



# the Whirling Disease Initiative Newsletter

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## On the whirling disease in rainbow trout

By Professor Dr. Bruno Hofer

Statement from the Royal Bavarian Center for Biological Studies of Fish  
General Fishing Newspaper, 1903



*Editor's note: This article is a translation of the original description of Myxobolus cerebralis by Dr. Bruno Hofer in 1903. The article was originally published in German and was translated into English by Karolina Krauss at Montana State University through the Whirling Disease Initiative in 2006. Dr. Mansour El-Matbouli of the University of Munich then reviewed the translation to ensure fidelity of the technical content. Since the publication is so often cited by English speakers, we wanted to make a high quality English translation available. You may download the article on the Whirling Disease Initiative Web site at <http://whirlingdisease.montana.edu/biblio/default.htm>.*

The rainbow trout is a fortunate type of fish in that it is affected only by few diseases, even in the unfavorable conditions of our fish-farms where they are kept crowded together in small spaces and are fed and fattened with more or less unnatural food. The disease to be described in the following—the whirling disease—occurs only rarely; since the inception of the Institute for Biological Studies, fish with this disease were received only twice for examination, and only once live fish in which the symptoms of the disease could be observed.

At first, the diseased fish show no outwardly visible signs, they swim in a lively way among the other fish of the species, at least in the aquarium, but suddenly one or another fish will start to swim madly around in circles, that is, it bends the body in a half-circle to the left or to the right and performs cramp-like circular movements ten to twenty times in a row. Afterwards, the fish lies exhausted on the bottom, only to get up again and swim in a normal position and to move for hours in an apparently normal way. This state can last for days or weeks, until the fish finally sticks out without any visible change.

*continued on page 2...*



*A rainbow trout showing clinical signs of whirling disease. Photo: Silvia Murcia*

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Montana Water Center

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Upon examining the inner organs, I have repeatedly found a parasite in the brain of the fish in remarkably small quantities, while all other organs appeared normal. This parasite belongs to the sporozoa and to the genus *Myxobolus*. Since it is still unknown and apparently breaks out only in the brain of fish, I will name the parasite *Myxobolus cerebralis*. As holds true for all myxosporidia, the parasite can only be identified clearly by its spores. The spores are of an elongated, egg-shaped form with a length of 0,009 millimeters and a width of 0,0072 millimeters. The polar capsules contained therein are of half of the length of the spores. At eight regularly distributed points, the outer involucre juts inward towards the interior of the spore in eight fine, tender, triangular prongs. Only few of these spores are found in the brain of the fish, esp. in the so-called midbrain. The seat of the parasite thus explains why the affected fish perform the characteristic whirling movements from time to time. I therefore have no doubt that *Myxobolus cerebralis* is the cause of the whirling disease.

Finally, I would welcome further information about the appearance of the whirling disease from fish hatcheries, in particular, examination material to determine whether the disease is caused by the same parasite in other locations as well. At this point in time, we have no detailed information about the development of the infection or about the manner in which it occurs. ☒

*Suggested citation: Hofer, B. 1903. Ueber die Drehkrankheit der Regenbogenforelle. Allgemeine Fischerei Zeitung 28:7-8.*

## Board meeting travels to New York

The National Partnership for the Management of Wild and Native Coldwater Fisheries provides oversight and direction for the Whirling Disease Initiative. The National Partnership's Board of Representatives meets annually to review the Initiative's accomplishments and discuss plans for the future (*for a list of Board members, see the sidebar on the right*). This year's meeting took place in Lake Placid, New York in conjunction with the American Fisheries Society annual meeting. Whirling Disease Initiative-funded researchers Robert DuBey and Billie Kerans made the trek to Lake Placid to provide an overview and update on their current investigations. After a review of the year's accomplishments, conversation turned to next year's agenda and the program's future. Despite progress, many questions remain to be solved by researchers in the coming years. An update on the Whirling Disease Initiative research agenda and 2007 Request for Proposal process will be released in November 2006. ☒



*Liz Galli-Noble and Board member Eileen Ryce.*

## Online bibliography triples in size – 664 records!

The Whirling Disease Initiative (WDI) online bibliography contains a growing library of books, book chapters, journal articles, conference proceedings, dissertations, government documents, and technical reports. In many cases, the entire article or document can be downloaded in .pdf format. Thanks to student help the online resource has tripled in size to more than 660 records searchable by title, author, year, and keyword. Find it under "Resources" on the WDI Web site. ☒

