the Whirling Disease Initiative
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in this issue...

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Waders and Wading Boots Shown to Spread *Myxobolus cerebralis*

Preliminary results from an Oregon State University study have documented what many have long suspected, that waders and wading boots can transport both the triactinomyxon (TAM) and myxospore life stages of *Myxobolus cerebralis*. The study, conducted by Paul Reno and David Latremouille, further demonstrated that the transport of TAMs and spores can cause infection in both rainbow trout and *Tubifex tubifex* worms.

Movement of infected fish is thought to be the primary mechanism for the spread of whirling disease. Transport by wildlife and human activities has long been suspected as another important vector. Research has been ongoing to document and quantify the spread of *M. cerebralis* through these mechanisms, however conclusive evidence has been hard to find. Funding for several of these projects has been provided through the Whirling Disease Initiative, including the study referenced above, "The potential of vehicles and fomites[1] to transfer the agent of whirling disease."

The study, slated for completion in June 2006, has so far demonstrated the transport and infectivity of *M. cerebralis* on waders and wading boots. The researchers are also investigating the viability of *M. cerebralis* after ingestion by several bird species. Stay tuned for their final results.

[1]fomites – an inanimate object that enables the transmission of a pathogen.

Whirling Disease Initiative Research

At any one time, three funding cycles are ongoing at the Whirling Disease Initiative. One cycle of projects is wrapping up, one cycle is ongoing, and one cycle is just beginning. Final reports have just been submitted for Initiative funded research in 2004-2005. Another group of projects funded for 2005-2006 is ongoing, and proposals have just arrived for research in 2006-2007. This means the Whirling Disease Initiative is currently supporting nearly 30 research projects today.

In this issue of the Whirling Disease Initiative Newsletter, we highlight some of the latest research findings for projects recently completed. We also list ongoing research projects, funded for 2005-2006.

New Whirling Disease Brochure Available

A new brochure about whirling disease is now available! Topics covered include whirling disease background and life cycle, frequently asked questions, and recommendations for anglers. Funding was provided by the Whirling Disease Initiative, Whirling Disease Foundation, and Montana Department of Fish, Wildlife and Parks. A copy of the new brochure is enclosed and additional copies may be ordered from the Whirling Disease Initiative (whirlingdisease@montana.edu / 406-994-2550).

Stocking of infected trout leads to criminal charges and fines

In October 2005, a plea agreement in federal court led to criminal convictions and fines for one private hatchery owner. Dwight Babcock, owner of Cannibal Canyon Ranches in Marvel, Colorado pled guilty to seven criminal counts of knowingly selling, transporting and stocking wildlife illegally in New Mexico and Utah.

According to court documents, Babcock's facility first tested positive for whirling disease in 1997. It tested positive again in 1998, 1999, and 2002. Babcock acknowledged that fish from his facility were unlawfully stocked into waters in Colorado on at least 25 occasions. Infected fish from Babcock's hatchery were also stocked in New Mexico and Utah. According to Mike Japhet, biologist for the Colorado Division of Wildlife (DOW), these introductions could have serious negative effects on wild trout waters and important cutthroat conservation waters in southwest Colorado.

> "Responsible trout growers won't mind showing a document that proves their hatcheries are free of whirling disease."
>
> *~Mike Japhet*

A two-year investigation and prosecution led to Babcock's criminal convictions and fines and restitution of $30,000. The fines include $4,800 to the federal government, and restitution of $15,000 to the state of New Mexico, and $10,000 to the Colorado State University Research Foundation to be used for whirling disease research.

The Colorado DOW certified the Cannibal Canyon Ranches facility as free of whirling disease in 2005. Despite his record, Babcock is currently allowed to release fish and sell fish for food in Colorado. However, he will not be allowed to release or export fish to New Mexico.

Illegal stocking of whirling disease-positive fish poses a significant threat to coldwater fisheries. Rigorous inspection and certification programs administered by state agencies can help reduce the risk of whirling disease introduction. All landowners considering stocking private waters must be cautious to avoid whirling disease and other potentially serious fish diseases. Landowners should ask hatchery operators for a copy of the hatchery's certification of whirling disease status. As Japhet notes, "Responsible trout growers won't mind showing a document that proves their hatcheries are free of whirling disease."

Whirling Disease Initiative Research Spotlight: Effects of Temperature, Photoperiod, and *Myxobolus cerebralis* Infection on Growth, Reproduction, and Survival of *Tubifex tubifex* lineages.

We used to think all *Tubifex tubifex* worms were created equal. Researchers now know that the species, the alternate host of the whirling disease parasite, actually includes several genetically distinct lineages. Research is now focused on finding out more about these lineages and what they might mean for management of whirling disease. The study in our research spotlight this issue is "Effects of Temperature, Photoperiod, and *Myxobolus cerebralis* Infection on Growth, Reproduction, and Survival of *Tubifex tubifex* lineages." The investigation evaluated the response of three *T. tubifex* lineages to environmental conditions and infection by *M. cerebralis*. Their research revealed important differences between worm lineages and provided more information about this complex problem that could potentially be used in habitat or population manipulations as a management tool.

