MONTANA CHAPTER
OF
THE AMERICAN FISHERIES SOCIETY

AND

THE MONTANA CHAPTER
OF
THE WILDLIFE SOCIETY

2009 JOINT CONFERENCE

Adapting Fish and Wildlife Management To Human Demographic Change In Montana

Red Lion Hotel, Kalispell
February 9th – 13th, 2009

2009 Program Guide – Joint Meeting MT TWS and AFS

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 (MTAFS) 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 meeting, which is the 42nd annual meeting of MT AFS, is the major gathering of the year for fisheries and other aquatic resource professionals of all affiliations across the state. Our annual meeting is a great opportunity for us to learn about what is happening in the management and conservation of fisheries resources across the state and explore timely issues.

2008-2009 Montana AFS Chapter Officers

President: Carter Kruse (Turner Enterprises, Inc.)
Past-President: David Schmetterling (Montana Fish Wildlife and Parks)
President-Elect: Scott Barndt (Gallatin National Forest)
Secretary-Treasurer: Windy Davis (Montana Fish Wildlife and Parks)
UM Student Subunit President: Bryan Bakevich
MSU Student Subunit President: Kris Homel

Montana AFS Committee Chairs

Newsletter Editor: Amber Steed
Awards: Travis Horton
Continuing Education: Lisa Eby
Public Outreach: John Wachsmuth
Resource Management Concerns: John Syslo
Historian: Paul Hamlin
Legislation: Scott Bosse
Membership: Kristi Webb
Raffle: MSU Student Subunit
Species of Special Concern: Craig Barfoot, Greg Hoffman, and Bob Bramblett
Web Page: Adam Petersen

About TWS and the Montana Chapter

The Wildlife Society (TWS) is an international professional society established in 1937. The Society's membership of more than 9,600 includes research scientists, educators, communications specialists, managers, conservation law enforcement officers, administrators, and students in more than 60 countries. The principal objectives of The Wildlife Society are: to develop and promote sound stewardship of wildlife resources and of the environments upon which wildlife and humans depend; (2) to undertake a role in preventing human-induced environmental degradation; (3) to increase awareness and appreciation of wildlife values; and (4) to seek the highest standards in all activities of the wildlife profession.

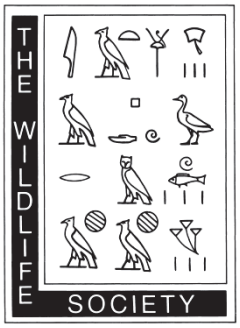
The Montana Chapter of The Wildlife Society was chartered in 1962 and formally organized with the election of the first officers in 1963. Adoption of chapter bylaws occurred in 1964. The mission of the Montana Chapter of the Wildlife Society is to serve and represent wildlife professionals in all areas of wildlife conservation and resource management. Goals of the Montana Wildlife Society include developing and maintaining a program that facilitates continuing education and professional development of wildlife professionals, promoting sound stewardship of wildlife and their habitats through the application of scientific information, increasing public awareness and appreciation of wildlife, and developing an active and diverse membership and maintain an organization that provides excellent service to members.

2008-2009 Montana TWS Chapter Officers

President: Ryan Rauscher (Montana Fish, Wildlife and Parks)
Past-President: Carolyn Sime (Montana Fish Wildlife and Parks)
President-Elect: Joe Weigand (Montana Fish, Wildlife and Parks)
Secretary: Sarah LaMarr (Bureau of Land Management)
Treasurer: Mike McGrath (Montana Department of Natural Resources and Conservation)
MSU Student Chapter President: Ashlee Perry
U of M Student Chapter President: Darin Newton

Montana TWS Committee Chairs

Awards: Jo Ann Dullum
Effects of Recreation (Ad hoc): Gayle Joslin
Financial Management: Frank Pickett
Grants (Ad Hoc): Vanna Boccadori
Legislative Affairs (Ad Hoc): Denise Pengeroth
Membership: Adam Messer
Nominations: Terry Lonner
Scholarships: Robert Garrott/Dan Pletscher
Species of Concern (Ad Hoc): Bryce Maxell



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2009 Program Committee

Program Chairs: Joe Weigand and Scott Barndt
Continuing Education: Lisa Eby
Registration: Windy Davis and Mike McGrath
Membership: Kristi Webb and Adam Messer
Raffle: Kris Homel (MSU AFS Subunit)
Silent Auction: Carolyn Sime and MSU Student Chapter

Acknowledgements

This meeting would not be possible without the active participation of the members of the Montana Chapters of the American Fisheries Society and The Wildlife Society. A special thanks to the invited speakers, some of whom traveled long distances, and those who took the time to prepare a presentation or poster, moderate a session, judge papers, and otherwise assist with the meeting agenda. Windy Davis was especially helpful in coordinating registration. Lisa Eby developed the Continuing Education course. Kris Homel and the MSU Subunit worked hard to organize the raffle, while Amber Steed, Leo Rosenthal and other Kalispell folks took care social arrangements and the hospitality room. Aubree Benson, Olga Helmy, Ryan Lamb, and Maria Naccarato were student volunteers who assisted with the audio visuals and meeting management. Chapter officers and committee chairs, listed on the previous page, provided invaluable advice and, of course, were instrumental in completing the business aspects of the meeting, including committee caucuses and the business meeting. Special thanks go to all those that provided critical Audio/Visual support throughout the conference. Finally, a hearty thanks to the meeting Sponsors and Exhibitors listed below whose support allowed us to develop a successful meeting and keep registration fees at a reasonable level.

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WE COULDN'T DO IT WITHOUT YOU

Adapting Fish and Wildlife Management
To Human Demographic Change In Montana

Welcome to the 2009 joint meeting of the Montana Chapters of the American Fisheries Society and The Wildlife Society! It has been a privilege for us to work together and alongside so many dedicated professionals on behalf of the memberships of our organizations to prepare the program for this annual gathering of biologists, researchers, managers, students, and practitioners in the great state of Montana. The genesis for a joint meeting occurred independently at each society's 2008 annual meeting. The mutual feeling of our societies was that a joint meeting would provide many benefits, including sharing ideas, culture, research, and, perhaps, solutions to challenges we share – which brings us to reflect on this year's theme. Each of our societies has, in recent years, organized meetings around major scientific challenges we face, such as climate change and energy development. However, all of the challenges we have thus far examined must be faced within the context of human demographic change, because success – in securing funding for research or in crafting management responses – can only occur if our efforts are deemed relevant by human society. Indeed, at a training session one of us recently attended, a researcher of human demography said, 'Human demographics are the plate tectonics driving societal change.'

Our challenge to you at this meeting, then, is three-fold. First, take advantage of the opportunity this joint meeting provides to share and provoke ideas, develop new partnerships, learn from one another, and find mutual solutions to our shared management challenges…indeed, enjoy and take advantage of the opportunity of the demographics of the meeting! Second, use the plenary session to remember our past, stand firmly in the present, and turn our focus to solutions for the future embodied by human demographic change. Third, let's take what we gain here and adapt our work so that it, and we, have a relevant future.

Welcome to Kalispell!

SCHEDULE AT A GLANCE

REGISTRATION ~ REGISTRATION DESK NEAR RESTAURANT
Monday, February 9th: 6:30 PM – 8:30 PM
Tuesday, February 10th: 7:00 AM – 10:00 AM; 5:30 PM – 7:00 PM
Wednesday, February 11th: 7:00 AM – 5:00 PM
Thursday, February 12th: 7:00 AM – 12:00 PM; 3:30 PM – 5:30 PM
Friday, February 13th: 7:30 AM – 9:00 AM

MONDAY, FEBRUARY 9
Working Groups
Montana Chapter of the American Fisheries Society Executive Committee Meeting
USDI Fish and Wildlife Service Refuge Biologist Workshop
6:30 PM – 8:30 PM Registration

TUESDAY, FEBRUARY 10
7:00 AM – 10:00 AM; 5:30 PM – 7:00 PM Registration
8:00 – 5:00 PRE-CONFERENCE WORKSHOPS (Lunch provided w/ registration)
8:00 – 12:00 USDI Fish and Wildlife Service Refuge Biologist Workshop - Continued
8:00 – 5:00 MFWP and USFWS Fisheries and Hatchery Managers – Fisheries Summit
1:00 – 5:00 Flathead/Swan Lake Trout Working Group
6:30 - 8:30 Bald Eagle Working Group Meeting
5:30 - 9:00 Workshop Mixer

WEDNESDAY, FEBRUARY 11
7:00 AM – 5:00 PM Registration
8:00 AM Welcome – President MT AFS and President MT TWS
8:10 AM Plenary Session: "Adapting Fish and Wildlife Management to Montana's New Demographics"
10:40 AM Break
12:00 – 1:00 PM *Lunch – On Your Own*
3:00 PM Break
4:35 PM *Putting It All Together: What it means for Natural Resource Managers in Montana; Now and Into the Future*
Session Chair: Brian Kahn
5:30 – 9:00 Plenary Social
8:00 - 5:00 Vendors and Natural Resource Organizations will be on hand to display and discuss their "wares" and missions.
4:45 - 5:30 MTAFS Committee Meetings
5:30 – 7:30 Montana Association of Fish and Wildlife Biologists – General Membership Meeting (MFWP)
6:00 – 8:00 Student Mentoring Session / Book Signing – *Montana's Wildlife Legacy*

THURSDAY, FEBRUARY 12
7:00 AM – 12:00 PM; 3:30 PM – 5:30 PM Registration
8:00 – 5:00 Concurrent Breakout Sessions
8:00 - 5:00 Vendors and Natural Resource Organizations will be on hand to display and discuss their "wares" and missions.
12:00 – 2:00 MT TWS and MT AFS Business Luncheons
Banquet, Silent Auction and Raffle, Election Results, Awards
Entertainment – Jim Dunnigan

FRIDAY, FEBRUARY 13
7:30 AM – 9:00 AM Registration
8:00-12:00 Concurrent Breakout Sessions

MT TWS and MT AFS 2009 KALISPELL

"ADAPTING FISH AND WILDLIFE MANAGEMENT TO HUMAN DEMOGRAPHIC CHANGE IN MONTANA"

Thursday, Feb. 12

Registration: 7:00 AM - 12:30 PM and 3:30 PM - 5:30 PM

Human Interactions with F&WL - Impacts and Solutions

	Ballroom A	Ballroom B	Triples
	Energy Development Impacts to Fish and Wildlife	Changing Demographics Changing Management Strategies	Use of CCAAs, Using Big Hole example
8:00	A. Steed et al. (Methane and Coal Impacts)	J. Vashro (Unauthorized Fish)	J. Everett (Big Hole Example)
8:20		*C. McCoy (Private Land Hunting Access)	D. Peterson (What are CCAAs?)
8:40	B. Martin (Wind Development Impacts)	J. Gude (Hunter Participation)	M. Bias (CCAAs and ESA)
9:00	J. Spinelli (Fish Entrainment)	T. Baumeister (User-Paid Conservation)	J. Everett (Fish)
9:20	C. Stafford (Mercury Levels)	M. Maskill (Fish Hatcheries)	K. Smucker (Birds)
9:40	J. Dunnigan (Bull Trout)	R. Rassmussen (Conservation Forest Lands)	TBD (Landscapes)
10:00	N. Merz (Libby Dam)	T. Carlsen (Bighorn Strategy)	M. Anderson (Human Demographics)
10:20	**BREAK**		
	Impacts to F&W from Human Resource Management	**F&WL Restoration Methods and Results**	**CCAA continued**
10:40	B. Gresswell (Trout Survival)	T. Mulholland (Floating Wetlands)	Panel discussion Future of CCAAs (moderator Buddy Drake)
11:00	G. Reed (Cattle Grazing)	J. Muhlfeld (LWD Placement)	
11:20	*R. McCaffery (Spotted Frogs)	M. Backes (Diversion Dams)	
11:40	D. Schmetterling (Trophic Cascades)	H. Billman (Amphibians and Piscicides)	Concluding remarks, future direction
12:00	**Montana Chapter of The Wildlife Society Business Luncheon - Glacier Room 12:00 - 2:00 PM**		
12:20			
12:40			
1:00	**Montana Chapter of the American Fisheries Society Business Luncheon - Fireside Room 12:00 - 2:00 PM**		
1:20			
1:40			

Joint Concurrent Sessions

	Monitoring and Spatial Analysis	Cryptic Critters	Avian Topics
2:00	B. Brock (GIS Land-Use Planning)	B. Maxell (Amphibs and Aquatic Reptiles)	C. Wightman (Bird Distribution)
2:20	S. Yeats (GIS Tools)	B. Maxell (Amphib. Distribution Models)	D. Waltee (Great Blue Herons)
2:40	C. Clancey (Bull Trout Monitoring)	D. Stagliano (Western Pearlshell Mussel)	T. Koel (Avian Vectors/Whirling Disease)
3:00	R. Russell (Occupancy and Abundance)	D. Waltee (Sylvan Deer Mice)	R. Domenech (Golden Eagles)
3:20	**BREAK**		

***Student Papers**

	Ballroom A	Ballroom B	Triples	Glacier
	Elk Predator Interactions	Fish	Wildlife	Elk
3:40	*K. Proffitt (Elk Resource Selection)	*T. Sedell (Colorado River Cutthroat)	*A. Ormesher (Osprey)	*V. Patrek (Supplemental Feeding)
4:00	*M. Becker (Wolf Prey Preferences)	*M. Talbott (White Sturgeon)	*J. Woolf (Black-Backed Woodpeckers)	B. Lindler (Cooperative Elk Mgmt)
4:20	*C. Gower (Elk Behavioral Responses)	*B. Cox (Swan Lake - Lake Trout)	*J. Merkle (Missoula Black Bears)	*S. Cleveland (Cooperative Elk Mgmt)
4:40	R. Garrott (Effects of Wolf Predation)	*J. Syslo (Lake Trout)	*K. Cutting (Lesser Scaup)	V. Edwards (Cooperative Elk Mgmt)
5:00		*L. Tennant (Bull Trout)	*B. Burkholder (Shiras Moose)	*M. Kohl (Elk and Weeds)

MT TWS and MT AFS 2009 KALISPELL

"ADAPTING FISH AND WILDLIFE MANAGEMENT TO HUMAN DEMOGRAPHIC CHANGE IN MONTANA"

Friday, Feb. 13

	Registration: 7:30 AM - 9:00 AM	
	Fish and Wildlife	
	Ballroom A	**Ballroom B**
	Large Carnivores	**Salmonids**
8:00	K. Laudon (Magic to Tragic)	C. Stafford (Lake Trout)
8:20	C. Sime (MT Wolf Status)	C. Stafford (Lake Trout Ages)
8:40	T. Manley (Backyard Griz)	L. Battle (Cutthroat Trout)
9:00	K. Kendall (Griz Demography and Genetics)	B. Shephard (Westslope Cutthroat)
9:20	T. Chilton (Griz in the NCDE)	M. Young (Cutthroat Movement)
9:40	Wayne Kasworm (Cabinet-Yaak Griz)	M. Ruhl (Cutthroat Restoration)
10:00	**BREAK**	
	Large Predators / Small Prey	**Salmonids and Genetics**
10:20	K. Annis (Public Opinion - Griz)	C. Downs (Juvenile Bull Trout)
10:40	E. Wenum (Black Bears & Cougars)	C. Muhlfeld (Cutthroat Hybridization)
11:00	Scott Story (Black-tailed Prairie Dog)	R. Leary (Cutthroat Genetics)
11:20		D. Peterson (Grayling Genetics)

Working Groups
Monday February 9th

8:00 – 10:00 Loon Working Group: Lake McDonald Room

10:00 – 11:00 Harlequin Duck Working Group: Swift Current Room

11:00 – 3:00 All Bird Working Group: Hanging Gardens Room

3:00 – 5:00 Herp and Amphibian Working Group: Lake McDonald Room

6:00 – 8:00 Bat Working Group: Hanging Gardens Room

1:00 – 5:00 Montana Chapter of the American Fisheries Society Executive Committee Meeting: Fireside Room

2:00 – 6:30 USDI Fish and Wildlife Service Refuge Biologist Workshop: Glacier Room

6:30 PM – 8:30 PM Registration

Continuing Education Agenda
Tuesday February 10th

Workshop Session I (Ballroom A):
Human Demographic Impacts:
Invasive Species and Other Species of Concern

Moderator: Aubree Benson

8:00-8:40 "Priorities for Aquatic Nuisance Species Management"
Robert Wiltshire (Center for Aquatic Nuisance Species)

8:40- 9:10 "Conservation of Cutthroat Trout: Collaboration, Adaptive Strategies, and Monitoring Experiences"
Brad Shepard (Montana Fish Wildlife and Parks and Montana Cooperative Fisheries Research Unit)

9:10 – 9:50 "Flowering Rush, an invasive aquatic macrophyte infesting the headwaters of the Columbia River System"
Peter Rice (University of Montana) and Virgil Dupuis (Salish Kootenai College)

9:50-10:10 Morning Break

10:10-10:40 "Exotics among us"
Tim Feldner (Commercial Wildlife Permitting, Montana Fish Wildlife &Parks)

10:40-11:05 "Ecology and management of invasive species - a conceptual framework"
Dean Pearson (U.S. Forest Service)

11:05-11:30 "Efficacy of a common weed control treatment for mitigating impacts of knapweed invasion "
Yvette Ortega (U.S. Forest Service)

11:30-12:00 "Resources for Invasive Plant Research, Science-based Management, and Outreach "
Mary McFadzen (Center for Invasive Plant Management, Montana State University)

12:00- 1:00 Lunch

1:00- 5:00 "Montana species of concern and accessing information on Montana Fish and Wildlife species from the Montana Natural Heritage Program and Montana Department of Fish, Wildlife and Parks"

Bryce A. Maxell (Zoologist, Montana Natural Heritage Program), Allan Cox (Systems and Services Manager, Montana Natural Heritage Program), Scott J. Story (Wildlife Information Specialist) and Bill Daigle (Fisheries Information Specialist, Information Management Bureau, Montana Fish, Wildlife,and Parks)

This workshop will consist of: (1) an overview of the Montana Animal Species of Concern list and the criteria used to identify Species of Concern; (2) an overview of the data products available from the Montana Natural Heritage Program and Montana Fish, Wildlife, and Parks; (3) hands on training with internet based applications for accessing detailed information on all Montana animal species.

1:00 – 1:05 Introductions, Overview, and Handouts
1:05 – 1:30 Overview of Montana Species of Concern List Criteria and Process
1:30 – 1:45 Break
1:45 – 3:15 Overview of Data Products Provided by MNHP and MFWP
3:15 – 3:30 Break
3:30 – 5:00 Hands on training on TRACKER application and other methods of data access

Workshop Session II (Ballroom B):
Human Demographic Impacts:
Solutions to Fish and Wildlife Management Challenges

Moderator: Dan Pletscher

8:00 - 8:30 "Suburban and exurban influences on wildlife and fish"
Paul Krausman*, Sonja Smith, Jonathan Derbridge & Jerod Merkle (Wildlife Biology Program, Univ. MT)

8:30 - 9:00 "Preventing conflicts with predators with an emphasis on bears"
Bill Lavelle* and Patti Sowka (Living with Wildlife Grant Program)

9:00 – 9:15 Break

9:15 - 9:45 "The Partners-In-Life Program: Bear Shepherding to Reduce Human-Wildlife Conflict"
Russ Talmo (Wind River Bear Institute)

9:45 - 10:15 "Bluegrass, Bunchgrass, Barbed Wire, and Black Bears: A Volunteer's Perspective on Subdivisions and Wildlife in Missoula's Grant Creek"
Bert Lindler (Prospect Meadows Homeowners Association)

10:15 - 10:30 Break

10:30 - 11:20 "Protecting the Endangered Golden Goose: Growth Management and the Preservation of Natural Assets"
Dennis Glick and Randy Carpenter (Sonoran Institute)

11:20 - 12:00 "Using Land Use Planning to Protect Montana's Wetlands and Riparian Areas"
Janet Ellis (Montana Audubon)

12:00 - 1:15 Lunch Break

1:15 - 1:45 "Protecting instream flows in a changing landscape"
Stan Bradshaw (Trout Unlimited)

1:45 – 2:15 "FWP's Crucial Areas and Connectivity Assessment – An Enhancement to Montana's Comprehensive Fish and Wildlife Conservation Strategy"
Bill Daigle, Janet Hess-Herbert*, Adam Messer, Adam Petersen, Joy Ritter, and Scott Story (Montana Fish, Wildlife & Parks, Information Management Bureau)

2:15 - 2:45 "River Recreation Management in Montana: Quantity versus Quality"
Charlie Sperry (Montana Fish Wildlife and Parks)

2:45 - 3:05 Afternoon Break

3:05 - 3:50 "A Fine Line between Success and Failure in Landscape Conservation"

Greg Neudecker (Vice President Blackfoot Challenge and USFW Service) and Ryen Aasheim (Big Blackfoot Chapter of Trout Unlimited)

3:50 - 4:05 Owning Eden (film)

4:05 - 4:35 "New Montana Landowners/Old Time Traditions: A Changing Landscape in Big Sky Country"
Alan Charles (Montana Fish Wildlife and Parks)

4:35 - 5:00 Wrap-up Panel discussion (with all speakers that are available)
Moderator: Dan Pletscher

Other Tuesday Functions

8:00 – 12:00 USDI Fish and Wildlife Service Refuge Biologist Workshop – Continued in Glacier Room
8:00 – 5:00 MFWP and USFWS Fisheries and Hatchery Managers – Fisheries Summit – Fireside Room
1:00 – 5:00 Flathead/Swan Lake Trout Working Group – Lake McDonald Room
6:30 - 8:30 PM Bald Eagle Working Group Meeting – Hanging Gardens Room

5:30 - 9:00 PM Workshop Mixer – Prefunction Area

.

