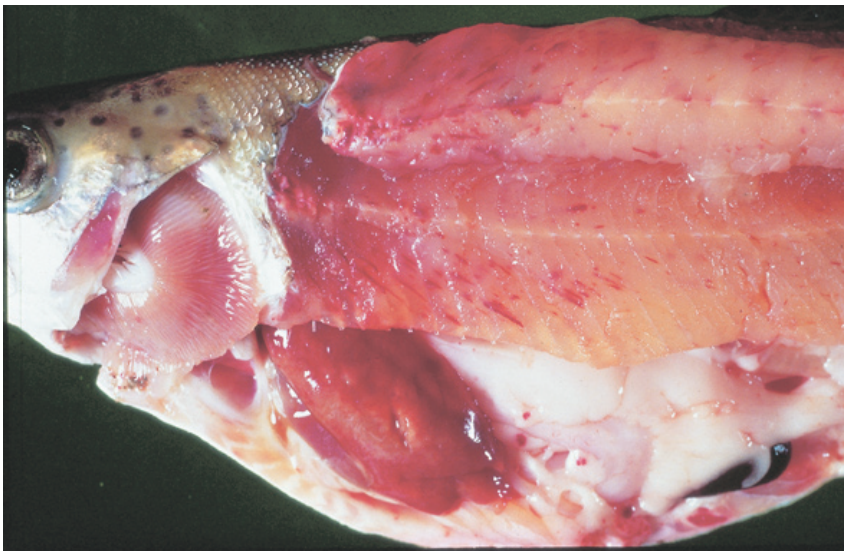
Viral haemorrhagic septicaemia (VHS)

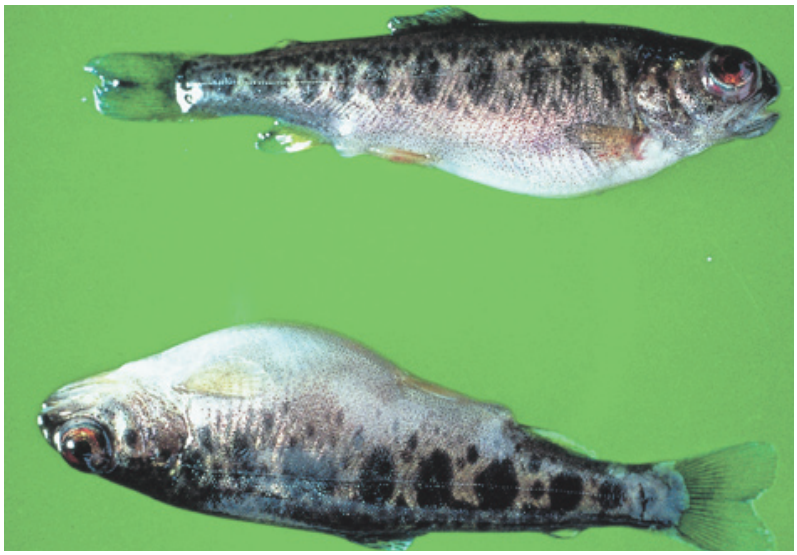
Exotic disease

VHS in rainbow trout (*Oncorhynchus mykiss*); note pale colour of stomach region, pinpoint haemorrhages in fatty tissue and pale gills



Source: T Håstein

VHS in rainbow trout (*Oncorhynchus mykiss*); note swollen stomach and 'popeye'



Source: T Håstein

Signs of disease

Important: Animals with disease may show one or more of the signs below, but the pathogen may still be present in the absence of any signs.

Disease outbreaks are seen in farmed trout and other salmonids, as well as in farmed turbot and Japanese flounder.

Disease signs of *acute* infection at the farm, tank or pond level are:

- rapid onset of high mortality
- lethargic swimming
- separation from shoal
- loss of appetite
- crowding at pond edges.

Disease signs of *chronic* infection at the farm, tank or pond level are:

- significant cumulative mortality (protracted)
- uncoordinated swimming (ataxia) with rotating movement around body axis (i.e. spinning).

Disease signs of the *neurological* form of the disease at the farm, tank or pond level are:

- low mortality
- severe abnormal swimming behaviour (flashing and spiralling).

General gross pathological signs are:

- exophthalmos (popeye)
- haemorrhaging under the skin, around the base of pectoral and pelvic fins and in the eyes
- swollen abdomen
- pale gills, with or without petechial (pinpoint) haemorrhages.

Gross pathological signs of *acute* infection are:

- slight darkening of the body colour
- exophthalmos (popeye)
- bleeding around the eyes
- bleeding under the skin around the base of the pectoral and pelvic fins
- skin ulceration
- swollen abdomen
- pale gills with pinpoint haemorrhages
- ascites (fluid in the abdominal cavity)
- petechial (pinpoint) haemorrhages in the fatty tissue, intestine, gonads, liver, swim bladder and muscle
- dark-red kidneys.

