AMERICAN FISHERIES SOCIETY
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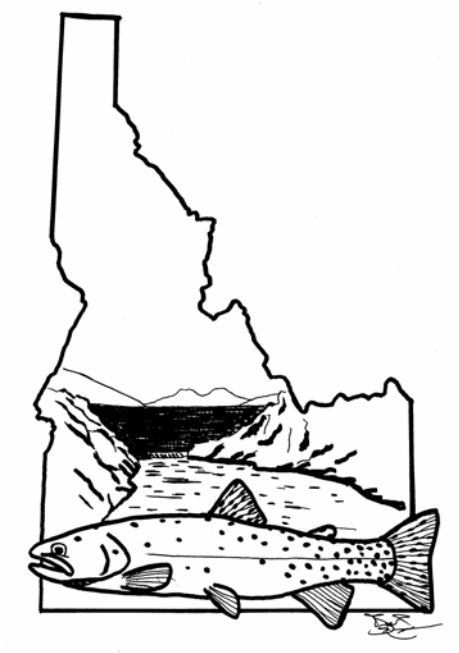
2007 Annual Meeting

Program and Abstracts

Diversions, Dams, and Fish: Understanding and Managing the Impact of Diversions and Dams on Fish in Idaho



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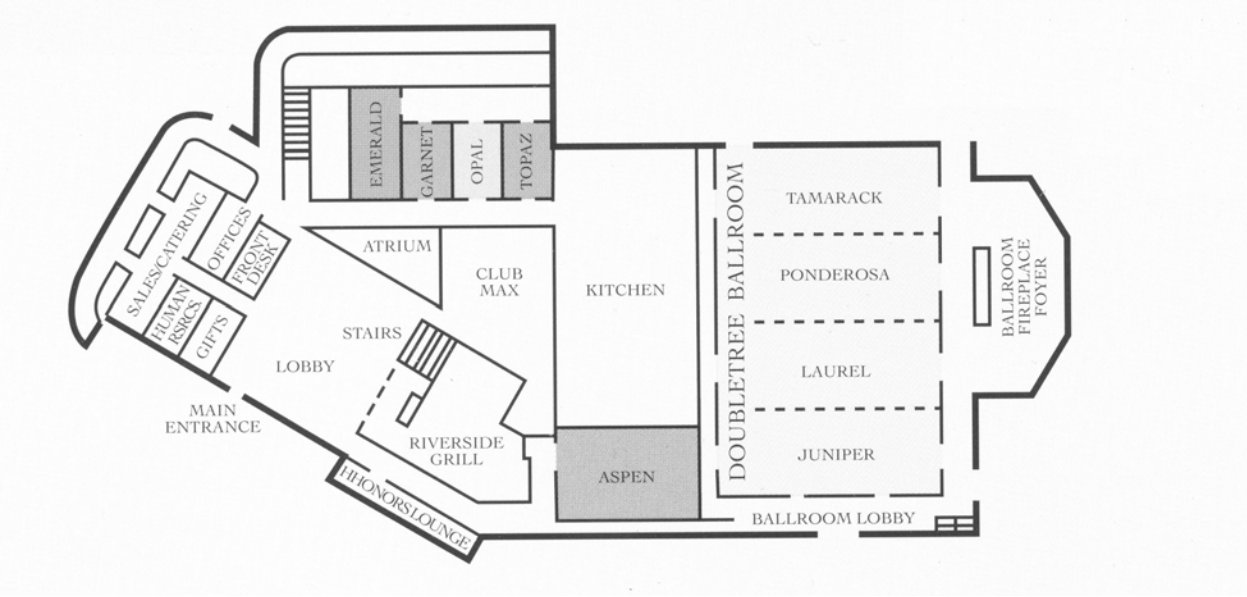
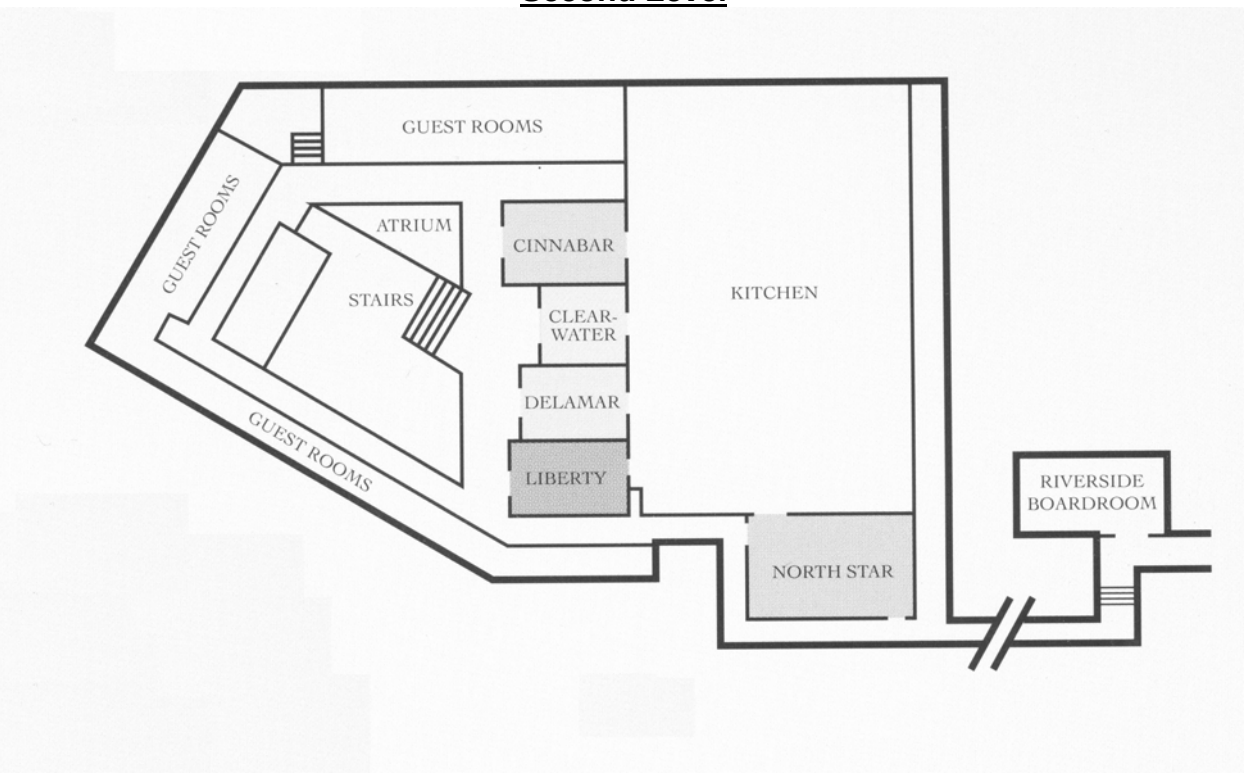
Hotel Map

Lobby Level



Second Level



AGENDA

Wednesday, February 21

7:00–8:00 AM Light Breakfast Foods and Beverages (Convention Center Lobby)

General Meeting
Tamarack Room

8:00–8:05 AM **Welcome**
President Elect Bart Gamett

8:05–8:20 AM **Opening Remarks and Presidential Message**
President James Capurso

Plenary Session: Diversions, Dams, and Fish
Tamarack Room
Moderator: Bart Gamett

8:20–8:35 AM **Introduction to Plenary Session**
Bart Gamett, ICAFS, President Elect

8:35–9:00 AM **Impacts of dam and diversion structures on fish in Idaho**
Paddy Murphy, Idaho Department of Fish and Game

9:00–9:25 AM **Impacts of flow alterations associated with dams and diversions on fish in Idaho**
Rob Van Kirk, Idaho State University

9:25–9:50 AM **Reducing fish entrainment at dam and diversion structures**
Brent Mefford, Bureau of Reclamation

9:50–10:10 AM BREAK (Convention Center Lobby)

10:10–10:30 AM **Improving fish passage at diversions**
Jim Gregory, Trout Unlimited

10:30–10:50 AM **Improving fish passage at diversions**
Warren Colyer, Trout Unlimited

10:50–11:10 AM **Managing flow alterations associated with diversions**
Tom Curet, Idaho Department of Fish and Game

11:10–11:30 AM **Managing flow alterations associated with dams**
Jim Fredericks, Idaho Department of Fish and Game

11:30–11:55 AM **Panel Discussion**
All Speakers

11:55-12:00 PM **Conclusions**
Bart Gamett, ICAFS, President Elect

12:00–1:25 PM BOX LUNCH: COMMITTEE BREAKOUTS

Location of Committee Meetings

Committee	Meeting Location
Anadromous Committee	Garnet
Fish Culture	Liberty
Mentoring	Opal
Native Fishes	Delamar
Public Education	Riverside
Riparian	Topaz
Water Quality	Cinnabar

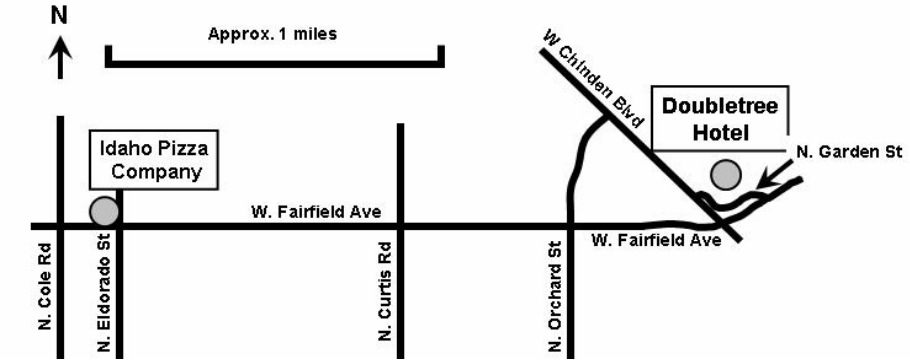
Wednesday, February 21 (continued)

Session 1: Diversion, Dams, and Fish (contributed papers)

Tamarack Room

Moderator: Matt Powell

1:25–1:30 PM	**Session 1: Introduction to Session**
1:30–1:50 PM	**Reconnecting anadromous and resident fish habitat in the Upper Salmon River Basin** Jeffrey Lutch, Idaho Department of Fish and Game
1:50–2:10 PM	**An overview of 50 years of fish screening in Idaho** Lynn Stratton, Idaho Department of Fish and Game
2:10–2:30 PM	**Federal Columbia River Power System Biological Opinion and the Bureau of Reclamation's Subbasin Habitat Program** Joe Spinazola, Bureau of Reclamation
2:30–2:50 PM	**Conservation of salmon and compliance with the Endangered Species Act – the challenge with irrigation diversions, as experienced within the Sawtooth National Recreation Area** Mark Moulton, Sawtooth National Recreation Area
2:50–3:10 PM	BREAK (Fireplace Foyer)
3:10–3:30 PM	**Hydropower projects: the FERC process, fisheries impacts and mitigation** Justin Jimenez, USDA Forest Service
3:30–3:50 PM	**Buffalo River hydro fishway design and results (how to pass age-0 trout)** Lee Mabey, Caribou Targhee National Forest
3:50–4:10 PM	**Dam and diversion rehabilitation in south central Oregon: Chewaucan, Chiloquin, Klamath, and Sycan projects** David M. Hogen, Fremont-Winema National Forests
4:10–4:30 PM	**Are Kootenai River white sturgeon BAD parents or have we just mucked up their habitat** Vaughn L. Paragamian, Idaho Department of Fish and Game
5:30–PM	STUDENT MIXER (Idaho Pizza Company – 7100 W. Fairfield Avenue)



Thursday, February 22

7:00–8:00 AM Breakfast Buffet (Aspen Room) - Limited number – first come, first served!!!
Light Breakfast Foods and Beverages (Fireplace Foyer)

