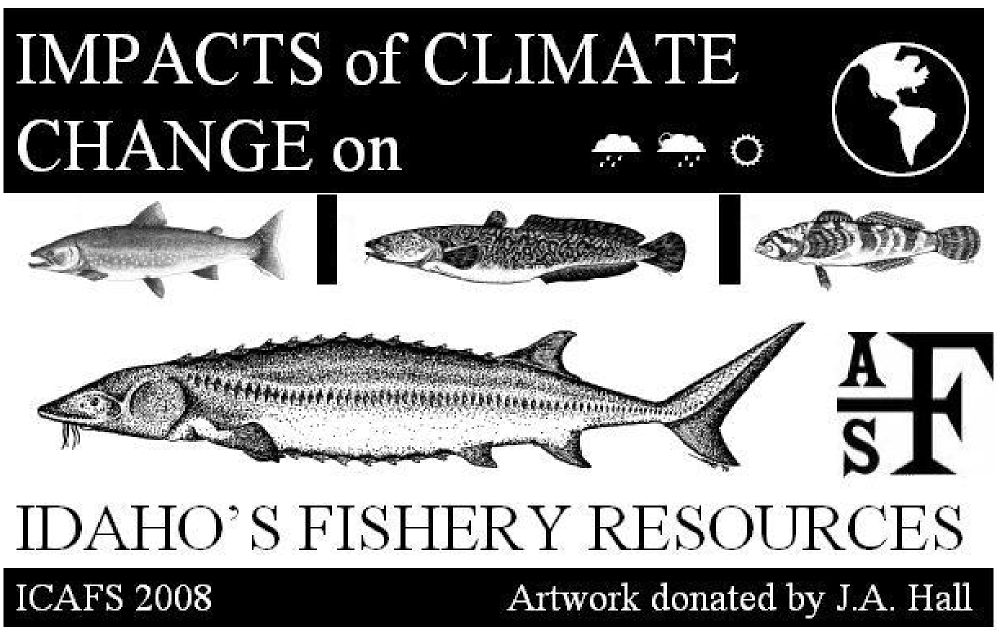
AMERICAN FISHERIES SOCIETY

Idaho Chapter

Established 1964

2008 Annual Meeting



February 6-8
Templin's Red Lion Hotel on the River
Post Falls, Idaho

Program and Abstracts

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Idaho Chapter Leadership

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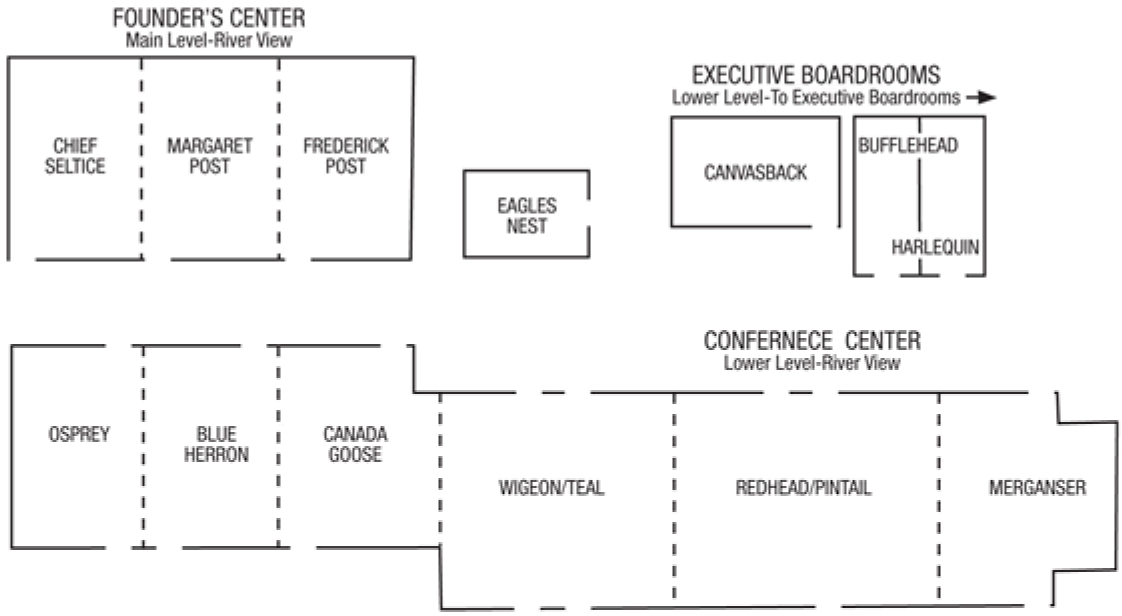
Water Quality/ Stream Hydrology	Steve Bauer (interim chair)	(208) 376-3263	stevebauer6@cableone.net

Templin's Red Lion Hotel Conference Center Map



Committee Room Assignments

Anadromous Fish	Canvasback
Fish Culture	Chief Seltice
Mentoring	Eagles Nest
Native Fishes	Frederick Post
Public Education	Margaret Post
Riparian	Harlequin
Water Quality/Stream Hydrology	Bufflehead

Wednesday, February 6

8:00–8:20 AM	**Opening Remarks and Presidential Message** ICAFS President Bart Gamett	

Plenary Session: Impacts and Implications of Climate Change on Idaho's Fishery Resources (Redhead/Pintail Merganser Rooms)

8:20–8:30 AM	**Introduction to Plenary Session** Jim Fredericks, Moderator, ICAFS President Elect
8:30–9:10 AM	**Keynote Address** ***Nature's Trust: A legal, political, economic, and moral frame for global warming*** Dr. Mary Christina Wood, University of Oregon School of Law
9:10–9:35 AM	***Changing climate patterns in Idaho*** Dr. Jen Pierce, Dept. of Geosciences, Boise State University
9:35–10:00 AM	***Implications of climate change to fish communities in headwater systems*** Dr. Dan Isaak, USFS Rocky Mountain Research Station
10:00–10:30 AM	BREAK (Lower Lobby) *Sponsored by U.S. Forest Service, Northern Region*
10:30–10:55 AM	***Implications of climate change to fish communities in mainstem systems*** Dr. Rob Van Kirk, Dept. of Mathematics, Idaho State University
10:55–11:25 AM	**Agency Perspectives** Virgil Moore, Deputy Director, Idaho Department of Fish and Game Ted Koch, Bull Trout Coordinator, US Fish and Wildlife Service Dave Tuthill, Director, Idaho Dept. of Water Resources
11:25–11:55 AM	**Panel Discussion** All Speakers
11:55-12:00 PM	**Concluding Remarks** Jim Fredericks, moderator
12:00–1:40 PM	BOX LUNCH: COMMITTEE BREAKOUTS (see previous page for room assignments)

Session 1: Implications of Climate Change (contributed papers)

1:40–1:45 PM	**Introduction to Session,** Jim Gregory, Moderator
1:45–2:05 PM	***Conservation and restoration of native trout in the face of climate change, invasive species, and development*** Robert E. Gresswell, US Geological Survey
2:05–2:25 PM	***A GIS-based approach to prioritizing strategies for restoring resistance and resilience to climate change in trout populations*** Helen M. Neville, Trout Unlimited

2:25–2:45 PM — ***An empirical assessment of salmonid distribution shifts associated with fires and climate trends in central Idaho streams***
Dona L. Horan, US Forest Service

2:45–3:05 PM — ***Spawning ecology and early life-stage survival influence the distribution of brown trout in a native cutthroat trout stream***
Jeremiah Wood, Utah State University

3:05–3:25 PM — ***Effects of water temperature on growth and physiology of different populations of redband trout (Oncorhynchus mykiss gairdneri)***
John Casinelli, University of Idaho

3:25–3:55 PM — BREAK

3:55–4:45 PM

Special Session: Palouse Unit History

Introduction to Session, Christine Moffitt, Moderator
Speakers: Dudley Reiser, Russell Strach, Kajsa Stromberg, and Jordan Neilson

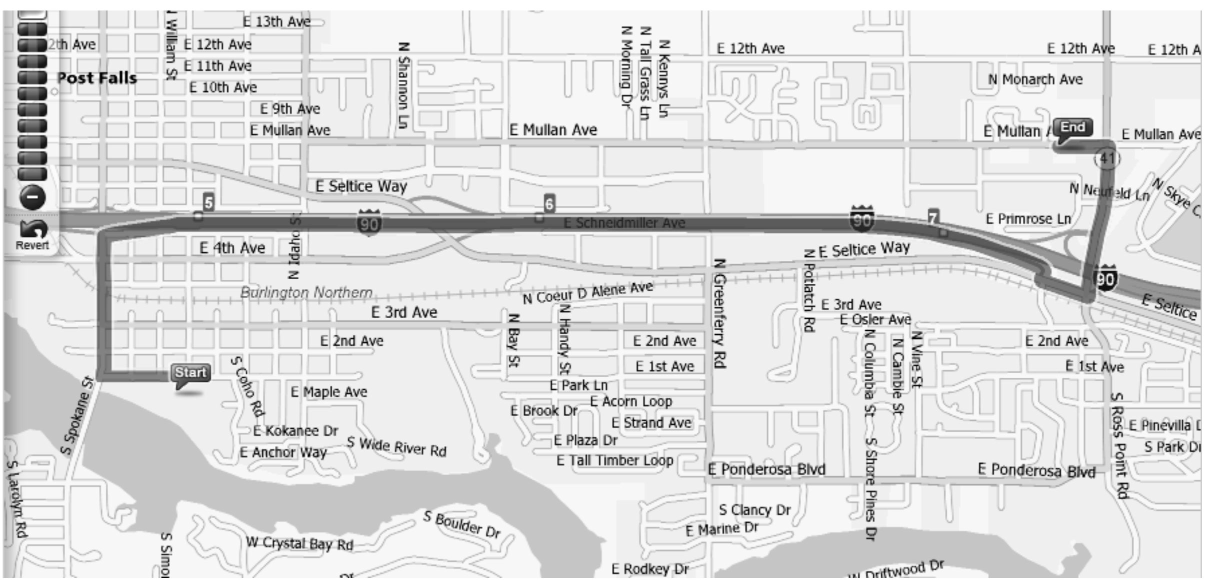
5:30–PM

STUDENT MIXER!!

Directions to Pizza Factory for Student Social Mixer

Travel Time: 7 minutes, Distance: 3.75 miles

1. Go West On E. 1st Ave Toward N. Henry Street
2. Turn Right onto N Spokane St.
3. Merge Onto I-90 E Toward Coeur d'Alene / Missoula.
4. Take Exit 7 Toward Id-41 / Rathdrum / Spirit Lake.
5. Turn Left onto E Seltice Way.
6. Turn Left onto Id-41 / Ross Point-Rathdrum Hwy.
7. Turn Left onto E Mullan Ave.
8. End At **Pizza Factory:** 3904 E Mullan Ave



Thursday, February 7 (concurrent sessions)

	Session 2: Culture (Osprey/Blue Herron Rooms) **Moderator: Bryan Grant**	***Session 3: Management (Seltice/Post Rooms)*** **Moderator: Martin Koenig**
8:00–8:10 AM	Announcements and introduction to Session	Announcements and introduction to Session
8:10–8:30 AM	***Estimating water, land, and other resources used to produce beef and trout for human consumption in Idaho*** Lubia Cajas-Cano, University of Idaho	***Identification of lake trout spawning locations in Lake Pend Oreille to enhance predator removal effort*** Greg Schoby, Idaho Dept. of Fish and Game
8:30–8:50 AM	***Preliminary investigation into disease susceptibility of Burbot Lota lota maculosa*** Mark Polinski, University of Idaho	***Feasibility of two-step system for removing New Zealand mudsnails from infested hatchery inflow waters*** Jordan Nielson, University of Idaho
8:50–9:10 AM	***Environmental assessments for therapeutants for aquaculture models, process and variables*** Christine M. Moffitt, University of Idaho	***Evaluating the success of fingerling trout stockings in the recreational fishery in Henrys Lake, Idaho*** Dan Garren, Idaho Dept. of Fish and Game
9:10–9:30 AM	***VHS virus: A threat to wild and cultured fish in Idaho*** Scott LaPatra, Clear Springs Foods, Inc.	***Tiger muskellunge growth, condition, and effect on target prey species in two eastern Washington lakes*** William Baker, Washington Dept. of Fish and Wildlife
9:30–9:50 AM	***Quantitative polymerase chain reaction for bacterial kidney disease surveillance at Idaho Department of Fish and Game Chinook salmon hatcheries*** Doug Munson, Idaho Dept. of Fish and Game	***Survival and dispersal of triploid hatchery rainbow trout in an Idaho river*** Brett High, Idaho Dept. of Fish and Game
9:50–10:15 AM	**BREAK**	
	Session 4: Anadromous Fish (Osprey/Blue Herron) **Moderator: Tom Curet**	***Session 5: Fish Passage and Entrainment*** **(*Seltice/Post Rooms*)** **Moderator: Lee Mabey**
10:15– 10:20 AM	**Introduction to Session**	**Introduction to Session**
10:20–10:40 AM	***Comparison of local versus aggregate population productivity for naturally produced spring/summer Chinook salmon in***	***Mountain whitefish Prosopium williamsoni entrainment by irrigation diversions from the Big Lost River***

	the Snake River basin Tim Copeland, Idaho Dept. of Fish and Game	Patrick Kennedy, Utah State University
10:40–11:00 AM	***Genetic variation and structure of Chinook salmon life history types in the Snake River*** Shawn R. Narum, Columbia River Inter-Tribal Fish Commission	***Effectiveness of fish screens to reduce entrainment and losses of threatened salmonids into irrigation systems on the Lemhi River*** Chuck Warren, Idaho Dept. of Fish and Game
11:00–11:20 AM	***The prevalence of wild juvenile Chinook salmon from Lake Creek, Idaho that rear a second year in freshwater*** Ryan Kinzer, Nez Perce Tribe Dept. of Fisheries	***A consumptive-use approach to estimating the effects of water diversions on streamflow, Upper Salmon River Basin*** Eric Rothwell, National Marine Fisheries Service
11:20–11:40 AM	***Effects of tributary streamflow on juvenile spring/summer Chinook salmon size, migration, and survival in relation to life cycle productivity*** David L. Arthaud, National Marine Fisheries Service	***Restoration of aquatic-habitat connectivity in Idaho: AOP-barrier removal on National Forests slowed by economic and political challenges*** Mike Kellett, USDA Forest Service
11:40–12:00 PM	***Abundance and age of migrating juvenile Lemhi River steelhead*** James V. Morrow Jr., National Marine Fisheries Service	***Movement, migration and spawning patterns of adult trout in a dammed and diverted section of the Henrys Fork*** Jim DeRito, Henry's Fork Foundation
12:00—2:15 PM	**BUSINESS LUNCHEON** **Location: Widgeon/Teal and Redhead/Pintail Meganser Rooms**	
	Session 6: Stream Ecology (Osprey/Blue Herron Rooms) **Moderator: Joe DuPont**	***Session 7: Resident Natives*** **(*Seltice/Post Rooms*)** **Moderator: Jordan Nielson**
2:15—2:20 PM	**Introduction to Session**	**Introduction to Session**
2:20—2:40 PM	***Juvenile Chinook salmon microhabitat use, availability, and selection in a central Idaho wilderness stream*** Dean E. Holecek, University of Idaho	***Abyssal oasis: A deeper look into Lake Pend Oreille fishes*** Tarah Johnson, Idaho Dept. of Fish and Game
2:40—3:00 PM	***The relative roles of biotic and abiotic factors in determining growth of juvenile Chinook in an Idaho wilderness stream*** Kara J. Cromwell, University of Idaho	***Evaluation of recovery goals for endangered white sturgeon in the Kootenai River, Idaho USA*** Vaughn L. Paragamian, Idaho Dept. of Fish and Game

