

## Project Summaries 2004 – 2005 Whirling Disease Initiative

### National Partnership for the Management of Wild & Native Cold Water Fisheries

Montana University System, MSU-Bozeman

Contract Dates: May 1, 2004 – December 31, 2005

**Total Awarded: \$661,990**

**Total Match: \$343,870**

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b>  <b>4.097</b>	<i>Non-lethal testing for Myxobolus cerebralis infection by Enzyme Linked Immunosorbent Assay (ELISA)</i>	Mark A. Adkison (Former Research Associate University of California, Davis) California Dept. of Fish and Game 2111 Nimbus Road Rancho Cordova CA 95670 ph. 916.358.2830 email: madkinson@dfg.ca.gov	(1) Dr. Ronald P. Hedrick, Professor University of California–Davis Department of Veterinary Medicine & Epidemiology School of Veterinary Medicine rphedrick@ucdavis.edu (2) Garry O. Kelley, Postdoctoral Researcher University of California–Davis Department of Veterinary Medicine & Epidemiology School of Veterinary Medicine gokelly@ucdavis.edu	\$53,542/ \$8,012

**Project Summary:**

The goal of this project is to determine the sensitivity and specificity of a *non-lethal* immune-based enzyme linked immunosorbent assay (ELISA) for the detection of *Myxobolus cerebralis* infections in fish. Currently used methods require killing the fish in question. The ELISA assay looks for and measures antibody against *M. cerebralis* circulating in the serum of trout, which can be collected without harming the fish in question. More specifically, the project goal is to determine how early researchers can consistently identify infected fish by measuring anti-*M. cerebralis* Ig in their serum. Confident in the sensitivity of the ELISA assay itself, researchers will be attempting to determine when fish produce enough *M. cerebralis* antigen-specific Ig to detect. They also want to confirm the belief that TAM lysate antigens are sufficient to measure Ig produced at all stages of the infection.

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b>  <b>4.098</b>	<i>Assessment of the risk of Myxobolus cerebralis introduction as a result of straying adult steelhead and spring Chinook salmon in the Columbia River Basin</i>	Jerri L. Bartholomew, Microbiologist Oregon State University Department of Microbiology 200 Nash Hall Corvallis, OR 97331 ph. 541.737.1856 fax: 541.737.0496 e-mail: Jerri.Bartholomew@oregonstate.edu	(1) Antonio Amandi, Acting Project Leader, Oregon Dept of Fish and Wildlife, Fish Health Services Oregon State University Dept of Microbiology 220 Nash Hall, Oregon State University amandia@onid.orst.edu (2) Susan K. Gutenberger, Supervisory Microbiologist, USFWS, Underwood, WA Susan_Gutenberger@fws.gov	\$153,173/ \$66,369

**Project Summary:**

One of the critical unknowns for managing systems containing anadromous fish is whether straying of infected adult fish plays a significant role in introducing *Myxobolus cerebralis*, and other pathogens, to new areas. Data from the Deschutes River risk assessment suggests that this is true. However, it is likely that stray rates differ between rivers. Analysis of data for recovery locations of adult salmon could identify rivers at high risk for introduction.

This project assesses the role of straying adult steelhead and spring Chinook salmon in disseminating *M. cerebralis* in the Columbia River Basin (CRB). The study integrates and expands on previous work on the effects of *M. cerebralis* on anadromous salmonids in the upper CRB, risk management assessments conducted on the Deschutes River (central CRB), and current investigations on establishment of the parasite in a tributary of the lower CRB. Specific study objectives are to: (1) estimate the frequency of adult salmonids straying into tributaries of the lower and mid-Columbia River, (2) determine the proportion of these fish infected with *M. cerebralis*, (3) integrate this data with existing data from the Deschutes River to develop estimates of introduction risk for these tributaries, and (4) determine infection efficiency under differing *T. tubifex* densities, susceptibilities, and under different flow regimes using a laboratory model.