	Session 2: Anadromous Migration Tamarack Room Moderator: Tim Copeland	Session 3: Cutthroat Trout Ponderosa Room Moderator: Jason Pyron
8:00–8:05 AM	Announcements	Announcements
8:05–8:10 AM	Introduction to Session	Introduction to Session
8:10–8:30 AM	**Migration survival of anadromous salmonids PIT-Tagged in the Salmon River, Idaho** David L. Arthaud National Marine Fisheries Service	**Identification of distinct populations of cutthroat trout *(Oncorhynchus clarkii ssp.)* across western North America using morphometric techniques** Meredith B. Seiler Idaho State University
8:30–8:50 AM	**Factors influencing migration survival of anadromous salmonids PIT-Tagged in the Salmon River, Idaho** James V. Morrow Jr. National Marine Fisheries Service	**Differences between brook trout and cutthroat trout populations in tributaries of the Teton River and potential consequences for stream-riparian ecosystems** Joseph R. Benjamin Idaho State University
8:50–9:10 AM	**Direct and indirect effects of barriers to migration-Pacific lamprey and the Columbia and Snake River Dams** Dustene Cummings University of Idaho	**Geographic patterns of introgressive hybridization between native Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri)* and introduced rainbow trout (*O. mykiss*) in the South Fork of the Snake River watershed** Ernest Keeley Idaho State University
9:10–9:30 AM	**Would removing the Lower Snake River dams constitute a Draconian action?** Bert Bowler Idaho Rivers United	**The effect of competition by rainbow trout and cutthroat-rainbow hybrids on the performance of Yellowstone cutthroat trout** Steven M. Seiler Idaho State University
9:30–9:50 AM	**The relationship of Snake River stream-type Chinook survival rates to river and ocean conditions: evidence of hydrosystem related delayed mortality** Charlie Petrosky Idaho Department of Fish and Game	**The abundance and distribution of trout in the Idaho Kootenai River Basin** Joshua McCormick Idaho Department of Fish and Game
9:50–10:15 AM	BREAK (Fireplace Foyer)	BREAK (Fireplace Foyer)

Thursday, February 22 (continued)

	Session 4: Anadromous Fish *Tamarack Room* *Moderator: Jason Vogel*	Session 5: Habitat Relationships and Population Monitoring *Ponderosa Room* *Moderator: Chris Reighn*
10:15–10:20 AM	Introduction to Session	Introduction to Session
10:20–10:40 AM	**The rationale for mainstem surface passage** Russ Kiefer Idaho Department of Fish and Game	**Habitat selection of Bonneville cutthroat trout based on summer temperature regimes in the Bear River drainage of Idaho and Wyoming** Ryan W. Hillyard Idaho State University
10:40–11:00 AM	**Incubation survival of fall Chinook salmon within historic and contemporary spawning areas of the Snake River** James Chandler Idaho Power Company	**Effects of water temperature on growth and physiology of different populations of redband trout *(Oncorhynchus mykiss gairdneri)*** John D. Cassinelli University of Idaho
11:00–11:20 AM	**Population contributions of life history variations in juvenile Chinook salmon** Timothy Copeland Idaho Department of Fish and Game	**Aquatic-terrestrial connectivity in a wilderness watershed: Do emerging insects and riparian predators increase following wildfire?** Rachel L. Wilkinson Idaho State University
11:20–11:40 AM	**Post-release performance of two groups of juvenile hatchery fall Chinook salmon in the Snake River** Stuart Rosenberger University of Idaho	**Distribution of fish and associated environment variables in the lower Boise River** Dorene MacCoy USGS
11:40–12:00 PM	**Escapement and harvest of adult Chinook salmon and steelhead in the Snake River upstream from Lower Granite Dam** Christopher A. Peery University of Idaho	**Bull trout monitoring on the Sawtooth National Forest** Jeb Wofford USDA Forest Service
12:00–2:15 PM	BUSINESS LUNCHEON (Laurel and Juniper Rooms)	

Thursday, February 22 (continued)

Session 6: Management

Tamarack Room
Moderator: Dan Schill

2:15–2:20 PM Introduction to Session

2:20–2:40 PM **A South Fork Salmon River history**
David Burns, USDA Forest Service

2:40–3:00 PM **Restoring Granite Creek: Implementing a broad-based collaborative stream restoration project**
Chris Downs, Idaho Department of Fish and Game

3:00–3:20 PM **Implementing designs for an incised stream channel: An integrated approach to achieve channel stability, habitat enhancement and resident fish recovery in Benewah Creek, Idaho**
Angelo Vitale, Coeur d'Alene Tribe

3:20–3:40 PM **Toxicity of CO_2 to New Zealand Mudsnails (*Potamopyrgus antipodarum*): Implications for Control**
Jordan Nielson, University of Idaho

3:40–4:00 PM **Impacts and uncertainties of climate change on Idaho streams and fish communities**
Dan Isaak, USDA Forest Service

Poster Session

Ponderosa Room

4:00–5:00 PM POSTER SESSION (Food and refreshing beverages!!!)

Poster listed alphabetically by last name of presenter

Adult steelhead spawner abundance in two small tributary streams of the Imnaha River subbasin, Oregon
Mike Blenden, Nez Perce Tribe

All fish screens are not created equal. Fish screen designs – what you should know
Jody Brostrom, U.S. Fish and Wildlife Service

No screens, no Fish? Know screens, know fish!
Jody Brostrom, U.S. Fish and Wildlife Service

Use of tributary confluence habitat by westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in a wilderness watershed affected by wildfire
Patrick Della Croce, Swiss Federal Institute of Technology, Zurich, Switzerland

Movement, migration and habitat use of adult trout in a dammed and diverted section of the Henrys Fork
Jim De Rito, Henry's Fork Foundation

Current diagnostic techniques for *Myxobolus cerebralis*, the parasite that causes salmonid whirling disease
Leah Steinbach Elwell, Federation of Fly Fishers

Distribution and status of Pacific lamprey in the Clearwater and Salmon River drainages of Idaho
Matthew W. Hyatt, Idaho Department of Fish and Game

Deer Lake
Tarah Johnson, University of Idaho

Migrational Dynamics and Life History of Adult Fluvial Bull Trout *Salvelinus confluentus* in the Lemhi River Drainage, Idaho
James Lamperth, Idaho Department of Fish and Game

"FISH ON"- LINE: A Web-Accessible Database of Aquatic Biological Data
Dorene MacCoy, USGS

Crooked River "To Hell and Back"
Wayne Paradis, USDA Forest Service

Clear as mud: Clearing the murky water about the roles of conservation districts
Justin Peterson, Nez Perce Soil and Water Conservation District

Developments in whirling disease research and management
Kajsa Eagle Stromberg, Whirling Disease Initiative

Understanding the effects of watershed-versus local-scale variables on stream fish assemblages
Mazeika S.P. Sullivan, University of Idaho

5:30–??? SOCIAL-FUNDRAISER (Ponderosa, Laurel, and Juniper Rooms)

Annual ICAFS Social-Fundraiser

FREE dinner and refreshing beverages!!!

Live music and dancing!!!

Raffle, silent auction, and live auction

Come support the Chapter's many activities

Thursday, February 22
5:30 P.M. – ???

Friday, February 23, 2007

7:00–8:00 AM Light Breakfast Foods and Beverages (Fireplace Foyer)

Session 7: The Lesser Known Species

Tamarack Room
Moderator: Lance Hebdon

8:00–8:05 AM Announcements

8:05–8:10 AM Introduction to Session

8:10–8:30 AM **Mountain Whitefish: A little biology for everyone**
Steve Elle, Idaho Department Fish and Game

8:30–8:50 AM **The Ecological Significance of Mountain Whitefish (Prosopium williamsoni) in a Central Idaho Wilderness Stream**
Michael Lance, Idaho State University

8:50–9:10 AM **Preliminary evaluation of PIT tagging and instream detection of shorthead sculpin (*Cottus confusus*)**
Donald W. Zaroban, University of Idaho

9:10–9:30 AM **Cryopreservation and methanol effects on sperm motility and egg fertilization rates for North American burbot semen**
Nathan R. Jensen, University of Idaho

9:30–9:50 AM **Population Dynamics of Lake Trout in Lake Pend Oreille, Idaho**
Michael J. Hansen, University of Wisconsin – Stevens Point

9:50–10:15 AM BREAK

Session 8: Water Quality, Passage, and Monitoring

Tamarack Room
Moderator: Shanda Dekome

10:15– 10:20 AM Introduction to Session

10:20–10:40 AM **Modeled response of Yellowstone cutthroat trout populations to chronic selenium exposure**
Rob Van Kirk, Idaho State University

10:40–11:00 AM **Fish and Invertebrate Diversity and Abundance in Association with Heavy Metal Levels within the Mt. Coeur d'Alene Area**
Edward Lider, USDA Forest Service

11:00–11:20 AM **Evaluation of Culvert Influence on Seasonal Movements of Juvenile Salmonids, an *In situ* PIT Tag Study in Alaska**
Mary King, Alaska Department of Fish and Game

11:20–11:40 AM **Fish Passage Evaluation at Forest Road Stream Crossings in Idaho: Results and Recommendations**
Chris Tretter, Idaho Department of Lands

11:40–12:00 PM **Preliminary Evaluation of Traffic Counters for Estimation of Angler Effort**
Rob Ryan, Idaho Department Fish and Game

12:00–12:15 PM Best Paper Awards

Abstracts by Session

Session 1: Diversions, Dams, and Fish

Reconnecting Anadromous and Resident Fish Habitat in the Upper Salmon River Basin

Jeffrey Lutch
Idaho Department of Fish and Game
Presenter: Jeffrey Lutch, jlutch@idfg.idaho.gov, 208-756-2271

Over the past several decades, conservation actions have been implemented in the Upper Salmon River basin to address factors that limit the abundance and distribution of native salmonids. Through a collaborative process involving State and Federal agencies, private landowners, and local watershed groups, fish passage was improved in mainstem rivers by consolidating diversions, installing fish screens, and removing or modifying diversion dams. Strategies developed through this process are now being applied at a much broader scale, with emphasis on reconnecting tributaries to provide previously unavailable high quality spawning and rearing habitat for ESA listed Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). In the Lemhi River watershed, the developing Conservation Program and Section 6 Agreement for incidental take under the Endangered Species Act will prove useful in this effort because it prescribes strategies to reconnect 10 prioritized tributaries with the Lemhi River. Significant progress has been made towards reconnecting Kenny Creek, and efforts are underway to reconnect Big Timber Creek, arguably the most biologically beneficial tributary in the Lemhi sub-basin because of its high intrinsic potential to support all anadromous and resident/fluvial salmonids in the watershed. For Big Timber Creek, collaborators developed a framework that identifies multiple socioeconomic and biological factors that must be considered for successful planning and implementation of this very complex action. Factors include coordination with private landowners, awareness of landowner interests, knowledge of water rights and administration under state law, knowledge of irrigation practices and concepts, an understanding of steps necessary for specific project implementation, and monitoring and evaluation. Critical to the development of this framework are the relationships developed between managers and the local community to ensure the needs of the resource and all interested parties are considered.

An Overview of 50 Years of Fish Screening in Idaho

Lynn Stratton
Idaho Department of Fish and Game, Anadromous Screen Program
Presenter: Lynn Stratton, lstratton@idfg.idaho.gov, 208-756-6022

The utilization of fish screens to reduce entrainment and mortality of migrating anadromous salmonids in irrigation ditches has been implemented in the Pacific Northwest for nearly 100 years. The Idaho Department of Fish and Game installed the first fish screen in the Salmon River basin in 1958. Since that time, the Screen Program has implemented several hundred fish screening and passage projects with Federal mitigation funding. In the early 1990's, attention turned away from merely installing fish screens and turned toward water conservation, diversion elimination, and improving fish passage in conjunction with screening. Advances in fish screen design accelerated following the establishment of the Fish Screen Oversight Committee (FSOC) of the Columbia Basin Fish & Wildlife Authority. Fabrication techniques, engineering design, fisheries data, and general maintenance knowledge passed freely among Northwest fish screen installers aided by FSOC. Prior to 1973, the primary fish screen designs installed in Idaho were wiper screens. Since 1973, the Screen Program has predominantly installed rotary drum screens which are cheaper to operate, better at self-cleaning, and more reliable for protecting fish. Early fish screens were powered by water-driven paddlewheels or electric motors. Today, new paddlewheel designs are still the preferred choice followed by solar power driven screens. All fish screens installed by the Screen Program since 1991 are built in accordance with National Marine Fisheries Service (NMFS) Juvenile Fish Screen and Pump Intake Screen Criteria. To have a successful

fish screen project, there must be a commitment to proper operation and maintenance of the fish screens otherwise the conservation benefits and functional lifespan of the projects will not be realized. Fish screen operational experience, monitoring and evaluation, improved screen designs, and fisheries evaluations have contributed to better resource protection.

