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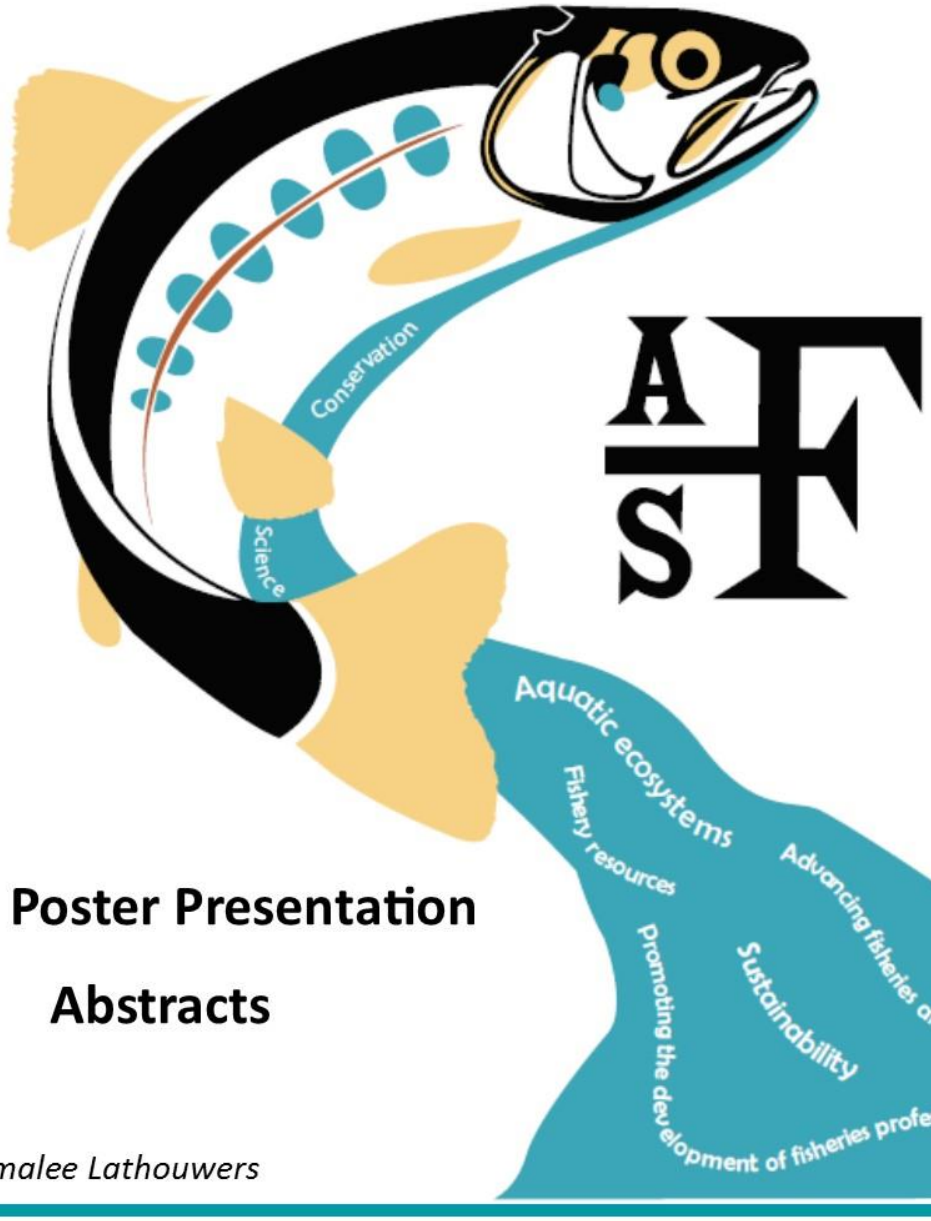
Abstracts



Oral & Poster Presentation

Abstracts

Artwork by Emalee Lathouwers

Poster-Presentation Abstracts (Alphabetized by Presenter)

Identification Of Thermal Bottlenecks Affecting Burbot Embryo Development: Implications For Restoring The Lower Kootenai River Population

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The lower Kootenai River once supported a thriving native population of Burbot (*Lota lota maculosa*) with major ecological and cultural importance to northern Idaho and southeastern British Columbia. Hydropower operations beginning in the 1970s dramatically altered the river regime and potentially pushed this wild population to the brink of extirpation. Pre-dam river conditions in mid-winter were characterized by low flows, extensive ice cover and stable water temperatures below 1 °C. Conversely, the post-dam winter regime fluctuates and is mostly ice-free due to reservoir discharges. Burbot are mid-winter spawners that may be sensitive to these wintertime river alterations. In 2016, a laboratory study evaluated embryo survival at temperature profiles similar to pre- and post-dam conditions. Rapid warming in conjunction with large thermal fluctuations caused minor, but statistically significant increases in embryo deformity and mortality; gradual warming with small thermal fluctuations had no detectable adverse effects. Follow-up research tested different rates of temperature change during early development. An increase in temperature (1.5 to 5.5 °C) over 3 days post-fertilization caused excessive deformity (75 %) and mortality (72 %). The same temperature change occurring over 10 days post-fertilization resulted in significantly less deformity (24 %) and mortality (31 %); a control group incubated at < 3 °C showed the lowest incidence of deformity (7 %) and mortality (24 %). A concurrent study of broodstock spawning and egg survival at different constant temperatures (2, 4 and 6 °C) confirmed that mortality due to warmer temperatures is mostly limited to the first 10 days of embryo development. Collectively, these results highlight the importance of stable, cold temperatures during the earliest life stages of Burbot. If spawning occurs in very cold water, it is possible that subsequent post-dam thermal fluctuations have relatively minor deleterious effects on embryo development. Recent observations of hatchery adults migrating into tributaries during February suggest other cold water habitats may exist for spawning and possibly offset unfavorable conditions in the main channel. Overall, it is recommended that resource managers continue stock enhancement and tributary habitat restoration efforts that improve opportunities for Burbot to spawn successfully under ice cover.

Abundance, Growth, Exploitation, And Survival Of Yellowstone Cutthroat Trout In A Large Secluded Alpine Lake

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Upper Palisades Lake, in the South Fork Snake River drainage in eastern Idaho, is a large and popular lake located almost 13 km from the trailhead with native Yellowstone Cutthroat Trout *Onchorhynchus clarki bouvieri* (YCT). The YCT in this lake are abundant, but trout sizes are uniformly small. We collected basic life history data on this important population, including abundance, fish age, growth, exploitation, and survival to provide managers with good information to base management decisions on. We used a multiple mark, multiple recapture methodology to estimate abundance. We used hook-and-line sampling during the spring to capture 544 YCT and anchor tags to individually mark them. We later used gill nets to recapture YCT. We estimate there are 17,744 (±9,133) YCT in Palisades Lake or 356.45/ha. Exploitation by anglers was extremely low; none of the 544 marked fish were reported by anglers. We collected otoliths from YCT captured in gillnets as well as lengths and weights. We used sectioned otoliths to age these YCT. Two readers independently aged the fish with a CV = 0.16. Fish ages ranged from two years old to ten years old, and we noticed a compression of ages as fish reached 260 to 310 mm. We measured distances from the focus to annuli to back-calculate length-at-age and used these data to create an age-length key for YCT in Upper Palisades Lake. We used the age-length key to estimate YCT survival. Survival is high, but the oldest fish are only reaching 300mm. To increase fish length and condition of the YCT we suggest decreasing YCT abundance in the lake.

Efficacy Of Using Angler-Caught Burbot To Estimate Population Rate Functions

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Age and growth estimates were compared between Burbot *Lota lota* collected by anglers and in trammel nets from two Wyoming reservoirs. Collection methods produced different length-frequency distributions, but no difference was observed in age-frequency distributions. Mean back-calculated lengths at age revealed that netted Burbot grew faster than angled Burbot in Fontenelle Reservoir. In contrast, angled Burbot grew slightly faster than netted Burbot in Flaming Gorge Reservoir. Von Bertalanffy growth models differed between collection methods, but differences in parameter estimates were minor. Estimates of total annual mortality (A) of Burbot in Fontenelle Reservoir were comparable between angled (A = 35.4%) and netted fish (33.9%); similar results were observed in Flaming Gorge Reservoir for angled (29.3%) and netted fish (30.5%). Beverton-Holt yield-per-recruit models were fit using data from both collection methods. Estimated yield differed by less than 15% between data sources and reservoir. Spawning potential ratios indicated that an exploitation rate of 20% would be required to induce recruitment overfishing in either reservoir, regardless of data source. Results of this study suggest that angler-supplied data are useful for monitoring Burbot population dynamics in Wyoming and may be an option to efficiently monitor other fish populations in North America.

Population Demographics, Diets, And Distribution Of Salmonids In A Groundwater-Fed Spring Brook

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The diets of freshwater salmonids shift with ontogeny. Understanding these shifts can provide insight into how salmonids interact with their environment across different life stages. Diggie Creek, a groundwater fed springbrook on a floodplain of the Snake River located on the Shoshone-Bannock Tribes' Fort Hall Reservation, hosts populations of rainbow trout (*Oncorhynchus mykiss*) and rainbow-cutthroat hybrids (*O. mykiss x O. clarkii bouvieri*). Regulation of the Snake River's flow, and overdraft of groundwater for agriculture, appears to have reduced scouring floods originating from the Snake River, and decreased flows in the floodplain springbrooks. There have been associated accumulations of fine sediment and dense beds of macrophytes in the springbrooks, and a commensurate loss of the gravel habitats that sustain important prey taxa for trout. Diggie Creek encompasses habitats that have not been connected to the Snake River via surface water flows since 1997, as well as those in its downstream reaches that are periodically scoured during spring high flows due to connection with a side channel of the Snake River. In this context, we compared the population distribution and demographics of salmonids in the scoured and non-scoured springbrook habitats by analyzing fish scales and generating size-at-age curves during 2015-2016. We found that juvenile fish composed a greater proportion of trout occupying the scoured reach, while adults were more prevalent in the non-scoured reach. In addition, diet analysis showed juvenile salmonids were more reliant on a greater diversity of aquatic insects, whereas adult diets were dominated by fewer, and non-insect, prey items. Taken together, these results suggest the spatial pattern in distribution and demography may reflect differences in foraging needs of the two ages classes of trout stemming from differences in the abundance and diversity of aquatic invertebrates within these distinct habitats. Overall, this may provide insight into resource demands of varying age classes and the associated habitat selection of rainbow trout and hybrids throughout their lifetime, as well has how trout populations are affected by management of ground and surface water associated with the Snake River.

Investigating Relationships Between Animal Diversity And River-Riparian Habitat Heterogeneity In A Wilderness Watershed

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Ecologists have long recognized that physical characteristics of landscapes and riverscapes drive patterns of habitat distribution and influence ecological patterns such as animal diversity. For example, landscapes and riverscapes can be stratified into valley segments with process domains that share similar tectonic, geologic, and climatic characteristics that govern disturbance processes and ecosystem structures and dynamics. While stream ecologists have developed related theories and conceptual papers, few empirical studies have explicitly examined the relationship between such process domains and ecological patterns in river networks. One reason for this gap may be traditional sampling methods such as Surber nets to sample invertebrates and electrofishing to sample fish, which limit the spatial scope of studies through logistical constraints in the field and lab. In addition, though it has been clearly demonstrated that aquatic and terrestrial ecosystems are linked by resource fluxes such as leaf litter and aquatic insect emergence, there have been few attempts to study how aquatic and terrestrial communities respond to different process domains or across spatial scales ranging from reaches and valley segments to drainage networks. We propose to develop new and repurpose traditional sampling methods in order to quantify animal diversity in the terrestrial habitat and riverine fishes and aquatic invertebrate diversity in aquatic habitats across multiple spatial scales of a wilderness river network. Here, we outline the conceptual framework with hypotheses that frame the basis for this study. Overall, we expect process domains that promote connectivity (vertical, lateral, and longitudinal) between the aquatic and terrestrial habitats, such as alluvial-fan-influenced valleys, to support both higher terrestrial and aquatic alpha diversity. In contrast, we expect process domains with less connectivity to harbor reduced alpha diversity but represent different species, which, at larger spatial scales, could increase beta diversity and gamma diversity. This study will provide an empirical base for landscape and community ecologists to understand the behavior and distributions of riverine and riparian species throughout their home ranges and how the occurrence and spatial arrangement of segment scale process domains may contribute to animal diversity.