Plenary Session Agenda
Grand Ballroom

Adapting Fish and Wildlife Management To Human Demographic Change In Montana

Wednesday February 11th

8:00 AM **Welcome** – Carter Kruse, President MT AFS and Ryan Rauscher, President MT TWS

8:10 AM **Plenary Session - *Learning from the past, but focusing on the future - adapting fish and wildlife management to Montana's new demographics***
Session Chair: Brian Kahn (Artemis Common Ground)

8:20 AM ***Montana's Wildlife Legacy: Decimation to Restoration***
Speakers: Jim Williams, Terry Lonner, Harold Picton

9:00 AM ***Chris Hunter's Interpretation of Hugh Zackheim's History of Montana Fish, Wildlife and Parks Fisheries Division 1901-2005***
Speaker: Chris Hunter

9:20 AM ***Montana Challenge: Defining Montana's New Demographics***
Speaker: SuzAnne Miller

10:00 AM Break

10:20 AM ***Fish and Wildlife Values in the West***
Speaker: Dr. Tara Teel

11:00 AM ***A Wildlife Manager's Challenge: Greater Yellowstone area elk movements: brucellosis risk and hunter access***
Speaker: Julie Cunningham

11:30 AM ***A Fishery Manager's Challenge – Case Study of fish management in "today's reality"***

Speaker: Jim Vashro

11:50 AM ***Putting It All Together: What it means for Natural Resource Managers in Montana; Now and Into the Future***
Session Chair: Brian Kahn

12:00 – 1:00 PM ***Lunch – On Your Own***

1:00 PM ***Montana's Landowners: Management Implications of Montana's Changing Demographics. (20 minutes each)***
Hunter Access – A Moving Target for Managers – Alan Charles (FWP)
Public Resources on Private Land – David Greer (Plum Creek)
Perspective of a Non-traditional Landowner/Manager – Russ Miller (Turner Enterprises)
Perspective of a Traditional Landowner/Manager – Jim Stone (Blackfoot Challenge)
Stream Access – Bob Lane (FWP Legal Counsel)
Water Rights – Stan Bradshaw

3:00 PM Break

3:15 PM ***How Are Fish and Wildlife Managers, and the Agencies or Organizations They Represent, Going to Adapt to This Change?***

FWP Wildlife Division Assistant Administrator – Jeff Herbert
USFS Deputy Regional Forester – Jane Cotrell
Rocky Mountain Elk Foundation – Jack Blackwell
Montana Trout Unlimited – Bruce Farling

4:35 PM ***Putting It All Together: What it means for Natural Resource Managers in Montana; Now and Into the Future***
Session Chair: Brian Kahn

5:30 – 9:00 **Plenary Social**
- Keg beer, wine, no host bar, appetizers

Other Wednesday Functions

8:00 - 5:00 Vendors and Natural Resource Organizations will be on hand to display and discuss their "wares" and missions.
4:45-5:30 MTAFS Committee Meetings Committee meetings
Species of Special Concern – Fireside Room
Resource Management Concerns – Glacier Room
Legislation – Ballroom A
Raffle – Ballroom A
Continuing Ed – Ballroom B
Public Outreach – Ballroom B
Web site – Triples
5:30 – 6:30 Montana Association of Fish and Wildlife Biologists – General Membership Meeting – Fireside Room
6:00 – 8:00 Poster Session (Can remain set up until Friday Noon)
6:00 – 8:00 Student Mentoring Session – Adjacent to Social
7:00 – 8:30 Book Signing: *Montana's Wildlife Legacy: Decimation to Restoration*

Thursday February 12th

7:00 AM – 12:00 PM; 3:30 PM – 5:30 PM Registration

Morning Joint Concurrent Sessions, Ballrooms A and B, and Triples Room

Ballroom A: ***Energy Development Impacts to Fish and Wildlife***

Moderator: Brian Marotz (Montana Fish, Wildlife and Parks)

8:00 AM **PROPOSED COAL MINING AND COAL-BED METHANE DEVELOPMENT THREATEN AQUATIC RESOURCES IN THE TRANSBOUNDARY FLATHEAD ECOSYSTEM,** Amber Steed (Montana Fish, Wildife and Parks), Clint Muhlfeld (US Geological Survey), and Erin K. Sexton (University of Montana)

8:40 AM **AN ECOLOGICAL RISK ASSESSMENT OF WIND ENERGY DEVELOPMENT IN MONTANA,** Brian H. Martin, , Amy J. Pearson, Brad D. Bauer (The Nature Conservancy)

9:00 AM **SPATIAL AND TEMPORAL FISH ENTRAINMENT FROM HAUSER RESERVOIR, MONTANA,** Justin P. Spinelli and Alexander V. Zale (Montana Cooperative Fishery Research Unit, Montana State University)

9:20 AM **MERCURY CONTAMINATION IN THE FISHES OF GLACIER NATIONAL PARK,** Craig Stafford (University of Montana), Chris Downs (Glacier National Park), Heiko Langner (University of Montana), and Elizabeth McGarry (St. Thomas University)

9:40 AM **BULL TROUT ENTRAINMENT AT LIBBY DAM ON THE KOOTENAI RIVER, MONTANA,** Jim Dunnigan (Montana, Fish, Wildlife & Parks)

10:00 AM **ASSESSING ECOLOGICAL IMPACTS DUE TO THE OPERATION OF LIBBY DAM, MONTANA**, Norm Merz (Kootenai Tribe of Idaho), Dwight Bergeron (Montana Fish, Wildlife & Parks)

10:20 AM **BREAK**

Ballroom A: ***Impacts to Fish and Wildlife from Natural Resource Management***

Moderator: Amber Steed (Montana Fish, Wildlife, and Parks)

10:40 AM **PATTERNS OF TROUT SURVIVAL AND MOVEMENT BEFORE AND AFTER LOGGING ON INDUSTRIAL FOREST LANDS,** Robert E. Gresswell (US Geological Survey), Aaron M. Berger (Oregon State University), Douglas S. Bateman (Oregon State University), David Hockman-Wert (US Geological Survey)

11:00 AM **EFFECTS OF CATTLE GRAZING ON SMALL MAMMAL COMMUNITIES AT RED ROCK LAKES NATIONAL WILDLIFE REFUGE**, Greg Reed* and Nathan Whelham ***(Montana State University),*** Jeffrey M. Warren (U.S. Fish and Wildlife Service), Michael R. Frisina (Montana Fish, Wildlife & Parks)

11:20 AM **THE IMPACT OF CLIMATE VARIATION ON COLUMBIA SPOTTED FROG (RANA LUTEIVENTRIS) SURVIVAL IN A HIGH MOUNTAIN ECOSYSTEM**, Rebecca McCaffery (University of Montana) and Bryce Maxell (Montana Natural Heritage Program)

11:40 AM **CLIMATE CHANGE MEDIATES THE SPATIAL PARTITIONING OF SCULPIN AND LONGNOSE DACE LEADING TO TROPHIC CASCADES IN RIVERINE ECOSYSTEMS OF WESTERN MONTANA,** David A. Schmetterling and Robert Clark (Montana Fish, Wildlife, & Parks), Susan B. Adams and Mike Young (US Forest Service)

12:00 PM **LUNCH BREAK, ALL SESSIONS – *BUSINESS MEETINGS; MT TWS GLACIER ROOM, MT AFS FIRESIDE ROOM***

Afternoon Joint Concurrent Sessions, Ballrooms A and B, Triples Room, and Glacier Room

Ballroom A: ***Monitoring and Spatial Analysis***

Moderator: Pat Clancey (Montana Fish, Wildlife, and Parks)

2:00 PM **GIS-BASED TOOLS TO IMPROVE LAND USE PLANNING FOR WILDLIFE CONSERVATION,** Brent L. Brock* and Lance Craighead (The Craighead Center for Landscape Conservation)

2:20 PM **A GIS TOOL FOR CONDUCTING LANDSCAPE-SCALE HABITAT QUALITY ASSESSMENTS,** Scott D. Yeats, Jonathan B. Haufler, and Carolyn A. Mehl (Ecosystem Management Research Institute)

2:40 PM **BULL TROUT MONITORING: LOOK DEEP AND WIDE,** Chris Clancy (Montana Fish, Wildlife, and Parks) and Mike Jakober (US Forest Service)

3:00 PM **RECENT ADVANCES IN THE ANALYSIS OF OCCUPANCY AND ABUNDANCE DATA IN RESPONSE TO MANAGEMENT ACTIVITIES**, Robin Russell (Montana Fish, Wildlife, and Parks)

3:20 PM **BREAK**

Ballroom A: ***Wildlife Student Papers – Elk Predator Interactions***

Moderator: Robert Garrott (Montana State University)

3:40 PM **CHANGES IN ELK RESOURCE SELECTION AND DISTRIBUTIONS ASSOCIATED WITH THE MADISON VALLEY LATE-SEASON ELK HUNT**, Kelly M. Proffitt* and Robert A. Garrott (Montana State University)

4:00 PM **WOLF PREY PREFERENCES IN MULTIPLE PREY SYSTEMS: INSIGHTS FROM THE MADISON HEADWATERS OF YELLOWSTONE NATIONAL PARK,** Matthew S. Becker* , Robert A. Garrott, and Claire Gower (Montana State University) and Patrick J. White (Yellowstone National Park)

4:20 PM **ELK BEHAVIORAL RESPONSES TO THE REESTABLISHMENT OF WOLVES: INTEGRATING MULTIPLE STRATEGIES TO ACCOMMODATE COMPETING DEMANDS**, Claire N. Gower*, Robert A. Garrott, and Matthew S. Becker (Montana State University) and P. J. White (Yellowstone National Park)

4:40 PM **EFFECTS OF WOLF PREDATION ON THE MADISON HEADWATERS ELK HERD: INSIGHTS FOR ELK AND WOLF MANAGEMENT IN MONTANA,** Robert A. Garrott, Claire N. Gower, and Matthew S. Becker (Montana State University), Patrick J. White (Yellowstone National Park) and Kenneth L. Hamlin (Montana Fish, Wildlife, and Parks)

Morning Joint Concurrent Sessions, Ballrooms A and B, and Triples Room

Ballroom B: ***Changing Demographics, Changing Fish and Wildlife Management Strategies***

Moderator: Trevor Selch (Montana Fish, Wildlife, & Parks)

8:00 AM **MONTANA UNAUTHORIZED FISH INTRODUCTIONS,** Jim Vashro (Montana Fish, Wildlife & Parks)

8:20 AM **HUNTING ACCESS MANAGEMENT ON PRIVATE LANDS IN MONTANA,** Caitlin McCoy* and Tara Teel (Colorado State University), Mike Lewis (Montana Fish, Wildlife and Parks)

8:40 AM **VIABILITY OF RESIDENT DEER AND ELK HUNTER PARTICIPATION IN MONTANA**, Julie A. Cunningham, Justin A. Gude, Thomas R. Baumeister, and Jeffrey T. Herbert (Montana Fish, Wildlife & Parks)

9:00 AM **VIABILITY OF USER-PAID SYSTEM OF WILDLIFE CONSERVATION IN MONTANA,** Thomas R. Baumeister, Jeffrey T. Herbert, Mike Lewis, Justin A. Gude, and Julie Cunningham (Montana Fish, Wildlife, and Parks)

9:20 AM **A FISH HATCHERY'S ROLE IN A CHANGING MONTANA,** Mark G. Maskill (US Fish and Wildlife Service)

9:40 AM **THE MONTANA LEGACY PROJECT -- CONSERVATION OF FOREST LANDS IN WESTERN MONTANA,** Robert Rasmussen (Trust For Public Land)

10:00 AM **MONTANA'S CONSERVATION STRATEGY FOR ROCKY MOUNTAIN BIGHORN SHEEP**, Tom Carlsen (Montana Fish, Wildlife and Parks)

10:20 AM **BREAK**

Ballroom B: ***Fish and Wildlife Restoration Methods and Results***

Moderator: Bruce Roberts (US Forest Service)

10:40 AM **CREATING WILDLIFE HABITAT AND EXPANDING FISHERIES WITH BIOHAVEN® FLOATING TREATMENT WETLANDS**, Tim Mulholland P.E. and Christine Pierce (Headwaters Floating Island)

11:00 AM **EFFECTS OF LARGE WOOD PLACEMENT ON CHANNEL MORPHOLOGY AND AQUATIC HABITAT HALLOWAT CREEK, NORTH FORK FLATHEAD RIVER DRAINAGE, MONTANA,** John Muhlfeld and Jonathan Ferree (River Design Group, Inc.)

11:20 AM **DIVERSION DAMS AND FISH PASSAGE – DON'T GIVE UP THE FIGHT!** Mike Backes (Montana Fish, Wildlife & Parks)

11:40 AM **TOXICITY OF ROTENONE TO LARVAL AMPHIBIANS,** Hilary G. Billman*, Sophie St. Hilaire, Charles R. Peterson (Idaho State University) and Carter Kruse (Turner Enterprises, Inc.)

12:00 PM **LUNCH BREAK, ALL SESSIONS – *BUSINESS MEETINGS; MT TWS GLACIER ROOM, MT AFS FIRESIDE ROOM***

Ballroom B: ***Cryptic Critters***

Moderator: Joanne Stewart (Montana Fish, Wildlife, and Parks)

2:00 PM **STATUS OF LENTIC BREEDING AMPHIBIANS AND AQUATIC REPTILES IN MONTANA,** Bryce A. Maxell and Dave Ratz (Montana Natural Heritage Program), P. Stephen Corn (US Geological Survey), and D. Grant Hokit (Carroll College)

2:20 PM **MODELING PREDICTED DISTRIBUTION AND LANDSCAPE-LEVEL HABITAT SUITABILITY FOR MONTANA WILDLIFE SPECIES,** Bryce A. Maxell (Montana Natural Heritage Program) and Scott Story and Joy Ritter (Montana Fish, Wildlife and Parks)

2:40 PM **WESTERN PEARLSHELL (MARGARITIFERA FALCATA) MUSSEL DISTRIBUTION & STATUS IN MONTANA: TWO YEARS LATER, IT'S WORSE THAN WE THOUGHT!** David M. Stagliano (Montana Natural Heritage Program)

3:00 PM **SEASONAL DISPERSAL TENDENCIES OF SYLVAN DEER-MICE (*PEROMYSCUS MANICULATUS*) WITHIN MONTANA RANGELANDS,** Dean Waltee and Richard J. Douglass (Montana Tech of the University of Montana) and Brent N. Lonner (Montana Fish, Wildlife, and Parks)

3:20 PM **BREAK**

Ballroom B: ***Fisheries Student Papers***

Moderator: Travis Horton (Montana Fish, Wildlife, and Parks)

3:40 PM **WATERSHED-SCALE APPROACH TO ASSESSING COLORADO RIVER CUTTHROAT TROUT ONCORHYNCHUS CLARKI PLEURITICUS ABUNDANCE AND HABITAT IN THE UPPER COLORADO RIVER HEADWATERS**, Ted R. Sedell* (Montana State University) and Robert E. Gresswell (U.S. Geological Survey)

4:00 PM **DETERMINING MORPHOLOGICAL AND BIOCHEMICAL PARAMETERS ASSOCIATED WITH EARLY OVARIAN FOLLICULAR ATRESIA IN WHITE STURGEON FEMALES,** Mariah J. Talbott* and Christopher S. Guy (Montana Cooperative Fishery Research Unit, Montana State University), Joel P. Van Eenennaam, Javier Linares-Casenave, and Serge I. Doroshov (University of California – Davis) and Molly A.H. Webb (US Fish and Wildlife Service)

4:20 PM **POPULATION CHARACTERISTICS OF LAKE TROUT IN SWAN LAKE, MONTANA,** Benjamin S. Cox* and Christopher S. Guy (Montana Cooperative Fishery Research Unit, Montana State University), Wade Fredenberg (US Fish and Wildlife Service), and Leo R. Rosenthal (Montana Fish, Wildlife and Parks)

4:40 PM **ANALYSIS OF POPULATION METRICS TO ASSESS THE EFFICACY OF LAKE TROUT SUPPRESSION IN YELLOWSTONE LAKE, YELLOWSTONE NATIONAL PARK,** John M. Syslo* and Christopher S. Guy (Montana Cooperative Fishery Research Unit, Montana State

University) and Patricia E. Bigelow, Philip D. Doepke, and Todd M. Koel (Yellowstone National Park)

5:00 PM **DISTRIBUTION, ABUNDANCE, AND AGE STRUCTURE OF JUVENILE BULL TROUT IN A TRIBUTARY TO QUARTZ LAKE, GLACIER NATIONAL PARK, MONTANA,** Lora B. Tennant* and Christopher Guy (Montana Cooperative Fishery Research Unit, Montana State University), Robert E. Gresswell (US Geological Survey)

Morning Joint Concurrent Sessions, Ballrooms A and B, and Triples Room

Triples Room: ***Candidate Conservation Agreements with Assurances (CCAAs) as a tool for adaptive fish and wildlife management: The Big Hole River story***

Symposium Co-Chairs: Dr. Michelle Anderson and Jeff Everett

8:00 AM **INTRODUCTION TO THE SYMPOSIUM**, Jeff Everett (US Fish and Wildlife Service)

Introduce speakers: Michelle Anderson (MT-Tech)

CCAA Background:

8:20 AM **AN OVERVIEW OF THE CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES PROGRAM, WITH SPECIAL REFERENCE TO THE BIG HOLE RIVER, MONTANA**, Doug Petersen (US Fish and Wildlife Service)

8:40 AM **PERSPECTIVES ON NOT LISTING THE FLUVIAL ARCTIC GRAYLING**, Mike Bias (Big Hole River Foundation)

CCAA results in the Big Hole watershed:

9:00 AM **CCAA IMPACTS ON THE FISHERY OF THE UPPER BIG HOLE WATERSHED**, Jeff Everett (US Fish and Wildlife Service)

9:20 AM **CCAA IMPACTS ON BIRDS OF THE BIG HOLE WATERSHED**, Kristina Smucker and Megan Fylling (University of Montana-Avian Science Center)

9:40 AM **LANDSCAPE CONSERVATION AND THE BIG HOLE CCAA PROGRAM**, Nathan Korb (The Nature Conservancy)

10:00 AM **RURAL STAKEHOLDERS AND ARCTIC GRAYLING (*THYMALLUS ARCTICUS*) MANAGEMENT IN THE BIG HOLE RIVER WATERSHED, MONTANA, USA,** Michelle Anderson and Kylene Owens (MT-Tech of the University of Montana) and Mike Bias (Big Hole River Foundation)

10:20 AM **BREAK**

10:40 AM **PANEL DISCUSSION**, Buddy Drake, moderator (Arctic Grayling Recovery Program)

11:30 AM **CONCLUDING REMARKS, FUTURE DIRECTION**

12:00 PM **LUNCH BREAK, ALL SESSIONS – *BUSINESS MEETINGS; MT TWS GLACIER ROOM, MT AFS FIRESIDE ROOM***

Afternoon - Triples Room: ***Avians***

Moderator: Dan Mahoney (National Park Service)

2:00 PM **BIRD DISTRIBUTION IN MONTANA: OPPORTUNITIES FOR PUBLIC INVOLVEMENT**, Catherine Wightman and Scott Story (Montana Fish, Wildlife, and Parks) and Coburn Currier (Montana State Library)

2:20 PM **TEMPORAL COMPARISONS OF GREAT BLUE HERON (*ARDEA HERODIAS*) ROOKERY DISTRIBUTION, ABUNDANCE AND REPRODUCTIVE SUCCESS IN THE LOWER YELLOWSTONE RIVER BASIN,** Dean J. Waltee and Ryan Rauscher (Montana Fish, Wildlife and Parks)

2:40 PM **AVIAN PISCIVORES VECTOR (*MYXOBOLUS CEREBRALIS)* IN THE GREATER YELLOWSTONE ECOSYSTEM,** Todd M. Koel (Yellowstone National Park), Billie L. Kerans (Montana State University), Scott C. Barras and Katie C. Hanson (USDA/APHIS/WS, National Wildlife Research Center) and John S. Wood (Pisces Molecular LLC)

3:00 PM **BLOOD-LEAD LEVELS OF FALL MIGRANT GOLDEN EAGLES IN WEST-CENTRAL MONTANA,** Robert Domenech (Raptor View Research Institute) and Heiko Langner (University of Montana)

3:20 PM **BREAK**

Triples Room: ***Wildlife Student Papers***

Moderator: Robin Russell (Montana Fish, Wildlife, and Parks)

3:40 PM **LONG-TERM MONITORING OF OSPREY (*PANDION HALIATUS*) POPULATIONS IN WESTERN MONTANA,** Amanda A. Ormesher* and Erick Greene (University of Montana)

4:00 PM **PATTERNS OF MOVEMENT IN BLACK-BACKEDWOODPECKERS,** Jennifer C. Woolf* and Fred W. Allendorf (University of Montana) and Michael Schwartz (US Forest Service)

4:20 PM **PUBLIC ATTITUDES TOWARDS BLACK BEARS IN MISSOULA, MONTANA,** Jerod A. Merkle* and Paul R. Krausman (University of Montana) and Melinda M. Booth (Sequoia Park Zoo Foundation and Humboldt State University)

4:40 PM **NUTRIENT ALLOCATION IN EGG FORMATION OF FEMALE LESSER SCAUP (*AYTHYA AFFINIS*) ON LOWER RED ROCK LAKE, RED ROCK LAKES NATIONAL WILDILFE REFUGE,** Kyle A. Cutting* and Jay J. Rotella (Montana State University), Jeffrey M. Warren (US Fish and Wildlife Service), and Susan E. Wainwright and John Y. Takekawa (U.S. Geological Survey)

5:00 PM **WINTER DISTRIBUTION, HABITAT USE, AND BROWSE UTILIZATION PATTERNS OF THE SHIRAS MOOSE ON THE MOUNT HAGGIN WILDLIFE MANAGEMENT AREA,** Braden O. Burkholder* and Vanna J. Boccadori (Montana Fish, Wildlife, and Parks) and Robert A. Garrott (Montana State University)

Afternoon - Glacier Room: Wildlife Student Papers – Elk Management

Moderator: Deb Wambach (Montana Department of Transportation)

3:40 PM **FAT BUT NOT HAPPY: THE EFFECTS OF SUPPLEMENTAL FEEDING ON STRESS HORMONE LEVELS OF WYOMING ELK,** Victoria Patrek*, Mark Taper, and Scott Creek (Montana State University) and Paul Cross (US Geological Survey)

4:00 PM **A COOPERATIVE APPROACH TO ELK MANAGEMENT IN THE WILDLAND/URBAN INTERFACE OF MISSOULA, MONTANA - A DYNAMIC STRATEGY FOR A GROWING PROBLEM,** Victoria Edwards (Montana Fish, Wildife, and Parks), Shawn Cleveland* (University of Montana) and Bert Lindler (North Hills Landowner)

5:00 PM **RELATIONSHIPS BETWEEN ELK AND NONNATIVE WEEDS ON MONTANE WINTER RANGES IN WESTERN MONTANA**, Michel T. Kohl*, Mark Hebblewhite, & Shawn M. Cleveland (University of Montana)

Friday February 13th

Morning Fish and Wildlife Concurrent Sessions, Ballrooms A and B

Ballroom A: ***Wildlife – Large Carnivores***

Moderator: Jim Williams (Montana Fish, Wildlife and Parks)

8:00 AM **FROM MAGIC TO TRAGIC: THE HISTORY OF WOLF RECOVERY AND MANAGEMENT IN NORTHWEST MONTANA**, Kent Laudon (Fish Wildlife & Parks)

8:20 AM **STATUS OF MONTANA'S WOLVES,** Carolyn Sime (Montana Fish, Wildlife, and Parks)

8:40 AM **WHY IS THIS GRIZZLY BEAR IN MY BACKYARD? MANAGING HUMAN/GRIZZLY BEAR CONFLICTS IN NORTHWEST MONTANA**, Timothy L. Manley (Montana Fish, Wildlife and Parks)

9:00 AM **DEMOGRAPHY AND GENETIC STRUCTURE OF A RECOVERING GRIZZLY BEAR POPULATION,** Katherine C. Kendall (US Geological Survey), Jeffrey B. Stetz and Amy C. Macleod (University of Montana Cooperative Ecosystem Studies Unit), John B. Boulanger (Integrated Ecological Research) and Gary C. White (Colorado State University)

9:20 AM **GRIZZLY BEAR TREND MONITORING RESEARCH IN THE NCDE: AN UPDATE, 2004-2008,** Tonya Chilton and Richard Mace (Montana Fish, Wildlife, & Parks)

9:40 AM **GRIZZLY BEAR POPULATION AUGMENTATION IN THE CABINET MOUNTAINS OF NORTHWEST MONTANA,** Wayne Kasworm (US Fish and Wildlife Service) and Kimberly M. Annis, Timothy Manley, Heather Reich, Derek Reich, and Jim Williams (Montana Fish, Wildlife & Parks)

10:00 AM **BREAK**

Ballroom A: ***Wildlife – NW Montana Predators and Prey***

Moderator: Jay Kolbe (Montana Fish, Wildlife and Parks)

10:20 AM **PUBLIC OPINION AND KNOWLEDGE OF GRIZZLY BEARS IN THE CABINET-YAAK ECOSYSTEM,** Sarah Canepa, Kim M. Annis (Montana Fish, Wildlife and Parks) and Wayne Kasworm (US Fish and Wildlife Service)

10:40 AM **MANAGING BLACK BEARS AND COUGARS WITH PEOPLE PROBLEMS,** Erik Wenum (Montana Fish, Wildlife and Parks)

11:00 AM **ESTIMATION OF BLACK-TAILED PRAIRIE DOG COLONY ACREAGE IN MONTANA,** Ryan Rauscher (Montana Fish, Wildlife & Parks), Scott Story (Montana Fish, Wildlife & Parks), Justin Gude (Motnana Fish, Wildlife & Parks)

Ballroom B: Fisheries – ***Salmonid Conservations***

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

8:00 AM **ARE LAKE TROUT IN FLATHEAD LAKE MORPHOLOGICALLY & GENETICALLY SEGREGATED BY DEPTH?** Craig Stafford, Lisa Eby, and Fred Allendorf (University of Montana) and Megan McPhee (Flathead Lake Biological Station)

8:20 AM **ADJUSTING LAKE TROUT AGES VERSUS OTOLITH MASS RELATIONSHIPS FOR VARIABLE GROWTH**, Craig Stafford (University of Montana) and Dale Hanson (US Fish and Wildlife Service)

8:40 AM **COMPETITION AS A FACTOR IN DISPLACEMENT OF NATIVE CUTTHROAT TROUT BY NONNATIVE RAINBOW AND HYBRID TROUT,** Laurie Battle (Montana Tech of University of Montana), Robert Van Kirk (Humboldt State University), and Bill Schrader (Idaho Department of Fish and Game)

9:00 AM **RECOVERY OF WESTSLOPE CUTTHROAT TROUT POPULATIONS FOLLOWING REMOVAL OF NONNATIVE BROOK TROUT,** Bradley B. Shepard (Montana Cooperative Fishery Unit and Montana Fish, Wildlife and Parks), Mark L. Taper (Montana State University), and Alexander V. Zale (Montana Cooperative Fishery Unit).

