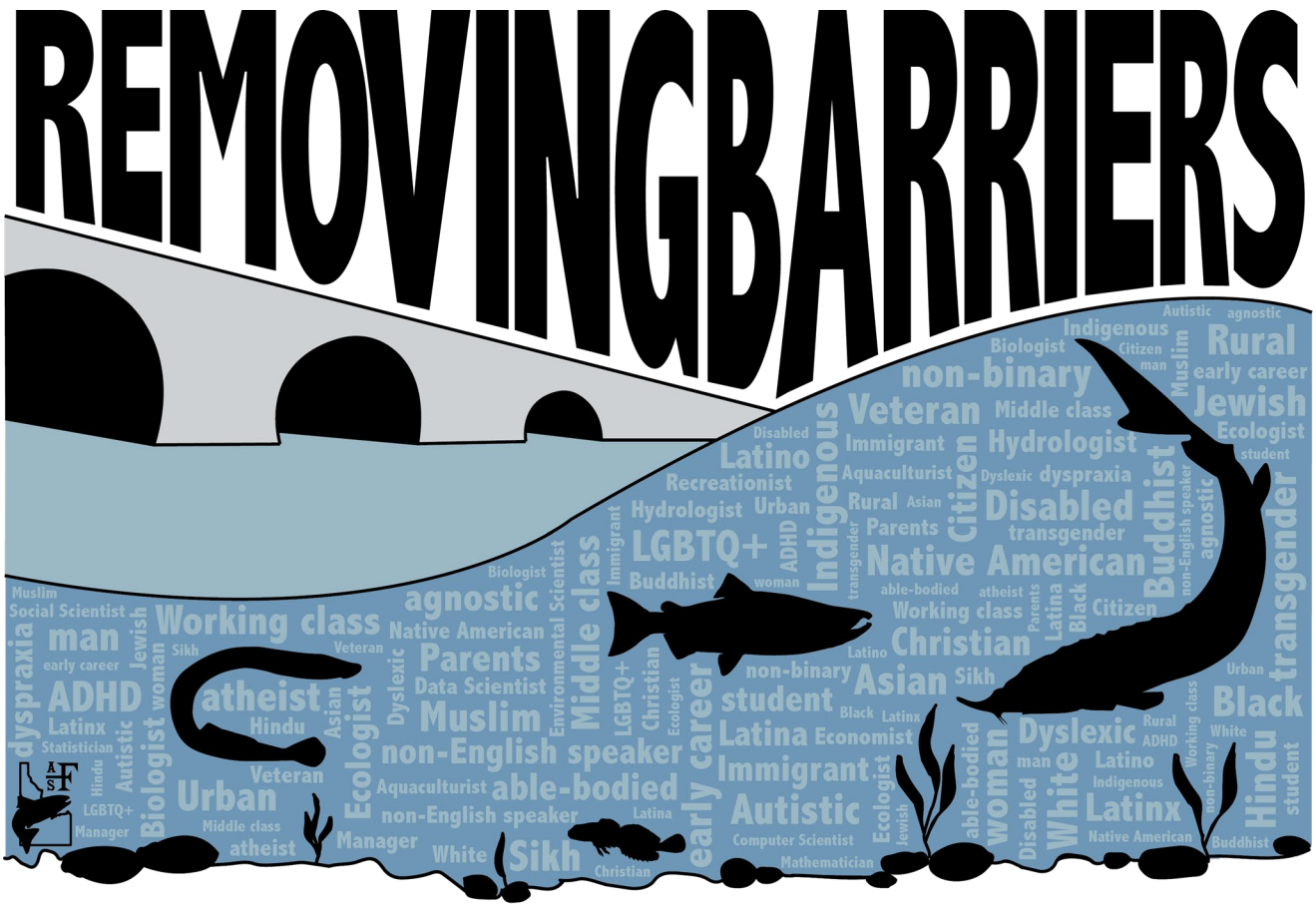
American Fisheries Society

Idaho Chapter

60th Annual Meeting



Opening pathways to the fisheries profession.

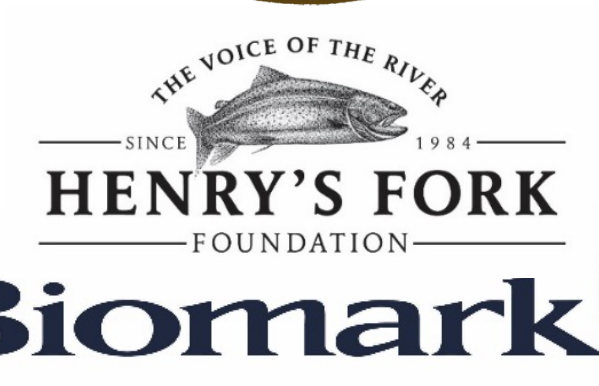
2022 ICAFS Meeting, Fort Hall ➸ Artwork by Paige Cahoon and Melissa Muradian, Henry's Fork Foundation

March 1 – 4, 2022

Shoshone-Bannock Hotel and Events Center

Fort Hall, Idaho

Sturgeon Sponsors ($1,000)



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	Jake Hughes	jhughes@idahopower.com

Meeting Committee	
Theme, plenary, and related sessions and workshops	Jessica Buelow, Kat Gillies-Rector, Sammy Matsaw, and Hannah Swain, with guidance from Christine Moffitt
Artwork	Paige Cahoon and Melissa Muradian
Program	Bryce Oldemeyer and Jenn Vincent
Judging, volunteers, moderators, and logistics	Jim Chandler, Laurel Faurot, Jake Hughes, and Kristi Stevenson

Schedule at a Glance

Green highlighted events will be livestreamed and allow full participation from remote attendees.

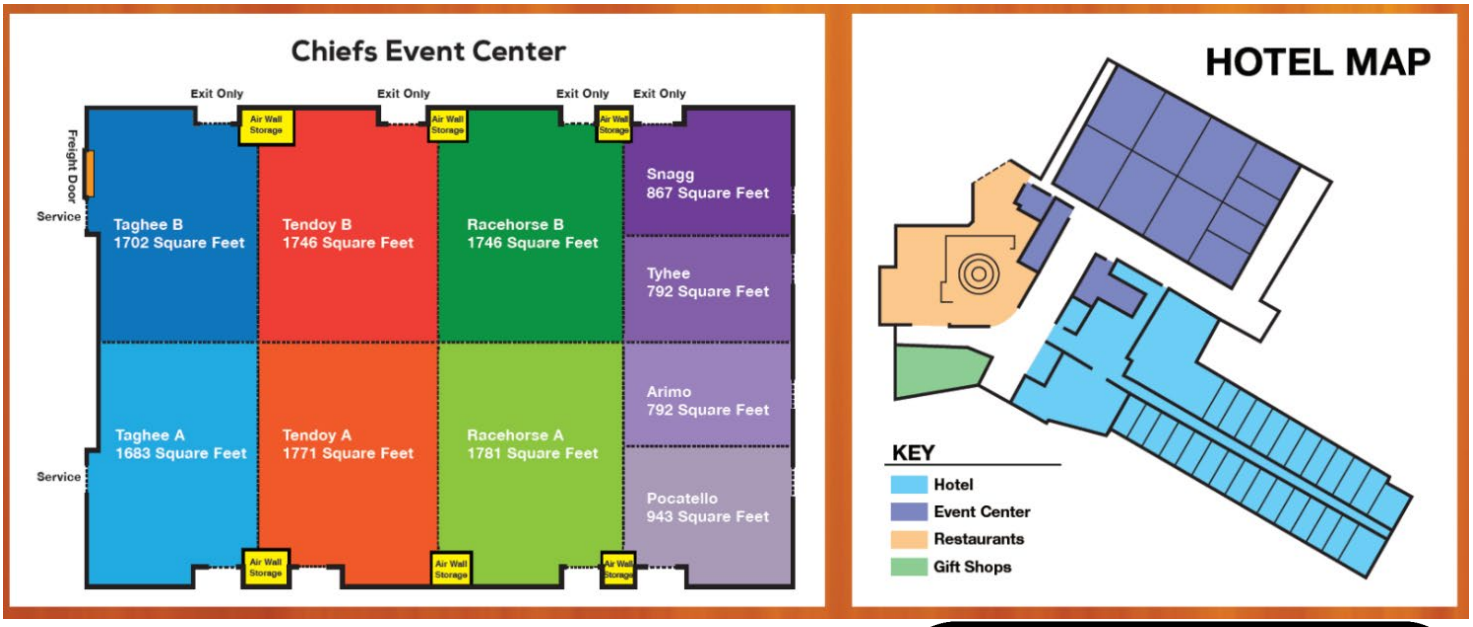
Orange highlighted events are virtual-only via online meeting platforms.

Friday, February 25		
8:00 AM -1:00 PM	**Workshop:** Diverse Perspectives on the Current and Emerging State of Aquaculture in Idaho	**Virtual-only**
Tuesday, March 1		**Room**
7:00 – 8:00 AM	**Pastries, coffee, tea, and juice**	Taghee
7:00 AM– 7:00 PM	**Registration**	Lobby
8:00 AM – 5:00 PM	**Vendor setup**	Hallway
8:00 AM – 12:00 PM	**Workshop:** Cultural Competency and Relevancy (includes refreshment break)	Racehorse (no virtual option)
12:00 – 1:00 PM	**Box lunch**	Lobby
1:00 – 5:00 PM	**Workshop:** Inclusion in the Workplace: Practical Strategies (includes refreshment break)	Pocatello (no virtual option)
5:00 – 5:30 PM	**Volunteer and moderator meeting**	Taghee
5:30 – 6:30 PM	**EXCOM meeting**	Racehorse
6:30 – 9:00 PM	**Welcome Social**	Taghee
Wednesday, March 2		**Room**
7:00 – 8:00 AM	**Continental breakfast**	Taghee
7:00 AM – 5:00 PM	**Registration and vendor displays**	Lobby and Hallway
8:00 – 10:00 AM	**Meeting opening and plenary session**	Taghee
10:00 – 10:20 AM	**Morning refreshment break**	Taghee
10:20 – 11:40 AM	**Invited presentations**	Taghee
12:00 – 1:00 PM	**Committee meetings with box lunch**	
	Anadromous Fish	Taghee
	Native Fish	Pocatello
	Public Education	Virtual only via Zoom
1:20 – 2:40 PM	**Contributed presentations (concurrent)**	Taghee and Pocatello
2:40 – 3:00 PM	**Afternoon refreshment break**	Taghee
3:00 – 4:00 PM	**Committee meetings**	
	Aquatic Habitat	Taghee
	Mentoring	Pocatello
	Aquaculture	Virtual only via Zoom
4:20 – 5:15 PM	**Spawning Run/Walk**	TBD
5:15 – 6:15 PM	**Pre-mixer mentoring event**	Pocatello and livestream
6:15 – 9:00 PM	**Student/Professional mixer**	Taghee

Continued on next page

Thursday, March 3		Room
7:00 – 8:00 AM	**Pastries, coffee, tea, and juice**	Lobby
7:00 AM – 5:00 PM	**Registration, vendor, and poster displays**	Lobby and Hallway
8:00 – 9:20 AM	**Contributed presentations (concurrent)**	Taghee and Pocatello
9:20 - 10:20 AM	**Poster session and morning refreshments**	Lobby and Hallway
10:20 – 11:50 AM	**Contributed presentations**	Pocatello
12:00 – 2:00 PM	**ICAFS Annual Business Meeting and Luncheon**	Taghee
2:20 –3:50 PM	**Contributed presentations**	Pocatello
3:50 – 4:10 PM	**Afternoon refreshment break**	Lobby
4:10 – 4:50 PM	**Contributed presentations**	Pocatello
6:00 – 9:00 PM	**Banquet and fundraiser!**	Taghee + GiveSmart App
Friday, March 4		**Room**
7:00 – 8:20 AM	**Pastries, coffee, tea, and juice**	Lobby
7:00 AM – 12:00 PM	**Vendor displays**	Lobby and Hallway
8:20 – 9:40 AM	**Contributed presentations (concurrent)**	Taghee and Pocatello
9:40 – 10:00 AM	**Refreshment break**	Lobby
10:00 – 11:15 AM	**Contributed presentations, IGNITE! talks**	Taghee
11:30 AM	**Meeting close and best paper awards**	Taghee
12:00 – 2:00 PM	**EXCOM meeting**	Racehorse

Shoshone-Bannock Events Center Floor Plan



Livestream, Web, and AV Services provided by

American Fisheries Society Code of Conduct

American Fisheries Society (AFS) meetings are among the most respected scientific meetings of fisheries professionals in the natural resource scientific community. AFS values the diversity of views, expertise, opinions, backgrounds, and experiences reflected among all attendees, and is committed to providing a safe, productive, and welcoming environment for all meeting participants and AFS staff. All participants, including, but not limited to, attendees, speakers, volunteers, exhibitors, staff, service providers, and others, are expected to abide by this Meetings Code of Conduct. This Code of Conduct applies to all AFS meeting-related events, including those sponsored by organizations other than AFS but held in conjunction with AFS events, in public or private facilities.

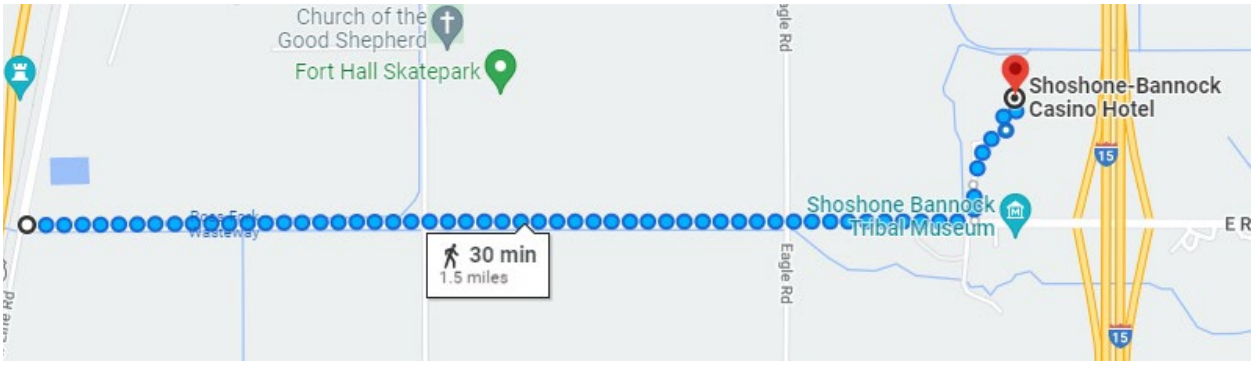
By participating in this meeting of the Idaho Chapter, all attendees—whether in-person or remote—agree to adhere to the Code of Conduct. The AFS Ethics and Professional Conduct Committee (EPCC) is responsible for handling complaints related to potential violations of the Code of Conduct, while helping to ensure consistent treatment of members across all AFS units. The EPCC has created an **online reporting form** for meeting attendees to submit complaints directly to the EPCC chair. Please take time to familiarize yourself with the Code of Conduct and its purpose. The full text is available on the AFS website at https://fisheries.org/about/governance/afs-meetings-code-of-conduct/.

Shoshone-Bannock Hotel and Events Center Covid Safety Policy

All persons that are entering the Shoshone Bannock Casino Hotel must be wearing a mask before entry. Masks must be worn at all times while inside the building unless persons are actively eating or drinking. Presenters speaking in one of the meeting session rooms may remove their mask while speaking. Sanitizing stations will be provided by the Shoshone Bannock Casino Hotel and be placed at the main event entrance and around the event center room for use by attendees. All public water fountains inside the Shoshone Bannock Casino Hotel will not be available for use as they are closed off and marked 'Temporarily Out of Order'.

Spawning Run location

The spawning run will start in the parking lot in front of the hotel, proceed out of the lot onto Ross Fork Rd., and turn right (west) on Ross Fork Rd. Runners will proceed west on Ross Fork Rd. to the intersection of Highway 91, turn around, and return to the hotel parking lot. Total distance is 5 km.



