AMERICAN FISHERIES SOCIETY
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IDAHO CHAPTER

2003 Annual Meeting:

Technology –

"Where are we, where are we headed, and has it made us better Managers and Investigators ? "

Agenda and Abstracts

February 27- March 1, 2003
Doubletree Riverside,
Boise, Idaho

ICAFS EXCOM

President
Steve Elle
465-8404
selle@idfg.state.id.us

President Elect
Vaughn L. Paragamian
769-1414
vparamag@idfg.state.id.us

Vice President
Matt Powell
837-9096
mpowell@uidaho.edu

Secretary/Treasurer
Rob VanKirk
282-2503
vankrobe@isu.edu

Past President
Brett Roper
(435)755-3566
broper@fs.fed.us

Palouse Subunit
Kajsa Stromberg
kajsa_eagle@hotmail.com
Jason Pyron
pyro0350@udiaho.edu

COMMITTEE CHAIRS

Anadromous Fishes
Catherine Willard
939-4114
cwillard@idfg.state.id.us
Stephen Grabowski
378-5030
sgrabowski@pn.usbr.gov

Funding
Lance Hebdon
465-8404
lhebdon@idfg.state.id.us

Fish Culture
Bob Esslemen
756-2271

Membership
Chris Downs
266-1141
cdowns@sandpoint.net

Native Fishes
Jim Capurso
524-7500
jcapurso@fs.fed.us

Public Education
Doug Megargle
324-4359
dmegargl@idfg.state.id.us
Dave Venditti
465-8404
dvenditt@idfg.state.id.us

Riparian
Dale Allen
634-8137
dallen@idfg.state.id.us

Stream Hydroaulic
Bill Clark
373-0263
wclark@deq.state.id.us

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Annual Meeting

Thursday, February 27 - Saturday, March 1, 2003

Technology –"Where are we, where are we headed, and has it made us better Managers and Investigators ? "

Wednesday, February 26, 2003

6:00 PM – 8:00 PM	Registration
8:30 AM – 4:30 PM	Manuscript Preparation Workshop (pre-registration required)
7:00 PM – 9:00 PM	ExCom Meeting

Thursday, February 27, 2003

7:00 AM – 10:00 AM	Registration
8:30 AM – 8:40 AM	Introduction and housekeeping
8:40 AM – 8:55 AM	President's Address - Introduction to the Plenary Session

Plenary Session — ***Vaughn L. Paragamian, moderator***

8:55 AM – 9:15 AM	Robert Ahrens – University of British Columbia, Lecturer - Fisheries Science or Rocket Science: Can We Send Fish to the Moon?
9:15 AM – 9:35 AM	Matt Powell – University of Idaho - Center for Salmonid Species at Risk - Advances in molecular genetics: addressing old questions and solving new problems
9:35 AM – 9:55 AM	Jim Lotimer – Lotek - Fish and wildlife monitoring the road ahead
9:55 AM – 10:15 AM	Tim Acker – Biosonics – Data on the swamp – or – swamped in data?

10:15 AM – 10:35 AM Break

Panel discussion — ***Vaughn L. Paragamian, moderator***

10:35 AM –10:40 AM	Introduction
10:40AM – 11:45 AM	Discussion

11:45 AM – 1:00 PM Lunch Committee Breakouts

Thursday, February 27, 2003 cont'd

Session 1 – Technical Applications 1 Shanda Fallau Dekome, moderator

1:00 PM – 1:05 PM	Introduction to session
1:05 PM – 1:25 PM	Mark Liter and Melo Maiolie - IDFG - Fishes of the Priest Lake System: Yesterday, Today and What Technology May Bring Tomorrow
1:25 PM – 1:45 PM	Jack Doyle – USGS -Use Of acoustic instrumentation in collecting hydrologic data
1:45 PM – 2:05 PM	Larry Brotman – ESRI - Incorporating Geographic Information Systems into Fisheries Data Management
2:05 PM – 2:25 PM	Break
2:25 PM – 2:45 PM	Jim Younk – Idaho Power Company – Continuous Chlorophyll a monitoring on the Snake River
2:45 PM – 3:05 PM	Gary Barton, and E. H. Moran – USGS – Instrumentation and methods used for bathymetric mapping of the Kootenai River white sturgeon habitat in Montana, Idaho, and British Columbia
3:05 PM – 3:25 PM	Steve Combe – Electronic Data Solutions - Datasight: A relational database for managing, integrating, and distributing environmental data
3:25 PM – 3:45 PM	Danielle Schiff – Spatial and temporal distribution of bull trout in the North Fork Clearwater River drainage, Idaho
3:45 PM – 4:00 PM	Break

Session 2 – Technical applications 2 Ken Lepla, moderator

4:00 PM – 4:05 PM	Introduction to session
4:05 PM – 4:25 PM	Melo A. Maiolie – IDFG - Strobe light testing to reduce kokanee entrainment losses
4:25 PM – 4:45 PM	Russell Moursund – Battelle – The DIDSON acoustic camera: a new technology for the In Situ observation of fish
4:45 PM – 5:05 PM	Dave Faurot – Nez Perce Tribe – Quantifying adult salmon spawner abundance in Lake Creek, Idaho
6:30 PM – ?	Paloose Unit Student mixer at Idaho Pizza Company, 7100 Fairview Ave, Boise

Friday, February 28, 2003

Session 2 – Contributed papers 1 ***Jody Walters, moderator***

8:00 AM – 8:10 AM	Housekeeping and Announcements
8:10 AM – 8:30 AM	Steve Chamberlain – Dept. of Aquatic, Watershed and Earth Resources, Utah State U - Evidence for a contracted thermal niche of exotic Brook trout in the presence of native Bull Trout in the Lost River Systems of SE Idaho.
8:30 AM – 8:50 AM	David Arthaud – Relationship of Anadromous Fish Stock Performance and Stream Flow in the Lemhi and Salmon Rivers, Idaho
8:50 AM – 9:10 AM	Darren R. Thornhill – Uof I - Using an Experimental Application of the Wolman Walk Pebble Count to Predict Fall Chinook Redd Site Selection in Priest Rapids Reservoir, Columbia River
9:10 AM – 9:30 AM	Wade P. Cavender, – U of I - Distribution of *Myxobolus cerebralis* within a free-flowing river system during the migration period for juvenile anadromous salmonids in Idaho
9:30 AM – 9:50 AM	Tammy Salow – USBR - Arrowrock Dam Outlet Works Rehabilitation Project: Mitigating potential Impacts ofr a large Construction Project on an Adfluvial Bull Trout Population

9:50 AM – 10:15 AM Break

Session 3 – Contributed papers 2 ***Darin Jones, moderator***

10:15 AM – 10:20 AM	Introduction to session
10:20 AM – 10:40 AM	Jason Pyron – U of I - Fish entrainment rates into helibuckets from central Idaho streams during fire suppression activities
10:40 AM – 11:00 AM	Tami Reischel – U of I -Temperatures of Lower Granite Reservoir and Response of Adult Salmon and Steelhead to Cold Water Releases from Dworshak Reservoir in 2001
11:00 AM – 11:20 AM	Brad Shepard – Montana Fish, Wildlife, and Parks - Status of westslope cutthroat Trout (*Oncorhynchus clarki lewisi*) in the United States: 2002 Tim Cochnauer* – IDFG - Utilization of tiger muskellunge for suppressing self-sustaining populations of introduced brook trout in high mountain lakes of Idaho
11:20 AM – 11:40 AM	Matt Campbell – IDFG - An assessment of introgressive hybridization between westslope cutthroat trout and both native and introduced trout in the Middle Fork Salmon River, ID: Conservation and management implications
11:40 AM – 1:40 PM	Lunch – ICAFS Annual Business Meeting, Western Division AFS Update

Friday, February 28, 2003 cont'd

Session 4 – Contributed papers 3 ***Joe DuPont, moderator***

1:45 PM – 1:50 PM	Introduction to session
1:50 PM – 2:10 PM	Bill Horton – IDFG - Collecting permits: more than any of us want to know
2:10 PM – 2:30 PM	Derek S. Fryer – U of I - Swimming performance of hatchery-reared yearling chinook salmon before and after passage through the Snake-Columbia River hydropower system
2:30 PM – 2:50 PM	Carla Hogge – IDFG -Differentiating the neurotrophic *Myxobollus* sp. from *M. cerebralis* and its distributon in Idaho waters
2:50 PM – 3:10 PM	David C. Burns – USFS - Developing an empirical model of bull trout persistence in south-central Idaho watersheds

3:10 PM – 3:30 PM Break

3:30 PM – 3:50 PM	Doug Munson – IDFG - Changes in the IDFG ELISA – based culling program for brood Chinook salmon
3:50 PM – 4:10 PM	Shawn R. Narum – CRITFC - No genetic divergence detected between pre and post supplemented chinook salmon spawning aggregates in Johnson Creek, ID
4:10 PM – 4:50 PM	Ted Koch, FWS; Greg Schildwachter, Idaho OSC; Tom Curet, IDFG - Upper Salmon Basin Watershed Restoration Project Initiative

4:50 PM – 5:30 PM POSTER SESSION

6:30 PM – 11:00 PM Raffle and auction

Saturday, March 1, 2003

Session 5 - Contributed papers 4 ***Art Butts, moderator***

8:00 AM – 8:05 AM	Housekeeping and Announcements
8:05 AM – 8:25 AM	Daniel J. Isaak – U of I -Temporal Variation in Synchrony Among Chinook Salmon Redd Counts from the Middle Fork Salmon River, Idaho
8:25 AM – 8:45 AM	Russ Thurow – USFS - Temporal and spatial dynamics of chinook salmon in the Middle Fork Salmon River, Idaho
8:45 AM – 9:05 AM	Benjamin R. LaFrentz – U of I - Antigenic characterization of *Flavobacterium psychrophilum* and determination of protective antigens

9:05 AM – 9:25 AM Stephen R. Clayton – Quantifying Physical and Biological Responses to Stream Restoration at the Reach Scale

Saturday, March 1, 2003 cont'd

9:25 AM – 9:45 AM Chris Claire* – U of I - Status, distribution, and habitat utilization of Pacific lamprey in the Clearwater River drainage, Idaho

9:45 AM – 10:05 AM Break

10:05 AM – 10:25 AM Doug Munson – IDFG - An epizootic of IHNV at Sawtooth hatchery

10:25 AM – 10:45 AM Michael Colvin – U of I - Prevalence of *Myxobolus cerebralis* in the Pahsimeroi watershed, Idaho: associations between landscape and fine scale habitat characteristics

10:45 AM – 11:05 AM Joseph R. Kozfkay – IDFG - Improving vulnerability to angling of rainbow trout-a selective breeding experiment

11:05 AM – 11:25 AM Kevin Meyer – IDFG – Makin' (fish) Whoopee: is length at sexual maturity predictable?

11:25 AM – 11:45 AM Patrick Murphy – IDFG - The effects of different species of introduced salmonids on amphibians in headwater lakes of north-central Idaho

11:45 AM – 12:05 PM 2002Tim Cochnauer* – IDFG - Utilization of tiger muskellunge for suppressing self-sustaining populations of introduced brook trout in high mountain lakes of Idaho

12:05 PM – 12:20 PM Chris Shockman – IDFG - An improved design for fish transport tank

12:20 PM – 12:35 PM Presentation of best paper awards, closing remarks

Adjourn

12:00 PM Executive Committee Meeting

Plenary Speakers

Robert Ahrens, Lecturer University of British Columbia

Fisheries Science or Rocket Science: Can We Send Fish to the Moon?

