



Better Training for Safer Food BTFSF

FISH DISEASES OF CONCERN UNDER EU LEGISLATION

GIUSEPPE BOVO

L 3

INTRODUCTION-1

According to annex IV, part II, of 2006/88/EC directive the following diseases are regarded of major concern :

EXOTIC

Epizootic hematopoietic necrosis (EHN)

Epizootic ulcerative syndrome (EUS)

NON EXOTIC

Viral haemorrhagic septicaemia (VHS)

Infectious hematopoietic necrosis (IHN)

Koi herpesvirus disease (KHVD)

Infectious salmon anemia (ISA)

INTRODUCTION -2

In addition to the previous notifiable diseases the following diseases may be considered at national level and MS may require additional guarantees (Dec. 2004/453)

Bacterial kidney disease (BKD)

Spring viraemia of carps(SVC)

Gyrodactylus salaris (Gs)

Infectious pancreatic necrosis (IPN)

EPIZOOTIC ULCERATIVE SYNDROME

- EUS -

DEFINITION AND HISTORY

EUS IS A SEASONAL EPIZOOTIC PATHOLOGICAL CONDITION AFFECTING SEVERAL FARMED AND WILD FISH SPECIES BOTH IN FRESH AND BRACKISH WATER ENVIRONMENT

AETIOLOGY

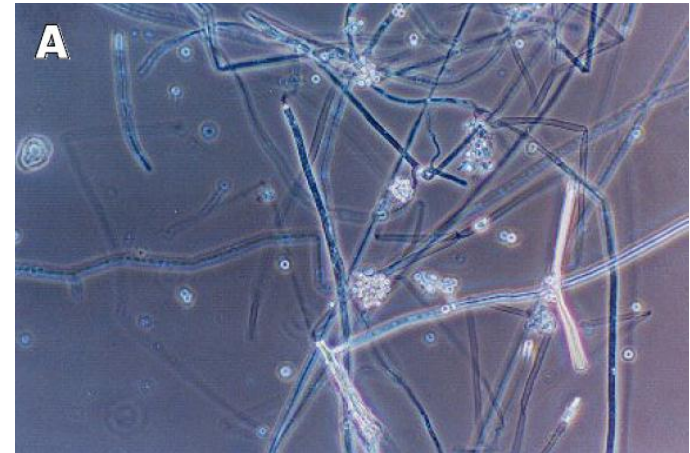
EUS HAS A COMPLEX AETIOLOGY

THE INVASIVE OOMYCETE *APHANOMYCES INVADANS*, IS CONSIDERED THE RESPONSIBLE AGENT FOR INDUCING THE TYPICAL LESIONS: ULCERS AND GRANULOMAS

THE TAXONOMY OF THE AGENT, A NON SEPTATE FUNGUS-LIKE IS NOT DEFINITIVE (Diatoms, brown algae)

CONCURRENT INFECTIONS WITH BACTERIA AND PARASITES MAY BE OFTEN DETECTED

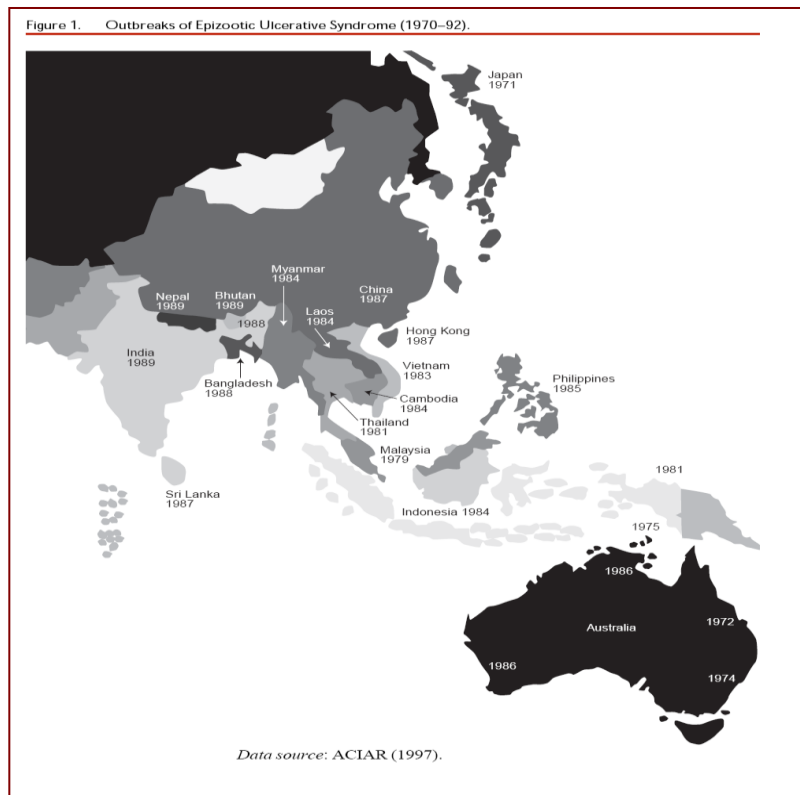
Musculature smear showing typical *Aphanomyces* sporangia (library .enaca.org.)



Daniel J. Fairweather, BSc.



GEOGRAPHICAL DISTRIBUTION



ENDEMIC :

First detection in Japan (1971), South east Asia , South Asia, Australia .

RECENT REPORTS:

Canada (2011)

USA

Central Africa (Botswana, Namibia, Zambia)

SUSCEPTIBLE HOSTS

TARGET SPECIES : > 76 SPECIES AFFECTED

- *Black bullhead*
- *Grey mullet & other mullets*
- *Well catfish*

RESISTENT SPECIES :

- *Common carp,*
- *Nile Tilapia,*

ORIGIN AND TRANSMISSION

WATER CONTAMINATED WITH THE ZOOSPORES IS THE MAIN INFECTION SOURCE

SECONDARY ZOOSPORES MAY INCIST AND SURVIVE IN THE ENVIRONMENT WAITING A SUSCEPTIBLE HOST

ORNAMENTAL FISH FROM ENDEMIC AREAS (i.e. Gourami spp.) MAY PLAY AN IMPORTANT ROLE IN SPREADING THE INFECTION

MORTALITY AND MORBIDITY

SEVERE EPIZOOTICS OCCUR DURING COLD SEASONS (18-22 ° C)

MORBIDITY AND MORTALITY OFTEN > 50%

LOW TEMPERATURE AND HEAVY RAINFALL IMPROVES SPORULATION CAUSING AN INCREASE OF OUTBREAKS

OUTBREAKS IN FARMS OFTEN SECONDARY TO EPIZOOTICS OCCURRING IN WILD POPULATION

CLINICAL SIGNS

LOSS OF APPETITE

DARKENING OF THE SKIN

**SWIMMING NEAR THE WATER
SURFACE**

RED SPOTS AND SKIN ULCERS

GROSS PATHOLOGY

**RED OR GREY
LARGE ULCERS IN
LATER STAGES**

**EROSION OF THE
MUSCULATURE,
AND SOFT AND
HARD TISSUES OF
THE CRANIAL
AREA WITH
BRAIN EXPOSURE**



J. D. Humphrey and M. Pearce, Fishnote 2004

MICROSCOPIC PATHOLOGY

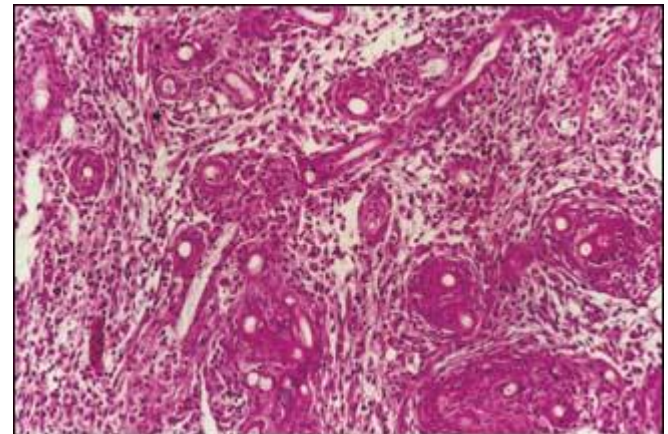
ERYTHEMATOUS DERMATITIS

**PRESENCE OF *APHANOMICES INVADANS* HYPHAE
GROWING IN THE SKELETAL MUSCULATURE**

NECROTISING GRANULOMAS

**SECONDARY MYCOTIC , BACTERIAL AND
PARASITIC INVASION**

M.G. BONDAD-REANTASO
*Typical severe mycotic granulomas from
muscle section of EUS fish (H & E)*



