

2012 - Arizona Risk Analysis

Whirling Disease



Name

Whirling Disease or black-tail (*Myxobolus cerebralis*)

Description

Whirling disease is caused by a microscopic parasite, *Myxobolus cerebralis*, which damages cartilage and compromises the nervous system of trout and other salmonids, but no other fish species. Fish with low numbers of spores may not show any visible signs of the disease. If sufficiently affected by the parasite, young fish may become more susceptible to predation and less able to feed and survive disturbances in the environment. When infection is severe in young fish, they may “whirl” when startled due to pressure on the nervous system from inflammations around damaged cartilage. Fish may also develop a “black tail”. (dfw.state.or.us 2011)



Myxobolus cerebralis spore



Tubifex worms

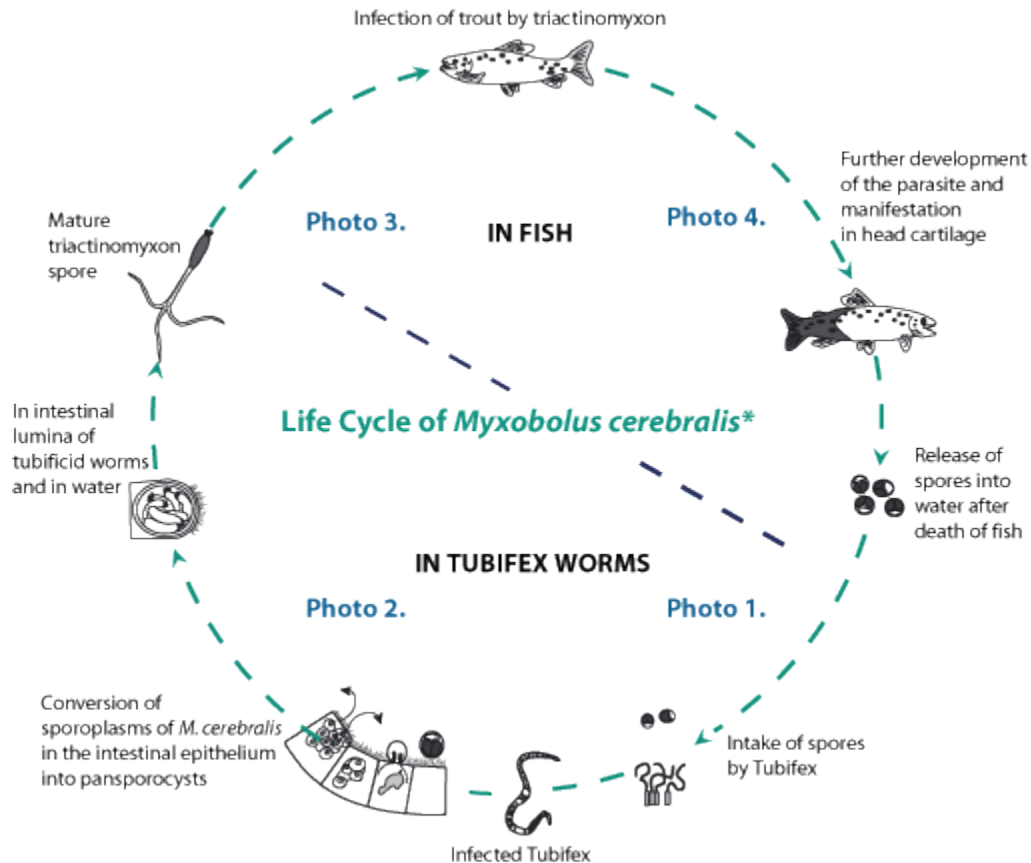
Life History

Myxobolus cerebralis takes several unique physical forms and requires both an invertebrate and a vertebrate host to complete its life cycle. *M. cerebralis* has two distinct infective stages: the myxospore and the triactinomyxon. The myxospore infects the invertebrate host, *Tubifex tubifex* worms, and the triactinomyxon infects the vertebrate host, salmonid fish. The parasite’s two infective stages were formerly thought to represent two separate species because they differ greatly in physical appearance and infect unique hosts. (Steinbach, et al. 2009)

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When an infected fish dies and decomposes, spores are released into the water, beginning the cycle again. Spores can also survive passing through the digestive tract of predators and can be transferred from place to place on muddy boots or other equipment. (www.dfw.state.or.us)

See Life Cycle diagram below.



