IDAHO CHAPTER of the AMERICAN FISHERIES SOCIETY

2006 ANNUAL MEETING AGENDA AND ABSTRACTS

February 15-17, 2006
Red Lion Riverside
Idaho Falls, Idaho

Plenary Session:
Economic Aspects of Idaho Fisheries
The Great, but Seldom Used, Conservation Tool

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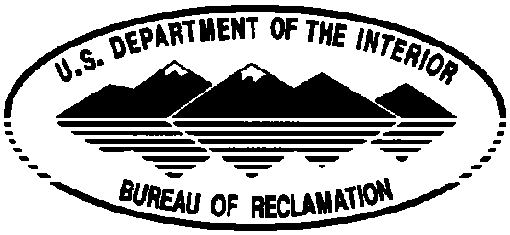

IDAHO CHAPTER AMERICAN FISHERIES SOCIETY
2006 ANNUAL MEETING AGENDA

February 15-17, 2006
Red Lion Riverside Hotel
Idaho Falls, Idaho

MONDAY, FEBRUARY 13

Workshop: Population Viability

TUESDAY, FEBRUARY 14

Symposium: Exploring the Differences between Fine-Spotted and Large-Spotted Varieties of Yellowstone Cutthroat Trout

Workshop: Hatchery Nutrition

6:00-8:00 PM ICAFS Annual Meeting Registration

7:00-9:00 PM ICAFS Executive Committee Meeting

WEDNESDAY, FEBRUARY 15

7:00-10:00 AM	Annual Meeting Registration
8:00-8:10 AM	Introduction and Announcements
8:10-8:25 AM	President's Address, Russ Kiefer

Plenary Session:
Economic Aspects of Idaho Fisheries and Other Natural Resources

Purpose: To expose the membership to powerful economic perspectives, data, and studies to enhance their effectiveness as natural resource conservationists.

Moderator: James Capurso, ICAFS President-Elect

8:25-8:30 AM	Introduction to session and presenters
830-915 AM	Protected landscapes and economic vitality in the Mountain West, Thomas Michael Power, Professor and Chair of Economics Department, University of Montana
915-945 AM	Pathways from sustained yield toward sustainability, Jay O'Laughlin, Professor, Department of Forest Resources and Director, Idaho Forest, Wildlife, and Range Policy Analysis Group, University of Idaho

945-1015 AM	**Break, Refreshments in Bannock Room**
10:15-10:40 AM	Idaho fisheries economic study, Virgil Moore*, Tom McArthur, and Sharon Clark *Idaho Department of Fish and Game Fisheries Bureau Chief
10:40-11:05 AM	The 2001 IDFG Chinook economic survey – More than the Money, Sharon Kiefer, Idaho Department of Fish and Game Anadromous Fisheries Manager
11:05-11:30 AM	The potential economic impact of restored salmon and steelhead fishing in Idaho, Don Reading, Ben Johnson Associates, Inc.
11:30-11:55 AM	Valuing ecosystem services: focus on freshwater fisheries, John W. Duffield, Research Professor, Economics Department, University of Montana
11:55-1:15 PM	**Lunch: Committee Lunch Meetings** Enjoy your boxed lunch with your choice of chapter committees. Choose from: Anadromous Fish: Meet in Yellowstone Room Fish Culture: Meet in Jefferson Room (Room #143) Mentoring: Meet in Bannock Room Native Fishes: Meet in Teton Room Public Education: Meet in Board Room Riparian: Meet in Madison Room (Room #142) Water Quality/Stream Hydrology: Meet in Targhee/Bonneville Rm

Session: Native Cutthroat Trout

Moderator: Amy Harig, Trout Unlimited Cooperative Native Trout Program

1:15-1:20 PM	Introduction to session and presenters
1:20-1:40 PM	Ecologically based variation in morphology among cutthroat trout (*Oncorhynchus clarki sp.*) of western North America. Meredith B. Seiler and Ernest R. Keeley
1:40-2:00 PM	Status of Yellowstone cutthroat trout in Idaho. Kevin A. Meyer, Daniel J. Schill, and James A. Lamansky, Jr.
2:00-2:20 PM	Fine-scale genetic structure of westslope cutthroat trout in a tributary to the Selway River. Dawson Dunning, Paul Spruell, Katherine Thompson, and Fred W. Allendorf
2:20-2:40 PM	Adult post-spawn movements and juvenile outmigration of fluvial Bear River Bonneville cutthroat trout in the Thomas and Smith's

	Fork rivers ID-WY. Warren T. Colyer, Adam Sepulveda, Amy L. Harig, Dana Degraaf, and Jeff Kershner
2:40-3:00 PM	Predation by double crested cormorants and American white pelicans on native Yellowstone cutthroat trout and hatchery rainbow trout in Blackfoot Reservoir, Idaho. David Teuscher and Richard Scully
3:00-3:20 PM	**Break**

Session: Invasive Species

Moderator: Laura Kessel-Hawn, USFWS Wild Fish Health Program Coordinator

3:20-3:25 PM	Introduction to session and presenters
3:25-3:45	Connectivity, habitat quality, and biotic resistance and their association with non-native brook trout occurrence in Panther Creek, Idaho. Joseph R. Benjamin, Jason B. Dunham, and Matthew R. Dare
3:45-4:05 PM	Morphological and swimming stamina differences between Yellowstone cutthroat trout (Oncorhynchus clarki bouvieri), rainbow trout (O. mykiss), and their hybrids. Steven M. Seiler and Ernest R. Keeley
4:05-4:25 PM	Survival and passage of New Zealand mudsnails in the gastrointestinal tract of rainbow trout. R. Louise Bruce and Christine M. Moffitt
4:25-4:45 PM	Seasonal population dynamics of New Zealand mudsnails (Potamopyrgus antipodarum) in Silver Creek Drainage, Blaine County, Idaho and Riley Creek Drainage, Gooding County, Idaho. Chris James and Christine M. Moffitt
5:30-9:00 PM	**Student/Professional Mixer Hosted by Palouse Unit at Papa Tom's Pizza, Directions:** Go South on River Parkway toward W Broadway St (0.1 mile) Turn left onto W Broadway St (0.3 mile) Turn Right onto Yellowstone HWY/N Yellowstone HWY. Continue to follow Yellowstone HWY (0.5 mile). Turn Left onto W 17th St. (2.2 miles). Turn Right onto S Woodruff Ave (0.1 mile). Estimated Drive time: 9 minutes. Estimated Distance: 3.39 miles.

THURSDAY, FEBRUARY 16

Session: Aquaculture and Conservation Hatcheries

Moderator: Rick Alsager, Idaho Department of Fish and Game
Nampa Fish Hatchery Manager

8:00-8:10 AM Information and Introduction to session and presenters

8:10-8:30 AM Do aquaculture drug treatments pose a serious risk to humans and the environment?-A case study. Christine M. Moffitt

8:30-8:50 AM SDS-PAGE and western blot analysis of *Flavobacterium psychrophilum* carbohydrate antigens and their potential role in protective immunity. Benjamin R. LaFrentz, Scott E. LaPatra, William D. Shewmaker, Aaron Weighall, and Kenneth D. Cain

8:50-9:10 AM Initial microsatellite analysis of wild Kootenai River white sturgeon and subset brood stock groups used in a conservation aquaculture program. Jeff Rodzen, Bernie May, Paul Anders, and Sue Ireland

9:10-9:30 AM Reproductive success of hatchery and natural origin Chinook salmon (*Oncorhynchus tshawytscha*) in a stream with a history of supplementation management. Brian Leth and Madison Powell

9:30-9:50 AM Performance of diploid and triploid rainbow trout in 16 Idaho high lakes. Joseph R. Kozfkay and Daniel J. Schill

9:50-10:10 AM **Break**

Session: Techniques and Analysis

Moderator: Ernest Keeley, Associate Professor, Department of Biological Sciences, Idaho State University

10:10-10:15 AM Introduction to session and presenters

10:15-10:35 AM Comparison of two methods used for describing relations between flow and year class strength on the Henrys Fork, Idaho. Dan Garren

10:35-10:55 AM A stock-recruit relationship for naturally produced spring/summer Chinook salmon in the Snake River basin. Timothy Copeland

10:55-11:15 AM Invertebrate drift as a predictor of salmonid abundance and distribution in the Panther Creek Watershed, Idaho. Sarra Moller

and Ernest R. Keeley

11:15-11:35 AM Use of an In-stream PIT-tag Detector System to Monitor Movement of bull trout between the Snake and Tucannon rivers. Steve Anglea, Carrie Bretz, and Mike Faler

11:35-1:40 PM **Lunch: ICAFS Annual Business Meeting and Western Division Update**

Session: Habitat Management and Conservation Actions

Moderator: Michael Kellett, Boise National Forest Fisheries Biologist

1:45-1:50 PM Introduction to session and presenters

1:50-2:10 PM Western Native Trout Initiative - habitat and conservation for the future security of our native trout. Virgil Moore

2:10-2:30 PM Fish Passage at Road Crossings in Idaho – Section 7 Consultation for ESA-Listed Species. Mary Faurot, Tim Burton, Chad Fealko, and Mark Robertson

2:30-2:50 PM Fisheries diversion and screening alternatives. Robert K. Weir

2:50-3:10 PM Effects of fluvial geomorphic adjustment on stream fish communities. Mažeika S.P. Sullivan, Mary C. Watzin, and W. Cully Hession

3:10-3:30 PM **Break**

3:30-3:50 PM Modeled hydrology predicts trout species composition of upper Teton River tributaries. Ryan Colyer, Rob Van Kirk, Kimberly Peterson, Martin Koenig, and Kirstin Keetch

3:50-4:10 PM Seasonal movement and the interaction of temperature and discharge on burbot in the Kootenai River, Idaho, USA, and British Columbia, Canada. Vaughn L. Paragamian and Virginia D. Wakkinen

4:10-4:30 PM Discharge and temperature influence on salmonid movements in the Deadwood River. Sarah M. Rose, Mathew R. Dare, and Tammy Salow

4:30-4:50 PM Stream food web response to a carcass analog addition to two central Idaho streams. Andre E. Kohler, Amanda Rugenski, and Doug Taki

4:50-5:10 PM	Spatial Distribution of the Threatened Bliss Rapids snail downstream from Bliss and Lower Salmon Dams. Barry Bean and Mathew R. Dare
5:10-6:00 PM	**Poster Session: View the contributed posters with poster preparers available for questions. Refreshments served.**
6:00 PM- 1200 AM	**Social, Raffle, and Auction** **Live Music From Swingshift** **Food and beverages provided by the chapter.** **No host bar.**

Posters

Mitochondrial DNA phylogeography of mountain whitefish *Prosopium williamsoni* in Idaho, Utah, and Montana. Campbell, M., A. Whiteley, and B. Gamett.

Evaluating genetic structure of interior Redband trout in environmental extremes of Idaho using microsatellite loci. Cegelski, C., M. Campbell, and K. Meyer.

Influence of year and local population on length at return of Snake River spring/summer Chinook salmon. Copeland, T. and J. Johnson

Evaluation of adult Pacific lamprey passage success at McNary and Ice Harbor Dam. Cummings, D., C. Peery, T. Dick, B. Daigle, and M. Moser.

Reconnecting fragmented Lahontan cutthroat trout populations in Northeastern Nevada. DeGraaf, J.D.

Rainbow trout movements in the Henry's Fork caldera in relation to population estimate monitoring and river flows. Emery-Miller, A.M., J. De Rito, J. Gregory, and D. Garren.

Fish community structure associated with bank stabilization on the metals-contaminated Coeur d'Alene River, Idaho. Gidley, C.A.

Ecosystem rehabilitation: restoring Kootenai River fisheries through maintaining a balance of nutrients. Hardy, R. and C. Holderman.

Application of the AQUATOX model on the Lower Boise River: A preliminary report. Harris, K., D. Bradley, B. Nydegger, R. Finch, D. Park, and T. Dupuis

Relative roles of habitat size, connectivity, and quality on occupancy of spawning patches by Chinook salmon. Isaak, D.J., R.F. Thurow, B.E. Rieman, and J.B. Dunham.

Evaluating affects of passage through the Columbia River hydrosystem on the survival and success of adult Chinook salmon using PIT tagged fish. Peery, C., C. Anderson, and B. Burke.

Testing recruitment failure hypothesis' by in-situ fertilization and release of Kootenai River white sturgeon eggs. Rust, P., T. Kiser, S. Richards, J. Siple, C. Lewandowski, and S. Ireland.

Monitoring Kootenai River white sturgeon migration and movement patterns with an array of fixed station sonic telemetry receivers. Rust, P., M. Neufeld, and S. Ireland.

