MONTANA CHAPTER

of the

AMERICAN FISHERIES SOCIETY

Communicating Fisheries Science in an Increasingly Skeptical Environment

Cover and Insert Photo: Sean Heavey Photography. Glasgow, MT

About the American Fisheries Society 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 the 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 composed of approximately 250 fisheries professionals affiliated with state and federal agencies, universities, and private industry across the state. This is the major gathering of the year for fisheries professionals of all affiliations from across the state. It is a great opportunity to learn about what is happening in the management and conservation of fisheries resources in Montana and explore timely issues.

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(National Park Service)

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Acknowledgements

THANK YOU to the members of MTAFS Executive Committee and past officers for their help and guidance in setting up this year's meeting. Thanks to Ladd Knotek for help with the plenary. Scott Opitz for helping with the meeting logistics, Earl Radonski and Ben Bailey for assisting with the raffle, off-site social and beer. Thanks to all of the plenary speakers for bringing your perspectives to our group on a very challenging topic that we are all facing. Thanks to all the committee chairs, student sub-units (raffle, fish trivia and volunteering), speakers, moderators, sponsors and vendors for helping to make this meeting happen. Thanks to Michael Fraidenburg of The Cooperation Company for his excellent Continuing Education program. Special thanks to Sam Bourett and Nathan Cook for their talents and energy putting together a great Newsletter and making the MTAFS webpage the best! Finally, thank you to all the Federal Government employees that have been so negatively affected by the partial government shutdown. Thanks for your continued support of MTAFS even through these difficult times.

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Trade Show Exhibitors

Welcome to the 52nd annual meeting of the Montana Chapter of the American Fisheries Society. I want to extend my sincere thanks to all of you for making the effort to attend this year's meeting. Billings is a long way for many of you and winter travel is hectic even if we are in a El Niño pattern! In addition, the Federal Government shutdown has had a huge impact on our members that have been furloughed during much of the planning and implementation of this meeting. Because of this, many of our members will not be in attendance. We are a weaker body without you. Certainly, our hope is that issues get resolved and you can return to your jobs that are so vital to the management and protection our valued aquatic resources.

At the risk of bending towards hyperbole, there has never been a more important time to be a scientist. In the age of "facts are relative", objective science and accurate, unbiased interpretation of results is at a premium. How do we as fisheries professionals continue to communicate with scientists and nonscientist about an underwater resource in the face of heightened skepticism? My goal with this year's meeting theme is to stimulate discussion and self-evaluate how we approach our craft and how we communicate our results.

In a recent article entitled, The Language of Conservation: Updated Recommendations on How to Communicate Effectively to Build Support for Conservation by FM3 Research, survey respondents were asked what they think of when they hear the phrase "the environment". More voters pointed to water than anything else. Protecting drinking water and protection of oceans, lakes, rivers and streams and the fish that live in them were "very important" to the majority of respondents (72%-87%). Furthermore, Biologists ranked near the top of most trusted occupations with an 85% "Total Trust" rating. Firefighters topped the list at 92% while Hunters and Fisherman were near the bottom at 73%. This parallels the April 2018 Tulchin Research poll (run to determine support for pallid sturgeon recovery in Montana) that again shows that the public finds Scientists and Biologists high on a "believability" scale. Scientists scored an 86% and Biologists scored 83% in this bi-partisan survey.

The fact that the public places high value on clean water and associated resources AND finds Biologists and Scientists trustworthy is a good position to be in! This is a direct result of the fisheries professionals that have gone before us and paved the way, standing strong on the science and advocating for what was best for the fish. It is also a testament to the hard work that every one of you do and your steadfast passion for the fisheries resources in Montana. Thank You!

Sincerely,

Steve Dalbey

Schedule at a Glance

Date/Time	Event	Location
Monday, January 28		
2:00 PM—6 PM	EXCOM Meeting	Conference Rm 4

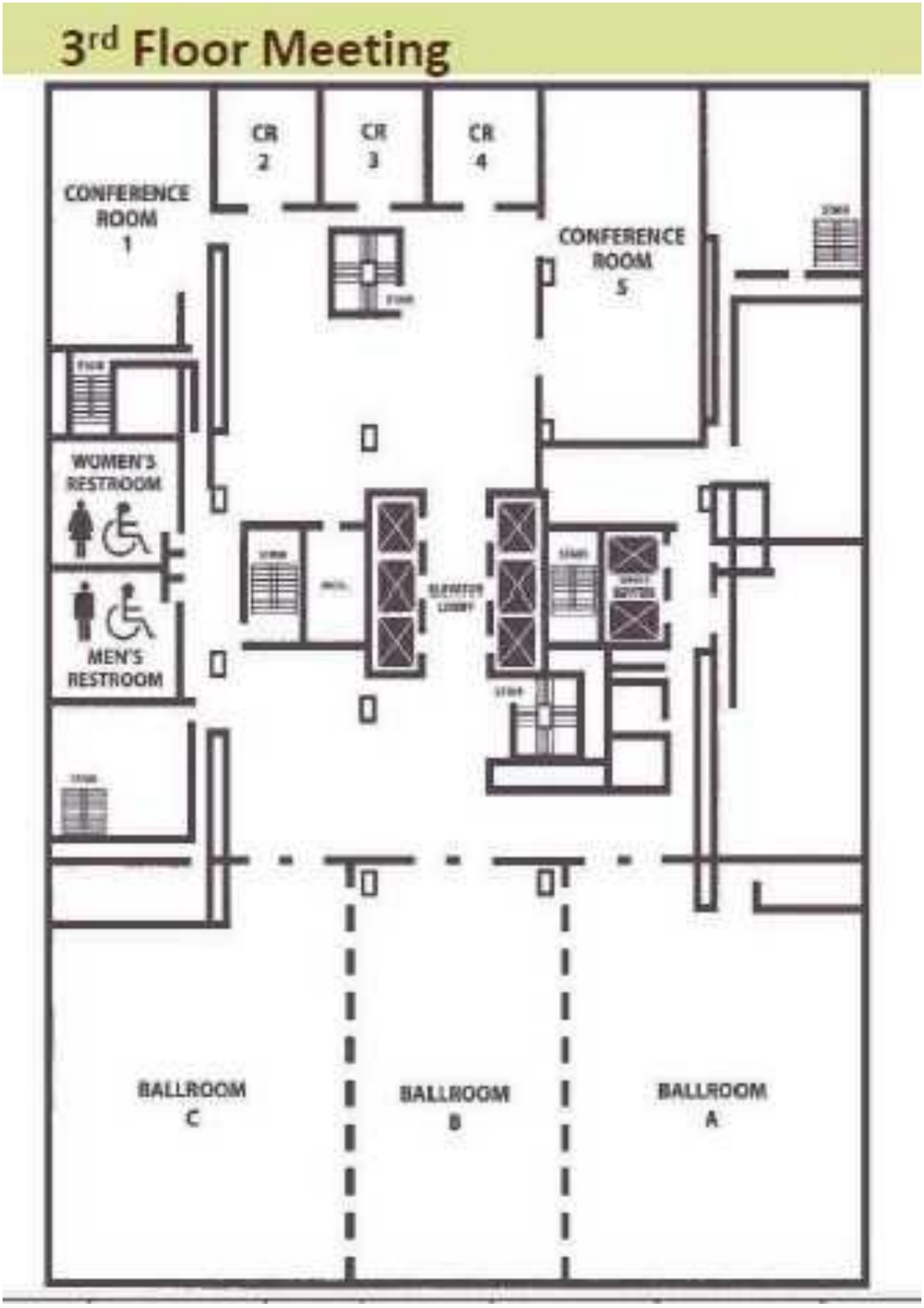
Date/Time	Event	Location
Tuesday, January 29		
10:00 AM	Continuing Education - Persuasive Communication with a Skeptical Audience Michael Fraidenburg—The Cooperation Company	Con Rm 4
1200 noon	Lunch on your own	
1:00 PM–5:00 PM	Continuing Education	Con Rm 4
6:00 PM-9:00 PM	Welcome Social and Hours d'oeuvres	North Foyer

Date/Time	Event	Location
Wednesday, January 30		
7:00 AM	Registration	South Foyer
7:00 AM	Breakfast	South Foyer
8:00 AM	Trade Show Ongoing	South Foyer
8:00 AM	Plenary Session	
9:30-10:00	**Break**	North Foyer
1000	Contributed Papers	Ball BC
1200	Lunch on your own	
1:00 PM	Contributed Papers	Ball BC
3:00-3:20	**Break**	
3:20 PM	Symposium-Beaver and Fish	Ball BC
5:30-6:00	Committee Caucuses	Various Rooms
6:00 PM	Trade Show	South Foyer
6:30-9:00 PM	Plenary speaker appreciation social	Pub Station
6:30-9:00 PM	Student Mentoring and Fish Trivia	Pub Station

Date/Time	Event	Location
Thursday, January 31		
7:00 AM	Registration/Breakfast	South Foyer
8:00 AM	Trade Show Ongoing	South Foyer
8:00 AM	Symposium: A Teacher, Reporter, Politician, Biologist, and a Fish Walk into a Bar…, How Do They Effectively Connect for the Future of Conservation?	
0935 AM	**Break**	
10:00 AM	Contributed Papers	Ball BC
11:30 AM	Business Lunch (buffet in South Foyer/Eat in Ballroom A)	Ballroom A
1:00 PM	Symposium: ~28 Years Later: Progress and prospects in the recovery of Pallid Sturgeon in the Upper Missouri River Basin since listing (1990-2019)	
2:45 PM	**Break**	North Foyer
3:10 PM	Pallid Sturgeon (continued)	Ball BC
4:30 PM	End Session	
5:00 PM	Montana Association of Fish and Wildlife Biologists meeting	Various
6:00 PM	Poster Session / Evening Social	North Foyer
7:00 PM	Trade Show Concludes	
7:00 PM	Awards banquet and raffle	Ballroom A

Date/Time	Event	Location
Friday, February 1		
7:00 AM	Breakfast	South Foyer
8:00 AM	Contributed Papers	Ball BC
10:00-10:20	**Break**	**South Foyer**
10:20	Contributed Papers	Ball BC
12:00 noon	Adjourn. Thank you for attending, travel safe.	

VENUE MAP


3rd Floor Meeting
CR 2
CR 3
CR 4
CONFERENCE ROOM 1
CONFERENCE ROOM 5
WOMEN'S RESTROOM
MEN'S RESTROOM
BALLROOM C
BALLROOM B
BALLROOM A

Continuing Education

Persuasive Communication with a Skeptical Audience

Gain the Edge in Difficult Situations

Presented by:

Michael Fraidenburg

Mike is the principal of The Cooperation Company, a firm best known for its work on improving the management effectiveness of natural resource agencies through conflict resolution and strategic thinking. He is a member of the National Speakers Association Northwest, a Senior Mediator at the Thurston County Dispute Resolution Center, Washington Mediation Association Certified Mediator, and American Fisheries Society Certified Fisheries Professional.