3:00—3:20 PM	***Factors influencing the use of side channel habitat by westslope cutthroat trout*** Bryan Stevens, University of Idaho	***Preliminary investigations of an egg release to determine environmental requirements for successful spawning and recruitment of Kootenai River white sturgeon Acipenser transmontanus*** Tim Kiser, University of Idaho
3:20—3:40 PM	***Floodplain contributions to basal resources and retention in montane rivers: Comparison of dredge-mined to reference segments*** J. Ryan Bellmore, Idaho State University	***An abundance estimate for redband trout (Oncorhynchus mykiss gairdneri) in the upper Spokane River, Washington*** Rod O'Connor, Washington Dept. of Fish and Wildlife
3:40—4:00 PM	***Comparison of benthic and emergent insect community composition affected by wildfires of varying burn severities*** Rachel L. Malison, Idaho State University	***Wood River sculpin distribution, abundance, and life history characteristics in Idaho*** Kevin Meyer, Idaho Dept. of Fish and Game
4:00—4:20 PM	***Do nonnative brook trout exhibit higher density, biomass and annual production than native cutthroat trout? A call for meta-analysis*** Joseph R. Benjamin, Idaho State University	***Tracking fluvial cutthroat trout movements in the Bear River with stable isotope markers*** Warren Colyer, Trout Unlimited

4:20—5:30 PM

POSTER SESSION (Canada Goose Room)

Poster	***Initial findings of the Potlatch River steelhead monitoring and evaluation project*** Brett Bowersox, Idaho Dept. of Fish and Game
Poster	***Genetic investigations of Bonneville cutthroat trout in the Bear River drainage, ID: Intra- and interspecific hybridization/introgression and distribution of mitochondrial DNA diversity*** Matt Campbell, Idaho Dept. of Fish and Game
Poster	***PIT Tag retention in stream-dwelling resident redband trout*** Nick Gastelecutto, Idaho Dept. of Fish and Game
Poster	***Angler use and economics of urban fisheries in Idaho's Treasure Valley*** J. Lance Hebdon, Idaho Dept. of Fish and Game
Poster	***Hangman Creek fisheries enhancement project: Summary of assessment phase*** Bruce Kinkead, Coeur d'Alene Tribe Fisheries Program
Poster	***The Iron Creek reconnection and habitat restoration project: A successful multi-agency collaboration in the Upper Salmon Basin*** Wendy Koons, Upper Salmon Basin Watershed Program
Poster	***Kootenai River Model Watershed Project*** Gretchen Kruse, KTOI/Free Run Aquatic Research

Poster	***Using full parental genotyping to determine the efficacy of streamside incubators for rearing hatchery-origin steelhead trout eggs, and increasing population abundance in the Yankee Fork, Salmon River, ID*** Kurt Tardy, Shoshone-Bannock Tribes
Poster	***Testing the Washington Department of Natural Resource's GIS based logistic regression model predicting the upper extent of fish distribution in a forested North Idaho Watershed*** Chris Tretter, Idaho Dept. of Lands
Poster	***Implementation of a model watershed approach in the Benewah Creek watershed*** Angelo Vitale, Coeur d'Alene Tribe Fisheries Program
Poster	***Implementation of a model watershed approach: Catalyzing a paradigm shift towards long-term, scientific, and adaptive river restoration*** Angelo Vitale, Coeur d'Alene Tribe Fisheries Program
6:00—?? PM	***EVENING SOCIAL AND AUCTION!*** **Location: Widgeon/Teal and Redhead/Pintail Meganser Rooms**

Friday, February 8, 2007

Session 8: Stream Restoration (Redhead/Pintail Merganser Rooms)

Moderator: Tarah Johnson

8:00–8:10 AM	Announcements and Introduction to Session
8:10–8:30 AM	***Restoring Kootenai River (Idaho) fisheries through nutrient enhancement*** Ryan Hardy, Idaho Dept. of Fish and Game
8:30–8:50 AM	***Benewah Creek temperature dynamics in relation to native westslope cutthroat trout requirements*** Stephanie Hallock, Coeur d'Alene Tribe Fisheries Program
8:50–9:10 AM	***Yellowdog Downey Watershed Restoration Project, its effects on channel condition, water quality, and fish habitat*** Ed Lider, USDA Forest Service
9:10–9:30 AM	***Integrating fish, forests, and fire to define restoration opportunities and conservation priorities in the South Fork Boise River, Idaho*** Matthew R. Dare, USDA Forest Service
9:30–9:50 AM	***Longitudinal variability in PNW Rivers: Implications for survey design*** Robert M. Hughes, Oregon State University
9:50–10:15 AM	BREAK

Session 9: Techniques (Redhead/Pintail Merganser Rooms)

Moderator: Dean Holecek

10:15– 10:20 AM	Introduction to Session
10:20–10:40 AM	***Effects of 8.5 mm Passive Integrated Transponder tags on juvenile Chinook salmon survival and growth*** Craig Rabe, Nez Perce Tribe Dept. of Fisheries

10:40–11:00 AM	***Development of a PIT-Tag detection array for the John Day River to monitor straying Snake River adult salmon and steelhead*** Steve Anglea, Biomark, Inc.
11:00–11:20 AM	***Efficacy of calcien as a fish mass-marking tool*** Steven Elle, Idaho Dept. of Fish and Game
11:20–11:40 AM	***An overview of otolith microchemistry: its application, utility and potential for addressing statewide issues in fish ecology and management*** Brian Kennedy, University of Idaho
11:40–12:00 PM	***Building the virtual museum: using digital photography to document fish populations for conservation and education purposes*** Ernest Keeley, Idaho State University
12:00–12:15 PM	Best Paper Awards

Abstracts

SESSION 1: IMPLICATIONS OF CLIMATE CHANGE

Conservation and Restoration of Native Trout in the Face of Climate Change, Invasive Species, and Development

Robert E. Gresswell
US Geological Survey, Northern Rocky Mountain Science Center
Presenter: Robert E. Gresswell, 406-994-7085 (w), bgresswell@usgs.gov

Evidence suggests that factors such as climate change and a century of fire suppression are altering fire regimes in some vegetation types of the western USA, and the probability of large stand-replacing fires has increased in those areas. It appears, however, that even in the case of extensive, high-severity fires, local extirpation of fishes is patchy, and recolonization is often rapid. Lasting detrimental effects on fish populations have been limited to areas where native populations have declined and become increasingly isolated because of anthropogenic activities. Unfortunately, this situation is exacerbated by decreasing water availability at a time when demand is increasing. Furthermore, the potential of invasive species to expand under these altered habitat conditions is poorly understood. Despite incomplete knowledge of the effects of fire in aquatic systems, it is apparent that managers must begin to develop a broad-based management strategy that focuses on protecting remaining native fish populations and associated habitat from further anthropogenic degradation and restoring degraded habitat and connectivity. Such a strategy will require a watershed-scale approach than integrates conservation and restoration activities throughout the stream network.

A GIS-based Approach to Prioritizing Strategies for Restoring Resistance and Resilience to Climate Change in Trout Populations

Jack E. Williams, Amy L. Haak, Helen M. Neville, and Warren T. Colyer
Trout Unlimited
Presenter: Helen M. Neville, 208-938-1110, hneville@tu.org

Climate change and associated global warming are likely to cause unprecedented environmental change, including severe impacts to stream systems and coldwater-dependent fishes in Idaho and other areas of the western U.S. These impacts include warmer temperatures, earlier stream runoff, reduced summer flows, and more frequent disturbances such as floods, drought, and wildfire. If native trout populations are to persist in the face of such change we will need effective strategies that protect and expand our best remaining populations while preventing further advances of non-native species. Scale-appropriate strategies for restoring resistance and resilience to climate change in trout populations will generally include bolstering population numbers, restoring migratory life histories, protecting best remaining populations, reducing outside habitat stressors, and reconnecting habitats. We describe a GIS-based approach to mapping climate change vulnerability at a landscape (species-wide) scale and prioritizing areas for implementing these strategies using data and examples from recent fisheries assessments, broadscale habitat indicators, and Trout Unlimited's Conservation Success Index. We discuss the assumptions and limitations of our approach but believe that characterizing relative risk among populations in a changing climate will be valuable in identifying areas where intensified protection, restoration, or monitoring and research may be needed. Because we face an uncertain future with regards to climate change and non-native species expansion, consistent monitoring practices and adaptive management strategies will also be important.

An Empirical Assessment of Salmonid Distribution Shifts Associated with Fires and Climate Trends in central Idaho Streams

D.L. Horan, D.J. Isaak, and B.E. Rieman.
US Forest Service, Rocky Mountain Research Station.
Presenter: D.L. Horan, 208-373-4399, dhoran@fs.fed.us

Environmental trends associated with a warming climate are expected to shift habitats and species distributions. Empirical assessments have documented this phenomenon for numerous taxa, but case histories for freshwater fishes are rare. During the summer of 2007 we assessed possible salmonid distribution shifts by resampling 185 sites in 12 central Idaho streams originally sampled in 1997. Sites were located to bound the downstream extent of juvenile bull trout and the upstream extent of rainbow trout and brook trout. Intersurvey comparisons suggest bull trout distributions did not change significantly in most streams, but moved up in streams recovering from fires in the early 1990s. Brook trout distributions moved up in 4 of 5 streams and no trend was apparent in rainbow trout distributions. With the exception of populations in streams affected by fire, our results suggest climate induced distribution shifts are not yet clearly discernable. Biotic responses may lag habitat trends, however, as reproduction, growth, and dispersal to new habitats is often limited by intergenerational timescales. As Idaho's climate continues to change, ongoing monitoring will be needed to track biological responses and to understand factors that impart spatial variability in response rate.

Spawning Ecology and Early Life-Stage Survival Influence the Distribution of Brown Trout in a Native Cutthroat Trout Stream

Jeremiah Wood and Phaedra Budy
USGS Utah Cooperative Fish and Wildlife Research Unit, Utah State University
Presenter: Jeremiah Wood, (435) 764-0372, jrwood@cc.usu.edu

Cutthroat trout populations have suffered significant losses throughout the American West, and the presence of exotic fish species is widely documented as an important factor leading to these declines through predation on, and competition with, native species. Our objectives were to: 1) document the spatial distribution of brown trout spawning along an elevational gradient, and 2) evaluate the potential for differential egg hatching success. We evaluated these objectives in the Logan River, Utah, where cutthroat trout and brown trout exhibit distinct allopatric distributions common to Intermountain West streams. We conducted an intensive survey of brown trout spawning activity over a 50 km stretch of the Logan River via weekly redd counts in suitable areas throughout two spawning seasons, and we assessed brown trout hatching success by placing replicated eyed hatchery eggs and fertilized wild eggs in enclosed incubation boxes in river gravel at eight different sites along the elevational gradient of the river. We documented brown trout spawning in areas at elevations higher than we capture brown trout during our summer electrofishing surveys. Redd densities decreased with increasing elevation, similar to trends observed in adult population estimates. Egg survival also decreased consistently with increasing elevation, indicating that survival at this life stage may play a role in limiting the upper elevational extent of brown trout in the Logan River. We hypothesize extreme winter conditions in higher elevations cause lower egg-to-fry survival for fall spawning fish, therefore preventing brown trout from expanding into these areas. Our results have important implications in terms of predicting and understanding the potential for brown trout expansion into remaining cutthroat trout habitat under both current and changing environmental conditions.