*Adapted from M. El Matbouli, T. Fischer Scherl, and R.W. Hoffmann. 1992. *Annual Review of Fish Diseases*, p. 392

Reproductive Strategy

Myxobolus cerebralis reproduction occurs in three distinct processes. First, sporogony occurs immediately after a sexual phase and consists of an asexual reproduction that culminates in the production of sporozoites. Secondly, Sporozoites will develop into forms that undergo another asexual replication known as merogony. In some species merogony is also referred to as schizogony. Finally, and as an alternative to asexual replication, schizogonites can become gametes through a process variously called gametogamy or gametogony. (www.issg.org)

The development and severity of whirling disease depend significantly on the age and size of the salmonid host when exposed to the parasite. Young fish are the most vulnerable to *M. cerebralis* and susceptibility decreases with age and growth as bone replaces cartilage in the developing fish. Recent studies have shown that younger fish are more vulnerable to nerve damage due to the parasite. Salmonid eggs cannot be infected by *M. cerebralis* possibly because eggs do not

provide the physical or chemical cues for the parasite's injection through the egg surface, and eggs do not contain the tissues necessary for parasite development. (Steinbach, et al. 2009)

Environmental Tolerances and Restrictions

Environmental factors strongly influence infection by *M. cerebralis* and the occurrence of whirling disease among salmonids. Environmental factors including water temperature, substrate, and flow can directly and indirectly influence the impacts of *M. cerebralis* on fish. These factors affect the parasite, its hosts, and the risk of disease, and may account for much of the variability observed in *M. cerebralis* detections and impacts. (Steinbach, et al. 2009)

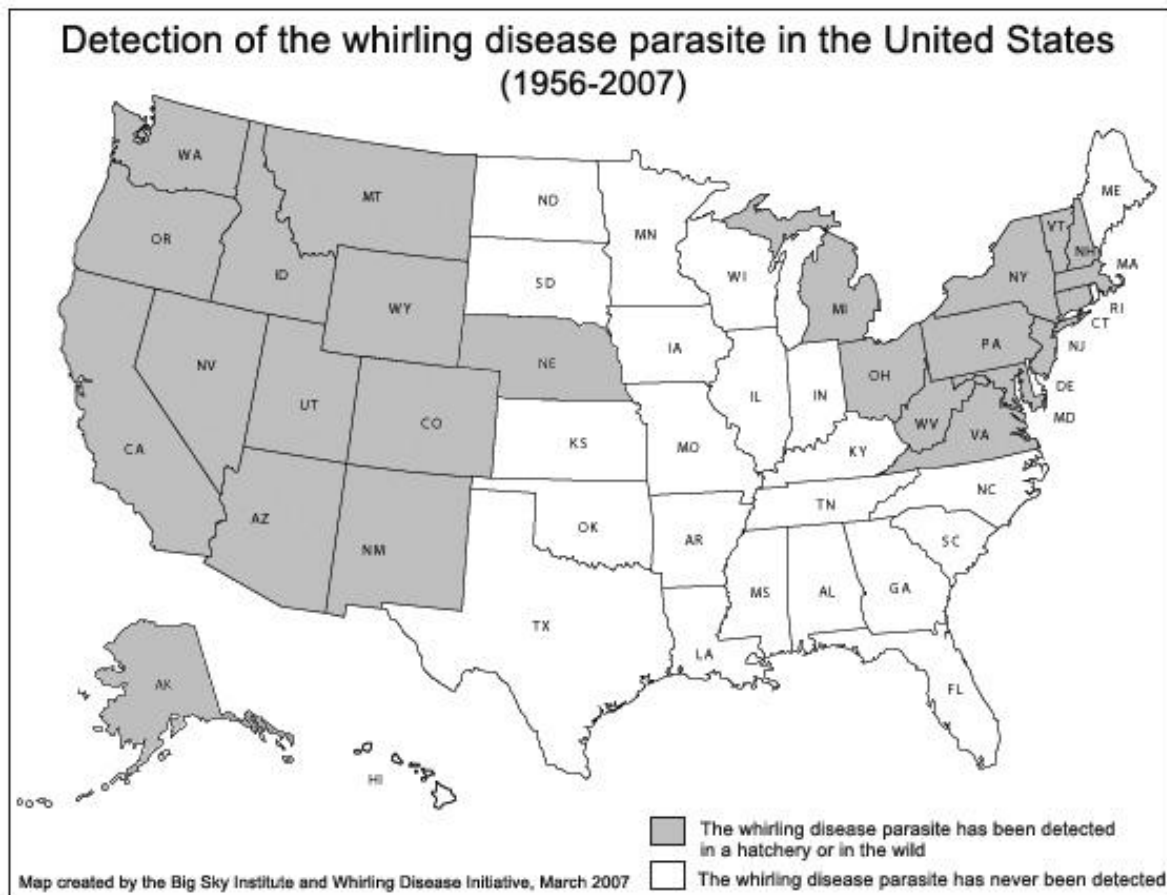
Preferred Habitat

Host, lakes, vectors, water courses, wetlands (www.issg.org)

Distribution

Whirling Disease is native to the Eurasian continent. It is found in throughout the United States, in several European countries, in South Africa, and in New Zealand.

