Montana Cooperative Fishery Research Unit

2013 Briefing Booklet

MONTANA COOPERATIVE
FISHERY RESEARCH UNIT

Coordinating Committee Meeting
Missoula, Montana
10 April 2013

Personnel and Cooperators

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    Research Scientist

Cooperators and Collaborators

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Wyoming Game and Fish Department
Paul Gerrity
Rob Gipson
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Current Graduate Students Advised by Unit Faculty

Alex Anderson	M.S.
Jan Boyer	M.S.
Mike Duncan	Ph.D.
Carter Fredenberg	M.S.
Ben Galloway	M.S.
Andrew Gilham	M.S.
Sean Lewandoski	M.S.
Ann Marie Reinhold	Ph.D.
Austin McCullough	M.S.
David Ritter	M.S.
John Syslo	Ph.D.
Brittany Trushel	Ph.D.
Brian Tornabene	M.S.
Patrick Uthe	M.S.

Current Graduate Students Advised by Cooperating Faculty

Kristen Homel	Ph.D.
Eric Scholl	Ph.D.
Shane Vatland	Ph.D.

Research Technicians 2012

Charles Birch	Nick Larson	Andrew Marx
Henry Busch	Nate Laulainen	Michael Moore
Cole Erickson	Ian Maddaus	Jordan Rowe
Chad Gabreski	Colin Manning	Nick Rubino
Luke Holmquist	Nathan Marotz	Michael Stein

Graduate Students Receiving Degrees in 2012

Russell Smith graduated with a M.S. in Plant Science and is working for K.C. Harvey Inc. as a Senior Environmental Science Project Manager.

2012 Statement of Direction

Research of the Montana Cooperative Fishery Research Unit will continue to focus on applied fisheries-management problems and issues. Our studies are initiated in response to the needs of the Cooperators and other management agencies and are designed to provide information useful in directly improving management of aquatic resources. Technical areas of special emphasis include habitat associations and requirements of fishes, large-river fish assemblages, native aquatic community restoration, effects of exotic fishes on native species, and regulated-river and reservoir fisheries. Other topics are addressed as needed, in keeping with the Cooperative Research Program's mission to best meet the needs of the Cooperators by remaining flexible and open to new areas of inquiry, as exemplified by our current emphasis on prairie streams. When Cooperator's needs occur outside our areas of expertise, we will recruit the assistance of appropriate University faculty.

Unit staff will advance the training and education of graduate students in fisheries science at Montana State University by teaching up to one graduate-level course per year, chairing graduate committees of Unit students, and serving on graduate committees of non-Unit students. In-service training will be provided to Cooperators and other agencies as the need exists.

Distribution, abundance, and movement of native cutthroat trout in the Snake River below Jackson Lake

Investigators

Robert Gresswell
USGS Northern Rocky Mountain Science Center

Graduate Student

Kristen Homel, Ph.D.

Collaborators

Rob Gipson
Wyoming Game and Fish Department
Sue O'Ney
National Park Service

Project Duration

January 2008 – January 2012
Completed

Funding

National Park Service, USGS RWO 57, MSU index 4W1974

Life-history diversity, movement patterns, and habitat associations of cutthroat trout *Oncorhynchus clarkii* have been widely studied in smaller river systems and are critical components of conservation planning. However, much less is known about how the patterns observed in smaller systems may "scale up" in larger, complex river systems. We evaluated the life-history variation and spatial ecology of Snake River finespotted cutthroat trout *O. c. behnkei* in the upper Snake River (Wyoming) and collaborated on a statistical method to characterize habitat occupancy from radio-telemetry data. We identified the life-history diversity and movement patterns of cutthroat trout in a large river network using radio-telemetry. Results indicated that life-history diversity in large river networks is substantially more complex than may be observed in headwater systems. Spawning occurred from May through July in spring creeks, tributaries, and side channels of the upper Snake River, a spatial extent of over 100 km. Post-spawning movement patterns varied among spawning areas and life-history strategies. We collaborated on a method to address three biases in radio-telemetry datasets: (1) data may be collected at sparse, unequal sampling intervals, (2) encountering an individual in a location does not imply occupancy, and (3) all locations between where individuals are encountered are occupied to some extent, despite the lack of observations. The resulting adaptive kernel density interpolation method treated location as a utilization distribution for each tracking interval (e.g., a week), such that the estimated time spent per location was a function of individual movement speed and time since last relocation. We evaluated habitat occupancy and movement patterns at multiple spatiotemporal scales. Spatial variation and hierarchical structure in the physical template interacted to produce contextual variation in the availability and function of habitat attributes (e.g., wood functioning as cover or as a velocity break). Collectively, these studies provide a more complete understanding of life-history diversity in a large river network and the way in which contextual variation in the physical template shapes habitat occupancy, and movement patterns.

Total Project Cost		$ 75,270.60
Beginning Balance - January 2012		$ 171.00
Expenditures - January 2012		
Salaries and Benefits	$ -0-	
Supplies	$ -0-	
Travel	$ -0-	
Tuition	$ -0-	
IDCs @ 15%	$ -0-	
Total Spent		$ -0-
Balance returned to sponsor		$ 171.00
Waived IDCs		$ -0-

Phytoremediation and revegetation of highly salinized, emerging shorelines of Hailstone Basin National Wildlife Refuge consequent to reservoir dewatering by upslope water spreading and evaporation

Investigators

James W. Bauder, Professor
MSU Land Resources and
Environmental Sciences

Collaborators

Robert Dunn, Laura Smith
Westscape Native Plants
Nursery

Graduate Student

Russell Smith, M.S.

Project Duration

December 2009 – January 2014

Funding

U.S. Fish and Wildlife Service
USGS RWO 62
MSU index 4W2934

Hailstone National Wildlife Refuge, located about 3.5 miles northeast of Rapelje, Montana, is part of the Big Lake Complex, a large drainage area beginning with Hailstone Basin to the north and ending at the state-owned and managed Big Lake to the south. This complex is one of the most productive breeding grounds for migratory birds and waterfowl in central Montana. The refuge has also served in the past as a principal stop-over flight for migratory birds of the Intermountain and Central Flyways. Hailstone Refuge is in wide-open short grass prairie country dominated by rocky outcroppings, small grassy hills, and a large alkaline playa, a remnant of dewatering the Refuge impoundment in 2011-2012. Prior to dewatering, anthropogenic factors, which include (1) restricted flows out of the Basin due to construction of an impoundment at the southern end of the Basin, and (2) discharges of saline water via ephemeral tributary channels into the basin as a consequence of long-term crop-fallow dryland cereal grain production on the northern fringe of the Basin, collectively have contributed to progressively increasing salinity and selenium levels within the remnant basin and previous shorelines of the impoundment. The U.S. Fish and Wildlife Service dewatered the Basin in 2010-2011, thereby reducing the open-water salinity and selenium hazards to migratory birds. In concert with this effort, this project has 1) completed a detailed characterization of plant communities existing and adaptable to the emerging lakebed conditions, 2) developed detailed quantification of abiotic factors either limiting or capable of allowing establishment of sustainable plant communities in saline-sodic environments, 3) identified and implemented on a trial basis bioremediation practices and proactive management strategies that are facilitating sustainable plant communities that are both stabilizing salt-rich land surfaces subject to wind scouring and sequester/volatilize soil-borne selenium, and 4) established large-scale field demonstrations and trials that will serve as prototype settings and long-term monitoring locations. The project has been able to establish, on a trial basis, expansive areas of sustainable, salt-tolerant plant communities across the recently exposed lake-bottom sediments and exposed shorelines. Tasks completed during this reporting period included 1) field testing and use of self-contained selenium volatilization trapping chambers to assess specific plant species capabilities for volatilizing soil-borne selenium, 2) assessment of 2011 planting trials, and 3) completion of planting of large-scale demonstration plots and revegetation of exposed shoreline and lakebed sediments, incorporating diverse species selections, mechanical surface manipulations, and multiple planting techniques.

Total Project Cost		$411,484.40
Beginning Balance – January 2012		$131,724.23
Additional Funding – 2012		$ 88,556.61
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 23,925.24	
Contracted Services	$ 35,136.92	
Supplies	$ 2,128.89	
Communications	$ 271.98	
Travel	$ 825.68	
IDCs @ 15%	$ 9,343.27	
Total Spent		$ 71,631.98
Balance		$148,648.86
Waived IDCs		$ 18,063.73

Limiting factors, thermal refuges, and connectivity in the Smith River system
(aka Tenderfoot Creek—Bair Ranch Foundation Fisheries Research)

Investigators
Alexander Zale
Unit Leader, MTCFRU

Collaborators
George Liknes
Montana Fish, Wildlife and Parks

Graduate Student
T. David Ritter, M.S.

Funding
Montana Fish, Wildlife and Parks
MSU index 4W2688

Project Duration
July 2009 – December 2013

The Smith River is a popular recreational sportfishery in western Montana, but salmonid abundances there are relatively low and believed to be potentially limited by high summer water temperatures and low discharges resulting from irrigation withdrawals and land-management practices. Smith River tributaries may serve as thermal refuges during summer and also as important spawning and nursery areas. If so, then maintaining connectivity between the mainstem river and its tributaries would be a management priority. Such use would also help identify deficiencies in the mainstem that could potentially be corrected through habitat or water management. Moreover, an understanding of salmonid habitat use and management in a thermally stressed and dewatered system could help identify potential global climate change adaptation management strategies and tactics. Our goal is to identify limiting factors in the Smith River system and evaluate the importance of its tributaries as spawning and nursery areas and thermal refuges. Our focus is on the lower reaches of Tenderfoot Creek, a largely undeveloped major tributary to the Smith River. Five PIT-tag stations were installed throughout the lower 13.6 kilometers of Tenderfoot Creek and operated intermittently, primarily during summer. This PIT-tag detection network monitored the seasonal movements of about 750 tagged fish. Abundances were estimated by depletion electrofishing surveys, mark-recapture studies, and snorkeling. Fish abundance was high in areas of low temperature, and mountain whitefish and brook trout exhibited distinct spatial patterns throughout the study reach. Autumn spawning surveys in 2011 and 2012 resulted in the location of 47 and 83 brown trout redds, respectively, and our detection network showed an annual spawning migration. In addition, hundreds of mountain whitefish were captured during autumn fish weir operation and detected on our fixed stations, providing evidence that Tenderfoot Creek serves as an important spawning area for brown trout and mountain whitefish. We are currently examining and modeling the relationships among fish movements and abundances and stream temperatures and discharges.