2022 ICAFS Meeting Theme

Fisheries professionals must address an ever-increasing list of threats to fish, their habitats, and the people who interact with them for cultural, economic, physical, and spiritual sustenance. Climate change, habitat fragmentation and loss, societal distrust of science, communicating in a digital world, and the ongoing covid-19 pandemic all present challenges to the management and conservation of fish and fisheries across the globe. Here in the western U.S., long-term drought, coupled with record-setting heat and compounded by hydrologic and habitat alteration, have negatively affected a wide variety of ecosystems and species, ranging from anadromous fish of the Columbia/Snake River basin to popular recreational fisheries in irrigation storage reservoirs to the iconic wild trout fisheries of the Yellowstone region. In turn, equally diverse groups of fisheries users and stakeholders have been negatively affected—Indigenous peoples, urban anglers, and tourist-dependent communities in rural areas. Themes of Idaho Chapter AFS meetings in recent years reflect the diversity of challenges posed by these problems and the diversity of potential solutions. Topics have included the land-water interface (joint with the Wildlife Society), science-based fishing regulations vs. angler ethics, science communication, and aquaculture. Tackling this diverse set of challenges with a diverse set of tools requires a diverse set of fisheries professionals. Sustaining that diverse profession will require removing barriers to entry, training, development and professional fulfillment of people currently under-represented in the profession. The 2022 meeting will explore some of these barriers and present ideas for their removal. Topics addressed in workshops, plenary talks, and invited papers will range from cultural competency to traditional ecological knowledge to locally based examples of how career opportunities for under-represented groups are being expanded. The planning committee hopes that this meeting will prompt conversations within ICAFS that will open career pathways for diverse fisheries professionals in Idaho.

Workshops

Diverse Perspectives on the Current and Emerging State of Aquaculture in Idaho

Organized by the Aquaculture Committee.

Speakers: Joe Kozfkay, Bob Becker, Kenny Naillon, Sean Nepper, Stuart Rosenberger, Nate Weise, Dr. Brian Small, Dave Venditti, Matt Campbell, Shawn Young, Sage Hallenbeck, Kelsey Lear, Matt Sutterfield

Aquaculture has a robust history here in Idaho and it has been utilized for several purposes throughout the years. These include the conservation of native fish species, providing sportfish and harvest opportunities for our residents and visitors, as well as a vital commercial sector which provides a sustainable food product and a strong contribution to the state's economy. For this 2022 ICAFS aquaculture workshop, the Aquaculture Committee would like to expose you to a diversity of fish culture programs and perspectives from around the state of Idaho. Presenters will discuss a variety of current and emerging topics from various public, private, tribal and educational foci. We hope this will serve as an educational tool to new and tenured fish culture professionals who are looking to supplement their understanding of how we got to where we are and where we are heading.

Cultural Competency and Relevancy

Conducted by Dr. Sammy Matsaw and Jessica Matsaw

In the sciences so much is lost in communication, when communicating is the heart of the work scientists do as managers and researchers in natural resources. The nuance in language is not lost in nomenclature, taxonomy, and so on; however, in everyday speaking with people from different ideas, backgrounds, and ways of knowing there is a lack of understanding. In this workshop we will enhance awareness of biases, communication skills, and the disparities between cultural knowledges. This workshop is not a be-all and end-all rather a starting point for ongoing self-work and labor to sustainably lift one's own awareness evolving towards social and environmental justice.

Jessica Matsaw is a tribal citizen of the Shoshone-Bannock Tribes. Jessica is an Alumni of the University of Idaho and IKEEP, receiving her M.Ed. in Curriculum and instruction plus (Idaho) teacher certifications, and certification in Diversity and Inclusion. Jessica teaches 9-12 grade Art, Cultural Arts and Tribal Government. Jessica is the Co-founder of River Newe, a non-profit organization that promotes and advocates for intergenerational learning experiences within Shoshone-Bannock Traditional Knowledge, teachings and homelands. Jessica is a mother of 4 children and shares her life with Sammy Matsaw.

Sammy is a father, husband, grandfather, and extended family member. Sammy, along with Jessica, oversees operations of River Newe; planning, coordination, website development, social media communications, and grant writing. He brings ten years of military experience and leadership. He has a Ph.D. with 10 plus years of science and management experience involved in Indigenous sovereignty and treaties with the Shoshone-Bannock Tribes' Fish and Wildlife department. He is also a pipe-carrier and Sundancer with both his mother's and father's tribes.

Inclusion in the Workplace: Practical Strategies for Consideration

Conducted by Dr. Tasha Souza

This interactive workshop will offer participants the opportunity to explore the concepts of diversity, equity, and inclusion (DEI) and how they can play a role in creating a more inclusive work environment. In particular, participants will be able to analyze and identify inclusion strategies most relevant to their position and role in fisheries agencies. In addition, the ways in which DEI plays a role in interactions, hiring, and decision making will be discussed.

Dr. Tasha Souza (she/hers) is the Director of BUILD (Boise State Uniting for Inclusion and Leadership in Diversity) and Professor of Communication at Boise State University. Prior to Boise State, she was Faculty Associate for Inclusive Teaching in the Office for Diversity and Inclusion and a Fulbright scholar at the University of the West Indies in Barbados. She has won several awards for her inclusion work and has published in such areas as difficult dialogues, addressing microaggressions with microresistance, and intercultural conflict. Dr. Souza is a consultant on communication, inclusion, and pedagogy broadly and has presented and facilitated workshops for over 20 institutions of higher education in the U.S. and abroad. She has also consulted and presented for numerous organizations such as Clearwater Analytics, the Yurok Tribe, Johnson Wax, Girls Inc., M & M/Mars, Clorox, Promotions Unlimited, Seattle Department of Public Health, San Jose Recreation and Leisure Department, and United Indian Health Services.

Plenary Session

Keynote Address: Decolonizing the "Fishing Hole"

Zachary L. Penney, PhD

National Oceanic and Atmospheric Administration

From a Western Science perspective, a "fishery" can be broadly defined as a system composed of three interacting components: habitat, biota, and humans, where "fishery management" is the manipulation of one or all these three elements (Murphy and Willis, 1996). Foundationally, the separation of the "human" element from the habitat and biota, is counter to many indigenous knowledge systems. Western Science fisheries objective[s] tend to focus on meeting some level of human exploitation, whether it be recreational, or commercial, whereas most indigenous resource management systems focus on reciprocity. The goal of this presentation is to highlight perspectives, differences in cultural values, and observations that may help further promote a sense of place not just for the benefit of the tribes, but all who live and work in places like the Columbia River Basin.

Zachary Penney, PhD *serves as a Senior Advisor to the NOAA Administrator, with a focus on fisheries and tribal engagement. Zach recently joined NOAA from the Columbia River Inter-Tribal Fish Commission (CRITFC), where he served as Fishery Science Department Manager from 2015-2022. Zach is Nimiipuu, a member of the Nez Perce Tribe, and has devoted his professional career to supporting tribal fisheries and treaty rights in the Columbia River basin and elsewhere. Prior to Zach's role at CRITFC, he served as a legislative fellow for Representative Jared Huffman (CA-2). Zach holds a Ph.D. in Natural Resources from the University of Idaho, a M.S. in Earth and Ocean Sciences from the University of Victoria, and a B.S. in Fisheries from Sheldon Jackson College in Sitka, Alaska. Zach grew up in Wallace, Idaho and his academic and professional career have serendipitously carried him along the same migration pathways as many of the anadromous salmonid populations he works to protect in the Columbia River Basin. As a Ph.D. student, Zach was a proud member of the Idaho Chapter of the American of the Fisheries Society (AFS), as well as a member of Palouse Student Subunit of AFS at the University of Idaho. Zach was awarded the American Fisheries Society's Emmeline Moore Prize in 2021.*

Cultivating Alliances: Beyond Colonial Unknowing and Toward Native Nation Building

Vanessa Anthony-Stevens, PhD

Department of Curriculum and Instruction, University of Idaho

Lack of attention to Indigenous sovereignty is pervasive in educational, research, and environmental management programs, and its void presents pressing tensions and challenges to be addressed in

Indigenous/non-Indigenous collaborations. Speaking particularly to non-Indigenous researchers, this presentation interrogates understanding of the role(s) and responsibilities of non-Indigenous collaborators in support of Indigenous community-driven solutions to pressing social and environmental issues. Questions of *when*, *where*, and *in what ways* non-Indigenous researchers can productively serve as allies in processes of community-driven social-ecological problem solving are addressed. Researchers are challenged to push beyond static recognition of colonial legacies and move toward productive, applied, and forward-facing alliance building that respects tribal sovereignty and supports Native nation building.

Vanessa Anthony-Stevens *holds a PhD in Language, Reading and Culture from the University of Arizona. She is an Associate Professor of Social and Cultural Studies and principal investigator of Indigenous Knowledge for Effective Education Program (IKEEP) in the Department of Curriculum and Instruction at the University of Idaho. Her research examines issues of diversity, equity, and justice in K-12 and higher education. She specializes in Indigenous education in the Americas. Vanessa's work has been funded by the U.S. Department of Education, the Spencer Foundation, and the Nation Science Foundation. She has published in journals such as the* Journal of American Indian Education*,* Cultural Studies of Science Education*, and the* Journal of Teacher Education*. She is married to Dr. Philip Stevens and is the mother to two daughters.*

Connecting the Dots: Scientific Collaborations Under the Lens of Diversity and Inclusion

Ivan Arismendi, PhD

Department of Fisheries, Wildlife and Conservation Science, Oregon State University

Productivity and impact are important qualities to evaluate fisheries careers, especially as they influence management, policy, and society. The inclusion of diverse groups in fisheries has shown little progress over the last two decades for various reasons, including structural barriers within both society and academia. Collaboration networks are important for productivity, promotion, and scientific impact, yet the extent to which the structure of these networks affects the inclusion of minoritized groups in fisheries remains unknown. I will present and summarize our current research about collaboration networks in fisheries focused on publications in international English-language journals and co-authorship networks over the last four decades. Fisheries science has experienced a profound transformation, becoming an inherently collaborative and larger discipline over time, yet women and people of color are not fully included. There is a consistent increase in the participation of minoritized groups as lead authors in research articles, but more than two thirds of all published research is still dominated by white men. This review will help us to understand gender disparities involved in fisheries science.

Dr. Ivan Arismendi *is an aquatic ecologist who currently holds an Associate Professor position at Oregon State University. Growing up in southern Chile, his interest for aquatic ecology was sparked as he witnessed the invasion of trout and salmon in his native waters. He leads scientific research focused on global environmental change, invasion biology, and aquatic food webs. He is also interested in the people who use or study in natural resources, which has led to emergent research on diversity, equity, and inclusion in science. To date, Dr. Arismendi has published 88 peer-reviewed articles and book chapters and has received various awards, including the "Savery Outstanding Young Faculty Award" from the College of Agricultural Sciences at Oregon State University and the Emmeline Moore Prize from the American Fisheries Society, a career achievement award that recognizes efforts in the promotion of demographic diversity in AFS.*

Invited Talks

Healing the Land and Water at the Bear River Massacre Site

Will Munger, Utah State University Climate Adaptation Science Program

Darren Parry, Former Chairman of the Northwestern Band of the Shoshone Nation

Removing Barriers Faced by Veterans in Joining the Civilian Natural Resources Workforce

Aaron Stanton, Mt. Adams Institute

Incorporating Diversity, Equity, and Inclusion in the Henry's Fork Foundation Internship Program

Kamberlee Allison, Henry's Fork Foundation

Mentoring: Opening Pathways for Young People to Enter the Fish Professions

Bart L. Gamett, Fish Biologist, U.S. Forest Service

Tuesday, March 1

7:00 AM – 5:00 PM	**Meeting and workshop registration, vendor setup**	Lobby and Hallway
8:00 AM – 12:00 PM	**Workshop: "Cultural Competency and Relevancy"**	Racehorse
12:00 – 1:00 PM	**Box lunch**	Lobby
1:00 – 5:00 PM	**Workshop: "Inclusion in the Workplace: Practical Strategies"**	Pocatello
5:00 – 5:30 PM	**Volunteer meeting**	Taghee
5:30 – 6:30 PM	**EXCOM meeting**	Racehorse

6:30 – 9:00 PM	**Welcome Social: Sponsored by Idaho Power**	**Taghee**

Wednesday, March 2

7:00 – 8:00 AM	**Continental breakfast**	Taghee
7:00 AM – 5:00 PM	**Registration and vendor displays**	Lobby and Hallway

8:00 – 10:00 AM	**Removing Barriers: Opening Pathways to the Fisheries Profession** Room: Taghee
8:00 – 8:05 AM	**Meeting opening** Tim Copeland, ICAFS President
8:05 – 8:15 AM	**Introduction to meeting theme and plenary session** Rob Van Kirk and Sammy Matsaw, ICAFS Executive Committee
8:15 – 8:20 AM	**Land Acknowledgment** Randy'L Teton, Shoshone-Bannock Tribes Public Affairs Manager **Welcome** Fort Hall Business Council Chairman Devon Boyer and/or Council Representative
8:20 – 9:00 AM	**Keynote address: Decolonizing the "Fishing Hole"** Dr. Zachary Penney, National Oceanic and Atmospheric Administration
9:00 – 9:20 AM	**Cultivating Alliances: Beyond Colonial Unknowing and Toward Native Nation Building** Dr. Vanessa Anthony-Stevens, Department of Curriculum and Instruction, University of Idaho
9:20 – 10:00 AM	**Connecting the Dots: Scientific Collaborations Under the Lens of Diversity and Inclusion** Dr. Ivan Arismendi, Department of Fisheries, Wildlife and Conservation Science, Oregon State University

10:00 – 10:20 AM	**Morning Break: Sponsored by Shoshone-Bannock Tribes**	**Taghee**

Wednesday, March 2 (Continued)

10:20 – 11:40 AM	**Invited Talks** Room: Taghee
10:20 – 10:40 AM	**Healing the Land and Water at the Bear River Massacre Site** Will Munger, Utah State University Climate Adaptation Science Program Darren Parry, Former Chairman, Northwestern Band of the Shoshoni Nation
10:40 – 11:00 AM	**Removing Barriers Faced by Veterans in Joining the Civilian Natural Resources Workforce** Aaron Stanton Mt. Adams Institute
11:00 – 11:20 AM	**Incorporating Diversity, Equity, and Inclusion in the Henry's Fork Foundation Internship Program** Kamberlee Allison Henry's Fork Foundation
11:20 – 11:40 AM	**Mentoring: Opening Pathways for Young People to Enter the Fish Professions** Bart Gamett US Forest Service

12:00 – 1:00 PM	**Committee Meetings** Box Lunch	
	Anadromous Fish Committee	Taghee
	Native Fish Committee	Pocatello
	Public Education Committee	Virtual only via Zoom

1:40 – 2:40 PM	**Wednesday Afternoon Contributed Presentations** **Concurrent Sessions**	
Room	Taghee	Pocatello
Moderator	Lauren Andrews	Brett High
1:20 – 1:40 PM	**Integrating Regional and Local Monitoring Data and Assessment Tools to Evaluate Habitat Conditions and Inform River Restoration** Eric Berntsen Kalispel Tribe Natural Resources Department	**Population Genetics Reveals Bidirectional Fish Movement Across the Continental Divide via an Interbasin Water Transfer in Colorado** Audrey Harris IDFG Eagle Fish Genetics Lab, PSMFC
1:40 – 2:00 PM	**Safe Passage: Using Fish Screen to Protect Migration Corridors of Fluvial Bull Trout** Kat Gillies-Rector Idaho Department of Fish and Game	**Effects of Initial Feed Timing on Early Survival of Bonneville Cutthroat Trout – Phase 2** Melissa Wagner Idaho Department of Fish and Game

Wednesday, March 2 (Continued)

2:00 – 2:20 PM	**Lower Granite Dam Data Shows Increasing Upstream Movement and Abundance of Walleye in the Snake River** Nolan Smith Idaho Department of Fish and Game	**Instream Complexity Increases Habitat Quality and Growth for Cutthroat Trout in Headwater Streams** Tyson Hallbert Idaho State University
2:20 – 2:40 PM	**Windfall Creek Stage 0 Project** Stephanie Hallock Coeur d'Alene Tribe	**Evaluating Target Levels of American White Pelican Abundance to Achieve Management Objectives for Adfluvial Yellowstone Cutthroat Trout** Josh McCormick Idaho Department of Fish and Game