Effects of Water Temperature on Growth and Physiology of Different Populations of Redband Trout (*Oncorhynchus mykiss gairdneri*)

John D. Cassinelli and Christine M. Moffitt
University of Idaho
Presenter: John Cassinelli, (208)860-5737, johncassinelli@hotmail.com

Redband trout are native to the Great Basin and Columbia River Basin, and populations occur in both cool mountain streams and low-elevation desert streams. These desert-adapted stocks appear to be unique in their ability to tolerate elevated water temperatures and little research has been done on these populations. We conducted a two-year laboratory evaluation of the physiology and growth of selected wild populations of desert and montane-adapted stocks from the Snake River Basin, Idaho. We collected gametes from wild fish and reared their offspring in the laboratory. Groups of fish were tested in a simulated desert or montane diel water temperature cycle for 35-days in both 2006 and 2007. Response variables included growth and survival, feed efficiency, plasma cortisol, heat shock proteins, and body proximate analysis. Desert temperature cycles ranged from 16 to 26°C but we observed little mortality. Growth and feed efficiency were slightly higher for wild stocks held in montane temperatures (8 to 14°C) in year one but were higher for stocks held in desert treatments in year two. We found significantly different growth rates and feed efficiencies among all stocks and temperature treatments. However, total lipid and protein efficiencies did not differ. Heat shock protein 70 (hsp 70) expression in liver and muscle tissues was significantly higher for fish sampled from the desert temperature cycles and levels increased over time. We conclude that these stocks of redband trout are equally versatile and dynamic and appear to be capable of adapting to a wide range of temperatures, regardless of their geographic origin.

SPECIAL SESSION: PALOUSE UNIT HISTORY

Palouse Unit @ 30 – Legacy of Student Involvement

Moderator: Christine M. Moffitt
USGS Idaho Cooperative Fish and Wildlife Unit, University of Idaho

This brief panel discussion will review the role of the Palouse Unit of the Idaho Chapter at the University of Idaho from the past to present. The panel will reflect on the changes, the successes, and lessons learned from AFS involvement. Participants include former presidents from the three decades: Dudley Reiser, Russell Strach, Kajsa Stromberg, and current student member Jordan Neilson. The panel will interact with the audience as they discuss the future challenges of professional societies. The annual student-professional pizza mixer will follow the panel discussion.

SESSION 2: AQUACULTURE

Estimating Water, Land, and Other Resources Used to Produce Beef and Trout for Human Consumption in Idaho

Lubia Cajas-Cano[1], and Christine M. Moffitt[2]
[1]Environmental Sciences Program and Department of Fish and Wildlife Resources
[2]UGSG Cooperative Fish and Wildlife Research Unit
University of Idaho
Presenter: Lubia Cajas-Cano, lubiacajas@vandals.uidaho.edu

In the United States, more than 65 percent of the total freshwater resources are used for agriculture, mainly for irrigation systems. Increasing human population is increasing the demand for animal protein products and is decreasing the options available to meet these production needs and preserve the quality of water and land resources. In developing nations such as China, freshwater and marine aquaculture production is providing a large portion of the animal protein consumed by their citizens. However, little is known about the total resource demands for aquaculture and few comparisons have been made between resource needs for aquaculture and terrestrially based animal protein production. The objectives of our study were to estimate the resource inputs and outputs for two systems of animal protein production systems that are important to the Idaho economy: beef cattle and trout. The production systems can be divided into three components: feed production, animal production, and slaughter. We estimated the quantity of water and land needed for feed and production. We estimated a kg of boneless beef needed an average land area of 1,100 m^2 depending on the production system, and an average of 16,555 L water. We estimated less than 5 m^2 of land area was needed to produce a kg of trout filets, mostly for growing feed ingredients. We estimated a range of 2,700 to 8,300 L of water was needed for consumptive use to produce 1 kg of boneless trout filets. This volume of water was determined from the water needed for producing the plant proteins and feed ingredients. Trout operations use additional water for raceway production that we estimated as 75,000 L per kg. However nearly 99% of this water is released back into the rivers to support other ecosystem services or consumptive use downstream. We provide other measures that can be helpful in comparing beef and trout production systems.

Preliminary Investigation into Disease Susceptibility of North American Burbot *Lota lota maculosa*

Mark P. Polinski[1], Keith A. Johnson[2], Kevin R. Snekvik[3], Susan C. Ireland[4] and Kenneth D. Cain[1]
[1]Department of Fish and Wildlife Resources, University of Idaho
[2] Idaho Department of Fish and Game
[3] Washington Animal Disease and Diagnostic Laboratory, Washington State University
[4]Kootenai Tribe of Idaho
Presenter: Mark P. Polinski, (208)885-7239, markpolinski@vandals.uidaho.edu

The decline of burbot (*Lota lota maculosa)* population to near extinction in the Kootenai River has resulted in an interest for a conservation aquaculture program for this species. In hopes of aiding this developing program, investigations into disease susceptibility and the development of diagnostic tools are currently underway. As a tool for fish virus isolation and diagnostics, a burbot larvae cell line has been established. Cells have been grown in Eagle's minimum essential medium supplemented with 10% fetal bovine serum (MEM10) and have now been passed over 50 times in culture. Optimal incubation temperature has shown to be approximately 20°C and cryopreservation has been achieved with >90% cell viability upon thaw 28 d post freeze. Cytopathic effect (CPE) was observed after inoculation of this cell line with both infectious pancreatic necrosis virus (IPNV) and infectious hematopoietic necrosis virus (IHNV). *In vivo* immersion challenges of 5 g juvenile burbot with IPNV and IHNV revealed a significant ($p < 0.05$) increase in mortality rate in IPNV infected groups. Surprisingly, attempts to re-isolate the pathogen in cell culture have been unsuccessful. In contrast, no clinical signs of disease or significant changes in mortality rate were observed after challenge of burbot with IHNV, but CPE was observed in cell culture after inoculation with kidney/liver/spleen tissues. Challenge of 5 g juvenile burbot by intra-muscular injection of *Flavobacterium psychrophilum*, the causative agent of coldwater disease, did not result in increased mortality. Fish showed no signs of disease and the bacteria were not re-isolated. Taken together, these preliminary observations suggest that burbot may serve as possible carriers of IHNV, but are not susceptible to *F. psychrophilum*. Although the burbot cell line appears to be susceptible to IPNV, results from IPNV challenges are inconclusive and further studies must be conducted to determine if burbot can harbor this virus.

Environmental Assessments for Therapeutants for Aquaculture Models, Process and Variables

Christine M. Moffitt
USGS Idaho Cooperative Fish and Wildlife Unit, University of Idaho
Presenter: Christine M. Moffitt, (208) 885-7047, cmoffitt@uidaho.edu

If aquaculture production for food and for conservation restoration is to succeed within the contemporary regulatory atmosphere, realistic assessments of the environmental effects of this production are needed. However, the general public has little information about fish culture practices, and media attention has perpetuated myths about the use of therapeutic substances and other factors. This study provides a summary of the current approach used by regulators in evaluating the effects on the environment of a therapeutic drug for fish culture. An environmental assessment is conducted using a framework risk assessment document that provides decision point and requires data inputs. Unique characteristics of the compound must be considered to understand degradation in water, sediments, and use patterns. Data from the scientific literature or other sources are used to estimate risk quotients for algae, invertebrates, and fish under chronic and acute exposures. This model uses the "weight of evidence" approach to illustrate effects for which specific studies were not conducted. The results from these tools provide regulators and the public information about the effects on the environment of therapeutic chemicals used in aquaculture.

VHS Virus: A Threat to Wild and Cultured Fish in Idaho

Scott E. LaPatra
Clear Springs Foods, Inc.,
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Viral hemorrhagic septicemia (VHS) has historically been considered to be the most serious viral disease of salmonids reared in freshwater environments in Europe. More recently, VHS virus has been associated with marine finfish species, and most recently has become an emerging disease of freshwater fish in the Great Lakes region of the United States and Canada. VHS was first detected in the Great Lakes region in the Bay of Quinte, Lake Ontario, in 2005, and was subsequently detected in an archived 2003 sample from Lake St. Clair. VHS virus also was detected in Lake St. Clair in 2005 and in Lake Ontario, Lake Erie, Lake St. Clair and the St. Lawrence River in 2006 in a variety of fish species. The virus has also been documented from inland waters in New York (Consensus Lake, Skaneateles Lake, Little Salmon River in Mexico, Oswego County, the Seneca - Cayuga Canal, and an isolated farm pond in Ransomville, Niagara County), Wisconsin (Lake Winnebago), and Minnesota (Budd Lake near Harrison, MI). Prior to 2003, isolations of VHS virus were limited in North America to saltwater finfish from the Atlantic and Pacific Oceans, including Chinook and coho salmon, Pacific herring, Atlantic herring and cod. Since 2005, the list of species known to be affected by VHS virus has risen to more than 40, including a number of ecologically and recreationally important fish. In many instances, VHS virus has been associated with extensive fish mortality, albeit only in wild fish. Because of the threat of this emerging disease to wild and farmed species in North America, fisheries professionals and anglers must be made aware of this potential threat immediately to minimize potential risks and help prevent impacts of this disease on wild and cultured fish species in Idaho and the rest of the United States and Canada.

Quantitative Polymerase Chain Reaction for Bacterial Kidney Disease Surveillance at Idaho Department of Fish and Game Chinook Salmon Hatcheries

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The Idaho Department of Fish and Game (IDFG) has reduced the prevalence and intensity of infection of *Renibacterium salmoninarum* (RS), the etiological agent of bacterial kidney disease (BKD), by a focused hatchery disease management program consisting of 1) Injection of erythromycin into returning adult Chinook salmon; 2) iodophor disinfection of eggs; 3) ELISA-based culling of eggs from high risk females; 4) metaphylactic erythromycin medicated feed treatments. The success of this program has been documented by diminishing detections of RS in hatchery reared juvenile Chinook salmon by direct fluorescent antibody test (dFAT), improved pre-smolt survival, and improving trends in enzyme link immunosorbent assay (ELISA) values in returning hatchery origin adult salmon. We are examining the ability of quantitative polymerase chain reaction (qPCR) to predict the need for metaphylactic treatments of erythromycin medicated feed to control BKD. Sixty fresh mortalities were examined on a monthly basis at three IDFG Chinook salmon hatcheries by DFAT and qPCR technology. In the brood year 2006, we have not detected RS by DFAT and only 6 lightly positive detection using qPCR. We are hopeful that qPCR will be able to predict the need for metaphylactic treatments or justify not using erythromycin medicated feed in the future.

SESSION 3: MANAGEMENT

Identification of Lake Trout Spawning Locations in Lake Pend Oreille to Enhance Predator Removal Efforts

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The kokanee salmon *Oncorhynchus nerka* population in Lake Pend Oreille is currently at a record low. To increase kokanee salmon survival in Lake Pend Oreille, extensive predator (lake trout *Salvelinus namaycush* and rainbow trout *O. mykiss*) removal efforts have occurred, including commercial fishing and angler incentive programs. To improve lake trout removal efforts and efficiency, we used depth and temperature sensitive acoustic transmitters to locate spawning areas. The identification of lake trout spawning areas will provide IDFG another means of reducing the predator population in Lake Pend Oreille, either though physical removal of adults (i.e. netting) or desiccation of eggs by lake level manipulations. Between May 18 and September 18, 2007, we tagged 31 adult lake trout ranging from 720 - 1010mm total length (mean TL: 858mm) and weighing from 3.62 – 9.52kg (mean mass: 6.20kg). Beginning in mid-July, we tracked tagged lake trout on a bi-weekly basis. In mid-August, tracking frequency increased to at least once per week, and increased through mid-October. Tracking occurred between 8 a.m. and 12 p.m. The 31 tagged lake trout were relocated 549 times, for an average of 18 relocations per tagged individual. Tagged lake trout aggregated in two shoreline areas with cobble and rubble substrates, but spawning did not occur in shallow habitat as in other systems. Based on depth data from tagged lake trout locations in mid-September to mid-October, we believe lake trout spawning occurred between 22.4m and 32.6m deep. Additionally, no tagged fish were observed using habitats less than 20.4m throughout any portion of the study. Scuba divers confirmed our belief of deepwater spawning by observing eggs at 29.3m deep. The information gathered in this study will help guide future removal efforts of lake trout by directing large-scale netting operations in the timing and location of spawning aggregations.

Feasibility of Two Step System for Removing New Zealand Mudsnails from Infested Hatchery Inflow Waters

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New Zealand Mudsnail (*Potamopyrgus antipodarum;* NZMS) infestations at fish hatcheries can restrict the options for stocking hatchery-reared fish because of the risks of spreading snails to new locations. Reliable and environmentally friendly methods that remove NZMS from source waters are required so that hatchery managers can create an environment for snail–free fish production and/or transportation. We are evaluating the feasibility of a two-step control method of removing NZMS in the piped spring water supply of Hagerman National Fish Hatchery (HNFH). The process involves hydrocyclonic separation of NZMS followed by carbonation of the hydrocyclone waste (snail) stream. Hydrocyclone filters use centrifugal force to remove particles with a specific gravity greater than water. We conducted field trials with a test prototype at HNFH during the summer and fall of 2007 and found that the hydrocyclone system successfully separated all sizes of NZMS present in the intake water including adults, juveniles and neonates. We measured and modeled the transit time of water and three sizes of

NZMS through the test system at two flow rates, 68 and 97 gpm. We found that the residence time of water particles was the same regardless of flow rate, but residence time of the snails increased with size of NZMS and with decreased flow rates. We have found that NZMS are sensitive to CO_2 under both atmospheric and hyperbaric pressure conditions. Testing of NZMS at 100 kPa CO_2 and 8°, 15°, and 20°C has been completed for the adult and juvenile life stages of snails (>2.5mm, 1mm to 2.5 mm). Probit models indicate that these life stages react very similarly to exposure to CO_2 at elevated dissolved gas pressure. A probit model of survival predicts the 100% lethal time of exposure for adult NZMS at 89.4, 13.9, and 8.9 h for 8°, 15°, and 20°C respectively indicating an inverse relationship between temperature and survival during elevated CO_2 treatments. Hydrocyclonic separation/ CO_2 treatment of NZMS from hatchery inflow shows promise because of the high filtration efficiencies observed, relatively low capital costs and the ability to operate on the line pressures present at the HNFH and other similar fish hatcheries in the Hagerman Valley.