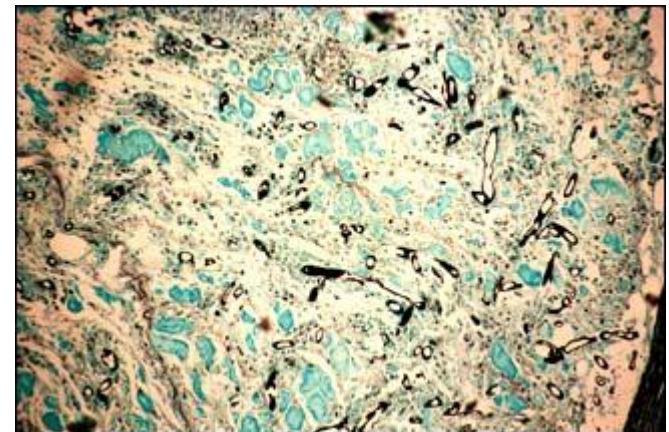
DIAGNOSIS

The diagnosis of EUS is based on clinical signs and confirmed by histopathology

**SELECT 10 FISH WITH TYPICAL LESION IN EARLY STAGES
KEEP THE SAMPLES AT 4 ° C FOR 1-2 DAYS OR FIX THEM IN
BUFFERED FORMALIN
DIAGNOSIS IS CONFIRMED BY :**

**OBSERVATION OF THE HYPHAE IN FRESH TISSUES
ISOLATION ON PEPTONE/GLUCOSE AGAR
DETECTION BY HISTOLOGY
DETECTION BY PCR METHODS**

*M.G. BONDAD-REANTASO
Mycotic granulomas showing fungal hyphae
(stained black) using Grocotts stain*



CONTROL AND PREVENTION

NO VACCINES AVAILABLE

NO CHEMICAL TREATMENT AVAILABLE

**TREATMENT OF INFECTED FARMS WITH LIME OR
HIDRATED LIME MAY REDUCE THE IMPACT OF THE
DISEASE.**

THE EXOTIC STATUS IN EU ?

EPIZOOTIC HAEMATOPOIETIC NECROSIS - EHN -

DEFINITION AND HISTORY

EHN IS AN EXOTIC SYSTEMIC VIRAL DISEASE AFFECTING WILD PERCH POPULATIONS (PERCA FLUVIATILIS) IN AUSTRALIA (LANGDON ET AL 1986)

FOLLOWING THE FIRST REPORT IN PERCH THE DISEASE HAS BEEN OBSERVED IN FARMED RAINBOW TROUT (LANGDON ET AL., 1986)

AETIOLOGY

The causative agent of EHN is a member of the family IRIDOVIRIDAE, genus Ranavirus , FROG VIRUS 3 (FV3) being the type species :

MORFOLOGY : Icosahedral
SIZE : 150-180 nm
BIOCHEMISTRY : 1 ds DNA ,

Robust serological and genomic homologies are shown with different ranaviruses causing similar diseases in different species

- | | |
|---|-------------------|
| • Japanese seabass (<i>Lates calcarifer</i>) | LMBV |
| • Pikeperch (<i>Stizostedion lucioperca</i>) | PPIV |
| • Short finned eel (<i>Anguilla australis</i>) | SERV |
| • European catfish (<i>Silurus glanis</i>) | <u>ESV</u> |
| • Blackbullhead (<i>Ameiurus melas</i>) | <u>ECV</u> |
| • B.cleaner wrasse (<i>Labroides dimidiatus</i>) | DFV |
| • Guppy (<i>Poecilia reticulata</i>) | GV6 |
| • Turbot (<i>Scophthalmus maximus</i>) | |

SUSCEPTIBLE HOSTS

**REDFIN PERCH (*PERCA FLUVIATILIS*)
IN WILD POPULATION**



Perca fluviatilis picture Kohout J

**RAINBOW TROUT (*ONCORHYNCHUS MYKISS*)
IN FARMS CONNECTED WITH RIVERS
SUFFERING EHN OUTBREAKS**



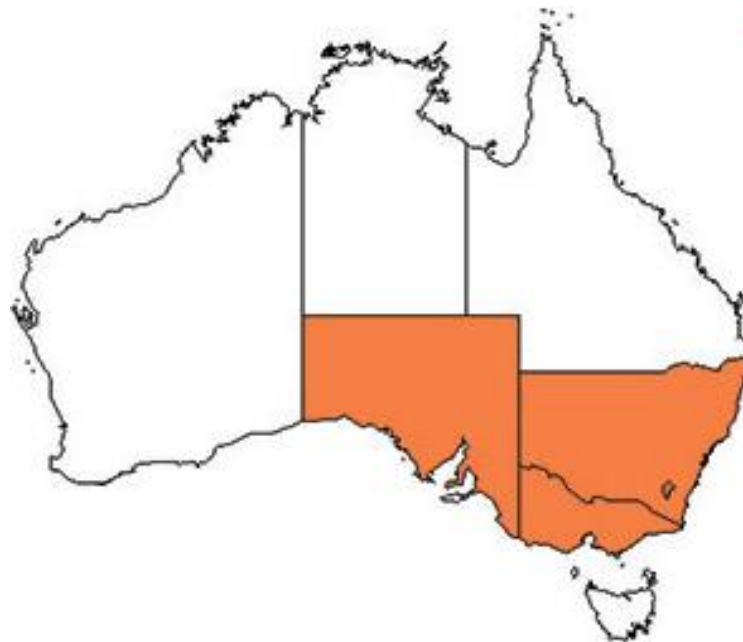
O. mykiss picture (Onmyk_f0.jpg)
by [McDowall, R.M.](#)

**THE DISEASE MAY AFFECT FISH AT ALL
LIFE CLASSES BUT IS MORE FREQUENT
AMONG JUVENILES**

**SEVERAL DIFFERENT SPECIES MAY
DEVELOP THE DISEASE WHEN
EXPERIMENTALLY INFECTED BY BATH**

GEOGRAPHICAL DISTRIBUTION

THE DISEASE HAS ONLY BEEN REPORTED FROM SOME REGIONS IN THE AUSTRALIAN CONTINENT



ORIGIN AND TRANSMISSION

EHN IS HORIZZONTALLY TRANSMITTED ; NO DATA ON VERTICAL TRANSMISSION ARE AVAILABLE

NEW OUTBREAKS IN FARMED FISH SEEMS TO BE CONNECTED WITH NATURAL EPIZOOTIC OCCURRING IN THE WILD POPULATION

THE VIRUS MAY BE TRANSPORTED BY NETS, BOATS, AND OTHER EQUIPMENTS

BAIT FISH ARE CONSIDERED AS A POTENTIAL RISK

PISCIVOUROUS BIRDS ARE CONSIDERED AS A POTENTIAL RISK (WITTINGTON, 1996)

AMPHIBIA ARE REGARDED AS NATURAL RESERVOIR

MORTALITY AND MORBIDITY

TROUT

**OUTBREAKS OCCUR AT 11-20° C
LOW DIRECT ECONOMIC LOSSES , MAINLY RELATED TO
OVERCROWDING , BAD WATER QUALITY AND INTERCURRENT
DISEASES .**

REDFIN PERCH

**OUTBREAKS OCCUR AT HIGH TEMPERATURE
IN SUMMER BOTH MORBIDITY AND MORTALITY BECOME
IMPORTANT LEADING TO A SIGNIFICANT LOSS OR REDUCTION
OF WILD POPULATION, PARTICULARLY WHEN LARGE NUMBER
OF JUVENILES ARE PRODUCED**



Mass mortality of redfin perch. Note the small size of individuals affected and swollen stomach of fish at the centre of the photograph

Source: anonymou

CLINICAL SIGNS

According to the OIE ref. Lab there are no specific clinical signs . Affected fish may show :

- **LOSS OF EQUILIBRIUM**
- **FLARED OPERCULA**
- **DARKENING OF THE SKIN**

GROSS AND MICROSCOPIC PATHOLOGY

EHN is an endotheliotropic agent causing extensive haemorrhages , oedema and reduction of peripheral circule .
A small proportion of fish may have :

KIDNEY , LIVER AND SPLEEN ENLARGMENT

The most prevalent lesions are represented by focal or extensive necrosis interesting :

HAEMATOPOIETIC KIDNEY SPLEEN

SAMPLING AND DIAGNOSIS

Select 10 specimens showing clear signs referred to EHN and submit them , in refrigerated box, to the laboratory :

- **VIRUS ISOLATION AND IDENTIFICATION**
 - Liver**
 - Anterior kidney**
 - Spleen**
- **VIRUS IDENTIFICATION BY ELISA**
- **PCR + REA (according to the OIE manual) to differentiate from different ranaviruses**

CONTROL AND PREVENTION

Because no commercial vaccine is available the impact of the disease may be reduced through

**REDUCTION OF THE STOCKING DENSITY
GOOD QUALITY WATER SUPPLY**

INFECTIOUS SALMON ANEMIA

- ISA -

DEFINITION AND HISTORY

ISA IS A SISTEMIC LETHAL VIRAL DISEASE , CAPABLE TO INDUCE SEVERE ANEMIA AND HEAVY LOSSES IN ATLANTIC SALMON (*Salmo salar*) DURING THE SEA-FARMING CYCLE .