Tuesday, January 29, 2019

Conference Room 4

10:00	**Welcome, Logistics, Set Up Practice Teams**
10:10	**Introductions**
11:30-1:00	**Lunch (on your own)**
1:00	**Practice Teams**
3:15-3:30	**Break**
5:10	**Adjourn**

Michael Fraidenburg, Owner
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THE COOPERATION COMPANY

THE 52nd ANNUAL MEETING OF THE MONTANA CHAPTER OF THE AMERICAN FISHERIES SOCIETY

Agenda

Wednesday, January 30, 2019
Plenary Session
Moderator: Ladd Knotek

8:00	**Welcome &Introduction of Plenary Session:** Steve Dalbey (Montana Fish, Wildlife & Parks)
8:15	Kathleen Williams
8:45	Dr. Steven Running
9:15	**When All Else Fails: Politics and Public Support for Conservation and Recovery of Pallid Sturgeon, Pat Byorth** (Montana Trout Unlimited)
9:45	**Break**

Contributed Papers — Co-Authors are listed in abstract section of the program
**** Indicates Student Paper**
Moderator: Brad Schmitz

10:00	**Using Recreational Catch and Release Snagging at Intake as a Paddlefish Management Tool,** Caleb Bollman (Montana Fish, Wildlife & Parks)
10:40	**Recruitment of paddlefish: hypotheses, evidence and implications** Dr. Dennis Scarnecchia (University of Idaho)
10:40	**An Evolving Fishery: Balancing Resource Management While Maintaining Traditional Angling Experiences During the Upper Missouri River Paddlefish Season** Cody Nagel (Montana Fish, Wildlife & Parks)
11:00	****Survival, Abundance, and Exploitation of Paddlefish in the Missouri River above Ft. Peck Reservoir** Haley Glassic (Montana Cooperative Fishery Research Unit)
11:20	**Movements of Native Fish Species at Intake Diversion Dam on the Yellowstone River, Montana. Matt Rugg** (Montana Fish, Wildlife & Parks)
12:00	**Lunch**

Contributed Papers — Co-Authors are listed in abstract section of the program
**** Indicates Student Paper**
Moderator: Patrick Uthe

1:00 **Prioritizing Montana Lakes for Prevention of Illegal Fish Introductions** Samuel Bourret (Montana Fish, Wildlife & Parks)

1:20 ****Experimental test of genetic rescue in isolated westslope cutthroat trout populations,** Donovan Bell

1:40 **Evaluation of Factors Limiting Rainbow Trout Growth on the Kootenai River Downstream of Libby Dam** Jim Dunnigan (Montana Fish, Wildlife and Parks)

2:00 **Selecting for a Legacy: Suppressing Hybrid and Rainbow Trout as a Conservation Strategy for Migratory Westslope Cutthroat in the Upper Flathead River Drainage** Amber Steed (Montana Fish, Wildlife and Parks)

2:20 **The differential controls of stream temperature and non-native brook trout on Yellowstone cutthroat trout in the Teton River, Idaho and Wyoming** Robert Al-Chokhachy (U.S. Geological Survey)

2:40 ****Patterns in the distribution, size, and ecology of non-native smallmouth bass in the Yellowstone River** Nicholas Voss (Montana Cooperative Fishery Research Unit, Montana State University)

3:00 **Break**

SYMPOSIA: Beavers and Fish An update on the current science, mimicry practices, and administration. Moderator: Peter Brown
Co-Authors are listed in abstract section of the program
**** Indicates Student Paper**

3:20 ****Reviewing the effects of beavers on aquatic ecosystems** Andrew Lahr (University of Montana)

3:40 **Best practices for construction of Beaver Dam Analogs (BDAs) and other beaver mimicry structures,** Amy Chadwick (Great West Engineering)

4:00 **BDA Projects on Federal Lands: Cherry Creek and North Derby Gulch Case Studies** Clint Sestrich (Custer Gallatin National Forest)

SYMPOSIA: Beavers and Fish An update on the current science, mimicry practices, and administration. Moderator: Peter Brown
Co-Authors are listed in abstract section of the program
**** Indicates Student Paper**

4:20 **Using monitoring and modeling to explore how beaver-mimicry stream restoration affects dynamic seasonal water storage** Andrew L. Bobst (Montana Bureau of Mines and Geology)

4:40 **A parafluvial response to Beaver Dam Mimicry in the Centennial Valley, MT** Briana Whitehead (Montana State University)

5:00 **Beaver Restoration Assessment Tool in Montana** Claudine Tobalske (Montana Natural Heritage Program)

5:20 **Adjourn**

6:00 **Evening Social at the Pub Station**

⇒ **Student Mentoring Session & Fish Trivia**

⇒ **Plenary Speaker Appreciation Social**

Thursday January 31, 2019

SYMPOSIA: A Teacher, Reporter, Politician, Biologist, and a Fish Walk into a Bar…How Do They Effectively Connect for the Future of Conservation?

Moderator: Amber Steed

8:00 **Announcements**

8:05 **Symposium Introduction** Amber Steed**,** (Montana Fish, Wildlife and Parks)

8:15 **If You Teach a Kid to Fish…** Kevin Croff (Bitterroot Elementary School)

8:35 **Communicating with communicators,** Brett French (Billings Gazette)

8:55 **Title to Be Announced,** Dan Vermillion

9:15 **Conservation through Outreach and Education: from Adopt-a-Trout to FishMT,** David Schmetterling (Montana Fish, Wildlife and Parks)

9:35 **Break**

Contributed Papers:

Moderator: Travis Horton

10:00 **Integrating environmental DNA surveillance into the USGS streamgage network,** Adam Sepulved (U.S. Geological Survey)

10:20 ****Variable demographic rates of sympatric fish species suggest sources, sinks, and ecological traps in a connected watershed.** Michael Lance (Montana Cooperative Fishery Research Unit)

10:40 **Fisheries and Aquatic Resources of the Black Butte Copper Project Area in Meagher County, MT: Trends and Observations from 5 years of Baseline Surveys,** David M. Stagliano (Montana Biological Survey)

11:00 **A Fishy Tale: Selenium in a transboundary waterbody,** Trevor Selch (Montana Fish, Wildlife and Parks)

11:30 **Business Lunch (Affiliate Membership Discussion)**
Tracey Wendt—Western Division Update

SYMPOSIA: ~28 Years Later: Progress and prospects in the recovery of Pallid Sturgeon in the Upper Missouri River Basin since listing (1990-2019)

Moderator: Bob Snyder

1:00 **Overview of past actions and contemporary status of Pallid Sturgeon recovery** Zach Shattuck (Montana Fish, Wildlife and Parks)

1:20 **The history of Pallid Sturgeon propagation: why the species is still here today,** Rob Holm (US Fish and Wildlife Service) and Bob Snyder (Upper Basin Pallid Sturgeon Workgroup)

1:40 ****Reproductive Ecology of Hatchery-origin Pallid Sturgeon: A New Hope,** Tanner Cox (Montana Cooperative Fishery Research Unit, Montana State University)

2:00 **Pallid Sturgeon movement and ecology: an upstream of Fort Peck perspective,** Luke Holmquist (Montana Fish, Wildlife and Parks)

2:30 **Break**

3:00 **Spawning migrations of Pallid Sturgeon in the Missouri River downstream of Fort Peck Dam,** Tyler Haddix (Montana Fish, Wildlife and Parks)

3:20 **Pallid Sturgeon movement and ecology: a Yellowstone River perspective,** Mike Backes (Montana Fish, Wildlife and Parks)

3:40 **High Resolution Hydro-Acoustic Mapping of the Missouri River Provides a Glimpse of How River Stage Influences 3D Current Velocities and Simulated Larval Drift Paths,** Brian Marotz (Montana Fish, Wildlife and Parks)

4:00 **Jeremy Monroe—Freshwater Illustrated**

5:00 **End Session**

5:30 **Committee Caucuses, Montana Association of Fish and Wildlife Biologists**

6:00 **Poster Session**

6:30 **Social**

7:00 **Awards Banquet and Raffle**

Friday February 1, 2019

Contributed Papers

Moderator: Leslie Nyce

8:00 **Announcements,** Dalbey

8:10 **How can I change the world? - perspectives from a 40-year fish biologist career,** Brad Shepherd (B. B. Shepard and Associates)

8:50 **Risk Communication for the Use of Piscicides,** Don Skaar (Montana Fish, Wildlife and Parks)

9:10 ****Evaluating the Efficiency of Denil Fish Ladders for Upstream Passage of Arctic Grayling and Other Species on the Big Hole River** Ben Triano (Montana State University)

9:30 **Evaluating Suppression Options for an Introduced Cyprinid in a Montane Lake Using a Population Model,** Troy Smith (University of Montana)

9:50 **Soda Butte Creek: A stream restoration success story**, Brian Ertel (National Park Service)

10:10 **Break**

Contributed Papers

Moderator: Mike Ruggles

10: 25 **Investigation of small Bull Trout populations in a naturally intermittent tributary to the lower Clark Fork River, Montana,** Jason R. Blakney (Montana Fish, Wildlife and Parks)

10:45 ****Diets of Nonnative Longnose Sucker in Yellowstone Lake, Yellowstone National Park,** Kaitlyn Furey (USGS, Montana Cooperative Research Unit)

11:05 ****Rainbow trout introgression alters the seasonal growth patterns of cutthroat trout in three wild populations** Jeffrey Strait (University of Montana)

11:25 ****The Validation of the Distell Fatmeter for use in juvenile Pallid Sturgeon (Scaphirhynchus albus),** Matea A. Djokic (Montana State University)

11:45 **Walleye Are Not Native in Montana; But What About That Map?** Zach Shattuck (Montana Fish, Wildlife and Parks)

12:10 Adjourn—Thanks for Coming!

When All Else Fails: Politics and Public Support for Conservation and Recovery of Pallid Sturgeon,

Patrick Byorth, Montana Water Director

Trout Unlimited's Western Water and Habitat Program
321 East Main Street, Suite 411, Bozeman, MT 59715
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For at least thirty years, a debate has echoed through meetings of the American Fisheries Society regarding the role of fisheries scientists: are we objective, dispassionate scientists who provide scientific data to decision-makers, or, are we fisheries experts charged with advocating for the well-being of the resources we study and manage? In my experience, the answer is "Yes." The biology and politics surrounding recovery of Pallid Sturgeon provides a case in point. Since pallids were listed as an endangered species, research and restoration efforts by state and federal biologists significantly advanced our understanding of the species. Yet, good science is often diluted in the political tensions between state and federal sovereignty, and decisions are made in office vacuums thousands of miles from pallids' home waters.

