspended until disease eradication has been confirmed.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of IHN in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of IHN.

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Infectious Salmon Anaemia (ISA)

Serious viral disease affecting farmed salmon.

- **External Signs:** pale gills, distended abdomen, lethargy, lack of appetite, protruding eyes and gasping at water surface
- **Affects:** farmed Atlantic salmon
- **Mortality:** up to 90% mortality in cage sites
- **Treatment:** no known treatment

Overview

Infectious salmon anaemia (ISA) is a disease of farmed Atlantic salmon (*Salmo salar*) in seawater. Mortality rates can vary from 1% per day to 90%. The UK was historically free of ISA, until an outbreak in Scotland in 1998. A further outbreak occured in farmed salmon in the Shetland Isles in 2008 and 2009.

Disease causing agent: Infectious salmon anaemia virus (ISAV) is the only recorded member of the Orthomyxoviridae family found in fish.

ISA has no implication for human health.

Geographical Distribution

ISA was first reported in Norway in the 1980's and since then has been identified in Canada, Scotland, the Faroes and the USA. The virus has been isolated in Coho salmon and rainbow trout in freshwater. ISA is having a serious economic impact on salmon farming in Chile.

Characteristics and Clinical Signs

The disease may be transmitted horizontally through contact with infected fish, faeces, urine or water. The gills are thought to be the most likely infection point.

Prominent clinical signs on fish include pale gills, protruding eyes (exophthalmia) and distended abdomen. Internally a darkened liver and swollen kidney may indicate the presence of infection. Bruising (haemorrhaging) in the intestine may also be seen. In many cases, one of the above symptoms may be more prevalent than others.

Behaviourally, infected stock may display lethargy, lack of appetite, and gasping at the water surface .

Susceptible Species

Outbreaks of ISA have mainly occurred in farmed Atlantic salmon. However the virus has been recovered from wild Atlantic salmon, brown and sea trout and also pollock and cod caught in the vicinity of cages holding farmed salmon. Recently the virus has been reported in freshwater farmed rainbow trout. Clinical disease is generally only seen in farmed fish

Diagnosis

The virus is isolated in cell culture from internal organs of affected fish and identification is confirmed by RT-PCR (Reverse Transcriptase Polymerase Chain Reaction).

Treatment and control

There are no effective treatment for ISA and no licensed vaccines in the EU. The occurrence and spread of ISA is reduced by good biosecurity measures and husbandry practices.

Like other notifiable diseases, suspicion of infection would result in movement restrictions being placed on all farms within the catchment, or zone, and contact sites. If confirmed, attempts to eradicate the disease and investigate all contact sites to establish the source and spread of the virus.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of ISA in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of ISA.

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Koi Herpesvirus Disease (KHV)

Serious viral disease affecting all varieties of common carp.

- **External Signs:** lethargy or erratic behaviour, loss of balance, sunken eyes and necrotic patches in the gills
- **Affects:** all varieties of common carp, including varieties such as mirror, leather, koi and ghost koi
- **Mortality:** up to 100% mortalities
- **Treatment:** no known treatment

Overview

Koi herpesvirus (KHV) disease is a viral disease of common carp, *Cyprinus carpio*, and all varieties of common carp including; koi, ghost koi, mirror, and leather carp. The virus is highly contagious and may cause up to 100% mortality. KHV has caused severe fish losses to ornamental fish trade and carp fishery owners, and continues to pose a significant threat to anyone dealing with or keeping common carp.

Disease causing agent: Cyprinid Herpesvirus III of the family Herpesviridae.

KHV has no implication to human health.

Geographical Distribution

KHV disease was first recorded in Israel in 1998, following large scale farmed fish mortalities. Further losses, attributed to the virus, were later found in Europe, the USA and have subsequently been reported in a number of countries worldwide.

In the UK KHV disease was first detected in imported koi in 2000. It has subsequently spread to angling waters, as well as occurring in ornamental dealers and hobbyists fish stocks.

KHV disease appears to be widespread in ornamental carp. It is possible the disease is widespread in more countries than have previously reported its presence.

Characteristics & clinical signs

The disease may be transmitted horizontally, through contact with infected fish or water, and the disease can possibly spread through contaminated nets and equipment. Vertical transmission cannot be ruled out from infected broodstock eggs. The virus is thought to be shed through faeces and urine, and also possibly via gills and skin.