Panther Creek Chinook Egg Boxes

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In 2015 we out-planted Chinook egg boxes in Panther Creek and I plan to present the results of the study.

Environmental DNA And Electrofishing Reveals Spatial Distribution Of Juvenile Chinook Salmon In The Yankee Fork Salmon River And Panther Creek, Idaho

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Environmental DNA (eDNA) has emerged as a reliable and cost effective tool for identifying the presence and distribution of aquatic species. Because this tool is highly sensitive and non-invasive, it is ideal for monitoring populations of threatened species that may be present at low densities, such as Chinook salmon. We used a combination of eDNA and electrofishing sampling to determine the spatial distribution of Chinook salmon throughout the Yankee Fork and Panther Creek sub-basins in central Idaho. eDNA samples were collected in late summer and fall of 2015 and 2016 and electrofishing surveys were conducted in the fall of 2015 and 2016. Preliminary results have identified areas of seasonal use and spread of juveniles into habitat that is conducive for rearing, but may not support redd production. Continued monitoring for expansion of occupied habitat throughout multiple seasons may identify seasonal habitat use by different life stages, as well as document the overall response of Chinook populations to supplementation efforts.

Southeast Idaho Fish Screen Inventory And Database

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Fish screens are increasingly being used in inland fisheries to prevent fish entrainment into irrigation canals. This has been the case in Southeast Idaho where numerous fish screens have been installed by several organizations during about the past 20 years. Heretofore, there were no overall efforts to inventory, summarize, and disseminate information about these projects. In 2017, we began the development of a database and inventory methodology. General information to populate the database was gathered by reviewing data files for fish screen projects and contacting personnel from organizations that had coordinated the installation of fish screens. Detailed information was collected with the development of a fish screen inventory and initial site visits completed in summer and autumn 2017. There are 80 fish screens located in the project area. Most of these screens are drum types (n=59) on small canals (less 5 cfs) that have been installed during about the past 10 years. Other types of screens include vertical (n=15), horizontal (n=4), and cone (n=2). The design capacity on five fish screens exceeded 50 cfs. Several screens are second or third generation of fish screens for a canal. The Bear River Watershed has the greatest number of fish screens (n=45), followed by the Henrys Fork Snake River (n=19), South Fork Snake River (n=9), Blackfoot (n=6), and Portneuf (n=1) watersheds. We continue to gather and compile data to facilitate information sharing and the improvement of fish screening efforts in Southeast Idaho and beyond.

Age, Growth, And Mortality Of Channel Catfish In The Snake River Upstream Of Brownlee Reservoir

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Channel catfish *Ictalurus punctatus* (CAT) were first introduced in the Snake River in 1939. The Idaho Department of Fish and Game manages this population to provide angler opportunity and harvest. CAT population dynamics, such as age, growth, and mortality, in the Snake River upstream of Brownlee Reservoir are poorly understood. In 2008, a random sample of CAT were collected using boat electrofishing, to improve our understanding of these metrics. CAT pectoral spines (n = 98) were removed and processed for aging. Cross-sections were cut from each pectoral spine and age was assigned by counting annuli. Fish length and age data were utilized to estimate length frequency, age structure, growth, proportional stock density (PSD), and annual mortality. Age estimates ranged from 3 to 10 years, with 67% of the sample aged at 7 and 8 years. PSD was calculated at 98, which indicates this population has an unbalanced size structure towards large fish. Annual mortality was estimated at 51% for fish age 7 or older. Fast growth in this population places it between the 50th and 75th percentile, when compared to CAT populations found throughout North America. Based on the age and size structure, exploitation for this population is relatively low. Additional work to collect a more representative sample of the population, over a greater spatial and temporal scale, should be completed to reduce biases associated with using one sampling methodology.

Ecological And Sociocultural Foundations Of Relational Values Found In River Systems

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The ecosystem service concept was developed by the Millennial Ecosystem Assessment in 2005. It consisted of four parts, regulating services, provisioning services, cultural services, and supporting services. Three of those four services are easy to pin down and place a value on and have aided in developing policies related to ecosystem conservation. However, cultural ecosystems have been hard to pin down due to their intangible nature. Here we are proposing to delve deeper into cultural ecosystems by examining a world renown cultural service provided by the Henrys Fork Watershed, fishing. We will be using the new concept of relational values which are values linking people and ecosystems via tangible and intangible relationships to nature as well as the principles, virtues and notions of a good life that may accompany these. We are investigating both the ecological and sociocultural foundations associated with fishing in the Henrys Fork in order to establish a tangible biophysical link to the ecosystem that would directly link fishing to; relational values, cultural ecosystem services, and the Henrys Fork ecosystem. To do this we will be asking and answering the following ecological questions: first, how important are various prey items to sustaining trout throughout the year and, second, how much do salmonflies contribute to trout production and angler satisfaction during their adult phase versus their larval phase. To better understand the socio cultural values associated with angling we developed a survey that was administered to watershed residents that consisted of four sections. First, there was a free listing section which allowed respondents to state unprompted any benefit they felt the watershed provided them. Second, was a section related to the benefits associated with fishing in the watershed. Third, was a section about agriculture in the watershed. Last was a basic demographic section about the respondents. Throughout the survey there were questions associated with relational values, we will be using these questions to better understand the cultural services associated with angling. We are hoping that this new investigative approach will provide policy makers with a novel tool to better place values on intangible ecosystem services.

Population Structure Of Common Carp (*Cyprinus carpio*) In Lake Spokane, Washington

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Common Carp *Cyprinus carpio* are regarded as a nuisance species throughout western North America. In Lake Spokane, Washington, Common Carp have been identified as a contributor to decreased water quality. In an effort to better manage the Common Carp population in Lake Spokane, information on the population structure of Common Carp is needed. In the spring of 2017, Avista sampled Common Carp from the littoral zone (≤ 2 m) of four sampling locations using monofilament and multifilament gill nets and electrofishing. The first dorsal spine was removed from 368 Common Carp and then aged. Length and weight measurements were also obtained to provide insight on body condition and length structure. The information will be used to describe the population structure and dynamics of Common Carp and to evaluate different scenarios for managing Common Carp in Lake Spokane.

Standard Weight (Ws) Equation And Length Categories For Utah Chub, *Gila atraria*

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Condition indices, such as relative weight (Wr), provide a simple and easy method for comparing length-weight relationships among populations. However, no standard weight (Ws) equation has been developed for Utah Chub *Gila atraia*. We obtained length-weight data for 30,541 Utah Chubs from 24 populations in Idaho, Montana, Utah, and Wyoming. We used the regression-line percentile (RLP), linear empirical percentile (EmP), and Froese's methods to develop Ws equations for Utah Chub. Length-related biases were detected in Ws equations developed using the RLP and Froese's methods. Both the linear and quadratic EmP Ws equations did not exhibit length-related biases for the 75th and 50th percentiles. We propose using the linear EmP Ws equation for fish between 110 and 390 mm (total length [TL]). The EmP 75th percentile equation was log10(Ws) = -4.984 + 3.049•log10TL and the 50th percentile equation was log10(Ws) = -5.137 + 3.100•log10TL. Additionally, we recommend that minimum TLs of 100 (stock), 200 (quality), 250 (preferred), 300 (memorable), and 380 (Trophy) be used to calculate proportional size distribution (PSD) indices. Better understanding Utah Chub population structure using Wr and PSD indices will aid managers in assessing management strategies (e.g., biological controls) aimed at controlling or reducing this species in popular sport fisheries.

Spatially-Explicit Growth In Snake River Fall Chinook Salmon: Evidence From Juvenile Otolith Analysis

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Historically, the majority of juvenile Snake River Fall Chinook salmon expressed a subyearling migration strategy. Typified by initiating migration within the hatch year, the subyearling strategy is common in systems where growth potential is diminished over longer freshwater residency or where the freshwater habitat becomes inhospitable during some portion of the year. Recent studies have demonstrated that a yearling juvenile migration strategy is emerging in the Snake River Fall Chinook population. Reservoir-rearing yearling juveniles spend an entire year or more in freshwater before migrating to the ocean. The new yearling strategy seems to be disproportionately expressed by fish originating in the Clearwater river, and new research suggests that early juvenile growth may be a key factor linked to expression of this migration strategy. We hypothesize that if significant spatial variation in juvenile growth exists within the population, it may explain some of the observed variation in migration strategies seen throughout the Snake River Fall Chinook population. In this study we used otolith growth increment analysis to examine spatially-explicit growth patterns in pre-migration juvenile Chinook from the Snake and Clearwater rivers. Additionally, we explored environmental factors including water temperature and flow as possible explanatory variables of observed growth variation.

Describing Spatial Variability And Life History Strategies Of Westslope Cutthroat Trout In The Coeur D'alene Lake Basin

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Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* are widely distributed throughout the Coeur d'Alene Lake basin and exhibit resident, fluvial, and adfluvial life history strategies. Westslope Cutthroat Trout are known to inhabit headwater streams, larger rivers like the St. Joe River, and to seasonally migrate from Coeur d'Alene Lake into drainages throughout the basin. The objectives of this study were to assess spatial variability and evaluate life history strategies of Westslope Cutthroat Trout caught throughout the Coeur d'Alene Lake basin by referencing 87Sr/86Sr stable isotope ratios across otolith growth axes. Changes in 87Sr/86Sr ratios across the growth axis of an otolith provides insight on life histories of fishes sampled. In 2016, single-pass backpack electrofishing was conducted in tributaries of Coeur d'Alene Lake (9 reaches), the Coeur d'Alene River watershed (8 reaches), the St. Joe River watershed (9 reaches), and the St. Maries River watershed (16 reaches). Sampling continued in 2017 in the mainstem of the St. Maries River (57 reaches), in tributaries of the St. Maries River (43 reaches), and in Coeur d'Alene Lake (134 sites). We used laser ablation multicollector inductively coupled plasma mass spectrometry (LA-MC-ICPMS) to analyze sagittal otoliths (n = 847) and water samples (n = 29) for 87Sr/86Sr ratios. Results from microchemistry analysis indicate that we can discriminate within and among watersheds and evaluate life history structure of Westslope Cutthroat Trout in the Coeur d'Alene Lake basin. Principle component analysis was used to assess differences and similarities among watersheds. Results from this study will be used to inform management decisions at multiple spatial scales and to guide Westslope Cutthroat Trout monitoring throughout the Coeur d'Alene Lake basin.

The Benefits And Challenges Of Transitioning To Digital Data Collection

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Each year, millions of dollars are spent collecting and analyzing fisheries data. As time has progressed, data collection and management has slowly evolved from the use of pencil, paper, and filing cabinets to one involving multiple digital programs and devices. Organizations use computers daily to store, manage, and analyze data while also using specific websites and/or programs such as PTAGIS, FINS, and SGS2 for information sharing. In our own program, there has been a tremendous focus on digitalizing our final data sets, but little change in the actual data collection. In 2017, we decided to replace most of our datasheets with a tablet. This decision has solved a host of previous challenges such as transcription errors and missing data sheets. This poster will have information about the tablet, applications, benefits, challenges, and future plans.