2:40 – 3:00 PM	**Afternoon Break: Sponsored by Idaho Department of Fish and Game**	**Taghee**

3:00 – 4:00 PM	**Committee Meetings**	
	Aquatic Habitat **Mentoring** **Aquaculture**	Taghee Pocatello Virtual only via Zoom

4:20 – 5:15 PM	**Spawning Run/Walk Sponsored by Biomark**	**TBA**
5:15 – 6:15 PM	**Pre-Mixer Mentoring Panel Discussion**	**Pocatello and livestream**
6:15 – 9:00 PM	**Student/Professional Mixer**	**Taghee**

Thursday, March 3

7:00 – 8:00 AM	**Pastries, coffee, tea, and juice**	Lobby
7:00 AM – 5:00 PM	**Registration, vendor and poster display**	Lobby and hallway

8:00 – 9:20 AM	**Thursday Morning Contributed Presentations Concurrent Sessions**	
Room Moderator	Taghee Jim Gregory	Pocatello Joe Theissen
8:00 – 8:20 AM	**The Role of Network Complexity in Sustaining Biodiversity in Meta-Food Webs of a Wilderness River** Laurel Faurot Idaho State University	**No Presentation**
8:20 – 8:40 AM	**A Multi-Trophic Level Comparison of Headwater Stream-Riparian Ecosystems in Yellowstone National Park** Jeremy Brooks Idaho State University	**Coping with Stress: The Effects Environment, Seasonality, and Sex on Cortisol in Redband Trout** Alexander Wooding Idaho State University
8:40 – 9:00 AM	**Restoration of Abundance and Assessment of Transport of Unanchored Large Wood in a Small River in Central Idaho** Cassi Wood Trout Unlimited	**The Origin and Purity of *Oncorhynchus mykiss* in the Wood River Basin of Central Idaho** Matthew Campbell Idaho Department of Fish and Game
9:00 – 9:20 AM	**Selenium and Elk River Coal Mines, BC: Downstream Impacts to the Kootenai River** Shawn Young Kootenai Tribe of Idaho	**Intraspecific Variation of Rainbow Trout in Idaho: Genetic Comparison of Populations Among Idaho Watersheds Using Mitochondrial DNA** Tyler Breech Idaho State University

9:20 – 10:20 AM	**Poster Session and Morning Refreshments Sponsored by Partner Steel**	**Lobby/Hallway**

Thursday, March 3 (Continued)

10:20 – 11:50 AM	**Thursday Late Morning Contributed Presentations** Room: Pocatello Moderator: Megan Heller
10:20 – 10:30 AM	**Sponsor TechTalk** Partner Steel
10:30 – 10:50 AM	**Reservoir Drawdown vs. Kokanee in the Henry's Fork** Jack McLaren Utah State University and the Henry's Fork Foundation
10:50 – 11:10 AM	**Low Flow in the Lower Henry's Fork, Snake River: Investigating Streamflow-Habitat Relationships to Inform Water Management** Christina Morrisett Utah State University and the Henry's Fork Foundation
11:10 – 11:30 AM	**Administering Minimum Streamflows in Idaho with Voluntary, Market-Based Water Transactions: A Primer in Idaho Water Law and 20 Years of Water Transactions in the Upper Salmon Basin** John Loffredo Idaho Water Resource Board
11:30 – 11:50 AM	**Policies and Procedures Related to Establishing State Fishing Regulations and Rules in Idaho** Joe Kozfkay Idaho Department of Fish and Game

12:00 – 2:00 PM	**Business Lunch**	**Taghee**

2:20 – 3:50 PM	**Thursday Afternoon Contributed Presentations** Room: Pocatello Moderator: Mike Peterson
2:20 – 2:40 PM	**Encounter Rates and Catch-and-Release Mortality of Steelhead in the Snake River Basin** William Lubenau Idaho Cooperative Fish and Wildlife Research Unit
2:40 – 3:00 PM	**Effects of Long-Term Supplementation in the Upper Yakima River Spring Chinook Salmon** Ilana Koch Columbia River Inter-Tribal Fish Commission
3:00 – 3:20 PM	**Recent Issues in the Idaho Steelhead Fisheries and Use of an Integrated Population Model to Address Them** Lance Hebdon Idaho Department of Fish and Game

Thursday, March 3 (Continued)

3:20 – 3:40 PM	**Catching Steelhead in Idaho's capital** John Cassinelli Idaho Department of Fish and Game
3:40 – 3:50 PM	**Sponsor TechTalk** Biomark

3:50 – 4:10 PM	**Afternoon Break** **Sponsored by Biomark**	**Lobby**

4:10 – 4:50 PM	**Thursday Late Afternoon Contributed Presentations** Room: Pocatello Moderator: Kat Gillies-Rector
4:10 – 4:30 PM	**Pilot Study: Corded PIT Antennas in Pass-Through Orientation to Study Fish Utilization of Side Channels in the Lemhi River, Idaho** Michael Hall Biomark
4:30 – 4:50 PM	**A Timeline of Lower Granite Dam Adult Trapping and Data Use** Marika Dobos Idaho Department of Fish and Game

6:00- 9:00 PM	**The 60th Annual ICAFS Banquet/Fundraiser**	**Taghee**

Friday, March 4

7:00 – 8:20 AM	**Pastries, coffee, tea, and juice**	Lobby
7:00 AM – 12:00 PM	**Vendor display**	Lobby/hallway

8:20 – 9:40 AM	**Friday Morning Contributed Presentations** **Concurrent Sessions**	
Room Moderator	Taghee Christina Morrisett	Pocatello John Heckel
8:20 – 8:40 AM	**Distribution and Habitat Associations of Warrior Bass *Micropterus marriorensis* in the Black Warrious Watershed, Alabama** Amber Young Auburn University	**First Documentation of Least Chub in the Snake River Drainage in Idaho** Eric Billman Brigham Young University – Idaho

Friday, March 4 (Continued)

8:40 – 9:00 AM	**Upper Snake River White Sturgeon Evaluation** Nathan Tillotson Idaho Department of Fish and Game	**Population Dynamics of Utah Sucker in the South Fork Teton River, Idaho** Trevor Wheeler Brigham Young University – Idaho
9:00 – 9:20 AM	**Rapid Recolonization of Upstream Habitats by Steelhead Following a Culvert Modification** Brian Knoth Idaho Department of Fish and Game	**Cryptic Catostomids: Using Morphological and Genetic Data to Assess Species Diversity in Bluehead and Mountain Suckers Across Watershed Boundaries** Brandy Smith Idaho State University
9:20 – 9:40 AM	**Growth and Seasonal Food Habits of Walleyes in Lake Pend Oreille, Idaho** Susan Frawley Idaho Cooperative Fish and Wildlife Research Unit	**Temperature and Winter Duration Requirements for Reproductive Success in Johnny Darter *Etheostoma nigrum* in the South Platte River Basin, Colorado** Carli Baum Idaho Department of Fish and Game

9:40 – 10:00 AM	**Morning Break: Sponsored by Idaho Governor's Office of Species Conservation**	**Lobby**

10:00 – 11:00 AM	**Friday Late Morning Contributed Presentations** Room: Taghee Moderator: Eric Geisthardt
10:00 – 10:20 AM	**Evaluating the Influence of Beaver Ponds on Nonnative Brook Trout in Idaho Streams Using Species Distribution Models** Chris Caudill University of Idaho
10:20 – 10:40 AM	**Investigating Threshold Relationships between Native Bull Trout and Invasive Brook Trout in Idaho Using a Large Geospatial Dataset** Nicholas Voss University of Idaho
10:40 – 11:00 AM	**Removal of Brook Trout and Response of Bull Trout and Westslope Cutthroat Trout in the West Fork Crooked River Watershed, Idaho** Dave Mays U.S. Forest Service

11:00 – 11:15 AM	**IGNITE! Presentations** Room: Taghee
11:00 – 11:07 AM	**Juvenile Age Validation of the Snake River Sockeye Salmon (*Oncorhynchus nerka*)** Karen Gregory PSMFC/IDFG

11:07 – 11:15 AM	**Get to Know Your Muscles Mussels!** Lyn Snoody Idaho Department of Fish and Game	
11:30 AM	**Meeting Close and Best Paper Awards**	**Taghee**
12:00 – 2:00 PM	**EXCOM Meeting**	**Racehorse**

Poster Titles and Presenters

In alphabetical order by presenter last name

Macroinvertebrate Community and Introduced Aquarium Species in Warm Springs Creek, Idaho. **Mercedes Batalla. Brigham Young University – Idaho.**

Dietary Overlap and Prey Selection of Longnose Dave and Sculpin in Two Streams in the Teton River drainage. **Ashton Buma, Brigham Young University – Idaho.**

The Jumping Ability of Wild Age-0 Brook Trout. **Clara Comer, U.S. Forest Service.**

Integrating 3-R Concepts Into a Multispecies Native Fish Assessment for the Bonneville Basin. **Daniel Dauwalter, Trout Unlimited.**

Timing of Spawning Runs of Yellowstone Cutthroat Trout and Bluehead Suckers in the South Fork Teton River, Idaho. **Claire Davis, Brigham Young University – Idaho.**

Trout Unlimited's Priority Waters Process for Idaho. **Jim DeRito, Trout Unlimited.**

Life History and Movement of Bull Trout in the Lemhi River basin. **Hunter Distad, Pacific States Marine Fisheries Commission.**

Comparing Catch, Precision, and Efficiency of five sampling gears commonly used to monitor Yellow Perch. **Justin Furby, Idaho Department of Fish and Game.**

Measuring Drift Density in Streams to Understand Invertebrate Food Availability for Redband Trout. **Hannah Kemp, University of Idaho.**

Whole Genome Re-sequencing of Chinook Salmon Populations Across the Columbia River Basin. **Rebekah Horn, Columbia River Inter-Tribal Fish Commission.**

Trends in Abundance of Juvenile Salmonids in Response to Large Wood Restoration Treatments in the East Fork Potlatch River, Idaho. **Beth Kennedy, Idaho Department of Fish and Game.**

First Documentation of *Ergasilus centrarchidarum* in Ririe Reservoir, Idaho. **Danielle Perkins, Brigham Young University – Idaho.**

A Comparison of Age Reader Bias and Precision Across Chinook Salmon Scales and Fin Rays. **Alex Stacy, Pacific States Marine Fisheries Commission.**

A Study of Sculpin Taxonomy and Distribution in Big Creek, a Central Idaho Wilderness River Network. **Colton Turner, Idaho State University.**

A Rising Tide: Engaging the AFS Community on Diversity and Inclusion. **Rebecca Waskovich. Idaho Department of Fish and Game.**

Testing Mark-Recapture Assumptions at the South Fork Salmon River Rotary Screw Trap. **Kaitlyn Wauhkonen, Pacific States Marine Fisheries Commission.**

Oral Presentation Abstracts

In alphabetical order by presenter last name

Incorporating Diversity, Equity, and Inclusion in the Henry's Fork Foundation Internship Program

Allison, Kamberlee. Henry's Fork Foundation; Morrisett, Christina. Henry's Fork Foundation; Van Kirk, Rob. Henry's Fork Foundation; Muradian, Melissa. Henry's Fork Foundation; Laatsch, Jamie. Henry's Fork Foundation

Diversity, equity, and inclusion (DEI) in the fisheries and natural resource industries has lagged behind US population trends for decades even though greater DEI in the workplace increases employee engagement and trust, and leads to greater innovation regardless of the field. Improving DEI in company policies and culture is necessary for the success and retention of underrepresented staff. However more improvements must be made to company recruitment policies and process---including internship recruitment and experience---to further expand job application pools and hire those staff in the first place. The Henry's Fork Foundation (HFF) is a non-profit organization focused on conserving the unique fisheries and water resources of the Henry's Fork and South Fork watersheds. This talk will discuss practical ways that HFF is working to improve DEI implementation in its internship program. These efforts include: improved representation in our seminar series guest speakers and topics; grant submissions to recruit and support interns from minority serving institutions; adding DEI language to our internship policies; and attending DEI trainings. HFF also plans to take steps towards equity by eliminating implicit and affinity biases in the intern selection process through creating a formalized intern application review process. A 2022 summer intern will conduct a comprehensive review and analysis of the internship program, which will help inform who the internship program is serving and how we can improve diversity and equity in recruitment. Fisheries and natural resource organizations can do more to improve DEI in the workplace; this talk offers several examples.

Macroinvertebrate Community and Introduced Aquarium Species in Warm Springs Creek, Idaho

Batalla, Mercedes. Brigham Young University – Idaho; Beatty, Ryan. Bureau of Land Management; Billman, Eric. Brigham Young University – Idaho

Geothermally influenced streams in high latitudes provide islands of habitat for organisms that are warm-adapted. Warm Springs Creek is in the Medicine Lodge drainage of Idaho and represents a warm-water stream amid cold, mountain streams. The objective of this paper was to assess relative abundance of macroinvertebrates and fish in Warm Springs Creek. We sampled at four 100-m sites in the first 3 km downstream of the spring source in April, July, and early October 2021. Macroinvertebrate samples were gathered with kick nets, and fish were collected with a backpack electrofisher. For macroinvertebrates, species richness was similar across sites and seasons. Species diversity was the lowest at Site 1 and highest in July for the other sites. Riffle beetles (family Elmidae) were the most abundant, representing 48% of macroinvertebrates across all samples. We also captured native Creeping Water Bugs (*Ambrysus mormon*) and invasive Red-rimmed Melania (*Melanoides tuberculate*). At all sites, we captured Guppies (*Poecilia reticulata*) and Green Swordtails (*Xiphophorus helleri*), both of which have been illegally introduced. Site 1 had a low fish abundance, presumably due to the steep gradient and high water velocities. Relative abundance of Green Swordtails increased at the downstream sites, representing 84% of fish captured at the most downstream site. The mean annual temperature near the spring source was 27.8°C, and showed minimal fluctuations (maximum range = 0.7°C). Water temperature had greater variability at the most downstream site (mean = 19.8°C; maximum range = 13.7°C). Water temperature and physical habitat (e.g. gradient, substrate, etc.) likely influence distribution and interactions among organisms in Warm Springs Creek. While Warm Springs Creek does not represent the typical cold, mountain stream of Idaho, it does represent unique habitat for warm-adapted species including invasive species that are illegally introduced; therefore, we should continue to study and monitor Warm Springs Creek.

Temperature and Winter Duration Requirements for Reproductive Success in Johnny Darter Etheostoma nigrum in the South Platte River Basin, Colorado

Baum, Carli. Idaho Department of Fish and Game; Winkelman, Dana. U.S. Geological Survey, Colorado Cooperative U.S. Fish and Wildlife Research Unit; Fitzpatrick, Ryan. Colorado Parks and Wildlife

Changes in water temperature and its seasonal timing influences the physiological processes of many aquatic ectotherms. Wastewater treatment plants (WWTP) along Front Range streams of Colorado have contributed to warmer and more consistent water temperatures throughout the year, particularly in winter months. Reduced variation in seasonal temperatures may have adverse effects on fishes that rely on temperature fluctuations or sustained periods of specific overwinter temperatures for reproductive cues and proper gonadal development. Assessing thermal requirements for reproduction is necessary for the conservation of native warmwater fishes residing in WWTP effluent-impacted streams. Johnny Darter *Etheostoma nigrum* (Family Percidae) are used as a sentinel species to assess winter water temperature regulations in Colorado because they are a thermally sensitive native species; however, their winter temperature requirements for successful reproduction are not known. Therefore, we evaluated the effects of winter stream temperature and winter duration on Johnny Darter reproductive success in the laboratory. Winter duration and temperature treatments simulated warmed effluent-impacted streams as well as streams with a natural thermal regime. Data indicated winter temperature and duration

influenced timing of reproduction and egg development. Earlier spawning initiation was observed in fish exposed to warm winters and along with longer development time of eggs spawned at cooler water temperatures. Egg and larval production was similar among treatments and indicates that the current winter water temperature standard may be adequate. However, reproductive output needs to be evaluated in the context of seasonal timing because spawning timing has the potential to effect overall production, egg development and survival. Temperature sensitive fishes like the Johnny Darter are most vulnerable to extirpation from urbanization, and our results contribute to policies protecting endemic fishes that serve as important indicator species for ecological integrity of Great Plains streams.