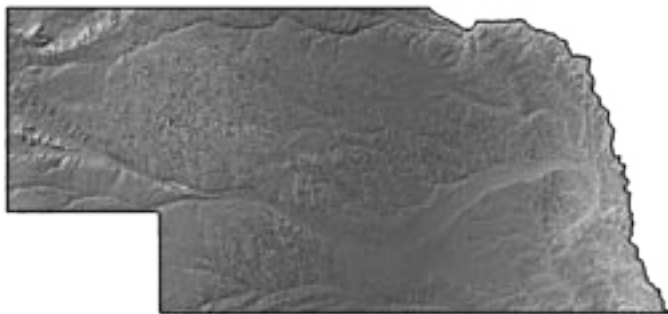
# Mini-symposium successful and stimulating in Lake Placid

During the 136<sup>th</sup> Annual Meeting of the American Fisheries Society (AFS) in Lake Placid, New York, leaders in whirling disease research and management participated in a day-long mini-symposium, “Whirling disease: what’s going on and what can we do about it?.” Presentations covered a wide spectrum of geographical areas and research topics to provide a comprehensive update on what we know and how to improve management.

If you missed this mini-symposium, you can access the abstracts and selected Powerpoint presentations online through the Whirling Disease Initiative Web site. The meeting was organized by Phil Hulbert, Bob Gresswell, Liz Galli-Noble and Kajsa Stromberg through the Whirling Disease Initiative. Thank you to everyone who participated. ☒

# Nebraska confirmed as 24<sup>th</sup> state to detect parasite

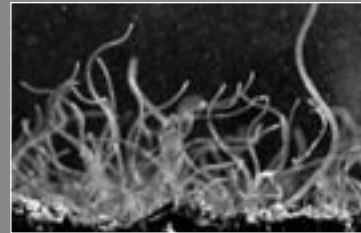
The Whirling Disease Initiative recently confirmed that Nebraska is the 24<sup>th</sup> state to detect the parasite *Myxobolus cerebralis*. The list of detections includes states that have detected *M. cerebralis* at least once in a hatchery, a wild fish population, or both. The list does not indicate the continued presence of the parasite or the extent of distribution within the state. According to Dean Rosenthal of the Nebraska Game and Parks Commission, the whirling disease parasite was first detected in Nebraska in spring 2001 among trout in a private hatchery near the town of Valentine. Testing in 2002 confirmed the continued presence of *M. cerebralis*. The facility has not been re-licensed to sell fish since 2002 and is no longer in business. The hatchery’s discharge water went into the Niobrara River, which does not support wild trout populations in that area due to high summer water temperatures. However, tributaries to the Niobrara River downstream from Valentine do support wild trout. At this time, the distribution of *M. cerebralis* in the wild is unknown, and all operating hatcheries in the state are free of the parasite. ☒



## Life Cycle



1. *M. cerebralis* spores exist in sediment.
2. Tubifex worms ingest spores.



3. Infected worms produce *M. cerebralis* TAMs and release them into the water column.



4. TAMs enter through the skin of fish.
5. Parasite travels to the head and cartilage of fish.



6. After several months, fish exhibit signs of whirling disease.
7. Mature spores are released from fish and cycle begins again.



Photos courtesy of (top to bottom): the Whirling Disease Foundation; Maria Markiw, U.S. Geological Survey; Mansour El Matbouli; and the U.S. Geological Survey

# Whirling Disease Initiative joins Stop Aquatic Hitchhikers in Yellowstone Region outreach project

When it comes to the management of natural resources, a consensus is generally hard to reach in mixed company. Yet, when a group of resource managers, biologists and non-profits gathered this spring to discuss aquatic nuisance species, an agreement was easily reached – an agreement to pursue public outreach activities in the Greater Yellowstone Area. This idea came to fruition in late September when an unusual group assembled in Jackson, Wyoming.

Representatives from state governments, federal agencies, academic institutions, non-profit organizations, and the regional business community gathered to discuss how to work together to effectively protect the aquatic resources of the Greater Yellowstone Area. The U.S. Fish and Wildlife Service Stop Aquatic Hitchhikers program and the Federation of Fly Fishers organized the workshop. The day began with an educational session about the problems posed by aquatic nuisance species, which led into a strategizing session to decide how this

broad partnership could educate and influence the public.

The group committed to work together on a regional basis to craft a campaign that will educate the public about aquatic invasive species and encourage the public to adopt behaviors that prevent their spread. Whirling disease is a concern in the Greater Yellowstone Area and the Whirling Disease Initiative will support the outreach effort with information and materials. It's particularly exciting to see how engaged the business community is in this effort.