Kootenai Tribe Of Idaho Permitting For In-State And International Fish Transport And Release

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The Kootenai Tribe of Idaho (KTOI) has two conservation aquaculture fish hatcheries that rear *Burbot Lota lota maculosa* and endangered Kootenai River White Sturgeon *Acipencer transmontanus*. To release fish both facilities are required to certify they are specific pathogen disease free. Disease free certification is required to procure state, federal and provincial permitting and screening processes take weeks to complete. A minimum of 180 individuals per lot of fish must be sacrificed for disease screening prior to release(s). To satisfy Canadian Food Inspection Agency (CFIA) requirements disease screening must be done at U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) accredited laboratories. KTOI Sturgeon are listed under the Endangered Species Act (ESA) and require additional permitting to comply with the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Canadian Species At Risk Act (SARA). Multiple state and provincial permits and licenses are also required. In total nine permits are required to transport/export/import Sturgeon and seven permits are required to transport/export/import Burbot. The objective of this informational poster is to detail the progression that KTOI follows to acquire permitting for in-state (Idaho, USA) and international (BC, Canada) transport and release of fish; or fish eggs, within the transboundary Kootenai/y River Basin. The agencies involved, specific documents, specific pathogens of concern and time line to procure required state, federal and provincial permitting will be presented. Implications of this work may be useful for: 1) future KTOI permitting requirements, 2) provide a framework for other hatchery managers to use to meet strict time constraints for timely permit acquisition, 3) safeguard that pathogens of concern are not spread from fish hatcheries into wild waters.

A Qualitative Analysis Of The Effects Of Landslides And Road Decommissioning On Aquatic Organisms And Habitat On A North-Central Idaho National Forest

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Landslides often deliver soil, rock, logs, and vegetative debris to stream channels, and the modification of stream and channel conditions resulting from these events can have acute, short-term, and chronic adverse effects to fish and other aquatic organisms. On the other hand, landslides often change instream and riparian conditions in a manner which increases aquatic habitat heterogeneity, and so these events also have the potential to improve fish habitat quality. While landslides and other types of mass soil movement are common natural events, forest land management activities, particularly the construction and existence of roads, have been shown to increase the likelihood of such events under certain hydrologic conditions. Road decommissioning is often implemented on National Forests, in part to reduce the potential for road-related landslides through restoration of natural hydrologic processes. Many road-related landslides occurred on the North Fork Ranger District of the Nez Perce-Clearwater National Forests during the wet season of 1995-1996, and substantial road mileage has been decommissioned on the District in response to these events during the ensuing years. The relationship between recent landslide/mass soil movement events and road decommissioning efforts on the District will be explored, and likely net benefits to aquatic organisms and habitat assessed.

Field Identification Of Juvenile Salmonids And Their Hybrids At A Rotary Screw Trap Site In The Lochsa River Basin

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Field identification of juvenile salmonids is paramount for effective monitoring of steelhead populations. One method used to monitor juvenile steelhead populations, is operating rotary screw traps (RST) in lotic systems. Rotary screw traps are designed to collect a sample of out-migrating juvenile steelhead and salmon for estimating abundances. A portion of the fish are tagged with passive integrated transponder (PIT) tags and are monitored for survival. The Idaho Department of Fish and Game operates numerous RSTs in anadromous waters. Westslope Cutthroat Trout (WCT) are also present at some of the RST sites. Due to similar phenotypic traits, especially at smaller sizes, and variation in phenotypic traits, accurate identification of juvenile steelhead, WCT, and hybrids can be problematic. Misidentification of juvenile fish can misconstrue abundance and survival estimates. This study examined field identification of steelhead and WCT in Fish Creek, a tributary to the Lochsa River in Idaho. A rating system was used to categorize juvenile fish by phenotypic traits (e.g., spotting pattern, maxillary extension, jaw shape, throat slash intensity). Furthermore, fish grouped into phenotypic categories were compared to assignment using genetic markers. Additionally, fork lengths were recorded and scale samples were collected to determine at what length or age, steelhead can be identified in the field with confidence. Information on the dependability of field identification of WCT, steelhead, and hybrids, will allow for correction factors to be calculated and may be used to produce more accurate abundance and survival estimates of out-migrating juvenile steelhead.

Investigating Trophic Status Of An Invasive Crayfish Using Stable Isotopes

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The ecological role of crayfish has traditionally been over-simplified when describing aquatic food webs. Recent studies show the functional role of these long-lived invertebrates vary among endemic and exotic populations in lentic or lotic habitats. The indiscriminate diet and adaptive behavior of crayfish has allowed multiple invasive crayfish species to spread across North America in the past century. In the process, these crayfish invasions have rapidly re-shaped benthic invertebrate assemblages and affected littoral community processes. Northern crayfish (*Orconectes virilis*) were introduced fifteen years ago to Buffalo Lake, an oligotrophic lake in north-central Washington State managed by the Confederated Tribes of the Colville Reservation. Northern Crayfish inhabit a novel ecological niche among the wholly-introduced Buffalo Lake fishery. In Buffalo Lake, crayfish are critical summer food source for sport fish and serves as a standalone fishery. Despite the importance of this species to the Buffalo Lake food web, the dietary requirements of this crayfish population remain unknown. As a result, the long-term sustainability of this species as a prey source and harvestable fishery is a question for resource managers. By using liver tissue that has a fast isotopic turnover rate, we can document near real-time trophic position and ontogenetic diet shifts of this crayfish population. We hypothesize that Northern Crayfish target algae early in the spring and summer before shifting to an aquatic invertebrate diet later in the year. Seasonal δ15N/δ13C isotope signatures of possible crayfish food sources were compared to δ15N/δ13C isotope signatures of crayfish liver tissue collected bi-weekly May through October 2017.

Restoring Chinook Salmon In The Yankee Fork Salmon River

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The Shoshone-Bannock Tribes (Tribes) initiated a Chinook salmon (*Oncorhynchus tshawytscha*) reintroduction project in Yankee Fork Salmon River, Idaho to meet Tribal harvest and conservation objectives. The Yankee Fork of the Salmon River is an important spawning and rearing stream for Chinook salmon. Historically, the system supported a large Tribal Chinook salmon fishery, but this fishery dwindled as the number of Chinook salmon returning to the Yankee Fork declined due to anthropogenic impacts within the basin (e.g., dredge mining) and out-of-basin (e.g., hydropower). In order to achieve Tribal harvest and conservation objectives, the Tribes utilized a combination of artificial propagation and monitoring techniques. The Tribes installed a rotary screw-trap in the Yankee Fork mainstem to monitor and evaluate yearling and sub-yearling juvenile Chinook salmon emigrating from the Yankee Fork. In addition, the Tribes installed and operated a picket weir in Yankee Fork for the purposes of managing the adult Chinook salmon return. Pole Flat weir was installed to enumerate all adult Chinook salmon that enter the watershed. All fish trapped at Pole Flat weir were directly released above the weir after biological data was collected. Further, the Tribes worked cooperatively with IDFG to outplant excess hatchery-origin fish trapped at Sawtooth Fish Hatchery to bolster natural production within Yankee Fork. Live adults and carcasses of Chinook salmon used for broodstock at Sawtooth were outplanted into Yankee Fork as part of a nutrient enrichment study. Beginning in August, extensive spawning ground surveys were conducted in Yankee Fork and its major tributary, West Fork, to determine spawn timing, redd enumeration and distribution, abundance of live fish, and to collect carcasses for biological information. Overall, the Yankee Fork Chinook salmon project is designed to incorporate harvest management, and artificial propagation to achieve the long term goal of returning 2,000 adults to meet Tribal harvest and conservation objectives.

Rise To The Future: USFS National Fish And Aquatic Strategy

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Founded more than 100 years ago, the Forest Service (USFS) plays a key role in the stewardship of fish and aquatic resources. The agency oversees protection, management, use, and stewardship of natural and cultural resources on 154 national forests and 20 national grasslands, containing more than 193 million acres. The USFS has a unique role to foster healthy watersheds and aquatic habitats that sustain abundant, uniquely adapted fish and wildlife populations for the ecological, social, and economic needs of the American people. The USFS, working in collaboration with many others and seeking input from a broad constituency, has updated its "Rise to the Future Fisheries Strategy: Action Plan for the 1990's" now called "Rise to the Future: National Fish and Aquatic Strategy." A team of nearly 60 participants across the agency and with representatives from the American Fisheries Society, American Sportfishing Association, Association of Fish and Wildlife Agencies, National Fish Habitat Partnership, National Fish and Wildlife Foundation, Recreational Boating and Fishing Foundation, The Nature Conservancy, The Wilderness Society, and Trout Unlimited developed this update. This strategy builds on three decades of success and lessons learned from the original Rise to the Future Fisheries Strategy developed in 1987. The updated strategy was requested by cooperators and partners. The updated strategy is needed to integrate USFS programs and actions related to fish and aquatic stewardship in all parts of the agency, particularly through watershed-scale restoration and partnerships. Additionally, it better aligns with and complements the agency's strategic plan (USDA Forest Service Strategic Plan: 2015–2020). The updated strategy is more relevant to the USFS's cooperators and partners, underscores and recommits the agency in stewarding aquatic resources by 1) Conserving fish and aquatic resources; 2) Connecting people to the outdoors through fishing, boating, and other aquatic activities; 3) Strengthening partnerships and working across boundaries; 4) Delivering and applying scientific research; 5) Build capacity through mentoring and training; and 6) Communicating the value and benefits of fish and aquatic resources, promoting recreational fishing and outdoor aquatic activities, and better addressing the economic value and benefits of fish and aquatic resources to the public.

Salmonflies: The Hidden Key To Family Cohesion

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The Henrys Fork watershed is a world-renowned fishing destination, which provides many ecosystem services that maintain the local inhabitants' welfare. We are investigating the importance of the salmonfly (*Pteronarcys californica*) to fishing-related ecosystem services and trout production. Although anglers have noted that emergences are seasonally available to trout in the Henrys Fork region, the significance of the salmonfly has not been documented. Salmonflies directly contribute to efficient angling, which in turn provides many ecosystem services, including cultural identity, relaxation, family cohesion, and a boost to the local economy. We are conducting an ecological and sociocultural assessment to better understand the contributions of salmonflies to fish population and cultural ecosystem services. To sample trout, we employed a hook and line technique. A non-lethal gastric lavage was then preformed to obtain their stomach contents. We have also conducted face-to-face surveys with locals and visitors to explore their perceptions and traditional knowledge about salmonflies. This study aims to evaluate the importance of salmonflies to sustaining direct and indirect ecosystem services in an angling-centric economy, both from the sociocultural and ecological perspective.

Mussel Enumeration In Lolo Creek, Clearwater River Basin, Idaho

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Freshwater mussels are one of the most imperiled groups of animals in the world. The U.S. Forest Service and Nez Perce Tribe developed a project to restore meander to a channelized segment of stream in Lolo Creek in the Clearwater River basin, Idaho. The project created a new channel and diverted the stream into it, dewatering the old channel. Numerous western pearlshell mussels (*Margaritifera falcata*) were observed in the channelized segment and interest was high among agencies in salvaging and translocating the mussels. Freshwater mussels are known to be reclusive with patchy distributions making accurate enumeration difficult. This situation provided an opportunity to compare different mussel estimation techniques to an actual census (the count of translocated mussels). Prior to translocation, the U.S. Fish and Wildlife Service's Idaho Fish and Wildlife Conservation Office's personnel estimated mussel abundance using quadrat subsampling and total counts from snorkelers. Additionally, three locations were demarcated representing low, medium, and high density mussel beds. Surface mussels were counted in these areas, removed, and then buried mussels were excavated and counted. Lengths of mussels found on the surface and buried were recorded at the three sites. Mussels were translocated to three sites in Lolo Cr. upstream of the project area that already contained mussel populations. Each recipient site received at least 30 PIT tagged mussels for future monitoring. This poster will provide data comparing methodologies to enumerate mussels versus the actual number of mussels present and discuss challenges and limitations to monitoring mussel populations in Idaho.