FRIDAY, FEBRUARY 17

Session: Lentic Habitat and Biota

Moderator: Ned Horner, Idaho Department of Fish and Game, Panhandle Regional Fisheries Manager

8:00-8:10 AM Information and Introduction to session and presenters

8:10-8:30 AM Movement and habitat use of bull trout in Arrowrock Reservoir. Carl Stiefel, Mathew R. Dare, and Tammy Salow

8:30-8:50 AM Are bull trout and lake trout living in harmony in Lake Pend Oreille, ID? Tom P. Bassista, Melo M. Maiolie, Mike P. Peterson, and Chris C. Downs

8:50-9:10 AM Lake Level Management to Enhance Kokanee Spawning. Melo Maiolie, Bill Ament, and Bill Harryman

9:10-9:30 AM Spawning characteristics of a rainbow trout population in the Kootenai River Drainage, Idaho. Dean E. Holecek and Jody P. Walters

9:30-9:50 AM Break

Session: Anadromous Fish

Moderator: Pete Hassemer, Idaho Department of Fish and Game, Columbia River Policy Coordinator

9:50-9:55 AM Introduction to session and presenters

9:55-10:15 AM A summary of recent Chinook salmon research from the Middle Fork Salmon River: What have we learned, where are we going? Daniel J. Isaak, Russell F. Thurow, Helen M. Neville, Bruce E. Rieman, and Jason B. Dunham

10:15-10:35 AM Influence of stock size and stream flow on Chinook salmon production in the Lemhi River and Marsh Creek, Idaho. Jim Morrow and David Arthaud

10:35-10:55 AM Origin of iteroparous steelhead from populations in the Snake River. Shawn R. Narum, Doug Hatch, Andre Talbot, Paul Moran, and Madison S. Powell

10:55-11:15 AM	The effects of temperature exposure on migration success and gamete quality of Snake River Chinook salmon and steelhead. Ryan Mann, Steve Lee, Christopher Peery, and Brian Burke
11:15-11:35 AM	Spring Chinook salmon, *Oncorhynchus tshawytscha*, survival to spawning associated with water temperatures in the Umatilla River, USA. Craig R. Contor, P. Kissner, and J. D.M. Schwartz
11:35-11:55 AM	Pacific lamprey distribution in the Clearwater System. Christopher W. Claire and Tim Cochnauer
12:00	**Adjourn and** **Executive Committee Meeting in Board Room**

CONTRIBUTED ORAL PRESENTATIONS IN ORDER OF APPEARANCE

PLENARY SESSION: ECONOMIC ASPECTS OF IDAHO FISHERIES

Protected landscapes and economic vitality in the Mountain West

T. M. Power, Economics Department, University of Montana, Missoula, MT, 59812. 406-243-45866. tom.power@mso.umt.edu.

ABSTRACT: The conventional wisdom is that protecting the natural characteristics of the landscape comes at a significant economic cost to local economies. Because landscape protection restricts commercial activities, especially the extraction of commercially valuable natural resources, it is assumed that this must reduce local employment and income, impoverishing local residents. Although this is a possible outcome, this assumed result looks at only one of the economic connections between natural landscapes and local economic well being. It ignores another powerful set of economic forces that has played an increasingly important role in stimulating local economic vitality in the Mountain West. Protected natural landscapes provide an ongoing flow of valuable environmental services to residents of adjacent communities including recreation opportunities, wildlife, clear water and air, open space, biodiversity, and scenic beauty. Because these are valuable to people, landscapes that provide them tend to attract new residents and businesses, stimulating local economic vitality. This has been one of the dominant economic forces that has transformed the Mountain West over the last several decades.

Pathways from sustained yield toward sustainability

Jay O'Laughlin, College of Forestry, Wildlife, and Range Sciences, University of Idaho, Moscow, ID 83844-1134. 208-885-5776, jayo@uidaho.edu,

ABSTRACT: The natural resource managers' world was simpler when all they were asked to do was perpetuate supplies of timber, fish, and other commodities to meet demands for the food and fiber products people wanted. Now people expect an expanded array of not only economic commodities, but also ecological and environmental goods, services, and values from forest and fishery ecosystems. The sustained yield commodity production idea that served managers for centuries still is necessary, but no longer sufficient. A benchmark for the modern evolution of resource management is the sustainable development idea in the 1987 World Commission on Environment and Development report "Our Common Future." We all face the challenge of finding a harmonious balance between environmental conservation and economic development of resources to meet human needs. There seems to be widespread agreement that sustainable resource management must be ecologically sound, economically feasible, and socially

desirable. These dimensions of sustainability can be assessed using scientific methods, but integrating such knowledge is difficult. Finding a fair and equitable way to balance environmental and economic concerns is an elusive but perhaps attainable goal. The larger the spatial scale at which one conceives sustainable resource management, the more elusive the quest becomes. When coupled with ecological and economic dimensions, stakeholders' perceptions of the fairness of resource management proposals can help identify the path toward sustainability. Designing inclusive forums where stakeholders interact with managers in collaborative learning exercises is an appropriate starting point, but issues such as who represents future generations and how broad social perspectives can be reconciled with local ones will always present challenges.

2003 Idaho sport fishing economic report

Virgil Moore, Tom McArthur, and Sharon Clark, Idaho Department of Fish and Game, PO Box 25, Boise, ID 83707-0025, 208-334-3790.
vmoore@idfg.idaho.gov

ABSTRACT: Current information about the economic benefit of sport fishing in Idaho is dated and has not been available at the local and county for use by business and government. The Idaho Department of Fish and Game sent 48,000 random mail surveys to Idaho fishing license holders quarterly in 2003. The 25,583 completed responses were usable for these results of the *2003 Idaho Sportfishing Economic Activity Report.*

In 2003, Idaho's population was 1,366,332 with one in four eligible people residing in Idaho purchasing a fishing license. There were 424,375 fishing licenses and 106,759 permits (chinook/steelhead/2 pole permits) sold to 400,824 individuals of which 124,297 were non-residents.

Fishing in Idaho generated $437,631,735 in statewide retail sales in 2003 with an additional $12,289,806 for fishing licenses and permits. Anglers fished 3,908,747 days on 2,917,972 trips with an average of 1.3 days per trip and 5.1 hours per day and $150 per trip. In comparison cash receipts in 2003 for potatoes and cattle in Idaho were $542,036,000 and $1,070,132,000 respectively.

Coeur d'Alene Lake had the most fished water with 91,000 trips generating $6.6 million in spending or $73/trip.
Henry's Fork had the largest spending by angler fishing there with $23 million during 59,000 trips or $393/trip spent.

Spending in Idaho for sportfishing in 2003 by category:

- $106,027,912 was spent on food and beverages in stores
- $ 42,241,442 was spent on food and beverages in restaurants

- $ 61,857,157 was spent on fishing supplies
- $ 59,982,392 was spent on other equipment and supplies
- $ 91,115,794 was spent on round-trip transportation
- $ 31,495,818 was spent on outfitters and/or guides
- $ 29,358,536 was spent on motels
- $ 10,008,279 was spent on campgrounds (public and/or private)
- $ 5,544,405 was spent on Access Fees (boat launches, parking, etc)
- $ 12,289,806 was spent on fishing licenses and permits

Economic information is available by county and individual body of water in Idaho.

The 2001 IDFG Chinook economic survey – more than the money

Sharon Kiefer, Idaho Department of Fish and Game, PO Box 25, Boise, ID 83707-0025, 208-287-2780, skiefer@idfg.idaho.gov

ABSTRACT: The largest run to date of hatchery spring and summer Chinook salmon to Idaho since finalization of Chinook fish hatcheries in the state occurred in 2001. As a result, Idaho Department of Fish and Game got an outstanding opportunity to manage a robust, selective fishery targeting hatchery Chinook salmon. We also got a chance to survey a much larger pool of anglers than recent years about their economic and other aspects of participation in the Chinook salmon fishery. The presentation will characterize the uniqueness of the 2001 fishery compared to previous years, and will describe the direct expenditures of anglers, the angler demographics, and the angler opinions derived from the survey.

The potential economic impact of restored salmon and steelhead fishing in Idaho

Don Reading, Consulting Economist, *Ben Johnson Associates*, 6070 Hill Road Boise, Idaho, 83703, (208) 342-1700, (208) 384-1511, dreading@mindspring.com

ABSTRACT: The recovery of Snake River Basin salmon and steelhead runs — to sustainable, abundant and harvestable levels — would provide a truly renewable resource that brings substantial economic benefit to Idaho.

This study analyzes the potential economic impact of a fully recovered salmon and steelhead fishery in Idaho, based on current data and data from the 1950s, when full salmon and steelhead fishing seasons were last allowed in the Gem State. This is the fourth in a series of studies examining various aspects of salmon and steelhead fishing economies in Idaho. It is the first study to examine the potential impact of a restored fishery.

The methodology used in this study is consistent with methodology used in previous analyses of salmon and steelhead fishing in Idaho. It utilizes community level input-output models developed by the University of Idaho. Expenditure data developed in earlier studies was also used, derived from angler surveys done by the Idaho Department of Fish and Game during Idaho's 1992-93 steelhead season and 2001 salmon season. Effort data, the number of angler trips, was taken from the previous studies and also from 1950s survey information.

Salmon fishing in Idaho has changed dramatically over the last 60 years. In the1950s, anglers had access to hundreds of miles of rivers and streams, with most fishing occurring in the headwater areas and tributaries of the Salmon River in June, July and early August, where the salmon stage to spawn. Due to low returns, however, salmon fishing has not been allowed in the Upper Salmon River Basin since 1978, limiting angling opportunities primarily to the Clearwater and Snake Rivers, and the Little Salmon, South Fork Salmon and mainstem Salmon River downstream from the town of Riggins.

In addition to changes in the location of salmon fishing opportunities, fishing technique has also changed. In the 1990s, fishing from jet boats or drift boats in the lower mainstems — a technique traditionally used by steelhead anglers — caught on during limited salmon seasons. And in 2001 and 2002, thousands of hours were expended in the mainstems of the Snake, Clearwater, and portions of the lower Salmon rivers during the months of May and June to catch spring Chinook in prime condition, just a month or two out of the ocean.

Research for this study shows the benefit of a restored salmon and steelhead fishery to the Idaho's economy could reach $544 million annually. Direct expenditures — out of pocket spending by anglers — measured $196 million, while indirect expenditures were estimated at $348 million. Indirect expenditures are estimates of the total economic impact of angler spending in a community — calculated by applying standard economic multipliers to direct expenditures.

The table below gives a brief summary of the Economic Impact of Restored Salmon and Steelhead Fisheries in Idaho:

	Direct	Indirect	Total
River Communities	$121,951,445	$ 208,576,476	$330,527,921
Rest of State	$74,207,952	$139,510,949	$213,718,901
Total	$196,159,397	$348,087,425	$544,246,822

In addition to examining the economic impact of a restored fishery on the state as a whole, this study also examines the impact on individual communities most likely to benefit from restored fisheries. Not surprisingly, we found that the communities of North Fork, Salmon, Challis and Stanley would see significant increases in direct spending due

to a re-emergence of a robust salmon fishery. Spending in those communities would also bolstered because they serve as primary staging areas for trips on the Middle Fork of the Salmon River, where salmon and steelhead fishing is currently not allowed.

This study utilizes earlier effort and expenditure data and analysis to validate its accuracy. Although the future contains many unknowns, this study reveals the potential economic benefits to Idaho if a fully restored salmon and steelhead fishery were available to anglers.

The work of Ben Johnson Associates was funded by a private, charitable foundation grant made to Idaho Rivers United, a non-profit river conservation group based in Boise, Idaho. IRU's native fisheries director, Bert Bowler, also contributed biological information to the study. The study results were reviewed and endorsed by the cities of Riggins and Stanley, Idaho, and economic and business organizations in Salmon, Challis and Stanley. Endorsement of this economic study does not indicate support for Idaho Rivers United, or for any particular view of how fully restored salmon and steelhead fisheries might be achieved.

Valuing ecosystem services: focus on freshwater fisheries

Dr. John W. Duffield, University of Montana Economics Department, 32 Campus Drive #5472, Missoula, MT 59812-5472 406-243-2043, john.duffield@mso.umt.edu

ABSTRACT: Healthy freshwater streams and the associated riparian habitat can potentially provide numerous benefits to society, including recreational fisheries, boating, clean water, improved aesthetics, and indirect ecological services such as nutrient cycling. Most of these services flows are what natural resource economists call "nonmarket uses" in that they are not generally traded and priced in established markets. Historically, management and policy decisions that impact these aquatic and riparian resources have tended to undervalue or even ignore nonmarket uses when compared to competing market-related uses -- such as for hydroelectric development, grazing, residential development, timber, and associated roads and other transportation corridors. The problem is that marketed uses have a ready and obvious value based on cash transactions and observable prices, while the corresponding economic values for nonmarket uses are not obvious. However, in the last thirty years there has been substantial progress in the development of the economic tools necessary for "nonmarket valuation" of both direct (on site) uses including sportfishing, as well as for so-called "passive use" values. The latter are generally associated with motives such as the desire to benefit future generations through conservation (bequest values) or values related to simply knowing that a species or ecosystem is in a healthy or viable state (existence values). For example, habitat conservation efforts that benefit endangered or threatened species of native fishes (such as salmon, bull trout, cutthroat, or grayling) may generate substantial nonmarket values related both to direct recreational use, as well as for the continued existence of these species. This presentation will provide an overview and summary of nonmarket valuation methods, and provide an introduction to their

application in specific fishery management contexts in the Pacific Northwest and Alaska, including decisions on dam removal, natural resource damage assessment, instream flow valuation, wade versus float angler conflicts, and critical habitat designation.

NATIVE CUTTHROAT TROUT SESSION

Ecologically based variation in morphology among cutthroat trout (*Oncorhynchus clarki sp.*) of western North America

Meredith B. Seiler and Ernest R. Keeley, Department of Biological Sciences, Idaho State University, Pocatello, ID 83204.

ABSTRACT: The purpose of our study was to compare variation in morphology among cutthroat trout species to determine whether variation within species due to differences in habitat characteristics are as great as variation between species. Much of the diversity exhibited by cutthroat trout species has been described as meristic differences. While these differences can be used to describe phylogenetic relationships, they may not represent characteristics important for survival in particular environments. In salmonid fishes, ecologically based differences are often exhibited in morphological characteristics associated with swimming and feeding ecology, particularly between populations from stream and lake environments. To test whether populations from stream or lake environments differ morphologically and whether differences are as great as between species differences, we sampled native populations of five species of cutthroat trout. We compared measures of body shape, fin length, head and mouth size and eye diameter and found differences between and within species. For example, stream dwelling populations of Yellowstone cutthroat trout have larger mouths, longer heads, more streamlined bodies, and a narrower caudal peduncle than Yellowstone populations occurring in lakes. Given that many cutthroat trout species are of conservation concern, our project provides a better understanding of intraspecific variation existing within these species and may provide a method of describing important units of diversity.

Status of Yellowstone cutthroat trout in Idaho

Kevin A. Meyer, Daniel J. Schill, James A. Lamansky, Jr. Idaho Department of Fish and Game, 1414 East Locust Lane, Nampa, Idaho 83686. email: kmeyer@idfg.idaho.gov

ABSTRACT: Despite the substantial declines in distribution and abundance that the Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri* has experienced over the past century, quantitative evaluations of existing population sizes over broad portions of its historical range have not been made. In this study, we estimate trout abundance (in streams only) throughout the Upper Snake River Basin in Idaho (and portions of adjacent states), based on stratified sample extrapolations of stream electrofishing surveys conducted at 961 study sites, the vast majority of which (84%) were selected randomly.