Federal Columbia River Power System Biological Opinion and The Bureau of Reclamation's Subbasin Habitat Program

Joe Spinazola
Bureau of Reclamation
Presenter: Joe Spinazola, jspinazola@pn.usbr.gov, 208-378-5378

Activities performed by Bonneville Power Administration, Corps of Engineers, and the Bureau of Reclamation for salmon and steelhead listed under the Endangered Species Act focus mostly on main stem hydro-system functions such as delivering and shaping flows, introducing spill during juvenile migration, barging smolts, and making structural modifications to hydro-power facilities. Habitat improvement actions in tributary subbasins were initiated in 2000. Reclamation's role in the subbasin habitat program is to help screen water diversions, and improve flow, access, and channel complexity conditions for populations of Upper Columbia; Mid-Columbia; and Snake River salmon and steelhead, respectively, in the Methow, Entiat, and Wenatchee; North Fork, Middle Fork, and Upper Main John Day; and Lemhi, Upper and Little Salmon tributary subbasins. Reclamation currently provides technical assistance in the form of project marketing and planning, engineering designs, environmental compliance, permit acquisition, and construction inspection. To date Reclamation has partnered with landowners, Tribes, and numerous local, State, and other Federal agencies to complete dozens of barrier, screen and flow projects in nine subbasins in Idaho, Oregon, and Washington. Partners in Idaho include the Office of Species Conservation, Department of Fish and Game, Water Resources Department, Soil Conservation Commission, Upper Salmon Basin Watershed Project, Adams, Custer, Idaho, and Lemhi County Soil and Water Conservation Districts, Shoshone-Bannock Tribes, Nez Perce Tribe, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Corps of Engineers, and the Bonneville Power Administration. Working with these groups and many other people, Reclamation helped complete 11 flow, 17 access, and 11 screen projects in Idaho since 2001. Working with private landowners on a voluntary basis, this program has resulted in successful water leasing during critical low flow periods benefiting anadromous fish, removal of fish barriers allowing the return of both anadromous and resident fish to historical habitat, and installation of fish screen facilities preventing entrainment into diversions.

Conservation of Salmon and Compliance With the Endangered Species Act – The Challenge with Irrigation Diversions, as Experienced Within the Sawtooth National Recreation Area

Mark Moulton
Sawtooth National Recreation Area, USDA Forest Service
Presenter: Mark Moulton, mmoulton@fs.fed.us, 208 727-5000

The effects of irrigation water withdrawal on salmon within the headwaters of the Salmon River has long been recognized. In 1972, in the legislation that created it, "the protection and conservation of salmon and other fisheries" was prominent as one of the key purposes for which the Sawtooth National Recreation Area was established. Some notable changes have occurred to these diversion related effects since 1972, but in most tributaries, threats and limitations to conservation and recovery still persist. The listing of Chinook salmon for protection under the Endangered Species Act in 1992 did not result in a wave of resolution to these long standing effects (as some might have expected), but rather frequently served to add legal uncertainty, complexity, analysis, and documentation to the already difficult issue. As a result, often more has been accomplished by way of "process" than progress towards the restoration of these affected habitats . Meanwhile, our best science continues to tell us answers difficult to hear – more water will be required for functioning fish populations. These legal, social, and technical conundrums have been recognized and a strategy for resolution formally outlined recently in an open agreement between the Sawtooth National Recreation Area and others involved in species recovery in the Area. Current

signatories to the agreement include the National Marine Fisheries Service, the US Fish and Wildlife Service, and the State Office of Species Conservation. This agreement is considered a very positive development, although the difficult part remains,…with success still just over the horizon.

Hydropower Projects: the FERC Process, Fisheries Impacts and Mitigation

Justin Jimenez, Jerry Bird, and Gerrish Willis
USDA Forest Service
Presenter: Justin Jimenez, jjimenez02@fs.fed.us, 801-236-3467

The purpose of this presentation is to share an overview of the Federal Energy Regulatory Commission's licensing procedures for hydropower projects. I will discuss the process of developing and implementing study plans and their importance in evaluating project impacts and developing mitigation measures. I will present examples of fisheries impacts and mitigation measures associated with diversions and dams, and will discuss monitoring plans designed to determine if mitigation is successful in alleviating impacts. Finally, I will describe the importance of collaboration between federal agencies, state agencies, NGO's, power companies, irrigation companies, and other interest groups and will provide examples of several successful collaborations.

Buffalo River Hydro Fishway Design and Results (How to Pass Age-0 trout)

Lee Mabey[1], Gary Vecellio[2], and Jim De Rito[3]
[1]Caribou Targhee National Forest, USDA Forest Service
[2]Idaho Department of Fish and Game
[3]Henry's Fork Foundation
Presenter: Lee Mabey, lmabey@fs.fed.us, 208-557-5784

The relicensing process began in 1999. Existing Information was gathered to determine what issues the 1930's era plant was causing. From this information it was determined what mitigations would be required. Following the FERC process, determining design criteria, writing many letters and repeating the comments time and time again. The Buffalo River Hydro project was relicensed in 2004. As part of the license a new fishway was required that would pass 100 mm age-0 rainbow trout with maximum velocities of 3.5 fps. The fishway was designed and built in 2004-05. The fishway is 270 feet long with 51 bays providing passage over a twelve foot high rock rubble dam. The baffles and bottom of the fishway are designed to minimize turbulence, provide laminar flow and low velocities. Trapping and monitoring of passing fish began in March 2006. The fishway has successfully passed brook trout, rainbow trout, whitefish, sculpin and dace. Lengths of fish passed have ranged from 80-590 mm. The Fishway has met its design criteria and has also successfully passed other life history stages and species.

Dam and Diversion Rehabilitation in South Central Oregon: Chewaucan, Chiloquin, Klamath, and Sycan Projects

David M. Hogen[1] and Brett J. Bowersox[2]
[1]Fremont-Winema National Forests, USDA Forest Service
[2]Idaho Department of Fish and Game
Presenter: David M. Hogen, dhogen@fs.fed.us, 541-947-6258

In south central Oregon there are a multitude of rehabilitation projects related to dams and diversions that are either completed, planned, or are strongly being talked about. The Fremont-Winema National Forests and other groups are partners on the Chewaucan, Chiloquin, Klamath, and Sycan Projects. Rehabilitation ranges from modifying existing structures to facilitate fish passage, replace existing structures with new structures, or total removal of the structures. This presentation will identify techniques being implemented, costs, and provide contacts for future projects.

Are Kootenai River White Sturgeon BAD Parents or Have We Just Mucked Up Their Habitat

Vaughn L. Paragamian[1], Richard McDonald[2], Gary Barton[2], Jonathan Nelson[2], and Sue Ireland[3]
[1]Idaho Department of Fish and Game
[2]USGS
[3]Kootenai Tribe of Idaho
Presenter: Vaughn L. Paragamian, vparagamian@idfg.Idaho.gov, 208-769-1414

Kootenai River white sturgeon *Acipenser transmontanus*, an endangered species, currently spawn in an 18-kilometer reach of the Kootenai River, Idaho. Since completion of Libby Dam, upstream from the spawning reach, there has been only one successful year of recruitment. Where successful in other rivers, sturgeon spawn over clean coarse substrate of gravel size or larger. The substrate in the current spawning reach is comprised primarily of sand, silt and some buried gravel; within a few kilometers upstream there is clean but imbedded gravel. We used a 2-dimensional flow and sediment-transport model and the measured locations of sturgeon egg collections from 1994-2002 to gain insight into the paradox between the current spawning location and absence of suitable substrate. Spatial correlations between spawning locations and the model simulations of velocity and depth indicate the white sturgeon tend to select regions of highest velocity and depth within any river cross-section to spawn. These regions of high velocity and depth are independent of pre- or post-dam discharge conditions. A simple sediment-transport simulations model suggests that high discharge and relatively long duration flow associated with pre-dam flow events might be sufficient to scour the sandy substrate and expose existing lenses of gravel and cobble as lag deposits in the current spawning reach. After sturgeon spawned in 2006 the river reached flood discharges similar to pre-dam for the first time since dam construction. Visual and sub-bottom acoustic profiles confirmed higher discharges and velocities scoured reaches of suitable cobbles and gravels in the present spawning locations. It is likely sturgeon are spawning in the same pre-dam locations but we have just mucked up their spawning habitat with river regulation. Habitat can only be restored with restored spring discharges, which is politically unacceptable, but habitat rehabilitation may be possible with the construction and placement of artificial incubation material.

Session 2: Anadromous Migration

Migration Survival of Anadromous Salmonids PIT-Tagged in the Salmon River, Idaho

David L. Arthaud and James V. Morrow Jr.
National Marine Fisheries Service, Idaho State Habitat Branch
Presenter: David L. Arthaud, david.arthaud@noaa.gov, 208-378-5694

Juvenile Snake River sockeye salmon, Snake River spring/summer Chinook salmon, and Snake River steelhead have been PIT-tagged in the Salmon River drainage since the late 1980s. An increasing number of facilities and improvements for detecting these tagged fish have been retrofitted to dams of the Federal Columbia River Power System (FCRPS) in the mainstem Snake and Columbia Rivers. We obtained data from the PIT-Tag Information System (PTAGIS) and used them to estimate reach and stock specific migration survival rates and to describe migration timing from the release points (1,450-1,290 km upstream from the Pacific Ocean) to the John Day Dam on the Columbia River (345 km from the Pacific Ocean).

Yearlings of all stocks tagged in spring migrated to the FCRPS during the same spring but subyearling Chinook salmon and steelhead PIT-tagged in late summer and fall typically over-wintered upstream from Lower Granite Dam. The vast majority of fish migrated through the FCRPS in one season but a few stopped in the FCRPS during spring or summer and resumed downstream migration the following spring. Lemhi River Chinook salmon sometimes migrated to the FCRPS within six months of emergence. Fish exhibiting this life history strategy had the most widely variable survival among years in the FCRPS, ranging from 3% during low streamflow years, to 60% during high streamflow years.

Migration survival rates averaged across all years by stock and species showed that 40-55% died upstream of Lower Granite Dam; 20-30% died between Lower Granite and John Day dams; and 25-40% died downstream from John Day Dam, in the transport system, or in the ocean. Numbers of smolts remaining in-river at John Day Dam were reliable predictors of returning adults for each stock. Smolt to adult return rates (SAR) estimated at John Day Dam and averaged by species varied from 0.2% for sockeye salmon to about 2% for steelhead and Chinook salmon. The SARs estimated for fish migrating in river from John Day Dam were similar to those for transported smolts.

Factors Influencing Migration Survival of Anadromous Salmonids PIT-Tagged in the Salmon River, Idaho

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Quality of spawning and rearing habitat for anadromous salmonids in the Salmon River drainage ranges from nearly pristine to extremely degraded. Although stock performance is generally related to growth and survival during early rearing life stages, all anadromous salmonid populations in the Salmon River are imperiled, all are characterized by low productivity and population size, and all must migrate long distances and through the FCRPS to reach the ocean. We compared reach specific survival rates of individual stocks of Snake River sockeye salmon, Chinook salmon, and steelhead to each other and to length at tagging, gaged streamflow, spill at FCRPS facilities, and water temperature. The goals were to identify trends among species, stocks, and migration corridor reaches and to identify environmental factors affecting migration survival.

By species, survival rates were similar for steelhead and Chinook salmon and lowest for sockeye salmon, however trends were similar among species. Reach specific survival for each stock were correlated, but reaches with the lowest survival varied by species and by life history strategy within species. Migrant mortality per km was about three fold higher in reaches downstream of Lower Granite Dam (within the FCRPS) than in the reach upstream from the dam. Survival in the mostly unimpounded reach upstream from Lower Granite Dam was consistently explained by stream discharge alone. Factors affecting survival in reaches within the FCRPS appeared more complex but could usually be explained by discharge, spill, or water temperature. Relationships were usually improved when size at tagging was included in the models, however, the degree to which size influenced migration survival varied from year to year and was related to streamflow.

Direct and Indirect Effects of Barriers to Migration-Pacific Lamprey and the Columbia and Snake River Dams

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Barriers in migration, such as dams, roads, and areas of deforestation, have both direct (mortality) and indirect (increase in disease susceptibility, decrease in genetic variability, and increase in predation) affects on species. This study specifically focuses on how migrational obstacles can prevent Pacific lamprey from accomplishing distinct life cycle events. During the 2005 and 2006 inland migration of adult Pacific lamprey (summer and early fall), 120 lamprey were trapped and equipped with a Half-Duplex PIT tag and a coded radio tag, while another 70 received only a Half-Duplex PIT tag. The movements of the lamprey were then monitored through McNary and Ice Harbor Dams. The success and functionality of the newly developed Half-Duplex PIT tag system was also determined. During the 2006 season, 29 adult Pacific lamprey were collected from Bonneville and McNary Dams to undergo disease and proximate analysis. Another 50 adult lamprey were captured at Lower Monumental and Little Goose Dams, and released above Lower Granite Dam to establish the spawning distribution and habitat in Idaho. It was

determined that 47.5% (38 out of 80) and 55.0% (22 out of 40) of the radio-tagged fish released 1 km below McNary and Ice Harbor Dams, respectively, re-ascended to the dam and were recorded on a radio telemetry antenna outside of a fishway entrance. At McNary Dam, 60.5% (23 out of 38) of the fish that approached an entrance eventually passed the dam. This measurement was 59.1% (13 out of 22) at Ice Harbor Dam. Individual movements of lamprey through the fish ladder showed that potential problem areas for adult Pacific lamprey at McNary and Ice Harbor dams include fishway entrances and exits, the top of the transition pool, and areas associated with diffuser grating. In the disease analysis, *Aeromonas hydrophilia* was the only disease agent found in the 29 lamprey collected.

