

# Oncorhynchus masou Virus Disease

Salmonid Herpesvirus  
Type 2 Disease

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## Importance

*Oncorhynchus masou* virus disease (OMVD) is an economically significant disease of farmed salmonid fish (salmon and rainbow trout) in Japan. This infection also occurs in wild fish. In young fish, OMVD is a systemic disease with a high mortality rate. Surviving salmon often develop cutaneous tumors, particularly around the mouth. Symptomatic and asymptomatic carriers can spread the virus to uninfected stocks.

## Etiology

OMVD results from infection by salmonid herpesvirus type 2 (SalHV-2), which is also known as *Oncorhynchus masou* virus (OMV). SalHV-2 is a member of the family Herpesviridae, but has not yet been assigned to a subfamily or genus. Other names for this virus include Yamame tumor virus (YTV), coho salmon tumor virus (CSTV), *Oncorhynchus kisutch* virus (OKV), coho salmon herpesvirus (CSHV), rainbow trout kidney virus (RKV), rainbow trout herpesvirus (RHV), Nerka tumor virus, and Nerka virus Towada Lake, Akita and Amori prefecture (NeVTA). NeVTA virus, unlike other strains of SalHV-2, does not seem to be oncogenic.

SalHV-2 is not the same virus as salmonid herpesvirus 1 (SalHV-1), a weakly virulent virus found in North America.

## Species Affected

*Oncorhynchus masou* virus disease affects only salmonid fish including sockeye/ kokanee salmon (*Oncorhynchus nerka*), masou/ yamame salmon (*O. masou*), chum salmon (*O. keta*), coho salmon (*O. kisutch*) and rainbow trout (*O. mykiss*).

## Geographic Distribution

*Oncorhynchus masou* virus disease occurs in Japan and has been reported from Kuwait. This disease probably exists throughout eastern Asia in coastal rivers that contain Pacific salmon.

## Transmission

SalHV-2 is transmitted by diseased fish and asymptomatic carriers. This virus is shed in the feces, urine, sexual products at spawning, and probably in skin mucus. Transmission is by direct contact or through the water. "Egg-surface associated" transmission probably occurs. SalHV-2 can also be spread by living vectors and fomites.

## Incubation Period

In one study, moribund rainbow trout were first seen 13 days after experimental infection. The period from infection to neoplasia varies from four to 18 months.

## Clinical Signs

During the initial systemic infection, the clinical signs may include lethargy, anorexia, darkening of the body, skin ulcers and petechiae. Many fish die. Four to eighteen months later, some surviving fish develop epitheliomas (cutaneous carcinomas). These tumors occur mainly on the jaws but also on the fins, operculum, cornea and body surface. Tumors can persist for up to a year. Infected rainbow trout may have very few external signs of disease other than skin ulcers, a darkened body and pale gills. Fish that recover from OMVD often become carriers.

## Post Mortem Lesions

Acute infections are characterized by edema and hemorrhages. In salmon, the lesions may include skin ulcers, white spots on the liver and neoplasia around the mouthparts or on the body surface. Tumors may also be found in the kidney. Skin ulcers, pale gills with hemorrhages in the gill filaments, intestinal hemorrhages and white spots on the liver can occur in rainbow trout. Swelling and hemorrhages of the spleen and kidneys have also been reported in this species.

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## Morbidity and Mortality

OMVD is usually seen in water temperatures below 14°C (57°F). The age of the fish is also critical; 1-month old alevins are most susceptible. High mortality rates may be seen among young salmon; in some outbreaks, the cumulative mortality rate in salmon fry exceeds 80%. Salmon are generally more susceptible to disease than rainbow trout, but the specific mortality rate in each species varies with the isolate and method of infection. Some isolates cause high mortality in coho salmon, low mortality in chum salmon and no deaths in rainbow trout, while others are highly virulent in masou salmon and less virulent in coho salmon and rainbow trout. Cumulative mortality rates of 40-100% have been reported in experimentally infected coho salmon, with higher mortality rates in younger fish. Higher mortality rates also occur in fish infected by intraperitoneal injection rather than immersion. Cumulative mortality rates of 34-77% have been reported in experimentally infected rainbow trout. Tumors develop on 12-100% of surviving salmonid fish.