Computing power available to the average fisheries scientist today has allowed for the development and refinement of techniques and models that would have previously been computationally prohibitive. In single species stock assessment we are now capable of integrating diverse sources of data into stock assessment models improving our ability to make inferences about population dynamics as well as present the uncertainty in the estimates explicitly. Our ability to perform complex simulations rapidly has lead to the discovery and exploration of hidden assumptions within assessments and the consequences if the assumptions are not met. As a result we have a clear understanding of the limits and failings of single species assessment and are beginning to admit that many of the assumptions made in assessment models are wishful thinking. Simulations have also facilitated the development of more effective experimental and monitoring programs by exploring the interaction between uncertainty and sampling design. At the ecosystem level large-scale models have also allowed for the screening of policies such as the necessary size of marine protected areas. Such models have also prompted careful thinking about how organisms interact revealing processes that have important consequences for management. Complex models are appealing for policy exploration because they provide an overview of an entire system and account for interactions between species furthermore; the process of creating such models inevitably reveals fundamental uncertainties in how a system will respond to change. Although as fisheries scientists we are capable of incorporating a great deal of understanding and data into assessment and can use large models to explore potential ecosystem interactions resulting from policy implementation, we still face some fundamental uncertainties. Until we improve out ability to observe the aquatic world we must face up to the fact that stock assessment can not provide the degree of certainty required by current management practices. We must therefore change the way we monitor harvesting impacts. Our ability to explore the potential impacts of policy at the ecosystem level is still qualitative and certitude can only be had through large-scale experimentation.

Matt Powell, Center for Salmonid and Freshwater Species at Risk, University of Idaho, 3059F National Fish Hatchery Road, Hagerman, ID 83332

Advances in molecular genetics: addressing old questions and solving new problems.

The field of molecular genetics has grown exponentially within the last 10 years. Exhaustive tagging, differential marking, and lethal sampling for disease are just a few techniques that can be augmented or in some cases replaced using molecular techniques.
As a resort, many traditional questions in fisheries biology and fisheries management can now be addressed with these novel methods which at times can provide greater precision and accuracy than other methods. However, molecular techniques are not a panacea for all intractable problems new or old and even though the expense of performing molecular genetic analyses is ever decreasing, their use still requires careful consideration. As with any study, experiment design is the most crucial step. Unfortunately, many times, the idea of employing genetics or molecular genetics occurs as an afterthought once the study has begun. Fortunately, with the advent of microsatellite and single-nucleotide polymorphism analysis, high throughput sequencing and several DNA isolation methods, historical allozyme analysis samples as well as dried scales and otoliths from other studies which did not address genetic questions per se can be used as sources of archived DNA.

Jim Lotimer, Lotek, Canada

Fish and Wildlife Monitoring The Road Ahead

This paper discusses the growing demand for scientific instrumentation used to gather bio-information and monitor fish and wildlife; provides a brief history of current product accomplishments and capabilities; and reveals the products of the future.

The hard commercial reality of large-scale resource exploitation is the driving force behind the growing demand for cost-effective environmental bio-information. The world's natural resources continue to be utilized and/or depleted at unprecedented rates. The public is demanding that industry and government cooperate in responsible environmental resource management. Environmental studies cannot be carried out without reliable information on the state of forests, oceans, land and atmosphere.

There is now substantial proof that by studying the biological inhabitants of natural environments, researchers can indeed gain valuable insight about the impact of worldwide industrial development. However, despite the substantial financial resources continuously committed to such research and management, the scientific knowledge base remains insufficient. It is apparent that more critical knowledge must be gathered. Correspondingly, the demand for environmental research focused products and services is growing. Fish, terrestrial animals and birds can be monitored to provide critical "bio-information" about the natural environment, information which cannot be obtained cost-effectively in any other way.

Since the advent of the transistor in the late 1950, biologists and scientists have been using electronics to monitor fish and wildlife. Early offerings were limited to positioning the animal but the steady growth of technological capabilities has drastically increased the utilization of animal borne instrumentation. Today, numerous products, specialized for the monitoring of animals as global environmental change "indicators", are available to researchers. These include: radio and acoustic receivers and data collection platforms, ultra-miniature transmitters, automatic positioning systems, specialized digital signal processing equipment and algorithms, signal coding systems, data storage tags and animal borne Global Positioning System (GPS) tracking equipment.

Recent technological advances are enabling researchers and engineers to develop even more sophisticated systems, which include compact instrumentation placed on, or in, animals to monitor behavior, physiology and biochemistry. These bio-information systems provide an unprecedented increase in scientists' capabilities to collect valuable data economically, and thus to analyze and predict environmental impact and subsequent solutions.

The road ahead looks even brighter as technology advances continue their hectic pace and the economic climate for environmental stewardship builds.

Arthaud, David and Jim Morrow U. S. Department of Commerce, National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Idaho Habitat Branch, 10215 W. Emerald, Suite 180, Boise, Idaho 83704. Phone: (208) 378-5696

Relationship of Anadromous Fish Stock Performance and Stream Flow in the Lemhi and Salmon Rivers, Idaho

Adequately describing the relationship of stream flows to performance of fish stocks has been a long standing problem for fisheries managers. A variety of methods have been used to determine the amount of flow necessary to achieve fishery management goals, but only in rare instances have methods been validated by observing the performance of fish populations at different stream flows. We compared production of juvenile chinook salmon in the Lemhi River, and survival of chinook salmon smolts migrating from the Lemhi river to the Federal Columbia River Power System, with instream flow measured at the USGS gauge near Lemhi, Idaho. We also compared stock recruitment ratios, estimated using redd count data, of chinook salmon in the Lemhi and Salmon Rivers with instream flows measured at the USGS gauges near Lemhi and Salmon, respectively. Production of juvenile chinook salmon in the Lemhi River and survival of juvenile chinook salmon migrating from the Lemhi River were positively correlated with flow. Likewise, stock recruitment ratios in the Lemhi and Salmon Rivers were positively correlated with stream flow experienced by juvenile chinook salmon in natal streams. Studies investigating the relationship of instream flow to juvenile production and survival, and to overall performance of anadromous salmonid populations, could prove useful in determining flows necessary to conserve imperiled fish stocks.

Barton, Gary J., E. H. Moran, PG, U.S. Geological Survey 230 Collins Rd, Boise, Idaho 83702 253-428-3600 x2613 gbarton@usgs.gov and Edward H. Moran, U.S. Geological Survey, 4230 University Dr. Suite 201,Anchorage, Alaska 99508 ehmoran@usgs.gov

Instrumentation and Methods Used for Bathymetric Mapping of the Kootenai River White Sturgeon Habitat in Montana, Idaho, and British Columbia

High-resolution bathymetric mapping of the Kootenai River white sturgeon spawning habitat is required for the construction of hydraulic flow models and multidimensional sediment transport models of the Kootenai River white sturgeon, *Acipenser transmontanu*s, spawning habitat. The U.S. Geological Survey is mapping the bathymetry of the Kootenai River from Libby Dam near Libby, Montana, to the confluence of Kootenay Lake, British Columbia. The survey is more detailed in the spawning reach near Bonners Ferry, Idaho. “A” and “B” order horizontal and 1st-order National Geodetic Survey quality vertical survey controls were established in the United States portion of the study area using Global Positioning Systems and procedures outlined in the National Geodetic Survey Technical Memorandum NOS NGS-58. Control points in British Columbia were established using 1- and 2-hour Global Positioning System occupations. Final network adjustments in British Columbia were based on a combined Canadian geoid model HTv2.0 and American Geoid99 model. The bathymetric mapping system consists of computers using navigational software, Real-Time Kinematic Global Positioning System, and a survey-grade echo sounder. Surveying| procedures consist of verifying that (1) the navigational system is within +/- 2 centimeters at survey control benchmarks, (2) the echo sounder is calibrated at multiple depths with a sounding rod, and (3) water temperature is monitored during the survey.
The bathymetric mapping is being conducted in cooperation with the Idaho Department of Fish and Game, the Kootenai Tribe of Idaho, and the U.S. Army Corps of Engineers. Hydraulic flow modeling is being done in cooperation with the Idaho Department of Fish and Game and the U.S. Army Corps of Engineers. Multidimensional sediment transport modeling is being done in cooperation with the Kootenai Tribe of Idaho.

Brotman, Larry, ESRI Northwest

Incorporating Geographic Information Systems into Fisheries Data Management

Geographic information systems (GIS) is a computer technology that integrates digital maps and tabular data thereby "spatially" enabling the information collected and maintained in traditional databases. The use of GIS to support the work of natural resource agencies is widespread and has an extensive history. Collecting data and "connecting" that to specific locations within coordinate space offers powerful potential for information warehousing, analysis, and decision support. This presentation will begin by briefly introducing the fundamental concepts of GIS and review a variety of natural resource applications to which the technology is applied. It will include a brief discussion suggesting how GIS may be incrementally incorporated into business processes and highlight the benefits gained from the effort. Finally, because the use of ESRI GIS products is expanding amongst State agencies in Idaho, including the State Department of Fish and Game, the presentation will conclude with a brief review of products that comprise the ArcGIS line of GIS software.

Burns, David C., Rodger L. Nelson, Caleb F. Zurstadt, David M. Hogen, Michael McGee, Dale Olson; Payette National Forest

Developing an Empirical Model of Bull Trout Persistence in South-central Idaho Watersheds

Although bull trout in south-central Idaho are not anadromous, they have long been associated with anadromous fish. Bull trout migrate, or have been known to migrate historically, throughout many large river systems in Idaho, often in concert with migrating anadromous species. They are presumed to have inhabited Idaho waters longer than anadromous species, but are suffering some of the same consequences of habitat fragmentation caused by construction of anthropogenic barriers that anadromous species are experiencing. In Idaho, bull trout populations may be fluvial, adfluvial, resident, or some combination of these life histories, and small populations of resident fish even persist above both natural and anthropogenic barriers. We considered whether bull trout distribution in watersheds known to have supported anadromous species was related to the amount of time that has elapsed since the watersheds were finally and totally blocked to anadromous fish as an index of the elapsed time since fragmentation began. Despite an incomplete data set, we felt that we knew enough about bull trout populations in the vicinity of the Payette National Forest to obtain a preliminary answer to this question. To do so, we identified all of the 6th field hydrologic units (HUs) in which bull trout are known to presently occur or to have occurred in the recent past, and generated a viability index from the proportion of occupied HUs, the area of the watershed normalized to area of the largest watershed, and the approximate time since isolation of the watershed. This left us with seven points (including three for one watershed in which we have been able to witness the reduction in occupied HUs) and a declining linear model with a sufficiently high coefficient of determination (R^2) to encourage us to continue. We obtained additional data on bull trout distribution from watersheds to the south and east of our Forest, and took the same analytical approach with our expanded data set. During mapping, however, it was immediately clear that that two of the watersheds, the South Fork and Middle Fork Boise Rivers, had wider bull trout distribution than most others for the length of time they've been isolated. We reasoned that this resulted from the fact that the two large reservoirs, Arrowrock and Anderson Ranch, that support adfluvial fish. These are the only watersheds in our study with substantial adfluvial populations, so we left them out of additional modeling. Using our original seven watersheds, plus three from the Boise National Forest, we were still able to develop a linear model with an R^2 that indicated we were explaining about half the variability in the data. There was still an apparent outlier, the South Fork Payette River watershed, which we intuitively feel is dissimilar to the others, and the linear relationship without that watershed is exceptionally tight considering the simplistic approach to modeling viability. We are continuing this effort by investigating whether adjusting the index with some measure of watershed elevation will be helpful. We are not proposing that we can accurately predict persistence in a given watershed, but we are suggesting that this model illustrates intuitively obvious relationships between elapsed time of bull trout fragmentation and the rate of extinction. This may provide the basis for a new line of research into bull trout persistence.

