



## What is Whirling Disease?

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**W**hirling disease is the common name for an infection in salmonids caused by the protozoan, *Myxobolus cerebralis*. Diseased fish usually show signs of circular swimming, hence the disease name “whirling.” In addition, diseased fish may show other signs, such as black tail, skeletal deformities, and shortened gill cover (Figure 1). Because of the erratic, uncontrolled circular swimming, the fish are unable to eat or escape predators.

*Myxobolus cerebralis* has a two-host life cycle, alternating between salmonid fish species and a benthic organism, the worm, *Tubifex tubifex* (Figure 2). The worms live in the mud of streams. As many as 10,000 worms can be found in one square yard of a muddy river bottom. The parasite’s free-swimming form,

called a triactinomyxon (TAM), develops in the worm host. Infection occurs when the TAM released from the worm attach to a fish’s skin, or when a fish eats an infected worm. Once TAM are in the fish body, the parasite settles in the cartilage, multiplies, and feeds on its contents. Pain associated with damaged cartilage cause swimming disturbance and deformed appearance in heavily infected fish (Figure 3). Spores can be shed from gills or feces of heavily infected fish. The spores are also released to the environment when infected fish die and decompose, or through feces of other fish-eating animals. The liberated spores are then taken by tubificid worms, develop in their guts into TAM, and then released back into the water, thus repeating the life cycle (Figure 2). Unfortunately, *M. cerebralis* spores are resilient in infected sediments and remain alive for more than 20 years.

### Which salmonids species are susceptible?

Of all salmonids, rainbow trout are the most susceptible species to whirling disease, followed by—in decreasing order of susceptibility: the sockeye salmon, brook trout,

chinook salmon, coho salmon, and brown trout. Lake trout may be resistant to infection.

### Which age is susceptible?

In general, young salmonids are more vulnerable than adult fish. In studies with rainbow trout, 2-day-old sac fry were the youngest to acquire the infection and develop spores. The severity of infection decrease with increased age of fish. This increased susceptibility is because the skeleton in young fish has not yet developed into mature bony tissue. Ossified bones take place gradually with the age.



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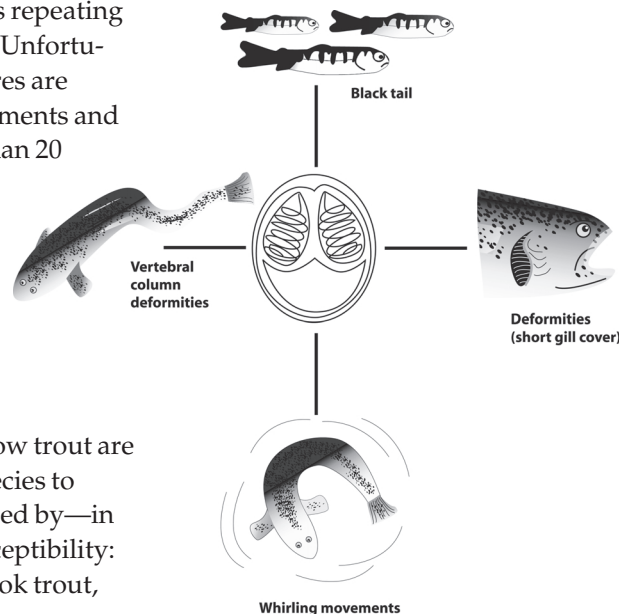


Figure 1. Characteristics of whirling disease.

## How is whirling disease spread?

Most transmission between rivers is the result of transplanting infected fish. Transmission within a river system occurs by spores carried out by water currents, contaminated equipment, boats, and birds that have consumed infected fish.

Getting the mud off, and cleaning and drying equipment should greatly reduce or eliminate the potential threat of spreading whirling disease.

How did Michigan and other North Central fish farms and rivers become infected by whirling disease?

Whirling disease was first identified in Pennsylvania in the 1950s, presumably arriving with frozen fish shipments from Europe. Since then, it has spread in 23 states. In fall of 1968, the disease was first reported in Michigan. A Michigan trout farmer had obtained fish from an Ohio trout farm known to be affected by the parasite. Later investigations showed that three hatcheries in Michigan were contaminated with this dangerous protozoan. Through voluntary agreements, all fish in infected ponds were killed and buried, and the facilities thoroughly disinfected. These efforts, however, were not effective in stopping the spread of the disease. By 1998, whirling disease has been reported in several Michigan river systems and a few fish farms.

Alarming reports came from Colorado and Montana. Massive declines of young trout were observed in the Colorado River at Middle Park in 1993. In 1994, a drastic decline in trout populations of Madison River in Montana were reported.

## Is whirling disease dangerous to humans?

The parasite does not infect humans or predators that eat infected fish. Trout and salmon with whirling disease can be safely eaten.

Can whirling disease be eradicated from affected streams?

