MONTANA CHAPTER

OF THE

AMERICAN FISHERIES SOCIETY

40TH ANNUAL MEETING

PROGRAM GUIDE

RETURN TO THE RIVER:

REVISITING AND REINVIGORATING THE SOURCE OF OUR PASSION AND PROFESSIONALISM

AMERICAN FISHERIES SOCIETY

MONTANA CHAPTER

FOUNDED IN 1967

The 40th Annual Meeting
of the
Montana Chapter
of the
American Fisheries Society

Return to the river:
Revisiting and reinvigorating the source of our passion and professionalism

February 13-16, 2007
Hilton Garden Inn
Missoula, Montana

Executive Committee:
Leanne Roulson, President
Kate Walker, Past President
David Schmetterling, President-Elect, and Program Chair
Matt Jaeger, Secretary- Treasurer
Travis Horton, Awards Chair

About AFS and the Montana Chapter

The American Fisheries Society (AFS), founded in 1870, is the oldest and largest professional society representing fisheries scientists. Our mission is to improve the conservation and sustainability of fishery resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals. AFS promotes scientific research and enlightened management of resources for optimum use and enjoyment by the public. We also encourage a comprehensive education for fisheries scientists and continuing on-the-job training. The AFS publishes some of the world's leading fisheries research journals and organizes scientific meetings where new results are reported and discussed. In addition to these primary functions, the Society has many other programs in areas such as professional certification, international affairs, public affairs, and public information.

The Montana Chapter of the AFS was formed in 1967 and our membership is currently comprised of approximately 300 fisheries professionals affiliated with state and federal agencies, universities, and private industry across the state. This is the major gathering of the year for fisheries professionals of all affiliations across the state. It is a great opportunity to learn about what is happening in the management and conservation of the fisheries resources across the state and explore timely issues.

Montana Chapter Officers

President: Leanne Roulson
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Craig Barfoot and Bob Bramblett
Raffle: MSU Student Subunit
Web Page: Eileen Ryce and Lee Nelson

Acknowledgements

Thanks to all the chapter officers and committee chairs for help arranging this conference, Michael K. Young for the conference title, Kiza Gates and Windy Davis from Montana State University's student subunit for everything, Shane Vatland for coordinating volunteers, and especially thanks to all the speakers, moderators, sponsors, and contributors, without whom this conference would not be possible.

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Plenary Session
Wednesday, February 14

Return to the river: revisiting and reinvigorating the source of our passion and professionalism

This year's theme is meant to inspire and celebrate the work we do as biologists and natural resource managers. The care and dedication many fisheries professionals show is truly special, and most share a strong passion and curiosity for nature, enjoyment of outdoor recreation, and fascination with science. These attributes separate us from other professions and drive us in our challenging jobs.

Annual meetings are important venues for networking, seeing old acquaintances, stimulating curiosity and invigorating passion for our work. Convening to share ideas not only lends intellectual benefits, but also helps renew our interest and enthusiasm in our field of work and study. I hope that this year's Montana Chapter of the American Fisheries Society Annual Meeting provides a way to recharge ourselves, emotionally and intellectually, as we ready ourselves for the coming months of work.

It is an honor to have two very well respected speakers representing different views of this profession, and I thank them both for their willingness to share their thoughtful approaches with us.

Welcome to Missoula.

Sincerely,

David Schmetterling

Keynote speaker, Pat Williams
The times, they are a' changing

Pat Williams was Montana's U.S. Congressman for 18 years. As a member of the U.S. House, Williams was a senior member of the House Interior Committee where he developed and supported national efforts to preserve Montana's and America's natural resources. Congressman Williams served as chair of the House Committee on Post Secondary Education and among his jurisdictions were the various higher education federal student loan and grant programs. Williams is a native Montanan, teacher at the university in Missoula, writes a regular newspaper column and provides regular commentary to Montana Public Radio.

Featured speaker, Chris Clancy
Fisheries professionals; rubbing and standing on shoulders

Chris Clancy was born and raised in Havre, Montana. His first fishing experiences were in the waters draining the Bear Paw Mountains and he still fishes there with his kids. Chris received his B.S. and M.S. in Fish and Wildlife Management from Montana State University. Since 1978, Chris has been a fisheries biologist for Montana Fish, Wildlife and Parks, working in southeast Montana, and the upper Yellowstone River drainage until moving to the Bitterroot Valley where he works and resides today. Throughout his career, Chris has been recognized and valued for his thoughtful approach to fisheries management, and has long been considered by his peers as one of the most well respected biologists in the state. As a management biologist Chris has been a leader in environmental protection though the permitting process. He has always tackled timely issues and he has become a leader in working with the divisive issues relating to the development of some of Montana's most popular valleys, including public access, stream setbacks, riprap bank reinforcement and even the way science is taught in schools.

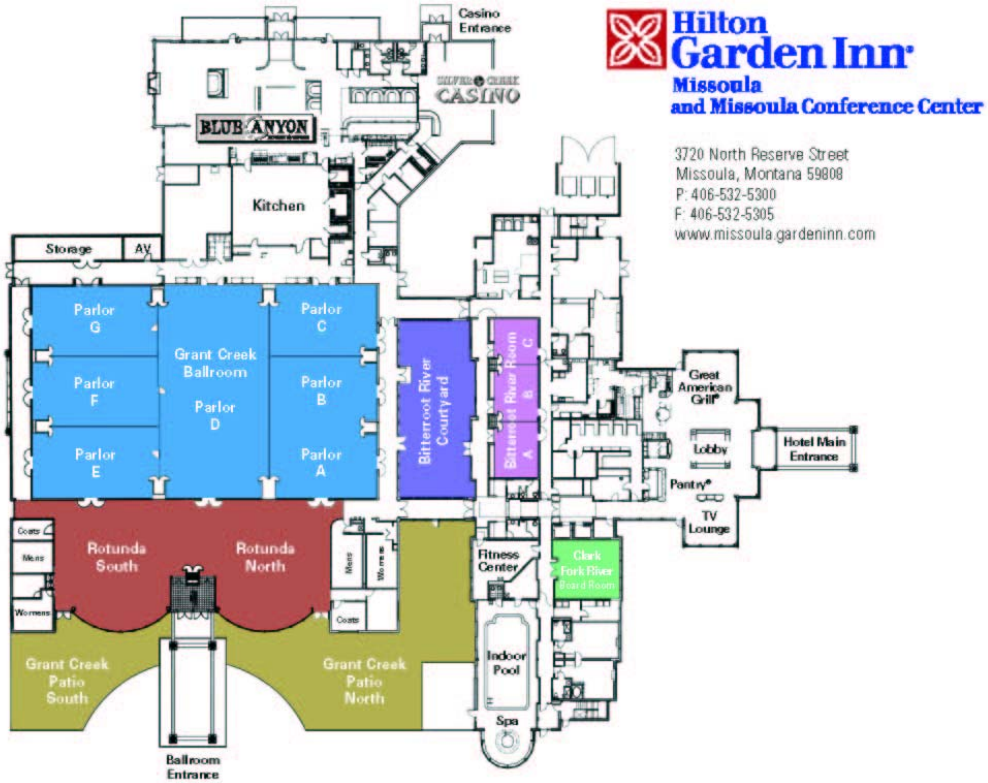
Schedule at a Glance

Date/ Time	Event	Location
Monday, February 12		
12:00-4:00	EXCOM meeting	Bitterroot River A
Tuesday, February 13		
7:00	Registration	Rotunda
7:00-8:00	Continental Breakfast	Parlor A
8:00-5:00	Continuing Education	Parlors B&C
12:00- 1:00	Lunch	Parlor D
5-8:00	Welcome social	Rotunda
Wednesday, February 14		
7:00	Registration	Rotunda
7:00-8:00	Continental Breakfast	Parlor A
8:00	Trade Show	Rotunda
8:00	Plenary Session: Return to the river: revisiting and reinvigorating the source of our passion and professionalism	Parlors E, F, G
9:10	Break	Rotunda
9:30	Contributed Papers	Parlors E, F, G
11:50	Awards Lunch	Parlor D
1:30	Symposium: Native fish and lake trout	Parlors E, F, G
2:30	Break	Rotunda
2:50	Symposium: Native fish and lake trout	Parlors E, F, G
4:10	Committee Caucuses	Parlors E, F, G & B, C
5:30	Trade Show Social -Dinner on own	Rotunda
Thursday, February 15		
7:00- 8:00	Continental Breakfast	Parlor A
7:00	Registration	Rotunda
8:00	Symposium: Barriers and Fish Movement	Parlors E, F, G
9:50	Break	Rotunda
10:10	Contributed Papers: Barriers	Parlors E, F, G

Date/ Time	Event	Location
1:10	Contributed Papers	Parlors E, F, G
3:30	Break	Rotunda
3:50	Business meeting	Parlor F & G
6:00	Trade show concludes	Rotunda
7:00	Banquet and raffle	Parlors A, B, & C

Friday, February 16

7:00- 8:00	Continental Breakfast	Rotunda
8:00	Symposium: Conservation of Arctic Grayling in Montana	Parlors A & B
10:10	Break	Parlors A, B, & C
10:30	Contributed Papers: Fisheries Management	Parlors A & B
8:00	Contributed Papers: Fisheries Techniques	Parlor C
10:10	Break	Parlors A, B, & C
10:30	Contributed Papers: Ecology	Parlor C
11:50	Adjourn	



Continuing Education Agenda

How to Move Fish, Water and Wood through Culverts

Tuesday, February 13, 2007

Hilton Garden Inn, Missoula Montana

8:00 Welcome, Introductions, Housekeeping, Show of hands of disciplines
Aquatic Organism Passage – why do we care
Brian Riggers, Fisheries Biologist, Lolo National Forest

8:45 **Introduction to Stream Simulation**
Anne Connor, P.E./Civil Engineer, Clearwater National Forest

9:30 Break

10:00 **Understanding Stream Processes, Function and Stability at Road Crossings**
Traci Sylte, P.E./Hydrologist, Lolo National Forest

11:00 **Hydrology, Discharge Estimates and Culvert Capacity**
Traci Sylte, P.E./Hydrologist, Lolo National Forest

11:45 Lunch - provided

12:45 **Stream Simulation, Bed and Grade Control Design**
John Kattell, P.E./Transportation Structures, R1-RO Engineering

2:45 Break

3:15 **Site Survey and Assessment**
Shane Hendrickson, Fisheries Biologist, Lolo National Forest

4:00 **Case Study – Hogback Creek, Montana - Pipe to Bridge**
Shane Hendrickson, Fisheries Biologist, Lolo National Forest

4:30 **Case Study- Badger Creek, Idaho - Pipe and Bottomless Arches**
Anne Connor, P.E./ Civil Engineer, Clearwater National Forest

5:00 **Question and Answer** (optional)

5:30 Adjorn

THE 40TH ANNUAL MEETING OF THE MONTANA CHAPTER OF THE AMERICAN FISHERIES SOCIETY

Agenda

Wednesday February 13

Plenary Session
Moderator: David Schmetterling (Montana Fish, Wildlife and Parks)

8:10 ***The times, they are a' changing,*** Pat Williams (Center for the Rocky Mountain West)

8:40 ***Fisheries professionals; rubbing and standing on shoulders*****,** Chris Clancy (Montana Fish, Wildlife and Parks)

9:10 **Break**

Contributed Papers
Moderator: Ladd Knotek (Montana Fish, Wildlife and Parks)

9:30 ***Relating Fish Assemblages to Environmental Patterns at Three Multi-state Scales,*** Robert M. Hughes*, Alan T. Herlihy, and Jean C. Sifneos (Oregon State University)

9:50 ***An Outbreak of Viral Hemorrhagic Septicemia in the Great Lakes: Montana's Next Whirling Disease?*** Ken Staigmiller (Montana Fish Wildlife & Parks)

10:10 ***Nuisance Alga Didymosphenia geminata: A Threat to our Fisheries,*** Leah C.S. Elwell (Federation of Fly Fishers)

10:30 ***Fish assemblages in the Powder and Tongue rivers in relation to coalbed natural gas development,*** Windy N. Davis*, Robert G. Bramblett and Alexander V. Zale (Montana State University)

10:50 ***Spatiotemporal Variation in Prairie Stream Fish Assemblages,*** Jason A. Mullen*, Robert G. Bramblett, Christopher S. Guy, and Alexander V. Zale (Montana State University)

11:10 ***Assessment of Post-stocking Dispersal of Age-1 Pallid Sturgeon: Implications for Acclimation,*** Eric W. Oldenburg* and Christopher S. Guy (Montana State University), William M. Gardner (Montana Fish, Wildlife and Parks)

11:30 ***Population viability of Arctic grayling in the Gibbon River, Yellowstone National Park,*** Amber C. Steed*, Alexander V. Zale, and Steven Kalinowski (Montana State University), Todd M. Koel (Yellowstone Center for Resources)

11:50 **Awards Luncheon**

Native Fish and Lake Trout: Churning New Water or Circling the Drain?
Moderator: Wade Fredenberg (U.S. Fish and Wildlife Service)

1:30 ***Lake Trout Suppression in Lake Pend Oreille Idaho – Will It Work?*** Ned J. Horner* Idaho Fish and Game and Michael J. Hansen (University of Wisconsin, Stevens Point)

1:45 ***Are anglers able to reduce lake trout abundance in Flathead Lake?*** Barry Hansen (Confederated Salish and Kootenai Tribes)

2:00 ***Lake trout suppression in Yellowstone Lake: the reality of this battle for cutthroat trout persistence,*** Todd M. Koel*, Patricia E. Bigelow, Philip D. Doepke, and Brian D. Ertel, (Yellowstone Center for Resources)

2:15 ***Lake Trout in the Lakes of Glacier National Park, Montana,*** Michael H. Meeuwig*, Christopher S. Guy (Montana State University), and Wade A. Fredenberg (US Fish and Wildlife Service)

2:30 **Break**

Native Fish and Lake Trout: Churning New Water or Circling the Drain?
Moderator: Chris Guy (Montana State University)