Campbell, Matthew R. Idaho Department of Fish and Game; Christine Cegelski Idaho Department of Fish and Game/University of Idaho; Michael P. Peterson and Madison Powell University of Idaho; Steven P. Yundt Idaho Department of Fish and Game

An assessment of introgressive hybridization between westslope cutthroat trout and both native and introduced trout in the Middle Fork Salmon River, ID: Conservation and management implications

Westslope cutthroat trout are currently under a second, court-ordered, status review by the U.S. Fish and Wildlife Service to determine whether the subspecies should be listed as threatened under the Endangered Species Act. Hybridization and introgression from stocking of non-native trout has been cited as the principal biological hazard to the persistence of the subspecies and was referred to by the court as the primary reason for the decision to order a second status review. The Idaho Department of Fish and Game and the University of Idaho have been investigating hybridization and introgression in westslope cutthroat trout populations throughout Idaho. This current research is focused on populations of westslope cutthroat trout in the Middle Fork of the Salmon River drainage. The two primary objectives of this study are (1) to assess whether past stocking of hatchery trout in high mountain lakes within the drainage has led to hybridization and introgression, and (2) to determine whether natural hybridization and introgression between sympatric westslope cutthroat trout and native rainbow trout occurs within the drainage. During the past two years, non-lethal fin samples were collected from over 1,000 trout in the Middle Fork of the Salmon River drainage. Sample sites were distributed over a large geographic area, from the headwaters to the mouths of 12 tributaries, as well as from the main-stem Salmon River, and included both areas that had been stocked as well as not stocked. Samples were genetically tested using species-specific nuclear and mitochondrial DNA markers. Preliminary results, indicate low levels of hybridization and introgression in many of the tributaries. The identification of probable F_1 hybrids as well as hybridization and introgression in stocked and non-stocked areas, suggests hybridization likely occurs between westslope cutthroat trout, and both native *Oncorhynchus mykiss* as well as introduced, non-native hatchery trout.

Cavender[1], Wade P., Keith A. Johnson[2] and Kenneth D. Cain[1.] [1]Department of Fish and Wildlife Resources, University of Idaho, Moscow ID, 83843-1136, USA. Phone: 208-885-7608; Fax: 208-885-9080. E-mail: cave0538@uidaho.edu and kcain@uidaho.edu. [2]Idaho Department of Fish and Game, Eagle Fish Health Laboratory, Eagle ID 83616, USA. Phone: 208-939-2413; E-mail: kjohnson@idfg.state.id.us

Distribution of Myxobolus cerebralis *within a free-flowing river system during the migration period for juvenile anadromous salmonids in Idaho*

To gain a better understanding of pathogen associated risks to resident and anadromous salmonid populations, the distribution and prevalence of *Myxobolus cerebralis* within the smolt migration corridor of the Salmon, Snake and Clearwater Rivers of Idaho was assessed. Sentinel exposures of rainbow trout fry (*Onchorhynchus mykiss*) were performed at 10 locations from the upper reaches of the Salmon River extending downstream including sites on the Snake and Clearwater Rivers from April 18-28, 2001 and from May 15-25, 2001. Following exposures, fish from each group were examined for prevalence and severity of infection by *M. cerebralis* using pepsin trypsin digest (PTD), histopathology and nested polymerase chain reaction (PCR). Infections did not occur in portions of the Snake or Clearwater Rivers included in this study, but were found in five of the Salmon River sites during April and seven during May. Results during April demonstrate moderate to high levels of infection occurring at Sawtooth (uppermost site), but infections decrease to low levels at Sunbeam (28 river kilometers downstream). Fish exposed at two sites further downstream (Pahsimeroi and Salmon) showed 100% prevalence in both April and May. These results suggest a discontinuity in the distribution of the infectious triactinomyxon spore (TAM) stage within the Salmon River corridor due to input from tributaries. Prevalence and infection severity increased from April to May in all up river sites indicating a temporal increase in TAM production during this period. These data also illustrate a spatial increase in the distribution of *M. cerebralis* throughout the Salmon River drainage, therefore extending the current known distribution. This study demonstrates that resident and anadromous salmonids emerging and/or migrating through portions of the Salmon River during April and May are exposed to the infectious stage of *M. cerebralis*.

Chamberlain, S. – Presenter, Department of Aquatic, Watershed and Earth Resources, Utah State University, Logan, UT, 84322-5210,435-797-**(W), cha@cc.usu.edu; J.L. Kershner, U.S. Forest Service – Fish and Aquatic Ecology Unit, Department of Aquatic, Watershed and Earth Resources, Utah State University, Logan, UT, 84322-5210,435-797-2500(W), 435-797-1871(F), kershner@cc.usu.edu.**

Evidence for a contracted thermal niche of exotic Brook trout in the presence of native Bull Trout in the Lost River Systems of SE Idaho.

Widespread displacement of bull trout from their historic range has been attributed to both increases in water temperatures and competition with exotic brook trout. However, it is not well understood how these two threats interact at the population level. Bull trout are known to have lower thermal optima than brook trout. However brook trout are competitively dominant at temperatures near their optima which are well within the tolerances of bull trout. The observed pattern of isolation in headwater streams when brook trout are present leads to the question: Does the presence of bull trout limit the ability of brook trout to invade colder streams? Can low temperatures reduce the competitive and demographic advantages of invading brook trout enough to allow bull trout to persist? These questions were evaluated by comparing distributions of exotic brook trout in two adjacent watersheds with and without native bull trout. Allopatric brook trout have invaded streams with much lower temperatures than they have colonized in the presence of bull trout. This pattern suggests a contracted thermal niche in the presence of competitors and hints at the potential for a thermal gradient in the ability of brook trout to displace native bull trout.

Clayton, Stephen R., Ph.D., Senior Associate,Philip Williams & Associates, Ltd.,967 E. Parkcenter Blvd. #246,Boise, ID 83706-6700. 208-433-9200 (phone) 208-433-9250 (fax) s.clayton@pwa-ltd.com. Jody K. Brostrom, and Peter Goodwin

Quantifying Physical and Biological Responses to Stream Restoration at the Reach Scale

While many active restoration projects are implemented on the assumption that biological conditions will improve if physical processes are restored, the ability to document such cause-and-effect relationships can be complicated by many factors. To investigate the potential for detecting responses to active stream restoration, the project team monitored biological and physical parameters before, during, and after implementation of the Lower Red River Meadow Restoration project. Located along a tributary to the South Fork Clearwater in north-central Idaho on property owned by Idaho Department of Fish and Game, the soft-engineered stream restoration project was implemented from 1996-2000 to improve habitat for chinook salmon (*Oncorhynchus tshawytscha*) by restoring natural, physical processes to a 4.1 km reach through the riparian meadow ecosystem. Power to detect response to habitat restoration is a function of effect size, variability, sample size, and significance level. From observed variability in physical and biological parameters monitored at the project reach, magnitude of detectable response was estimated as a function of years of monitoring. For example, with five years of post-restoration

monitoring, biological parameters (e.g., age 0 chinook density) would require an order of magnitude larger response than physical parameters (e.g., median particle size) to be statistically detectable. To document the effectiveness of restoration efforts, monitoring must be incorporated prior to and during the initial phases of restoration planning otherwise there is little opportunity to distinguish between response due to natural variability and that induced by the restoration activity.

Cochnauer, Tim and Christopher Claire, Idaho Department of Fish and Game, Lewiston, ID

STATUS, DISTRIBUTION, AND HABITAT UTILIZATION OF PACIFIC LAMPREY IN THE CLEARWATER RIVER DRAINAGE, IDAHO

Recent decline of Pacific lamprey *Lampetra tridentata* adult migrants to the Snake River drainage has focused attention on the species. Adult lamprey counted passing the Ice Harbor Dam fishway averaged 18,158 during 1962-69 and 361 during 1993-2000. Human resource manipulations in the Snake River and Clearwater River drainages have altered ecosystem habitat in the last 120 years, likely impacting the productive potential of Pacific lamprey habitat. Clearwater River drainage hydroelectric facilities impacted Pacific lamprey populations to an unknown degree. The Pacific Power and Light Dam on the Clearwater River in Lewiston, Idaho, restricted chinook salmon passage in the 1927-1940 period, altering the migration route of outmigrating juveniles/larvae and upstream adult migrants (1927-1972). Construction of the Harpster hydroelectric dam on the South Fork of the Clearwater River resulted in obstructed salmonid passage in the mid-1900's. In 2000 and 2001 trapping, electrofishing, and spawning ground redd surveys were used to determine Pacific lamprey distribution, life history strategies, and habitat requirements in the South Fork of the Clearwater River drainage. Findings indicated Pacific lamprey juveniles-larvae, are not numerous or widely distributed. Lamprey distribution in the South Fork of the Clearwater River basin was confined to lower reaches of Red River (rkm 8.0 to mouth) and the South Fork of the Clearwater River. More Pacific lamprey ammocoetes were captured in lateral scour pool habitat than any other single habitat type. Individuals were mostly found inhabiting sand-silt substrate behind boulders and were captured in water depths ranging from just over 1.0 meter to less than 0.1 meter. Temperature monitoring in the Red River subbasin infers lamprey juveniles/larvae are capable of surviving stream temperatures in excess of 20.0^{0}C. However, Red River substrate temperatures were cooler in the maximum temperature period in comparison to stream temperatures.

Colvin[1], Michael, Kara Anlauf[1], Keith Johnson[2] and Christine M. Moffitt[1]. [1]Idaho Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife, University of Idaho, Moscow, ID 83844. Phone: (208) 885-7193 Fax: (208) 885-9080. colv3803@uidaho.edu; kanlauf@uidaho.edu; cmoffitt@uidaho.edu. 2Eagle Fish Health Laboratory, Idaho Department of Fish and Game, Eagle, ID 83616, Phone: (208)-939-2413 FAX: (208)-939-2415, kjohnson@IDFG.state.id.us.

Prevalence of Myxobolus cerebralis *in the Pahsimeroi Watershed, Idaho. Associations between landscape and fine scale habitat characteristics.*

In 2000 – 2001, Idaho Department of Fish and Game conducted seasonal exposures at Pahsimeroi State Fish Hatchery, and confirmed the presence of *Myxobolus cerebralis,* cause of salmonid whirling disease, year around (Munson and Johnson 2001). In 2001, University of Idaho and IDFG began a cooperative project to expose groups of susceptible fry at sites throughout the watershed. We exposed rainbow trout at four times (October 2001; April 2002; July 2002, and September 2002). For each exposure we exposed fish at the intake of the hatchery to assess seasonal variations. We observed variation in the prevalence and intensity of infection of *M. cerebralis* in fish from sites that can be attributed to variations in landscape, fine

scale habitat, and seasonal variations. Sampling distributions showed variations in intensity of infection and prevalence of *M. cerbralis* in all exposures moving towards greater intensity of infection in lower reaches. We observed high prevalence and increasing intensity of infection from in October and April exposures. We observed a seasonal variation at sites where repeated sentinel exposures occurred with lowest infectivity occurring in fall 2002 exposures. *M. cerbralis* was not present in upper reaches of streams. In lower reaches we observed variability between sites in close proximity, indicating a heterozygous distribution and density of *M. cerbralis* within the drainage both spatially and temporally.