Total Project Cost		$145,003.00
Beginning Balance - January 2012		$ 24,867.57
Additional Funding – 2012		$ 57,195.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 22,534.37	
Contracted Services	$ 198.34	
Supplies	$ 3,360.40	
Communications	$ -0-	
Travel	$ 3,400.57	
Rent	$ -0-	
Repairs Maintenance	$ 210.80	
Tuition	$ 1,561.05	
Total Spent		$ 31,265.53
Balance		$ 50,797.04
Waived IDCs		$ 13,756.83

Effects of abiotic and biotic factors on life history characteristics and vital rates of Yellowstone cutthroat trout in a headwater basin

Investigators

Robert Al-Chokhachy
USGS Northern Rocky Mountain Science Center
Alexander Zale
Unit Leader, MTCFRU

Collaborators

Jeffrey Kershner, USGS, Northern Rocky Mountain Science Center
Rob Gipson, Wyoming Game and Fish Department

Graduate Student

Patrick Uthe, M.S.

Project Duration

March 2012 - June 2014

Funding

U.S. Geological Survey, Priority Ecosystems Science Program, RWO 67**,** MSU index 4W3919, 4W4253

Habitat degradation and introduction of non-native salmonids have caused substantial declines in abundance and distribution of Yellowstone cutthroat trout. Additionally, global climate change is expected to exacerbate current threats through changes to thermal regimes, hydrology, stream productivity, and distributions of non-native species. Understanding how factors such as climate and local stressors (e.g., non-native species) interact to affect Yellowstone cutthroat trout is critical for developing management strategies to enhance future persistence. However, research investigating relationships among these factors and life history characteristics and vital rates of Yellowstone cutthroat trout is lacking. Therefore, we are examining the influences of temperature, streamflow, food availability, and presence of brook trout on life history characteristics of Yellowstone cutthroat trout in Spread Creek, Wyoming. We are using passive integrated transponder (PIT) tags and a combination of stationary and mobile PIT tag antennae within a capture-recapture framework to monitor growth, movement, and survival of Yellowstone cutthroat trout and brook trout throughout the Spread Creek drainage. In 2012, we tagged 375 trout in the summer (320 Yellowstone cutthroat and 55 brook trout) and 391 trout in the autumn (324 Yellowstone cutthroat and 67 brook trout). We estimated growth rates of 43 Yellowstone cutthroat trout and 19 brook trout recaptured in the autumn. Significant differences in growth rates existed among streams, but not between species. These differences were not caused by temperature, but were influenced by interactions of streamflow, fish densities, and prey abundances. We made 478 total detections on 385 different trout during mobile PIT tag surveys in 2012. Considerable differences existed in frequencies of movements between species and among tributaries. This multiyear project will provide information to aid in restoration efforts and help refine climate risk assessments to better prioritize future conservation actions.

Total Project Cost		$ 64,744.00
Beginning Balance – March 2012		$ 13,743.00
Additional Funding – 2012		$ 51,001.00
Expenditures – March 2012 - December 2012		
Salaries and Benefits	$ 17,317.55	
Supplies	$ 505.01	
Communications	$ -0-	
Travel	$ 7,327.81	
Tuition	$ 1,599.00	
IDCs @ 15% 4W3919	$ 3,634.43	
IDCs @ 0% 4W4253	$ -0-	
Total Spent		$ 30,383.80
Balance		$ 34,360.20
Waived IDCs 4W3919		$ 7,026.52
Waived IDCs 4W4253		$ 1,108.80
Waived IDCs TOTAL		$ 8,135.32

Grazing effects on stream fish assemblages on Blackfeet Nation lands

Investigators

Alexander Zale
Unit Leader, MTCFRU
Bradley Shepard
Western Conservation Society

Collaborators

Robert Bramblett, MSU
Andrea Litt, MSU
Keith Tatsey, Blackfeet Community College

Graduate Student

Andrew Gilham, M.S.

Funding

Wildlife Conservation Society
MSU index 423187

Project Duration

June 2012 – December 2014

We are evaluating aquatic conditions in ten headwater streams with various levels of past livestock grazing within, and adjacent to, lands of the Blackfeet Nation located on the East Front of the Rocky Mountains near Glacier National Park. This research is a cooperative effort between the Wildlife Conservation Society, the U.S. Fish and Wildlife Service, the Blackfeet Fish and Wildlife Department, the Montana Cooperative Fisheries Research Unit, and the Blackfeet Community College. Originally, this study was developed to compare grazing effects of domestic cattle and bison on stream morphology and fish abundance; however, field reconnaissance in 2012 revealed that no analogous streams existed where bison or cattle grazing occurred on the reservation. Consequently, we are assessing effects of cattle and horse grazing on fish assemblages and also sampling streams where future bison reintroduction is proposed. Fish asemblage compositions, abundances of trout species, and habitat conditions are being estimated in two 150 m long sample sections within each of the ten study streams. Study streams were selected based on fish assemblages, level of livestock grazing, and physical characteristics (basin area, order, discharge, size). Three of the streams have little to no obvious grazing effects whereas the other seven have varying levels of effects. Hoof print and scat surveys are being used to quantify relative grazing use. A combination of electrofishing and netting gears are being used to sample fish. Habitat condition of stream channels (wetted width, average depth, thalweg depth), stream banks (proportion undercut and trampled by livestock), streambed composition (proportion of each size class and embeddedness), and riparian vegetation (vertical structure, community composition, and livestock use) are also being assessed at each sample site.

Total Project Cost		$ 39,104.16
Beginning Balance – June 2012		$ 39,104.16
STIP interest 2012		$ 23.08
Expenditures – June 2012 - December 2012		
Salaries and Benefits	$ 7,973.18	
Supplies	$ 1,740.01	
Travel	$ 2,400.00	
Total Spent		$ 12,113.19
Balance		$ 27,014.05

Assessment of population and assemblage level effects of the Exxon oil spill on Yellowstone River fishes

Investigators

Alexander Zale
Unit Leader, MTCFRU
Robert Bramblett
Assistant Research Professor
Michael Duncan, MTCFRU
Ann Marie Reinhold, MTCFRU

Collaborators

Larry Peterman, LP Consulting, LLC
Doug Martin, Natural Resource Damage Program

Project Duration

June 2012 – June 2013

Funding

Montana Natural Resource Damage Program
MSU index 4W4011

Fish sampling (fyke and trammel nets, electrofishing) was conducted on the Yellowstone River from July to October 2012 at sites where samples had been collected prior to 2011. Fish were identified, measured, and examined before being released. All sampling was completed as planned. An interim report was submitted to the Natural Resource Damage Program on 1 January 2013 and a final report was submitted on 1 April 2013. A confidentiality agreement prevents the disclosure of any results without prior written consent of the State of Montana.

Total Project Cost		$ 33,400.00
Beginning Balance – June 2012		$ 33,400.00
Expenditures – June 2012 - December 2012		
Salaries and Benefits	$ 12,744.25	
Contracted Services	$ 165.00	
Supplies	$ 2,167.63	
Travel	$ 2,736.41	
Rent	$ 850.00	
Repair and Maintenance	$ 747.80	
Tuition	$ 1,599.00	
IDCs @ 0%	$ -0-	
Total Spent		$ 21,010.09
Balance		$ 12,389.91
Waived IDCs		$ 9,244.44

Assessment of population effects of the Exxon oil spill on Yellowstone River softshell turtles

Investigators

Alexander Zale
Unit Leader, MTCFRU
Robert Bramblett
Assistant Research Professor
Michael Duncan, MTCFRU

Collaborators

Larry Peterman, LP consulting, LLC
Doug Martin, Natural Resource Damage Program
Allison Begley, Montana Fish, Wildlife and Parks

Project Duration

June 2012 – June 2013

Funding

Montana Natural Resource Damage Program
MSU index 4W4088

Turtle sampling with baited traps was conducted on the Yellowstone and Missouri rivers in July and August 2012 at sites where samples had been collected prior to 2011. Captured turtles were measured, weighed, and tagged before being released. All sampling was completed as planned. An interim report was submitted to the Natural Resource Damage Program on 1 January 2013 and a final report was submitted on 1 April 2013. A confidentiality agreement prevents the disclosure of any results without prior written consent of the State of Montana.

Total Project Cost		$ 16,600.00
Beginning Balance – June 2012		$ 16,600.00
Expenditures – June 2012 - December 2012		
Salaries and Benefits	$ 9,811.23	
Supplies	$ 3,362.96	
Travel	$ 2,155.91	
Rent	$ 800.00	
Repair and Maintenance	$ 469.90	
IDCs @ 0%	$ -0-	
Total Spent		$ 16,600.00
Balance		$ -0-
Waived IDCs		$ 7,304.00

Spatial and temporal dynamics of the queen conch stock at Turneffe Atoll, Belize

(aka Turneffe Atoll Trust student support)

Investigators

Alexander Zale
Unit Leader, MTCFRU
Robert Bramblett
Assistant Research Professor

Collaborators

Leandra Cho-Ricketts,
Environmental Research Institute
University of Belize
Craig Hayes, Turneffe Atoll Trust

Graduate Student

Alex Anderson, M.S.

Funding

Turneffe Atoll Trust
MSU index 423192

Project Duration

August 2012 – December 2013

Queen conch is the second most valuable commercial fishery in Belize. It currently provides livelihood for about 2,800 commercial fishermen and their families, and supports in total about 13,000 Belizeans. In 2011, conch exports generated US$4.09 million for the Belizean economy. Conch also provides a popular food and cultural experience for tourists; tourism is the largest industry in Belize.

Conch landings at Belize's fishery cooperatives that originated at Turneffe Atoll declined 57% from 2004 to 2009. Moreover, a recent survey indicated that the commercial fishermen at Turneffe thought that the fishery at Turneffe has declined about 50% over the last 15 years. The status of the conch stock at Turneffe Atoll is therefore of particular concern, and more data are needed to determine the sustainability of the Turneffe Atoll conch fishery.

International concern over the status of conch may affect Belize's ability to maintain its conch export fishery. International trade in queen conch is regulated by the Convention on the International Trade of Endangered Species, and the U.S. Fish and Wildlife Service has considered listing queen conch under the Endangered Species Act. Scientific data are needed to ensure that Belize is sustainably managing its conch stocks if Belize is to continue to be allowed to export conch.

The Belize Ministry of Forestry, Fisheries and Sustainable Development recently designated the Turneffe Atoll Marine Reserve (TAMAR). A primary management objective for TAMAR is to reverse the decline in production of commercial species, including conch. To address this objective, the Turneffe Atoll Management Plan states that assessment of current populations of conch, development of a monitoring plan, and determination of the percentage decline in commercial production of conch are needed.

The study will have two components: 1) Stock Assessment Modeling of conch at TAMAR, and 2) Determination of the current status of conch at TAMAR and relationships of conch to physical features of TAMAR. We will use the ASPIC stock-production model as well as the Conch Simulator for conch stock assessment modeling. ASPIC is a stock-production computer program that estimates fisheries parameters (e.g., MSY) from historical fisheries landings and abundance data. The Conch Simulator provides a framework for assessing the status of exploitation of queen conch stocks as required by CITES regarding international trade. It is especially useful for examining the predicted effects of various management scenarios. These two methods were specifically recommended for these purposes in the Caribbean Fishery Management Council's Conch Stock Assessment Manual.