T. Tubifex. *Photo courtesy of Leah Steinbach Elwell.*

How do T. tubifex lineages vary in response to *M. cerebralis* infection and environmental conditions?

Research

The research team of DuBey, Caldwell and Gould addressed this question in the December 2005 edition of the *Journal of Aquatic Animal Health* (DuBey et al 2005). Several lineages of *T. tubifex* are found in the whirling disease-infected tailwater of the San Juan River in New Mexico. These lineages, identified by polymerase chain reaction (PCR) amplification of 16S mtDNA, are known as I, III, and VI. By learning more about these lineages, researchers hope to develop management tools that can mitigate the impacts of whirling disease on fisheries.

Researchers Robert DuBey and Colleen A. Caldwell of New Mexico Cooperative Fish and Wildlife Research Unit, and William R. Gould of New Mexico State University, tested two lineages (III and VI) of *T. tubifex* to determine their response to a range of photoperiod and temperatures when infected by *M. cerebralis*. The research was partially funded by the Whirling Disease Initiative.

Results

In laboratory experiments, lineage VI exhibited resistance to *M. cerebralis* infection at all three temperatures tested (5°C, 17°C, and 27°C). Lineage III became infected at both 5°C and 17°C. These results seem to confirm other studies that have shown a wide range of susceptibility among *T. tubifex* to *M. cerebralis* infection.

Lineage VI was resistant to *M. cerebralis* infection at all three temperatures tested, while lineage III became infected at both 5°C and 17°C.

Although survival of lineage VI was consistently higher at 17°C, the effects of temperature on survival of the two lineages were not statistically significant. The researchers suggest further study of the effects of temperature. Photoperiod did not appear to have any effects on survival and growth of the two lineages.

Lineage VI exhibited greater survival than lineage III regardless of treatment.

Photoperiod and temperature did not have significant effects on *T. tubifex* growth and survival.

The researchers also found that *T. tubifex* of lineage VI had greater weight gains and greater reproductive rates than lineage III. These results confirm studies that have shown a range of growth and reproductive rates among *T. tubifex* from different geographical populations. However, this is the first report of differences in growth and reproduction between these two lineages.

***T. tubifex* of lineage VI had greater weight gains and greater fecundity than lineage III.**

Why do variations in *T. tubifex* lineages matter?

Relevance

The variations between *T. tubifex* lineages may be very important in whirling disease management and control. Other experiments have shown that the severity of whirling disease in juvenile rainbow trout was directly related to the production of triactinomyxons (TAMs) by *T. tubifex* (Ryce et al. 2001). If some lineages of *T. tubifex* are resistant to infection by *M. cerebralis*, they might produce fewer TAMs and lessen the severity of whirling disease in fish.

Other research found that resistant *T. tubifex* lineage V from Hamilton Bay in Ontario, Canada, actually ingested and deactivated *M. cerebralis* spores (El-Matbouli et al. 1999). This suggests some resistant worms could possibly act as filters–deactivating *M. cerebralis* spores from the sediment and preventing their contact with less resistant lineages, potentially lessening the severity of whirling disease in fish.

In summary, varied lineages of *T. tubifex* may mean less severe impacts of whirling disease in some infected water bodies. It may also help account for the varied impacts we have observed from whirling disease so far. There may even be management techniques to exploit variations in *T. tubifex* to reduce the occurrence and severity of whirling disease.

Varied lineages of *T. tubifex* may mean less severe impacts of whirling disease in some infected water bodies.

References

Dubey, R., C. A. Caldwell, and W.R. Gould. 2005. Effects of temperature, photoperiod, and *Myxobolus cerebralis* infection on growth, reproduction, and survival of *Tubifex tubifex* lineages. Journal of Aquatic Animal Health 17:338-344.

El-Matbouli, M., T.S. McDowell, D.B. Antonio, K.B. Andree, and R.P. Hedrick. 1999. Effect of water temperature on the development, release and survival of the tractinomyxon stage of *Myxobolus cerebralis* in its oligochaete host. International Journal of Parasitology 29:627-641.

Ryce, E.K.N., A.V. Zale, and R.B. Nehring. 2001. Lack of selection for resistance to whirling disease among progeny of Colorado River rainbow trout. Journal of Aquatic Animal Health 12:63-68.

Looking for more information? Check out our BIBLIOGRAPHY!

For more whirling disease research information, visit http://whirlingdisease.montana.edu. Our searchable "Bibliography" contains a growing library of books, book chapters, journal articles, conference proceedings, dissertations, government documents, and technical reports.

Whirling Disease detected at Montana's Miles City Hatchery

Annual fish health tests in November, 2005 detected a low level of whirling disease infection among rainbow trout at the Miles City Fish Hatchery. The facility, which is Montana's first hatchery to test positive for whirling disease, has been placed under quarantine. The Miles City Hatchery raises warm-water fishes like walleye, northern pike, smallmouth bass and others that are not susceptible to the disease. Rainbow trout are raised onsite as a food source for their bass brood stock, and it was among these fish that whirling disease was detected.