Yellowstone cutthroat trout were the most widely distributed species of trout (caught at 457 study sites), followed by brook trout *Salvelinus fontinalis* (242 sites), rainbow trout *O. mykiss* and rainbow x cutthroat hybrids (136 sites), and brown trout *Salmo trutta* (70 sites). Of the sites that contained cutthroat trout, more than half did not contain any other species of trout. Where nonnative trout were sympatric with cutthroat trout, brook trout were most commonly present. In the 11 Geographic Management Units (GMUs) where sample size permitted abundance estimates, there were about 2.2 million trout ≥ 100 mm in total length (± 1.2 million), and of these, about 1.0 million (± 0.4 million) were cutthroat trout. Similarly, we estimated that about 2.0 million trout < 100 mm (± 1.4 million) were present, of which about 1.2 million (± 0.7 million) were cutthroat trout. The latter estimate is biased low because our inability to estimate abundance of trout < 100 mm in larger-order rivers negated our ability to account for them at all. Cutthroat trout were divided into approximately 70 sub-populations but estimates could be made for only 55 sub-populations; of these, 44 sub-populations contained more than 1,000 cutthroat trout. We estimated that an average of about 30% of the cutthroat trout ≥ 100 mm were spawners. We compared visually-based phenotypic assessments of hybridization with subsequent genetic analyses from 55 of the study sites and found that: 1) genetic analysis corroborated our visual determination that hybridization was absent at 37 of 55 sites; 2) at the 7 sites where we visually failed to discern genetically-detected hybridization, the percent of rainbow trout alleles in the population was low (< 1 %) at all but two locations; and 3) where we detected hybridization both visually and genetically (11 sites), levels of introgression were positively correlated between methods ($r = 0.81$). Based on this strong agreement, we phenotypically classified cutthroat trout as "pure" and "≥ 90% pure" at 81% and 90%, respectively, of the study sites within these GMUs.

Fine-scale genetic structure of Westslope cutthroat trout in a tributary to the Selway River

Dawson Dunning[1], Paul Spruell[1], Katherine Thompson[2], and Fred W. Allendorf[1]

[1] UM Conservation Genetics Laboratory, Division of Biological Sciences, The University of Montana, Missoula, Montana 59812. (Author for correspondence: e-mail: flashbackpt@yahoo.com)
[2] Nez Perce National Forest, USFS, Route 2 Box 475, Grangeville, Idaho 83530.

ABSTRACT: Conservation strategies for westslope cutthroat trout should focus on identifying and preserving as much adaptive genetic diversity as possible in natural populations. Because much of the genetic diversity of this species is found among subpopulations, conservation of many isolated populations and metapopulations is necessary. However, few studies have been conducted that specifically look at fine-scale genetic population structure. In this study, we describe the genetic structure of 9 tributary samples of westslope cutthroat trout in the Selway River drainage, which is a regional stronghold for the species. Specifically, we focus on the fine-scale genetic structure of populations in Meadow Creek, a tributary immediately upstream of Selway Falls. Our results indicate that westslope cutthroat trout populations in the headwater reaches of

Meadow Creek are greatly differentiated over small spatial scales (< 10 km), owing largely to the presence of migration barriers. We also found that fish sampled from the lower mainstem reaches of Meadow Creek show extreme genetic differentiation from the upstream populations, but do resemble fish collected from tributaries to the upper Selway River. These data indicate that little gene flow has occurred between Meadow Creek headwater populations and the remainder of the Selway River drainage. We discuss the drawbacks of analyzing single mainstem samples for population genetic studies of westslope cutthroat trout. In addition we elaborate on the observed genetic patterns for conservation of westslope cutthroat trout, and what we can learn from studying relatively unaltered populations in pristine areas such as the Selway River.

Adult post-spawn movements and juvenile outmigration of fluvial Bear River Bonneville cutthroat trout in the Thomas and Smith's Fork rivers, ID—WY

Warren T. Colyer[1], Adam Sepulveda[2], Amy L. Harig[3], Dana Degraaf[3], Jeff Kershner[2]

[1] Trout Unlimited, 249 South 100th West, Providence, UT 84332
[2] Fish and Aquatic Ecology Unit, US Forest Service, Aquatic, Watershed, and Earth Resources Department, Utah State University, 5210 University Hill, Logan, UT, 84322-5210
[3] Trout Unlimited, 1020 W Main Street, Suite 440, Boise, ID 83702

ABSTRACT: Like many interior cutthroat trout subspecies, Bonneville cutthroat trout (BCT) have been widely extirpated from large rivers by anthropogenic activities that have fragmented habitats and introduced non-native competitors. Selective pressures against migratory behaviors and mainstem river occupation have relegated BCT to isolated headwater habitats and prevented the expression of fluvial life history traits in most populations. Bear River BCT, however, are unique in that they continue to persist in the mainstem river system in which they evolved, despite wide-spread habitat degradation. These fish exhibit a true fluvial life history strategy, traveling large distances to satisfy specific habitat requirements during different life stages. Whereas recent research has used telemetry to begin to describe movement patterns of fluvial Bear River BCT, little is known about the patterns of juvenile outmigration and adult spawning numbers in key tributaries. As part of a fish passage restoration project in the central Bear River watershed we used two-way fish traps to monitor movements of post-spawn adult and juvenile outmigrant BCT in two major spawning tributaries to the Bear River—the Thomas Fork and Smith's Fork—between 2003 and 2005 . We found that (i) most juvenile and adult BCT migrated out of spawning tributaries during high flows in early summer, (ii) numbers of adults and juveniles varied significantly across the three years of this study, and (iii) appeared to be correlated with stream flow.

Predation by double crested cormorants and American white pelicans on native Yellowstone cutthroat trout and hatchery rainbow trout in Blackfoot Reservoir, Idaho

David Teuscher and Richard Scully, Idaho Department of Fish and Game, SE Idaho Region, 1345 Barton Road, Pocatello, ID 83204, 208-232-4703, dteuscher@idfg.idaho.gov

ABSTRACT: Expansion of double crested cormorants *Phalacrocorax auritus* and American white pelicans *Pelecanus erythrorhynchos* nesting on Gull Island in Blackfoot Reservoir has increased concerns over their impact on native Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri* and hatchery rainbow trout *O. mykiss* populations. Nesting bird abundance increased from less than 200 total birds in 1993 to 3,000 pelicans and 600 cormorants in 2005. Those birds have an estimated consumption demand of about 4 metric tons of fish per day (9,000 pounds). Utah chubs *Gila atraria* and Utah suckers *Catastomus ardens* dominate prey consumed by birds nesting on Gull Island. However, the piscivorous birds demonstrate opportunistic feeding behavior focused on hatchery trout stocking events and native trout spawning migrations. In 2003, an estimated 6.9 metric tons of rainbow trout were consumed by piscivorous birds. Total bird predation loss was very similar to the total biomass of rainbow trout stocked in the reservoir. In a similar response to that observed during hatchery rainbow trout stocking events, hundreds of pelicans flock to feed where Yellowstone cutthroat trout and Utah suckers congregate to spawn. In 2004, 70% of spawning Yellowstone cutthroat trout sustained severe wounds or scars from piscivorous birds. While most of the bird predation occurs at the confluence of the Blackfoot River with Blackfoot Reservoir, three of 14 (21%) cutthroat trout tagged with radio transmitters were consumed by pelicans about 30 miles upstream in two key spawning tributaries. The adfluvial spawning run of Yellowstone cutthroat trout in the Blackfoot River has declined from about 5,000 in 2001 to less than 20 in 2005. Expanding piscivorous bird populations coupled with drought contribute to the cutthroat trout collapse. To protect spawning Yellowstone cutthroat trout, the Idaho Department of Fish and Game began a bird hazing program in 2004. Details of the hazing program will be briefly discussed.

INVASIVE SPECIES SESSION

Connectivity, habitat quality, and biotic resistance and their association with nonnative brook trout occurrence in Panther Creek, Idaho

Joseph R. Benjamin[1,2], Jason B. Dunham[3], and Matthew R. Dare[1]

[1]Department of Biology, Boise State University, 1910 University Drive, Boise, ID 83705; [2] U. S. Forest Service, Rocky Mountain Research Station, 316 E. Myrtle Street, Boise, ID 83702; [3]USGS, FRESC, 3200 SW Jefferson Way, Corvallis, OR 97331

ABSTRACT: Theoretical models suggest the invasion of nonnative freshwater species is facilitated through the interaction of three factors: biotic resistance, habitat quality, and connectivity. We measured variables that represented each component to determine which were associated with juvenile (<150 mm) and adult (≥150 mm) brook trout occurrence in Panther Creek, a tributary to the Salmon River, Idaho. We measured the abundance of rainbow trout as a measure of biotic resistance. Habitat variables included summer and winter temperature, cover, and channel size. Lastly, we believe beaver ponds play an important role in sustaining connected source populations of brook trout so we measured valley bottom area, which is correlated with the presence of beaver ponds. The inclusion of valley bottom area to the juvenile brook trout model resulted in a separation of the data and ultimately the variable was dropped. Habitat variables were the most important variables associated with both juvenile and adult brook trout presence. Akaike's information criterion suggested a model including maximum summer temperature and winter degree days was the best approximating model of juvenile brook trout presence. A composite model for adult brook trout included maximum summer temperature and winter degree days. As with juveniles, the two temperature variables had a positive relationship with adult brook trout. Rainbow trout abundance showed insufficient evidence (odds ratio confidence interval overlapping one) to confirm or exclude the importance of biotic resistance to the occurrence of brook trout in either size class. The results of this study indicate that habitat, specifically temperature, plays an important role in the occurrence of brook trout; however, further evidence is needed in regards to biotic resistance and connectivity.

Morphological and swimming stamina differences between Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), rainbow trout (*O. mykiss*), and their hybrids.

Steven M. Seiler and Ernest R. Keeley, Department of Biological Sciences, Box 8007 Idaho State University, Pocatello, ID 83209, 208 282-4458, seilstev@isu.edu

ABSTRACT: We hypothesized that body shape differences between Yellowstone cutthroat trout (*O.clarki bouvieri*), rainbow trout (*O. mykiss*), and their hybrids may influence swimming ability and thus play an important role in the invasion of nonnative rainbow trout into native cutthroat trout populations. We reared Yellowstone cutthroat trout, rainbow trout, and reciprocal hybrid crosses in a common environment and conducted sustained swimming ability trials in order to test for genetically based morphological and swimming fitness differences. Traditional and geometric morphometric analyses identified differences in body shape with cutthroat trout having slender bodies and small caudal peduncles and rainbow trout having deep bodies with deep and long caudal peduncles. Hybrid crosses were morphologically intermediate to the parental genotypes with a considerable maternal effect. Consistent with morphological differences, cutthroat trout had the lowest sustained swimming velocity. Hybrid genotypes had intermediate sustained swimming ability, although the differences were not different from rainbow trout. Our results suggest that introduced rainbow trout may, in part, outcompete native Yellowstone cutthroat trout through higher sustained swimming ability and may accelerate the spread of rainbow trout genes within

Yellowstone cutthroat trout populations by conferring a rainbow trout advantage to hybrid genotypes.

Survival and passage of New Zealand mudsnails in the gastrointestinal tract of rainbow trout

R. Louise Bruce and Christine M. Moffitt, Idaho Fish and Wildlife Cooperative Unit, College of Natural Resources, University of Idaho, Moscow, Idaho 83844-1136
bruc9238@uidaho.edu and cmoffitt@uidaho.edu

ABSTRACT: Since their recognized introduction to the United States in 1987, the New Zealand mudsnail (*Potamopyrgus antipodarum*) has been found in many locations throughout the western United States. In high biomass, the NZMS can affect functioning of the aquatic ecosystem. This invasive species has become established in several fish hatcheries. Fish stocking and transfers from hatcheries may accelerate the spread and introduction of the NZMS, as the snail has been reported to survive passage through the gastrointestinal tract of trout and travel in distribution truck water. We are examining the passage and survival of NZMS in the gastrointestinal tract of rainbow trout (*Oncorhynchus mykiss*).

We force-fed four large snails to each of 40 individual fish held in aquaria. Fish were sampled at five time intervals (3, 6, 12, 24 and 48 hours) following feeding to determine the number of alive and dead snails in the stomach, anterior intestine, and posterior intestine. We found live snails in all gastrointestinal tract regions and 11.80% were alive in the fish fecal material. Snail survival appears to decrease as time exposed in the trout gastrointestinal tract increases. We are continuing our evaluation to explore the effects of snail size, meal size, and fish feeding regime on snail transit time and survival. Our ultimate goal is to provide a potential depuration strategy to reduce the risk of transferring snails during fish stocking.

Seasonal population dynamics of New Zealand Mudsnails (*Potamopyrgus antipodarum*) in Silver Creek Drainage, Blaine County, Idaho and Riley Creek Drainage, Gooding County, Idaho

Chris James* and Christine Moffitt, Idaho Cooperative Fish and Wildlife, College of Natural Resources, University of Idaho, Moscow, Idaho 83844-1136
* presenter and corresponding author: jame0667@uidaho.edu

ABSTRACT: New Zealand mudsnails *Potamopyrgus antipodarum* are a prolific invasive species that have invaded waters in every western state in the past 20 years, except New Mexico. Previous surveys for New Zealand mudsnails in the Silver Creek drainage, Blaine County, Idaho have identified two areas of infestation with little expansion: Loving and Butte Creek downstream of IDFG's Haypsur Hatchery and Silver Creek proper near the Nature Conservancy's Silver Creek Preserve Visitor Center. In December 2004 and January 2005, we began collecting samples of New Zealand

mudsnails to assess seasonal changes in the population both in the Silver Creek drainage and in Riley Creek, Gooding County, Idaho. In addition to assessing the densities of NZMS in the streams, we are also assessing the size class distribution and reproductive potential between winter and summer acclimated snails. Winter densities ranged from 12 to 32,000 snails/m^2 in Loving Creek and from 460 to 450,000 snails/m^2 in Riley Creek. Snails <3.0 mm in shell length were particularly abundant in Riley Creek, while snails were fairly evenly distributed in all size classes in Loving Creek. Snails from Riley Creek appeared to reproduce at a smaller shell height than those in Loving Creek. In laboratory trials, we observed 100% lethality in snails exposed to temperatures of 0°C for periods longer than 72 hrs. Densities of New Zealand mudsnails in Loving Creek are extensively lower than densities in Riley Creek and this difference may well be attributable to length of time since introduction into each stream. However, given that the snail has been present in the Silver Creek drainage since at least 2001 and its prolific reproductive potential, it seems likely that temperature regimes in the Silver Creek drainage may be a limiting factor in its ability to be prolific.