Conch surveys will be conducted along transects following the Long-term Atoll Monitoring Program protocol. We will survey transects previously established by BFD and ERI. In addition to these transects, we will survey additional transects stratified by geography (north, south, east, west), general location (fore reef, back reef), habitat type (seagrass beds, sparse algae/sand, shallow reefs), depth strata, and management status (take or no take zones). We will design our conch transect survey based on a power analysis such that the optimal distribution and number of transects can be established to enable detection of significant changes in conch abundance.

Total Project Cost		$ 18,315.00
Beginning Balance – August 2012		$ 18,315.00
STIP interest - 2012		$ 9.20
Expenditures – August 2012 - December 2012		
Salaries and Benefits	$ 5,027.52	
Supplies	$ -0-	
Tuition	$ 2,665.00	
Total Spent		$ 7,692.52
Balance		$ 10,631.68

Feasibility assessment for translocation of imperiled bull trout populations in Glacier National Park

Investigators

Christopher Guy
Assistant Unit Leader, MTCFRU
Clint Muhlfeld
USGS Northern Rocky Mountain Science Center

Graduate Student

Ben Galloway, M.S.

Collaborators

Chris Downs
National Park Service

Funding

USGS RWO 64
National Park Service
MSU index 4W3190

Project Duration

May 2010 - December 2012

Translocations are becoming an important management action for native fish conservation. However, many translocations have been unsuccessful because complete knowledge regarding the abiotic and biotic factors influencing translocation success was unknown. This project was designed to develop a novel framework to assess the feasibility of translocation of imperiled bull trout populations in Glacier National Park (GNP). Bull trout populations are at risk of extirpation in several lakes in GNP because of nonnative lake trout. Translocation has been proposed as a possible solution to mitigate against the negative effects of lake trout in GNP. Spawning, rearing, foraging, and overwintering habitats and aquatic biota were evaluated in three isolated headwater stream and lake drainages (Logging, Camas, and Lincoln) to determine their suitability for bull trout translocation. A scoring framework was developed to compare proposed translocation sites based on the likelihood of success in each system. Criteria for scoring were developed from metrics reported in the literature to influence bull trout recruitment and survival. Based on the scoring criteria, the Camas and Logging drainages are most suitable for translocation, containing physical and biological conditions comparable to other systems supporting bull trout. The Lincoln drainage is less suitable, containing a minimal amount of stream habitat (< 300 m) and nonnative brook trout. These results will be used to prioritize and plan potential translocation strategies for bull trout within GNP and provide a framework for evaluating the feasibility of translocation in aquatic ecosystems elsewhere.

Total Project Cost		$ 66,163.00
Beginning Balance – January 2012		$ 18,116.18
Additional Funding – 2012		$ 5,000.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 16,536.95	
Supplies	$ 202.60	
Communication	$ -0-	
Travel	$ 201.38	
Tuition	$ 3,160.05	
IDCs @ 15%	$ 3,015.20	
Total Spent		$ 23,116.18
Balance		$ -0-
Waived IDCs		$ 5,829.28

Suppression of lake trout in Quartz Lake, Glacier National Park

Investigators

Christopher Guy
Assistant Unit Leader, MTCFRU
Clint Muhlfeld
USGS Northern Rocky Mountain Science Center

Collaborators

Chris Downs
National Park Service

Funding

through USGS Northern Rocky Mountain Science Center

Graduate Student

Carter Fredenberg, M.S.

Project Duration

January 2011- December 2013

Until the discovery of nonnative lake trout in 2005, Quartz Lake was considered to be among the largest natural bull trout lakes in the Columbia River Basin that contained an intact native fish assemblage. Quartz Lake currently hosts the most viable and un-impacted bull trout population remaining among the larger lakes in Glacier National Park and thus provides a model of a fully functioning native aquatic ecosystem. The concern is that invading lake trout will probably overwhelm and replace bull trout within 10-20 years in this system, as they have done in several other lakes in Glacier National Park. Delay of measures that abate this expanding population will undoubtedly result in the proliferation of invasive lake trout, making it impossible to control them in the future. It is expected that if lake trout successfully reproduce in Quartz Lake, then the entire Quartz Lake chain will be severely and perhaps permanently compromised for native fish and wildlife, including osprey, otters, eagles, loons, and bears. Therefore, to conserve threatened bull trout populations in western GNP, in 2009 the U.S. Geological Survey and the National Park Service began a four-year experimental research project to assess the feasibility of suppressing lake trout in Quartz Lake. To identify the timing and location of spawning, adult lake trout were surgically implanted with acoustic transmitters and released each year. Two spawning areas have been identified and harvest during spawning has been highly successful. For example, 81% of acoustic tagged adults have been recaptured and 248 adult lake trout have been removed. Furthermore, adult biomass removed (kg/ha/yr) decreased from 0.90 in 2009 to 0.38 in 2011. Bull trout redd counts have remained stable from 2009 through 2011. Although further data analyses and modeling are needed, these results suggest that suppression efforts are negatively influencing the lake trout population in this remote backcountry lake.

Lake trout suppression in Yellowstone Lake: developing benchmarks for harvest and a sampling design to measure efficacy

Investigator
Christopher Guy
Assistant Unit Leader, MTCFRU

Collaborators
Todd Koel and Patricia Bigelow
National Park Service

Graduate Student
John Syslo, Ph.D.

Project Duration
February 2010 - June 2014

Funding
USGS RWO 63
National Park Service
MSU index 4W2997

Introduced lake trout threaten to extirpate native Yellowstone cutthroat trout, a keystone species in the Yellowstone Lake ecosystem of Yellowstone National Park. A National Park Service (NPS) lake trout suppression program has been on-going since 1994; however, the effort has not resulted in a lake trout population decline. Consequently, recovery of the cutthroat trout is lacking. In August 2008, a panel of 15 independent scientists convened and evaluated the program. It was determined that because of the lack of an adequate monitoring design, existing data and analyses are insufficient for guiding the program. A top recommendation was that NPS address this issue and ultimately determine the level of harvest required to reduce lake trout abundance and set quantifiable benchmarks for the number of lake trout to be removed annually.

Statistical catch at age and matrix population models are used to assess the efficacy of the lake trout suppression program and quantify targets for exploitation and fishing effort. The current rate of population growth is positive; however, it is lower than it would be in the absence of lake trout suppression. Fishing effort needs to increase above levels prior to 2011 to reduce population growth rate below replacement. In 2012, fishing effort was 45,710 100-m net nights which exceed the recommended target of 41,000 100-m net nights. The fishing effort in 2012 resulted in an instantaneous fishing mortality of 0.84 (0.62-1.13; 95% CI) and exploitation equal to 0.57 (0.46-0.68). It is forecasted that the fishing effort exerted in 2012 will cause the lake trout abundance to decline.

Total Project Cost		$102,770.00
Beginning Balance – January 2012		$ 22,516.70
Additional Funding – 2012		$ 35,400.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 15,981.41	
Contracted Services	$ -0-	
Supplies	$ 687.81	
Travel	$ 2,307.51	
Communication	$ -0-	
Tuition	$ 799.50	
IDCs @ 15%	$ 2,966.44	
Total Spent		$ 22,742.67
Balance		$ 35,174.03
Waived IDCs		$ 5,735.11

Estimate density of lake trout vulnerable to capture in trap nets using mark-recapture methods appropriate to sampling design

Investigators

Jay Rotella
MSU Professor
Christopher Guy
Assistant Unit Leader, MTCFRU

Collaborators

Todd Koel, National Park Service
Pat Bigelow, National Park Service

Project Duration

June 2012 – December 2015

Funding

National Park Service, CESU
MSU index 4W4058

Non-native species of fish threaten native fishes throughout North America. In Yellowstone National Park (YNP), introduced populations of invasive lake trout increasingly threaten Yellowstone cutthroat trout. Prior to the recent invasion of non-native lake trout, the streams around Yellowstone Lake contained thousands more Yellowstone cutthroat trout than present. These declines are directly attributed to the invasion and establishment of introduced lake trout. In response, the YNP initiated a project to suppress lake trout. To date, results seem promising but underscore the urgency to continue suppression to prevent continued loss of remaining native fish populations and evaluate the success of the suppression of lake trout. Success of the suppression effort is often measured by exploitation rate. Currently, several methods are used to estimate the exploitation rate, but a more direct measure is calculated from population abundance, which has not been estimated for lake trout in Yellowstone Lake.

Thus, this research project will estimate the population abundance of lake trout vulnerable to trap nets in Yellowstone Lake. A Lincoln-Petersen estimator for mark-recapture data or a modification of that method that allows one to incorporate length of fish as a covariate that might be related to capture probability will be used to estimate abundance. All modeling efforts will employ rigorous methods of estimation, evaluation of competing models, and model selection methods currently available in software such as Program MARK, WinBUGS, and other related packages designed for the analysis of the data type that will be generated in this project. Once an estimate is obtained then exploitation for similar sized fish can be calculated as the quotient of the number harvested and the population estimate. This estimate can be compared to other independent exploitation estimates to build multiple lines of evidence for evaluating the success of the suppression program.

Use of mobile electrofishing to induce mortality in lake trout embryos in Swan Lake

Investigator
Christopher Guy
Assistant Unit Leader, MTCFRU

Collaborators
Leo Rosenthal
Joel Tohtz
Montana Fish, Wildlife and Parks

Post-Doctoral Researcher
Peter Brown

Funding
Montana Fish, Wildlife and Parks
MSU index 4W3625, 4W4157

Project Duration
July 2011 – June 2014

An apparent rapid increase in the abundance of nonnative lake trout has occurred in Swan Lake, which is of concern to state, federal, tribal, and private entities because Swan Lake contains one of the most stable bull trout populations in Montana. Consequently, an experimental lake trout suppression program has been initiated in Swan Lake, which targets juvenile and adult lake trout. Targeting lake trout embryos may be a complementary and effective method for suppressing lake trout. Exposure of fish embryos to voltage gradients in the upper range of those produced by electrofishing equipment has been shown to result in mortality. Therefore, the efficacy of using benthic-oriented, mobile electrofishing techniques to induce mortality in lake trout embryos was evaluate in a Montana State University laboratory and *in situ* in Swan Lake. Rainbow trout embryos were exposed to 2, 5, and 10 v/cm for 0.1, 0.5, and 1.0 s in a laboratory. All embryos died when exposed to 10 v/cm for 1 s, and mortality did not different from the control exposures (no electricity) at 2 v/cm. Two trials were conducted where lake trout embryos were placed in enclosures at known locations in Swan Lake and an electrode array was dragged over the enclosures. The mean proportion of eggs killed at the substrate surface was 0.79 (SD, 0.21), and 0.13 (SD, 0.13) when eggs were 20 cm below the substrate surface. Survival of eggs increased with burial depth. However, variability in mortality by treatment was high, suggesting that the electric field surrounding the array was not uniform. This allowed embryos to survive in areas of low voltage gradient during a short duration exposure. These results suggest a towed electrode array will not be effective in reducing embryo survival. Future studies will focus on an array that is still mobile but can increase electricity exposure time on embryos.