2:50 ***Lake Trout Population Control in Lake Pend Oreille, Idaho: Reversing Lessons from the Great Lakes,*** Michael J. Hansen* (University of Wisconsin – Stevens Point), and Ned J. Horner (Idaho Department of Fish and Game)

3:05 ***Simple population models: what can they tell us about lake trout suppression?*** Lisa Eby* and John Syslo(University of Montana)

3:20 **Panel Discussion**

4:10 **Committee Caucuses**

5:30 **Trade Show Social**

Thursday, February 14

8:00 **Welcome and Announcements:** David Schmetterling (Montana Fish, Wildlife and Parks)

Barriers and Fish Movements
Moderator: Shane Hendrickson (USFS, Lolo Nation Forest)

8:10 ***Analyzing tradeoffs between the threat of invasion by nonnative trout and effects of intentional isolation for native westslope cutthroat trout using a Bayesian belief network,*** Douglas P. Peterson*(US Fish and Wildlife Service), Bruce E. Rieman(USDA Forest Service), Jason B. Dunham (US Geological Survey), Kurt D. Fausch (Colorado State University), and Michael K. Young (USDA Forest Service)

8:30 ***Fish Barrier Design in Northcentral Montana,*** David C. Moser (Montana Fish, Wildlife and Parks)

8:50 ***Effects of Road Culverts on Eastern Montana Prairie Fish Assemblages*****,** Leo R. Rosenthal*, Thomas McMahon, Joel Cahoon, Robert Bramblett and Matt Blank (Montana State University)

9:10 ***Use of PIT Tag-Detecting Antennas to Assess Culvert Passage of Yellowstone Cutthroat Trout and Rainbow Trout in Mulherin Creek, a Tributary of the Yellowstone River,*** Andrew Solcz*, Thomas E. McMahon, Joel Cahoon (Montana State University), and Robert Gresswell (USGS Northern Rocky Mountain Science Center)

9:30 ***Fish Passage Planning and Development for Bull Trout at Thompson Falls Dam, Montana,*** Ginger G. Gillin* (GEI Consultants, Inc.), and L. Brent Mabbott (PPL Montana)

9:50 **Break**

Contributed Papers: Barriers
Moderator: Chris Clancy (Montana Fish, Wildlife and Parks)

10:10 ***Expected changes to the distribution, abundance and life history expression of fishes following the removal of Milltown Dam,*** David A. Schmetterling (Montana Fish, Wildlife and Parks)

10:30 ***Restoration Plan for the Clark Fork River and Blackfoot River near Milltown Dam,*** John M. Muhlfeld **(**River Design Group, Inc.)

10:50 ***Influence of Migratory Barriers on Genetic Diversity and Similarity among Bull Trout Populations in Glacier National Park, Montana,*** Michael H.

Meeuwig* and Christopher S. Guy, (Montana State University) and Wade A. Fredenberg (US Fish and Wildlife Service), Steven T. Kalinowski (Montana State University)

11:10 ***Big Coulee: an Attempt to Thwart Extinction,*** Stan Vansickle* and Mike Enk (USDA Forest Service)

11:30 ***Barrier Assessment of the Chadbourne Diversion Dam on the Shields River,*** Matt Blank* (Montana State University), Mike Cox and Drake Burford (OASIS Environmental)

11:50 ***Fish Losses to Irrigation Diversions on Two Tributaries of the Bitterroot River, Montana,*** Leslie Bahn*, Al Zale (Montana State University), Christopher G. Clancy and Mark Lere (Montana Fish, Wildlife, and Parks)

12:10 **Lunch**

Contributed Papers
Moderator: Michael K. Young (USFS, Rocky Mountain Research Station)

1:10 ***Efficacy of fish screens at preventing entrainment of westslope cutthroat trout Oncorhynchus clarkii lewisi juveniles in three irrigation canals of Skalkaho Creek, Montana,*** Ryan A. Harnish*, Alexander V. Zale (Montana State University), and Christopher G. Clancy (Montana Fish, Wildlife, & Parks)

1:30 ***Seasonal and spawning movements of genetically pure and hybridized westslope cutthroat trout in the Fan Creek drainage, Yellowstone National Park,*** Carrie Brooke (Montana State University)

1:50 ***Movement of Anglers and Sediment Transport: Implications for Moving Aquatic Nuisance Species,*** Kiza K. Gates, Christopher S. Guy, Alexander V. Zale **(**Montana State University),Travis B. Horton **(**Montana Fish, Wildlife and Parks)

2:10 ***Effects of Water Temperature and Angling on Mortality of Salmonids in Montana Streams,*** James W. Boyd* and Christopher S. Guy (Montana State University)**,** Travis B. Horton (Montana Fish, Wildlife & Parks) and Stephen A. Leathe (PPL Montana)

2:30 ***Environmental conditions affecting the toxicity of piscicides,*** Peter J. Brown* and Al V. Zale **(**Montana State University)

2:50 ***Collection of Samples to Detect Hybridization: One of These Things May Not be Like the Other,*** Matthew P. Corsi***,*** Paul Spruell (University of Montana) and Craig Barfoot (Confederated Salish and Kootenai Tribes)

3:10 ***Tracking fluvial cutthroat trout movements with stable isotope markers in a stream network,*** Adam Sepulveda* , Winsor Lowe (University of Montana), and Warren Colyer (Trout Unlimited)

3:30 **Break**

3:50 **Business Meeting**

6:30 **Dinner Banquet and Raffle!**

Friday, February 16

Conservation of Arctic Grayling in Montana
Moderator: Buddy Drake (Drake and Associates)

8:10 ***Montana Arctic Grayling: Status, Concerns and Antidotes,*** Jim Magee (Montana Fish, Wildlife and Parks)

8:20 ***Can Candidate Conservation Agreements Save Montana's Fluvial Arctic Grayling?*** Peter Lamothe (Montana Fish, Wildlife & Parks)

8:40 ***The Restoration of the Upper Big Hole Watershed's Riparian and Instream Habitat using Candidate Conservation Agreements,*** Jeff Everett **(**US Fish and Wildlife Service)

9:00 ***Improving Streamflows in the Upper Big Hole Using Candidate Conservation Agreements,*** Michael J. Roberts (Montana Department of Natural Resources and Conservation)

9:20 ***Understanding Entrainment Dynamics and Potential Implications to the Conservation of Arctic Grayling in the Big Hole River,*** Adam Petersen (Montana Fish, Wildlife, and Parks)

9:40 ***Grayling Reintroduction in the Ruby River, Montana,*** Emily N. Rens (Montana Fish, Wildlife & Parks)

10:10 **Break**

Contributed Papers: Fisheries Management
Moderator: Peter Brown (Montana State University)

10:30 ***Changes in Angler Use Following an Unauthorized Walleye Introduction in Canyon Ferry Reservoir,*** Eric L. Roberts* and Steven R. Dalbey (Montana Fish, Wildlife & Parks)

10:50 ***Effects of Spill on the Kootenai River below Libby Dam in 2006,*** Ryan M. Sylvester *, and Brian L. Marotz (Montana Fish, Wildlife and Parks)

11:10 ***Correct implementation of variable flow flood control (VARQ) at Libby Dam during 2006 could have avoided spill and prevented impacts to Kootenai River fish,*** Brian Marotz (Montana Fish, Wildlife & Parks)

11:30 ***Investigations into Rapid Temperature Decreases in the Upper Madison River downstream from Quake Lake, MT,*** Frank J. Pickett*, Timothy B. Schulz (PPL Montana), and Pat Clancy (Montana Fish, Wildlife and Parks)

Contributed Paper: Fisheries Techniques
Moderator: Leslie Bahn (Montana State University)

8:10 ***Estimation of Fish Age Using Otolith Relative Mass*****,** Craig P. Stafford (University of Montana)

8:30 ***A new biochemical genetic technique to examine hybridization among westslope cutthroat, Yellowstone cutthroat, and rainbow trout,*** John Powell* (University of Montana) and Robb Leary (Montana Fish, Wildlife and Parks)

8:50 ***Evaluation of Stocking as a Means of Replacing Introduced Trout Populations in Lakes with Westslope Cutthroat Trout,*** Robb F. Leary* (Montana Fish, Wildlife, and Parks), George K. Sage, and Fred W. Allendorf (University of Montana)

9:10 ***Who's Yer Daddy? Photo Documentation of Bull Trout and Brook Trout Hybridization,*** Wade Fredenberg (U.S. Fish and Wildlife Service)

9:30 ***Considering Natural Vegetation Development Processes in Streambank Stabilization Design,*** Amy Sacry* and Tom Parker (Geum Environmental Consulting, Inc.)

9:50 ***Dual-Frequency Identification Sonar (DIDSON) for Fisheries Applications: Cool Tool or Expensive Toy?*** Susan L. Camp*, Eric Best and Steve Hiebert (U.S. Bureau of Reclamation)

10:10 **Break**

Contributed Papers: Ecology
Moderator: Rob Clark (Montana Fish, Wildlife and Parks)

10:30 ***Spawning Abundance of Bull Trout (Salvelinus confluentus) in relation to Geomorphology, Temperature and Roads in tributaries of Rock Creek Basin (Missoula and Granite Counties), Montana, USA,*** Christopher A. Frissell and Gary Carnefix* (The University of Montana)

10:50 ***Eustache Creek Mine Site and Stream Channel Reclamation- Planning, Monitoring, and Implementation,*** Scott Spaulding*, Traci Sylte (USDA Forest Service) and Rob Roberts (Trout Unlimited)

11:10 ***Hebgen Reservoir Activities Update: Still Looking at Factors that could Potentially be Limiting Wild Rainbow Trout Recruitment to the Hebgen Fishery,*** Travis Lohrenz (Montana Fish, Wildlife and Parks)

11:30 ***Population Structure and Seasonal Habitat Use of the Northern Pike Population of Cabinet Gorge Reservoir, Montana,*** Sean S. P. Moran* and Shana R. Bernall (Avista Corporation)

11:50 **Ajourn!**

Abstracts

Relating Fish Assemblages to Environmental Patterns at Three Multi-state Scales

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Key challenges to studying and managing riverscapes include understanding how factors measured at various spatial-scales influence aquatic biota and developing accurate predictive models where study data are limited. Currently fish zones, physiographic regions, ecoregions, and river basins are commonly used for classifying fish faunas. All these classifications reduce the apparent variability occurring at a large scale, but also include considerable heterogeneity. We analyzed a 780 site data set obtained from the USEPA's EMAP western survey. First, we determined fish clusters at three spatial scales in the western USA (all 12 conterminous states, all western mountains, Pacific Northwest mountains). We next determined that the predictor variables for those clusters changed with spatial scale. For example, longitude, dams and temperature were the best predictors for all sites, longitude, dams and catchment area were the top predictors for mountain sites, and latitude, turbidity, and canopy density ranked highest for Pacific Northwest mountains. The best three variable models included site, basin, and ecoregion predictor variables. However, basin, ecoregion, state, and abiotic site variables alone only accounted for half of the mean within-group similarity demonstrated by the fish clusters. We conclude that using large quantitative fish assemblage data sets linked with quantitative physical and chemical habitat data and landscape data to predict fish assemblage patterns is preferable to using preexisting landscape classifications.

An Outbreak of Viral Hemorrhagic Septicemia in the Great Lakes: Montana's Next Whirling Disease?

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Viral Hemorrhagic Septicemia (VHS) is an aquatic rhabdovirus that has the potential to cause significant mortality in fish. It is believed to have originated in Europe where it affects mostly freshwater fish in culture situations. It was first reported in the United States in 1988 and has since become enzootic in the Pacific Northwest in several marine species including pacific herring and several salmon species. In 2005 a variant of the virus was discovered in the Great Lakes Region and has been associated with significant mortality in a variety of freshwater fish species. Although the origin of this Great Lakes genotype of VHS is unclear, it has demonstrated the ability to cause severe mortality among a number of species unaffected by previously isolated strains of the virus, including most game fish found in Montana. Due to this unique characteristic, the outbreak in the Great Lakes generated an unprecedented regulatory response from a variety of State and Federal Agencies. There is already in place a national framework of regulations from various jurisdictions aimed at preventing the spread of destructive pathogens and organisms; however, it is not a perfect system. It is important to remain active and informed at the local level so as to increase our level of protection even more. Though it has not been found in Montana, this pathogen has significant implications to fisheries managers in Montana. It is important to remain vigilant in our oversight of potential transmission vectors to ensure that this pathogen does not find it's way into Montana waters.

Nuisance Alga *Didymosphenia geminata*: A Threat to our Fisheries

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Didymosphenia geminata, a type of freshwater diatom alga, has recently been documented outside its historic northern circumboral range and has resulted in highly visible algal blooms. Additionally, in locations with previous record of *D. geminata* in North America, algal growth has increased in spatial coverage and temporal persistence. The changes in growth habit may negatively impact fisheries and macroinvertebrates. Nuisance benthic growth of *D. geminata* can extend for greater than 1 km, persist for several months of the year, and cover up to 100% of substrate with thicknesses greater than 20 cm. Nuisance growth, characterized by thick mats that cover the stream bed, consists primarily of mucopolysaccaride stalks secreted by single cells of *D. geminata*. The thick mats are resistant to degradation and may influence the ecological properties of the stream (e.g., species diversity, population sizes, nutrient pools), alter the invertebrate food base, and reduce appropriate habitat and spawning sites for fish. The observed

nuisance and invasive behavior patterns of *D. geminata* have prompted studies to improve our understanding of and methods to control this species. Questions that examine the impact of algal blooms on species composition and diversity are under investigation. Preliminary studies suggest that *D. geminata* may be transported to new locations by recreation activities and equipment. With limited information gathered on the basic biology of this species and little understanding of impacts upon fisheries, the best defense against this alga is to limit its spread to new locations with proper equipment cleaning techniques and effective outreach education.