Integrating Regional and Local Monitoring Data and Assessment Tools to Evaluate Habitat Conditions and Inform River Restoration

Mejia, Francine. U.S. Geological Survey; Connor, Jason. Kalispel Tribe Natural Resources Department; Kaufmann, Phillip. U.S. Environmental Protection Agency; Torgersen, Christian. U.S. Geological Survey; **Berntsen, Eric. Kalispel Tribe Natural Resources Department**; Andersen, Todd. Kalispel Tribe Natural Resources Department

Restoring degraded rivers requires initial assessment of the fluvial landscape to identify stressors and riverine features that can be enhanced. We associated local-scale river habitat data collected using standardized national monitoring tools with modeled regional water temperature and flow data on mid-sized northwest U.S. rivers (30-60 m wide). We grouped these rivers according to quartiles of their modeled mean August water temperature and examined their physical habitat structure and flow. We compared local conditions in the Priest River, a river targeted for restoration of native salmonid habitat in northern Idaho, with those in other rivers of the region to infer potential drivers controlling water temperature. We found that the warmest rivers exhibited uniformly simplified physical structure, suggesting that thermal and physical degradation together may comprise a syndrome. The Priest River sites had approximately twice as many deep residual pools and incision that averaged twice that in the coldest rivers. Percentage fines and natural cover in the Priest were also more typical of the higher-temperature river groups. We found low instream cover and low levels of large wood both across the region and within the Priest River. This approach can help define attainable goals for management and restoration. The views expressed in this abstract are those of the authors and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

First Documentation of Least Chub in the Snake River Drainage in Idaho

Billman, Eric. Brigham Young University – Idaho; Stokes, Dallin. Brigham Young University - Idaho; Calderwood, Isaac. Brigham Young University - Idaho; Diehl, Cody. Brigham Young University - Idaho; Johnson, Jerald. Brigham Young University – Idaho

The Least Chub is a small minnow endemic to the Bonneville Basin in Utah where current distribution of extant populations is limited to a few small spring complexes. We report on the first documentation of Least Chub in the upper Snake River drainage in Idaho. In June and October 2021, we surveyed for small-bodied fishes in off-channel habitat of lower Henry's Fork in Cartier Wildlife Management Area west of Rexburg. Small-bodied fishes were sampled at 17 sites in off-channel habitat; five baited minnow traps (galvanized steel) were set for approximately 24 hr at each site. In June, we captured a total of 216 Least Chub at six of the 17 sites. Least chub ranged in size from 35 - 52 mm total length (mean = 43 mm; SD = 3.3 mm). Both females and males within the sample of Least Chub were mature; females were expressing

eggs and males had red/orange coloration laterally. In October, we captured a total of 34 Least Chub at six of the 17 sites. Least Chub were captured at two sites where we captured Least Chub in June. Two sites where Least Chub were captured in June were dry when we sampled in October. Least Chub ranged in size from 39 - 51 mm total length (mean = 45 mm; SD = 2.8 mm). The habitat in sites where Least Chub were captured consisted of muddy or sandy substrate, slow-moving or stagnant water, submerged and emergent macrophytes, and filamentous algae. Additional surveys should be completed to determine the extent of the distribution of Least Chub in Henry's Fork and Snake River. Genetic analyses should also be completed to determine the relationship of this population of Least Chub to populations of Least Chub in the Bonneville Basin.

Intraspecific Variation of Rainbow Trout in Idaho: Genetic Comparison of Populations among Idaho Watersheds Using Mitochondrial DNA

Breech, Tyler. Idaho State University; Keeley, Ernest. Idaho State University; Loxterman, Janet. Idaho State University

Widely distributed species often exhibit intraspecific variation between populations, and accounting for intraspecific variation is a crucial consideration in species assessments and conservation plans. Often, species are divided into subspecies or distinct population segments to describe within-species differences, and historically, phenotypic differences were used to define subspecies. However, genetic tools have increasingly revealed divergence patterns generalized phenotypic observations may not characterize. Rainbow Trout (*Oncorhynchus mykiss*) are one of the mostly distributed salmonid species, and exhibit a substantial amount of within-species variation. There have been many efforts to accurately define subspecies and distinct populations, but recent analyses have suggested classical phenotypic demarcations do not capture significant genetic divergence between some populations. To examine the range of genetic variation between native Rainbow Trout populations in Idaho watersheds, we collected genetic data from Rainbow Trout in nine river drainages. Using mitochondrial DNA sequences, we examined genetic variation between populations. This study is one part of a larger study examining concordance between phenotypic and genetic divisions in Rainbow Trout, and provides a piece of the framework for determining relationships among populations across the entire native range.

A Multi-Trophic Level Comparison of Headwater Stream-Riparian Ecosystems in Yellowstone National Park

Brooks, Jeremy. Idaho State University; Baxter, Colden. Idaho State University; MacNeill, Keeley. Oregon State University; Warren, Dana. Oregon State University; Ripple, William. Oregon State University; Beschta, Robert. Oregon State University;

In northern Yellowstone National Park, the extirpation of apex predators had cascading consequences for riparian plant communities, transitioning them from willow/alder to grassland dominated. In some locations this trajectory has been reversed over the past few decades through trophic cascades triggered by large carnivore restoration, along with other biotic and abiotic factors. Thus, these streams have varying histories and trajectories of change. Across the current mosaic of stream-riparian conditions, we conducted a multi-trophic level comparison to evaluate how riparian vegetation state influences food webs and ecosystem processes. From 2018 - 2021, we repeatedly sampled five headwater streams (three willow/alder and two grassland-dominated) to characterize the diversity and productivity of aquatic primary producers, invertebrates, and fishes, as well as food-web linkages and trophic-transfer

efficiencies. Most metrics of aquatic primary producers (e.g., alpha and beta diversity), invertebrates (e.g., alpha and beta diversity, annual secondary production), and fishes (e.g., species assemblage, annual secondary production, annual demand) varied as much within willow/alder and grassland streams as between. We found the clearest differences between stream categories in abiotic characteristics and primary productivity. Grassland-dominated streams had greater solar radiation and more extreme summertime daily maximum temperatures than willow/alder streams. Mean daily stream temperatures, however, were similar across all streams, except during the winter when only willow/alder streams froze. Annual gross primary production was 2 - 20 times higher in grassland streams, though some willow/alder streams had comparable peaks of productivity in spring prior to leaf-out. Despite higher primary production, grassland streams did not exhibit consistently higher annual secondary production of invertebrates or fishes. Together, this suite of observations suggests that in addition to riparian vegetation state, individual site characteristics, from traits of primary producers, invertebrates, and fishes to hydrologic and geomorphic conditions, mediate the diversity, productivity and trophic-transfer efficiency of these Northern Range headwater stream-riparian ecosystems.

Dietary Overlap and Prey Selection of Longnose Dace and Sculpin in Two Streams in the Teton River Drainage

Radke, Shaleigh. Brigham Young University - Idaho; **Buma, Ashton. Brigham Young University - Idaho**; Baker, Trevor. Brigham Young University - Idaho; Billman, Eric. Brigham Young University - Idaho

Longnose Dace (*Rhinichthys cataractae*) and sculpin (*Cottus spp.*) are small benthic fishes that occupy a similar niche in the streams of Southeast Idaho. The objective of this study was to determine the dietary overlap and prey selectivity of Longnose Dace and sculpin in Canyon Creek and South Fork Teton River in the Teton River drainage. We collected at least 30 fish from each species and macroinvertebrate samples in both streams during October 2021. Stomach contents of individual fish were identified to the order level, and relative abundance of available prey was determined using the macroinvertebrate samples. We compared dietary overlap and prey selectivity among small, medium, and large size classes within each species and among species for each site. Sculpin had significant dietary overlap (>60%) among size classes within each stream. In South Fork Teton River, sculpin of all size classes positively selected for trichopterans and dipterans, while sculpin of all size classes in Canyon Creek positively selected for trichopterans. Only large sculpin (>90 mm) in each stream preyed on other fishes. Longnose Dace had significant dietary overlap among all size classes in South Fork Teton River, whereas in Canyon Creek the only significant dietary overlap was among medium and large fish. In South Fork Teton River, Longnose Dace positively selected for dipterans. In Canyon Creek, prey diversity of Longnose Dace increased with the total length of fish. Longnose Dace and sculpin had significant dietary overlap in Canyon Creek, but not in South Fork Teton River. Increased habitat and prey diversity in Canyon Creek may allow for more dietary overlap and less niche partitioning between Longnose Dace and sculpin.

The Origin and Purity of *Oncorhynchus mykiss* in the Wood River Basin of Central Idaho

Campbell, Matthew. Idaho Department of Fish and Game; Delomas, Thomas. U.S.D.A. A.R.S. National Cold Water Marine Aquaculture Center; Meyer, Kevin. Idaho Department of Fish and Game; Peterson, Michael. Idaho Department of Fish and Game

The origin and taxonomic identification of trout within the Wood River basin of central Idaho has been in question for more than 120 years. The earliest surveys described specimens from the Wood River as

cutthroat trout *Oncorhynchus clarkii* (Gilbert and Evermann 1894). Later surveys described them as rainbow trout *O. mykiss* and based on meristic examination of a single museum specimen, it was suggested they were a relict form of redband trout (Behnke 1979). Genetic investigations conducted over the last 30 years, using a variety of genetic markers, suggested they were Columbia River redband trout *O. m. gairdneri*, but had been extensively introgressed or replaced with coastal hatchery rainbow trout *O. m. irideus*. In an attempt to disentangle the various hypotheses of native contemporary, native relict, non-native, or some admixture between native and non-native forms, we greatly expanded the sampling and genetic screening that had been completed in previous studies. Our results suggest that *O. mykiss* are native to the Wood River Basin, have been isolated for a long period of time, and represent a unique, previously undescribed lineage of *O. mykiss*. Surprisingly, despite extensive hatchery stocking throughout the basin, introgression from non-native hatchery rainbow trout of coastal origin appears limited. We discuss management and conservation implications for current populations within the basin.

Catching Steelhead in Idaho's Capital

Cassinelli, John. Idaho Department of Fish and Game; Butts, Art. Idaho Department of Fish and Game; D'Amico, Tim. Idaho Department of Fish and Game

Adult steelhead trapped in addition to broodstock needs at Idaho Power's Hells Canyon trap are distributed between the Nez Perce Tribe, Oregon Department of Fish and Wildlife, and the Idaho Department of Fish and Game (IDFG). Since 1983, IDFG has utilized their portion of these surplus adults to create a steelhead fishery in the Boise River. While this fishery is highly popular, an evaluation of how many of these out-planted adult steelhead get caught by anglers has been lacking. In 2020 and 2021, we utilized IDFG's Tag! You're It! program to evaluate what percent of these fish are both caught and harvested by implanting T-bar anchor tags into a portion of the fish at the time of stocking. Results from these tagging efforts will help guide future management related to out-planted adult steelhead.

Evaluating the Influence of Beaver Ponds on Bonnative Brook Trout in Idaho Streams Using Species Distribution Models

Caudill, Chris. University of Idaho; Herrington, Autumn. University of Idaho; Seaborn, Travis. University of Idaho

Beavers (*Castor canadensis*) alter the hydrologic, biotic, and geomorphic processes of stream systems in ways that benefit many aquatic species. As a result, beaver relocation is increasingly being used as a stream restoration tool. However, beaver impoundments could also facilitate the spread of nonnative fish species. This study aims to evaluate the influence of beaver ponds on nonnative Brook Trout (*Salvelinus fontinalis*) in Idaho because Brook Trout can impact native salmonids in western streams. We are using species distribution modeling techniques to evaluate the role of beaver ponds, relative to other environmental variables, in determining the observed distributions of Brook Trout. Specifically, we used the Beaver Restoration Analysis Tool (BRAT) outputs, IDFG Brook Trout distribution data, a valley confinement algorithm, NHDPlusV2 data, and other existing environmental data layers to generate alternative distribution models for Brook Trout. Beaver ponds were associated with Brook Trout presence, though the best model had a combination of additional variables and temperature, velocity, hydraulic conductivity, and valley confinement were more influential predictors than beaver complex capacity score. Overall, the results suggest beaver impoundments could facilitate Brook Trout in some ecological contexts. Thus, the potential positive effects of impoundments on watershed processes will have to be

weighed against the risks of Brook Trout to native fishes as beaver recolonize watersheds and as beaver dam analogs are implemented as a habitat restoration measure. Similar models may prove useful for exploring the role of beaver impoundment on the distribution of native and nonnative fishes as beaver recolonize landscapes.

The Jumping Ability of Wild Age 0 Brook Trout

Comer, Clara. U.S. Forest Service; Gamett, Bart. U.S. Forest Service

Understanding the ability of Brook Trout *Salvelinus fontinalis* to jump vertical plunges is essential to fish conservation efforts aiming to protect native species. This information is useful for management strategies that seek to limit the movement of Brook Trout in areas where they have been introduced and pose a risk to native species. It is also useful in efforts to maintain or restore connectivity within the native range of Brook Trout. While previous efforts have described the jumping ability of hatchery-reared Brook Trout, additional work is needed to determine the maximum jump height of wild Brook Trout less than 100 mm in length. Our objective was to determine the maximum jump height of wild Brook Trout ranging from 50-99 mm in length (69.6 mm mean total length) by exposing fish to vertical plunges of varying heights while maintaining a plunge pool depth of 50 cm. Fish successfully passed over plunge heights of 0, 10, and 20 cm but did not pass a 30 cm plunge height. This suggests that wild Brook trout in the size class we evaluated cannot jump a 30 cm fall. We anticipate this information will aid management agencies in designing impassable barriers and, conversely, toward efforts that seek to facilitate the ability of Brook Trout to move freely within their native range.

Integrating 3-R Concepts Into a Multispecies Native Fish Assessment for the Bonneville Basin

Dauwalter, Daniel. Trout Unlimited; Seegert, Sarah. Utah Division of Wildlife Resources; Burnett, Paul. Trout Unlimited; Oplinger, Randy. Utah Division of Wildlife Resources; Badame, Paul. Utah Division of Wildlife Resources

Freshwater fishes continue to be threatened by myriad anthropogenic land and water uses, climate change, and other factors. The 3-R framework (representation, redundancy, and resiliency) has been used to develop conservation portfolios for native trout, maximize [sub]species viability, and hedge against future uncertainty. We integrated 3-R concepts for native trout with non-game species data to highlight core areas for native fish conservation across the Bonneville Basin. The core-area analysis - implemented in Zonation 4.0 software - resulted in a hierarchical ranking (0 - 1, with 1 being highest) of Bonneville Basin catchments that maximizes species (or life history and genetics) representation and redundancy while considering species-specific weightings and connectivity needs, stream network connectivity, and threats to aquatic habitat. For Bonneville Cutthroat Trout, representation focused on resident, fluvial, and adfluvial life histories within regions harboring unique genetic diversity (Bear River versus other regions), whereas resiliency was inferred by population density (N/km). Native non-game fishes were represented by known or predicted occurrences. The assessment highlights high-ranking catchments, such as Bear Lake, Logan and Weber rivers, and Leland Harris Spring Complex, that harbor unique life histories, endemic fish assemblages, or populations of rare native fishes. The landscape assessment will be used by the Desert Fish Habitat Partnership (DFHP) and Western Native Trout Initiative (WNTI) to inform granting programs and identify watersheds for collaborative conservation. It will also serve as an important tool

for use by agencies and organizations conserving and managing a portfolio of native fish diversity in the Bonneville Basin.