## Diagnosis

### Clinical

*Oncorhynchus masou* virus disease should be suspected in salmon with epithelial tumors, and in young salmonids that develop a systemic disease with a high mortality rate. Infected rainbow trout may have few signs of disease other than skin ulcers.

### Differential diagnosis

The differential diagnosis includes infectious hematopoietic necrosis, whirling disease, viral hemorrhagic septicemia, infection with atypical *Aeromonas salmonicida* and erythrocyte inclusion body syndrome.

### Laboratory tests

*Oncorhynchus masou* virus disease can be diagnosed by virus isolation in cell cultures; appropriate cell lines include RTG-2 (Rainbow trout gonad) and CHSE-214 (Chinook salmon embryo) cells. Infections can also be diagnosed by co-culturing neoplastic tissues with salmonid cell lines. The identity of the virus is confirmed by virus neutralization, immunofluorescence, enzyme-linked immunosorbent assay (ELISA) or polymerase chain reaction (PCR) tests. Viral antigens can be identified directly in tissues by immunofluorescence or ELISA techniques. PCR can be used to detect nucleic acids in tissues.

Serologic tests including virus neutralization, indirect immunofluorescence, and ELISA may be available, but these methods remain to be validated for routine diagnosis.

### Samples to collect

Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should only be

sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

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 4-6 cm long. Ulcerative skin lesions, any neoplastic tissues, the kidney, spleen, liver and encephalon should be sent from larger fish. Samples from asymptomatic animals should include the kidney, spleen and encephalon, as well as ovarian fluid at spawning.

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 *Oncorhynchus masou* virus disease is suspected

### Notification of authorities

*Oncorhynchus masou* virus disease should be reported to state or federal authorities immediately upon diagnosis or suspicion of the disease.

Federal: Area Veterinarians in Charge (AVIC):

[www.aphis.usda.gov/animal\\_health/area\\_offices/](http://www.aphis.usda.gov/animal_health/area_offices/)

State Veterinarians:

[www.usaha.org/Portals/6/StateAnimalHealthOfficials.pdf](http://www.usaha.org/Portals/6/StateAnimalHealthOfficials.pdf)

## Control

In areas where OMDV is not endemic, outbreaks are controlled by culling, disinfection, quarantines and other measures. Where this disease is endemic, good biosecurity and sanitation decrease the risk of introducing SaHV-2 to a farm. Fertilized eggs should be disinfected. Fry and alevins should be raised on premises that are completely separate from areas where SaHV-2 carriers may be found. Fish of different species should not be mixed. Management should also address virus entry on fomites and in water.

SaHV-2 is readily inactivated by many common disinfectants including iodophors, sodium hypochlorite and potassium permanganate solution. It is also susceptible to ozonization of seawater, UV irradiation or electrolyzation. This virus is relatively labile, particularly at warmer temperatures, and does not survive for more than 5 to 7 days in fish rearing water.

## Public Health

There is no indication that OMDV is a threat to human health.

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## Internet Resources

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USDA APHIS Aquaculture Disease Information  
[http://www.aphis.usda.gov/animal\\_health/animal\\_diseases/aquaculture/](http://www.aphis.usda.gov/animal_health/animal_diseases/aquaculture/)

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

OIE Manual of Diagnostic Tests for Aquatic Animals  
<http://www.oie.int/international-standard-setting/aquatic-manual/access-online/>

OIE Aquatic Animal Health Code  
<http://www.oie.int/international-standard-setting/aquatic-code/access-online/>

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\*Link defunct as of 2007