Effect Of Temperature On Growth, Maturation, And Reproduction Of Brook Trout

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Brook trout, *Salvelinus fontinalis*, is a non-native species in many drainages of Idaho. Where introduced, brook trout can have a negative impact on native species including threatened bull trout, *Salvelinus confluentus*. Our objective was to determine the effect of temperature on growth, maturation, and reproduction of brook trout. We collected brook trout from Summit Creek (Little Lost River drainage) and Methodist Creek (Big Lost River drainage) prior to fall spawning in 2017. Summit Creek has higher summer temperatures compared to Methodist Creek. We estimated age for each fish using length frequency histograms for each site, and reproductive traits were measured for both sexes. Brook trout in Summit Creek expressed faster growth rates than brook trout in Methodist creek. In Summit Creek, both males and females matured at age-1; however, females matured a year later than males (age-2 and age-1, respectively) in Methodist Creek. Female brook trout in Methodist Creek had greater reproductive allocation (gonad wet mass). Egg number did not differ between sites; however, egg size was larger in female brook trout in Methodist Creek. Stream temperatures influenced growth and reproduction in brook trout, and resulting impacts on population dynamics may influence the extent to which brook trout negatively impact native species.

Effect Of A Trematode On Growth And Reproduction Of Shorthead Sculpin In Birch Creek, Idaho

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Shorthead sculpin *Cottus confusus* in Birch Creek, Idaho are infected with metacercariae of the trematode *Euryhelmis cotti*. Prevalence and parasite load of metacercariae exhibit longitudinal variation in Birch Creek with higher prevalence and parasite load in upstream sites. Shorthead sculpin have been collected with over 900 metacercariae on a single individual. Our objective was to determine if trematode infection influences growth and reproduction in shorthead sculpin in Birch Creek. We collected shorthead sculpin in April 2017 from two sites in Birch Creek that varied in prevalence and parasite load of *E. cotti* (hereafter Upper Site and Lower Site). We determined prevalence and parasite load of metacercariae, estimated age using length-frequency histograms, and measured reproductive traits for both sexes. Shorthead sculpin had higher growth rates in Upper Site, despite a higher parasite load, when compared to Lower Site as evidenced by the length of age-1 individuals. As a consequence, age at maturity was younger in both sexes at the Upper Site (age-1) compared to the Lower Site (age-2). Gonadosomatic index did not differ between sites for either sex, indicated equal allocation to reproduction. Metacercariae of *E. cotti* do not appear to have an influence on growth and reproduction of shorthead sculpin; rather environmental characteristics (e.g. temperature, fish density, etc.) appear to have a greater influence on shorthead sculpin.

Effects Of Air Exposure On The Survival Of Salmonids Captured Via Mid-Summer Angling Events

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Despite the success of catch-and-release regulations, exposing fish to air during release is a recent concern. The purpose of this study was to evaluate the effect of mid-summer air exposure on survival of Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri*, Bull Trout *Salvelinus confluentus*, and Rainbow Trout *O. mykiss*. Yellowstone Cutthroat Trout were sampled by angling on a tributary of the South Fork Snake River, Idaho, during August 2016. Bull Trout and Rainbow Trout were sampled from July through August 2017 in Sawmill Creek and the Main Fork of the Little Lost River, Idaho. After capture, fish remained in the water while they were measured and tagged with T-bar anchor tags. Anglers were placed into groups of two to four people. For each angling group, the first fish captured was randomly assigned and exposed to air for 0, 30, or 60 s. Air exposure treatments were then systematically cycled. In total, 328 Yellowstone Cutthroat Trout (0 s, n = 110; 30 s, n = 110; 60 s, n = 108), 278 Bull Trout (0 s, n = 92; 30 s, n = 94; 60 s, n = 92), and 323 Rainbow Trout (0 s, n = 103; 30 s, n = 106; 60 s, n = 113) were sampled with hook-and-line gear. Two weeks after angling, single-pass backpack electrofishing was used to recapture tagged fish. In total, 204 Yellowstone Cutthroat Trout (i.e., 0 s, n = 75, 68%; 30 s, n = 63, 57%; 60 s, n = 66, 61%) were recaptured via single-pass backpack electrofishing. Additionally, 163 Bull Trout (i.e., 0 s, n = 48, 52%; 30 s, n = 56, 60%; 60 s, n = 59, 64%) and 184 Rainbow Trout (i.e., 0 s, n = 65, 63%; 30 s, n = 61, 58%; 60 s, n = 58, 51%) were recaptured. No significant difference in mortality rates were observed between treatment groups for all three species. Results from the present study suggest that mortality from exposing fish to air for 60 s or less is not a concern in catch-and-release fisheries for these species.

Long-Term Monitoring Of Fish Distribution And Abundance In The Big Lost River Drainage, Idaho

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The Big Lost River drainage is located in central Idaho. Due to the richness of recreational activity, high scenic quality, and close proximity to the resort town of Sun Valley, the Big Lost drainage sees a sizeable amount of recreational use, with angling being one of the most popular recreational activities in the area. Fish population monitoring sites were established in the basin in the 1980s and a formal long-term monitoring strategy was established in the early 2000s .in response to declining Mountain Whitefish populations. Typically surveys are conducted every five years. In 2017, we conducted electrofishing surveys at 27 long-term monitoring sites in the Big Lost River drainage to evaluate species composition and estimate population densities for Mountain Whitefish and trout. Artic Grayling were found in 19% of the sites sampled (Big Lost River, East Fork Big Lost, Lake Creek, Star Hope Creek). We also examined overwinter survival of adipose clipped juvenile trout stocked in the fall of 2016 throughout the drainage. No adipose clipped trout were observed in our 2017 survey suggesting poor overwinter survival may be limiting recruitment. These surveys will provide managers critical information in establishing management recommendations (e.g., bag limits) aimed at sustaining this popular fishery.

Does Temporal Variability In Stream Flow And Temperature Influence The Growth Of Cutthroat Trout In Headwater Streams?

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For fishes in streams and rivers, habitat suitability is influenced by seasonal fluctuations in flow and temperature. Decreasing variability of stream flow and temperature in ground water or spring fed streams can create more stable annual discharge and temperature regimes that may provide more suitable habitat throughout the year. In this study, we compared the growth rates of cutthroat trout (*Oncorhynchus clarkii*) from spring-fed streams to populations with typical snow-melt or runoff-fed streams. To estimate growth rates, trout populations were sampled twice per year by electrofishing in all study streams. Captured fish were measured for length and mass, and implanted with PIT tags to monitor change in size between sampling intervals. Relative growth rates were calculated for all recaptured fish and compared between the two stream types. This study will further contribute to our understanding of how variation in abiotic factors influences habitat suitability for salmonids in headwater streams.

A Decade of Scales: Examining Juvenile Steelhead Age Characteristics in 10 Idaho Streams

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Accurately aged population structures are an integral aspect of anadromous salmonid management. Steelhead Trout (anadromous *Oncorhynchus mykiss*) display complex life histories with freshwater and saltwater phases. During their juvenile freshwater phase, steelhead rear in diverse streams throughout intermountain Idaho, producing populations with dynamic growth from year to year and different growth patterns between sites. In an effort to further understand yearly differences and variations between locations, scale age and fork length analysis was conducted on over 23,000 samples. These samples were collected from 2007-2017 at 10 significant steelhead rearing streams. We identified and compared distinct annual pattern characteristics in population size, age class distribution, and length at age relationships over a period of 10 years. Exploration of scale age over time and by population assists in ageing accuracy of individual sites. It also gives a new understanding of the variation seen in juvenile steelhead life histories from diverse stream reaches. Recognition of changing growth and age structure during the freshwater lifecycle of juvenile steelhead can also be beneficial to fisheries research management and habitat evaluations in the future.

Oral-Presentation Abstracts (Alphabetized by Presenter)

Habitat Selection And Dispersal Of Juvenile Steelhead (*Oncorhynchus Mykiss*) In Small Streams

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The availability of high quality habitat is critical for growth, survival, and reproduction of animals. Individuals occupy habitat patches which may vary in quality through both time and space. Dispersal is an important mechanism that allows individuals to move between patches to follow or seek out high quality habitat. This study was designed to evaluate habitat selection and dispersal behavior in a wild population of juvenile steelhead (*Oncorhynchus mykiss*) at the habitat unit (HU) scale. The study was carried out in the Lapwai Creek basin in north central Idaho. Four 500-meter study sites were selected, one on each of the four major streams in the basin. Each study reach was partitioned into HUs (pools, riffles, and runs) and was electrofished 5 times between July and October 2017. All captured steelhead >=65mm in fork length were PIT tagged and returned to their respective habitat unit of capture. Individuals were classified as subyearling or yearling (>1 year), as Lapwai Creek contains primarily age 0 and 1 steelhead. Yearling fish nearly always occupied pool habitat at higher densities than subyearlings and in greater proportions than the representation of pool habitat in the environment. Conversely, the pattern for subyearlings favored occupancy of run habitat. This suggests yearlings select for and dominate pools, relegating subyearlings to utilize less energetically favorable runs. Dispersal was defined as movement of >=3 HUs between recapture events. Of recaptured individuals with locational capture information, 7.5% (7/93) of subyearlings and 21.6% (117/541) of yearlings performed dispersal behavior, suggesting that dispersal was practiced by a minority of the population. Dispersal rates across sites ranged from 16.3-22.8%, and directional bias (up or downstream) was stream dependent. On average, subyearling dispersers moved 4.9 ± 2.0 HUs (max 8) and yearling dispersers moved 8.6 ± 6.0 HUs (max 29). Growth analysis suggests no significant difference in daily growth rates between individuals that dispersed and those that did not. Analysis also suggests no significant difference in growth rates between individuals occupying the different habitat types. Further analysis of habitat selection and movement will be presented at the meeting.

Status Of Steelhead And Fluvial Trout In Upper Salmon River Tributaries

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The Idaho Department of Fish and Game and Bureau of Land Management collaborated on a study examining salmonid use and movement in tributaries in the upper Salmon River basin between 2005 and 2017. The primary objective of this effort was to identify the status and utilization of upper Salmon River tributaries by adult Steelhead (*Oncorhynchus mykiss*) and fluvial trout species including Westslope Cutthroat Trout (*O. clarki lewisi*), Redband Rainbow Trout (*O. mykiss*), and Bull Trout (*Salvelinus confluentus*). We also identified migratory timing, run composition, escapement estimates (where possible), and origin (hatchery vs wild). To address these objectives, IDFG-Salmon Region fisheries staff operated temporary picket weirs during each spring between 2005 and 2017. We sampled between two and eight tributaries in any given year (20 tributaries total over the course of the study) throughout the upper Salmon River basin, and we typically sampled from the middle of March to the beginning of June. A total of 1,598 Steelhead (1,101 hatchery origin and 497 wild/natural origin), 23 Rainbow Trout, 3 Bull Trout, and 2 Westslope Cutthroat Trout were captured during the 12 years of this project. Steelhead hatchery proportion ranged from 0.0-1.0 across years and across weirs with an overall proportion of 0.69. Migration timing into and out of tributaries varied across years with general trends suggesting that Steelhead move into tributaries in mid-April, and those that survive move out of tributaries in mid-May. Escapement trends were variable across weirs with an unusually large run year in 2010 observed at all weirs. Steelhead are distributed throughout the upper Salmon River tributaries we studied, and habitat projects like barrier removal (e.g. Iron Creek) and water savings (e.g. Carmen Creek and Poison Creek) in tributaries led to immediate benefits for Steelhead. Continued monitoring of tributaries where habitat actions occur can help document the response of fish and inform managers where future project implementation is warranted.