“Collective industry action is the only viable way to combat the threat that aquatic nuisance species pose for all of us, and the recent GYA workshop was definitely a step in the right direction,” said Whitney McDowell, Marketing Manager for Simms Fishing Products. “It all comes down to public awareness and education, and as a leading manufacturer, Simms is fully committed to both immediate and long-term initiatives to help educate both our retail partners and consumers about aquatic

invasive species and how they can be a part of the solution.”

To participate, join the Stop Aquatic Hitchhikers partnership online (<http://www.protectyourwaters.net>) or contact Leah Elwell, Conservation Coordinator for the Federation of Fly Fishers at (406) 222-9369 or [conserve@fedflyfishers.org](mailto:conserve@fedflyfishers.org). ☒



**STOP AQUATIC  
HITCHHIKERS!™**

## Whirling disease leads to conflict in Utah

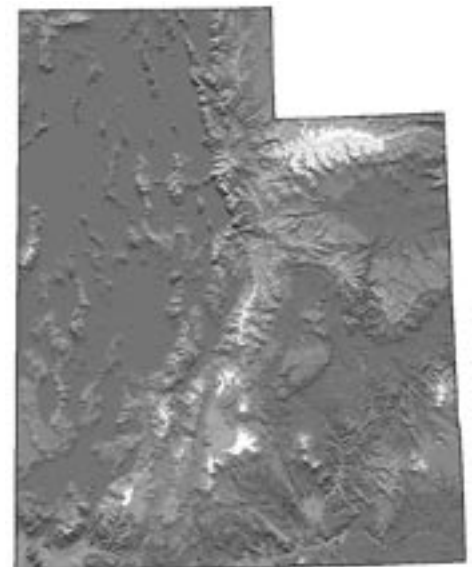
At a recent legislative hearing in Utah, the fight over whirling disease management reached a new level of hostility. According to the Salt Lake Tribune, the hearing dissolved into fisticuffs as private fish growers accused the state Department of Agriculture of mishandling its fish health regulatory responsibilities. At the root of this conflict is a dispute over regulation of whirling disease in aquaculture.

Originally, the Utah Division of Wildlife Resources was charged with regulating fish health in private aquaculture. This changed in the early 1990s, when legislation placed fish health regulation under the Utah Department of Agriculture. After this transfer of authority, a Fish

Health Policy Board was established made up of representatives from the Division of Wildlife Resources, the Department of Agriculture, and the sport fishing community. The Fish Health Policy Board is then responsible for setting fish health policy and monitoring for disease among aquaculture producers.

The whirling disease parasite was first detected in Utah in 1991. Since that time, the whirling disease parasite has become dispersed in the state's coldwater aquaculture industry. When the parasite was detected, it often dealt a severe financial blow to the producer. Their infected fish were disposed of and

*continued on page 5...*



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facilities were disinfected and renovated. Sometimes these expenses were enough to drive the company out of business. As the economic consequences continued to mount, the industry became increasingly vocal about the problem.

This year, several Utah fish producers filed suit against the state Department of Agriculture, charging that the agency's

testing protocols were inaccurate. The growers claimed that their facilities were quarantined following a single, unreliable test. The Department of Agriculture says the tests are reliable and that a single test is sufficient. They will re-test a facility once disinfection has occurred. In September 2006, a hearing on the issue was conducted by the Interim Committee on Natural Resources, Agriculture, and Environment. Several

legislative options have been discussed including a deregulation of *Myxobolus cerebralis* in the state's aquaculture industry, and a requirement that the state compensate growers who are forced to destroy fish stocks. The outcome remains unclear while stakeholders have their say and policymakers hash it out. ☒

## Resource for researchers: The Myxozoan Network

By Jerri Bartholomew

In view of the ever-increasing interest in myxozoan parasites, a group of researchers got together during the 2003 European Association of Fish Pathologists meeting in Malta and agreed to initiate a network for scientists involved with myxozoan research. The network has two main objectives:

- \* To link myxozoan researchers for the purposes of sharing knowledge and encouraging collaboration, thereby advancing our understanding of myxozoan biology and ecology on a worldwide scale.
- \* To serve as a directory and information source for aquaculture professionals affected by myxozoan-related problems.

The core of the network is a group of international researchers working on different aspects of myxozoan biology. The group maintains a Web site (<http://www.myxozoa.org/>) for the purpose of making contacts and sharing information about upcoming meetings, publications, research opportunities and positions.