9:20 AM **LIFETIME MOVEMENT PATTERNS OF CUTTHROAT TROUT IN A STREAM NETWORK,** Michael K. Young (US Forest Service)

9:40 AM **THE EAST FORK SPECIMEN CREEK WESTSLOPE CUTTHROAT TROUT RESTORATION PROJECT: THE GOOD, THE BAD, AND THE SMOKY,** Michael E. Ruhl*, Todd M. Koel, Jeffery L. Arnold, and Brian D. Ertel (Yellowstone National Park)

10:00 AM **BREAK**

Ballroom B: ***Fisheries – Salmonid Conservation***

Moderator: Beth Gardner (US Forest Service)

10:20 AM **ESTIMATING LAKE SURVIVAL OF JUVENILE BULL TROUT IN TRESTLE CREEK, IDAHO IN THE PRESENCE OF CHANGING FISH COMMUNITIES, LAND USE, AND FISH MANAGEMENT,** Christopher C. Downs (Glacier National Park), Rob Jakubowski (Avista Corp.), and Rob Ryan (Idaho Department of Fish and Game)

10:40 AM **HYBRIDIZATION RAPIDLY REDUCES FITNESS OF NATIVE CUTTHROAT TROUT IN THE WILD,** Clint C. Muhlfeld, (U.S. Geological Survey), Steven T. Kalinowski, Thomas E. McMahon, and Mark L. Taper (Montana State University), Sally Painter, Fred W. Allendorf (University of Montana), and Robb Leary (Montana Fish, Wildlife, and Parks)

11:00 AM **REDUCED GENETIC VARIATION IN UPPER MISSOURI RIVER DRAINAGE WESTSLOPE CUTTHROAT TROUT POPULATIONS APPEARS TO BE DUE TO HISTORICAL AND CONTEMPORARY FACTORS,** Robb F. Leary (Montana Fish, Wildlife & Parks), Sally Painter, Steve Amish, Angela Lodmell, and Fred W. Allendorf (University of Montana), John H. Powell (Stanford University)

11:20 AM **GENETIC VARIATION, ANCESTRY AND POPULATION STRUCTURE IN NATIVE ARCTIC GRAYLING IN THE UPPER MISSOURI RIVER,** Douglas P. Peterson and William R. Arden (US Fish and Wildlife Service)

INVITED ABSTRACTS AND BIOGRAPHIES

MONTANA'S WILDLIFE LEGACY - DECIMATION TO RESTORATION

Harold Picton, Emeritus Professor of Wildlife Management, Department of Ecology, Montana State University, Bozeman, MT 59717

Terry Lonner, Retired Chief of Wildlife Research, Montana Fish, Wildlife and Parks, Multimedia Producer, Media Works, Bozeman, Montana 59715

The main intent of this overall project was to pay tribute to the generations of Montanans who made our current wildlife resources possible and for public education, especially in junior high and high schools and hunter safety classes.

The use of the wildlife resource for the settlement of Montana produced a catastrophe by the end of the 19th century. But by the end of the 20th century wildlife was more abundant than at any time during the previous 130 years. The passage of protective laws during the late years of the 19th century coupled with gradually increasing efforts to enforce those laws accounts for a portion of this resource rebirth. The remainder of the story is largely untold and is the subject of this book.

Game bird resources were heavily affected by the "cow and the plow". New agricultural lands provided new habitats unsuited for native species. Pheasant introductions began before 1895 by private individuals and became a state game farm program in 1929. Over 3/4 million pheasants were planted by the time the state program was discontinued in the early1980s. At the beginning of the 20h century elk were considered to occur only in the Sun River-South Fork of the Flathead and Yellowstone National Park areas. Rod and Gun clubs held fund raising events and paid $5 per elk to have the Northern Pacific Railroad deliver rail car loads of 40 elk to areas near their towns from the Gardiner, Montana area just north of Yellowstone National Park. The transplants began in 1910 with releases near Butte, Hamilton and in the Glacier Park area. Elk continued to be transplanted until 1997 when the last of 11,364 were released. Similar programs for other species were developed after the Pitman-Robertson act was accepted by the Montana Legislature in 1939 with the Wildlife Restoration Division of the Montana State Fish and Game Department established in 1940. For example, almost 4,000 pronghorn antelope were trapped and transplanted, 1,000 more than existed in the entire state in the 1920s. Significant, but regulated hunter harvests of the biological surplus and habitat preservation programs became prominent in the last third of the century.

This resurrection of Montana's wildlife resource was an epic effort extending through 6 generations, 5 wars, an economic collapse, and the greatest North American climate disaster of the 20th century. Citizen leadership arose in generation after generation and melded with the leadership and science furnished by the state, federal agencies and universities to bring about a successful effort. The wildlife resources that we enjoy today are a gift of the people from the 20th century to the people of the 21st century. They come with a message to care for and cherish them, to value and maintain them. Resources that are not valued tend to end up on the trash heaps of human history. For more information go to: www.montanaswildlifelegacy.com

CHRIS HUNTER'S INTERPRETATION OF HUGH ZACKHEIM'S HISTORY OF MONTANA FISH, WILDLIFE AND PARKS FISHERIES DIVISION 1901-2005

Chris Hunter, Montana Fish, Wildlife and Parks, P.O. Box 200701, Helena, MT 59601
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The Fisheries Division was created in 1901. The first resident licenses were created at the same time, with more than 30,000 of the $1 licenses purchased in the first year. For the first 50 years the emphasis of the division was on stocking fish. The first fisheries biologist was hired in 1947. The results of scientific investigations by these biologists led to changes in fish management including changes in stocking policy and increased emphasis on the effect of environmental damage to Montana's fishery resources. A spate of new environmental laws in the 1960s and 70s made significant progress toward protecting Montana's aquatic environments. In 1974 the Fish and Game Commission adopted the wild trout policy. The 1980s and 90s saw increasing emphasis on native fish, T and E species issues and continuing efforts to secure water for instream flows. There was also an increased emphasis on habitat restoration with the Future Fisheries Program, hydro relicensing and Natural Resources Damages suits. These areas of emphasis have continued into the new millennium. State and national trends for hunting and fishing are clearly on the decline. There is increasing concern about the lack of time our children spend involved in nature related activities. What are the implications for the future of our agencies and the resources we manage?

Biography: Chris Hunter receive his BA in Biological Sciences in 1972 from University of California, Santa Barbara, and an MS Zoology in 1974 from The University of Montana, Missoula (he says 'Go Griz'). Chris spent a year in the Peace Corps in Iran after getting his graduate degree. He came back to Montana and in 1975 got his first real job working for Flathead and Lake counties on an EPA funded water quality project. After four years he moved to Helena and worked for DNRC for two years getting a good education in water rights and their administration. He left DNRC to join a small Helena consulting firm as Staff Limnologist/General Manager. During eight years with OEA Research he participated in a lot of great field work in Montana, Idaho and the Dakotas. In 1989 Chris was hired by Montana Fish, Wildlife and Parks Fisheries Division in Helena where he has worked for almost 20 years-the last 7 plus as Chief of Fisheries.

During his career he has received the Fishery Worker of the Year award from MCAFS; served as president of MCAFS; authored Better Trout Habitat-A Guide to Stream Restoration and Management; and owned and operated a soccer store. Chris has two grown and married kids living in Helena, one granddaughter (Marley) and another on the way. He has never taken a fisheries management course of any kind.

THE MONTANA CHALLENGE

SuzAnne M. Miller, Dunrovin Research, P.O. Box 822, 5375 Terry Lane, Lolo, MT 59847-0822

The Montana Challenge begins with a question posed by the U.S. Forest Service and Montana Fish, Wildlife & Parks. How can management of Montana's fish and wildlife resources best contribute to Montana's social and economic well being? By employing prominent socioeconomic researchers from across the Rocky Mountain region, and digging for authoritative public-sector data, *The Montana Challenge* establishes an unexpectedly vital role of clean air, clean water, fish, wildlife, and wild lands in Montana's culture and economy. The Rocky Mountains are the fastest growing section of the U.S. in population, personal income, and total employment; while the Great Plains are in population and economic decline. Montana's counties reflect this trend with rapid growth along the mountains in the west, slower growth along the Rocky Mountain front, and rapid decline in the eastern plains. "Quality of life" is driving the Rocky Mountain West's population and economic growth and natural resource amenities are key to quality of life and economic prosperity. Montana and other Rocky Mountain states are in the midst of a transition from an economy based on natural resource commodities to a human resource based economy where jobs follow the people. Montana's prosperity depends on attracting people who create economic opportunities. Healthy ecosystems, healthy fish and wildlife populations, and broad public access create Montana's unique and desirable lifestyles. Montana's wild resources draw people and economic activity. Diversity is a source of strength for both ecosystems and economies. Human resource sectors are the most rapidly growing sectors of Montana's economy, especially in the western region. Montana's traditional natural resource based economic activities remain important to Montana, especially in the eastern region. Montana's challenge is to both utilize and protect its natural resources.

FISH AND WILDLIFE VALUES IN THE WEST

Michael J. Manfredo and *Tara L. Teel, Human Dimensions of Natural Resources Department, Colorado State University, Fort Collins, CO

Western states are going through a number of changes that have affected and will continue to affect wildlife management. Changes include population growth, changes in in-migration rates and land ownership patterns, increasing income and education levels, growth in technology, and urbanization. The recent study, *Wildlife Values in the West*, explores how some of these broad societal forces are shaping the composition of public values toward wildlife throughout the western region. *Wildlife Values in the West* is a project of the Western Association of Fish and Wildlife Agencies Human Dimensions Committee. It is a collaborative regional effort involving social science researchers from Colorado State University and representatives from 19 participating state fish and wildlife agencies who assisted in development of a mail survey. Data were collected through administration of the survey to a sample of residents in each state in the fall of 2004 (n = 12,673). Results and related implications from this 19-state effort will be discussed, including the impacts value shift may have on public acceptance of wildlife management strategies and on demand for participation in wildlife-related recreation activities in Montana. We will also discuss how study results provide a broad context to assist state fish and wildlife agencies better understand diverse publics and plan for the future of wildlife management in the west.

GREATER YELLOWSTONE AREA ELK MOVEMENTS: BRUCELLOSIS RISK AND HUNTER ACCESS

Kenneth L. Hamlin and *Julie A. Cunningham, Montana Fish, Wildlife and Parks, 1400 S. 19th Ave., Bozeman, Montana 59718

Thomas O. Lemke, Montana Fish, Wildlife and Parks, 406 Chestnut Lane N. Livingston, Montana 59047

We examined elk movement data from across the Greater Yellowstone Area (GYA) from 1976-2006, comparing and contrasting movement patterns within and between herds. Our objectives were to understand how public hunter access related to elk movements and brucellosis risk in different areas of the GYA. We focused on the Madison Valley, Gallatin Valley and east side Paradise Valley. In the Madison Valley, we compared elk movement dynamics between 27 cow elk monitored 1976-1986 (VHF collars) and 43 cow elk monitored 2005-2006 (GPS collars). Over this time period, land ownership changes resulted in reduced hunter access to private lands for cow elk hunting. We found that, compared to the 1976-1986 movements, 2005-2006 elk migrated earlier to wintering ranges, left later to summer ranges, and used private land areas more extensively. During 2005-2006, cow elk were less available to hunters due to use of private land refuges during the hunting season. In the Northern Yellowstone, we compared elk movements from 1984-1987 (VHF collars) with preliminary data from 2007-2008 (GPS collars). Preliminary analysis suggests that elk migrated to and from winter range generally with expectation given weather conditions. Some individuals were more available to public hunters than others (range = 0% to 100%) based on behavioral and movement patterns. Flight and GPS data from 2007-2008 elk indicate Northern Yellowstone elk spend summertime further south and west in Yellowstone National Park than had previously been thought, and that Northern Yellowstone elk may be coming into contact with Jackson Hole, WY elk on these ranges.

A FISHERY MANAGER'S CHALLENGE

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Fisheries management is increasingly defined by changes in human populations, loss of access to public waters, native fish management and the struggle to maintain aquatic habitat in the face of both climate change and physical alterations. Angling pressure has not kept pace with population growth and combined with the decline of rod and gun clubs and the increase in special interest groups threatens both funding and social and political support for aquatic resource management. Changes in land ownership funnels increasing numbers through fewer access sites with resulting conflicts. Changing land ownership also leads to increasing applications and violations for fish ponds and streambank alterations and old financial constraints do not always apply. Many anglers do not have a good grasp of biological principles which leads to illegal fish introductions and challenges to management programs.

Today's biologists are better trained than ever but recruitment and retention is an increasing problem for Fish, Wildlife and Parks. Many management tools have not changed but new technologies offers greater understanding if we use them intelligently. Native fish management increasingly drives management through statutes, policies and funding priorities. Suppression of unwanted species is the latest strategy but not always applied well. The angling public has not been educated well on the need

for native fish management and often challenges programs. Climate change and a growing demand for energy development could trump many of today's programs.

Bio : Jim Vashro
Attended undergrad at Carroll College and University of Montana where I graduated from the Wildlife Honors Program under the Aquatic Option in 1972. Attended Cornell University and worked on yellow perch and walleye with a M.S. degree in 1974.
Started working for FWP in 1974 finishing out a creel survey on Georgetown Lake. I then transferred to the Jocko River State Fish Hatchery to work on Arlee rainbow and westslope cutthroat broods for 18 months. I then transferred back to the headwaters of the Clark Fork as a fisheries management biologist for 6 years. In 1982 I transferred to northwest Montana as regional fisheries manager where I'm still having fun, although a little less so some days. Sort of a rags to rags story.

HUNTER ACCESS – A MOVING TARGET FOR MANAGERS

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Traditionally, fish and game agency program managers deal with science as biologists or laws as game wardens. Agencies typically adopt the regulations, issue the licenses, and hunters set forth on their own to find a place to hunt. However, in recent years, Montana Fish, Wildlife, & Parks has found it necessary to develop access programs and become more involved in helping ensure that the hunters who buy the licenses have a place to hunt. This has become necessary not only to maintain Montana's hunting heritage and traditions, but also to ensure that public hunting remains an effective tool to help manage the state's populations of deer, elk, and antelope. Changes in who owns the land, how the land is managed, what hunters expect, and what hunters are willing to do all pose challenges for wildlife agency program managers as the world changes around them.

PROTECTING PUBLIC RESOURCES ON PRIVATE LAND: ADAPTING BUSINESS STRATEGIES TO CHANGING DEMOGRAPHICS AND DEMANDS

David Greer, Plum Creek Timber Company, Inc. Columbia Falls, Montana 59912

Plum Creek is the largest private forest landowner in the United States with 7.4 million acres in 19 states and1.1 million acres in Montana. While Plum Creek's core business is timber management, real estate transactions have always been a part of the business, including conservation transactions and land sales to private entities. Conservation strategies, beyond easements and sales, are integrated into routine management efforts including adherence to the standards of the Sustainable Forestry Initiative ®, habitat conservation plans, cooperative agreements, and land exchanges. Since 1989, conservation transactions to public agencies, conservation organizations, and timber companies have accounted for 81% of all Plum Creek land sales in Montana. Additionally, conservation easements sold to public agencies in Montana have amounted to more than 149,000 acres and include one of the largest easements completed in the U.S. Private parties seeking Montana property increasingly want to be viewed as "green" and consequently are more receptive to deed restrictions and protection practices that address public resources, such as grizzly bears and native fish habitat. The "recipe" for success in conservation land transactions includes: availability of large, strategically important tracts; willingness by Plum Creek to work with innovative partnerships; patience; and adherence to a "win-win" strategy for the company and the public. The potential for future conservation transactions in Montana will hinge on finding creative financing solutions and incorporating active forest management provisions to support local timber-based economies. The Montana Working Forest Project, seeking to transfer

320,000 acres of Plum Creek property to federal, state, and other private ownership is an example of this type of conservation transaction.

PERSPECTIVE OF A NON-TRADITIONAL LANDOWNER/MANAGER

Russ Miller, Turner Enterprises, Inc. Bozeman, MT 59718

TEI's philosophy is to manage their lands in an economically sustainable and ecologically sensitive manner, while promoting the conservation of native species.

Biography: Russ Miller graduated from MSU in 1973, and spent the next 11 years on a family farm/ranch outside of Billings. He was an agricultural loan officer for two years, and in 1986 developed a ranch management consulting division for Hall and Hall, Inc., a regional real estate firm. Russ began working with Ted Turner in 1989 with the purchase of the Flying D Ranch outside of Bozeman, Montana. Russ became General Manager of Turner Enterprises, Inc., in 1992, with responsibility for building and operating the ranch portfolio – presently 15 ranches encompassing 1.9 million acres in seven western states. The ranches have diverse operations in bison, wildlife, recreation, sustainable forestry, oil and gas, and endangered fauna and flora, and are managed with the guiding principles of economic sustainability, ecological sensitivity, and the conservation of native species.

MONTANA'S LANDOWNERS: MANAGEMENT IMPLICATIONS OF MONTANA'S CHANGING DEMOGRAPHICS FOR WATER RIGHTS

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Water rights, long recognized as a property right in Montana, are among the least understood of all property rights. It's not like a chunk of land—it's a "use right." A viable water right doesn't exist simply as a statement on a certificate. If it is not put to a beneficial use, it can be lost. For over 100 years, it was widely believed that water had to be diverted to establish a water right. Water left in stream was a waste. Over the past four decades, Montana's changing demographic—a gradual shift to a less rural population--first enabled the passage of instream flow legislation in the 1960s and 1970s and then again in the 1980s and 1990s when the legislature authorized leasing. So the first management implication is that we now have some tools. The changing demographic doesn't always understand the limitations of those tools, but we have tools nonetheless.
The other changing demographic is the influx of a new species onto traditional ranch lands—the amenity buyer. Always well-heeled, often well-intentioned, they can occasionally cause more problems than they can solve. On the other hand, the newcomers bring with them a different perspective that can enhance watershed restoration in ways not previously possible. The greatest challenge, will be educating both the traditional landowner and newcomer alike in the limitations of their water rights, while showing them the possibilities of creative change to those rights.

Biography: Stan Bradshaw works for Trout Unlimited's Montana Water Project as a water lawyer. His job includes working with irrigators and other water users to improve stream flows on trout streams. This work has included working on voluntary cooperative drought response efforts and negotiating instream leases with willing irrigators and pursuing DNRC approval of those leases. He has worked extensively in the Blackfoot River drainage with the Big Blackfoot Chapter of Trout Unlimited. Stan first became involved in water rights work as chief counsel for the Montana Department of Fish,

Wildlife, and Park in the early 1980s, representing the department in the statewide water rights adjudication. After leaving the department in 1986, he worked on behalf of Trout Unlimited on drought and streamflow issues both in watershed efforts and at the legislature. In 1990, governor Stan Stephens appointed him to the State Water Plan Advisory Council, where he chaired a subcommittee on drought planning. The committee developed a proposal that was enacted as drought planning legislation in 1991. Stan also was instrumental in the passage of Montana's first instream flow water rights leasing bill in 1989. In addition to his conservation work, Stan was a principal in Greycliff Publishing with his wife Glenda and the late Gary LaFontaine. When he's not talking water with ranchers or anyone else who will listen, he spends as much time as he can on water, in one form or other--he's an accomplished whitewater canoeist, enthusiastic fly fisherman, and avid skier. Squeezed in among everything else, he managed some guiding on the Missouri, Blackfoot, and the Smith Rivers.

CHANGING HUMAN DEMOGRAPHICS INFLUENCE FOREST SERVICE MANAGEMENT IN MONTANA

Jane Cotrell, US Forest Service, Deputy Regional Forester, Northern Region, 200 E. Broadway, P.O. Box 7669, Missoula, MT 59807-7669

Human demographic changes in Montana have been occurring for some time, bringing both challenges and opportunities for Forest Service Managers. Movement of people into urban/forest interfaces have created social, political and legal interest and action regarding the management of forests with respect to both fire and wildlife habitat. Human demographic changes have brought increasingly diverse perspectives to bear on issues surrounding management of the National Forests, making analysis and decision on issues such as travel management very complex. Emerging issues involving open space, aquatic health, invasive species and instream flow needs have also shaped management on the National Forests in Montana. We have also seen recent successes where diverse public interests have come together to resolve issues.

Biography: Jane Cottrell has over 27 years with the Forest Service, managing a variety of resources and public lands issues. She has earned two Bachelor of Science degrees in Forest Management and in Outdoor Recreation Management from Washington State University.
Jane began her career as a pre-sale forester and after 10 years in timber management she moved to recreation management. Her experience in managing a variety of natural resources spans her entire career. Bouncing through 3 regions and 10 national forests in her career, Jane has a wealth of experience that includes management positions as a District Ranger, Deputy Forest Supervisor, and Forest Supervisor. Jane's current position as the Northern Region Deputy Regional Forester gives her the opportunity to share her expertise of resource issues on a broader scale. Natural Resource management is a family affair. Dave Henifin, her spouse of 21 years, also works in timber and fuels management for the Bureau of Land Management. Both daughters are still in school. Miranda attends Hellgate High School, in Missoula, MT and Amanda attends Lewis Clark College in Lewiston, Idaho.

STREAM ACCESS: PAST, PRESENT AND FUTURE

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The public's right to recreate in streams, rivers, and lakes will be discussed starting with its past roots in public trust concepts, covering how the present statutes and case law define the public use of streams and rivers, and concluding with an examination of how ongoing and future controversies will

or may continue to shape rights of the public to recreate in streams, rivers, and lakes. The presenter will cover: how Montana's Stream Access Law and rules and the Natural Streambed and Land Preservation Act (SB 310 Law) protect and help direct management of streams and rivers; how these laws and rules are balanced with private property rights; and what the public trust means for fisheries managers.

THE FUTURE AIN'T WHAT IT USED TO BE!

