

# Whirling Disease *Myxobolus cerebralis*

## About

Whirling disease is an infectious disease of salmonids caused by the freshwater parasite *Myxobolus cerebralis* (myxosporean parasite). The parasite has a two-host lifecycle, infecting both a common aquatic worm, *Tubifex tubifex*, and salmonids, i.e., fish from the family Salmonidae. The disease affects this large family, including trout, salmon, char, grayling, and whitefish. Currently, *M. cerebralis* has not been officially confirmed in British Columbia (BC), it was first detected in Alberta in 2016. In infected juvenile salmonids, mortality rates can reach up to 90%. Whirling disease is not known to cause any harmful effects to humans or non-host animals, whether from eating contaminated fish or ingesting contaminated water.

## Legal Status

Whirling disease is listed as a Prevent species on the BC Priority Species list, meaning that the disease is determined to be **high risk** to BC and has not yet been established. The management objective in this stage is to prevent the introduction and establishment.

Whirling disease is a federally reportable disease, meaning it's a disease of significant importance to aquatic animal health and/or the Canadian economy. Anyone who knows of or suspects whirling disease in the aquatic animals they own or work with is required by law to notify the Canadian Food Inspection Agency (CFIA).

## Distribution

Originating in Europe, whirling disease was first identified in North America in Pennsylvania in 1956. Canada's first confirmed detection came from Johnson Lake in Banff National Park in 2016, and as of 2018, it is present in Alberta's Bow, Oldman, Red Deer and the North Saskatchewan River watersheds. Whirling disease is also present in 25 US states, including the bordering states of Idaho, Montana and Washington. A suspected case of whirling disease was detected for the first time in August 2023 in Yoho National Parks, Emerald Lake in Field, BC.

## Identification

**Behavioural:** Whirling disease is named for the erratic circular, or "whirling" swimming behavioural symptom exhibited by infected fish. This behaviour is the result of the parasite impairing the nervous system and feeding on spinal cartilage.

**Physical:** Infected fish have skeletal deformities of the body and/or head. The mandible is often shortened, and indentations appear on the top of the head. The tail of infected fish may appear dark or black due to damage to the caudal nerves controlling pigment deposition. However, *NOT ALL* infected fish exhibit physical symptoms, so laboratory testing is required for diagnosis. Fry or juvenile fish are more susceptible to infection by the parasite and more likely to show symptoms of the disease.

## Ecological Characteristics

**Life Cycle:** The cycle begins with the release of parasite spores (myxospores) from the cartilage of infected fish. The spores are then ingested by the parasite's first host, a common aquatic worm (*Tubifex tubifex*). Once ingested by the worm, the spores develop into triactinomyxons (TAM), the parasite's free-swimming form (lasting approximately 74-120 days), which are then released from the worm into the water. The TAMs are free to infect further worms or infect a salmonid host through ingesting the infected worms or by TAMs in the water, which penetrate into the skin of the fish. The latter can be completed within one minute after contact. Once in the salmonid host, the parasite moves to the nerve tissue and begins feeding on cartilage in the central nervous system as it matures. About 80 days after entering the fish, the parasite produces spores, beginning the lifecycle again.

Juvenile fish are more susceptible to becoming infected by *M. cerebralis* than older fish due to the presence of more cartilage as a food source. Juvenile fish can also become infected through exposure to fewer spores, while older fish require exposure to more spores to become



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infected. Fish eggs cannot become infected, though juvenile fish can become infected as young as two days old.

Spores of *M. cerebralis* can survive freezing conditions at -20 °C and survive digestion by some fish and bird species. Fish-eating birds can spread the parasite to uninfected water bodies.

## Impacts

**Ecological:** Whirling disease can infect many salmonid hosts, including threatened and endangered species that are already impacted by stressors such as climate change, chemical pollution, and habitat loss. Salmonid ecosystems may also be impacted if the number of salmon-like species changes and local population losses impact food webs and nutrient cycles, the way nutrients are processed in an ecosystem, like a lake.