AETIOLOGY

The causative agent of ISA is an RNA virus belonging to the family ORTOMYXOVIRIDAE , genus ISAVIRUS :

MORFOLOGY : PLEOMORPHIC PARTICLES
DIZE : 100-130 nm
BIOCHEMISTRY : 8 SS RNA , >10 STRUCTURAL PROTEINS
BIOPHISIC : INACTIVATION 30 min a 56° C
INACTIVATION Cl₂ 100 ppm 15 min
INACTIVATION O₃ 8 mg/l 4 min
INACTIVATION pH 4 e pH 12 x 24 h.

SUSCEPTIBLE HOSTS

ATLANTIC SALMON (*SALMO salar*) IS THE MAIN TARGET SPECIES . MOST OUTBREAKS HAVE BEEN REPORTED FROM MARINE ENVIRONMENT

THE DISEASE HAS BEEN ALSO REPORTED FROM SILVER SALMON (*Oncorhynchus kisutch*) IN CHILE

RAINBOW TROUT (*O. mikiss*) IS CONSIDERED A POTENTIAL CARRIER (detection of the virus in Ireland)

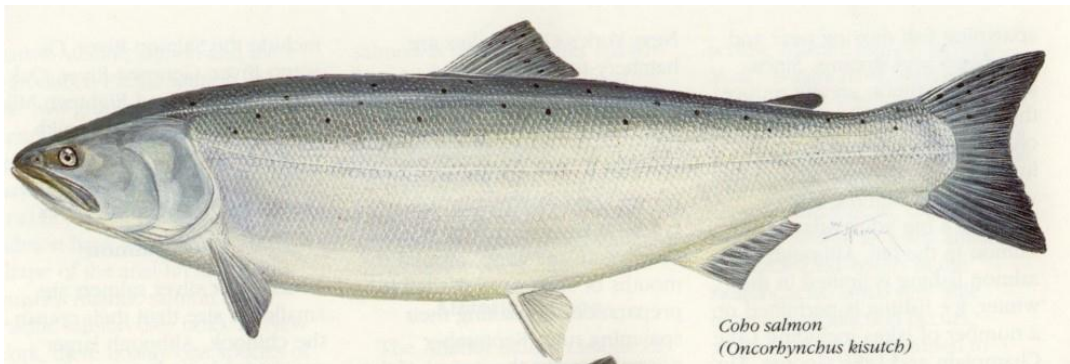
ISAV HAS BEEN FURTHERMORE ISOLATED FROM HEALTHY ATLANTIC COD (*Gadus morhua*) AND POLLOCK (*Pollachius virens*) REARED IN THE SAME CAGE WITH ATLANTIC SALMON SHOWING ISA CLINICAL SIGNS



Salmo salar - Sasal_u5.jpg) by [McDowall, R.M.](#)



O. mykiss picture (Onmyk_f0.jpg) by [McDowall, R.M.](#)



Oncorhynchus kisutch
pond.dnr.cornell.edu

GEOGRAPHICAL DISTRIBUTION

ISA was first observed in 1984 in a hatchery located along the west norwegian coast . In the following years the disease spread the southern coast .

To date ISA has been diagnosed in the following areas :

<i>GEOGRAPHICAL AREA</i>	<i>YEAR</i>	<i>REFERENCES</i>
NORWAY	1984	
CANADA (New Brunswick)*	1996	Bouchard et al.,
SCOTLAND	1998	Rodger et al.
CANADA(Nova Scotia)	2000	
FAROER	2000	report OIE
USA (Maine)	2001	
CHILE	2001	Kibenge et al.,

*** Preliminarily reported as HKS**

ORIGIN AND TRANSMISSION

ISA IS HORIZZONTALLY TRANSMITTED

CONTAMINATED WATER

WILD FISH

SHARING STAFF

WELL BOATS

SEA LICE(*Lepeophtheirus salmonis*)

**VERTICAL TRANSMISSION HAS BEEN PROPOSED BY SOME
AUTHORS (Nylund et al., 2007)**

VIRUS ENTRY :

**MOST LIKELY THROUGH GILLS . ENTRY THROUGH THE
INTESTINE HAS BEEN PROPOSED**

VIRUS SHEDDING : THROUGH NATURAL XCRETIONS/SECRETIONS

CLINICAL SIGNS

LETHARGY WITH FISH KEEPING CLOSE TO THE NET PEN
PALE GILLS
EXOPHTHALMIA
DISTENDED ABDOMEN
PETECHIAE ON THE SKIN
HAEMORRHAGIES IN THE ANTERIOR EYE CHAMBER
DURING THE LAST PHASE FISH REMAIN ON THE BOTTOM
OF THE CAGE
NO FEED IN THE DIGESTIVE TRACT



Figure 3. Moribund (sick) Atlantic salmon in an ocean netpen floating on their sides at water surface. Fish are clinically ill from infection by Infectious Salmon Anemia virus. Image from M. Opitz University of Maine.

GROSS PATHOLOGY

YELLOWISH/ REDDISH LIQUID IN CARDIAC AND PERITONEAL CAVITY

LIVER , KIDNEY AND SPLEN AND INTESTINE CONGESTION

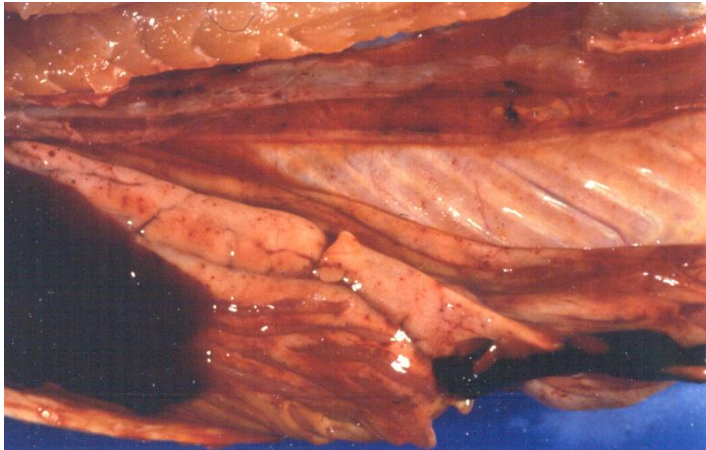
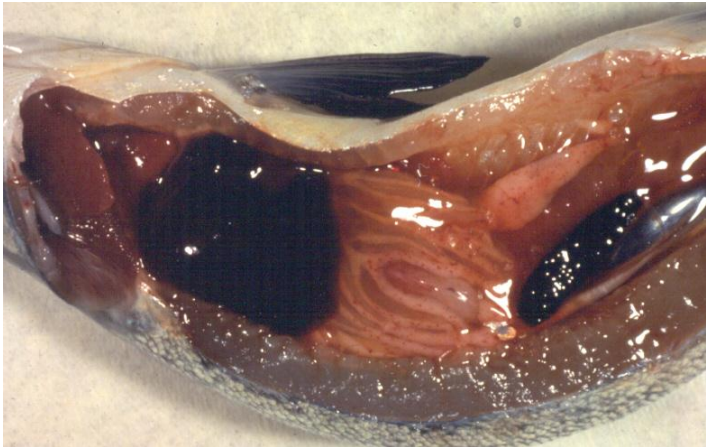
FOCAL HAEMORRHAGIES AND NCROSIS IN THE LIVER

DARK RED LIVER

GILL AND CARDIAC ANEMIA

HAEMORRHAGIES IN THE MUSCULATURE AND PERIVISCERAL FAT

OEDEMA OF THE SWIM BLADDER (CHRONIC STAGE)



MICROSCOPYC PATHOLOGY

MULTIFOCAL/EXTENSIVE HAEMORRHAGIES WITH NECROSIS FOCI IN THE LIVER .

ERYTHROCYTES ACCUMULATION IN THE SPLEEN STROMA, IN KIDNEY GLOMERULI AND IN BLOOD VESSELS OF THE INTESTINAL LAMINA PROPRIA

SLIGHT MULTIFOCAL/EXTENSIVE INTERSTITIAL HAEMORRHAGIES WITH TUBULAR NECROSIS .