Myxobolus cerebralis, has been detected in 25 states in a hatchery, wild fish population, or both. However, this does not mean that it always causes whirling disease or is widespread in all those states. In fact, its distribution is patchy within states and within watersheds. (Whirling Disease Initiative) (See map below)



Current Status in Arizona

Lees Ferry within Glen Canyon National Recreation Area in northern Arizona. Samples have been analyzed from Lees Ferry for whirling disease since 1999; two samples have been positive, one in 2007 and the other collected in 2011 and analyzed in 2012.

Pathways

Infected fish and fish parts are the primary vector for transmitting whirling disease. It may also be transmitted by birds and it is possible fishermen could spread the disease on contaminated fishing equipment.

Transfer, by means of stocking or natural movement, of infected fish or infected Tubifex worms. Also, the transport of sediment containing spores of the parasite is another method of spreading whirling disease. (Whirling Disease Foundation)

Known/Potential Impacts

All species of salmonid are susceptible to whirling disease and the impacts it has on fish populations. When an infected fish dies, thousands of the parasite spores are released to the water. These parasitic spores are virtually indestructible; they can withstand freezing, desiccation and are able to survive in an aquatic system for up to 30 years.

Benefits

None.

Effective Treatments

In watersheds where *Myxobolus cerebralis* is present in wild populations, there is currently no cure or means to eradicate it. The parasite can be managed in hatchery environments with careful management. The key to preventing the spread of whirling disease is to prohibit the movement of the parasites from infected areas. This can be accomplished by:

- Never transport live fish from one body of water to another
- Do not dispose of fish heads, skeletons or entrails in any body of water, this can spread the disease-causing parasites;
- Do not discard entrails or heads of fish down a garbage disposal. The whirling disease parasite can survive most water treatment plants and infect areas downstream.
- Carefully clean mud and vegetation from all equipment, such as boats, trailers, waders, boots, float tubes and fins. Rinse all mud and debris from equipment and wading gear, and drain water from boats before leaving the area where you've been fishing;
- Drain and dry boat bilges, live wells, and lower units.

BEFORE using waders, wading shoes, or fishing gear at another waterway, clean equipment with one of the following:

- Saturate waders and other gear with full-strength Commercial Solutions Formula 409® Cleaner Degreaser Disinfectant" or "Formula 409® All Purpose Cleaner Antibacterial Kitchen Lemon Fresh" or other cleaners, that contain at least 0.3 percent of the quaternary ammonium compound alkyl dimethyl benzyl ammonium chloride for at least 10 minutes or,
- Dip, wipe, or spray waders and other gear with 50-percent bleach solution (one part household chlorine bleach to one part water) or,

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- Soak waders and other gear for 10 minutes in a 10-percent bleach solution (one part household chlorine bleach to nine parts water) or,
- Pour boiling water (at least 200°F) over your gear and allow cooling.

Threats to Arizona

Potentially cause significant decreases in wild trout populations if allowed to persist and spread.

Human Health Threats

None. The parasite does not infect humans or other warm-blooded animals.

Recommendations

Through Directors Order, list *Myxobolus cerebralis* as an aquatic invasive species in Arizona per ARS 17 – 255.01 B1.

Any and all licensed fish farm or other facility where source fish are raised or reared must be certified free of diseases and other causative agents. Certification must be performed within 12 months of the date of stocking unless otherwise stipulated. If fish are brokered from other facilities, certification must be included for all facilities where subject fish are held. If stocking any cold water fish (e.g., trout, grayling, and char) in Arizona, the fish production facility must be certified free of Whirling Disease - *Myxobolus cerebralis*.



References

www.dfw.state.or.us/fish/diseases/whirling.asp Last updated 11/16/2012

www.protectyourwaters.net/hitchhikers/others_whirling_disease.php ANS Taskforce

www.issg.org/database/species/ecology.asp National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG). Last modified November 10, 2005

www.whirling-disease.org Whirling Disease Foundation, Updated 4/05.

Steinbach Elwell, Leah C., Stromberg, Kajsa Eagle., Ryce, Eileen K.N., Bartholomew, Jerri L. *Whirling Disease in the United States A summary of Progress in Research and Management* 2009.

<http://whirlingdisease.montana.edu> Whirling Disease Initiative; Montana Water Center, Updated 9/12.