### Susceptible animal groups:

Fish: more than 80 susceptible marine and freshwater species. The virus has also been detected in amphipods, leeches, and turtles, although it is not known what role these non-fish species play in the ecology of the virus.

### Causative organism:

Viral hemorrhagic septicemia virus (previously known as Egtved virus) that is in Family Rhabdoviridae

### Zoonotic potential:

No

### Distribution:

Viral hemorrhagic septicemia virus has a broad distribution in the northern hemisphere. Four primary strains of VHSV are known to exist, distributed in Europe (VHSV-I, II, III), East Asia (VHSV-I, III, IV), and North America (VHSV-IV). VHSV-IV is further divided into marine (VHSV-IVa) and freshwater (VHSV-IVb). In North America, VHSV-IV has been detected off the Northern Pacific and Atlantic coasts as well as in the Great Lakes region. North American states and provinces considered VHS-regulated regions by USDA APHIS include Indiana, Illinois, Michigan, Minnesota, New York, Ohio, Ontario, Pennsylvania, Quebec, and Wisconsin.

### Incubation period:

An inverse correlation has been recorded between virus stability and water temperatures ranging from 1°C - 20°C. Transmission occurs at cooler temperatures (1-12°C) with an incubation time of 1-2 weeks at high temperature to 3-4 weeks at low temperature.

### Clinical signs:

**Acute:** Results in rapid destruction of endothelial cells and extravasation of the blood supply, which may ultimately result in diffuse or petechial hemorrhage, ascites, exophthalmia, organ failure, anemia, and high mortality.

**Chronic:** Results in prolonged disease with neurologic-type behavior characterized by erratic swimming or lethargy.

Clinical presentation is dependent on a variety of factors including host, pathogen, or environmental variables. Some species exhibit no clinical lesions while infected with high levels of VHSV, while others develop severe lesions with low levels of VHSV. Presumptive diagnosis can be difficult and secondary testing is recommended.

### Post mortem, gross, or histologic findings:

VHSV has a predilection for endothelial cells and will commonly induce hemorrhagic lesions throughout the body visible by gross and histologic examination. The virus will also cause necrosis and degeneration of hematopoietic tissues, macrophage proliferation.
within renal tissue, and degeneration and vacuolization of hepatic tissue.

**Diagnosis:** The gold standard for VHSV detection is virus isolation by cell culture. Suitable cell lines include epithelioma papulosum cyprini (EPC), rainbow trout gonad (RTG-2), bluegill fry (BF-2), Chinook salmon embryo (CHSE-214), and the fathead minnow (FHM) cell lines incubated at 15°C. Cytopathic effects are typically observed within 4-6 days but may take up to four weeks and two passages to appear. Secondary testing by RT-PCR or IFA are recommended. Real-time RT-PCR is becoming widely used for preliminary diagnosis and surveillance testing and can be performed on non-lethal samples (i.e., fin or gill biopsy).

**Material required for laboratory analysis:**

**Virology:** Fresh tissue homogenate of the kidney and spleen should be placed in plastic tubes or whirlpack bags with 1g tissue to 10mL dilution with virus transport media (i.e. Hank’s Balanced Salt Solution). Ship samples overnight on frozen gel packs.

**RT-PCR:** Tissue should be placed in tubes with RNALater or immediately frozen; both techniques could be used. Some recommendations have been provided for storage in 70% ethanol but freezing would be necessary and technique is less than ideal for RT-PCR. Contact the diagnostic lab where tissues will be sent to determine the types of tissues they will accept for non-regulatory testing and their recommended method of preservation.

**Relevant diagnostic laboratories:**

Please see the list of experts below; all of whom will accept diagnostic samples for preliminary testing. Additionally, USDA-APHIS approved labs for export certification of aquacultured species can be found at: http://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/

**Virus Reference Laboratory**
**Diagnostic Virology Laboratory**
**USDA-APHIS National Veterinary Service Laboratory**
1920 Dayton Avenue, Ames, Iowa 50010
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**Treatment:** Therapeutics are not widely used to control VHS infection. General supportive care and stress reduction are recommended.

**Prevention and control:** Given the lack of available therapeutics, preventing the introduction of VHSV is the primary method of control. In addition, early detection of the virus by proactive surveillance programs provides value in determining areas or activities of risk. Strict biosecurity protocols should be implemented in areas of risk.

Prevention can be achieved by eliminating the transfer of the virus via contaminated fomites, eggs, fish, and water. Typical anti-viral disinfectants, such as chlorine, hypochlorite, and UV irradiation are effective. Iodophor treatment of eggs is not always effective at removing the virus from the eggs’ surface. However, at this time, no evidence for true vertical transmission of VHSV has been recorded; viral adherence to the egg surface and presence in ovarian fluid has been documented.

**Suggested disinfectant for housing facilities:** If captive fish test positive, the population should be isolated or euthanized. Housing facilities should be cleaned and disinfected with standard product such as chlorine and hypochlorite. Facility effluent should also be disinfected with similar chemicals. For recirculating facilities, in-line UV sterilization should be incorporated to prevent the transmission of the virus via contaminated water.

**Notification:** VHSV is a reportable pathogen to the OIE and USDA. Upon suspicion or preliminary diagnosis, the area veterinarian in charge should be notified.

**Measures required under the Animal Disease Surveillance Plan:** The National Aquatic Animal Health
Plan just gives some guidelines on how to conduct surveillance in aquatic animals. Individual states conduct surveillance for this disease in wild populations and any potential case in a new species or geographic region need to be reported to AVIC USDA APHIS since it is a reportable disease.

**Measures required for introducing animals to an infected animal(s):** Susceptible species of naïve fish should not be introduced to a previously infected population. It may be possible to co-habitat non-susceptible species with a previously infected population; however, this approach is risky because the host range is broad and rapidly expanding.

**Conditions for restoring disease-free status after an outbreak:** No specific standards exist at this time; however, non-lethal antibody and quantitative RT-PCR methods are available to monitor a population over time.

**Experts who may be consulted:**

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**References:**