ERYTROPHAGOCYTOSIS IN THE SPLEEN AND HAEMORRHAGIES IN LIVER AND KIDNEY

CLINICAL CHEMISTRY

DEGENERATION AND VACUOLATION OF RED BLOOD CELLS

LEUCOCITES REDUCTION

HEMATOCRIT < 10 (FINAL STAGE)

HAEMATOCRIT 25-30 (INTERMEDIATE STAGE)

LIVER ENZIMES >>

MORBIDITY AND MORTALITY

SIGNIFICANT DIFFERENCES AMONG CAGES AT FARM LEVEL AND BETWEEN FARMS

DAILY MORTALITY 0.5-1%

PEAKS IN EARLY SUMMER AND WINTER

IN SERIOUS OUTBREAKS CUMULATIVE MORTALITY > 90%

STRESS (HANDLING OF FISH) MAY INITIATE DISEASE OUTBREAK

DIAGNOSIS (Dec. UE 2003/1831)

ISA suspicion is confirmed when A or B or C criteria are satisfied

A) CLINICAL SIGNS CONSISTENT WITH ISA + DETECTION OF ISAV :

**isolation in cell culture and identification
by PCR
in tissues (ie BY IF)**

B) VIRUS ISOLATION AND IDENTIFICATION OF ISAV FROM 2 SAMPLES COLLECTED ON SEPARATE OCCASIONS

C) VIRUS ISOLATION AND IDENTIFICATION FROM 1 SAMPLE + POSITIVE PCR OR IFAT FROM TISSUES

DIFFERENTIAL DIAGNOSIS

**Different anemic and haemorrhagic pathological conditions
Winter ulcers and septicaemia caused by *Moritella viscosa***

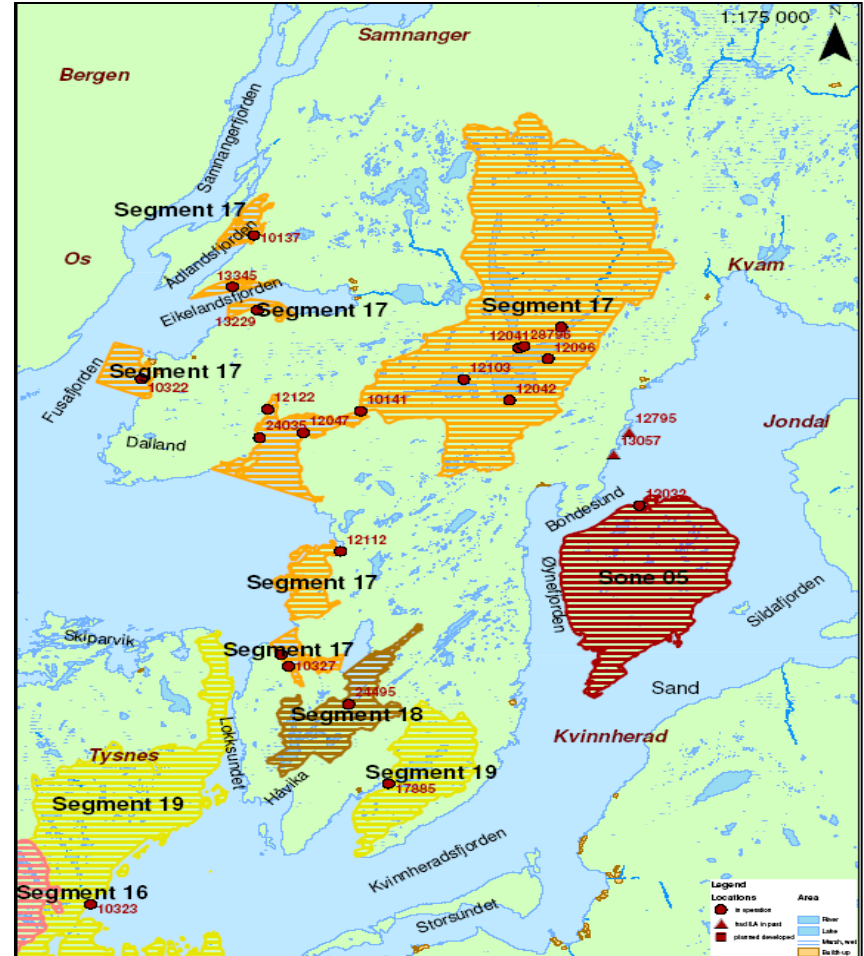
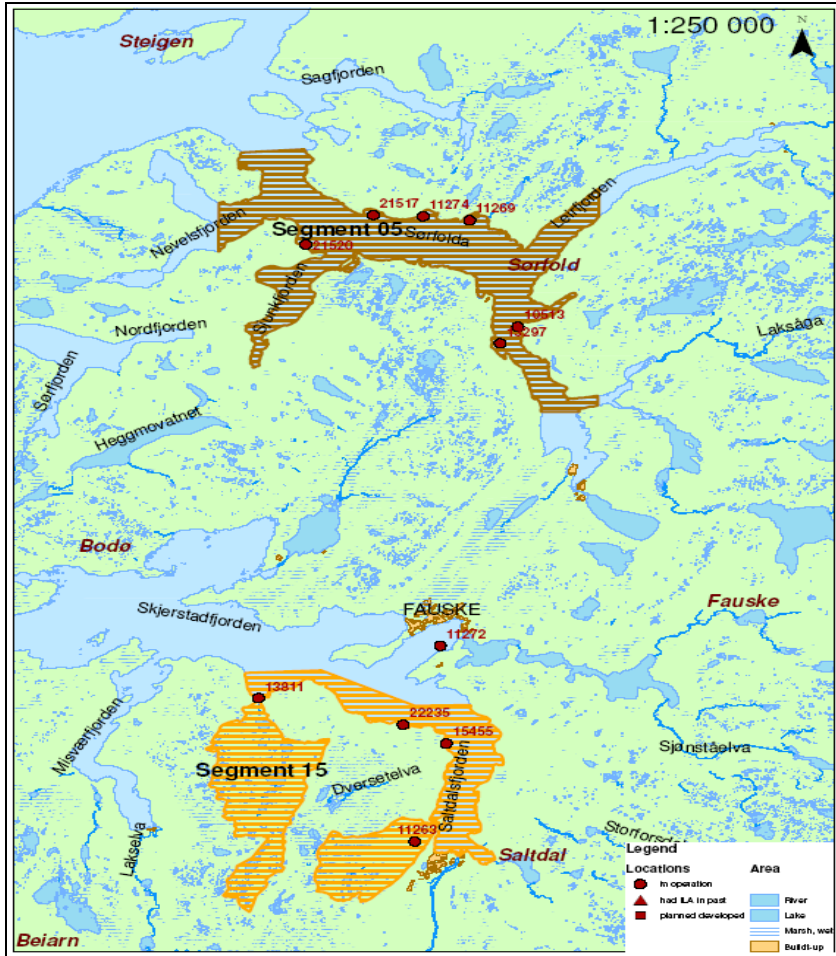
CONTROL AND PREVENTION

Vaccination has been used in North America and Faroes Islands with no complete protection and risk to establish carriers . The prevention and control of ISA may be obtained according to the following measures :

- **CATEGORIZATION OF COMPARTMENTS**
- **STRICT SURVEY OF CONTAINEMENT ZONE**
- **PROHIBITION OF VACCINATION**
- **TRANSPORT AND SLAUGHTERHOUSE REGULATION**
- **DISINFECTION OF TRUCKS AND WELL BOATS**
- **TRADE RESTRICTION FROM INFECTED AREAS**
- **EGG DISINFECTION**
- **CONTROL OF VECTORS (*Lepeophtheirus salmonis*)**



European
Commission



VIRAL HAEMORRHAGIC SEPTICAEMIA

- VHS -

DEFINITION AND HISTORY

VHS is a systemic disease characterized by haemorrhagic picture affecting several species both from freshwater and marine environment .

The disease has been observed since 1938 in Rainbow trout (*O. Mykiss*) which is the major affected species and described with different sinonims

All the VHS isolates react with the MAb IP5B11

AETIOLOGY

The causative agent is an RNA virus belonging to the *Rhabdoviridae* family , genus *Novirabdomavirus* . 4 main genotypes described

TYPE	PREVALENT HOST TYPE AND LOCATION
I-a	Farmed rainbow trout and a few other freshwater fish in continental Europe ^[10]
I-b	Marine fish of the Baltic Sea , Skagerrak , Kattegat , North Sea , Japan ^[1]
I-c	Farmed rainbow trout Denmark
I-d	Farmed rainbow trout in Norway , Finland , Gulf of Bothnia
I-e	Rainbow trout in Georgia, farmed and wild turbot in the Black Sea ^[11]
II	Marine fish of the Baltic Sea
III	Marine fish of the British Isles and northern France, farmed turbot in the UK and Ireland, and Greenland halibut (<i>Reinhardtius hippoglossoides</i>) in Greenland . Rainbow trout in Norway (marine environment)
IV-a	Marine fish of the Northwest Pacific (North America), North American north Atlantic coast, ^[13] Japan, and Korea ^{[11][14]}
IV-b	Freshwater fish in North American Great Lakes region ^[14]

SUSCEPTIBLE HOSTS

In the last 20 years the causative agent has been isolated from > 80 species . In farmed condition the target species is RT but the disease has been observed in different species . According to Directive 2006/88 susceptible species are :