Combe, Steve; Electronic Data Solutions, PO Box 31, Jerome, ID 83338

DATASIGHT:A RELATIONAL DATABASE FOR MANAGING, INTEGRATING, AND DISTRIBUTING ENVIRONMENTAL DATA

Environmental data is typically voluminous and multi-disciplinary. Organizations that are tasked with sharing and distributing data encounter problems with differing organizational needs, different programs and incompatible data formats. DataSight was designed to help solve this problem. DataSight allows users to import and integrate data from different sources and file formats. Collections of data are organized into configurable hierarchies. A DataSight filtering function is used to retrieve data subsets and can be saved to use on other data. DataSight graphing tools make examining and understanding environmental data easier. Users can scroll up or down through consecutive sampling dates and see how the data profile changes dynamically from date to date. Select data can be distributed to other organizations by exporting in various file formats or by exporting a database set or subset using DataSight as a common application form.

Faurot, Dave, Nez Perce Tribe

Quantifying Adult Salmon Spawner Abundance in Lake Creek, Idaho

Underwater time-lapse video technology was used to monitor adult chinook salmon escapement into Lake Creek, Idaho, from 1997 to 2002. Underwater video is a passive technique that does not trap or handle this Endangered Species Act listed species. The Secesh River/Lake Creek chinook salmon subpopulation represents a wild spawning aggregate that has not been supplemented with hatchery fish. This subpopulation serves as a control population under the Idaho Salmon Supplementation study. Adult salmon spawner abundance has varied from 51 fish in 1998 to 697 salmon in 2001. Salmon spawner abundance in 2002 was 410 fish. The adult spawner migration timing has ranged from June 9 to September 6, and has varied by as much as three weeks. Fish per redd numbers have ranged from 1.02 to 3.58 salmon per redd (including jacks). Lake Creek adult salmon spawner abundance information was compared to redd count expansion methods which are typically used to estimate salmon abundance. Redd count expansion abundance estimates varied from 214 % higher to 46 % lower than the actual underwater video determined salmon abundance. Monitoring and evaluation results indicated that the salmon spawning migration was not impeded by the fish counting station, nor was spawner distribution affected. There appeared to be a segment of nomadic males that moved in and out of the Lake Creek spawning area, presumably into the Secesh River spawning aggregate.

Accurate adult salmon abundance information will provide quantifiable population status data for the 2005 and 2008 mid point assessment of the National Marine Fisheries Service Biological Opinion for operation of the Federal Columbia River Power System.The 2003 Secesh River escapement will be monitored with an acoustic camera.

Hogge, Carla, Matt Campbell and Keith Johnson, Idaho Department of Fish and Game, Eagle Fish Health and Genetics Laboratories, 1800 Trout Road, Eagle, Idaho 83616. Phone: (208) 939-2413: E-mail: chogge@idfg.state.id.us

DIFFERENTIATING THE NEUROTROPIC MYXOBOLUS SP *FROM* M. CEREBRALIS *AND ITS DISTRIBUTION IN IDAHO WATERS*

Background

Since 1987 when *Myxobolus cerebralis* was first confirmed in Idaho waters, the Eagle Fish Health Laboratory has sampled cultured and wild/natural salmonid populations from all river systems state-wide using AFS/FHS Blue Book protocols. During that time we also detected a neurotropic *Myxobolus sp* in brain and nervous tissues (Andree et al. 2002). Since morphology and spore dimensions overlap those of *M. cerebralis,* use of such criteria is difficult to apply diagnostically. Tissue tropism allows for differentiation but histological examination is difficult, expensive, and lacks sensitivity. The current histologically confirmed distribution of the neurotropic species includes nearly all river systems of the state and overlaps those demonstrated positive for *M. cerebralis.* We have demonstrated mixed infections from the same collection of fish and, in some cases, mixed infections of the same individual host. We embarked on this study to develop a polymerase chain reaction (PCR) based diagnostic technique for the differentiation of the two species of *Myxobolus.*

Methods

Samples: Eighty-one samples considered positive for *M. cerebralis* and/or the neurotropic *Myxobolus sp.* were chosen based on pepsin/trypsin digests and histology reports. The *M. cerebralis* PCR control and a *Myxobolus* negative rainbow trout were included.

DNA isolation: Genomic DNA was isolated from a 6mm punch of tissue located behind the eye encompassing the brain and cartilage of the brain case using a Qiagen DNeasy tissue kit (Qiagen Inc., Valencia, CA) following the manufacturer's protocol.

Oligonucleotide design: GenBank® sequences of approximately 1,600 base pairs of the 18S rRNA gene from 12 different species in the genus Myxobolus (*arcticus ,bramae, cerebralis,cyprini, djragini, elipsoides, insidiosus, musculi, neurobius, portucalensis, sandrae, squamalis)* were aligned using the CLUSTALW-multiple sequence alignment program found on the University of California's San Diego Supercomputer Center Biology Workbench (SDSC workbench) http://workbench.sdsc.edu. The primer construction program PRIMER3 from the SDSC workbench was used to identify primer pairs in highly conserved regions capable of amplifying sequences of varying length in all 12 of the Myxobolus species listed above. The following primer pair was selected to amplify 277 bp within the 18S rRNA gene:

Primers: Mc5L TCCGTATTGGGGTGATGATT
Mc3R CCCGTAACCGAAAAACTTGA.

PCR amplification: Using a subset of samples the PCR was optimized in 50 Φl reactions consisting of 1X PCR buffer, 2.5 mM $MgCl_2$, 5ΦM TMAC (tetramethylammonium chloride), 400ΦM dNTP, 20pmole Mc5L primer, 20pmole Mc3R primer, 2U Taq, and 2Φl template DNA. DNA was denatured at 94°C for 4 min, followed by 35 cycles of 94°C for 1 min., 56°C for 45 sec., and 72°C for 1 min. Good amplification was achieved and the products were sequenced (Amplicon Express, Pullman, WA). These sequences were aligned and analyzed with the online DNA restriction mapping program NEBcutter V1.0 (New England Biolabs) to identify restriction enzymes that could be used to identify differences in the sequences with suitable sized diagnostic fragments to allow viewing on a gel. We determined *Mse-I* (BioLabs Beverly, MA) to yield the best results.

Sample Screening: All samples were analyzed for the presence of *M. cerebralis* using a nested PCR following the protocol of Andree et al. (1998). All samples were amplified with the Mc5L and

Mc3R primers and digested with *Mse-1,* following the manufacturer's protocol, electrophoresed in an acrylamide gel, and visualized.

Results
Digest of the 277 bp product with *Mse-I* resulted in two banding patterns: pattern "A" with 2 fragments, 168 & 109 bp, corresponding to *M. cerebralis* PCR positive samples, and pattern "B" having 3 fragments, 109, 95, & 73 bp, corresponding to *M. cerebralis* PCR negative i.e. histologically confirmed neurotropic samples (Figure 1). Sequences (277bp) from White Bird Ck., Duncan Ck., and Blackfoot R. samples, all demonstrating banding pattern B, were identical and were substantially different from the *M. cerebralis* sequence (Pahsimeroi) at 32 of the 277 positions. These locations were specifically chosen for sequencing: White Bird Ck. in northern Idaho has anadromous access; Duncan Ck. in southwestern Idaho, is an isolated creek inhabited by indigenous redband trout with no stocking history; the Blackfoot R., in southeastern Idaho, is isolated from anadromous access by a natural barrier, Shoshone Falls.

Implications for Fisheries Management
The primary application of this differential technique lies in explaining which species is present from a collection of wild/natural salmonids. It should aid in defining which parasite is present when the nested PCR (Andree, et al 1998) fails to confirm the presence of *M. cerebralis* even though spores are detected from pepsin/trypsin digests. Identification of the neurotropic species should also prevent the inadvertent destruction of hatchery production groups resulting from misdiagnosis. We have occasionally encountered *Myxobolus* spores from chinook salmon smolts and adults from Rapid River Hatchery. The *M. cerebralis* nested PCR examination of these samples has routinely been negative. The Rapid River stock was used to re-establish spring chinook runs in the Clearwater River system and adults that are deemed surplus to hatchery spawning needs are distributed into the Clearwater and lower Salmon River tributaries. Hatchery carcasses are also in high demand for nutrient enrichment programs in the same aquatic environments. These practices have always created concern that we are authorizing the expansion of the range of *M. cerebralis* to new locations. It took many years to resolve histologically that the spores seen at Rapid River Hatchery were those of the neurotropic species. We expect this specific technique will have application in such cases. We also hope that this PCR diagnostic method will facilitate the description of the life cycle of the neurotropic species. Duncan Creek and Bennet Creek in Southwest Idaho would be ideal sites for this work since both are isolated, small, unconnected creeks with no history of hatchery stocking and they contain indigenous Idaho redband trout, the focus of current population and genetic testing efforts to avert an ESA listing.

Horton, Bill, Fred Partridge, Scott Marshall and Sharon Clark

COLLECTING PERMITS: MORE THAN ANY OF US WANT TO KNOW

We will lead a discussion on the state and federal rules regarding applying for, restrictions required and the reports needed for fisheries collecting permits in Idaho. This process has become considerably more detailed and complicated in recent years with the ESA listing of wild steelhead, fall chinook salmon, spring/summer chinook salmon, sockeye salmon and bull trout. In some cases, the state permit will designate you as an agent of the state and you will only need the state permit. In other cases, you may need both a state permit and federal ESA authorization to work with or in waters contain listed species. Definitions of take are different for bull trout than for anadromous species, resulting in different requirements for data collection and reporting. What are Sec 10, 4(d) and Sec 6? *If we figure this out, we will let you know.*

Isaak[1], Daniel J. (disaak@fs.fed.us), Russell F. Thurow (rthurow@fs.fed.us), Bruce E. Rieman(brieman@fs.fed.us), And Jason B. Dunham[2] (jbdunham@fs.fed.us).[1]University of Idaho, Ecohydraulics Research Group , 800 Park Blvd., Suite 200, Boise, ID 83712; [2]U.S. Forest Service, Rocky Mountain Research Station, Boise Forest Sciences Laboratory, 316 East Myrtle Street, Boise, Idaho 83702

Title: Temporal Variation in Synchrony Among Chinook Salmon Redd Counts from the Middle Fork Salmon River, Idaho

We used a spatially and temporally extensive database of chinook salmon redd counts from transects within the Middle Fork Salmon River drainage to examine patterns in synchrony as these fish underwent a six-fold decrease in abundance. Our results suggest that synchrony among redd counts was moderate when abundances were relatively high in the 1950s and 1960s. Synchrony became much stronger as abundances declined, thereby increasing the probability that local populations could experience simultaneous extirpations during years with low adult escapements. Several factors may have contributed to increased synchrony including: decreased importance of density dependent processes, loss of within population phenotypic diversity, construction of the Columbia/Snake River hydrosystem, and changing marine conditions. Distinct from the systemic change in synchrony were short-term interpopulation fluctuations that suggest the relationship between two populations is rarely consistent for an extended period. Implications for managers are that the resilience of many metapopulations to large-scale disturbance and anthropogenic suppression may not depend only on the size and productivity of component populations, but also on maintaining a broad distribution and diversity of habitats that are capable of supporting a wide array of life history forms.

Koch, Ted, FWS; Greg Schildwachter, Idaho OSC; Tom Curet, IDFG;and Deb Mignogno, FWS

Upper Salmon Basin Watershed Restoration Project Initiative

Opportunities for conserving habitat for native salmonids on private land in the upper Salmon River basin are growing rapidly, and landowners and cooperators are working to take advantage of them while meeting local community needs. Because of broader economic and social pressures, and some environmental regulations and litigation stemming from the federal Endangered Species Act (ESA), ranchers, irrigators, and other landowners in the upper Salmon River basin are motivated to consider opportunities, both on their own and by participating in government programs, to conserve fish habitat. Conservation opportunities and programs include receiving funding and technical assistance for fish habitat protection and restoration, selling development rights, and receiving ESA regulatory assurances. Specific fish habitat protection and restoration projects include stream flow restoration and protection, irrigation diversion screening, and riparian habitat protection. Covered species would include bull trout, Chinook salmon, steelhead, redband trout, and westslope cutthroat trout. Covered lands and activities would include irrigated agriculture and livestock ranching activities on, or associated with, private land.

