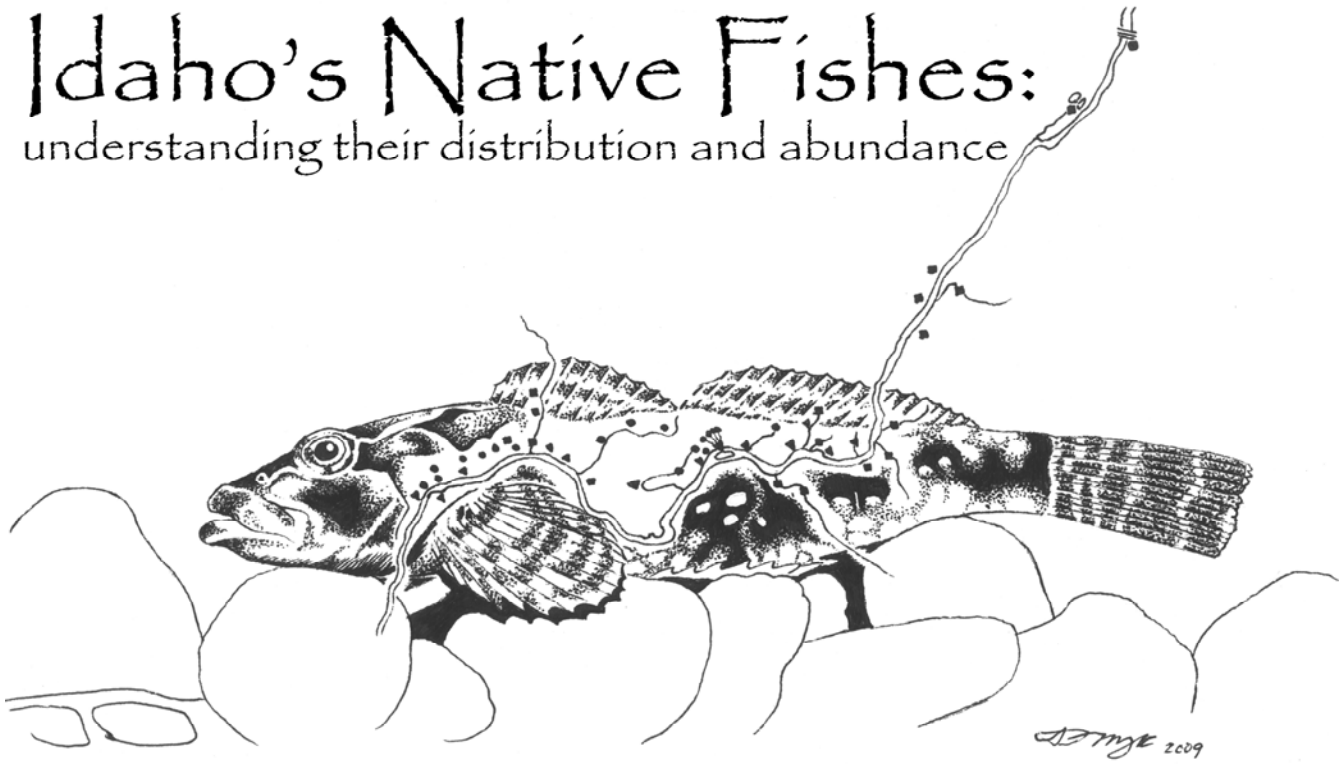
American Fisheries Society

Idaho Chapter

Established 1964

Idaho's Native Fishes:

understanding their distribution and abundance

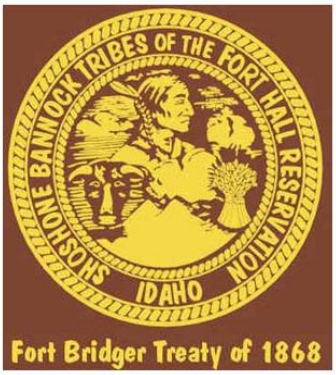


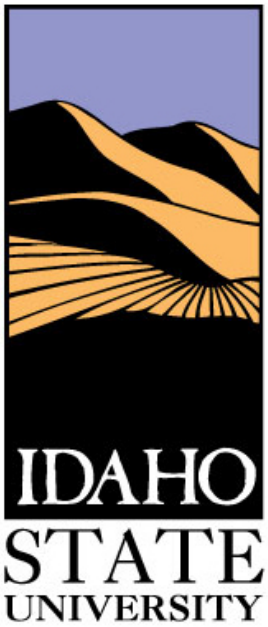
2010 Annual Meeting

March 3 -5, 2010
Red Lion Hotel, Pocatello Creek Road
Pocatello, Idaho

Program and Abstracts

Thanks to our Meeting Sponsors!





EXCOM AND COMMITTEE CHAIRS

Executive Committee

Jim Fredericks, President	(208) 769-1414	jim.fredericks@idfg.idaho.gov
Ernest Keeley, President Elect	(208) 282-3145	keelerne@isu.edu
Jason Vogel, Vice President	(208) 843-7145	jasonv@nezperce.org
Bart Gamett, Past President	(208) 588-2224	bgamett@fs.fed.us
Mick Hoover, Secretary	(208) 588-2219	mick.hoover@idfg.idaho.gov
Chris Kozfkay, Treasurer	(208) 939-6713	christine.kozfkay@idfg.idaho.gov
Martin Koenig, Nominations Chair	(208) 465-8404	martin.koenig@idfg.idaho.gov
Tarah Johnson, Palouse Unit President	(208) 691-5485	john3002@vandals.uidaho.edu
Sam Matsaw, Portneuf Unit President	(208) 282-4458	matssamm@isu.edu

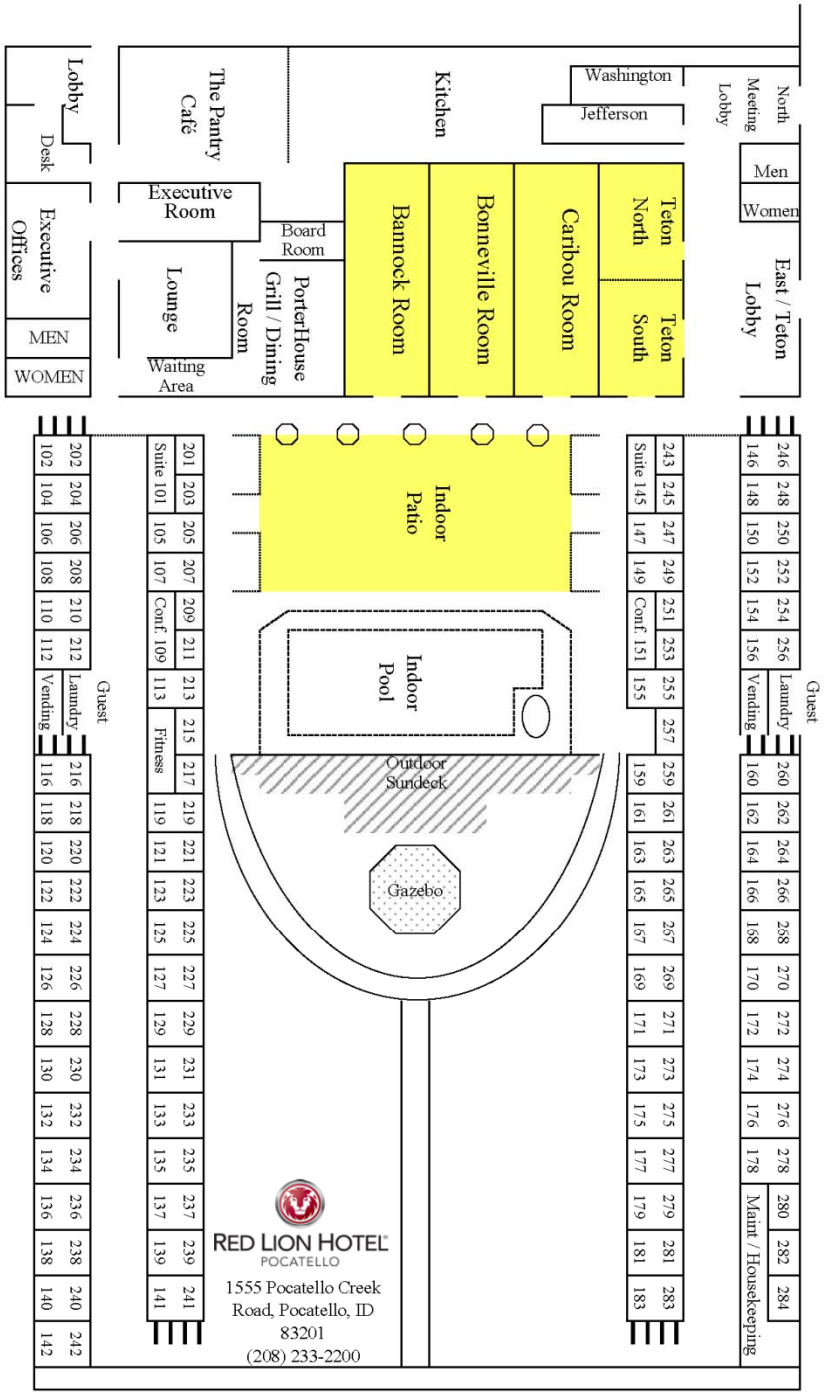
Committee Chairs

Tim Copeland , Anadromous Fish	(208) 465-8404	tim.copeland@idfg.idaho.gov
Bryan Grant, Aquaculture	(208) 427-6364	bryan.grant@idfg.idaho.gov
Eric Stark, Fundraising	(208) 465-8404	eric.stark@idfg.idaho.gov
John Cassinelli, Fundraising	(208) 465-8404	john.cassinelli@idfg.idaho.gov
Matt Dare, Membership	(208) 373-4371	mdare@fs.fed.us
Steve Elle, Mentoring	(208) 465-8404	steve.elle@idfg.idaho.gov
Vaughn Paragamian, Native Fishes	(208) 769-1414	vaughn.paragamian@idfg.idaho.gov
Lauri Monnot, Public Education	(208) 373-0461	lauri.monnot@deq.idaho.gov
Corey Lyman, Riparian	(208) 557-5838	clyman@fs.fed.us
Stephanie Hallock, W.Quality/Str. Hydr.	(208) 686-0701	shallock@cdatribe-nsn.gov

Committee Room Assignments

Anadromous Fish	Teton North
Fish Culture	Teton South
Mentoring	Board Room
Native Fishes	Executive Room
Public Education	Caribou Room
Riparian	Washington
Water Quality/Stream Hydrology	Jefferson

Floorplan for Red Lion Hotel - Pocatello



Driving direction from Red Lion Hotel to Goody's Pizza:

1.) From the parking lot take a LEFT on Pocatello Creek Rd (going downhill). Continue going straight 1.3 miles (Pocatello Creek Rd. turns into Alameda Rd)
2.) Take a LEFT on Yellowstone Avenue. Continue going straight 2.2 miles (Yellowstone Ave. turns into 4th street).
3.) Take a LEFT on Carter St. (Carter St. is two blocks past the stop light on Benton St)
4.) Continue straight across 5th St., and Park in the campus Parking Lot on the RIGHT.
5.) Park at the far end of the parking lot. Goody's is located on the other side of 5th street.

***There is also parking in the Goody's parking lot, but these spots will likely fill quickly.**

Wednesday, March 3

8:00–8:20 AM **Opening Remarks and Presidential Message**
ICAFS President, Jim Fredericks

Plenary Session: Idaho's native fishes: understanding their distribution and abundance

Location: Caribou and Teton rooms

8:20–8:30 AM **Introduction to Plenary Session**
Ernest Keeley, Moderator

8:30—8:55 **The biogeography of Idaho's native fishes: patterns and problems**
J.D. McPhail, The University of British Columbia

8:55—9:20 **Historic species occurrence records from Idaho and their utility in native fish management**
Donald W. Zaroban, Orma J. Smith Museum of Natural History and Idaho Department of Environmental Quality

9:20—9:45 **Genetic investigations of Idaho's native fishes – a taxonomic and genomic black-box**
Christine C. Kozfkay, Idaho Department of Fish and Game

9:45—10:15 **BREAK**

10:15—10:40 **Distribution, abundance, trends, and genetic purity and diversity: key components to Idaho Fish and Game's status assessments**
Kevin A. Meyer, Idaho Department of Fish and Game

10:40—11:05 **Status of Native Fish in the Western United States: a range-wide perspective**
Scott A. Grunder, Idaho Dept. of Fish and Game

11:05–11:30 **Conserving native fishes across geographical and jurisdictional boundaries**
Jody K. Brostrom, U.S. Fish and Wildlife Service

11:30—11:55 **Panel discussion**
All speakers

11:55- 12:00 **Concluding remarks**
Ernest Keeley, moderator

12:00—1:40PM BOX LUNCH: COMMITTEE BREAKOUTS (room assignments see page 1)

Session 1: Native fishes - contributed papers

Location: Caribou and Teton rooms

1:40–1:45 PM **Introduction to Session,**
Dan Garren, Moderator

1:45–2:05 PM **Diverse values and relevance of native species in wildlife management: perspectives for wildlife managers**
Mark Gamblin, Idaho Department of Fish and Game

2:05–2:25 PM **Yellowstone cutthroat trout status and trend in the Henrys Fork, Teton, and Sinks drainages**
Jim DeRito, Henry's Fork Foundation

2:25–2:45 PM **Update on protecting and restoring mountain whitefish in the Big Lost River**
Jim Gregory, Gregory Aquatics

2:45–3:05 PM **Barriers to movement and genetic population structure of westslope cutthroat trout (*Oncorhynchus clarkii lewisi)* in the Salmon River Basin, Idaho**
Sammy L. Matsaw, Idaho State University

3:05–3:35 PM **BREAK**

3:35–3:55 PM **A comparison of life histories among selected Snake River steelhead populations**
Timothy Copeland, Idaho Department of Fish and Game

3:55–4:15 PM **Range-wide phylogenetic analysis of cutthroat trout (*Oncorhynchus clarkii* ssp.) subspecies from western North America**
Janet L. Loxterman, Idaho State University

4:15—4:35 PM **Conservation aquaculture as a critical tool to recover burbot populations in Idaho's Kootenai River**
Ken Cain, University of Idaho

4:35—4:55 PM **Genetic adaptation of redband trout in desert and montane environments**
Shawn R. Narum, Columbia River Inter-Tribal Fish Commission

4:55—5:10 PM **Concluding comments and wrap-up**
Moderator

5:30–PM **STUDENT MIXER at Goody's !! See attached map.**

Thursday, March 4 (concurrent sessions)

6:00—7:00 AM ***ICAFS Spawning Run- meet outside hotel***

	Session 2-A: Restoration **Moderator: Stephanie Hallock**	***Session 2-B: Anadromous Fish ecology and management*** **Moderator: Danielle Dorsch**
	Location: Caribou Room	Location: Teton Room
8:00–8:10	Announcements and introduction to Session	Announcements and introduction to Session
8:10–8:30	**Restoration within the Rainier reach of the upp** CANCELLED Regional Land Trust	**Rogues in the river: how spill and flow influence estimation of migration survival in three stocks of Snake River anadromous salmonids** James Morrow, National Marine Fisheries Service
8:30–8:50	**North Fork Coeur d'Alene River Basin Watershed restoration! How is recovery defined?** Edward Lider, Two-C Consulting	**Increasing water temperature and spawner abundance were associated with increased Chinook salmon female prespawn mortality in the South Fork Salmon River** William Young, Nez Perce Tribe

