Infectious Hematopoietic Necrosis

Oregon Sockeye Salmon Disease, Columbia River Sockeye Disease, Sacramento River Chinook Disease

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Importance

Infectious hematopoietic necrosis (IHN) is a serious viral disease of salmonid fish. This disease was first reported at fish hatcheries in Oregon and Washington in the 1950s. The causative virus now exists in many wild and farmed salmonid stocks in the Pacific Northwest region of North America. It has also spread to Europe and some Asian countries. Clinical infections are most common in young fish, particularly fry and juveniles. Infectious hematopoietic necrosis can have a major economic impact on farms that rear young rainbow trout or salmon; the cumulative mortality rates on these farms can reach 90-95%. Occasional epizootics have also been reported in wild salmon.

Etiology

Infectious hematopoietic necrosis is caused by infectious hematopoietic necrosis virus (IHNV), a member of the genus Novirhabdovirus and family Rhabdoviridae. Virus strains vary in their pathogenicity.

IHNV isolates can be grouped into three genetic types, which are correlated mainly with geographic regions. The U genogroup includes isolates from Alaska, British Columbia, coastal Washington watersheds and the Columbia River basin, as well as a few isolates from Oregon, California and Japan. The L genogroup contains most of the viruses from California and the Oregon coast. The M genogroup contains isolates from Idaho, the Columbia River basin and Europe, as well as a virus from the Washington coast. The M genogroup has significantly higher genetic diversity than the L or U groups.

Species Affected

Infectious hematopoietic necrosis affects rainbow/steelhead trout (Oncorhynchus mykiss), cutthroat trout (Salmo clarki), brown trout (Salmo trutta), Atlantic salmon (Salmo salar), and Pacific salmon including chinook (O. tshawytscha), sockeye/kokanee (O. nerka), chum (O. keta), masou/yamame (O. masou), amago (O. rhodurus), and coho (O. kisutch). Experimental infections have been reported in species other than salmonids including pike fry, sea bream and turbot.

Geographic Distribution

Infectious hematopoietic necrosis is endemic in fish hatcheries and wild fish in the Pacific Northwest region of North America. Affected provinces and states include British Columbia, Alaska, Washington, Oregon, Idaho and California. Outbreaks have been reported in Minnesota, West Virginia, South Dakota and Colorado. IHN is also endemic in continental Europe and Japan. In addition, outbreaks have been reported in Korea, Iran and parts of China.

Transmission

IHNV is transmitted by clinically ill fish and asymptomatic carriers. This virus is shed in the feces, urine, sexual fluids and external mucus. Transmission is mainly from fish to fish, primarily by direct contact, but also through the water. IHNV can survive in water for at least one month, particularly if the water contains organic material. This virus can also be spread in contaminated feed. The gills or the digestive tract have been suggested as the major sites of virus entry, but recent evidence suggests that IHNV may enter at the base of the fins. “Egg-associated” (vertical) transmission also occurs; whether IHNV can be present inside the egg as well as on the surface is controversial. Invertebrate vectors may exist.

Incubation Period

The incubation period is 5 to 45 days.

Clinical Signs

The clinical signs include abdominal distension, exophthalmia, darkened skin and pale gills. Long, semi-transparent fecal casts often trail from the anus. Affected fish are typically lethargic, with bouts of hyperexcitability and frenzied, abnormal activity. Petechial hemorrhages commonly occur at the base of the pectoral fins, the mouth,
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Diagnosis

Clinical
Infectious hematopoietic necrosis should be suspected in salmonid fish with typical clinical symptoms and necropsy lesions. In some cases, the major symptom is a significant rise in mortality in young fish, with few clinical signs. Most outbreaks occur in the spring and early summer.

Differential diagnosis
The differential diagnosis includes infectious pancreatic necrosis, viral hemorrhagic septicemia and whirling disease.

Laboratory tests
Infectious hematopoietic necrosis can be diagnosed by virus isolation in cell cultures; appropriate cell lines include EPC (Epithelioma papulosum cyprini) and BF–2 (bluegill fry) cells. Virus identity is confirmed by virus neutralization, immunofluorescence, enzyme-linked immunosorbent assay (ELISA), DNA probes or polymerase chain reaction (PCR) tests. Nucleic acids can also be identified directly in tissues by PCR. Antibody-based techniques can identify viral antigens in tissues, but these methods are not in routine use. Rapid serologic tests have been developed and are becoming more readily available. Serologic tests have not been validated yet for international trade.

Samples to collect
The samples to collect from symptomatic animals vary with the size of the fish. Small fish (less than or equal to 4 cm) should be sent whole. The viscera including the kidney should be collected from fish that are 4 to 6 cm long. The kidney, spleen, and encephalon should be sent from larger fish. If the fish are asymptomatic, the samples should include the kidney, spleen, and encephalon, and the ovarian fluid at spawning. A new test has been reported to diagnose infections in live fish by virus isolation from mucus.

Samples should be taken from ten diseased fish and combined to form pools with approximately 1.5 g of material (no more than five fish per pool). The pools of organs or ovarian fluids should be placed in sterile vials. The samples may also be sent in cell culture medium or Hanks’ balanced salt solution with antibiotics. They should be kept cold [4°C (39°F)] but not frozen. If the shipping time is expected to be longer than 12 hours, serum or albumen (5-10%) may be added to stabilize the virus. Ideally, virus isolation should be done within 24 hours after fish sampling.

Recommended actions if infectious hematopoietic necrosis is suspected

Notification of authorities
Infectious hematopoietic necrosis is endemic in the U.S. State guidelines should be consulted for reporting requirements.

Federal: Area Veterinarians in Charge (AVIC):
http://www.aphis.usda.gov/vs/area_offices.htm
State Veterinarians:

Control
Most epizootics have been linked to the importation of infected eggs or fry, but IHNV can also be introduced in asymptomatic carriers. In areas where this disease is not endemic, outbreaks are controlled by culling, disinfection, quarantines and other measures. Where IHNV is endemic, good biosecurity and sanitation decrease the risk of introducing the virus to a farm. Eggs should be disinfected with an iodophor solution, and virus–free water should be used to incubate eggs and raise.
animals. Feed should be sterilized for at least 30 minutes at 60°C (140°F) IHNV is readily inactivated by most common disinfectants including iodophors. It is also acid and ether labile, but is resistant to ethanol. In addition, this virus can be inactivated by drying, or by heating to 60°C (140°F) for 15 minutes. Promising vaccines have been tested in field trials, but no vaccines are commercially available as of July 2007.

If an outbreak occurs, it may be possible to limit losses by raising the water temperature. Simultaneous fallowing of infected sites can control virus spread in saltwater net pens. Autogenous vaccines have been used during outbreaks in some areas. After an outbreak, it may be helpful to harvest all remaining fish, as recurrences have been reported in surviving fish on some farms.

Public Health
There is no indication that infectious hematopoietic necrosis is a threat to humans.

Internet Resources

USDA APHIS Aquaculture Disease Information
http://www.aphis.usda.gov/animal_health/animal_disease/aquaculture/

World Organization for Animal Health (OIE)
http://www.oie.int

http://www.oie.int/eng/normes/fmanual/A_index.htm

http://www.oie.int/eng/normes/fcode/a_summary.htm

References


Brudeseth BE, Castric J, Evansen O. Studies on pathogenesis following single and double infection with viral hemorrhagic septicemia virus and infectious hematopoietic necrosis virus in rainbow trout (Oncorhynchus mykiss). Vet Pathol. 2002;39:180-9.


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