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b>  <b>4.099</b>	<i>Susceptibility of Rio Grande cutthroat trout (Oncorhynchus clarki virginalis) to experimentally induced infection with Myxobolus cerebralis</i>	Colleen Caldwell Research Fishery Biologist, Assistant Leader New Mexico State University US Geological Society New Mexico Cooperative Fish and Wildlife Research Unit MSC 4901, Box 30003 Las Cruces, NM 88003-8003 ph. 505.646.8126 fax: 505.646.1281 e-mail: ccaldwel@nmsu.edu	Robert DuBey, New Mexico State University, Department of Fishery and Wildlife Sciences Box 30003, MSC 4901 Las Cruces, NM 88003-8003 Phone: 505-646-1544 rdueby@nmsu.edu	\$53,235/ \$8,736
<p><b>Project Summary:</b>            This project will evaluate the susceptibility of Rio Grande cutthroat trout (RGCT; <i>Oncorhynchus clarki virginalis</i>) to infection by <i>Myxobolus cerebralis</i> through paired laboratory challenges using commercially-reared rainbow trout of known sensitivity to whirling disease. RGCT presently occupies a fraction of its presumed historic range, and is considered “at risk” by the New Mexico Department of Game and Fish and “imperiled” by the US Fish and Wildlife Service. If <i>M. cerebralis</i> were to spread into genetically isolated populations of RGCT, they would be at great risk of infection. Increased disease susceptibility of several cutthroat trout subspecies when compared to rainbow trout has been demonstrated using sentinel fish. This study will use a controlled laboratory approach using a suite of diagnostic metrics to provide a more quantitative estimate of susceptibility for RGCT. Diagnostic metrics will include mortality, clinical symptoms (behavioral and skeletal abnormalities), histology, and DNA diagnostics of <i>M. cerebralis</i> (nested PCR) in both RGCT and rainbow trout. Accurate assessment of RGCT susceptibility will allow fisheries management agencies to formulate risk management strategies to mitigate for the devastating effect of infection.</p>				

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b> <b>4.100</b>	<i>Evaluation of increased survival of young-of-the-year wild rainbow trout in the upper Madison River in the face of increased whirling disease infection intensities in wild rainbow trout spawning areas</i>	Patrick T. Clancy, Fisheries Biologist Montana Department of Fish Wildlife and Parks Ennis, MT 59729 Phone: 406.682.7807 pcensfwp@3rivers.net	Billie L. Kerans, Assistant Professor Montana State University Biology Department Bozeman, MT 59717 ph. 406.994.3725 fax: 406.994.3190 e-mail: bkerans@montana.edu	\$23,911/ \$7,500
<p><b>Project Summary:</b>            Whirling disease remains a serious problem in the Madison River of Montana. From the disease's onset in 1990, the recruitment of young wild rainbow trout into the fish population of the upper Madison River has been seriously compromised. The goals of this project are to: (1) determine if existing wild rainbow trout in the Madison River are beginning to develop some resistance to severe infections by <i>M. cerebralis</i>; (2) determine if the wild rainbow trout resident to the upper Madison River has changed their primary spawning, hatching, and rearing sites from the sites utilized in 1998-99; (3) determine if the wild rainbow trout resident to the upper Madison River are spawning at a earlier or later time period than found in 1998-99, when the potential for high infection rates of hatching and emerging young rainbow are less likely to occur; and (4) determine if there has been a change in the rate or level of infection of <i>Tubifex tubifex</i> worm populations in various side channels that were heavily utilized by spawning rainbow trout in the late 1990s.</p>				