Total Project Cost		$176,800.00
Beginning Balance – January 2012		$ 50,100.71
Additional Funding – 2012		$ 80,500.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 62,638.42	
Contracted Services	$ 1,919.69	
Supplies	$ 9,540.43	
Communications	$ 318.70	
Travel	$ 7,959.32	
Rent	$ 951.75	
Repair and Maintenance	$ 220.00	
Equipment	$ -0-	
IDCs @ 0%	$ -0-	
Total Spent		$ 83,548.31
Balance		$ 47,052.40
Waived IDCs		$ 36,761.26

Cost-effectiveness of gill netting for suppressing non-native lake trout in Swan Lake, Montana

Investigators

Christopher Guy
Assistant Unit Leader, MTCFRU
John Syslo, Ph.D. student, MTCFRU
Ben Cox, Oregon Department of Fish and Wildlife

Project Duration

January 2011 – December 2012
Completed

Population suppression for non-native species has become a common management endeavor. Given the large amount of resources required by long-term control or eradication projects, it is important to assess all possible strategies and associated costs and outcomes before a particular plan is implemented. The lake trout is an apex predator that has been introduced into several large lakes and reservoirs in the western U.S. Negative effects on receiving ecosystems have motivated population suppression projects throughout the region. Eradication is not a likely outcome given large spatial scales and current technology; therefore, management goals may best be quantified as the greatest reduction in lake trout abundance possible for a given time and cost. A population model was developed to assess the cost-effectiveness of mechanical removal strategies for suppressing long-term abundance of non-native lake trout in Swan Lake, Montana. The efficacy of targeting life stages (i.e., juveniles or adults) and using temporally pulsed fishing effort was examined for reducing abundance and program cost. High exploitation rates (0.80 for juveniles and 0.68 for adults) allowed a 97% (82% - 100%; 95% CI) reduction relative to unharvested abundance within 10 years. Reductions in abundance increased as a function of annual cost; however, total program cost could be minimized with greater expense and fishing pressure in the first 10 years. Substantial variation existed in the long-term reduction that can be achieved for a given annual cost. Thus, the comparison of multiple competing strategies for cost-effective, long-term lake trout control should be useful in larger ecosystems with lower exploitation rates.

Effects of the reservoir headwater environment on survival and behavior of larval sturgeon: are reservoirs an ecological sink for recruitment of sturgeon?

Investigators

Christopher Guy
Assistant Unit Leader, MTCFRU
Molly Webb, Kevin Kappenman
U.S. Fish and Wildlife Service
Bozeman Fish Technology Center

Research Associate

Hilary Treanor

Collaborators

William Gardner, Anne Tews
Montana Fish, Wildlife and Parks

Funding

Montana Fish, Wildlife and Parks,
MSU index 4W1928

Project Duration

January 2008 – April 2013

Natural recruitment of shovelnose sturgeon has been documented in the upper Missouri River; however, pallid sturgeon are not recruiting to the wild adult population. The reservoir headwater environment is hypothesized to be the mechanism of this recruitment failure, and understanding how specific abiotic components of the headwater environment contribute to larval pallid sturgeon mortality is important to the recovery of the species.

In 2012, we redesigned the sedimentation rate and substrate experiments, and evaluated the effects of unionized ammonia (NH_3) on mortality of larval shovelnose sturgeon and pallid sturgeon. There was no effect of sedimentation rate on larval mortality, despite that one treatment had twice the sedimentation rate as the naturally occurring rate. Larval mortality was significantly lower in the sand substrate treatment than the Missouri River 'muck' and the cobble treatments. Larval mortality differed significantly between the control (0.00 mg/L) and 0.20 mg/L of NH_3. Empirical measurements of NH_3 in the headwater habitat were typically less than 0.02 mg/L. Thus, NH_3 and sedimentation rate do not negatively influence survival of sturgeon larvae in the headwater habitat. Empirical measurements of dissolved oxygen in the headwater habitat in 2012 indicated that dissolved oxygen might be the cause of larval mortality. Mean dissolved oxygen was 1.32 mg/L near the maximum depth of the thalweg (where larval sturgeon drift) in the headwater habitat. Additional dissolved oxygen measurements will be made in 2013 to enhance our understanding of low dissolved oxygen in the headwater habitat. Preliminary results suggest reservoir headwater habitat is an ecological sink for sturgeon.

Total Project Cost		$272,937.00
Beginning Balance - January 2012		$ 88,698.70
Expenditures - January 2012 - December 2012		
Salaries and Benefits	$ 50,164.75	
Contracted Services	$ 103.54	
Supplies	$ 24,191.81	
Communications	$ -0-	
Travel	$ 5,843.21	
Maintenance	$ -0-	
IDCs @ 0%	$ -0-	
Total Spent		$ 80,303.31
Balance		$ 8,395.39
Waived IDCs		$ 35,333.46

Spawning of pallid sturgeon and shovelnose sturgeon in an artificial stream

Investigator
Christopher Guy
Assistant Unit Leader, MTCFRU
Kevin Kappenman, Molly Webb
U.S. Fish and Wildlife Service

Collaborator
Greg Watson
U.S. Fish and Wildlife Service

Project Duration
May 2011 – July 2014

Funding
U.S. Fish and Wildlife Service SSP
USGS RWO 66
MSU index 4W3528

Understanding the spawning behavior and spawning habitat requirements of shovelnose sturgeon and pallid sturgeon affected by regulated rivers is necessary to better manage shovelnose sturgeon and recover endangered pallid sturgeon. Shovelnose sturgeon spawning behavior was evaluated in an artificial river (developed at the Bozeman Fish Technology Center) in 2011 and 2012. Shovelnose sturgeon spawning duration varied from 3 to 18 h (defined as the shortest and longest periods from first oviposit to final oviposit for an individual female), a 2-3 second spawning bout or coupling, approximately 50 individual spawning bouts or couplings for a female, and thousands of eggs released per spawning bout. Shovelnose sturgeon spawned on gravel (2 - 64 mm) and cobble substrate (65 - 256 mm), spawned in close proximity to the substrate (0 - 18 cm), and the majority of eggs released by a female attached to the substrate a few meters downstream of the spawning site. Shovelnose sturgeon courtship behaviors included polyandrous and polygynous mating, a single couple per spawning bout, male blocking behavior (used to stop a female during a spawning attempt), male rubbing of female abdomen (a precursor to a spawning attempt), and male milt release without a reciprocated egg release. Spawning and social aggregation patterns and cannibalistic egg predation were also observed.

Multiple trials were performed in 2012 to examine shovelnose sturgeon velocity use associated with spawning site selection. Water velocities available in the living stream were characterized for each individual trial. Preliminary evidence using Manly Selection ratios and chi-squared log likelihood selection ratios indicates that shovelnose sturgeon did not select velocities in proportion to availability. Additional trials in 2013 will be used to examine velocity and substrate preference for spawning site selection. Understanding the spawning habitat needs of sturgeon will help river managers determine how controlled flow regimes might be best used to promote sturgeon spawning. The information can aid in the design of artificial spawning structures. Artificial structures are currently being used by natural resource agencies to increase the production of lake sturgeon and white sturgeon populations limited by quality spawning habitat.

Total Project Cost		$107,840.00
Beginning Balance – January 2012		$ 54,811.58
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 13,926.66	
Contracted Services	$ 415.00	
Supplies	$ 27,057.95	
Travel	$ 74.12	
IDCs @ 15%	$ 6,221.06	
Total Spent		$ 47,694.79
Balance		$ 7,116.79
Waived IDCs		$ 12,027.38

White sturgeon mitigation and restoration in the Columbia and Snake rivers upstream from Bonneville Dam

Investigators

Molly Webb, Kevin Kappenman
U.S. Fish and Wildlife Service
Bozeman Fish Technology Center
Christopher Guy
Assistant Unit Leader, MTCFRU

Collaborators

Brad Cady, Brad James
Washington Department of Fish and Wildlife

Project Duration

October 2006 – September 2013

Funding

Oregon Department of Fish and Wildlife, MSU indexes 4W1587, 4W1960, 4W2412, 4W2965 4W3495, 4W4289

During 1 April 2011 through 31 March 2012, Montana State University and the U.S. Fish and Wildlife Service collected gonadal biopsies from adult white sturgeon below Bonneville Dam with Washington Department of Fish and Wildlife. The objective of this research is to describe the maturation cycle in wild white sturgeon. The white sturgeon were caught by hook-and-line (n=26) or set-line (n=25) in 2011. Gonadal tissue was collected by biopsy, and the gonad samples were processed histologically. A total of 758 adult white sturgeon have been marked with spaghetti tags, scute marks, and PIT tags below Bonneville Dam since 2000 (n=183 in 2000, n=90 in 2001, n=67 in 2002, n=101 in 2003, n=57 in 2004, n=37 in 2005, n=67 in 2006; n=58 in 2007; n=32 in 2008; n=35 in 2009; n=21 in 2010; n=36 in 2011). In 2011, 51 fish were handled, 26 were tagged in previous years, 10 were "new" fish to the study, and 15 were handled twice or more in the season (i.e. within season recapture). Thirty-six gonad samples were collected for histological analysis from white sturgeon below Bonneville Dam. Of the 36 gonad samples, 26 were collected from females and 10 were collected from males. The reproductive structure of the adult white sturgeon population below Bonneville Dam was determined using the 2000-2011 data. Of the females (n=526), 65% were pre-vitellogenic (Stages 1 and 2), 24% were vitellogenic (Stages 3 and 4), 2% were post-vitellogenic or ripe (Stage 5), 6% were postovulatory (Stage 7), and 3% were undergoing follicular atresia (Stage 8). Of the males (n=293), 69% were pre-meiotic (Stage 2), 13% were mid-spermatogenic (Stage 3 and 4), 13% were spermiating (Stage 5), and 5% were post-spermiation (Stage 6). Using the shortest maturation cycle assigned, a 2-year or longer maturation cycle was possible in 12% of the females, a 3-year or longer cycle was possible in 35% of the females, a 4-year or longer cycle was possible in 29% of the females, and a 5-year or longer cycle was possible in 12% of the females in 2011. A 1-year or longer maturation cycle was possible in 33% of the males, a 2-year or longer cycle was possible in 22% of the males, a 3-year or longer cycle was possible in 33% of the males, and a 4-year or longer cycle was possible in 10% of the males in 2011. The sex ratio of the adult white sturgeon population below Bonneville Dam using the 2005-2011 data was 1:1.6 males to females.