FRESHWATER

Brown trout
Northern pike
Grayling
Whitefish

Salmo trutta fario
Esox lucius (Meyer , 1985)
Thymallus thymallus (Meyer and Whali, 1988)
Coregonus sp. (Meyer et al., 1986)

MARINE

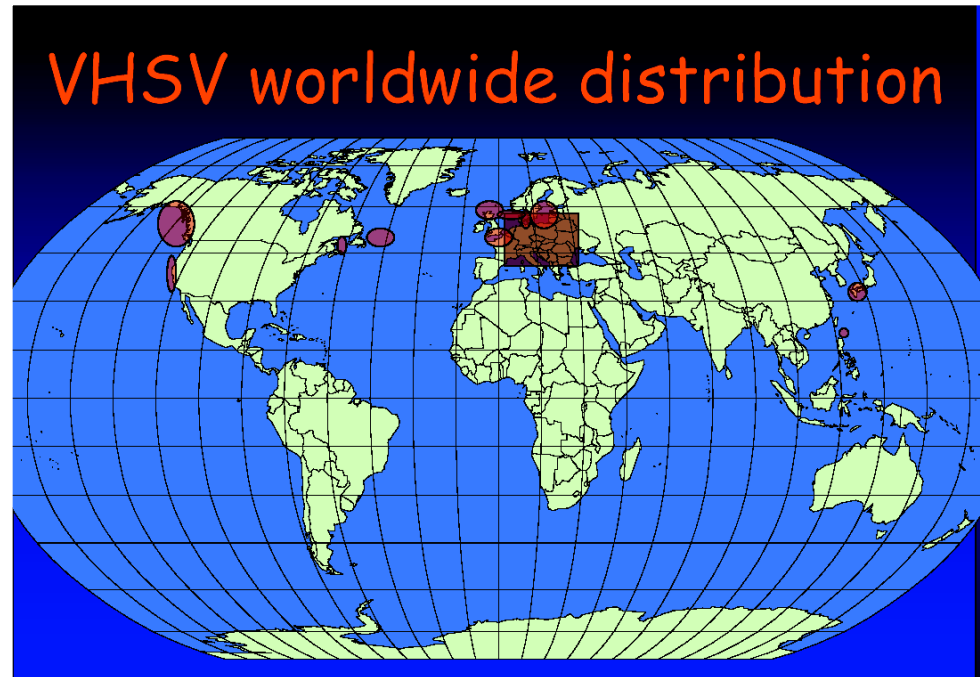
Turbot
European cod
Pacific cod
Pacific herring
Sprat
Pacific salmon
Haddock
Rocking

Scophthalmus maxim.(Schlotfeldt et al., 1991)
Gadus morhua
GADus macrocephalus
Clupea pallasii
Sprattus sprattus
Oncorhynchus spp
Gdus aeglefinus
Onos mustelus

GEOGRAPHIC DISTRIBUTION

VHS in trout has been only observed in Europe , representing one of the most serious disease affecting salmonid aquaculture. The disease is still present in :

AUSTRIA
BELGIUM
BULGARIA
CZECH REPUBLIC
FINLAND
GERMANY
ITALY
NETHERLANDS
POLAND
SLOVAKIA
SLOVENIA
SWITZERLAND



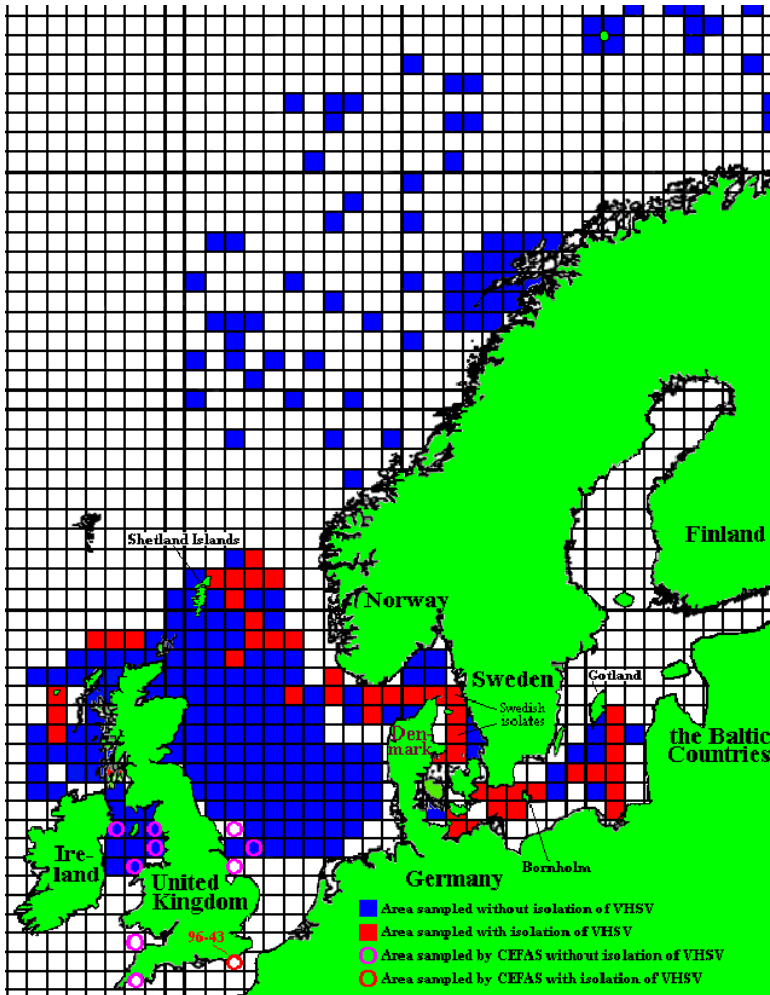
Courtesy prof. N.J. Olesen Fish Diseases EU Ref. Lab. (Aarhus –DK)



European
Commission

Date	Location	State or Province	Primary species (Other species)	Estimated	Comments
2003-05	Lake St. Clair	MI	Muskellunge	4 of 27	Samples submitted over several years
Summer 05	Bay of Quinte/Lake Ontario	Ontario	Freshwater Drum (Muskellunge Round Goby)	Several hundred tons	Very large natural mortality
May 06	Sandusky Bay/Lake Erie	OH	Freshwater Drum	Very large mortality	"Windrows" of fish on beach
May 06	St. Lawrence River	NY	Round Goby (Muskellunge)	Large die off	River origin
May 06	Lake Erie			Large die off	Fish dying in commercial traps
May 06	Lake Ontario			Mortality event	Acute mortality - no external signs
May 06	Lake Erie			Mortality in wild	Samples from area of traps and mortality
June 06	Lake St. Clair			Large mortality	

Northern Pike
Consumers
(Yellow perch)



VHS INFECTION IN WILD MARINE FISH

Epidemiological investigations
carried out by CEFAS (UK)
And by EU- RL Aarhus (DK)

Data from EU Fish Diseases Reference Laboratory (Aarhus –DK).

ORIGIN AND TRANSMISSION

VIRUS ENTRY : GILLS ARE THE MAJOR PORTAL

**VIRUS REPLICATION : FIRST IN THE EPITELIAL CELLS OF THE GILLS
FOLLOWING THE TISSUE INVASIONS
EPLICATION TAKE PLACE IN THE ENDOTHELIA**

VIRUS SHEDDING: URINE , OVARIAN FLUID AND SKIN

**NOTE . EGGS MAY TRANSMIT THE INFECTION TO THE OFFSPRING BY
EXTERNAL CONTAMINATION .**

SIGNS AND PATHOLOGICAL CHANGES

The infection is characterized by three major phases

ACUTE

Lethargy , mono-bilatera exophthalmus, hepatic congestion, haemorrhages, high mortality

SUB-ACUTE – CHRONIC

Iperpigmentation exophthalmus , liver and kidney anemia anemia epatica e renale, moderate mortality

NERVOUS

Abnormal swimming, kidney anemia , low mortality

EXTERNAL SIGNS

Affected fish are lethargic and remain along the wall of the concrete tanks or, in earthen ponds, near the surface of the water lying on the crevices of the banks. The main signs :

**DARKENING OF THE SKIN
SEVERE GILL ANEMIA
EXOPHTHALMUS MONO-BILATERAL
PERIORBITAL HAEMORRHAGIES
ABDOMEN DISTENSION**



GROSS SIGNS

Main internal signs are characterized by the presence of ascitic fluid and a diffuse haemorrhagic picture interesting :