Evaluating the Success of Fingerling Trout Stocking in the Recreational Fishery in Henrys Lake, Idaho

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The Idaho Department of Fish and Game has stocked fingerling trout in Henrys Lake, Idaho since the early 1900's to supplement natural reproduction and ultimately increase angler catch rates. Annual stocking rates have varied from 42 to 914 fingerling trout per ha from 1950 to present. Stocking densities can influence angler catch rates, but are limited by production constraints and costs associated with raising, transporting and stocking fish. By refining fingerling trout stocking densities, managers can optimize the fishery and minimize hatchery expenditures. To fully understand the effects of stocking density on angler catch rates in a lake with natural reproduction, we estimated the contribution of hatchery fish to the fishery by analyzing eight years of marked fingerling stockings and found natural reproduction added little to the adult population. We then explored the relation between stocking density, fish size and angler catch rates to determine the optimal stocking rate needed to achieve our management objectives of 0.7 fish per hour and 10% of harvested fish exceeding 500 mm. As expected, we found increased catch rates following years when stocking levels were high. We estimate that approximately 618 fingerling trout per ha are needed annually to achieve angler catch rates of 0.7 fish per hour. However, at this stocking density mean size of fish harvested by anglers is estimated at 411 mm, with approximately 5% of the catch exceeding 500 mm. This falls below our management goal of 10% of catch exceeding 500 mm, and suggests our catch rate goals and size goals are incompatible.

Tiger Muskellunge Growth, Condition, and Effect on Target Prey Species in Two Eastern Washington Lakes

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Tiger muskellunge were stocked into two eastern Washington lakes with differing fish assemblages; one dominated by spiny-rayed, compressiform species and the other dominated soft-rayed, fusiform species. In both lakes, target prey species were identified prior to tiger muskellunge stocking (Northern pikeminnow *Ptychocheilus oregonensis* in Curlew Lake (Ferry County) and tench *Tinca tinca* in Silver Lake (Spokane County). Target prey species are defined as undesirable fishes likely to be preferred by tiger muskellunge based on body length, fusiform body shape and soft-rayed fins. Our objectives were to determine tiger muskellunge growth, condition, and effect on abundance of target prey species in the two lakes. Differences in mean length of known-age tiger muskellunge at time of stocking and subsequent recapture were used to determine growth rates. Condition of tiger muskellunge was evaluated with the relative weight (W_r) index. Catch per effort (CPE) of target prey species, during standardized fall electrofishing samples conducted each year, was used to track changes in target forage species abundance. Tiger muskellunge stocked in the lake dominated by soft-rayed, fusiform prey grew more quickly and were consistently in better condition than those stocked in the spiny-rayed, compressiform-dominated lake. Tiger muskellunge appeared to impact target prey populations through predation, as target prey species CPE declined in both lakes following multiple years of tiger muskellunge stocking. However, change in target prey species CPE was not detectable in either lake until at least 5 years following the initial tiger muskellunge stocking. Tiger muskellunge are capable of reducing the abundance of undesirable fish. However, managers should carefully consider potential impacts on soft-rayed, fusiform non-target fish species. Managers should also understand that it may take longer to develop trophy tiger muskellunge fisheries and achieve reduction of target forage in waters dominated by spiny-rayed, compressiform fish due to slow tiger muskellunge growth.

Survival and Dispersal of Triploid Hatchery Rainbow Trout in an Idaho River

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Hatchery rainbow trout *Oncorhynchus mykiss* of catchable size (catchables) are commonly released into streams to improve angler catch and harvest rates, but returns from this investment are often much less than 50%, and the fate of unharvested catchables is largely unknown. Survival and dispersal of catchables was investigated using snorkel and telemetry techniques to quantify the life span and dispersal distances of triploid catchable rainbow trout stocked into an Idaho river where a minimum length regulation precluded harvest of catchables used in this study. Counts of catchables released with Floy®-tags (n = 900) and motion-sensitive radio tags (n = 54) steadily declined throughout the observation period. Dispersal of Floy-tagged catchables was generally limited to 1 km upstream and downstream of the stocking point. Median values for maximum known downstream and upstream dispersal distances for radio-tagged catchables ranged from 2.8 to 1.2 km from the stocking point, respectively. Telemetry efforts continued through November 1, 2006, at which time four catchables were still alive, as indicated by the motion-sensitive radio tags. Radio signals had been lost from an additional three catchables. All of the remaining 47 catchables had signals changed to mortality (no movement) transmissions, of which 39 tags were recovered. On average, at 30 d post-stocking, 87% of radio-tagged catchables were dead, with an average lifespan of 14.3 d. Managers wishing to maximize return to creel rates of sterile catchables might do so by limiting stocking events to within three weeks of expected needs, and limiting the stocking locations to no more than 1 km away from areas frequented by anglers.

SESSION 4: ANADROMOUS FISH

Comparison of Local versus Aggregate Population Productivity for Naturally Produced Spring/Summer Chinook Salmon in the Snake River Basin

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Stock-recruit (SR) relationships are important to understanding forces influencing abundance, but it is critical to understand the processes that shape the relationship. Aggregate SR curves are the product of the life stages and spatial components that compose the stock. The aggregate freshwater productivity of naturally spawning spring/summer Chinook salmon in the Snake River (as measured at Lower Granite Dam) exhibits Beverton-Holt (BH) density dependence during brood years 1990-2004. Our objective was to compare and contrast the relationship described in aggregate to comparable data from the spawning areas of eight selected component populations. Strength of density dependence varied widely among populations with model form including linear, Ricker, and BH. In general, local populations did not exhibit as much density-dependence as the aggregate, indicating that density-dependence occurs downstream from spawning areas. Intrinsic productivity predicted by the aggregate BH model was 474.5

smolts/female. Intrinsic productivity of local populations ranged from 31.5 to 393.6 smolts per redd (mean = 173.0) and from 337.2 to 874.3 parr/presmolts per redd (mean = 526.4). Relative to the aggregate, low local smolt productivities versus high parr/presmolt productivity indicate the importance of juvenile life history diversity to population regulation. There was density-dependent survival from the natal stream to Lower Granite Dam in almost every population and life stage combination that we examined. We conclude that a focus on spring smolts alone ignores important components of population productivity. Further, local limitations will be different among populations, which should reduce population synchrony and increase resilience of the aggregate. We recommend that managers should recognize the importance of the 'mid-stem' black box because juvenile dispersal is important to population functioning and juvenile life histories should be considered in recovery plans.

Genetic Variation and Structure of Chinook Salmon Life History Types in the Snake River

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In this study, we evaluated 25 inland populations of Chinook salmon (*Oncorhynchus tshawytscha*) in the Snake River with 13 microsatellite loci to test for contemporary genetic differentiation at three scales: between life history types, among regions within life history type, and among populations within regions. Genetic distance and diversity of natural Chinook salmon populations were also contrasted with those of Chinook salmon from several hatcheries. Results indicate strong evidence for reproductive isolation among ocean- and stream-type life histories (F_{ST} range from 0.080 to 0.120). Regional structuring of stream-type Chinook salmon within sub-basins was also significant as all populations were differentiated (F_{ST} range from 0.017 to 0.045; P values < 0.005), but generally clustered together by region in a neighbor-joining dendrogram. This evidence suggests high levels of philopatry to natal areas in stream-type Chinook salmon, but ocean-type collections were not significantly different from one another (F_{ST} range from 0.001 to 0.002; P values between 0.038 and 0.218). Higher levels of genetic diversity in ocean-type (306 total alleles; allelic richness equal to 16.5) than stream-type collections (206 total alleles; allelic richness equal to 12.2) may also reflect variable levels of gene flow within each life history type and colonization history. Genetic similarity of populations within regions suggests gene flow from not only transplanted stocks, but also natural dispersal that provides meta-population structure. None of the 25 populations in this study had significant evidence for a genetic bottleneck (M ratio < 0.68) despite apparent demographic bottlenecks in several populations throughout the Snake River drainage in the last century. The combination of dispersal through metapopulation dynamics, and transfers of hatchery stocks may be responsible for reducing signal of genetic bottlenecks. The significant regional structure observed in this study may also serve as a resource for identification of unknown origin fish based on genotypic data. The genetic relationships of populations provide a genetic baseline for determining stock proportions in mixed stock analyses. Preliminary results of mixture analyses from Chinook salmon collected at Lower Granite Dam will be presented.

The Prevalence of Wild Juvenile Chinook Salmon from Lake Creek, Idaho that Rear a Second Year in Freshwater

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Several distinct migration strategies were identified from wild juvenile Chinook salmon (Oncorhynchus tshawytscha) captured in Lake Creek, a headwater tributary of the Secesh River, located in central Idaho. From 1997 through the spring of 2007, a rotary screw trap was operated in Lake Creek to monitor migration and survival of juvenile Chinook salmon to Lower Granite Reservoir. Analyses of fish marked with passive integrated transponder tags detected through the Columbia River system showed migration occurred for age 1+ and 2+ age smolts. Further analysis confirmed the presence of multiple age classes of fish in the natal stream, verified through scale analysis and length frequency distributions, providing evidence that two life history strategies occur within each brood year. There is the normal migration group (NMG) which is most common and a delayed migration group (DMG). The NMG initiates the smoltification process at age 1+ and may rear in the natal stream or at locations downstream. The DMG contains fish that rear an additional year in freshwater. Two variations of the DMG exist; one is precocial males that are sexually mature and may become smolts the following spring at age 2+, and the second is individuals that are not sexually mature but also become smolts at age 2+. Variables analyzed for the DMG were location of rearing (natal stream or downstream) and evidence of precocity. Ecologically, the presence of the DMG life history strategy spreads genetic risk across multiple migration years and potentially guards against the negative effects of small adult returns. Measurable proportions of the DMG life history strategy within a brood year can affect certain results such as, incorrect brood year production and survival estimates, underestimates of smolts reaching the ocean, and biased estimates of smolt to adult ratios. Utilizing these biased results could inhibit the ability to make sound management decisions.

Effects of Tributary Streamflow on Juvenile Spring/Summer Chinook Salmon Size, Migration, and Survival in Relation to Life Cycle Productivity

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The Lemhi River and Marsh Creek are drainages within the Salmon River Basin with independent populations of wild spring Chinook salmon. Most flow of the Lemhi River is diverted and used for irrigation, whereas Marsh Creek flow is not affected by water use. We estimated life cycle production of Chinook salmon in the Lemhi River and Marsh Creek and estimated effects of flow on growth, size and age at migration, egg to trap survival, and migration survival. In Marsh Creek, flow had little effect on survival but was a positive regulator of growth, especially at its extremes. During low flow years, density-dependent growth in Marsh Creek was balanced by emigration with smaller and younger fish emigrating at greater rates as density increased. In the Lemhi River flow was a strong positive regulator of growth and survival, and during normal to low flow years, density-dependent growth and density-dependent mortality began immediately after emergence and continued to older groups. Average egg to trap survival in Marsh Creek (35%) was almost four times higher than in the Lemhi River (10%). Marsh Creek produced seven times more yearling recruits per unit of rearing habitat and had more consistent survival, with a three-fold difference in the best and worst years, compared to ten-fold variability in survival in the Lemhi River. However, migrant size was positively related to downriver and ocean survival and both were greater for older groups of Lemhi River fish. Downriver migration flows and survival were also positively related for both stocks. These factors caused variability in survival to triple again by John Day Dam. At this point year class survival rates had fallen to 3% and 2% for Marsh and Lemhi stocks, respectively.

Abundance and Age of Migrating Juvenile Lemhi River Steelhead

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Presenter: James V. Morrow Jr.

Knowledge of population parameters and migration timing of naturally produced Lemhi River steelhead is limited. In 2003, Idaho Department of Fish and Game started PIT tagging all *O. mykiss* captured at the Lemhi weir screw trap that were greater than 100 mm total length. We used data from these tagging efforts to determine age at migration, estimate number of steelhead produced in the upper Lemhi River, and determine proportion of tagged steelhead that survive to the FCRPS. A total of 242 young-of-year, 5,751 age-1, and 464 age-2 steelhead were tagged. Three percent of fish tagged as young-of-year, 4% tagged as age-1 and 21% tagged as age-2 were later detected in the FCRPS on the way to the ocean, however, young-of-year and age-1 fish usually reared for at least one year after tagging. Of the 363 steelhead detected in the FCRPS, none were detected as young-of-year, 8% were detected as age-1, 91% as age-2, and 1% as age-3. Average estimated number of steelhead migrating from the upper Lemhi River during 2003-2006 was 14,315 and ranged from 8,757 in 2004 to 20,552 in 2005. The number of steelhead migrating from the upper Lemhi River during 2003-2006, when no stocking occurred in the upper Lemhi River, was comparable to the number that migrated during 1965-1974 when 193,300 to 853,200 steelhead fry were stocked annually. Recent genetic analysis of naturally produced Lemhi River steelhead suggest they are similar to other Salmon River stocks, particularly to wild Pahsimeroi River steelhead, and not to the hatchery-origin steelhead stocked in the 1960s and 1970s. Steelhead in the upper Lemhi River typically rear for two full years before migrating to the ocean and have apparently retained their genetic identity. Although abundance is low, production of juvenile steelhead has apparently not declined markedly since the late 1960s.

SESSION 5: FISH PASSAGE AND ENTRAINMENT

Mountain Whitefish *Prosopium williamsoni* Entrainment by Irrigation Diversions in the Big Lost River, Idaho

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Recent research suggests the Big Lost River mountain whitefish population is genetically divergent from its parent population in the Upper Snake River. Management agencies have documented a decline in the mountain whitefish *Prosopium williamsoni* population on the Big Lost River. Unscreened diversions have been recognized as a potential factor for the decline. During 2007, entrainment was evaluated in ten canals. Canal selection was based on the volume of water diverted, the orientation of the point of diversion (POD), and preliminary entrainment surveys conducted by the US Forest Service (USFS) and Idaho Department of Fish and Game (IDFG). Entrainment was evaluated in canals using multiple pass electrofishing depletions in conjunction with a weir. We found that entrainment rates varied widely between diversions. Variations are attributed to seasonal patterns and the physical characteristics of the diversion. We believe that the substantial numbers of fish entrained in some canals may be having a population effect. Our results suggest that the screening of some diversions may provide substantial benefits to the population, while the screening of other diversions may not be warranted when resources are limited.