AQUACULTURE AND CONSERVATION HATCHERIES SESSION

Do aquaculture drug treatments pose a serious risk to humans and the environment? – A case study

Christine M. Moffitt, USGS Coop Unit, Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID 83844-1136, cmoffitt@uidaho.edu

ABSTRACT: Lack of basic information, few large-scale studies, and misperceptions about fish culture operations have caused the public and regulators to be concerned about environmental and human risks from operations at fish culture facilities. This study provides the most complete assessment of aquaculture drug use for a seven-year period at more than 60 hatcheries in the Pacific Northwest. The use characterization and information on the mitigation factors at these facilities support the conclusion that the risk of therapeutic treatments to humans and the environment are likely very low.

SDS-PAGE and western blot analysis of *Flavobacterium psychrophilum* carbohydrate antigens and their potential role in protective immunity

Benjamin R. LaFrentz[1], Scott E. LaPatra[2], William D. Shewmaker[2], Aaron Weighall[2], and Kenneth D. Cain[1]

[1] Department of Fish and Wildlife Resources and the Aquaculture Research Institute, University of Idaho, CNR Room 105, P.O. Box 441136, Moscow, ID 83844-1136
Email: lafrentz@uidaho.edu, Phone: 208-885-5018
[2] Clear Springs Foods, Inc., Research Division, PO Box 712, Buhl, ID 83316

ABSTRACT: *Flavobacterium psychrophilum* is the etiological agent of coldwater disease (CWD) and rainbow trout fry syndrome (RTFS) and has emerged as one of the most significant bacterial pathogens in salmonid aquaculture in the Pacific Northwest and worldwide. Research efforts focused on the development of an efficacious vaccine have been implemented, since current disease prevention and therapeutic options are inconsistent and often ineffective. Previous studies in our laboratory and others have suggested that the O-polysaccharide (O-PS) component of the lipopolysaccharide (LPS) of *F. psychrophilum* is highly immunogenic and may be involved in eliciting a protective immune response in rainbow trout (*Oncorhynchus mykiss*) following challenge with *F. psychrophilum.* Further characterization of the carbohydrate antigens of *F. psychrophilum* by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) and western blotting revealed the presence of two distinct carbohydrate banding patterns. One banding pattern is characteristic of bacterial LPS, while the other banding pattern has not previously been characterized. We suggest that this newly identified carbohydrate antigen is the loosely associated slime layer, or glycocalyx of *F. psychrophilum*. This is a significant finding because the antigens that have been referred to as the O-PS of LPS (and implicated as a potential vaccine candidate antigen) appear to be components of the glycocalyx of *F. psychrophilum* and not LPS. Passive immunization experiments utilizing a monoclonal antibody specific for the glycocalyx are underway to determine if antibodies to the glycocalyx of *F. psychrophilum* provide protection to rainbow trout following experimental CWD challenge. If protection is conferred, future research will focus on purification and further characterization of the glycocalyx as a potential vaccine candidate antigen for CWD and RTFS.

Initial microsatellite analysis of wild Kootenai River white sturgeon and subset brood stock groups used in a conservation aquaculture program.

Jeff Rodzen[1],Bernie May[2], Paul Anders of S.P. Cramer and Associates[3*], and Sue Ireland[4]
[1]California Fish and Game, [2]University of California, Davis, Genomic Variation Lab[3] University of Idaho, [4]Kootenai Tribe of Idaho,* Presenter

ABSTRACT: White sturgeon microsatellite variation in the Kootenai/y population was quantified and compared to that in other white sturgeon populations. Genetic variability in the wild Kootenai Hatchery broodstock group was also quantified and compared to the wild (source) population and other conspecific populations. The utility of 8 recently developed microsatellite loci was tested for parentage analysis of Kootenai Hatchery progeny. 952 samples were analyzed: 306 from the Kootenai/y population, 63 Kootenai Hatchery broodstock, with the remainder from populations in ID, WA/OR, BC, and California. The Kootenai/y population possessed 52 microsatellite alleles, approximately one third the number observed in other white sturgeon populations in the Columbia, Fraser, and Sacramento river basins. Eighty to 90% of the genetic variability in the wild Kootenai River population was represented by 30 to 40 broodstock sampled from the same population. Because success of parentage assignment is highest when the number of alleles is high and the number of possible parents is low, and because the Kootenai/y

population had lower numbers of alleles and many possible parents, additional loci are needed to improve parentage assignment accuracy. Producing a white sturgeon gene library developed from Kootenai/y white sturgeon is recommended to improve the accuracy of future parentage assignment.

Reproductive success of hatchery and natural origin Chinook salmon (*Oncorhynchus tshawytscha*) in a stream with a history of supplementation management

Brian Leth[1] (presenter) and Madison Powell[2]

[1] Brian Leth, Idaho Dept. of Fish and Game, Nampa Research Office, 1414 E. Locust Lane, Nampa ID 83685, (208) 465-8404 ext. 242, (bleth@idfg.idaho.gov)
[2]Madison Powell, Hagerman Fish Culture Experiment Station, 3059 F National Fish Hatchery Road, Hagerman, ID 83332, (208) 837-9096, (mpowell@uidaho.edu)

ABSTRACT: Hatchery supplementation is considered a possible alternative for recovering natural populations of Pacific anadromous salmonids whose numbers have declined as a result of anthropogenic influence. For supplementation to benefit a natural population, the hatchery component must contribute to production, the hatchery and natural groups must not diverge genetically, and productivity of the natural population must not decline due to hatchery influence. In this study, parental exclusion analyses, using microsatellite DNA markers, were used to determine the genetic contribution of hatchery- and natural-origin Chinook salmon (*Oncorhynchus tshawytscha*) to resultant juvenile offspring in a stream with a history of supplementation management. Proportional genetic contribution of hatchery and natural adults to smolt offspring was not significantly different for males or females ($p = 0.37$ and $p = 0.39$ respectively). Parental cross-types (e.g. hatchery male x natural female) that gave rise to smolt offspring were not significantly different than would be expected under the assumption of random mating ($p = 0.92$). Additionally, proportions of parental cross-types that gave rise to juveniles sampled over three different life stages (parr, presmolt and smolt) were not significantly different ($p = 0.11$). Thus, it appears hatchery and natural adults interacted and spawned in a random fashion with similar reproductive success. Future parentage analysis on returning F_1 adults will provide more insight into the relative lifetime reproductive success of these two groups.

Performance of diploid and triploid rainbow trout in 16 Idaho high lakes

Joseph R. Kozfkay[1] and Daniel J. Schill[2]

[1]Idaho Department of Fish and Game, Resident Fisheries Research Section, Nampa, Idaho 83686, USA, [2]Idaho Department of Fish and Game, Fisheries Bureau Boise, Idaho 83707

ABSTRACT: Increased growth, improved survival, and genetic protection of wild stocks have been suggested as benefits of stocking triploid (i.e., sterile) fish. We examined the relative growth and survival of triploid and diploid rainbow trout *Oncorhynchus mykiss* in 16 high mountain lakes. Rainbow trout fingerlings were differentially grit marked and stocked during 2001. During 2004, 779 fish were sampled with floating experimental gill nets and angling, including 99 test fish. Of these 99 test fish, 56 diploids, 29 triploids, and 14 unmarked fish were identified. Eight of the lakes were re-sampled during 2005. An additional 34 test fish were caught, including 19 diploids, 7 triploids, and 8 unmarked fish. Over the 2 years of sampling the ratio of diploids:triploids caught equaled 2.1:1. Based on overlapping confidence intervals, there was no statistical difference in length or weight between the test groups, possibly due to very small sample sizes; however, there was a tendency for the diploids to be about 10 mm longer and 75 g heavier. Our results suggest that triploid hatchery fish do not survive as well as diploids in high mountain lakes, contradicting previous results we have gained from lowland lakes and streams.

TECHNIQUES AND ANALYSIS SESSION

Comparison of two methods used for describing relations between flow and year class strength on the Henrys Fork, Idaho.

Dan Garren, Idaho Department of Fish and Game, Upper Snake Region, 4279 Commerce Circle, Idaho Falls, ID 83401, 208-525-7290, dgarren@idfg.idaho.gov

ABSTRACT: I used linear regression and annual abundance estimates of age-two rainbow trout in the Henrys Fork to explore the relation between year class strength and flow. Thirteen years of abundance estimates were compared to discharge from Island Park Reservoir, and indicated that winter flow had a significant effect on shaping year class strength. A second method used residuals from a catch curve regression to describe year class strength in the same reach. Using linear regression, I plotted catch curve residuals against a variety of flow variables and found similar results to those shown above. Both methods used were able to identify the same strong and weak year classes. Therefore catch curve regressions may be a viable alternative to exploring the relation between abiotic factors and yearclass strength in the absence of long-term data.

A stock-recruit relationship for naturally produced spring/summer Chinook salmon in the Snake River basin

Timothy Copeland, Idaho Department of Fish and Game, 1414 E. Locust Lane, Nampa, Idaho 83686

ABSTRACT: Stock-recruitment relationships are important to understanding density-dependent forces affecting abundance. I fit Beverton-Holt (BH) and Ricker curves to estimates of female spring/summer Chinook salmon *Oncorhynchus tshawytscha* available for natural reproduction above Lower Granite Dam during brood years (BY) 1990-2001 versus the number of smolts produced and conducted a sensitivity analysis. Estimated 2004 smolt migration (BY 2002) was compared to predictions based on the BH and Ricker models. All model fits were significant (F >25.0, P <0.001). The inverse transformation of the BH model fit the data most precisely (r^2 = 0.95). Neither the Ricker model nor its log transformation fit the data as well as the inverse BH model (r^2 = 0.69-0.72). Maximum observed productivity (402.5 smolts/female) accorded better with density-independent productivity predicted by the BH model (411.2 smolts/female) than by the Ricker model (269.1 smolts/female). Perturbing the number of females +/-10% induced a 10% change in intrinsic productivity in the opposite direction but did not change estimated capacity. Perturbing smolts +/-10% induced 10% changes in both output parameters in the same direction as the perturbation. The 2004 smolt prediction from the BH model was 7% lower than the actual estimate. The Ricker prediction was 40% higher, although within the 90% prediction interval. Compared to historic data (1962-1974), the BH model suggests reduced system capacity (1.6 x 10^6 smolts), while the Ricker model does not. However, while the BH model has superior predictive ability at this scale, it is not possible to definitively corroborate or reject the Ricker model. The model should be validated further by continued refinement and mechanistic investigations. Model choice has practical implications for management of density-dependent factors in Idaho.

Invertebrate drift as a predictor of salmonid abundance and distribution in the Panther Creek Watershed, Idaho

Sarra Moller and Ernest R. Keeley, Department of Biological Sciences, Idaho State University, Pocatello, ID 83204.

ABSTRACT: Although it is commonly thought that there is a positive relationship between trophic levels based on the 10% transfer efficiency rule, there is little understanding of the functional relationship between abundance at one trophic level and the next. Past studies in stream ecosystems have shown that increased invertebrate drift abundance may result in a lower than expected increase in fish abundance. To quantify the relationship between drifting invertebrate abundance and salmonid abundance, we collected data on seven streams in the Panther Creek Watershed, Idaho. We sampled drift and snorkeled a total of 21 sites over the seven streams once a month throughout the summer. In addition, we collected data on factors that may influence invertebrate abundance such as benthic organic matter, periphyton, and nutrients in order to determine whether 'bottom-up' factors may limit invertebrate populations. Quantifying the relationship between the abundance of salmonids and biomass at lower trophic levels may help to explain variation in salmonid distribution and has important implications for using fertilization as a recovery strategy for fish populations.

Use of an In-stream PIT-tag Detector System to Monitor Movement of Bull Trout between the Snake and Tucannon rivers

Mike Faler, Carrie Bretz[1] Steve Anglea[2]

[1]US Fish and Wildlife Service, Idaho Fishery Resource Office
P.O. Box 18, Ahsahka, ID 83520
[2]Biomark, Inc., 7615 W. Riverside Dr., Boise, ID 83714

ABSTRACT: The ESA listing of the Columbia River Distinct Population Segment of bull trout identified one of the major threats to the species as fragmentation resulting from dams on over wintering habitats of migratory subpopulations. At the time of listing, it appeared that a migratory subgroup in the Tucannon River may have utilized the mainstem Snake River for adult rearing on a seasonal basis. The occurrence of bull trout in the hydropower system had been verified by a few incidental observations during sampling in Lower Monumental Pool and in the adult passage facilities at Lower Monumental and Little Goose dams in the early 1990s.

Installation of in-stream PIT-tag detector arrays in the lower Tucannon River (river miles 1.2 and 2.7) enabled monitoring of adult and sub-adult bull trout movement in the lower river. Three antenna configurations were installed: flat plate, pass-through, and crump weir. Each antenna was designed to optimize detection of Digital Angel model TX1400SGL PIT tags. The flat plate antennas are each approximately 10 ft in length, the pass-through antennas have an opening measuring 3.5 x 20 ft, and the crump weir antennas are each 6 ft wide. The flat plate and crump weir antenna designs were pursued because they are less susceptible than pass-through antennas to being "blown out" by debris or high flow events. The crump weir antenna was adapted from the design of commonly used resistivity weir counters. The hydraulic environment created by the weir forces upstream migrating fish to pass near the weir surface, thus enhancing detection. Weir sections are secured to the substrate, eliminating the need for existing structures, and each section abuts adjacent sections resulting in a nearly continuous monitoring weir.

From 2002 through 2004, we PIT tagged and released 528 adult bull trout within the Tucannon River basin. In 2005 alone, we PIT tagged 319 bull trout by expanding our efforts to include juvenile and sub-adults. Sampling was conducted in conjunction with an on going radio telemetry study designed to address needs associated with the FCRPS Biological Opinion.