8:50–9:10	**Restoring an entrenched mountain meadow stream by emulating natural processes** Angleo Vitale, Coeur d'Alene Tribe	**Characteristics of steelhead kelts in the Snake River** Jessica Buelow, University of Idaho
9:10–9:30	**Bonneville cutthroat trout restoration in a Bear Lake tributary – a top to bottom approach** Arnie Brimmer, Idaho Department of Fish and Game	**Quantifying the effects of Snake River dam operations on the collection and detection of subyearling fall Chinook salmon** John M. Plumb, University of Idaho
9:30–9:50	**Restoring connectivity to spawning and rearing habitat for Chinook salmon (*Oncorhynchus tshawytscha*) in the Pahsimeroi River, ID** Patrick Murphy, Idaho Department of Fish and Game	**Influence of seaward migration and ocean/climatic conditions on survival rates of Snake River Chinook salmon and steelhead** Charles E. Petrosky, Idaho Department of Fish and Game
9:50–10:15	**BREAK**	
	Session 3-A: Aquatic Ecology **Moderator: Tony Lamansky**	***Session 3-B: Habitat modeling and assessment*** **Moderator: Corey Lyman**
	Location: Caribou Room	Location: Teton Room
10:15–10:20	**Introduction to Session**	**Introduction to Session**
10:20–10:40	**Riparian insect response to experimental salmon carcass additions to Idaho streams** Scott Collins, Idaho State University	**Seasons other than summer: the need for collecting annual stream temperature** Dona Horan, US Forest Service
10:40–11:00	**Idaho's freshwater mussels – their distribution, biology, and status** Cynthia Tait, US Forest Service	**GIS tools to assess the risks and benefits of barrier removal to native fish populations in Idaho** Paul Reyes, University of Idaho
11:00–11:20	**Does replacement of a native salmonid by a nonnative reduce subsidies to riparian consumers?** Joseph Benjamin, Idaho State University	**Habitat model for predicting the upstream extent of fish occurrence based on GIS data: an Idaho pilot study** Chris Tretter, Idaho Department of Lands
11:20–11:40	**Development of biosecurity measures for hatcheries to protect against invasive mollusks** Kelly Stockton, University of Idaho	**Quantifying temporal variability in stream habitat data: implications for restoration and monitoring** Robert Al-Chokhachy, US Forest Service
11:40–12:00	**The function of floodplain vs. confined segments in an Idaho river network: organic matter dynamics and invertebrate production** Ryan Bellmore, Idaho State University	**Evaluating watershed condition: bottom up vs. top down approaches?** Eric Archer, US Forest Service

12:00—2:15

BUSINESS LUNCHEON
Location: Bannock and Bonneville rooms

Session 4: Fisheries Management

Moderator: Greg Schoby

Location: Caribou and Teton Rooms

2:15—2:20 **Introduction to Session**

2:20—2:40 **Mentoring within Idaho Chapter AFS: an open discussion**
Steven Elle, Idaho Department of Fish and Game

2:40—3:00 **Evaluation and adaptation of a non-native brook trout suppression program in a watershed of the Coeur d'Alene basin**
Jon Firehammer, Coeur d'Alene Tribe

3:00—3:20 **Validation of scales and otoliths for estimating age of redband trout in high desert stream of Idaho**
Dan Schill, Idaho Department of Fish and Game, University of Idaho

3:20—3:40 **Relative performance of diploid and triploid catchable rainbow trout in lowland lakes and reservoirs**
Martin Koenig, Idaho Department of Fish and Game

3:40—4:00 **Hooking mortality and landing success with baited circle hooks compared to traditional types for stream-dwelling trout**
Brett High, Idaho Department of Fish and Game

4:00—4:20 **Don't move a mussel – news from Idaho's invasive species program**
Amy Ferriter, Idaho State Department of Agriculture

4:20—4:40 **Teton Rooms - Poster Session Speed Presentations!**

Speed Presentations (3 minutes each):
Moderator: Steve Elle

Speed Presentation **Putting aquatic science in to practice**
Kerry Overton, USFS Rocky Mountain Research Station's Boise Aquatic Sciences Lab

Speed Presentation **2nd Annual Western Division Student Colloquium**
Kelly Stockton, University of Idaho

Speed Presentation **Angler exploitation of redband trout in eight Idaho desert streams**
Dan Schill, Idaho Fish and Game/Univ of Idaho

Speed Presentation **Save money by building or refurbishing your Smith-Root backpack electrofishers 24 volt batteries**
Corey Lyman, Caribou-Targhee National Forest

4:40 – 5:30 **POSTER SESSION (location: Indoor Patio Area)**

The distribution of genetic variation among Chinook salmon lineages in the Columbia River Basin: a landscape genetics perspective
Andrew Matala, Columbia River Inter-Tribal Fish Commission

Efficacy of Virkon Aquatic ® to disinfect wading gear infested with New Zealand mudsnails

Amber Barenberg, University of Idaho

Mountain whitefish rehabilitation in response to nutrient restoration in the Kootenai River, Idaho

Cathy A. Gidley
Idaho Department of Fish and Game

Predicting spawning ground occupancy and assessing spawning habitat selection by Chinook salmon (*Oncorhynchus tshawytscha*) in a central Idaho wilderness stream

Ellen J. Hamann, University of Idaho

Relative genetic diversity estimates amongst four Pacific salmonids

Nathan Campbell, Columbia River Inter-Tribal Fish Commission

Modeling the effect of pelican predation on Yellowstone cutthroat trout in the upper Blackfoot River system

Matt Green, Idaho State University

Application of new spatial statistical stream models for precise downscaling of climate change effects on temperatures in river networks

Dona Horan, Rocky Mountain Research Station

Characterization of an attenuated *flavobacterium psychrophilum* vaccine

Tarah Johnson, University of Idaho

Burbot extensive rearing - exploring short term solutions for burbot rehabilitation in the Kootenai River

Corie Laude, Idaho Department of Fish and Game

Genetic stock identification of steelhead kelts in the Yakima River Basin

Jeff Stephenson, Columbia River Inter-Tribal Fish Commission

Evidence of iteroparity in wild Snake River summer-run steelhead (*Oncorhynchus mykiss*) from scale patterns

Kristin Ellsworth, Idaho Dept of Fish and Game

Studying the effects of environmental variables on the seaward migration of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) in Big Creek Idaho, – A comparative analysis across multiple sites and years

Kristen Pilcher, University of Idaho

A non-parametric assessment of Snake River fall Chinook salmon (*Onchorynchus tshawytscha*) out-migration timing

John M. Plumb, Presenter, University of Idaho

Using bioenergetic models to estimate changes in habitat quality for stream-dwelling salmonids: implications for climate change and nutrient supplementation

Steven Campbell, Idaho State University

6:30—?? PM

EVENING SOCIAL AND AUCTION!

Location: Bannock and Bonneville rooms

Friday, March 5, 2009

Session 5: Native fishes, fish ecology, and fisheries management

Moderator: Dan Kenney

Location: Caribou and Teton rooms

8:00–8:10 AM	Announcements and Introduction to Session
8:10–8:30	**Broad-scale genetic and compositional monitoring of fish populations: a proof of concept in the interior Columbia River and upper Missouri River basins** Michael K. Young, Rocky Mountain Research Station
8:30–8:50	**Interspecies synchrony in salmonid densities and large-scale environmental conditions in central Idaho** Timothy Copeland, Idaho Department of Fish and Game
8:50–9:10	**Flow regime influences distributions of brook trout, bull trout and cutthroat trout in the upper Columbia Basin** Seth Wenger, Trout Unlimited
9:10–9:30	**Distribution of hybrid trout, hybrid zone structure, and management of native cutthroat trout in the Jocko River watershed, MT** Matthew Corsi, University of Montana
9:30–9:50	**Two native suckers in a dammed river: a tale of persistence** Kevin Donner, Idaho State University
9:50– 10:20	**BREAK**
10:20–10:40	**Tissue composition and condition of sexually mature hatchery origin steelhead trout from the Snake River** Zachary Penney, University of Idaho
10:40–11:00	**Trends in annual migratory run time of Columbia River steelhead: genetic stock identification (GSI) of biweekly mixtures sampled at Bonneville Dam** Jon E. Hess, Columbia River Inter-Tribal Fish Commission
11:00-11:20	**Resolving natal origins and spatial distribution of juvenile migration strategies in wild Fall Chinook salmon (*Oncorhynchus tshawytscha*) using otolith microchemistry and geospatial analysis** Jens Hegg, University of Idaho
11:20-11:40pm	**An evaluation of the spawning ecology of Bonneville cutthroat trout** Brett Roper, USDA, Forest Service
11:55-12:15	Best paper awards

Travel Safely!

Plenary session: Idaho's native fishes: understanding their distribution and abundance.

The biogeography of Idaho's native fishes: patterns and problems

J.D. McPhail
The University of British Columbia
Presenter: Don McPhail, mcphail@zoology.ubc.ca

Although Idaho does not have a large native fish fauna, it is arguably the most puzzling and interesting freshwater fish fauna in North America. First, within the state, there are four major fish faunas each with its own distinctive set of species. Second, fossils in Idaho and adjacent states provide an almost continuous record of the Idaho fish fauna from the Miocene through to the Holocene. Third, over time, the complex geological history of the state has severed and connected drainage systems in ways that have brought fish faunas together in some places and split them in others. These historical processes have forged the distribution patterns that are the subject of the first half of this talk: however, along with biological events like opportunities for hybridization and the evolution of reproductive isolation and resource partitioning they have produced an exceptionally puzzling fish fauna. In the recent past these puzzles were of interest primarily to academics, but growing concern with the conservation of biodiversity has propelled some of these evolutionary puzzles into the realm of management issues. Modern technology, especially DNA studies, has uncovered layers of complexity within what were once thought to be single species. The second half of this talk will outline a few examples of such problems among native fishes in Idaho.

Historic species occurrence records from Idaho and their utility in native fish management

Donald W. Zaroban
Orma J. Smith Museum of Natural History and Idaho Department of Environmental Quality
Presenter: Don Zaroban, (208) 373-0405; don.zaroban@deq.idaho.gov

Historic records are useful in the management of native fishes, particularly non-salmonids, since they can provide a basis for temporal comparisons. Records that include voucher specimens are the most irrefutable evidence of a species occurrence by providing for taxonomic verification. Typical limitations of historic data are that they were collected for a variety of purposes using different methods with varying efficiencies, their collection event information is frequently incomplete and they are often not compiled digitally. To begin to address the event and digital compilation issues in Idaho, the Orma J. Smith Museum of Natural History (OJSMNH) has made taxonomic determinations, verified locality information of data collection events, compiled a geo-referenced database of specimens and is developing a web page for distribution of information. The OJSMNH holdings of Idaho native species currently include 50,551 specimens collected between 1918-2009, representing 8 families and 39 species. The principal sources of these specimens are the Idaho DEQ, Richard L. Wallace (University of Idaho), US Geological Survey, Idaho Fish and Game, US Environmental Protection Agency, US Forest Service and the College of Idaho. Recent inquiries of the OJSMNH fish collection include requests for occurrence data of Pacific lamprey, northern leatherside chub and Wood River sculpin. An example of the utility of historic records in Idaho native fish management is the identification of subwatersheds where additional sampling is needed to confirm or refute apparent changes in Wood River sculpin occupancy.

Genetic investigations of Idaho's native fishes – a taxonomic and genomic black-box

Christine C. Kozfkay
Idaho Department of Fish and Game
Presenter: Christine Kozfkay, (208)939-6713, christine.kozfkay@idfg.idaho.gov

Historically, fisheries assessments and management efforts has focused primarily on commercially or recreationally important freshwater fish species. But, in recent years, interest in non-game fish has also stimulated an increase in ecological studies and threat assessments for many under-described species in Idaho and other western states. This effort has somewhat been driven by the need to construct status reviews for ESA listing determinations but also driven by large-scale ecosystem approaches to fisheries management and gaps in our scientific knowledge. Generally, genetic investigations are a key component to these assessments. Genetic techniques can help refine taxonomic relationships and species ranges among morphologically indistinguishable species or hybridizing species, delineate conservation and management units, identify stocks for captive propagation and re-introduction, and develop baselines for short and long-term monitoring programs. This presentation focuses on the application of genetic techniques to our present understanding of species distributions and status for Idaho species such as sculpin, whitefish, burbot, bull trout, redband trout, and cutthroat trout species. Future directions for genetics in species assessments are also discussed.

Distribution, abundance, trends, and genetic purity and diversity: key components to Idaho Fish and Game's status assessments

Kevin A. Meyer and Daniel J. Schill
Idaho Department of Fish and Game,
Presenter: Kevin Meyer, 208-465-8404, Kevin.meyer@idfg.idaho.gov

The Idaho Department of Fish and Game was created in 1899 to preserve, protect, perpetuate, and manage wildlife in Idaho for the citizens of the state. Over the years much of the department's work focused on monitoring fish and wildlife populations to determine whether changes were needed to harvest regulations. In recent years population monitoring has shifted in some instances to focus on the status of species of special concern. Often these status assessments have involved broadly distributed game and nongame species, presenting challenges to collecting adequate data to make meaningful inferences regarding the species' status. Objectives for these assessments have usually included 1) estimating current distribution of the species, in terms of kilometers or percent occupied; 2) estimating the number of current populations and overall abundance; 3) determining trends in abundance; and 4) determining genetic purity, diversity, and structure among populations across the landscape. Historical occupancy has been given only minor consideration because it is usually not measurable and therefore largely a matter of conjecture. Because money has only recently become available to adequately assess status of native fishes at broad scales, existing data is usually sparse, and subsequently trend analysis is often not possible. In these cases, the original status assessment may serve as a baseline for future monitoring. We present results from several status assessments recently conducted by the department, and highlight some of the strengths and weaknesses inherent in broad-scale sampling and analyses.

Status of Native Fish in the Western United States: a range-wide perspective

Scott A. Grunder
Idaho Dept. of Fish and Game
Presenter: Scott Grunder, 208-287-2774*, scott.grunder@idfg.idaho.gov*

The distribution and abundance of native game fishes in the western United States have declined from historical levels over part or all of their native ranges. In response to petitions to list native fishes as threatened or endangered under the Endangered Species Act, natural resource agencies and other stakeholders have collaborated to develop range-wide status assessments. These assessments describe current population abundance and distribution, genetic status, and risks and threats. They can be done at several geographic scales including the basin, state, or range-wide depending on the need or application. Status assessments are used for two primary reasons: 1) to have current information on native species for conservation and management purposes, and 2) to respond to Endangered Species Act-related matters such as a formal listing petition. I will describe the process recently used to complete a range-wide status assessment for westslope cutthroat trout (*Oncorhynchus clarkii lewisi*).

Conserving native fishes across geographical and jurisdictional boundaries

Jody K. Brostrom
U.S. Fish and Wildlife Service
Presenter: Jody Brodstrom, Jody_Brostrom@fws.gov

Human demand for water, energy and land has resulted in a drastic decline in the genetic diversity and geographic distribution of native fishes in the United States. With the reality of increasingly limited resources and competing demands, it is clear that those involved in conserving native species need to work collaboratively in order to maintain healthy, diverse, self-sustaining populations of fish and other aquatic resources. I will discuss two processes which the U.S. Fish and Wildlife Service has been involved with to elevate native fish species conservation. The first is the National Fish Habitat Action plan, where Fish Habitat Partnerships provide leadership and develop habitat projects at regional and local levels to conserve native fish species. Partnerships such as the Desert Fishes Habitat Partnership and the Western Native Trout Initiative are formed around wide geographical areas to recover and enhance important aquatic habitats for their keystone species (179 species of native desert fishes and 15 species of native trout). The second is the Pacific Lamprey Conservation Plan, which is a regional effort to describe what is known about the species life history and distribution, identify and prioritize threats and limiting factors, and then identify watershed and regional suites of actions to conserve the species.