There are a variety of associated clinical signs with KHV disease. Affected fish may display erratic behaviour, often gathering at water inlets or points of oxygenation, show loss of balance, loss of mucus resulting in dry, rough patches, sloughing of mucus and sunken eyes. The gills generally show the most dramatic clinical signs, characterised by patches of dead tissue. In addition to the direct clinical signs of KHV disease, the gills are often affected by secondary bacteria and fungi infections.

The disease occurs at water temperatures between 16ºC and 28ºC. Acute mortalities occur within this temperature range and are often highest mid-range. Stress may contribute as a 'trigger' before an outbreak of the disease.

Diagnosis

The virus is detected and its identification confirmed by PCR (Polymerase Chain Reaction) from gills and internal organs of affected fish.

Susceptible species

Currently KHV infections have been recorded in common carp, *Cyprinus carpio,* and its different varieties (mirror, leather, koi, ghost koi, etc). There is also evidence KHV disease may occur in common carp hybrids such as goldfish/common carp hybrids and crucian carp/ common carp hybrids.

Treatment and control

There is no treatment for KHV. Fish that recover from KHV disease may carry the virus and act as an infection source.

On confirmation of KHV disease a risk based approach is used to determine controls imposed. This is dependent upon the type of water infected. Other factors include whether it is a fishery or inland water, fish farm, fish dealer or retailer, aquaria or garden pond.

Controls may include the application of movement restrictions to the site, culling of stocks and disinfection of the facility. Investigations into the source of infection will be undertaken by the FHI on a case by case basis.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of KHV disease in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of KHV disease.

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Spring Viraemia of Carp (SVC)

Serious viral disease affecting all varieties of carp and other coarse fish species.

- **External Signs:** include darkening of the skin, protruding eyes, abdominal swelling, pale gills, trailing faecal casts and protusion of the anus
- **Affects:** common carp and other coarse fish species
- **Mortality:** large scale mortalities up to 100%
- **Treatment:** no known treatment or vaccine

Overview

Spring viraemia of carp (SVC) is a viral disease of carp and many other coarse fish species. The disease causes up to 100% mortality and affects fish of all ages. Outbreaks have resulted in significant economic losses in fisheries across England and Wales.

Disease causing agent: A viral disease caused by *Rhabdovirus carpio* of the family Rhabdoviridae.

SVC has no implications for human health.

Geographical Distribution

The disease is widespread in continental Europe and western Eurasia. The first cases seen in the USA occurred in 2002.

SVC was first found in Great Britain in 1976. Outbreaks within Great Britain are infrequent and often associated with illegal movements of fish.

Characteristics & clinical signs

SVC is usually spread horizontally through close contact between infected fish. There is no evidence to suggest the disease can be transmitted vertically through eggs. Some vectors, such as the fish louse *Argulus* spp. and the fish leech *Piscicola geometra,* also transfer the disease to healthy fish.

Outbreaks of SVC occur as water temperatures rise above 5°C in the spring. Maximum mortalities occur between 10°C and 15°C. Mortalities usually decrease at water temperatures over 17°C but may sometimes occur up to 23°C.

Clinical signs vary but include darkening of the skin, swollen eyes, abdominal swelling (dropsy), pale gills, trailing faecal casts and protrusion of the anus. Infected fish may be lethargic, show loss of balance and display areas of bleeding on the gills, skin and internal organs. It is important to note one or more signs may be absent at any stage of the outbreak, especially during the earliest and very late stages.

Susceptible species

SVC affects common carp (including all variants, such as mirror, leather and koi carp), grass carp, bighead carp, silver carp, crucian carp, goldfish, orfe, pike, tench and wells catfish. Fish of all ages are susceptible.

Diagnosis

The virus is isolated in cell culture from internal organs of affected fish and identification confirmed by PCR (Polymerase Chain Reaction).

Treatment and control

There is no known treatment for SVC.

In the event of an SVC outbreak in a UK site, fish movement restrictions are applied. All sites receiving fish from, or supplying fish to a confirmed positive site would be inspected and sampled to establish the infection source.

Movement controls will be lifted following the clearance and disinfection of the infected site under supervision of the Fish Health Inspectorate (FHI), or after a period of negative disease testing results.

Fishery owners and managers must be sure any fish introduced are disease free. Do not buy fish of unknown origin; one 'bargain' fish may cost the stock and reputation of a fishery. Fishery managers should ensure animals in their care are kept according to good husbandry practices.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of SVC in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of SVC.