SKELETAL AND CARDIAC MUSCULATURE

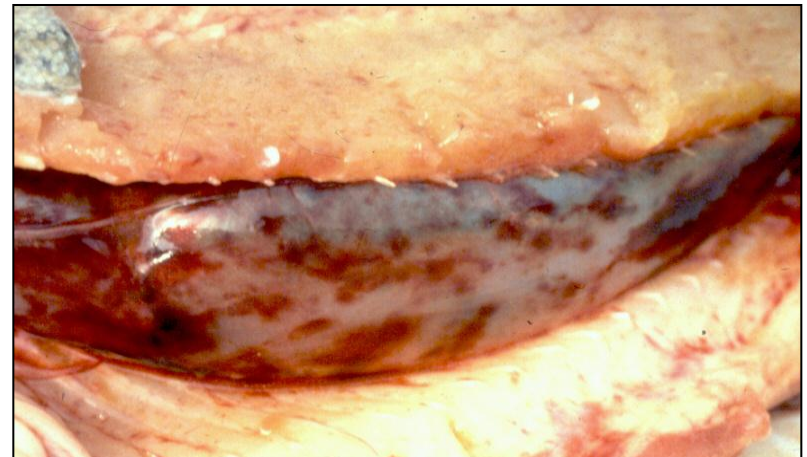
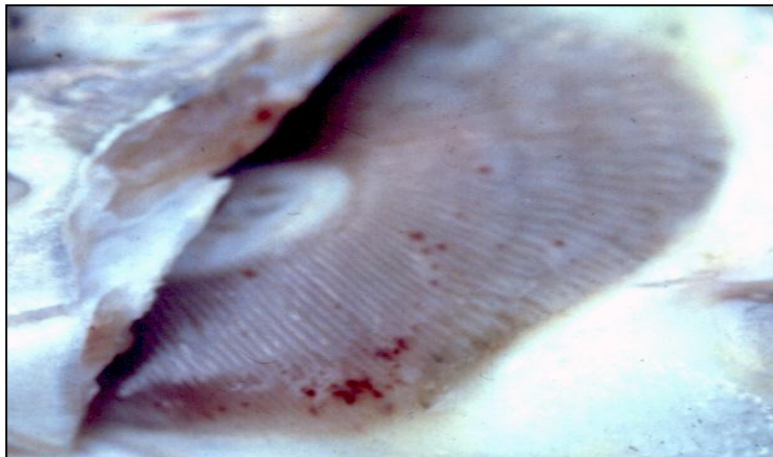
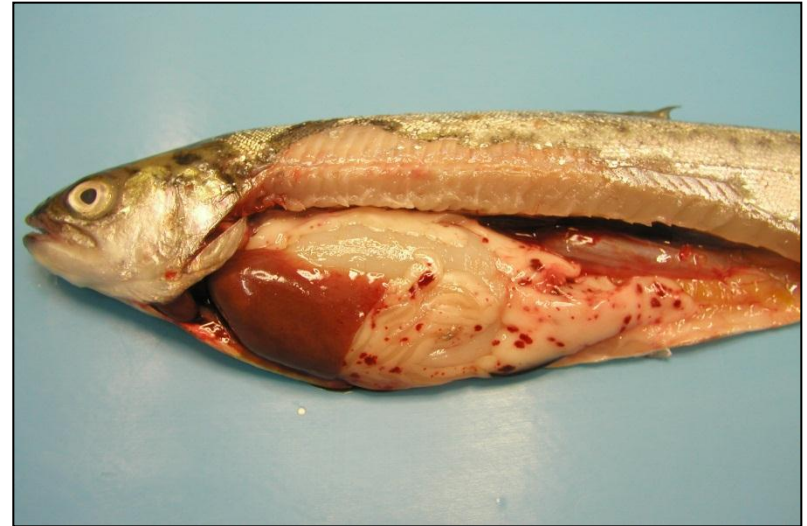
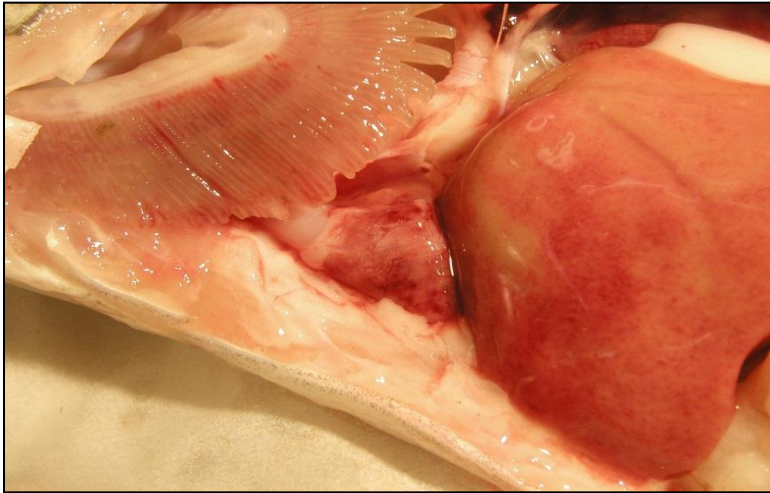
LIVER

KIDNEY

SWIMBLADDER

PERIVISCERAL FAT

PERITONEUM



DIFFERENTIAL DIAGNOSIS

DISEASE

LESIONS

TEST

Gas bubble disease **Exophthalmus** **gas bubbles in the gills**

Acute bacterial dis. **Haemorrhagies** **Bacteria isolation**

PKD **Kidney enlargement** **PKX detection**

IHN **Haemorrhagies** **Virus identification**

IPN **Exophthalmus/** **Virus identification**

PREVENTION AND CONTROL

Because no commercial vaccines are available VHS may only be controlled by eradication methods :

**COLLECT AND ELIMINATE ALL THE FISH POPULATION
DRY ALL THE BASINS SIMULTANEOUSLY (6 WEEKS)
DISINFECT ALL THE FARM
RESTOKE WITH FREE FISH**



INFECTIOUS HAEMATOPOIETIC NECROSIS

- IHN -

DEFINITION AND HISTORY

IHN is a systemic viral disease reported, with different synonyms, since 1953 and affecting some wild and reared salmonid species along the pacific coast of USA :

YEAR	REGION	DISEASE	AFFECTED SPECIES
1953	Washington	SSVD	O. nerka
1958	Oregon	OSVD	O.nerka
1958	California	SRCD	O. tschawyytscha
1969	Brithish C.	IHN	O. nerka
		IHN	O. mykiss

AETIOLOGY

**The causative agent of IHN is a Rhabdovirus , genus Novirhabdovirus
3 main genotypes described (Kurath et al., 2003) :**

GROUPS

ORIGIN

- U :** Isolates from Alaska, British Columbia Washington, Oregon, California and Japan obtained from :
- Sockeye salmon (*O. nerka*)
 - Chinook salmon (*O. tshawytscha*)
- M:** isolates from Idaho, Washington, France and Italy obtained from
rainbow trout (*O. mikiss*)
- L:** isolates from California, Oregon and Japan obtained from
e Giappone, obtained from :

GEOGRAPHICAL DISTRIBUTION

- *CANADA*
- *USA*
- *DOMINICAN REP.*
- *JAPAN*
- *KOREA*
- *PAKISTAN*
- *EUROPE*
 - BELGIUM
 - CZECH REPUBLIC
 - GERMANY
 - ITALY
 - FRANCE
 - NETHERLANDS
 - POLAND
 - SLOVENIA

SUSCEPTIBLE HOSTS

According to directive 2006/88 the following species are considered susceptible to the natural disease :

**rainbow or steelhead trout (O. mykiss),
Chum salmon (Oncorhynchus keta),
coho salmon (O. kisutch),
Masou salmon (O. masou),
sockeye salmon (O. nerka),
pink salmon (O. rhodurus)
Chinook salmon (O.tshawytscha),
Atlantic salmon (Salmo salar**

TRASMISSION AND PATHOGENESIS

VIRUS ENTRY : Gills , skin, oral

VIRUS SHEDDING : Feces , urine , sessual fluids, mucus

TRASMISSION : Mostly orizontally
Vertical suspected
Confirmed by vectors (invertebrates)

TEMPERATURE : Most of the outbreaks at 8-15° C

REPLICATION : Viremia AT 5-10 days

TARGET ORGANS : haematopoietic tissues (kidney, spleen) ,
brain and gastro- intestinal.