Session 1: Native fishes – contributed papers

Diverse values and relevance of native species in wildlife management: perspectives for wildlife managers

Mark Gamblin
Idaho Department of Fish and Game
Presenter: Mark Gamblin, 208-232-4703, mark.gamblin@idfg.idaho.gov

Oral presentation, Professional

Native species are increasingly important in North American public wildlife resource management policy, programs and resource allocation decisions. Native species management policy and programs should reflect the values and expectations of the society we serve. In practice, that responsibility is a challenge for state wildlife management agencies as the demand for natural

resources increases and our society evolves from its agrarian- utilitarian roots. Maintaining relevance of wildlife management policy and programs in our evolving society will be essential for the continued success of fisheries and wildlife management in North America. I suggest that the continued success of North American wildlife management in general and native species in particular will rely on making the objectives of wildlife conservation and stewardship relevant to American society. That relevance will require that conservation objectives are clearly explained to be in the best interest of the individual. Examples of past successes and suggestions for future successful strategies will be discussed.

Yellowstone cutthroat trout status and trend in the Henrys Fork, Teton, and Sinks drainages

Jim DeRito[1], Jim Gregory[2] and Lee Mabey[3]
[1]Henry's Fork Foundation
[2]Gregory Aquatics
[3]Caribou-Targhee National Forest

Presenter: Jim DeRito,208-652-3567, jderito@henrysfork.org

Oral Presentation, Professional

Yellowstone cutthroat trout (YCT) are the only native trout in the Henrys Fork of the Snake River, Teton, and Sinks drainages, but their distribution and abundance across about 4,300 km of stream length has been greatly diminished by non-native trout introduction and habitat alteration. Yellowstone cutthroat trout status (distribution and abundance) was initially compiled using data collected through 1999. Among these drainages, YCT were present in 17% to 89% of the total stream length surveyed, but exclusively occupied only 3% to 19% of the surveyed length. Since 2000, the remaining unsurveyed stream length has been completely assessed in the Henrys Fork and Teton drainages and further assessed in the Sinks drainage and these data are being used to update YCT status and assess trends. A few additional YCT-only populations have been found, but YCT populations with non-native trout that were repeat surveyed have shown a consistent pattern of decline. Several organizations are working cooperatively to protect and restore YCT among these drainages.

Update on Protecting and Restoring Mountain Whitefish in the Big Lost River

Jim Gregory[1], Bart Gamett[2], Dan Garren[3], and Jim Fredericks[3]
[1]Gregory Aquatics
[2]US Forest Service
[3]Idaho Fish and Game

Presenter: Jim Gregory, 208-588-2447, Fishchief@yahoo.com

Oral Presentation, Professional

The Big Lost River, which is an isolated stream system located along the northern rim of the Snake River Plain in south central Idaho, is occupied by a unique form of mountain whitefish. Since 2003, studies have been conducted to identify the historic, recent, and current distribution and abundance of mountain whitefish in this area. Although current abundance and distribution remain below historic levels, sampling from 2007 – 2009 indicates that whitefish distribution increased from 83 km in 2005 to 135 km of river now used by mountain whitefish. Additionally, the adult population grew from an estimated 2,539 adult fish in 2005 to the current estimate of 12,639 adult fish. Concurrent with these increases, partners have implemented projects throughout the basin aimed at benefiting whitefish populations. These projects have included a whitefish management plan; salvaging and reintroducing whitefish; providing passage over

barriers; riparian protection and restoration; and five reports to summarize these efforts and findings.

Barriers to movement and genetic population structure of westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) in the Salmon River Basin, Idaho

Sammy L. Matsaw Jr., Janet L. Loxterman and Ernest R. Keeley
Idaho State University
Presenter: Sammy Matsaw, (208) 705-6191, matssamm@isu.edu

Oral Presentation, Student

Barriers to movement in aquatic ecosystems can impede gene flow or connectivity between fish populations leading to changes in gene frequencies between populations. Although historic isolation of fish populations was caused by natural geologic events, such as land up-lifting, leading to canyons, mountains, and islands; more recent human activities (roads, dams, urban and agricultural expansion) are rapidly fragmenting native fish populations. In this study, we assess genetic differentiation and diversity of westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) populations to examine the effects of habitat fragmentation isolated by natural and artificial barriers. Our study was conducted in the Salmon River Basin of central Idaho within the traditional-use area of the Shoshone-Bannock Tribes. Currently, we are genotyping individual fish and our results should be mostly complete to verify effects of natural and artificial barriers on the genetic population structure of cutthroat trout. Also, we are assessing the differentiation and diversity for future management and conservation of westslope cutthroat trout populations in the Salmon River Basin.

A comparison of life histories among selected Snake River steelhead populations

Timothy Copeland, Brett Bowersox and Alan Byrne
Idaho Department of Fish and Game

Presenter: Tim Copeland, 208-465-8404, tim.copeland@idfg.idaho.gov

Oral Presentation, Professional

Life history diversity is important to population resilience. The suite of life histories in a population influence its spatial structure, productivity, genetic diversity, and ultimately its abundance. Knowledge of these parameters is lacking for individual Snake River steelhead populations. Status assessments have been based on information from the Snake River aggregate or from coastal populations. We contrasted freshwater life histories present in selected populations within the Snake River steelhead ESU and considered implications for population productivity and management. We examined migration timing, age composition, and length at age of young steelhead leaving their natal streams in 2008 (Big Bear Creek, East Fork Potlatch River, Fish Creek, Crooked Fork, and Rapid River). In Fish Creek, 75% of emigrating juveniles left during the fall. In Big Bear Creek, East Fork Potlatch River, Rapid River, and Crooked Fork, the spring emigration comprised a much larger portion of the outmigration (87%, 65%, 61%, and 46%, respectively). Of the fish detected passing Lower Granite Dam, most spring emigrants were detected by mid-June; however, based on past data, fall emigrants will be detected 1-3 years later. Mean length at emigration out of natal stream differed among populations; average spring lengths ranged from 110.2 mm (East Fork Potlatch River) to 179.3 mm (Rapid River). In each population, 3-4 age classes emigrated. In East Fork Potlatch River, spring emigrants ranged 1-2 years in age; whereas they were 3-4 years in Crooked Fork. We attribute variation in juvenile life histories to habitat conditions within the different drainages (e.g., temperature regime and biological productivity). The distance from the ocean and diversity in elevation, hydrology, and geology in the landscapes Snake River steelhead inhabit make these populations diverse. Age

structure of Snake River steelhead is more complex than assumed from previous status assessments. Management should account for these differences.

Range-wide phylogenetic analysis of cutthroat trout (*Oncorhynchus clarkii* ssp.) subspecies from western North America

Janet L. Loxterman and Ernest R. Keeley
Idaho State University
Presenter: Janet Loxterman, 208-282-6167, loxtjane@isu.edu

Oral presentation, Professional

Although 14 different subspecies of cutthroat trout have been described from various sources over the past 100 years, few comparative analyses have attempted to determine the validity of such taxonomic categories; and the American Fisheries Society only officially recognizes one species of cutthroat trout. We collected cutthroat trout tissue samples from across their geographic range to evaluate the phylogenetic relationships among extant populations and determine whether current taxonomic categories reflect evolutionary relationships. Using mitochondrial DNA (mtDNA) sequence divergence data, we assessed the common ancestry of cutthroat trout from 235 different stream or lake populations representing eight subspecies of cutthroat trout. We attempted to represent within subspecies genetic diversity by sampling populations over a broad geographic area. Our results indicate that the primary phylogenetic divisions in cutthroat trout coincide with major watershed boundaries, as previously defined by most cutthroat trout subspecies ranges. However, our data also indicate that not all described subspecies represent distinct lineages, and a portion of two subspecies ranges represents an undescribed lineage as distinct as all other subspecies of cutthroat trout. When applied to species with large geographic ranges, mtDNA sequence divergence may be an effective means of identifying distinct population segments for conservation and management.

Conservation aquaculture as a critical tool to recover burbot populations in Idaho's Kootenai River

Ken Cain[1], Nate Jensen[1], Jimmy Barron[1], Mark Polinski[1], Matt Neufeld[2], and Sue Ireland[3]
[1]University of Idaho
[2]BC Ministry of the Environment
[3]Kootenai Tribe of Idaho

Presenter: Ken Cain, 208-885-7608, kcain@uidaho.edu

Oral Presentation, Professional

Burbot are native to the Kootenai River in northern Idaho. Following a multitude of anthropogenic changes to the Kootenai system, current burbot populations in this river are considered functionally extirpated. The Kootenai Tribe of Idaho (KTOI) has recently developed a burbot conservation strategy aimed at recovery or re-establishment of this species. A number of habitat and flow regime improvements were identified as essential for recovery, but conservation aquaculture of burbot was considered a key critical component for this strategy to be successful. The challenge to this approach was that very little information on burbot culture efforts was available and the life history pattern of this species presented many significant challenges to developing reliable aquaculture methods. However, through collaborative efforts between the KTOI, British Columbian Ministry of Environment, Idaho Department of Fish and Game, the US Fish and Wildlife Service, and the University of Idaho's Aquaculture Research Institute (UI-ARI), we have established burbot aquaculture as a feasible approach to recovery. This program was initiative in 2003 with the capture and transport of adult broodstock from British Columbia to the UI-ARI. Since initiation, our efforts have resulted in the successful production of fish annually.

Spawning and incubation methods were initially developed and optimized. Since burbot have a larval stage of development, live prey items (rotifers and artemia) must be cultured to provide a food source prior to attempting to transition fish to a commercial cod diet. In addition, disease susceptibility of this species was characterized to address possible concerns with trans-boundary stocking efforts. Current research is exploring semi-intensive/extensive rearing protocols and growth potential over a range of rearing temperature is being determined. Each step in the process presents challenges, but in October of 2009 the first experimental releases of burbot occurred. An overview of this program and future plans will be discussed.

Genetic adaptation of redband trout in desert and montane environments

Shawn R. Narum[1], Nathan R. Campbell[1], Christine Kozfkay[2] and Kevin Meyer[2]

[1]Columbia River Inter-Tribal Fish Commission
[2]Idaho Department of Fish and Game

Presenter: Shawn Narum, nars@critfc.org

Oral Presentation, Professional

Natural populations that evolve under extreme climates are likely to diverge due to selection and adaptation to local environments. To explore whether local adaptation has occurred in redband trout occupying differing climate regimes, we used a limited genome scan approach to test for candidate markers under selection in populations occurring in desert and montane streams. Outlier methods generally lacked sensitivity to detect selection gradients among populations, however, linear regression of minor allele frequency with temperature revealed six candidate markers associated with temperature in this species ($p < 0.01$). Literature reviews of these six candidate genes provided strong corroboration for their role in thermal adaptation and response to heat stress. Putatively neutral markers identified high genetic differentiation among warm populations relative to cooler sites, likely due to intermittent flows in desert streams. Additionally, populations exhibited a highly significant pattern of isolation-by-temperature ($p < 0.0001$) and those adapted to the same environment had similar allele frequencies across the six candidate markers, indicating selection for differing climates. These results implicate that many genes are involved in adaptation of redband trout to high temperature environments, and selection acts to reinforce localization. We further illustrate the capability of candidate markers to predict the adaptive potential of populations currently found in cool versus warm streams. The potential to predict genetic adaptability of individuals and populations to changing environmental conditions may have profound implications for many species that face extensive anthropogenic disturbances.

Session 2-A

Restoration within the Rainier Reach of the upper Teton River

Tamara Sperber, Matt Lucia and Wray Landon
Teton Regional Land Trust

Presenter: Tamara Sperber, 208-354-8939, tamara@tetonlandtrust.org

Oral Presentation, Professional

In 2008 Teton Regional Land Trust, along with multiple partners, completed a large-scale riparian restoration project on the Teton River in southeastern Idaho. The Teton River Basin is the number one conservation priority for private lands in the 26 million-acre Greater Yellowstone Ecosystem due to its irreplaceable aquatic, wetland, and riparian habitat resources associated

with the Teton River and their vulnerability to loss (Noss et al. 2001). The Teton River provides habitat for the Yellowstone cutthroat trout and, along with its expansive associated wetlands, supports remarkable waterbird populations including sandhill cranes, trumpeter swans, and the globally-imperiled long-billed curlew. In 2003 and 2005, the landowners protected over one mile of the Teton River corridor by placing a portion of their active cattle ranch under conservation easements, making this—along with adjacent conservation easements and State-owned parcels—the longest contiguous protected reach of the Teton River within the basin. Historical land use on the property has resulted in severely impacted riverbanks and riparian vegetation that has compromised the habitat value along this reach. The landowners, who expressed a desire to improve wildlife habitat and long-term management to benefit priority conservation species, initiated a change in management on their property by enrolling in the Environmental Quality Incentive Program (EQIP) through the Natural Resources Conservation Service. Through the EQIP program, the landowner fenced both banks of approximately one mile of the Teton River corridor to exclude uncontrolled cattle-grazing. This riparian restoration project actively restored 2,170 feet of streambank to increase bank stability and establish riparian vegetation. Restoration techniques included recontouring banks, creating floodplain terraces, planting willows and wetland sod, and installing large woody debris and an armored water gap.

North Fork Coeur d'Alene River basin watershed restoration! How is recovery defined?

Edward Lider[1], Wade Jerome[2], John Ruebke[2], Matt Davis[2] and Tammy Maiolie[2]
[1]Two-C Consulting
[2]U.S. Forest Service
Presenter: Edward Lider, (208) 651-3249, jelider@gmail.com

Oral Presentation, Professional

From 1980 through 2010, the USDA Forest Service has performed extensive restoration efforts within the North Fork Coeur d'Alene River Basin. Over 1000 miles of road and 3000 stream crossings have been treated. During this time 30 miles of streams have been treated improving fish habitat and providing migration for all fish species and life stages. Modeling within the basin indicates that restoration efforts are meeting targets for sediment reduction. We are now evaluating how recovery can be defined. This paper presents information that looks at the physical, biological and social aspects of basin recovery. Modeling efforts show that restoration efforts are reducing potential sediment loads within the basin. Monitoring of channel conditions and biological populations also indicate that recovery is occurring and beneficial uses are being met. Physical and biological components can have a wide range of variability and can be interpreted in a number of ways. We will discuss what recovery means for a number of agencies within the county, state, tribal and federal governments.

Restoring an entrenched mountain meadow stream by emulating natural processes

Angelo Vitale[1] and Robin Jenkinson[2]
[1]Coeur d'Alene Tribe
[2]Bonneville Environmental Foundation

Presenter: Angelo Vitale, (208) 686-6903, ajvitale@cdatribe-nsn.gov

Oral Presentation, Professional

Benewah Creek runs through a valley floor that has experienced logging, clearing, grazing, and beaver trapping. Floodplain test pits provided critical evidence that (1) the current entrenched state of the channel, which was hypothesized to be the result of anthropogenic incision, was also the pre-settlement condition, and (2) the valley floor formed predominantly through aerial rather than fluvial deposition. Beaver appear to have been a significant factor controlling floodplain connectivity and maintaining a mosaic of vegetation by creating flow obstructions, not historic

channel grade control. We used this corresponding natural process template as the basis for designing channel and floodplain restoration measures. A crucial component was the design of flow-choking, modular wood structures emulating local hydraulic effects of beaver dams and wood jams. Combined with strategic re-vegetation and engagement of relict channels, the design should give the system a 'kick-start' and allow natural processes to take over in the long run.

Bonneville cutthroat trout restoration in a Bear Lake tributary – a top to bottom approach

Arnie Brimmer[1] and Kirl Dahle[2]
[1]Idaho Department of Fish and Game
[2]Trout Unlimited.

Presenter: Arnie Brimmer, (208)251-0959, arnie.brimmer@idfg.idaho.gov

Oral presentation, Professional.