Effectiveness of Fish Screens to Reduce Entrainment and Losses of Threatened Salmonids into Irrigation Systems on the Lemhi River

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Unscreened irrigation diversions are suspected to pose a threat to the survival of migratory pre-smolt and smolt Chinook salmon *Oncorhynchus tshawytscha* and steelhead *O. mykiss*. Fish screens designed to keep downstream migrating fish from becoming entrained into irrigation ditches have been installed on 98 diversions in the Lemhi River subbasin, a tributary to the upper Salmon River basin. All screens constructed and installed since the early 1990's have been designed to meet National Marine Fisheries Service criteria for screening juvenile salmonids. These criteria provide a means to safely return fish that enter irrigation ditches to the main river channel. In 2003, the Idaho Department of Fish and Game Anadromous Fish Screen Program implemented a study to evaluate fish screen bypass efficiency. The objectives of the study were: 1) document the utilization of fish screen bypasses by juvenile Chinook salmon and steelhead, 2) document the correlation between the timing of the downstream migration of juvenile Chinook salmon and steelhead and the Lemhi River hydrograph, 3) and document the correlation between the rate of entrainment and Lemhi River discharge when instream flows are significantly reduced by irrigation withdrawals. Objectives were met by monitoring fish screen bypass pipes for downstream migrating anadromous smolts and presmolts that had been implanted with Passive Integrated Transponder (PIT) tags in the upper Lemhi River subbasin. Three to four automated PIT tag interrogation systems were installed on various bypass pipes for monitoring throughout the irrigation season from 2003 through 2007 to measure entrainment rates. The highest rate of entrainment occurred during the Chinook salmon smolt spring emigration, with entrainment rates varying from 6% up to 34% on the Lemhi River. A strong negative correlation was noted between the volume of flow measured in the Lemhi River and the rate of entrainment.

A Consumptive-Use Approach to Estimating the Effects of Water Diversions on Streamflow, Upper Salmon River Basin

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Reduced stream flow is a limiting factor for spawning, rearing, and migrating anadromous salmonids in the Salmon River drainage. Irrigation diversions from the Salmon River mainstem and its tributaries are the primary anthropogenic cause of reduced flows in the basin. Under our Endangered Species Act obligations, NMFS has attempted to quantify the effects of this land-use on habitat for salmon and steelhead, as a crucial step towards minimizing adverse effects and prioritizing restoration projects. The effect of diversions on habitat is most apparent in places where tributaries are disconnected from a mainstem river, but there also may be cumulative effects to flows and habitat on the Salmon River itself. However, quantifying the effects of diversions on streamflow in tributaries and mainstem rivers remains difficult due to lack of data on the timing and volume of the diversions themselves and on timing and volume of return flows. In this report we therefore focus on consumptive use, the portion of diverted flows most readily quantified. By using existing data on evapotranspiration rates and irrigation patterns, we calculated monthly consumptive use rates at varying spatial scales within the basin and compared these to measured streamflow values. The greatest consumptive use rate occurs in July when evapotranspiration rates are at their highest, but the greatest ratio of consumptive use to flow occurs in August during baseflows. We found that in late summer, even in drainages larger than 1000 square miles, consumptive use rates can exceed streamflow by as much as 30 times measured flow. The most affected drainages are those in which greater than 5% of total land is irrigated. Effects to streamflow are relatively smaller in high elevation watersheds and on the mainstem Salmon River, but they are still substantial. Habitat in the larger tributary rivers (Lemhi River and Pahsimeroi River) receives the most impact from irrigation diversions because these watersheds have the highest percentage of land-base under irrigation and thus have greatly reduced flows.

Restoration of Aquatic-Habitat Connectivity in Idaho: AOP-Barrier Removal on National Forests Slowed by Economic and Political Challenges

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The Boise National Forest identified over 350 road-stream crossings that are barriers to aquatic organism passage (AOP) through three years of comprehensive inventories using the San Dimas protocol. Habitat-based prioritization indicates that the top 200 identified barrier culverts collectively block access to over 690 stream miles within the historic range of native salmonids. In the four years following the inventory, the Boise N.F. has replaced six high-priority culvert barriers with structures designed to provide AOP through natural stream simulation. Implementation of these six projects restored access to 25.5 miles of stream habitat at a total cost of $715,000. Approximately 40% of the implementation funding for the six completed projects came from external sources (partnerships/grants). As this experience demonstrates, AOP restoration at road-stream crossings on National Forests relies on a substantial mix of internal and external funds. Although there are numerous potential external funding sources available to support AOP restoration at road-stream crossings, most require a substantial funding match, and many require a non-federal match. Sources of non-federal funds for AOP restoration are relatively few, and vary by state, which limits the ability of National Forests in certain areas to compete for restoration funding. Furthermore, Forest Service budget direction and primary purpose rules stipulate that only specific Engineering budget line items (BLIs) can be used to fund work on Forest System Roads, and prohibit use of Fish and Wildlife program funding for this work. Fish and Wildlife program funds can be used for planning AOP restoration, but not implementation. Forest Service appropriations in both programs have declined over the last five years. The resulting fiscal and policy environment hinders AOP restoration on National Forests in the intermountain west.

Movement, Migration and Spawning Patterns of Adult Trout in a Dammed and Diverted Section of the Henrys Fork

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The lower Henrys Fork of the Snake River below Chester Dam is affected by numerous low head dams that serve seven large irrigation diversions. Above Chester Dam there are over 600 trout per mile, mostly rainbow trout. Whereas below all the dams and diversions the number of trout is greatly decreased, despite seemingly healthy and complex fish habitat, and consists of mostly brown trout. The objectives of this project are to: 1) evaluate if adult trout are able to move and migrate among the many fragmented reaches of the river created by the low head dams; 2) compare spawning patterns between rainbow trout and brown trout; and 3) assess habitat limitations, if any, within and among river reaches. Seventy-one adult rainbow trout were radio-tagged among the river reaches, beginning in winter 2006. Spawning movements for most of the rainbow trout were made to downstream areas within the same river reach. Spawning areas were typically associated with midstream islands and side channels. A number of rainbow trout moved downstream below a dam and two passed upstream of a dam. Twenty brown trout were radio-tagged in autumn 2007. Spawning movements for brown trout were both upstream and downstream of their tagging locations. Brown trout spawning areas were typically along the river margins and associated with overhead cover. One brown trout has moved downstream of a diversion dam. To date, three radio-tagged trout have been harvested by anglers; two of these fish were caught within irrigation canals. The project is ongoing and one more round of brown trout are planned to be radio-tagged in 2008. Fisheries management implications may include establishment of upstream fish passage at dams, reconnection of river fragments limited by specific habitat features, and an assessment of fish entrainment mitigation opportunities.

SESSION 6: STREAM ECOLOGY

Juvenile Chinook Salmon Microhabitat Use, Availability, and Selection in a Central Idaho Wilderness Stream

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Chinook salmon *Oncorhynchus tshawytscha* have declined throughout much of their range in the Pacific Northwest. The Big Creek drainage, a tributary to the Middle Fork Salmon River (MFSR), is located in the Frank Church River of No Return Wilderness and offers some of the least anthropogenically disturbed rearing habitat for age-0 Chinook salmon. Within the Big Creek drainage there are substantial size, density and survival differences between age-0 chinook in upper Big Creek when compared to salmon in lower Big Creek. Habitat use and availability were measured at each study site in Big Creek; water depth, water velocity, substrate, and cover were the habitat characteristics measured. During snorkel surveys, 125 age-0 Chinook salmon were observed for habitat use measurements. Habitat availability measurements were recorded from 280 transects located throughout the Big Creek drainage. Juvenile Chinook habitat use was similar to other reported values for Chinook salmon in the Pacific Northwest. Sand and gravel substrates, low velocity (< 0.30 m/s) water, and pool habitats were selected for in this study. Upper and lower Big Creek microhabitat characteristics differed statistically; upper Big Creek was narrower, with slower velocity water and shallower water depths, more pool habitat, and more gravel substrates. Linear regression was used to show that as juvenile Chinook salmon grew, they used increased total water depths ($R^2 = 0.69$), increased focal water depths ($R^2 = 0.70$), and increased focal velocities ($R^2 = 0.42$). Identifying habitat selection for age-0 Chinook salmon will help fisheries managers in the conservation, restoration, and quantification of suitable rearing habitat for juvenile Chinook salmon throughout their range. Microhabitat use and availability differences between upper and lower Big Creek may also partially explain differences in size, density, and survival between the two reaches of Big Creek.

The Relative Roles of Biotic and Abiotic Factors in Determining Growth of Juvenile Chinook in an Idaho Wilderness Stream

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Food consumption is among the most important determinants of fish growth and survival. Variable foraging opportunity and success, intervened by many biotic and abiotic factors, can contribute to growth disparities. In the Big Creek watershed of central Idaho there are notable size, density, and survival differences between populations of juvenile Chinook salmon in the upper versus lower reaches of the drainage. With the broad objective of describing causes of variable growth, we focused on aspects of juvenile Chinook trophic ecology—including the prey resources, consumption, behavior, and spatio-temporal distribution of foraging animals—to explain effects of foraging on size differences. Observations of juvenile Chinook behavior were made during snorkeling surveys in two study reaches in upper Big Creek and one lower Big Creek reach. We surveyed every six hours over a 24-hour period on four occasions through July and August 2007, with an additional 5 daytime surveys in the same period. Chinook were observed for approximately five minutes to record foraging strikes, strike destination, foraging radius, and number and nature of aggressive interactions. Simultaneously, we estimated fish size and neighbors. After fish were observed they were collected, sized, and sampled for stomach contents. Macroinvertebrates were collected to quantify food availability. We weighed stomach contents to determine daily ration, and characterized juvenile Chinook food webs through stomach content analysis and stable isotope analysis. We also recorded the site-specific thermograph to consider effects of thermal regime on metabolism and activity. We observed differences both in size and density of juvenile Chinook between sites in upper versus lower Big Creek. Data suggest that size characteristics play a significant role in foraging behavior, which may contribute to variable growth. We have identified temperature as a major component of this variation and are in the process of analyzing macroinvertebrate and food web data to address the relative importance of biotic interactions in determining growth and survival.

Factors Influencing the Use of Side Channel Habitat by Westslope Cutthroat Trout

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Cutthroat trout in the North Fork Coeur d'Alene River have been found to use side channel habitat as a cold water refugia during hot summer months. We attempted to determine the characteristics of side channels that maintained cold water and supported high densities of cutthroat trout. Data collection included temperature monitoring, weekly snorkel surveys and habitat inventories. Data were collected in 26 reaches from 21 different side channels and 9 reaches in the mainstem of the North Fork Coeur d'Alene River. Of the 26 side channels surveyed, about 15% had adult cutthroat trout densities above 0.3 fish per 100 m^2, with a peak density of about 2.1 fish per 100 m^2. In contrast, the main river surveys resulted in about 22% of the reaches with adult cutthroat trout densities above 0.3 fish per 100 m^2, with a peak of about 0.4 fish per 100 m^2. About 62% of the side channels had maximum average weekly temperatures below 17° C, whereas 0% of the main river locations had maximum average weekly temperatures below 17° C. Robust regression modeling predicted that adult cutthroat trout densities in side channels were influenced mostly by the ratio of maximum depth to bottom temperature, available run habitat, and water visibility. Multiple regression modeling predicted water temperatures in side channels are influenced by the location of the side channel in the floodplain, substrate composition in the channel, and riparian vegetation levels. Identifying characteristics of thermal refugia used by trout will aide in management and restoration efforts to protect and restore suitable side channel habitat for cold water fish species.

Floodplain Contributions to Basal Resources and Retention in Montane Rivers: Comparison of Dredge-Mined to Reference Segments

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River-floodplains are thought to be hotspots of productivity, yet few studies have quantified their contribution to fueling montane river ecosystems, or the consequences should their connectivity be lost. During summer-fall 2006, we compared availability and retention of the basal resources (aquatic primary producers and allochthonous inputs) that fuel the production of aquatic invertebrates and fish, in five reference-condition floodplains and a dredge-mined floodplain segment in the Salmon River basin, central Idaho. The dredged segment has a simplified channel and limited riparian vegetation, thus we hypothesized it would support less periphyton, receive fewer allochthonous inputs, and retain less organic matter. We observed that the total biomass of chlorophyll *a* in the main channel was actually higher in the dredged versus reference segments, though filamentous forms dominated in the dredged segment. Allochthonous input was greatest to reference segments, yet fluxes to the dredged segment were within the range of reference values. In contrast, estimates of potential surface (via leaf-release) and subsurface (via NaCl tracer) organic matter retention indicated reference segments had more than five-fold greater retentive capacity. These measures will be combined with estimates of invertebrate biomass and production and fish abundance and production, in an attempt to quantify the importance of intact river-floodplains and the potential for restoration of impaired floodplains in this region.

Comparison of Benthic and Emergent Insect Community Composition Affected by Wildfires of Varying Burn Severities

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Wildfire is an important natural disturbance that can create different habitat patches in streams. Newly disturbed habitats are recolonized by stream insects, opening the possibility for changes in the aquatic insect community composition following wildfire. Disturbance adapted taxa including *Baetis* and Chironomidae, *r*-strategists that produce many cohorts each year, may be favored over others in streams following wildfire. We conducted our comparative study to examine the mid-term effects of wildfire on invertebrate community composition through the use of both benthos data collected once in July and emergence data collected during the spring, summer, and early fall of 2005 in 2^{nd}-3^{rd} order stream reaches with varying fire histories, within a central Idaho wilderness watershed. We designed this study to investigate three hypotheses: (a) wildfire would result in a shift in aquatic insect community structure to include more *r*-selected primary consumers, (b) primary consumer productivity would increase as a result of more *r*-selected individuals following wildfire, and (c) greater prey resources would lead to increased production of invertebrate predators following wildfire. We observed differences in community composition of both benthic and emergent communities. Furthermore, we observed differences in total biomass of both benthos and emergence, with sites that experienced high severity wildfires having the greatest total biomass. The primary consumers *Baetis*, Chironomidae, and Simuliidae contributed most to greater emergence from high severity sites and were also a greater prey resource for invertebrate predators within the benthos. Consequently a greater biomass of insect predators also emerged from high severity burn sites. Our results show that wildfire may lead to increased production by aquatic primary consumers, a result that propagated to higher levels of the food chain within the stream.