Total Project Cost		$ 68,042.00
Beginning Balance - January 2012		$ 11,284.33
Additional Funding – 2012		$ 3,500.00
Expenditures - January 2012 - December 2012		
Supplies	$ 98.58	
Communication	$ 99.49	
Contracted Services	$ -0-	
Travel	$ 3,208.18	
Rent	$ 4,507.32	
IDCs @ 42.5%	$ 3,363.27	
Total Spent		$ 11,276.84
Back to Sponsor (closed 4W3495)		$ 7.49
Balance		$ 3,500.00
Waived IDCs		$ -0-

Environmental and endogenous factors affecting egg quality and caviar yield in farmed sturgeon

Investigators

Christopher Guy
Assistant Unit Leader, MTCFRU
Molly Webb
U.S. Fish and Wildlife Service

Funding

Western Regional Aquaculture Center, MSU index 4W3678
4W3927

Project Duration

June 2011 – August 2015

Several families of the captive broodstock of pallid sturgeon are experiencing high levels of accumulation of gonadal fat that impairs reproductive performance. Sturgeon farmers in California and Idaho also observe highly variable roe yield in mature sturgeon associated with accumulation of fat in the ovaries. Environmental, genetic, and developmental factors can all affect gonadal fat accumulation, but the role of these factors is not well understood. Understanding these effects is essential for conservation propagation of endangered sturgeons and sustained production of high quality sturgeon caviar. The aquaculture farms in California and Idaho are used to conduct a collaborative study, with participation of four states and four sturgeon farms, aimed to investigate these effects on the ovarian adiposity, roe yield, and caviar quality in farmed sturgeon. These results will be directly applicable to sturgeon conservation propagation programs to understand the influence of culture conditions, genetics, and developmental factors on the reproductive performance of captive populations.

Total Project Cost		$ 34,327.00
Beginning Balance - January 2012		$ 18,327.00
Additional Funding – 2012		$ 16,000.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 4,912.99	
Communication	$ -0-	
Supplies	$ 449.23	
Travel	$ -0-	
IDCs @ 0%	$ -0-	
Total Spent		$ 5,362.22
Balance		$ 28,964.78
Waived IDCs		$ 2,359.38

Assessment of carbon dioxide (CO_2) to enhance winter kill in natural rearing ponds used for fish production in the north central region

Investigators

Christopher Guy
Assistant Unit Leader, MTCFRU
Molly Webb
U.S. Fish and Wildlife Service
Michael Jones
Michigan State University

Research Associate

Hilary Treanor

Funding

North Central Regional Aquaculture Center, Michigan State University
MSU index 4W4260

Project Duration

October 2012 – December 2013

In most natural waters, aquatic organisms are exposed to relatively low concentrations of dissolved carbon dioxide (CO_2). During the middle part of the 20th Century, concerns over the introduction and fate of organic pollution in surface water led to observations and experiments documenting stress and mortality of freshwater fishes exposed to elevated levels of free CO_2. Experimental CO_2 introductions are now being considered as a tool for suppression and manipulation of aquatic species in a variety of field and aquaculture settings. Trials were conducted to determine the lethal concentration (LC_{100}) for fingerlings of three fish species (rainbow trout, common carp, and channel catfish) important to the aquaculture industry and often identified as aquatic invasive species. Fish were exposed to six concentrations of CO_2 for a period of 24 h, and mortality was recorded at the end of each exposure. Rainbow trout experienced 100% mortality when exposed to 225 mg CO_2/L, while common carp and channel catfish experienced 100% mortality at the 495 mg CO_2/L treatment level. We also wanted to determine whether our LC_{100} values could be affected by the rate at which the test tanks were brought to concentration. Using rainbow trout, tanks were raised to concentration over the course of four time periods and then held fish at the empirically-derived LC_{100} (i.e., 225 mg CO_2/L) for 24 h. The rate of CO_2 application did not affect the 24 h LC_{100}. The results demonstrate that CO_2 can be used to induce mortality in multiple species of fish in a laboratory setting. Future research in 2013 will focus on evaluating the capacity of CO_2 to induce mortality and function as a method for deterring or manipulating fish movements in the field.

Total Project Cost		$ 38,250.00
Beginning Balance – October 2012		$ 38,250.00
Expenditures – October 2012 - December 2012		
Salaries and Benefits	$ -0-	
Supplies	$ 1,930.67	
Travel	$ -0-	
IDCs @ 0%	$ -0-	
Total Spent		$ 1,930.67
Balance		$ 36,319.33
Waived IDCs		$ 849.49

Exploitation, abundance and large-scale movements of burbot in the upper Wind River Drainage

Investigator
Christopher Guy
Assistant Unit Leader, MTCFRU

Graduate Student
Sean Lewandoski, M.S.

Collaborators
Mark Smith
Paul Gerrity
Wyoming Game and Fish Department

Project Duration
July 2011 – June 2015

Funding
Wyoming Game and Fish Department
MSU index 4W3554

Management of burbot stocks is poorly understood given the lack of biological information for the species. However, burbot are beginning to receive more attention from natural resource agencies because of information regarding their population declines, particularly at the southern extent of their range. In Wyoming, much of the work conducted on burbot has been in the Wind/Bighorn River drainage. Interestingly, burbot in the Wind/Bighorn River drainage represent the most southwest portion of the species natural range. Burbot are an important sportfish in the Wind/Bighorn River drainage, are a native species of special concern (classified as an NSS3), and an important cultural resource to the Eastern Shoshone and Northern Arapahoe tribes.

Understanding the mechanisms that influence burbot in the Wind/Bighorn River drainage will assist in making sound management decisions to maintain sustainable populations. Much of the research conducted on burbot in the Wind/Bighorn River drainage has suggested that the cumulative effects of high exploitation and entrainment probably have the largest effect on burbot populations in the drainage. However, the exact mechanism for the decline in burbot is not well understood. Thus, this project is designed to evaluate the extent of exploitation within the upper Wind River drainage. The specific objective is to estimate exploitation, abundance, population growth rate, and develop deterministic population models to guide management of burbot populations in the upper Wind River drainage. Burbot were tagged during the autumn of 2011 (N=726) and 2012 (N = 728), and 25 tags were returned in 2011 and 28 were returned in 2012. Estimating exploitation requires adjusting angler tag returns by angler reporting. High reward tags were used to estimate angler reporting and the estimated was 28%. Thus, the exploitation rate, after adjusting for reporting rate, for burbot in Bull Lake was 20% in 2012. These preliminary results suggest that burbot stocks are not overexploited in the Wind River drainage.

Total Project Cost		$154,899.00
Beginning Balance – January 2012		$ 32,832.77
Additional Funding – 2012		$ 25,540.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 21,185.86	
Contracted Services	$ 32.00	
Supplies	$ 4,596.16	
Communication	$ -0-	
Travel	$ 4,686.73	
Rent	$ -0-	
Repair and Maintenance	$ 107.14	
Tuition	$ 2,360.55	
Participant Support	$ 240.00	
IDCs @ 15%	$ 6,641.74	
Total Spent		$ 39,850.18
Balance		$ 18,522.59
Waived IDCs		$ 9,630.45

Spawning characteristics and early life history of mountain whitefish in the Madison River, Montana

Investigator
Christopher Guy
Assistant Unit Leader, MTCFRU

Collaborators
Travis Horton
Montana Fish, Wildlife and Parks

Graduate Student
Jan Boyer, M.S.

Funding
Montana Fish, Wildlife and Parks
MSU index 4W3860

Project Duration
January 2012 – January 2014

Mountain whitefish are often abundant and widespread in streams throughout the Northern Rocky Mountains. Historically mountain whitefish may have been one of the most abundant sport fishes in Montana, and mountain whitefish prey on a variety of aquatic and terrestrial insects. Therefore, mountain whitefish often compose a large portion of the biomass present within streams and lakes and likely contribute substantially to ecosystem processes. In the Madison River drainage, mountain whitefish numbers have declined in Hebgen Lake over the last decade and there is concern that mountain whitefish are also declining in the river. Unfortunately, in many rivers, including the Madison River, there is not adequate information to assess population status or determine what factors may be limiting population growth. Understanding the life history of a population is important for identifying factors that may affect vital rates and limit populations. Recruitment is strongly influenced by spawning success and juvenile survival, thus this research project will focus on spawning adults and age-0 mountain whitefish. Mature mountain whitefish will be radio-tagged and tracked from September through November for two years to determine spawning locations and the timing of migration and spawning. Habitat variables will be measured at spawning sites and reference sites and analyzed to determine if mountain whitefish select specific spawning habitat. Mountain whitefish will be collected in October, before spawning, to obtain otoliths for aging and gonad samples to assess age-at-maturity, fecundity, and spawning periodicity. During spring and summer 2013, various sampling gears will be evaluated to determine which gear is most effective for sampling age-0 mountain whitefish. In spring and summer 2014, the most efficient sampling gear for age-0 mountain whitefish will be used to describe their spatial and temporal distribution in the Madison River. These data will be used to develop a standardized monitor program for age-0 mountain whitefish. Furthermore, this research will begin to address the bottleneck for survival of mountain whitefish and provide knowledge regarding the spawning ecology of mountain whitefish in the Madison River.

Total Project Cost		$ 59,566.00
Beginning Balance – January 2012		$ 59,566.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 20,281.38	
Contracted Services	$ 1,030.00	
Supplies	$ 19,606.98	
Communications	$ 11.17	
Travel	$ 6,371.58	
Rent	$ 1,550.00	
Repair and Maintenance	$ 31.99	
Tuition	$ 1,599.00	
IDCs @ 0%	$ -0-	
Total Spent		$ 50,482.10
Balance		$ 9,083.90
Waived IDCs		$ 22,212.12

Evaluation of management actions in the Big Hole River basin on Arctic grayling relative abundance

Investigator
Christopher Guy
Assistant Unit Leader, MTCFRU

Collaborators
Travis Horton
Montana Fish, Wildlife and Parks

Graduate Student
Austin McCullough, M.S.