Historically, Bear Lake cutthroat trout *Oncorhynchus clarkii utah* spawned in the major tributaries of Bear Lake. Over time, many of these spawning streams have been impacted due to water withdrawals, habitat degradation, non-native fish introductions, and barriers to migration. Fish Haven Creek, the second largest tributary in (terms of habitat) on the west side of the lake, has suffered from all of above. In 2007 Trout Unlimited and Idaho Department of Fish and Game partnered with local residents to restore Fish Haven Creek. In phase one of the project, 5 diversions were screened to prevent entrainment of fish down irrigation canals. Phase two required the chemical removal of eastern brook trout *Salvelinus fontinalis* and rainbow trout *Oncorhynchus mykiss* and the reintroduction of Bear Lake cutthroat trout. Stream renovation and trout reintroduction occurred in the fall of 2009. The final phase of the project required the removal of a migration barrier at the confluence of the creek and subsequent stream restoration efforts. The barrier was removed and replaced by a bottomless culvert in November/December 2009. The completion of this project was made possible by a large network of partners and funding sources.

Restoring connectivity to spawning and rearing habitat for Chinook salmon (*Oncorhynchus tshawytscha*) in the Pahsimeroi River, ID

Patrick Murphy, Chuck Warren, and Mike Anderson,
Idaho Department of Fish and Game

Presenter: Paddy Murphy, 208-756-6022, patrick.murphy@idfg.idaho.gov

Oral Presentation, Professional

The distribution of Chinook salmon (*Oncorhynchus tshawytscha*) in the Pahsimeroi River subbasin is currently limited to the mainstem Pahsimeroi River and Big Springs Creek. The occupied spawning and rearing habitat utilized by this population is almost entirely on private property. This low-gradient, ground-water influenced river system has extensive irrigation development for agricultural purposes. For the last 15 years, multiple State and Federal resource agencies have worked collaboratively with private landowners in the subbasin to address limiting factors to these threatened salmonids. Conservation actions undertaken to address factors influencing survival and distribution of native salmonids have included reducing fish entrainment by installing fish screens at water diversions, improving fish passage at diversion structures, implementing water conservation measures, and protecting riparian and instream habitat. Currently, Big Springs Creek is the only connected tributary to the mainstem Pahsimeroi River. However, Chinook salmon spawning access in the late summer is typically limited due to low water levels created from irrigation water withdrawals. The P-09 Cross-Ditch diversion which diverted water from Big Springs Creek was the most significant low-water barrier to salmon

accessing the mid and upper reaches of this tributary. With the combination of multiple projects to address entrainment, fish passage, water efficiency, changes in points of diversion, and culminating with the closure of P-09 Cross-Ditch in 2008, flow in the lower reaches of Big Springs Creek have significantly enhanced fish passage. In 2008, two Chinook salmon redds where observed upstream of the P-09 Cross-Ditch diversion the first year it was closed. In 2009, 69 Chinook salmon redds were observed in this reach, constituting approximately 29 % of all the redds in the subbasin resulting in a significant shift in the spatial spawning distribution of Chinook salmon from the previous decade.

Session 2-B

Rogues in the river: how spill and flow influence estimation of migration survival in three stocks of Snake River anadromous salmonids

David L. Arthaud, James V. Morrow Jr., and Correigh Greene
National Marine Fisheries Service, Idaho State Habitat Branch

Presenter: James Morrow, 208-378-5695, jim.morrow@noaa.gov

Oral presentation, Professional

Estimation of migration survival rates using tag and detection methodologies requires accurate estimates of detection efficiency. We estimated tag detection efficiencies of FCRPS PIT tag scanning arrays for three stocks of Snake River anadromous salmonids from the Sawtooth Valley: Chinook salmon, steelhead, and sockeye salmon. We then compared probability of juveniles migrating past all detection arrays without being detected (non-detection probability) to proportion of returning adults that were not detected as juveniles (rogues) to determine if there was bias in detection efficiencies which could result in inaccurate migration survival estimates. We found small differences between non-detection probability and rogue proportion for steelhead, moderate differences for Chinook salmon, and substantial differences for sockeye salmon. When differences occurred for sockeye salmon, proportion of rogues was always greater than non-detection probability, which would result in underestimation of migration survival. For Chinook salmon, proportion of rogues was greater than non-detection probability in four years and less in three, but differences were more than three times higher when the proportion of rogues was greater. For all three stocks, differences between proportion of rogues and non-detection probability were only observed during years when hydrosystem spill was above average. These differences caused underestimation of sockeye and Chinook salmon migration survival which selectively reduced the apparent leverage of spill, and to a lesser extent flow, as factors potentially regulating migration survival. Underestimation of migration survival during years with high spill may explain why estimates of high ocean survival tend to follow years with above average spill, and could inflate the relative importance of ocean survival on adult returns. These results may also explain why some researchers have failed to demonstrate relationships of migration travel time and survival rate.

Increasing water temperature and spawner abundance were associated with increased Chinook salmon female prespawn mortality in the South Fork Salmon River

William Young and Mike Blenden
Nez Perce Tribe
Presenter: William Young, 208-634-5290, billy@nezperce.org

Oral Presentation, Professional

We evaluated 12 years of carcass recovery data to investigate the biological and physical factors influencing female Chinook salmon spawning success in the South Fork Salmon River (SFSR). We recovered hatchery-origin (HOR) and natural-origin (NOR) female Chinook salmon carcasses

during annual multiple-pass spawning ground surveys and categorized them as successfully spawned or female prespawn mortality (FPM; retaining > 75% of their eggs) based on the percentage of eggs remaining in the body cavity. For all carcasses combined, FPM ranged from 0.46% to 35.0%, with significantly higher (P=0.022) overall FPM in HOR (mean FPM=13.9%, S.E.=3.85) compared to NOR females (mean FPM=3.77%, S.E.=1.67). Factors that were correlated with FPM in HOR, NOR and total female Chinook salmon included spawner abundance (P=0.009; R^2=0.51) measured by total returns to the McCall Hatchery trap (MHT) and average August water temperature (P=0.015; R^2=0.46) measured with an in stream temperature logger. Other non-significant factors were investigated including female fork length, FPM at the MHT, river flow and average August air temperature at a nearby weather station (SNOTEL site). Although we could not determine if the effects of spawner abundance or temperature directly contributed to FPM, the significant relationship suggested these or some related factors significantly influenced FPM in the SFSR. The relationship between average August water temperature and FPM increased linearly within a relatively small temperature range (12.8° – 15.3° C), suggesting that low to moderate increases in average water temperatures likely will not make this river section inhospitable to spawning, but could reduce overall salmon productivity. Understanding the effects of spawner abundance and temperature on female Chinook salmon spawning success has significant management implications for habitat protection and restoration programs, management of hatchery fish, salmon reintroductions and long-term recovery plans.

Characteristics of steelhead kelts in the Snake River

Jessica Buelow[1], Christine Moffitt[1,2], Zach Penney[1], Kala Hamilton[1], Andy Pape[1],
[1]University of Idaho
[2]US Geological Survey

Presenter: Jessica Buelow, 208-885-7139, buel0184@vandals.uidaho.edu

Oral Presentation, Student

Steelhead (*Oncorhynchus mykiss*) are iteroparous, but the degree is variable throughout their range. In the Snake River, the proportion repeat spawning is reported to range from 0.5% to 1.2 %. We are examining several nonlethal methods to determine factors that may be affecting the survival of post spawning steelhead (kelts) in the Snake River system, with a goal of increasing the number of iteroparous fish in the system. Non lethal tools include using PIT tags to assess the outmigration success, examination of nutritional, hormonal and enzymatic blood parameters from plasma samples, and visual assessment of condition. We collected 271 Natural and 46 hatchery origin steelhead kelts at the juvenile bypass facility at Lower Granite Dam, WA, the upstream most dam on the Snake River. We sampled blood from each fish and assessed condition. Natural origin fish were PIT tagged and released into the river, trucked, or barged below Bonneville Dam. Of the 176 Pit tagged steelhead released in river, we detected 62 fish at lower river hydro dams and PIT tag arrays. Average km migrated per day was faster for fish detected at Columbia River dams than within the Snake River system. We found no significant differences in most blood parameters between male and female fish, and few differences between kelts greater than or less than 70 centimeters fork length. Kelt condition for wild female fish was rated as good, fair, or poor. We found significant differences by fish condition in several plasma parameters.

Quantifying the effects of Snake River dam operations on the collection and detection of subyearling fall Chinook salmon

John M. Plumb[1], Christine M. Moffitt[1, 2] and William P. Connor[3]
[1]University of Idaho
[2]US Geological Survey
[3]U.S. Fish and Wildlife Service
Presenter: John Plumb, 208-885-4008, plum2404@vandals.uidaho.edu

Oral Presentation, Student

Recent management actions and prototype fish passage structure operations may alter PIT tag detection and collection rates of juvenile salmonids passing dams during their seaward migration, which could bias results of studies based on counts of PIT-tagged fish at the dams. Even though fish-flow relationships have been incorporated into system-wide management models (i.e., COMPASS), many relationships have yet to be rigorously estimated and tested. Further, most of the relationships used by managers are based on PIT-tag detections, over relatively large time scales (> 1 month) and one passage route at a dam. In this study two different multi-strata mark-recapture models are parameterized; one for radio and one for PIT-tagged fish as they passed Lower Granite Dam on the Lower Snake River over 5 and 13 years, respectively. The data from a total of 3,852 radio-tagged subyearling fall Chinook salmon were divided into 66 consecutive 1–2 d cohorts for each of the five years of study. These results were used to estimate the probability of fish bypassed into the juvenile fish facility at the dam. The PIT tag data set included a total of 1,797,826 PIT-tagged fish released over 13 years. These data were arranged into cohorts of 15 d to also estimate bypass collection probabilities. Hypothesis tests among candidate models indicated turbine allocation and total river discharge as the primary factors affecting PIT-tag detection and collection probabilities. Surface spill operations did not explain sufficient variation in passage and detection probabilities. The 95% confidence interval about the detection probabilities for radio-tagged fish encompassed the estimates of PIT-tagged fish over a range in powerhouse allocations (36-100%) and river flows (from 850 to 3,540 $m^{-3} \bullet s^{-1}$). Thus, the relationships developed in this study may be used to account for potential biases in PIT-tag detection counts as result of different dam operations.

Influence of seaward migration and ocean/climatic conditions on survival rates of Snake River Chinook salmon and steelhead

Charles E. Petrosky, and Howard A. Schaller
Idaho Department of Fish and Game
Presenter: Charles Petrosky, 208-334-3791, charlie.petrosky@idfg.idaho.gov

Oral Presentation, Professional

Improved understanding of the relative influence of ocean and freshwater factors on survival of at-risk anadromous fish populations is critical to success of conservation and recovery efforts. Abundance and smolt to adult survival rates of Snake River Chinook salmon and steelhead decreased dramatically coincident with construction of hydropower dams in the 1970s. However, separating the influence of ocean and freshwater conditions is difficult because of possible confounding factors. We used long time series of smolt to adult survival rates for Chinook salmon and steelhead to estimate first year ocean survival rates. We constructed multiple regression models that explained the survival rate patterns using environmental indices for ocean/climate conditions and in-river conditions experienced during seaward migration. Survival rates during the smolt to adult and first year ocean life stages for both species were associated with both ocean and river conditions. Best fit, simplest models indicate that lower survival rates for Chinook salmon are associated with warmer ocean conditions, reduced upwelling in the spring or downwelling in the fall, and with slower river velocity during the smolt migration or multiple passages through powerhouses at dams. Similarly, lower survival rates for Snake River steelhead are associated with warmer ocean conditions, reduced upwelling in the spring or downwelling in the fall, and with slower river velocity. Given projections for warming ocean conditions, a precautionary approach would focus on improving in-river migration conditions by increasing water velocity, relying on increased spill, or other actions that reduce delay of smolts during their seaward migration.

Session 3-A

Riparian insect response to experimental salmon carcass additions to Idaho streams

Scott F. Collins[1], Colden V. Baxter[1], Amy Marcarelli[2], and Mark S. Wipfli[3]
[1]Idaho State University
[2]Michigan Technological University
[3]University of Alaska

Presenter: Scott Collins, (208) 282-2139, collscot@isu.edu

Oral Presentation, Student

Terrestrial and emerging aquatic insects incorporate marine-derived nutrients from salmon carcasses either directly by consuming carcass material, or indirectly when salmon nutrients stimulate primary and secondary producers. We hypothesized that addition of salmon carcasses would increase abundance, alter species composition, and affect distribution of insects in riparian areas. In summer 2008 we initiated a large-scale field experiment across 9 streams, consisting of 500-m reaches treated with salmon carcasses (n=3), pelletized salmon (n=3), and un-treated reference reaches (n=3). Sticky traps were deployed laterally at 0, 5, and 25 m intervals at each stream to track patterns. From direct counts, roughly eighty percent of aquatic insects captured were within 5 m of the stream. Treatments caused significant increases in abundance of adult aquatic insects. In addition, terrestrial insects, particularly adult dipterans were attracted to reaches receiving carcass and analog treatments, resulting in altered insect assemblage composition in the stream riparian zone. Increases in both terrestrial dipterans and adult aquatics occurred two to four weeks post-treatment, but effects on aquatic adults persisted longer. Higher aquatic and terrestrial insect abundance could affect predator-prey dynamics in linked stream-riparian food webs, as these insects are prey for stream fishes and terrestrial insectivores.

Idaho's freshwater mussels — their distribution, biology, and status

Cynthia K. Tait
US Forest Service
Presenter: Cynthia Tait, 801-625-5358, ctait@fs.fed.us

Oral Presentation, Professional

Of the 250+ species of native freshwater mussels that occur in North America, Idaho is home to only three or so, due to their lockstep co-evolution with host fishes and the region's geologic past. Records of western freshwater mussels date from the mid-1800s, but there is little current information on their distribution and abundance, in part because few comprehensive surveys have been done. I will review the outlandish life histories of Idaho's three mussel taxa (including their obligate use of fish hosts), their habitat requirements and known distribution, and their taxonomic and conservation status.

Does replacement of a native salmonid by a nonnative reduce subsidies to riparian consumers?

Joseph R. Benjamin[1], Kurt D. Fausch[2], and Colden V. Baxter[1]
[1]Idaho State University
[2]Colorado State University

Presenter: Joe Benjamin, (208) 282-2139, benjjose@isu.edu

Oral presentation, Student

Top-down effects of predators in donor habitats can influence indirect effects on consumers in adjacent recipient habitats. When the native predator is replaced by a nonnative predator, the indirect effects may be stronger. However, few studies have investigated the effects of nonnative

species on subsidies and their consumers. Additionally, most nonnative species replace their native counterparts across a wide geographic range so the effects may be heterogeneous. We examined whether streams invaded by nonnative brook trout (*Salvelinus fontinalis*) in the Rocky Mountains U.S.A. produced fewer emerging adult aquatic insects, and, in turn, had fewer riparian spiders that specialize in capturing these prey compared to paired streams with native cutthroat trout (*Oncorhynchus clarkii*). We also tested whether these effects differed between northern and southern Rocky Mountains regions, owing to ecological context. As predicted, streams invaded by nonnative brook trout had a 24% lower flux of emerging insects compared to streams with native cutthroat trout. Brook trout had a small effect on the number of riparian spiders (i.e., a 3% reduction), but wider streams had more spiders, probably owing to greater emergence flux. More spiders were counted along streams in the southern versus northern Rocky Mountains, but there was no detectable effect of region on emergence, suggesting that climate or other factors may account for the difference in spiders. Our results indicate that when brook trout replace cutthroat trout they can reduce cross-habitat resource subsidies and thus alter ecosystem function in stream-riparian food webs.

