Myxobolus cerebralis **System:** Freshwater

Kingdom	Phylum	Class	Order	Family
Animalia	Myxozoa	Myxosporea	Bivalvulida	Myxobolidae

Common name whirling disease (English)

Synonym

Similar species *Myxobolus lentisuturalis*

Summary Myxobolus cerebralis is a microscopic parasite that causes a chronic disease which often results in high mortalities among young, hatchery reared fish. It is called \"whirling disease\" as infected fish swim in radical, circular motions. Myxobolus cerebralis has a wide distribution that appears to be expanding. It is thought that the principle method of spread is through the stocking of live, infected fish. Myxobolus cerebralis has a two-host life cycle that involves fish and the bottom-dwelling tubifex worm, which releases Myxobolus cerebralis spores into the water.

view this species on IUCN Red List

Species Description
El-Matbouli *et al*. (1999) note that the spores of *M. cerebralis* demonstrate classic characteristics of the Myxozoa phylum. They have thin polar filaments (50 nm in diameter), which can be everted from the polar capsule in response to stimuli. Spore appearance differs depending on the host.

Lifecycle Stages
According to Kent *et al*. (2001), *Myxobolus cerebralis* has a two-host life cycle that involves the fish and an alternate host, the bottom-dwelling tubifex worm (*Tubifex tubifex*). When an infected fish dies and decays, spores are released and ingested by tubifex worms. The spores undergo development in the worm's intestine and multiply rapidly. When released by the worm, the water-borne spores infect susceptible fish by attaching to the fish's body. The parasite then migrates through the skin to the central nervous system, and ultimately into the cartilage of the fish. The spores are believed to be capable of remaining dormant in mud for thirty years (Storey, 2003).

Habitat Description
Melrose (2002) states that oligochaete worms and all species of trout and salmon may be susceptible to the *M. cerebralis* parasite. Rainbow trout and cutthroat trout appear to be more susceptible than other trout species.

Reproduction
Melrose (2002) characterises *Myxobolus cerebralis* reproduction 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.

General Impacts
According to Kent *et al*. (2001), *Myxobolus cerebralis* is a metazoan parasite that penetrates the head and spinal cartilage of fingerling trout where it multiplies very rapidly, putting pressure on the organ of equilibrium. This causes the fish to swim erratically (hence the name, whirling disease) and have difficulty feeding and avoiding predators. This disease has pronounced economic effects. It is responsible for high mortalities in hatchery fry and fingerling salmonids, especially rainbow trout. As finfish aquaculture has increased dramatically in the United States since the 1990's, the problem has been the focus of a growing amount of research. As the disease has now been detected in some wild populations, it may also decrease revenue from recreational fisheries.

Management Info
Preventative measures: According to Melrose (2002), no known treatments exist to counteract the effects of *M. cerebralis* in infected organisms. Those fish that do recover still retain the physical damage associated with infection. To decrease or prevent economic losses, various management techniques have and are being developed for use in fish hatcheries. As young fish are the most susceptible, management techniques have traditionally focused on controlling exposure of fry to the infectious stage of *M. cerebralis*, which are microscopic spores called triactinomyxons. Hatcheries have previously done this in two ways: 1) rear the young fish in well water to prevent exposure until they are older and more resistant, or 2) use pond designs that reduce potential habitat for oligochaetes. New research suggests that exposing water to unltraviolet light can inactivate triactinomyxons. A dose of 1300 mWs cm-2 ultraviolet light can inactivate 100% of the triactinomyxon sporoplasm cells. Sporoplasm is the infective mass of protoplasm within the spore that is injected into the host cell by various parasitic microorganisms.
The Whirling Disease Foundation, the Whirling Disease Initiative, and sponsored researchers are leading research on the development of a working risk assessment model for whirling disease and how it might be used as a management tool by fisheries managers to estimate risks and identify actions to reduce these risks. For details and updates on this project please see *Whirling Disease Initiative: Risk Assessment*.

Pathway

Principal source: Melrose, 2002. *Myxobolus cerebralis*: The causative agent of whirling disease in salmonid fish

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

Review: Dr. Jerri Bartholomew. Center for Fish Disease Research Department of Microbiology, Nash Hall 220 Oregon State University Corvallis. USA

Pubblication date: 2005-11-10

ALIEN RANGE

[1] EUROPE
[1] SOUTH AFRICA
[1] NEW ZEALAND
[23] UNITED STATES

BIBLIOGRAPHY
8 references found for **Myxobolus cerebralis**

Managment information
Melrose, E. 2002. *Myxobolus cerebralis*: The causative agent of whirling disease in salmonid fish. Dalhousie University.
Summary: A detailed report on background information on *Myxobolus cerebralis*. The report also includes management information.
Moffit, Christine M. Paul Reno and Steven Intelmann., 2000. Disease Interactions Between Wild and Cultured Salmonids
Summary: Available from: http://www.fish.washington.edu/wrac/images/Wild&CulturedSalmon99-00.pdf [Accessed 24 September]

Whirling Disease Initiative, 2005b. Publications and Resources
Summary: This webpage gives accesss to reports, publications, bibliography and links dealing with whirling disease, its impacts and management in the USA. Also available are maps of spread in the USA and profiles of whirling disease research projects.
Available from: http://whirlingdisease.montana.edu/resources/default.htm [Accessed 10 November 2005]
Whirling Disease Initiative, 2005c. Risk Assessment
Summary: Available from: http://whirlingdisease.montana.edu/resources/risk.htm [Accessed 10 November 2005]

General information

El-Matbouli, M., Hoffmann, R.W., Schoel, H., McDowell, T.S., and Hedrick, R.P. 1999. Whirling disease: host specificity and interaction between the actinosporean stage of *Myxobolus cerebralis* and rainbow trout *Oncorhynchus mykiss*. Diseases of Aquatic Organisms. 35: 1-12
Summary: A detailed report on the biology, distribution and ecology of *Myxobolus cerebralis* in Rainbow trout.
Available from: http://www.int-res.com/abstracts/dao/v35/n1/p1-12.html [Accessed 18 May]
Kent, M.L., Andree, K.B., Bartholomew, J.L., El-Matbouli, M., Desser, S.S., Devlin, R.H., Feist, S.W., Hedrick, R.P., Hoffman, R.W., Khattra, J., Hallett, S.L., Lester, R.J.G., Longshaw, M., Palenzeula, O., Sidall, M.E., and Xiao, C. 2001. Recent advances in our knowledge of the Myxozoa. Journal of Eukaryotic Microbiology. 48(4): 395-413
Summary: This report reviews available information on *Myxobolus cerebralis*. It also contains information on recent research about the virus and new prevention and treatment methods. Available from: http://www.jeukmic.org/INDEX.html [Accessed 18 May 2003]
Storey, P. 2003. Whirling Disease: A Threat to Fisheries?. The New Zealand Trout Fisher.
Summary: A report on Whirling disease in the fish industry.
Available from: http://www.agron.missouri.edu/flyfishing/nz_wd.html [Accessed 4 June 2003].
Whirling Disease Initiative, 2005a. What is Whirling disease?
Summary: Available from: http://whirlingdisease.montana.edu/ [Accessed 10 November 2005]