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Montana's demographic landscape is comprised of three states within a state: The rapidly growing West, the modestly growing Central and the shrinking East. Close examination of each reveals important value shifts affecting fish, wildlife, recreation and habitat protection. Among these shifts are reduced opportunities for access to private lands for hunting and fishing, producing either a corresponding increase in pressure on public lands or fewer people choosing to hunt and fish. In response, managers will have to re-evaluate geographic and demographic priorities. The state's new demographic profile, which includes counties with high population growth rates that also have high rates of population turnover, means that traditional perspectives about wildlife and fish are in flux and influenced to an inordinate degree by values honed outside Montana or in an increasingly media-influenced world. Change elsewhere in the country, including that precipitated by a shifting climate, new resource demands, immigration, wealth transfer and the desire to live where the quality of life is high, could overwhelm the traditional bottlenecks that have moderated population growth in Montana, including winter weather, limited employment opportunities, and shortcomings in communication and transportation infrastructure. Demographic trends in Montana will necessitate new types of fish and wildlife managers, with different skill sets, tools and priorities that focus more on effective communication with greater attention to ecosystem protection, non-consumptive wildlife and fish values and equitable access to public resources – possibly resulting in less attention to traditional management that focuses on hunters and anglers as primary beneficiaries.

Biography: Bruce Farling has been executive director of Montana Trout Unlimited for 15 years. He formerly was conservation director of the Clark Fork Coalition for five years, a regional water quality advocacy organization in Missoula, Montana. Before that he worked for the U.S. Forest Service in Montana and Idaho for 10 years. He has a B.S. in environmental sciences and geomorphology from the University of Oregon and completed work on an M.A. at the University of Montana School of Journalism, where he was an environmental writing fellow. Trout Unlimited is the nation's leading trout and salmon conservation organization. Its mission is to conserve, protect and restore coldwater fisheries and their watersheds. Trout Unlimited has 150,000 members and 400 chapters nationwide. Montana TU is comprised of 3,300 TU members and 13 TU chapters or affiliates.

GENERAL ABSTRACTS – Alphabetical Order by First Author's Last Name (* denotes presenter)

RURAL STAKEHOLDERS AND ARCTIC GRAYLING (THYMALLUS ARCTICUS) MANAGEMENT IN THE BIG HOLE RIVER WATERSHED, MONTANA, USA

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In order to counteract Arctic grayling population declines in the Big Hole River, rural stakeholders have partnered with natural resource managers on Candidate Conservation Agreements with Assurances (CCAA) activities. Surveys designed to assess attitudes towards grayling management practices were sent to 300 watershed residents in February 2008. We received 83 responses, mostly from men 50 years or older who identified their occupation as farming, ranching, government or retired. Respondents indicated grayling numbers had declined (31%) or stayed about the same (25%) in the last 10 years, and that it would be favorable for grayling numbers to increase (60%). Respondents chose drought, habitat loss and birds as factors strongly associated with declining grayling numbers. Activities listed as strongly associated with increasing grayling numbers varied, but often included drought management. Demographic trends among area residents match those typical of rural western communities; 62% are 45 years or older, 17% live below the poverty line, and 76% lack a college degree. The benefit of CCAA activities to the local "restoration" economy included an influx of nearly $2 million dollars since 2006. CCAA activities could be linked to future federal infrastructure, education and workforce training programs, with substantial benefits to the local populace.

DIVERSION DAMS AND FISH PASSAGE – DON'T GIVE UP THE FIGHT!

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The Tongue River, in southeastern Montana, is a major tributary to the Yellowstone River. Numerous Yellowstone River fish species utilize the Tongue River for spawning. However, diversion dams have limited fish migrations up this system. Through persistent efforts, measured in careers not years, fish passage around these diversion dams and complete removal of other dams is occurring. T&Y Diversion dam, constructed in the 1880's, is the first dam migrating fish encounter and it is a complete fish barrier. In the fall of 2007, a fish bypass (named Muggli Bypass) was completed to allow fish passage around T&Y Diversion Dam. Fish sampling was conducted in 2008 to evaluate the success of this structure. A fyke net was utilized to sample fish that successfully navigated the complete length of the bypass channel. Electrofishing was conducted upstream and downstream of the diversion dam to compare relative abundances of fish in the river to those collected in the bypass. Nineteen fish species were successful in passing through the bypass during the sampling period and four additional species were collected in the bypass channel when it was block netted and drained. Comparatively, 29 fish species were collected downstream of the diversion dam. Electrofishing upstream of T&Y Dam found four species (freshwater drum, goldeye, smallmouth buffalo and western silvery minnow) which have never been documented upstream of the dam. In summary, the Muggli Bypass is a noteworthy success story.

COMPETITION AS A FACTOR IN DISPLACEMENT OF NATIVE CUTTHROAT TROUT BY NONNATIVE RAINBOW AND HYBRID TROUT

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Native salmonid fishes have been displaced worldwide by nonnatives through competition and hybridization, but the dynamics of these factors are poorly understood. We apply a Lotka-Volterra population model to displacement of cutthroat trout by rainbow/hybrid trout in the Snake River, USA. Cutthroat trout are susceptible to hybridization in the river but are reproductively isolated in tributaries via removal of migratory rainbow/hybrid spawners at weirs. Hybridization is the primary mechanism for initial growth of the rainbow/hybrid trout population, but a model with hybridization alone does not explain observed trends. Two models, in which competition occurs 1) among river-spawned fish only and 2) among all fish, explain observed trends, but are indistinguishable from one another based on fit to data. When tributary-spawned cutthroat trout out-migrate as fry, competition with rainbow/hybrid trout results in extinction of cutthroat trout, even though reproductive segregation is maintained.

VIABILITY OF USER-PAID SYSTEM OF WILDLIFE CONSERVATION IN MONTANA

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Julie A. Cunningham, Montana Fish, Wildlife, & Parks, Bozeman, MT 59718

Montana Fish, Wildlife & Parks is entrusted with the responsibility to conserve all species of fish and wildlife to meet a variety of public interests and values. To date, users of these resources, namely hunters and anglers, have provided the financial and political support for the state to achieve this mandate. With this presentation, we make the business case for why user participation is critical to the future of fish and wildlife stewardship in the state, and compare current participation trends in Montana to those of other states in anticipation of what we might experience in the future. This will be followed by a brief discussion of the primary factors leading to changes in participation, and how they relate to the user-paid model of wildlife conservation using a conceptual framework. We will then present and discuss a variety of strategic initiatives Montana could explore to address the implications of a changing user demographic. We will conclude by providing an overview of ongoing efforts by FWP to date including the role of marketing and branding of our services and products. We're hopeful that these two presentations will be supportive of TWS-Montana Chapter's efforts to explore ways in which we can promote sound stewardship of wildlife and their habitats in Montana in a manner that is economically and socially sustainable.

WOLF PREY PREFERENCES IN MULTIPLE PREY SYSTEMS: INSIGHTS FROM THE MADISON HEADWATERS OF YELLOWSTONE NATIONAL PARK

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Patrick J. White, Yellowstone Center for Resources, Yellowstone National Park, Wyoming 82190

Claire N. Gower, Ecology Department, Montana State University, Bozeman, Montana 59717

We studied wolf prey selection and kill rates during 1996-97 through 2006-07 winters in a newly established one predator two-prey system in central Yellowstone National Park. Prey differed substantially in their vulnerability to wolf (*Canis lupus*) predation and wolves preyed primarily on elk (*Cervus elaphus*) but also used bison (*Bison bison*) to varying degrees within and among winters. Winter severity, wolf abundance, distribution, and prey selection varied during the study, concurrent with variations in the demography, distribution, and behavior of elk and bison. Patterns of prey selection trends were strongly correlated to elk calf abundance. While wolves increasingly killed bison with increasing bison:elk ratios, snow pack duration, and wolf numbers, they did not appear to change their preference for elk. Similarly, variation in elk kill rates were not related to or reduced by increases in bison kill rates. The wolf functional response for elk was a Type II, indicative of a preferred prey, and strongly influenced by wolf abundance, as it was positively correlated with increased competition and anti-predator responses of elk. Prey-switching evaluations indicated increasing selection of bison with increasing bison:elk ratios, however no concurrent decrease in elk predation occurred. Increased bison predation is not solely dependent on relative abundance of the two prey species; therefore it is unlikely at this time that wolf prey-switching will stabilize the system. The pervasive influence of differential vulnerability among prey species and age classes and its effects on the potential trajectories of wolf-ungulate systems in Montana is discussed.

PERSPECTIVES ON NOT LISTING THE FLUVIAL ARCTIC GRAYLING

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I summarize the views held by the Big Hole River Foundation and provide insights into potential positive and negative outcomes of listing the fluvial Arctic grayling under the Endangered Species Act. The perception that listing would lead to recovery of the grayling was evaluated based on past recovery of listed species. Currently, 1,925 species are on the Endangered Species List as either Threatened or Endangered. The number of species listed increased during the 1990s, but has decreased in recent years. To date, 48 species have been removed from the list; 22 have been 'recovered', 17 have been reclassified due to data errors, and nine have gone extinct. For species that exist in the contiguous US, 15 have been recovered, seven have gone extinct, and 15 have been removed due to data errors. The rate of recovery is estimated at 1.1% for North American species, and no fish species have been recovered to date. A common perception that a listing would increase funding was evaluated and showed that relatively little funds are available for species recovery under Section 6 of the ESA, when compared to other federal funding sources. Although the Foundation thinks evidence suggests a listing is warranted, they are supporting the CCAA is an appropriate means of addressing species recovery in the Big Hole.

TOXICITY OF ROTENONE TO LARVAL AMPHIBIANS

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Piscicide use in fisheries management is becoming increasingly common. Rotenone, specifically, is being used to remove non-native fish species from aquatic systems. While the effects of this chemical on fish are well-studied, the impacts of rotenone on non-target species, such as amphibians, are not well known. This study was conducted to determine the toxicity of rotenone on two native species of tadpoles in Montana – *Rana luteiventris* and *Bufo boreas* – under laboratory conditions. For each species, tadpoles at three developmental stages were exposed to either a control or CFT Legumine (5% active rotenone) at one of four doses (0.1 mg/L, 0.5 mg/L, 1 mg/L, 2 mg/L). Total exposure time was 96 hours. Parameters measured included mortality at 96 hours post treatment, and, in the survivors, weight, Snout-Urostyle Length, and time to metamorphosis. In addition to the rotenone exposure trials, a recovery trial was conducted with early stage spotted frog tadpoles to determine survivability of tadpoles exposed to rotenone at 1 mg/L and then placed in clean water. Spotted frog tadpoles exposed to rotenone at 1mg/L – typical field application dose – experienced significantly greater mortality than control tadpoles. Although all stages of frog tadpoles exposed to rotenone were negatively affected by the chemical the effect was worse at earlier life stages. Early stage toad tadpoles were significantly more resistant to rotenone exposure at 1 mg/L than early stage spotted frog tadpoles; however they were still negatively affected by the chemical. Sub-lethal effects, though statistically different between control and exposed survivors in 2 instances, were not consistent and therefore thought not to be biologically significant. Spotted frog tadpoles exposed to rotenone and then transferred to clean water experienced significantly lower mortality than those exposed for the full 96 hours. Overall, rotenone exposure was found to be lethal to tadpoles of both species at all three developmental stages, though mortality was not uniform across dosages or age groups.

GIS-BASED TOOLS TO IMPROVE LAND USE PLANNING FOR WILDLIFE CONSERVATION

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Conserving wildlife and habitat connectivity in the face of a growing human population is one of the greatest challenges facing wildlife managers in the 21st Century. The Northern Rocky Mountain region is experiencing some of the most rapid human population increases in the United States and rural sprawl is now recognized as one of the most serious threats facing Montana wildlife in the near future. To address this challenge, land use planners must incorporate the best available science about wildlife requirements into planning decisions and policy. We developed a suite of GIS-based tools to simplify incorporating scientific information into landscape-level land use planning for wildlife. These tools are designed to be flexible to accommodate a range of wildlife conservation objectives. The current suite includes tools for estimating appropriate development densities likely to provide adequate habitat or movement connectivity for specified wildlife targets, as well as evaluate existing landscapes, or potential development scenarios, to estimate their potential for supporting wildlife. These tools were employed in conjunction with the development of a wildlife overlay in the Madison Valley, MT.

The Madison Valley provides an example of how these tools can assist with creating criteria for development near or within important wildlife areas.

WINTER DISTRIBUTION, HABITAT USE, AND BROWSE UTILIZATION PATTERNS OF THE SHIRAS MOOSE ON THE MOUNT HAGGIN WILDLIFE MANAGEMENT AREA

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Robert A. Garrott. Fish and Wildlife Management Program, Department of Ecology, Montana State University, Bozeman, MT 59717

Moose populations across Montana have expanded in the last century, both in geographic range and in population size. This expansion has had a negative impact on moose winter range in some locations where moose have overutilized key browse species such as aspen and willow. Excessive and unsustainable browsing has the potential to reduce local biodiversity and carrying capacity of moose and other ungulates. The browse species of interest in this study are willow (*Salix* spp.), a highly palatable and abundant browse source for moose on many winter ranges, including our study area in southwestern Montana. Knowledge of spatial and temporal patterns of moose willow community use and willow utilization patterns is limited in Montana and would be helpful in moose population management. The objectives of this study are to determine patterns of willow community use by selected female moose during winter and to quantify willow utilization across the study area to examine population scale habitat use through browse patterns. To accomplish these objectives we deployed GPS collars on 12 cow moose in the winters of 2007 and 2008 and completed large scale, systematic browse surveys in the spring of 2008. Preliminary results indicate cow moose spend the majority of the winter in or adjacent to willow communities, but overall willow utilization across the study area is low. Our data suggest that while moose have the potential to significantly impact willow communities, this does not appear to be the case on the Mount Haggin WMA at current moose densities.

PUBLIC OPINION AND KNOWLEDGE OF GRIZZLY BEARS IN THE CABINET-YAAK ECOSYSTEM

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To measure the publics understanding of grizzly bears and their management in the Cabinet-Yaak Ecosystem (CYE), a telephone survey was conducted in Lincoln and Sanders County, Montana. In the summer of 2007, 502 residents of the 7 communities within the CYE answered questions about their knowledge and opinions of grizzly bears in the CYE and of related management activities. Ninety percent of respondents felt that humans can prevent most conflicts with grizzly bears and 62% stated that they would accept changes to current garbage disposal methods if it would help prevent problems with grizzly bears. Fifty-seven percent supported the recovery of the grizzly bear population in the CYE. Support decreased to 44% for achieving a population goal of 100 bears. Support increased to 75% if population recovery could be achieved without using augmentation. Thirty-three percent stated they were unaware of road access restrictions on National Forest lands, due in part to grizzly bear

recovery efforts. The majority of respondents indicated some level of support for grizzly bears, yet had concerns over specific management actions used to achieve population recovery. Respondents were more aware of augmentation efforts in the early 1990's than of more recent efforts, suggesting that managers need to keep the public better informed. Educational efforts may benefit residents' understanding of general grizzly bear biology and of related management practices.

MONTANA'S CONSERVATION STRATEGY FOR ROCKY MOUNTAIN BIGHORN SHEEP

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Montana Fish, Wildlife and Parks (FWP) is currently in the process of developing a comprehensive Conservation Strategy for Rocky Mountain bighorn sheep. The strategy includes the history of bighorn sheep in Montana from decline to recovery. Direction on how FWP monitors and manages populations, herd health, and bighorn habitat is defined. Protocols for resolving situations where bighorn sheep and domestic sheep/goats commingle, recommendations regarding use of domestic sheep/goats for noxious weed control, and a protocol for responding to die-offs have been developed. A Translocation program, including processes for identifying and evaluating potential habitats and prioritizing transplant sites are included in the strategy. Integral aspects of the strategy are narratives for each hunting district or population. These narratives include a complete history of the individual population, overall management goals, and objectives for habitat, access, and population demographics. As part of the strategy, how individual populations are managed through hunting and translocation is clearly linked to monitoring efforts.

GRIZZLY BEAR TREND MONITORING RESEARCH IN THE NCDE: AN UPDATE, 2004-2008

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In 2004, monitoring of grizzly bear population trend in the NCDE (Northern Continental Divide Ecosystem) was initiated by Montana Fish, Wildlife & Parks (MFWP), in cooperation with other state and federal agencies. Also in 2004, an interagency field effort was undertaken to enumerate population size of grizzly bears over the entire NCDE using DNA methods. From these data, researchers have recently estimated population size with confidence limits and relative bear density across the NCDE. However, Managers and the public agree that a companion program is needed that would track population trend and female vital rates over time and provide ancillary information on other indices of population health. Having estimates of both size and trend will greatly improve our collective knowledge of grizzly bear ecology and provide more measurable and precise information with which to judge the status of the grizzly population in the NCDE. The purpose of this long-term trend program is to monitor the vital population parameters of grizzly bears by assessing the survival and reproductive rates, as well as trend, by following a number of radio-collared female grizzly bears. We summarize the objectives and field design of population trend and report on our success to date.

BULL TROUT MONITORING; LOOK DEEP AND WIDE

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In most of the Bitterroot drainage fluvial westslope cutthroat trout are fairly common and fluvial bull trout are rare. Monitoring the fluvial cutthroats is not difficult because mainstem population estimates are possible. However, due to the small number of fluvial bull trout, population estimates are not obtainable and redd counts are inconclusive. Monitoring of juvenile and resident populations also presents challenges. Population estimates (intensive) of bull trout that have the potential of providing quantitative data can be difficult to collect and basinwide distribution (extensive) generally does not provide quantitative information. On the Bitterroot National Forest we have monitored bull trout and westslope cutthroat trout using mark-recapture population estimates for nearly 20 years. While this data does allow us to follow trends within the reaches of stream where populations are densest, it is not designed to identify trends in distribution. We have collected more extensive data but not in a systematic manner. We propose formalizing the collection of single pass electrofishing on short reaches throughout selected streams to augment the monitoring reaches established many years ago.

POPULATION CHARACTERISTICS OF LAKE TROUT IN SWAN LAKE, MONTANA

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The recent establishment of lake trout *Salvelinus namaycush* in Swan Lake, Montana threatens one of the most productive bull trout *Salvelinus confluentus* fisheries remaining in the USA. Management of invasive lake trout in other systems has been focused on suppression often without establishing a thorough baseline from which to evaluate the impacts of suppression efforts. Describing the population dynamics of lake trout in Swan Lake prior to suppression efforts will provide a baseline for evaluating the effects of exploitation in the future. In 2007 and 2008 extensive gill net sampling provided data to estimate size structure, density, condition, maturity, fecundity, age structure and mortality of lake trout. Size structure indices in 2007 and 2008 were low with proportional size distributions (PSD) values of 7 and 8 respectively. Lake trout density was estimated at 8,800 (7,300-10,500 95% CI) fish greater than 160 mm. Condition of lake trout in Swan Lake is among the highest recorded for populations in the northwestern USA. Relative weight (W_r) values varied from 92 for fish between 300 and 499 mm to greater than 120 for fish between 800 and 999 mm. Fifty percent of male lake trout mature at 584 mm and 50% of females at 726 mm. Fishing mortality was estimated between 36% and 52% based on the population estimate in 2008 and those fish removed. The thorough baseline established by this study provides managers with a reference point for evaluating the effects of exploitation on the lake trout population in Swan Lake, Montana.

VIABILITY OF RESIDENT DEER AND ELK HUNTER PARTICIPATION IN MONTANA

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The majority of funding for Montana FWP programs is generated or tied to sales of deer and elk hunting licenses. Future declines in deer or elk hunter participation could therefore have negative consequences for wildlife management and conservation programs. To investigate deer and elk hunter participation rates in Montana, we made use of the FWP Automated Licensing System (ALS) database. Since 2002, the number of individuals buying deer and elk licenses has been roughly stable. We converted the data in ALS to a 6 (years) by 255,851 (unique individuals) matrix of resident hunter encounter histories for the period 2002-2007. Using a multi-state mark recapture model, we estimated hunter retention rates, hunter license buying probabilities, and transition probabilities between major age classes, considering hunter sex and region of residence as group covariates. We then used FWP hunter education databases to estimate hunter recruitment rates. Using these estimated rates, we parameterized and analyzed a stage-based population projection matrix. Estimated recruitment rates for teenagers following hunter education courses were sufficient to stabilize the trend in deer and elk hunter participation, given our estimates of retention and license buying rates, in agreement with the overall trend in license sales for 2002-2007. Based on sensitivity and elasticity analyses of the projection matrix, future hunter participation rates and license sales would be most influenced by increases in recruitment rates and license buying probabilities for middle-aged adult and teenage males. We discuss the implications of these results for FWP hunter recruitment and retention efforts and social trends.

NUTRIENT ALLOCATION IN EGG FORMATION OF FEMALE LESSER SCAUP (*AYTHYA AFFINIS*) ON LOWER RED ROCK LAKE, RED ROCK LAKES NATIONAL WILDILFE REFUGE

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North American lesser scaup (*A. affinis*) populations have been declining for nearly three decades. Recent evidence suggests that decreases in the quantity and quality of wintering and spring staging habitat may be reducing the ability of scaup to obtain the dietary resources necessary to undertake breeding activities. We used stable isotope techniques to explore the relative contributions of endogenous (body) and exogenous (local) reserves in clutch formation and how nutrient contributions changed throughout the clutch formation period. Female scaup body tissue samples (blood, claw, and lipid) were collected from mid-May (shortly after their arrival on the study site) through the nesting period during 2007-08; eggs were collected from nests during 2006-08. Tissue isotopic signatures from mid-May were significantly enriched in stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope values compared to local dietary sources. Eventually tissue signatures equilibrated with local dietary resources by the end of the egg laying period in early July. Egg albumen, and to a lesser extent lipid-free yolk protein, were primarily derived from local sources. However, approximately half of yolk lipid was derived from endogenous body reserves. There was no significant relationship between

isotopic signatures of eggs and the laying date. Our results indicate that while local resources are very important for meeting the nutrient demands of clutch formation, a majority of lipids and some protein are obtained from the spring staging areas.

CUTTHROAT TROUT STRUGGLE FOR PERSISTENCE IN THE FACE OF AN EXPANDING LAKE TROUT POPULATION IN YELLOWSTONE LAKE

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Lake trout *Salvelinuus namaycush* were discovered in Yellowstone Lake in 1994. The ecological threat of this non-native fish was immediately recognized and efforts to control lake trout were initiated the following year. The objective of the removal program is to reduce lake trout to the point where their effect on native Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri i*s minimized. Lake trout capture techniques have focused on mechanical methods, mostly gill netting, and more recently electrofishing. Despite removal of almost 350,000 lake trout since 1995, with 76,140 removed in 2008 alone, all indicators point toward continued population growth. Catch per effort of juvenile lake trout has steadily increased since 2002 with 2008 being the highest on record (5.0 lake trout per 100 m gill net set per night) since 1998. However, cutthroat trout have not shown a positive response to lake trout removal efforts. Numbers of spawning cutthroat trout in Clear Creek, a tributary to Yellowstone Lake, are at the lowest levels ever recorded and the lakewide cutthroat trout assessment catches are averaging 40% fewer cutthroat trout over the past 5 years when compared to pre-lake trout years. In 2008 a panel of experts convened to assess the current status of cutthroat trout and review lake trout removal efforts in Yellowstone Lake. The panel concluded that while current levels of suppression have slowed lake trout population growth, more is required if a healthy cutthroat trout population is expected to persist in Yellowstone Lake. They concluded it was imperative that we immediately increase suppression efforts, and develop/implement lake trout monitoring.