Would Removing the Lower Snake River Dams Constitute a Draconian Action?

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Lower Snake River Dam (LSRD) removal analysis has been ongoing since the mid 1990s. Most studies concluded that removal offers the best if not the only opportunity to recover listed stocks of Snake River anadromous fish. A Corps of Engineers final EIS in 2002 made the concept of breaching LSRDs credible. Anadromous fish recovery in the Columbia/Snake is currently in federal court as part of ESA litigation. Dam elimination is somewhat removed from the court deliberations for numerous reasons – one being the belief that removing four relatively large federal hydroelectric dams in the lower Snake River constitutes a draconian action. Loss of power generation and navigation are among the most contentious consequences but others including irrigation, recreation and river restoration are important. LSRDs provide about 2% of Northwest power supply mostly influenced by river discharge in the Snake. Replacing the energy can be done without fossil fuels that contribute to global climate change. Cost competitive renewable clean energy in the form of conservation, efficiency and wind can serve as a replacement. Barge shipping can be mitigated with upgraded rail infrastructure and equitable transportation pricing. Irrigation pumps in the Ice Harbor pool can be lowered from reservoir to river level. River restoration in the form of sediment management and riparian rejuvenation will require innovation. A recent cost benefit analysis shows that dam removal could save billions of dollars in the long-term compared to the status quo. Abundant salmon and steelhead returning to the Snake River basin will contribute millions of dollars of added benefit to local economies. Belief in the draconian disposition of LSRD removal rests in the eyes of the observer. In reality - it could serve as the silver lining.

The Relationship of Snake River Stream-type Chinook Survival Rates to River and Ocean Conditions: Evidence of Hydrosystem Related Delayed Mortality

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Snake River salmon and steelhead have substantially declined since the completion of the Columbia River hydrosystem. A key remaining uncertainty for evaluating recovery options for upper basin salmon populations relates to the source of mortality that fish experience while in the estuary and early ocean. Sources of estuary and early ocean mortality include not only elements of the natural ocean environment, but also delayed effects of earlier life-stage experiences. Multiple analytical approaches are presented addressing this delayed mortality for Snake River spring/summer Chinook and steelhead. The water velocity conditions in the river (water travel time) and ocean/climatic conditions are considered in describing the variation in survival rates. In all results water travel time proved to be a significant factor in explaining the variation in survival. The hydrosystem has delayed migration of in-river fish; with later arriving components of the population exhibiting lower survival rates. The results of these multiple analyses provide compelling evidence that passage through the hydrosystem strongly influences levels of delayed mortality of in-river migrants for Snake River populations.

Session 3: Cutthroat Trout

Identification of Distinct Populations of Cutthroat Trout (*Oncorhynchus clarkii* ssp.) Across Western North America Using Morphometric Techniques

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Presenter: ***Meredith B. Seiler,*** *seilmere@isu.edu, 208-282-4458*

Morphometric techniques may provide a powerful tool for identifying unique populations of cutthroat trout subspecies based on ecologically important characters. In fishes, these important characters are often related to swimming and feeding ecology. Previous studies have shown that stream dwelling salmonids have longer paired fins and a more streamlined body than lake dwelling salmonids. Therefore, we hypothesized that linear measures of paired fin length and measures of body shape will be the best determinants for separating our lake and stream populations of cutthroat trout and identifying unique populations within each environment. We used linear and geometric morphometric techniques to compare taxonomic versus ecologically based differences in subspecies of cutthroat trout. We compared measures of body shape, fin length, head and mouth size and eye diameter and found differences between and within subspecies. Our study provides a powerful complement to genetic techniques used in identifying unique populations that are of conservation concern.

Differences Between Brook Trout and Cutthroat Trout Populations in Tributaries of the Teton River and Potential Consequences for Stream-riparian Ecosystems

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Species invasions are a principal agent of global environmental change. When an invader displaces a native species the question arises, “Are there functional consequences for the ecosystem?” Brook trout are among the most broadly introduced fishes worldwide, and have invaded small streams throughout the western U.S. where cutthroat trout are native. Invading brook trout may achieve densities greater than those exhibited by native cutthroat trout. We hypothesized that streams with nonnative brook trout would have greater fish density, biomass, and production than streams with cutthroat trout. We addressed these hypotheses by comparing five pairs of streams within the Teton River drainage. Streams were paired based on physical characteristics and the presence of brook trout or cutthroat trout in allopatry. In accordance with our hypotheses, those streams with brook trout had consistently higher fish density, biomass, and estimated production than those with cutthroat trout. However, we observed no difference in the production to biomass ratio (P/B) between paired streams, suggesting biomass turnover may be essentially the same for the two species. If brook trout attain higher densities and production than cutthroat trout, are there effects on other organisms? Might brook trout consume more aquatic invertebrates than cutthroat trout? If so, could this affect algae or terrestrial consumers that depend on emerging aquatic insects? We are currently conducting research to address these questions.

Geographic Patterns of Introgressive Hybridization Between Native Yellowstone Cutthroat Trout (*Oncorhynchus clarkii bouvieri)* and Introduced Rainbow Trout (*O. mykiss*) in the South Fork of the Snake River Watershed

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Throughout its native range, the Yellowstone cutthroat trout, *Oncorhynchus clarkii bouvieri,* is declining dramatically in both abundance and distribution as a result of introgression with introduced rainbow trout,

O. mykiss. We sampled over 1200 trout from the South Fork of the Snake River (SFSR) watershed, in southeastern Idaho and measured the extent of introgression of rainbow trout (RBT) genes into native gene pools of Yellowstone cutthroat trout (YCT) using seven species-specific, co-dominant nuclear genetic markers. We also used mitochondrial DNA (mtDNA) haplotype differences between the two parental trout species to determine the directionality of the hybridization. We found low levels of RBT introgression (only 7% of sampled individuals had one or more RBT alleles) into YCT gene pools, with the majority of hybrids (78%) occurring in mainstem localities of the SFSR and in lower elevation reaches of certain tributaries. Hybridization was bidirectional with respect to mtDNA haplotype, but the majority of hybrids (96%) had YCT maternal haplotypes, indicative of the greater proportion (90%) YCT-genotypes in the SFSR watershed. The primary factor influencing the geographic distribution of RBT introgressed individuals was dispersal distance from localities of stocking origin. The degree of tributary flow/access to the main-stem river, and to a lesser extent, elevation, also influenced the distribution of hybrid genotypes, with several entire tributaries and all upper elevation reaches within tributaries harboring only YCT-genotypes. Important management implications of the study suggest targeting particular tributaries and upper reaches within tributaries for YCT protection and exclusion of RBT hybrid colonization.

The Effect of Competition by Rainbow Trout and Cutthroat-rainbow Hybrids on the Performance of Yellowstone cutthroat trout

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In western North America, introduced rainbow trout (*Oncorhynchus mykiss*) have completely displaced many native cutthroat trout (*O. clarkii* spp.) populations; however, few studies have identified potential pathways which may allow rainbow trout to out compete cutthroat trout. In this study we measured the strength of competition between Yellowstone cutthroat trout, rainbow trout, and F1 hybrids by measuring the growth rate of juvenile trout cohorts in artificial stream channels. To control for possible environmental effects on competitive ability of our experimental crosses, we reared Yellowstone cutthroat trout (*O. c. bouvieri*), rainbow trout, and their F1 hybrids at similar densities in a common environment. We then used a minimally substitutive design to measure differences in growth between Yellowstone cutthroat trout in allopatry versus Yellowstone cutthroat trout when competing against similar size rainbow trout and F1 hybrid crosses. Yellowstone cutthroat trout competing against either F1 cross experienced lower growth rates than Yellowstone cutthroat trout in allopatry, however, Yellowstone cutthroat trout competing against rainbow trout did not experience lower growth rate than Yellowstone cutthroat trout in allopatry. The variation in growth rate for Yellowstone cutthroat trout competing against rainbow trout was large indicating that some Yellowstone cutthroat trout experience lower growth rates when competing against rainbow trout. Our study provides evidence that juvenile Yellowstone cutthroat experience lower growth rates when competing against cutthroat-rainbow hybrids.

The Abundance and Distribution of Trout in the Idaho Kootenai River Basin

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In 2006 we sampled 116 sites using electrofishing or snorkeling gear to estimate trout abundance in 1st through 4th order streams throughout the Idaho Kootenai River basin. Our sample sites were selected based on the EMAP sample design using spatially distributed random sites. There are an estimated 1,835km of 1st through 4th order streams in the Idaho Kootenai River basin. We estimated the number of trout 100mm and larger to be 340,534 ± 109,295 (mean ± 95% confidence interval); of these, we estimated that 176,208 ± 95,539 were westslope cutthroat trout *Onchorhynchus clarki lewisi,* 116,310 ± 49,743 were rainbow trout *O. mykiss,* and 48,016 ± 18,532 were brook trout *Salvelinus fontinalis.* Of the 116 sites we sampled, westslope cutthroat trout were present at 34 sites, rainbow trout were present at 40 sites, and brook trout were the most widely distributed species, present at 47 sites. Eleven sites were dry or were not practical to sample because of low water, and 38 sites had no trout present. Brook trout

were present at 19 of the 34 sites where westslope cutthroat trout were found. At sites where westslope cutthroat trout and brook trout were sympatric, westslope cutthroat trout densities were about half of what they were compared to sites where only cutthroat were found. Our results suggest that management may be needed to limit further expansion of brook trout in the drainage or prevent further increases within streams where they already exist to minimize impact on native species.

Session 4: Anadromous Fish

The Rationale for Mainstem Surface Passage

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This paper will present information demonstrating the rationale for Mainstem Surface Passage in the lower Snake and lower Columbia rivers. Information will be presented primarily for Snake River stream type (spring/summer) chinook salmon, the evolutionary significant unit with the most pertinent data.

Stream type chinook salmon spawning ground survey data from the Middle Fork Salmon River will be used to show the current perilous status and trend of anadromous fish in the Snake River. The Middle Fork Salmon River is contained mostly within the Frank Church River of No Return Wilderness, authorized in part to serve as a refuge for wild anadromous fish. Stream type chinook salmon from the Middle Fork Salmon River have had very little hatchery influence, their spawning/rearing habitat remains relatively pristine, and estimated current human harvest is very low.

Two independent empirical data sets (stock/recruitment relationships and smolt-to-adult return rates) will be presented to demonstrate that the large hydroelectric dams and reservoirs on the lower Snake and lower Columbia rivers are in all probability the primary human cause of the current perilous status of Snake River anadromous fish. These data sets encompass periods of both good and poor ocean productivity. Ocean productivity sets the range of potential adult return rates, yet these data sets clearly indicate that the large hydroelectric dams and reservoirs causes Snake River anadromous fish to consistently return at the lower end of the potential range.

Current efforts to mitigate for the impacts of these large hydroelectric dams and reservoirs on anadromous fish are primarily; collection and transportation, mechanical bypass, and voluntary spill. Adult return data indicates that as implemented, these mitigation efforts have been inadequate. Smolt-to-adult return rate data indicates only an enhanced voluntary spill program has a reasonable potential to recover Snake River anadromous fish with the current configuration and operation of these large hydroelectric dams.

The surface passage concept, current technologies, and future options being considered will be presented. Recent research results indicating the potential for surface passage technologies to perform as desired will also be presented.