A current proposal to raise and fortify Intake Dam exemplifies the biologists' dilemma. Science supports the hypothesis that improving passage at Intake should contribute to recovery by adding up to 150 miles of drift distance for larval pallids. Accordingly, a bypass structure has been designed to meet that objective, but science remains skeptical that the design will work for sturgeon and concludes, with certainty, that a raised, concrete-capped dam will eliminate all upstream fish passage in the mainstem. Furthermore, science strongly demands changes at Fort Peck Dam necessary to recover pallids. Unfortunately, a variety of agency decisions and planning documents appeared to ignore, or cherry-pick science, while . At this stage, should scientists chalk it up as a loss and move on?

The Montana Chapter of AFS decided to engage in the legal and political process on behalf of pallids, teaming up with Trout Unlimited, Defenders of Wildlife, and the Natural Resource Defense Fund to make sure the voice of science was heard. While the lawsuit was dismissed on a very fine legal point, the effort was worthwhile. First, public polling demonstrated that Montanans were aware of the plight of Pallid Sturgeon, and a strong majority supported restoration efforts alongside ensuring irrigators getting their water. Public support raised the attention of state and federal elected officials. Second, the Judge made it clear that the legal story was not over, should the federal agencies ignore their responsibilities at Fort Peck. Finally, the Chapter's scientific objectivity and authority held sway in the legal and political process, opening the door to alter the outcome at Intake, and potentially Fort Peck, with the full backing of Montana's Governor and at least one Senator.

Scientific objectivity and rigor imparts political power to scientists willing to wield their expertise and make the voice of science heard. For pallids, the voices of fisheries scientists in the political process may be their last chance.

Connecting to your inner Cousteau - painting a richer picture of freshwater fish and aquatic ecosystems

Jeremy Monroe, Director Freshwaters Illustrated, Corvallis, Oregon

About the speaker

I founded Freshwaters Illustrated as a way to help reconnect people to the vibrant and diverse worlds of freshwater. My background in aquatic ecology helps me to access stories that celebrate the beauty and value of freshwater ecosystems, and with a talented group of visual artists and communicators, I work to make those stories as immersive as they can be.
www.freshwatersillustrated.org

Contributed Paper Abstracts (in order of presentation)

Using Recreational Catch and Release Snagging at Intake as a Paddlefish Management Tool

C. Bollman Montana Fish, Wildlife & Parks
M. Rugg Montana Fish, Wildlife & Parks
M. Backes Montana Fish, Wildlife & Parks
K. McKoy Montana Fish, Wildlife & Parks
D. Scarnecchia University of Idaho

Catch and release angling has been used as a management tool for the Yellowstone Sakakawea Paddlefish stock for decades. Mandatory catch and release for two days per week during the Paddlefish season was established in 1995 to increase angling opportunity without increasing harvest. In 2007, catch and release opportunity was expanded, and current seasons offer three days weekly through the harvest season and 10 consecutive days following harvest closure. Objectives are to satisfy angler demand for more catch and release opportunity in addition to but not in place of a harvest opportunity and break up harvest momentum to extend seasons that had become progressively short. Since 2008 annual phone surveys of Paddlefish anglers have documented that 27% of Paddlefish anglers participate in catch and release. They catch and release an average of 6 paddlefish per angler and account for 2,194 angler days annually. Catch and release has provided an opportunity to increase the number of jaw tagged Paddlefish at large in the population which has improved our understanding of population size, survival, and immigration. Catch and release angling for Paddlefish is expected to remain a valuable management tool for the Yellowstone Sakakawea stock into the future but how it is offered can be expected to adapt as angler demands and stock needs change with time.

Recruitment of paddlefish: hypotheses, evidence and implications

Dennis L. Scarnecchia, Department of Fish and Wildlife Sciences, University of Idaho
Moscow, ID 83844-1136, scar@uidaho.edu
Aaron Slominski: North Dakota Game and Fish Department
K. Michael Backes; Montana Fish, Wildlife and Parks
Steven R. Dalbey; Montana Fish, Wildlife and Parks
Jason D. Schooley: Oklahoma Department of Wildlife Conservation

Successful paddlefish harvest management is strongly predicated on understanding paddlefish recruitment and factors affecting it. We update current knowledge of paddlefish recruitment based primarily on studies and observations in Montana, North Dakota and Oklahoma. Investigations on the Yellowstone-Sakakawea (Y-S) stock indicate that reproduction, as evidenced by age-0 fish at least 100 mm in fork length in August, has occurred in most years over the period 1992-2018 but successful recruitment has been strongly episodic, with two strong year classes (1995 and 2011). Similar episodic recruitment, although less extreme, has been documented in Oklahoma. In contrast, data from Fort Peck Reservoir indicate modest but more regular and consistent recruitment. Year class strength appears to be determined late in the first year or second year. Successful recruits must avoid predation from piscivorous fishes and birds and survive a harsh overwinter environment. Fish growing fast and exhibiting some lipid storage (another aspect of growth) may succeed.

An Evolving Fishery: Balancing Resource Management While Maintaining Traditional Angling Experiences During the Upper Missouri River Paddlefish Season

Cody Nagel - Montana Fish, Wildlife and Parks cnagel@mt.gov
Steve Dalbey- Montana Fish, Wildlife and Parks
Dennis L. Scarnecchia, Department of Fish and Wildlife Sciences, University of Idaho

A popular recreational snag fishery for paddlefish *Polyodon spathula* has occurred on the Upper Missouri River since 1963. Regulations and harvest limits were liberal at the very beginning. As managers slowly gathered more information through monitoring programs and research, changes to the season structure, harvest limits and regulations started to be discussed and implemented. Early changes to this season were minor and infrequent. The trend changed in 2006, when substantial changes to the season structure and regulations no longer reflected the liberal paddlefish season anglers came to expect on the Upper Missouri River. Public outcry ensued, and managers relied on historical data collected, as well as creel and angler surveys to communicate why these changes were necessary. Angler surveys would become a valuable component to collect angler comments that provided critical on-the-ground information to make additional changes to this fishery in 2008 and 2016. However, with each regulation change that occurred since 2006, managers noticed anglers began adapting to the new regulations. The new regulations transformed the entire paddlefish snagging experience on the Upper Missouri River and managers had to find a way to restore the traditional experience most anglers could accept and were accustomed to.

Survival, Abundance, and Exploitation of Paddlefish in the Missouri River above Ft. Peck Reservoir

Hayley Glassic 1,3, Christopher Guy 2, Jay Rotella 3, Cody Nagel 4, David Schmetterling 4

1 Montana Cooperative Fishery Research Unit
2 USGS, Montana Cooperative Fishery Research Unit
3 Ecology Department, Montana State University
4 Montana Department of Fish, Wildlife, and Parks

Paddlefish (Polyodon spathula) fisheries in Montana are highly valued by Montana Fish, Wildlife & Parks (MFWP) and anglers within and outside Montana. Given their life-history characteristics, and their susceptibility to overharvest, sustainably managing Paddlefish requires precise and accurate population dynamics information. Here, we describe the survival, abundance, and exploitation of the Paddlefish population in the Missouri River above Ft. Peck Reservoir. We combined a 25-year MFWP mark-recapture dataset to determine the feasibility of estimating survival and abundance using Paddlefish capture-histories. MFWP tagged 8,518 individuals between 1993-2017 and recorded length, weight, sex, and tag number (if present) during each encounter. We used a suite of Cormack-Jolly-Seber (CJS) models to estimate female survival and recapture rates. Additionally, we used a modified Jolly-Seber (POPAN) model to estimate sexually mature paddlefish abundance. The best-supported CJS model estimated a maximum female recapture rate of 2.6% . Female survival was estimated at a constant rate of 92.2% (89.2% – 94.4%). Our best supported POPAN model estimated abundance of sexually mature females between 5745 (3045 – 10839) and 9982 (7183 – 13827) over the 25-year period. Exploitation varied from 1% to 5% and was estimated using the proportion of harvested individuals from phone creel surveys and the POPAN population estimates. Our results suggest these data can be used to estimate population vital rates. We will expand upon these preliminary model results and incorporate additional covariates to create a further-customized model for the paddlefish population in the Missouri River above Ft. Peck reservoir. This will provide more precise information about the fishery and guide future sustainable management of the population.

Movements of Native Fish Species at Intake Diversion Dam on the Yellowstone River, Montana.

M. Rugg, J. Pesik, C. Bollman, M. Backes, K. Mckoy – Montana Fish, Wildlife & Parks E. Best, D. Trimpe – Bureau of Reclamation

Intake Diversion Dam (Intake) was constructed in 1905 on the Yellowstone River near Glendive to provide irrigation water to Eastern Montana and Western North Dakota. Spanning the entire river channel, the dam has impeded fish movements since its completion. Consequently, the leading hypothesis to the lack of wild recruitment of the endangered Pallid Sturgeon in Montana and North Dakota is inadequate larval drift distance between current spawning locations and reservoir headwaters. Construction of a bypass channel at Intake has been proposed by the U.S. Army Corps of Engineers and the Bureau of Reclamation to facilitate passage by Pallid Sturgeon and other native fish species. Our goal was to document current fish passage at Intake to allow for a post-construction evaluation on the functionality of the bypass channel. To establish this baseline data set, radio transmitters were implanted into five native species (Pallid Sturgeon, Shovelnose Sturgeon, Blue Sucker, Paddlefish, and Sauger) in a 10km test reach immediately downstream of Intake and a 10km control reach upstream of Intake. From 2015 through 2018, individuals were tracked passively through movements past continuously-monitoring, ground-based logging receivers, as well as actively located weekly via boat-mounted telemetry equipment. Passage rates and routes (over the dam or around the dam via ephemeral side channel) at Intake varied between species and by year. Blue Sucker movements appeared to be unaffected by Intake in all years. Conversely, Intake was shown to be a passage impediment to the other four species monitored. Pallid Sturgeon and Paddlefish passage at Intake was dependent on high river discharge. Sauger and Shovelnose Sturgeon upstream movements at Intake appeared truncated when compared to those same species in the control reach. Implementation of a fish bypass structure at Intake has the potential to affect the ability of Pallid Sturgeon and other native species to move past the site.

Evaluation of Factors Limiting Rainbow Trout Growth on the Kootenai River Downstream of Libby Dam

Jim Dunnigan, Montana Fish, Wildlife & Parks

We are conducting an experimental test of genetic rescue in WCT populations east of the Continental Divide in Montana. In the spring of 2017, we introduced a small number of WCT (6-8) into four isolated populations that had low abundance and genetic variation. We have now monitored these study populations and two control populations for two years. Genetic analyses of two of the study populations show that offspring from resident by immigrant matings constituted 29% and 55% of age-1 fish in 2018. Age-1 resident by immigrant offspring had a similar length to resident offspring in one population and a significantly greater length in the other population. The high proportion of immigrant ancestry and the greater length at age-1 provides initial, albeit limited, evidence of higher fitness for resident by immigrant offspring relative to resident offspring. We will continue to monitor these populations to further evaluate whether genetic rescue occurred and to help determine if, when, and how genetic rescue should be implemented for freshwater salmonids.