Currently, the state of Idaho, Governor's Office of Species Conservation, on behalf of landowners, has engaged the federal endangered species agencies (USFWS and NOAA Fisheries) in negotiations to develop short- and long-term agreements to exchange assurances of fish habitat conservation for ESA-regulatory assurances. Significant new funding and public support will be required to implement this watershed restoration project. The state is currently designing a process to ensure fish conservation in exchange for ESA regulatory assurances. This effort is following a similar effort embodied in the Lemhi Agreement.

The Upper Salmon Basin Watershed Project (formerly Lemhi Model Watershed) is currently leading fish conservation planning and implementation. The Project is guided by a 16 member

Advisory Committee consisting of local residents, tribes, state and federal resource managers and conservation groups, and uses a technical committee of professionals from state and federal resource management agencies, water users, and tribes to implement the plan. The Project has completed over 98 projects in the last 10 years, including; 35 livestock fencing projects affecting 41.3 miles of stream; many projects implementing protective grazing management practices; 11 stream bank stabilization projects; removal of 6 fish migration barriers; conservation of over 42 CFS of water flow on the Lemhi River and 12 CFS on the Pahsimeroi River through irrigation diversion modifications and changes in irrigation practices; 20 irrigation diversion consolidations and modifications, including fish screens; formation of a water bank to conserve flows in the lower Lemhi River; and completion of stream habitat inventories on private lands, with over 98% of landowners cooperating.

Kozfkay, Joseph R., Idaho Department of Fish and Game, 1414 E. Locust Lane, Nampa, ID 83686, Phone: 208-465-8404 ext.269, jkozfkay@idfg.state.id.us. David M. Teuscher, Idaho Department of Fish and Game, 1345 Barton Road, Pocatello, ID 83204, Phone: 208-232-4703, dteuscher@idfg.state.id.us

Improving Vulnerability to Angling of Rainbow Trout-A Selective Breeding Experiment

A primary goal of Idaho Department of Fish and Game's hatchery program is to maximize the return to creel of stocked trout, thereby improving cost efficiency. We compared the relative return to creel and number of days to harvest for two groups of catchable-sized rainbow trout *Oncorhynchus mykiss*. The groups were produced from: 1) normal Hayspur-strain broodstock and 2) Hayspur-strain broodstock that exhibited high levels of vulnerability to angling. One-year old replacement brood fish were uniquely tagged and held in three outdoor raceways. Ninety-four, one hour fishing trials were conducted, and capture frequency for each fish was recorded. Fish caught three or more times were retained. Equal numbers of progeny from the two groups were jaw tagged and stocked in 32 waters during 2001-02. Reward incentives, press releases, personal contacts, and signs were used to encourage tag returns from anglers. A total of 798 tags were returned out of 6,389 stocked during 2001. Mean first year return rate for the vulnerable group (12.7 3.5%) was not statistically different from the normal group (11.7 3.8%; paired *t*-test, $p = 0.30$). Only 17 tags (2%) were returned from fish caught during the second fishing season. The mean time to harvest was 46.4 9.8 d for the vulnerable group and 50.6 10.7 d for the normal group. This disparity was not statistically different (paired *t*-test, $p = 0.77$). For fish stocked in 2002, 700 tags were returned out of 9,593 stocked. Mean first year return rate for the vulnerable group (7.2 2.5%) was not different from the normal group (7.4 2.7%; paired *t*-test, $p = 0.80$). There was no difference in mean time to harvest for the normal group (36.0 8.0 d) and the vulnerable group (38.7 7.3 d; paired *t*-test, $p = 0.45$). No performance benefit in terms of increasing return to creel or reducing time to harvest was achieved through selective breeding.

LaFrentz[1], Benjamin R., Scott E. LaPatra[2], Gerald R. Jones[2], and Kenneth D. Cain[1]. (1) Department of Fish and Wildlife Resources and the Aquaculture Research Institute, University of Idaho, Moscow, ID 83844-1136, USA. Benjamin R. LaFrentz, Department of Fish and Wildlife Resources, CNR 101A, University of Idaho, P.O. Box 441136, Moscow, ID 83844-1136, Tel: (208) 885-5018; Fax: (208) 885-9080, lafr9818@uidaho.edu. (2) Clear Springs Foods, Inc., Research Division, P.O. Box 712, Buhl, ID 83316, USA

Antigenic characterization of Flavobacterium psychrophilum *and determination of protective antigens*

Vaccine development for coldwater disease (CWD), caused by *Flavobacterium psychrophilum*, has primarily been based on whole-cell bacterins or outer-membrane fractions of the bacterium.

In the present study, immunogenic antigens were identified by western blot analysis with rainbow trout (*Oncorhynchus mykiss*) immune serum. Three antigenic regions were identified corresponding to 18-28 kDa, 41-49 kDa, and 70-100 kDa and were selected for further analysis. Following SDS-PAGE, these antigenic regions were excised and eluted from gels and used directly for vaccination. Groups of rainbow trout fry were vaccinated with these three antigenic regions and a formalin-killed bacterin emulsified with Freund's complete adjuvant (FCA). It was demonstrated that the 70-100 kDa antigenic region elicited significant protection following challenge with a virulent strain of *F. psychrophilum*. Cumulative percent mortality (CPM) in these groups averaged 6% and a relative percent survival (RPS) of 94% was achieved. This vaccine preparation also stimulated a high level of specific antibody to *F. psychrophilum* as detected by enzyme-linked immunosorbent assay (ELISA). Western blot analysis on whole-cell lysates and proteinase K digested cells indicates that lipopolysaccharide (LPS) and associated proteins are recognized by serum antibodies and may be important in eliciting a protective immune response.

Liter, Mark and Melo Maiolie, IDFG

Title: Fishes of the Priest Lake System: Yesterday, Today and What Technology May Bring Tomorrow

Major changes in the Priest Lakes ecosystem including establishment of Mysis shrimp *Mysis relicta*, loss of kokanee salmon *Oncorhynchus nerka* population and a significant expansion in the lake trout *Salvelinus namaycush* population not only eliminated popular fisheries for kokanee and westslope cutthroat trout *O. clarki* but also resulted in an abrupt decline of the bull trout *S confluentus* population in the Priest Lake system. The Priest Lake bull trout population is now considered functionally extinct and the Upper Priest Lake population is seriously depleted and at risk of extinction. Lake trout have been shown to contribute to the decline of bull trout in other systems, and are likely the major threat to the persistence of bull trout in Upper Priest Lake. Starting in 1998 we began gillnetting lake trout from Upper Priest Lake to protect the remaining bull trout. However, it soon became obvious that Upper Priest Lake cannot be treated as a closed system and in order for lake trout reduction in Upper Priest Lake to be successful immigration from Priest Lake must be controlled. A fish barrier is necessary to minimize immigration of lake trout into Upper Priest Lake. In September 2002 we evaluated the efficacy of strobe lights as a lake trout migration barrier in the Thorofare, which connects Priest Lake and Upper Priest Lake. Strobe lights were placed on the bottom and set at 5m intervals with a flash rate of 360 flashes/min. Strobe lights were evaluated using paired on and off treatments during nighttime. Testing was conducted in the Thorofare in a 200-m long and 15- m wide net pen. We used wild lake trout that were captured by gillnets in Upper Priest Lake. Based on paired t-tests, movement of lake trout past strobe lights were significantly lower ($p=0.004$) during lights on treatments than during lights off treatments. These results indicate that strobe lights have the potential to repel most lake trout from migrating upstream to Upper Priest Lake at night.

Maiolie, Melo A., Principal Fishery Research Biologist and Eric J. Stark, Fishery Research Biologist, IDFG

Strobe Light Testing to Reduce Kokanee Entrainment Losses

We tested the response of kokanee *Oncorhynchus nerka* to underwater strobe lights to determine if they can reduce kokanee entrainment at Dworshak Dam. Testing was conducted both off-site and on-site. Off-site tests were conducted on wild, free ranging kokanee in Lake Pend Oreille and Spirit Lake, Idaho. Four strobe lights were lowered into the lakes and flashed at rates of 300, 360 and 450 flashes/min. Densities of fish (thought to be mostly kokanee) were monitored with a split beam echosounder. Kokanee moved an average of 30 to136 m away from the lights in waters with Secchi transparencies from 2.8 to 17.5 m. Density of kokanee within 30 m of the lights dropped 72% to 100%. Both changes were statistically significant ($p<0.001$) and all three flash rate were equally effective. We then tested a set of nine strobe lights flashing at a rate of 360 flashes/min that were placed near the intake of an operating 90 mW turbine at Dworshak Dam. Densities of fish were again monitored with a split beam echosounder. During five paired tests between December 2001 and January 2002, fish densities averaged 110 fish/ha when no lights were flashing. Mean densities dropped to 13 fish/ha when the strobe lights were flashing at a rate of 360 flashes/min. This 88% decline in densities was statically significant ($p = 0.009$). There appeared to be no tendency for fish to habituate to the lights during the night. These results indicate that strobe lights may be effective at reducing kokanee entrainment at Dworshak Dam. Currently, strobe light testing is being conducted at the intakes to the reservoir's outlets.

Kevin A. Meyer kmeyer@idfg.state.id.us, Daniel J. Schill, F. Steven Elle, and James A. Lamansky, Jr. Idaho Department of Fish & Game, 1414 East Locust Lane, Nampa, ID 83686, USA

Makin' (fish) Whoopee: is length at sexual maturity predictable?

Length and age at sexual maturity for Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri* vary across their historical range, but the factors that influence this variation are poorly understood. We collected 610 Yellowstone cutthroat trout from 11 populations across southeastern Idaho from streams and rivers with a variety of physical characteristics to determine length and age at sexual maturity and other reproductive demographics. The oldest Yellowstone cutthroat trout captured was 10 years old from the South Fork Snake River; most fish (90%) were between ages 2 and 4, and only three (< 1%) were older than age 7 (all from the South Fork Snake River). South Fork Snake River trout did not mature until 300 mm in length and five years in age, whereas cutthroat trout from other migratory and resident sites began maturing at age 2-3 and lengths of 100-150 mm. Fish 100-250 mm in length were much more likely to be mature if they were from sites with resident rather than migratory reproductive life histories. Sex ratio (expressed as percentage of females) averaged 46% and varied from 27% to 66% among sites. At all but one study site, males matured at a smaller size than females. For both male and female Yellowstone cutthroat trout, length at maturity was directly related to stream order and width, negatively related to gradient, and weakly correlated with conductivity, elevation, mean aspect, and mean summer water temperature. Length-at-maturity models were stronger and fit the data better than age-at-maturity models. Our results enable prediction of length at maturity for Yellowstone cutthroat trout using readily derived physical data from streams. As such, they could be useful in estimating risk assessment parameters such as the number of breeders in and the genetic effective population size of Yellowstone cutthroat trout populations.

Moursund, Russell, Battelle for the U.S. DOE, P.O. Box 999, MSIN: K6-85, Richland, WA 99352. 509-376-3251, russell.moursund@pnl.gov.