Timing of Spawning Runs of Yellowstone Cutthroat Trout and Bluehead Sucker in South Fork Teton River, Idaho

Davis, Claire. Brigham Young University – Idaho; Vincent, Jennifer. Idaho Department of Fish and Game; High, Brett. Idaho Department of Fish and Game; Billman, Eric. Brigham Young University - Idaho

The objective of this study was to determine the timing of spawning runs of Yellowstone Cutthroat Trout (YCT) and Bluehead Sucker in the South Fork Teton River. Earlier research suggested YCT migrate earlier in the South Fork Teton River than adjacent drainages, and little is known about the spawn timing of Bluehead Sucker. We installed and operated a fish trap in the South Fork Teton River's existing fish ladder at the Rexburg Canal diversion from March through June in 2018, 2019, and 2021. Over the three years, we captured a total of 467 YCT of which 84% were likely juveniles (< 350 mm). The number of YCT that we assumed to be mature (> 350 mm) decreased each year. We captured 52 mature fish in 2018, 14 mature fish in 2019, and 10 mature fish in 2021. Yellowstone Cutthroat Trout arrived in the trap progressively later each year; the 50% run date was 22 April in 2018, 6 May in 2019, and 18 May in 2021. We captured a total of 143 Bluehead Sucker across the three years: 35 in 2018, 15 in 2019, and 88 Bluehead Sucker in 2021. All Bluehead Sucker appeared to be mature based on secondary sexual characteristics except for one individual in 2021 (TL = 230 mm). Each year, Bluehead Sucker were captured between 22 April and 9 June with the 50% run date occurring between 16 - 29 May. Our work leads us to conclude that further studies of both species describing run timing and factors affecting it would help managers better understand population dynamics of YCT and Bluehead Sucker in the South Fork Teton River.

Trout Unlimited's Priority Waters Process for Idaho

DeRito, Jim. Trout Unlimited; Crawford, Eric. Trout Unlimited

Trout Unlimited has begun a nationwide priority waters process as part of its current strategic plan (2021 to 2026) to further our mission to conserve, protect and restore cold-water fisheries throughout the nation. This process is intended to guide where TU puts its staff resources and attention to benefit trout and salmon for this time period. In each state, TU is using a GIS mapping application to assist identification of priority watersheds and places. In Idaho, we used existing data at the watershed level (10-digit Hydrologic Unit Code) aggregated to subbasins (HUC-08) to summarize ecological variables such as trout and salmon distribution, land protection, and climate resiliency, along with social variables to characterize needs and opportunities for wild and native trout conservation. We worked with TU state councils and chapters to use local knowledge to further inform our analyses of wild and native fishes. Here we present preliminary results of this process and seek input from state and federal agencies, tribes, and other stakeholders on identified subbasins and landscapes. The goal of the priority waters process is to create a more effective and efficient means for TU to work both internally and externally to further the conservation of trout and salmon in Idaho and beyond.

Life History and Movement of Bull Trout in the Lemhi River Basin

Distad, Hunter. Pacific States Marine Fisheries Commission; Meyer, Stacey. Idaho Department of Fish and Game; Diluccia, Jeff. Idaho Department of Fish and Game

We evaluated 20 years of Bull Trout *Salvelinus confluentus* data collected in the Lemhi River sub-basin to determine current Bull Trout distribution, migration patterns, and habitat use. The Lemhi River and its multiple tributaries support populations of resident and fluvial Bull Trout which are listed under the Endangered Species Act. Stream dewatering resulting from irrigation water withdrawals, has limited the migratory form to Hayden Creek, a large tributary that maintains year-round connection with the Lemhi River. With ongoing habitat restoration efforts aimed at improving watershed connectivity and habitat quality, understanding the distribution and varying life history patterns of Bull Trout in the Lemhi River sub-basin, and more importantly the response to these efforts, is critical to supporting ongoing conservation actions and future effectiveness monitoring. Distributed throughout the basin are a series of Passive Integrated Transponder (PIT) arrays (N = 24). We used PIT arrays to assess movement and distribution of individually PIT-tagged Bull Trout across multiple watersheds. Extensive monitoring in Hayden Creek shows Bull Trout movement in and out of Hayden Creek, as well as the Lemhi sub-basin. Bull Trout detections outside of Hayden Creek included Little Springs Creek and Big Timber Creek, both of which have undergone rehabilitation efforts in recent years. While most Bull Trout stayed within the Lemhi Basin, we observed other migrations as far as 35 km downriver and 44km upriver from the mouth of the Lemhi. These results will help managers more precisely assess habitat restoration, while informing future management decisions throughout the Lemhi Basin.

A Timeline of Lower Granite Dam Adult Trapping and Data Use

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The Lower Granite Dam adult fish trapping facility was constructed as an extension of the fish ladder during the construction of the dam which was completed in 1975. The facility is operated through personnel from the NOAA's Northwest Fisheries Science Center and when constructed, was designed to have improved fish trapping and handling capabilities over other Snake River dam adult traps operating that monitored salmonid returns to the Snake River basin. Over the years, there have been several structural trap improvements, program inceptions and expansions, technological advancement, and several more agencies involved with using the traps abilities to monitor anadromous fish returns. Important capabilities of the trap include being able to specifically select certain PIT-tagged fish for handling purposes and systematically select a percentage of the run-at-large for sampling or collections. The Lower Granite Dam adult trap became a crucial tool used to collect fish for hatchery broodstock, assess movement, survival, age composition, stock composition, hatchery and wild proportions, and abundances to name a few. Data collected at the trap are also used to inform fish managers of in-season stock-specific information of fish available for broodstock collections upstream of Lower Granite Dam and recreational and tribal harvest shares. The trap also serves many purposes in downriver collaborations for managing anadromous fish returns. Because Lower Granite Dam is situated downstream of most of the major Snake River basin Chinook Salmon and steelhead spawning habitat and hatchery releases, it remains the most important trapping facility that benefits most of the salmon and steelhead programs and fish managers in Northeast Oregon, Southeast Washington, and Idaho.

The Role of Network Complexity in Sustaining Biodiversity in Meta-Food Webs of a Wilderness River

Faurot, Laurel. Idaho State University; Baxter, Colden. Idaho State University; Finley, Sawyer. Idaho State University

Free-flowing, unfragmented river networks are increasingly rare and their study is vital to understanding natural river ecosystems, including the fish populations they sustain. We are studying network complexity and its consequences for aquatic meta-food webs and biodiversity across four tributary confluence complexes (where multiple tributaries enter a mainstem in close proximity) in Big Creek, a wilderness drainage of central Idaho. We hypothesized that these complexes create mosaics of habitats, biodiversity, and complexity in meta-food webs, each of which may contribute to food web traits that confer community and food web stability. We performed aquatic vertebrate surveys and habitat measurements, and collected gut contents and tissues for stable isotope analyses of fishes and amphibians across 10 tributaries and 12 mainstem sites. We are analyzing these at nested spatial scales using an iterative, aggregation simulation to investigate the effect of increasing habitat complexity on biodiversity and food web metrics linked to its maintenance. Thus far, our results indicate that aquatic vertebrates are supported by a wide array of resources, as evidenced by a large range of $\delta^{13}C$ contributing to their tissues, and a diversity of prey items found in gut contents. Moreover, within any given confluence-complex, no single habitat takes up as much space on an C-N isotope biplot nor contributes the same diversity of food web links as all the habitats combined. This means that the combination of the food webs from unique habitats increases the trophic niche space and complexity of the resultant meta-food web. Additionally, in many habitats unique taxa are more isotopically similar to different taxa found in the habitat they occupy than the same taxa from different habitats, pointing to a large degree of trophic plasticity when animals occur in complex, connected river networks like Big Creek.

Growth and Seasonal Food Habits of Walleyes in Lake Pend Oreille, Idaho

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The introduction of a non-native species can have negative consequences on existing aquatic systems. Walleye *Sander vitreus* have been introduced widely throughout the United States and now occur throughout the Columbia and Missouri river drainages. In 2006, Walleyes were first sampled in Lake Pend Oreille (LPO). Since 2011, the Walleye population has doubled every three years. Information regarding the food habits and population dynamics of Walleyes is necessary to assess potential effects on the existing fish assemblage. This project aims to evaluate the growth and seasonal variation in food habits of Walleyes throughout LPO. In total, 1,155 Walleyes were caught during April 2020 to May 2021. Stomachs and otoliths were collected from all individuals. Walleye total length varied from 175-822 mm and ages varied from 0-20. Stomach content analysis suggests that Walleye consume a wide variety of prey species including kokanee *Oncorhynchus nerka*, Peamouth Chub *Mylocheilus caurinus*, Northern Pikeminnow *Ptychochelius oregonensis*, Black Crappie P*omoxis nigromaculatus*, and Yellow Perch *Perca flavescens*. Additionally, few instances of predation on Westslope Cutthroat Trout *O. clarkia lewisi*, Rainbow Trout *O. mykiss*, and Smallmouth Bass *Micropterus dolomieu* were documented. Results from this study provide

important information about Walleye food habits which will be used to guide future management actions in this system.

Comparing Precision and Efficiency of Five Sampling Gears Commonly Used to Monitor Recruitment of Yellow Perch

Furby, Justin. Idaho Department of Fish and Game; Thomas, Mike. Idaho Department of Fish and Game; Messner, Jordan. Idaho Department of Fish and Game

Recruitment is often described as the most important process affecting fish population abundance and size structure. For several species, including Yellow Perch (*P. flavescens*), a variety of factors can influence recruitment and sources of variation are poorly understood. Although numerous biotic and abiotic interactions have been proposed to explain variation in perch recruitment, little research has been conducted to evaluate differences in catch between common sampling gears. Currently, fishery managers at Lake Cascade, Idaho use benthic otter trawls to monitor trends in relative abundance of young-of-year (YOY) and age-1 perch. However, several different gears (i.e., mini-fyke nets, cloverleaf traps, micro-mesh gillnets) have been used for monitoring perch recruitment across their range. We sought to compare the precision (coefficient of variation; CV) and relative efficiency (n workdays [replicates * mean operational time / 8 h] to detect 20% change in mean catch) of five sampling gears using catch of YOY and age-1 perch. Across all gears, very few age-1 perch (N = 22) were caught in our study. For YOY perch (n = 37,865), preliminary results suggest that micro-mesh gillnets were the most precise (CV = 52) and efficient gear (11 days). Cloverleaf traps with cyalume glow stick attractants were more precise (CV = 101) and efficient (22 days) than cloverleaf traps baited with chicken livers (CV = 106; 24 days), benthic otter trawls (CV = 134; 74 days), and mini-fyke nets (CV = 290; 344 days). While average operational time was similar between micro-mesh gill nets and benthic otter trawls (~ 25 min per set), the latter accounted for ~95% of all perch collected in this study (n = 35,783). We recommend that fishery managers at Lake Cascade continue to use benthic otter trawls to monitor trends in perch recruitment.

Mentoring: Opening Pathways for Young People to Enter the Fish Professions

Gamett, Bart, U.S. Forest Service

Mentors can open pathways for young people to enter the fish professions by helping them develop an interest in fish, explore fish-related jobs, and start on the path to a fish-related career. There are numerous ways for fish professionals to mentor young people. This can include participating in formal mentoring programs such as the Hutton Junior Fisheries Biology Program; providing educational opportunities such as Trout in the Classroom; offering volunteer or employment opportunities; engaging in informal actions such as offering advice and encouragement; and serving as a positive role model. Those who actively engage in mentoring young people can have a profound impact on these individuals, bring strength and diversity to the fish professions, and ultimately improve the management of fish resources.

Safe Passage: Using Fish Screens to Protect Migration Corridors of Fluvial Bull Trout

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Irrigation practices in the intermountain West can pose considerable risk to migratory fishes by direct mortality from loss into ditches or delaying migration. Fish passage projects such as fish screens, instream flow agreements, and water conservation measures can be costly to develop and sustain. Historically most fish screens have been installed using mitigation funding in anadromous bearing streams to facilitate out-migration of juvenile salmonids. Migratory species in non-anadromous waters are more likely to inhabit unscreened stream networks and their risk of entrainment has not been widely evaluated. To evaluate the effectiveness of irrigation passage projects for non-anadromous migratory species we examined the impacts of fish screening and flow management on post-spawn migrations of Bull Trout (*Salvelinus confluentus*) in a central Idaho stream. We used weir trapping and PIT tagging to monitor the movement and entrainment of adult fluvial Bull Trout over the course of four irrigation seasons (2018-2021) in Fourth of July Creek, a tributary to the Upper Salmon River. Fourth of July Creek has three screened diversions and a flow agreement meant to maintain fish passage throughout the irrigation season. During the course of the study we PIT tagged 513 adult bull trout during their post spawn outmigration. A proportion of these fish returned to spawn in subsequent years. Using PIT tag readers mounted on fish screen bypass pipes we estimated between 54.9% and 92.6% of returning fish were entrained in at least one irrigation structure in any given year. Many fish encountered multiple bypasses or were bypassed in the same diversion multiple times, and the majority of Bull Trout post-spawn migration occurred during the protected flow period. We conclude that screens and flow agreements could have a significant, population-level implications for non-anadromous fish species like Bull Trout. We suggest that in relatively simple systems like Fourth of July Creek, investing in irrigation passage projects can be an affordable and impactful way to protect the migratory corridor of vulnerable fish species.

Juvenile Age Validation of the Snake River Sockeye Salmon (*Oncorhynchus nerka*)

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Accurate estimates of age composition is essential for fisheries management. However, assessment of the accuracy of the estimates is seldom performed. We evaluated the accuracy of juvenile Snake River Sockeye Salmon (*Oncorhynchus nerka*) scale-based age estimates by comparing scale-based estimates to known ages of juvenile salmon from parentage-based tagging (PBT). Scale-based estimates were made by trained personnel with the combined experience of 18 years ageing fish scales. Overall accuracy for all fish was 90%, whereas accuracy for age two fish in this study was 78%. Results from a multinomial logistic regression model of over and underprediction events indicated that fork length and referred scales (i.e., scales that personnel disagreed on age) were statistically significant and were positively related to the probability of over and underpredicting fish ages using scales. Although refereed scales only constituted 10% of the samples collected, they constituted 45% of the ageing errors. Further examination of scales indicated that 60% of the overpredictions did not have a visible annulus on the edge suggesting that plus growth (i.e., circuli growth past the last annulus) on juvenile Sockeye Salmon scales should not be counted. We believe that the lower accuracy for age two and larger sized juvenile Sockeye Salmon was in part, due to difficult to read scales with weak annuli and larger foci. Additionally, we believe that the different growth patterns between juvenile Sockeye Salmon and steelhead may have caused ageing errors by personnel experienced ageing scales from juvenile steelhead. The results from this study suggest that

overestimation of ages on juvenile Sockeye Salmon could affect estimates of age compositions and juvenile life history models and ultimately future fisheries management.

Pilot Study: Corded PIT Antennas in Pass-Through Orientation to Study Fish Utilization of Side Channels in the Lemhi River, Idaho

Hall, Michael. Biomark; Porter, Nick. Biomark; Carmichael, Richie. Biomark

In-stream passive integrated transponder (PIT) tag detection antennas are commonly used to monitor and evaluate aquatic species in river and stream ecosystems. The most common deployment of these antennas are pass-by/pass-over orientation; lying flat atop the stream bed where a single face creates a detection field from the anchoring location, across the antenna, reading typically between 20-30 inches. In changing the orientation of the antenna to a pass-through, we can monitor the entirety of the water column from top to bottom, allowing for the detection of surface orientated fish such as migrating salmonids in complex environments with variable water depths. In the fall of 2021, we took a novel approach and implemented corded PIT antennas in pass-through orientation in three separate side-channel complexes with an observed detection field of up to ~48 inches. These cord antennas have multiple benefits over traditional instream antennas including a less permanent installation. Additionally, these antennas can be efficiently adjusted or removed to account for unexpected high flows or changing physical conditions, can cost efficiently move with the stream bed over time, are flexible allowing for coverage of irregularly shaped channels, are adapted for more coverage of the floodplain during variable flow scenarios, and can be removed or relocated for a new project. These cord antennas are relatively simple to setup, quickly and easily tuned, and offer remote communication to assist in monitoring the functionality of the site and data interrogation. Currently, we have deployed 18 antennas to monitor juvenile salmonid movement and utilization of side channel complexes beginning in fall 2021. These three side-channel complexes represent both pre and post restoration areas, and while results are still preliminary, in over three months of deployment we have detected 913 unique tags, where these data will be used to further understand habitat utilization and restoration effectiveness.