Gross pathological signs of *chronic* infection are:

- often an absence of external signs
- intense darkening of the skin
- exophthalmos (popeye)
- pale gills (anaemic)

- pale abdominal organs
- pale and mottled liver (evidence of haemorrhages on surface)
- pale gastrointestinal tract that is empty of food.

Microscopic pathological signs are:

- accumulation of erythrocytes in skeletal muscle fibres
- extensive focal necrosis in the liver, kidney and spleen
- VHS virus-positive endothelial cells in vascular system evident from immunohistochemistry.

Disease agent

VHS virus is a rhabdovirus of the genus *Novirhabdovirus*. Several genogroups or genotypes of the virus have been identified from different environments in different parts of the world:

- type I, continental Europe—freshwater group, trout farms (highly pathogenic to rainbow trout)
- type II, European marine strain (Baltic sea)—marine strain affecting wild and cultured marine and freshwater species (has low pathogenicity in rainbow trout)
- type III, north Atlantic marine group (North sea near the British Isles)
- type IVa, west coast of north America and east Asian group—marine group affecting a range of free-living marine and cultured species (highly pathogenic in Pacific herring; however, rainbow trout appear refractory to infection with this genotype)
- type IVb, Great lakes region—significant mortalities in wild freshwater species in the Great lakes.

Host range

VHS virus has been isolated from a broad range of marine and freshwater fish in Europe and the north Pacific (including cod, sprats, herring, haddock and turbot).

Species known to be susceptible to VHS are listed below.

Common name	Scientific name
Armoured weaselfish	*Hoplobrotula armata*
Atlantic cod	*Gadus morhua*
Atlantic halibut	*Hippoglossus hippoglossus*
Atlantic herring	*Clupea harengus*
Atlantic salmon	*Salmo salar*
Black crappie	*Pomoxis nigromaculatus*
Black sea bream or black porgy	*Acanthopagrus schlegeli*
Bluegill	*Lepomis macrochirus*
Blue whiting	*Micromesistius poutassou*
Bluntnose minnow	*Pimephales notatus*
Brook trout	*Salvelinus fontinalis*
Brown bullhead	*Ictalurus nebulosus*
Brown trout	*Salmo trutta*
Burbot [a]	*Lota lota*
Channel catfish	*Ictalurus punctatus*
Chinook salmon	*Oncorhynchus tshawytscha*

Common name	Scientific name
Chub mackerel	*Scomber japonicus*
Coho salmon	*Oncorhynchus kisutch*
Dab	*Limanda limanda*
Emerald shiner	*Notropis atherinoides*
English sole	*Parophrys vetulus*
Eulachon **a**	*Thaleichthys pacificus*
European eel	*Anguilla anguilla*
European seabass	*Dicentrarchus labrax*
European sprat	*Sprattus sprattus*
Flounder	*Platichthys flesus*
Fourbeard rockling	*Enchelyopus cimbrius*
Freshwater drum **a**	*Aplodinotus grunniens*
Gilt-head sea bream	*Sparus aurata*
Gizzard shad	*Dorosoma cepedianum*
Golden trout	*Oncorhynchus aguabonita*
Grayling	*Thymallus thymallus*
Greenland halibut	*Reinhardtius hippoglossoides*
Haddock	*Melanogrammus aeglefinus*
Hairtail	*Trichiurus lepturus*
Hybrid (rainbow trout × coho salmon)	*Oncorhynchus mykiss* × *O. kisutch*
Iberian nase	*Pseudochondrostoma polylepis*
Japanese flounder **a**	*Paralichthys olivaceus*
Japanese yellowtail	*Seriola quinqueradiata*
Korean flounder	*Glyptocephalus stelleri*
Lake trout	*Salvelinus namaycush*
Lake whitefish	*Coregonus clupeaformis*
Largemouth bass	*Micropterus salmoides*
Lesser argentine	*Argentina sphyraena*
Mullet	*Mugil cephalus*
Mummichog **a**	*Fundulus heteroclitus*
Muskellunge **a**	*Esox masquinongy*
Norway pout	*Trisopterus esmarki*
Pacific cod	*Gadus macrocephalus*
Pacific hake **a**	*Merluccius productus*
Pacific herring **a**	*Clupea pallasii*
Pacific salmon	*Oncorhynchus* spp.
Pacific sand eel	*Ammodytes personatus*
Pacific sand lance	*Ammodytes hexapterus*
Pacific sardine **a**	*Sardinops sagax*
Pacific tomcod	*Microgadus proximus*
Pike **a**	*Esox lucius*
Plaice	*Pleuronectes platessa*
Poor cod	*Trisopterus minutus*
Pumpkinseed	*Lepomis gibbosus*
Rainbow trout **a**	*Oncorhynchus mykiss*
Red-spotted grouper or Hong Kong grouper	*Epinephelus akaara*
River lamprey	*Lampetra fluviatalis*