Once whirling disease is in a stream, there is no effective way to eradicate this infection. However, there are measures that can be done to reduce the impact of the disease. The severity of the problems observed in Montana may be the result of other factors that have contributed to the decline of the fish including high rates of catch and release, and increased stream sediment loads from grazing, mining and development of the surrounding area. Increasing sedimentation provides additional growing areas for tubificid worms. Many federal, state and university research studies are being conducted to develop more sensitive tests for the diagnosis of the protozoan in worms, fish, and water. Additional studies are being conducted to determine why some fish survive infections while other species succumb to the disease.

## How can fish farmers avoid whirling disease infection?

1. Use only ground water sources (springs and wells) free of fish.
2. Purchase only fish certified free of whirling disease or surface-disinfect eggs.
3. Use only concrete or lined raceways.

4. Frequently clean solids from settling areas to prevent growth of tubificid worms.
5. Clean and dry equipment before going from one body of water to another.

How can fish farmers eradicate whirling disease?

1. Remove all infected fish.
2. Change to a ground water source (springs and wells) free of fish or the pathogen.
3. Convert to concrete or lined raceways.
4. Restock only fish certified free of whirling disease or surface-disinfect eggs.
5. Frequently clean solids from settling areas to prevent growth of tubificid worms.
6. Clean and dry equipment before going from one body of water to another.

How can fish farmers avoid magnifying infection levels in receiving waters if eradication is impossible?

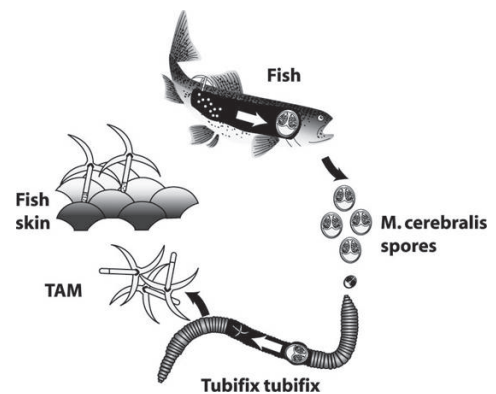


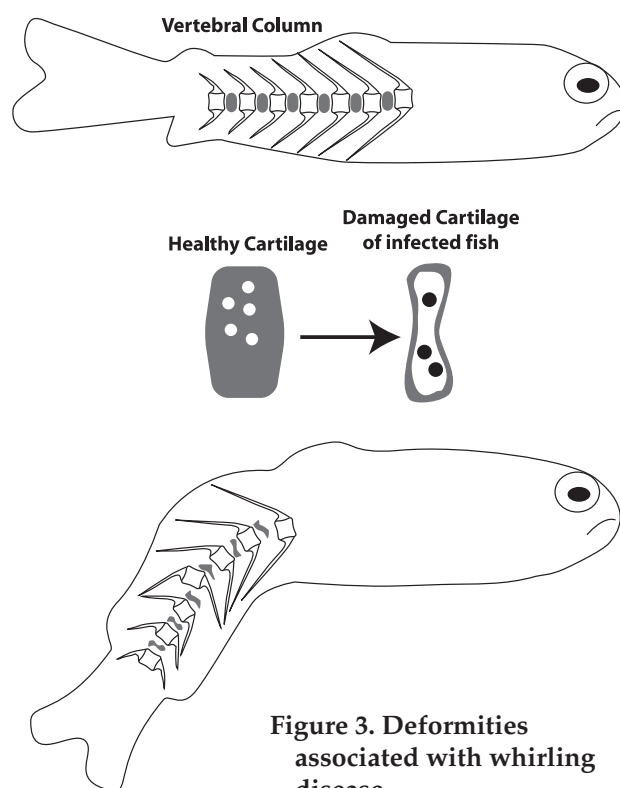
Figure 2. Life cycle of *Myxobolus cerebralis*.

1. Remove mortalities as frequently as possible.
2. Frequently clean solids from settling areas to prevent growth of tubificid worms.
3. Cease rearing susceptible fishes.

**Does Michigan or other North Central states have any regulations concerning fish farms with whirling disease?**

The Great Lakes Fish Disease Control Policy and Model Program, published by the Great Lakes Fish Commission, prohibits the stocking fish from farms infected with whirling disease in the Great Lakes and their tributaries. The Michigan Department of Agriculture and Natural Resources and other Great

Lakes states are developing policies for fish farms that have tested positive for whirling disease. Most states within the North Central Region require that fish imported into the state are certified free of whirling disease before an import permit can be obtained.



**Figure 3. Deformities associated with whirling disease.**

**Acknowledgements:**

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**Additional sources of information:**

- <http://www.whirlingdisease.org>
- <http://water.montana.edu/mwc/programs/fisheries/whirling/default.htm>
- <http://hmsc.oregonstate.edu/classes/MB492/whdchelsea/index.htm>
- <http://www.montana.edu/commserv/csnews/nmview.php?article=1441>

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