PROGNOSIS : 35- 40 giorni

MORBIDITY & MORTALITY : 90-95% in fry . Not significant in market-size fish

CLINICAL SIGNS

The first IHN sign is usually represented by a suddenly increase of mortality associated with :

Severe gill anemia

Exophthalmus mono-bilateral

Letargy

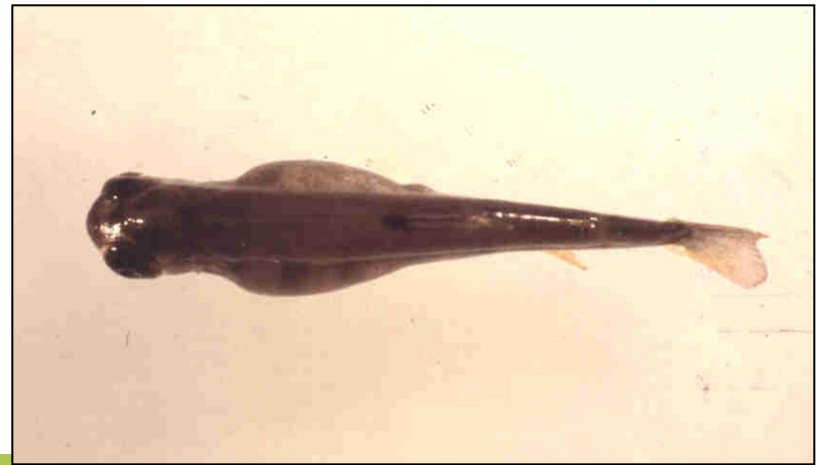
Darkening of the skin

Abdomen distension

Mucoid feces

Emorrhagies at the fin base

Deviation of the spinal column in survivors





Courtesy dr. S. LaPatra

GROSS LESIONS

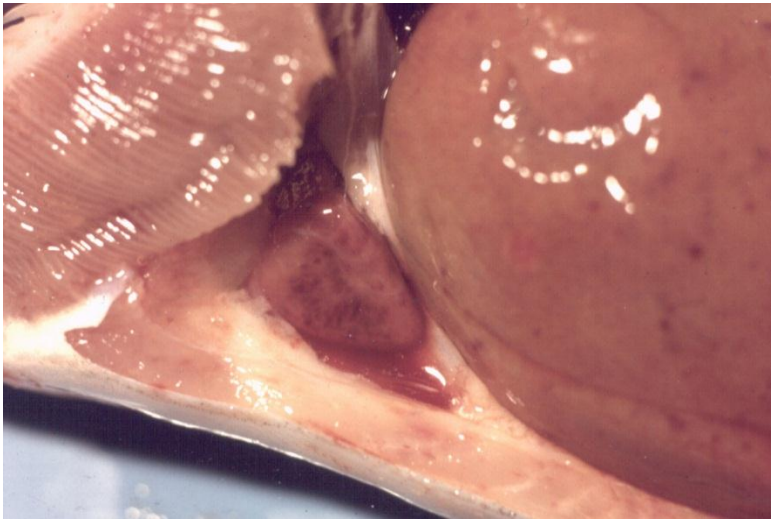
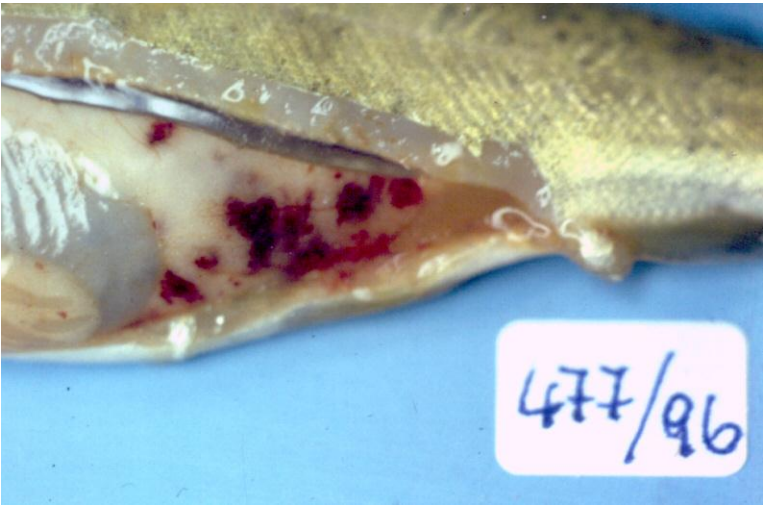
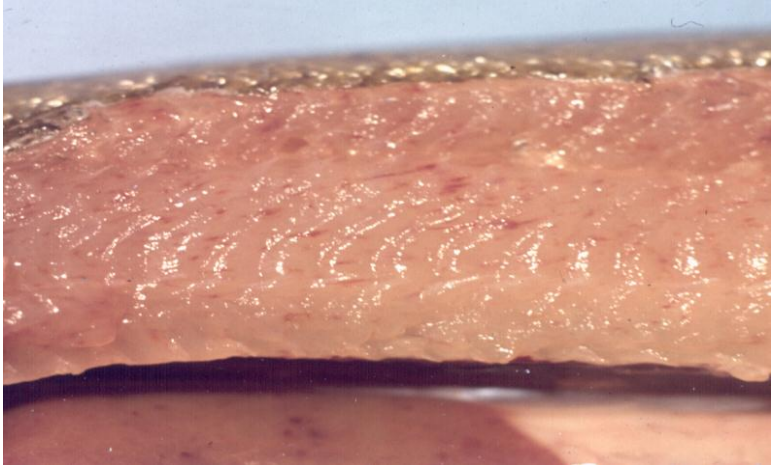
The haemorrhagic picture appearing during an IHN outbreak is usually less severe than in VHS . Affected specimen show :

Visceral anemia

Empty stomach

Haemorrhagies in the skin and musculature

Haemorrhagies in the perivisceral fat



MICROSCOPICAL LESIONS

Necrosis of the haematopoietic tissue

Focal necrosis in the liver

Necrosis of the pancreatic tissue

**Necrosis of the granular cells found in the
stomach and intestine**

DIFFERENTIAL DIAGNOSIS

DISEASE

LESIONS

TEST

Gas bubble disease

Exophthalmus

gas bubbles in the gills

Acute bacterial dis.

Haemorrhagies

Bacteria isolation

PKD

Kidney enlargement

PKX detection

VHS

Haemorrhagies

Virus identification

IPN

Haemorrhagies

Virus identification

PREVENTION AND CONTROL

In addition to the disinfection of eggs , the control of IHN may be obtained by

ERADICATION METHODS

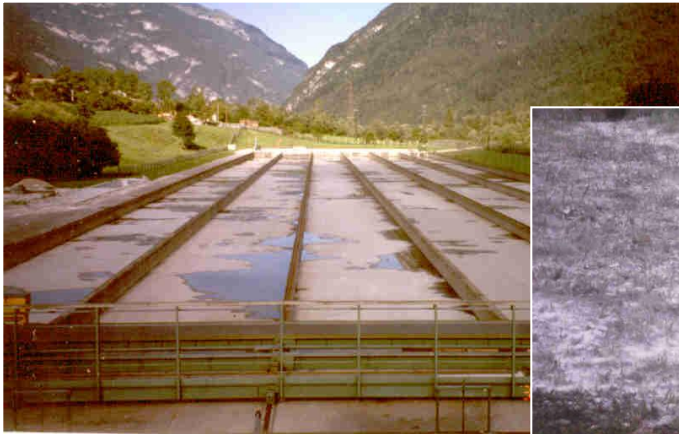
- HARVEST AND ELIMINATE ALL THE FISH POPULATION
- DRY ALL THE BASINS SIMULTANEOUSLY (6 WEEKS)
- DISINFECT
- RESTOKE WITH FREE FISH

VACCINATION

- A DNA VACCINE HAS BEEN REGISTERED IN CANADA TO BE USED IN SALMON INDUSTRY (*Salmo salar*) .



European
Commission



Health and
Consumers

KOI HERPESVIRUS DISEASE

- KHVD -

HISTORY AND DEFINITION

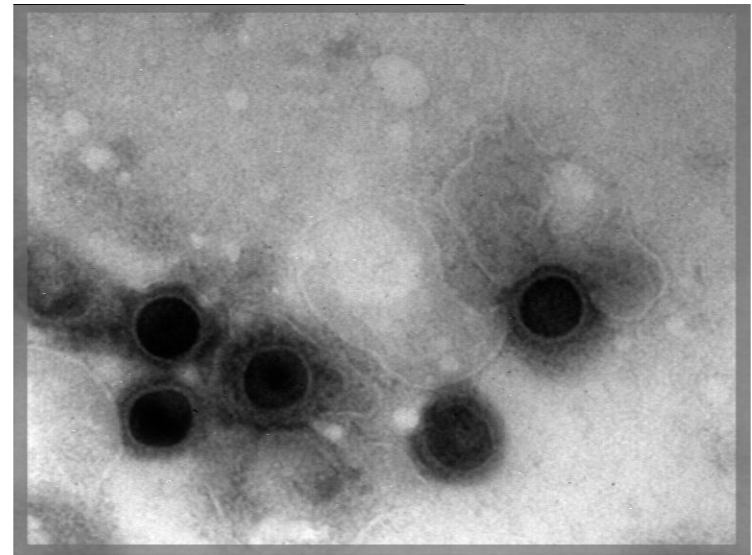
SINCE 1997-1998 SERIOUS MORTALITIES AFFECTING KOI CARPS (*Cyprinus carpio koi*) AND CHARACTERIZED BY SEVERE NECROSIS OF GILL EPITHELIAL CELLS ASSOCIATED WITH THE PRESENCE OF HERPESVIRUS PARTICLES HAVE BEEN OBSERVED

VERY SOON SIMILAR MORTALITIES WERE OBSERVED IN COMMON CARPS (*Cyprinus carpio*)

AETIOLOGICAL AGENT

The causative agent of KHVD , is a member of the **HERPESVIRIDAE** family, identified as:
CyHV-3 .