Funding
Montana Fish, Wildlife and Parks
MSU index 423194

Project Duration
August 2012 – December 2014

Arctic grayling currently occupy less than five percent of the native range in Montana and recently the species was listed as a candidate species. Of the five known remaining native populations, the Big Hole River population is the only strictly fluvial population, which was historically the dominant life-history form. Monitoring data from the 1980s to early 2000s indicated abundance and distribution of Arctic grayling were in decline in the upper watershed. Thus, in 2006, Montana Fish, Wildlife & Parks initiated the "Candidate Conservation Agreement with Assurances for Fluvial Arctic Grayling in the upper Big Hole River (Big Hole CCAA)" program with the U.S. Fish and Wildlife Service to secure and enhance the population. Through the Big Hole CCAA, individual conservation plans are developed for voluntarily enrolled non-Federal properties to address limiting factors for Arctic grayling. In return, landowners are assured no further regulatory requirements than those detailed in their conservation plan should Arctic grayling be listed as threatened or endangered.

Since the inception of the Big Hole CCAA program, 14 conservation plans, encompassing 57,000 acres, have been completed to improve conditions for Arctic grayling. Conservation plans address limiting factors for Arctic grayling, which are thought to be degraded riparian and in-stream habitat, adverse stream-flow conditions, barriers to fish migration, and entrainment of individuals in irrigation ditches. Through the Big Hole CCAA, over 300 projects have been completed to address limiting factors, which have previously included stream restoration, native riparian vegetation supplementation, riparian and pasture fence construction, irrigation structure replacement/improvement, modifying irrigation structures to allow year-round fish migration, screening fish from irrigation ditches, and providing off-stream livestock water sources. Additionally, conservation plans develop grazing management plans for livestock in riparian areas and stream-flow agreements, whereby landowners agree to reduce irrigation water diversion when Big Hole River flows reach minimum target levels. To evaluate Arctic grayling population response to management actions, annual sampling is conducted to document relative abundance (fish/mile) of age-1 and older individuals captured within 10 index reaches. Arctic grayling relative abundance has increased from 2006 (0.3 fish/mile) through 2012 (3.2/mile). Big Hole CCAA management actions have presumably contributed to the increase in relative abundance; however, the effect of each management action is unclear. A better understanding of the relationship between management action and Arctic grayling response would provide natural resource agencies with information to implement projects that provide the most benefit.

Therefore, the goal of this project is to evaluate the effects of each management action on Arctic grayling relative abundance.

Total Project Cost		$ 2,500.00
Beginning Balance – August 2012		$ 2,500.00
STIP interest – 2012		$ 1.07
Expenditures – August 2012 - December 2012		
Travel	$ -0-	
Communication	$ -0-	
Tuition	$ 1,599.00	
Total Spent		$ 1,599.00
Balance		$ 902.07

Distribution, habitats, and tributary linkages of small and non-game fishes in the lower Yellowstone River

Investigators

Robert Bramblett
Assistant Research Professor
Alexander Zale
Unit Leader, MTCFRU

Collaborator

Matt Jaeger, Travis Horton,
Tyler Haddix
Montana Fish, Wildlife and Parks
Ryan Wilson
U.S. Fish Wildlife Service

Graduate Student

Michael Duncan, Ph.D.

Funding

Montana Fish, Wildlife and Parks
MSU index 4W1855

Project Duration

October 2007 – June 2012
Completed

The Yellowstone River is the longest undammed river in the contiguous United States. However, we still lack a basic understanding of small and nongame fishes in the mainstem Yellowstone River because most research and management is focused on the game and larger nongame species within the river. Two small nongame species, the sturgeon chub *Macrhybopsis gelida* and sicklefin chub *M. meeki* are species of special concern within Montana and potentially important prey items for the endangered pallid sturgeon.

The objectives of this project were to compare the efficiencies of several gears for sampling small and nongame fishes in large rivers, determine the distribution and habitat use of these fishes in the Yellowstone River, examine the connectivity of selected species between the Yellowstone River and its tributaries, and evaluate differences in the lower Yellowstone and Missouri river fish assemblages.

We found that fyke nets were more effective than seines at sampling the shoreline fish assemblage. Fyke nets consistently had higher catch rates ($P < 0.01$) and captured more species ($P < 0.01$) than seines. Two fyke net sets in each macrohabitat were enough to characterize the abundances and distributions of dominant species. However, we recommend three fyke net sets in each macrohabitat to develop complete species lists that include rare species.

Nearly 100 sites were sampled using mini-fyke nets, seines, and otter trawls. We have captured 46 fish species, totaling over 150,000 individual fish. The catch was dominated by western silvery minnow *Hybognathus argyritis*, emerald shiner *Notropis atherinoides*, sand shiner *N. stramineus*, flathead chub *Platygobio gracilis*, and longnose dace *Rhinichthys cataractae*. The range of sturgeon chub in the Yellowstone River appears to be restricted to reaches below the confluence of the Tongue River whereas the range of the sicklefin chub abruptly ends at the Intake diversion dam.

To quantify linkages between tributary streams and the lower Yellowstone River, we compared ^{87}Sr:^{86}Sr otolith profiles from western silvery minnows, flathead chubs, and sand shiners to the water chemistry of the lower Yellowstone River and its tributaries. We found that 69% of fish collected in the Yellowstone River were migrants between the Yellowstone River and its tributaries. All of the fish collected in the Powder River were migrants whereas about 50% of the fish collected in smaller tributaries were residents. Between 10-20% of each species moved between at least two tributaries. These findings indicate that connectivity between large rivers and tributaries is critical to maintain populations of small fish species in both large river and tributary habitats.

The lower Yellowstone and Missouri rivers probably had similar fish assemblages prior to the damming of the Missouri River by the Fort Peck dam. We compared fish assemblages in the Yellowstone River with those in the Missouri River using data collected by Montana Fish, Wildlife & Parks and U.S. Fish and Wildlife Service personnel. We collected 80,937 fish in the Yellowstone River (n = 49 sampling reaches) whereas only 36,244 fish were captured in the Missouri River (n = 93 reaches) from 2008 to 2010. Mean catch per unit effort was greater in the Yellowstone River (224 fish/net night) than in the Missouri River (49 fish/net night). Much of the difference was the result of nets with large numbers of native cyprinids in Yellowstone River samples, which were not common in Missouri River samples. Although twice as many Missouri River reaches were sampled, both native and nonnative species richness were greater in the Yellowstone River. However, nonnative fish made up only 1.1% of the total catch in the Yellowstone River as opposed to 4.4% in the Missouri River. We also observed higher relative abundances of degradation-tolerant and coldwater species in the Missouri River. Our results indicate that naturally-functioning rivers may sustain higher species richness and densities of both native and nonnative fish, whereas altered rivers may sustain lower overall densities of all fish, but higher relative abundances of nonnative fish.

The final report for this project has been completed. We are currently finishing the dissertation and preparing manuscripts for publication.

Total Project Cost		$308,926.00
Beginning Balance - January 2012		$ 9,378.15
Expenditures - January 2012 - December 2012		
Salaries and Benefits	$ 7,521.67	
Contracted Services	$ 35.27	
Supplies	$ -0-	
Travel	$ 328.80	
Tuition	$ 1,492.41	
IDCs @ 0%	$ -0-	
Total Spent		$ 9,378.15
Balance		$ -0-
Waived IDCs		$ 4,126.39

Anthropogenic habitat change effects on fish assemblages of the middle and lower Yellowstone River

Investigators

Robert Bramblett
Assistant Research Professor
Alexander Zale
Unit Leader, MTCFRU

Collaborators

George Jordan
U.S. Fish and Wildlife Service
Matt Jaeger
Montana Fish, Wildlife and Parks
Sean Lawlor, U.S. Geological Survey
Tony Thatcher, DTM Consulting

Graduate Student

Ann Marie Reinhold, Ph.D.

Project Duration

January 2008 – December 2013

Funding

U.S. Army Corps of Engineers
USGS RWO 56, MSU index
4W1987, 4W2650

Although the Yellowstone River remains the longest undammed river in the contiguous US, it nevertheless faces anthropogenic perturbations such as bank stabilization. Banks are stabilized to prevent erosion of agricultural, residential, and urban lands, as well as transportation structures (e.g., roads, railroads and bridges). However, bank stabilization leads to changes in local main-channel geomorphology. These geomorphological changes include main-channel bed degradation, channel width reduction, and increased stream gradient. Moreover, bank stabilization impairs floodplain connectivity and normal riverine processes such as lateral channel migration and the formation of backwaters, braids, and side channels. Thus, bank stabilization alters local fish habitat and may result in changes in habitat suitability for fishes. Changes in habitat suitability probably result in changes in fish assemblage structure. Therefore, we are evaluating how bank stabilization affects the fish assemblages in the Yellowstone River with three study objectives.

1. Determine if fish assemblages differ between non-stabilized and bank-stabilized habitats. We have completed field sampling and are now comparing fish assemblages in non-stabilized habitats to those in bank-stabilized habitats. We stratified habitats by longitudinal position, regional and local geomorphology, and pool type. To obtain the most complete and representative sample for the assemblages, multiple gear types were used, including boat electrofishing, trammel nets, otter trawls, mini-fyke nets, and bag seines. Thirty-two river bends were sampled from Billings, Montana to Sidney, Montana during baseflow from 2009 through 2011. In total, we collected 151,553 fish from 15 families and 46 species. We have integrated our fish data and habitat data with existing GIS layers to generate a powerful and spatially explicit dataset. We have begun analyzing these data using appropriate generalized linear models.

An Acoustic Doppler Current Profiler (ADCP) survey of each river bend was conducted in 2011. Use of the ADCP allows us to determine whether differences in depths and velocities at bank-stabilized and non-stabilized sites exist. If differences in depths and velocities are found, these

differences provide a potential mechanism for why fish assemblages may differ between non-stabilized and stabilized river bends. This survey was conducted in collaboration with Sean Lawlor, United States Geological Survey (USGS), and the data was transferred from the USGS to us in early 2012. We generated a database to effectively store and query this data and have integrated it with our spatial datasets.

2. Determine the importance of side channels for fish assemblages during runoff and baseflow. To determine if side channels provide important fish habitat during runoff, we sampled seasonal side channels and contiguous shallow, slow-current velocity habitat in the mainstem during this period at 32 river bends. To determine the relative importance of side channels during baseflow, we sampled side channels and the contiguous mainstem during baseflow at the same 32 river bends. We are comparing the fish assemblages in the side channels to the fish assemblages in the contiguous main stem to assess if fish assemblages differ between side channels and the main stem during runoff and baseflow conditions. Comparing the fish assemblage structure between the side channels and main stem allows us to assess the relative importance of these habitats.

The fish sampling for this objective is complete. During runoff 2010 through 2012, we collected 153,984 fish of 41 species and 12 families from 32 river bends. Preliminary data analysis indicates that during runoff, fish catch is greater in side channels than in main channels for several species. We are currently exploring if this trend is also present during baseflow. In addition, we will determine if fish assemblages differ between river bends with and without side channels.