Instream Complexity Increases Habitat Quality and Growth for Cutthroat Trout in Headwater Streams

Hallbert, Tyson. Idaho State University; Keeley, Ernest. Idaho State University

The availability of suitable habitat is a primary factor limiting the abundance of natural populations. In many stream ecosystems, human caused habitat degradation has reduced population productivity for lotic species through the removal of critical habitat features. For salmonid fishes, the deeper slow-moving water of pool habitats in stream ecosystems constitute an important source of energetically favorable foraging space. As such, we hypothesized that the addition of pool habitat would increase the availability of suitable habitat for salmonid fishes and may improve their productivity in headwater streams. To test this, we experimentally added pool habitat to three 100 meter reaches in four natural streams characterized by simplified channel morphology resulting from habitat degradation. We used a bioenergetic foraging model to assess the proportion of suitable habitat available for cutthroat trout (*Oncorhynchus clarkii*) within artificially created pool habitats, across treatment reaches, and in unmanipulated control sections. Cutthroat populations were monitored over five years to evaluate how increasing available forging space influenced population productivity and fish growth. We found that the

proportion of suitable habitat was higher in artificially created pool habitats but were unable to detect significant differences at the reach scale. The proportion of suitable habitat decreased with increasing fish size across all treatment categories, and we found that young-of-the-year fish densities were higher in reaches with added pool habitat, but age 1+ fish did not differ. Growth rates of cutthroat trout differed between treatment and control sections, with fish from treatment reaches having higher growth rates. These results show that availability of pool habitat influences habitat suitability, densities in early life-stage salmonid fishes, and provides energetically favorable habitat where salmonids can attain higher growth rates.

Windfall Creek Stage 0 Project

Hallock, Stephanie. Coeur d'Alene Tribe; Vitale, Angelo. Coeur d'Alene Tribe

The Coeur d'Alene Tribe's Fisheries Program recently completed a Stage 0 restoration project during the summer of 2021 on lower Windfall Creek, a 1,105-hectare catchment within the Benewah Creek watershed. Windfall Creek is an important tributary for the production of adfluvial Westslope Cutthroat Trout that migrate to Coeur d'Alene Lake. The limitations at the project site included lack of habitat complexity, bank erosion, and reduced floodplain connectivity. The existing stream reach was moderately entrenched. The 600 meter project reach was identified through an analysis process that looked at unconfined depositional valleys where multi-thread channels could form on the historic floodplain and combined that with land use that supported restoration actions. The goals of the project were to create wetland habitats and increase the hydraulic connections with the valley bottom and to establish native plant communities that can sustain beaver populations. To meet these goals, the fisheries program developed a stage 0 restoration design using the GGLREM tool to model current valley conditions. This design incorporated historic meanders and wetland swales that could be activated by filling discrete channel segments. Three main sections of stream channel (286 meters in total) were filled with compacted soil fill. A grade control was created to connect the stage 0 elevation to the existing downstream channel elevation which was constrained by a culvert. Large wood was placed throughout the project site to create complexity and to promote project stability. This work raised the water level in channel segments that were not filled. Over a two-month period following construction, the valley recharged so that the current water table is at or just below the valley surface. It is expected that the well-connected stream will form multiple new channels on valley bottom floodplain surfaces through natural processes of sediment transport and deposition.

Population Genetics Reveals Bidirectional Fish Movement Across the Continental Divide via an Interbasin Water Transfer in Colorado

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Interbasin water transfers are becoming an increasingly common tool to satisfy municipal and agricultural water demand, but their impacts on movement and gene flow of aquatic organisms are poorly understood. The Grand Ditch is an interbasin water transfer that diverts water from tributaries of the upper Colorado River on the west side of the Continental Divide to the upper Cache la Poudre River on

the east side of the Continental Divide in Colorado. We used single nucleotide polymorphisms to characterize population genetic structure in cutthroat trout (*Oncorhynchus clarkii*) and determine if fish utilize the Grand Ditch as a movement corridor. Samples were collected from two sites on the west side and three sites on the east side of the Continental Divide. We identified two genetic clusters, but they did not align with the west and east sides of the Continental Divide. Spatial distributions of admixed individuals indicated that the Grand Ditch facilitated bidirectional fish movement across the Continental Divide, a major biogeographic barrier. Many others have demonstrated the ecological impacts of interbasin water transfers, but our study is one of the first to utilize genetics to understand how interbasin water transfers affect connectivity between previously isolated watersheds. We also discuss implications on native trout management and the need for balancing water demand and biodiversity conservation.

Recent Issues in the Idaho Steelhead Fisheries and Use of an Integrated Population Model to Address Them

Hebdon, Lance. Idaho Department of Fish and Game; Copeland, Timothy. Idaho Department of Fish and Game; McCormick, Josh. Idaho Department of Fish and Game

Idaho Department of Fish and Game recently completed the ESA consultation on steelhead fisheries in Idaho which included updates and public comments on our Steelhead Fisheries Management and Evaluation Plan (FMEP). Here we briefly review the issues raised by the public during our FMEP review and the research that is helping inform our understanding of the biological significance of the issues. Using juvenile and adult steelhead abundances from 1992 to 2020 in Fish Creek, a major spawning area for the wild Idaho Lochsa River steelhead population, allowed us to develop an integrated population model to test the effects of minimum escapement thresholds prior to opening the fishery, variable encounter rates in the fishery, and increased catch and release mortality rates on the projected steelhead adult returns. The combination of a long time series of data and the integrated population model has enhanced our understanding of the biology and management of wild steelhead in Idaho.

Whole Genome Re-sequencing of Chinook Salmon Populations Across the Columbia River Basin

Horn, Rebekah. Columbia River Inter-Tribal Fish Commission; Narum, Shawn. Columbia River Inter-Tribal Fish Commission

Chinook salmon (*Oncorhynchus tshawytscha*) populations in the Columbia River Basin represent a diversity of life history traits that result in multiple distinct lineages. Previous genetic and genomic work in this system has been able to elucidate neutral population structure and the genes which underly migration return timing. Further questions remain in how to detect finer-scale structure among populations and the variation in allele frequencies among lineages on a basin-wide scale for important candidate regions associated with life history variation. This study uses whole genome re-sequencing data from 53 populations of Chinook salmon representing the three lineages (stream-type, ocean-type, and lower Columbia) and three seasonal migration times (spring, summer, and fall). A low coverage sequencing approach was used, in which each individual sample gets a barcode before samples from a population are prepared in libraries for whole genome sequencing. After filtering, there were over 16 million SNPs across all 53 populations for further analyses. Putatively neutral SNPs provided classification on neutral genomic structure across the basin, and putatively adaptive SNPs to characterize important

genomic regions that may underly traits of interest. Allele frequency variation in the GREB1L/ROCK region, previously identified as controlling migration timing in Chinook salmon was clearly able to differentiate spring- and fall-run populations. The genomic data generated in this study will continue to be used to classify genomic regions under selection, develop SNP markers to further refine assignments of genetic stock, and to incorporate with landscape variables to assess how landscape features influence local adaptation.

Measuring Drift Density in Streams to Understand Invertebrate Food Availability for Redband Trout

Kemp, Hannah. University of Idaho; Caudill, Christopher. University of Idaho; Giwa, Tawa. College of Western Idaho; Tonina, Daniele. University of Idaho

Invertebrate drift is the downstream transport of benthic invertebrates while in suspension in streams and acts the key food for drift-feeding fishes, including salmon and trout. Recent models of stream habitat quality for fish require estimates of drift density; the concentration of drifting insects. How or whether the concentration of invertebrates varies within a stream in areas such as pools and riffles is poorly known. Our study aims to test whether drift density differs across stream habitats and flow conditions in an effort to improve drift foraging models of fish habitat quality and growth in streams.

Trends in Abundance of Juvenile Salmonids in Response to Large Wood Restoration Treatments in the East Fork Potlatch River, Idaho

Kennedy, Beth. Idaho Department of Fish and Game; Stephenson, CeCe. Idaho Department of Fish and Game; Kennedy, Beth. Idaho Department of Fish and Game; Knoth, Brian. Idaho Department of Fish and Game; Fortier, Jason. Pacific States Marine Fisheries Commision

Habitat restoration efforts are underway to benefit wild steelhead (*Oncorhynchus mykiss*) in the East Fork Potlatch River, ID. Beginning in 2009, large wood structures were added to the stream to improve instream habitat complexity and increase over-winter rearing habitat. To date, approximately 8.4 km of stream has been treated and > 190 large wood structures have been installed. Our objective was to examine if the completed restoration treatments have increased juvenile (age 1+) steelhead abundance. Further, we examined if the treatments influenced the abundance of juvenile (age 1+) Brook Trout (*Salvelinus fontinalis*), a non-native competitor of steelhead. We selected one control reach and one treatment reach in the drainage and examined changes in species abundance from snorkel surveys conducted from 2008-2019. We had two years of pre-treatment data (2008, 2009) and 10 years of treatment data (2010-2019). On average, 13 treatment sites and 12 control sites were surveyed annually. We observed decreasing trends in abundance for each species over time, in both reaches. Overall, mean steelhead densities decreased from 4.37 fish/100 m^2 in the pre-treatment period to 0.94 fish/100m^2 in the treatment period. Similarly, mean Brook Trout densities decreased from 4.24 fish/100m^2 to 1.24 fish/100 m^2 over the same periods. Pre-treatment trends in species abundance were similar between the treatment and control reaches indicating each reach experienced similar environmental pressures. It is also encouraging that juvenile Brook Trout abundance has not increased in response to the restoration treatments. Although we have not documented a positive response in juvenile steelhead abundance at this time, it is important to note that restoration treatments are still ongoing. The goal is to enhance ~ 25% of the drainage with

large wood treatments by 2029. Once restoration goals are achieved, we anticipate the treatments will produce a detectable change in steelhead abundance.

Rapid Recolonization of Upstream Habitats by Steelhead Following a Culvert Modification

Knoth, Brian. Idaho Department of Fish and Game; Hargrove, John. Pacific States Marine Fisheries Commission

Habitat restoration efforts are ongoing to increase wild steelhead (*Oncorhynchus mykiss*) productivity in the Potlatch River basin in northern Idaho. A key strategy is to improve fish passage at barriers to expand juvenile steelhead rearing habitat. Big Meadow Creek is the main tributary to the West Fork of Little Bear Creek, which contains the highest rearing densities of juvenile steelhead in the basin. However, a culvert at the mouth of Big Meadow Creek restricted access to an additional 10 km of rearing habitat. In 2018, the culvert was modified to enhance steelhead passage into the drainage. Prior to culvert modification, the population upstream of the culvert was primarily resident *O. mykiss* while anadromous *O. mykiss* were found downstream of the culvert. We analyzed the genetic composition of juvenile *O. mykiss* captured upstream of the culvert to assess the effectiveness of the passage project. We hypothesized the genetic composition of juvenile *O. mykiss* upstream of the culvert would shift from resident to more anadromous characteristics with improved fish passage. Genetic samples were collected from juvenile *O. mykiss* upstream of the culvert in 2018 (pre-treatment), and in 2019 and 2020 (post-treatment) and then compared against steelhead reference samples. We examined changes in genetic composition across years using a series of complimentary genetic approaches including analyses of genetic diversity, ancestry, and structure. We observed an increase in genetic diversity and ancestry across years, with anadromous signals becoming more dominant upstream of the culvert. Anadromous steelhead that were better able to access Big Meadow Creek due to the culvert modification were the source for the shift in genetic composition of juveniles from resident to anadromous characteristics. The genetic approach was an effective technique to assess the project's effectiveness and results indicate the culvert modification was successful in enhancing steelhead passage into Big Meadow Creek.

Effects of Long-term Supplementation in Upper Yakima River Spring Chinook Salmon

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To promote recovery of natural salmon populations, managers are utilizing hatchery supplementation programs to increase abundance of spawners on the spawning grounds. However, numerous studies have provided evidence that captive breeding can result in domestication demonstrated by lower fitness of hatchery-origin compared to natural-origin fish. Supplementation programs, therefore, typically use natural-origin broodstock in an effort to minimize long-term negative fitness impacts. Here we evaluated the upper Yakima River spring Chinook Salmon *Oncorhynchus tshawytscha* supplementation program, which has broodstock comprised exclusively of natural-origin fish. Using five years of spawner data, we tested for effects of hatchery spawning and rearing on total adult returns and individual reproductive success. Our study revealed that supplementation increased overall abundance of fish spawning naturally on the spawning grounds. However, on average, compared to natural-origin spawners, hatchery-origin fish had reduced reproductive success, which also translated to reduced reproductive success for natural-

origin fish who spawned with hatchery-origin fish. As expected, body length and return timing were also significant predictors of reproductive success. More generations of data are needed to establish a heritable component, as has been shown in other studies. Future studies measuring the effects of spawning location, habitat quality, potential factors affecting inter-year variation in reproductive success, and studies designed to address the long-term effects of supplementation using multigenerational pedigrees will help to inform conservation and management decisions in both upper Yakima Chinook Salmon and similar supplementation programs.

Policies and Procedures Related to Establishing State Fishing Regulations and Rules in Idaho

Kozfkay, Joe. Idaho Department of Fish and Game

Fisheries managers must enact appropriate and efficient fishing regulations and rules, in order for society to reap optimal benefits from these common resources. If done properly, these tools may shape fish populations, fish communities, and affect how and when a diversity of angling constituencies interact with each other. In this presentation, I talk will focus on policies and procedures considered by Idaho Department of Game staff during development of Idaho's 2022-2024 fishing seasons and limits. Modification of state fishing regulations (i.e. seasons and limits) fall under the statutory authority of the Idaho Fish and Game Commission, whereas fishing rules (i.e. definitions) are implemented through the Idaho Administrative Procedures Act. Adoption and publication of statewide regulations were the culmination of a nearly year-long process that included public scoping, proposal development, public outreach, random and non-random public opinion surveys, as well as refinement of staff recommendations before final deliberation and eventual adoption by the Idaho Fish and Game Commission. Throughout the process, staff assessed a wide variety of biological, social, economic, and political factors to ensure that the adopted regulations would meet a wide variety of social and biological needs.

Administering Minimum Streamflows in Idaho with Voluntary, Market-Based Water Transactions: a Primer in Idaho Water Law and 20 Years of Water Transactions in the Upper Salmon basin

Loffredo, John. Idaho Water Resource Board

It is widely understood that low streamflow is a major limiting factor for salmonids at multiple life-stages in the Upper Salmon River Basin. The low stream flows negatively affecting salmonids generally occur when the greatest competition for water exists between instream flow needs for fish and when irrigation demand peaks. The fact that the Upper Salmon Basin has been over-appropriated, meaning there is often times more demand for water than there is supply, only exacerbates this competition. The Idaho Water Transaction Program focuses on protecting flow on paper, which requires expertise in water rights and Idaho water law. The overarching goal of the program is to improve instream flow in order to: improve passage at all salmonid life stages, improve egg-to-smolt survival, reduce density-dependent limiting factors, and increase aquatic species diversity and abundance. This presentation will cover some basic principles of Idaho water law, what water transaction tools exist in the context of Idaho water law and observed benefits to threatened anadromous and resident fish species over the last 20 years of water transactions in the upper salmon basin.

Encounter Rates and Catch-and-Release Mortality of Steelhead in the Snake River Basin

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Steelhead *Oncorhynchus mykiss* are ecologically, economically, and culturally important throughout the Pacific Northwest. The potential influence of recreational fisheries on wild steelhead is poorly understood and is a function of the abundance of wild fish, how many are encountered by anglers (i.e., encounter rate), and the mortality of fish that are caught and released. In Idaho, estimates of wild steelhead encounter rates are derived using the number of wild and hatchery steelhead passing Lower Granite Dam, the number of hatchery steelhead harvested, and the number of hatchery steelhead caught and released. Currently, managers assume hatchery and wild steelhead have equal encounter rates and apply a 5% catch-and-release mortality rate to the portion of the wild steelhead population caught by anglers. I sampled, tagged, and released 1,277 spawn-year 2020 (SY2020) and 2,072 spawn-year 2021 (SY2021) adult steelhead at Lower Granite Dam with T-bar anchor tags and passive integrated transponder (PIT) tags to estimate steelhead encounter rates and catch-and-release mortality. Tagged fish moved into fisheries where 312 SY2020 and 639 SY2021 fish were caught and reported by anglers. Estimated encounter rates were 30.2% (95% confidence interval; 22.2, 39.5) for wild fish and 57.4% (20.7, 87.4) for adipose-clipped fish in SY2020. In SY2021, encounter rates were 37.0% (31.9, 43.6) for wild fish and 52.4% (44.9, 59.9) for adipose-clipped fish. Differences in survival of caught steelhead and those not reported as caught were evaluated using detections at various locations (e.g., PIT arrays, weirs). Based on this analysis, catch-and-release mortality of wild fish tagged with high reward tags (i.e., US $100 and $200 tags) was 3.9% (95% credible interval; 0.2, 16.0) and averaged 3.8% (SE; 8.1%) across all reward values. Results of my research provide important information that will be useful in guiding management of steelhead in Idaho and the region.