Population Dynamics And Evaluation Of Management Strategies For White Sturgeon (*Acipenser transmontanus*) In The Sacramento-San Joaquin River Basin, California

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White Sturgeon *Acipenser transmontanus* are a species of high conservation concern in the Sacramento-San Joaquin River basin (SSJ). Recent surveys suggest that the population may be declining. Potential reasons for the decline include overharvest, habitat degradation, and altered flow and temperature regimes compounded by poor recruitment during a recent record drought. Despite their importance and status, knowledge of the population dynamics of White Sturgeon in the SSJ is incomplete. Therefore, additional information may help guide future management decisions. The objectives of this study were to estimate the population dynamics and demographics of White Sturgeon, and to develop age-structured population models for White Sturgeon in the SSJ. Population age-structure, growth rates, and mortality were estimated from existing data and pectoral fin rays collected during recent sampling events from 2014–2016. Age-structured population models were constructed and used to evaluate potential population growth rates under different management scenarios (e.g., bag limits, length restrictions). Results from this study will help identify knowledge gaps associated with White Sturgeon in the SSJ and quantitatively assess different management scenarios.

Relative Performance Of Triploid Kokanee In Idaho Lakes And Reservoirs

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The stocking of kokanee salmon *Oncorhynchus nerka* in lakes and reservoirs across the western United States and Canada has created popular recreational fisheries. However, kokanee mature early and typically spawn and die between ages 2 and 3, thus kokanee are sometimes only exploited by anglers for a short period of time during their last year of life. Using triploid kokanee in hatchery-supported freshwater fisheries may serve to increase longevity, survival, or growth of fish populations while providing an immediate benefit to the angler. In this study, populations were monitored annually via gill net catch to compare growth, longevity, and catch-per-unit-effort (CPUE) in waters stocked with either diploid (Lower Twin Lake and Devils Creek Reservoir) or triploid (Mirror Lake and Montpelier Reservoir) fish. Lower Twin Lake had the largest kokanee, followed by Devils Creek Reservoir, Montpelier Reservoir, and Mirror Lake. Across six years of sampling, CPUE and mean length was highly variable across all waters. Results from this study provide information relating to the performance of triploid fish with the intention of guiding future management actions for kokanee fisheries in Idaho.

Population Characteristics Of Invasive Burbot In Fontenelle And Flaming Gorge Reservoirs, Wyoming

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Since their illegal introduction into the Green River in the 1990s, Burbot *Lota lota* have been sampled at increasing frequency in lotic and lentic environments throughout the Green River system of Wyoming. Burbot in the Green River system are a threat to native species and socially, economically, and ecologically important recreational fisheries. In response to this invasion, managers of the Green River have begun to explore the efficacy of a suppression effort targeting Burbot. An age-structured population model developed from previous Burbot research in the Green River showed that high annual mortality rates are required to effectively suppress the population. The model used demographic data from Burbot in the Green River and did not include the dynamic rates (growth, recruitment, mortality) of Burbot in Fontenelle Reservoir or Flaming Gorge Reservoir. Due to differences that can occur between lotic and lentic Burbot populations, determining differences in dynamic rate functions is crucial to accurately model this population's response to future management efforts. Burbot for this study were collected from Fontenelle and Flaming Gorge Reservoirs in October and November 2016. Mean back-calculated lengths at age of Burbot were estimated using the Dahl-Lea method, and age structure was estimated. Growth was described using a von Bertalanffy model and total annual mortality was estimated using a Chapman-Robson estimator. These rates were then compared to data collected from Burbot in the Green River to determine significant differences in dynamic rates between the two environments. Results from this study will validate the previously developed population model for the Green River and provide baseline data for future management of Burbot in the Green River system.

Lessons Learned In Lamprey Low Head Dam Passage

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Reclamation has been a partner in evaluating and addressing effects from low-head diversion dams to Pacific Lamprey in the Yakima River in Washington and the Umatilla River in Oregon. While passage impediments due to large dams in the Columbia River mainstem are a known issue, we have also found passage issues associated with low-head irrigation diversions in the tributaries. Thanks to collaborative efforts with several partners, structural modifications have been made at these dams to help adult lamprey migrate upstream more easily in these tributary habitats. We've learned that each site is unique, and that partners, passion, patience, and perseverance are all key to successful lamprey passage.

Development And Evaluation Of A SNP Marker Panel For Parentage Based Tagging Of Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* In Henrys Lake, Idaho

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Henrys Lake is a stronghold for native Yellowstone cutthroat trout (YCT) and a popular trophy fishing lake in Idaho. Over the last 30 years, Idaho Department of Fish and Game has assisted with habitat restoration in tributaries to the lake in an effort to increase natural recruitment of adfluvial YCT. In the past decade, these efforts have increased substantially. Confounding the ability to estimate natural recruitment and judge the success of habitat restoration efforts, is the large population of hatchery YCT stocked annually (~1,000,000), of which only a small percentage (~10%) are marked with an adipose clip. Managers are currently interested in whether Parentage Based Tagging (PBT) of the hatchery broodstock could be a cost effective mass marking method of providing more precise estimates of natural recruitment in the lake, as well as improve harvest and survival monitoring of hatchery and wild YCT. This presentation summarizes the first year of work which included the development and optimization of a SNP genetic marker panel, sampling and genotyping of all hatchery broodstock (N = 1,806), and testing dual and single parentage assignments on juveniles of known parentage.

Air Exposure And Fight Times For Steelhead Fisheries In Idaho

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Increasing concern exists about the effects of air exposure and fight times on fish being caught and released. Such effects are usually tested in laboratory or hatchery settings, with little knowledge of actual angler behavior. We measured air exposure and fight times by anglers catching and releasing fish in popular steelhead fisheries in Idaho, and recorded other relevant factors such as fishing gear (fly or non-fly), occurrence of anglers photographing their catch, and landing method (net or hand). Overall air exposure time for fish caught and released averaged 28.1 s (±3.2). Air exposure time did not differ by gear type but was 1.69 times (16 s) longer if the angler took a photo of their catch. Fight time averaged 130 s (±10.7) and differed by gear type, with fly anglers taking 1.54 times (70 s) longer to land fish than non-fly anglers. Deep hooking rate was 0% for fly (n = 40) and bait/jig terminal tackle (n = 49), and 1% for lures (n = 99). In the context of previous studies that have measured mortality of salmonids, the effects of these fight and air exposure times and deep hooking rates are likely negligible, particularly from a population-level perspective.

Assessment Of Habitat Restoration Effects On The Pahsimeroi River Chinook Salmon Population

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Habitat restoration is considered an important tool for fisheries management in lotic systems that have been impaired by human activities. Although small-scale benefits of stream habitat restoration are commonly investigated, it has proven difficult to demonstrate population-level effects. The Pahsimeroi River spring/summer Chinook Salmon population was previously restricted to the lower portion of the mainstem Pahsimeroi River by multiple irrigation diversion structures. To address related fish passage issues, a combination of restoration projects was initiated including barrier removals, instream flow enhancements, and installation of diversion screens. Work is on-going but the largest barrier was removed in 2009, allowed spawning and rearing salmon to access 20.7 km of previously inaccessible habitat in the main stem Pahsimeroi River and Patterson Creek. This removal approximately doubled the amount of available linear habitat and provides a good case study to investigate the effects of relatively large and concentrated restoration actions on the population scale. We hypothesized the restoration efforts would expand the distribution of spawning Chinook Salmon in the Pahsimeroi River watershed, and this effect would contribute to a broader distribution of juveniles. We also hypothesized a broader juvenile distribution would have population-level effects by reducing the prevalence of density-dependent growth and survival. Our objectives were to document the response of Chinook Salmon redd and juvenile distribution in the Pahsimeroi River following the 2009 restoration and to evaluate the population-level impact of the increased habitat area. Redds were documented in newly accessible habitat immediately following restoration and accounted for 25% - 57% of all redds in the Pahsimeroi River watershed from 2009-2015. Snorkel surveys also indicated juvenile rearing in newly accessible habitat. Juvenile productivity approximately doubled from 247 emigrants/female spawner for brood years 2002-2008 to 482 emigrants/female spawner for brood years 2009-2014. Overall, results suggested increased habitat availability in the Pahsimeroi River broadened the distribution of spawning adult and rearing juvenile Chinook Salmon and reduced the incidence of density-dependent growth and survival.

Top Down And Bottom Up Influences On Kokanee Population Dynamics In Lake Pend Oreille, Idaho

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Recent research on Lake Pend Oreille, Idaho, has focused on the influence of two potential limiting factors for kokanee *Oncorhynchus nerka*: competition with *Mysis diluviana* (Mysids) and predation by Lake Trout *Salvelinus namaycush*. In the last two decades each of these animals has experienced dramatic changes in abundance that provide an opportunity to evaluate kokanee response to reduced predation and interspecific competition. Abundance of age-6 and older Lake Trout was estimated to be 1,792 fish in 1999, 56,880 fish in 2007 and 26,787 fish in 2016 after 11 years of suppression activities. Mysid densities were stable throughout the 1980s -2000s, but the population inexplicably collapsed in 2012. Mysids have since rebounded to approximately 38% of their long-term average density. These population fluctuations have represented major perturbations to the food web, apparently altering both top-down and bottom-up dynamics. We assessed the relative influences of Lake Trout and Mysid abundances on kokanee production-biomass relationships and survival. Prior to Mysid collapse, the kokanee production-biomass relationship followed a Ricker model. Observations since Mysid collapse indicated a marked increase in kokanee production at high levels of biomass, approximately twice what the Ricker model predicted for carrying capacity. We have concurrently observed an increase in the slope of the age 1 to age 2 kokanee cohort relationship since implementation of Lake Trout suppression programs, thereby indicating a predation effect. These findings indicate Mysids have a strong ability to influence density-dependent effects within the kokanee population, which should determine the extent that production can compensate for predation effects. It also has important implications for fishery expectations and management decisions, such as setting kokanee stocking rates.

Historical Abundance Of Oregon Coho: It's Not What We Thought

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It has become a frequent practice when describing the status of salmon populations at risk to compare historic and present estimates of abundance. We investigated historic data on Oregon Coast Coho fisheries as an example for the reliability of historic population estimates. We found that coastwide, from California to Alaska, broad-scale monitoring of salmon spawner escapement did not begin until the 1950's. Regional estimates of salmon populations before 1950 are based entirely on harvest data, combined with assumptions about what fraction of the population those catches represented. For Oregon Coast Coho, we tested the prevailing assumption that in-river landings represented a constant 40% of the population extending back to 1892. Data on license sales and harvest restrictions, as well as accounts by fisheries managers all established that populations were being over-fished prior to 1945, and harvesting was sharply curtailed by regulatory action after 1947. Fin-mark studies at Oregon hatcheries beginning in the 1940s also provide a basis to estimate harvest rates in the late 1940s and 1950s, as do mark-recapture studies with adult Coho tagged as they entered freshwater in the 1950's. These early data collected by the Oregon Fish Commission and Oregon Game Commission indicate historic harvest rates were roughly double those of prevailing assumptions, which means the fraction that escaped to spawn was much lower than prevailing assumptions. The earliest surveys of OCN coho also show low numbers of spawners that began increasing, not decreasing, into the mid 1950's. Revised harvest rate assumptions consistent with these historic data indicate spawner abundance of OCN coho during 1892-1956 was not greater than today, but varied within a similar range to that in recent decades. The OCN example illustrates the danger of placing faith in historic population estimates that depend on speculation about historic harvest rates.