Installation of the streamwidth antenna arrays was completed in late October, 2005, and as a result, this will be the first year of data collection. Our hopes are to saturate the Tucannon River with PIT-tagged bull trout, and quantify the proportion of the population that utilizes the Snake River hydropower system for winter foraging and rearing. Indirectly, the antenna arrays will provide additional monitoring and evaluation capabilities for LSCRP anadromous production programs in the Tucannon River.

HABITAT MANAGEMENT SESSION

Western Native Trout Initiative - habitat and conservation for the future security of our native trout.

Virgil Moore, Idaho Department of Fish and Game, PO Box 25, Boise, ID 83707-0025, 208-334-3790. vmoore@idfg.idaho.gov

ABSTRACT: Current actions for management of western trout are generally segregated into individual species recovery plans, conservation agreements, management plans and site-specific actions, and have dominated many agencies fish conservation activities. Implementation of conservation or management actions has progressed slowly due to inadequate funding and staffing. The Western Native Trout Initiative (WNTI) a project from the Western Association of Fish and Wildlife Agencies is envisioned to focus on common conservation, management, and information needs of western trout and addressing those through a joint venture strategy involving federal, state, tribal and local governments, conservation and recreational organizations, private landowners, and individual citizens. The end result will be improved species status, improved habitats, and improved recreational opportunities for anglers across western states.

Conservation and management actions will focus on common themes that include but are not limited to; water quantity, water quality, fish passage, instream and riparian habitat, introduced species, introgression, and broodstock development. This includes elements of focus in the National Fish Habitat Initiative (NFHI).The WNTI will support NFHI specifically by 1) Developing a joint venture to identify and implement conservation strategies for western native trouts and associated habitats on a broad scale, 2) Investigating conservation and management needs that are high priority throughout western States, and 3) Developing this WNTI through coordination, planning, and sharing of information.

Fish passage at road crossings in Idaho – Section 7 consultation for ESA-listed species

Mary Faurot*, Tim Burton, Chad Fealko, Mark Robertson

*U.S. Forest Service, Payette National Forest, PO Box 1026, McCall, Idaho 83638, (208)634-0618, mfaurot@fs.fed.us

ABSTRACT: The US Forest Service, BLM, and their partners have embarked on a strategic approach to improve fish passage in Idaho. As part of this strategy, several thousand road/stream crossings have been assessed for fish passage throughout federal lands on six National Forests and seven BLM field offices. Results of these assessments

show that 75-90% of these crossings failed to pass fish at some life stage. These crossings are being prioritized and considered for replacement or removal to facilitate fish passage. Replacement or removal of crossing structures on Federal lands often requires site-specific Section 7 consultation with the National Marine Fisheries Service (NMFS) when the stream contains anadromous fish, and with the US Fish and Wildlife Service (USFWS) when the stream contains bull trout. To help streamline the Section 7 consultation process when removing or improving these fish barriers, a programmatic Biological Assessment (BA) has been developed that addresses the effects of these actions on fish, wildlife, and plant species listed under the Endangered Species Act (ESA). The BA describes programmatic design standards for culvert, bridge, and ford replacement and removal projects, and should be useable across most of Idaho without requiring site-specific consultation for ESA-listed species. The BA was authored by a core team representing the US Forest Service (Regions 1 and 4), BLM, NMFS, and USFWS. Land and species managers who design culvert projects to tier to this Biological Assessment will expedite the Section 7 consultation process, get more for their restoration dollar, and further address the habitat needs of listed fishes in the state of Idaho.

Fisheries diversion and screening alternatives

Robert K. Weir, P.E., Hydroscreen Co., 303-333-6071, rkweir@aol.com

ABSTRACT: The preservation and passage of many species of fish is of concern to biologists, engineers, conservationists, and the public and private agencies that make their living dealing with, or impacting the fishery. The alternatives are numerous and the costs are significant, so the selection of the best solutions require a thorough knowledge and an evaluation of the alternatives available.

The presentation will review the basics of site evaluation and selection, including such things as flow requirements, head availability, civil construction alternatives, fish passage considerations, current Federal and State design guidelines, and the costs associated with each.

Screening alternatives and hardware involved will be reviewed and will include, orifice and wedge wire plate screens, drum screens, tilted wire Coanda wedge wire screens and infiltration diversions. The operation and different methods of cleaning will be reviewed; this will include both active and passive cleaning and operation. The engineering, function, operation and maintenance of each will be evaluated and a methodology for selection, including the pros and cons of each will be put forth.

The presentation will include, samples of different screens, and pictures and drawings of proposed and existing sites and diversion screening examples. The paper will review suggested approaches utilizing teamwork. The “dream team” might be made up of biologists, foresters, engineers, consultants, landowners, conservationists and other interested parties. The goal of the paper is to give the participants the tools necessary to

make informed decisions regarding fisheries diversion, passage and screening alternatives.

Effects of fluvial geomorphic adjustment on stream fish communities

Mažeika S.P. Sullivan*, Mary C. Watzin, W. Cully Hession

*Postdoctoral Fellow, Department of Fish and Wildlife Resources, College of Natural Resources, University of Idaho, Moscow, ID 83844-1136, 208-885-7323, smazeika@uidaho.edu

ABSTRACT: Evaluations of stream geomorphic condition may increase our understanding of the cumulative effects of human-induced habitat change on fish communities. To this end, we explored relationships between stream geomorphic condition and fish community characteristics by sampling fish communities in 44 reaches spread across 26 rivers in Vermont from 2002 through 2004. At each study reach, we identified the morphological unit according to common stream classification systems, and then evaluated the extent of deviation from reference geomorphic condition using a regionally-adapted geomorphic assessment methodology. We used principal component analysis (PCA) and linear regression to build exploratory models linking stream geomorphic condition to measures of fish community characteristic. Our results suggest that geomorphic condition significantly influences fish community diversity, productivity, and condition. Geomorphic condition was a significant factor in all of our fish community models. In conjunction with additional reach characteristics, geomorphic condition explained up to 31% of the total variance observed in models for fish community diversity, 44% of the variance in assemblage biomass, and 45% of the variance in a regional index of biotic integrity. To determine if these relationships are consistent across geographical regions, we are currently replicating this work in two watersheds in northern Idaho. This research contributes to a growing body of evidence that links stream geomorphology and attributes of fish communities, and suggests that composite measures of geomorphic condition have ecological relevance and can enhance our understanding of the hierarchy of factors that influence fish community diversity and organization.

Modeled hydrology predicts trout species composition of upper Teton River tributaries

Ryan Colyer[1],Rob Van Kirk[2,3,] Kimberly Peterson[2,] Martin Koenig[4,] Kirstin Keetch[5]

[1]Friends of the Teton River, Driggs, ID 83422
[2]Department of Mathematics, Idaho State University, Pocatello, ID 83209
[3]Idaho Water Resources Research Institute, Idaho Falls, ID 83402
[4]Utah State University, Logan, UT 84322
[5]Department of Mathematics, Brigham Young University-Idaho, Rexburg, ID 83460

ABSTRACT: Eight major Teton River tributaries drain the west slope of the Teton Range. With one exception, these streams flow perennially out of the mountains, lose all or most of their surface flow during parts of the year to groundwater and/or irrigation diversions in intermediate reaches, and then re-emerge from groundwater springs in their lower reaches. Our objective was to correlate trout species composition with hydrologic characteristics in these tributaries under three different water management scenarios: pre-irrigation (mid-19th century), flood irrigation (late 19th century to 1970s), and sprinkler irrigation (current practice). Due to absence of continuous flow data, we used an integrated surface-ground water model to calculate hydrologic connectivity among the perennial, intermittent, and groundwater-fed reaches and hydrologic regime characteristics in these reaches. Then, based on previous work correlating rainbow trout invasion success to annual maximum/minimum discharge ratio, known trout species compositions in the main stem, and location of tributary confluences, we predicted success of nonnative brook and rainbow trout in invading various reaches of the tributaries. Our model predicted that all currently intermittent streams had intermittent flow even prior to development of irrigation in the basin but that irrigation has significantly reduced the annual time window during which streams flow continuously from the mountains to the river. This window varies significantly across the study streams due to local hydrologic and geologic factors. We successfully predicted 1) the inability of rainbow trout to invade the headwater portions of all tributaries, 2) the reproductive success of rainbow trout in lower Fox Creek but not lower Teton Creek, and 3) the presence of brook trout in the headwater reaches of three of the tributaries and their absence in four others, where strong populations of native cutthroat trout remain. We predicted a low probability of brook trout invasion into the headwater reach of Fox Creek, but field data confirmed complete displacement of cutthroat trout by brook trout there. With this one exception, we conclude that we were able to successfully model at least those hydrologic characteristics most relevant to population connectivity and trout species composition in upper Teton River tributaries.

Seasonal movement and the interaction of temperature and discharge on burbot in the Kootenai River, Idaho, USA, and British Columbia, Canada

Vaughn L. Paragamian* and Virginia D. Wakkinen

*Idaho Department of Fish and Game, 2750 Kathleen Avenue, Coeur d' Alene, Idaho 83815, USA, E-mail: vparagamian@idfg.idaho.gov (presenter)

ABSTRACT: Burbot in the Kootenai River, Idaho, USA, and Kootenay Lake, British Columbia, Canada, are in decline. Ecological changes are thought to be responsible including the operation of Libby Dam. From 1994 through 2004 we monitored movements of 11 sonic tagged burbot through two to three spawning seasons, a unique opportunity not known to have been done before. Our objectives were to determine differences in behavior of individual burbot and how temperature and discharge interactions may effect seasonal movement of burbot. Burbot demonstrated multiple life

history patterns, spatial differences in spawning but temporally spawning was similar. Three burbot were very mobile, five were sedentary, five exhibited transboundary movement, and two were adfluvial entering Kootenay Lake and returning to the river. Two of the 11 burbot demonstrated an apparent non-spawning or rest year but this could have been due to environmental conditions. Six burbot were thought to have spawned in the Goat River, British Columbia, a tributary to the Kootenai River; three showed a consistent pattern of spawning fidelity for the Goat River, returning to an apparent home pool following spawning season, and then exhibiting sedentary behavior until the following autumn. Six burbot began spawning migrations when river temperature fell to a range of 3.0 to 4.9 ^{o}C. Logistic regression analysis of three of the six Goat River spawners suggested migration to be best correlated to decreasing temperature and discharge. The logistic model predicted pre-Libby Dam Goat River spawners would have followed a very consistent pattern of spawning migration in November but post-Libby Dam showed migrations to be very erratic and unpredictable. Results of this study suggest that rehabilitation measures should promote cooler winter water temperatures of 3 to 4.9 ^{o}C by the first week in November, lower discharge, and measures that promote increased numbers of burbot returning to specific spawning tributaries.

Discharge and temperature influence on salmonid movements in the Deadwood River

Sarah M. Rose, Matthew R. Dare[1] and Tammy Salow[2]

[1]Department of Biology, Boise State University, 1910 University Drive Boise, ID 83725, sarahrose3@mail.boisestate.edu
[2]Snake River Area Office, Bureau of Reclamation, 230 Collins Road Boise, ID 83702-4520

ABSTRACT: It is well documented that the movement of many stream fishes is affected by discharge and temperature. The Deadwood River, located in central Idaho, contains populations of rainbow trout *Oncorhynchus mykiss* (RBT) and cutthroat trout *Oncorhynchus clarki* (CTT) which is regulated by a hypolimnetic release dam. Bull trout *Salvelinus confluentus* are also found in the watershed; however, migratory individuals are rare. We used a combination of weirs and radio telemetry to monitor movements of RBT and CTT within and among tributaries upstream and downstream from the dam from mid-June through September 2005. Our objective was to examine the effect of variation in discharge on the movement and habitat use of salmonids downstream from Deadwood Dam and to develop guidelines for the operation of Deadwood Dam that will avoid negative impacts to salmonid populations in the watershed. Movement from the mainstem into tributaries was strongly correlated with increases in discharge as were downstream movements by radio-tagged fish. Radio-tagged fish remained relatively sedentary until a threshold was reached where they either moved downstream or into tributaries. Radio-tagged RBT and CTT upstream of the dam moved to the reservoir by early July. As flows decreased in the fall, some radio-tagged fish that had spent the

summer in tributaries began moving back to the mainstem. Movement in and out of tributaries upstream from the dam did not show the patterns observed downstream.

Stream food web response to a carcass analog addition in two central Idaho streams

Andre E. Kohler[1], Amanda Rugenski[2], Doug Taki[1]

[1]Shoshone Bannock Tribes, Fisheries Department, Fort Hall, ID 83203
[2] Idaho State University, Pocatello, ID 83209

ABSTRACT: The importance of marine derived nutrients to freshwater and terrestrial ecosystems has received considerable attention. Significant reductions in anadromous returns to the upper Salmon River in central Idaho represent a potentially system wide nutrient deficit. This loss of nutrients may limit primary productivity, disrupt stream food web dynamics, and ultimately reduce the rearing capacity of Idaho streams. We investigated stream food web response to a carcass analog addition in two streams using an upstream/downstream, before/after design. In addition, two reference streams were monitored in the absence of nutrient additions. We measured periphyton response through chlorophyll *a,* nutrient diffusing substrata, and stable isotope analyses. Macroinvertebrates were analyzed for abundance, biomass, community composition and structure, and stable isotope composition. Leaf litter (willow (*Salix)*) breakdown rates were determined. Pre-treatment periphyton and macroinvertebrate variables showed no significant differences between upstream and downstream reaches. Following a carcass analog addition, treatment reaches in both streams had significantly higher periphyton chlorophyll *a* and macroinvertebrate abundance and biomass values. No significant difference was detected in leaf breakdown rates. Reference streams showed no significant differences in measured variables between upstream and downstream reaches. Stable isotope analysis confirmed that nutrients added to the stream ecosystem in the form of carcass analogs were transferred to periphyton and macroinvertebrate communities. Preliminary results suggest that carcass analog additions to nutrient impoverished streams in central Idaho can be used as a management tool to increase stream productivity where nutrients are limiting.