Selecting for a Legacy: Suppressing Hybrid and Rainbow Trout as a Conservation Strategy for Migratory Westslope Cutthroat in the Upper Flathead River Drainage

Amber Steed Montana Fish, Wildlife & Parks
Matthew Boyer Montana Fish, Wildlife & Parks
Rick Hunt Montana Fish, Wildlife & Parks
Durae Belcer

Opportunities to conserve native cutthroat trout within entire river drainages are generally limited; yet, this spatial scale maximizes access to habitat types and seasonally available resources, providing additional population resiliency to environmental change. The North and Middle forks of the Flathead River drainage (7,255 sq. km.) comprise a substantial portion of remaining interconnected habitat for migratory, non-hybridized Westslope Cutthroat Trout (WCT) in Montana. However, genetic and radio telemetry data document the spread of Rainbow Trout (RBT) introgression within the drainage, predominantly from downstream tributaries. Beginning in 2000, migrant traps and electrofishing were used to capture and remove hybrid trout from source populations with a high proportion of RBT admixture. Drainage-wide surveys conducted in 2015-2016 provided an updated assessment, revealing that RBT introgression continues to spread to sites where it was previously not detected, yet many sites categorized as "conservation" populations (< 10% admixture) still exist. Radio telemetry demonstrated that 49% of tagged hybrids and RBT likely spawned in the Mainstem Flathead River and side channels during 2016-2018 as compared to about 10% during 2000-2007 when most spawning occurred in tributaries containing WCT – suggesting that RBT may have changed their proportional use of spawning habitat. Further, the suppression effort has resulted in a decline in the rate at which RBT admixture has increased among sites in the drainage, a reduction in the number of highly admixed hybrids within mid-range sites, and a decrease in CPUE of up to one order of magnitude across sites. Although non-hybridized WCT continue to be threatened by spreading RBT introgression, these results suggest that focused suppression of hybridization sources can be a beneficial strategy for maintaining conservation populations of WCT in a large, interconnected river drainage.

The differential controls of stream temperature and non-native brook trout on Yellowstone cutthroat trout in the Teton River, Idaho and Wyoming

Robert Al-Chokhachy: U.S. Geological Survey

A warming climate is likely to have pronounced effects on coldwater species such as Yellowstone cutthroat trout (Oncorhynchus clarkii bouvieri). Much of the existing research considering climate-trout relationships, however, has focused on distributional patterns but there have been considerably fewer efforts to consider other attributes important to fish populations (e.g., abundance). Here, we integrated fish sampling data systematically collected across the Teton River basin in Idaho and Wyoming to consider the factors associated with Yellowstone cutthroat trout distribution, abundance, and demography. We used a combination of analytical approaches to provide a more holistic understanding of the effects of abiotic factors influenced by climate, geomorphic attributes and non-native brook trout (Salvelinus fontinalis) on Yellowstone cutthroat trout. In streams sympatric with Brook Trout, the probability of Yellowstone cutthroat trout presence was generally low where stream temperatures were below 10ºC but increased with temperatures above 10ºC. Across all sites cutthroat trout had a high probability of presence up to the warmest temperatures in the Teton River basin (17.0ºC). We found a strong negative relationship between brook trout abundance and Yellowstone cutthroat abundance and a positive relationship between temperature and stream temperature, with the highest Yellowstone cutthroat abundances at temperatures between 9 and 11°C. Quantile regression results illustrated the importance of access to warmer, likely more productive stream reaches as fish size was strongly correlated with stream temperature. Together, our results illustrate that conservation efforts that focus solely on smaller, headwater streams may limit the resilience of trout populations

Patterns in the distribution, size, and ecology of non-native smallmouth bass in the Yellowstone River

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Smallmouth bass are socioeconomically valuable sportfish that have been introduced worldwide. Smallmouth bass were sporadically stocked through the early 1990s at a variety of locations in the mid- to lower Yellowstone River basin and were thought to be limited to the River's warmer waters downstream of Billings. However, recent observations of adults as far upstream as Livingston and Emigrant elicit concern, and illustrate a need to identify the factors limiting their upstream establishment (i.e., successful reproduction). We systematically sampled the Yellowstone River in the summer and autumn of 2016 – 2018 to quantify the distribution and size of young-of-year (YOY) smallmouth bass. We used these data to locate the upstream extent of establishment, and to quantify attributes associated with these patterns such as YOY size at the onset of winter, which is critical for their overwinter survival and is known to limit smallmouth bass distribution at northern latitudes. The upstream extent of establishment was located between Reed Point and Big Timber in each year, in contrast with observations of adults up to 120 river kilometers upstream. Surprisingly, the median size of YOY at the onset of winter was not significantly different across study sites ranging from Custer to Reed Point (about 200 river kilometers apart), despite cooler upstream water temperatures. However, variability in size was consistently higher at warmer, more downstream sites. We consider our results in the context of spatial patterns in YOY age, growth, and diet, as well as broader patterns in discharge, water temperature, and fish assemblage composition.

Preliminary results indicate that males (>9 years of age) are reaching sexual maturity and could be contributing to annual spawning events. Results from this study are important to evaluating the long-term genetic risks and recovery of the wild population.

Reviewing the effects of beavers on aquatic ecosystems

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The American beaver (*Castor canadensis*) is commonly acknowledged as an ecosystem engineer due to its strong influence on both abiotic and biotic components of the habitats where they are found. In recent years, the importance of beavers as agents for stream restoration as well as their ability to create climate resilient fish habitat have become topic of several scientific studies leading to many empirical findings regarding their specific benefits to aquatic systems. Here we review the pertinent literature and findings concerning the physical changes induced by beaver that in turn influence fish ecology. We will also examine practitioner concerns regarding fish passage and potential negative fish species interactions in beaver created habitats as well as future considerations and implications of beaver restoration in Montana.

Best practices for construction of Beaver Dam Analogs (BDAs) and other beaver mimicry structures

Amy Chadwick, Great West Engineering

Beaver mimicry techniques are gaining acceptance as a restoration method that can complement engineered restoration design or provide an alternative where cost and access limitations preclude traditional restoration design. Beaver mimicry techniques are simple but are subject to failure if certain details are not incorporated during construction and if site-specific conditions and processes are not considered. Beaver mimicry is a relatively new branch of restoration and techniques continue to evolve; while there is no substitute for experience with multiple projects and sites, guidelines provided in this presentation can help practitioners avoid common pitfalls and recognize opportunities to modify structure "design" for maximum habitat benefit. Photos of example BDAs and related structures from multiple sites are included to demonstrate potential variations and common threads among structure types.

BDA Projects on Federal Lands: Cherry Creek and North Derby Gulch Case Studies

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Amy Chadwick, Great West Engineering, achadwick@greatwesteng.com

Beaver dam mimicry techniques are increasingly being used in the Intermountain West to restore resilience of streams, wetlands, and floodplains to increased frequency and severity of wildfire, flood, and drought. We present two case studies employing different beaver dam mimicry approaches to restore function to two fire and flood affected streams located on federally administered livestock grazing allotments. We provide an overview of approaches for efficient BDA project planning on federal lands, review project design considerations and implementation methods, and discuss preliminary results and lessons learned.

Using monitoring and modeling to explore how beaver-mimicry stream restoration affects dynamic seasonal water storage

Andrew L. Bobst
Robert A. Payn

We monitored two beaver-mimicry stream restoration (BMR) sites and used numerical modeling to understand the effects of BMR on dynamic seasonal water storage, and late-summer stream flows.
The BMR sites were monitored for one year before, and two years after BMR treatment (2016-2018, with BMR installation during the late-summer and fall of 2016). Data collection included measurements of groundwater levels, stream stage, and stream flow.
We developed relatively simple numerical models of groundwater and surface water exchanges in fluvial systems to assess the magnitude and timing of changes in dynamic seasonal storage and late-summer stream flow resulting from the installation of different types of BMR structures in different hydrological settings (i.e. gaining, losing, and strongly losing streams).
Monitoring showed that groundwater elevations increased rapidly near the stream in response to the rapid increase in stream elevation created by BMR. Groundwater level response was slower further from the stream. The treated streams also had higher net stream gains following treatment.
Model analyses shows that the hydrogeologic setting of the stream, and the type of BMR structures both influence the potential for dynamic water storage in the riparian aquifer. Treatments that created seasonal surface-water storage in off-channel ponds resulted in the greatest increases in late-summer stream flow and groundwater outflow. BMR treatments in strongly losing streams can cause late-summer stream flows to decrease.
This combination of field and modeling studies contributes a more mechanistic understanding of how BMR design and exchange with groundwater jointly influence seasonal water storage in riparian systems.

A parafluvial response to Beaver Dam Mimicry in the Centennial Valley, MT

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The ecological connections between the fluvial and parafluvial systems have been shown to be fundamental to fish survival. Historically, the Upper Missouri River Basin (UMRB) has experienced a degradation of these connections due to human land use, and now restoration practitioners are using innovative techniques to restore these disconnected systems. Beaver Dam Mimicry (BDM) is one of these approaches to restore hydrologic connections, however the effect of this technique on floodplain soils remains poorly understood. Therefore we compared control (-BDM) and treatment (+BDM) reaches along Long Creek, a highly incised stream and tributary to Red Rock River in the UMRB. Soil volumetric water content, soil temperature, and Indicators of Reduction in Soil (IRIS) data was collected from June to September 2018. To support the soil measurements, hourly Green Chromatic Coordinate photographs were taken of the treatment and control meander vegetation. Our results generally showed 1. BDM structures provide increased soil moisture that, 2. Produce extended anaerobic soil condition, and 3. Extended the green period of adjacent vegetation. This study illustrates several methods for quantifying the effectiveness of restoration practices such as BDM, and furthers our understand of the influences of BDM on parafluvial soils.

Beaver Restoration Assessment Tool in Montana

Claudine Tobalske GIS Analyst/Ecologist, Spatial Analysis Lab, Montana Natural Heritage Program, University of Montana Claudine.tobalske@umontana.edu

The Beaver Restoration Assessment Tool (BRAT) is a series of spatial models that predict the capacity of riverscapes to support dam-building activity by beaver. A product of the Ecomorphology & Topographic Analysis Laboratory of Utah State University, BRAT was originally developed for a pilot area, then extended to the entire state of Utah. Several BRAT projects are currently underway, including one in the Greater Yellowstone Ecosystem.

In February 2017, the Bureau of Land Management (Montana/Dakotas state office) contracted the Spatial Analysis Lab to assess the feasibility of applying BRAT to watersheds in Montana. After testing BRAT 2.0 on the Red Rock River watershed, I ran it statewide at the 8-digit HUC level. However, significant modifications are currently being made to the models, especially regarding outputs; we are awaiting a stable release before running BRAT statewide again.