Fish assemblages in the Powder and Tongue rivers in relation to coalbed natural gas development

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The Powder River Basin in Wyoming and Montana is currently undergoing one of the world's largest coalbed natural gas (CBNG) developments. Potential exists for substantial effects on aquatic ecosystems because CBNG development involves production and disposal of large quantities of coalbed ground water that differs from surface waters. We used four different approaches to determine the effects of coalbed natural gas development on fish assemblages in streams of the Powder River Basin in 2005 and 2006. First, we compared fish assemblages in streams with CBNG development and streams without development. Second, we compared the longitudinal distribution patterns of fish assemblages at multiple points above and below CBNG development. Third, we compared fish assemblages present in 2006 to fish survey data from the mid 1990s in areas with and without CBNG development. Finally, we compared growth and survival of native fish in streams with and without CBNG development. Several fish metrics and an index of biotic integrity were used to compare fish assemblages in relation to the status of development within a drainage area. Streams in drainages with CBNG development on average had lower species richness than those without development.

Spatiotemporal Variation in Prairie Stream Fish Assemblages.

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Fisheries biologists must be certain that their samples represent true parameters to make sound management decisions. Thus, assessing the spatiotemporal variation of fish assemblages in Montana prairie streams will allow for a better understanding of these ecosystems and their management. We used stratified random sampling to select five tributaries of the Yellowstone River that represent a gradient of stream sizes. To assess spatial variation, fish were sampled at

sites arrayed from the confluence to the headwaters of each stream during June and July 2005 and 2006. To assess temporal variation, downstream, middle, and headwater sites (i.e., drainage position) were sampled on each stream in spring 2005 and summer and fall 2005 and 2006. In general, species richness increased with increasing watershed size from 16 to 26 species. Species richness varied spatially and decreased from downstream to upstream sites. Species richness in the smallest stream varied spatially from 12 to 0 (CV=86.73) species; likewise, species richness varied from 16 to 2 (CV=41.63) in the largest stream. The downstream site of the largest stream exhibited the greatest temporal variation in species richness--from 16 to 9 species (CV=21.03). Overall, species richness did not vary consistently among seasons. Canonical correspondence analysis showed that drainage position and proportion of fine substrate were significant in explaining the most variation in fish assemblage structure. Given logistic and monetary constraints, we suggest that biologists design their surveys to maximize spatial coverage to adequately characterize fish assemblages of prairie streams.

Assessment of Post-stocking Dispersal of Age-1 Pallid Sturgeon: Implications for Acclimation

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A propagation program for pallid sturgeon *Scaphirhynchus albus* in the upper Missouri River was implemented by the U. S. Fish and Wildlife Service in 1997. However, evidence suggests that many hatchery-reared pallid sturgeon are experiencing significant downstream post-stocking dispersal, negatively affecting their recruitment. Therefore, the objective of this study was to evaluate the effects of acclimation to flow and site-specific water conditions on post-stocking dispersal of age-1 pallid sturgeon. Fish from three acclimation treatments were radio-tagged, released at two locations, and monitored using passive remote telemetry stations. Treatment 1 fish were acclimated to flow and site specific water conditions in tanks along the Marias River. Treatment 2 fish were acclimated to flow in tanks at the Bozeman Fish Technology Center (BFTC), and Treatment 3 fish were reared with no acclimation at the BFTC. In 2005, Treatment 2 experienced 100% mortality. Further, Treatment 1 fish drifted less, experienced lower mortality, and nearly twice as many fish remained in suitable pallid sturgeon habitat than Treatment 3 fish. In 2006, drift rates, mortality rates, and fish remaining in suitable habitat were similar among treatments. In both years, all pallid sturgeon drifted less in the lower reaches of the study area where more sand substrate is present. Fin curl was present in nearly all

individuals in 2005, and 28% of individuals in 2006. These data suggest that acclimation can reduce post-stocking dispersal when fin curl is present.

Population viability of Arctic grayling in the Gibbon River, Yellowstone National Park

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Fluvial Arctic grayling *Thymallus arcticus* are presently restricted to less than 5% of their native range in the contiguous United States and are listed as Category 3 under the Endangered Species Act. Fluvial grayling are thought to be restricted to a segment of the Big Hole River, Montana, in which declining abundances have been observed since 1998. Although fluvial grayling of the Madison, lower Firehole, and lower Gibbon Rivers of Yellowstone National Park were thought to be extirpated by 1935, anglers report catching grayling throughout the Gibbon River annually. Our goal was to determine if a viable population of fluvial grayling persists in the Gibbon River, or if fish caught in the river are downstream emigrants from lacustrine populations in headwater lakes. In 2005 and 2006, sixteen and fourteen grayling respectively, were sampled from the Gibbon River by electrofishing and fly-fishing. In both years, fry-trapping yielded no grayling at sites on the Gibbon River below the farthest upstream barrier to headwater lakes (Little Gibbon Falls). Sixteen grayling were caught on a weir established above Little Gibbon Falls in 2006. Genetic analyses will be performed in 2007 on grayling within and outside of the Gibbon River System. Few grayling adults and fry inhabit the Gibbon River, implying that a reproducing

fluvial population may not exist. Our findings may affect the potential Endangered Species Act listing of fluvial grayling while providing valuable data for sound management within and outside of Yellowstone National Park.

Lake Trout Suppression in Lake Pend Oreille Idaho – Will It Work?

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The lake trout population in Lake Pend Oreille, Idaho has been increasing exponentially since about the mid 1990's threatening the collapse of the kokanee population and one of the best adfluvial bull trout populations remaining in the Pacific Northwest. Traditional sport angling has done little to curb lake trout population growth. Deep water trap nets were used to estimate lake trout population abundance and evaluate harvest efficiency. Lake trout abundance was estimated at 6,400 fish >52 cm in 2003 and 10,700 in 2005. The steep sides and extreme depth of Lake Pend Oreille limited harvest efficiency by trap netting to about 12%. Based on recaptures in gill nets, the estimated population was 35,800 fish with 15,600 > 52 cm. An aggressive angler incentive program using $110,000 of Avista mitigation funding was used to encourage harvest of rainbow and lake trout to reduce predation on kokanee. A $10/fish bounty was more effective at motivating anglers than rewards based on PIT tags ($100-$2,000), lottery tickets, or monthly cash drawings for every fish entered. Anglers harvested 5,800 rainbow trout and 10,800 lake trout between May and November. The combined exploitation from netting and angling resulted in a total annual exploitation rate on lake trout of 44% and total annual mortality rate of 60%. We conclude that lake trout suppression can only be achieved through a combination of netting and angling. Next, we will employ population models to estimate the number of years needed to collapse the lake trout population in Lake Pend Oreille.

Are anglers able to reduce lake trout abundance in Flathead Lake?

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Flathead Lake's native fish fauna have declined in large part from predation by introduced lake trout (*Salvelinus namaycush*). The state and tribal co-managers completed a plan in 2000 to reduce the lake trout population. The primary strategy to accomplish this goal is recreational angling. We improved access and increased bag limits, number of lines, and publicity, but have yet to substantially increase harvest above 40,000 fish. While catch rates are high and

increasing, anglers resist keeping large numbers of fish. We addressed this behavior with fishing contests where participants receive lottery tickets for every fish they harvest. The contests are growing rapidly, accounting for greater than 11,000 fish in 2006. Many have equated the success of these contests with reduction of the lake trout population, but our data contradict this conclusion. We estimated the harvest needed to reduce the population so we could better evaluate which tools were capable of achieving that harvest. We estimated that a total harvest of 60,000 lake trout would result in a mortality rate sufficient to cause the population to decline. With increased angler incentives this harvest may be achievable in two years. However, the degree of compensation that the increased harvest will cause is unknown. We have measured reductions in growth rates and increases in age at maturity of lake trout that indicate a large compensatory reserve that must be overcome. While reaching the 60,000 target by angling appears imminent, it is presently speculative whether the additional compensatory recruitment can be removed by angling alone.

Lake trout suppression in Yellowstone Lake: the reality of this battle for cutthroat trout persistence

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Soon after the 1994 discovery of lake trout in Yellowstone Lake, Yellowstone National Park initiated a gillnetting program aimed at suppression of the population. In 2001, our efforts were enhanced by acquisition of a Great Lakes-style gillnetting boat and funding to support additional staff. From 2001 to 2006, we set 105,000 net nights of gillnet (100m/night) and removed 170,000 lake trout. Despite this effort, lake trout remain abundant. A new spawning site was discovered in 2006, and increasing numbers of smaller, immature lake trout have been removed for the fifth year in a row. Suppression efforts are surely slowing the rate of population growth, but whether or not the program will be able to suppress the lake trout population to an equilibrium that allows cutthroat trout to co-exist is unknown. Recent results are encouraging, in that larger, older lake trout continue to be caught with low frequency, and the mean length of lake trout caught on spawning areas has declined each year (559 mm in 2001 as compared to 505 mm in 2006). Program effectiveness is now being evaluated through collaboration with scientists at Montana State University and USGS Cooperative Fisheries Research Units in Montana and Wyoming. Population models created during the next two years, based on information collected over the past decade, will help to guide our program. As lake trout will never be fully removed from Yellowstone Lake, the development of new, advanced techniques for improving efficiency of suppression efforts is needed for this program to continue long term.

Lake Trout in the Lakes of Glacier National Park, Montana

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Glacier National Park, Montana, contains a significant portion of natural lake habitat available to adfluvial populations of bull trout *Salvelinus confluentus* throughout the United States. Because of the complex landscape in Glacier National Park some bull trout populations are relatively isolated; however, other populations are less isolated and susceptible to deleterious effects of invasion by nonnative species. Of particular concern is the invasion by nonnative lake trout *Salvelinus namaycush*, which was introduced into the Flathead drainage in the early 1900s. Past research has shown that invasion by lake trout may result in significant declines in bull trout populations. However, little effort has been made to manage the invasion in lakes within Glacier National Park. Using historical and contemporary data we examined the effect of lake trout invasion on bull trout populations in the four largest lakes in Glacier National Park west of the Continental Divide; Bowman Lake, Kintla Lake, Lake McDonald, and Logging Lake. Dramatic declines in bull trout numbers were observed over the last 36 years; these declines were associated with an increase in the numbers of lake trout. In 2005, relative abundance (mean catch per unit effort) of lake trout was 2.85 to 4.06 times higher than that of bull trout among lakes. These data suggest that further invasion by lake trout in this system may have a negative effect on native bull trout populations under a management strategy of "no action."

Lake Trout Population Control in Lake Pend Oreille, Idaho: Reversing Lessons from the Great Lakes

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The lake trout (*Salvelinus namaycush*) is widely distributed throughout the northern half of North America, but is generally thought to be susceptible to recruitment over-fishing because of its long-lived, late-maturing life history. For example, in the Laurentian Great Lakes, the World's largest lake trout populations were nearly extirpated by excessive fishery exploitation and predation by non-native sea lampreys. Experience in the Great Lakes shows that lake trout stocks have been exceedingly slow to recover, largely because fishery exploitation has been excessive. Lake trout stocks have recovered only in Lake Superior and isolated areas of Lake Huron, whereas populations are sustained by hatchery production elsewhere in the basin. Therefore, lake trout populations in western lakes, where the species was introduced in the early 1900s, but is now negatively impacting native species such as bull trout (*Salvelinus confluentus*), should be relatively easy to control through intentional programs of excessive fishery exploitation. Why then has lake trout population control been elusive in most western lakes? We suspect that fishery exploitation has not been high enough to drive lake trout populations into collapse in most western lakes. In contrast, population modeling suggests that exploitation on the lake trout population in Lake Pend Oreille, Idaho, during 2005–2006 will cause the population to collapse, if maintained for at least several years. If successful, the lake trout population control program on Lake Pend Oreille will provide fishery managers throughout the West with a formula for similar programs elsewhere.

Simple population models: what can they tell us about lake trout suppression?

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Simple population model projections and elasticity analyses have been used in evaluating and prioritizing techniques for population conservation. These types of analyses have been particularly effective in comparing the relative impact of different conservation efforts. These same techniques can help us compare potential lake trout population suppression efforts. We built an age-based matrix model for a lake trout population and parameterized it with both unpublished data of lake trout in Flathead Lake and other published demographic studies of lake trout. We then examined multiple model simulations to begin to evaluate potential suppression scenarios for a newly established lake trout population. Overall lake trout adult survival had high elasticity values, implying that a proportional change in demographic rates of this life stage

would produce a relatively large impact on population growth rates. Eradication often requires decreased survival of multiple life stages. Techniques that reduce egg survival in addition to decreased adult survival can influence population numbers substantially. Scenarios with adult and egg survival reduced (75% and 50%, respectively), population sizes decreased by one-half after 15 years over reducing adult survival alone. This benefit of increased egg mortality is dependent upon the role of density-dependence in early life history stages. Finally, we examined scenarios associated with delaying suppression a decade as the population continues to increase. As expected, to either maintain the lake trout population at a set reduced level or eradicate the population, delaying suppression efforts results in either more or a longer effort required to achieve a similar end point.

Analyzing tradeoffs between the threat of invasion by nonnative trout and effects of intentional isolation for native westslope cutthroat trout using a Bayesian belief network

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Conservation of inland cutthroat trout can involve either the placement or removal of migration barriers to address threats from invading species and habitat fragmentation, respectively. Such

efforts may proceed without a formal mechanism for considering potential tradeoffs from addressing these competing threats. A consistent decision process would include an analysis of when and where intentional isolation or removal of barriers is most appropriate, and we explored the application of a Bayesian belief network (BBN) as a tool for such analyses. We focused on westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) and nonnative brook trout (*Salvelinus fontinalis*), and current understanding of environmental factors influencing both species, their potential interactions, and the effects of isolation on the persistence of individual cutthroat trout populations. Analysis indicated the tradeoff between isolation and invasion was strongly influenced by the size of the stream network (or cutthroat trout population) to be isolated and existing demographic linkages within and among cutthroat trout populations. Intentional isolation was predicted to benefit demographically isolated cutthroat trout populations facing certain invasion by brook trout. The relative benefits of isolation depended strongly on the size and quality of isolated habitat. Intentional isolation generally reduced the probability of persistence for migratory populations regardless of invasion threat. The BBN does not provide a decision; rather it allows a biologist or manager to explore management options within streams and prioritize conservation actions among streams with a transparent and consistent logic. It can also facilitate discussion that encourages clarification of conservation values, management goals, and biological uncertainties.