Incubation Survival of Fall Chinook Salmon Within Historic and Contemporary Spawning Areas of the Snake River

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Fall Chinook salmon have been extirpated from historic habitat of the Marsing Reach of the Snake River, upstream of the Hells Canyon Complex, for over 50 years. There is interest in re-establishing these fish in

historic habitat. Over three incubation seasons we compared embryonic survival and hyporheic water quality between the historic and contemporary (below Hells Canyon Dam) mainstem habitats. We planted green and eyed eggs within artificial redds to assess survival. During each season we periodically measured several water quality parameters, including dissolved oxygen (DO), within the river, the undisturbed hyporheic zone, and in artificial redds. Survival was depressed within the historic reach (green eggs – 0%, eyed eggs – 13%), while in the contemporary reach it was higher (green eggs – 47%, eyed eggs – 75%). River DO was elevated throughout incubation within both reaches (11.3 and 10.9 mg/L, respectively). Within the historic reach, DO in the undisturbed hyporheic was depressed (≈ 0.5 mg/L) in comparison with observations from the contemporary reach (≈ 8.9 mg/L). During the pre-hatch phase, DO within artificial redds in the historic reach was high (green eggs – 7.7 mg/L, eyed eggs – 9.4 mg/L); this was also the case for redds within the contemporary reach (green eggs – 9.0 mg/L, eyed eggs – 9.7 mg/L). While DO continued to be elevated during post-hatch within the contemporary reach (green eggs – 10.1 mg/L, eyed eggs – 10.4 mg/L), it tended to decline within the historic reach (green eggs – 7.0 mg/L, eyed eggs – 6.8 mg/L). Our data indicate a strong connection/interaction between the water column and the shallow hyporheic zone within contemporary habitat but suggest a disconnect between those zones within historic habitat. This lack of interaction is likely caused by increased intrusion of fine organic matter, and helps explain why incubation survival is depressed within historic habitat.

Population Contributions of Life History Variations in Juvenile Chinook Salmon

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Life history diversity is thought to increase population resilience. Our objective was to understand how variations in juvenile life history contribute to the Chinook salmon population emigrating from the Pahsimeroi River in Idaho. We assembled data on juveniles that migrated as age-0 smolts, fall parr, or age-1 smolts for brood years 1992-2003. Survival from the Pahsimeroi River to Lower Granite Dam (LGD) was lower for fall parr (median = 0.29, range 0.18 - 0.41) than for age-0 smolts (median = 0.55, range 0.18 - 0.75) and age-1 smolts (median = 0.58, 0.35 - 0.74). Length at emigration within life history type depended on density (redds versus fork length, $r^2 > 0.49$). Differences in average lengths among the three groups became smaller as density increased. Differences in size at emigration between juveniles collected as fall parr and age-1 smolts stabilized when redd counts exceeded 150 redds. This is consistent with size-selective overwinter mortality at higher densities. The proportion of a brood year that migrated as an age-1 smolt was related curvilinearly to density (Ricker-type curve, $r^2 = 0.73$). The age-0 smolt life history appears to be adaptive because an individual has a much greater chance of surviving from hatch to LGD if they can grow fast enough to become a smolt their first year. However, this may create a trap if survival from LGD to the ocean is too low for the smaller, later-migrating age-0 smolts to contribute meaningfully to adult returns, because increased growth at low densities would lead to more age-0 smolts.

Post-release Performance of Two Groups of Juvenile Hatchery Fall Chinook Salmon in the Snake River

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Lyons Ferry hatchery produces subyearling fall Chinook salmon *Oncorhynchus tshawytscha* to supplement wild production in the upper Snake River. The subyearlings are acclimated at facilities near release sites in an effort to increase juvenile survival and adult returns. Two "shifts" of subyearlings have been acclimated in past years. The first shift was acclimated in early May and the second in late May to early June. Prior studies have shown that the second shift survived at a lower rate. A proposed solution

was to replace the second shift with a direct release concurrent to the first release of acclimated juveniles. The purpose of this study was to compare post-release attributes of subyearlings that were acclimated versus those that were directly released. A total of 3,500 subyearlings from each group were PIT tagged prior to release in 2005 and 2006. Seaward movement, condition factor, and survival were measured in both 2005 and 2006 for comparison between acclimated and directly released subyearlings. We found significant differences in the post-release attributes between acclimated and directly released subyearlings. These results, in conjunction with the adult return data collected in subsequent years, may help explain differences in adult survival.

Escapement and Harvest of Adult Chinook Salmon and Steelhead in the Snake River Upstream from Lower Granite Dam

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Radiotelemetry studies from 2000-2003 was used to estimate escapement and harvest of spring–summer Chinook salmon and steelhead upstream from Lower Granite Dam. Analyses of this relatively unstudied portion of adult migration were secondary objectives of the original project, yet a substantial database has been amassed for 1,383 Chinook and 1,617 steelhead that passed Lower Granite Dam. We developed a series of estimates with increasingly stringent criteria for successful escapement and we have attempted to characterize the uncertainty associated with each.

When only fish with unknown fates in Lower Granite reservoir were considered unsuccessful, escapement averaged 99.3% for Chinook and 97.1% for steelhead. Mean reported harvest for Chinook was 0.4% in the Snake River (including Lower Granite reservoir) and 20.7% in tributaries and was 7.2% in the Snake and 18.1% in tributaries for steelhead. When treating catch and release as non-harvest, estimates for steelhead dropped to 6.0% and 15.9%, respectively. Mean escapement to major tributaries minus all harvest was 76.7% (74.9-78.6%) for Chinook and 64.2% (60.2-69.3%) for steelhead (catch and release = successful).

Fin-clipped Chinook salmon and steelhead were less likely to escape in almost all estimates, especially when harvest was treated in the traditional manner as non-escapement. Higher percentages of unclipped steelhead had an unknown fate in the Snake River, perhaps due to spawning at unmonitored sites, lower likelihood of collection by agencies and hatcheries, and/or unreported harvest. Fin-clipped Chinook and steelhead that fell back while passing through the Hydrosystem had lower escapement estimates than fin-clipped fish that did not fall back. The same pattern was observed for ‘wild’ Chinook, while results were mixed for the relatively small samples of ‘wild’ steelhead. The fallback relationship suggests potential negative delayed effects of Hydrosystem experience, though multiple factors may be influential and we recommend a more thorough evaluation.

Session 5: Habitat Relationships and Population Monitoring

Habitat Selection of Bonneville Cutthroat Trout Based on Summer Temperature Regimes in the Bear River Drainage of Idaho and Wyoming

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Alterations to an ecosystem's thermal regime can significantly effect growth and survival of organisms. Human alterations of the Bear River watershed in Idaho and Wyoming have changed the river's thermal

characteristics and have potentially impacted the native Bonneville cutthroat trout *(Oncorhynchus clarkii utah)* population. In the summer of 2005, we collected temperature data from the Bear River that indicated periodic temperatures exceeding lethal limits for cutthroat trout. We studied habitat selection of cutthroat trout in the Bear River by comparing temperature used by cutthroat trout versus temperature available in the Bear River. We hypothesized that cutthroat trout would select habitats with lower temperatures more frequently than habitats with temperatures that often exceeded lethal limits. We measured habitat selection by surgically implanting radio-telemetry tags equipped with temperature sensors into 84 cutthroat trout. We also measured habitat quality, based on temperature, using three methods: (1) floating temperature surveys, (2) temperature data loggers and (3) airborne thermal imagery. The results from our study will identify locations of cold-water refuge, during the peak of summer, and determine if such habitats are used more frequently than those that are dominated by lethal temperatures in the Bear River.

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

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Redband trout (*Oncorhynchus mykiss gairdneri*) are native to the Snake River drainage below Shoshone Falls in southern Idaho. The habitat redband trout occupy within this drainage varies from high elevation mountain streams with high flows and cool temperatures to low elevation desert streams with little flow and warm temperatures. We are evaluating the physiology and growth of selected wild populations exposed to simulated desert or montane daily water temperature treatments in the laboratory to test for differences between desert and montane stocks. We collected gametes from three wild stocks of redband trout (two desert and one montane), performed single parent crosses from these gametes, and incubated and reared these F1 offspring. At about 930 degree-days, fish from all stocks were placed into a simulated desert or montane stream diel water temperature cycle for 35 days. The fish were monitored daily, and samples of fish were collected before, during and at the end of the 35 day trial to evaluate various parameters. To serve as a control, we also reared gametes from a commonly used hatchery stock (Hayspur State Fish Hatchery). Response variables evaluated in trials included growth and survival, feed efficiency, plasma cortisol levels, heat shock proteins, and body proximate analysis. The hatchery fish had the fastest growth rates and most efficient feed efficiency in both the desert and montane treatments. In all wild populations, growth and feed efficiency were slightly higher in the montane treatments. We found significantly different growth rates and feed efficiency among all stocks and between the two temperature treatments. Plasma cortisol levels showed no differences between temperature treatments. The hatchery fish grew fastest in the desert temperature treatments, but feed efficiency was higher for fish maintained in the montane treatment. At day 35, heat shock protein 70 (hsp 70) expression in liver and muscle tissues was significantly higher for fish sampled from the desert temperature treatments but did not differ among stocks. The quantity of hsp 70 in muscle tissue of the fish showed variation among the stocks of fish tested with wild fish from desert streams showing the greatest hsp 70 expression in the desert treatment.

Aquatic-terrestrial Connectivity in a Wilderness Watershed: Do Emerging Insects and Riparian Predators Increase Following Wildfire?

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Wildfire has the potential to alter many land-water connections, yet few studies have addressed its influences on linked stream-forest ecosystems. Mid-term (5-10 years post-fire) effects of fire may lead to increased solar insolation and in-stream primary production, as well as greater inputs of labile plant detritus to streams. We hypothesized that these mid-term effects would lead to increases in benthic insect larvae, which would translate to greater emergence of adult insects from burned versus unburned

streams. In turn, we hypothesized that terrestrial predators such as spiders and bats that specialize in capturing these insects would be more abundant at burned sites. During summer-fall 2005, we tested these hypotheses in 2nd-3rd order stream reaches with varying fire histories, within a central Idaho wilderness watershed. We observed greater biomass of emerging adult insects at sites that burned with high intensity and whose conifer canopy had been lost. Tetragnathid spiders were most abundant at these same sites, as were the echolocation calls of bats. Our findings from this wilderness study may contribute to development of land management policies that more explicitly address the coupled responses of aquatic and terrestrial ecosystems to wildfire.

Distribution of Fish and Associated Environment Variables in the Lower Boise River

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Within the last century, the lower Boise River has been transformed from a meandering, braided, gravel-bed river that supported large runs of salmon to a channelized, regulated, urban river that provides flood control and irrigation water to over 1,200 mi^2 of land. An understanding of the current status of the river's fish communities and related environmental conditions is important to support the ongoing management of the Boise River. Fish community data collected by the U.S. Geological Survey and the Idaho Department of Fish and Game from 1974 to 2004 describe the status of fish communities in the lower Boise River. None of these data sets comprised a sampling of the entire lower Boise River; various reaches were studied at various times. Though each set of data was collected to address different study objectives, combining them provides an estimation of the distribution of fish in the lower Boise River over the last 30 years. Twenty-two species of fish, in 7 families, have been identified in the lower Boise River - 3 salmonidae, trout and whitefish; 2 cottidae, sculpins; 3 catostomidae, suckers; 7 cyprinidae, minnows; 4 centrarchidae, sunfish; 2 ictaluridae, catfish; and 1 cobitidae, loach.

Analysis of fish community data using an Index of Biotic Integrity (IBI) for Northwest Rivers shows a decline in the biotic integrity in a downstream direction, with the lowest IBI near the mouth of the Boise River. A larger number of tolerant and introduced fish were found in the lower reaches of the river. Changes in land-use, habitat, and water quality, as well as regulated streamflow have affected the lower Boise River fish community. Biotic integrity declined with increasing maximum instantaneous water temperature, specific conductance, and suspended sediment. Reduced biotic integrity also correlated with increased: area of developed land, impervious surface area, and the number of major diversions above a sampling reach. Fish communities in the upstream reaches were dominated by invertivores and picivores, whereas the downstream reaches were dominated by tolerant, omnivorous fish. The percent of sculpin found in the river decreased in a downstream direction, and sculpin disappear completely at sites below Glenwood Bridge. The reason for the absence of sculpin in the downstream reaches is unknown. Sculpin are abundant in most Idaho streams and are native to cold water gravel-bed rivers such as the lower Boise River. The loss of sculpin in the downstream reaches of the lower Boise River raises a red flag and further study is needed to identify the reasons for their disappearance. The condition of the mountain whitefish (*Prosopium williamsoni*) throughout the lower Boise River was good and was similar both to the condition of mountain whitefish from least-disturbed rivers in southern Idaho and to the North American standard weight for mountain whitefish.