The most current version of BRAT, pyBRAT-3.0.19, is a series of Python scripts deployed as an ArcGIS toolbox. In this brief overview of BRAT I describe the datasets that serve as input in Montana, and present what outputs can be expected from BRAT once a stable release is available.

Symposium: A Teacher, Reporter, Politician, Biologist, and a Fish Walk into a Bar…How Do They Effectively Connect for the Future of Conservation?

Symposium Introduction

Amber Steed, Montana Fish, Wildlife and Parks

Effectively connecting with diverse audiences using communication and education is integral to successful natural resource conservation. Increasingly, fisheries professionals must navigate skepticism among stakeholders who may consider fact and data to be four-letter words. Further, being a subject matter expert may not infer the credibility it once did. In a time of post-truth politics, conservationists must be strategic in identifying their education and communication goals, how best to achieve them, and what success means. Yet, effectively connecting with our intended audiences requires we first listen to and learn from those we aim to reach. In this symposium, experts in the fields of youth education, news media, civic engagement, and aquatic conservation will offer their advice and examples of effective outreach in action.

If You Teach a Kid to Fish...

Kevin Croff, Principal - Bitterroot Elementary

Children hold the keys to future conservation efforts. In a world filled with distractions, generational challenges and electronics dominating youth activities, it can be difficult to engage them in nature. We will dive into some challenges involving students in conservation efforts and offer strategies to help them develop interests in the natural world around us. Additionally, we will look at a few programs and organizations that are having success with student-based conservation efforts.

Communicating with communicators

Brett French, Billings Gazette

The landscape for traditional news gatherers has changed dramatically in the last 20 years. Whereas newspapers once dominated local markets as information purveyors, they now compete with online social media platforms in addition to the more traditional television and to a lesser extent radio broadcasts. At the same time the number of journalists has shrunk considerably. Despite these changes, stories about fisheries studies, waterways and recreation remain important to Montanans. Developing a relationship with a news gatherer can help raise the profile of these important resources and the work done to preserve and enhance them. How to go about that will be part of the discussion presented by Brett French, a Montana native, 33-year veteran of the newspaper industry and current outdoors editor at the Billings Gazette newspaper.

Title to be Announced

Dan Vermillion,

Conservation through Outreach and Education: from Adopt-a-Trout to FishMT

David Schmetterling, Montana Fish, Wildlife and Parks

Many scientifically sound projects fail from lack of public support. Education and outreach are necessary components of controversial projects and are increasingly necessary for all projects in today's connected world. We are facing a scientific crisis that is partly of our making. Unfortunately, science has been devalued in our society, equated with opinion, and removed from public policy considerations. The public is skeptical of science, and the rift between the public and scientists has never been greater. We have responsibility for this situation due to our own ineffective communication and comfort in anonymity. As a result, people with questions have been left to their own devices to find answers. Due to social media, there are plenty of answers out there, but those answers are unlikely from us. This is troubling, but there are reasons for optimism, too. For example, we can also use various new tools and platforms to communicate with people. I will share two examples of how I incorporated education and outreach into projects: research on the effects of Milltown Dam on fish in the late 1990's, and the FishMT web application that provides fisheries information to the public. Biologists should be visible in our communities, advocate, show why fish and their habitats are important, and why others should care. We do important work, for which we are uniquely qualified, and it is our responsibility to embrace that role.

Integrating environmental DNA surveillance into the USGS streamgage network

Adam Sepulveda[1], Elliott Barnhart[2], Christian Schmidt[3]

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USGS has been the Nation's leader in monitoring hydrologic conditions through the national streamgage network, however, little work has been done to explore how eDNA monitoring could be integrated into this network and the cost-benefit of such an integration. In 2018, we evaluated the efficacy of adding eDNA 'low-tech' and 'high-tech' surveillance to USGS streamgages. Low-tech eDNA surveillance consisted of hydrologic technicians, during routine gage site visits from May - September, collecting water samples at USGS streamgages located downstream of Columbia River Basin reservoirs considered to have moderate to high suitability for invasive dreissenid mussels. Water samples were tested for eDNA of dreissenid mussels and fishes. High-tech eDNA surveillance consisted of integrating robotic samplers at two USGS streamgages on the Yellowstone River. Robots collected water samples every 3 – 12 hrs for 42 days. Water samples were tested for eDNA of fish parasites, invasive species, sportfish, and human pathogens. We will present preliminary results, discuss the cost-benefits of streamgage eDNA surveillance, and identify next steps.

Variable demographic rates of sympatric fish species suggest sources, sinks, and ecological traps in a connected watershed.

Michael J. Lance Montana Cooperative Fishery Research Unit, Ecology Department, Montana State University, Bozeman, Montana, United States of America, **Alexander V. Zale[2], Grant G. Grisak[3], Jason A. Mullen[3], T. David Ritter[1], Robert Al-Chokhachy[4], Thomas E. McMahon[5], and George A. Liknes[6]**

Demographic rates of animal populations can vary across landscapes and subpopulations. Studies of demographic rates of stream-dwelling fishes have indicated that rates of survival and site fidelity can vary both spatially and temporally, but most of these studies were conducted in small, headwater streams and focused on a single species of conservation, economic, or social value. We therefore determined rates of site fidelity, survival, and apparent survival (the product of site fidelity and survival) of Brown Trout (Salmo trutta), Mountain Whitefish (Prosopium williamsoni), and Rainbow Trout (Oncorhynchus mykiss) in the Smith River watershed in central Montana, a mid-sized river system with three distinct geomorphic regions. Annual site fidelity was generally high across all species and geomorphic regions (≥ 0.89), but cumulative rates of site fidelity indicated that permanent emigration was common among some groups of fish. Survival varied among geomorphic regions, seasons, and species. Survival was generally highest in the semi-wilderness canyon geomorphic region compared to the more agricultural headwaters and downstream prairie. Seasonal survival was highest in the summer with decreased survival during species-specific spawning periods. In the canyon, survival rates were similar across all three species, but in the prairie and headwaters, survival rates of Mountain Whitefish and Rainbow Trout were lower than survival of Brown Trout. Apparent survival varied across geomorphic regions and species, and rates of apparent survival indicated that the canyon may serve as a population source whereas the headwaters and prairie are probably population sinks or ecological traps. Identification of potential source habitats and the connections to adjacent sink habitats can help managers protect meta-population function of stream-dwelling fish populations. However, demographic rates can vary among species and therefore, investigators should evaluate demographic rates across a suite of sympatric species.

Fisheries and Aquatic Resources of the Black Butte Copper Project Area in Meagher County, MT: Trends and Observations from 5 years of Baseline Surveys

David M. Stagliano and Peter J. Brown

Since 2014, we have been conducting fisheries surveys in the Sheep and Tenderfoot Creek Basins prior to the permitting and operation of the Black Butte Copper Mine. We established 11 stream reaches in a BACI design that are located downstream (Impact) and upstream (Control) of potential project disturbances, and outside of the sub-basin (Reference). At replicate stream sections within each monitoring class, seasonal fish populations were estimated with 2-pass depletion and mark/capture electrofishing methods, as well as redd counts. All salmonids captured since 2016 were also scanned with a Biomark 601 pit-tag reader to detect implants from the MSU/FWP movement study. We identified 10 fish species (six native/four introduced) from ~14,300 individuals collected seasonally between 2014 and 2018. Native species collected, in order of abundance, were rocky mountain sculpin, mountain whitefish, longnose dace, white and mountain suckers and westslope cutthroat trout. Rainbow trout were the dominant salmonid at all Sheep and Tenderfoot Creek sites achieving highest average densities at site SH17.5 (224 per mile ± 45 SE). Brook trout occupied nine of 11 sites with highest densities in Little Sheep Creek (823 per mile ± 168 SE). Brown trout were detected at 8 of 11 sites, achieving highest densities at sites SH19.2 and SH18.3 averaging ~94 per mile ± 15 SE. Yearly estimates of total trout abundance at Sheep Creek SH22.7 (108 per mile ± 36 SE) were substantially lower than a 1992 estimate (325 per mile). No pit-tagged brown or rainbow trout were detected at any sites above the USFS boundary from 2016 to 2018, only tagged mountain whitefish (n=4) were detected in the project area at Sheep Creek sites SH19.2 and SH18.3. Between 2016 and 2018, fall redd counts in the project area averaged 32 per mile (19-48); highest in 2016 and lowest during 2017. No spring redds have been observed in the Sheep Creek project area, and lower numbers of adult rainbows captured during spring surveys indicate that rainbow trout are likely migrating elsewhere to spawn. Multiple years of seasonal surveys have allowed us to elucidate many of the fish movement patterns in this Sheep Creek area.

Aquatic Invasive Species (AIS) Risk Management at a Local Level: The Whitefish AIS Management Program

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One of the challenges of a transboundary waterbody with multiple stakeholders is how to communicate monitoring plans and results in a manner that is transparent, fair, and defensible. In the international waterbody, Lake Koocanusa, the mobilization of selenium (Se) released from expansive coal mines in the Elk Valley of southeastern BC have resulted in elevated concentrations in fish. Selenium concentrations in the water column of Lake Koocanusa have been increasing over the past decade, ultimately being listed as a threatened waterbody in 2012 on the Montana Department of Environmental Quality (DEQ) State's Integrated Water Quality Report. Montana Fish, Wildlife, & Parks, in coordination with DEQ has been monitoring fish tissue Se concentrations since 2008 and collecting additional data to inform a Se model with the goal of developing a site specific Se standard for the reservoir that would ultimately be adopted by both Montana and British Columbia. Described as the "paradox of Se" in fish, Se is nutritionally required in small quantities, yet becomes highly toxic in slightly greater amounts. The most sensitive aquatic biological end point is eggs, where newly hatched larval fish can experience teratogenic deformities and death while feeding off the Se-rich yolk sac, while adult fish still appear healthy. This atypical relationship could shift a fish population from un-impacted to complete reproductive failure with only a small increase in Se loading. Through the International Lake Koocanusa Monitoring and Research Working Group, we have discussed monitoring objectives, distributed plans for review and presented results at annual meetings. This format allows access to all stages of the monitoring process with the goal of increasing confidence in the program and results.

Symposia: ~28 Years Later: Progress and prospects in the recovery of Pallid Sturgeon in the Upper Missouri River Basin since listing (1990-2019).

Recovering an endangered species is wrought with uncertainty. After more than 28-years since ESA-listing, the future of Pallid Sturgeon depends on; a basin-wide adaptive management plan directed by a primary federal action agency, the development of a Species Status Assessment to prioritize recovery efforts, and a changing political and public atmosphere making it arguably more important than ever to address "communicating fisheries science in an increasingly skeptical environment". To make significant strides towards the recovery of Pallid Sturgeon, it is imperative to understand how the species has responded to evolving recovery actions and where efforts thus far have led the program. Primarily, without the foresight and ingenuity of those involved in the development of broodstock and propagation programs, the current status of the species would be quite different. This primary action afforded time to study the ecology of Pallid Sturgeon in the Upper Missouri River Basin and what potential limiting factors should be the focus of recovery for the interconnected Missouri River-Yellowstone River population and the population upstream of Fort Peck Reservoir. However, aspects of Pallid Sturgeon life history remain relatively unknown. Bridging these knowledge gaps will undoubtedly require an innovative and collaborative research-management approach to inform and implement recovery actions. It will also be essential to convey results and understanding more-effectively in public and political landscapes to increase support and allow time and understanding enough to reach the species' recovery objectives.