Do Nonnative Brook Trout Exhibit Higher Density, Biomass and Annual Production than Native Cutthroat Trout? A Call for Meta-Analysis

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Brook trout *Salvelinus fontinalis* are the most widely distributed and abundant nonnative fish in the western U.S., invading most small streams to which they have gained access. They have excluded cutthroat trout *Oncorhynchus clarkii* from much of its native range, and along with habitat degradation are the leading causes of cutthroat trout decline. Brook trout have been observed at higher densities than cutthroat trout in Rocky Mountain streams. Two differences between brook trout and cutthroat trout may contribute to the dissimilarity of their densities. First, brook trout are capable of becoming sexually mature at an earlier age than cutthroat trout, thus brook trout may have positive population growth and occur at higher densities. Second, brook trout spawn in the fall, whereas cutthroat trout spawn in the spring. Hence, cutthroat trout fry emerge later in the growing season than brook trout fry. This size advantage can increase over-winter survival of brook trout and the size range of benthic insect prey they can consume, which could lead to greater density and biomass of brook trout versus cutthroat trout. If brook trout do exhibit a greater density and biomass than cutthroat trout, then their annual production may be greater as well. Therefore, we hypothesize that streams with brook trout have greater trout density, biomass, and production than streams with cutthroat trout across the historical range of cutthroat trout. To address these hypotheses, we have begun a meta-analysis. Data from streams within Idaho and Colorado show a consistent pattern of brook trout with higher fish density, biomass, and estimated production than those with cutthroat trout, regardless of region. However, to fully address these hypotheses additional data are needed. Here we describe the approach and expected outcomes of this meta-analysis effort, with the aim of recruiting additional datasets from the region.

SESSION 7: RESIDENT NATIVES

Abyssal Oasis: A Deeper Look into Lake Pend Oreille Fishes

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Lake Pend Oreille was created by glacial floods during the last ice age and is the 5th deepest lake in the United States with a maximum depth of 357 m. To our knowledge, this study is the first attempt to survey the fish populations that occur at depths below 305 m. This deep water region was surveyed using split-beam hydroacoustics. We estimated an average fish density of 0.17 fish/ha with sizes ranging from -50 dB (50 mm, our minimum setting) to –34 dB (377 mm). This density estimate is thought to be a minimum due to the difficulty of measuring fish near the bottom, but if expanded would equal a population of 1,200 fish at depths below 305 m. Fourteen gillnet sets, with attached minnow traps, were placed in this deep water area. Three bull trout, two pigmy whitefish, and one slimy sculpin were collected, all of which are species native to the lake. Finding that native species occur at the bottom of the lake, shows that this region is an important habitat to protect.

Evaluation of Recovery Goals for Endangered White Sturgeon in the Kootenai River, Idaho USA

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Our objective was to evaluate recovery goals for endangered white sturgeon *Acipenser transmontanus* in the Kootenai River, Idaho. We used demographic statistics for white sturgeon in the Kootenai River in a stochastic density-dependent population model to estimate recruitment rates needed for population recovery. We simulated future abundance of white sturgeon in the Kootenai River over a 25-year period and a range of hypothetical recruitment rates to estimate the level of recruitment that would lead to population recovery (7,000 fish, the number that were present before the population suffered recruitment failure). We compared simulations of future abundance at enhanced levels of recruitment to those based on the present status of the population and to the recruitment criterion in the Kootenai River White Sturgeon Recovery Plan. We found that the population would decline to only 57 individuals after 25 years and 6 individuals after 50 years if recruitment failure continued. The population reached the target carrying capacity of 7,000 individuals within 25 years only when each adult produced 0.4 age-1 recruits, a recruitment rate equivalent to reaching the target level of recruitment in the recovery plan every year. In contrast, the population grew to only 1,200 individuals if the target level of recruitment in the recovery plan was produced in only three of every ten years, as specified in the recovery plan. We recommend that recovery goals for white sturgeon in the Kootenai River be modified as follows: (1) a population goal of 7,000 sub-adults and adults; (2) population recovery within 25 years; and (3) a minimum recruitment rate of at least 20 age-1 juveniles detected from each year class in each of 10 years using a standardized monitoring protocol.

Preliminary Investigations of an Egg Release to Determine Environmental Requirements for Successful Spawning and Recruitment of Kootenai River White Sturgeon *Acipenser Transmontanus*

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In 2005 Idaho Fish and Game and the Kootenai Tribe of Idaho conducted an experimental egg release with Kootenai River white sturgeon. Lack of clean substrates due to decreased velocities may be a limiting factor in Kootenai River white sturgeon recruitment failure. The purpose of the egg release was to determine environmental conditions in the field that enable successful egg hatching and larval recruitment. In 2005 over one million fertilized eggs were released at four sites above Bonners Ferry that closely resembled sites of other successful white sturgeon spawning populations. Larval white sturgeon sampling was conducted using D-ring or conical ½ meter plankton nets below release sites to determine hatching success. No early life stage sturgeon were captured. Failure to capture larval white sturgeon could have been due to poor site conditions or low numbers that may have made collection difficult in a large river.

An Abundance Estimate for Redband Trout (*Oncorhynchus Mykiss Gairdneri*) in the Upper Spokane River, Washington

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We conducted a mark-recapture study to estimate the abundance of redband trout in the upper Spokane River from the WA/ID State Line to Plantes Ferry Park (Rkm 155.1 – 136.2) in October 2007. Over the course of three passes, we captured 328 trout during both day and night periods with a drift boat outfitted with an electrofishing unit. Trout were weighed, measured (TL), fin-clipped, and marked with Floy® tags then released. Data from the first two passes were pooled to provide the initial mark occasion and the third pass comprised the recapture occasion for the analysis. We estimated the abundance of redband trout using the Darroch model (M_t) with Program Capture. Our abundance estimate was 1149 redband trout (95% C.I. 859 – 1600, C.V. 0.16) > 200 mm TL, which was lower than previous estimates. Previous studies produced density estimates of 336 – 2409 redband trout per kilometer in the upper Spokane River in Washington and Idaho (Bailey and Saltes 1982; Bennett and Underwood 1988). Our density estimate was 61 redband trout per kilometer. Causes of the apparent decline in abundance of redband trout since the 1980's are unknown and require further study. We are also uncertain whether the abundance of redband trout has declined in the Idaho reach.

Wood River Sculpin Distribution, Abundance, and Life History Characteristics in Idaho

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The Wood River sculpin *Cottus leiopomus* is endemic to the Wood River Basin in central Idaho and is a species of special concern because of its limited distribution, but little is known of this species. We used backpack electrofishers to assess their distribution, abundance, and life history characteristics, and sequenced mitochondrial DNA to investigate genetic variation. Wood River sculpin were present at 20% of the study sites, including 50, 15, and 0% of the sites predetermined to contain, possibly contain, or not contain them, respectively. Comparatively, native redband trout *Oncorhynchus mykiss* were present at

21% of the study sites, including 90% of the sites that contained Wood River sculpin. The presence of Wood River sculpin was positively associated with stream width:depth ratio and percent cobble/boulder substrate and negatively associated with stream gradient. Mitochondrial DNA haplotype differences were observed between and within three major river subbasins, with the most striking difference observed between populations in the Camas Creek subbasin and the other two subbasins, in which no haplotypes were shared, suggesting relatively long-term isolation. Most fish were estimated to be age-1 (16%), age-2 (33%), age-3 (30%), and age-4 (12%), and < 2% were older than age-5. Total annual survival rate averaged 66% and ranged only from 56 to 70%. Wood River sculpin reached 60 mm by age-2 and reached 100 mm at around age-4. Sex ratio was near 50:50 for most populations. Fecundity ranged from 38 to 314 eggs and formed a linear relationship with fish length ($r^2 = 0.67$). Almost all Wood River sculpin age-3 and older were mature, regardless of gender. No age-1 fish were mature, and no age-2 males were mature, but 83% of age-2 females were mature. We estimated that females transitioned from immature to mature at about 55 mm and males at about 60 mm.

Tracking Fluvial Cutthroat Trout Movements in the Bear River with Stable Isotope Markers

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Movement between environments is a common phenomenon across taxa because it allows individuals to match their phenotype to the biotic and abiotic conditions that maximize fitness. However, biologists and managers did not consider movement between distinct habitats important for stream-resident fishes until recently because field methods and monitoring favored relocating immobile fish or fish large enough for tags. As a result, little is known about the frequency of movement in stream fishes and the critical locations that fishes move to within a stream network. We used nitrogen stable isotope analysis to provide precise information about individual movement patterns and frequency for Bonneville cutthroat trout (BCT; *O. clarkii utah*) in the Bear River. We combined site-specific and trophic level-specific N isotopic signatures of BCT to estimate the frequency of movement to downstream environments and to differentiate between fluvial and resident individuals.

SESSION 8: STREAM RESTORATION

Restoring Kootenai River (Idaho) Fisheries Through Nutrient Enhancement

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Libby Dam and Lake Kookanusa (western Montana) are responsible for the depletion of nutrients and the decline of primary productivity in the Idaho portion of the Kootenai River. The Kootenai Tribe of Idaho and the Idaho Dept. of Fish and Game began adding inorganic phosphorous (P_2O_5; 0.3 L/min) July 13, 2005 to the Idaho portion of the Kootenai River to stimulate productivity and reverse downward trends in resident fish populations such as trout, kokanee, mountain whitefish, burbot, and white sturgeon. A target concentration of 1.5ug P_2O_5/L (following dilution) was used to stimulate primary productivity. This concentration was increased to 3.0 ug/L the following two seasons to maximize growth in the river. Ambient nitrate (NO_3) concentrations stayed well above 85 ug/L during the application seasons, so nitrate additions were not necessary. Within 21 days, algal growth was visually apparent on near-shore substrates that were within 200 meters of the application pipe (areas previously void of growth). All trophic levels have shown significant increases in biomass and density since the treatment began. Mean cumulative algal cell density of chlorophyta (green algae) at treatment sites were 1425 (cells/mm^2) as compared to control groups at 33 (cells/mm^2). Similar increases were seen in the macroinvertebrate community, where treatment locations increased densities by a phenomenal 15,000 insects/m^2 from pre-treatment years. The majority of the increase in biomass was represented by caddisfly and stonefly species in the upper canyon reach closest to the nutrient release location. Current relative weights mountain whitefish, large-scale sucker, and rainbow trout have also increased. Total fish biomass in a sample reach approx. 20 rkm form the addition site increased by 2 – fold in the 3 seasons of nutrient additions. Fish densities for all species are expected to show even greater increases within the next couple of seasons with increased recruitment from higher fecundity and better over-winter survival of younger year classes.

Benewah Creek Temperature Dynamics in Relation to Native Westslope Cutthroat Trout Requirements

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The Coeur d'Alene Tribe's Fisheries Program is focused on improving the westslope cutthroat trout fishery in Benewah Creek, a tributary of Coeur d'Alene Lake. Low densities are present in the mainstem of Benewah Creek compared to its tributaries. Currently, a multi-year restoration project is being completed along three miles of the mainstem that has become incised and degraded. The goal of this restoration work is to reconnect the stream channel with its floodplain and increase the quality of rearing habitat. We hypothesize that this work will decrease mainstem stream temperature and increase thermal refuge. A study was developed to 1) gather baseline temperature data throughout the watershed and determine how often thermal requirements are met and 2) examine the response of stream temperature to restoration activities. Stream temperature has been continuously monitored at sites along the longitudinal profile of upper main stem and three tributaries since July of 2005. Water temperature was continually monitored at 24 sites within the watershed using Hobo temperature sensors. In addition, discrete measurements were taken in pools and riffles above, below, and within the restoration area during summer months. Air temperature was also monitored at 3 sites. Thermal requirements were determined from Bear et al. 2005. Preliminary results showed that mainstem temperatures are within the optimum growth range 49% to 75% of the time but are not lethal to westslope cutthroat trout. Tributary temperatures were found to be within the optimum growth range nearly 100% of the time. Cold springbrooks were also found to be present throughout the floodplain but their contribution to stream temperature is likely reduced due to lack of floodplain connectedness. In the restored sites, thermal refuge was increased through the creation of deeper pools. Future work includes analyzing the data to detect the effectiveness of restoration.

Yellowdog Downey Watershed Restoration Project, its Effects on Channel Condition, Water Quality, and Fish Habitat

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In 1994 an Environmental Analysis was conducted on the Yellowdog and Downey Creek watershed. As late as 1937 the Yellowdog Downey project area was virtually unroaded and minimal timber management had occurred within either watersheds. By the 1950's human influences from road building and timber harvest were evident on the landscape. By 1994, approximately 7500 acres (61%) in the two watersheds had been treated by some method of timber harvest A total of 164 miles of road were built in the two watersheds resulting in very high road densities, >10 miles/$mile^2$. Both watersheds had roads within the flood plain and in some cases constricting the stream. Roading in the riparian zone, unstable channel crossings and riparian zone harvest have contributed to poor channel conditions and water quality. In

1996 the Department of Environmental Quality (DEQ) conducted an evaluation of the Yellowdog Creek and it was placed on the 303 (d) list as impaired because of sediment in 1998. Downey Creek was not evaluated and was not listed. In November of 2001 a TMDL was completed for the North Fork Coeur d'Alene river watershed. Both Yellowdog and Downey Creeks were determined to have sediment levels that negatively affected beneficial uses and TMDL's were assigned to each stream. Numerous opportunities existed in Yellowdog and Downey Creek watersheds to restore natural channel function and initiate trends toward a healthy watershed condition. Watershed restoration work was completed from the summer of 2002 to the summer of 2006. Hillslope road removal and headwater channel restoration used techniques as described by Moll et al (1996). Riparian road removal utilized similar techniques, except in some areas fill was end hauled out of the flood plain. Standard restoration structures as described by Rosgen were used. Woody debris was placed based on field experience of project stream ecologist and an artistic appreciation of stream restoration. Woody debris loading was based on monitoring data and what "fit" on the ground. Our data shows how restoration work has directly affected stream channel and fish habitat conditions. We have decreased channel entrenchment, increased flood plain width, increased pool numbers, pool volumes, and large woody debris loadings. Our modeling efforts show the benefits of road and in-channel restoration work and how they relate to meeting total maximum daily load allocations (TMDL's), watershed recovery and the removal of the watersheds from the 303(d) water quality impaired listing for sediment. We did experience some problems during project implementation with meeting water quality standards for turbidity. Three areas were selected for long term monitoring within the Yellowdog watershed. Our monitoring techniques used permanent sites based on recommendations from Roper et al (2003).