Reproductive Success Of Hatchery Chinook Salmon Spawning Naturally In The Yankee Fork Salmon River, Idaho

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The Shoshone-Bannock Tribes (SBT) has an ongoing Chinook salmon (*Oncorhynchus tshawytscha*) supplementation project in the Yankee Fork Salmon River (YFSR), Idaho with goals of restoring population viability and increasing harvest opportunities. The SBT is currently investigating a combination of supplementation methods involving releasing hatchery smolts and outplanting hatchery adults. This project describes the results of the hatchery outplanting of 171 adults (31 females and 140 males) in a closed, 500 m reach within Eightmile Creek (EMC), a tributary of the YFSR in the fall of 2014. Mark-recapture electrofishing was used to estimate production from these adults and genetic parentage analyses were used to estimate relative reproductive success. Spawning ground surveys estimated the construction of 36 redds and mark recapture of parr, collected the following summer, indicated that a minimum of 8,805 (7,848–9,762) juvenile were produced, contributing to ~35% of the total parr production in the YFSR in SY2014. Genetic results indicate that a minimum of 21/31 (67.7%) hatchery females released in EMC successfully reproduced. Initial results from this study support the continued investigation of this technique for accelerating recolonization of newly restored habitats.

Efficacy Of Remote Site Incubators For Producing Juvenile Chinook Salmon In Panther Creek, Idaho

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The Shoshone-Bannock Tribes (SBT) has an ongoing Chinook salmon (*Oncorhynchus tshawytscha)* supplementation project in the Panther Creek (PC), Idaho with goals of restoring population viability and increasing harvest opportunities. The SBT is currently investigating a hatchery supplementation method involving outplanting eyed-egg in remote site incubators. This project describes the results of outplanting 693,610 eyed-eggs in 2015 and subsequent juvenile Chinook salmon production observed in 2016. A total of 46 remote site incubators were installed in 2015 and 31 were recovered in the spring of 2016. We also documented 131 Chinook salmon redds in Panther Creek in 2015 and collected 98 carcasses to assess natural production. Emergence success for remote site incubators was high at 96 ± 5% of the outplanted individuals. Electrofishing surveys were conducted in 2016 to capture and genetically sampled juvenile Chinook salmon to determine relative reproductive success. A total of 916 juvenile Chinook salmon tissue sample were inventoried. Two samples were duplicates and removed from the genetic analysis. Eight samples failed to genotype, giving an overall genotyping completeness rate of 99.1%. All samples were run at 298 SNP markers, with baseline populations being genotyped at 95 markers. The Parentage-Based Tagging (PBT) analysis was conducted using this subset of SNPs. Purported source of the sample juveniles is Pahsimeroi Fish Hatchery SY 2015 hatchery broodstock and Panther Creek carcass collections for SY 2015. Of the 906 samples analyzed, 222 received a PBT assignment to Pahsimeroi Hatchery SY 2015 broodstock leading to an overall rate of 24.5% of the juvenile Chinook salmon population being produced from remote site incubators. Approximately 17 samples or 1.9% of the juveniles received a PBT assignment to the SY 2015 Panther Creek carcass collections. Genetic results indicate that remote site incubators are successfully producing viable offspring and initial results from this study support the continued investigation of this technique for accelerating recolonization of newly restored habitats.

Bear Lake Tributaries Fish Passage And Increased Wild Cutthroat Trout

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Bear Lake is an oligotrophic, historically terminal lake located in Southeast Idaho and Northeastern Utah in the Bear River Watershed. Up to seven tributary streams provided spawning habitat for native, adfluvial Bonneville cutthroat trout (BVCT). Irrigation diversions and other fish passage barriers, along with irrigation water withdrawal greatly limited BVCT access to these tributaries. In 1973, the Utah Division of Wildlife Resource began a hatchery propagation program to increase BVCT numbers and enhance the lake's sport fishery. Hatchery production was successful and nearly 90 percent of BVCT caught in annual gill-netting surveys in the lake were hatchery origin during the late 1990's. Beginning in the early 2000s, numerous efforts were begun to improve survival of cutthroat trout produced in Bear Lake's tributary streams. The most significant habitat work included removing a fish migration barrier on Fish Haven Creek and the installation of fish screens on 14 irrigation diversions. As a result, there has been a steady increase in the wild-produced BVCT, with nearly two-thirds of all gill-netted fish in the lake being wild in 2014-2017. Also during the last seven years annual hatchery stocking of yearling BVCT was decreased from 270,000 to 170,000. Despite the reduction in hatchery stocking, the overall gill-net catch rate has remained the same or increased. Since 2015, over 80% of the adult BVCT returning to the Swan Creek fish trap were of natural origin. Anglers are also reporting catching primarily wild BVCT (i.e., no fin clip) in the lake fishery. We conclude that the tributary projects are responsible for the recent population increases in BVCT. Additional research will be required to determine the magnitude of recruitment for individual tributaries and what steps could be taken to effectively optimize limited tributary stream flows to produce the greatest BVCT recruitment to Bear Lake.

Diversity Of The Life History Of A Wild Steelhead Population In The Lochsa River Basin In Idaho

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Resiliency of *Oncorhynchus mykiss* is attributed to their diverse life history with varying timing and occupancy in both freshwater and saltwater habitats. Management decisions for returning adult steelhead (anadromous form) are based on estimating the abundance, timing, and age and sex composition of the run as they are entering the Columbia River system. In order to make these predictions, managers need to understand the complex life history of steelhead populations. However, few long-term, complete datasets for steelhead are available. One such dataset accounts for timing, abundance, length, age, and survival of wild juvenile steelhead of a subpopulation in the Lochsa River in Idaho from 1995 through 2017. Adult detections and biological information collected at an adult weir were used to determine the same metrics for adults returning to spawn. We examined this dataset to delineate the diversity of one steelhead population and how such information can be used to improve adult return predictions for management purposes. Survival to Lower Granite Dam varied between the seasons in which juvenile steelhead were PIT tagged. Timing and ages of juveniles to Lower Granite Dam were also highly variable. Likewise, twelve different freshwater and saltwater age combinations have been identified in adult steelhead returning to spawn. These findings will help inform managers the best methods for estimating important parameters of returning adults and could be used to determine the best management practices for the perpetuity of Idaho steelhead.

Response To A Decade Of Lake Trout Suppression In Lake Pend Oreille, Idaho

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The nonnative Lake Trout *Salvelinus namaycush* population in Lake Pend Oreille, Idaho increased exponentially from 1999-2006. This led to an unsustainable level of predation on kokanee *Oncorhynchus nerka*, increased the conservation threat to native Bull Trout *Salvelinus confluentus*, and had undesirable effects on the popular recreational fishery. In response, an aggressive Lake Trout suppression program was implemented in 2006 using both incentivized angling and contract netting (gill nets and deepwater trap nets). From 2006 through 2016, 199,228 Lake Trout were removed (85,081 by anglers; 114,147 by netting). During the same time period, abundance of age-3 and older Lake Trout declined from 135,894 to 56,968 fish and population size structure was reduced. Kokanee biomass reached a record low of 74 metric tonnes in 2007, but steadily increased and averaged 433 metric tonnes from 2013-2016. The Bull Trout population remained robust and stable during the period of Lake Trout suppression. To date, Lake Trout suppression has allowed the nearly collapsed kokanee population to rebound to levels similar to those observed prior to Lake Trout population expansion. Additionally, conservation benefits for native Bull Trout have been realized, and we have observed desired improvements to the recreational fishery. Our results support the efficacy of suppression as a management strategy for nonnative Lake Trout in a large, deep lake.

Connections And Containers: Using Genetic Data To Understand How Watershed Evolution And Human Activities Influence Cutthroat Trout Biogeography

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Species with large geographic distributions often exhibit complex patterns of diversity that can be further complicated by human activities. Cutthroat trout (*Oncorhynchus clarkii*) are one of the most widely distributed native freshwater species in western North America that exhibit substantial phenotypic and genetic variability; however, fish stocking practices have translocated populations outside of their native range and may have obscured intraspecific boundaries. This study focuses on cutthroat trout populations representing three distinct evolutionary lineages that are found intermixed within the Bonneville and upper Snake River watersheds. We used mitochondrial and microsatellite genetic data, as well as historical stocking records to evaluate whether populations of cutthroat trout in the contact zone are native or have been introduced by stocking activities. Significant genetic differentiation and fine-scale genetic population structure was organized primarily by watershed boundaries throughout the study area. While we detected some increased genetic diversity in areas nearest to the greatest number of stocking events, it did not disrupt a highly organized population structure both within and between areas of the contact zone. Intermixing of distinct evolutionary lineages of cutthroat trout appear to be a result of historical connections between the watersheds. Our analyses help identify remaining populations of native cutthroat trout and prioritize them for conservation planning.

Population Ecology Of Adult Snake River Steelhead Returning To The Yankee Fork Salmon River

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Adult steelhead are difficult to study because of their highly plastic, iteroparous life history strategies and spawn time in the early spring. As such, information on the ecology of adult steelhead is limited to a few watersheds. With the expansion of PIT array infrastructure in the Snake River basin over the last decade, we are increasing our understanding of these fish. My objective was to estimate the population size, population composition, and migration characteristics of steelhead entering the Yankee Fork Salmon River using PIT detections on an array installed in 2012. The Yankee Fork adult steelhead run is comprised of hatchery-reared fish, individuals released from streamside egg incubators, and natural origin fish. Over 5 years of PIT detections, we detected 368 adult steelhead tagged at Lower Granite Dam and 105 adult steelhead tagged as juveniles at Hagerman and Magic Valley Fish Hatcheries. Using this data, I show that steelhead enter the Yankee Fork Salmon River when discharge begins to rise in the middle of March, with peak migration occurring between 200-400 cfs. Overall, peak migration is later for hatchery origin fish than natural origin fish. A substantial increase in the fork length of individuals tagged at Lower Granite Dam in 2016 and 2017 relative to previous year indicate the successful shift to a "B-run" hatchery stock. As of the abstract due date, I am still analyzing the PIT array data to obtain population estimates and parent-based tagging data to differentiate between natural origin fish and streamside incubator origin fish. Overall, this research will fill gaps in our understanding of sources of steelhead in the upper Salmon River and the efficacy of streamside incubators for producing adult steelhead.

An Evaluation Of Rearing Strategies For Steelhead Production At Hagerman National Fish Hatchery – Implementation Of A Partial Reuse Aquaculture System And Early Results

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Many benefits are realized with a recirculating aquaculture system for rearing of juvenile salmon and steelhead including water savings, limited cleaning, improved fish exercise and a potential higher smolt to adult return. Faced with reduced rearing potential due to decreased water availability at the eastern Snake River Plain Aquifer, Hagerman NFH completed construction of a partial recirculating aquaculture system (P-RAS) in 2014 as a pilot project. The constructed P-RAS uses three circular rearing tanks and associated reuse infrastructure housed in a stand-alone building to rear a portion of the steelhead mitigation for the Lower Snake River Compensation Plan. Early issues with the P-RAS in terms of operation and brood year 2014 rearing of juvenile steelhead for the Hagerman NFH program were identified and overcome. A number of paired evaluations between steelhead production reared from the P-RAS and the traditional raceway setting at Hagerman NFH have been implemented since 2014 and are in various stages of completion. Several variables of the evaluation including whole body proximate composition, juvenile growth, fin erosion, general fish health screening, juvenile survival to Lower Granite Dam and early adult return information show differences in early years of the evaluation or appear to be stabilizing as familiarity with fish culture using the P-RAS grows.

Seasonal Distribution Of Wild Steelhead, Hatchery Steelhead, And Anglers In The Clearwater River, Idaho

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Steelhead *Oncorhynchus mykiss* is a species of high economic value and supports popular sport fisheries across the Pacific Northwest. The purpose of this study was to describe movement and distribution patterns of wild and hatchery steelhead in the Clearwater River, Idaho. We were also focused on describing spatial movement patterns of anglers in the system. One-hundred-and-seventy-eight wild (n = 38) and hatchery (n = 140) steelhead were radio tagged at Lower Granite Dam in the fall of 2016 and spring of 2017. Steelhead tracking efforts have focused on the main-stem Clearwater River and Middle Fork Clearwater River. Tracking was conducted using twelve fixed stations and mobile tracking (automobile and drift boat). Steelhead movement data have provided insight on steelhead timing into the Clearwater River and timing into natal tributaries. Additionally, creel data was collected to provide information on the number of steelhead anglers and their locations. Results from this study will identify seasonal movement patterns of steelhead and distribution of anglers that will help manage the fishery.