Fish Barrier Design in Northcentral Montana

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Genetically unaltered westslope cutthroat trout *(Oncorhynchus clarkii lewisi)* in northcentral Montana (Missouri River Drainage) currently occupy less than 3% of their historical habitat. Declines in westslope cutthroat trout abundance and range in northcentral Montana are primarily attributable to hybridization with introduced rainbow trout *(Oncorhynchus mykiss)* and competition with introduced brook trout *(Salvelinus fontinalis)*. In many instances protection and short term restoration of extant stocks of westslope cutthroat requires immediate suppression of brook trout and construction of fish barriers. Barrier construction has been a process of adapting various designs, which either use height or current velocity to block fish, to site conditions. Construction methods have included blasting and chipping out native bedrock, pouring concrete, anchoring of native materials, use of gabions, and installation of perched culverts. Design and funding considerations will be discussed along with advantages and difficulties associated with each barrier method. Responses of westslope cutthroat populations to blockage and removal of non-native brook trout using electrofishing has been uniformly positive and in some cases dramatic.

Effects of Road Culverts on Eastern Montana Prairie Fish Assemblages

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Road culverts can restrict passage of fish migrating between seasonal habitats. The development of new roads, as well as the repair and upgrade of existing roads, has led to research addressing the effects culverts have on fish populations. The majority of this research has focused on salmonid species, and the effect of culverts on movements of small-bodied, weak swimming species is largely unknown. Fish passage within a species-rich assemblage of prairie fishes was examined in two tributaries of the lower Yellowstone River having a variety of culvert types. Passage restriction at culverts was determined using a combination of existing fish passage models, mark-recapture experiments, and patterns of longitudinal fish distribution above and below culverts. Fish movement was not significantly different through culvert versus natural reaches for most species ($P>0.05$). Additionally, few differences were observed in relative abundance and species richness above and below culvert crossings. A survey of culverts throughout much of eastern Montana showed that the conditions observed in study culverts were typical of many low gradient, prairie streams. Many culverts had small outlet drops, low gradients, contained natural substrate, and low water velocities similar to those of natural reaches. Our results suggest that in these conditions, culverts may allow for adequate passage of most prairie species. However, more research is needed to determine what thresholds in these variables negatively influence passage of prairie fishes.

Use of PIT Tag-Detecting Antennas to Assess Culvert Passage of Yellowstone Cutthroat Trout and Rainbow Trout in Mulherin Creek, a Tributary of the Yellowstone River

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Road crossing culverts create passage barriers during fish migration and, as a result, there are various tools for predicting passage success. Most tools have not been field-tested and give a "yes" or "no" answer to passage success. However, an estimate of the probability of passage could be more useful given that success is contingent on dynamic interactions of fish size, discharge, water temperature, and hydraulic conditions. We utilized half-duplex PIT (passive integrated transponder) tags to assess the probability of passage of Yellowstone cutthroat trout and rainbow trout in relation to biotic and abiotic factors among three different culvert types on a spawning tributary to the Yellowstone River. Velocities were significantly different between smooth box, baffled box and smooth circular culverts but did not differ significantly between a natural stream reach and one baffled box culvert. There was a positive linear relationship between number of attempts and velocity and a negative linear relationship between number of attempts and drop height, most likely due to culverts with lower velocity having larger drop heights. Time required for passage was inversely related to water velocity. Culverts where velocities were most similar to natural reaches allowed fish to pass multiple times in both directions and some remained in the culvert for up to 22 hr. These results show that culverts that simulate natural conditions are most efficient for allowing fish passage and that PIT tags are an efficient method for determining not only probability of passage success but also can provide measures of passage difficulty.

Fish Passage Planning and Development for Bull Trout at Thompson Falls Dam, Montana

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PPL Montana is the owner of the Thompson Falls Dam, built in 1917 on the Clark Fork River near Thompson Falls, Montana. The listing of the bull trout as a threatened species under the Endangered Species Act prompted the preparation of a biological assessment (BA) to assess the impacts that the Project may be having on bull trout (*Salvelinus confluentus*), and to make recommendations about possible conservation measures to reduce those impacts. That BA concluded that the Project might adversely affect bull trout, in large measure due to a lack of upstream fish passage. An Interagency Technical Advisory Committee was established to help guide PPL Montana in their efforts to conserve bull trout by providing upstream passage. Proper location of a fish collection facility is critical to the success of an effective fish passage solution. In order to find the most effective location for the fishway, trout were radio tagged, and stationary receivers were positioned at key locations to continuously monitor fish movements. Results indicated that trout migrate upstream to the main dam, the upstream most location in the tailrace, during the early spring. Therefore, the main dam was selected as the fishway site. An alternatives analysis assessed three potential fishway configurations at that site. The Interagency Technical Advisory Committee recommended the right bank full height ladder alternative, and PPL Montana concurred. This fishway is currently being designed, and will include fish sampling facilities that will allow maximum operational flexibility for fisheries managers.

Expected changes to the distribution, abundance and life history expression of fishes following the removal of Milltown Dam

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Milltown Dam has fragmented the Clark Fork watershed since1907. Historically, fish used large, connected, ecologically and geographically distinct habitats spanning hundreds of kilometers to express different stages of their life histories. The dam as not allowed upstream fish passage, has limited downstream fish movements and created a reservoir that has fostered a population of exotic northern pike. Recent studies show the dam's continued affect on an

enormous geographic scale. Milltown Dam annually impedes migrations of tens of thousands of fish, and data suggest that fish that migrate to the dam do not spawn once their migration is impeded. Native migratory fishes like westslope cutthroat trout and bull trout have been especially affected by the dam but their annual presence at the dam suggests the potential to reestablish fluvial life history forms and enhance local or up-river populations. Milltown Dam will be removed in the next few years and the watershed will once again regain connectivity. Biotic changes from dam removal will range from drastic local changes in species composition, fish densities, and unimpeded fish passage. However, on most scales, the changes will be subtle and offer populations more resilience and better expression of life history tactics.

Restoration Plan for the Clark Fork River and Blackfoot River near Milltown Dam

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In 2005, a consent decree set forth the terms and conditions for the removal of Milltown Dam near Bonner, Montana. Constructed in 1907 at the confluence of the Blackfoot and Clark Fork rivers, Milltown Dam is a fish passage barrier and impounds approximately 6.6 million cubic yards of contaminated sediments transported to Milltown Reservoir from upstream historical mining in Butte and Anaconda. The State of Montana, in consultation with the Confederated Salish and Kootenai Tribes and the US Fish and Wildlife Service, are developing a plan that will restore the Clark Fork and Blackfoot rivers to naturally functioning, free-flowing fluvial systems. Project goals include: 1) maintaining water quality, 2) accommodating sediment transport and channel dynamics, 3) providing habitat for native fishes and other trout, 4) creating functional wetlands and riparian communities, 5) enhancing visual and aesthetic values, and 6) providing safe recreational opportunities compatible with other restoration goals. Design approaches are process and form based and include stream classification, regional hydraulic geometry relationships, regime and tractive force equations, and one and two-dimensional flow and sediment transport computations. These approaches are being used to meet both ecological and stability objectives. Preliminary results indicate that the most probable state of the rivers is a slightly entrenched, meandering, gravel-dominated, riffle-pool channel transitioning to a moderately entrenched channel near the confluence with the Blackfoot River. Following restoration activities, fish passage will be restored resulting in the full expression of fluvial life histories for species including bull trout, westslope cutthroat trout, and largescale suckers.

Influence of Migratory Barriers on Genetic Diversity and Similarity among Bull Trout Populations in Glacier National Park, Montana

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Adfluvial populations of bull trout *Salvelinus confluentus* in Glacier National Park, Montana, occupy a complex landscape of interconnected and fragmented lake habitat. Natural barriers (e.g., waterfalls) may limit migration among available habitat and result in fragmentation and isolation of some populations. Polymorphic microsatellite loci were used to examine patterns of genetic diversity and similarity among populations of bull trout in Glacier National Park and to examine differences between populations isolated by migratory barriers and those occupying more interconnected habitat. One hundred ninety-six bull trout, comprising 16 populations, were genotyped at 10 microsatellite loci. Five populations were isolated by migratory barriers (i.e., waterfalls with a vertical drop ≥ 1.8 m). Expected heterozygosity (averaged across loci) varied from 0.18 to 0.73 among populations and was lower on average for populations isolated by barriers (0.27 ± 0.09) compared to those not isolated (0.61 ± 0.08). Allelic diversity (averaged across loci and adjusted for sample size) varied from 1.47 to 3.45 among populations and was lower on average for populations isolated by barriers (4.53) compared to those not isolated (6.46) based on a hierarchical classification. Pairwise F_{st} values varied from 0.00 to 0.69 with larger values representative of comparisons between populations isolated by barriers. These data indicate that natural barriers have had an influence on the genetic diversity and similarity among bull trout populations in Glacier National Park.

Big Coulee: an Attempt to Thwart Extinction

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Westslope cutthroat trout (WCT), *Oncorhynchus clarkii lewisi*, in Big Coulee Creek were first surveyed in 1995 after the Forest Service received information from Montana Fish Wildlife and Parks biologist, Anne Tews. The other headwater tributaries of Highwood Creek were later inventoried and it was determined that the WCT in Big Coulee were the last extant population in the drainage. Information concerning Big Coulee showed that if action was not taken quickly, this small remnant population would likely become extinct. In order to prevent the loss of these native fish, fishery managers faced many challenges: competition/predation by brook trout, habitat degradation, and illegal angler harvest. Habitat improvement and fishery projects have been implemented to protect these aboriginal westslope cutthroat. At the end of the 2006 field season, brook trout had almost been eradicated and a fish migration barrier was successfully stopping the immigration of non-native fish. The WCT population is now rebounding with dramatic increases in juveniles and adults. Due to collaborative efforts of the US Forest Service, Montana Fish, Wildlife and Parks, and a number of volunteers there are still WCT in the Highwood Basin.

Barrier Assessment of the Chadbourne Diversion Dam on the Shields River

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The Shields River supports widely distributed populations of Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) that show very little to no evidence of introgression with rainbow (*O. mykiss*) or westslope cutthroat trout (*O. c. lewisi*). The Chadbourne diversion dam, approximately 12.5 river miles upstream of the confluence with the Yellowstone River, is suspected to be a partial barrier to upstream passage of large trout. We performed a fish passage assessment of the diversion using a combination of hydraulic modeling under a range of flows combined with fish swimming and leaping abilities of Yellowstone cutthroat, rainbow, brown (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) to characterize its barrier status. We analyzed three potential passage scenarios: (1) the development of a side-channel that bypasses the diversion at high flows, (2) the potential for trout to leap over the structure, and (3) the

potential for trout to pass through a keyhole or notch in the structure. Results indicate that a side-channel may form at flows exceeding the 2-year recurrence interval (RI) when the diversion is operating with wooden planks in place and a 10-year RI when the diversion is operating without wooden planks in place. The analysis also indicates that the leap heights are too great for all operating scenarios and flows. However, the analysis indicates that large trout of all four species may be able to pass the structure by swimming up the key hole or notch at some flows.

Fish Losses to Irrigation Diversions on Two Tributaries of the Bitterroot River, Montana

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Withdrawals of surface water for irrigation and stock water leave the mainstem of the Bitterroot River and its tributaries chronically dewatered during the irrigation season. These water withdrawals affect local trout populations by entraining migratory trout in irrigation diversion canals at multiple life stages, and through the loss and degradation of available habitat for aquatic species. Irrigation losses may be responsible in part for the low abundances and restricted distributions of migratory native westslope cutthroat trout *Oncorhynchus clarkii lewisi* and bull trout *Salvelinus confluentus* in this system. Information about entrainment rates of fish into irrigation diversion canals and the factors that influence these rates is limited. Our goals were to quantify entrainment of fish into 7 irrigation diversions on Lost Horse Creek and 5 irrigation diversions on Tin Cup Creek, two tributaries of the Bitterroot River, and to identify characteristics of these diversions that correlate with rates of entrainment. We sampled fish species by snorkeling, electrofishing, fry trapping, and reconnaissance at the end of the irrigation season at 60 sites in 2005 and 54 sites in 2006. In August, the period of peak abundances of

entrained fish, we estimated 5,525 fish in 2005 and 3,372 fish in 2006 to be present in Lost Horse Creek diversions. We estimated 1,904 fish in 2005 and 1,158 fish in 2006 to be present in Tin Cup Creek diversions in August. The highest entrainment of fish occurred in canals diverting the greatest amounts of water.

Efficacy of fish screens at preventing entrainment of westslope cutthroat trout *Oncorhynchus clarkii lewisi* juveniles in three irrigation canals of Skalkaho Creek, Montana

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Fish screens have been installed to prevent fish loss in many irrigation canals of the western U.S., costing millions of dollars annually. However, few studies have attempted to evaluate the effectiveness of fish screens. Our goal was to determine the efficacy of fish screens installed in three of seven irrigation canals on Skalkaho Creek, a tributary of the Bitterroot River. Fish screen efficacy was quantified using half-duplex PIT tags and PIT tag-detecting antennae located in the headgate opening(s), around the bypass pipes, and in the canal downstream from the fish screens. Throughout the irrigation season, juvenile westslope cutthroat trout *Oncorhynchus clarkii lewisi* were captured, PIT-tagged, and introduced into each screened canal between the headgates and the fish screen. Fish screens in the Highline, Ward, and Hughes canals prevented entrainment of 97.5% (116 of 119), 96.7% (116 of 120), and 74.2% (72 of 97) of the PIT-tagged fish introduced into the canals, respectively. Whereas none of the PIT-tagged fish became entrained beyond the screens, 9.5% (32 of 336) remained in the canals upon headgate closure. Seventy-percent (21 of 30) of the PIT-tagged fish introduced into the Hughes Canal two weeks prior to headgate closure remained in the canal because no water was being bypassed and the headgates were not open enough to provide an easy upstream exit. If not rescued, fish remaining in the canal upon headgate closure would have perished. Fish screens are an effective management tool for reducing irrigation canal entrainment but their effectiveness varies among specific installations.