BLOOD-LEAD LEVELS OF FALL MIGRANT GOLDEN EAGLES IN WEST-CENTRAL MONTANA

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Lead has long been documented as a serious environmental hazard to eagles and other predatory, opportunistic and scavenging avian species. Due to lead poisoning in the Bald Eagle (*Haliaeetus leucocephalus*) the use of lead shot for waterfowl hunting on federal and state lands was banned in 1991. More recently, lead poisoning from spent ammunition has been identified as the leading cause of death in California Condors (*Gymnogyps californianus*), prompting the recent ban of lead ammunition within the "California Condor Recovery Zone." Another study on Common Ravens (*Corvus corax*) in Wyoming has shown a direct correlation between elevated blood-lead levels and the on-set of rifle hunting season. Indeed, there is overwhelming evidence showing that lead is still prevalent in the environment and mounting data points to lead based rifle bullets as the primary source. We sampled blood from 42 Golden Eagles (*Aquila chrysaetos*) captured on migration during the fall of 2006 and 2007 to quantify a suite of possible heavy metal contaminants, with an emphasis on lead. Lead was measured in micrograms per deciliter (ug/dl) and ranged from 0 - 481 ug/dl. The blood-lead

levels were broken in four exposure stages and our results were as follows: eagles with 0 - 10 ug/dl (N = 18) were considered background, 10 – 60 ug/dl (N= 19) sub-clinically exposed, 60 – 100 ug/dl (N = 2) clinically exposed and any eagle with ≥100 ug/dl (N = 3) were considered acutely exposed. In all, we found that 58% of the 42 Golden Eagles sampled had elevated blood-lead levels.

ESTIMATING LAKE SURVIVAL OF JUVENILE BULL TROUT IN TRESTLE CREEK, IDAHO IN THE PRESENCE OF CHANGING FISH COMMUNITIES, LAND USE, AND FISH MANAGEMENT

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A total of 921 age-1 and older juvenile bull trout were marked emigrating from Trestle Creek, Idaho, from 2000 through 2002. Individual juvenile bull trout were marked with abdominally implanted PIT tags, and adult returns were monitored at an automated PIT tag detection weir, as well as at fish traps through 2008. All marked juveniles returned as adults by the end of the 2007 field season. Minimum estimates of survival from outmigrating juvenile to returning adult were similar across study years, and ranged from 8.9% to 15.5%. Short-term tag retention and survival of marked juveniles was high, but long-term tag loss estimated by examination of double marked returning adult bull trout indicated substantial tag loss over time. Generally, outmigrating juveniles reared in the lake environment for between 3 and 5 growing seasons before returning as adults, with most spending 4 growing seasons in the lake (not including their "return year" as a year at-large in the lake). In general, return rates for larger outmigrants were higher than those for smaller outmigrants. Additional studies quantifying lake/river survival of migratory bull trout in other systems are needed to put these results into an appropriate ecological context, and to better understand the complex and likely interacting effects of non-native fish, land use, and fish management on bull trout recruitment.

BULL TROUT ENTRAINMENT AT LIBBY DAM ON THE KOOTENAI RIVER, MONTANA

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Montana Fish, Wildlife and Parks has used nighttime jetboat electrofishing to conduct annual mark recapture population estimates of adult bull trout in the Libby Dam tailrace since 2004. Estimates are conducted during April or May within this 3.5-mile section of the Kootenai River, and have ranged from 176 bull trout in 2006 to 1,079 bull trout in 2005. We collected tissue and scale samples from all bull trout we handled, and marked all fish with PIT tags, which allowed us to obtain capture histories across years for many fish. We recaptured 53 bull trout that were previously marked ranging between 285 to 1,469 days prior. The recaptured bull trout grew an average of 101.4 mm (0.2 mm per day), and gained an average of 1,869 g (3.1 g per day). Juvenile bull trout were collected from 15 tributaries within the Kootenai River Basin in British Columbia and Montana to develop a genetic methodology using microsatellite loci to assess whether fish originated above or below Libby Dam. Results indicated that there is a high degree of genetic variation among different bull trout populations within the Kootenai River basin. Jackknife analysis of our baseline dataset indicated that we had a high degree of power (greater than 95%) to correctly assign unknown fish captured in the Kootenai River as

originating either upstream or downstream of Libby Dam. We applied this methodology to the tissue and scale samples collected each year below Libby Dam during the population estimates to predict origin, and estimated that the proportion of the fish originating above Libby Dam ranged from 49.1% in 2004 to 62.7% in 2006. The majority of the adults assigned to populations above the dam were assigned to the Wigwam River, British Columbia, which represented the tributary with the highest number of bull trout redds in recent years.

A COOPERATIVE APPROACH TO ELK MANAGEMENT IN THE WILDLAND/URBAN INTERFACE OF MISSOULA, MONTANA - A DYNAMIC STRATEGY FOR A GROWING PROBLEM

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The Missoula Valley in western Montana is home to nearly 800 wintering elk, of which 300 are from the North Hills elk herd. From 1980 to 2007, this herd grew from 17 elk to 290, with a 48% growth rate occurring between 2000 and 2007. Without an effective harvest, this population is projected to double every five years. With increased residential development in elk winter range, a diverse public's opinion on the management objectives of the herd, and the herd's juxtaposition to the City of Missoula and the Rattlesnake Wilderness and National Recreation Area, wildlife biologists have needed to become more creative with their management strategies. To more effectively manage the herd at a sustainable level and to keep it wild, wildlife biologists from Montana Fish, Wildlife and Parks have coordinated and collaborated with numerous landowners and staff at the University of Montana and the USDA Forest Service. This presentation is an integration of the social and biological sciences, with discussions on the successes and failures of tested strategies to manage elk in the wildland/urban interface. The discussion will include the perspective and efforts of a North Hills homeowner, and data from a Master student's thesis project on survival, habitat use, daily/seasonal movements, and elk redistribution related to hunting pressure as collected with 10 GPS and 11 VHF collars. The discussion will conclude with a description of the adaptive management approaches utilized by Montana Fish, Wildlife and Parks' wildlife biologists, and the efficacy of those strategies.

EFFECTS OF WOLF PREDATION ON THE MADISON HEADWATERS ELK HERD: INSIGHTS FOR ELK AND WOLF MANAGEMENT IN MONTANA

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Studies of the non-migratory Madison Headwaters elk herd in Yellowstone National Park revealed that the herd appeared to be regulated near ecological carrying capacity by food limitation prior to the

reestablishment of wolves. Eleven years of post-wolf data indicated a substantial proportion of wolf predation was additive and overwhelmed any potential for the elk to demographically compensate. Thus, wolf predation resulted in a dramatic decrease in elk abundance and the system transitioned from being bottom-up regulated in the absence of a significant predator to strong top-down limitation due to wolf predation. It is uncertain if predation will ultimately regulate the elk population at a lower, alternate state or if predation and other factors influencing elk vulnerability will interact to result in further decreases in elk abundance. Fundamental to this question is the role of alternative prey and the interactions of winter severity and landscape heterogeneity on the vulnerability of elk to wolf predation. We contrast the impacts of wolf predation on elk in different drainages of the Yellowstone study area, as well as nearby areas studied outside the Park, to gain insights into the varying impacts of wolves on elk populations that occupy diverse landscapes in Montana. We suggest that wolves will have little to modest impacts on numbers of elk in most areas of the state, but that additive wolf predation could result in reduced elk numbers in some herds that winter in deep snow, forested environments where limited conflicts with livestock production can result in higher wolf:elk ratios.

ELK BEHAVIORAL RESPONSES TO THE REESTABLISHMENT OF WOLVES: INTEGRATING MULTIPLE STRATEGIES TO ACCOMMODATE COMPETING DEMANDS

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Over the past few decades a large body of literature has provided evidence that predators can influence the ways in which prey behave. This in turn may influence prey demography and predator-prey dynamics, and therefore may influence prey populations independent of direct killing. Using data collected from 1991 to 2007, we evaluated the behavior of elk in the Madison headwaters area of Yellowstone National Park in response to the colonization and establishment of wolves. Changes in home range size, fidelity, group size, foraging, and large-scale spatial responses were evaluated. Prior to wolf colonization, grouping behavior was relatively stable and predictable as elk attempted to conserve energy and decrease starvation risk in the absence of wolves. Following reintroduction group size and group size variation increased. This more dynamic behavior likely reflects a strategy to minimize predation and maximize food acquisition. After wolf colonization, elk moved more over the landscape as they were increasingly encountered, attacked, and displaced by wolves. Home ranges were slightly larger, with some decreases in fidelity. Long-distance dispersal and migratory movements were also adopted away from high-density wolf areas. These apparent predator-avoidance movements were never observed prior to wolf colonization or from areas where predation risk was lower. The decision to forage was heavily influenced by local snow, habitat, and time of day but remained relatively stable with and without the presence of wolves. We suspect that this lack of any substantial change in foraging behavior illustrates that elk can maintain the same level of foraging time and retain a relatively constant level of nutrition. Together these results suggest that in a harsh winter environment, elk can adaptively manage their behavior to cope with environmental constraints both in the presence and absence of wolves.

PATTERNS OF TROUT SURVIVAL AND MOVEMENT BEFORE AND AFTER LOGGING ON INDUSTRIAL FOREST LANDS

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Clear-cut timber harvest continues to be a common practice that frequently results in a patchwork of disturbance across the landscape. Although harvest techniques have greatly improved over the past half-century, the effects of contemporary harvest methods on adjacent (point) and downstream (cumulative) portions of the aquatic network are not well documented. Therefore, we sought to quantify spatial and temporal patterns of survival and movement of coastal cutthroat trout (*Oncorhynchus clarkii clarkii*) in two, experimentally-paired watersheds in the Cascade Mountains of Oregon, before and recently after logging. All harvest units were located along non-fish bearing channels upstream from the end of fish distribution. A total of 4,406 trout (>100 mm, fork length) were implanted with half-duplex passive integrated transponder (PIT) tags and monitored seasonally during a 5-year period (3 years before and 2 after harvest) using a combination of electrofishing and mobile and stationary PIT-tag antennas. Apparent survival varied widely among seasons and years, and variation among subcatchments was small in comparison. Seasonal apparent survival, regardless of year or subcatchment, was always lowest during the fall (September 15-December 15). There was no significant effect of this logging treatment on survival of coastal cutthroat trout in this headwater stream network, and although there was some increase in the probability for movement following logging, it remained low. In general, these data suggest that contemporary forest harvest practices regulations provided adequate short-term protection for coastal cutthroat trout from potentially negative consequences of timber harvest in the non-fish bearing portions of the Hinkle Creek drainage.

GRIZZLY BEAR POPULATION AUGMENTATION IN THE CABINET MOUNTAINS OF NORTHWEST MONTANA

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The Cabinet Mountains grizzly bear population was estimated at 15 or fewer individuals in 1988 and believed to be declining toward extinction. In response to this decline, a test of population augmentation techniques was conducted during 1990-1994 when 4 subadult female grizzly bears were transplanted into the area. Two criteria were identified as measures of success: bears must remain in the target area for one year, and bears should ultimately breed with native male grizzly bears and reproduce. Three of four bears remained in the target area for one year or more. One bear died after one year. Reproductive success of any of the remaining individuals could not be established until 2006

when genetic analysis of hair snag samples collected from 2002-2005 was completed. This analysis indicated that at least one of the transplanted bears remained in the Cabinet Mountains and had reproduced. The detected bear was transplanted in 1993 as a 2-year-old and was identified by a hair snag within 5 miles of the original release site. Genetic analysis indicated she had produced at least 4 offspring and those offspring had also reproduced. This information indicates that the original test of augmentation was successful with at least one of the transplanted individuals. The success of the grizzly bear augmentation test has prompted continuation of this effort. The Northern Continental Divide Ecosystem area of north central Montana has been the source of 4 additional bears transplanted to the Cabinet Mountains during 2005-08. Monitoring of these recent transplants is described.

DEMOGRAPHY AND GENETIC STRUCTURE OF A RECOVERING GRIZZLY BEAR POPULATION

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The threatened grizzly bear (*Ursus arctos*) population in northwestern Montana has been managed for recovery since 1975, yet no rigorous data were available to monitor program success. We assessed population status using data from one of the world's largest noninvasive genetic sampling efforts and 33–years of physical captures. Our population estimate, $\ddot{N} = 765$ (CV = 3.8%) was double the working estimate. Based on our results, the recent human–caused mortality rate approached a sustainable 4% although the high proportion of female mortalities raises concern. Genetic interchange has recently increased in areas exhibiting generations of low gene flow. This study illustrates the power of molecular techniques to rapidly assess populations at landscape scales and provide detailed demographic and genetic data needed to guide and evaluate recovery efforts.

AVIAN PISCIVORES VECTOR *MYXOBOLUS CEREBRALIS* IN THE GREATER YELLOWSTONE ECOSYSTEM

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Although often blamed on movement of trout, the dispersal vector of *Myxobolus cerebralis* among aquatic habitats often remains unknown. Occurrence of whirling disease in native Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) within the highly protected environment of Yellowstone Lake is one example. Given their local abundances, we sought to clarify the potential role of highly mobile piscivorous birds in the dissemination of *M. cerebralis* to otherwise isolated habitats. Six each of American White Pelicans (*Pelicanus erythrorhynchos*), Double-crested Cormorants (*Phalacrocorax auritus*), and Great Blue Herons (*Ardea herodius*) were held in an aviary and fed known-infected or uninfected rainbow trout (*O. c. mykiss*). Fecal material produced during 10-day periods before and after feeding was collected to determine if *M. cerebralis* could be detected and, if so, remained viable after passage through the gastrointestinal tract of these birds. Fecal samples from all (100%) of the nine birds fed known-infected trout and collected during days 1-4 following feeding tested positive for the presence of *M. cerebralis* by PCR. In addition, *Tubifex tubifex* fed fecal material from known-infected herons produced triactinomyxons in laboratory cultures, confirming the persistent viability of the parasite. Given the infection prevalence of cutthroat trout within Yellowstone Lake, pelicans, cormorants, and herons can move an estimated 1.27 billion *M. cerebralis* myxospores in the ecosystem during a 100-day breeding season each year. Piscivorous birds have the potential to concentrate and release *M. cerebralis* myxospores with fecal material into habitats highly suitable for *T. tubifex*, forming the basis of a positive feedback loop where the proliferation of *M. cerebralis* is supported.

RELATIONSHIPS BETWEEN ELK AND NONNATIVE WEEDS ON MONTANE WINTER RANGES IN WESTERN MONTANA

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Through physiological and competitive mechanisms, spotted knapweed has become established in many critical winter-range habitats, primarily in the northwestern United States and southwestern Canada. In areas of high density, elk may reduce the competitive ability of native grasslands through overgrazing. I predict that the benefits of weed spraying to reduce knapweed biomass are reduced in areas of high elk density and elk density and knapweed cover are positively correlated with high elk density creating high levels of weed biomass. A linear regression was calculated using vegetation data against kernel density estimates obtained from GPS telemetry locations in the North Hills Elk Herd of Missoula Valley, MT. This analysis shows a trend for increased and decreased percent cover of knapweed and native grasses at high elk densities respectively, providing support for our overgrazing hypothesis through the mechanism of apparent competition. Fecal diet analysis further shows and avoidance of knapweed and a selection for native grasses and forbs as well as invasive cheat grass. Finally, elk exclosures were constructed and will be measured annually for comparisons between forage class (native, invasive) biomass and elk densities on herbicide treatment areas using a statistical analysis of covariance. This information is essential in understanding the secondary effects of weed spraying in areas of high ungulate densities. With this understanding, management may be better informed how to spend limited resources for invasive weed control. If benefits of weed spraying are diminished at high ungulate densities, managers will need to adopt very different weed control treatments.

LANDSCAPE CONSERVATION AND THE BIG HOLE CCAA PROGRAM

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Beyond the tangible results across riparian and aquatic habitats of the upper Big Hole basin, the CCAA restoration program creates new opportunities for an array of landscape-scale conservation activities. The public and private partnerships forged through the CCAA program and the local watershed groups provide a valuable system for advancing collaboration conservation including: private land conservation, invasive species management, wetland restoration, bird and plant monitoring, fire management, and preservation of other species of concern or federally listed species. Proposed and on-going projects in the Big Hole, as well as lessons that can be applied to other biologically important landscapes, will be presented.

FROM MAGIC TO TRAGIC*:* THE HISTORY OF WOLF RECOVERY AND MANAGEMENT IN NORTHWEST MONTANA

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In 1973, Northwest Montana wolf recovery began with Dr. Bob Ream, University of Montana Wolf Ecology Project, and a handful of volunteers trying to verify presence. Verified presence increased slowly until 1986 when the first pack and reproduction, the Magic Pack, was documented. Since then and until recently, the Northwest Montana Recovery Area (NMRA) was the slowest growing, and survivorship of individual wolves was the lowest of the three recovery areas within the Northern Rocky Mountain Population (NRMP). In the last three years the NMRA population rate of increase is now similar to the Greater Yellowstone Recovery area. The NRMP wolf population reached recovery goals in 2002 and will soon be delisted. During this 35 year recovery period numerous biologists working for University, Federal, State, Tribal, and private interests monitored and managed the population and devoted much to the success of the project. The numerous events, stories, and people behind it's ultimate success are colorful and scattered with both accomplishments and set backs. Managers developed a complex bag of tools for population monitoring and management, livestock conflict resolution, and public relations unique to wolves. Wolf management is one of the more controversial programs that face wildlife professionals, and as the wolf population increases so do the challenges. An increased wolf population is met with increased public concerns on multiple issues including ungulate hunting opportunity, livestock interests, human safety, and domestic dog conflicts. Emotions have run high recently when managers have been severely criticized by diametrically opposing publics for either killing too many wolves or for white-tailed deer declines believed to be caused by wolves. The future holds yet more challenges with litigation, pending wolf hunts, as well as the same challenges of the past.

REDUCED GENETIC VARIATION IN UPPER MISSOURI RIVER DRAINAGE WESTSLOPE CUTTHROAT TROUT POPULATIONS APPEARS TO BE DUE TO HISTORICAL AND CONTEMPORARY FACTORS

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The number of westslope cutthroat trout *Oncorhynchus clarkii lewisi* local populations has decreased over the past 100 years. In Montana, this decrease has been most severe in the upper Missouri River drainage. The remaining populations in the drainage tend to be small and confined to headwater streams isolated above man made or natural barriers. Data from 14 nuclear loci indicate that mean average expected heterozygosity (Columbia = 0.155, Missouri =0.064), mean proportion of polymorphic loci (0.321, 0.179), and mean average number of alleles per locus (2.040, 1.313) were all significantly smaller within 16 Missouri populations than within 34 upper Columbia River populations. Total heterozygosity among the Missouri populations (0.106) was only about half of that observed among 16 randomly chosen Columbia populations (0.194). The average number of alleles per locus was also lower among the Missouri (2.714) than Columbia (3.643) populations. These latter two observations suggest that the reduced genetic variation in the Missouri populations is partially the result of a significant founder effect when the fish colonized the drainage. The relative amount of genetic divergence among the Missouri populations (F_{ST}=39.4%) was about twice that observed among the Columbia populations (20.5%) suggesting that subsequent to colonization the former have experienced more genetic drift and isolation than the latter. Because of their reduced genetic variation, genetic rescue is more likely to be required in Missouri than Columbia populations. Furthermore, the reduced genetic variation in the Missouri populations may retard their response to other conservation actions.

WHY IS THIS GRIZZLY BEAR IN MY BACKYARD? MANAGING HUMAN/GRIZZLY BEAR CONFLICTS IN NORTHWEST MONTANA

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The question may seem simple, “Why is this grizzly bear in my backyard”? A reasonable answer would be “Because it has probably found something to eat”. While the question and answer are basic, the solutions and prevention of future conflicts are more complex. From 1993 through 2008, there were 244 management captures of grizzly bears in Northwest Montana. These captures ranged from responses to grizzly bears causing property damage to incidental captures. Interagency Grizzly Bear Committee (IGBC) Guidelines give direction on capture and fate of the bear, but it is up to the Bear Conflict Management Specialists to work with both the grizzly bear and the people on the ground. Techniques to deal with the grizzly bears include relocation, on-site releases, hazing, aversive-conditioning, securing attractants, and removal from the population. Techniques to deal with the people include education, assistance in securing attractants, and citations. Just like people, grizzly bears are all individuals and what might work for one situation will not work for all situations. Methods for dealing with and preventing conflicts is evolving as new techniques and technology gives grizzly bear managers new tools and options. The ultimate goals are to keep people safe and to keep grizzly bears alive and in the wild.

AN ECOLOGICAL RISK ASSESSMENT OF WIND ENERGY DEVELOPMENT IN MONTANA

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In 2008, the United States led the world in wind power generation, providing 35% of the nation's new electrical generating capacity. Montana ranks fifth among states for wind energy potential. Wind facilities are not stand-alone features—they cover vastly more area than the footprint of the turbines, requiring extensive road systems and transmission corridors. The challenge for wind energy development in Montana is to produce relatively clean energy that does not contribute to global climate change, while minimizing impacts to biodiversity. We have completed an ecological risk assessment at coarse and fine scales for Montana. We utilized a diverse assemblage of wildlife species of concern, selecting for those that research suggests would be the most susceptible to wind energy development. We estimate that in total about 17 million acres of available good-to-superb wind energy potential exists within Montana, and of that, at least 7.7 million acres have a high risk to potentially impact species of concern. We strongly suggest that these areas be avoided as locations for wind energy development, rather than considering mitigation approaches, as the lands identified are often critical habitat for multiple species.

A FISH HATCHERY'S ROLE IN A CHANGING MONTANA

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Demographic change is sweeping across Montana like a racing wild fire, rapidly changing the mix of rural and urban dwellers and the face of Montana politics. A good percentage of these new residents have relocated to Montana specifically to partake in the time honored Montana traditions of hunting and fishing. Interest in fish and wildlife is at an all time high. As the natural resources of our state are pursued more intensely by residents and nonresidents, as well as consumptive and non-consumptive users, the management of these resources must adjust in order to protect fragile native populations. How will fish managers respond to this growth? What role should fish hatcheries play in Montana today? Are fish managers utilizing this conservation tool in the right manner? How much effort should be put into restoring threatened native populations? What attempts should be made trying to increase recreational opportunities throughout the state? The Creston NFH has served a unique role in Montana fish production, constantly changing and evolving, for over seventy years. Creston has played a support role in several restoration and recreational fishery projects. Some of these have failed and some have created world class fisheries. This talk will focus on the lessons we have learned and how we can put those lessons to use in playing a future role in conserving, protecting, and enhancing Montana's fishery resource.

MODELING PREDICTED DISTRIBUTION AND LANDSCAPE-LEVEL HABITAT SUITABILITY FOR MONTANA WILDLIFE SPECIES

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Models predicting spatial distribution and habitat suitability are critical for natural resource managers making decisions that impact species for which there is limited information. We are using presence-only data in conjunction with pseudo-absences in program Maxent to model the distribution and landscape-level habitat suitability for Montana wildlife species. Our primary goals are to produce: (1) continuous statewide outputs as a tool to identify variables that limit species' distributions and areas that need field surveys; (2) binary outputs that can be used to create lists of predicted species for various administrative boundaries and, (3) outputs showing marginal, suitable, and optimal habitat classes at a local landscape-level. To date, models have identified scale dependent responses to environmental variables, opportunities to extend the known ranges of species, areas that support potentially isolated populations in need of conservation efforts, areas that are critical for maintaining landscape connectivity, areas that may provide the best habitat for reintroduction of species that have declined, and areas where exotic and nonindigenous species are most likely to become established. In general, inductively based Maxent models provide realistic depictions of species distributions when survey data is available for a region. However, deductive models will still be important for representing some species distributions in areas lacking survey effort. Models will be used for various planning efforts including Montana Fish, Wildlife, and Parks' Crucial Areas and Corridors Assessment. Model outputs can be obtained from the Montana Natural Heritage Program or the Montana Fish, Wildlife, and Parks' Information Management Bureau.