Spatial Distribution of the Threatened Bliss Rapids Snail downstream from Bliss and Lower Salmon dams

Barry Bean[1] and Matthew R. Dare[2],

[1]Idaho Power Company, 1221 W. Idaho St. Boise, ID 83702, USA, bbean@idahopower.com
[2]Department of Biology, Boise State University, 1910 University Drive Boise, Idaho 93725, USA

ABSTRACT: The Bliss Rapids snail, *Taylorconcha serpenticola*, was listed as threatened by the USFWS in 1992. The species inhabits free-flowing sections of the Snake River and its springs and tributaries from King Hill to Buhl, Idaho. While a small number of *T. serpenticola* colonies have been studied intensively, very little is known regarding the species' distribution and abundance. *T. serpenticola* was previously thought to be restricted to a small number of isolated colonies found in close proximity to springs. In this study, we focused on two free-flowing reaches of the Snake River between Hagerman and King Hill. The reaches were divided into a total of 633 50-m sections and 63 sections were randomly selected and surveyed for *T. serpenticola* using a 40-cobble-count method. Habitat data were also collected. Surprisingly, *T. serpenticola* were present in 70% of sampled sections. The high rate of occurrence found in this study may be attributed to changes in sample methods from previous efforts. Presence of the species was negatively associated with distance from rapids, possibly indicating a relationship with water velocity.

LENTIC HABITAT AND BIOTA SESSION

Movement and habitat use of bull trout in Arrowrock Reservoir

Carl Stiefel and Matthew R. Dare[1] and Tammy Salow[2]

[1]Department of Biology, Boise State University, 1910 University Drive, Boise, Idaho 83725, carlstiefel@mail.boisestate.edu
[2]U.S. Bureau of Reclamation, 230 Collins Rd. Boise, ID 83702.

ABSTRACT: Arrowrock Reservoir provides important winter habitat for adfluvial bull trout, which spawn in the North and Middle Forks of the Boise River. In the fall of 2004, 17 bull trout were surgically implanted with acoustic tags during their post-spawn migration in the North Fork of the Boise River. Weekly boat surveys were conducted from October 2004 to May 2005 to examine the movement patterns and habitat use of bull trout in the reservoir. Twelve fish used Arrowrock Reservoir for at least 143 days. The remaining fish either over wintered in tributaries to the reservoir or died. Movements in the reservoir were highly variable ranging from 3 to 1600 meters per day. Some fish displayed a strong affinity to certain areas while other fish moved throughout the reservoir. Three fish are suspected of leaving the reservoir for 10 to 43 days but later returned. Fish were most frequently found in water depths of 10 to 15 meters in areas having little vertical relief.

Are bull trout and lake trout living in harmony in Lake Pend Oreille, ID?

Tom P.Bassista[1] (tbassista@idfg.idaho.gov), Melo M. Maiolie[1] (mmaiolie@idfg.idaho.gov), Mike P. Perterson[1] (mperterson@idfg.idaho.gov), and Chris C. Downs[2] (cdowns@idfg.idaho.gov)

[1]Idaho Department of Fish and Game, Bayview Research Station, PO Box 301, Bayview Idaho 83803-0806, Phone (208) 683-3225;
[2]Idaho Department of Fish and Game, 1402 E. Spring Creek Rd., Clark Fork, Idaho 83811, Phone (208) 266-1141

ABSTRACT: Lake trout have the undoubted distinction of displacing indigenous bull trout populations in Pacific Northwest lentic waters. Prime examples are Flathead Lake, MT and Priest Lake, ID where lake trout numbers greatly surpassed bull trout numbers when the kokanee populations crashed. Lake Pend Oreille, ID supports a sympatric population of bull trout and lake trout and this possibly occurs because hatchery stockings of kokanee supplement the lakes principle forage. Redd counts of adfluvial bull trout during 2005 in tributary streams of Lake Pend Oreille suggested the lake contained at least 3,000 adult fish (typically fish > 400 mm). The adult lake trout population (fish > 520 mm) was approximately 6,400 fish in 2003. Between 2002 and 2004 we monitored the habitat used by 11 lake trout and 10 bull trout on a seasonal basis using sonic telemetry techniques. We found that our tracked bull trout and lake trout used similar areas of the lake. On average bull trout were found in shallower depths than lake trout though both species depth ranges overlapped. Based on previous work done on diet analysis and our observations, bull trout and lake trout consume similar food resources and occupy similar habitats. If kokanee were extirpated from Lake Pend Oreille food would become limiting, competition between the species would increase, and bull trout could be replaced by lake trout, as in other Northwest lake systems.

Lake Level Management to Enhance Kokanee Spawning

Melo Maiolie*, Bill Ament, and Bill Harryman,

*Idaho Department of Fish and Game, Bayview Research Station, PO Box 301, Bayview Idaho 83803-0806, Phone (208) 683-3225; mmaiolie@idfg.idaho.gov

ABSTRACT: Like many large natural lakes, Lake Pend Oreille was dammed in order to produce electricity, provide flood control, and enhance recreation. This was done with little recognition of the potential impacts to shoreline spawning habitat for kokanee. Typical dam operation between the mid-1960s and mid-1990s was to draw the lake down to its low pool elevation each fall, which affected the composition of shoreline substrates, and impacted historical spawning areas. In our study, the winter elevation of the lake was changed in an attempt to increase spawning habitat. During some years the water was lowered to the minimum pool elevation to allow wave action to clean and resort shoreline gravel at the wave-shoreline interface. We estimated at least 25,000 m^2 of potential spawning area were created during one such winter. In other years, the lake was held 0.6 to 1.2 m higher to allow kokanee to spawn on the newly created gravel

areas. Kokanee were found to show a marked preference for spawning on these gravel areas. During winters of full drawdown and limited spawning habitat, kokanee egg-to-fry survival averaged 2.8%. Raising the winter lake level and increasing spawning habitat produced significantly higher egg-to-fry survival rates that averaged 6.6% ($p<0.05$). Additionally, we found that egg-to-fry survival was high regardless of lake elevation when adult kokanee abundance was very low (<80,000 adults), indicating spawning habitat was not limiting at low densities. A pattern of lowering the lake one winter, then keeping it raised the next three winters was recommended to maximize the benefit to kokanee spawning.

Spawning Characteristics of a Rainbow Trout Population in the Kootenai River Drainage, Idaho

Dean E. Holecek* and Jody P. Walters,

*University of Idaho, College of Natural Resources, Fisheries and Wildlife Resources, Moscow, ID 83844-1136, hole2993@uidaho.edu

ABSTRACT: An adfluvial form of rainbow trout from Kootenay Lake, British Columbia spawns in the Deep Creek drainage of Idaho, but little is known about their spawning habitat. Spawn timing and redd characteristics were measured in Trail Creek, a known spawning tributary that supports the highest rearing densities of rainbow trout in the Deep Creek drainage. A total of 103 excavations were identified in Trail Creek; 51 of those were measured and checked for the presence of eggs. Peak spawning occurred as discharge was decreasing and as average daily water temperature exceeded 6.0ºC. A total of 34 excavations (67%) contained eggs (redds), while 17 (23%) did not contain eggs and were considered test digs. Mean total redd area was 1.18 m² (range = 0.27-2.40 m²). Mean water depth at the upstream edge of the redds was 0.18 m (range = 0.05-0.38 m) with a mean velocity of 0.39 m/s (range = 0.14-0.67 m/s). Gravel was the most common substrate in redd tailspills. Water depths and upstream velocities measured at Trail Creek redds were similar to those reported for resident rainbow trout populations and other non-anadromous *Oncorhynchus sp*. Tailspill substrate and total redd area were different between adfluvial rainbow trout in Trail Creek and other *Oncorhynchus sp*. Those differences are likely a function of fish size, where larger fish can use bigger substrates and dig larger redds. The results of this research could be used to guide future habitat mitigation in rainbow trout spawning tributaries of the Kootenai River drainage, Idaho. Also, rainbow trout redd counts have to account for test digs because redds and test digs cannot be visually discerned in the field without checking for the presence of eggs.

ANADROMOUS FISH SESSION

A Summary Of Recent Chinook Salmon Research From The Middle Fork Salmon River: What Have We Learned, Where Are We Going?

Daniel J. Isaak[1] (disaak@fs.fed.us), Russell F. Thurow[1] (rthurow@fs.fed.us), Helen M. Neville[2] (hneville@unr.nevada.edu), Bruce E. Rieman[1] (brieman@fs.fed.us), and Jason B. Dunham[1] (jbdunham@usgs.gov)

[1]U.S. Forest Service, Rocky Mountain Research Station, Boise Aquatic Sciences Laboratory, 322 E. Front St. Suite 401, Boise, ID 83702
[2]University of Nevada, Reno, Department of Biology, 314, Reno, NV 89577

ABSTRACT: Declines in anadromous salmonids across the Pacific Northwest have led to reassessments of management goals, often changing the focus from harvest-centric approaches to be more about maintaining species persistence. Guidance for effective conservation may be obtained through study of natural populations and by understanding their characteristic spatial and temporal dynamics. Beginning in 1995, we initiated an annual survey designed to georeference all Chinook salmon redds across 800 km of stream network in the Middle Fork Salmon River—one of the few areas in the Pacific Northwest that supports wild populations unaffected by hatchery fish. Data from these surveys, and related efforts to obtain genetic samples and use IDFG redd count data, have facilitated a series of studies that provide insights useful for managing this species. Results suggest that populations retain significant genetic diversity despite recent demographic bottlenecks. Spatial genetic structure exists at scales smaller than the MFSR, although it appears to be shaped by environmental characteristics. Autocorrelation analysis of redd distributions confirms this environmental effect and suggests dispersal distances on the order of 3 – 9 km. Maintaining suitable spawning habitats within these distances may be important, as it appears that habitat geometry (i.e., habitat size and connectivity) plays a dominant role in determining habitat use. Large habitats, supporting high densities of spawners, are most important when abundances are low and could serve as refugia during periods of population stress. A significant space x time interaction, however, indicates that distributions are dynamic and conservation efforts should not focus exclusively on the best contemporary habitats or populations. Temporal synchrony analysis highlighted the dramatic changes that can occur among populations, and also revealed that populations have become strongly synchronized in recent decades, potentially increasing the likelihood of simultaneous extirpations and regional loss. Therefore, although it will remain important to maintain large, interconnected networks of habitat, populations in these areas may be susceptible to broad disturbances and spatial replicates in other portions of the species range will be needed to ensure persistence. Georeferencing and spatially continuous sampling lent tremendous analytical flexibility to the databases used in these studies and these data will remain foundational in efforts to explore new spatial and temporal themes associated with Chinook salmon in the Middle Fork Salmon River.

Influence of Stock Size and Streamflow on Chinook Salmon Production in the Lemhi River and Marsh Creek, Idaho

Jim Morrow and David Arthaud, National Marine Fisheries Service, Boise, Idaho.
Phone: (208) 378-5695 Fax: (208) 378-5699, jim.morrow@noaa.gov

ABSTRACT: We used simple and multivariate regression to compare Chinook salmon parr density, number of migrating subyearlings, number of migrating yearlings, and number of return year redds to number of stock redds and streamflow in the Lemhi River and Marsh Creek. In Marsh Creek, number of stock redds alone explained 52%, 92%, and 48% of variability in parr density, number of migrating subyearlings, and number of migrating yearlings, respectively, but only 1% of variability in number of return year redds.
Adding streamflow did not substantially improve the models for parr density, number of migrating subyearlings or number of migrating yearlings in Marsh Creek but it did improve the model for number of return year redds, with the combination of streamflow and number of stock redds explaining 27% of the variability. In the Lemhi River, number of stock redds alone explained 86% of the variability in parr density but only 17%, 17%, and 12%, respectively, of the variability in number of migrating subyearlings, number of migrating yearlings, and number of return year redds. Adding streamflow substantially improved all models for the Lemhi River with the combination of number of stock redds and streamflow explaining 94%, 76%, 89%, and 92% of variability in parr density, number of migrating subyearlings, number of migrating yearlings, and number of return year redds, respectively. In the Lemhi River, Chinook salmon year class strength is heavily influenced by environmental conditions in the natal stream during the first months after emergence, whereas in Marsh Creek, environmental conditions may not substantially influence year class strength until the downstream migration portion of the life cycle.

Origin of iteroparous steelhead from populations in the Snake River

Shawn R. Narum[1], Doug Hatch[2],Andre Talbot[3], Paul Moran[4], Madison S. Powell[5],

[1]Presenter, University of Idaho, Department of Fish and Wildlife,
3059-F National Fish Hatchery Rd, Hagerman ID 83332, 208-837-9096,
nars@critfc.org
[2]Columbia River Inter-Tribal Fish Commission, 729 NE Oregon Suite 200,
Portland, OR 97232, 503-731-1263; hatd@critfc.org
[3]Columbia River Inter-Tribal Fish Commission, 729 NE Oregon Suite 200,
Portland, OR 97232, 503-731-1250; tala@critfc.org
[4]NOAA Fisheries, NWFSC Montlake Laboratory, Seattle, WA,
paul.moran@noaa.gov
[5]University of Idaho, Center for Salmonid and Freshwater Species at
Risk, 3059-F National Fish Hatchery Rd, Hagerman ID 83332,
mpowell@uidaho.edu

ABSTRACT: Historically, iteroparity was a naturally occurring reproductive strategy of *Oncorhynchus mykiss*, and has the potential to provide an important source of genetic

variation to steelhead populations over multiple generations. Construction of multiple hydropower dams in the Columbia River Basin throughout the 20th Century has greatly restricted downstream adult steelhead migration. In fact, results from telemetry studies indicate that kelt steelhead may suffer up to 86.7% mortality during downstream migration. We collected tissues from kelt steelhead mixtures sampled at Lower Granite Dam and genotyped samples with 14 microsatellite loci. Based on multi-locus log likelihood, individual kelts were assigned to a population of origin with a baseline of steelhead collections from Snake River tributaries. Results indicate that iteroparity is a trait found in several tributaries of the Snake River Basin. Simulations suggest that iteroparity is a valuable source of genetic variability that may increase effective population size, especially in years with poor recruitment or recently bottlenecked populations.