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b> <b>4.101</b>	<i>Analysis of epidemiology data for whirling disease in the Rock Creek (Montana) drainage: 1998-2003</i>	Willard O. Granath Jr. University of Montana Division of Biological Sciences 32 Campus Drive #4824 Missoula, MT 59812-1002 ph. 406.243.2975 fax: 406.243.4184 e-mail: bill.granath@mso.umt.edu	None	\$49,678/ \$16,750
<p><b>Project Summary:</b></p> <p>During the summer of 1998, a study of whirling disease was initiated in the Rock Creek Watershed, Montana with the expectation that this would be a long-term research effort. These studies have continued uninterrupted to date and have brought together the expertise of numerous qualified investigators. The following has been learned about <i>Myxobolus cerebralis</i> in Rock Creek: (1) both the prevalence and severity of <i>M. cerebralis</i> infections in sentinel rainbow trout increased dramatically throughout the drainage between 1998 and 2003; (2) an increase in disease severity was not accompanied by an increase in the number of <i>T. tubifex</i> recovered or an increase in the prevalence of <i>M. cerebralis</i> infected <i>T. tubifex</i>; (3) the parasite is still expanding its range within Rock Creek; (4) sentinel fish become infected at many sites where no infected <i>T. tubifex</i> are recovered and it is likely that fish at these sites are being infected by TAMs that originated miles upstream; and (5) decreasing stream flow is likely to play a major role in increasing disease severity.</p> <p>Since 1998, a large data set of epidemiological data for Rock Creek has been generated, including the following:</p> <ol style="list-style-type: none"> <li>(1) Disease severity in trout, using sentinel cages placed throughout the Rock Creek drainage,</li> <li>(2) Prevalence of <i>M. cerebralis</i> in <i>T. tubifex</i> from numerous locations throughout Rock Creek,</li> <li>(3) Quantitative macroinvertebrate sampling throughout Rock Creek,</li> <li>(4) Habitat evaluation of Rock Creek using EPA habitat assessment protocols,</li> <li>(5) Water quality measurements (temperature, pH, dissolved oxygen, total dissolved solids, etc.) at sentinel cage and other locations, and</li> <li>(6) Water flow measurements (since 2001) at sentinel cage and other sites. These data require significant analysis and interpretation which should lead to a better understanding of disease transmission in this drainage, and will aid fishery biologists in making management decisions.</li> </ol> <p>The major goal of this project is to analyze the data generated from performing the above, and to submit these data in the form of manuscripts to peer-reviewed journals.</p>				

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b>  <b>4.102</b>	<i>Movements of resident and non-resident anglers in Montana: implications of transferring whirling disease among drainages</i>	Dr. Christopher S. Guy Montana Cooperative Fishery Research Unit Lewis Hall Montana State University Department of Ecology Bozeman, MT 59717 Phone: 406.994.3491 cguy@montana.edu	(1) Dr. Alexander V. Zale Montana Cooperative Fishery Research Unit Montana State University Department of Ecology Bozeman, MT 59717 Phone: 406-994-2380 zale@montana.edu  (2) Travis B. Horton Montana Dept of Fish Wildlife and Parks 4600 Giant Springs Road Great Falls, MT 59405 Phone: 406-454-5853 thorton@state.mt.us	\$49,993/ \$15,469

**Project Summary:**

Whirling disease remains a problem throughout much of the Intermountain West. Despite numerous studies on the biology of *Myxobolus cerebralis*, little is known about the incidental transfer of *M. cerebralis* among drainages by anglers. It is highly likely that anglers can transfer *M. cerebralis* based on the data that myxospores are found in the sediment, myxospores are highly resilient to environmental stress, fishing equipment often captures benthic sediment, and anglers are highly mobile organisms. Therefore, this research study will identify the likelihood of detecting myxospores relative to sediment amount, quantify the amount of angler movement among basins, quantify amount of sediment on angling equipment, determine if the sediment on angling equipment contains myxospores, and determine sediment load and presence of myxospores on various wader and boot types. The results from this study will be useful in developing management strategies to reduce the spread of whirling disease and other invasive species throughout Montana and likely most of the Intermountain West.

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b>  <b>4.103</b>	<i>Forensic applications of otolith microchemistry for tracking sources of illegally stocked whirling disease positive trout</i>	Dr. Brett M. Johnson Associate Professor Department of Fishery and Wildlife Biology, Colorado State University 1474 Campus Delivery Fort Collins, CO 80523-1474 Phone: 970.491.5002 Fax: 970.491.5091 <a href="mailto:brett.Johnson@colostate.edu">brett.Johnson@colostate.edu</a>	(1) Patrick J. Martinez, Aquatic Researcher Aquatic Research Section Colorado Division of Wildlife 711 Independent Drive Grand Junction, CO 81505 Phone: 970-255-6141 Fax: 970-255-6111 Pat.martinez@state.co.us (2) Dr. Dana Winkelman, Professor and Leader Colorado Cooperative Fish and Wildlife Research Unit 1474 Campus Delivery Colorado State University Fort Collins, CO 80523-1474 Phone: 970-491-1414 dlw@cnr.colostate.edu (3) Dr. Gregory Whitley, Postdoctoral Research Assistant Dept of Fishery and Wildlife Biology, Colorado State University 1474 Campus Delivery Fort Collins, CO 80523-1474 Phone: 970-491-2749 whitgw@cnr.colostate.edu	\$49,963/ \$19,456
<p><b>Project Summary:</b></p> <p>Maintenance of viable, self-sustaining wild and native trout fisheries is jeopardized by the spread of whirling disease, but the extent to which illegally stocked, whirling disease positive fishes have contributed to this spread has been difficult to assess. This project seeks to develop a reliable method for determining origins of illegally stocked, whirling disease positive trout through microchemical analysis of otoliths. The research will be conducted collaboratively between Colorado State University and Colorado Division of Wildlife Aquatic Research. Colorado State University and CDOW are already developing otolith microchemistry techniques for determining origins and movement patterns (collectively termed "provenance") of nonnative fishes in Colorado River Basin. This research has three primary components aimed at (1) determining the geographic resolution possible based on chemical signatures of otoliths and water samples from CDOW hatcheries throughout Colorado, (2) assessing the utility of these signatures for tracing hatchery origins of fish at large, and (3) determining variation in microchemical fingerprints and isotopic signatures of otoliths obtained from select private hatchery fish, and assessing the utility of these signatures for tracing hatchery origins of fish at large.</p>				