Bull Trout Monitoring on the Sawtooth National Forest

Jeb Wofford and John Chatel
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Presenter: Jeb Wofford, jwofford@fs.fed.us, 208-727-5034

Federal regulations require the U.S.F.S. to monitor select species whose population trends are believed to reflect the effects of management activities on aquatic ecosystems. An inherent question integral to this requirement is, how does one monitor population trend? For aquatic species, trend is frequently monitored using abundance estimates over time in a select set of streams. However, numerous challenges arise when using abundance data to monitor at landscape scales, including: high costs, sampling and scaling errors, and spatial and temporal variation in population numbers. Due to the difficulties associated with abundance data, a presence/absence approach was developed to monitor bull trout distributions through time. Current protocols provide a landscape scale procedure for assessing bull trout populations and quantifying uncertainty associated with sampling events. Results to date reveal large-scale patterns in bull trout occurrence. Ultimately, it is hoped that an analysis of spatial patterns of bull trout distributions will provide information on population persistence, recovery (recolonization), and overall viability.

Session 6: Management

A South Fork Salmon River History

David Burns and Rodger Nelson
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The South Fork Salmon River is the heart of the Payette National Forest. We share it with the Boise National Forest, but two-thirds of the subbasin is on the Payette and the river divides the Forest from north to south. We intended to be a synopsis of some of the things The Forest Service has done to rehabilitate damage done by historic management actions.

Logging began in earnest in the South Fork in the late 1940s. Storms in winter of 1964-65, caused many hillsides to fail and the river-bed was covered with sand. Other events included the development of the Stibnite Mine in the first half of the 20th century, dredge mining in the 19th century, and grazing. By 1948, there were already complaints about sedimentation in the river. Throughout history, salmon and steelhead returns were mostly in decline. Potential decreases in carrying capacity from sedimentation were of widespread concern.

It is generally believed that the river was in good shape before the 1960s and worse afterward. These perceptions are without objective evidence. We do know there were sand deposits in the river in the 1950s. We also know that the hillsides are unstable and flooding was common throughout the 20th century. Since 1965, we have assembled an considerable information documenting changes following the famous 1960s floods. Lines of evidence confirm that the river has improved with respect to salmonid habitat. We have been able to observe significant changes in the ecosystem. We can now say that the system is more resilient than it was 50 years ago. The river basin is now managed more for natural processes.

Restoring Granite Creek: Implementing a Broad-based Collaborative Stream Restoration Project

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Granite Creek, and eastern shoreline tributary to Lake Pend Oreille, supports one of the largest runs of adfluvial bull trout in the system. The stream channel underwent significant channel changes in January 1996 due to an extreme rain-on-snow event. These channel changes resulted in adverse habitat changes that impaired fish passage, reduced habitat quality, and resulted in conflicts with existing flood plain development through the impacted stream reach. Restoration efforts were considered for this area in the past, but were not pursued due in part to the large numbers of private landowners that would be involved in such a project. We assembled a working group consisting of fish biologists, hydrologists, and engineers, along with real estate staff from Avista Corporation to develop a plan to complete a restoration project on Granite Creek. By including a wide variety of technical disciplines and laying the groundwork ahead of time with local landowners and permitting agencies, we were able to successfully implement a complex restoration project of approximately 3,000' of stream channel with broad support, and reduced the future likelihood of conflicts with existing floodplain development. Both biological and social objectives were achieved and the Granite Creek bull trout population has responded through record high redd counts.

Implementing Designs for an Incised Stream Channel: An Integrated Approach to Achieve Channel Stability, Habitat Enhancement and Resident Fish Recovery in Benewah Creek, Idaho

Angelo Vitale and Dale Chess
Coeur d'Alene Tribe
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Efforts by the Coeur d'Alene Tribe have been undertaken to restore stream habitats and increase adfluvial westslope cutthroat trout production in the Benewah Creek watershed. Legacy effects of logging and riparian management have resulted in channel entrenchment that exceeds the 5-year return interval peak flow in some mainstem reaches. Local changes in channel slope, velocity and shear stress have increased substrate mobility and bank erosion rates and resulted in elevated summer water temperatures as overbank flows have become increasingly infrequent and the connectivity to local groundwater tables has been reduced. To date, 1,219 m of channel construction have been completed as part of a larger project to restore stable channel geometry to 5.1 km of incised stream. Channel treatments take the approach of filling the stream channel to historical elevations and utilizing historical alignments where possible. The designed planform creates channel grade and profiles within the range of what is believed to be historical conditions, based on topographic and field analysis. Within the restored reach, sinuosity has increased by 27%, belt width has increased by 70%, and floodprone width has increased by 126%. Mean residual pool depth and pool volume have increased by 133% and 179%, respectively, while estimated sediment yield from streambank erosion has decreased by 69%. The project has implications for improving dynamic and long-term groundwater storage and recharge resulting in increased exchange of cold water to the stream channel. Improved rearing habitat for early, juvenile and adult life stages of westslope cutthroat trout has implications for increased survival and productivity at the watershed scale.

Toxicity of CO_2 to New Zealand Mudsnails (*Potamopyrgus antipodarum*): Implications for Control

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Introduced populations of New Zealand Mudsnails (*Potamopyrgus antipodarum;* NZMS) have caused concern for managers in the western United States because in high numbers, these snails can alter the trophic dynamics of aquatic systems. Infestations of NZMS at fish hatcheries limit or restrict the options for stocking hatchery-reared fish because of the risks of spreading snails to uninfested locations. Development of reliable and environmentally friendly methods that remove NZMS from source waters would be helpful to hatchery managers by creating an environment for snail–free fish production and/or transportation. We are evaluating a two-step control method for the piped spring water supply of the Hagerman National Fish Hatchery in Idaho (USA). We are testing the efficacy of hydrocyclonic separation of NZMS, followed by carbonation of the hydrocyclone waste (snail) stream. Our analysis of NZMS particle size distributions, combined with proprietary simulation tools (Krebs Engineering, Tucson Arizona), suggest that hydrocyclonic separation of NZMS will be complete. Testing of hydrocyclonic separation will be completed during the summer of 2007. Recent tests have demonstrated that aquatic species are generally intolerant to forced increases in dissolved carbon dioxide concentrations (DC) given its effect on water, blood, and hemolymph pH. These species are also sensitive to elevated total dissolved gas pressures. The gas bubble trauma that develops following exposure can, as with elevated DC exposure, cause mortality. We are exploiting this sensitivity in NZMS under both atmospheric and hyperbaric pressure conditions. Testing of NZMS at 100 kPa CO_2 and 15°C has been completed for the reproductive stage of snails (>2.5mm). A probit model of survival predicts the 100% lethal time of exposure at 9.6 h for 15°C. Testing is continuing at 8°C and 20°C for representatives of at least three sizes of snails to determine NZMS sensitivity under elevated DC conditions. Preliminary results indicate an inverse relationship between temperature during elevated DC exposure and survival. To determine whether altered pH of test water affects survival, we are evaluating the effects of a range of pH from 2 to 12. When water is saturated with CO_2 the pH can drop to approximately 5. Our results indicate that these pH shifts have little effect on the survival of NZMS.

Impacts and Uncertainties of Climate Change on Idaho Streams and Fish Communities

Dan Isaak, John Buffington, Charlie Luce, Jim McKean, Bruce Rieman, and Russ Thurow
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Evidence of rapid climate change continues to accumulate. Several recent assessments of the western United States corroborate air temperature increases predicted by global climate models and document related trends associated with decreasing mountain snowpacks, earlier stream runoff, and increasing wildfire severity. Trends are predicted to continue and possibly accelerate, which could have dramatic effects on the spatial and temporal distribution of habitats and resources available to stream fishes. Some species will benefit and others will be harmed, but broad distributional adjustments are likely to occur. Already challenging management issues will be exacerbated. Proactive risk mitigation will require the ability to translate broadscale climate signals to forecast trends in aquatic habitats at spatial and temporal scales commensurate with management activities. Biologists will need to be strategic in identifying habitats that are most important and how much of these habitats are needed. Our ability to address these issues is improving, but uncertainties are likely to persist due to the complexity of biophysical interactions associated with climate change. As a fisheries community, we may have to accept the loss of some species from large portions of their current range so that resources can be focused where populations may continue to persist. In other instances, new species will expand into local fish communities and flexibility will be needed in management response.

Session 7: The Lesser Known Species

Mountain Whitefish: A Little Biology for Everyone

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Mountain whitefish *Prosopium williamsoni* are the most widespread native salmonid in Idaho, occupying most major drainages. We sampled 18 populations of across southern Idaho to examine population structure, age and growth, size at maturity, and try to determine environmental limiting factors. Whitefish generally mature between 2-4 years of age with males typically maturing 1 year earlier than females. Fecundity for 300 mm females ranges from 2700 to 9000 eggs with a 500 mm female with an estimated 36,300 eggs. Whitefish typically grow rapidly until reaching maturity. Once mature, it appears both males and females spawn every year. Growth slows markedly following maturity. For example, a 250 mm fish matures for the first time at age 2-3 and a 350mm fish from the same stream could range in age from 8-10 years old. We used otoliths to age all populations and typically used cross sections of otoliths mounted in epoxy to age fish older than 6 years of age. Most populations appear to have low exploitation with all populations containing individual fish 10 years of age or older. South Fork Payette River in Garden Valley had an individual whitefish estimated at 23 years old. Whitefish appear to tolerate elevated temperatures better than trout in southwestern Idaho, living in the presence of channel catfish and small mouth bass in the lower Boise, Payette and Weiser rivers. We also found whitefish in the Bruneau River during summer sampling with few trout present. One limiting factor appears to be low dissolved oxygen, where whitefish are more susceptible to mortality compared to trout.

The Ecological Significance of Mountain Whitefish (*Prosopium williamsoni*) in a Central Idaho Wilderness Stream

Michael Lance and Colden V. Baxter
Idaho State University
Presenter: Michael Lance, lancmic2@isu.edu, 208-282-2139

Organisms that may be ecologically important are often overlooked if they have not been perceived as being beneficial to humans or esthetically appealing. Mountain whitefish (*Prosopium williamsoni*) are among the most abundant native fishes in western North America, yet their ecological role is largely unknown because they have not been considered a valuable game fish. This study investigated the ecological significance of mountain whitefish in Big Creek, a wilderness watershed in central Idaho using underwater counts and hook and line surveys to determine whitefish distribution and abundance and estimate their biomass, nutrient, and energy contributions within the aquatic ecosystem. It was found that within the main stem of Big Creek, there is approximately 1.25 metric tons of mountain whitefish tissue, and approximately 0.23 metric tons of mountain whitefish tissue are produced every year. We were able to use these numbers to calculate the standing crop mass of nutrients and energy as well as estimate nutrient and energy uptake within the system. Through this study, we have been able show that mountain whitefish can play a very important ecological role in stream nutrient and energy pathways.

Preliminary Evaluation of PIT Tagging and Instream Detection of Shorthead Sculpin (*Cottus confusus*)

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We conducted this study to evaluate the feasibility of using passive integrated transponder (PIT) tags to mark and track individual sculpins. We tagged two size categories (60-80 mm and > 80 mm total length)

of sculpins along the spinous dorsal fin and in the body cavity. We evaluated sculpin mortality, tag retention and net-avoidance behavior for 29 days. We observed no mortality directly attributable to PIT tag injection at either tagging location. We observed a 38.8% shed rate of dorsal tags and a 2.5% shed rate of body cavity tags. No change in net-avoidance behavior was observed. We released 116 PIT-tagged sculpins into the artificial stream at the Morrison Knudsen Nature Center, Idaho Department of Fish and Game, Boise, Idaho. Sculpin were re-detected using three fixed antenna and during 10 mobile surveys. Fifty-nine sculpin were detected at least once and twenty sculpin were detected multiple times. These results indicate that PIT tagging is a feasible method for marking and tracking individual sculpin.

Cryopreservation and Methanol Effects on Sperm Motility and Egg Fertilization Rates for North American Burbot Semen

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Cryopreservation of North American (NA) burbot *Lota lota maculosa* semen was investigated and optimal methanol concentrations determined. Methods in this study were modified from those reported for Eurasian burbot *Lota lota lota*. The concentration of permeable cryoprotectant (methanol; CH_3OH) in semen extender was varied to provide final methanol concentrations of 5%, 10%, and 20%. Semen motility was evaluated at 80 d and 363 d post freeze (dpf). Fertilization rates were determined using samples at 340 d and 367 dpf. Methanol concentration in the extender was shown to significantly affect ($p < 0.05$) sperm motility and egg fertilization rate. It was found that motility and fertilization rates were lowest at both 80 and 363 dpf using 5% methanol extender. Motility of semen 80 dpf was not significantly different between 10% and 20% methanol, but by 363 dpf semen stored in 20% methanol had significantly higher motility than any of the other treatments. Egg fertilization rates were highest using semen stored at 10% or 20% methanol and were comparable to fresh burbot semen. Results suggest that good motility and fertilization rates can be achieved following cryopreservation of NA burbot semen using cryoprotectant containing between 10% and 20% methanol in the extender. This study demonstrates the potential to utilize cryopreserved burbot semen in the development of germ plasm repositories for imperiled stocks.

