

Research Findings 1997-1998 Whirling Disease Initiative

National Partnership on the Management of Wild and Native Cold Water Fisheries
Montana University System Water Center, MSU-Bozeman

Category	Title	Principal Investigator	Other Partners	Award/Match
1. Field Study		Jerri L. Bartholomew , Microbiologist Oregon State University Department of Microbiology 220 Nash Hall Corvallis, OR 97331 ph. 541.737.1856 fax: 541.737.0496 e-mail: bartholj@bcc.orst.edu	John L. Fryer, Professor Emeritus, Department of Microbiology, Oregon State University	\$40,000/\$50,420
Research Findings: While assessing the impact of whirling disease on Pacific Northwest salmonid populations is a major challenge, the initial observations indicate that: (1) whirling disease has not caused large native population losses in northeastern Oregon rivers; and (2) a balance may exist between the parasite and host. The study also examined the abundance and distribution of the <i>T. tubifex</i> worm and the TAMs stage of the parasite in the Lostine River; the environmental parameters; and, the life histories of the native salmonid species. This data will be used as the study expands to examine the dynamics of this relationship. A second objective of this study was to test the efficacy of UV irradiation for killing spores of <i>Myxobolus cerebralis</i> . The data will be useful for designing effluent treatments.				
2. Field Study	Dynamics of Whirling Disease on the Cache La Poudre River	Eric P. Bergersen , Fisheries Biologist Colorado Cooperative Fish & Wildlife Research Unit Colorado State University 201 Wagar Building Fort Collins, Colorado 80523 ph. 970.491.5396 fax: 970.491.1413 e-mail: ericb@cnr.colostate.edu	Brady Allen, GRA, Fish Pathologist, Colorado Division of Wildlife	\$34,487/\$20,000
Research Findings: The Cache la Poudre River, part of which is managed for wild trout, has experienced a dramatic rainbow population decrease from whirling disease. The fine sediment deposits in pools and alcoves below and above the Poudre Rearing Unit, along with the earthen bottom ponds within the Unit, are infected. High densities of worms—particularly <i>T. tubifex</i> —are found in these areas, but are rare elsewhere. The most heavily infected fish (rainbows and browns) were collected directly below the Rearing Unit; high densities of TAMs have been filtered from its effluent; the daily cycle of TAMs found low densities during the day, higher at night, and peaking at 4 am; other reaches of the river have no TAMs.				

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3. Field Study	Relation of Life History Type to Whirling Disease Susceptibility in Missouri River Rainbow Trout	Thomas E. McMahon , Associate Professor Montana State University Biology Department Bozeman, MT 59717 ph. 406.994.2492 fax: 406.994.3190 e-mail: ubitm@msu.oscs.montana.edu	(1) Billie L. Kerans, Assistant Professor, Biology Department, MSU-Bozeman (2) Alexander V. Zale, Asst Unit Leader, MT Cooperative Fishery Research Unit; MSU-Bozeman (3) E. Richard Vincent, Coordinator Whirling Disease Program, MTFWP (4) Steve Leathe, Regional Manager, MT Dept of FWP	\$39,786/\$61,844
Research Findings: This ongoing experiment will examine the relationships of trout life histories, worm host distribution, infection severity, and fishery response. To date, it has been found that Missouri River rainbow spawn early, their movements are extensive—sometimes 75 miles, and the population is highly productive. Whirling disease infection continues to increase in Little Prickly Pear Creek, a major spawning tributary, but no effects on the trout fishery have yet been observed. Efforts are underway to pinpoint the center of infection in Little Prickly Pear Creek and to examine environmental factors associated with infection “hot spots.” Continued trapping will allow comparisons between the productivity of infected versus uninfected streams. And temperature, which may be a critical life history determinant, will be tested as to its role in a trout population’s response to infection.				
4. Field Study	An Evaluation of Immune Responses to Whirling Disease among Trout above and below a Potential Point Source of <i>Myxobolus cerebralis</i> Infectivity in the Colorado River	R. Barry Nehring , Life Sciences Researcher IV Colorado Division of Wildlife 2300 S. Townsend Montrose, CO 81401 ph. 970.249.3431 fax: 970.249.2857 e-mail: barry.nehring@state.co.us	None	\$30,000/\$81,928
Research Findings: This ongoing experiment is comparing the immune responses of brown and rainbow trout fry, and comparing mortality rates at varying locations from the “hot spot”—Windy Gap Reservoir on the Colorado River. To date, the youngest wild rainbows exposed directly below the dam were found more likely to die than those exposed directly upstream or downstream. Average mortality: (a) above reservoir—56%, (b) spilling basin—69%, (c) bypass outlet channel—77%, (d) 26 km downstream—37% The pattern was not duplicated with the other three treatments which included brown trout, and two groups of larger and older rainbow trout.				