STATUS OF LENTIC BREEDING AMPHIBIANS AND AQUATIC REPTILES IN MONTANA

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We developed a statewide inventory and monitoring scheme for lentic breeding amphibians and aquatic reptiles in Montana. We stratified sampling by 11 ecoregions and surveyed 6,741 potential lentic sites on public lands between 2000 and 2008 within 429 randomly selected 12-digit hydrologic-unit-code watersheds. Surveys and associated incidental observations have resulted in over 11,400 species occurrence records to date. Watershed and site breeding rates of 10 amphibian species and occupancy rates of 4 aquatic reptile species support previously noted declines of the Western Toad (*Bufo boreas*) and Northern Leopard Frog (*Rana pipiens*) in western Montana. We used classification trees to examine patterns in rates resulting from different groupings of major habitat features that are able to be affected with management actions. Seven of the 10 amphibian species and the Common Gartersnake (*T. sirtalis*) were detected at significantly fewer sites when fish were detected. The presence of emergent vegetation was positively associated with the proportion of sites where breeding or occupancy was detected for all but one of the amphibian and reptile species examined and appeared to partially mitigate the presence of fish. Resource managers could enhance habitats for wetland herpetofauna by (1) creating new lentic sites on the landscape either directly or through the reintroduction and protection of beaver, (2) creating emergent vegetation at portions of existing sites that currently lack it via rotational fencing to temporarily exclude grazing, and (3) eliminating some introduced fish populations. All observations and survey locations, including digital photographs of sites surveyed are available at: http://nhp.nris.state.mt.us/Tracker.

THE IMPACT OF CLIMATE VARIATION ON COLUMBIA SPOTTED FROG (*RANA LUTEIVENTRIS*) SURVIVAL IN A HIGH MOUNTAIN ECOSYSTEM

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Amid growing concern over the impacts of long-term climate change, a fundamental challenge for wildlife biologists is determining how animal populations will respond to a changing climate. In amphibians, little research has addressed how climate variation may affect vital rates and population sizes. We evaluated the relationship between annual age- and sex-specific survival rates and local and global climate variables using a nine-year mark-recapture dataset of Columbia spotted frogs (*Rana luteiventris*) from the Bitterroot Mountains. Local climate variables included peak snowpack, winter length, summer length, and growing degree days. Global climate variables included the Southern Oscillation Index (SOI) and the North Pacific Oscillation (NPO). We estimated annual survival for four age classes: juveniles, subadult and adult females, and adult males. We found that survival in this population was best predicted by snowpack and winter length. In this model, an increase in snowpack resulted in a decrease in juvenile ($b = -0.083 \pm 0.007$), adult male ($b = -0.036 \pm 0.016$), and adult female ($b = -0.037 \pm 0.015$) survival, and had no significant effect on subadult survival ($b = -0.011 \pm 0.027$). An increase in winter length led to a slight increase in survival, but only for juveniles and adult males. These results suggest that a warming climate with less severe winters might be good for montane frog populations. Survival is only one vital rate, however, and future work will determine the influence of climate on other vital rates such as growth and fecundity, as well as examine the contribution of intrinsic drivers to population variation.

HUNTING ACCESS MANAGEMENT ON PRIVATE LANDS IN MONTANA

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In the summer of 2008, a study of hunting access on private lands in Montana was conducted cooperatively by Colorado State University, Montana Fish, Wildlife & Parks, and the Western Association of Fish and Wildlife Agencies. The purpose of this effort was to examine the extent to which Montana landowners are providing hunting access and the approaches they use to manage access on their property. The focus was on access for hunting of deer, elk, antelope, and upland game birds (defined to include pheasant, sharp-tailed grouse, and Hungarian partridge). The study also included an assessment of landowner values toward wildlife and wildlife management. Data were collected via a mail survey administered to a randomly-selected sample of landowners with at least 160 acres. A total of 1,418 landowners participated, resulting in an overall response rate of 47%. The majority of landowners indicated that hunting occurs for the species that are present on their lands. Landowners in the eastern region of the state reported the highest levels of hunting occurrence across species, except for elk. The largest difference in hunting occurrence across regions was reported for upland game birds – 63% of respondents from the western region with upland game birds on their property allowed access, compared to 80% in the East and 74% in the central region. For the ungulate species (deer, elk, and antelope), hunting tended to occur more often for male animals. The average number of hunters per year allowed on private lands was highest for elk and lowest for antelope. The

two most common forms of access management reported by landowners were “non-Block Management hunting without a fee” involving mostly hunters who are (1) family/friends and (2) NOT family/friends. The third most frequently selected approach was the Block Management Hunting Access Program. By facilitating a better understanding of how hunting is currently managed on private lands in Montana, these results provide a baseline that can assist FWP in developing plans for working with private landowners on issues related to hunting access and wildlife management in the future.

PUBLIC ATTITUDES TOWARDS BLACK BEARS IN MISSOULA, MONTANA

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Successful wildlife management actions and policies depend on public acceptance. Management actions minimizing human-black bear (*Ursus americanus*) conflicts are controversial, and research that articulates public attitudes in a diversity of situations is often lacking. Our objectives were to examine public attitudes towards black bear management of residents in the Wildland-Urban Interface (WUI; where bears and humans coexist) and the city core (i.e., where no bears are present). We also examined the effects of education and information (EI) efforts to minimize human-bear conflicts. Two questionnaires were distributed to residents living in Missoula, Montana before (2004) and after (2008) EI efforts were implemented. Residents living in the city core and the WUI both attracted bears with bird feeders, BBQ grills, and gardens but had significantly different frequencies of available vegetation and garbage. In the WUI, the frequency of available native and non-native vegetative bear food was significantly higher, whereas the frequency of outdoor garbage storage was significantly lower. In 2008, attitudes were not significantly different between residents in the WUI and the city core. The 4 years of EI efforts did not alter resident behaviors that produce attractants in the WUI. However, the EI efforts in the WUI did increase support for non-lethal management actions. Managers may be able to use EI efforts to gain support for black bear management actions, but must realize that behaviors producing attractants may be spatially ubiquitous and difficult to modify.

ASSESSING ECOLOGICAL IMPACTS DUE TO THE OPERATION OF LIBBY DAM, MONTANA

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Damming of rivers represents a cataclysmic event for large river-floodplain ecosystems. By altering water, sediment, and nutrient flow dynamics, dams interrupt and alter a river's important ecological processes in aquatic, riparian, floodplain and surrounding terrestrial environments. The Kootenai Tribe of Idaho and Montana Fish, Wildlife and Parks, with the support of numerous subcontractors, are currently exploring the ecological impacts related to the operation of Libby Dam. To assess the cascading effects, KTOI personnel and subcontractors are developing indices to assess individual abiotic and biotic components. These individual assessments will be combined into an Index of Ecological Integrity (IEI) at a geomorphic reach or subbasin scale. The IEI will be used to assess, mitigation, monitor, and rehabilitate the Kootenai River Floodplain.

HYBRIDIZATION RAPIDLY REDUCES FITNESS OF NATIVE CUTTHROAT TROUT IN THE WILD

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Human-mediated hybridization between native and invasive species is a leading cause of biodiversity loss worldwide. How hybridization affects fitness and what level of hybridization is permissible pose difficult conservation questions with little supportive empirical information to inform policy and management. This is particularly true for salmonids, where widespread introgression among nonnative and native taxa often create hybrid swarms over extensive geographic areas, threatening natives with genomic extinction. Here, we used parentage analysis with multilocus microsatellite markers to measure how varying levels of genetic introgression with nonnative rainbow trout (*Oncorhynchus mykiss*) affect reproductive success (number of offspring per adult) of native westslope cutthroat trout (*O. clarkii lewisi*) in the wild. Small amounts of hybridization markedly reduced reproductive success of male and female trout, with fitness sharply declining by ~50% with only 20% nonnative admixture. Despite heavy fitness costs, our data suggest that hybridization may spread due to relatively high fitness of first-generation hybrids and inordinately high reproductive success of a few males with high levels of nonnative admixture. This outbreeding depression suggests that even low levels of nonnative genetic admixture may have negative effects on reproductive success in the wild and that policies protecting hybridized populations may need reconsideration.

EFFECTS OF LARGE WOOD PLACEMENT ON CHANNEL MORPHOLOGY AND AQUATIC HABITAT HALLOWAT CREEK, NORTH FORK FLATHEAD RIVER DRAINAGE, MONTANA

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Montana Fish, Wildlife and Parks (MFWP) documented a substantial reduction in bull trout *Salvelinus confluentus*, spawning redds in Hallowat Creek, a tributary to Big Creek of the North Fork Flathead River. The Big Creek watershed is an important spawning tributary for fluvial bull trout, a federally-listed threatened species (USFWS, 1998). USFS fire suppression efforts undertaken during the 2001 Moose Creek Fire influenced channel hydraulics and spawning habitat distribution in Hallowat Creek. Fire suppression activities included cutting large woody debris within the active channel and riparian zone. Stable large wood loss resulted in a more simplified channel characterized by coarse substrate,

few pools, and infrequent large woody debris. In 2005, River Design Group, Inc. (RDG), MFWP and FNF implemented an in-channel treatment plan for Hallowat Creek. Large wood was imported to the active channel and arranged in stable wood complexes to promote pool development. Reach-specific treatments were developed to either meet or exceed large woody debris counts that were enumerated in a pre-fire, 1998 R1R4 survey conducted by the FNF. Channel monitoring surveys and annual bull trout redd counts were completed in 2005, 2006 and 2008 to assess spawning and geomorphic response to the structures. Results suggest augmenting existing stable large wood structures with additional wood, and building structures that are anchored to stable floodplain features provide the best opportunity for increasing complex pool habitat in Hallowat Creek. This presentation summarizes the monitoring data and provides recommendations to practitioners engaged in similar habitat restoration projects in forested, mountain streams.

CREATING WILDLIFE HABITAT AND EXPANDING FISHERIES WITH BIOHAVEN® FLOATING TREATMENT WETLANDS

Tim Mulholland P.E. and Christine Pierce, Headwaters Floating Island, 1018 2nd Ave. North Billings, Montana 59101 406-860-1589

BioHaven® floating islands are an environmentally low impact and economical way to create new wetland, while augmenting the vitality and biodiversity of a waterway. They are made using non-toxic recycled materials and are hands off and non-mechanical. The biomimetic design gives our fish, wildlife and waters the least carbon footprint and the most natural support for the systems they depend upon for healthy and productive lifecycles. The benefits are many: habitat creation and restoration for a myriad of fauna, from microbiological systems to aquatic and wetland wildlife; reduced turbidity and pollution mitigation (with resource recovery of nutrients such as nitrate and phosphate); and aesthetic and unique living water features of any size or shape for any water body. Floating Islands used in landscaped water features and pools offer a chemical free approach to managing water quality. Placed in a stream or pond, BioHavens and their suspended root complex give secure habitat for fish, offering shade and protection from currents and predators. The living islands attract a range of insects that also become a food source for fish and wildlife and further promote biodiversity. Unique configurations can be designed for nesting sites, spawning platforms and load bearing hanging banks to increase protective fish habitat. Several projects have developed successful, protective bird habitat specifically for Duck, Loon and Swan and a 22,000 sf Caspian Tern Habitat Island.

LONG-TERM MONITORING OF OSPREY (*PANDION HALIATUS*) POPULATIONS IN WESTERN MONTANA

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Ospreys are important apex predators and continue to be important indicators for environmental contaminants in aquatic ecosystems. Although Osprey populations made rapid recoveries in Montana after the 1972 ban on the use of DDT, there have been surprisingly few studies monitoring Osprey populations since then. During the last 20 years some Osprey populations in western Montana have declined over 75%, and are now approaching the low numbers of the DDT era. The causes and geographical extent of these declines are not known, although companion studies have shown some very high levels of mercury in Osprey chicks. For these reasons, we are establishing a long-term monitoring program for Ospreys in western Montana. Here we report on our Osprey studies on Flathead Lake and adjacent watersheds, which appear to be a major stronghold for Ospreys. During

the summer of 2008, we located and monitored 87 Osprey nests on Flathead Lake. At least 69 (80%) of these nests were occupied; a sub-sample of 47 of these nests had 1.9 chicks produced per productive nest. This is above the productivity estimated to maintain stable Osprey populations.

FAT BUT NOT HAPPY: THE EFFECTS OF SUPPLEMENTAL FEEDING ON STRESS HORMONE LEVELS OF WYOMING ELK

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On 23 feedgrounds in Wyoming, elk (*Cervus elaphus)* are provided with supplemental feed throughout the winter. Brucellosis seroprevalence of feedground elk is 26% whereas other elk in the Greater Yellowstone Ecosystem have a brucellosis seroprevalence of 2-3%. The aggregation of elk during peak transmission allows brucellosis to persist in the fed populations. In addition to creating the opportunity for disease transmission, the aggregation of elk on feedgrounds may have detrimental physiological effects. Other studies have shown that chronically high stress hormone concentrations can suppress the immune system and lead to increased disease susceptibility. Potential stressors on the feedgrounds include high densities, large group sizes and aggressive social interactions. In this study we investigated how supplemental feeding and environmental variables affect stress hormone levels in fed and unfed populations of elk. We also manipulated resource distribution on the feedgrounds to examine how feeding density affects stress hormone levels and aggression rates. Results show that elk on feedgrounds have stress hormone levels significantly higher than unfed elk. Experimental reduction of feed density did not have an effect on stress hormone levels or aggression rates. Group size and density during feeding were important predictors of stress hormone levels. This study indicates that feedgrounds are not only creating an epidemiological setting for disease transmission, but also creating a physiological state that may increase susceptibility to disease. The impact of these stress hormone concentrations on disease susceptibility remains unknown, but may potentially be an important driver of disease dynamics in feedground elk populations.

AN OVERVIEW OF THE CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES PROGRAM, WITH SPECIAL REFERENCE TO THE BIG HOLE RIVER, MONTANA

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In 1999 the Candidate Conservation Agreement with Assurances (CCAA) program was initiated by the US Fish and Wildlife Service to engage private landowners in species conservation before a potential listing under the Endangered Species Act (ESA). For their participation, private landowners receive assurances that they will not be subjected to additional regulatory burden should the species be listed. Hundreds or thousands of species are potentially eligible for this program, but only a few dozen CCAA's have been completed and the scope and complexity varies widely among individual agreements. Because the program is relatively new, there are little data to evaluate the biological effectiveness of CCAAs. However a few agreements can be considered a success in terms of

landowner participation. Issuing permits under the ESA has led to litigation for other conservation programs like Habitat Conservation Plans (HCPs), but the validity of the CCAA policy and individual CCAA agreements have not yet been subjected to formal legal challenge. I briefly summarize the basic premise of the CCAA program, the different organizational frameworks to structure these agreements, and some of the institutional and social challenges to effective implementation, highlighting the example of the CCAA for fluvial Arctic grayling in the upper Big Hole River, Montana.

GENETIC VARIATION, ANCESTRY AND POPULATION STRUCTURE IN NATIVE ARCTIC GRAYLING IN THE UPPER MISSOURI RIVER

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Arctic grayling (*Thymallus arcticus*) were thought to be historically widespread in the Missouri River system in Montana and Wyoming, but have been reduced to a handful of remnant populations since Euro-American colonization.. Conservation efforts have focused primarily on protecting the fluvial population in the Big Hole River, and re-establishing fluvial populations elsewhere. Widespread historical stocking of exogenous grayling has created some uncertainty about the origin of extant populations and the composition of native gene pools. Additionally, declines in native populations may have reduced the genetic template for adaptation and recovery. Effective conservation would benefit from a better understanding of genetic ancestries, and whether bottlenecks have substantially altered genetic diversity of remnant populations. Consequently, we conducted a population-level genetic analysis of native and introduced grayling from 18 locations. We genotyped 730 grayling at 10 microsatellite loci and used these data to identify population groupings, genetic variation within and among groups, and evaluate evidence for population bottlenecks. We found significant divergence among native populations from the Big Hole River, Madison River, and Red Rock lakes. The Big Hole population had greater heterozygosity and allelic diversity than the Madison and Red Rock populations, both of which showed some evidence of recent bottlenecks. Most introduced populations traced their ancestry to the adfluvial Red Rock lakes population, and we did not find strong evidence that stocking of hatchery grayling homogenized native gene pools. Geographic patterns of genetic variation among native Missouri River grayling were consistent with differentiated local populations historically connected by occasional gene flow.

CHANGES IN ELK RESOURCE SELECTION AND DISTRIBUTIONS ASSOCIATED WITH THE MADISON VALLEY LATE-SEASON ELK HUNT

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Changes in resource selection associated with human predation risk may alter elk distributions and availability for harvest. Using Global Positioning System (GPS) data collected from telemetry-collared cow elk (*Cervus elaphus*), we evaluated effects of refuges (areas where hunting was prohibited), spatial variation in hunting risk, and landscape attributes on resource selection within an established Greater Yellowstone Area wintering range and we evaluated elk distributions during and outside of a late-season hunting period. Refuge areas and landscape attributes such as habitat type and

snow water equivalency (SWE) affected resource selection. During the hunting period, selection for refuge areas increased, and we estimated odds of elk occupancy in refuge areas more than doubled. Elk selection for flat grasslands increased as SWE increased likely because these areas are heavily windswept leaving grasses exposed for foraging. Elk distributions differed during hunting and no-hunting periods, and during the hunting period elk distribution shifted to privately owned land where hunting was prohibited. Risk-driven changes in resource selection resulted in distributions that reduced the availability of elk for harvest. Elk selection for areas where hunting is prohibited presents a challenge for resource managers that use hunting as a tool for managing herd sizes.

THE MONTANA LEGACY PROJECT -- CONSERVATION OF FOREST LANDS IN WESTERN MONTANA

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The Montana Legacy Project implements an agreement between Plum Creek Timber Company and a partnership between The Nature Conservancy of Montana and The Trust for Public Land for the acquisition of 312,000 acres of Plum Creek lands in western Montana. The goals of the project include: protection of the area's clean water and abundant fish and wildlife habitat, maintenance of forests in productive timber management, and promotion of public access for fishing, hiking hunting and other outdoor recreation. The project includes several areas where Plum Creek lands are in a checkerboard ownership pattern with public lands. The potential conversion of these lands to subdivision and development could significantly fragment wildlife habitat, interrupt movement corridors, restrict traditional public recreational access, and increase the costs of wildfire protection and the provision of local services. This project is the result of collaboration by many individuals and organizations from across the state. Business leaders, sportsmen, elected officials, federal and state agencies, conservationists, citizen groups and others are working together to conserve the important resource values within this project area.

ESTIMATION OF BLACK-TAILED PRAIRIE DOG COLONY ACREAGE IN MONTANA

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The first statewide inventory of black-tailed prairie dog (Cynomys ludovicianus) colonies in Montana was conducted in the mid 1980s and produced an estimate of 120,000 – 130,000 acres. A cooperative statewide inventory effort (1996 -1998) yielded a minimum estimate of 66,000 acres of occupied habitat. However, this inventory did not include areas where access was denied and results of alternate survey efforts. The minimum management objective for black-tailed prairie dog abundance in Montana is 90,000 – 104,000 occupied acres, according to the statewide management plan. A current, comprehensive, and rigorous statewide estimate of prairie dog acreage was needed to determine the area of Montana occupied by black-tailed prairie dog colonies. We surveyed known black-tailed prairie dog distribution in Montana using an aerial line-intercept survey stratified by county from June to August, 2008. We recorded the length of prairie dog colony intercepts on approximately 35,000 linear miles on 771 transects in 32 counties in central and eastern Montana. Transects were flew in fixed-wing aircraft in an east-west direction at approximately 110 mph at less than 300 feet above ground

level. Prairie dogs colonies were detected in 21 counties. We recorded roughly 750 prairie dog colony intercepts. We attempted to ground truth 10 % of detected prairie dog colonies along transects, and at least one black-tailed prairie dog colony intercept in each county. Data analysis is ongoing at this time. However, preliminary results indicate black-tailed prairie dog occupancy exceeds Montana abundance objectives. A comprehensive analysis is expected to be complete in April, 2009.

EFFECTS OF CATTLE GRAZING ON SMALL MAMMAL COMMUNITIES AT RED ROCK LAKES NATIONAL WILDLIFE REFUGE

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Cattle grazing is a common land practice on public lands in the west that can have complex impacts on both wildlife and vegetation. However, many studies of wildlife response to grazing only compare grazed versus ungrazed treatments, ignoring the dynamic nature of grazing and the many levels of grazing intensity and frequency commonly utilized. We undertook the current study to better understand the response of small mammals to the frequency of cattle grazing in wet meadow habitats on Red Rock Lakes NWR. Three adjacent grazing units were selected for study with grazing frequencies of 1, 3, and 8 years of rest in 2007 and 0, 2, and 4 years of rest in 2008. Two randomly placed trapping grids were placed within the Juncus balticus – Carex praegracilis vegetative alliance (wet meadow) in each unit. Trapping occurred from late June –August each year. Vegetation was quantified in each unit each year using point-intercept transects. We conducted raptor surveys during 2008 to examine raptor response to vole abundance. Voles (meadow and montane; Microtus spp.) made up the overwhelming majority (~99%) of individuals captured. Results from 2007 indicated that vole abundance increased with increasing rest from grazing. Vole abundance in 2008 was substantially lower and did not follow the same pattern as 2007 – in 2008 the unit with an intermediate level of rest (2 years) had the highest abundance. Raptor numbers tracked vole abundance closely in 2008. Additional years of study will be necessary to determine the role grazing plays in vole population dynamics.

THE EAST FORK SPECIMEN CREEK WESTSLOPE CUTTHROAT TROUT RESTORATION PROJECT: THE GOOD, THE BAD, AND THE SMOKY

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Initiation of the East Fork Specimen Creek (EFSC) westslope cutthroat trout *Oncorhynchus clarkii lewisi* (WCT) restoration project in 2005 marked the beginning of a renewed effort to actively restore native fish in Yellowstone National Park. That summer an interdisciplinary team was assembled to begin a NEPA compliance process and within 12 months an EA and FONSI were complete. Project implementation began immediately with chemical removal of nonnative fish in High Lake, a 7 acre

isolated headwater lake, in August 2006. Unfortunately, the construction of a fish barrier on EFSC, planned for completion in 2007, was delayed by a natural wildfire that destroyed all previous work and left an unsafe worksite. Rotenone treatment of High Lake was successful and we began efforts to restock the lake with genetically-pure WCT (from multiple sources) that year. In 2008 we again stocked High Lake with WCT and undertook a vigorous effort to complete the EFSC fish barrier. Because of its remoteness, 93 mule loads and 5 helicopter sling loads were required to move supplies and tools to the site. Contracted log crafting specialists, Montana Conservation Corps crews, and park staff collaborated to bring the barrier to successful completion. Immediately afterwards two piscicide treatments were conducted on EFSC from High Lake downstream to the fish barrier (12 km). Additional treatments of this reach are planned for 2009 and WCT reintroduction efforts will begin as soon as complete removal of non-native fish is verified.

RECENT ADVANCES IN THE ANALYSIS OF OCCUPANCY AND ABUNDANCE DATA IN RESPONSE TO MANAGEMENT ACTIVITIES

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Recent advances in the analysis of occupancy data collected from repeated visits to sampling stations will be presented along with an example analysis of avian community responses to prescribed fire. The occupancy analysis is a Bayesian hierarchical model, allows fixed and random effects, and is a composite analysis that allows researchers to estimate management effects for rare species as well as community level indices such as species richness. Additional examples of applied research projects that have used Bayesian hierarchical models will be briefly discussed to demonstrate the flexibility of the method and introduce the audience to techniques they may not be familiar with. Additionally, an example using variable circular plot (i.e. distance data) will be presented demonstrating an analysis of red squirrel densities in response to prescribed fire. These methods are appropriate for studies designed to investigate the impact of management practices on wildlife species and represent improvements over previous techniques.