3. Determine the cumulative effects of channel alteration on fish assemblages. We are determining the cumulative effects of anthropogenic channel alteration on the Yellowstone River fish assemblages. We will quantify the changes in the distribution and availability of fish habitat since the 1950s, when almost no bank stabilization was present. Tony Thatcher (DTM Consulting) used aerial photographs to map the area and distribution of fish habitat units in the early 1950s and in 2001; mapping was completed in December 2011. We will use these maps to quantify the amount and types of changes in habitat units from the 1950s to the 2000s. Next, we will model the changes to the fish assemblages of the bank-stabilized habitats by applying current data from non-stabilized habitats to represent baseline conditions prior to bank stabilization.

We are determining how bank stabilization may have altered the depth profiles of the lower Yellowstone River and how these changes in fish habitat may have altered fish assemblages. We will use shapefiles generated as part of the Hydraulics and Hydrology Scopes of Work to compare the depth profiles with bank stabilization to the depth profiles without bank stabilization (under regulated flows). We will use these modeled changes in depth profiles to model potential changes to the Yellowstone River fish assemblages.

Total Project Cost		$ 466,242.68
Beginning Balance - January 2012		$ 37,928.65
Additional Funding – 2012		$ 112,287.74
Expenditures - January 2012 - December 2012		
Salaries and Benefits	$ 56,092.19	
Contracted Services	$ 45.00	
Supplies	$ 3,386.19	
Communications	$ 261.61	
Travel	$ 3,316.92	
Rent	$ 1,550.00	
Maintenance	$ 73.22	
Tuition	$ 2,360.55	
IDCs @ 15%	$ 10,062.86	
Total Spent		$ 77,148.54
Balance		$ 73,067.86
Waived IDCs		$ 18,113.13

Habitats and movements of spiny softshells in the Missouri River in Montana

Investigators
Robert Bramblett
Assistant Research Professor
Alexander Zale
Unit Leader, MTCFRU

Collaborators
Jo Ann Dullum
US Fish and Wildlife Service
Steve Leathe
PPL Montana
Lauri Hanuska-Brown
Montana Fish, Wildlife, and Parks

Graduate Student
Brian Tornabene, M.S.

Project Duration
August 2009 - December 2013

Funding
U.S. Fish and Wildlife Service, PPL Montana, US Bureau of Land Management, Montana Fish, Wildlife, and Parks, Bureau of Reclamation
MSU index 4W2596, 4W4273

Little is known about the populations of spiny softshells *Apalone spinifera* in Montana, where they are a state Species of Concern, a Tier 1 Species with greatest conservation need, and a Bureau of Land Management Sensitive Species. The spiny softshell populations upstream of Ft. Peck Dam are isolated from other Montana populations and are therefore at risk of extirpation. Although dam operations affect riverine and riparian habitats, the relationships between hydrograph and use of habitats for nesting, feeding, basking, and overwintering by spiny softshell are not known.

Our overall goal is to document how human activities and natural factors affect spiny softshell habitat use, movements, nesting habitat and behavior, and overwintering locations in a 50-mile reach of the Missouri River from Judith Landing on the Upper Missouri Breaks National Monument downstream to the Fred Robinson Bridge on the Charles M. Russell National Wildlife Refuge. This reach spans a gradient of spiny softshell catch per unit effort ranging from 16.7 turtles per trap night in the upstream part of the reach to 0.3 turtles per trap night near the downstream end.

We captured 57 spiny softshell turtles using hoop nets and fitted them with radio transmitters since August 2009. Additionally, over 35 trips have been made allowing us to locate our turtles over 1,500 times and characterize habitat at more than 500 locations.

Preliminary data analysis indicated that turtles used main channel habitats during most of the year. However, habitats along the river margins (i.e., creeks, ephemeral side channels, and floodplains) were used more than main channel habitats during the ascending limb and peak of the hydrograph. Accordingly, basking habitats were most often on main channel shorelines or tributary mudflats composed of silt or sand substrates in sparsely vegetated areas. Movement rates and ranges of activity varied widely among individual turtles. Turtle home ranges ranged from 0.8 to 55.6 river miles with an average of 10.5 river miles from 2010-2011. However, most

turtles had a home range of about 2 to 10 river-miles and little difference between male and female turtle home ranges was observed.

We observed that turtles aggregated during the overwintering periods from 2009 through 2012. In 2009 and 2010, more than 50% of the relocated turtles were found in aggregations with other turtles. However, in 2011 only 32% of relocated turtles were found in aggregations. Overwintering sites were typically about 2 m deep, with moderate current velocity (i.e., 0.3 to 1.0 m/sec), and about 14 m from shore. Substrate in overwintering sites varied, but sand and silt were often the dominant substrate. This population of turtles used the same locations across years and individual turtles may show fidelity to sites across years.

Aggregation and fidelity to overwintering sites may be related to the ice dynamics and scour in certain reaches of the river, forcing turtles to seek out refuges from moving ice flows. We are investigating this by monitoring overwintering sites suspected to have increased ice activity throughout the winter. The frequency and duration of ice jams at these sites are being monitored with scout cameras programmed to take pictures at daily intervals from November to April 2010 to 2011 and 2011 to 2012.

We located 25 nests in 2011 and 97 in 2012. Most nests were in mixed-gravel substrates; only 3% were in pure sand. Vegetative cover at nest sites was sparse. Mean distance of nests to the water's edge was 13.7 m and mean height above the water surface elevation was 0.7 m. Proportion of nests found on island and mainland habitats were similar in 2011, but 90% of nests were on islands in 2012. Predation occurred on 46 nests; mainland nests incurred higher predation rates than island nests. Nesting followed peak river stage, and mostly occurred in the afternoon. Durations of nesting, incubation, and emergence periods were similar in both years, but nesting and emergence occurred about three weeks later in 2011 than in 2012. Only 36% of nests were successful in 2011, but 60% were successful in 2012. Flooding in 2011 probably decreased nesting effort and success by reducing nesting habitat availability, delaying nesting, thereby prematurely ending incubation at the onset of freezing temperatures. However, flood events maintain and create nesting habitats by clearing vegetation and depositing substrates. Temperature loggers were deployed in artificial nests in the winter of 2011 to 2012 to investigate the possibility of hatchlings overwintering in nests and emerging the next spring. Additionally, temperature loggers were deployed in artificial nests in the summer of 2012 to investigate the possible difference in incubation thermal regime in pure sand and gravel and sand mixed nesting substrates.

Total Project Cost		$262,993.86
Beginning Balance - January 2012		$ 25,103.48
Additional Funding - 2012		$ 89,786.00
Expenditures - January 2012 - December 2012		
Salaries and benefits	$ 63,198.04	
Contracted Services	$ 390.99	
Supplies	$ 12,024.66	
Communications	$ -0-	
Travel	$ 7,517.77	
Rent	$ 3300.00	
Maintenance	$ 526.58	
Tuition	$ 1,561.05	
IDCs @ 0% 4W2596	$ -0-	
IDCs @ 17.5% 4W4273	$ 2,536.94	
Total Spent		$ 91,056.93
Balance		$ 23,832.55
Waived IDCs 4W2596		$ 32,570.15
Waived IDCs 4W4273		$ 3,841.69
Waived IDCs TOTAL		$ 36,411.84

Predicting effects of climate change on native fishes in northern Great Plains streams

Investigators

Robert Bramblett
Assistant Research Professor
Alexander V. Zale
Unit Leader, MTCFRU
Dave Roberts
MSU Department of Ecology

Collaborators

Robert Gresswell
USGS Northern Rocky Mountain Science Center
Kathy Chase and Rod Caldwell
USGS Montana Water Science Center

Project Duration

September 2011 – September 2013

Funding

U.S. Geological Survey, CESU
MSU index 4W3769

The fish assemblages of Great Plains streams may be perceived as "living on the edge," because water quantity and water quality are often precariously close to ecological tolerance limits. At the same time, prairie streams provide critical "green lines" of habitat, in a sea of semi-arid prairies for both aquatic and terrestrial wildlife. For example, in Montana, prairie streams are a stronghold of native biodiversity that support 25 native fish species, 14 amphibian and reptile species, and more than 130 bird species. It appears, however, that changes in water quantity and quality associated with global climate change may substantially alter these networks of biodiversity. Our goal is to predict the effects of climate change on the hydrology and biota of northern Great Plains streams. The goal of this study is to predict the effects of climate change on the hydrology and fish assemblages of northern Great Plains streams. Predicted changes in precipitation and air temperature will be linked to changes in streamflow and in turn, fish assemblages by using empirically derived relations between streamflow and fish assemblages as follows: (1) simulate baseline daily streamflows at about 1,500 fish sample sites in eastern Montana using the Precipitation-Runoff Modeling System (PRMS) and existing precipitation, temperature, and basin characteristics; (2) model relations between streamflow characteristics and baseline fish assemblage structures at these fish sample sites; (3) use PRMS to simulate future daily streamflows at the fish sample sites using projected precipitation and temperature output from a regional climate model; and (4) model future fish assemblage structures based on streamflow projections. Index of Biotic Integrity scores will be calculated for the 1,500 fish sample sites to identify areas of primary conservation concern and compare them to the areas that are most likely to change. Results will be presented at workshops with fishery and land managers to help them understand and plan for potential effects of climate change on the hydrology and fish assemblages of northern Great Plains streams.

Total Project Cost		$101,414.00
Beginning Balance – January 2012		$ 34,114.61
Additional Funding – 2012		$ 65,493.00
Expenditures – January 2012 - December 2012		
Salaries and Benefits	$ 15,370.86	
Contracted Services	$ 29,935.00	
Supplies	$ 57.51	
Travel	$ 93.26	
IDCs @ 17.5%	$ 7,954.93	
Total Spent		$ 53,411.56
Balance		$ 46,196.05
Waived IDCs		$ 12,046.01

Taxonomic and ecological services

Investigator
Molly Webb
BFTC

Undergraduate Researchers
Luke Holmquist

Duration
Ongoing

Funding
U.S. Fish Wildlife Service
MSU Index 433295

We started a new program in 2011 for Montana State University undergraduate students to work on research projects at the Bozeman Fish Technology Center. We provide temporary student services to the BFTC and our students gain valuable research experience.

Beginning Balance - January 2012		$ 6,625.40
Additional Funding – 2012		$ 12,378.24
Expenditures - January 2012 - December 2012		
Salary and Benefits	$11,046.49	
Supplies	$ -0-	
Communications	$ -0-	
Travel	$ -0-	
Administrative fee @ 4%	$ 441.87	
Total Spent		$ 11,488.36
Balance		$ 7,515.28

MTCFRU Sales and Service Account

Investigator

Alexander Zale
Unit Leader, MTCFRU

Funding

MT Fish Wildlife & Parks
MSU Index 433309

This account manages non-grant work that the Montana Cooperative Fishery Research Unit performs in association with the Bozeman Fish Technology Center.