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5. Laboratory Study	Development of a Method for Field Collecting the Triactinomyxon Stage of <i>Myxobolus cerebralis</i> using Paired Rotating-drum Filtration	Frederic T. Barrows, Research Physiologist US Fish & Wildlife Service 4050 Bridger Canyon Road Bozeman, MT 59715 ph. 406.587.9265 ext. 130 fax: 406.582.5942 e-mail:	(1) Alexander V. Zale, Asst Unit Leader, MT Cooperative Fishery Research Unit; MSU-Bozeman (2) Thomas McMahon, Biology, MSU-Bozeman (3) Ronald P. Hedrick, Medicine Epidemiology, School of Veterinary Medicine, University of California-Davis	\$22,932/\$16,244
Research Findings: The equipment for this project was received and assembled in early 1998. Methods for collecting and enumerating TAMs are currently being developed and tested to optimize recovery rates of the parasite when used in the field.				
6. Laboratory Study	Parameters that Determine Development and Production of <i>Myxobolus cerebralis</i> in <i>Tubifex tubifex</i>	Willard O. Granath, Jr., Pathologist University of Montana Division of Biological Sciences Missoula, MT 59812-1002 ph. 406.243.2975 fax: 406.243.4184 e-mail: snail@selway.umt.edu	none	\$41,716/\$23,943
Research Findings: (1) In seeking to develop tubficid strains that resist or are susceptible to the parasite, strains were developed via parthenogenesis. Genetic characteristics were found to be distinct in each line, but parents and progeny within strains appeared homogenous. (2) In examining the effects of temperature, no difference was found on worm ingestion of spores in temperatures ranging between 5-13° C. (3) As temperatures increased, the time between spore ingestion and TAM release decreased; and, as temperatures decreased, the viability of TAMs increased. (4) In examining resistant worms, parasite DNA was detectable in all susceptible worms tested one and 24 hours post-exposure at varying temperatures; but, in resistant worms only for the first two hours after exposure. (5) To test susceptibility of oligochaetes from different drainages, the prevalence of infection of a large sample from an infected creek was 1.7%.				

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7. Laboratory Study	Tubificid Ecology and <i>Myxobolus cerebralis</i> Infections in the Madison River Drainage	Billie L. Kerans , Assistant Professor Montana State University Biology Department Bozeman, MT 59717 ph. 406.994.3725 fax: 406.994.3190 e-mail: ubibk@montana.edu	E. Richard Vincent, Coordinator Whirling Disease Program, MTFWP	\$19,078/\$18,860
Research Findings: One hopeful management strategy to decrease the impact of whirling disease is to modify the environment to make it less favorable to the worm host. This ongoing study uses a combination of <i>in situ</i> exposures of rainbow trout, combined with surveys of the worm host and environmental conditions which may influence severity in rainbow trout. The goal is to make quantitative connections among whirling disease severity, worm ecology, and environmental conditions, and to provide useful information for management of wild populations.				
8. Laboratory Study	Effects of Age, Dose, and Environmental Stress on Development of Whirling Disease in Rainbow Trout	Elizabeth MacConnell , Fish Health Biologist US Fish and Wildlife Service Bozeman Fish Technology Center 4050 Bridger Canyon Road Bozeman, MT 59715 ph. 406.587.9265 ext. 129 fax: 406.582.5942 e-mail: bmacconnell@montana.campus.mci.net	Alexander V. Zale, Asst Unit Leader and Affiliate Associate Professor MT Cooperative Fishery Research Unit; MSU-Bozeman	\$45,372/\$36,166
Research Findings: Preliminary results show that fish age and parasite doses are critical in the development of clinical whirling disease, and sub-clinical infections may be a significant factor in their over-winter survival. At one week of age, exposure to the highest dose of parasite is lethal, but young fish exposed after 13 weeks showed no symptoms. (1) <i>In fish groups of ages 1 to 11 weeks</i> , clinical signs of the disease became evident 5 weeks after high-dose exposure. (2) <i>At the age of one week</i> , after exposure to the highest dose, all fish expired and only one survived for 17 weeks. (3) <i>After 13 weeks of age</i> , no exposed fish showed clinical signs of whirling disease. (4) <i>At 7 weeks of age</i> , both stressed and unstressed fish showed clinical signs at the same time. (5) <i>At age 5 weeks or less</i> , the stamina of exposed fish was significantly less than unexposed fish.				