Integrating Fish, Forests, and Fire to Define Restoration Opportunities and Conservation Priorities in the South Fork Boise River, Idaho

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Forest lands are managed for multiple uses which translate into conflicts among resource management objectives. In the last two decades the role of federal lands in the conservation of sensitive species has become increasingly important, often resulting in conflicts with resource extraction, recreation, and growth of the wildland-urban interface. The potential for uncharacteristic wildfire represents a danger to all uses of forest lands. Our objective was to integrate information on current conditions, potential threats, and distribution of humans and bull trout to identify engineered, maintenance, and restoration habitats in the South Fork Boise River. Engineered habitats, such as WUI, are areas where management objectives do not include natural disturbances, such as wildfire. Maintenance habitats, on the other hand, are areas in relatively pristine condition in which human intervention in natural disturbance processes is unwarranted. In between these ends of a fire-tolerance spectrum are restoration opportunities where terrestrial, aquatic, or both components of the forest require attention in order to accommodate fire and post-fire disturbances. We classified 56% of the SFBR as maintenance habitat, based on terrestrial vegetation conditions. Engineered habitat was concentrated within WUI. We found most terrestrial restoration opportunities could be facilitated by existing roads and that fish habitat networks were largely resilient to disturbance. In situations where fish networks were likely to go extinct in the next two decades, resilience could typically be conferred via reconnection to the larger stream network. The results of our analysis suggest all management activities should be concentrated in the western half of the basin in close proximity to WUI and the bull trout habitat in Elk Creek and Trinity Creek. Habitat networks in the eastern portion of the SFBR are large, well-connected, and robust to disturbance suggesting management activity in this area would do little to improve the likelihood of long-term persistence.

Longitudinal Variability in PNW Rivers: Implications for Survey Design

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The riverscape concept favors study of an entire river and a recommended number for probability sampling designs is 50 sites. However a riverscape census of an entire river and a 50 site sample are both daunting undertakings for most institutions, and they limit the number of rivers that can be sampled with limited resources. On the other hand, a handful of samples near bridges underestimates the ecological variability expressed by a large river. We sought to determine the number of sites that would yield relatively precise estimates of ecological condition for raftable rivers 100-200 km long and 20-120 km wide. We used a probability design to select 20 sites on each of two rivers in Washington (Chehalis, Okanogan) and four rivers in Oregon (Willamette, Malheur, Umpqua, Sprague). We selected rivers to include those draining cold deserts, dry and wet forests, and agricultural plains. All sites were sampled by a four person crew from two rafts. Crews collected physical and chemical habitat and fish and macroinvertebrate assemblage data at each site through use of EMAP-West methods. The reach length for each site was 50 times the mean wetted width of the channel, and crews sampled 1-2 sites per day depending on site size and the distance between sites and access/egress locations. The data indicate considerable ecological change among upper and lower sites in some rivers and little in others, as well as variability in biological assemblages associated with local changes in macrohabitat types. Based on preliminary analyses on these six rivers, our data suggest a high degree of spatial autocorrelation between sites that are < 10-40 km apart, and we observed no marked changes between adjacent sites. This autocorrelation needs to be considered when designing river monitoring surveys.

SESSION 9: TECHNIQUES

Effects of 8.5 mm Passive Integrated Transponder Tags on Juvenile Chinook Salmon Survival and Growth

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Application of 12 millimeter Passive Integrated Transponder (PIT) tags represents a commonly used procedure for mark-recapture studies for anadromous salmonids, yet the use of the 12 millimeter tags have generally been restricted to fish >65 millimeters. The recent development of an 8.5 millimeter PIT tag provides a means to tag younger, smaller salmonids, however effects of the tag have not yet been tested. The purpose of our study was to measure instantaneous and delayed mortality of juvenile spring/summer Chinook salmon Oncorhynchus tshawytscha following implantation of an 8.5 mm PIT tag, and to assess differences in growth and condition factor between three different size groups of fish that received three different treatments; PIT tags, punctures only (no tag), or those that were anesthetized only. Results showed a lack of tag-related mortality across any of the groups of fish. Tag loss was higher in smaller fish and was influenced by tag placement. Neither growth nor condition factor appreciably differed between treatments. These results, provided there is strict adherence to tagging protocols, provide support for use of the 8.5 millimeter PIT tag in fish as small as 46 millimeters.

Development of a PIT-Tag Detection Array for the John Day River to Monitor Straying Snake River Adult Salmon and Steelhead

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Straying rates are an essential adjustment factor to adult survival estimates used to evaluate whether the adult salmonid Federal Columbia River Power System Biological Opinion survival goals are being met. Currently, radio-telemetry is the only methodology used to obtain straying rates. Mean values from the years of radio-telemetry studies can be used as a correction factor for assessing adult performance, but that would not reflect any annual variation that might normally occur. An alternative is to develop tributary PIT detection systems that can give us annual estimates of straying. The goal of this project is to evaluate the feasibility of using PIT-tag systems to estimate straying rates in large tributaries. The project was initiated in spring 2006 and comprises several phases: site selection, scour analysis, permitting, antenna design, fabrication, and installation, and data collection and analysis. We collected hydrologic and bathymetric data in December 2006 and deployed "dummy" antennas at the site in February 2007 to evaluate potential scour of similar structures. Electrical and mechanical antenna design and test phases were executed in spring and summer 2007 with installation of the antennas in September 2007. Two 60 ft long arrays, each consisting of 3-20 ft antennas, were installed the week of 17 September 2007. The two arrays are separated by 30 ft; each extending into the river channel from the right-bank. Twenty-nine steelhead were detected by early November 2007. Sixteen of the detected fish were from the John Day River and thirteen of the detected fish were from the Snake River; two fish were detected twice. We will continue monitoring the site for PIT-tagged fish and evaluate its durability and performance during spring 2008.

Efficacy of Calcien as a Fish Mass-Marking Tool

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Calcein, a flourochorme dye, has been used as a mass-marking technique for larval and postscale developmental life stages of various fishes. The process involves the submersion of fish in alternate salt and calcein bathes for a total of 7 minutes. The mark, (flourenscent green) can be detected by external observation without requiring sacrifice of fish. However, it is degraded by ultraviolet (UV) light and covered rearing of hatchery fish is recommended to enhance the mark retention and exterior detection. We tested mark retention of fish marked with calcein on two test groups of rainbow trout marked as post swim-up fry (6160 fish per kg or 2795 fish per pound). One group was reared indoors with no UV exposure. The second was reared outside with full UV exposure. We tested the mark retention on the exterior of fish and on otoliths observed under microscopic inspection. After 200 days of rearing, the external mark was not detectable on fish reared in full sunlight and only partially detectable on fish reared indoors. The mark on the otoliths was retained on both groups throughout the entire experiment, although the mark was partially degraded on the fish reared under UV exposure. Based on our results Calcein has promise for mass-marking hatchery reared salmonids including the application of multiple marks. We applied a single mark to 58,000 fry in 2 hours. However, the technique has several drawbacks: 1) the drug is still in the research phase and can only be applied through an INAD permit issued by USFWS, 2) a secondary, external mark must be applied to identify marked fish for future otolith evaluation, 3) the process was labor intensive, requiring 15-25 minutes per fish for otolith extraction, mounting, surface grinding, and microscope inspection. For external mark detection rearing under covered conditions is required and the mark degradation will occur in the natural environment over 6 months or longer time periods. Marking of larger fish, closer to the time of release, can minimize mark degradation for hatchery fish, but will require more calcein and more marking time due to smaller fish lots per bath.

An Overview of Otolith Microchemistry: Its Application, Utility and Potential for Addressing Statewide Issues in Fish Ecology and Management

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Otolith microchemistry is now regularly employed in fisheries sciences to address questions about the movements, natal origins and life history variation of fish. Despite the increased use and expanding utility of otolith microchemistry, the applicability of this approach is not universal and varies depending upon the questions being asked. In order to use the chemical signatures in otoliths to answer questions about fish movements and origins, one must consider issues of environmental variability, the temporal and spatial scale of variation, and the limitations on the confidence of spatial classification. In this talk, I will discuss preliminary data from 3 different projects addressing varied fisheries issues in the state of Idaho. With collaborators from across the region, we are working on projects that address the timing and source habitats for salmon. By way of these projects, I will provide an overview of the questions that are being addressed with otolith microchemistry and the general strengths and limitations of this approach in freshwater systems. I will compare the spatial variability and discriminatory ability of our regional studies to comparable datasets in the Great Lakes, the Colorado River, the Connecticut River and Trondheimsfjord, Norway in which I have attempted to apply otolith microchemistry to distinguish among source populations. For each of these studies, I have sampled water and resident fish otoliths at multiple spatial scales, and have quantified both elemental concentrations and Sr isotope ratios in source material. My results describe the geologic conditions that drive variations in freshwater geochemistry and the predictability with which this determines variability in otolith microchemistry. Finally, I compare how these results compare for elemental and Sr isotopic ratios.

Building the Virtual Museum: Using Digital Photography to Document Fish Populations for Conservation and Education Purposes

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Museums warehouse preserved biological specimens as reference for species descriptions and as a record of their distribution. Digital photography offers an additional level of information by compiling large databases of morphological data that can be used to quantitatively compare both inter and intraspecific variation. In this presentation, I describe how digital images can be used to document morphological variation among fish populations, and how such images can be used to develop diagnostic measures both within and among fish species. Unlike traditional museum collections, digital collections can be made non-lethally and can be disseminated via electronic copies. In addition, digital images can also be used to create visual keys of critical morphological characters that can diagnose species-specific differences. For closely related species that are difficult to tell apart and are rarely observed by biologists, images that point out critical features on live specimens can be an invaluable tool for people that encounter an unfamiliar fish species. I provide an example of how digital images can be used to create a simple dichotomous field key to distinguish sucker species (Catostomidae) in Idaho, a commonly distributed, but poorly studied, group of fish.

POSTERS
(Abstracts in Alphabetical Order by Senior Author's Last Name)

Initial Findings of the Potlatch River Steelhead Monitoring and Evaluation Project

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In recent years the Potlatch River drainage has come under additional scrutiny given its habitat restoration potential and wild steelhead resource. The Idaho Department of Fish and Game monitoring and evaluation project in the Potlatch River is attempting to establish baseline levels of steelhead population production and productivity. Pacific Coastal Salmon Recovery Funds and NOAA Intensively Monitored Watershed Funds have been used to create an umbrella watershed monitoring effort within the Potlatch River drainage. The main objective of the project is to determine changes in steelhead population dynamics related to habitat restoration efforts within the drainage. During the past three years two adult steelhead weirs and one rotary screw trap have been operated in Big Bear and Little Bear Creeks, tributaries to the lower Potlatch River. Combined annual steelhead escapement estimates have ranged from 77-266 adults and annual smolt outmigration estimates have ranged from 9,119 – 14,164 juveniles. Outmigration and in-stream survival rates have been calculated for the population using juvenile steelhead PIT-tagged at the screw trap and summer PIT-tagged fish from tributaries in the lower Potlatch River. Outmigration survival to Lower Granite Dam has ranged from 38-67% and we have estimated in-stream juvenile survival ranging from 34-36% in Lower Potlatch River tributaries. During the 2008 field season the project is expanding into the Upper Potlatch River drainage with additional adult steelhead weirs being operated on the East and West Fork Potlatch River and an additional rotary screw trap on the East Fork Potlatch River. In addition to one PIT-tag array site currently being operated on Big Bear Creek, three additional sites, two in the upper watershed and one on the mainstem Potlatch River, will be added during the 2008 field season.

Genetic Investigations of Bonneville Cutthroat Trout in the Bear River Drainage, ID: Intra- And Interspecific Hybridization/Introgression and Distribution of Mitochondrial DNA Diversity

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Due to substantial reductions in the distribution and abundance of Bonneville cutthroat trout *Oncorhynchus clarkii utah* in the Bear River drainage in Idaho, considerable attention has been focused on better understanding the subspecies' demographic, life history, and genetic characteristics to assist with conservation and restoration purposes. This study focused on two areas of population genetics. To assess the impacts from past non-native hatchery trout stocking on intraspecific and interspecific hybridization/introgression we used a combination of diagnostic nuclear and mitochondrial DNA (mtDNA) markers. To assess genetic population structure we sequenced a highly variable mtDNA gene region that had previously revealed genetic variation within and between populations of cutthroat in the Snake River and Bear River drainages. Based on comparisons to hatchery reference populations, we found little evidence of intraspecific hybridization. Only three non-native mtDNA haplotypes were found among the 750 samples analyzed. Evidence of interspecific hybridization was detected throughout much of the Bear River drainage, but many sites exhibited low levels of rainbow trout introgression (<3%). The confirmation of naturally reproducing rainbow trout populations and the identification of F_1 hybrids indicates hybridization is an on-going problem. Management policies implemented to stock only sterile rainbow trout and to remove existing non-native rainbow trout populations will have to be continued to prevent the further spread and increase of introgression throughout the drainage. Patterns of genetic structuring generally supported previously defined management units indicating both current and historic reproductive isolation of groups of populations throughout the drainage. Managers will have to carefully consider these findings when considering taxonomic assessments, prioritizing populations for conservation and management purposes, identifying suitable populations for translocations, reintroductions and broodstock development programs.