CLIMATE CHANGE MEDIATES THE SPATIAL PARTITIONING OF SCULPIN AND LONGNOSE DACE LEADING TO TROPHIC CASCADES IN RIVERINE ECOSYSTEMS OF WESTERN MONTANA

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Sculpin (*Cottus spp.*) and longnose dace (*Rhinichthys cataractae*), perform diverse roles in trophic interactions. Both are abundant inhabitants of the benthos and longnose dace are present in nearly every Montana drainage. The ecological importance of both genera arises, in part, from their tendency to occur in high abundances, often dominating fish assemblages in number and biomass. Although both are numerous, small- bodied, and largely confined to the benthos, they occupy different trophic positions, express different life history tactics, and perform different ecological roles. Over the last few decades, west-central Montana rivers have warmed affecting the distribution of, among other

species, longnose dace, and sculpin. Both species have undergone dramatic shifts in occupancy of habitats leading to ecotonal shifts on a broad geographical scale and this change has occurred rapidly and quietly. In general, as waters have warmed, longnose dace have replaced sculpin leading to the retreat and isolation of many sculpin metapopulations. Both species are sympatric with endangered species like the bull trout (*Salvelinus confluentus*), whose populations are targets for protection, mitigation, and enhancement. It is unclear the effects of the replacement of sculpin by longnose dace, though they are likely large and measurable, and since they represent the basis of the food chain for higher trophic order organisms, this change could ultimately could affect the restorative potential of the systems for target species. Furthermore, warming and species replacement may lead to a further homogenization or regional distinctive ecotones and fauna.

WATERSHED-SCALE APPROACH TO ASSESSING COLORADO RIVER CUTTHROAT TROUT *ONCORHYNCHUS CLARKI PLEURITICUS* ABUNDANCE AND HABITAT IN THE UPPER COLORADO RIVER HEADWATERS.

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Information concerning the effects of physical habitat on the distribution, abundance, and population structure of salmonid fishes has been routinely gathered at the site and reach scales, but data collected at these scales has provided little insight into spatial and temporal structure of fish assemblages within the stream network. This is especially relevant where periodic disturbances across the landscape are extensive, and effects are not uniform (spatially or temporally). To gain new insight into the relationships between trout abundance and population structure and the physical habitat at multiple spatial scales, we surveyed six watersheds in the upper Colorado River basin and assessed Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) abundance and habitat variables continuously throughout the stream network. The watersheds were selected randomly from a sampling frame based on presence of Colorado River cutthroat trout populations, percent beetle infestation of the watershed area, and erosion potential of the upslope geology. Although similar physical habitat conditions existed within and among several watersheds, fish distribution was patchy at the channel-unit scale, and physical habitat was not strongly related to distribution. However, at the reach scale, patterns of fish distribution explained a substantial amount of the variation in abundance. Further refining of these relationships will provide critical information necessary to assess future changes related to restoration activities, wildfire, and climate change.

RECOVERY OF WESTSLOPE CUTTHROAT TROUT POPULATIONS FOLLOWING REMOVAL OF NONNATIVE BROOK TROUT

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We investigated whether 75 mm and longer westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) and brook trout (*Salvelinus fontinalis*) occupied similar niches by comparing biomasses, population densities, and condition factors prior to and following total removal of brook trout in 2.3 to 3.0 km reaches of three headwater streams in Montana. Biomasses and their associated errors were estimated using depletion estimators. Total trout biomass did not change significantly after brook trout removal indicating that these two species have similar niches in these streams. Densities of juvenile westslope cutthroat trout were significantly and negatively affected by densities of juvenile brook trout and positively related to densities of adult westslope cutthroat trout (R^2=0.482; F-ratio=15.415; P<0.001). Including densities of westslope cutthroat trout or brook trout from the previous year did not measurably improved model performance. Densities of juvenile brook trout were negatively associated with body condition of juvenile westslope cutthroat trout. We found evidence for size-asymmetric competition in one stream, but not in the other where it was assessed. Interspecific competition between brook trout and westslope cutthroat trout was nearly as strong as intraspecific competition within westslope cutthroat trout, especially among juveniles, providing insight into one mechanism by which brook trout displace westslope cutthroat trout.

AS THE WORLD TURNS: MANAGING WOLVES AND NAVIGATING THE LEGAL LABYRINTH

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This is the 29th year that wolves have been in northwest Montana and the 14th year that wolves have been in southwest Montana. It's the 5th year Montana Fish, Wildlife & Parks (FWP) has led wolf management. And it's the 7th straight year in which the northern Rockies biological recovery goal was met. The real success story is that roughly 88% of the recovered wolf population lives outside national parks. Through it all, science has advanced and the rhetoric has ebbed and flowed. Somewhere in the midst are the biological, political, and social realities of managing a recovered population. Outside national parks, wolves share a landscape with people who have very diverse viewpoints about wolves and their management. Like other wildlife species, Montana's wolf population is subject to checks and balances, including strong reproduction in some areas, disease, vehicle strikes, and mortality due to conflicts with people. Montana's population is secure, but dynamic. At the end of 2007, Montana had a minimum of 422 wolves in 73 packs, 39 of which were breeding pairs. In 2008, the legal framework was equally dynamic when federal government efforts to delist the northern Rockies population were challenged. Wolves were delisted for about 4 months before a federal judge reinstated federal legal protections through a preliminary injunction and then permanently when the federal government withdrew its decision. Delisting efforts were renewed late in 2008 and carried forward into 2009. This will be summarized and an FWP program update will be provided. See also: www.fwp.mt.gov/wildthings/wolf.

CCAA IMPACTS ON BIRDS OF THE BIG HOLE WATERSHED

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Through the Big Hole CCAA, a coalition of groups has undertaken extensive restoration work aimed at improving habitat conditions for the last remaining fluvial population of Arctic grayling in the U.S. Riparian-associated birds are also likely to respond positively to such restoration activities, and this is significant because riparian habitats support a greater diversity of breeding birds than any other habitat type in Montana. In the summers of 2007 and 2008 the Avian Science Center obtained permission from participating landowners along the Big Hole River to document bird communities during this pre-restoration phase. We surveyed birds at reference points that serve as the target habitat condition for restoration efforts, and impact points that are currently impaired, but likely to improve with restoration activities. We also measured vegetation at each point to evaluate vegetation quality. We detected 107 species across the two survey years, and this represents 44% of bird species (107/245) known to breed in Montana. This speaks to the outstanding diversity of birds associated with riparian areas in the Big Hole watershed. Both the vegetation characteristics and bird communities were decidedly different between reference and impact sites. Thirteen of the 25 most frequently encountered bird species were detected on a significantly higher proportion of reference points while six species were more frequently encountered on impact sites. We suggest using the occurrence of five species: Willow Flycatcher, Veery, Northern Waterthrush, Fox Sparrow and Song Sparrow, all of which were encountered much more frequently at reference sites, to evaluate the success of restoration work in future years.

SPATIAL AND TEMPORAL FISH ENTRAINMENT FROM HAUSER RESERVOIR, MONTANA

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Management sport fish populations of Hauser Reservoir, Montana, is hindered by undesirable and unpredictable downstream entrainment of fish through Hauser Dam. We quantified fish entrainment through Hauser Dam using hydroacoustic technology at turbine intakes from July 2007 to November 2008 and over the spillway from May 21 to July 18, 2008. Species composition of entrainment was characterized using multiple netting gears. Annual estimated turbine entrainment was higher in 2007 (N = 99,148 ± 5,582) than in 2008 (N = 53,456 ± 5,118). Spillway entrainment (N = 29,931 ± 3,173) was 36% of total annual entrainment in 2008. Entrainment was higher in fall than in summer in both years, likely in response to fall turnover and the annual release of hatchery rainbow trout. Most entrained fish (about 60%) were less than 220 millimeters total length in both turbine discharge and spill. The most common fish captured were rainbow trout (43%), white sucker (27%), and walleye (15%). The least common were common carp and yellow perch. We applied species composition by size to the hydroacoustic data to identify fish species entrained, but most fish (N = 74,062 ± 4,834)

could not be reliably assigned to a species because concurrent net catches did not include individuals of similar size. Most identified entrained fish were rainbow trout (N = 33,472 ± 3,014) and walleye (N = 35,439 ± 2,953). Identification of patterns in spatial and temporal fish losses affords fishery managers the ability to make more informed decisions about operation of this dam.

MERCURY CONTAMINATION IN THE FISHES OF GLACIER NATIONAL PARK

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We investigated mercury contamination in fishes from four lakes in Glacier National Park. Three of these lakes (Bowman, Harrison, McDonald) are on the west side of the park and one is on the east side (St Marys). We focused our sampling on lake trout but also collected lake whitefish, burbot, and incidentally killed bull trout. Mercury contamination generally increased with fish size but not always. Lake trout and burbot were the most contaminated species and levels exceeding 0.5 ppm Hg wet occurred in the larger fish. We found that lake whitefish and bull trout generally had lower mercury levels than lake trout on a size normalized basis. Examination of the lake trout and lake whitefish data revealed that males and females had similar levels of mercury. Mercury levels in lake trout from the west side lakes showed similar trends with fish size, and were comparable to other lake trout populations in the region.

ADJUSTING LAKE TROUT AGES VERSUS OTOLITH MASS RELATIONSHIPS FOR VARIABLE GROWTH

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Otolith weight holds considerable promise for increasing the speed and consistency of age estimates relative to otolith thin sections, especially for species such as lake trout where age and otolith weight are highly related. Using known age lake trout from Lake Michigan we demonstrate that the age versus otolith mass relationship is dependent body growth rate, reducing the utility of otolith mass alone for estimating age when growth rates vary between samples. To compensate for this growth bias we developed a correction procedure. This procedure uses otolith weight versus total length relationships to estimate the body growth rate difference between samples, and then estimates the bias in the age versus otolith mass relationship. Using the correction procedure we successfully adjusted the Lake Michigan age versus otolith mass relationship to the more slowly growing Flathead Lake fish, revealing a pattern of declining body growth rates through time in the Flathead Lake population.

ARE LAKE TROUT IN FLATHEAD LAKE MORPHOLOGICALLY & GENETICALLY SEGREGATED BY DEPTH?

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We compared muscle lipid content, muscle stable isotope ratios, body morphology, and microsatellite allele frequencies between shallow (0-25 m) and deep caught (>50 m) lake trout from Flathead Lake, Montana. We found that lipid content was similar between depth groups. Stable isotopes of N and C varied between depth groups, demonstrating that individual fish exhibit long term depth preferences. Depth groups varied in their morphology. Relative to shallow fish, deep fish had a head more in line with the rest of the body, bigger eye, deeper body, wider skull, longer pectoral fin, and a deeper and shorter caudal peduncle (Fig 2a). Microsatellite allele frequencies were similar between depth groups, strongly suggesting gene flow between shallow and deep fish.

WESTERN PEARLSHELL (MARGARITIFERA FALCATA) MUSSEL DISTRIBUTION & STATUS IN MONTANA: TWO YEARS LATER, IT'S WORSE THAN WE THOUGHT!

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Montana's only trout stream mussel, the western pearlshell (*Margaritifera falcata*), has disappeared from many of our watersheds in relatively recent times. During 2006 & 2007, we reviewed western pearlshell occurrence records and systematically resurveyed sites of current and historic occupation in watersheds throughout the state. Twenty-five of the original 40 site records proved to be either absent or had non-viable mussel populations; only 7 of the 15 viable populations documented in 2007 were classified as having excellent integrity. Extensive field surveys and biologist training workshops continued in 2008, but only 4 additional viable populations were reported. Of the ~820 stream reaches (avg. length ~150m) surveyed over the course of 3 years, western pearlshell populations were absent from 660 (76 %) of the reaches and non-viable to severely declining from another 139 sites (16%). Sites with excellent population viability (9) were rare and represented disjunct metapopulations with little ability to colonize other stream reaches in the watershed. Because of this fact, the evaluation of current vs. previously occupied river miles and the severity of the decline, we officially placed this species on the Species of Concern list in November ranked an S2 (vulnerable to extirpation in the state). Introduction of non-native fishes, reduction of westslope cutthroat populations, reduced in-stream flows and warmer water temperatures have all been implicated in the decline of populations of the western pearlshell. Reintroduction of western pearlshells into westslope cutthroat trout restored stream reaches is currently being investigated.

PROPOSED COAL MINING AND COAL-BED METHANE DEVELOPMENT THREATEN AQUATIC RESOURCES IN THE TRANSBOUNDARY FLATHEAD ECOSYSTEM

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The Transboundary Flathead River basin in Montana (USA) and British Columbia (Canada) hosts one of the most diverse and unique aquatic ecosystems throughout North America. Migratory bull trout (*Salvelinus confluentus*) and non-hybridized westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) migrate from Flathead Lake upstream to the Canadian headwaters to spawn and rear, representing some of the last remaining strongholds in the basin. However, proposed open-pit coal mining and coalbed methane (CBM) drilling in the Canadian headwaters threaten water quality, invertebrate communities, and migratory fish populations downstream to Glacier National Park (GNP) and Flathead Lake. In response to these threats, a multi-agency, long-term research and monitoring program was initiated in 2005 to examine water and sediment chemistry, contaminant levels, aquatic habitat, and the distribution and genetic diversity of native fishes. Comparative data collected in the neighboring Elk River drainage, a system impacted by coal mining and CBM development, show increased nutrients and heavy metal concentrations in the water and lower invertebrate species richness than the Flathead. In 2008, basin-wide fisheries surveys were initiated and data were collected at 119 sites in Canada and GNP. Native fishes were found throughout much of the system, including proposed mining locations. Additionally, the highest quantity of bull trout redds in the system was detected immediately downstream of proposed mine sites. Continuation of these collaborative investigations will provide necessary baseline data to inform conservation and management decisions impacting this diverse and sensitive transboundary system.

ANALYSIS OF POPULATION METRICS TO ASSESS THE EFFICACY OF LAKE TROUT SUPPRESSION IN YELLOWSTONE LAKE, YELLOWSTONE NATIONAL PARK

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Introduced lake trout *Salvelinus namaycush* threaten to extirpate native Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* from Yellowstone Lake, Yellowstone National Park. The National Park Service removed nearly 280,000 lake trout from Yellowstone Lake between 1997 and 2007. Lake trout population size has not been estimated; therefore, it is difficult to determine what proportion has been removed. We evaluated several population metrics to determine if the removal program has caused the lake trout population to exhibit characteristics typical of overharvested populations. Biomass of lake trout harvested has increased through the duration of the suppression program and was 0.74 kg/ha in 2007. Catch-per-unit-effort of lake trout has increased in both targeted-removal and survey netting. Mean length at age declined from 2000 through 2006 for lake trout older than 8 years. Total annual mortality in 2007 was 37% for lake trout of ages 3 through 5 and 12% for lake trout over age 5. Population metrics do not indicate that lake trout suppression has been effective at reducing abundance in Yellowstone Lake, however, the quality of existing data limit the certainty of conclusions. Yield-per-recruit modeling indicates that growth overfishing may begin to occur when conditional fishing mortality exceeds 10% for lake trout of all ages. Spawning potential ratio computed with rates of mortality from 2007 was 0.14, and could be reduced to 0.04 with a conditional

fishing mortality rate of 20% for lake trout over age 5. An increase in fishing mortality of lake trout over age 5 may increase the effectiveness of lake trout suppression.

DETERMINING MORPHOLOGICAL AND BIOCHEMICAL PARAMETERS ASSOCIATED WITH EARLY OVARIAN FOLLICULAR ATRESIA IN WHITE STURGEON FEMALES

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In order to improve quality and yield of caviar in farmed white sturgeon, it is essential to correctly assess stage of ovarian maturity and avoid harvesting females with atretic ovarian follicles. To detect atresia by changes in blood plasma parameters, individual females (N=11) in the late phase of oogenesis were repeatedly bled and their ovaries biopsied before and after onset of ovarian atresia. Follicular atresia was induced by transferring females at Sterling Caviar, LLC, California from cold (10–13°C) to warm water (20°C). Follicle diameter increased and oocyte polarization indices decreased over time. Plasma testosterone and estradiol concentrations in fish with normal follicles were higher, compared to fish exhibiting early histological signs of follicular atresia, such as structural changes in the egg coat. Total plasma protein and calcium concentrations did not differ between fish with normal and regressing ovaries. In the future, our study may benefit sturgeon conservation propagation programs in Montana by improving techniques for detection of ovarian atresia in the late phase of oogenesis.

DISTRIBUTION, ABUNDANCE, AND AGE STRUCTURE OF JUVENILE BULL TROUT IN A TRIBUTARY TO QUARTZ LAKE, GLACIER NATIONAL PARK, MONTANA

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Lacustrine-adfluvial bull trout *Salvelinus confluentus* occupy lakes west of the Continental Divide in Glacier National Park (GNP), Montana. Research in GNP has focused primarily on the relative abundance of bull trout within lakes, patterns of connectivity among bull trout populations, and interactions between adult bull trout and nonnative lake trout *S. namaycush*. Consequently, there is little known about the ecology, abundance, and distribution of juvenile bull trout within headwater drainages in GNP. The expanding distribution and potential negative effects of lake trout on bull trout within GNP has made understanding the ecology of juvenile bull trout a high priority. This study documented the distribution, relative abundance, and age structure of juvenile bull trout in the Quartz

Drainage upstream of Quartz Lake. The study area included Quartz Creek and Rainbow Creek; a tributary that enters Quartz Creek about 1.25 km upstream of Quartz Lake. Juvenile bull trout were sampled using a backpack electrofishing unit; bull trout were enumerated and measured for length. Juvenile bull trout were distributed throughout the study area. Relative abundance of juvenile bull trout was greater downstream of the confluence of Quartz and Rainbow creeks than upstream. A bimodal length-frequency distribution suggested that the bull trout present were age 1 and age 2+. These data provide baseline information needed for future recovery efforts aimed at mitigating potential negative effects associated with lake trout colonization.

MONTANA UNAUTHORIZED FISH INTRODUCTIONS

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Montana Fish, Wildlife and Parks has maintained an unauthorized fish introduction database for more than 15 years that documents unwanted fish introductions across the state that have persisted long enough to be detected. The database currently covers 49 species of fish in 536 introductions in 298 waterbodies. Unauthorized introductions cover every drainage in the state and have caused impacts on native and recreationally important fish species, increased management costs, decreased recreational opportunity, and spread disease. Types and spread of introductions are discussed. The motivations behind illegal introductions are examined and linked to possible means of prevention and control.

SEASONAL DISPERSAL TENDENCIES OF SYLVAN DEER-MICE (*PEROMYSCUS MANICULATUS*) WITHIN MONTANA RANGELANDS

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We examined seasonal dispersal habits and timing of new infection by Sin Nombre virus (SNV) (as determined by recent acquisition of antibodies [seroconversion]) of sylvan deer mice (*Peromyscus maniculatus)* within two Montana rangelands over a three year period. The rangelands included a grassland and a shrub-steppe habitat. In Montana, both habitat types commonly contain peridomestic settings associated with the agricultural. Peridomestic environments are where most reported human cases of hantavirus pulmonary syndrome (HPS) originate (Armstrong et. al.1995). We trapped each site twice a month at two-week intervals accumulating 85,200 trap nights of effort and capturing 6,185 individual deer mice a total of 22,654 times. We documented a total of 980 dispersing individuals over three years. We found a positive correlation between the number of dispersing individuals and number of individuals captured at both sites. Our results demonstrated no statistically significant seasonal differences in the number of dispersing individuals. However, we did find seasonality in the timing of seroconverion combined with dispersal during spring and summer. Spring/summer bias in mice that seroncoverted and dispersed suggests that time is when deer mice are most likely to enter settings where humans are most likely to be exposed to SNV.

TEMPORAL COMPARISONS OF GREAT BLUE HERON (*ARDEA HERODIAS*) ROOKERY DISTRIBUTION, ABUNDANCE AND REPRODUCTIVE SUCCESS IN THE LOWER YELLOWSTONE RIVER BASIN

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In response to declining trend information from Montana Audubon Society, Breeding Bird Surveys, and as part of an ongoing effort to assess the status of eastern Montana's non-game wildlife and identify critical habitats, we assessed the distribution and abundance, occupancy and reproductive success of great blue heron (*Ardea herodias*) rookeries within the lower Yellowstone River Basin. We conducted an aerial census of the lower Yellowstone, Tongue and Powder river corridors to document existing rookeries. Rookeries were revisited prior to fledgling abondonment to assess reproductive success. We compared the distribution, abundance and reproductive success of rookeries along the lower Yellowstone River to data from similar surveys conducted in 1976 and 1988. Great blue heron rookery abundance and reproductive success were also compared to river flows during corresponding time periods.Between 1976 and 1988, active rookery abundance increased from 9 to 18 but declined back to 9 by 2008. The average number of occupied nests per active rookery for each time peroid was 14 in 1976, 16.8 in 1988 and 12.1 in 2008.Rookery distribution showed temporal variance, however, some areas supported rookeries during all survey periods. Reproductive success data were not available for 1976. Comparisons between 1988 and 2008 showed that the percentage of reproductively successful rookeries in 1988, when river flows remain primarily below average, was 61%. During 2008, when river flows were cosistantly above average, the percentage of successful rookeries decreased to 44%. Combine data suggests that great blue heron rookery abundance and reproductive success along the lower Yellowstone River fluctuates temporally in response to various ecological factors, yet to be fully understood.

MANAGING BLACK BEARS AND COUGARS WITH PEOPLE PROBLEMS

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The Flathead Valley area and most of northwest Montana is currently growing at a rate of 6% per year. Given the increasing human population and expanding residential development in the urban interface, there will continue to be bears and cougars living in close proximity to homes and human activity centers. During the 2007 and 2008 field seasons we received 774 and 881 black bear conflict calls, respectively, concerning incidents of some kind. Most of these black bear calls occurred between May 1 and November 30, during 2008 that results in 881 calls in a 7-month period or 126 calls per month or 4.1 calls per day – everyday. During the 2007 and 2008 field seasons we received 70 and 152 cougar conflict calls, respectively, concerning cougar conflicts of some kind. The 6 years previous to 2008 we received an average of 68 calls per year concerning cougar conflicts. This dramatic increase in cougar conflicts in 2008 reflects an increasing cougar population trend in the last few years. Through continued education efforts it will be possible to disseminate the best available information to pre-emptively reduce human / wildlife conflicts. The continued use of a bear trap to relocate or trap and aversively condition program will address bears that have already made a positive association with people or their dwellings. The continued response to cougar conflicts will reduce (though not eliminate) the potential public safety issues that exist anywhere there are healthy cougar populations. It is our hope that we will be able to maintain the public tolerance for these highly prized big game

animals in western Montana by maintaining this effective wildlife conflict, safety and education program.

BIRD DISTRIBUTION IN MONTANA: OPPORTUNITIES FOR PUBLIC INVOLVEMENT

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Montana's diverse landscapes provide habitat to a wide assortment of birds. Climate, ecology, and human activity can influence landscape changes and patterns of bird distributions across the state. Every year, birdwatchers, biologists, and landowners document the occurrence of common and rare bird species throughout Montana. The Montana Bird Distribution program promotes stewardship of birds and their habitats by using information gathered by Montana's citizens to track the distribution and seasonal occurrence of the 409 bird species documented in the state. Over 30 new species have been documented in the state of Montana since 1980 through this program. As of 2003, 29 species appeared to be increasing their distribution across the state (e.g., tundra swans, several flycatcher species) and 27 species appeared to be decreasing their distribution (e.g., stilt sandpipers, 2 species of rosy-finch). The Montana Bird Distribution partnership consists of Montana Audubon, Montana Bird Records Committee, Montana Natural Heritage Program, and Montana Fish, Wildlife and Parks. The Partnership collects observations by professional and nonprofessionals, maintains a high-quality database of observations, and disseminates information via a website and *P.D. Skaar's Montana Bird Distribution* book series. Publication of the next book edition is planned for 2010 and observations are due by December 31, 2009 for inclusion in this edition. Here we present examples from the previous edition and a tutorial on *Tracker*, the web-based system for contributing data points.