The DIDSON Acoustic Camera: a New Technology for the In Situ Observation of Fish

Recent research has demonstrated the effectiveness of the Dual-Frequency Identification Sonar (DIDSON) as a useful new tool in describing in situ fish behavior and passage both within and near structures. The DIDSON is a very high-resolution imaging sonar that obtains near video-quality images, functionally an acoustic camera. The Applied Physics Laboratory at the University of Washington developed the DIDSON for the Space and Naval Warfare Systems Center harbor surveillance program. It can detect objects out to 48 meters and identify objects out to 12 m. The acoustic camera bridges the gap between existing fisheries assessment sonar and optical systems. Traditional fisheries assessment sonar detects targets at long ranges but cannot record the shape of targets. The images within 12 m of the acoustic camera are so clear that one can see fish undulating as they swim and can tell the head from the tail in otherwise zero-visibility water. Field deployments have collected data at The Dalles Dam on the lower Columbia River by the U.S. Army Corps of Engineers, Portland District in 2000 and 2001. The implications of this innovative field sampling and monitoring technique at hydropower are examined. This tool is extensible to the general case of monitoring fish movement in turbid and low light environments.

Munson, Douglas and Keith A. Johnson, Idaho Department of Fish and Game, Eagle Fish Health Laboratory, 1800 Trout Rd., Eagle, ID 83616, 208-939-2413, dmunson@idfg.state.id.us and kjohnso@idfg.state.id.us

Changes in the IDFG ELISA-based Culling Program for Brood Chinook

Since 1992 the Idaho Dept. of Fish and Game has implemented an enzyme linked immunosorbent assay (ELISA) to limit the transmission of *Renibacterium salmoninarum* from brood fish to egg in IDFG chinook hatchery programs. This program has limited epizootics of bacterial kidney disease (BKD) to high BKD segregation groups and one low BKD segregation group since 1992. Recent changes in ELISA reagents have forced the Eagle Fish Health Laboratory to adapt and change the ELISA test results to accommodate the segregation/culling program for chinook salmon.

Munson, Douglas and Keith A. Johnson, Idaho Department of Fish and Game, Eagle Fish Health Laboratory, 1800 Trout Rd., Eagle, ID 83616, 208-939-2413, dmunson@idfg.state.id.us and kjohnso@idfg.state.id.us

An Epizootic of IHNV at Sawtooth Hatchery

In 2002 both Bonneville Fish Hatchery in Oregon and Sawtooth Fish Hatchery in Idaho experienced epizootics of Infectious Hematopoietic Necrosis in ESA-listed populations of sockeye and chinook. BY’00 RFL sockeye at Bonneville Fish Hatchery were moved on to Tanner Creek surface water in February of 2002. Rich Holt of ODFW informs Keith Johnson at Eagle Fish Health Laboratory that one pool of twelve, taken during inspection sampling, was positive for IHNV. Virus had not been detected in prior inspections. John Kaufman (ODFW) confirms IHNV serotype 2. DNA typing by Gail Kurath (USGS) suggests this isolate typical of the Columbia River IHNV type. By 6 June 2002, population mortality was at 44.1 %. The decision to kill these sockeye was based on the IHOT definition of epizootic and exceeded the “destroy and disinfect” provision. Since these fish did not represent a genetically different sockeye than what was being cultured in Idaho, euthanasia would not jeopardize the integrity of the BY’2000 RFL sockeye. The decision to destroy the RFL sockeye at Bonneville Fish Hatchery was in the best interest of the RFL sockeye, the Sawtooth Fish Hatchery program, and the wild/natural fish of the Upper Salmon River. RFL sockeye will no longer be reared at Bonneville Fish Hatchery because RFL sockeye cannot be kept on SPF well water for the entire rearing cycle. Mortalities in BY’00 Sawtooth spring chinook were noticed to be elevated as soon as the ice in the raceways thawed in mid-February. A diagnostic examination on 6 March 2002 found IHNV in both viral samples. The adjacent raceway (sharing a common wall) was occupied with BY’00 RFL sockeye. The infected chinook were a supplementation group and thus genetically important to Sawtooth Fish Hatchery’s program. No other chinook were detected with IHNV nor did the RFL sockeye in the adjacent raceway test positive for IHNV. Even though the mortality did meet the IHOT “destroy and disinfect” provision, these fish were released because of their genetic importance to the chinook program at Sawtooth. Mortality attributed to IHN was 4.1 %. The future of Sawtooth Fish Hatchery must include additional SPF well water to accommodate the RFL sockeye program and reduce the jeopardy of epizootics to listed fish being cultured at this facility.

Murphy, Patrick, Regional Fishery Biologist, Idaho Department of Fish and Game, Anadromous Screen Program, 97 N. Highway 93., Salmon, ID 83467, (208) 756-6022

The Effects of Different Species of Introduced Salmonids on Amphibians in Headwater Lakes of North-central Idaho.

The common practice of stocking previously fishless, high-elevation lakes with introduced salmonids has significantly influenced the distribution and abundance of some native amphibians. I examined the relationships between the occurrence and abundance of the Columbia spotted frog (*Rana luteiventris*) and long-toed salamander (*Ambystoma macrodactylum*) with the occurrence of different species of salmonids and individual lake habitat characteristics across different spatial scales on the Clearwater National Forest, Idaho. Occurrence and abundance were examined at three categorical spatial scales: at individual lake sites, watersheds, and subwatersheds. This study incorporates 214 individual lakes that were surveyed from 1991 and 1995-1999 for amphibians and fish across 48 watersheds (6^{th} field HUC), and 26 major watersheds (5^{th} field HUC). Of all lakes surveyed, 49% were located in the Selway-Bitterroot Wilderness. Salmonids were found in 41% of all lake sites and occupied 77% of the lentic surface area of sites surveyed. There were no significant differences between the occurrence of spotted frog adults and the presence of fish at any spatial scales, although the abundance of all frog lifestages was significantly lower in lakes with fish. Spotted frog occurrence was positively associated with a greater amount of sedge meadow perimeter and higher percentage of silt/organic substrate. Long-toed salamanders (all life-stages) were negatively affected by fish at all spatial scales. After accounting for habitat effects, only fish presence was a significant predictor of salamander occurrence. Brook trout (*Salvelinus fontinalis*) had the most marked effect on salamanders, which weren't found in any of the 20 lakes with populations of brook trout. At the watershed scale, the occurrence of spotted frog breeding and long-toed salamanders was significantly related to the percent of surface area containing salmonids. Although, both species of amphibians were present in all 26 watersheds surveyed, I suggest that mountain lakes be managed with long-term monitoring and prioritized management objectives to protect and provide fishless habitat in watersheds dominated by introduced fish.

Murphy, Patrick, Tim Cochnauer, Ed Schriever, Idaho Department of Fish and Game

Utilization of tiger muskellunge for suppressing self-sustaining populations of introduced brook trout in high mountain lakes of Idaho

In the last two decades, introduced brook trout *Salvelinus fontinalis* have gained notoriety as a fisheries management problem because of their competitive interactions with native, western salmonids. This situation is exacerbated where declining populations of threatened char species such as bull trout *S. confluentus*, are negatively impacted due to displacement and competition. Brook trout have been stocked in many high-elevation lakes across western North America and have raised concerns about potential downstream impacts to native fauna including salmonids, amphibians, and zooplankton. The objective of this study was to evaluate the effectiveness of using an introduced predator, sterile tiger muskellunge, to control brook trout populations in high-elevation, upper montane/subalpine lakes. We selected two lakes in north-central Idaho, Ice Lake and Rainbow Lake, to evaluate utilization of tiger muskellunge for brook trout control or eradication. These lakes are typical low conductivity water bodies in batholithic mountains of north-central Idaho. Both lakes have bull trout populations downstream of the outlets. Ice Lake was selected because of its relatively small size and is located in the North Fork Clearwater River drainage. Rainbow Lake is a larger lake located in the South Fork Clearwater River drainage. The introduction of tiger muskellunge into Ice Lake significantly reduced the brook trout population while the introduction into Rainbow Lake changed the composition of the brook trout population, and decreased the overall abundance of brook trout within the lake. This study illustrates the potential for utilizing tiger muskellunge as a biological agent for depressing brook trout populations in small, high-elevation lakes. Stocking high-densities of tiger muskellunge may be able to severely reduce the population of brook trout within small, mountain lakes or at least significantly change the abundance and age-class composition within the lake. The tiger muskellunge alone will not be able to eradicate brook trout, especially in lakes with extensive large inlet and outlet systems. However, if additional suppression techniques such as electrofishing and chemical treatment are utilized eradication may be achieved.

Narum, Shawn R, Columbia River Inter-Tribal Fish Commission, 3059-F National Fish Hatchery Rd, Hagerman ID 83332, 208-837-9096, nars@critfc.org; Jason Vogel, Nez Perce Tribal Fisheries, McCall ID, 208-634-5290, jasonv@nezperce.org; Andre Talbot, Columbia River Inter-Tribal Fish Commission, 729 NE Oregon Suite 200, Portland, OR 97232, 503-731-1250; tala@critfc.org; and Madison S. Powell, University of Idaho, Center for Salmonid Species at Risk, 3059-F National Fish Hatchery Rd, Hagerman ID 83332, 208-837-9096, mpowell@uidaho.edu

No genetic divergence detected between pre and post supplemented chinook salmon spawning aggregates in Johnson Creek, ID

Johnson Creek has traditionally acted as an unstocked "control stream" for Idaho Department of Fish and Game's supplementation program of chinook salmon. However, extremely low returns of wild fish in the mid 1990's prompted action to supplement natural production with hatchery production using Johnson Creek natural fish as brood stock. Since the first release of the supplemented juveniles in 2000, the initial returns of supplemented adults were collected and genetically compared to pre-supplemented collections using 7 microsatellite loci. Results indicate higher temporal genetic variation than genetic variation between current natural and supplemented juvenile collections, as well as post and pre supplemented collections. This would indicate that genetic integrity of the natural stock has been preserved through the natural broodstock supplementation effort in Johnson Creek. This is an ongoing monitoring project with returning natural and supplemented adults to be added in coming years. This study allows close monitoring of genetic drift in a newly supplemented system.

Pyron, Jason C., Department of Fish and Wildlife, University of Idaho, Moscow, ID 83844-1136, (208) 885-3558, pyrojaso@hotmail.com and Bart L. Gamett, Fish Biologist, Salmon-Challis National Forest, P.O. Box 507, Mackay, Idaho, (208) 588-2224, bgamett@fs.fed.us

Fish Entrainment Rates into Helibuckets Filled from Central Idaho Streams During Fire Suppression Activities

Helicopters are a tool commonly used to suppress wildfires. One of the most important functions of these aircraft is the delivery of water to a fire. Helicopters generally transport water to a fire using either a large bucket that is attached to the bottom of the helicopter with a cable or by a large tank which is attached directly to the bottom of the helicopter. Some fish managers have expressed concerns that filling these buckets from natural water sources such as lakes and rivers could adversely affect fish populations and fish habitat. One common concern is fish entrainment into the buckets or tanks. This concern has led some biologists to prohibit helicopters from obtaining water from certain lakes and streams during fire suppression activities. In this study, we examined fish entrainment rates into buckets filled from streams by Type III helicopters. These helicopters are capable of transporting between 455 and 1359 liters of water in a single flight. The study was conducted in central Idaho at 29 locations representing a wide variety of fish assemblages and stream habitats. Although helicopters filled the buckets a total of 145 times during the study only two fish were entrained into the buckets. Both fish were sculpin. These data suggest that the number of fish entrained into buckets filled from streams by Type III helicopters likely has little or no affect on fish populations. Therefore, we believe that in circumstances similar to those in our study, it is not biologically warranted to restrict Type III helicopters from filling buckets from streams during fire suppression activities due to concerns over fish entrainment.