Overview of past actions and contemporary status of Pallid Sturgeon recovery

Zach Shattuck, Montana Fish, Wildlife & Parks, Helena, MT

Spanning more than 28-years since its listing under the Endangered Species Act, the recovery of Pallid Sturgeon has seen several actions that have substantially shaped the contemporary status of the species. While early efforts to establish broodstock and propagation programs have afforded time to continue to elucidate uncertainties regarding primary life-history aspects of Pallid Sturgeon and their relationships with environmental drivers, progress in the recovery of the species will rely on the success of a new paradigm of adaptive management. Future direction of conservation, management, and ultimately recovery of Pallid Sturgeon in the Upper Missouri River basin will rely on; a basin-wide adaptive management plan directed by a primary federal action agency under direction of a diverse group of stakeholders, the development of a Species Status Assessment to prioritize recovery efforts within and outside of objectives linked to programmatic avoidance of jeopardy to the species, and effective conveyance of priorities from one process to the other. Although much of the anticipated adaptive management will focus on the interconnected Missouri River-Yellowstone River population of Pallid Sturgeon, it will be imperative to also take steps to further understanding of the ecology and behavior of the population of Pallid Sturgeon upstream of Fort Peck Dam. Bridging these knowledge gaps will undoubtedly require an innovative and collaborative research-management approach to inform and implement recovery actions, but the potential for recovery of the species depends on it.

Spatio-temporal dynamics of introgressive hybridization in river systems

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After more than 28-years since ESA-listing, the contemporary prospects for recovery of Pallid Sturgeon have largely been made possible by early efforts to conserve the available genetics of the species and to pioneer hatchery production. Without the foresight and ingenuity of those involved in the development of broodstock and propagation programs, the current status of the species would be quite different. This primary action afforded time to study the ecology of Pallid Sturgeon in the Upper Missouri River Basin and what potential limiting factors should be the focus of recovery for the interconnected Missouri River-Yellowstone River population and the population upstream of Fort Peck Reservoir. Today, much of the urgency shared in early efforts has subsided and the propagation and broodstock programs are run under more-focused directives to provide precise and efficient augmentation to unique populations of a species that has staved-off imminent extinction. However, these programs continue to be a vital aspect in recovery, as they maintain genetic integrity of the species and to allow for the best chance at contributing to natural recruitment.

Reproductive Ecology of Hatchery-origin Pallid Sturgeon: A New Hope

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Luke Holmquist, Montana Fish, Wildlife & Parks

The Pallid Sturgeon population above Fort Peck Reservoir, MT has not produced a year class in 50 years. Recruitment failure is hypothesized to be a result of inadequate drift distance for embryo development. Additionally, a high incidence of follicular atresia has been observed in wild and hatchery-origin Pallid Sturgeon in the study area. Here, we used radio-telemetry to describe movement and spawning locations in the Missouri and Marias rivers by hatchery-origin Pallid Sturgeon. Furthermore, we used historical data and reproductive assessments to determine sex and stage of maturity of Pallid Sturgeon and to evaluate possible causes of ovarian follicular atresia. Three of the six hatchery-origin female Pallid Sturgeon we tracked spawned in the Missouri River between river kilometers 3100 and 3127—this is the first record of spawning in the Missouri River above Fort Peck Reservoir. Furthermore, reproductively-active female Pallid Sturgeon were documented in the Marias River for the first time and were located up to 52 km upstream from the confluence with the Missouri River; however, these fish did not spawn in the Marias River. Three Pallid Sturgeon underwent follicular atresia, similar to previous years. We found that reproductively-active Pallid Sturgeon will use the Marias River and that hatchery-origin Pallid Sturgeon will spawn in the Missouri River. This study demonstrates the importance of long-term monitoring of the reproductive status of hatchery-origin Pallid Sturgeon.

Pallid Sturgeon movement and ecology: an upstream of Fort Peck perspective

Luke Holmquist, Montana Department of Fish, Wildlife and Parks

Pallid Sturgeon in the Missouri River upstream of Fort Peck Reservoir have not had a documented spawning event that resulted in recruitment in over half a century. Recruitment failure has been linked to the construction and operation of dams and impoundments on the Missouri River and associated tributaries. The wild population of pallid sturgeon was estimated to be only 45 individuals in the mid-1990's, and only 8 individuals are known to remain in 2019. To augment the population, a conservation propagation program was initiated and has preserved wild genetics and staved off extirpation by stocking over 150,000 individuals representing 16 year-classes since 1997. Hatchery-origin fish have experienced relatively high survival rates, with the exception of some early year-classes and those stocked as fingerlings. Previous investigations into the reproductive ecology of pallid sturgeon in RPMA1 were hindered by the small sample size of wild pallid sturgeon that remained, but in the last few years there has been an increase in the number of hatchery-origin fish that are sexually mature which combined with radio telemetry has greatly improved our knowledge of the reproductive ecology of the species in RPMA 1. Most notably, in 2018 we documented ripe female pallid sturgeon utilizing the Marias River while discharge was high and later confirmed that hatchery-origin female pallid sturgeon had ovulated, both of which have never been documented, and may hold the key to recovery in RPMA

Spawning migrations of Pallid Sturgeon in the Missouri River downstream of Fort Peck Dam

Tyler Haddix, John Hunziker and David Fuller. Montana Fish, Wildlife and Parks, Glasgow, MT.

Pallid Sturgeon Scaphirynchus albus were listed as endangered throughout their range in 1990. Although this wild adult population is dwindling, hatchery propagated Pallid Sturgeon are beginning to recruit to the spawning population. Under existing hydrological conditions within the Missouri and Yellowstone River system, most Pallid Sturgeon appear to spawn annually in the lower Yellowstone River although no natural recruitment has been documented since the construction of Garrison Dam in North Dakota in 1953. The lack of recruitment is likely due to the limited distance of riverine habitat downstream of current spawning sites. Past studies have suggested that some level of recruitment could potentially occur if Pallid Sturgeon were to spawn in the Missouri River near Fort Peck Dam. Although Pallid Sturgeon use of the Missouri River is common, use of the areas near Fort Peck Dam has been limited to high water years. Our investigations indicate that a manipulated flow regime from Fort Peck Dam could be used to attract Pallid Sturgeon to the upper Missouri River to spawn. During 2018 we documented three gravid females and several adult males in the area of the Fort Peck Spillway, which was releasing water due to higher than normal water levels in the reservoir. Although spawning was not confirmed from these telemetered individuals, record number of Scaphirhynchus spp. larvae and young-of-year were collected and genetic results are pending. These results may be useful in providing empirical data to assist in developing flow scenarios that could lead to natural recruitment.

Pallid Sturgeon movement and ecology: a Yellowstone River perspective

Mike Backes **M. Backes, M. Rugg, J. Pesik, Z. Shattuck, Montana**, Fish, Wildlife and Parks

Contemporary understanding of Pallid Sturgeon ecology and usage of the interconnected Missouri-Yellowstone River system began approximately 30 years ago and continues today. Pallid Sturgeon knowledge and literature available for the Yellowstone River in 1990, when the species was listed, was minimal and has evolved immensely. However, numerous uncertainties still exist today. Thirty years ago, some of the most basic questions were unknown: how many fish exist in the population, where do they exist, what habitats do they use, what do they eat, are they spawning, are there young fish, and do they use Lake Sakakawea? Just a few years ago researchers were still asking: will they use side channels, are they motivated to migrate and spawn upstream of Intake Dam, is there functional spawning habitat available upstream of Intake Dam? By 2019 many of these questions are answered, but uncertainties, challenges and additional questions continue to surface and evolve. Lack of adequate larval drift distance between known spawning locations and reservoir headwaters is a key hypothesis of why natural recruitment of Pallid Sturgeon is not occurring. This hypothesis has directed the focus of recovery in the Yellowstone River towards providing connectivity, primarily via passage at Intake Dam. Monitoring data from the last five years has provided an early indication of Pallid Sturgeon migrations and habitat usage of the Yellowstone River upstream of Intake Dam. The data demonstrates a potential for increasing the abundance and frequency of Pallid Sturgeon migrations upstream of Intake Dam, thus maximizing larval drift distance upstream of Lake Sakakawea, and perhaps leading to natural recruitment. Questions and uncertainties for Pallid Sturgeon will still exist 28 years from now in 2047, hopefully we will have moved from basic fact-finding objectives, to a thorough ecological understanding of the species, and finally well-supported and hypothesis-driven recovery actions.

High Resolution Hydro-Acoustic Mapping of the Missouri River Provides a Glimpse of How River Stage Influences 3D Current Velocities and Simulated Larval Drift Paths

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We compared particle drift paths at three river stages in the Missouri River downstream of Fort Peck Dam to simulate dispersal of drifting Pallid Sturgeon free-embryos. Eight boats with Acoustic Doppler Profilers and compass-oriented GPS drifted downstream, spanning the river, to measure 3D water velocities, current directions and bathymetry. In 2014, we mapped a 4-km reach downstream of the Milk River confluence at 170 cms (6000 cfs). We surveyed 50 km in 2015 at 127 cms (4,500 cfs) and 338 km at 247 cms (9,000 cfs) in 2016. Flow maps allowed simulating drift speed and pathways using a standard kriging methodology. While we recognize that free-embryos can re-suspend themselves in low-velocity habitat and continue drifting, water velocities throughout most of the river channel overwhelm the motility of embryos and larvae, so they have little ability to control their drift paths. At the lowest discharges (127 and 170 cms) drift paths converged within the confined channel, whereas at the highest discharge (247 cms), drift paths rapidly dispersed from the thalweg into low-velocity habitats.

Comparisons in this short reach provide only a glimpse of how river stage effects drift. Repeat surveys of the 338-km study reach at higher and lower discharges would enable identifying the range of dam discharges that optimizes larval dispersion and the aerial extent of low-velocity rearing habitat. The US Army Corps recently designed experimental flow scenarios for Fort Peck Dam. Our results indicate that discharges should be set higher during the larval drift phase to increase larval survival.