PIT Tag Retention in Stream-Dwelling Resident Redband Trout

Nick Gastelecutto and Brett High
Idaho Department Fish and Game
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Passive integrated transponder (PIT) tags allow biologists to recognize individual fish during routine sample surveys, providing opportunities for the use of more robust analysis tools and techniques than standard rough population descriptors, but tag retention is critical and little information for resident stream-dwelling trout exists in the literature. During the summer of 2006, we PIT tagged 4,694 redband trout *Oncorhynchus mykis*s in 11 streams by intraperitoneally inserting tags and using an adipose fin clip as a secondary mark. These 11 streams were sampled a year later and PIT tag loss rate was quantified by identifying the rainbow trout that were adipose clipped and tagless versus those that had tags. The tag loss rate varied from stream to stream with a high of 56% and a low of 0%. The average loss rate across all 11 streams was 19%. We hypothesized that one of the factors leading to tag loss may have been fish maturing and releasing the tag during spawning, as larger individuals were more apt to lose tags than smaller individuals. Despite the relatively high loss rates of PIT tags in resident rainbow trout, we did recover marked fish in every one of our open study stream sections that had retained PIT tags. We believe PIT tags are a viable option for biologists studying resident redband trout if biologists can accommodate 80% retention rates when deciding necessary sample sizes.

Angler Use and Economics of Urban Fisheries in Idaho's Treasure Valley

J. Lance Hebdon, Jeff Dillon, and Tom McArthur
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Southwest Idaho's Treasure Valley includes the Boise, Meridian, Nampa and Caldwell metropolitan areas and several other smaller communities. Over 500,000 residents, about 35% of the entire state population lives in the Treasure Valley. The Boise River flows through Boise and through or near several other communities. Despite substantial habitat and flow alterations the river provides an important fishery for both wild and hatchery trout and transplanted steelhead trout. A complex of 16 small ponds, Community Fisheries, support warm water and stocked trout fisheries. Many of the small ponds are associated with city parks and other recreational facilities. We estimated >80,000 angler trips in Southwest Idaho's urban fisheries in 2003 with direct expenditures exceeding US $2 million. Angling pressure on Southwest Idaho's urban fisheries averaged >1,000 trips/ha. Average trip cost for the urban fisheries averaged $22 compared to $167 for selected Idaho fisheries. Trip costs for urban anglers were primarily associated with groceries and fishing supplies purchased before the trip. Community Fisheries also provide an opportunity to introduce new people to the sport of fishing with over 3,000 people participating in fishing clinics in the Treasure Valley in 2007.

Hangman Creek Fisheries Enhancement Project: Summary of Assessment Phase

Bruce Kinkead
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The Poster outlines the Coeur d'Alene Tribe's efforts to assess and restore native Redband Trout to Hangman Creek within the Spokane River watershed. Using Bonneville Power funding, as part of the Fish Substitution Policy set forth by the Power Planning Council, the Coeur d'Alene Tribe's Fisheries Program began an Assessment Phase in 2002 to determine native trout: distribution; population estimates; genetic characteristics; physical and chemical habitat conditions and limiting factors; and to implement a Public Outreach Program to gain new partners for future restoration implementation. Fish were sampled using backpack electro-shockers using multiple pass methods and migration trapping using simple upstream and downstream box traps in the tributaries of Hangman Creek, as well as a Resistance Board Weir on the main-stem. Water quality studies were implemented to sample discharge; lab analysis of TSS, turbidity, ammonia, TKN, nitrate, nitrite, Total Phosphorus, Orthophosphate, chloride, fluoride, alkalinity, and bacteria; dissolved oxygen, conductivity, temperature, and pH using a multi-parameter probe sampling; continuous temperature at 24 locations and continuous flow at 4 locations. Rosgen channel typing methods were used to access cross section and longitudinal profiles, canopy, pebble and large woody debris counts. Bank pins and road/culvert inventory were used to identify sources of point and non-point pollution.

The Iron Creek Reconnection and Habitat Restoration Project: A Successful Multi-agency Collaboration in the Upper Salmon Basin

Wendy S. Koons
Upper Salmon Basin Watershed Program
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Iron Creek is a tributary to the main-stem Salmon River, which enters the main Salmon between the East Fork Salmon and North Fork Salmon. Within this reach of approximately 128 river miles, aside from the Pahsimeroi River, there exists a mere three tributaries of significant size and connectivity to provide thermal refuge for anadromous and resident fish species – Iron Creek is one of these three. When connected to the main-stem Salmon, in addition to its cooling temperatures and high quality aquatic habitat, the creek provides a safe haven for anadromous fish to escape several predatory species that inhabit the main river channel. During winter months, Iron Creek remains free of anchor and frazzle ice, which collects in the main-stem, providing a more hospitable rearing environment for ESA-listed species. The Idaho Department of Fish and Game completed intensive habitat surveys of the Iron Creek drainage, finding Chinook parr (Oncorhynchus tshawytscha), as far as 4-miles up the drainage when the habitat is accessible via adequate flow. These surveys additionally recorded high densities of Steelhead/rainbow trout (Oncorhynchus mykiss). NOAA’s National Marine Fisheries Service Critical Habitat Analytical Review Team (CHART) ranked Iron Creek as high for its conservation value. Until recently, however, water withdraws for irrigation regularly disconnected the creek from the river. Typically, this dewatering occurred during the months of August and September when flows in the creek drop as crop needs increase, and river temperatures often reach potentially lethal levels for salmonids – upwards of 70ºF. Through a collaborative effort of twelve federal, state and local conservation and natural resource agencies, and the cooperating landowner, Iron Creek now remains connected to the main-stem Salmon year-round, providing ESA-listed and resident fish species access to the creek’s high quality aquatic habitat. Initial project planning began in 2003, and culminated with the closure of the four lower-most diversions on Iron Creek in 2007. These four diversions accounted for 5.43 cfs (more than one-third of the creeks total water rights), previously withdrawn for flood irrigation. Additional project components included the installation of over 4,000 feet of riparian protection fencing, an off-stream stock-water system, water rights transfer, a substantial three-phase power-line upgrade, and an extensive new and more efficient irrigation system. Grant awards from the twelve partnering resource agencies provided materials and technical assistance, while the landowner provided cost-share through in-kind labor in excess of 2,500 hours. To date, this project is one of the largest conservation and irrigation improvement projects ever undertaken in the Upper Salmon Basin, in terms of cost, inter-agency partnerships, and biological benefits. It is an excellent example of how private landowners, working with resource professionals, can provide opportunities for the benefit of threatened species. The Iron Creek Reconnection and Habitat Restoration Project is expected to serve as a model for future tributary reconnect projects throughout the region.

Kootenai River Model Watershed Project

Gretchen Kruse
Kootenai Tribe of Idaho/ Free Run Aquatic Reasearch
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The Kootenai River Model Watershed project is managed by the Kootenai Tribe of Idaho. The long-term goal of this project is to restore a properly functioning ecosystem that protects the abundance, productivity, and diversity of biological communities and habitat across the watershed. The short-term goal is to restore functioning condition in three lower Kootenai River tributary streams (Trout Creek, Parker Creek and Long Canyon Creek). Restoration objectives, quantifiable objectives, limiting factors, and restoration strategies have been identified for each stream. Baseline conditions in each stream were established by monitoring biological and physical parameters during the initial 4 years of the project. A second monitoring period is scheduled to begin in 2008. Resulting data from the two sampling periods will be compared to determine project effectiveness and impacts of restoration methods. The long-term financial and professional commitment associated with this project has provided the opportunity to identify limiting factors, engage landowners, remain flexible with methods, and provide follow-up to our restoration efforts.

Using Full Parental Genotyping to Determine the Efficacy of Streamside Incubators for Rearing Hatchery-Origin Steelhead Trout Eggs, and Increasing Population Abundance in the Yankee Fork, Salmon River, Idaho

L.P. Denny, K.A. Tardy, and C. Lopez
Shoshone-Bannock Tribes
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The Yankee Fork Salmon River (YFSR), a major tributary to the upper Salmon River, is an important spawning and rearing system for anadromous salmonids, as well an important traditional use area for the Shoshone-Bannock Tribes. Based on the population delineations and viability criteria from the Interior Columbia Basin Technical Recovery Team, the Yankee Fork is underutilized by anadromous species. The Shoshone-Bannock Tribes developed supplementation activities designed to improve viability of natural populations of steelhead to support harvest and improve abundance, productivity, spatial structure, and genetic diversity. Adult steelhead are trapped, spawned, tissue sampled, and incubated at the Sawtooth Fish Hatchery. Once eggs reach the eye-up stage, they are randomized and incubated separately in five stream-side incubators in the YFSR. Eyed-eggs are incubated in river water to ensure natural hatch timing. Three-pass removal electrofishing studies are conducted in twenty-one randomly, stratified reaches throughout the YFSR to collect genetic tissue samples and preliminary density and population estimates. Tissue samples from both 0+ and 1+ age *Oncorhynchus mykiss* are transferred to the Abernathy Fish Technology Center for full parental genotyping to identify hatchery-origin fish outplanted as eggs in the YFSR. Genetic parentage analysis will evaluate the relative abundance of hatchery-origin and natural-origin juvenile steelhead in the YFSR. Relative abundance will be measured as the proportion of parr produced from streamside incubators relative to natural-origin parr encountered in the sample. Proportions will be scaled by the estimated number of eggs planted or produced naturally, and the corresponding egg-to-hatch survival rates. Initial results indicate low densities for overall salmonids (0.080 fish/m^2) and *O. mykiss* (0.060 fish/m^2), well below the suggested 1.0 fish/m^2 for Yankee Fork, although higher than densities observed in 2006. Currently, analyses of length, condition factor, and density of juvenile *O. mykiss* from areas below stream-side incubators appear to indicate that supplementation activities are working.

Testing the Washington Department of Natural Resource's GIS Based Logistic Regression Model Predicting the Upper Extent of Fish Distribution in a Forested North Idaho Watershed

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Fish presence/absence determines stream protection zone (SPZ) dimensions and dictates the type of structures that can be installed at stream crossings. The rules pertaining to Idaho's Forest Practices Act require a 75 foot SPZ on all Class I (fish bearing) streams, a 35 foot SPZ on all Class II (non-fish bearing) streams, and all stream crossings on Class I streams must provide fish passage. For private landowners and land management agencies planning timber sales, stream classification affects timber sale layout; ultimately affecting cost versus revenue. In order to assist with timber sale planning in Washington, the Washington Department of Natural Resources (WADNR), with technical assistance from Weyerhaeuser Corporation, developed and tested a logistic regression model for predicting fish presence or absence in western Washington streams. The model is based on readily available GIS products such as stream gradient, basin size, and basin weighted average annual precipitation. Modeled results were then tested against field verified end of fish points. Results indicate that the model was very close to 95% accurate and spread risk equally between over and under prediction. The success of the western Washington model encouraged WADNR to develop a second model for eastern Washington. The eastern Washington model was tested in the East River drainage in northern Idaho to see if the model "fit" local conditions. Results of this initial test look encouraging, and a second project has been developed to test the model throughout the Idaho Panhandle region.

Implementation of a Model Watershed Approach: Catalyzing a Paradigm Shift towards Long-Term, Scientific, and Adaptive River Restoration

Angelo Vitale[1] and Robin Jenkinson[2]
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The Bonneville Environmental Foundation promotes policy and management shifts that effect the implementation of increasingly scientific, holistic, and accountable watershed restoration strategies through long-term support of a "Model Watershed" approach. Several projects throughout the Pacific Northwest, including the Benewah Creek Model Watershed on the Coeur d'Alene Reservation, and the Kootenai River Model Watershed Project in Boundary County, are now supported through a 10-year commitment of financial and technical support. The projects reflect a collaborative relationship with partners, which are characterized by development of a detailed objectives-based monitoring matrix that synthesizes restoration strategies, hypotheses, and evaluation plans. Most Partners are successfully applying the Model Watershed Approach, including community-driven initiatives, scientific assessment, watershed-scale focus, and long-term adaptive management. In a few cases, watershed groups have experienced staff turnovers, funding shortfalls, and divergent social perspectives that have threatened to disrupt the continuity (and effectiveness) of the established Model Watershed Partnership. In addition, both restoration and monitoring strategies appear to require continuous review and adjustment in order to achieve desired results. The challenges experienced to date have reinforced our assumption that dedicated institutional support and sustained funding for monitoring and evaluation are essential to maintaining an efficient, accountable, and scientific restoration approach.

Implementation Of A Model Watershed Approach In The Benewah Creek Watershed

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The Bonneville Environmental Foundation promotes policy and management shifts that effect the implementation of increasingly scientific, holistic, and accountable watershed restoration strategies through long-term support of a "Model Watershed Approach". Several projects throughout the Pacific Northwest, including the Benewah Creek Model Watershed on the Coeur d'Alene Reservation, are now supported through a 10-year commitment of financial and technical support. In the Benewah Creek watershed, the Coeur d'Alene Tribe has characterized historical and current baseline conditions for physical and biological factors prior to implementing restoration with broad support from federal agencies, private landowners and non-governmental entities. Several goals with measurable objectives and strategies have been developed and are being monitored. These include restoring floodplain connectivity in upper mainstem reaches, increasing thermal heterogeneity, increasing westslope cutthroat trout populations at the reach and watershed scales, and controlling exotic brook trout. The restoration and monitoring strategies have been adjusted and strengthened in response to peer review that has been coordinated as part of the collaborative relationship that characterizes the Model Watershed Approach. The dedicated institutional support and sustained funding for monitoring and evaluation, as well as the flexibility inherent in the Model Watershed approach, is providing substantial benefit toward maintaining an efficient, accountable, and scientific restoration approach.