Reischel, Tami (Paper presenter), Chris Peery, and David Bennett. Idaho Cooperative Fish and Wildlife Research Unit, U.S. Geological Survey, University of Idaho, Moscow, ID 83844-1141, 208-885-6400 or treische@uidaho.edu.

Temperatures of Lower Granite Reservoir and Response of Adult Salmon and Steelhead to Cold Water Releases from Dworshak Reservoir in 2001.

In recent years cold water has been released from Dworshak Dam to aid juvenile migration and to cool summer water temperatures. The effects of the cold water releases on adult migration are unknown. In 2001, we outfitted 199 adult salmon and steelhead with MAP (Multiple Array Processor) tags at the adult fish trap at Lower Granite Dam to monitor their migration through Lower Granite Reservoir. Fish were tracked June through October by boat from Lower Granite Dam to the Snake and Clearwater River confluence. One hundred and sixty-five fish were located using two hydrophones mounted on a boat and a Map_500 receiver mobile and 113 of those were intensively tracked through the reservoir. Real time data was transmitted and stored on a laptop computer from the map receiver. Tri-level temperature probes were used to monitor temperature regimes in the reservoir and temperature transects were taken in the Snake and Clearwater confluence area. Fish mainly migrated near the bottom of the reservoir and stayed in the cooler available water.

Schiff, Danielle, Idaho Department of Fish and Game, Clearwater Region, Lewiston, Idaho, 208-799-5010, dschiff@idfg.state.id.us

Spatial and Temporal Distribution of Bull Trout in the North Fork Clearwater River Drainage, Idaho

The relationship between Dworshak Dam operations and the bull trout *Salvelinus confluentus* population utilizing Dworshak Reservoir is relatively unknown. The primary objective of this study is to document spatial and temporal distribution of bull trout in Dworshak Reservoir and the North Fork Clearwater River. The secondary objectives are to estimate the annual population size of bull trout utilizing Dworshak Reservoir. Radio telemetry techniques are used to document movements and utilization of the reservoir and riverine habitats. Adult population estimates were attempted in tributaries of Dworshak Reservoir through a modified Lincoln-Peterson estimate, using radio telemetry combined with snorkeling techniques. This presentation is going to focus on the distribution portion of this study. Distribution of radio tagged fish were grouped into three time periods based on bull trout's life history patterns and the different critical habitats that are required at these time periods. The three time periods are: migration, May through July; spawning, August through September; and overwinter, November through April. Migration from Dworshak Reservoir begins on the descending limb of the hydrograph after peak spring flows, generally late May to early June. In 2001 migration from the reservoir was delayed approximately two weeks corresponding to abnormally high spring flows extending longer than normal. These fish are migrating a maximum of 152 km in a single year from their tagging to spawning locations. We have documented incidences of repeat year spawners migrating a total of 441 km from tagging location to spawning grounds back to the reservoir for overwintering and then returning to spawning areas the following year. These bull trout are reaching spawning areas beginning in early August and extending through mid-September. Shortly after spawning is complete they will move into the mainstem North Fork Clearwater River or return to Dworshak Reservoir. Overwintering is mainly occurring in Dworshak Reservoir. They are distributed between river kilometer (rkm) 12.2 and rkm 67.3. There is a high propensity for individuals to remain in the middle reaches of the reservoir, between rkm 30.1 and rkm 49.9. It is unclear if this is their historical overwintering areas or if they are concentrated in this area because of food availability.

Shockman, Chris, Idaho Department of Fish and Game,Clearwater Fish Hatchery

An Improved Design for Fish Transport Tank

At the Clearwater Fish Hatchery, we designed and built a transport tank that resulted in:

1. Increased access to the tank, making the fish easier to net,
2. Fewer injuries to fish due to a smoother interior construction,
3. An improved life support system, and
4. A tank suitable to hauling both juveniles and adult fish.

All the above factors contributed to the ability to haul more fish per load.

Bradley B. Shepard, Montana, Fish, Wildlife and Parks, Montana Cooperative Fishery Research Unit, Bozeman, Montana, bshepard@montana.edu, ans Bruce May and Wendi Urie, USDA Forest Service

*Status of Westslope Cutthroat Trout(*Oncorhynchus clarki lewisi*) in the United States: 2002*

The distribution and abundance of westslope cutthroat trout (*Oncorhynchus clarki lewisi*; WCT) have reportedly declined from historical levels over part or all of their historical range. For the U.S. range of WCT we used existing information provided by 112 fisheries professionals applied through a consistent methodology to assess the extent of their historical range, their current distribution, including genetic status, and evaluated the foreseeable risks to 539 populations designated as "conservation populations" by management agencies. We estimated that WCT historically occupied about 56,500 miles of habitat within the U.S. WCT currently occupy an estimated 33,500 miles of historically occupied habitats (59%). Genetic testing has been completed across about 6,100 miles of habitat (18% of occupied habitats), but sample sizes were variable and sample sizes of 25 fish or more (a sample size that likely would detect as little as 1% levels of introgression with a 95% level of confidence) made up only 30% of the samples. WCT with no evidence of genetic introgression currently occupied about 3,400 miles (10%) of currently occupied habitats. Another 1,000 miles of currently occupied habitats (3%) contained WCT that were probably part of a mixed stock where the WCT were not introgressed. We suggest that even though genetic sampling was nonrandom, sampling likely occurred more frequently in WCT populations that appeared non-introgressed, some, if not much, of the habitat currently occupied by WCT that has not been genetically tested likely support populations that are not introgressed. Much of the habitat currently occupied by WCT was located in designated parks (2%), wilderness areas (19%), and roadless areas (40%), and almost 70% of habitats currently occupied lie within federally managed lands. A total of 563 separate WCT populations currently occupying 24,450 miles of habitat were designated as "conservation populations". These conservation populations were spread throughout the historical range, occuring in 67 of the 70 hydrologic units historically occupied by WCT. Most of these conservation populations were believed to be "isolets" (457 or 81%); however, metapopulations occupied much more of the habitat (21,600 miles or 88%). Of the 563 designated conservation populations, 339 (60%) had at least some component that was genetically unaltered and 172 (30%) consisted entirely of stream segments that were genetically unaltered. In general, more of the isolet populations were at higher risk due to temporal variability, population size, and isolation risk than metapopulations, but were at less risk from genetic and disease factors than metapopulations. These data and population designations suggest that two different conservation management strategies are needed and being implemented to conserve WCT. One strategy concentrates on preventing introgression, disease and competition risks by isolation and the other concentrates on preserving metapopulation function and multiple life-histories by connecting occupied habitats.

Thornhill*, Darren R. and David H. Bennett (Dept. of Fish and Wildlife Resources, College of Natural Resources, University of Idaho, Moscow ID, darrenraythornhill@hotmail.com, dbennett@uidaho.edu

Using an Experimental Application of the Wolman Walk Pebble Count to Predict Fall Chinook Redd Site Selection in Priest Rapids Reservoir, Columbia River

We used an experimental video technique to quantify available spawning gravels for fall chinook salmon *Oncorhynchus tshawytscha* in the Priest Rapids Reservoir, Columbia River, immediately downstream of Wanapum Dam. Traditional Wolman walk pebble counts are well suited for sampling spawning gravels located in shallow, wadable water; however, this method's usefulness in large rivers, like the Columbia River, is limited. In the fall of 2000 and 2001, we quantified available spawning habitat in a reach of the Priest Rapids Reservoir using an experimental video application of the Wolman walk pebble count and later used the same video technique to quantify gravels being used for redd construction. We then used multivariate discriminate analysis to predict redd site selection based on gravel size. Preliminary results suggest that redd site location can be predicted based on median and mean gravel size. The video method will be a useful tool for analyzing spawning gravels and predicting redd locations in large rivers with depths greater than 1.5 m.

Thurow, Russ (**rthurow@fs.fed.us**) **U.S. Forest Service, Rocky Mountain Research Station, 316 E. Myrtle, Boise, ID 83702,** and Dan Isaak (**disaak@fs.fed.us**), **University of Idaho, Ecohydraulics Research, Dept. of Civil Engineering,** 800 Park Blvd., Suite 200, **Boise, Idaho 83712. Phone: 208-373-4377**

Temporal and spatial dynamics of chinook salmon in the Middle Fork Salmon River, Idaho

Emerging conservation theory suggests that recolonization and persistence of many species may be strongly influenced by the spatial geometry of remaining habitats. The relevance of these concepts to the persistence of declining stocks of chinook salmon is unknown. Since 1995, we have used a Global Positioning System to map wild chinook salmon redd locations in all potential habitats within the Middle Fork Salmon River (MFSR) drainage. In this paper, we describe temporal and spatial changes in redd distributions from 1995 through 2002. Annual redd counts averaged 641 and ranged from 20 in 1995 to 1,789 in 2001. Cumulative redd distribution curves suggest spawning aggregates contract into core areas during periods of very low escapement. We observed redds at elevations between 1100m and 2100m and a majority were constructed between 1500m and 2000m. Although chinook salmon spawned in both the mainstem MFSR and tributaries, about 99% of the redds were constructed in 10 tributaries. We provide preliminary results and describe how we are applying the spatially explicit and extensive redd distributional dataset to describe factors influencing the spatial distribution and persistence of wild chinook salmon. We believe our approach will advance current understanding of the relationship between landscape characteristics and the distribution, pattern, and persistence of chinook salmon. Such information could be key for development of conservation and restoration strategies for salmonids.

Younk, Jim, Idaho Power Company

Continuous Chlorophyll a monitoring on the Snake River

The dynamic nature of algal biomass in flowing waters is difficult to estimate with periodic chlorophyll a measurements. To gain understanding of organic matter and dissolved oxygen

dynamics in Brownlee Reservoir, it is important to characterize short-term algal biomass changes in the inflowing Snake River. A Turner Designs SCUFA® (Self-Contained Underwater Fluorescence Apparatus) was deployed in the Snake River approximately 10 miles upstream of Brownlee Reservoir, to study the feasibility of high frequency *in situ* monitoring of chlorophyll a levels. Preliminary results show that *in situ* fluorescence agrees well with laboratory chlorophyll a measurements (R^2 = 0.83), and large changes in chlorophyll a levels (60 – 100 µg/L) can occur rapidly (4-5 days). Problems were encountered, as is to be expected when using any new type of instrument. The SCUFA proved useful in tracking relative changes in algae populations. Results will be useful to improve modeling efforts of Brownlee Reservoir and the inflowing Snake River.

Posters

Anlauf, Kara J., Christine M. Moffitt, Michael E. Colvin; Idaho Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife, University of Idaho, Moscow, Idaho 83844. Phone (208) 885-7139. Fax (208) 885-9080. E-mail kanlauf@uidaho.edu, cmoffitt@uidaho.edu, colv3803@uidaho.edu. Alf H. Haukenes; University of Alaska, Fairbanks, SFOS-FITC, 118 Trident Way, Kodiak, AK 99615. Phone: 907-486-1534; Fax: 907-486-1540. fnahh@uaf.edu. Bruce Rieman; U.S.D.A Forest Service, Rocky Mountain Research Station, 316 E. Mrytle St., Boise, Idaho 83702. Phone (208) 373-4386. Fax (208) 373-4391. Email brieman@fs.fed.us

Progress in using GIS based landscape parameters to model the likely influence of Myxobolus cerebralis in Idaho.