Population Dynamics of Lake Trout in Lake Pend Oreille, Idaho

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Trap nets were fished from 10 September through 15 December 2005 and gill nets were fished from 12 February to 6 April 2006 to quantify movement and abundance of lake trout *Salvelinus namaycush* in Lake Pend Oreille. Size structure of the lake trout population in Lake Pend Oreille in 2005 was skewed toward fish 50–80 cm long based on trap netting and 40–80 cm long based on gill netting. Catch rates of trap nets were generally higher in the central and northern parts of the lake than the southern part of the lake and decreased steadily from the first lift date to the last lift date. Recapture rates of previously tagged lake trout ranged 0–23% at all trap-net locations, except at Sheepherder Point, where the recapture rate was 65%. Recapture rates of previously tagged lake trout were much lower in the northern (16%) and southern (27%) areas of the lake than in the central area of the lake (65%). Abundance of lake trout was about 11,000 adult fish and 36,000 total fish in Lake Pend Oreille on 15 December 2005. Abundance of lake trout estimated by mark-recapture in 1999, 2003, and 2005 in Lake Pend Oreille was nearly perfectly described by a simple exponential growth model, for which the instantaneous rate of growth was $r = 0.428$ and the annual rate of increase was $\lambda = 1.535$. Based on these population growth

rates, the adult lake trout population in Lake Pend Oreille would double every 1.6 years and reach 131,000 adult fish by 2010, if the population did not reach carrying capacity sooner. The cause of the recent increase in lake trout abundance is unclear, but population modeling should be used to evaluate sustainability of the population in the face of increased exploitation.

Session 8: Water Quality, Passage, and Monitoring

Modeled Response of Yellowstone Cutthroat Trout Populations to Chronic Selenium Exposure

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Selenium is a natural metalloid commonly mobilized by mining, fossil fuel processing, and irrigation and can be toxic to fish at high concentrations. In Idaho, selenium bioaccumulates in areas of the Blackfoot and Salt river drainages affected by phosphate mining. I used stochastic simulations to investigate the effects of chronic selenium exposure on Yellowstone cutthroat trout (YCT) populations. The model incorporated density dependence in juvenile first-winter survival and was parameterized with data from Snake River basin YCT populations. Response curves fit to toxicological data modeled decrease in juvenile survival and growth as a function of selenium concentration. Results predicted that long-term abundance of resident YCT populations was significantly lower than carrying capacity when whole-body selenium concentrations exceeded a mean of 7.39 µg/g dry weight (range 5.5 to 10.5) and significantly lower than one-half carrying capacity when concentrations exceeded 13.03 µg/g (range 10.0 to 17.0). Abundances in migratory populations were significantly lower than carrying capacity and one-half carrying capacity, respectively, when whole-body concentrations exceeded 10.60 µg/g (range 8.5 to 14.0) and 14.64 (range 11.0 to 19.0). Populations of both life history types became extinct when concentrations exceeded 25 µg/g. Population declines were driven primarily by decreased juvenile survival. At low selenium concentrations, populations compensated for toxicity-induced juvenile mortality through increased winter survival. However, at higher concentrations, insufficient numbers of juveniles remained alive at the onset of winter to take advantage of years with favorable winter conditions, even though average survival rates remained high. The model suggests that EPA's proposed selenium criterion of 7.91 µg/g will protect migratory YCT populations but may not prevent declines in resident populations. All publicly available salmonid selenium concentration data (n = 63) from the Blackfoot and Salt watersheds had a geometric mean of 9.81 (range 1.8 to 52.3) µg/g, indicating potential for population-level effects on YCT.

Fish and Invertebrate Diversity and Abundance in Association with Heavy Metal Levels within the Mt. Coeur d'Alene Area

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Through a cooperative research project we conducted a heavy metal study on fishes and macroinvertebrates within the watersheds that surround the Mt. Coeur d'Alene Area from April to July 2005. Understanding why we are not observing Sculpin (*Cottus spp.*) and higher diversity of macroinvertebrate fauna is important to ensure proper actions are being taken to correct this problem. Significant efforts and money over the last 20-years have been put into the Coeur d'Alene River basin to help improve fish habitat and reduce heavy metal impacts. One objective of this study was to evaluate the heavy metal concentrations in these watersheds and their affect on fish and macroinvertebrate diversity. We sampled stream organisms (e.g. insects, amphibians and fish) to associate their abundance and diversity to heavy metal concentrations. Macroinvertebrate sampling was conducted in riffle habitat

where three samples were taken at both the middle and edges of the stream channel using a 500-micron mesh Surber Sampler. Metal analysis was conducted by taking sediment samples from random reach sites and filtered through a 63-micrometer nylon screen into acid washed polypropylene jars then individual elements were determined by an ICP spectrometer. Preliminary results indicate that both background and heavy metals levels associated with mining activities have affected both fish and macroinvertebrate populations in the watersheds in this study area. Preliminary results also indicate that the species diversity of fish in the study area are affected by heavy metal concentrations, as no Sculpin (*Cottus spp.*) are present in many of the streams sampled. Further analysis of streambed sediments found moderate levels of heavy metals, which altered the community diversity of macroinvertebrates.

Evaluation of Culvert Influence on Seasonal Movements of Juvenile Salmonids, an *In situ* PIT Tag Study in Alaska

Mary King[1] and Steve Anglea[2]
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Much research has been conducted in laboratory situations to understand culvert physical requirements for juvenile fish passage. Culvert design criteria have been developed based on this research. However, fish behavior near culverts in natural stream conditions may be much different. We are evaluating juvenile salmonid movements proximal to a culvert that was assessed as a fish barrier in Slikok Creek, Alaska. Spawning adults seasonally pass upstream, but juveniles may be seasonally restricted, thus limiting access to rearing habitat.

We implanted PIT tags in juvenile salmonids (55-120mm) located upstream and downstream of the culvert. To monitor fish movement and culvert passage, we installed an array of four streamwidth PIT-tag antennas (up to 6.4m wide): 30m upstream of the culvert, the entrance of the culvert, retro-fitted to the exit of the culvert, and 20m downstream of the culvert. Fish movements are being monitored to determine 1) if "stacking" occurs as fish approach the culvert and 2) the proportion of successful passage events through the culvert at low, medium, and high discharge periods. Fish monitoring will continue through the winter of 2006/2007 to allow detections of seasonal movements as well.

The existing culvert will be replaced with an improved design culvert in June 2007. We will then tag a new sample of juveniles and repeat the assessment. Fish passage and hydraulic conditions for the existing culvert will be compared with that of the replacement culvert to evaluate whether or not juvenile fish passage conditions were improved. Results will provide better understanding of culvert function relative to natural stream conditions and juvenile fish movement: 1) are older culverts necessarily a barrier, as determined by current assessment criteria? 2) do new culverts with improved design criteria significantly increase juvenile fish passage? The presentation will focus on the technology and preliminary results.

Fish Passage Evaluation at Forest Road Stream Crossings in Idaho: Results and Recommendations

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In 2002, the Forest Practices Act Advisory Committee sought answers to what constitutes acceptable fish passage, and what field and analytical methods are used to make this determination. Field crews measured 198 culverts for fish passage evaluation during the 2003 and 2004 field seasons. Culvert slope was determined by measuring culvert inlet and outlet elevations with a surveying rod and level. Other physical measurements including culvert diameter, inlet and outlet drop height, and culvert length were measured with a standard measuring tape to the nearest 0.10 foot. Water depth at low flow was measured with the surveying rod, and water depth at ordinary high water was estimated by measuring the

distance from the bottom of the culvert to the rust line in the culvert barrel. The results were analyzed using two different methods. The first method uses Maning's equation and simple visual observations to estimate the height of water in the culvert at ordinary high flows to calculate average water velocity in the stream crossing structure. The second method uses the San Dimas FishXing model to analyze fish passage at 5% (high water) and 95% (low water) annual exceedence flows. The two methods yielded similar results. Findings revealed that 81.5% of surveyed culverts exceed maximum allowable water velocities, 19% and 26% had inlet and outlet drop heights, respectively, exceeding criteria, and 91% failed to meet minimum water depth criteria. Three percent of the total culverts surveyed met all requirements for fish passage. In 2005, a technical sub-committee was formed to develop guidelines for installing stream crossing structures that meet Idaho's fish passage criteria, and develop educational material for state agencies and the general public.

Preliminary Evaluation of Traffic Counters for Estimation of Angler Effort

Rob Ryan, Doug Megargle, and Dan Schill
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Estimating angler effort using conventional creel survey methods is often time consuming and costly. Incorporating vehicle counts made by traffic counters to model angler use could potentially reduce time and cost requirements associated with collecting this information. TRAFX traffic counters were used to collect vehicle counts at key access locations on Salmon Falls Creek Reservoir, Twin Falls County, ID. Linear regression was used to evaluate the utility of vehicle counts as predictors of angler use. Results indicated traffic counters do have potential in estimating daily angler counts and/or angler effort.

Poster Session (listed alphabetically by last name of presenter)

Adult Steelhead Spawner Abundance in Two Small Tributary Streams of the Imnaha River Subbasin, Oregon

Neal Espinosa, Cameron Albee, Mike Blenden, and Jason Vogel
Nez Perce Tribe
Presenter: Mike Blenden, mikeb@nezperce.org, 208-843-7145

Snake River steelhead (Oncorhynchus mykiss; Hey'ey in Nez Perce), are listed as threatened under the Endangered Species Act. Annual non-biased and precise quantification of adult abundance in component populations is essential to effective management. In this study, we estimated adult A-run steelhead abundance of two non-supplemented tributaries of the Imnaha River via upstream and downstream portable picket weirs. Monitoring in Lightning Creek started in 2000, Cow Creek in 2001 and have continued to date. These streams are relatively small with a drainage area of 103.8 km^2 (Cow Creek) and 152.6 km^2 (Lightning Creek). These extremely flashy systems from spring snowmelt and/or heavy thunderstorm precipitation can render picket weirs unable to function. Tributary specific abundance estimates for Lightning Creek have ranged from 36 (33-39 95% CI) in 2000 to 232 (166-297 CI) adults in 2002. Estimated abundance in Cow Creek have ranged from 26 (16-37 CI) in 2006 and 128 (118-138 CI) adults in 2004. Stray hatchery origin adults have comprised 1.4 to 26.6 percent of the total escapement. Sex compositions have ranged from 61.2 to 84.8 percent female. Scale analysis from 2000 through 2004 have shown natural origin adult one ocean steelhead comprising of 62 percent in Lightning Creek and 71.1 percent in Cow Creek. In 2005 and 2006 we deployed a Logie 2100 resistivity counter with day-time video, to passively calculate an independent population estimate in Lightning Creek with attempt to determine weir impedance.

All Fish Screens are Not Created Equal. Fish Screen Designs – What You Should Know

Jody Brostrom[1], Lynn Stratton[2], and Paddy Murphy[2]
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[2]Idaho Department of Fish and Game, Salmon Screen Shop
Presenter: Jody Brostrom, jody_brostrom@fws.gov, 208-476-2257

The goals and principles of fish screening are the same regardless of the size of the diversion. Fish screens should: 1) safely separate fish of all life stages from water withdrawal; 2) allow unhindered upstream and downstream passage; 3) not create new problems for fish by poor design choices, and 4) minimize the impact to water users. Since the advent of fish screens over 100 years ago, research, development and testing have evolved so that several screen designs are available. These screens meet tested criteria developed by fish screening experts, and have been shown to protect all life stages of most salmonids, as well as other fish species. There is no "magic bullet screen" that will meet all situations, but those interested in installing fish screens have a range of options to choose from. All screens require a degree of money and labor for operations and maintenance, but if the screen design is matched up to the appropriate site, species and water use, the operations and maintenance can be minimized.

No Screens, No Fish? Know Screens, Know Fish!

Jody Brostrom[1], Paddy Murphy[2],and Lynn Stratton[2]
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[2]Idaho Department of Fish and Game, Salmon Screen Shop
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Fish screens have been installed at water diversions for over 100 years to prevent loss of sport and commercial fish and to prevent extinction of species. However, installing even a properly designed fish screen will not have the desired effect unless several factors are considered. The most important thing to consider is if a fish screen is needed, or would have real benefits based on other factors going on in the drainage. Other factors include water withdrawal season, watershed connectivity, water savings, current and potential habitat, current and potential fish species, life history, migration timing, cooperation of landowner, irrigators and agencies, complementary on-farm improvements, funding availability, and cost-benefit ratio. It takes time, the involvement of all parties, and communication to "do the homework" and resolve all the issues before project design and construction takes place.