Seasonal and spawning movements of genetically pure and hybridized westslope cutthroat trout in the Fan Creek drainage, Yellowstone National Park

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Once the dominant salmonid of the Gallatin River, westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) have been reduced to four isolated headwater populations in this river drainage. We used radio telemetry to investigate the seasonal movement of westslope cutthroat trout and hybrids in the Fan Creek drainage, focusing on the North Fork. Fish were tracked for an average of 60 days throughout the summer of 2001 and an average of 262 days throughout the end of 2001 and 2002. Westslope cutthroat trout moved an average of 2143 meters in the summer of 2001 and an average of 2990 meters throughout the study period of 2001-2002. The majority of movement for 2001-2002 occurred in the spring and summer months, whereas sedentary behavior was observed in the fall and winter months. R1/R4 inventory data was collected for the North Fork of Fan Creek and personal observation was used for the main stem. Westslope cutthroat trout were relocated in areas of increased instream habitat complexity and a high percentage of cover in the North Fork of Fan Creek. There was no discernable difference found in habitats where fish were relocated and where fish were not located in the North Fork of Fan Creek. In the mainstem, westslope cutthroat trout were relocated in areas where deep bends provided undercut banks and areas with root wads. In summation, fish moved throughout the Fan Creek drainage throughout the study. Adequate habitat appeared to be provided for fish to remain in the North Fork for all seasons.

Movement of Anglers and Sediment Transport: Implications for Moving Aquatic Nuisance Species.

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Movement of anglers among rivers presents a potential pathway for the spread of whirling disease and other aquatic nuisance species (ANS). The objective of this study was to quantify

the movement of anglers in southwestern Montana and the quantity of sediment they carry on angling equipment. Anglers were surveyed at randomly selected high use fishing access sites on six rivers in southwestern Montana. Survey questions focused on locations of angling trips in the past 30 days, planned fishing trips for the next 7 days, equipment cleaning practices, and aquatic nuisance species awareness. In addition to the questionnaire, sediment samples were collected from boots and waders with a pressure sprayer. Mean distance traveled by Montana residents form their home to the survey site was 115 km and 1,738 for non-residents. The median number of fishing access sites used during the previous 30 days by resident and non-resident anglers was three. Non-residents fished in more states in the previous 30 days than residents and traveled further distances to fish in the previous 30 days than residents. Mean quantity of sediment carried on one boot-wader leg was 8.39 g (± 1.5, 95% CI). Combining angler movement data, sediment quantity carried, and fishing license data, anglers in southwestern Montana are potentially moving thousands of kilograms of soil among fishing access sites every year making transport of ANS highly likely. Control of future ANS infestations will be difficult unless sediment transport is addressed.

Effects of Water Temperature and Angling on Mortality of Salmonids in Montana Streams

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The effects of catch and release angling on salmonid mortality during elevated (>20°C) water temperatures is largely unknown. In addition, few field studies have quantified salmonid mortality associated with angling during varying times of diel temperature cycles. Thus, our objectives were to quantify post-release salmonid mortality during elevated summer water temperatures and cooler fall water temperatures, and quantify mortality from morning and evening angling events. Angling occurred on the Gallatin and Smith rivers. Anglers were allowed to use only fly-fishing gear and techniques, without any other restrictions. Angled fish were transported from the anglers to *in-situ* holding cages and monitored for 72 h. Mean rainbow trout *Oncorhynchus mykiss* mortality during summer varied from 7% in the Gallatin

River to 9% in the Smith River, whereas brown trout *Salmo trutta* mortality varied from 0% in the Gallatin River to 8% in the Smith River. Mountain whitefish *Prosopium williamsoni* mortality varied from 2% in the Gallatin River to 21% in the Smith River. No mortalities for any species occurred in either river during fall sampling. Rainbow trout (N=125) and mountain whitefish (N=114) mortality in the Smith River differed significantly between summer and fall angling events. Different diel water temperature cycles between rivers likely contributed to this difference. No significant differences were detected between morning and evening angling events during the summer in either river. Currently, it appears that mortality associated with catch and release angling during elevated water temperatures (>20°C) is relatively low for rainbow trout and brown trout.

Environmental conditions affecting the toxicity of piscicides

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The piscicides rotenone and antimycin are important tools in fisheries conservation but their application is inefficient and not always effective. We examined the persistence of both piscicides in the laboratory and field to determine the causes of their detoxification. The effects of sunlight and turbulence were isolated in the laboratory and studied using 96-hour toxicity tests. Sunlight rapidly detoxified both rotenone and antimycin. Turbulence affected antimycin more than rotenone. The interactive effects of combined stream characteristics were measured in streams using a single drip station and sentinel fish at 100-m intervals. Stream characteristics were measured along the entire reach that detoxified rotenone. Environmental characteristics most abundant in the stream section that detoxified rotenone were identified using logistic regression. The abundance of substrates >150 mm diameter, total dissolved solids, and oxidation reduction potential were significantly related to the persistence of rotenone in streams. The predictive ability of models was good using reclassification procedures. However, the predictive ability of the models will need to be tested in streams before they can be used in future piscicide applications. This information will make piscicide use more efficient and effective by reducing the uncertainty associated with its application.

Collection of Samples to Detect Hybridization: One of These Things May Not be Like the Other

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Hybridization is an important factor to consider for the conservation of many native stream fishes. Fisheries biologists often collect samples to test for hybridization where there is ready access to stream habitats or in spatially limited stream reaches. Because stream salmonids are highly mobile animals and rapidly re-assort into mixed stock assemblages, it is often difficult to interpret the meaning of results obtained for hybridization assays at the population level. We have assayed 35 samples (n = 14-35 fish) at 5 codominant diagnostic microsatellite loci to determine the geographic distribution of hybrids in the Jocko River Basin. Samples were collected in 100m sections with a backpack electrofisher. We detected hybridized individuals at only 3 of 16 sites in the South Fork Jocko River in preliminary analysis. One of those sites was non-adjacent to the other two, indicating the distribution of hybrid fish in that system is variable. To design a robust sampling strategy to determine the hybridization status of a population, we assessed the spatial variability of samples in 47 stream kilometers of the upper Jocko River drainage.

Tracking fluvial cutthroat trout movements with stable isotope markers in a stream network

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Movement between environments is a common phenomenon across taxa because it allows individuals to match their phenotype to the biotic and abiotic conditions that maximize fitness. However, biologists and managers did not consider movement between distinct habitats important for stream-resident fishes until recently because field methods and monitoring favored relocating immobile fish or fish large enough for tags. As a result, little is known about the frequency of movement in stream fishes and the critical locations that fishes move to within a

stream network. I used stable isotope analysis to provide precise information about individual movement patterns and frequency for Bonneville cutthroat trout (BCT; *Oncorhynchus clarkii utah*). I combined site-specific and trophic level-specific N isotopic signatures of BCT to estimate the frequency of movement to downstream environments, to identify downstream environments that fluvial BCT move into from headwater streams, and to identify important food resources in these habitats.

Montana Arctic Grayling: Status, Concerns and Antidotes

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Arctic grayling (*Thymallus arcticus*) have a holarctic distribution in northern latitudes of North America and Asia. Montana Arctic grayling represent the most southerly distributed populations of the species. Species existing at the periphery of their range are often more susceptible to extinction due to habitat and environmental changes. Historic distribution and abundance of fluvial (permanently stream dwelling) Arctic grayling has decreased due to a variety of human caused and environmental factors that have imperiled the future existence of the species in Montana. The last remaining fluvial population exists in the Big Hole River representing approximately 4% of the native range in Montana. Population abundance and distribution of Arctic grayling in the Big Hole River has declined substantially. Assessing the factors that have contributed to the decline of grayling is essential to focus restoration efforts. This presentation will provide current population abundance, distribution, age structure, and genetic demographics of the Big Hole River grayling population. Habitat limitations, climatic fluctuations, and potential effects of non-native fishes will be evaluated with regards to grayling restoration efforts. This presentation will also introduce a basin wide conservation strategy that is essential to ensure persistence of grayling in Montana.

Can Candidate Conservation Agreements Save Montana's Fluvial Arctic Grayling?

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A Candidate Conservation Agreement with Assurances (CCAA) is an agreement between the U.S. Fish and Wildlife Service (USFWS) and any non-Federal entity whereby non-Federal property owners who voluntarily agree to manage their lands or waters to remove threats to species at risk of becoming threatened or endangered receive assurances against additional regulatory requirements should that species be subsequently listed under the Endangered Species Act (ESA). The goal of the Big Hole CCAA is to secure and enhance a population of fluvial Arctic grayling (*Thymallus arcticus*) within the upper reaches of their historic range in the Big

Hole River drainage. Under this Agreement, Montana Fish, Wildlife and Parks (MFWP) holds an ESA Enhancement of Survival Permit issued to it by USFWS and will issue Certificates of Inclusion to non-Federal property owners within the project area who agree to comply with all of the stipulations of the Agreement and develop an approved site-specific plan. Site-specific conservation plans will be developed with each landowner by an interdisciplinary technical team made up of individuals representing MFWP, USFWS, USDA Natural Resources Conservation Service, and Montana Department of Natural Resources and Conservation. The conservation guidelines of the Big Hole CCAA will be met by implementing conservation measures that: 1) improve streamflows; 2) improve and protect the function of riparian habitats; 3) identify and reduce or eliminate entrainment threats for grayling; and 4) remove barriers to grayling migration. We believe this program represents the best opportunity to conserve the Big Hole River grayling population.

The Restoration of the Upper Big Hole Watershed's Riparian and Instream Habitat using Candidate Conservation Agreements

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The Candidate Conservation Agreement with Assurances (CCAA) for fluvial Arctic grayling (*Thymallus arcticus*) in the upper Big Hole watershed presents a unique opportunity to develop and implement comprehensive restoration and conservation projects on private land. During the preliminary sing-up in 2005, 40 landowners enrolled just under 220,000 acres of private land, representing nearly 70% of the private land in the project area. Site-specific restoration plans for each property, which addresses everything from instream and riparian restoration, grazing management, irrigation efficiency improvement, off-stream livestock water development, entrainment and fish passage, need to be developed with consideration of the unique physical and hydrologic characteristics of each property, as well as the agricultural goals and objectives of each livestock operation. The cumulative effects of restoration on one property upstream have tremendous ramifications downstream. The scale and complexity of this undertaking, the largest of its kind ever developed in the country, relies upon the dedication and creativity of many valuable partners.

Improving Streamflows in the Upper Big Hole Using Candidate Conservation Agreements

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Streamflow improvement is a key conservation guideline outlined in the Candidate Conservation Agreement with Assurances (CCAA) presently being implemented for fluvial Arctic grayling in the Big Hole River drainage. Eight years of drought conditions, over-appropriation of water rights, and dependence on the beneficial use of its water for irrigation, presents a water management challenge for agencies and CCAA enrollees in the upper Big Hole basin. The Montana Department of Natural Resources and Conservation (DNRC) provides technical support to meet this challenge through the quantification and assessment of basin hydrology, water use, and water management practices. Data has been collected from an established flow monitoring network, tributary and mainstem synoptic streamflow measurement runs, and water rights compliance checks. These data helped establish flow conditions prior to the implementation of the CCAA and provide the basis for understanding the timing and magnitude of water use and its influence on streamflows. Water savings to be converted to streamflow are anticipated through CCAA-associated activities with landowners such as supplemental flow agreements, infrastructure improvements, irrigation management planning, and water rights compliance. While it will take years to fully implement all facets of the CCAA water management goals, improvements to river flows have already been realized. Between 2003 and 2006, increases in river flows relative to water availability were documented. These increases can be attributed to voluntary flow reductions by irrigators. Irrigator cooperation such as this will need to continue to ensure the success of streamflow improvement using the CCAA.

Understanding Entrainment Dynamics and Potential Implications to the Conservation of Arctic Grayling in the Big Hole River

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Arctic grayling (*Thymallus arcticus*) in the upper Big Hole River watershed display significant migratory patterns, and as such, are susceptible to becoming entrained in irrigation ditches during their annual migrations. The extent of entrainment and its impact to the population, however, is poorly understood. To gain insight into entrainment dynamics in the Big Hole River watershed, survey and salvage efforts were conducted in 2006. We completed electrofishing surveys on approximately 2% (42.5 miles) of the irrigation ditches owned by landowners that have enrolled in the Big Hole Grayling Candidate Conservation Agreement with Assurances (CCAA) Program. One of the CCAA conservation goals is to assess and minimize the effects of entrainment on the grayling population. In 2006, five adult grayling were captured in irrigation ditches. This represents 12% of all adult grayling that were captured during annual fall population monitoring efforts by Montana Fish, Wildlife, and Parks in 2006. The implication of these findings and previous efforts are discussed in relation to their potential effects on grayling population abundance and recovery efforts. Strategies to minimize entrainment may include the installation of fish screens, changes to irrigation infrastructure, and voluntary flow reductions. Implications of these actions are also discussed in terms of their potential impact on water rights, pending water rights legislation, and the Big Hole Grayling CCAA.

Grayling Reintroduction in the Ruby River, Montana

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The Arctic Grayling (*Thymallus arcticus*) Workgroup designated the Ruby River as a potential restoration site for fluvial grayling based on an assessment of historic grayling streams in Montana. The Ruby was chosen among candidate streams because of its long sections of unimpeded stream, suitable habitat conditions, and relatively low densities of non-native salmonids. Potential negative characteristics of the Ruby include access to Ruby reservoir, and the presence of non-natives. Reintroduction efforts began in the Ruby in 1997 following the Grayling Restoration Plan (1995). Grayling derived from the Big Hole River were stocked as age-one and young-of-the-year. Natural reproduction of stocked grayling was documented two different years, indicating suitable habitat was available; however, high over-winter mortality rates illustrated the need for an alternative to stocking. Reintroduction efforts have evolved from stocking, to the use of Remote Site Incubators (RSIs) which emerge grayling fry reared under selective mechanisms of the stream. RSIs have been used since 2003 and have been very successful at introducing grayling to the system. Over-winter survival of grayling from RSIs has been documented 3 years in a row. Habitat enhancement projects to increase adult pool, spawning, and rearing habitat for grayling are now complimenting RSI efforts. Future direction of Ruby reintroductions will be determined by current revision and updating of the Grayling Restoration Plan. This plan will revisit restoration goals, provide genetic and brood stock management direction, and create short and long-term goals that address connectivity, habitat, and population goals for grayling in Montana.