Removal of Brook Trout and Response of Bull Trout and Westslope Cutthroat Trout in the West Fork Crooked River Watershed, Idaho

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Bull trout in the West Fork of Crooked River, Idaho, a third-order stream, represent one of the most important bull trout populations remaining in the South Fork Clearwater River subbasin. A Brook Trout (*Salvelinus fontinalis*) population in a single tributary in the entire Crooked River watershed presented a threat to this population through hybridization and competition. We investigated the use of annual, two-pass electrofishing removals to eliminate or greatly reduce Brook Trout within a sympatric zone in the West Fork that supported Bull Trout (*S. confluentus*) and Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*). Immediately upstream of this zone we repeated the same removal procedure throughout Rainbow Creek, a 3.2 km tributary that consisted almost entirely of Brook Trout. In an effort to delay later reinvasion by Brook Trout or prevent full population reestablishment, we translocated wild Westslope Cutthroat from downstream reaches in the watershed to Rainbow Creek. In 2013, after 12 years of annual two-pass removals and monitoring, Brook Trout in the West Fork sympatric zone decreased to 0.1 fish/100 m^2, from a high of 6.6 fish/100 m^2 in 2000. During the same time period, Bull Trout and Westslope Cutthroat Trout numbers increased 336.4% and 384.2% respectively. In Rainbow Creek, Brook Trout were reduced from a high of 33.8 fish/100 m^2 in Reach 3 in 2004, to 0.00 fish/100 m^2 in reaches 4 and 5 by 2008

and 2005 respectively, and recruitment appeared to have terminated. The translocated cutthroat trout quickly acclimated to Rainbow Creek and reached densities as high as 36.4 fish/100 m2 within four years of introduction. The low levels of woody debris encountered, shallow pool depths, modest treatment length (3.6 km), and persistent removal efforts by the electrofishing crews were the main factors leading to the successful removal treatments.

Evaluating Target Levels of American White Pelican Abundance to Achieve Management Objectives for Adfluvial Yellowstone Cutthroat Trout

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Recent declines in abundance of Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* in the upper Blackfoot River drainage in Idaho coincided with establishment of a nearby nesting colony and increased abundance of American White Pelicans *Pelicanus erythrorhynchos* (hereafter pelicans). Published pelican predation rates have been estimated to be as high as 70% on Yellowstone Cutthroat Trout in the Blackfoot River. Consequently, the Idaho Department of Fish and Game established management objectives for pelicans of less than 350 breeding pairs or 700 adults. However, a thorough assessment has not been conducted to evaluate if the pelican abundance objective would reduce predation to an extent that would allow Yellowstone Cutthroat Trout to recover to levels that meet minimum objectives for abundance. A Bayesian state-space model that integrated survival and abundance data was used in this study to evaluate the effects of local pelican abundance on survival, abundance, and population growth rate of Yellowstone Cutthroat Trout. Survival of both juvenile and adfluvial adult Yellowstone Cutthroat Trout decreased as pelican abundance increased, and there was a positive relationship between survival of both lifestages and population growth rate. If the current management objective for abundance of 700 breeding pelicans were met, the probability of meeting or exceeding the Yellowstone Cutthroat Trout objective was 0.44 and declined substantially as simulated pelican abundance increased beyond 700. Results of this study suggest that if pelican abundance can be maintained at or below their current management objective that there is a reasonable chance of meeting the management objective for Yellowstone Cutthroat Trout.

Reservoir Drawdown vs. Kokanee in the Henry's Fork

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Increased drought frequency and water demand due to climate change and development places pressure on water storage reservoirs in Idaho with uncertain effects on their economically important fisheries. Island Park Reservoir is a mid-sized hypolimnetic-release water storage reservoir on the Henry's Fork River that supports a kokanee Oncorhynchus nerka fishery. A region-wide drought in 2021 provided an opportunity to examine how drought-induced drawdown affects habitat for kokanee in Island Park Reservoir. We hypothesized that drawdown would negatively affect physical habitat within the reservoir, resulting in kokanee population declines. We found drawdown interrupts seasonal stratification dynamics in the reservoir, resulting in rapid increases in water temperature during the summer drawdown period. Within most of the reservoir's volume, water temperatures exceeded thresholds for optimal (<17°C) and survivable (<20°C) kokanee habitat, thereby restricting kokanee to small volumes (<1% of full volume, ~18

million m^3 or 1500 acre-feet) of optimal spring-fed refugia during the summer drawdown period. Our findings explain patterns long-term spawning kokanee numbers in tributaries upstream of the reservoir, which exponentially declined with increased reservoir drawdown. We found that water conservation and precision management in the Henry's Fork watershed saved ~39 million cu. m (32,000 acre-feet) in Island Park Reservoir in 2021 compared with recent drought years with similar water supply, resulting in a ~150% increase in future spawning kokanee numbers from ~250 to ~650 within our 4.5 km study reach. Our study highlights the effectiveness of hydrological management and projects to reduce water consumption for fisheries management. Our findings contradict those from other locations, which found that reservoir drawdown had a positive effect on kokanee. Our results therefore highlight the case-specific effects of drawdown and the need to develop generalized mechanistic models of water quality and fish habitat to improve the predictive capacity of fisheries management.

Low Flow in the Lower Henry's Fork, Snake River: Investigating Streamflow-Habitat Relationships to Inform Water Management

Morrisett, Christina. Department of Watershed Sciences - Utah State University, Henry's Fork Foundation; Van Kirk, Rob. Henry's Fork Foundation; Null, Sarah. Department of Watershed Sciences - Utah State University

Low-flow targets are important for maintaining aquatic habitat amid multi-stakeholder water use but can also create conflict among users. A collaborative water management group in the Henry's Fork watershed recommends strategies for reservoir operations to meet an irrigation-season low-flow target downstream of all diversions on the Henry's Fork, 100 km downstream of the reservoir. However, in drought years it can be difficult to maintain this low-flow target and meet other objectives important for watershed management, such as maximizing end-of-season storage, meeting irrigation demand, and maintaining the fisheries in the reservoir and adjacent stream reaches. Thus, the low-flow target is an irrigation-season management crux. We used a combination of eco-hydraulic measurements, mapping, and statistical modeling to quantify habitat and understand how streamflow relates to Brown Trout habitat in the lower Henry's Fork. In addition to quantifying suitable habitat for Brown Trout at various flows, we show that summer habitat for adult Brown Trout is likely limiting the fishery and has been variable both within and across years in the last 20 years. Implementation of watershed-scale precision management, which this research contributes to, has reduced lower river habitat variability in recent years. Findings from this research inform collaborative summer low-flow management in the basin and provide a basis for quantifying tradeoffs between watershed management objectives.

Healing the Land and Water at the Bear River Massacre Site

Munger, Will. Utah State University; Perry, Darren. Northwest Band of the Shoshone Nation

In 2018, the Northwestern Band of the Shoshone Nation announced the purchase of more than 500 acres of land surrounding the Bear River Massacre Site. Efforts are underway to restore the site's ecological integrity and honor the generations who lived there. Part of this restoration is focused on a riparian area at the confluence of Beaver Creek and the Bear River. This riparian area has been altered by years of agriculture and now the challenge is to begin a process that can heal the land and water. To address this challenge, leaders from the Northwestern Band of the Shoshone Nation are collaborating with scientists from Utah State University to study the watershed, assess risks from climate change, and co-produce

restoration science. In this presentation, Darren Parry and Will Munger will share the history and progress of this ecological restoration collaboration.

First Documentation of *Ergasilus centrarchidarum* in Ririe Reservoir, Idaho

Perkins, Danielle. Brigham Young University – Idaho; Heckel, John. Idaho Department of Fish and Game; High, Brett. Idaho Department of Fish and Game; Billman, Eric. Brigham Young University - Idaho

Ergasilus centrarchidarum is a parasitic copepod that infects the gills of fishes in the family Centrarchidae. This parasite has been introduced in many regions of North America through introduction of infected Smallmouth Bass; however, effects of *E. centrarchidarum* on its hosts have been poorly studied. *Ergasilus centrarchidarum* was first discovered infecting Smallmouth Bass in Ririe Reservoir in 2020, although timing of introduction remains uncertain. Our objective was to determine prevalence and intensity of infection of *E. centrarchidarum* on Smallmouth Bass in Ririe Reservoir. We used angling to collect Smallmouth Bass in the upstream portion of Ririe Reservoir in July 2021. On each fish, we documented presence of copepods and qualitatively assessed intensity of infection in the left gill chamber (i.e. low < 10 copepods, medium = 10 - 20 copepods, and high > 20 copepods). Additionally, we euthanized 24 Smallmouth Bass to quantitatively determine intensity of infection. Prevalence of infection of *E. centrarchidarum* on Smallmouth Bass was 100% (n = 69 fish). Half of the Smallmouth Bass sampled were classified as having a high infection while only 10% were classified with a low infection. In the lethally sampled fish, mean intensity of infection in the left gill chamber was 27 copepods (SE = 3.9). We did not observe damage to the gills of infected Smallmouth Bass. Additionally, we did not observe a relationship between relative weight and intensity of infection of fish we lethally sampled. Therefore, we did not find evidence that *E. centrarchidarum* was negatively influencing Smallmouth Bass in Ririe Reservoir; however, further research should directly study potential negative impacts of *E. centrarchidarum* on Smallmouth Bass. We did not find documentation of *E. centrarchidarum* elsewhere in Idaho; however, freeliving *Ergasilus* spp. have been documented in Dworshak Reservoir suggesting that *E. centrarchidarum* may be found in other waterbodies in Idaho.

Cryptic Catostomids: Using Morphological and Genetic Data to Assess Species Diversity in Bluehead and Mountain Suckers across Watershed Boundaries

Smith, Brandy. Idaho State University; Loxterman, Janet. Idaho State University; Keeley, Ernest. Idaho State University

Effective monitoring and conservation strategies for natural populations require an accurate description of the classification and occurrence of species. For poorly studied and morphologically similar species, uncertainty in species identification can lead to erroneous conclusions regarding a species distribution and abundance. Catostomid fishes of the Intermountain western United States have been the subject of taxonomic debate due to overlapping ranges, similar morphology between species, and limited sampling efforts. Recent studies have investigated the taxonomic classification of the bluehead sucker (*Catostomus discobolus*), a native species previously described from the upper Snake River, Bonneville basin, and Colorado River drainages. Molecular data have shown significant intraspecific divergence across watershed boundaries, leading to a proposed reclassification of bluehead sucker populations in the upper Snake River and Bonneville basin as a new species, the green sucker (*Pantosteus virescens*). Attempts to quantify diversity of bluehead suckers are complicated by range overlap with the closely related and morphologically similar mountain sucker (*Catostomus platyrhynchus*). The area of species co-occurrence

encompasses the entire range of the proposed green sucker, causing uncertainty in species classifications and distributions across watersheds. In an effort to unravel this cryptic species complex, we conducted extensive sampling of bluehead and mountain suckers across three watersheds in the Intermountain West. We examined morphological and genetic variation in bluehead and mountain sucker populations using linear and geometric morphometrics, mitochondrial DNA and single nucleotide polymorphisms (SNPs)/microhaplotypes. This study will provide management relevant information by evaluating evidence for the proposed species reclassification, investigating potential distinguishing characteristics, and clarifying species range boundaries.

Lower Granite Dam Data Shows Increasing Upstream Movement and Abundance of Walleye in the Snake River

Smith, Nolan. Idaho Department of Fish and Game; Vrablik, Patrick. Idaho Department of Fish and Game, Pacific States Marine Fisheries Commission; Dobos, Marika. Idaho Department of Fish and Game

Walleye, (*Sander vitreus*), are fecund and effective predators that have spread throughout the Columbia River Basin following an unauthorized introduction to Lake Roosevelt in 1960. The presence of piciverous non-native fish, including Walleye, pose a threat to populations of anadromous salmonids that occupy the Lower Snake River. In the three lowest Columbia River reservoirs it is estimated that the yearly loss of salmonids from Walleye could be up to two million individuals. Data from Lower Granite Dam has shown an increasing number of Walleye sampled from the adult fish ladder since 2016. Monitoring upstream movements of Walleye at Lower Granite Dam and understanding demographic characteristics of colonizing individuals (e.g., age, sex) will provide researchers with necessary information to evaluate the need for a management plan. Starting in the summer of 2020, we began lethal sampling of Walleye that were encountered at the Lower Granite Dam adult trap. From each Walleye sampled, measurements of total length (cm) and weight (g) were taken and otoliths, dorsal fin rays, stomachs, gonads and fin tissue were removed for analysis. Since lethal sampling began in July 2020, the abundance of Walleye migrating upstream of Lower Granite Dam has continued to increase annually, with the vast majority of Walleye observed from late summer through early fall. Males have comprised 87.5% of the sampled population, most of which have demonstrated underdeveloped, developing or dormant gonadal condition. Walleye sampling at the Lower Granite Dam adult trap will continue in 2022, as evaluations for a management plan continue.

Get to Know Your ~~Muscles~~ Mussels!

Sauder, Joel. Idaho Department of Fish and Game; **Snoddy, Lyn. Idaho Department of Fish and Game**

You may know the difference between a gluteus, abdominis, and bicep, but do you know Gonidea, Anodonta, and Margaritifera? These three mussel species are all species of greatest conservation need in Idaho. *Gonidea angulata*, the Western Ridged Mussel, was recently petitioned for listing under the Endangered Species Act, and will soon be undergoing a species status assessment. Here we show how to identify these three species, broad habitat associations, and preliminary results mined from the Aquatic eDNA Project organized by the Rocky Mountain Research Station. We cover key knowledge gaps and how you can provide data to inform the forthcoming status assessment.

A Comparison of Age Reader Bias and Precision Across Chinook Salmon Scales and Fin Rays

Stacy, Alex. Idaho Department of Fish and Game, Pacific States Marine Fisheries Commission; Dondero, Corey. Idaho Department of Fish and Game, Pacific States Marine Fisheries Commission; Davison, Micah. Idaho Department of Fish and Game, Pacific States Marine Fisheries Commission

Quantifying precision and accuracy of age assignments is a high priority in fisheries management. Idaho Department of Fish and Game's Nampa Research Anadromous Ageing Lab (NRAAL) assigns ages to both fin rays and scales of adult Chinook (*Oncorhynchus tshawytscha*) that are collected in streams throughout the state of Idaho and at Lower Granite Dam. Each year, we age approximately 2500 adult scale samples as they pass Lower Granite Dam and approximately 1000 fin ray samples that are collected upstream at spawning grounds from fish carcasses. Occasionally, a single fish may be sampled more than once if a scale is collected as it passes Lower Granite Dam and a fin ray is collected from its carcass upstream. Fish sampled at Lower Granite Dam are often PIT tagged and using these tag numbers, we can associate a scale and fin ray sample to a single fish. To determine the precision between the two ageing methods, we calculated the average coefficient of variants. Additionally, Evans-Heonig and Bowker Bias tests were used to assess bias between the two ageing methods. These results can help us to better understand how well these two validated structures agree with each other for Snake River Chinook Salmon.