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9. Laboratory Study	Partnerships to Provide Integrated and Expanded Data from Promising Laboratory and Field Techniques to Enhance Understanding of Factors Affecting the Epidemiology of Whirling Disease (in process of redesign)	Christine M. Moffitt , Research Scientist Fish and Wildlife Resources Department University of Idaho Moscow, ID 83843-1136 ph. 208.885.7047 fax: 208.885.9080 e-mail: cmoffitt@uidaho.edu	(1) Kathy Clemens, Project Leader, USFWS, Dworshak Fish Health Center, Ahsahka, Idaho (2) Steven M. Huffaker, Chief, Bureau of Fisheries, Idaho Fish and Game	\$15,000/\$64,386
Research Findings: To study the prevalence of Myxobolus cerebralis this experiment used a non-radioactive in situ hybridization DNA probe applied to thin histological sections prepared from rainbow and cutthroat trout fry, and compared the findings to other techniques and other exposed fish. The results showed that field-exposed fish were more difficult to analyze with DNA probes since the natural exposure is patchy, and sample collection is more difficult. The different techniques produced similar results, but it was concluded that the prevalence of infection from a 2-day exposure was lower than in fish held 10 days and reared 4 months in the laboratory. The study recommends that longer field exposure be used to adequately evaluate the DNA probe, and more comparisons take place before any technique is accepted as the primary method for evaluating infections in natural populations.				
10. Laboratory Study	Development of New Cultured Cell Line from Salmonids	C.A. Speer , Professor and Director of Electron Microscope Facility Montana State University Veterinary Molecular Biology Bozeman, MT 59717-3610 ph. 406.994.6389 fax: 406.994.6389 e-mail: uvscs@gemini.oscs.montana.edu	none	\$20,000/\$22,902
Research Findings: Upon entering fish, the whirling disease parasite first infects epidermal tissue, then migrates through neural tissue, and then matures and produces spores in the cartilage of the head. Since this process happens over several months, this project developed techniques to generate cultures of those three kinds of cells to assist further studies on the development of the parasite, and its interactions with the tissues of the host fish. The long-term goal is to develop unconventional strategies to block the parasite's invasion, migration, and development. The study also developed an improved processing method for detecting the parasite in worm and fish hosts by using a different buffer for extracting the parasite DNA and PCR analysis.				

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11. Laboratory Study	Field and Laboratory Evaluation for Whirling Disease using a Novel Polymerase Chain Reaction Diagnostic Assay and Assessing Risk of Whirling Disease becoming Established in Wisconsin (in process of redesign)	Daniel R. Sutherland, Associate Professor Biology and Microbiology University of Wisconsin 1725 State Street La Crosse, WI 54601 ph. 608.785.6982 fax: 608.758.6959 e-mail: daniel_sutherland@mail.uwlax.edu	(1) Diane L. Waller, Research Fisheries Biologist, Upper Mississippi Science Center, USGS—NBS (2) Becky A. Lasee, Fish Health Biologist, La Crosse Fish Health Center, USFWS (3) Scott Cooper, Assistant Professor, Biology and Microbiology, University of Wisconsin-La Crosse	\$25,000/\$0
Research Findings: This study emphasized class A trout streams of the Coulee Region near La Crosse. No myxosporeans were recovered from brook and brown trout. Myxosporeans from local fish (including <i>Myxobolus</i> spp from six species of fish) did not cross react with the Hedrick-Andree PCR assay for <i>Myxobolus cerebralis</i> . Oligochaete diversity in Coulee Region trout streams is low, perhaps reflecting impacts of agriculture and reclamation. <i>T. tubifex</i> represented about 50% of all oligochaetes recovered at each site. Seasonal data suggests that reproduction is concentrated in late winter and early spring. Pure cultures of five species of oligochaetes have been established. Also, whirling disease was not found in fish examined from the Au Sable River (a tributary of Lake Huron) in lower Michigan, which had tested positive in 1996. However, the Mainstee River (a Lake Michigan tributary) that parallels the Au Sable was found to be whirling disease positive near a private trout hatchery.				
12. Manual/ Workshop	Occurrence and Distribution of Aquatic Oligochaete Worms as Related to Whirling Disease (in process of redesign)	R. Deedee Kathman , Director Aquatic Resources Center PO Box 680818 128 Holiday Court, Suite 112 (37067) Franklin, TN 37068 ph. 615.790.0172 fax: 615.790.0173 e-mail: aquatres@ix.netcom.com	Idaho Fish and Game Colorado Division of Wildlife Oregon State University Utah Department of Natural Resources	\$9,028/\$12,000
Research Findings: Manuals are available with protocols for sampling, collecting, identifying, and processing oligochaetes. Popular demand for workshops prompted a second round of funding.				