The effects of temperature exposure on migration success and gamete quality of Snake River Chinook salmon and steelhead

Ryan Mann, Steve Lee, Christopher Peery[1], and Brian Burke[2]

[1]University of Idaho, Fish and Wildlife Dept. / PO Box 441141 / Moscow, ID 83843 /mann3157@uidaho.edu
[2]NOAA Fisheries

ABSTRACT: Examinations into the effects of high sub-lethal water temperature exposures on the reproductive success of migrating anadromous fish were preformed. Investigations included analysis of migration success and the subsequent embryo viability of steelhead and fall Chinook salmon in the Snake River. Radio telemetry methods were used in 2004 to study migration patterns related to temperature, while viability tests were completed at Lyons Ferry, Nez Perce, and Dworshak Hatcheries in 2004 and 2005. Comparisons between internal and external temperature tags showed that internal body temperature tracked external water temperature closely. Chinook salmon were exposed to temperatures as high as 23.6°C, and had total migration temperature exposures as high as 19.2 degree days above 20°C and 60.0 degree days above 18°C. Steelhead experienced maximum temperatures of 24°C and had total migration temperature exposures as high as 15.7 degree days above 20°C and 48.8 degree days above 18°C. Migration temperature exposures were highly correlated with release date and the temperature at Ice Harbor Dam at the time of passage. Embryo mortality was tracked for thirty Fall Chinook in 2004, and ranged from 1.11% to 19.8%, though one brood exhibited losses over 99% due to soft shell disease. Total embryo mortality was tracked for six steelhead, and ranged from 5.67% to 81.2% with steelhead generally having higher losses than fall Chinook. Embryo mortality data in relation to temperature exposures were analyzed for 13 Chinook salmon. The five fish with the highest temperature exposures above 20°C exhibited five of the six highest embryo mortalities at the eye up stage and the button up stage. A similar, but weaker, relationship was observed when temperature exposures were calculated using an 18°C threshold.

Spring Chinook salmon, *Oncorhynchus tshawytscha*, survival to spawning associated with water temperatures in the Umatilla River, USA

Craig R. Contor[1]*, P. Kissner[2], and J. D.M. Schwartz[2]

[1] Confederated Tribes of the Umatilla Indian Reservation, PO Box 638, Pendleton, OR 97801, 541-966-2377, craigcontor@ctuir.com,
[2] Confederated Tribes of the Umatilla Indian Reservation, PO Box 638, Pendleton, OR 97801

ABSTRACT: Spring Chinook were extirpated from the Umatilla Subbasin more than eighty years ago. Reintroduction efforts have focused on passage, flow, habitat improvements and hatchery of Carson stock spring Chinook. As a result a small but persistent natural population has been established. We assessed the relationship between summer stream temperatures and pre-spawning mortality of spring Chinook using temperature loggers and visual 3-pass spawner/carcass surveys respectively. Pre-spawning mortality increased from about 5% in reaches with maximum summer water temperatures at or below 16ºC, to 45-55% in reaches with maximum water temperatures above 23ºC. Based on fourteen years of data, a significant relationship was observed and can be described by the equation: Pre-spawn mortality = $1.4465\times10^{-5} \times T^{4.7033}$ (R^2 =0.9028). Water temperature can be an important factor in spring Chinook pre-spawning mortality, but other factors can also play a role. Disease load, injury rate, non-consumptive harvest effects, cumulative migration stress, and other water quality factors can all contribute to variability in spring Chinook salmon pre-spawning mortalities. However, the correlation between temperature and mortality presents strong inference of a cause-effect relationship. In the Umatilla spring Chinook salmon survive in reaches where the recorded maximum water temperature exceeds the published incipient lethal levels. However, fish appear to be utilizing spring seeps and other thermal refugia to reduce the stress of the ambient river temperatures during the warmest periods of the day.

Distribution and Status of Pacific Lamprey in the Clearwater River Drainage of North Central Idaho

Christopher W. Claire and Tim Cochnauer, Idaho Department of Fish and Game, Clearwater Region, 3316 16th St., Lewiston, ID, 208-799-5010, cclaire@idfg.idaho.gov

ABSTRACT: Pacific lamprey *Lampetra tridentata* have received little attention in fishery science until recently. Pacific lamprey in Idaho have to circumvent the eight lower Snake River and Columbia River hydroelectric facilities for migration downstream as juveniles 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 1997-2004. Lower Granite Dam adult passage counts have dropped from

approximately 1200 in 1994 to less than 200 in 2004. Historical adult counts at the Lewiston Dam in 1950 were in excess of 5,000 fish. Based on potential accessible streams upstream of Lower Granite Dam, it is expected that no more than 50 Pacific lamprey adult spawners annually utilize the Clearwater River drainage for spawning and contribution to the larval rearing population. Dworshak Dam on the N.F. Clearwater River halted passage to approximately 213 km of suitable habitat for this species. Migratory corridor hydroelectric facility impacts in combination with inbasin habitat degradation are considered the primary factors contributing to declines. The rearing population dynamics are disjunct in the South Fork Clearwater River and Red River, a tributary to the South Fork Clearwater. Age classes 3, 4, and 5 are absent or underrepresented in the South Fork Clearwater, with age classes 0, 1, 2, and potentially age 3 absent from Red River. Pacific lamprey persistence patterns in the Clearwater River drainage are potentially linked to habitat in subbasins with high water quality. Present distribution in the Clearwater River drainage is now limited to the lower mainstems of the Lochsa and Selway rivers, the mainstem M.F. Clearwater River, the mainstem Clearwater River, the entire S.F. Clearwater River mainstem, and the lower 7.5 km of Red River.

POSTERS IN ORDER OF FIRST AUTHOR'S NAME

Mitochondrial DNA phylogeography of mountain whitefish *Prosopium williamsoni* in Idaho, Utah, and Montana.

Campbell, M. [1], A. Whiteley, and B. Gamett.

[1]Idaho Department of Fish and Game, Eagle Fish Genetics Lab, 1800 Trout Road, Eagle, ID 83616, 208-939-6713. mcampbell@idfg.idaho.gov

ABSTRACT: Nucleotide sequences of the cytochrome b gene (~910 bp) and D-loop control region (~274 bp) of mitochondrial DNA (mtDNA) were used to assess the phylogeography of mountain whitefish Prosopium williamsoni in Idaho, Montana and Utah. Initial results support previous allozyme and microsatellite studies that found evidence for three well-defined genetic assemblages corresponding geographically to the 1) Upper Snake River drainage (upstream of Shoshone Falls) and the Bonneville basin, 2) the Snake River drainage (downstream of Shoshone Falls) including the Pahsimeroi and Salmon Rivers and 3) the upper Missouri River. Levels of sequence divergence between these three genetic assemblages were equal to or greater than published levels of divergence found in other salmonid subspecies occupying these drainages.

Evaluating genetic structure of interior Redband trout in environmental extremes of Idaho using microsatellite loci.

Cegelski, C. [*], M. Campbell, and K. Meyer.

[*]Idaho Department of Fish and Game, Eagle Fish Genetics Lab, 1800 Trout Road, Eagle, ID 83616, 208-939-6713. ccegelski@idfg.idaho.gov

ABSTRACT: Management and conservation of native, redband trout *Oncorhynchus mykiss* gairdneri is an important priority for many state and federal agencies due to dramatic population declines throughout its historical range. A common goal among agencies is to achieve long-term sustainability of viable fish populations. To obtain this goal, an understanding of genetic purity, genetic diversity, genetic structure, and their relationship to habitat features are needed. In this study, we used thirteen microsatellite loci to examine levels of genetic diversity and genetic structure in both high-mountain and desert stream populations in Idaho. As well as characterizing diversity, a Mantel test was used to determine the association between genetic distance and geographic distance and to test for differences in genetic structure between the environmental extremes. We hypothesized significant spatial structuring at the drainage scale and that populations within desert environment would be more structured and have lower levels of genetic diversity than those in the mountains due to intermittent water levels. These data will provide essential information on how genetic variation is partitioned in contrasting environments and guide managers in future prioritization and restoration of redband trout throughout its range.

Influence of year and local population on length at return of Snake River spring/summer Chinook salmon

Timothy Copeland and June Johnson, Idaho Department of Fish and Game, 1414 E. Locust Lane, Nampa, Idaho 83686

ABSTRACT: Length at age is an important consideration in fish biology because growth integrates the effects of environmental and genetic factors on fish performance. The Idaho Department of Fish and Game has collected age and fork length data of spring/summer Chinook salmon (*Oncorhynchus tshawytscha*) from across the Snake River basin during 1998-2004. This poster is a summary of that work. Growth appears to slow greatly after three years in the ocean such that four ocean lengths were wholly within the range of three ocean lengths. We modeled fork length for two- and three-ocean ages as a function of return year, sex, and local population. Population and year were significant for two-ocean salmon ($F > 15.0$, $P < 0.001$) but sex was not ($F = 0.58$, $P = 0.45$). All factors were significant for three-ocean fish ($F \geq 4.37$, $P \geq 0.037$). Average length was longest in 2003 and shortest in 2004 for both the two- and three ocean ages. Spring run Chinook were typically shorter than summer run Chinook but there was not a clear-cut difference. Mean adjusted length at age graded from the spring to summer populations with mixed-run populations intermediate. Population length differences may result from local adaptations or consistent environmental effects related to juvenile migration, e.g. early ocean entry by some populations may confer a growth advantage. These differences should be considered in management and recovery planning.

Evaluation of adult Pacific lamprey passage success at McNary and Ice Harbor Dam

Dustene Cummings, Dr. Christopher Peery, Travis Dick, and Bill Daigle[1], Dr. Mary Moser[2].

[1]Fisheries Ecology Research Laboratory, Department of Fish and Wildlife Resources, College of Natural Resources, University of Idaho, Moscow, Idaho 83844.
[2]Fish Ecology Division Northwest Fisheries Science Center, National Marine Fisheries Service 2725 Montlake Blvd. East, Seattle, Washington 98112.

ABSTRACT: Through 1997-2002, adult Pacific lamprey (*Lampetra tridentata*) inland migrations were monitored in the lower Columbia River through radio telemetry. Results from those evaluations indicated that Pacific lamprey do not readily pass Columbia River dams. During summer and early fall of 2005, a combination of radio telemetry and Half-Duplex Passive Integrated Transponder (HD PIT) tag antenna arrays were used to characterize adult Pacific lamprey passage and identify potential problem areas for the lamprey at McNary and Ice Harbor dams. We tagged 102 Pacific lamprey at McNary Dam between 8 July and 17 September; 60 lamprey were tagged with radio-tags and HD

PIT tags, and 42 were tagged with HD PIT tags only. It was determined that 52.5% (21 out of 40) and 45.0% (9 out of 20) of the radio-tagged fish released approximately 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, 61.9% (13 out of 21) of the fish that approached an entrance eventually passed the dam. This measurement was 33.3% (3 out of 9) at Ice Harbor Dam. The median passage time for adult Pacific lamprey that passed through a fish ladder was 1.14 d (n = 9) at McNary Dam, and 9.72 d (n = 2) at Ice Harbor Dam. By following individual movements through the fish ladder, we were able to ascertain potential problem areas for adult Pacific lamprey at McNary and Ice Harbor dams. At McNary Dam, lamprey appear to have the greatest difficulty at fishway entrances, and exit areas associated with auxiliary makeup water channels, and possibly at areas associated with diffuser grating. Pacific lamprey also had difficulty with the fishway entrances at Ice Harbor Dam and with a section of the south ladder that includes the transition pool. The functionality of the HD PIT tag system was determined by comparing the number of Pacific lamprey detected at the ladder exits on a HD receiver to the number detected through radio telemetry. At McNary Dam, 5 of the 13 double-tagged lamprey that passed the dam were detected at the exit through the HD system. The HD detection at Ice Harbor Dam was 1 out of 3. Information collected during this first year of study will be used to improve monitoring systems at both dams during 2006.

Reconnecting fragmented Lahontan cutthroat trout populations in Northeastern Nevada

J.D. DeGraaf[1], A.L. Harig[2], and W.T. Colyer[3]

[1]Trout Unlimited, 1020 W. Main St. Suite 440, Boise, ID 83712, 208-938-1110, ddegraaf@tu.org;
[2]Trout Unlimited, 1020 W. Main St. Suite 440, Boise, ID 83712, 208-938-1110, aharig@tu.org;
[3]Trout Unlimited, 249 South 100 West, Providence, UT 84332, 435-753-3132, wcolyer@tu.org.

ABSTRACT: Restoring habitat connectivity by removing road culverts and other structures that block fish movement has the potential to increase Lahontan cutthroat trout (LCT) abundance and distribution throughout their range. However, most barrier removal efforts have been inadequately monitored to evaluate success. In 2001, we began scientifically monitoring such an effort using a BACI (before-after-control-impact) research design to provide critical data for evaluating, planning, and implementing future large-scale reconnection projects. In the Maggie Creek drainage of northeastern Nevada, three road culverts and an irrigation diversion that had fragmented tributary habitat and isolated critical LCT populations were removed in fall 2005. Each year prior, we conducted electrofishing surveys throughout the drainage to document characteristics of local LCT populations including population size and age structure, giving us five years of "before" data. These surveys suggested the presence of large migratory adults that use

tributary habitats for spawning, so we have attempted to monitor movement of these large LCT using two-way picket weirs since 2003. We will continue our movement studies and population monitoring post-barrier removal through 2008 to evaluate LCT response to tributary-main stem reconnections.