Changes in Angler Use Following an Unauthorized Walleye Introduction in Canyon Ferry Reservoir

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Angler use of Canyon Ferry Reservoir has changed following an unauthorized walleye *Sander vitreus* introduction. In summer 1986, majority of anglers targeted rainbow trout *Oncorhynchus mykiss* (81.9%) and fished from the shoreline (62.9%). It took an average time of 96 minutes for an angler to catch any species of fish. Following expansion of the walleye population in the late 90s, the majority of anglers in 2005 target walleye (69.2%) and fish from boats (83.2%). In 2005 it took an average of 399 minutes to catch any species of fish. Total angler pressure has decreased from 98,768 angler days in 1989 to 80,249 angler days in 2005. Angler origin has changed little since walleye introduction with Lewis & Clark, Gallatin, and Broadwater Counties representing most anglers. Percent of out of state anglers have decreased from a peak of 10.7% in 1987 to a low of 2.3% in 2004. Walleye contribute little to the winter fishery, however heavy

predation of yellow perch *Perca flavescens* has led to declines in winter angler pressure. With declines in perch numbers, rainbow trout have become the primary component of the winter fishery. Since the introduction of walleye the Canyon Ferry fishery has become less accessible to general and shoreline anglers. Predation by walleye has reduced numbers of other sport fishes in the reservoir to the point that walleye are currently the only sport fish that meets management goals.

Effects of Spill on the Kootenai River below Libby Dam in 2006

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Mismanagement of reservoir elevations in the spring of 2006 caused forced spill to occur from Libby Dam on the Kootenai River from June 8, 2006 to June 27, 2006. Spill discharge reached a maximum of 31,000 cubic feet per second, leading to the highest discharge (55,000 cfs) from Libby Dam since regulated flows began in 1974. Spill discharges above approximately 1,200 cfs cause gas supersaturation and subsequent violation of the state and federal water quality standards of 110%. Gas levels reached a maximum of 133.5% and the 110% saturation level was exceeded for 18.5 consecutive days (446 hours) below the Dam. Initially, higher percentages of fishes exhibited gas bubble trauma symptoms on the left bank when compared to the right bank, but after 14 days of spill, 93.0% of rainbow trout, 82.0% of mountain whitefish, and 100.0% of bull trout exhibited symptoms of gas bubble trauma. No mass mortality of fishes was seen in the river below the Dam, with the exception of kokanee that passed over the spillway. The long term effects on fishes below the dam are unknown at this time, but monitoring will continue in the spring of 2007 for rainbow and bull trout populations, downstream displacement of PIT tagged fishes, and genetic analysis of the bull trout population using pre and post spill genetic analyses.

Correct implementation of variable flow flood control (VARQ) at Libby Dam during 2006 could have avoided spill and prevented impacts to Kootenai River fish

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The variable flow flood control strategy (VARQ) was designed to improve conditions for resident fish species including the endangered Kootenai white sturgeon (*Acipenser transmontanus*) and threatened bull trout (*Salvelinus confluentus*) while dam operations are modified to recover ESA-listed anadromous fish species in the lower Columbia River. Failure to follow VARQ at Libby Dam during 2006 caused an uncontrolled spill and flooding in the Kootenai River. As much as 31,000 cubic feet per second was released through the spillway, exceeding Montana's water quality standard of 110 percent gas supersaturation for 19 days. Gas levels reached a maximum of 133.5 percent causing gas bubble trauma in Kootenai River fish. Flood stage at Bonners Ferry, Idaho was exceeded, causing some stakeholders in the US and Canada to doubt the effectiveness of this flood control strategy. The US Army Corps of Engineers considered abandoning VARQ and reinstating standard flood control practices. Analysis of the event revealed that the Corps' discharge protocol had not been implemented as designed. Dam discharge during April and early May was therefore insufficient to control the slightly-above-normal inflow. Spill, flooding and gas bubble trauma in Kootenai River fish could have been avoided if VARQ had been implemented as designed.

Investigations into Rapid Temperature Decreases in the Upper Madison River downstream from Quake Lake, MT

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During the review of temperature data collected from the Madison River downstream from Quake Lake, we noticed two cases of short term, very sharp temperature decreases. On June 23, 2001, river temperature decreased 8.1 °F over 7.5 hours and on July 28, 2001, river temperature decreased 15.2 °F over 9.5 hours. Water temperature remained low for approximately 30 minutes to one hour and then rebounded quickly to typically normal levels. We believe that the cause for these anomalies may be a wind driven disturbance tilting the Quake Lake thermocline allowing cool hypolimnetic water to spill out of the Quake Lake outlet. We support this hypothesis with a presentation of the geographical orientation of the Lake, wind data from a nearby weather station, and temperature profile data taken from Quake Lake. Other cases of this phenomenon at this site are identified.

Estimation of Fish Age Using Otolith Relative Mass

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Otolith and body growth rates are non proportional, resulting in fast growing fish with relatively small otoliths at a given body size and vice versa. Thus use of otolith mass alone to estimate fish age will be biased when body growth rates vary from those in the established age versus otolith mass relationship. By accounting for the otolith mass at a given body size (defined as otolith relative mass) it should be possible to improve age models particularly when growth rates are variable. Herein I compared two multiple regression models incorporating otolith relative mass to predict Flathead Lake lake trout (*Salvelinus namaycush*) annuli with a conventional otolith mass regression. I found that the models incorporating otolith relative mass were less prone to growth bias, and produced growth curves that better mimicked the empirical relationship. The best performing otolith relative mass model was applied to archived otoliths, revealing a pattern of sharply declining growth from 1986-1991 to 1998, and a smaller decline from 1998 to 2005. Coherent with these temporal growth declines I observed increases in otolith mass at a given body length, suggesting that the otolith mass vs. body length relationship can be used to monitor growth rates.

A new biochemical genetic technique to examine hybridization among westslope cutthroat, Yellowstone cutthroat, and rainbow trout

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Hybridization is a large threat to the continued existence of native cutthroat trout *Oncorhynchus clarkii*. Considerable effort has been spent identifying and attempting to conserve nonhybridized native cutthroat trout populations. Previously, Montana Department of Fish, Wildlife, and Parks used a procedure examining fragments of nuclear DNA located between transposable elements (PINE analysis) to determine whether or not populations were hybridized and to what extent. A problem with this technique was that the markers used were inherited in a dominant/recessive fashion making identification of all genotypes not possible which from a statistical aspect

weakens the power of the data. We developed a procedure that examines codominant insertion/deletion (indel) events as well as microsatellite markers that distinguish among westslope cutthroat *O. c. lewisi*, Yellowstone cutthroat *O. c. bouvieri*, and rainbow trout *O. mykiss*. The codominant nature of these markers allows for the direct determination of all genotypes and estimates of allele frequencies in samples which greatly increases the power of the data. Furthermore, the new procedure requires only two independent polymerase chain reactions which reduces the amount of effort required to collect the data. This technique, therefore, is far superior to the previously used PINE analysis.

Evaluation of Stocking as a Means of Replacing Introduced Trout Populations in Lakes with Westslope Cutthroat Trout

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Conservation and restoration plans often call for the elimination and replacement of nonnative fish populations. Elimination in lakes has generally been successful only by poisoning. Poisoning is becoming increasingly problematic, however, because of legal and permit issues and potential social and political opposition. As an alternative to poisoning, we investigated the effectiveness of stocking as a means of replacing nonnative lake populations of trout. Among six lakes in the South Fork Flathead River drainage, Montana, genetic analysis indicated after stocking began that the proportion of westslope cutthroat trout, *Onchorhynchus clarkii lewisi*, alleles had progressively increased from zero, or near zero, to 0.75 up to 0.99. Some of this increase was due to hybridization and introgression with the stocked fish. Examination of individuals, however, indicated that most of the change was due to the replacement of fish in the lake with westslope cutthroat trout. The results suggest that in small headwater lakes with limited spawning and juvenile rearing habitats stocking juveniles can be an effective means of replacing introduced nonnative trout populations or hybrid swarms with westslope cutthroat trout.

Who's Yer Daddy? Photo Documentation of Bull Trout and Brook Trout Hybridization

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Field survey and genetic sampling of fish in Goat and Lion Creeks, two tributaries of the Swan River in northwest Montana, indicated hybridization between bull trout *Salvelinus confluentus* and brook trout *Salvelinus fontinalis*. In 2006, I used an easily-constructed Plexiglas streamside solarium and a digital camera to individually photograph each of 336 *Salvelinus* specimens that were randomly captured by electrofishing crews at five sites in the two drainages. Finclip samples from each fish were analyzed, using a set of 13 microsatellite loci previously identified as being useful to distinguish between bull trout, brook trout, and hybrid individuals. Preliminary results of the genetic analysis determined that about 53% of sampled fish were bull trout, 38% were brook trout, and 9% were hybrids. Field identification matched closely with these proportions and well-trained observers adequately identified hybrid specimens. However, nine field misidentifications that were detected by genetic analysis were correlated to hybrids; some due to inability to recognize larger fish (>200 mm) as hybrids, and several due to smaller brook trout (<100 mm) that were improperly identified as hybrids. Additional evaluation of the genetic attributes of hybrid individuals will determine more about individual ancestry and spatial and temporal patterns of hybridization. The unique archive of broadside digital photos, most of which provide good or excellent representation of phenotypic characteristics, will allow us to use "visual virtual recall" to reexamine phenotypic characters of each fish (such as coloration and spotting patterns) and may be useful as future training aids.

Considering Natural Vegetation Development Processes in Streambank Stabilization Design

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Stabilizing eroding streambanks is a common component of stream and river restoration projects, and is addressed by various disciplines using a wide range of techniques. A native species revegetation approach to streambank stabilization has numerous benefits and is being used with increasing success in western Montana. The most successful streambank stabilization efforts combine techniques from the tool boxes of different disciplines, such as incorporating soil bioengineering techniques with natural channel design structures like log vanes and engineered

log jams. In addition to improving channel function and stability, including native species revegetation as part of streambank stabilization accounts for ecological processes necessary for long-term self-maintenance of restoration projects. Ecological processes that influence vegetation development along streams include alluvial bar deposition, plant community succession and related soil development, surface water/groundwater connection, and wildlife influences such as deer browse and beaver dams. Considering different vegetation development pathways in the context of these processes will result in streambank stabilization efforts that are self-sustaining and support objectives for instream habitat, riparian revegetation, and dynamic stability at the reach scale.

Dual-Frequency Identification Sonar (DIDSON) for Fisheries Applications: Cool Tool or Expensive Toy?

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The Dual-Frequency Identification Sonar (DIDSON) camera was developed for inspection and identification of objects underwater in highly turbid environments, using acoustic lenses and sonar technology to deliver near video-quality images. Although developed primarily for the Navy to image underwater structures, such as mines and ship hulls, the DIDSON is now available to the public and is being used for other applications. Reclamation has been exploring the technology to determine if it can provide a useful tool for fisheries management. The DIDSON camera operates using sound frequencies and allows observations of fish behavior in large, turbid rivers where video camera observations are impossible, and is also useful in identification of substrates and observation of other underwater structures. Reclamation has captured images of razorback sucker (*Xyrauchen texanus*) spawning behavior in the Colorado River, and is currently using the technology on the Yellowstone and Missouri Rivers in hopes of

documenting behavior of the endangered pallid sturgeon (*Scaphirynchus albus*) and other native fish. Preliminary results are promising. We found that the best image quality is obtained by deploying the camera on a remote controlled underwater tripod. The most effective methods are either using the camera in conjunction with radiotelemetry to locate a known target or by setting the camera in favorable habitat and waiting for fish. Though there are some limitations, DIDSON technology appears to be a useful tool for fisheries applications.

Spawning Abundance of Bull Trout (*Salvelinus confluentus*) in relation to Geomorphology, Temperature and Roads in tributaries of Rock Creek Basin (Missoula and Granite Counties), Montana, USA

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Land management is a pervasive influence on imperiled native aquatic species, but its effects are often difficult to tease from those of natural environmental variation. To discriminate these effects, we first indexed bull trout *Salvelinus confluentus* spawner abundance from redd survey counts made in 19 tributaries of Rock Creek (Upper Clark Fork Basin, Montana (Missoula and Granite Counties). We compared response metrics of spawner abundance against a large suite of environmental variables, including measures of geomorphology, summer stream temperature and land management. We iterated multivariate analyses to compare effects of alternate aggregation and stratification methods for both response and environmental variables. Significance tests revealed several robust results: spawner abundance increased with channel or sub-basin slope, declined with maximum stream temperature, increased with proportion of sub-basin in wilderness and roadless area, and increased with extent of bounded alluvial valley geomorphology. Catchment road density did not correlate with bull trout spawning, but the range of road density among Rock Creek sites was one order of magnitude lower than in a previously published analysis for Swan River tributaries (Baxter et al. 1999). The two studies showed highly consistent associations with catchment and stream hydrogeomorphic features. We hypothesize that proportional roadless area, a variable that reflects the dispersion of road disturbance within the catchment, is an important factor at low road density, but at moderate and higher road densities prevailing across the bull trout's range, total road density tends to saturate or override the effect of spatial distribution of roads within the catchment.