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b>  <b>4.104</b>	<i>Use of high resolution thermal imagery as a tool to locate Tubifex tubifex in Pelican Creek, a Myxobolus cerebralis positive stream in Yellowstone National Park</i>	Billie L. Kerans, Assistant Professor Montana State University Biology Department Bozeman, MT 59717 ph. 406.994.3725 fax: 406.994.3190 e-mail: bkerans@montana.edu	Todd Koel, Supervisory Fisheries Biologist, Fisheries and Aquatic Sciences Section, Center for Resources PO Box 168, Yellowstone National Park, WY 82190 and Affiliate Professor, Department of Ecology, Montana State University Phone: 307-344-2281 todd_koel@nps.gov	\$67,378/ \$119,539
<p><b>Project Summary:</b> <i>Myxobolus cerebralis</i> is the cause of a recent, significant decline of spawning, native Yellowstone cutthroat trout in Pelican Creek, a large tributary to Yellowstone Lake. The goal of this project is to examine the potential of high resolution, thermal imagery and habitat characteristics to detect "hot spots" of <i>M. cerebralis</i> infection and high <i>T. tubifex</i> abundance. Water temperature plays a critical role in development of the parasite in fish and oligochaetes and of disease in fish. In an aerial flyover, NASA mapped the thermal regime of Pelican Creek using a high-resolution thermal imaging (2.5m resolution) sensor (ATLAS). Researchers will validate this thermal imaging as a tool for locating areas of high <i>M. cerebralis</i> severity by linking it with infection risk, assessed using infection in tubificids. Specific project objectives are to: (1) document <i>M. cerebralis</i> infection risk in Pelican Creek using infection in <i>T. tubifex</i> and sentinel fish exposure (where possible); (2) assess the habitat characteristics (both physical and chemical) where tubificids are collected; and (3) correlate <i>M. cerebralis</i> infection risk to habitat characteristics and high resolution, thermal imagery. The outcome of this work may result in a non-invasive tool to target areas of high <i>M. cerebralis</i> infection in stream systems of the Intermountain West.</p>				

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b> <b>4.105</b>	<i>Myxobolus cerebralis</i> in a pristine environment: the role of American white pelicans as a dispersal vector in the Greater Yellowstone Ecosystem	Todd Koel, Supervisory Fisheries Biologist, Fisheries and Aquatic Sciences Section, Center for Resources PO Box 168, Yellowstone National Park, WY 82190 and Affiliate Professor, Department of Ecology, Montana State University Phone: 307.344.2281 todd_koel@nps.gov	Dr. Billie Kerans, Associate Professor Department of Ecology Montana State University 311B Lewis Hall Bozeman, MT 59717 Phone: 406-994-3725 Fax: 406-994-3190 bkerans@montana.edu	\$35,219/ \$26,315
<p><b>Project Summary:</b> <i>Myxobolus cerebralis</i>, the invasive exotic parasite that causes whirling disease in wild and native salmonids of the Intermountain West, is prevalent in native Yellowstone cutthroat trout <i>Oncorhynchus clarki bouvieri</i> throughout Yellowstone Lake. Infection severity is extremely high in Pelican Creek, the second largest cutthroat trout spawning tributary and a common foraging stream for American white pelicans <i>Pelecanus erythrorhynchos</i>. Dissemination of <i>M. cerebralis</i> in the region is blamed primarily on movement of infected fishes by humans. However, no fishes have been (legally) transported to the waters of the Yellowstone Lake basin or in many places elsewhere in Wyoming where the parasite now exists. The goal of this study is to determine the potential of American white pelicans as a dispersal vector for <i>M. cerebralis</i>. In the Yellowstone Lake ecosystem and elsewhere, white pelicans are feeding, moving among waters, and defecating. Unknown is the potential viability of any defecated <i>M. cerebralis</i> myxospores. Specific project objectives are to: (1) examine white pelican feces for the presence of <i>M. cerebralis</i>, and (2) determine if any defecated myxospores are capable of infecting <i>Tubifex tubifex</i> resulting in viable <i>M. cerebralis</i> triactinospores. Little is known about the vectors of dissemination of <i>M. cerebralis</i>. The results of this study will provide some of the first information on the potential of a common avian piscivore, the American white pelican, to spread <i>M. cerebralis</i> among waters in Yellowstone National Park and throughout the western United States.</p>				