Rainbow trout movements in the Henry's Fork caldera in relation to population estimate monitoring and river flows

Anne Marie Emery-Miller and Jim De Rito[1], Jim Gregory[2], Dan Garren[3]

[1]Henry's Fork Foundation, PO Box 550, Ashton, ID 83420, phone: 208-652-3567, emails: aemery11@yahoo.com and jderito@henrysfork.org
[2]Gregory Aquatics, 5306 Zollinger Road, Mackay, ID 83251, phone: 208-588-2447, email: fishchief@yahoo.com
[3]Idaho Department of Fish and Game, 4279 Commerce Circle, Idaho Falls, ID 83404, phone: 208-525-7290, email: dgarren@idfg.idaho.gov

ABSTRACT: Sixty-one radio-tagged adult rainbow trout (*Oncorhynchus mykiss*) in the Henrys Fork of the Snake River were tracked between October, 2003 and September, 2005. Spawning migrations of radio-tagged fish were used to evaluate the effects of fish movement on the timing and location of Idaho Department of Fish and Game population estimate monitoring in the Box Canyon. In addition, flows out of Island Park Reservoir were used to assess affects to fish movement and survival. Following their release in the fall, radio-tagged fish moved both up and downstream to wintering areas where they remained until early March, when movement to spawning areas began. Fish remained in spawning areas for 2 – 4 weeks, and left these areas by late May. Some fish from downriver areas moved into the Box Canyon for spawning, whereas almost all fish from Box Canyon remained there for spawning. Therefore, population estimates conducted in the Box Canyon may be sampling some fish from downriver areas, but fish movement during population estimates may be minimal, depending on timing in May. Low winter flows from Island Park Reservoir in 2003 did not cause mortality of radio-tagged fish and did not appear to cause major changes in movement.

Fish Community Structure Associated With Bank Stabilization on the Metals-Contaminated Coeur d'Alene River, Idaho

Catherine A. Gidley University of Idaho, College of Natural Resources, Fisheries and Wildlife Resources, Moscow, ID 83844-1136, gidley2970@msn.com

ABSTRACT: The Coeur d'Alene River, Idaho is a metals-contaminated system due to historic mining inputs beginning in the 1880's. As a result of contaminated sediments entering the river system, organisms in the river were nearly non-existent in the early 1900's. While populations of benthic invertebrates, phytoplankton, and fish have

increased since that time, water quality remains a limiting factor. As part of the Bunker Hill Superfund Site remediation, bank stabilization was identified as a means of reducing the amount of contaminated sediments contained in banks and floodplains from re-entering the river. A Clean Water Act Grant provided funding to conduct a pilot bank stabilization project on the lower Coeur d'Alene River. As part of this pilot project, effects on fish will be monitored. The lower river currently has some 5,970 m of stabilized shorelines, consisting largely of riprap structures (approximately 90%). The Coeur d'Alene River basin is home to both native and non-native, as well as warmwater and coldwater, species. The aim of this thesis study is to: 1) establish baseline fish community structure and, 2) determine whether or not significant differences in fish community exist between stabilized and un-stabilized areas or among riprap sites where different techniques were used. In order to accomplish these objectives, a total of 24 sites were identified on the lower Coeur d'Alene River, representing one of four habitat types. These habitat types include: vegetation, representing an unaltered site, failing bank, sites which may be identified for future stabilization, riprap, and riprap with vegetation. Fish community at these sites will be evaluated using electrofishing and gillnetting methodologies as well as a habitat assessment. Field work will be conducted in the summer of 2005 and the spring and summer of 2006. Preliminary results will follow.

Ecosystem Rehabilitation: Restoring Kootenai River Fisheries Through Maintaining A Balance of Nutrients

Ryan Hardy, Idaho Dept. of Fish and Game and Charlie Holderman, Kootenai Tribe of Idaho

ABSTRACT: Libby dam and Lake Kookanusa (western Montana) are responsible for the depletion of nutrients and the decline in primary productivity in the Idaho portion of the Kootenai River. The Kootenai Tribe of Idaho in partnership with the Idaho Dept. of Fish and Game began adding inorganic phosphorous (0.3L/min) July 13, 2005 to the Idaho portion of the Kootenai River to stimulate production in the Kootenai's depleted food web and annul downward trends in resident fish populations such as trout, kokanee, mountain whitefish, burbot, and white sturgeon. Prior to nutrient additions, Rhodamine WT dye tracer tests determined that phosphate would potentially be fully mixed at approximately 1.6 rkm below the application pipe. Phosphate (P_2O_5) fertilizer was added to the river on July 13, 2005 (0.31L/min) at a river flow of 25,559 cfs to achieve a fully mixed concentration of 1.5ug/L of P_2O_5 following dilution. Ambient nitrate (NO_3) concentrations stayed above 85ug/L the entire season, therefore, no nitrate fertilizer was added. Within 21 days, algal growth was visually apparent on substrates lining the bank within 200 meters of the application pipe (areas previously void of growth). Water samples taken throughout the summer indicated that orthophosphate (SRP) levels were still extremely low (below detection limits; < 0.005 mg/L) even within 1 rkm below the outlet pipe, indicating adequate uptake by the surrounding biota with little to no surplus SRP. Phosphate additions were stopped on September 28, 2005. Approximate amount of phosphate that was utilized through the season was 21,000 L for the 11 week growing season. It is expected that through the addition of these limiting nutrients (N and P) there

will be a measurable restoration of ecosystem functions (including resident fish production) in the Idaho portion of the Kootenai River within a 5 year period.

Application of the AQUATOX model on the Lower Boise River: A Preliminary Report

K. Harris[1], D. Bradley[3], B. Nydegger[1], R. Finch[1], D. Park[2], T. Dupuis[3],

[1]City of Boise, Boise, ID; [2]EcoModeling, Diamondhead, MS; [3]CH2M Hill, Boise, ID.

ABSTRACT: AQUATOX is a simulation model for aquatic systems that predicts the fate of various pollutants such as nutrients and organic chemicals, and their effect on the ecosystem and its organisms. AQUATOX differs from most water quality models in that it links primary productivity to nutrient concentrations, while taking into account the impacts of multiple, interacting stressors (for example, sediment, toxics, biological variables). Specifically, the model will be used to relate nutrient "stressor variable" concentrations (TP, TN) to levels of nutrient "response variables" (periphytic and planktonic algae, chlorophyll a, turbidity).

The lower Boise River (LBR) is located in the southwestern Idaho and drains over 1,200 square miles of rangeland, forests, agricultural lands, and urban areas. The 64 mile study area lies between Lucky Peak Dam and the confluence of the Snake River. The reach is dominated by urban and agricultural influences and is cited as one of the fastest developing areas in the Northwest. The LBR has been affected by the land uses, hydrologic modifications, and various water quality characteristics and has been on Idaho's 303(d) list for nutrient impairment since 1996.

The purpose of this project is to assess the effectiveness and applicability of the AQUATOX model to evaluate process-based nutrient criteria within the LBR. Using biological, chemical, and physical data collected by the City of Boise, the USGS, and the Idaho Department of Fish and Game, the analysis will create scenarios examining the attainability of beneficial use criteria. Further, the model will be used for updating allocations for biochemical oxygen demand (BOD) for municipal point sources and for assessing potential for local impacts associated with water quality trading.

This preliminary report will provide background on the model, its components, and its benefits for use in a large river within the arid West. Further, the report will provide preliminary findings on the biological, chemical, and physical data to be used in the AQUATOX model.

Relative roles of habitat size, connectivity, and quality on occupancy of spawning patches by Chinook salmon

Daniel J. Isaak (disaak@fs.fed.us), Russell F. Thurow (rthurow@fs.fed.us), Bruce E. Rieman (brieman@fs.fed.us), and Jason B. Dunham (jbdunham@usgs.gov),

U.S. Forest Service, Rocky Mountain Research Station, Boise Aquatic Sciences Laboratory, Suite 401322 E Front St., Boise, ID 83702

ABSTRACT: Declines in many fish populations have caused alarm and led to reassessments of management goals, often changing the focus from harvest-centric approaches to species persistence. As management has shifted, our perception of relevant environmental characteristics has evolved from traditional metrics that describe habitat quality to include characteristics of patch geometry, or those factors related to the size and connectivity of these habitats. Despite this shift and the implications it may have for how habitats are conserved and restored, habitat quality metrics have rarely been evaluated relative to patch geometry metrics. We used an information theoretic approach to select the best candidate models from logistic regressions that linked habitat quality, size, and connectivity to the occurrence of Chinook salmon redds in spawning patches. Spawning distributions were sampled annually from 1995 – 2004 and complimented with field measurements that described habitat quality in 43 spawning patches across an interconnected stream network that drained 1150 km^2 in central Idaho. Our results indicate that the most plausible models were dominated by patch geometry metrics and patch quality variables were of minor importance in determining redd occurrence. This pattern remained consistent when the analysis was rerun using data from low abundance years. Patch connectivity was the single strongest predictor when the entire time series was used, but patch size became more important when populations were reduced. Implications for management are that the size and connectivity of existing habitats should be maintained whenever possible. In situations where habitat restoration is occurring, decisions about which habitats are prioritized for treatment could be made after consideration of habitat size and connectivity to surrounding areas.

Evaluating affects of passage through the Columbia River hydrosystem on the survival and success of adult Chinook salmon using PIT tagged fish

Dr. Chris Peery, Chris Anderson and Brian Burke, University of Idaho and NOAA Fisheries

ABSTRACT: In the summer of 2005 we radio tagged adult summer Chinook salmon *Onchorhynchus tshawytsha* migrating to the South Fork of the Salmon River at Bonneville dam. These fish were selected for by the presence of PIT tags indicating release origin. The total number of fish tagged was 47. In addition to the insertion of radio transmitters, fish were measured according to a set of morphometric measurements to estimate energy condition and lipid contents were assessed using a handheld microwave device. Fish were diverted and measured at Lower Granite dam which was used as the middle point in the migration as well as being the final dam in the hydrosystem. In total 42 of these tagged fish crossed the receiver site on the South Fork of the Salmon River. Carcasses of 11 radio tagged fish were collected off the spawning grounds and processed to obtain tissue samples.

This project is an expansion on a previous study conducted by Amy Pinson. In Pinson's research, constituent partitioning from tissues and energy condition of the fish at the start and the end of the migration were studied. This research hopes to explore the individual energy usage of fish and will attempt to determine the role that energy condition plays in the successful migration and spawning of adult Chinook salmon. The goal of this study is to determine the affects if any of delayed passage time, temperature exposure and fallback on energy usage, prespawn mortality and spawning success.

Testing recruitment failure hypothesis' by in-situ fertilization and release of Kootenai River white sturgeon eggs

Pete Rust, Tim Kiser, and Seth Richards[1], Jack Siple, Chris Lewandowski, and Sue Ireland[2]

[1]Idaho Department of Fish and Game
2750 Kathleen Avenue, Coeur d' Alene, Idaho, 83814
[2]Kootenai Tribe of Idaho Fisheries Department
Box 1269, Bonners Ferry, Idaho, 83805

ABSTRACT: A continuing lack of recruitment is a major concern for the Kootenai River white sturgeon population. Over 10 years of egg collections and telemetry data suggests that Kootenai River white sturgeon are primarily spawning over sand and clay substrates. Sturgeon eggs are adhesive and research has shown that small amounts of silt and sand will cause eggs to suffocate. While there may be many factors limiting juvenile recruitment, field sampling data strongly suggests that failed or reduced recruitment to the larval stage is the result of a survival bottleneck at the egg-to-hatch stage, with egg suffocation being a major source of mortality. One purpose of this research project was to test this survival bottleneck hypothesis, and establish whether Kootenai River white sturgeon eggs will hatch and recruit if we release fertilized eggs at sites with more suitable flow and substrate (gravel and cobble) conditions. This research may provide specific site criteria which may be able to be applied to large-scale Kootenai River white sturgeon habitat restoration projects. Sexually mature male and female Kootenai River white sturgeon were captured with setlines and angling and transferred to the Kootenai Tribe of Idaho hatchery facility. Once gametes were ripe, females were spawned and eggs and sperm were transported to one of four suitable sites between rkm's 250.3 and 274.5, fertilized on site, and released. All release sites were composed of gravel, rock, and/or cobble substrates, with minimum water velocities of 1 m/s. These sites were selected based on the flow, substrate, and depth conditions of Columbia River white sturgeon spawning sites, where egg hatching and larval recruitment is successful. Larval sampling with D-ring, ½ meter and 1 meter nets began just prior to hatch below each release site to try to document which specific sites had successful hatching and larval recruitment. Twelve white sturgeon egg cases were collected, but no larval or juvenile white sturgeon were collected. Drift net sampling at relatively high discharge may not be a practical sampling technique for documenting larval recruitment from this experiment.

Larval recruitment and ensuing juvenile survival may be better measured by gill net sampling in subsequent years.

Monitoring Kootenai River white sturgeon migration and movement patterns with an array of fixed station sonic telemetry receivers

Pete Rust[1], Matt Neufeld[2], and Sue Ireland [3]

[1]Idaho Department of Fish and Game, Region 1, 2750 Kathleen Avenue, Coeur d' Alene, Idaho, 81814
[2]British Columbia Ministry of Environment, 401-333 Victoria Street, Nelson, BC V1L 4K3
[3]Kootenai Tribe of Idaho Fisheries Department, Box 1269, Bonners Ferry, Idaho, 83805

ABSTRACT: Traditional active sonic and radio telemetry techniques have provided useful information on large scale seasonal movements of Kootenai River white sturgeon. To determine seasonal movement patterns, behavioral response to temperature change and flow modifications from Libby dam, passive telemetry techniques were incorporated into our standard Kootenai River adult white sturgeon monitoring and evaluation program. Beginning in 2002 by British Columbia Ministry of Environment on Kootenay Lake and continuing to the present on the Kootenai River in Idaho, an array of 47 Vemco VR2 stationary receivers have been deployed from Kootenay Lake, British Columbia near the mouth of the Lardo River (rkm 18) to above Boulder Creek (rkm 276), Kootenai River, Idaho. This provides the opportunity to monitor fish movements continuously throughout the Kootenai River system and into Kootenay Lake. Other advantages include cost savings from technician or bioaide time, and less sampling bias, which occurs when field staff tends to track fish on the same routes at about the same times. To date, 30 adult Kootenai River white sturgeon have been tagged with Vemco transmitters. All transmitters are long life (5-6 year) and should provide useful movement data for many years. The primary purpose of this presentation is to provide movement summaries for selected adult Kootenai River white sturgeon tagged between 2003 and 2005. Secondary objectives of this presentation are to provide examples of the types of data collected with passive telemetry techniques and possibly give researchers an option to point collection methods when designing telemetry studies when spatial and temporal scale are an issue.

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