How can I change the world? - perspectives from a 40-year fish biologist career

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I will present my perspectives on what I learned during my 40-year career as a Fisheries Biologist and Scientist who worked for government agencies (Montana FWP and US Forest Service), two universities (MSU and U of I), a non-profit conservation organization (The Wildlife Conservation Society), and as a private consultant. I will discuss the roles of philosophy, religion, science, education, family, and communication in becoming an effective fish biologist. I will provide examples and perspectives from my career on several broad topics. First, know yourself and your underlying beliefs. Understand your motivations – love, fame, or fortune. Set long- and short-term career goals for yourself and communicate these goals to those around you. Realize that your motivations and goals might change over time and adjust accordingly. Secondly, accept that different people have different motivations and different gifts and seek out people with whom you want to collaborate. Work to develop meaningful professional and personal relationships with people around you. Give of yourself to others. Find one or more good mentors and seek out people whom you can mentor. Thirdly, acquire the skills and education needed to reach your goals. During my career I discovered that for me the fishery profession was more of a "life style" than a profession. Make time and take time for your family. Fourthly, understand your tolerance for risk versus reward and have the grace to forgive people who make mistakes because we are all human. Lastly, acknowledge the roles that field data, science, economics, politics, and social pressures have on management decisions, but ensure that data and science are included and that all information used in decision-making is transparent. Make sure you enjoy what you are doing and have fun!

RISK COMMUNICATION FOR THE USE OF PISCICIDES

Don Skaar, Montana Department of Fish, Wildlife and Parks

The primary issues of concern expressed by the public about piscicide projects include the collection and disposal of dead fish, pesticide residues in dead fish, animal welfare, liability and property damage, adequate public information and notification, impact on air quality, impact of chemicals on public health, impact of chemicals on ground and surface water. These all differ however, in terms of the potential to generate outrage and potentially derail projects. Examples of such outrage and ideas for reducing it are discussed.

Evaluating the Efficiency of Denil Fish Ladders for Upstream Passage of Arctic Grayling and Other Species on the Big Hole River

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The introduction of novel organisms can have outsized impacts on naive ecosystems. Introduced species alter the dynamics of predation, food webs, and species interactions. This can disrupt ecological function and reduce a system's recreational value. Illegal introductions of redside shiners (Richardsonius balteatus) to high mountain lakes have resulted in declines in sizes and abundance of salmonid species. In Montana, redside shiners were illegally introduced to Green Canyon Lake in the 1980s resulting in a decline in the size of westslope cutthroat trout (Oncorhynchus lewisi) and subsequent angler satisfaction. In 2017 and 2018, we minnow trapped the lake to estimate redside shiner demographic rates. We observed fish up to 7 years of age, high cohort annual survival (>50%), and mature females starting at age 2. We used a female based Leslie Matrix model to evaluate two hypothetical suppression actions: a single piscicide application and a one-time stocking event of a biotic control (tiger trout, Salmo trutta x Salvelinus fontinailis). We assumed the population was currently at carrying capacity ($\lambda \sim 1$). Assuming a 95% population reduction with piscicide application, the shiner population returned to 90% of carrying capacity in 26 years under our highest growth scenario. Energetics estimates indicate that an individual 1000g tiger trout likely consumed 1920g of fish annually. Incorporating this additional mortality and a type II functional response curve, a stocking event of 100 tiger trout would decrease the population growth rate by approximately 10% ($\lambda=0.91$). It would take a one-time stocking event of approximately 1000 tiger trout to extirpate the shiner population in five years. Our results suggest that redside shiners have the capacity for rapid population growth requiring suppression actions to be persistent and targeted due to the potential for rapid population growth.

Evaluating Suppression Options for an Introduced Cyprinid in a Montane Lake Using a Population Model

Troy Smith1, Brad Liermann2, Lisa Eby1

The introduction of novel organisms can have outsized impacts on naive ecosystems. Introduced species alter the dynamics of predation, food webs, and species interactions. This can disrupt ecological function and reduce a system's recreational value. Illegal introductions of redside shiners (Richardsonius balteatus) to high mountain lakes have resulted in declines in sizes and abundance of salmonid species. In Montana, redside shiners were illegally introduced to Green Canyon Lake in the 1980s resulting in a decline in the size of westslope cutthroat trout (Oncorhynchus lewisi) and subsequent angler satisfaction. In 2017 and 2018, we minnow trapped the lake to estimate redside shiner demographic rates. We observed fish up to 7 years of age, high cohort annual survival (>50%), and mature females starting at age 2.

We used a female based Leslie Matrix model to evaluate two hypothetical suppression actions: a single piscicide application and a one-time stocking event of a biotic control (tiger trout, Salmo trutta x Salvelinus fontinailis). We assumed the population was currently at carrying capacity (λ~1). Assuming a 95% population reduction with piscicide application, the shiner population returned to 90% of carrying capacity in 26 years under our highest growth scenario. Energetics estimates indicate that an individual 1000g tiger trout likely consumed 1920g of fish annually. Incorporating this additional mortality and a type II functional response curve, a stocking event of 100 tiger trout would decrease the population growth rate by approximately 10% (λ=0.91). It would take a one-time stocking event of approximately 1000 tiger trout to extirpate the shiner population in five years. Our results suggest that redside shiners have the capacity for rapid population growth requiring suppression actions to be persistent and targeted due to the potential for rapid population growth.

Soda Butte Creek: A stream restoration success story

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Andrew Ray, **Tom Henderson**, **Clint Sestrich**, and **Jason Rhoten**

As stream restoration projects grow in scale from individual habitat units, to stream reaches, to entire watersheds, managers must now work together more than ever to accomplish project goals. Because stream networks or habitat patches of sufficient size to maintain viable functioning ecosystems often span multiple jurisdictional boundaries, resource managers, wildlife biologists, fisheries biologists, etc., must work together to effectively restore and manage the terrestrial and aquatic ecosystems under their stewardship. The Soda Butte Creek drainage, located in southwest Montana and northwest Wyoming is one such example. Despite being just 40,000 acres, this small drainage bisects lands under the management authority of the states of Montana and Wyoming, the National Park Service, and the National Forest Service. Soda Butte Creek also flows through the municipalities of Silvergate and Cooke City, Montana as well as the North Absaroka Wilderness. For over a century, Soda Butte Creek has been impacted by human activity. Mining, building, pollution have all impacted the drainage greatly. Over the years, multiple agencies have worked together to protect and restore the waters and native species from the negative human impacts. One of the main focuses has been to protect and restore native Yellowstone Cutthroat Trout Oncorhynchus clarkii bouvieri (YCT) by cleaning up tailings left by historic mining activity and controlling nonnative Brook Trout Salvelinus fontinalis (BKT) abundance and distribution. Following successful tailings clean up, chemical treatment, to remove nonnative trout and reintroduce native YCT was initiated. Following two years of chemical treatment, Soda Butte Creek appears to be BKT free and YCT are recovering nicely. The ongoing success of this project is a testament to what can be achieved by agencies (government and non-governmental) and the public working together to achieve a common goal.

creeks are natural sources of cold, clean water, serving as thermal refugia and moderating temperatures in receiving water bodies. Consequently, spring creeks can play a critical role in climate and drought resiliency planning. A spring creek restoration project near Dillon, Montana, incorporated a several management and restoration actions to mitigate thermal impacts. Preliminary monitoring results indicate the project successfully reduced high summer stream temperatures in the Beaverhead River. Ongoing temperature and flow monitoring will evaluate the relative efficacy of these temperature mitigation measures for potential application to other locations.

Investigation of small Bull Trout populations in a naturally intermittent tributary to the lower Clark Fork River, Montana.

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Prospect Creek is a tributary to the lower Clark Fork River and historical accounts noted the stream once held significant spawning runs of migratory Bull Trout. While the lower watershed is currently dominated by non-native salmonids, natural intermittency has allowed streams in the upper watershed to retain native fish assemblages. The upper Prospect Creek watershed is among the last remaining drainages in the lower Clark where non-native salmonids are not established and where Bull Trout occur in multiple streams, making it a focal area for conservation and restoration efforts. Streams in the upper watershed are impaired by anthropogenic stressors including power line corridors, riparian timber harvest, forest roads, mining, a gas pipeline and a forest highway. Two neighboring study streams were chosen with differing levels of Bull Trout abundance to investigate factors limiting these populations. Generalized linear mixed-effects models were used to evaluate the influence of habitat variables on Bull Trout abundance over a two-year period. Modeling results for each stream will be presented in the context of known fish distribution and abundance, spawning habitat, as well as past and future restoration activities. The low abundance Bull Trout stream was found to have significantly higher discharge along with more large woody debris, undercut banks and pool area when compared to the high abundance stream. What then could be limiting Bull Trout in the low abundance stream? The presence of sculpins? Does a Benthic Index of Biological Integrity offer clues? Does intermittency provide us with an opportunity to supplement the low abundance population?

Diets of Nonnative Longnose Sucker in Yellowstone Lake, Yellowstone National Park

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1 Montana Cooperative Fishery Research Unit

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In Yellowstone National Park, nonnative species introductions have contributed to the decline in native fish population. The Longnose Sucker (Catostomus catostomus) was accidentally introduced into Yellowstone Lake by anglers in the early 1930s. In the early 1950s, Longnose Sucker diets were analyzed from fish sampled in tributary streams of Yellowstone Lake. To provide a contemporary assessment of Longnose Sucker diets and to better understand their role in the food web, we extracted the alimentary canal of Longnose Suckers sampled between August 1 and September 20, 2018. Once extracted, we used microscopy to identify diet items. Main diet items were dipteran, detritus, zooplankton, and amphipods. Diet data were analyzed by length class to test for ontogenetic diet shifts. As Longnose Sucker length class increased, mean proportion by weight of amphipods decreased from 16% in the smallest length class to 0.7% in the largest length class. Feeding patterns were assessed by evaluating prey-specific abundance against frequency of occurrence. This assessment indicates that Longnose Suckers have a generalized feeding strategy and have a relatively high within-phenotype component, as all prey items had a prey-specific abundance value of less than 50%.

Diet data were also compared between the historical data and this study. Frequency of occurrence of prey items differed between Longnose Suckers sampled in 1951-1952 and 2018. Frequency of occurrence of dipteran was 54% in 1951-1952 and 84% in 2018. We believe the disparities are related to the differences in where Longnose Suckers were sampled. The diet data described in this study provides useful information to better understand the food web in Yellowstone Lake.

Rainbow trout introgression alters the seasonal growth patterns of cutthroat trout in three wild populations

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Huma-mediated hybridization is a major conservation problem threatening all subspecies of cutthroat trout in western North America. Landscape-level patterns of introgression between non-native rainbow trout and native cutthroat trout suggest that environmental variation and physiological differences between cutthroat and rainbow might mediate the occurrence and spread of rainbow trout alleles Moreover, individual growth may also act as a mechanism mediating the spread of introgression, as fish growth is known to be under both genomic and environmental control that influence key vital rates such as survival and fecundity. We investigated the effects of rainbow trout admixture on individual somatic growth rates over two time periods, summer and winter-spring in three populations of westslope cutthroat trout inhabiting streams with different hydrologic and thermal regimes. From 2013 to 2016, we individually genotyped, marked, and recaptured Oncorhynchus spp. (total recaptures = 1,172). Regardless of admixture, individual growth was higher during the winter-spring season than the summer season. Interestingly, rainbow trout admixture had a positive effect on summer growth rates, but a negative effect on winter-spring growth rates. This suggests that rainbow trout admixture may have a net negative effect on annual growth. Future analyses will investigate the effects of admixture on seasonal survival, reproductive success, and life history strategies to fully understand the evolutionary and ecological impacts of invasive hybridization on native trout in the wild.