Salmonid ecosystems may also be impacted if declines in salmonid populations result in their population being replaced by other fish species. This can also impact food chains and nutrient cycles.

**Economic:** Whirling disease can impact BC's sport fishing and angler tourism, fisheries, and aquaculture industries. In aquaculture facilities with whirling disease, economic losses could be incurred by closure, disinfection, and renovation of facilities. In Colorado, more than \$11 million (US) was spent renovating hatcheries for whirling disease between 1987 and 2006.

## Management

There is no treatment for whirling disease currently available. Therefore, containment of infested areas, identification of new infestations, and prevention of spread to uninfected water bodies are the priority best management practices.

**Prevention:** Whirling disease is spread by humans through the transport of infected live or dead fish and fish parts, contaminated worms, equipment, or water sources. Please remember that the disease can live in mud and water. To prevent the spread of the disease, do not use fish as bait. Do not move fish from one body of water to another or release live fish. Instead, dispose of fish parts in the municipal solid waste system. The movement of equipment or gear from recreational activities such as boating, paddling, swimming, and fishing can spread whirling disease, so it is important to CLEAN DRAIN DRY. <https://bcinvasives.ca/play-your-part/clean-drain-dry/>

1. CLEAN off all plants, animals, sand and mud from your boat and gear.
2. DRAIN all water from your boat and gear onto land.
3. DRY all parts of your boat and gear completely.

**Cleaning Specifics:** Best practices are to clean non-plastic gear with hot water (90° C+) or high-pressure spray. You may also use a solution of one part household bleach to 32 parts water. If using bleach, ensure that the solution is not disposed

of or rinsed off into municipal storm drains or water systems. Disposing of this solution in a yard will not cause damage at the recommended dilution. Ensure equipment is cleaned away from any water sources. Allow the gear to dry fully for a minimum of 24 hours before entering a new water body. Anglers can do their part by ensuring all their gear is Clean, Drain, Dry on site and felt-soled waders are fully cleansed with Tech Wash® or a similar detergent.

## Reporting

Report any suspect infected fish to the CFIA (<https://inspection.canada.ca/about-cfia/contact-a-cfia-office-by-telephone/eng/1313255382836/1313256130232>) at 587-230-2200 or to your local CFIA Animal Health Office. Alternatively, report to the Province through their online form (<https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species/reporting-invasive-species>) or to ISCBC through the website, [info@bcinvasives.ca](mailto:info@bcinvasives.ca) or 1-888-933-3722. <https://bcinvasives.ca/take-action/report/#websiteReportForm>.

## References/Links

News release: First case of whirling disease in Canada.

Whirling Disease of Salmonid Fish: Life Cycle, Biology, and Disease (Gilbert & Granath, 2003). <https://www.canada.ca/en/food-inspection-agency/news/2016/08/first-case-of-whirling-disease-in-canada.html>

The History and Dissemination of Whirling Disease (Bartholomew 2003). [https://www.researchgate.net/publication/285691216\\_The\\_history\\_and\\_dissemination\\_of\\_whirling\\_disease](https://www.researchgate.net/publication/285691216_The_history_and_dissemination_of_whirling_disease)

Status of Whirling Disease in the Crowsnest River – Technical Report 2019. <https://open.alberta.ca/dataset/564d1c08-bf40-4f5e-bef4-b80d2c8d205e/resource/70d3f48e-3a7e-4224-86b7-7ac3bad5e6b1/download/aep-whirling-disease-2019-technical-report-crowsnest-river-2020-09.pdf>

Steinbach Elwell *et al.* (2009) Whirling disease in the United States. *A summary of progress in research and management, 2009*, p.61. [http://myxozoa.org/files/WD%20in%20the%20United%20States\\_2009\\_sc.pdf](http://myxozoa.org/files/WD%20in%20the%20United%20States_2009_sc.pdf)

Dr. J.J. Alava, pers. comm., Ocean Pollution Research Unit, Institute for the Oceans and Fisheries, University of British Columbia, November 10, 2023.