Development of biosecurity measures for hatcheries to protect against invasive mollusks

Kelly Stockton and Christine Moffitt[1, 2]
[1]*University of Idaho*
[2]*US Geological Survey*

Presenter: Kelly Stockton, 208-885-7139, stoc4872@vandals.uidaho.edu

Oral Presentation, Student

Invasive mollusks such as New Zealand mudsnails and quagga mussels are a threat to most Idaho aquaculture facilities that produce fish for mitigation and supplementation, food production or recreation use. Invasive mollusks can flourish within facilities because of constant temperature and flows. Aquaculture effluent is also a high risk for invasive mollusk infestation. In addition, human activity, wading and fishing gear are all likely sources of transporting invasive mollusks. The dispersal of New Zealand mudsnails throughout southern Idaho and the western US provide an example of the ease of this transportation. Aquaculture managers must make decisions to adequately assess and reduce the risk of invasion. Recent regulations developed for Idaho require that fish transportation be accomplished with certification of mollusk free fish and water. We provide a framework and decision tree to evaluate and characterize risks at a facility, and measures that can be used to disinfect water sources, facilities, and transport systems. In this process the manager assesses vectors, vehicles, and water sources likely to introduce or transport invasive mollusks. Monitoring programs are essential tools to use in and surrounding facilities at risk. We provide likely certainty of various options that can be used for filtration, disinfection, and mollusk removal.

The function of floodplain vs. confined segments in an Idaho river network: organic matter dynamics and invertebrate production

J. Ryan Bellmore and Colden Baxter
Idaho State University

Presenter: Ryan Bellmore, 208-282-2139, belljame@isu.edu

Oral Presentation, Student

Floodplains are considered to be hotspots of organic matter retention and biotic production (including invertebrates and fish) in river networks. However, in montane systems they are typically juxtaposed with more confined segments, and the relative roles of the two segment types, and their potential interactions, have received little investigation. In this study we

compared the sources (autochthonous and allochthonous) and retention of organic matter, and the subsequent production of aquatic invertebrates, in five floodplain vs. five canyon-confined segments in the upper Salmon River basin, central Idaho. We hypothesized that floodplains would have higher algal biomass and terrestrial leaf litter input, greater retentive capacity, and higher invertebrate production than confined segments. Instead, we observed that algal biomass, terrestrial leaf litter input, and aquatic invertebrate production were similar between segment types. Ongoing analysis may reveal differences in the composition of organic matter sources and invertebrate consumers. As expected, retentive capacity of floodplain segments, measured via leaf-releases and conservative-tracers, was considerably higher than that of confined segments. Given the differences in retentive capacity between confined and floodplain segments, we hypothesize that organic matter inputs and aquatic primary production in confined river segments is not retained in these segments, but transported downstream, retained and processed in floodplain segments. Much of this processing may be in the form of microbial production in both surface and subsurface environments, but this remains to be tested. Floodplain processing of organic matter may then subsequently help fuel production in downstream confined segments. This study highlights the need for further investigation into the interaction between different geomorphic segment types in river networks.

Session 3-B

Seasons other than summer: the need for collecting annual stream temperature

Dona Horan and Daniel Isaak
U.S. Forest Service

Presenter: Dona Horan, 208-373-4399, dhoran@fs.fed.us

Oral Presentation, Professional

As climate change becomes more pervasive, the ability to predict future stream temperatures will be an important contribution. Currently, most researchers collect stream temperature data during summer months when streams are accessible and devices will not be flushed by high flows. Work has been done to successfully model stream temperatures from air temperature data, yet there is limited empirical stream data available for model development and validation. In this paper, we describe a simple, inexpensive method that allows scientists to deploy thermographs in a stream with the intent to collect year-round records. The device we used is the *Tidbit* from Onset, as it is durable, submersible, and has a long battery life. Onset manufactures an underwater shuttle that can be used to download data periodically, while leaving the *Tidbit* in place. We conducted a low-tech laboratory study to test the practicality of gluing *Tidbits* to boulders in streams. Using three different underwater epoxies, we glued *Tidbits* to submerged rocks in two different temperature baths (cold: 6ºC, and warm: 21.5ºC). *Tidbits* were allowed to cure 14 days before we tried to dislodge them by hand. *Tidbits* that remained fixed to the rock were dislodged using a sophisticated device and we measured the pressure it took to dislodge them. The three epoxies tested were: Mr. Sticky's Underwater Glue, Fox Industries' Underwater Paste, and Hilti's Epoxy Anchor System. Attend this talk to discover who gives the most stick for the buck! And please, consider measuring year-round temperatures in your streams.

GIS tools to assess the risks and benefits of barrier removal to native fish populations in Idaho

Paul Reyes[1], Christine Moffitt[1, 2] and Jody Brostrom[3]
[1]University of Idaho
[2]US Geological Survey
[3]US Fish and Wildlife Service

Presenter: Paul Reyes, (208) 885-7139, paulreyes@vandals.uidaho.edu

Oral Presentation, Student

Removing fish passage barriers is often considered as a strategy for improving native fish habitat, however it involves complex tradeoffs. Some of the benefits include extending access to upstream spawning areas, and enhancing the viability of metapopulations. Conversely, eliminating barriers can favor the spread of invasive species and pathogens to areas suitable for native fish. In this study, we developed a framework to assess the risks and benefits of barrier removal using GIS tools. The framework combines landscape- and local-level approaches and has two main phases: (1) delineation of habitat characteristics of selected invasive species (brook trout, New Zealand mudsnail and tubificid annelids likely to host the whirling disease parasite) and (2) spatial analysis of stream network connectivity. For the first phase we derived habitat requirements variables (e.g., stream channel slope, contributing area, stream temperature, percentage agriculture) as well as spreading dynamics (e.g., density of use at relevant angling sites). For the second phase, we prioritized barriers based on the largest amount of native salmonids habitat gained from barrier removal while minimizing the spreading potential of invasive species. A geodatabase including relational tables of the location of barriers relative to delineated habitats was produced. The framework was applied to the Upper Boise River Basin (UBRB) in Southwestern Idaho as a case study and we used bull trout habitat models generated by the Rocky Mountain Research Station as the native species of reference. A Spatial Decision Support System (SDSS) was developed to facilitate replicating the framework to other watersheds and basins. The results and approach used in this study can help managers prioritize barrier removals for native species to minimize risks from invasive species.

Habitat model for predicting the upstream extent of fish occurrence based on GIS data: an Idaho pilot study

Chris Tretter, Scott Marshall, and Ed Deyoung
Idaho Department of Lands
Presenter: Chris Tretter,(208) 769-1525, ctretter@idl.idaho.gov

Oral Presentation, Professional

The rules pertaining to Idaho's Forest Practices Act state that fish presence or absence is used to determine stream class. Class I streams support the spawning, rearing or migration of fish, whereas Class II streams do not. Field surveys of fish presence or absence are time consuming, expensive, and often performed by persons with little training in identifying fish habitat. This has lead to stream classification that is very spotty in some areas, to non-existent in others. Washington State has similar rules governing activity in streams and riparian zones based on the presence or absence of fish. In an attempt to improve the accuracy and efficiency of stream class designation, Washington's Instream Scientific Advisory Group developed a multiple parameter logistic regression model based on geographical information systems (GIS) inputs that predicts the upstream extent of fish occurrence. Model variables include stream gradient, upstream drainage area, elevation, and mean annual precipitation. Using the model developed in eastern Washington, we tested surveyed upper limit of fish observation points against predicted points in five north Idaho sub-basins. Results show differences between sub-basins; however, the model correctly classified 93.25 % of occupied fish habitat. Similar to results obtained in Washington, large prediction errors were primarily associated with barriers to fish movement, and the model performed best (correctly classifying up to 98.02% of occupied habitat) in watersheds with low topographic relief. We believe application of this model in north Idaho will improve the efficiency and accuracy of Idaho's stream classification process.

Quantifying temporal variability in stream habitat data: implications for restoration and monitoring

Robert Al-Chokhachy, Brett Roper, Eric Archer, and Scott Miller.
US Forest Service, Logan, UT

Presenter: Robert Al-Chokhachy, 435-755-3597, ralchokhachy@fs.fed.us

Oral Presentation, Professional

Quantifying natural and anthropogenic-induced levels of temporal variability is essential for robust trend analyses and for evaluating the effectiveness of restoration activities or changed management actions. Here, we used data collected as part of the Pacfish/Infish Biological Effectiveness Monitoring Project to evaluate the extent of temporal variability in instream habitat collected at the reach scale. We integrate habitat data collected yearly (2001 to 2009) at 50 sites experiencing a range of management activities into our analyses to better understand the consistency of temporal variability in watersheds with inherently different landscape characteristics and disturbance regimes. We initially decompose variance estimates to remove site-to-site variability, sampling error, and year effects and use the remaining variance as a measure of site-specific temporal variability. We then relate this temporal variability to landscape, management, and climate attributes at multiple scales to better understand which characteristics result in more or less variability in habitat attributes at specific sites. Our results suggest temporal variability differs significantly across individual sites and attributes within sites, indicating our ability to detect significant changes as a result of management changes and/or restoration efforts are context dependent. The spatial scale of landscape attributes (e.g., stream buffer vs. catchment) related to temporal variability also varied across individual attributes. Our efforts highlight the importance of considering site-specific measures of temporal variability as they relate to specific restoration and management goals.

Evaluating watershed condition: bottom up vs. top down approaches?

Eric Archer, Brett Roper, Jeremiah Heitke, and Robert Al-Chokhachy.
US Forest Service, Logan, UT

Presenter: Eric Archer; 435-755-3597, earcher@fs.fed.us

Presentation: Oral, Professional

Habitat degradation has been identified as one of the major factors affecting the declines of fishes in the Columbia River Basin. The condition of physical habitat and the biotic integrity of stream systems are often directly correlated with substantial alterations to key landscape attributes. As such, numerous approaches to measure watershed condition have been developed. Here, we compare two separate measures of watershed condition: 1) a GIS-based measure of condition (i.e., top down); and 2) a ground based assessment of condition (i.e., bottom up) using field data collected across 1,200 sites in the Interior Columbia River Basin under the PIBO Effectiveness Monitoring Project. With our GIS approach, we integrate land management and natural disturbance from watershed upstream of sample reaches into an overall watershed condition score. With our bottom-up approach, we integrate stream temperature data, indices of macroinvertebrate health, and an index of physical habitat condition from reach-level field data into an overall condition score. Our results indicate significant differences in assessments of condition across the two methods, as the GIS approach ranked considerably more watersheds with management activities into a low condition category than found in the bottom-up approach. Conversely, the GIS approach also categorized most watersheds with no or minimal management activities (i.e., reference) as low risk, while the field-based, bottom up approach illustrated a wide range of condition of reference sites due to natural disturbances. Our results suggest GIS-based approaches tended quantify the 'risk' rather than condition within watersheds.

The bottom-up approach tended to quantify actual conditions within streams, but do consideration of potential risks associated with land management activities. Here, we advocate the most beneficial approach would be some combination of the two to help guide and prioritize restoration activities to enhance habitat conditions and minimize risk of catastrophic disturbances.

Session 4

Mentoring within Idaho Chapter AFS: an open discussion

Steven Elle
Idaho Department Fish and Game

Presenter: Steve Elle, 208-465-8404(225), steve.elle@idfg.idaho.gov

Oral presentation, Professional

My presentation will facilitate a group discussion of implementing the concept of mentoring students and young professional by older professionals within Idaho Chapter AFS. A mentor as defined by Webster is "a trusted counselor or guide, a tutor or coach". Typically, mentoring relationships develop between students and advisers. I am suggesting we extend this relationship to include professionals within our society to volunteer for a "mentoring pool". I propose those interested in being mentors would be listed on our website possibly by professional expertise and by employing agency. Students and young professionals could then access this pool to develop ongoing one-on-one relationships to facilitate discussions on issues the mentees might have in college or their early professional careers. Ideally these relationships would develop and last over an extended period of time. After the introduction of the concept, the remainder of the time would be available for open floor discussion.

Evaluation and adaptation of a non-native brook trout suppression program in a watershed of the Coeur d'Alene basin

Jon Firehammer, Presenter and Dale Chess
Coeur d'Alene Tribe
Presenter: Jon Firehammer, 208-686-7037, jfirehammer@cdatribe-nsn.gov

Oral presentation, Professional

Over the past 5-10 years, the Coeur d'Alene Tribe's Fisheries Program has been implementing stream restoration measures in Benewah Creek, a watershed of the Coeur d'Alene basin, to improve rearing habitat for westslope cutthroat trout. As a complement to the habitat enhancement, a brook trout suppression program was initiated in 2004 given that modest densities of this non-native species have been detected during prior surveys in those reaches receiving treatment. Data from these annual removals have provided information that has allowed us to evaluate and improve the efficiency of our efforts. From 2004 to 2008, more than 7000 brook trout were removed, using single-pass electrofishing, from upper reaches of the Benewah watershed. During the first three years, it was discovered that brook trout were more often mature and found in greater numbers in mainstem (400 fish/km) than in tributary (113 fish/km) reaches. As a result of the redirection of effort over these three years from tributaries to the progressive inclusion of additional mainstem habitat, numbers of removed fish increased from 666 to 2517 with the percent of mature adults increasing from 26 to 55%. Over the last two years, the numbers of total and adult fish removed have decreased. Index sites that have been annually monitored throughout the duration of the suppression program indicate that densities of age 1+ brook trout have declined substantially in some tributaries but have increased in others. However, estimated numbers generally remained relatively low (< 10 fish/100 m) when compared with a neighboring watershed, Alder Creek, where densities were typically greater than 30 fish/100 m and demonstrated considerable increases over the same time period. In 2009, traps

were employed as a measure to reduce the electrofishing effort expended by field personnel. Future monitoring will focus on evaluating the effectiveness of a curtailed suppression program.

Validation of scales and otoliths for estimating age of redband trout in high desert streams of Idaho

Dan Schill[1, 2] Liz Mamer[2] and George LaBar[1]
[1]University of Idaho
[2]Idaho Department of Fish and Game

Presenter: Dan Schill, 208-287-2777, dan.schill@idfg.idaho.gov

Oral Presentation, Professional

Studies validating aging structures for rainbow trout are sparse and none have been conducted for redband trout in either desert or montane environments. Oxytetracycline mark-recapture methods (M-R), marginal incremental analysis (MIA), and comparisons across multiple populations were used to evaluate the accuracy of three structures for aging redband trout in high desert streams. We assessed periodicity of annulus formation on paired scale and otolith samples from all age classes of trout residing in two streams, identify the location of the first annulus on otoliths from these waters, and compared age estimates and between-reader coefficient of variation on nine additional streams. Edge analysis revealed that Age 0 redband trout in both study streams grow two translucent bands in their otoliths during their first year of life, concurrent with growth cessation likely induced by the cycling annual temperature regime. Our results demonstrate that scales were an unacceptable aging structure for desert redband trout. A combination of MR and MIA methods successfully validated otolith age estimates for fish 1-9 years old. Whole otoliths were validated to be 100% accurate to within one year over the entire length range of redband trout sampled in both streams, and sectioned otoliths for Age 2 and older trout also proved to be 98-100% accurate within one year. Between-reader CV for scales was unacceptably high (11.5%), while that observed for sectioned otoliths with whole otoliths used as corroboratory structures averaged only 2.3%. The lack of cohesive, multi-species study designs evaluating otolith growth patterns and zonation via formal research hypothesis testing has resulted in longstanding confusion about the timing and meaning of otolith zone formation. Several formal hypotheses are proposed for future evaluation.