The Validation of the Distell Fatmeter for use in juvenile Pallid Sturgeon (Scaphirhynchus albus)

Matea A. Djokic, Joshua Heishman, Kevin Kappenman, Christine Verhille

Fisheries managers possess a limited toolset for assessing the health status of wild-captured fish. This is especially problematic for rare and endangered species like pallid sturgeon (Scaphirhynchus albus). We are investigating a suite of analytes to assess the overall health status of wild-captured pallid sturgeon. Here, we report on preliminary results testing the Distell Fatmeter to non-lethally quantify whole-body lipid and whole-body energy content within pallid sturgeon.

Whole-body lipid and whole-body energy content can be used as metrics of health in various fish species; however, lethal methods are necessary to directly determine these metrics. The Distell Fatmeter is a handheld device that has been validated for salmonid fish species to non-lethally estimate whole-body lipid and energy content but has never been validated for sturgeon. Preliminary results gathered on 20 juvenile pallid sturgeon indicate that there is a significant relationship between whole-body energy and Fatmeter readings on pallid sturgeon ($r2 \sim 0.4$, $p < 0.05$). For whole-body lipid content, preliminary analysis showed no significant relationship ($r2 \sim 0.4$, $p \sim 0.05$).

Walleye Are Not Native in Montana; But What About That Map?

Zach Shattuck, Mike Ruggles, Eric Roberts: Montana Department of Fish, Wildlife and Parks

Walleye Sander vitreum have long been classified as a nonnative species in Montana (Brown 1971; Cross et al. 1987; Fuller and Neilson 2019). Patterns of glacial retreat at the end of the Pleistocene indicate colonization of the Missouri River upstream to the Great Falls near present-day Great Falls, MT was limited to highly migratory, big-river fishes especially those adapted to highly turbid conditions (e.g., Sauger, Paddlefish, Blue Sucker, and Pallid Sturgeon). There is no evidence of Walleye colonizing Montana during preglacial periods, as demonstrated by fossil records and drainage reconstructions, nor are they found during postglacial retreat, where conditions were not suitable for colonization by the species (Metcalf 1966; Pflieger 1971; Cross et al. 1987). This understanding is supported by early fish collections in Montana, none of which document presence of Walleye (Cope 1879; Everman and Cox 1896; Henshall 1905). In fall 2018, Walleyes Unlimited presented a peer-reviewed article by Billington et al. (2011) in Barton (editor) which contained a continental-scale map that depicted the native range of Walleye to include all of Montana east of the Continental Divide (i.e., the Missouri River drainage). However, the contents of the article and its included references corroborated the original position; that Walleye are not native to the State. Thus, further investigation into the sources of information yielded no new scientifically-valid evidence to warrant changing the status of Walleye in Montana and Montana Fish, Wildlife & Parks and other classifying entities are not expected to make a change to the species' designation.

Poster Abstracts

Effects of Lake Trout Suppression Methods on Amphipods in Yellowstone Lake

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In Yellowstone Lake, illegally introduced Lake Trout have collapsed the population of native Yellowstone Cutthroat Trout, which are significant to the lake ecosystem. To suppress Lake Trout, the National Park Service has been investigating the deposition of Lake Trout carcasses on Lake Trout spawning sites to induce embryo mortality. It is hypothesized that carcasses cause embryo mortality through a reduction in dissolved oxygen levels. The effects of carcass deposition on other components of the lake ecosystem besides invasive Lake Trout eggs are unknown. Amphipods, a dominant benthic invertebrate and major food source for both Lake Trout and Yellowstone Cutthroat Trout, could respond to changes in biogeochemistry in the lake's littoral zone when carcasses are deposited. This study sampled amphipod populations at six total Lake Trout spawning sites in Yellowstone Lake in 2018: three carcass deposition sites and three control sites. Two approaches for sampling amphipods were evaluated: i) a diver-operated suction sampler and ii) emergent fry traps. No correlation was observed between the number of amphipods collected in fry traps and the density of amphipods measured in the suction samples, indicating that fry traps are not an effective way to estimate amphipod abundance. Results suggest amphipod populations did not respond to carcass treatment, which is likely due to the sparse carcass cover achieved at spawning sites in 2018.

Tracking the Individual Stories of Pallid Sturgeon Within Two Rivers Calls for One System Recovery Approach

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[1]Montana Fish, Wildlife & Parks; [2]Bureau of Reclamation

The endangered Pallid Sturgeon is a long-lived, slow-maturing fish native to the Missouri River Basin. Since documentation of Pallid Sturgeon spawning in the Yellowstone River in 2007, monitoring efforts have increased substantially within the Recovery Priority Management Area 2 (RPMA 2) between Fort Peck and Garrison dams. Despite the presence of spawning fish, this population is at risk due to the lack of wild recruitment. Past recovery action plans frequently limited scope to either the Missouri or the Yellowstone River, with the viewpoint that these large rivers are separate systems. Yet, the integral connectivity of these two rivers and their tributaries calls for a more unified management approach. Therefore, future recovery plans should address limitations identified in both rivers to have the greatest likelihood of success. Our goals were to document movement patterns of Pallid Sturgeon throughout RPMA 2, and to demonstrate the extensive use of available river reaches throughout the system by single individuals. Radio telemetry has been used for the past decade to monitor movements of Pallid Sturgeon using ground-based receivers supplemented with intensive relocations by boat during open-water months. Most fish showed an affinity for the confluence region of these rivers for at least some part of the year. However, individuals made large forays up both rivers, including tributary use, during the timeframe of this study. While past recovery action plans have been geared towards one river or the other, tracing the movements of individuals has highlighted the functional connectivity of these rivers. Moving forward, RPMA 2 should be managed as a single system for Pallid Sturgeon recovery to best encompass the life history characteristics of this endurance specialist.

Tracking Forest Fire Impacts on Stream Temperatures & Ensuing Shifts in the Salmonid Community

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Understanding how salmonids will respond to habitat changes associated with wildfire is necessary to predict the impacts of future increases in wildfire frequencies and severities on salmonid populations of western Montana. This is especially important in headwater streams which serve as cold water refuge for the threatened bull trout (*Salvelinus confluentus*) during the summer months. A loss of canopy cover after a wildfire event can result in increased stream temperatures, leading to displacement of cold-water fishes. In the summer of 2018 we evaluated habitat changes one year after the 2017 Meyers Fire of the Beaverhead-Deerlodge National Forest. We performed habitat surveys and installed temperature loggers at 28 study sites throughout Montana's upper Rock Creek and Flint Creek drainages including 20 sites across 7 wildfire-affected streams and 8 sites across 2 control streams. We found a trend of decreased canopy cover at sites with higher burn severities. Across all sites 2018 mean August stream temperatures were 1.06°C higher on average than the baseline predicted stream temperatures (Norwest modeled 1993-2011 August averages) and there was an increasing trend of higher differences between observed and predicted temperatures at sites with higher burn severity. We also assessed current native and non-native salmonid distributions by sampling the fish communities at 24 of the 28 sites throughout the study basin. Nonnative brown trout (*Salmo trutta*) were found at novel upstream locations relative to previous sampling events in both burned and unburned (control) watersheds. In 2018, bull trout and brown trout distributions were found to be overlapping in all locations where brown trout were observed. Nearly all sites with mean August stream temperatures above 10°C showed declines in the relative proportion of bull trout present. Overall, the relative proportions of community composition of native bull trout and westslope cutthroat trout (*Oncorhynchus clarki lewisi*) were found to have decreased and the relative proportions of nonnative brown trout and brook trout (*Salvelinus fontinalis*) were found to have increased since the previous sampling events likely irrespective of fire. Future monitoring of this watershed could allow for a better understanding of the long-term impacts of wildfires on these salmonid communities.

Historical Analysis Reveals Site-Specific Phenotypic Differences in *Oncorhynchus clarki lewisi*

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Sekokini Springs Hatchery in Montana, USA, produces fish to supplement declining *Oncorhynchus clarki lewisi* populations in isolated tributaries of the Flathead River. The hatchery has difficulty rearing wild-sourced *O. clarki lewisi*, leading to reduced quantities of offspring stocked. We evaluated three years of historical records for two source streams to identify potential trends in growth that may explain this decline. We compared the specific growth rate (SGR), percent mass gained (MG), and growth index (GI), between females from each source stream and modeling these variables with proportion of eyed eggs to total eggs (PEE) to identify predictors of reproductive success. When we examined all data, we found no significant correlations between any growth variables and PEE. However, a MANOVA revealed that a significant portion of the variation observed was due to source stream (MANOVA, p-value= 2.2×10^{-16}). When source stream was analyzed separately, there were no significant correlations between any of the variables and PEE, but we were able to demonstrate that Young's Creek had higher SGR, MG, GI and PEE. These results highlight the potential of hatcheries to demonstrate phenotypic differences in *O. clarki lewisi* and can inform hatchery-rearing strategies to improve the productivity of Sekokini Springs.

Non-native predators are associated with range contractions of native cyprinids in Montana

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Northern Pearl Dace *Margariscus nachtriebi*, Northern Redbelly Dace *Chrosomus eos*, and Northern Redbelly Dace × Finescale Dace hybrids *C. eos* × *C. neogaeus* (Northern Redbelly Dace and Northern Redbelly Dace × Finescale Dace hybrids hereafter collectively referred to as chrosomid dace) have undergone range contractions in Montana. Nonnative Northern Pike *Esox lucius* have expanded from stocking locations to prairie streams that are inhabited by native cyprinids. Our objectives were to: (1) clarify the probable historical distributions of Northern Pearl Dace and chrosomid dace, (2) establish the current distributions of Northern Pearl Dace and chrosomid dace, and (3) evaluate the extent to which their current distributions may have been influenced by the expansion of non-native predators such as Northern Pike. We collected Northern Pearl Dace at 8 of 80 sites in their historical distribution, which corresponded to an estimated 63.3 to 83.3% reduction in their distribution in Montana. We found almost no co-occurrence of Northern Pearl Dace and influential non-native predators (Northern Pike and non-native trout) at sample sites. We collected chrosomid dace at 43 of 128 sites in their historical distribution, which corresponded to an estimated 28.6% to 69.7% reduction in their distribution in Montana. We found little overlap between chrosomid dace and influential non-native predators. Northern Pike and non-native trout probably contributed to the reduction in Northern Pearl Dace and chrosomid dace distributions, and further expansion of these non-native predators may lead to extirpation of Pearl Dace and substantial declines in chrosomid dace in Montana.

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