Beginning Balance - January 2012		$ 1,823.32
Additional Funding – 2012		$ 19,896.00
Expenditures - January 2012 - December 2012		
Salary and Benefits	$14,579.69	
Contracted Services	$ -0-	
Supplies	$ 3,788.48	
Travel	$ 584.98	
Administrative fee @ 4%	$ 810.05	
Total Spent		$ 19,763.20
Balance		$ 1,956.12

Montana Cooperative Fishery Research Unit Vehicle Account

Administrator
Alexander V. Zale
Unit Leader, MTCFRU

Funding
Designated Account - projects are charged mileage based on project use. MSU index 433099

The purpose of the Unit vehicle account is to cover all expenses related to Unit vehicles, which includes replacement, repairs and maintenance, insurance, and fuel.

Beginning Balance - January 2012		$ 54,178.47
Expenditures - January 2012 - December 2012		
Repairs and Maintenance	$ 7,705.62	
Fuel	$ 17,739.44	
Insurance	$ -0-	
Administrative Assessment Fee @ 4%	$ 1,017.86	
Total Spent		$ 26,462.92
Total Revenue Reimbursed		$ 40,929.86
Balance		$ 68,645.41

Montana Cooperative Fishery Research Unit Watercraft Account

Administrator
Alexander V. Zale
Unit Leader, MTCFRU

Funding
Designated Account – projects are charged a daily fee when using boats. MSU index 433301

The purpose of the Unit watercraft account is to cover expensive repairs and replacement of Unit research vessels.

Beginning Balance - January 2012		$ 13,746.84
Expenditures - January 2012 - December 2012		
Insurance	$ -0-	
Supplies	$ 419.54	
Equipment	$ -0-	
Maintenance	$ 1,788.27	
Administrative Assessment Fee @ 4%	$ 88.31	
Total Spent		$ 2,296.12
Total Revenue Reimbursed		$ 8,950.00
Balance		$ 20,776.32

Montana Cooperative Fishery Research Unit Operations Account

Administrator
Alexander V. Zale
Unit Leader, MTCFRU

Funding
Yearly: $12,000 from MSU VP Research
MSU index 436899

Beginning Balance - January 2012		$ 15,294.94
Expenditures - January 2012 - December 2012		
Salary and Benefits	$ -0-	
Communications	$ 679.78	
Contracted Services	$ 3,762.99	
Supplies	$ 2,514.96	
Travel	$ 634.98	
Rent (Storage Unit)	$ 5,961.00	
Maintenance	$ -0-	
Administrative Assessment Fee @ 4%	$ 225.43	
Total Spent		$ 13,779.14
Total Revenue from VPR		$ 12,000.00
Balance		$ 13,515.80

Monetary Equivalence for MSU Services and Facilities
January 2012 - December 2012

Accountant salary and benefits	$ 43,691.78
Office space	
Staff - 515 sq. ft. @ $13/sq. ft.	$ 6,695.00
Students - 742 sq. ft. @ $13/sq. ft.	$ 9,646.00
Laboratory space - 40% of 942 sq. ft. @ $16/sq. ft.	$ 6,028.80
Storage space	
AJMJ cages (2) - 71.5 sq. ft. @ $3.24/ sq. ft.	$ 231.66
Museum facilities - 12.5% of 936 sq. ft. @ $16/ sq. ft.	$ 1,872.00
Library @ 0.8% of total expenditures ($875,737)	$ 7,005.90
Utilities - General @ 12% of total expenditures ($875,737)	$105,088.44
Unit Operations Account	$ 12,000.00
Waived IDCs	$257,939.62
Total	**$450,199.20**

Montana Fish, Wildlife and Parks Annual Contribution
Montana Cooperative Fishery Research Unit Operations

Investigator	**Funding**
Alexander V. Zale	Montana Fish, Wildlife and Parks
Unit Leader, MTCFRU	MSU index 428513

Beginning Balance - January 2012		$ 7,769.00
Additional Funding – July 2012		$ 30,000.00
Expenditures - January 2012 - December 2012		
Salaries and Benefits	$ 3,351.33	
Communication (Telephone/postage)	$ 82.02	
Correction from 2011	< 2,093.94>	
Travel	$ 3,594.67	
Supplies	$ 5,843.10	
Repairs and Maintenance	$ 48.56	
Equipment	$ -0-	
Tuition	$ 1,523.10	
Total Spent		$ 12,348.84
Balance		$ 25,420.16

Federal Budget
January 2012 - December 2012

Salaries and Benefits	$301,966.08
Supplies	$ 5,028.04
Equipment: microscope	$ 20,936.00
Working Capital Vehicle Fund	$ 5,000.00
Total	**$332,930.12**

Unit Equipment Inventory (items with acquisition values greater than $5,000)

USGS

2011 Ford F250 4x4 crew cab (green)
Property No. 433429 – Serial No 1FT7W2BTOBEA70586
Acquisition value $ 31,697.00
Mileage 14,666

2009 Chevrolet HHR (red)
Property No. 433291 – Serial No. 3GNBAADB4AS513678
Acquisition value $18,720.00
Mileage 13,987

2005 Chevrolet Silverado 2500, 4x4 crew cab (green)
Property No. 430750 - Serial No. 1GCHK23G15F926039 (2005)
Acquisition value $22,948.21
Mileage 79,072

2002 Chevrolet 4x4 Suburban (white)
Property No. 261052 - Serial No. 3GNGK26U52G249012
Acquisition value $31,988
Mileage 111,307

1999 Chevrolet 3/4-ton 4x4 pickup truck (white)
Property No. 252537 -- Serial No. 1GCGK24R9XF049122
Acquisition value $21,009
Mileage 151,322

1989 Chevrolet 4x4 Suburban (tan)
Property No. 261114 - Serial No. 1GNGV26K2KF176088
Acquisition value $15,766
Mileage 151,801

Leica M165 C Stereomicroscope System
Serial No. 10450035
Leica DFC450 Digital Camera
Serial No. 12730411
Acquisition value $20,936

Wooldridge 20' Custom Boat and Trailer with a Honda 200 Four Stroke Motor and Electrofishing combo.
Property No. Boat 4005308 - Serial No. WLG20635I405
Property No. Trailer 430697 - Serial No. 47AVA221250061126
Property No. Motor 4005305 - Serial No. BAEJ-1300065
Property No. Electrofisher Combo 4005309
Acquisition value $50,871.57 (2004)

1990 23' Sea Ark Marine Boat and EZ-Load Trailer with a Zodiac life raft, Mobile Radio, Binoculars, Ross Depthfinder and Hummingbird Fish Finder.
Property No. Boat 632069 - Serial No. SAMA0093J989/FSC 1940
Property No. Trailer 632068 - Serial No. 12EIGN224LLW19678/FSC 2330
Property No. Mobile Radio 632015 - Serial No. 1391568/FSC 5820
Property No. Depthfinder 632014 - Serial No. 1975-201/FSC 6605
Property No. Life Raft 632007 - Serial No. 2845 or 2860/FSC 4220
Property No. Fish Finder 618216 - Serial No. 4765325
Property No. Binoculars 237807 - Serial No. 308594
Acquisition value $42,845.99 (Transferred from USFWS Creston Fish and Wildlife Center June 2006)

Hyde Aluminum Drift Boat
Property No. 3800001 - Serial No. TAD00230D696
Acquisition value $5,262 (1996)

VideoRay Pro3-XE-N ROV System
Property No. 4005775 - Serial No. G09028
Acquisition value $25,424.00 (2009)

Electrofisher SRI Backpack Combo
Serial No. BC-170057
Acquisition value $7,467.59 (2004)

Olympus BX40 microscope
Property No. 6001157 - Serial No. 9810089
Acquisition value $5,601 (1999)

U.S. Army Corps of Engineers

Wooldridge Jet Boat
Serial No. WLG18428K596
Acquisition value $19,447 (1996)

Montana State University

2008 Ford Escape Hybrid 4WD (grey)
Property No. 132775
Serial No. 1FMCU59H78KA13346
Acquisition Value $26,553.65 (2007)
Mileage 26,793

2005 GMC Sierra 2500 crew cab truck (green)
Property No. 132353
Serial No. 1GTHK23G65F944780
Acquisition Value $24,463.00 (2005)
Mileage 89,501

2001 GMC 1/2 ton 4x4 extended cab truck (green)
Property No. 132228
Serial No. 2GTEK19T911227311
Acquisition Value $15,255.00 (2005)
Mileage 145,540

1999 Ford F250 4x4 crew cab (blue)
Property No. 125014
Serial No. 1FTNW21S8XEA98840
Acquisition Value $11,002 (2005)
Mileage 172,079

1999 Chevrolet 1/2 ton 4x4 extended cab truck (white)
Property No. 132229
Serial No. 2GCEK19T8X1144560
Acquisition Value $12,459.00 (2005)
Mileage 196,244

2012 Wooldridge 18’ Custom Boat with a Mercury 150 Optimax motor
Serial No. WLG18379H112
Mercury Serial No. 1B881822
EZ Loader trailer Serial No. 1ZEAAAMC5CA001832
Acquisition Value $36,080.50 (2011)

BRP Evinrude 200 hp (for 1996 Wooldridge boat)
Serial No. 05257091
Acquisition value $10,444.00 (2009)

2008 Crestliner 18’ Boat
Serial No. CRC36198J708
90 hp Evinrude engine, Serial No. 05265364
19’ Shorelander trailer VIN No. IMDAPLP188A402650
Acquisition value $16,107.00 (2009)

2008 18’ Wooldridge Custom Boat
Serial No. WLG18099B808
150 hp Yamaha engine Serial No. 63PL1070949
EZ Loader Trailer Serial No. 1ZEADAMB08A152874
Acquisition value $32,182 (2008)
Smith-Root Electrofisher
Serial No. 11363T
Acquisition value $14,074 (2007)

2008 Workskiff Custom Boat
Serial No. MGN19S06D808
135 hp Honda engine Serial No. BARJ-1301242
EZ Loader Trailer Serial No. 1ZEADMPK28A158379
Acquisition value $36,615 (2008)

HT 2000 Backpack Electrofisher
Serial No. B068MK4
Acquisition value $6,162 (2006)

Electrofisher Backpack
Property No. 131644
Serial No. C00162
Acquisition value $5,792 (2003)

Acoustic Doppler Current Profiler
Property No. 133442
Serial No. StreamPro930
Acquisition value $16,975 (2009)

YSI Water Quality Monitor
Serial No. 08F100275, 08F100274, 08E100745
Acquisition value $15,923 (2008)

SRX 400A Datalogging Coded Series Receivers with W31 CT Firmware (two)
Property No. 132057
Serial No. 11826A
Acquisition value $7,950 (2004)
Property No. 132058
Serial No. 11827A
Acquisition value $7,950 (2004)