Predicting The Distribution Of Yellowstone Cutthroat Trout In The Upper Snake River Using Spatial Stream Network Analysis

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Evaluating the status of species over large geographic areas can be difficult but recent compilations of fish distribution records may provide a more comprehensive analysis of the remaining range and extent of fish species. Geographic information systems (GIS) can be used to map the extent of a species distribution and identify important associations between habitat characteristics and a species range; however, traditional GIS analyses are primarily designed for terrestrial organisms that can move across a landscape. For fish species that are confined to a network of streams, rivers, or lakes, GIS analyses are needed to map habitat associations within a network of locations. In the Snake River watershed, Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) have declined in abundance because of various forms of habitat alteration, fragmentation and by invasion of non-native fish species. In this study, we used fish sampling records, remote sensing data, and GIS software to identify the current distribution of cutthroat trout in relation to habitat conditions. We used Spatial Tools for the Analysis of River Systems (STARS) and an R package, Spatial Stream Networks (SSN), to evaluate how environmental variables affect the distribution of Yellowstone cutthroat trout. Our study will map the extent of streams that have a high probability of containing populations of Yellowstone cutthroat trout based on habitat variables and identify areas that have low probability of supporting native cutthroat trout populations.

Isotopic Niche Differentiation And Dietary Overlap Among Salmonids And Utah Chubs In Henrys Lake, Idaho

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The introduction and subsequent expansion of Utah Chubs *Gila atraria* since the early 1990's in Henrys Lake has prompted concerns regarding their potential competitive interactions with the popular trophy trout fishery. We examined the interspecific interactions among salmonids and Utah chubs using a dual approach of gut content analysis and stable isotopes. We examined the stomach contents of Brook Trout (n=114), Hybrid Trout (n=146), Yellowstone Cutthroat Trout (n=365), and Utah Chub (n=586) from May to October to assess diet composition. For stable isotope analysis we collected white muscle tissue across a wide size range of Brook Trout (n=9), Hybrid Trout (n=9), Utah Chub (n=20), and Yellowstone Cutthroat Trout (n=10). The stable isotope Bayesian ellipses indicated Brook Trout exhibited the widest dietary niche (SEAc = 1.77) while Utah Chub contained the narrowest dietary niche (SEAc = 0.87) suggesting a more specialized diet than trout. We found no biologically-significant dietary overlap (Schoener index >0.60) between trout and Utah Chubs based on gut content and stable isotopes analysis. At current fish abundances, impacts to trout performance (e.g. growth, condition) from competitive interactions with Utah Chub for pelagic and benthic food resources appears to be minimal.

Effects Of Instream Complexity On Habitat Suitability For Stream-Dwelling Cutthroat Trout Populations

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The availability of suitable habitat is a primary factor limiting the abundance of stream-dwelling salmonid fishes. For drift-feeding fishes that must swim against the stream current in order to forage, suitable habitat can be defined areas where individuals can maintain a positive energy balance and capture enough food for growth and reproduction. In this study, we examined whether the addition of instream habitat complexity increases the availability of suitable habitat for cutthroat trout (Oncorhynchus clarkii) populations. We manipulated the availability of pool habitat by adding instream structures to four headwater streams in southeast Idaho and compared the change of habitat quality to un-manipulated control sections within the same streams. We measured habitat quality at monthly intervals between July and October 2016 and estimated the energetic profitability of the available habitat with a bioenergetic model. The model estimates habitat quality by subtracting the energetic costs accrued from the total energy gained by trout while foraging. The aim of this study is to determine how space limitation may restrict the growth of salmonid populations, and to determine the mechanism by which habitat complexity creates suitable habitat for drift feeding fishes.

A Mark-Recapture-Based Approach For Estimating Angler Harvest

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Fishing effort in "traditional" creel surveys is derived from instantaneous angler counts, which in some fisheries can carry high cost in personnel time, resources, and safety. To estimate angler effort more efficiently and at lower cost, we eliminated angler counts and used the interview instrument to implement mark-recapture methods to estimate weekly angler populations in salmon and steelhead fisheries on the Salmon River, Idaho, USA. Weekly harvest estimates were the product of weekly angler population, mean number of days fished per angler per week, and mean harvest per angler per day. We used the mark-recapture method to estimate angler effort and harvest over 92 different weeks across both species, five river reaches, and 4 years (2013-2016). The sample for comparison consisted of 48 of these 92 weeks for which weekly harvest was estimated by both traditional and mark-recapture methods. There was no evidence that difference in point estimates between the traditional and mark-recapture methods differed between salmon and steelhead. With species pooled, there was no significant difference in point estimates between the two methods, and the mark-recapture estimates in our fisheries could be made at up to 50% savings in vehicle mileage associated with conducting angler counts. However, width of 95% confidence intervals around harvest estimates was significantly higher for the mark-recapture method, due to higher upper confidence limits resulting from right-skewness of the sampling distribution of the mark-recapture based estimator. Precision could be improved by replacing time spent on counts in the traditional method with more time spent "capturing" anglers at access sites, still providing savings in vehicle mileage.

Modeling Long-Term Suppression Of Lake Trout In Lake Pend Oreille, Idaho

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We developed a simulation model of lake trout population dynamics in Lake Pend Oreille, Idaho, to determine the level of fishing effort needed to suppress abundance by 90% within 10 years and the level of fishing effort needed to sustain abundance at this reduced level. The model was constructed from biological data collected during suppression fishing in 2006-2016. Results indicated that fishing effort exerted in 2014 would suppress lake trout abundance by 90% within one decade, after which fishing effort could be reduced to only 17% of 2014 levels to sustain lake abundance at the reduced level. Our findings will be implemented in two stages of future suppression netting, with 10 years of continued high-intensity fishing, followed by sustained low-intensity fishing thereafter.

Effects Of Release Strategies On The Survival Of Hatchery Reared Kootenai River White Sturgeon

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The wild Kootenai River White Sturgeon (Acipenser transmontanus) population is mainly comprised of older adults due to a lack of any significant recruitment since the 1970s. Egg and/or larval suffocation, predation, and other factors of mortality associated with these early life stages are the primary causes of persistent recruitment failure. To maintain a population structure until the bottleneck can be address, a conservation aquaculture program began in 1989 by the Kootenai Tribe of Idaho. The reliance on hatchery-reared fish to maintain this wild population prompted a need to continually evaluate the efficacy of the releases. In this study, we evaluated estimates of annual survival by age, the influence of individual covariates (e.g. length at release, hatchery of origin, etc.…) on survival, and provided an estimate on hatchery juvenile abundance. This analysis provided the first age-specific estimates of annual survival for the hatchery-reared portion of Kootenai White Sturgeon. The modeling indicated that size and timing of release were important predictors of survival. Fish of larger size (>300mm FL) survived better their first year at large. Annual survival of spring released sturgeon was 40% greater than those released in the summer. Data suggests age-1 survival has declined from 90% in 1992 to below 20% since 2003. This decline was likely the result of a combination of changes in release strategy, an increase in density, as well as other factors. The hatchery origin of stocked fish was also an important predictor of age-1 survival, with the two hatcheries involved using varying rearing strategies, with fish reared in British Columbia having significantly greater survival than those reared at the original Kootenai Tribal Hatchery. Raising fish to a larger size and limiting releases to the spring appears to result in greater survival and is now prioritized to maximize year class strength of stocked fish. Monitoring and evaluation of population vital rates continues to be paramount in identifying optimal hatchery operations as well as to the continued success of this recovery effort.

Kootenai River White Sturgeon Research And Recovery Efforts

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Kootenai River White Sturgeon research and recovery effort is a highly collaborative program, involving many partners working to together to restore a self-sustaining population that would hopefully one day support a fishery. The reduced hydrograph and cutting off of floodplain are thought to have drastically reduced juvenile recruitment. Many adults spawn on clay and sand, reducing egg viability. Actions like ESA listing in 1994, Conservation Aquaculture from the Kootenai Tribe of Idaho, Habitat Restoration Efforts, and Effectiveness Monitoring were all implemented early on to save these fish from extinction. From the very beginning, this recovery program was and is very collaborative between partners to try to move the needle on Sturgeon Recovery. In addition to aquaculture, the Kootenai Tribe constructed and IDFG is evaluating the addition of spawning substrate in areas of clay and sand where they currently spawn. In their Habitat Program, the Tribe constructing large pools to entice adults to spawn in proper spawning substrates. The excavation materials from the pools were also used to build islands that would continually add nutrients and hiding habitat for drifting larvae at high water. Idaho Dept. of Fish and Game, BC Ministry, and MT Fish Wildlife and Parks do the evaluations on the river to determine if these and other actions are affecting growth, survival, and recruitment. This research is directly utilized by the aquaculture program to determine the number of juveniles to release annually into the River and at what locations. We also estimate juvenile and adult abundance to determine recovery criteria set by USFWS. Our research team is currently working diligently on determining the if fine tuning of Libby's operation will move more fish upstream to spawn in good substrates. We continue to press forward to assist in the recovery of this population.

Fish Assemblage Structure And Habitat Associations In The St. Maries River Basin, Idaho

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The St. Maries River basin is located in northern Idaho and is a major component of the Coeur d'Alene Lake system. Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* are known to inhabit headwater streams and use the mainstem of the St. Maries River during spring runoff as a migration corridor from Coeur d'Alene Lake to spawning areas in the basin. Even though Westslope Cutthroat Trout are known to occupy portions of the watershed, little is known about habitat and species associations in the St. Maries River basin. Our objective for this study was to assess patterns in fish assemblage structure and relations to habitat characteristics in the St. Maries River watershed. Fish and habitat characteristics were sampled from 250 macrohabitats in 33 different tributaries in the St. Maries River basin from May – August 2017. Regression modeling was used to predict fish species occurrences and nonmetric multidimensional scaling was used to visualize patterns in fish assemblage structure in the watershed. Results from this study will help inform fisheries management decisions, as well as fill critical knowledge gaps pertaining to fish assemblage structure and related habitat associations.

Oxytetracycline Does Not Cause Growth Promotion In Finfish

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Administering sub-therapeutic doses of antibiotics to improve animal growth is a controversial agricultural practice that is neither substantiated nor legal in aquaculture. Although fish culturists generally do not accept this practice as beneficial, it is a common misconception within the public sphere that antibiotics are widely used for this purpose. We conducted a study to determine if oral administration of oxytetracycline dihydrate, one of the most commonly used antibiotics in aquaculture, affects growth in finfishes. We evaluated the growth and health effects of oxytetracycline on four commercially relevant species: Channel Catfish *Ictalurus punctatus*, hybrid Striped Bass *Morone chrysops × M. saxatilis*, Nile Tilapia *Oreochromis niloticus*, and Rainbow Trout *Oncorhynchus mykiss*. Fishes were randomly divided into four replicate tanks (20 fish/tank for Nile Tilapia, 10 fish/tank for all other taxa) per treatment group: therapeutic (80 mg/kg fish/d), sub-therapeutic (16 mg/kg fish/d), or control dose (none) of Liquamycin® top-coated feed. Fishes were fed once daily (3% body weight/day) and weighed every two weeks to adjust rations. After eight weeks, percent weight gain, specific growth rate, feed conversion ratio, feed intake, and organsomatic indices were assessed, and subsamples of fish were necropsied to determine general health. Data were analyzed with one-way analysis of variance (ANOVA) with tanks representing experimental units. Tissue data were analyzed with a chi-square test for differences in the frequency of normal vs. abnormal observations between the treatments. We observed no statistically significant treatment effects on growth, survival, or tissue normality in any taxon. There were no significant differences in performance metrics with the exception of HSI in hybrid Striped Bass, in which fish fed the sub-therapeutic dose exhibited higher HSI values than the controls. Overall, these data demonstrate that there are no growth or health benefits to administering sub-therapeutic oxytetracycline to these commercially relevant fish species, and therefore no incentive to misuse antibiotics this way in aquaculture.