Special sessions on myxozoan research have been held at the 2005 European Association of Fish Pathologists meeting in Copenhagen, Denmark and the 2006 International Symposium on Aquatic Animal Health in San Francisco. The session summary for the 2005 meeting and abstracts from the 2006 meeting are available on the Myxozoan Network Web site.



Network members' research interests are diverse and include phylogeny, description of new species, epidemiology, parasite biology, pathology and host response and parasite transmission. Examples of manuscripts published this year or that are currently in press can be found on the Web site.

If you are interested in becoming part of the network, please fill in the subscription form on the website. Network members receive periodic email newsletters and are listed in our online network contacts database. ☒



Members of the first myxozoan workgroup in Malta. From left: Jerri Bartholomew, USA; Arik Diamant, Israel; Oswaldo Palenzuela, Spain; Ariadna Sitja-Bobadilla, Spain; Mansour El-Matbouli, Germany and Steve Feist, UK.

# Q&A from the “Ask an Expert” files

**Q: Is it possible to acquire whirling disease in a hatchery facility by importing eyed salmonid eggs from sources that are not certified whirling disease free?**

**A:** Yes, it is possible to acquire the whirling disease parasite in a hatchery facility by importing salmonid eggs from sources that are not certified disease free. It is true that whirling disease is not vertically transmitted from broodstock to eggs; however, the water used to transport the eggs could carry the parasite and transmit it to the receiving facility.

It is recommended that hatcheries never import fish or fish eggs from sources whose disease status is unknown. If this cannot be avoided, careful handling of the water used to transport the eggs and disinfection will reduce the risk of disease. Disinfection of eggs with iodine is generally recommended, both for *M. cerebralis* and for other pathogens.

**Q: I caught a lake trout with signs of whirling disease. I hear that all salmonids can be infected with the exception of lake trout. Do you have information that would confirm that lakera are an exception?**

**A:** It is extremely unlikely that the lake trout you caught had whirling disease. All salmonids can be infected by the parasite, but not all will develop the disease. There is a wide range in susceptibility among salmonid species (see table at right). Lake trout can be infected by the parasite, but as a species, they are not known to develop whirling disease. The physical deformities you saw can be caused by other diseases and parasites. The only way to positively diagnosis whirling disease is through microscopic examination by a pathologist or through genetics testing by polymerase chain reaction (PCR). Next time you observe this kind of phenomenon, consider bringing the fish in to your local fish and wildlife office for investigation.

**Susceptibility of salmonid species to whirling disease**

Genus	Species	Common Name	Susceptibility*
<i>Oncorhynchus</i>	<i>mykiss</i>	Rainbow trout	3
	<i>mykiss</i>	Steelhead trout	3
	<i>clarki</i>	Cutthroat trout	
	<i>c. bouvieri</i>	Yellowstone cutthroat	2
	<i>c. lewisi</i>	Westslope cutthroat	2
	<i>c. pleuriticus</i>	Colorado River cutthroat	2
	<i>c. virginalis</i>	Rio Grande cutthroat	2
	<i>c. stomias</i>	Greenback cutthroat	2
	<i>tshawytscha</i>	Chinook salmon	2
	<i>nerka</i>	Sockeye salmon/Kokanee	3
	<i>keta</i>	Chum salmon	1 S
	<i>gorbuscha</i>	Pink salmon	1 S
	<i>kisutch</i>	Coho salmon	1
	<i>Salvelinus</i>	<i>fontinalis</i>	Brook trout
	<i>malma</i>	Dolly Varden	1 S
	<i>confluentus</i>	Bull trout	1
	<i>namaycush</i>	Lake trout	0 S
<i>Salmo</i>	<i>salar</i>	Atlantic salmon	2 S
	<i>trutta</i>	Brown trout	1
<i>Prosopium</i>	<i>williamsoni</i>	Mountain whitefish	2 S
<i>Thymallus</i>	<i>arcticus</i>	Arctic grayling	0

\*Scale of 0-3 or S: 0=resistant, no spores develop; 1=partial resistance, clinical disease rare and develops only when exposed to very high parasite doses; 2=susceptible, clinical disease common at high parasite doses, but greater resistance to disease at low doses; 3=highly susceptible, clinical disease common; S=susceptibility is unclear (conflicting reports, insufficient data, lack of *Myxobolus cerebralis* confirmation). Chart provided by Elizabeth MacConnell and E. Richard Vincent.