Relative performance of diploid and triploid catchable rainbow trout in lowland lakes and reservoirs

Martin Koenig
Idaho Department of Fish and Game

Presenter: Martin Koenig, 208-465-8404, martin.koenig@idfg.idaho.gov

Oral presentation, Professional

Increased growth, improved survival, and genetic protection of wild stocks have been suggested as benefits of stocking triploid (i.e. sterile) salmonids for recreational fisheries. We examined the relative survival, growth and return-to-creel of diploid (2N) and triploid (3N) all-female catchable rainbow trout *Oncorhynchus mykiss* across 13 lakes and reservoirs stocked in spring 2008. The number of 2N rainbow trout returned varied across reservoirs, but was higher than the number of 3N rainbow trout caught in nine of 13 reservoirs. In fall 2008, 635 2N and 456 3N adipose-clip marked rainbow trout were recaptured, indicating 3N rainbow trout returned to gill nets at 72% of marked 2N rainbow trout, on average. Creel census results in 2008 yielded 1,215 2N and 989 3N marked rainbow trout, suggesting 3N rainbow trout returned to anglers at 81% of 2N rainbow trout. While the proportion of 2N fish in the creel varied across locations, most reservoirs showed higher returns of 2N rainbow trout to anglers. Sampling in 2009 recovered 152 2N and 145 3N

rainbow trout, indicating that 3N trout returned to gill nets at 95% of 2N trout in the second year, on average. The 2009 creel census recovered only 90 2N and 64 3N rainbow trout overall. While lengths of diploid and triploid trout were similar during all sampling periods, 2N fish were significantly heavier in weight and dressed weight in Fall 2008 and Spring 2009. Results suggest that trout fisheries in these reservoirs are heavily dependent on hatchery stocking and that carry-over of catchable trout through the winter is low in most locations. While diploid rainbow trout may grow and survive better in chronic warm water conditions, triploid rainbow trout will perform well in good conditions while avoiding genetic impacts to wild stocks or establishing self-sustaining populations. As such, 3N catchable rainbow trout remain a valuable management option for put-take fisheries where adequate habitat exists to support trout.

Hooking mortality and landing success with baited circle hooks compared to traditional hook types for stream-dwelling trout

Brett High and Kevin Meyer
Idaho Department of Fish and Game

Presenter: Brett High, 208-525-7290, brett.high@idfg.idaho.gov

Oral Presentation, Professional

We compared hooking mortality and hooking and landing success, of trout caught with barbed baited circle hooks to other common hook types, including barbed single-hook dry flies, barbed treble hook spinners, and barbed baited J hooks. In one experiment, 300 wild trout were caught in equal numbers in an unexploited 1 km reach of Badger Creek in eastern Idaho, marked using passive integrated transponder tags, and released for 69 d. Deep-hooking rate was high for baited J hooks (21%) but low for spinners (5%), baited circle hooks (4%), and dry flies (1%). Mark and recapture population estimates indicated that mortality rates for trout captured with baited J hooks (25%) and treble hook spinners (29%) were significantly higher than for trout captured with baited circle hooks (7%) and dry flies (4%). For J-hooked fish, mortality was 2.8 times higher for those that were hooked deep. In a second experiment (n = 604 wild trout), hooking success (i.e., number of successful hook-ups ÷ number of strikes) was lower for circle hooks (whether passively or actively fished) than all other hooks except passively-fished J hooks. Once hooked, landing success (i.e., number of fish to hand ÷ number of hook-ups) was high and relatively constant for all hook types (range 68-87%), but was lowest for both passively-fished baited hooks. Deep hooking was at least twice as high for J hooks than for circle hooks for both actively- and passively-hooked comparisons. For circle hooks, deep hooking was over two times higher when the angler did not actively set the hook compared to actively setting the hook, which conflicts with manufacturer's recommendations. Our combined results suggest that when bait fishing for trout in streams, circle hooks may reduce deep hooking and hooking mortality regardless of whether they are fished in the recommended manner.

Don't move a mussel – news from Idaho's invasive species program

Amy Ferriter
Idaho State Department of Agriculture

Presenter: Amy Ferriter, (208) 332-8686, Amy.Ferriter@agri.idaho.gov

Oral presentation, Professional

The Idaho Invasive Species Law was enacted by the Legislature in 2008. The intent of this law is to address the increasing threat of invasive species in the state by providing policy direction, planning and authority to combat invasive species infestations and to prevent the introduction of new invasive species. This law establishes the duties of ISDA, authorizes the director to

promulgate rules and gives authority to conduct inspections as necessary. It also established the Idaho Invasive Species Fund (IISF). New Legislation in 2009 requires motorized and non-motorized boats to have an Invasive Species Sticker to launch and operate in Idaho. The sticker program is administered by the Idaho Department of Parks and Recreation. Funding generated by this program is deposited in the IISF. The IISF is administered by the Idaho State Department of Agriculture (ISDA) and will be used to implement Idaho's Action Plan for Invasive Species. While the sticker program and the invasive species programs are linked through the IISF, the programs are independent in nature. ISDA has developed a comprehensive program that is designed to educate the public about aquatic invasive species, monitor Idaho water bodies for possible introduction of those species, and inspect and decontaminate (as necessary) watercraft that travel to and through Idaho. This presentation will provide an overview of this program.

Poster Presentations

Putting aquatic science in to practice

Kerry Overton, Emily Leavitt, and Angelica Vicente
USFS Rocky Mountain Research Station

Presenter: Kerry Overton, 208-373-4357, koverton@fs.fed.us

Poster (speed presentation), Professional

The objective of the poster is to describe the RMRS Boise Aquatic Sciences Lab Fisheries Technology Transfer Program www. The web site has been designed to deliver the latest aquatic information, technical tools and procedures relevant to land managers, field practitioners, and researchers. The web site has the following features:

- Centralized one-stop shopping site for our aquatic and fisheries science;
- Organized around science topics (i.e. fish & fire, climate change and fish, invasive non-native fish, etc.) for easy finds by diverse audiences;
- Hierarchical design, multiple levels of scale and detail to cater to the needs of various audiences;
- Highlight the significance and connection of our scientists, science outputs, - partners and stakeholders;
- Highlight integrated interdisciplinary research and science syntheses;
- Demonstrate the connection and integration of researchers and managers and partners;
  Use WebMD as a model to reach and supply diverse audiences – WebMD is considered to be highly valued and the most used web site by a diversity of users for medical information.

2nd annual Western Division student colloquium

Kelly Stockton, Lubia Cajas, Kristen Pilcher, and Jamilee Lords
University of Idaho

Presenter: Kelly Stockton, 208-885-7139, Stoc4872@vandals.uidaho.edu

Poster (speed presentation), Student

Members of the Palouse Unit participated in the WDAFS Student Colloquium hosted by Colorado State University in Fort Collins, Colorado, October 22nd-24th. The Palouse Unit would first like to thank ICAFS for their generous monetary donation which made it possible for us to travel to this meeting. During the meeting, PUAFS members were able to present their research to their peers, engage in hands-on field work, network with fellow students and fisheries professionals, and above all, gain a new appreciation for research being conducted in the western region of our country. The Palouse Unit would like to extend our thanks to the Colorado State University AFS chapter for organizing this educational and entertaining meeting. At the conclusion of the

Colloquium, it was decided that PUAFS would host the 2010 Western Division AFS Student Colloquium in Idaho next
Fall.

Angler exploitation of redband trout in eight Idaho desert streams

Dan Schill[1,2], Steve Elle[1], Liz Mamer[1], and George LaBar[2]
[1]Idaho Fish and Game,
[2]Idaho University of Idaho

Presenter: Dan Schill, 208-287-2777, Dan.Schill@idfg.idaho.gov

Poster (speed presentation), Professional

In this study, we estimate angler exploitation rate for redband trout *Oncorhynchus mykiss gairdneri* in reaches of eight desert streams in southern Idaho using angler reported catches of 716 jaw-tagged fish. Only two tagged redband trout were reported as harvested by anglers during the angling season. Estimates of annual angler exploitation for seven of the study reaches in question equate to 0.0% and from 3.4 to 5.7% on the Sinker Creek reach, depending on the level of angler tag reporting rate assumed. Exploitation for the eight study reaches combined was 0.6 to 0.9%. Our results indicate that jaw tagging did not markedly reduce survival or catchability of redband trout. We conclude that redband trout residing in streams within southern Idaho are virtually unexploited and that angler harvest is well below levels observed on other Idaho redband trout fisheries in more accessible montane environments.

Save money by building or refurbishing your smith-root backpack electrofishers 24 volt batteries

Corey Lyman
US Forest Service

Presenter: Corey Lyman, 208-557-5838, clyman@fs.fed.us

Poster (speed presentation), Professional

Save money by building or refurbishing your 24 Volt batteries for your Smith-Root Backpack Electrofishers. By providing a components list and following these easy diagrammed steps, you too can build your own batteries. For the price of parts you can refurbish 4 batteries or build 3 new batteries for the same price as you would pay for a single battery from the manufacturer. Save money, recycle existing battery components, and learn something new!

The distribution of genetic variation among Chinook salmon lineages in the Columbia River basin: a landscape genetics perspective

Andrew Matala1, Shawn Narum[1], and Vanessa Jacobson[2]
[1]Columbia River Inter-Tribal Fish Commission
[2]University of Idaho

Presenter: Andrew Matala, 208-837-9096, mata@critfc.org

Poster, Professional

Chinook salmon (*Oncorhynchus tshawytscha*) life history types in the Columbia River Basin (CRB) exhibit a high degree of variability. Three primary Chinook salmon lineages persist in the CRB, including one form occupying the lower Columbia River, and two sympatric interior forms with distinct biological attributes (ocean- and stream-type). Ocean- and stream-types likely

originated from separate glacial refuges and have experienced long-term geographic/reproductive isolation (F_{ST} = 0.100). Low level variation and evidence of population bottlenecks within the stream-type lineage suggests substantial genetic drift has occurred among populations. We genotyped 52 Chinook salmon populations sampled among lineages, ranging in location from the upper Salmon River to near the Columbia River estuary, using a panel of 96 single nucleotide polymorphism (SNP) assays. Our goal is to investigate the basis of genetic variation beyond the limit of inference possible with neutral marker data. Because SNPs represent potential sites (or are identified from sequenced regions) within functional genes, they retain an advantage as candidate markers for detecting positive selection. This feature provides the added evolutionary perspective of evaluating natural populations based on local adaptation. Our current efforts focus on identifying the correlations between multilocus or locus-specific SNP genotypes and environmental factors associated with Chinook salmon habitat and life histories. Differences in the distribution of SNP allele frequencies across landscapes may help delineate patterns of local and regional adaptation that influence genetic differentiation. Preliminary analyses have identified at least six candidate loci for positive selection among stream-type Chinook salmon, and allele frequencies appear most highly correlated with temperature, elevation, and migratory distance. We did not observe a significant association of isolation by distance (restricted geneflow as a function of population pairwise distances) with our SNP panel.

Efficacy of Virkon Aquatic ® to disinfect wading gear infested with New Zealand mudsnails

Amber Barenberg, Christine Moffitt, Kelly Stockton,
University of Idaho
US Geological survey

Presenter: Amber Barenberg, (208)989-0065, bare6282@vandals.uidaho.edu

Poster Presentation, Student

New Zealand mudsnails (NZMS) are a harmful invasive species in the United States, first discovered in the Snake River basin of Idaho in 1987. They have since spread into several of the western states and a separate introduction likely introduced them into the Great Lakes. The NZMS have high reproductive rates, and are clonal, needing only one female snail to begin a colony. In some locations, NZMS have been reported to consume as much as 75% of primary productivity, thus out competing native invertebrates. A significant transportation vector for NZMS is via attachment to wading gear used by anglers, biologists, and other workers entering streams that are infested with NZMS. The snails have an operculum that can close and keep snails alive for several days, and the small snails can easily be lodged on wading gear, especially felt soles. Virkon Aquatic® is labeled for use against fungi, bacteria, and viruses, and is used in many fish hatcheries. Previous research in our laboratory demonstrated that Virkon Aquatic® is effective in killing snails held in small laboratory test systems. We have determined that exposure to 2% will kill snails in laboratory tests. This current research project will determine the length of exposure needed for a 2% solution to kill NZMS on wading gear. This study evaluates two application methods: bath or spray techniques testing a 2% concentration with three types of waders, felt soles, neoprenes, and rubber soles. We also will report damage that Virkon Aquatic® causes to the waders. We believe this tool may provide anglers and other recreationists an alternative way to safely disinfect their equipment without the fear of spreading the invasive NZMS to other locations.

Mountain whitefish rehabilitation in response to nutrient restoration in the Kootenai River, Idaho

Cathy A. Gidley Ryan Hardy, and Vaughn L. Paragamian
Idaho Department of Fish and Game

Presenter: Cathy A. Gidley, (208) 610-6139 Cell, cathy.gidley@idfg.idaho.gov

Poster, Professional

Mountain whitefish *Prosopium williamsoni* is one of the most abundant fish species in the Kootenai River, Idaho. Densities of mountain whitefish have fluctuated since Libby Dam went into operation in 1972. One serious impact of the dam on the Kootenai River ecosystem is a loss of productivity downstream of the dam, which results in the loss of approximately 63% of nitrates and 25% of phosphorous through binding to sediments in the reservoir. By the 1990's this reduction in productivity translated into a two- to four- fold decrease in the number of mountain whitefish, as compared with 1980-81. In addition to a reduction in numbers, growth of mountain whitefish also declined. In 1994, length at age-4 was reduced by more than 50 mm compared with the length at age-4 reported in 1981. In 2005 a nutrient enhancement project was initiated as a partnership between the Idaho Department of Fish and Game and Kootenai Tribe of Idaho to add phosphorous (as ammonium polyphosphate 10-34-0) to the river during the growing season from June-September. Our objective was to increase primary and secondary productivity in order to improve fisheries (increase population numbers and biomass, growth, and condition and relative weight) in the river. After five years of nutrient addition, we have successfully increased the population of mountain whitefish in the treatment reach of the river to levels seen in the early 1980's, considered similar to pre-dam numbers. Length at age, relative weight (Wr), and condition factor (K) have increased in the treatment reach, whereas these indices have experienced decreases at the control site. Plans are to continue addition of phosphorous and monitoring of the fish population in the Idaho portion of the Kootenai River and serve as an example of a successful ecosystem restoration through nutrient addition.

Predicting spawning ground occupancy and assessing spawning habitat selection by Chinook salmon (*Oncorhynchus tshawytscha*) in a central Idaho wilderness stream

Ellen J. Hamann and Brian P. Kennedy
University of Idaho,

Presenter: Ellen J. Hamann, (970)778.5242, ejhamann@vandals.uidaho.edu

Poster, Student

Chinook salmon survival during early life stages depends largely on spawning habitat selection by adults, which has been linked to biophysical stream parameters (e.g. stream flow, velocity, substrate, etc.) as well as proximity to riffle/pool transitional zones. Here we used remote sensing techniques to identify critical areas along the length of one stream in central Idaho that would be most suitable for spawning based on the location of transitional areas. Additionally we sought to determine if salmon selected for a different suite of habitat variables in relation to the spatial scale of the stream. We found that transitional zones were chosen more frequently by spawners in the upper and middle sections of the basin, but redds were constructed in other habitat types as well. Overall, salmon chose spawning locations based on different habitat attributes in different reaches of the stream, with velocity and depth accounting for the majority of the variation. This study illustrates that caution should be exercised in assuming that habitat preference is static throughout the length of a stream, which has further implications for large-scale critical habitat designation.