PATTERNS OF MOVEMENT IN BLACK-BACKEDWOODPECKERS

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Black-backed woodpeckers inhabit recently burned forests, forcing both sexes to regularly disperse during the course of their lifetime. Yet we know little about their pattern of dispersal, including both distance traveled and the range of habitat types colonized for reproduction. We collected genetic samples from 274 black-backed woodpeckers across North America. We found a large amount of gene flow across the boreal forest and used a simulation approach to test if this pattern is best explained by frequent colonization of burned patches. We then used the fire history in the boreal forest to estimate the average distance between fires to determine if burned patches are readily available for colonization. Finally, we estimated the average dispersal distance based on the genetic relatedness among birds in our study. In combination, this information can be used to help prioritize land management decisions, such as salvage logging, that affect black-backed woodpecker populations.

A GIS TOOL FOR CONDUCTING LANDSCAPE-SCALE HABITAT QUALITY ASSESSMENTS

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Evaluating and quantifying human impacts and improvements to wildlife habitat at large scales is a continuing challenge for wildlife managers. To help such evaluations, we have developed a GIS-based habitat modeling tool that quantifies the number and quality of home ranges for species of interest in existing, historical, or potential future landscape conditions. We used this tool in a 1.5 million acre landscape in northern Idaho to model habitat-based species viability for 8 species of concern. This presentation will focus on the results for Canada lynx, northern goshawk, and flammulated owl. We developed habitat potential maps at the scale of the home range for each species. Models were created for existing, historical, and predicted future habitat conditions. Future habitat conditions were projected based on an objective of maintaining or restoring 20% representation of historical conditions. Model runs were used to produce an estimate of the number of high, moderate, low, and very low quality home ranges, with implications from this for likely persistence of each species. Improvements in future habitat quality varied among the species, but improved the most for those species dependent upon drier forest types where greater restoration efforts are needed and planned. The ability to model habitat-based species viability allows land managers to estimate the impacts or improvements to wildlife species of concern that are likely to result from development, management or restoration activities.

LIFETIME MOVEMENT PATTERNS OF CUTTHROAT TROUT IN A STREAM NETWORK

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Although recent research has emphasized the ubiquity of movements in freshwater fish life histories, the timing, prevalence, and extent of these movements remain contentious. I used juvenile-adult distributions, PIT tagging, and turnover rates of unmarked fish to assess lifetime movement patterns of Colorado River cutthroat trout throughout the 40-km North Fork Little Snake River watershed in southern Wyoming from 1996 to 2001. Turnover rates indicated that about 30% of fish moved an average of at least 100 m annually. Juvenile and adult fish exhibited little spatial overlap in about half of the stream segments in this basin, and length-frequency discrepancies between tributary and main-stem fish implied widespread movement of fish age 2 and younger. About 40% of recaptured PIT-tagged fish were mobile. The probability of movement was related to the length of time between first and last capture and to specific growth rate, but not to fish length or condition. Fish marked in tributaries were less likely to move and moved shorter distances than did fish marked in the main stem, but fish from both sources were most likely to move upstream between captures. Median movement was 300 m and many fish moved several kilometers and between tributaries and the main stem, but migration barriers appeared to influence movement in some areas. These complex movement patterns support the conclusion that even slow-growing salmonids in small streams regularly alter their positions to feed, grow, reproduce, and seek refuge from unfavorable environments.

POSTER ABSTRACTS – Alphabetical Order by First Author's Last Name

RESPONSE OF NON-TARGET ORGANISMS FROM ROTENONE TREATMENTS WITHIN THE EAST FORK SPECIMEN CREEK DRAINAGE, YELLOWSTONE NATIONAL PARK

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Fish removal by rotenone applications is a highly effective fish management tool. However, rotenone is nondiscriminatory and can have negative impacts on non-target aquatic organisms. In 2004, Yellowstone National Park staff began planning a native fish restoration project within East Fork Specimen Creek. We conducted pre- and post- treatment monitoring on invertebrate communities throughout the drainage and on amphibian populations in the vicinity of High Lake, a 7 acre headwater lake where initial rotenone treatments took place. In August 2006, fish in High Lake were chemically removed using rotenone (CFT-Legumine). CFT Legumine is a relatively new formulation of rotenone in the United States that doesn't contain petroleum hydrocarbon solvents that are used in traditional rotenone formulas. As a result, CFT Legumine is likely less harmful to the environment but affects on non-target organisms, such as invertebrates and amphibians, are poorly understood. Among invertebrate populations, both pre- and post- treatment studies indicate that midge larvae were the most common invertebrate groups in the stream and lake benthos with increasing densities after rotenone treatment. Results from the stream invertebrate samples indicate that mayfly, stonefly, and caddisfly larvae were most susceptible to rotenone with some taxa experiencing 100% mortality. One year after treatment, however, most taxa had recovered with densities exceeding pre-treatment conditions. Higher invertebrate densities could be a result of the absence of fish predation the year following treatment. Similarly, larval amphibians appeared to experience 100% mortality from the initial rotenone application but tadpoles were observed in greater numbers one year post-treatment.

IMPACTS OF TWO SMALL DAMS ON MIGRATORY BULL TROUT IN THE CLEARWATER RIVER, MONTANA

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Dams are well known for their negative impacts on fish populations, and dam removal decisions are becoming increasingly common. In collaboration with Montana Fish, Wildlife and Parks and the U.S. Forest Service, we used radio telemetry to explore the impacts of the small Emily-A and Rainy Dams on movement of migratory bull trout (Salvelinus confluentus) throughout the Clearwater River Drainage. We captured a total of 88 adfluvial bull trout or bull trout/brook trout (Salvelinus fontinalis) hybrids below the two small dams, primarily by angling. We implanted radio tags in 31 fish and released them above the dams, passing a total of 75 fish in 2007-2008. We monitored their movements and those of 27 other bull trout tagged in the surrounding lakes. The Emily-A is a complete upstream migration barrier, whereas Rainy is a partial barrier. Ninety-seven percent of the radio tagged fish we moved over the dams swam into one of three previously unknown spawning tributaries and

presumably spawned. Although we passed a relatively large number of bull trout, redd counts were low, and we estimated only 13% detection probability at the dams. In one tributary, approximately 40-47% of the spawning adults were fish we passed over the Emily-A Dam. Post-spawning mortality rates were high and attributed primarily to predation. Our data suggests that the dams have large impacts on population sustainability, and will contribute to the decision-making process involving dam modifications or removal to balance the benefits of upstream passage for native fish with the risk of expansion by undesirable non-native fish.

MANAGEMENT OF ANTHROPOGENICALLY DERIVED HYBRID POPULATIONS: EXPLICIT RECOGNITION OF ASSUMPTIONS

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Hybridization and introgression between native and introduced species is one of the most challenging issues currently facing fisheries managers. While recognizing we are simplifying arguments, we suggest two hybrid management paradigms have emerged. The first posits that as long as introgression is at moderate to low level, and the resulting hybrids are morphologically and ecologically similar to the native taxon, they should be considered a member of the parental species. The alternative view suggests that conservation efforts should be focused on pure native genomes that have evolved in response to localized selective pressures and hybridized populations are a conservation threat. We suggest that both management approaches are based on a few key assumptions about the nature and ultimate outcome of hybrid fitness and ecology. Although these assumptions are implicit in the arguments presented by both sides of the debate, neither the assumptions nor the management implications of violations of those assumptions are consistently clarified and discussed. In our poster, we present a framework that addresses various assumptions surrounding hybridization in cutthroat trout *Oncorhnchus clarkii* populations by introduced rainbow trout *O. mykiss* and the ecological outcomes each assumption would predict. We further suggest hybridization management actions should have clearly defined goals and be explicit about their assumptions. Finally, we provide an example of our framework applied to a common management action used to manage hybrid invasions: the use of barriers.

IDENTIFYING LAKE TROUT SPAWNING LOCATIONS IN SWAN LAKE, MONTANA

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Knowledge of spawning locations is critical to the management of invasive lake trout *Salvelinus namaycush* populations by providing areas to efficiently target sexually mature fish. In Swan Lake, Montana spawning locations were identified using acoustic telemetry, short-set gill nets, and in-situ

egg nets. Telemetry locations were recorded manually after dark with a directional hydrophone from mid-October to mid-November in 2007 and 2008. Two primary sites were identified as potential spawning areas based on kernel-density analysis of 2007 telemetry locations. In 2008, thirty in-situ egg nets were buried by SCUBA divers at each of the 2007 locations to confirm egg deposition. One gill net (274.2-m long X 2.4-m deep with 5.08-cm bar mesh) was set at each primary spawning location once weekly through the tracking period in 2008 to confirm the presence of ripe lake trout and to explore the efficacy of targeting adult lake trout for removal at these locations. Kernel-density analysis of telemetry data identified the same primary spawning locations in 2008. Catch per unit effort of adult lake trout was over four times greater at these locations versus lake-wide gill netting. Egg density varied from 38 eggs/m^2 to 114 eggs/m^2 at the two spawning locations. Lake trout spawning locations were confirmed in Swan Lake, Montana. We recommend targeting these areas as an effective option for removing adult fish from the population.

LAKE TROUT REMOVAL EFFORTS CONTINUE IN YELLOWSTONE LAKE

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Abstract Lake trout removal efforts in Yellowstone lake began in 1995, the year following documentation of this non-native fish in Yellowstone Lake. The objective of the removal program is to reduce lake trout to the point where they have a negligible effect on the native Yellowstone cutthroat trout. Lake trout capture techniques have focused on mechanical, mostly gill netting, and more recently electrical methods. The lake trout infestation in Yellowstone Lake continues while fishery managers remove greater numbers of lake trout every year, 76,140 lake trout were removed in 2008, and 348,794 have been removed since 1995. Amount of gill net effort has increased every year with the exception of 2008, total effort is mainly dependent on ice-off dates, and seasonal crew staffing and experience. Removal strategies target both adult and juvenile components of the population. Catch per effort of juvenile lake trout has steadily increased since 2002 with 2008 being the highest on record (5.0 lake trout per 100 m gill net set per night) since 1998. However, cutthroat trout have not shown a positive response to lake trout removal efforts. Numbers of spawning cutthroat trout in Clear Creek, a tributary to Yellowstone Lake, are at the lowest levels ever recorded with just 538 counted. Yellowstone cutthroat trout gill net assessment, which averaged over 15 fish/net in 1994, has averaged approximately 9 fish/net over the past 5 years. The continued suppression of lake trout is imperative for there to be a healthy Yellowstone Cutthroat trout population in Yellowstone Lake.

RESTORING THE BALANCE: THE FISH & WILDLIFE PROGRAMS AT THE CRESTON FISH & WILDLIFE CENTER

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The Creston Fish & Wildlife Center is a U.S. Fish & Wildlife Service facility located in Creston, Montana. There are three FWS programs working from the Center; the Creston National Fish Hatchery, Ecological Services and Partners for Fish & Wildlife. These programs work with partners and stakeholders to protect and conserve wildlife habitat, and to restore and enhance the fish and wildlife species who occupy these healthy habitats. This poster provides an introduction to the programs at the Center and a sampling of the species they strive to preserve.

ARCTIC GRAYLING EMERGENCE AND DEVELOPMENT IN ODELL CREEK, RED ROCK LAKES NATIONAL WILDLIFE REFUGE, MONTANA

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Red Rock Lakes National Wildlife Refuge in southwest Montana supports the last endemic population of adfluvial Arctic grayling (*Thymallus arcticus*) in the contiguous United States. The population has been declining for the last several decades and there is concern about its persistence on the Refuge. The goal of this study was to understand how Odell Creek is contributing to the maintenance of this critical population by investigating its use as a spawning stream and rearing ground for grayling fry as well as inventorying overall habitat. Surveys were conducted in 2006 and 2007 to determine the timing of spawning and emergence, to track fry movement in the creek and to make determinations about fry habitat selection. In 2006, 1868 fry were observed throughout the survey period with fry showing apparent movement downstream. During the same period in 2007 only 311 fry were observed. The majority were concentrated at the creek mouth. An a priori suite of models determined that there was little correlation between fry abundance and habitat. The most important parameter for fry abundance in 2006 was water velocity. Fry >30 mm were rarely observed, at this life stage they have improved swimming ability and are able to select different habitat types. Odell Creek's habitat was surveyed and determined to be a suitable grayling stream. The difference in fry abundance between years appears attributable to timing and intensity of spring runoff which affects spawning and incubation periods. This indicates the importance of climate as a factor affecting this population.

MODELING PREDICTED DISTRIBUTION AND LANDSCAPE-LEVEL HABITAT SUITABILITY FOR MONTANA WILDLIFE SPECIES

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Models predicting spatial distribution and habitat suitability are critical for natural resource managers making decisions that impact species for which there is limited information. We are using presence-only data in conjunction with pseudo-absences in program Maxent to model the distribution and landscape-level habitat suitability for Montana wildlife species. Our primary goals are to produce: (1) continuous statewide outputs as a tool to identify variables that limit species' distributions and areas that need field surveys; (2) binary outputs that can be used to create lists of predicted species for various administrative boundaries and, (3) outputs showing marginal, suitable, and optimal habitat classes at a local landscape-level. To date, models have identified scale dependent responses to environmental variables, opportunities to extend the known ranges of species, areas that support potentially isolated populations in need of conservation efforts, areas that are critical for maintaining landscape connectivity, areas that may provide the best habitat for reintroduction of species that have

declined, and areas where exotic and nonindigenous species are most likely to become established. In general, inductively based Maxent models provide realistic depictions of species distributions when survey data is available for a region. However, deductive models will still be important for representing some species distributions in areas lacking survey effort. Models will be used for various planning efforts including Montana Fish, Wildlife, and Parks' Crucial Areas and Corridors Assessment. Model outputs can be obtained from the Montana Natural Heritage Program or the Montana Fish, Wildlife, and Parks' Information Management Bureau.

STATUS OF LENTIC BREEDING AMPHIBIANS AND AQUATIC REPTILES IN MONTANA

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We developed a statewide inventory and monitoring scheme for lentic breeding amphibians and aquatic reptiles in Montana. We stratified sampling by 11 ecoregions and surveyed 6,741 potential lentic sites on public lands between 2000 and 2008 within 429 randomly selected 12-digit hydrologic-unit-code watersheds. Surveys and associated incidental observations have resulted in over 11,400 species occurrence records to date. Watershed and site breeding rates of 10 amphibian species and occupancy rates of 4 aquatic reptile species support previously noted declines of the Western Toad (*Bufo boreas*) and Northern Leopard Frog (*Rana pipiens*) in western Montana. We used classification trees to examine patterns in rates resulting from different groupings of major habitat features that are able to be affected with management actions. Seven of the 10 amphibian species and the Common Gartersnake (*T. sirtalis*) were detected at significantly fewer sites when fish were detected. The presence of emergent vegetation was positively associated with the proportion of sites where breeding or occupancy was detected for all but one of the amphibian and reptile species examined and appeared to partially mitigate the presence of fish. Resource managers could enhance habitats for wetland herpetofauna by (1) creating new lentic sites on the landscape either directly or through the reintroduction and protection of beaver, (2) creating emergent vegetation at portions of existing sites that currently lack it via rotational fencing to temporarily exclude grazing, and (3) eliminating some introduced fish populations. All observations and survey locations, including digital photographs of sites surveyed are available at: http://nhp.nris.state.mt.us/Tracker.

THE PATHOGENIC CHYTRID FUNGUS, BATRACHOCHYTRIUM DENDROBATIDIS, IN MONTANA AMPHIBIANS

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The chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), is pathogenic to many amphibians and has been linked to declines and extinctions in a number of species around the globe. We collected 484 tissue samples and swabs of ventral surfaces of 9 species at 161 locations across Montana in the course of fieldwork between 1998 and 2005. We detected Bd in 161 samples taken at 64 sites between 1998 and 2005 for 6 species; *A. tigrinum*, *B. boreas*, *B. woodhousii*, *P. maculata*, *R. luteiventris*, and *R. pipiens*. Overall, 40 percent of sites had at least one species test positive and, across all species, 33 percent of samples tested positive. We detected Bd in samples taken throughout the active season of these species across Montana at a variety of elevations, in a variety habitats, and up to 17.5 km from the nearest road. However, a higher percentage of samples and sites (37 to 41 and 47 to 66 percent, respectively) tested positive for Bd within 1 km of roads. While this effort provides no definitive evidence, Bd, acting alone or synergistically with other stressors, appears to be the most likely cause of declines observed in *B. boreas* and *R. pipiens* populations in western Montana in light of its widespread distribution and association with declines in other regions. Further evaluation of the status of Bd and other amphibian pathogens in Montana is warranted and strict adherence to protocols preventing the spread of these pathogens is needed.

IMPROVING SCIENCE LITERACY THROUGH VISUAL COMMUNICATION

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Communicating science effectively to diverse audiences including natural resource managers, policy makers, and the general public, has broad implications for implementing science-based solutions to environmental problems such as those associated with non-native species invasions. If audiences are able to understand and assess scientific information, they are more likely to make decisions based on facts rather than on hearsay or speculation. Frequently, popular press articles on invasive species are designed to promote fear-based responses. Previous work in an ecological publication identified that even invasion biologists use militaristic and combative language as metaphors, often leading to an inaccurate perception of invasive species and loss of scientific credibility, which can be counterproductive to achieving conservation and management goals. Scientists and educators are natural collaborators to increase the science literacy about the biology and ecology of non-native species invasions to audiences, while consistently maintaining scientific integrity and credibility. Further, as increasing numbers of research granting entities require an outreach and education

component in project proposals and outputs, proven ability to effectively present and disseminate scientific information to diverse audiences is becoming highly valued. This poster presents examples of how visual design strategies and learning theory can be used to engage audiences and communicate science effectively.

SEROPREVALENCE OF CANINE PARVOVIRUS AND CANINE DISTEMPER IN WOLVES (*CANIS LUPUS*) IN RELATION TO HUMAN ACTIVITY IN THE CANADIAN ROCKY MOUNTAINS

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Diseases affect social carnivores that occur in high density areas, like wolves (*Canis lupus*). Carrier species (feral dogs, coyotes, foxes) travel between the urban/wildlife interface; thus, transmitting diseases to wolves. We sampled 99 wolves from the years 2000 to 2008 for canine parvovirus (CPV) and canine distemper virus (CDV) in Banff and Jasper National Parks and surrounding areas of the Canadian Rockies. Of the 99 wolves, 92 tested positive for CPV, 22 tested positive for CDV and 22 tested positive for both diseases. We tested whether seroprevelence of CPV and CDV was higher closer to human activity (roads, town sites, campgrounds, federally designated Indian reserves) and as a function of sex, age class, and different wolf packs using mixed-effects logistic regression models. CPV and CDV seroprevalence was found to be higher in areas closer to human activity and was higher in younger age classes of wolves. Understanding disease transmission between urban areas and wildlife areas with high wolf densities, like the Canadian Rockies, could yield pertinent information about disease profiles. Disease profiles from the Canadian Rockies could help conserve the recently delisted wolf species in areas like Yellowstone National Park where human activity is high relative to wolf activity.

ARE RESERVOIRS ECOLOGICAL SINKS FOR RECRUITMENT OF PALLID STURGEON?

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Natural recruitment of pallid sturgeon *Scaphirhynchus albus* in the Missouri River upstream of Fort Peck Reservoir has been nonexistent for at least four decades. Deviations from the natural river morphology are likely driving the lack of natural recruitment. An obligate riverine species, pallid sturgeon require large drift distances (> 245 km) before transitioning to benthic habitats. Insufficient lotic habitat downstream from hatch locations because of river impoundment is one hypothesis for the lack of pallid sturgeon recruitment. During 2008, we sampled the aquatic habitat in the headwaters of Fort Peck Reservoir. The headwaters were described as separate habitat units based on visible characteristics (i.e., "river," "transition zone," "side channel," "lake," and "reference"). Velocity decreased longitudinally through the headwaters of Fort Peck Reservoir suggesting that there is insufficient drift distance for pallid sturgeon to transition through the larval stage. Water-quality data examined at the diel scale indicated abrupt changes in temperature, dissolved oxygen, and pH that may negatively influence larval pallid sturgeon. These diel fluctuations in water quality parameters correlate with an increase in discharge from Canyon Ferry Reservoir. Further research includes spatial analysis of larval drift dynamics, evaluating larval sturgeon survival under fluctuating water-quality conditions, and experimentally evaluating larval pallid sturgeon survival in the headwaters environment.

MOVEMENT AND SPAWNING LOCATIONS OF SHOVELNOSE STURGEON AND PALLID STURGEON IN THE MISSOURI RIVER ABOVE FORT PECK RESERVOIR

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The lack of recruitment by pallid sturgeon *Scaphirhynchus albus* over that last 40 years in the Missouri River above Fort Peck Reservoir has caused their abundance to decrease to less than 150 individuals. Interestingly, shovelnose sturgeon *Scaphirhynchus platyrhynchus* exhibit recruitment in the same area and their abundance is higher than most other rivers in the U.S. Understanding the dichotomy between the two species with respect to recruitment is receiving much attention throughout the Mississippi River basin. The objectives of this study are to identify spawning locations and the effects of varying

discharge on spawning locations and spawning movements for pallid sturgeon and shovelnose sturgeon. Two pallid sturgeon and 39 shovelnose sturgeon were radio tagged and tracked from 1 May 2008 to 5 July 2008. Unfortunately, no data is available for pallid sturgeon movement due to small sample size and loss of one of the radio-tagged fish mid-study. Seventy-four percent of the shovelnose sturgeon moved downstream during the spawning period. Of those that moved downstream the average movement was 39 km. One fish moved 123 km downstream and this was the largest movement of any fish tracked. Only 26% of the shovelnose sturgeon moved upstream and their average movement was 51.5 km. Shovelnose sturgeon concentrated in two areas during the spawning period; river kilometer 3090 to 3190 and 3235 to 3270. These data will provide a greater understanding of sturgeon *Scaphirhynchus* spp. spawning movements and spawning locations in the upper Missouri River and will help guide management decisions aimed at recovery of pallid sturgeon.

LARGE WOODY DEBRIS DEPLETION RATES IN WESTERN MONTANA STREAMS

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Maintenance of in-stream habitat diversity through recruitment of large woody debris (LWD) is a principal goal of Plum Creek Timber Company's Native Fish Habitat Conservation Plan (NFHCP). Because LWD loads are governed by long-term processes such as riparian tree growth and mortality, direct measurement of LWD to judge effectiveness of management actions is unlikely to provide timely feedback for adaptive management. Instead, trends must be forecast using models. For the NFHCP, the Riparian Aquatic Interaction Simulator (RAIS, Welty et al. 2002) was used to support development of riparian management options. To help validate this model, several key assumptions are being field-tested as part of the NFHCP's adaptive management program. This study examines the effects of channel size and gradient on annual in-stream LWD depletion rates. Thirty-one sample sites were randomly selected from among a pool of stream segments that represent combinations of channel types and sizes for perennial streams on Plum Creek lands. At each 100-m site, all pieces of LWD with minimum qualifying dimensions of 10-cm diameter and 2-m length in zones 1-3 (Robison and Beschta 1990) were tallied and marked with numbered aluminum tags. Resurveys of these sites were completed in 2007. This poster summarizes five-year LWD depletion rates, and the factors most associated with LWD movement.

MONTANA UNAUTHORIZED FISH INTRODUCTIONS

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Poster display will consist of a map of Montana with illegal fish introduction locations marked by symbols. Display would include a list of species and distribution by region. A copy of the database would be available with an invitation for fisheries personnel to review their area and report any fish introductions not yet documented. Report forms would be available.

Montana Department
of
Fish, Wildlife & Parks