Removing Barriers Faced by Veterans in Joining the Civilian Natural Resources Workforce

Stanton, Aaron. Mt. Adams Institute

Veterans returning to civilian life often report a loss of meaning or value in the careers they find. They describe a lack of mission. They also experience some very practical hurdles such as transferring skills or training and certification to the civilian workforce. VetsWork Environment is Mt. Adams Institute's (MAI) national career development internship program for military veterans interested in starting a career in public lands and natural resources management. The 45-week AmeriCorps program offers hands-on training in which participants learn career related skills while expanding capacity for their sponsoring agencies like the U.S. Forest Service, U.S. Fish and Wildlife Service, state and local agencies, and nonprofit organizations. By far the most notable barrier we have witnessed in successfully transitioning veterans to the civilian workforce is the divide between the military and civilian workplace cultures.

Upper Snake River White Sturgeon Evaluation

Tillotson, Nathan. Idaho Department of Fish and Game; Thiessen, Joe. Idaho Department of Fish and Game; Peterson, Mike. Idaho Department of Fish and Game

White Sturgeon (*Acipenser transmontanus*) are the largest freshwater fish in North America and provide one of the most unique angling opportunities in the state of Idaho. In the Snake River, historical distributions of White Sturgeon extend from its confluence with the Columbia River upstream to Shoshone Falls, which is a natural barrier to fish passage. Since 1990, Idaho Department of Fish and Game (IDFG) has released White Sturgeon upstream of Shoshone Falls from the American Falls Dam spillway through Idaho Falls. A subset of these outplant groups were PIT-tagged at release, providing known age upon capture and a means to track emigration from release locations. In 2021, IDFG conducted setline and

angling surveys across nine reaches of the Snake River from the Minidoka spillway upstream through Idaho Falls to investigate White Sturgeon relative abundance, size-structure, movement, and entrainment. Prior to 2021, no formal assessment of Snake River White Sturgeon population characteristics upstream of Shoshone Falls had been attempted In total, 116 White Sturgeon were captured, with sizes ranging from 0.50 - 2.01 m FL. Catch rates were generally highest in the tailwaters of large impoundments such as American Falls Reservoir and Gem Lake. The results of this study provide an important baseline for future studies and management decisions, including the potential for harvest, stocking needs, and monitoring natural recruitment in this reach.

A Study of Sculpin Taxonomy and Distribution in Big Creek, a Central Idaho Wilderness River Network

Turner, Colton. Idaho State University; Faurot, Laurel. Idaho State University; Baxter, Colden. Idaho State University

Sculpin (Family *cottidae*) are a ubiquitous family of small, benthic fishes whose taxonomy and distribution remains incomplete, especially in remote drainages. We are investigating the distribution and trophic ecology of sculpin in the Big Creek drainage in the central Idaho wilderness. Literature and past observations suggested the species present in the drainage would likely be shorthead (*Cottus confusus*), mottled (*C. bairdii*), and torrent (*C. rhotheus*) sculpin. We captured specimens from sites along the length of the mainstem of Big Creek as well as from all tributaries where sculpin were present. Morphometric analyses (aligned with current taxonomic keys) confirmed the three specie's presence, and revealed that the ratio of head length to total length, the number of pectoral fin rays, and presence of prickles were characteristics that appeared to reliably differentiate these species in many (but not all) cases. Based on our surveys and these characteristics, we coarsely defined distribution patterns within the drainage. Shorthead sculpin appeared to be the dominant species in all tributaries and the upper half of the mainstem. They appeared to occur in sympatry with mottled and (rarely) torrent sculpin in the mid-lower drainage. However, in the lower drainage, about 15% of fish sampled possessed characteristics inconsistent with a single species, indicating hybridization (perhaps especially between mottled and shorthead sculpin) may be occurring. This points to a need for genetic analysis (which is underway) to assess hybridization and more confidently differentiate these taxa. Furthermore, we are presently analyzing gut contents of sculpin sampled from throughout the drainage to investigate how sculpin feeding ecology may differ in areas of allopatry versus sympatry. The aims of gut content analysis are the assessment of potential trophic niche partitioning, and the study of sculpin contributions to the complexity of food webs in this wilderness river network.

Investigating Threshold Relationships Between Native Bull Trout and Invasive Brook Trout in Idaho Using a Large Geospatial Dataset

Voss, Nicholas. University of Idaho; Quist, Michael. U.S. Geological Survey

Bull Trout *Salvelinus confluentus* is an iconic coldwater salmonid native to the Pacific Northwest and is listed as threatened under the Endangered Species Act. Bull Trout face a wide array of biotic and abiotic threats, which can make identifying the primary stressor in a given locality difficult. Invasive Brook Trout *S. fontinalis* is a particularly widespread threat to Bull Trout persistence. We sought to identify site-level threshold or "tipping-point" densities of Brook Trout, beyond which Brook Trout may become the

principal threat to juvenile or stream-resident Bull Trout. Such values could aid in broad-scale threat assessments, help inform which management tools may be most effective in a given area, or set goals for Brook Trout suppression efforts. We combined a large stream survey dataset maintained by the Idaho Department of Fish and Game with publicly available stream habitat data and selected sites with conditions suitable to both Brook Trout and Bull Trout ≤250 mm TL. We then used a two-dimensional Kolmogorov-Smirnov test to identify threshold Brook Trout densities associated with significant declines in Bull Trout densities across a range of abiotic conditions. Bull Trout and Brook Trout were rarely sympatric, even in areas where both species were present. Very low densities of Brook Trout were associated with low Bull Trout densities, and the two almost never co-occurred at moderate densities. These patterns were consistent across a wide range of abiotic conditions, suggesting that the presence of Brook Trout is a leading threat to Bull Trout where their distributions overlap. Our results support previous postulations that the long-term co-occurrence of these two species may be "inherently unstable". However, the timeframe under which displacement occurs remains uncertain. We discuss our results in the context of Bull Trout conservation strategies and fruitful directions for future research.

Effects of Initial Feed Timing on Early Survival of Bonneville Cutthroat Trout - Phase Two

Wagner, Melissa. Idaho Department of Fish and Game

Since 2010, the Grace Fish Hatchery has been responsible for managing a conservation aquaculture program to help supplement and reestablish populations of Bonneville Cutthroat Trout *Oncorhynchus clarkii utah* within the Bear River basin in southeast Idaho. The timing of initial feeding is an important element in fish culture and can have a significant impact on the survival and growth of larval fish. Historically, the initial feeding phase of Bonneville Cutthroat Trout rearing is where the highest mortality is experienced at Grace Fish Hatchery. The purpose of this evaluation was to expand upon results from findings in the first phase of our initial feed timing research in 2020. Results from this second phase will be utilized to further define an initial feed timing that can be implemented to maximize survival of Bonneville Cutthroat Trout. Treatment groups were fed for 30 days with initial feeding times of 968 and 1,012 daily thermal units. Phase One study results indicated that these two treatments yielded the highest percent direct survival, which is why they were chosen for further evaluation. In Phase Two, average percent direct survival ranged from 82% - 97% across the treatment groups. A statistically significant difference was detected between the treatment groups with 968 daily thermal units yielding the highest percent direct survival.

Testing Mark-Recapture Assumptions at the South Fork Salmon River Rotary Screw Trap

Wauhkonen, Kaitlyn. Pacific States Marine Fisheries Commission; Poole, Josh. Idaho Department of Fish and Game

Rotary screw traps have become a common tool to calculate the abundance of out-migration juvenile salmonids through mark-recapture. Testing that assumptions in mark-recapture are not being violated is essential to ensure validity of estimates and steer best management practices for Chinook Salmon, Oncorhynchus tshawytscha, and steelhead, O. mykiss.We conducted field manipulations and analyzed pre-existing data on Chinook Salmon and steelhead atthe South Fork Salmon River Rotary Screw Trap for two of our acknowledged assumptions. We questioned the impact of time of release and location of release on recapture rate for our first assumption that all marked fish mix randomly within the population.

We then questioned the impact of size on recapture rate for our second assumption where all marked fish have an equal chance of being recaptured. The first question was tested by using three different release strategies that manipulated release location and/or time of release. A total of 2,033 Chinook and 197 steelhead were PIT tagged for this study and 238 Chinook and 17 steelhead were recaptured. Through chi-squared tests, results show there was no significant difference between the release strategies and recapture rate for either Chinook salmon ($p = 0.419$) or steelhead ($p = 0.421$). We compiled and analyzed data from 2015 to 2021 for our second question in relation to size impacts on recapture rate. We observed a significant difference with recapture probability and fork length with Chinook ($p < .001$) and steelhead ($p < .001$). Larger Chinook were recaptured at a high rate, whereas larger steelhead were recaptured at a lower rate. Each trap set up is unique, thus our findings that release site and time did not have significant bearing on recapture rate, but size did, does not necessarily apply to all traps; each unique trap set up should test assumptions independently.

Population Dynamics of Utah Sucker in the South Fork Teton River, Idaho

Wheeler, Trevor. Brigham Young University – Idaho; Bezzant, Lisa. Brigham Young University - Idaho; Billman, Eric. Brigham Young University - Idaho; High, Brett. Idaho Department of Fish and Game; Vincent, Jenn. Idaho Department of Fish and Game

Utah Sucker *Catostomus ardens* are native to the upper Snake River drainage and are poorly studied despite being common and widespread. The objective of this study was to determine population characteristics of Utah Sucker in the South Fork Teton River, including timing of spawning runs, growth, mortality, recruitment, and fecundity. We captured Utah Sucker in an upstream fish trap on the South Fork Teton River from April through June in 2018, 2019, and 2021. We removed pectoral fin rays to determine age of Utah Sucker captured in 2019 and 2021. Additionally, we removed asteriscus otoliths from fish captured in 2021 to compare precision in age estimates between both hard structures. We captured between 982 and 2,002 Utah Sucker in the fish trap each year. The 50% run date occurred between 28 April and 18 May each year. Utah Sucker exhibited dimorphic growth with females having a significantly larger (573 mm) compared to males (513 mm). Annual mortality was estimated to be 17.9% for Utah Sucker between the ages 9 - 19. Utah Sucker have had successful recruitment of year classes for at least 20 years. However, we found evidence that Utah Sucker had weak year classes in 2003 and 2007. Age estimation was more precise using fin rays compared to otoliths. Average coefficient of variance (ACV) was lower in fin rays (ACV = 6.2) than otoliths (ACV = 14.7); and the percent agreement within one year (PA-1) was higher in fin rays (PA-1 = 83.7) compared to otoliths (PA-1 = 48.0). This research will provide a baseline to which other populations can be compared to determine the influence of management and anthropogenic effects.

Restoration of Abundance and Assessment of Transport of Unanchored Large Wood in a Small River in Central Idaho

Wood, Cassi. Trout Unlimited; Gregory, Jim. Lost River Fish Ecology; Gamett, Bart. U.S. Forest Service; Wood, Caselle. Trout Unlimited; Van Kirk, Robert. Henry's Fork Foundation

Restoration of rivers, which have been degraded by a variety of impacts, is often completed through additions of large wood, as large wood plays an important role in hydro-geomorphic processes that form and maintain fish habitat. In portions of the Yankee Fork of the Salmon River in Idaho, historic timber

harvest was suspected to have reduced in-stream large wood abundance, and a large wood deficit was observed in these areas when compared to reference reaches where timber harvest did not occur. Deficit amounts of large wood were added to the Yankee Fork to achieve natural abundance by simulating the results of natural processes including streamside recruitment, avalanches, and debris flows, with the wood not being buried, anchored, or purposefully wedged to prevent movement. Large wood abundance in treatment reaches, although not static, maintained natural wood abundance over a four-year period, which incidentally included a near 25-year flood event. Tracking of twenty radio-tagged large wood pieces over five years showed that the longest distance any of these pieces moved was 940 m and that most moved <20 m in any given year. Simulation of natural large wood recruitment processes, despite lack of anchoring of wood, was successful at increasing and maintaining wood abundance at natural levels. This approach to restoration was appropriate for our study, as land in the project area was primarily public or undeveloped private land. This approach may need to be used carefully where infrastructure is at risk.

Coping with Stress: the Effects Environment, Seasonality, and Sex have on Cortisol in Redband Trout

Wooding, Alexander. Idaho State University; Jirik, Anna. Idaho State University; Keeley, Ernest. Idaho State University; Pradhan, Devaleena. Idaho State University

Cortisol is the major corticosteroid in teleost fishes and is a key mediator of stress-associated responses. Redband trout (*Oncorhynchus mykiss gairdnerii*) are a cold-water species that have adapted to persist in cool montane streams as well as the thermally stressful environments of arid desert streams. Here, we investigate environmental, seasonal, and sex differences in the chronic stress response and its downstream effects on growth and size demography of wild redband trout from 3 desert streams in the Owyhee range and 2 montane streams in the Hitt mountains in Southwest Idaho . We captured trout (N = 480) from these five streams at monthly intervals from June through October. Across all streams, cortisol levels in fish were highly variable in June, peaked in August and September, and dramatically decreased in October. These fluctuations in cortisol concentration could be related to changing water temperatures associated with seasonal transitions and/or the differential cessation of spawning behavior across streams in June. There was a significant effect of sex and environment on cortisol concentrations ($p = 0.03$), with males from desert environments expressing greater cortisol concentrations than other groups. Furthermore, there was a significant effect of both environment type ($p<0.0001$) and month ($p<0.0001$) on cortisol concentrations, such that fish from desert streams had higher cortisol concentrations than montane fish. Interestingly, morphometric analyses showed that both ecotypes of trout exhibited similar body condition. These data indicate that redband trout that persist in desert streams are able to cope with these environments and maintain healthy body condition and growth rates despite differences in the stress response indicated by cortisol concentrations. This could be due to increased clearance rates of cortisol in circulation for desert fish.

Distribution and Habitat Associations of Warrior Bass *Micropterus warriorensis* in the Black Warrior Watershed, Alabama

Young, Amber. Auburn University; Sammons, Steve. Auburn University

The Southeastern United States possesses the richest diversity of freshwater fishes in North America, and black bass *Micropterus* spp. follow this diversity trend. Nine of the 14 described species and subspecies of

black bass are endemic to the Southeastern United States. Warrior Bass *Micropterus warriorensis* are found in the Black Warrior River Watershed in Alabama that were elevated to species status in 2013, but little is known about their distribution, life-history, and status. Therefore, resource managers need a better understanding of Warrior Bass distribution and habitat use before management actions can be implemented. The goal of this study was to investigate the distribution of Warrior Bass and to evaluate the influence of various factors on their presence. We used a single season occupancy model to identify relationships between Warrior Bass occurrence and multiscale habitat factors. Warrior Bass distribution was assessed by conducting electrofishing (backpack and canoe) surveys at 70 stream sites from May - August 2020 and from May - July 2021. During electrofishing surveys, all black bass were captured and identified to species. Habitat surveys were then conducted within the same section of stream as the electrofishing survey to characterize the habitat of each stream reach. Warrior Bass were detected in 26% of the stream sites sampled, suggesting that distribution of Warrior Bass is limited within the Black Warrior Watershed. The probability of occurrence for Warrior Bass was higher in stream reaches with larger amounts of boulder, bedrock, and limestone. Warrior Bass had lower occurrence probabilities in reaches with increased percent pool habitat, sinuous stream segments, and higher levels of human disturbance in the watershed. Results of this study will allow resource managers to identify areas within the Black Warrior Watershed that should be prioritized for Warrior Bass conservation and management.

Selenium and Elk River Coal Mines, B.C.: Downstream Impacts to the Kootenai River

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The Kootenai River, in Idaho and Montana, has been experiencing changes in its water chemistry since the development and expansion of strip coal mining in the Elk River Valley, B.C., Canada. Waste rock disposal sites have been leaching various contaminants into the tributaries to the Kootenay River, B.C., Koocanusa Reservoir, and the Kootenai River downstream of Libby Dam. A primary contaminant of concern includes Selenium. The Kootenai Tribe has expanded their sampling to include a more robust Selenium and selenium speciation program, and has also conducted fish tissue analysis on Kootenai River fish including Kootenai River White Sturgeon (*Acipenser transmontanus*), Burbot (*Lota lota*), Mountain Whitefish (*Prosopium williamsoni*), Northern Pikeminnow (*Ptychocheilus oregonensis*), and Peamouth Chub (*Mylocheilus caurinus*). Several Burbot females, and most Mountain Whitefish females recently sampled exceeded EPA Selenium egg/ovary criteria. The results are concerning and have ramifications to the long-standing restoration efforts in the Kootenai Basin.

Notes