Relative genetic diversity estimates amongst four Pacific salmonids

Nathan Campbell and Shawn Narum
Columbia River Inter-Tribal Fish Commission

Presenter: Nathan Campbell, 208-837-9096 x1128, camn@critfc.org

Poster, Professional

Genetic diversity within a species is a reflection of its evolutionary past and ongoing mutation, drift, and adaptation. Species that occupy a diverse range of habitats and have adapted for generations under selective pressures will carry a genetic imprint of that adaptation within specific genes. Alternatively, genetic diversity may be reduced within a species due to historical bottlenecks and genetic drift. For this study, genetic diversity was estimated in four species of Pacific salmon (*Oncorhynchus mykiss*, *Oncorhynchus tshawytscha*, *Oncorhynchus kisuch*, and *Oncorhynchus nerka*) using 208-573 kilobases of DNA sequence data from thirty-two individuals per species. Individual samples were chosen to represent the major lineages of each species across their natural range. Results show the highest genetic diversity estimates for *O. mykiss* while the lowest were in *O. nerka*. Statistically significant differences were observed between the two species displaying the highest genetic diversity (*O. mykiss* and *O. tshawytscha*) and the two least diverse (*O. kisuch* and *O. nerka*). A list of loci displaying the highest genetic diversity scores is included.

Modeling the effect of pelican predation on Yellowstone cutthroat trout in the Upper Blackfoot River system

Matt Green and Ernest Keeley
Idaho State University,

Presenter: Matt Green, 208-251-0197, greemat3@isu.edu

Poster, Student

Recent increases in piscivorous migratory bird populations and their impacts on fish populations have created conservation concerns for fish populations. These impacts can be especially dramatic in situations where naïve fish are exposed to exponentially increasing bird numbers. Such is the case with American white pelicans preying upon Yellowstone cutthroat trout in the upper Blackfoot River system of southeast Idaho. In order to evaluate potential population changes, we plan to model the effects pelican predation has on cutthroat population dynamics. We plan to use radio telemetry tagged fish to estimate total pelican predation on Yellowstone cutthroat trout, and also attempt to estimate overall cutthroat density within Blackfoot Reservoir using a variety of techniques including electrofishing, gillnetting, trapnetting, and angling. Along with fish density, these techniques will allow us to investigate the age structure of the cutthroat population over time. All of these data will then be input into a model to estimate the effect of pelican predation on the cutthroat trout population. The model will help both bird and fish biologists understand if pelicans will eventually lead to the extinction of adfluvial Yellowstone cutthroat trout in the upper Blackfoot system under different scenarios. It may also determine if there is a pelican population that will allow for equilibrium between the pelicans and cutthroat trout over time.

Application of new spatial statistical stream models for precise downscaling of climate change effects on temperatures in river networks

Daniel J. Isaak[1], Charles H. Luce[1], Erin E. Peterson[2], Bruce E. Rieman[1], Dave Nagel[1], Dona Horan[1], Sharon Parkes[1], and Gwynne Chandler[1]

[1]U.S. Forest Service, Rocky Mountain Research Station
[2]CSIRO Mathematical and Information Sciences

Presenter: Dona Horan, 208-373-4399, dhoran@fs.fed.us

Poster, Professional

A warming climate will bring unprecedented changes to river ecosystems, with temperature considerations being highly important, given that most aquatic organisms are ectothermic. Previous assessments of climate impacts to streams have been limited by inadequate availability of stream temperature data. Mechanistic models have sometimes been used to model stream thermal responses directly, but intensive parameterization limits the spatial scope of these applications. Modeling approaches are needed that address stream temperatures directly at larger spatial scales commensurate with most conservation and restoration planning efforts. We applied new spatial statistical models that account for network topography (i.e., flow direction, volume) to an extensive, but non-random stream temperature database compiled across a 13 year period (1993–2006) for a large network in Idaho. Four predictors—radiation, elevation, air temperature, stream flow—were used in the spatial. Spatial models incorporated autocorrelation among sample sites to provide improved parameter estimates and predictive accuracy (R^2 = 0.93; RMSPE = 0.74°C) relative to traditional, non-spatial models (R^2 = 0.68; RMSPE = 1.53°C). A small bias between observed stream temperatures and those predicted by the spatial models amounted to 0.5°C at the extremes of the observed temperature range (5°C – 20°C) and caused over- (under-) predictions for the coldest (warmest) streams. This bias could have arisen from elevational gradients associated with influxes of cold, snowmelt groundwater or alterations in valley form due to past glacial activity. Better understanding of these and other factors that affect local variability in stream warming rates is needed to optimize future downscaling efforts. However, the application of new spatial models for streams provides a significant advance in our ability to translate climate change impacts to aquatic ecosystems. The approach is widely scalable given GIS capabilities, increasing availability of stream temperature sensor networks, and flexibility to accommodate climatic forcing data from a variety of sources.

Characterization of an attenuated F*lavobacterium psychrophilum* vaccine

Tarah Johnson[1], Doug Call[2], Ben LaFrentz[3], Tanya Miura[1], and Ken Cain[1]

[1]University of Idaho
[2]Washington State University
[3]US Department of Agriculture

Presenter: Tarah Johnson, 208 691-5485 john3002@vandals.uidaho.edu

Poster, Student

Previous studies have demonstrated that passage of a virulent strain of *Flavobacterium psychrophilum* (CSF 259-93), the bacterial agent for Coldwater Disease (CWD), on increasing concentrations of the general antibiotic rifampicin lead to the attenuation of virulence. Using this strategy, a resistant strain (259-93B.17) has been developed and may serve as a live attenuated vaccine. The B.17 strain has been shown to be completely attenuated, and immunization of rainbow trout (*Oncorhynchus mykiss*) with this vaccine strain by injection or immersion of fish provides protection against CWD. The current study is focusing on optimizing practical delivery methods in light of potential use of this vaccine in both the private and public aquaculture sectors. Additionally, the safety of this attenuated strain must be confirmed through back passage trials. Immunization trials are underway to confirm previous observations of protection via immersion delivery and also test the potential to orally immunize fish. Fish were given a primary immunization (Week 0) followed by two booster immunizations (Week 4 & 12) and treatments included immersion of 0.7 g fry, 2.0 g fry, and 2.0 g fry with adipose fin removed. An oral treatment was incorporated where fish were fed the bacteria for 7 d following mixing in fish oil and top coating on feed. Fish were then challenged with the parent strain (CSF 259-93) to determine level of protection against CWD. For the back passage trials, the B.17 strain was examined for reversion back to virulence. Following 5 *in vivo* passages using both an injection and immersion delivery, it was determined that the B.17 strain does not revert to virulence and is safe. During this trial no mortality was observed in any passage.

Burbot extensive rearing - exploring short term solutions for burbot rehabilitation in the Kootenai River

Corie Laude and Vaughn L. Paragamian
Idaho Department of Fish and Game

Presenter: Corie Laude, 208-267-2714, corie.laude@idfg.idaho.gov

Poster, Professional

Extensively reared burbot *Lota lota* maculosa may be an important short term measure to population rehabilitation in the Kootenai River. Our objective was to determine if extensively reared burbot larvae could achieve a 10% survival rate and grow to a range of 70 to 98 mm total length within six months of stocking. On May 18, 2009 we placed 467 burbot larvae into five, 500 µm nitex mesh pens at high and low stocking densities within a private (0.15 ha) pond. An additional 15,000 were released into the pond. Two pens (1.83 m^3) were stocked at low density of 14.8 larvae/m^3 and 16.4 larvae/m^3, two pens (1.83 m^3) were stocked at high density of 32.8 larvae/m^3, and a fifth, larger net pen (3.66 m^3) was stocked at 79.3 larvae/m^3. We used light traps in the pens to determine general abundance and growth. On September 2, 2009 we recovered 96 burbot from the pens with an average total length of 49 mm. No Burbot were recovered from the pond. Growth rates per pen were: low density 0.46 mm/day, high density 0.34 mm/day and the large pen was 0.44 m/day. Survival rates were: high density pens averaged 43.3%, the low density pens averaged 43.5%, and the larger, high density pen was 7%. This compares to 2008 daily growth of 0.37 mm/day and overall survival of 77%. This extensive rearing study will likely be carried out one more year. Mortality in the net pens was likely due to cannibalism. Rearing of low numbers of burbot in net pens can reduce early mortality but unless plankton (food) densities are maintained at adequate levels mortality due to cannibalism, after about 60 days, can be a limitation. Extensive rearing without predators can lead to improved survival for burbot rehabilitation, however without habitat change such as winter flow and temperature management, this recruitment limited population has little chance of recovery in the Kootenai river drainage.

Genetic stock identification of steelhead kelts in the Yakima River basin.

Jeff Stephenson, Doug Hatch, David Fast, Bill Bosch, Todd Newsome, John Whitaker and Ryan Branstetter
Columbia River Inter-Tribal Fish Commission

Presenter: Jeff Stephenson, 208-837-9096 x1121, stej@critfc.org

Poster, Professional

We tested the ability to differentiate steelhead populations in the Yakima River Basin using a combination of microsatellite and SNP (Single nucleotide polymorphism) markers. Population assignment was performed for unknown origin kelt steelhead leaving the system as well as first time spawners entering the system. We discuss the ability to use this information to select locations amenable to kelt reproductive success studies.

Evidence of iteroparity in wild Snake River summer-run steelhead (*Oncorhynchus mykiss*) from scale patterns

Kristin Ellsworth, Lisa A. Kautzi, Rachel D. Neuenhoff, and Timothy Copeland
Idaho Department of Fish & Game

Presenter: Kristin Ellsworth, 208-465-8404, kristin.ellsworth@idfg.idaho.gov

Poster, Professional

Iteroparity has been documented for steelhead populations in the Pacific Northwest, but the phenomenon has not been well-described for Snake River steelhead. To our knowledge, the only study to investigate iteroparity in Snake River steelhead was conducted in the early 1950's, and was specific to the Clearwater River. In that study, the author used scale pattern analysis but did not elaborate on the criteria used to identify repeat spawners. We investigated patterns from scale samples collected at Lower Granite Dam (N=500) in order to develop criteria for identifying repeat spawners. We focused on two patterns commonly reported in the literature and a third displayed only in published photographs: scar-like marks which are known indications of previous spawning, continuous strong dark lines visible in the anterior and posterior regions of the scales, and folding or crossing of circuli. Of the samples viewed, scar-like marks were rare (n=3). Strong dark lines were the most common (n=71), and folding of circuli occurred less frequently (n=23). All samples demonstrating the scar-like mark additionally displayed a dark line continuing into the posterior region. Folding of circuli most commonly occurred with saltwater annuli but did not occur with scar-like marks. The three patterns may not be obvious in all scales from an individual sample. In the literature, the appearance of scar-like marks are considered diagnostic; we speculate that dark lines and folding of circuli may be indicative of weak spawn checks and help flag a sample for further examination. We intend to validate all three patterns with samples from PIT tagged repeat spawners and comparison to scales from post-spawned steelhead.

Studying the effects of environmental variables on the seaward migration of juvenile Chinook salmon (*Oncorhynchys tshawytscha*) in Big Creek Idaho, – A comparative analysis across multiple sites and years

Kristen Pilcher and Brian Kennedy
University of Idaho

Presenter: Kristen Pilcher, 208-863-9964, kpilcher@vandals.uidaho.edu

Poster, Student

Chinook Salmon (*Oncorhynchus tshawytscha*) have a complex life history which includes a seaward migration as a juvenile and a return migration as an adult. Life history decisions are both environmentally and genetically influenced. Therefore, migration patterns vary across watersheds. Understanding how this variation occurs in wilderness settings and how it confers adaptive benefits is an important question in ecology and fisheries management. In this study we focused on the early life history of this species. We attempted to monitor juvenile Chinook salmon downstream movements in Big Creek, Id and describe relationships between individual movements and environmental measures at multiple spatial scales. My work integrates from many concurrent efforts including Idaho Fish and Game screw traps that provide data on smolt size and date of passage. These smolt traps occur in both Big Creek as well as in more accessible locations that span a gradient of relative human impact. Additionally, we coordinated with NOAA scientists, USFS scientists and ISU researchers to collect data on the flow and temperature regimes of Big Creek at Taylor Wilderness Research Station (TRWS) and throughout the Big Creek basin. A comparison between these variables to the downstream movements of fish to other sites helps us describe how environmental variables generally affect early life history decisions of juvenile Chinook salmon on a larger scale.

A non-parametric assessment of Snake River fall Chinook salmon (*Oncorhynchus tshawytscha*) out-migration timing

John M. Plumb, Christine M. Moffitt,and William P. Connor,
University of Idaho
U.S. Fish and Wildlife Service

Presenter: John M. Plumb, 208-885-4008, plum2404@vandals.uidaho.edu

Poster, Student

Given temperature and density-dependent mechanisms, a warmer temperature regime and higher rearing density might affect earlier seaward migration of juvenile salmon than a cooler temperature regimes and lower rearing density. This might be the case in the Snake River where the abundance of Snake River fall Chinook salmon has increased overtime in two reaches with different temperature regimes. We used the Kaplan-Meier estimator to quantify daily proportions and uncertainty of fish remaining upstream of Lower Granite Dam during 1995-2007. Data consisted of detection dates of 7,098 PIT-tagged wild subyearling fall Chinook salmon at the dam. Statistical tests (ANCOVA, F=4.02, P=0.047, by randomization) confirmed earlier detection timing for the fish tagged in the upper and warmer rearing area during years of high fish abundance. However, 63–96% of tagged fish were not detected at the dam, and thus, were censored from this analysis. Fish not detected could have: 1) died upstream of the dam, 2) passed the dam undetected during the migration season, or 3) passed undetected outside the migration season. Federal courts have mandated higher spill volumes, which could reduce fish detection probabilities within the migration season. Also, fish sampling does not occur during winter (November – March), and thus, if fish delayed out-migration until winter detection timing could actually have been later, and not earlier, as indicated by this analysis. Even though this study supports the notion of environmental and abundance related effects on detection timing, different operations and sampling effort at the dam could alter this conclusion. A concurrent presentation at this meeting is directed towards quantifying the effect of Snake River dam operations on fish detection probabilities and accounting for this bias in detection timing so that detection timing data can be used to represent actual migration timing.

Using bioenergetic models to estimate changes in habitat quality for stream-dwelling salmonids: implications for climate change and nutrient supplementation

Steven Campbell and Ernest Keeley
Idaho State University

Presenter: Steven Campbell, 208-282-4458, campste2@isu.edu

Poster, Student

Large scale changes in habitat quality are thought to be one of the most serious threats to fish populations world-wide. Despite the potential importance of such large scale changes, estimating their impacts is not well understood. Bioenergetic models incorporate estimates of energy expenditure under varying biotic and abiotic conditions. It is also dependent on basic measures of the physical habitat in which the fish reside coupled with aspects related to their foraging ecology. Parameters such as stream temperature, depth, and velocity along with aspects related to food abundance, provide an estimate of the net energy intake (NEI) at any particular stream position. This provides a criterion that does not depend on the presence or absence of a fish to determine habitat quality, but instead tries to understand a particular habitat by way of the energetic cost or benefit to the fish. In this presentation we demonstrate the potential utility of bioenergetic models in estimating changes in habitat quality by simulating changes in temperature and food abundance. We use the range of temperature change predictions from climate models and we estimate the potential change due to food additions that might be expected by nutrient supplementation experiments.