We are exploring the relationships between *Tubifex tubifex* habitat and *Myxobolus cerebralis* populations at fine and landscape scales, using the Pahsimeroi River, a tributary of the Salmon River in Eastern Idaho as our field laboratory. The subbasin contains public and private lands, hosts a state fish hatchery rearing chinook salmon (*Oncorhynchus tshawytscha*), and the tributary waters are home to bull trout (*Salvelinus confluentus*) populations. The purpose of the study is to identify stream characteristics ubiquitous to all drainages and landscape-parameters that influence stream structure to develop a predictive model of T. tubifex habitat. To account for the spatial heterogeneity that occurs beyond the habitat-scale, broad-scale landscape parameters can be used to develop a stronger predictive model and can be extended to additional drainages. Three landscape-scale attributes have been selected based on their importance in influencing stream habitat structure. Elevation is a common gradient influencing stream structure and a variable from which many additional landscape parameters can be derived. In our model, elevation has been chosen to serve as surrogate to temperature. Temperature is important in regulating T. tubifex densities and release rates of the triactinomyxon stage. The timing of fry emergence and their susceptibility to infection is also temperature dependent. A second attribute directly influenced by elevation is channel slope. The slope of a channel will influence substrate composition and the deposition of fine materials. The presence of T. tubifex is a function of substrate composition; areas rich in fine particulates and organic matter provide the best habitat. Catchment area is the final parameter chosen at this time while it is an important feature when comparing streams within and across a subbasin. Additionally, with an increase in watershed area, there is not only an increase in probability for increasing species densities, but also a decrease in some spatial variance associated with broad-scale analysis. Adjacent catchment areas likely have a similar suite of landscape-scale attributes and have the potential to influence the habitat in similar ways. A Geographic Information System was used to derive slope and delineate catchments from a 30-meter digital elevation model. Metrics were based on the contributing area above an exposure site. We collected invertebrates at sites where fry were exposed and analyzed for determination of pathology of Myxobolus cerebralis. Fine-scale and local habitat variables measured include water quality metrics conductivity, dissolved oxygen, pH, and water temperature. Stream morphology metrics measured include average depth, wetted width, and stream discharge.

Dunham, Jason, Bruce Rieman, Charlie Luce, Joseph Benjamin*, USDA Forest Service, Rocky Mountain Research Station, Boise Aquatic Sciences Laboratory, 316 E. Myrtle, Boise, ID 83702, 208/373-4380 (voice), 208/373-4391, jbdunham@fs.fed.us (email)

Conservation of aquatic ecosystems and changing patterns in wildfire and fuels are defining challenges for managers of forested landscapes in the western United States.

Through funding from the National Forest System and National Fire Plan, we are investigating the influences of fire and fire-related management on aquatic ecosystems in the Rocky Mountain Region. Our most recently completed work is a synthesis of current knowledge regarding effects of fire on aquatic ecosystems. This will be published in a series of peer-reviewed papers in *Forest Ecology and Management*. Pre-publication drafts are available: http://www.fs.fed.us/rm/boise/teams/fisheries/fire/firehome.htm.

We are also developing new information and tools to assist management of aquatic ecosystems in fire-prone landscapes. Our work will provide an integrated view of both biological and physical responses to fire through the following:

Track patterns of stream channel succession in response to fire.
Study linkages between riparian zones, instream wood, and fire.
Compare patterns of major stream disturbances (e.g debris flows and landslides) to patterns of fish distribution.
Describe post-fire patterns of stream heating and effects on thermal habitat for key aquatic species (e.g. fish and amphibians).
Define responses of key aquatic species to fire and associated disturbances (e.g., stream channel reorganization, changes in thermal habitat).
Study the utility of post-fire rehabilitation efforts.

This effort represents collaborations within the Forest Service and with external cooperators, including the University of Idaho and U.S. Geological Survey. Products from this work will assist managers implementing a variety of policy directives outlined in the National Fire Plan, Cohesive Strategy, forest planning, and Clean Water and Endangered Species Act regulations.

Fitzgerald, Gretchen, (Department of Interdisciplinary Studies, Boise State University; 208/334-9007; FAX 208/334-9562; gfitzgerald@pn.usbr.gov) and Matthew R. Dare (Biomark, Inc. 149 S. Adkins Way, Suite 104 Meridian, ID 83642; 208/288-0011; FAX 208/288-0031; mattdare@biomark.com), Jason B. Dunham (US Forest Service Rocky Mountain Research Station, Boise Forestry Sciences Laboratory, 316 East Myrtle, Boise, ID 83702; 208/373-4380; FAX 208/373-4391; jbdunham@fs.fed.us)

Bull Trout Movement and Habitat Use: A Meta-analytical Synthesis

Movement and habitat use by bull trout *Salvelinus confluentus* has been studied extensively using radio telemetry throughout the Northwestern United States and Canada. This information is distributed in published literature, and in numerous unpublished reports. This large body of case studies presents a unique opportunity to study the biology of bull trout across a major portion of the species' range. We believe a synthesis of existing information from telemetry studies of bull trout will provide important new insights into our understanding of the biology and management of this threatened species. We propose to identify all available data on bull trout distribution, movement, and habitat use as collected via radio telemetry techniques. This information will be archived in an accessible database. Using this database, we can address broad scale questions pertaining to movement and habitat use of bull trout, and provide a context for future case studies.

Hostettler, Lauri * Department of Biology, Boise State University, 1910 University Drive, Boise ID 83705. (* Contact: Phone – (208) 334-9007 E-mail – lhostettler@pn.usbr.gov.), Pete Koetsier, Department of Biology, Boise State University, 1910 University Drive, Boise ID 83705, Jason B. Dunham Rocky Mountain Research Station Boise Forestry Sciences, Laboratory 316 East Myrtle Boise, ID 83702

Factors Influencing Juvenile Bull Trout Migration in the North Fork Boise River

Federal listing of bull trout (*Salvelinus confluentus*) in the Pacific Northwest prompted a need for detailed life history investigations to determine specific habitat requirements. Currently, little is known about movement and habitat use patterns of juvenile fish. Baseline data does not exist concerning juvenile bull trout migration in the upper Boise River or their use of Arrowrock Reservoir. Scheduled construction by the U.S. Bureau of Reclamation to replace water release valves for Arrowrock Reservoir will require different reservoir operations at the time that bull trout may be overwintering in the reservoir. This study was conducted on the North Fork Boise River to acquire baseline migratory and habitat use data from juvenile bull trout. Three initial objectives were established. 1) Document timing and magnitude of juvenile bull trout movement from Boise River tributaries to Arrowrock Reservoir. 2) Examine environmental factors that may key daily or yearly juvenile movement patterns. 3) Examine timing and extent of reservoir occupancy prior to first spawning migration for bull trout which rear in Arrowrock Reservoir. Radio transmitters were implanted in juvenile bull trout less than 400 mm at a weir located on the North Fork Boise River in the fall of 2001 and 2002. Bull trout were tracked for 59-405 days dependent on battery life of the transmitters. Data from bull trout tagged in 2001 suggests that migration to Arrowrock reservoir is positively correlated to fish length and age. In 2002, emphasis was placed on relating morphometric measurements, fish condition, and growth rate to fish movement patterns. This poster presents a summarization of our current data and analyses.

McLaughlin, Lia, , Nez Perce Tribe, Department of Fisheries Resources Management, 3404 Highway 12, Orofino, ID 83544

Evaluation of a Subsampler to Estimate Numbers of Juvenile Fish from Rotary Screw Trap Catches

Rotary screw traps are commonly used to capture emigrating juvenile salmonids to estimate production in streams and rivers. During migration peaks, trap catches (e.g., > 1,000 fish) can exceed processing ability. Under these circumstances, some method of subsampling is necessary. Field conditions require an accurate, precise, portable, and easy to implement subsampling method that minimizes stress on captured fish. Two subsamplers were constructed from 208 L plastic barrels. Ten quarter and five half subsamples were taken at four fish densities (approximately 11, 13, 16, and 22 fish/liter). Across all densities, subsamplers tended to overestimate the actual number of fish by nearly 4.3 percent. Twenty-two fish per liter yielded the most accurate estimate of the sample population, with subsamples overestimating the actual population by an average of 0.04 percent. Subsampling would allow large catches to be processed more quickly; however, important information on species composition and tagged or marked fish would be missed. Therefore, the ability of subsampling methods to estimate subgroups within the larger population needs to be evaluated. While it is best to estimate juvenile production from total counts of trap catches, with some modifications this method may be useful when large catches make total counts unfeasible.

Paragamian, Vaughn L., Virginia D. Wakkinen, and Gretchen Kruse, *Idaho Department of Fish and Game*

Spawning Locations and Movement of Kootenai River White Sturgeon

The Kootenai River white sturgeon *Acipenser transmontanus,* an endangered species, spawns within an 18-km reach in the Kootenai River, Idaho, river kilometer (rkm) 228.0-246.0. Preliminary observations of adult white sturgeon have shown what appeared to be a progressive upstream movement during the spawning season, spawning over sand substrate seldom reaching the typical sturgeon spawning habitat of gravel and cobble located upstream of rkm 244.6. This behavior may be unusual for a white sturgeon population. The primary objective of this paper is to compare, within each spawning season and between seasons, the spatial and temporal pattern of egg collections (as an indicator of spawning location) and the spatial and temporal pattern of suspected spawners, as determined by their movement from 1994 through 1999. Adult white sturgeon were tagged with sonic and radio transmitters. Artificial substrate mats were deployed within three sampling reaches to determine approximate spawning locations and timing in reference to locations of spawners. Eggs were collected 207 different times from 1994 through 1999, including 123 times in the lower reach and 84 times in the middle reach. White sturgeon demonstrated a consistent temporal pattern of shifting spawning location as the season progressed, spawning in the lower reach first then moving upstream to the middle reach. A total of 1,234 contacts of potential spawners were made during May and June for the years 1994−1999. Some spawners were located in as many as four different locations from which eggs were collected within a season. There appeared to be at least five primary spawning locations, most in the vicinity of outside bends. This movement and temporal spawning pattern appears to be unique when compared to published studies of other sturgeon populations. Companion studies indicate that the species is not recruiting despite mitigative measures and white sturgeon are thought to be spawning in unsuitable habitat. The combination of movement by white sturgeon within this sandy reach during the spawning season and spawning in unsuitable habitat may be contributing to the failure of recruitment. Present measures to recover the population may be inadequate. Further study is needed to determine if this movement pattern is due to changing water velocities. Also, if historic spawning locations cannot be identified and rehabilitated then we suggest consideration be given to habitat enhancement measures at the present spawning locations.

Santora, Maura K., and Christine M. Moffitt, Idaho Coop. Fish and Wildlife Research Unit, , Department of Fish and Wildlife Resources, University of Idaho, sant9514@uidaho.edu, cmoffitt@uidaho.edu

Modeling Effects of Myxobolus cerebralis *on the Population Dyanmics of* tubifec tubifex *and* Oncorhynchus mykiss

Declines in intermountain western United States rainbow trout, *Onchorynchus mykiss*, populations have been attributed to whirling disease, caused by the *Myxobolus cerebralis* parasite. Models of the impact of this specific pathogen on its two host populations have not been published, as of yet. We have developed the foundation for a deterministic model of the epidemics of *M. cerebralis* through review of existing published literature. The dynamics of the model are regulated by parameters such as the basic salmonid and *Tubifex tubifex* host demographic reproduction, growth, and mortality rates; parasite production and decay rates; and disease transmission and recovery rates. We examine the influence of these parameters on host population numbers in order to assess which cause greater population declines over a unit of time. Preliminary results indicate only a small decrease in susceptible rainbow trout numbers with increasing prevalence of infection in the *T. tubifex* population, and that transmission probability most likely has the greatest effect on infected and susceptible trout numbers. We discovered gaps in knowledge of the population dynamics of *M. cerebralis* through the practice of building this model from literature review. Future development of the model should focus on parameter probability distributions, parsimony, validation, and inclusion of environmental modifiers to be more useful to fish managers trying to contain whirling disease in the wild.