*Do you have a question about whirling disease? Visit our Web site and click on the “Ask an Expert” link.*

# Whirling Disease Initiative Funded Studies, 2006-2007/08

## New Projects:

### **An ecological assessment of large-scale spatial and temporal patterns of whirling disease risk and salmonid population response**

Billie Kerans, Thomas McMahon, Jay Rotella, and James Robison-Cox,  
Montana State University  
Travis Horton, Montana Department of Fish, Wildlife, and Parks

### **Southwest regional risk assessment for whirling disease in native salmonids in arid and semi-arid lands: Arizona, Colorado, New Mexico, and Utah**

Colleen Caldwell, USGS, New Mexico Cooperative Fish and Wildlife Research Unit  
Robert DuBey and Scott Schrader, New Mexico State University  
Dana Winkelman, USGS, Colorado Cooperative Fish and Wildlife Research Unit, Colorado State University  
Phaedra Budy, USGS, Utah Cooperative Fish and Wildlife Research Unit, Utah State University  
Scott Bonar, USGS, Arizona Cooperative Fish and Wildlife Research Unit

### **Effect of substratum on the development and release of the triactinomyxon stage of *Myxobolus cerebralis* in resistant strains of *Tubifex tubifex***

Dolores Baxa and Ron Hedrick, University of California - Davis

## Continuing Projects:

### **Resolving uncertainties in *Myxobolus cerebralis* introduction and establishment risks**

Jerri Bartholomew, Antonio Amandi, Oregon State University

### ***Myxobolus cerebralis* risk to Yellowstone cutthroat trout related to variation in *Tubifex tubifex* abundance and susceptibility: Year two**

Billie Kerans, Montana State University  
Todd Koel, Yellowstone National Park

### **Investigating competition among lineages of *Tubifex tubifex* and the potential for biological control of whirling disease in natural streams**

Dana Winkelman, Colorado Cooperative Fish and Wildlife Research Unit  
Barry Nehring and Kevin Thompson, Colorado Division of Wildlife  
Christine Clapp, Colorado State University

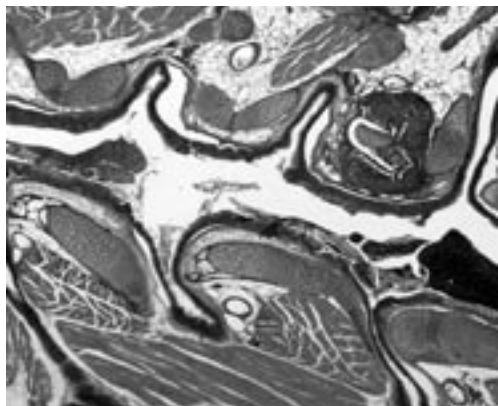
## Meetings and Conferences:

- » 57<sup>th</sup> Annual Pacific Northwest Fish Culture Conference; December 4-6, 2006; Portland, Oregon
- » 2007 Coolwater Fish Culture Workshop; January 7-9, 2007; Allamuchy, New Jersey
- » Montana Chapter American Fisheries Society; February 13, 2007; Missoula, Montana
- » 7<sup>th</sup> Nordic Symposium on Fish Immunology; July 17-23, 2007; Stirling, Scotland

**For more updates and events, visit:**  
<http://whirlingdisease.montana.edu/events.asp>

## We want your feedback!

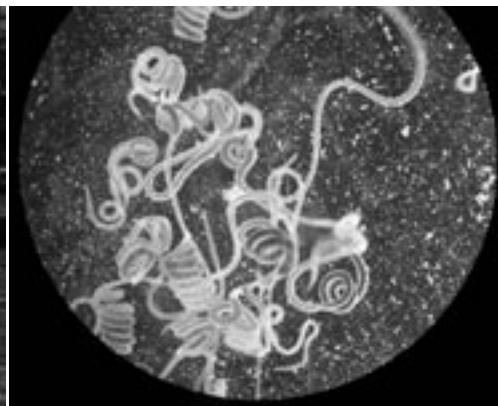
Is this newsletter helpful? Accurate? Informative? Please give us your comments and suggestions. We would also appreciate story ideas or article submissions. Simply e-mail Kajsa Stromberg, Outreach Program Coordinator, at [kstromberg@montana.edu](mailto:kstromberg@montana.edu).



*A cross-section of infected trout jaw.*  
Photo: Silvia Murcia



*Sampling oligochaete worms in an Oregon stream.* Photo: Stephen Atkinson



*Tubificid worms observed in the laboratory.*  
Photo: Leah Steinbach Elwell

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