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Viral Haemorrhagic Septicaemia (VHS)

Serious viral disease of rainbow trout in Europe.

- **External Signs:** haemorrhaging, protruding eyes, anaemia, spiral swimming behaviour
- **Affects:** a wide and increasing range of fish species
- **Mortality:** up to 80% mortalities
- **Treatment:** no known treatment

Introduction

Viral haemorrhagic septicaemia (VHS) is considered the most serious disease of rainbow trout in aquaculture. In affected stocks it can cause up to 80% mortality. The UK was historically free from this disease. However, in spring 2006, a VHS outbreak caused high levels of mortality in a Yorkshire trout farm. This outbreak, which was subsequently controlled and eradicated, resulted in serious economic losses to farms in the designated area.

Disease causing agent: Viral haemorrhagic septicaemia virus (VHSV) of the family Rhabdoviridae.

VHS has no implications for human health.

Geographical Distribution

VHS was first reported in a rainbow trout farm in Denmark. The disease has since caused significant losses in rainbow trout farms in continental Europe. It has also been reported in Japan and Russia. A highly virulent new strain of VHS has recently been reported in the USA, affecting a range of freshwater fish species.

The VHS virus has also been isolated from the marine environment in the Baltic and North seas, the Atlantic Ocean and off the Pacific coast of North America.

Characteristics & clinical signs

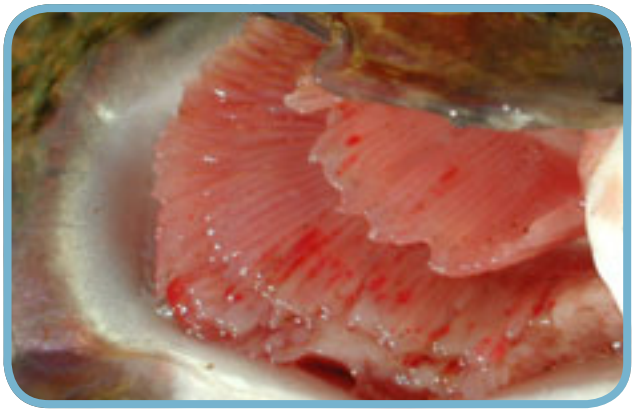
The disease is transmitted horizontally, through contact with infected fish or water. Large numbers of virus particles are shed in the faeces, urine and sexual fluids. There is thought to be no vertical transmission of the virus.

The disease normally progresses in three stages.

1. The acute stage sees a rapid onset of high mortalities, often exhibiting severe clinical signs such as darkening of body colour, protruding eyes (exophthalmia), bleeding around eyes and fin bases, pale gills and pinpoint bruising (petechial haemorrhaging) on the surfaces of the gills, internal organs and in the muscle.

2. During the second sub acute, or chronic, stage mortalities may decline but the body colour continues to darken, protruding eyes may become more pronounced, and bruising around the eyes and fin bases is often reduced. Fish are severely anaemic, and paleness is particularly evident in the abdomen. Fish may develop a spiralling swimming motion, corkscrewing around the body axis.
3. The final, nervous stage, sees reduced mortality. Clinical signs are usually absent other than the corkscrew swimming motion which may become more pronounced.

Outbreaks of VHS in rainbow trout typically occur between temperatures of 7°C and 14°C.



Susceptible species

VHS is principally a disease of farmed rainbow trout, but most salmonid fish are considered susceptible, as are whitefish, grayling and pike. The disease has also been reported in farmed turbot, wild Pacific herring and numerous other marine fish species. The list of host species is increasing substantially with the emergence of the North American strain of VHS.

Diagnosis

The virus is isolated in cell culture from internal organs of affected fish and identification confirmed by ELISA (Enzyme Linked Immunosorbent Assay) and PCR (Polymerase Chain Reaction).

Treatment and control

There is no treatment for VHS.

If VHS occurs on a UK farm the site would be subject to an eradication and disinfection programme. Movement restrictions would be applied to all farms on the river catchment and all contact sites. Attempts would then be made to eradicate the disease. All contact sites would be investigated for evidence of the virus source and spread.

The approved status of any infected area would be suspended until a testing programme has confirmed VHS eradication.

Legal obligation and who to notify

Under the Aquatic Animal Health (England and Wales) Regulations 2009 it is a legal obligation to report suspicion of VHS in any farmed or wild fish to the Fish Health Inspectorate.

It is an offence under the Regulation to fail to inform the FHI of suspicion of VHS.

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