Common name	Scientific name
Rock bass	*Ambloplites rupestris*
Rockfish	*Sebastes* spp.
Round goby **a**	*Neogobius melanostomus*
Sablefish **a**	*Anoplopoma fimbria*
Sand eel	*Ammodytes* spp.
Sand goby	*Pomatoschistus minutus*
Senegalese sole	*Solea senegalensis*
Shiner perch	*Cymatogaster aggregata*
Shorthead redhorse	*Moxostoma macrolepidotum*
Silver pomfret	*Pampus argenteus*
Silver redhorse	*Moxostoma anisurum*
Smallmouth bass **a**	*Micropterus dolomieui*
Snapper	*Pagrus auratus*
Splake (lake trout × brook trout)	*Salvelinus namaycush* × *S. fontinalis*
Spottail shiner	*Notropis hudsonius*
Striped bass	*Morone saxatilis*
Surf smelt **a**	*Hypomesus pretiosus*
Three-spined stickleback	*Gasterosteus aculeatus*
Trout-perch	*Percopsis omiscomaycus*
Tubesnout	*Aulorhynchus flavidus*
Turbot **a**	*Psetta maxima (also known as Scophthalmus maximus)*
Walleye pollock or Alaska pollock **a**	*Theragra chalcogramma*
White bass	*Morone chrysops*
Whitefish	*Coregonus* spp.
White perch	*Morone americanus*
Whiting	*Merlangius merlangus*
Yellowback seabream	*Evynnis tumifrons*
Yellow perch **a**	*Perca flavescens*

a Naturally susceptible (other species have been shown to be experimentally susceptible)

Presence in Australia

EXOTIC DISEASE—not present in Australia.

Epidemiology

- Variant strains of the virus are responsible for disease in different geographical locations.
- Marine and freshwater species are susceptible to VHS virus infection. Younger fish are generally more susceptible to disease.
- Rainbow trout appear to be less susceptible to infection by marine strains of the virus.
- Water temperatures in an outbreak are generally near 10°C. At water temperatures between 15°C and 18°C, the disease generally takes a shorter course with a modest accumulated mortality, but transmission can occur at water temperatures up to 22°C. Mortality and morbidity have rarely been documented when water temperatures are above 18°C, although VHS virus genotype IV has caused at least one fish kill at 20–22°C, and some isolates can replicate in vitro at temperatures up to 25°C.

- Transmission is horizontal directly through the water, from virus shed in faeces, urine (predominantly) and sexual fluids of clinically infected or carrier fish. The virus can also be spread by birds that have consumed infected fish, via blood-feeding vectors such as leeches, and on equipment that has been in contact with water from infected fish. The virus gains entry via the gills, skin wounds, oral exposure (predation) and possibly through the skin.
- Once infected, survivors are lifelong carriers of the virus; however, shedding is intermittent.
- Stressors including overcrowding, extreme temperatures and overfeeding will greatly reduce an animal's resistance to infection.
- Mortality rate can range from 10% to 80%, depending on the VHS virus isolate, environmental variables (temperature), age, species, route of exposure and presence of additional stressors (highest mortality rates occur with acute infection, and lowest mortality rates in the neurological form).
- VHS virus is thought to have existed in the marine environment before its apparent transfer to fresh water, where it first became virulent in trout.
- It has been suggested that the European freshwater strains of VHS virus originated from fish in the northern Pacific and Atlantic oceans. The mechanism of transfer was possibly through the feeding of marine fish to cultured freshwater species.

Differential diagnosis

The list of similar diseases below refers only to the diseases covered by this field guide. Gross pathological signs may be representative of a number of diseases not included in this guide, which therefore should not be used to provide a definitive diagnosis, but rather as a tool to help identify the listed diseases that most closely account for the gross signs.

Similar diseases

Enteric red mouth disease, epizootic haematopoietic necrosis, epizootic ulcerative syndrome, infectious haematopoietic necrosis, infectious pancreatic necrosis, whirling disease

Sample collection

Due to the uncertainty in differentiating diseases using only gross pathological signs, and because some aquatic animal disease agents might pose a risk to humans, only trained personnel should collect samples. You should phone your state or territory hotline number and report your observations if you are not appropriately trained. If samples have to be collected, the agency taking your call will provide advice on the appropriate course of action. Local or district fisheries or veterinary authorities may also provide advice regarding sampling.

Emergency disease hotline

The national disease hotline number is 1800 675 888. This number will put you in contact with the appropriate state or territory agency.

Further reading

The accepted procedures for a conclusive diagnosis of VHS are summarised in the World Organisation for Animal Health *Manual of diagnostic tests for aquatic animals 2011*, available at www.oie.int/en/international-standard-setting/aquatic-manual/access-online.

For more information on VHS virus isolates, refer to the European Community Reference Laboratory for Fish Disease at www.fishpathogens.eu/vhsv.

These hyperlinks were correct and functioning at the time of publication