Use of Tributary Confluence Habitat by Westslope Cutthroat trout (*Oncorhynchus clarki lewisi*) in a Wilderness Watershed Affected by Wildfire

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During summer and fall 2005 we conducted a study of adult cutthroat trout use of confluence habitat in Big Creek a central Idaho wilderness watershed, much of which was burned by wildfire in 2000. We characterized habitat use vs. availability by adult cutthroat trout in mainstem reaches that included junctions with small tributary streams that varied in their history of wildfire (3 unburned and 3 burned). We constructed maps of each study reach to characterize habitat availability, with confluence habitat delineated by size of mainstem temperature influence. We conducted 68 underwater surveys of trout distribution during day and night, summer and fall. We also sampled drifting invertebrate prey over a 24-hr period in one burned and one unburned tributary, just above the confluence. Adult trout often selected habitat at tributary confluences. Their preference for this habitat was stronger in the night than in the day, and their selection for confluences was stronger in the summer than in the fall. Confluences with tributaries that were burned were more strongly selected by trout than those with unburned tributaries during summer days, but in the night these differences were not observed. Burned tributaries were similar

in size and temperature to the unburned streams, but the burned tributary we sampled delivered more than twice as many drifting invertebrates to the confluence habitat than the unburned stream. Such differences may have been partially responsible for the uneven use of confluence habitats. However, confluences differed in physiognomy, and habitat arrangement created variability in distance and pathways to safety for trout (evaluated by observing trout "escapes" underwater). Our results suggest a trade-off involving thermoregulation, foraging opportunity, and predation risk may mediate the use of confluence habitat by cutthroat trout.

Movement, Migration and Habitat Use 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 the trout population consists of about 1,000 trout per mile, mostly rainbow trout. Whereas below all the dams and diversions the trout population is nearly non-existent, despite seemingly healthy and complex fish habitat, consisting 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) assess habitat limitations, if any, within and among river reaches; and 3) compare summer habitat usage between adult brown trout and adult rainbow trout. The project was begun with the radio tagging of a total of 32 rainbow adult trout below two diversion dams in February and March, 2006. Spawning movements for most of the fish were made to downstream areas within the same river reach. A number of trout did move downstream below a dam and two passed upstream of a dam. One trout was harvested by an angler in a downriver canal following the end of the irrigation season. The project will be continued with the radio-tagging of more rainbow trout in December, 2006 and brown trout will be radio tagged in spring, 2007. Fisheries management implications may include establishment of upstream fish passage at dams, reconnection of river fragments limited by specific habitat features, and a relative assessment of fish entrainment mitigation opportunities.

Current Diagnostic Techniques for *Myxobolus cerebralis*, the Parasite that Causes Salmonid Whirling Disease

Leah Steinbach Elwell[1] and Kajsa Eagle Stromberg[2]
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[2]Whirling Disease Initiative
Presenter: Kajsa Eagle Stromberg, kstromberg@montana.edu, 406-994-2550

Techniques to isolate *Myxobolus cerebralis*, the parasite that causes whirling disease, from the salmonid host have existed for several decades. Dramatic declines in wild rainbow trout populations in the United States heightened the need for sensitive techniques for accurate and rapid identification of *M. cerebralis* in both of the parasite's hosts and environment. In the last decade, the diagnostic techniques to detect *Myxobolus cerebralis* have improved dramatically. New techniques are more sensitive and specific for distinguishing among parasites, and characterizing impacts of infection within the host. The parasite can be detected in the salmonid fish host, the oligochaete host *(Tubifex tubifex),* and the environment. The salmonid fish and oligochaete worm hosts have different methods for assessing the presence of the parasite and the intensity of the infection. Further, the detection of the parasite in water and sediment is an important development for researchers determining the presence of the parasite and the potential for its spread. In recent years, many detection methods have been developed and refined. Each method is appropriate for a particular context and they are not interchangeable. This project summarizes current methods for detecting *M. cerebralis,* and addresses the appropriate applications for each.

Distribution and Status of Pacific Lamprey in the Clearwater and Salmon River Drainages of Idaho

Matthew W. Hyatt, Tim Cochnauer, and Christopher W. Claire
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Pacific lamprey *Lampetra tridentata* have garnered little attention in fishery science until recently, despite being an important native element to river ecosystems. Pacific lamprey in Idaho must pass eight hydroelectric facilities on the Snake and Columbia rivers as juveniles migrating downstream to the Pacific Ocean and again as adults migrating upstream to their spawning grounds. The number of adult Pacific lamprey annually entering the Snake River basin has declined from an average of just over 18,000 in 1962-1969 to fewer than 600 during 1997-2006. Lower Granite Dam adult passage counts have dropped from approximately 1200 in 1994 to less than 250 annually in 2005 and 2006. Historical adult counts at the Lewiston Dam in 1950 were in excess of 5,000 fish. Hydroelectric facility impacts within the migratory corridor in combination with inbasin habitat degradation are considered the primary factors contributing to declines. In the Clearwater subbasin, a lack of recruitment has resulted in the likely extirpation of Pacific lamprey in two major tributaries (Lolo and Newsome creeks), with the possibility of Red River being the third in the past 10 years alone. Pacific lamprey persistence patterns in the Clearwater and Salmon River drainages are potentially linked to habitat in subbasins with high water quality. Our sampling from 2000 to 2006 throughout the historical range of Pacific lamprey in Idaho suggest that the current distribution is 35% of the area occupied in 1960 in the Clearwater River drainage, and 22% of that occupied in the Salmon River drainage. Information obtained during this study reflects population minimal numbers and distribution ranges restricted to remaining preferred habitat in the Snake River basin.

Deer Lake

Tarah Johnson
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A student report on the ecology, survey, species, and restoration of Deer Lake, WA. In the southeast corner of Stevens County, Washington, in the beautiful, rugged mountains north of Spokane, sits a body of water known as Deer Lake. This paper discusses the abundant species located within the lake, and the geology and geomorphology of this lake. Water Quality issues as well as macro-invertebrate species are also discussed in this paper. In conclusion, the paper discusses options for optimal management of this particular body of water, and also, ways to continue to improve the water quality of this lake.

Migrational Dynamics and Life History of Adult Fluvial Bull Trout *Salvelinus confluentus* in the Lemhi River Drainage, Idaho

James Lamperth and Christopher W. Claire
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Fluvial bull trout *Salvelinus confluentus* distribution in the Lemhi River sub-basin has been effected by habitat fragmentation caused by irrigation withdrawals. Nearly all tributaries to the Lemhi River are disconnected during the irrigation season resulting in limited access to spawning habitat. To determine current fluvial bull trout distribution, migration patterns, and habitat use, we surgically implanted radio transmitters in 32 adult fish (mean TL 493 mm, range 352-696 mm) in the main-stem Lemhi River between 14 April and 6 July 2006. Tagged bull trout were monitored weekly through 1 November 2006 via ground tracking and three fixed telemetry stations. Bull trout migrated upstream from the Lemhi River in the spring/summer exclusively into Hayden Creek, the largest remaining perennially connected tributary in the Lemhi River sub-basin. Bull trout entering Hayden Creek did so by 20 July 2006 (50% entrance by 22 June 2006). We documented a mean upstream migration distance of 40.9 km (range 6.5-58.9 km) from main-stem tagging locations. All tagged bull trout returned to the Lemhi River by 25

September 2006 after the cessation of spawning activity in Hayden Creek. We observed a spawning mortality and/or spawning tag expulsion frequency of 7.4%. Redd surveys were conducted in six streams in the Hayden Creek watershed documenting 306 redds of which 52.2 % were assumed to be fluvial bull trout redds based on the observed relationship between total length of spawning adults and redd size. These results suggest Hayden Creek supports the only fluvial population of bull trout in the Lemhi River sub-basin. As part of the ongoing Lemhi Conservation Program, measures are being implemented to reconnect tributary streams with the Lemhi River. Future monitoring efforts will evaluate whether fluvial bull trout expand their current distribution and utilize these newly connected tributary habitats.

"FISH ON"- LINE: A Web-Accessible Database of Aquatic Biological Data

Dorene MacCoy, Linda Schueck, and Traci Hoff
USGS
Presenter: Dorene MacCoy, demaccoy@usgs.gov, 208-387-1354

Aquatic biological data collected by the USGS in the Pacific Northwest for more than a decade is in demand, but scientists must respond to each request individually. Because the USGS has a long-standing policy of storing all data in a computer database, the Western Region Director supported a partnership between the USGS Idaho Water Science Center (IWSC) and the Biological Resources Division National Biological Information Infrastructure (NBII) Great Basin Information Project to develop a Web-accessible database for aquatic biological monitoring data gathered over more than a decade. An online database provides easy access to the available data. Also, the database developed by the partnership could help to guide the design of a National aquatic biological database.

Since the early 1990s, aquatic biological data from over 160 stream reaches has been collected by IWSC personnel using the collection methods developed by the USGS National Water Quality Assessment (NAWQA) program. Aquatic biological community data integrates both water quality and habitat conditions. Information about biological communities (fish, macroinvertebrates, and algae) increases the knowledge of aquatic biodiversity and helps managers to determine if a stream is supportive of certain species such as cold water biota or pollution tolerant species. Community data has been used recently to determine beneficial use of streams and rivers required for the total maximum daily load process. Long-term trend analysis of aquatic communities also helps managers to evaluate best management practice effectiveness. Aquatic communities are highly correlated with water quality and habitat conditions and are a good indicator of the decline or improvement in the quality of a water body.

Crooked River "To Hell and Back"

Wayne Paradis[1] and Erik Ryan[2]
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[2]Headwaters Engineering
Presenter: Wayne Paradis, wparadis@fs.fed.us, 208-983-4016

This poster will show the continuing work of rehabilitating a placer-mined stream. Restoration work on Crooked River began in 1984. Under the guidance of American and Crooked River Environmental Impact Statement (USFS, 2005) and using Stewardship Contracting, work completed between 1984 and1989 was improved and modified in 2006. The poster will show results of this work and highlight things that worked and things that did not work.

Clear as Mud: Clearing the Murky Water About the Roles of Conservation Districts

Justin Peterson, Lynn Rasmussen, Dash Dieringer, and Amanda Hendrix
Nez Perce Soil and Water Conservation District
Presenter: Justin Peterson, jpeterson@turbonet.com, 208-843-2931

Describing what roles Conservation Districts can play in restoring fish habitat thru collaboration and cost sharing with: Federal, State, Tribal, and private entities.

Developments in Whirling Disease Research and Management

Kajsa Eagle Stromberg
Whirling Disease Initiative
Presenter: Kajsa Eagle Stromberg, kstromberg@montana.edu, 406-994-2550

The Whirling Disease Initiative is a national research program to conduct research that develops practical management solutions to maintain viable, self-sustaining wild trout fisheries in the presence of the whirling disease parasite. Since the Whirling Disease Initiative was established in 1997, the Initiative has provided funding for more than 120 research investigations in a wide variety of specialties including parasitology, epidemiology, and landscape ecology. Research focuses increasingly on larger scale evaluations and development of management tools. Recent developments in risk assessment, gear treatment, parasite and host ecology, parasite detection, and environmental factors have great potential to inform and improve management related to whirling disease. This project summarizes recent developments in whirling disease research and management and describes the current research emphasis of the Whirling Disease Initiative.

Understanding the Effects of Watershed-versus Local-scale Variables on Stream Fish Assemblages

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Presenter: Mazeika S.P. Sullivan, smazeika@uidaho.edu, 208-885-7323

Numerous variables operating across different spatial scales are known to affect stream and river biota. However, the hierarchical relationships among these predictor variables present unique challenges in understanding the relative impact of these variables. The spatial scale (e.g., local versus watershed) at which these variables have the greatest ecological impact is also particularly important in understanding biotic-habitat riverscape connections and in developing effective management strategies. From research in Vermont and Idaho, USA, we are examining the effects of various hierarchical predictor variables across spatial scales on riverine fish assemblages. We are analyzing these data using of a variety of modeling tools. Results to date indicate that while a combination of watershed- and local-scale factors likely interact to have the greatest impact on fish community diversity and structure, local-scale variables (e.g., morphometric measures, geomorphic condition, habitat quality, etc.) may represent the most time and cost-effective measures of stream fish assemblages.

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