The source of infection is unknown at this time, but officials suspect that the fish were exposed to *Myxobolus cerebralis* in the hatchery's rearing tanks supplied by Yellowstone River water. Investigations are underway in the facility and in the Yellowstone River drainage to determine the extent and source of the infection. The quarantine will be lifted once the parasite has been eliminated from the hatchery. Montana Department of Fish Wildlife and Parks Hatchery Bureau Chief Gary Bertellotti stressed that no infected fish would be stocked into Montana waters.

Meetings and Conferences:

- Whirling Disease Symposium; February 9-10, 2006; Denver, Colorado
- Western Division American Fisheries Society Annual Meeting; May 15-19, 2006; Bozeman, Montana
- The 5th International Symposium on Aquatic Animal Health; September 2-6, 2006; San Francisco, California
- American Fisheries Society 136th Annual Meeting; September 10-14, 2006; Lake Placid, New York

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

Comments? Suggestions? Submissions?

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.

Whirling Disease Initiative Funds Vital Research in 2005-2006

Ten research projects were selected for funding through the Whirling Disease Initiative in 2005-2006. Projects cover the spectrum from risk assessment and vectors of introduction to *Tubifex* ecology. As we continue to learn about this complicated disease, management answers become more and more refined.

Current Whirling Disease Initiative Research:

Resolving uncertainties in *Myxobolus cerebralis* introduction and establishment risks
Jerri L. Bartholomew and Antonio Amandi, Oregon State University

Effect of benthic invertebrate populations, riparian zone and associated water quality on infection rates of *Tubifex tubifex* with *Myxobolus cerebralis*
Deborah Cartwright, University of Georgia
Vicki Blazer and W. Bane Schill, USGS National Fish Health Laboratory

Movements of resident and non-resident anglers in Montana: Implications of transferring whirling disease among drainages
Christopher S. Guy and Alexander V. Zale, Montana State University
Travis B. Horton, Montana Department of Fish, Wildlife and Parks

Forensic applications of otolith microchemistry for tracking sources of illegally stocked whirling disease positive trout
Brett M. Johnson, Daniel Gibson-Reinemer, Dana Winkelman, and Gregory Whitledge, Colorado State University
Patrick J. Martinez, Colorado Division of Wildlife

Whirling disease risk at multiple spacial scales
Billie Kerans, Montana State University
E. Richard Vincent, Montana Department of Fish, Wildlife and Parks

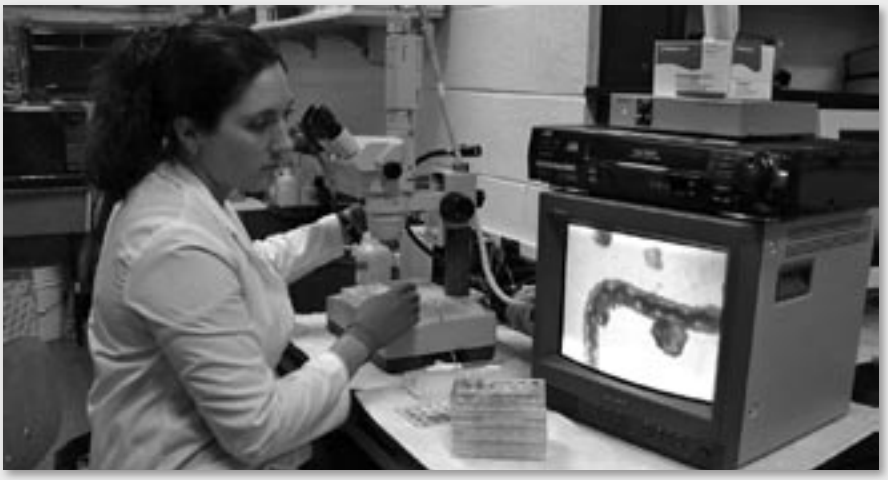
***Myxobolus cerebralis* risk to Yellowstone cutthroat trout related to variation in *Tubifex tubifex* abundance and susceptibility**
Billie Kerans, Montana State University
Todd Koel, National Park Service, Yellowstone National Park

The viability of *Myxobolus cerebralis* myxospores after passage through the alimentary canal of avian piscivores in the Greater Yellowstone ecosystem
Todd Koel, National Park Service, Yellowstone National Park
Billie Kerans, Montana State University

Characterization of whirling disease resistance patterns in rainbow trout from Harrison Lake, Montana: Classification of resistant and susceptible individuals and elucidation of the effects of recent natural selection
Eric Wagner and Chris Wilson, Utah Division of Wildlife Resources

Assessing the density and distribution of *Tubifex tubifex* lineages in Windy Gap Reservoir, Colorado
Dana Winkelman, Colorado State University
R. Barry Nehring, Colorado Division of Wildlife

Investigating competition among lineages of *T. tubifex* and the potential for biological control of whirling disease in natural streams
Dana Winkelman and Kevin Thompson, Colorado Division of Wildlife



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