Some Fish Hosts of Viral Hemorrhagic Septicemia.

Atlantic salmon  Salmo salar
Brook trout  Salvelinus fontinalis
Brown trout  Salmo trutta
Chinook salmon  Oncorhynchus tshawytscha
Coho salmon  Oncorhynchus kisutch
GirbeI  Carassius auratus gibelio
Golden trout  Oncorhynchus aguabonita
Grayling  Thymallus thymallus
Lake trout  Salvelinus namaycush
Northern pike  Esox lucius
Pollan  Coregonus lavaretus
Sea bass  Diplorhinchus labrax
Steelhead or sea-run rainbow trout  Oncorhynchus mykiss
Turbot  Scophthalmus maximus
Whitefish  Coregonus sp.
INTRODUCTION
Viral hemorrhagic septicemia, or VHS, is a viral disease of trout, salmon, and several nonsalmonid fishes. The disease formerly was known by other names such as infectious kidney swelling and liver degeneration, trout plague, and Elgev disease (after a small village in Denmark where there was an outbreak of the disease). The disease occurs in susceptible fishes of any age and is known to cause significant losses in fish populations. Survivors of the infection usually become carriers of the virus. Until recently, when it was detected in the State of Washington (United States), VHS virus was confined to European and Scandinavian countries.

DIAGNOSIS AND IDENTIFICATION
Clinical signs of the disease vary with the severity of the infection. In acute infections, deaths are rapid and numerous. Fishes are sluggish, appear dark in color, have protruding eyeballs, and are anemic. Externally, hemorrhaging occurs in the eyes, skin, and gills, and at the base of the fins. Pinpoint hemorrhages appear internally in tissues around the eyes, in skeletal muscles, and in body organs. The liver is enlarged and discolored, and the kidneys are red and thin.

In chronic infections, deaths are numerous but they occur over a greater period. External signs of the chronic disease are similar to the acute stage, but hemorrhaging is not as extensive. The abdomen is swollen from accumulation of fluid in the liver, kidneys, and spleen. Internally, the liver is pale and the kidneys are gray.

In latent infections, most fishes appear normal and few die. However, some fishes may show signs of hyperactivity such as whirling, swimming erratically, or nervousness. Virus carriers show no signs of the infection.

Confirmed diagnosis can be made only by isolating and identifying the virus in the laboratory.

CAUSE OF THE DISEASE
The VHS virus, a member of the rhabdovirus group, is typically bullet-shaped. There are three distinct serological types of VHS virus. The virus is moderately stable in cell culture medium and can be preserved for years by freezing at 4°F (−20°C). The virus is inactivated by ether, chloroform, glycerol, formalin, sodium hypochlorite, iodophors, ultraviolet light, and by heating at 133–140°F (56–60°C). It is stable at pH 5.0–10.4 but inactivated at pH 3.5.

SOURCE OF INFECTION
Viral hemorrhagic septicemia infection can occur in susceptible fishes of all ages. Surviving fishes become virus carriers and shed the virus with urine and sex products. However, transmission of virus from adults to offspring through sex products has not been proven.

TRANSMISSION
The virus can be transmitted by infected fishes and through the water supply. Humans, rodents, herons, and probably other fish-eating birds, can mechanically transmit the virus. The virus is not known to be transmitted by parasites or insects. Transmission can occur in a hatchery by exposure of fishes to contaminated nets, pails, and other equipment.

Experimentally, the virus can be transmitted by injection, brushing the gills with the virus, and feeding fishes with food that contains the virus.

INCUBATION
The incubation period (from infection to the first signs of the disease) can be 7–15 days or up to a year or longer and depends on water temperature. Outbreaks usually occur in water temperatures below 59°F (15°C) and cease when the temperature rises. The greatest loss of infected fishes occurs at 37–41°F (3–5°C).

DETECTION
The most reliable technique for diagnosing VHS infection is laboratory isolation of the virus in cell cultures and serological virus identification. The virus can be isolated from fishes just before, during, and immediately after an active case of the disease, from ovarian fluid during spawning, and from organs and tissues of inapparent virus carriers. Infected fishes develop an immune response, but the presence of antibody is not an indicator of active infection.

Susceptibility of Fish Species
Viral hemorrhagic septicemia is primarily a disease of rainbow trout, but other species can be affected. Fingerlings 2–6 months of age are most severely affected, particularly during their first winter when water temperatures are colder than 59°F (15°C). Eurasian perch also have occurred among brown trout and northern pike. Other species known to be naturally infected include grayling, whitefish, pollan, lake trout, chinook and coho salmon, and steelhead trout.

Experimentally, Atlantic salmon, brook trout, golden trout, gibel, sea bass, and turbot are susceptible to VHS virus infection; common carp, chub, Eurasian perch, roach, and tench are not.

GEOGRAPHIC DISTRIBUTION
Viral hemorrhagic septicemia is known to occur in Denmark, Germany, France, Italy, Switzerland, and Scandinavia. In 1989, VHS was isolated from wild returning chinook and coho salmon in the State of Washington (United States). The virus has not been detected in the British Isles, Canada, Mexico, South America, or the Far East.

DISEASE OCCURRENCE
Viral hemorrhagic septicemia occurs in winter and spring when water temperatures fall below 59°F (15°C). At coldwater hatcheries, the disease can be a problem the entire year. Viral hemorrhagic septicemia is rarely lethal in warm water with a temperature above 59°F (15°C). In a hatchery, stressful conditions such as handling, overcrowding, and poor nutrition increase the probability of disease. With good fish cultural management practices, few fishes develop the disease unless stress occurs.

CONTROL METHODS
As with other viral diseases, drugs or vaccines are not available for control of the VHS virus. The only control is preventing contact of fishes with the virus. Disinfection of facilities followed by restocking with VHS virus-free fishes and eggs is a successful method of control in hatcheries. The water supply to a culture station should be virus-free or treated with ultraviolet light. Stressful conditions should be eliminated. Presently several vaccines are being developed.

SUGGESTED READING