Eustache Creek Mine Site and Stream Channel Reclamation- Planning, Monitoring, and Implementation

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Mining for gold in middle and headwater tributary streams of the Ninemile Creek watershed, a middle Clark Fork River tributary, has left numerous physical and biological legacies slow to heal. These legacies include unstable channel and floodplain habitats, an inhibited riparian community, increased water temperatures, reduced stream channel complexity, disconnected surface flow and altered fish assemblages. Large-scale fire and landscape scale evaluations in Ninemile watershed provided the planning backdrop for prioritization, partnership, and implementation of the Eustache Creek project, a 1-mile reclamation project in the headwaters of Ninemile Creek. Reclamation objectives include: provide bedload transport through the reach by facilitating deposition and scour without excessive aggradation or degradation, increase channel complexity (wood, pools, substrate), re-watering dewatered channel segments, and improving the ability of floodplain surfaces to support primary and secondary succession of native vegetation. We used a geomorphic design approach to establish stream channel and floodplain configurations in an attempt to achieve these objectives. Restoration techniques included collection and propagation of native riparian seed for transplant back to reclaimed surfaces, use of shallow groundwater retention sills, rootwad composites and wood vane structures to assist with initial channel stability and complexity, and organic amendments to mine spoils. No large rock was imported to fix the channel in place. Pre and post project monitoring includes longitudinal and cross-section profiles, fish abundance and movement estimates, aquatic invertebrate metrics, water temperature monitoring, instream habitat metrics, and photo points in both the reconstructed and a reference tributary similar to Eustache Creek. Preliminary findings are discussed.

Hebgen Reservoir Activities Update: Still Looking at Factors that could Potentially be Limiting Wild Rainbow Trout Recruitment to the Hebgen Fishery

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Seldom does a lake or reservoir environment contain sufficient spawning and rearing habitat to support a self-sustaining fishery and maintenance of the sport fishery is achieved through stocking. Hebgen Reservoir, however, is rare among reservoir systems. Numerous tributaries with in the Hebgen system provide high quality spawning and rearing habitat. Brown trout (*Salmo trutta)* have been self-sustaining since 1956, and spawning runs of wild rainbow trout (*Oncorhynchus mykiss*) occur in nine Hebgen tributaries. In 2002, a graduate research project investigated tributary potential for recruitment of wild rainbow trout. Results of the study suggested that quantity and quality of spawning and rearing habitat was not likely limiting wild rainbow trout production, but other factors in the tributaries and reservoir may be affecting recruitment to the adult population. Therefore, upon recommendations of the 2002 study, Montana Fish, Wildlife and Parks in conjunction with the Gallatin National Forest have initiated investigations to identify other factors within tributaries and the reservoir that may be influencing wild rainbow trout survival and recruitment to the adult population in the Hebgen Basin.

Population Structure and Seasonal Habitat Use of the Northern Pike Population of Cabinet Gorge Reservoir, Montana

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Northern pike *Esox lucius* have been shown to impact salmonid communities in many areas where this predatory species has become established. The potential for such impacts to limit the effectiveness of native salmonid management and mitigation programs for Cabinet Gorge Reservoir and its tributaries provided the impetus for this study. This study employed active and passive capture techniques to characterize the northern pike population and to provide fish for radio-tagging. A total of 51 northern pike were radio-tagged and tracked over the course of this study (April 2003 - July 2005) to ascertain habitat use and possible overlap with native salmonids. Telemetry depicted northern pike closely associated with shallower habitats characterized by abundant aquatic vegetation. Hard part aging found most northern pike captured were between 4 and 6 years of age. Proportional Stock Density and Relative Weight indices averaged 85 and 141 respectively. Opportunistic angler surveys portrayed a northern pike-based recreational fishery of increasing popularity. Extensive efforts to document reproduction suggested that water level fluctuations negated successful spawning. Although no bull trout *Salvelinus confluentus* or westslope cutthroat trout *Oncorhynchus clarkii lewisi* were found in 66 stomachs sampled or 19 instances when levage was performed, the preponderance of northern pike detections in Bull River Bay represented a significant opportunity for predation of

migratory native salmonids from this important nursery tributary. Based on the history of impacts northern pike have had on native salmonids in other systems, possible corrective fisheries management measures may be warranted.

Things to do while you are in Missoula

Missoula has over 100 restaurants, some are even good. Here is a list of some of the best places to eat, drink, and spend your money from the *Missoula Independent's* Best of 2006…

Best Restaurant Service
Garcon, a cocktail fork and the envelope please! Voters say that Red Bird (120 W. Front St., 549-2906), known for its intimate dining atmosphere, may also hoist our Best Service award. Too bad you can't eat dinner there and pull a Fletch by charging it "to the Underhill's bill." Always a bridesmaid, never the bride, Finn & Porter (100 Madison St., 542-4660) takes another runner-up lap.

Best New Restaurant
Note to restaurateurs: Build your new eatery on a one-way street. This year's first place Pearl Café (231 E. Front St., 541-0231) sits on an eastbound-only road, and second-place Union Club Bar and Grill (208 E. Main St., 728-7980) calls a westbound street home. Coincidence? Johnny Carino's received the second most votes but was disqualified after winning first place last year. Sorry Johnny, you're only new once.

Best Breakfast
Apparently, not all eggs are cooked equally. The Shack (222 W. Main St., 549-9903) remains Missoula's favorite scrambled/omelet/ over-easy destination, with the egg's age-old competitor—the pancake—taking second. Paul's Pancake Parlor (2305 Brooks St., 728-9071), which serves plenty of eggs as well as killer cakes, is the runner-up.

Best lunch for under $6:
With more votes than all other establishments combined, the rapid rollers at Taco Del Sol (422 N. Higgins Ave., 327-8929) crank out delicious and well-balanced Mexi-meals as cheap and fast as anyone north of the border. The only trouble has been their popularity: the lunch line gets longer and longer—a situation only partially remedied by a new outpost at 1555 Liberty Lane (543-1584). Next in line is Sa Wad Dee Thai Restaurant (221 W. Broadway, 543-9966) with their fast, delicious and spicy-as-you-want-it fare.

Best Romantic Dining
If your idea of a romantic dinner involves mariachi guys surrounding you and your date with maracas, gold teeth and a song you can't understand, but you think might refer to your date's anatomy, then you're not like most Indy readers, who prefer Red Bird (120 W. Front St., 549-2906) for a romantic evening. If Red Bird is booked and you're into sunsets and golf courses, check out runner-up Shadows Keep (102 Ben Hogan Dr., 728-5132).

Best Sandwich
In a college town, any business with the word "staggering" in the title is sure to succeed. Well, maybe not "Staggering Dentistry," but Staggering Ox (123 E. Main St., 327-9400) holds claim to best sandwich this year. Also way rad, but not as totally tubular as Staggering Ox, is tasty runner-up Worden's Deli (451 N. Higgins Ave., 549-1293).

Best Place to Eat Alone
What we'd like to know is, who doesn't eat at Taco Del Sol (422 N. Higgins Ave., 327-8929)? The fish tacos are fast, tasty and cheap, and when we join the taco line for nourishment, all of downtown stands with us. Viva Taco Del Sol! In second place, Butterfly Herbs (232 N. Higgins Ave., 728-8780) has a most delicious coffee milkshake, so of course you want to be alone there. Who'd want to share one of those?

Best Mexican Food
Hunt no more for the best Mexican food in town. To quench their south-of-the-border joneses, Indy readers head north of the Higgins Street bridge to trophy-worthy El Cazador (101 S. Higgins Ave., 728-3657), or its brother El Cazador South (3021 Brooks St., 829-3800), for their tortilla-wrapped love. Runner-up: Fiesta En Jalisco (3701 Brooks St., 728-1323).

Best Asian Food
Sa Wad Dee Thai Restaurant (221 W. Broadway, 543-9966) curried the favor of Missoulians for the second year in a row with versatile cafeteria-style lunches and tasty dinners. Runner-up: The Mustard Seed Asian Cafe (Southgate Mall, 542-7333).

Best Seafood
Affordable prices, $1 Sushi Wednesdays and the name, of course, are a few reasons why we think Sushi Hana (403 N. Higgins Ave., 549-7979) is voted the best. Don't give up Depot (201 W. Railroad St., 728-7007), you're still in second.

Best Vegetarian Food
The spices of East Indian cuisine will lead you to the oasis in the alley, Tipu's Tiger (115 1/2 S. Fourth W., 542-0622). Triangle-wrapped samosas, homemade cheese and date-raisin chutney are the preferred stock. With an all-you-can-eat lunch buffet and killer breakfast burritos at the Saturday Farmers Market, Tipu's is the choice for Missoula's critter-compassionate set year after year. If you prefer to eat your lunch community-style with a-la-carte everything, The Good Food Store (1600 S. Third W., 541-3663) will satisfy any taste bud.

Best Hamburger
If you're in need of a big ol' burger, there's no better place to find it than Nap's Grill (231 W. Front St., 829-1207). For the third year in a row, it's edged out the former longtime favorite Missoula Club (139 W. Main St., 728-3740).

Best French Fries
Whether you call 'em Freedom Fries or French Fries, you should know that the Union Club Bar and Grill (208 E. Main St., 728-7980) serves up the best fry. Period. And in addition to regular fries, their sweet potato fries are the best around. Can't get a table 'cause there's too many people enjoying their freedom to eat fries? Walk a couple of blocks to runner-up Nap's Grill (231 W. Front St., 829-1207).

Best Pizza
Maybe it's their Monday-through-Thursday free-slice-with-a-drink happy-hour special or their new deli where Crystal Video used to be, but in a turnaround from 2004, The Bridge (515 S.

Higgins Ave., 542-0638) beats out last year's winner Mackenzie River Pizza Company (137 W. Front St., 721-0077) for best pie in our slice of the Big Sky. Stay tuned and keep yourself informed (read: eat pizza): The coming year could shape up to be a heated one in the thin-crust, deep-dish world.

Best Ice Cream
Ice cream is one of those indulgences that tastes so good it must be good for you—and in this category, the healthy competition continues. Once again, the Big Dipper (631 S. Higgins Ave., 543-5722) licks Baskin-Robbins (1880 Brooks St., 542-2731, and 2230 N. Reserve St., 543-2731), proving that long lines on hot summer nights on the edge of the Hip Strip can be a key part of this delicacy.

Best Milkshake
How do you do it, decide on the best milkshake, especially with so many choices in this town? Well, the only way we can think of is to go to every ice-cream store and try every milkshake available. Did y'all really do that? Readers gave a lip-lickin' first place to the Uptown Diner (120 N. Higgins Ave., 542-2449). Runner-up: Big Dipper (631 S. Higgins Ave., 543-5722).

Best Steak
If the crowds are any indication, and a smidgen of common sense will tell you they are, you'll get one hell of a good piece of meat at Guy's Lolo Creek Steakhouse (6600 Hwy. 12, Lolo, 273-2622), which has staked out its place at the top of the steak pile in our readers' minds. Runner-up: The Depot (201 Railroad St., 728-7007).

Best Bakery
Cheers to alliteration: Best Bakery goes to Bernice's Bakery (190 S. Third St. W., 728-1358), continuing a legacy that heralds their sweets and long predates their new lunch specials. A panini's throw away, Le Petit Outre (129 S. Fourth St. W., 543-3311) takes second.

Best Delicatessen
Only a few places in Missoula can satisfy sophisticated gastronomic cravings by the pound. The Broadway Market retired last year but still received a good number of votes. The winner, however, was Worden's Market and Deli (451 North Higgins Ave., 549-1293), which won by a landslide over The Good Food Store (1600 S. Third St. W., 541-3663).

Best Coffee
They'll grind your coffee beans if you ask them; it's Butterfly Herbs (232 N. Higgins Ave., 728-8780) in the lead for the second year in a row, with Break Espresso (432 N. Higgins Ave., 728-7300) breaking out the silver.

Best Microbrewery
We don't know if it's the hoppy beer or the fact that it offers free samples, but Big Sky Brewing Company (5417 Trumpeter Way, 549-2777) owns the title again this year. Bayern Brewing (1507 Montana St., 721-1482) is the runner-up, but when it all comes down to it, there is no such thing as bad microbrew in this town, is there?

Best Supermarket
The Good Food Store (1600 S. Third St. W., 541-3663) does it again, edging out Orange Street Food Farm (701 S. Orange St., 543-3188) for the second year in a row. Maybe it's the Good Food Store's maze of bulk foods or its uncanny flow of beautiful people that keeps them in first. As for the difficulty with which one now navigates an SUV in their new parking lot, we're not sure if that gained or lost them votes.

Best Retail Beer Selection
No surprise here as perennial powerhouse Orange Street Food Farm (701 S. Orange St., 543-3188) chugs past the competition with an entire wall full of cheap, cold beer. As Montana's biggest distributor of Pabst Blue Ribbon, the OSFF also regularly rotates selections of cheap-o post-expiration brews. Whether we're heading out for a trip down the sunny Blackfoot or a day of skiing at Lolo Pass, Missoula gets its six-packs at the Food Farm. With the broadest selection of higher-end beers in town, Worden's Market and Deli (451 N. Higgins Ave., 549-1293) takes second place.

Nightlife

Best Place to Dance
Do-si-do, boys! For the fifth year running, The Union Club (208 E. Main St., 728-7980) shines brightest for dancing. Whether Indy readers dig live swing, blues, rockabilly or bluegrass, they're sticking with the Union. El Segundo: Club Cabo (2902 Brooks St., 541-3555), the new Mexican-themed dance club at the mall where DJs rule the sound system.

Best Club DJ
Give it up for The Wild Boyz as they seize top honors in this new category recognizing the best tricksters on the turntables. Many readers seemed unclear on the concept and voted Club Cabo as best club DJ with a vote total amounting to second place; sorry folks, but since Club Cabo is not a club DJ, second place goes to KBGA's DJ Raven and DJ Kind, tied in the runner-up spot.

Best Beer Selection
Talk about big decisions. While locals had no trouble giving the hands-down nod to The Rhino (158 Ryman St., 721-6061), they may run into trouble when it comes to picking from the 50 beers on tap, not to mention many more of the bottled variety. Runner-up: The Iron Horse (501 N. Higgins Ave., 728-8866).