Session 5

Broad-scale genetic and compositional monitoring of fish populations: a proof of concept in the interior Columbia River and upper Missouri River basins

Michael K. Young[1], Kevin McKelvey[1], Michael Schwartz[1], and Shawn Narum[2]
[1]Rocky Mountain Research Station
[2]Columbia River Inter-Tribal Fish Commission

Presenter: Michael Young, 406-542-3254, mkyoung@fs.fed.us

Oral presentation, Professional

Monitoring fish populations is essential to gauge the success of conservation efforts and the status and trends of individual species, but obtaining abundance estimates is time-consuming and problematic because of spatial and temporal variation in abundance. Also, relations between fish populations and their surrogates, such as habitat characteristics, are often obscure. As an alternative, genetic assessment and monitoring offers promise as an indicator of population status and trends by providing information on effective population size, genetic diversity, connectivity among populations, and the prevalence of hybridization with non-native species. We have undertaken intensive sampling of native and nonnative fishes and amphibians with lotic life histories on a subset of streams currently monitored by the Pacfish/Infish Biological Opinion Monitoring Program. These streams represent a spatially comprehensive, random sample of subbasins in the interior Columbia River Basin. We are developing a new set of genetic markers—single nucleotide polymorphisms—derived from nondestructively collected tissue samples that should be more cost-effective to process than those previously used. If fully realized, sampling of over 1500 streams in Montana, Idaho, eastern Oregon, and eastern Washington on federal lands should permit broad-scale evaluations of the status and distribution of much of the aquatic vertebrate fauna and enable detection of responses to climate change. Although many aspects of this project are in developmental stages, preliminary sampling at over 400 sites on 150 Montana streams indicates that brook trout are more widely distributed than previously recognized, the taxonomic diversity of sculpins is underappreciated, and that westslope cutthroat trout occupy headwater sites in most of their historical range except in the Kootenai and Missouri River basins.

Interspecies synchrony in salmonid densities and large-scale environmental conditions in central Idaho

Timothy Copeland and Kevin A. Meyer
Idaho Department of Fish and Game

Presenter: Tim Copeland, 208-465-8404, tim.copeland@idfg.idaho.gov

Oral Presentation, Professional

Abundance of stream-dwelling salmonids often varies substantially through time, frequently because of environmental stochasticity. Previous analysis of long-term, spatially extensive monitoring data from central Idaho found synchronous changes in densities of six salmonid species. In this paper, we compare correlations in salmonid density at regional and site-specific levels and examine the effects of broad-scale environmental variation on changes in salmonid density. Average densities of all salmonids in central Idaho declined from the mid 1980s to the mid 1990s, and then rebounded through 2003. Most of the correlations in fish density among native salmonids were statistically positive at both regional and site-specific levels. However, nonnative brook trout *Salvelinus fontinalis* were positively correlated to native salmonids at the

regional scale but not at the site-specific scale, suggesting that niche partitioning among native salmonids at small scales may have been disrupted by brook trout, but this disruption was overridden at the landscape scale by extrinsic environmental conditions. Canonical correlation analyses demonstrated that stream flow and the number of Chinook salmon *Oncorhynchus tshawytscha* redds (representing nutrient influx and therefore increased productivity to streams) influenced fish densities across the landscape, but the importance of environmental conditions differed by species and varied by the lag times applied to environmental variables. Our finding that broad-scale environmental conditions influence the abundance of several salmonid species is important for fish managers charged with managing entire ecosystems with complex and sometimes sensitive species assemblages.

Flow regime influences distributions of brook trout, bull trout and cutthroat trout in the Upper Columbia Basin

Seth Wenger[1,2] Dan Isaak[2], Bruce Rieman[2], Charlie Luce[2], Helen Neville[1], Kurt Fausch[3], and Dave Nagel[2]

[1] Trout Unlimited
[2] US Forest Service, Rocky Mountain Research Station
[3] Colorado State University

Presenter: Seth Wenger, 706-207-0440, swenger@tu.org

Oral presentation, Professional

Researchers have hypothesized that the distribution of trout species is determined in part by hydrologic regime. In particular, fall spawning species such as brook trout and bull trout may be best adapted to snowmelt-driven regimes, which do not experience high flows during the critical winter period of egg incubation and fry emergence. In contrast, spring spawning species may be sensitive to high summer flows but insensitive to high winter flows. To test these hypotheses, we analyzed the occurrence of brook, bull and cutthroat trout in response to hydrologic metrics at 4155 sites in the Upper Columbia Basin. We used a hierarchical linear modeling approach to minimize bias due to spatial autocorrelation of clustered points. We also considered other predictor variables, such as temperature and landscape-scale geomorphic features. On the basis of both Akaike's Information Criterion and cross-validated predictive performance, we found that the research hypotheses were supported: brook trout and bull trout were less likely to occur in areas with frequent high winter flows, whereas cutthroat trout showed no such response. However, cutthroat trout were less likely to occur in the presence of brook trout, indicating potential indirect effects. If climate change continues to increase the frequency of high winter flows the Northern Rockies, as expected, trout species distributions may show substantial shifts.

Distribution of hybrid trout, hybrid zone structure, and management of native cutthroat trout in the Jocko River watershed, MT

Matthew P. Corsi[1], Lisa Eby[1], Paul Spruell[2], and Craig Barfoot[3]
[1]University of Montana
[2]Southern Utah University
[3]Confederated Salish and Kootenai Tribes

Presenter: Matthew Corsi, 406-396-2760, mp.corsi@gmail.com

Oral Presentation, Student

Management of native cutthroat trout is a difficult issue, especially where popular and productive sport fisheries comprised of nonnative fishes may complicate conservation efforts. We collected

62 population genetic samples from cutthroat trout populations in the Jocko River watershed, MT in 2005-2009 to describe the distribution of cutthroat trout x rainbow trout hybrids. In order to gain fine-scale genetics data in some drainages, while still obtaining a comprehensive dataset for the entire watershed, we employed two sampling approaches. We used a spatially intensive sampling approach, with samples obtained every 1- 4 km in the upper Jocko River, a portion of the watershed considered to be a stronghold of native cutthroat trout. In other drainages, we collected one or two samples from each tributary, and made the assumption that the samples were representative of the tributary population. We detected at least one rainbow trout allele in at least one individual at 51 sample locations. Despite this signal of widespread introgression in the Jocko River watershed, sample proportions of rainbow trout alleles were below 5% in 43 (69%) of the population samples, despite the presence of RBT in the drainage for approximately 100 years. In general, highly hybridized populations exist at sites low in the watershed, though at least one major source of rainbow trout is in a headwater system. Opportunities may exist in the Jocko River watershed to balance conservation of pure populations of cutthroat trout with maintenance of a viable sport fishery for cutthroat trout, rainbow trout, hybrid trout, and other salmonid species. We used this hybridization dataset to explore cutthroat trout conservation options and reevaluate traditional viewpoints on cutthroat trout hybrid zone structure.

Two native suckers in a dammed river: A tale of persistence.

Kevin C. Donner[1], Sarah E. Zahn[2], Colden V. Baxter[1], Emma J. Rosi-Marshall[3], Theodore A. Kennedy[4], and Scott Rogers[5]

[1]Idaho State University
[2]Loyola University of Chicago
[3]Cary Institute of Ecosystem Studies
[4]United States Geological Survey
[5]Arizona Department of Game and Fish

Presenter: Kevin Donner, 541-961-7184, donnkevi@isu.edu

Oral presentation, Student

The ecological characteristics of large rivers throughout the world are transformed as a result of regulation by dams and these changes coincide with the decline and extirpation of native fish fauna. Native fishes that persist in these environments are subject to altered thermal, hydrologic, and sediment regimes, habitat fragmentation, shifted prey availability and composition, and interactions with non-native species. Research often focuses on native species that become imperiled under regulated conditions, but of equal importance may be an understanding of characteristics of those that persist or even thrive under these conditions. The Colorado River in Grand Canyon, AZ is regulated by Glen Canyon dam and has experienced local extirpations and declines in its native fish assemblage. Despite these losses, native flannelmouth (*Catostomus latipinnis*) and bluehead (*Catostomus discobolus*) suckers continue to persist throughout the canyon and maintain relatively large populations in certain reaches. Using AZGF monitoring data from 11 sites over 9 years, we analyzed the distribution and population dynamics of these species. In addition, we studied the trophic ecology of these catostomids, their potential predators and competitors at 3 sites over 2 years. Catostomids are most abundant far downstream of the Glen Canyon tail-water in contrast to the dominant non-native, rainbow trout. Successful recruitment events occur every several years and appear to coincide with increased water temperatures. As adults, blueheads are specialists and have little dietary overlap with large bodied non-native fishes while flannelmouths are generalists and overlap with carp and rainbow trout. Here, we present our findings in the context of what little is known regarding life history, in an attempt to paint a picture of life for these fishes and generate hypotheses as to the reasons for their persistence. Similar studies may be critical to effective native fish management within regulated rivers of Idaho and throughout the West.

Tissue composition and condition of sexually mature hatchery origin steelhead trout from the Snake River

Zachary L. Penney[1], Christine Moffitt[1,2], Jessica Buelow[1], Kala Hamilton[1], and Andy Pape[1]
[1]University of Idaho
[2]US Geologic Survey

Presenter: Zachary Penney, 208-885-7139, penn4282@vandals.uidaho.edu

Oral Presentation, Student

Little information is available to describe condition of vital organs the storage, and mobilization of energy reserves in mature and post-spawn (kelt) steelhead trout (*Oncorhynchus mykiss*). In 2009, we examined parameters from 69 lethally sampled steelhead from Dworshak National Fish Hatchery collected at or within 2 weeks after spawning, and compared these with samples removed from 36 migrating hatchery origin kelts at Lower Granite Dam Juvenile Bypass Facility. We assessed measured organo-somatic indices for the liver, spleen, and GI tract, and sampled the liver and white muscle to determine proximate contents and total energy content. We also collected tissue samples of the spleen, liver, gonads, cardiac stomach, pyloric stomach, and anterior intestine for histological analysis. We found organo-somatic ratios of the spleen, liver, and GI tract were significantly higher (Wilcoxon *P*: < .001) in migrating kelts than fish collected at the time of spawning. Median values of the organo-somatic ratios for the spleen, liver, and GI tract of Dworshak origin steelhead were 0.112%, 0.82%, 0.614% ; versus 0.169%, 1.334%, and 1.314% of body weight, for spleen, liver and GI tract of migrating kelts, respectively Lipid content of the livers for all fish was low ranging from 1.14% to 4.46% of wet weight. Protein content of livers ranged from 12.79% to 24.08% of wet weight. We plan further comparisons with external condition factors and non-lethal samples of blood plasma with a goal of identifying relationships that may enhance criteria associated with successful iteroparity.

Trends in annual migratory run time of Columbia River steelhead: genetic stock identification (GSI) of biweekly mixtures sampled at Bonneville Dam

Jon E. Hess and Shawn Narum
Columbia River Inter-Tribal Fish Commission

Presenter: Jon Hess, 208-837-9096 x1107, hesj@critfc.org

Oral Presentation, Professional

The Columbia River Basin supports ESA listed wild stocks of steelhead as well as hatchery supplemented populations. Accurate estimates of stock proportions that account for both hatchery and wild fish, and knowing how these stocks are distributed throughout the migration season, would benefit steelhead fisheries managers. In this study, we tested whether genetic stock identification (GSI) analysis could accurately distinguish between stocks of steelhead within the Columbia River Basin and discriminate these stocks according to their peak run-timing. Tissue samples were obtained from adult steelhead during migration runs at Bonneville Dam in each of five years between 2004 to 2008 (n=715, 570, 1429, 1931, and 2545 respectively). Samples were pooled into 14 biweekly strata (mean n = 174, range 23 -584 per strata) spanning the majority of the run-year from April to October. Thirteen standardized microsatellite loci were used to genotype steelhead mixtures and a genetic baseline was used to perform genetic stock identification. Variation in stock proportions was minimal when comparing similar time strata across years, while intra-annual variation across time strata within the migrating season was relatively large. Stocks above 5% average proportion of the total run were lower Columbia R. (0.055 ± 0.016), upper Columbia R. (0.135 ± 0.013), middle Columbia R. and lower Snake R. (0.254 ± 0.050), upper Salmon R. (0.154 ± 0.037), and upper Clearwater R (0.320 ± 0.069). The

biweekly strata in which these major stocks were observed to peak were 18-19, 24-25, 28-29, 32-33, and 38-39, respectively. All other stocks were less than 5% average proportion. This study demonstrates great potential for the application of genetic stock identification in the management of Columbia River steelhead fisheries evidenced by high accuracy of stock assignment, and the consistency of estimated stock proportions across years combined with the ability to discriminate steelhead stocks by run-timing.

Resolving natal origins and spatial distribution of juvenile migration strategies in wild Fall Chinook salmon (Oncorhynchus tshawytscha) using otolith microchemistry and geospatial analysis

Jens Hegg[1], Brian Kennedy[1], Rich Zabel[2] and Paul Chittaro[2]
[1]University of Idaho
[2]Northwest Fisheries Science Center

Presenter: Jens Hegg, 509-592-8867, hegg1432@vandals.uidaho.edu

Oral Presentation, Student

The development of divergent life history strategies in salmon is the result of variation in migratory behavior for individual fish and the effects of environmental fluctuation. It is fundamentally important to understand how these divergent life history strategies confer fitness advantages to individuals within the population, and how variation in environmental conditions in turn affects the spatial distribution of life history strategies. Recent research has shown increased variation in the migration strategies of juvenile wild Snake River fall Chinook salmon (*Oncorhynchus tshwasytscha*) with marked increases in representation of juvenile migrants at older ages in a population that historically has been dominated by sub-yearling juvenile migrants. Understanding the ecological drivers and spatial distribution of migration strategy has implications for management and hydropower operations. Reconstructing the spatial distribution of juvenile strategies and origins of wild, ESA listed populations can be difficult, however, when tagging large numbers of individuals is not a feasible option. Using otolith microchemistry and geospatial techniques we are reconstructing the life history of individual returning adult Fall Chinook from return years 2006-2008. Our goal is to understand the spatial distribution and fitness consequences of alternate life history strategies among juvenile Fall Chinook salmon in the Snake River. Our results show significant spatial differences in the geochemistry of key O. tshawytscha spawning locations. These chemical signatures are recoverable in the otoliths of returning wild fish and allow us to examine site-specific differences in migration strategy in a spatial context within the basin. We are using geospatial techniques to examine the strong correlation between geologic variation and microchemical signatures of watersheds within the basin. Using this relationship we hope to improve our fish classification methods and develop predictive indices for the usefulness of similar studies in other systems.

An evaluation of the spawning ecology of Bonneville cutthroat trout

Brett Roper[1], Steve Bennett[2], Robert Al-Chokhachy[1], and Jared Randall[3]
[1]USDA Forest Service
[2] Ecological Research
[3] Utah State University

Presenter: Brett Roper, 435-755-3566, broper@fs.fed.us

Oral, Professional

Understanding the spawning ecology of a species is critical for robust assessments of population status and trends and the effective management of populations. Despite the growing concern about the conservation of inland trout, comparatively little is known about their spawning

behavior. Here we used intense spawning surveys across multiple years (2006-2009) and time-lapse photography in two small tributaries of the Logan River, UT to investigate the spawning ecology of Bonneville cutthroat trout. Our intensive redd surveys indicated the average residence time on redds was 2.4 days (SD = 1.5), and the average number of fish-per-redd was 2.2 (SD = 0.5). Despite a multi-day residence time, our results from time-lapse photography indicated that fish were present on redds for short periods of time (average = 94 minutes, SD= 80), suggesting complex behavioral patterns and the importance of habitat refugia. Within a tributary, we found considerable spatial variability in the location of highest-density of spawners, which we attribute to temporal variability of habitat across years. Multiple-year surveys indicated the onset of spawning was generally consistent, despite significantly different runoff patterns across tributaries. However, the relationship between peak spawning and hydrology differed considerably across tributaries with Bonneville cutthroat trout spawning on the ascending limb of the hydrograph in one key tributary within this system. Overall, our results highlight the need for research directed at understanding the complexities of salmonid spawning behavior as it relates to habitat requirements, interactions with non-native species, and specific methods to monitor cutthroat trout populations.