Project #	Title	Principal Investigator	Other Partners	Award / Match
<b>Project #</b> <b>4.106</b>	<i>The potential of vehicles and fomites to transfer the agent of whirling disease</i>	Paul W. Reno, Associate Professor Oregon State University Hatfield Marine Science Center 2030 S. Marine Science Dr. Newport, OR 97365-5296 Phone: 541.867.0147 paul.reno@oregonstate.edu	None	\$70,892/ \$42,560
<p><b>Project Summary:</b></p> <p>The general goals of this study are to determine the likelihood of transferring the agent of whirling disease from site to site by a mechanism other than movement of fish. Two potentially likely indirect methods of transfer to be examined are passive transfer by birds and movement via contaminated wader boots. Specific project objectives are: (1) to determine if piscivorous/scavenger/herbivorous birds can transfer the agent of whirling disease to either piscine or tubificid hosts over a short time interval, thereby emulating scenarios that might occur in a field situation, and (2) to determine if angler-associated fomites, specifically waders, can transfer the agent of whirling disease to either piscine or tubificid host over a short time interval, emulating inadvertent transfer from watershed to watershed during fishing.</p>				

Project #	Title	Principal Investigator	Other Partners	Award / Match
<p><b>Project #</b> <b>4.107</b></p>	<p><i>The role of sediment size distribution and other microhabitat factors in the abundance and relative dominance of various T. tubifex lineages</i></p>	<p>Dr. Dana Winkelman, Leader Colorado Cooperative Fish and Wildlife Research Unit Room 201, Wagar Building Colorado State University Fort Collins, CO 80523 Phone: 970.491.1414 Fax: 970.491.1413 dlw@cnr.colostate.edu</p>	<p>(1) Terry Waddle, Hydrologist USGS Fort Collins Science Ctr. 2150 Centre Ave, Bldg C Fort Collins, CO 80526 Phone: 970-226-9386 terry_waddle@usgs.gov (2) Kevin Thompson, Fisheries Biologist, Colorado Div of Wildlife 2300 S. Townsend Ave. Melrose, CO 81401 Phone: 970-252-6037 kevin.thompson@state.co.us (3) Jim Terrell, Fish &amp; Wildlife Biologist, USGS Fort Collins Science Ctr., 2150 Centre Ave, Bldg C Fort Collins, CO 80526 Phone: 970-226-9416 Jim_terrell@usgs.gov (4) Robert Milhous, Hydraulic engineer, USGS Fort Collins Science Ctr., 2150 Centre Ave, Bldg C Fort Collins, CO 80526 Phone: 970-226-9322 Robert_milhous@usgs.gov</p>	<p>\$55,006/ \$13,164</p>
<p><b>Project Summary:</b> Ongoing whirling disease research and monitoring by the Colorado Division of Wildlife (CDOW) in Spring Creek and the William's Fork River indicate that these sites are dominated by different strains of <i>T. tubifex</i> that differ in their susceptibility to infection by whirling disease. In this study, researchers will examine the relationship between habitat variables and the distribution and abundance of <i>T. tubifex</i> lineages in these systems. Potential differences in habitat requirements for the different strains will be evaluated by comparing strain abundance and dominance (as determined by PCR analysis and paired kicknet/core samples) with particle size distributions and organic content of core samples at each stream sites. Researchers will conduct similar evaluations on the Poudre River in 2005 to assess habitat relationships in another system.</p>				