- **SUBSPHERICAL MORPHOLOGY**
- **150-200 NM DIAMETER**
- **PRESENCE OF ENVELOPE**



SUSCEPTIBLE SPECIES

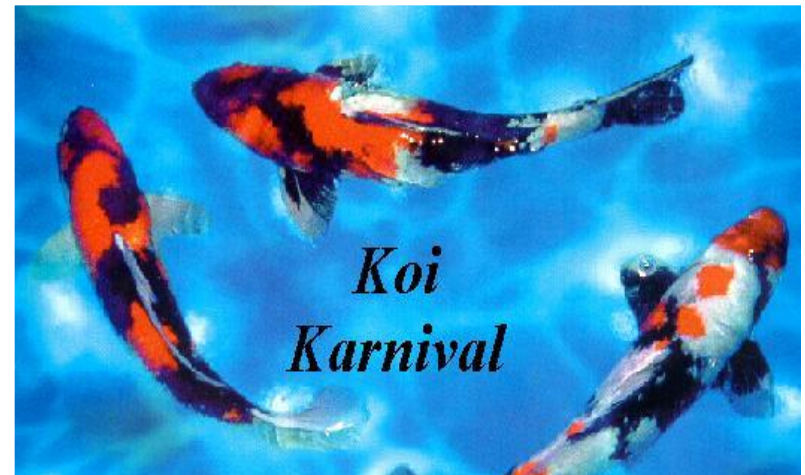
CYPRINUS CARPIO IS
THE ONLY
SUSCEPTIBLE SPECIES
TO NATURAL KHVD



Common carp
(*Cyprinus carpio*)

Common carp
(*C. carpio koi*)

ACCORDING TO
RECENT FINDINGS
ALL CYPRINID SPECIES
SHOULD BE REGARDED
AS POTENTIAL
CARRIERS OF KHV



GEOGRAPHICAL DISTRIBUTION

KHVD HAS BEEN REPORTED FROM THE FOLLOWING COUNTRIES :

Israele	Anonimous, 1998
Germany	Bretzinger et al., 1999
UK	Walster et al., 1999
USA	Hedrick et al., 2000
Belgium	Body et al., 2000
Netherland	2001
China , Malaysia	2001
Denmark	2002
Sumatra; Indonesia , Taiwan	2002
Austria, France,Poland	2003
Luxembourg Switzerland	2003
Japan, Thailand,	2003
South Africa	2003
Singapore	

ORIGIN AND TRASMISSIONE

VIRUS ENTRY : SKIN INCLUDING FINS AND GILLS
VIRUS SHEDDING : SKIN , URINE , FECES,

INCUBATION : 7-21 DAYS
TEMPERATURE : 17-26° C
MORBIDITY : 100%
MORTALITY : ≤ 90 %

CLINICAL SIGNS

LETHARGY OR HIPERACTIVITY

**SWIMMING CLOSE TO THE WATER SURFACE NEAR TO THE
INLET WATER**

DISCOLOURATION OR REDDENING OF THE SKIN

FOCAL OR TOTAL LOSS OF THE EPIDERMIS

OVER OR UNDER- PRODUCTION OF MUCUS

SUNKEN EYES

LOSS OF EQUILIBRIUM



European
Commission



Health and
Consumers

GROSS AND MICROSCOPIC PATHOLOGY

- **SEVERE NECROTIC AREAS IN THE GILLS**
- **GILLS HYPERPLASIA AND HYPERTROPHY BRANCHIAL EP.**
- **ADESIONS IN THE ABDOMINAL CAVITY**
- **ENLARGED KIDNEY AND SPLEEN**
- **FUSION OF SECONDARY LAMELLAE**
- **EOSINOPHILIC INCLUSION BODIES**



Picture C.E.F.A.S

MORTALITY AND MORBIDITY

MORBIDITY : 100%

MORTALITY : 70-80% IN SEVERE OUTBREAKS 100%

***Note : CUMULATIVE MORTALITY MAY BE AFFECTED BY
CONCOMITANT BACTERIAL AND PARASITIC INFECTIONS***

SAMPLING AND DIAGNOSIS

The diagnosis of KHV must be confirmed by the laboratory

COLLECT 10 FISH WITH TYPICAL KHV SIGNS

POOLED SAMPLES (< 5 FISH EACH) FROM TARGET TISSUES :

KIDNEY

GILLS

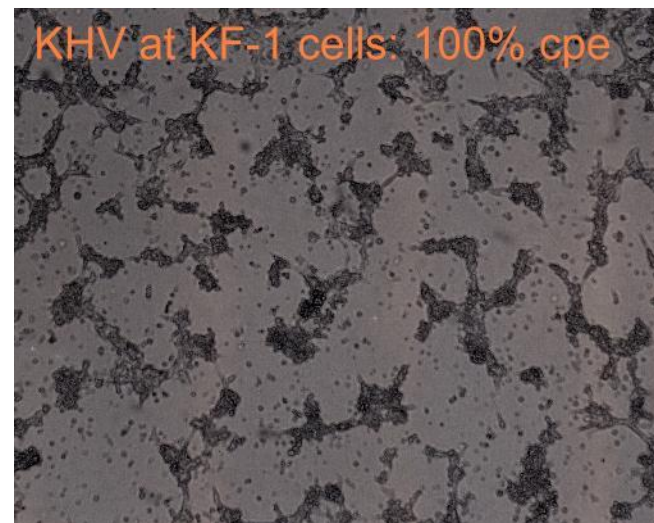
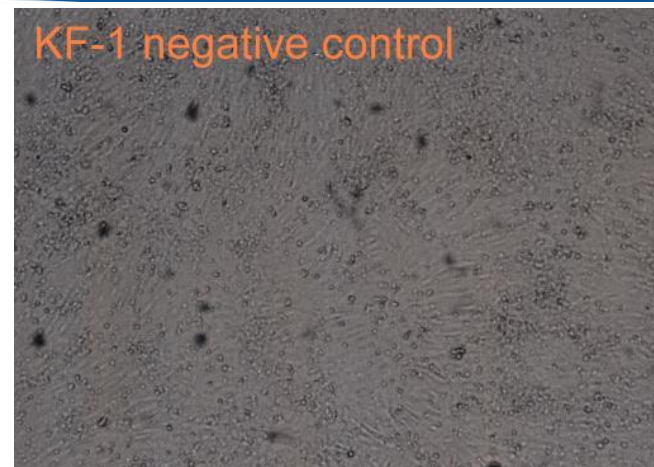
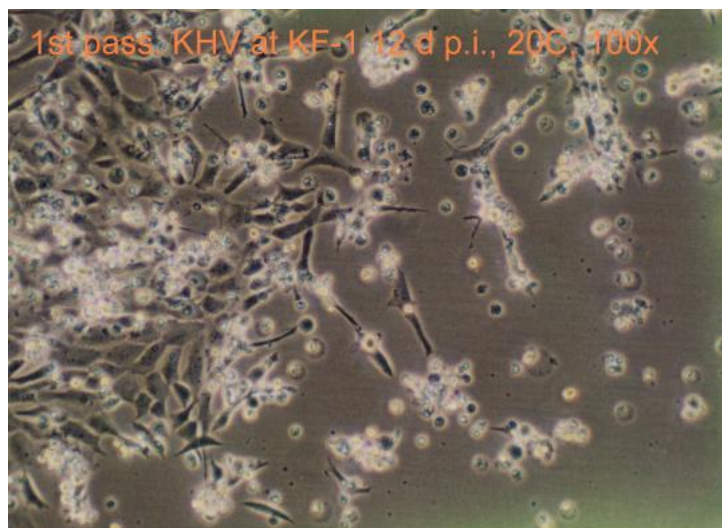
PROCESS SAMPLES FOR

VIRUS ISOLATION ON CCB or KF-1 (22-26 ° C)

PCR (according to Barcovier + Nested)

DIFFERENTIAL DIAGNOSIS

FLAVOBACTERIOSIS



By courtesy Dr.Keith Way

CONTROL AND PREVENTION

AN ATTENUATED VACCINE REGISTERED IN ISRAEL

**IN ABSENCE OF VACCINE, PREVENTION BY
AVOIDING EXPOSURE IS THE ONLY POSSIBILITY**

**SMALL FARMS MAY ADOPT ERADICATION
METHODS**

BTSF



**THANK YOU FOR
YOUR ATTENTION**

giuseppe.bovo@yahoo.it