Best Sports Bar
With live poker, pool tables and three floors of TVs, The Press Box (835 E. Broadway, 721-1212) continues to earn the loyalty of Missoula's sports fans. But keep an eye out for newcomer and second-placer Hammer Jacks (147 W. Broadway, 721-3854).

Best Pool Table
Too cool for school? How about some pool, fool? Head on down to Palace Billiards (147 W. Broadway, 543-9102) for the best tables in town. Once again, the Palace is king and the runner-up is The Raven Café (130 E. Broadway, 829-8188).

Best Place To Hear Live Music
Let's face it: There are fewer contenders every year that goes by. Last year's winner, The Ritz, has been replaced by glaring screens, The Blue Heron flew away a while ago and the defunct Jay's Upstairs still frequents the ballots. This year, The Union Club (208 E. Main St, 728-7980) tipped The Top Hat (134 W. Front St., 728-9865).

Best Martini
Hang onto your olive—this was a tight race. Perugia Old World Cooking (1106 W. Broadway, 543-3757) traditionally blasts the competition. (Rumors have the Mediterranean restaurant closing, but a voice recording says Perugia is "still open for business.") This year, there was almost a shake up. Newer Finn & Porter (100 Madison St., at the DoubleTree Hotel, 728-3100) crept up close behind. Does "Josh" have something to do with the closeness of the vote? Voters kept writing in his name alongside Finn & Porter's. We like ours dry, Josh.

Best Bloody Mary
Bloody Marys are an acquired taste, but once you're hooked The Last Run Inn at Snowbowl (1700 Snow Bowl Rd., 549-9777) is the place to savor the drink with a bite. Be careful driving back down! If you're thirsty for more, go to The Old Post (103 W. Spruce St., 721-7399) where the kind bartenders make your second-favorite bloody.

Best Bar for a Stiff Pour
Votes poured in for Al & Vic's (119 W. Alder St., 728-4804). Some voters were offended that we even had to ask. ("Duh," wrote one.) We'll drink to—and at—Al & Vic's. Charlie B's takes second. We'll drink to Charlie's, too, and gorge ourselves at its restaurant.

Best Happy Hour
In a reversal of fortune from last year, Arriba Fresh Mexican Grill (2901 Brooks St., 541-3555) wins the title over The Old Post (103 W. Spruce St., 721-7399). During Arriba's two-hour happy hour, even the burly 45-ounce margaritas are half off. Here's a tip for you—don't ever drink more than three if you have dinner plans later in the evening.

Best Casino
One reliable thing about luck—it can change. If there's another reliable thing about luck, it's that you can't tell it when to. So if you were looking for an upset, you're just going to have to buy back in and ride out another couple of rounds. It's got the smoke, it's got the shadows, it's got the regulars, it's got the games, and it fries up a mean burger to boot. Flipper's Casino (125 S. Third St., 721-4895) doubles up and repeats from last year. Diamond Jim's (multiple locations) places second.

Oral presentation schedule

Day	Time	Panel	Title	Speaker	Moderator
Wednesday	8:00	Welcome and Announcements	Plenary Session: Return to the river: revisiting and reinvigorating the source of our passion and professionalism		David Schmetterling
Wednesday	8:10	Keynote Address	The times they are a' changing	Pat Williams	David Schmetterling
Wednesday	8:40	Invited speaker	Fisheries professionals; rubbing and standing on shoulders	Chris Clancy	David Schmetterling
Wednesday	9:10	Break			
Wednesday	9:30	Contributed Papers	Relating Fish Assemblages to Environmental Patterns at Three Multi-state Scales	Bob Hughes	Ladd Knotek
Wednesday	9:50	Contributed Papers	An Outbreak of Viral Hemorrhagic Septicemia	Ken Stagmiller	Ladd Knotek
Wednesday	10:10	Contributed Papers	Nuisance Alga *Didymosphenia geminata* : A Threat to our Fisheries.	Leah C.S. Elwell	Ladd Knotek
Wednesday	10:30	Contributed Papers	Fish assemblages in the Powder and Tongue river in relation to coalbed natural gas development	Windy Davis	Ladd Knotek
Wednesday	10:50	Contributed Papers	Spatio-temporal variation in prairie stream fish assemblages	Jason Mullen	Ladd Knotek
Wednesday	11:10	Contributed Papers	Assessment of Post-stocking Dispersal of Age-1 Pallid Sturgeon: Implications for Acclimation	Eric Oldenburg	Ladd Knotek
Wednesday	11:30	Contributed Papers	Population viability of Arctic grayling in the Gibbon River, Yellowstone National Park.	Amber Steed	Ladd Knotek
Wednesday	11:50	Awards Lunch			
Wednesday	1:30	Native fish and lake trout: churning new water or circling the drain	Lake Trout Suppression in Lake Pend Oreille Idaho – Will It Work?	Ned Horner	Wade Fredenberg
Wednesday	1:45	Native fish and lake trout: churning new water or circling the drain	Are anglers able to reduce lake trout abundance in Flathead Lake?	Barry Hansen	Wade Fredenberg
Wednesday	2:00	Native fish and lake trout: churning new water or circling the drain	Lake trout suppression in Yellowstone Lake: the reality of this battle for cutthroat trout persistence	Todd Koel	Wade Fredenberg
Wednesday	2:15	Native fish and lake trout: churning new water or circling the drain	Lake Trout in the Lakes of Glacier National Park, Montana	Michael Meeuwig	Wade Fredenberg
Wednesday	2:30	Break			
Wednesday	2:50	Native fish and lake trout: churning new water or circling the drain	Lake Trout Population Control in Lake Pend Oreille, Idaho: Reversing Lessons from the Great Lakes	Mike Hansen	Chris Guy
Wednesday	3:05	Native fish and lake trout: churning new water or circling the drain	Simple population models: what can they tell us about lake trout suppression?	Lisa Eby	Chris Guy
Wednesday	3:20	Native fish and lake trout: churning new water or circling the drain	Panel Discussion		Chris Guy
Wednesday	4:10	Committee Caucuses			

Day	Time	Panel	Title	Speaker	Moderator
Thursday	8:00	Welcome and Announcements		David Schmetterling	
Thursday	8:10	Barriers and Fish Movement	Analyzing tradeoffs between the threat of invasion by nonnative trout and effects of intentional isolation for native westslope cutthroat trout using a Bayesian belief network	Doug Peterson	Shane Hendrickson
Thursday	8:30	Barriers and Fish Movement	Fish Barrier Design in Northcentral Montana	David C. Moser	Shane Hendrickson
Thursday	8:50	Barriers and Fish Movement	Effects of Road Culverts on Eastern Montana Prairie Fish Assemblages	Leo R. Rosenthal	Shane Hendrickson
Thursday	9:10	Barriers and Fish Movement	Use of PIT Tag-Detecting Antennas to Assess Culvert Passage of Yellowstone Cutthroat Trout and Rainbow Trout in Mulherin Creek, a Tributary of the Yellowstone River	Andrew Solcz	Shane Hendrickson
Thursday	9:30	Barriers and Fish Movement	Fish Passage Planning and Development for Bull Trout at Thompson Falls Dam, Montana	Ginger Gilin	Shane Hendrickson
Thursday	9:50	Break			
Thursday	10:10	Contributed Papers: Barriers	Expected changes to the distribution, abundance and life history expression of fishes following the removal of a Montana hydroelectric dam	David Schmetterling	Chris Clancy
Thursday	10:30	Contributed Papers: Barriers	Restoration Plan for the Clark Fork River and Blackfoot River near Milltown Dam	John Muhlfeld	Chris Clancy
Thursday	10:50	Contributed Papers: Barriers	Influence of Migratory Barriers on Genetic Diversity and Similarity among Bull Trout Populations in Glacier National Park, Montana	Michael Meeuwig	Chris Clancy
Thursday	11:10	Contributed Papers: Barriers	Big Coulee: an Attempt to Thwart Extinction	Stan Vansickle	Chris Clancy
Thursday	11:30	Contributed Papers: Barriers	Barrier Assessment of the Chadbourne Diversion Dam on the Shields River	Matt Blank	Chris Clancy
Thursday	11:50	Contributed Papers: Barriers	Fish Losses to Irrigation Diversions on Two Tributaries of the Bitterroot River, Montana	Leslie Bahn	Chris Clancy
Thursday	12:10	Lunch			
Thursday	1:10	Contributed Papers	Efficacy of fish screens at preventing entrainment of westslope cutthroat trout *Oncorhynchus clarkii lewisi* juveniles in three irrigation canals of Skalkaho Creek, Montana	Ryan Harnish	Mike Young
Thursday	1:30	Contributed Papers	Seasonal and spawning movements of genetically pure and hybridized westslope cutthroat trout in the Fan Creek drainage, Yellowstone National Park	Carrie Brooke	Mike Young
Thursday	1:50	Contributed Papers	Movement of Anglers and Sediment Transport: Implications for Moving Aquatic Nuisance Species	Kiza Gates	Mike Young
Thursday	2:10	Contributed Papers	Effects of Water Temperature and Angling on Survival of Trout in Montana Streams	James Boyd	Mike Young
Thursday	2:30	Contributed Papers	Environmental conditions affecting the toxicity of piscicides.	Peter Brown	Mike Young
Thursday	2:50	Contributed Papers	Collection of Samples to Detect Hybridization: One of These Things May Not be Like the Other	Matt Corsi	Mike Young
Thursday	3:10	Contributed Papers	Tracking fluvial cutthroat trout movements with stable isotope markers in a stream network	Adam Sepulveda	Mike Young
Thursday	3:30	Break			
Thursday	3:50	Business meeting			

Day	Time	Panel	Title	Speaker	Moderator
Friday	8:00	Welcome and Announcements			Buddy Drake
Friday	8:10	Conservation of Arctic Grayling in Montana	Montana Arctic Grayling: Status, Concerns and Antidotes	Jim Magee	Buddy Drake
Friday	8:30	Conservation of Arctic Grayling in Montana	Can Candidate Conservation Agreements Save Montana's Fluvial Arctic Grayling?	Peter Lamothe	Buddy Drake
Friday	8:50	Conservation of Arctic Grayling in Montana	The Restoration of the Upper Big Hole Watershed's Riparian and Instream Habitat using Candidate Conservation Agreements	Jeff Everett	Buddy Drake
Friday	9:10	Conservation of Arctic Grayling in Montana	Improving Streamflows in the Upper Big Hole Using Candidate Conservation Agreements	Mike Roberts	Buddy Drake
Friday	9:30	Conservation of Arctic Grayling in Montana	Understanding Entrainment Dynamics and Potential Implications to the Conservation of Arctic Grayling in the Big Hole River	Adam Petersen	Buddy Drake
Friday	9:50	Conservation of Arctic Grayling in Montana	Grayling Reintroduction in the Ruby River, Montana	Emily Rens	Buddy Drake
Friday	10:10	Break			
Friday	10:30	Contributed Papers: Fisheries Management	Changes in Angler Use Following an Unauthorized Walleye Introduction in Canyon Ferry Reservoir	Eric Roberts	Peter Brown
Friday	10:50	Contributed Papers: Fisheries Management	Effects of Spill on the Kootenai River below Libby Dam in 2006	Ryan Sylvester	Peter Brown
Friday	11:10	Contributed Papers: Fisheries Management	Correct implementation of variable flow flood control (VARQ) at Libby Dam during 2006 could have avoided spill and prevented impacts to Kootenai River fish	Brian Marotz	Peter Brown
Friday	11:30	Contributed Papers: Fisheries Management	Investigations into Rapid Temperature Decreases in the Upper Madison River downstream from Quake Lake, MT	Frank Pickett	Peter Brown
Friday	8:00	Welcome and Announcements			Leslie Bahn
Friday	8:10	Contributed Papers: Fisheries Techniques	Estimation of Fish Age Using Otolith Relative Mass	Craig Stafford	Leslie Bahn
Friday	8:30	Contributed Papers: Fisheries Techniques	A new biochemical genetic technique to examine hybridization among westslope cutthroat, Yellowstone cutthroat, and rainbow trout	John Powell	Leslie Bahn
Friday	8:50	Contributed Papers: Fisheries Techniques	Evaluation of Stocking as a Means of Replacing Introduced Trout Populations in Lakes with Westslope Cutthroat Trout	Robb F. Leary	Leslie Bahn
Friday	9:10	Contributed Papers: Fisheries Techniques	Who's Yer Daddy? Photo Documentation of Bull Trout and Brook Trout Hybridization	Wade Fredenberg	Leslie Bahn
Friday	9:30	Contributed Papers: Fisheries Techniques	Considering Natural Vegetation Development Processes in Streambank Stabilization Design	Amy Sacry	Leslie Bahn
Friday	9:50	Contributed Papers: Fisheries Techniques	Dual-Frequency Identification Sonar (DIDSON) for Fisheries Applications: Cool Tool or Expensive Toy?	Susan Camp	Leslie Bahn
Friday	10:10	Break			
Friday	10:30	Contributed Papers: Ecology	Spawning Abundance of Bull Trout (*Salvelinus confluentus*) in relation to Geomorphology, Temperature and Roads in tributaries of Rock Creek Basin (Missoula and Granite Counties), Montana, USA	Gary Carnefix	Rob Clark
Friday	10:50	Contributed Papers: Ecology	Eustache Creek Mine Site and Stream Channel Reclamation- Planning, Monitoring, and Implementation	Scott Spaulding	Rob Clark
Friday	11:10	Contributed Papers: Ecology	Hebgen Reservoir Activities Update: Still Looking at Factors that could Potentially be Limiting Wild Rainbow Trout Recruitment to the Hebgen Fishery	Travis Lohrentz	Rob Clark
Friday	11:30	Contributed Papers: Ecology	Population Structure and Seasonal Habitat Use of the Northern Pike Population of Cabinet Gorge Reservoir, Montana	Sean Moran	Rob Clark

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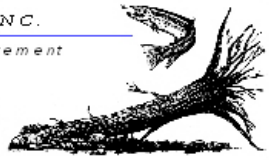

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