Evaluating The Size Selectivity Of Mid-Water Trawls For Sampling Kokanee

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Kokanee *Oncorhynchus nerka* are arguably one of the most important fish in Idaho. Kokanee provide valued recreational fisheries, and also serve as an important prey resource for economically, socially, and ecologically important fishes. As such, kokanee are a major focus of natural resource agencies throughout Idaho. Kokanee are largely monitored using hydroacoustic surveys and mid-water trawls. However, the validity of data collected using mid-water trawls has been questioned due to the potential size selectivity of the gear. Therefore, we sought to assess the length selectivity of mid-water trawls by comparing estimates obtained from gill nets to those obtained using mid-water trawls. Experimental curtain gill nets were used to sample kokanee in six lakes and reservoirs throughout Idaho. Concurrently, kokanee were sampled using standard mid-water trawl techniques. The relative selectivity of gill nets was quantified using the SELECT method and was used to estimate a corrected length distribution. The corrected length distribution was then compared to estimates obtained from mid-water trawls to identify potential size-biases of mid-water trawls. In total, 2,414 kokanee were sampled during 2015 and 2016. Data collected in 2015 and 2016 suggest that mid-water trawls overestimate the number of small fish and underestimate the number of large fish in a population. The apparent size-selectivity of mid-water trawls could bias population demographic and dynamics data used to manage kokanee populations. As such, managers should clearly identify the goals of a given monitoring program and choose gears that best address questions relating to the management of kokanee in Idaho.

Commercial Fisheries Of The Upper Mississippi River

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Commercial harvest is largely regarded as a primary cause of fishery declines in marine and inland systems throughout the world. However, much of the data supporting the negative attributes of commercial harvest are derived from marine fisheries and are not directly applicable to inland fisheries. The Upper Mississippi River (UMR) was described to better understand how inland commercial fisheries function. In addition, we address concerns associated with the sustainability of commercial fisheries in freshwater systems. Annual yield was summarized by species and pool (3–26) to evaluate spatiotemporal trends in harvest in the UMR. Additionally, trends in species-specific market value were evaluated to understand the influence of exogeneous factors on harvest. Trophic indices were calculated to assess the stability of harvest in the UMR. Total harvest in the UMR varied from 2,508,631 kg to 6,037,058 kg and was valued at US$1,486,702 to US$13,189,718. Common Carp *Cyprinus carpio* and Freshwater Drum *Aplodinotus grunniens* were consistently the most harvested species throughout the UMR. Harvest was variable through space and time, but was largely centered around particularly productive pools (i.e., pools 4A, 9, 13, 19, 26). Overall, harvest in the UMR has remained relatively stable over the past 60 years and has not negatively influenced fish populations or recreational fisheries. Our results refute the common claim that all commercial fisheries are in decline and show that proper management can achieve sustainable fisheries.

Modeling Impacts Of Habitat Restoration Actions On Juvenile Steelhead *Oncorhynchus Mykiss* Production In The Potlatch River, Idaho

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The Potlatch River basin has been severely impacted by land use practices over the past century. Restoration efforts are ongoing to enhance and restore critical freshwater habitat and boost production and productivity of wild steelhead *Oncorhynchus mykiss* in the basin. Effectiveness monitoring is conducted for habitat restoration projects addressing limiting factors within two index watersheds, Big Bear Creek (BBC) and the East Fork Potlatch River (EFPR). In addition, we developed a life-cycle model to evaluate potential responses in juvenile steelhead production following the implementation of restoration projects in each watershed. Understanding the potential magnitude of a fish response to particular restoration actions will help guide future restoration planning in the basin. The individual-based simulation model was parameterized using watershed-specific steelhead productivity and life history data. In BBC, we modeled the potential increase in smolt production following the implementation of three large-scale barrier removal and flow supplementation projects that would restore access to ≥ 30 km of additional rearing habitat. In the EFPR, we modeled smolt production changes following the completion of large wood treatments designed to increase habitat complexity in 15 km of additional rearing habitat. In BBC, the model predicted average smolt production would increase from 10,714 to 20,596 fish following the implementation of planned projects. In the EFPR, the model predicted an increase in average smolt production between 1,900 to 8,000 fish from the current production of about 17,000 fish. Smolt production increases were proportional to either increases in rearing habitat (BBC) or rearing density (EFPR). Model predictions correlated well with empirical observations indicating good model performance in each simulation. Overall, results indicate planned restoration projects have the potential to generate substantial increases in smolt production in the index watersheds, though the magnitude of response differed. The model provides a valuable tool to prioritize future restoration actions and helps establish restoration benchmarks for achieving population-level changes in Potlatch River steelhead.

Drone Surveys For Stream Restoration And Passage Projects

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Data collection for stream restoration and fish passage projects can be relatively costly to acquire using LiDAR or ground based surveying techniques, especially for planning level analysis. Drone based imagery combined with ground survey control and Structure from Motion software can, under appropriate field circumstances, be utilized to cost effectively collect survey data for small to moderately sized projects. This presentation provides an overview of the expected accuracy of drone based imagery surveys, and the constraints of using this technology for project data acquisition.

Distribution And Conservation Status Updates For The Western Endemic Crayfishes *Pacifastacus connectens* and *Pacifastacus gambelii*

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Western North America is home to five endemic crayfishes in the genus Pacifastacus. Among these western crayfishes, one has become a globally widespread invasive species (*P. leniusculus),* one has been declared extinct (*P. nigrescens*), one is federally listed in the United States as Endangered (*P. fortis*), and two are virtually unstudied (*P. connectens* and P. *gambelii*). These two data-deficient pilose (or hairy) crayfishes were historically known from the middle and upper Snake River watershed and adjacent closed desert basins of Idaho and neighboring states. We sought to evaluate the distribution and conservation status of *P. connectens* and *P. gambelii* by revisiting their historic localities from natural history museums and other records, as well as sampling other sites within the presumed native range of these species. We sampled 162 sites for crayfish during the summers of 2016 and 2017 using a combination of timed searches and overnight baited trapping, ranging from western Wyoming across to eastern Oregon, as well as into northern Nevada and Utah. We found *P. gambelii* at only 10 sites, and only five of 31 (16%) historic localities. Similarly, we found *P. connectens* at only nine sites, and eight of 21 (38%) historic localities. More common were non-native crayfishes, including the virile crayfish *Orconectes virilis*, which we found at 22 sites, including widespread throughout the mainstem Snake River above Shoshone Falls. Non-native crayfish were more common than native crayfish at historic localities for *P. gambelii* in particular, occurring at 39% of sites where this species had been found previously. Educational outreach and management intervention may be needed to prevent further spread of non-native crayfishes in this region and associated impacts to native crayfish; for example, the extinction of *P. nigrescens* and Endangered status for *P. fortis* are specifically attributed to displacement by invasive crayfishes through competitive interactions. More work is also needed to better understand habitat associations, population trends, and ecological function and interactions for *P. connectens* and *P. gambelii* throughout their ranges.

Genetic Monitoring Of Sockeye Salmon Reintroductions: A Strategy Comparison For Informed Opportunities

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Columbia River Tribes have recently initiated efforts to restore natural spawning, anadromous sockeye salmon populations to historically indigenous regions of the Columbia River Basin that were previously extirpated. In 2009 the Yakama Tribe began outplanting sockeye salmon into Cle Elum Lake in the Yakima River Basin using genetically distinct donor stocks from Wenatchee and Osoyoos lakes in the upper Columbia River. Genetic monitoring has revealed successful reproduction by both of the outplant stocks, but spatial and temporal differences in spawning behavior have restricted interbreeding, and outplant progeny have thus far remained highly differentiated. In 2016 there were ~3670 naturally produced sockeye salmon from Cle Elum that returned to the Yakima River. Continued monitoring will focus on evaluating potential reproductive and adaptive differences between 1st generation outplants and their wild counterparts. In a similar effort, the Warm Springs Tribe (CTWSR) initiated reintroduction of anadromous sockeye salmon into Lake Billy Chinook (LBC) in the Deschutes River Basin beginning in 2010. To guard against disease risks from out-of-basin, cooperating managers agreed that anadromous sockeye salmon reintroduction should stem from the local kokanee population. However genetic structure analyses have been inconclusive regarding whether or not the local population, which has been heavily influenced by stocking, may yet sustain a remnant of the historical sockeye salmon gene pool. To facilitate an anadromous life history a withdrawal system is used to divert juvenile O. nerka downstream for outmigration, but passage is limited to only those fish that exhibit smolt characteristics. In 2016 there were ~530 sockeye salmon that returned to the adult trap below LBC. Genetic stock identification has confirmed that 92% of the returns did in fact originate from the LBC population, and 4 were confirmed passing Bonneville Dam during upstream migration. These examples will be valuable for informing reintroduction strategies in other subbasins that historically supported sockeye salmon populations, including Wallowa Lake in the Grande Ronde River Basin, should such action be warranted.

Population Dynamics Of Smallmouth Bass In The Snake River, Idaho

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Smallmouth Bass *Micropterus dolomieu* are a popular sport fish native to portions of the midwestern and northeastern United States. They have been stocked outside of their native distribution for more than a century and were reportedly stocked in the Snake River as early as the late 1800s. In addition to past stocking efforts, impoundment of the Snake River and water storage practices have led to habit alterations that more closely resemble the native habitat of Smallmouth Bass. Between 1972 and 2006 Smallmouth Bass abundance increased (2,200%) in the portion of the Snake River near Swan Falls Dam. As a result of these changes (i.e., habitat alteration, increase in abundance), the Snake River between Swan Falls Dam and Brownlee Reservoir now supports a popular Smallmouth Bass sport fishery. Other than some long-term trends, little is known about the Smallmouth Bass population(s) in this portion of river or in its major tributaries (Boise, Payette, and Weiser rivers). Forty, 2-km long sites were sampled in the Snake River via boat electrofishing in 2016. Additionally, nine sites (13.5 km) were sampled in the three major tributaries using a combination of boat, canoe, and raft electrofishing. Length and weight of captured fish were recorded and dorsal spines were collected. Fish over 260 mm were tagged with individually marked T-bar anchor tags. Tags displayed a phone number that allowed anglers to report capture. Angler reports were used to identify coarse movement patterns from the initial tagging location to the point of capture and to estimate exploitation. Several population indices such as proportional size distribution, relative growth index, and relative weight were calculated. Furthermore, recruitment, and mortality were characterized and used to describe the population.

Evaluating Early Rearing Feeding Techniques On Hatchery Rainbow Trout

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During the early rearing stages of Rainbow Trout production, many fish production facilities utilize either automatic belt feeders or manual hand feeding techniques. Individual facilities may prefer one method over the other based on time and labor availability, ease of use or observed performance of fish. The purpose of this study was to see if observable trends in size variation of a population could be identified using these two feeding methods during early rearing of triploid Rainbow Trout. In the spring of 2017, an experiment was implemented on a unique lot of triploid Rainbow Trout at the American Falls Fish Hatchery. Study group populations were of equal numbers, with one group being fed using 12-hour duration belt feeders and the other group via hand feeding multiple times a day. Feed rates for both control and treatment groups were equivalent throughout the entire evaluation period. This evaluation began when fish reached an average weight of around 0.5 grams per fish and continued until average weight was approximately 13 grams per fish. Individual total fish length and weight samples were collected on a bi-weekly basis during this growth period. This trial was replicated on another unique lot of triploid Rainbow Trout several months later. Trends in variation within length and weight samples were analyzed for this evaluation. Initial results indicate a practical difference in the change in amount of variation within both weight and length observed between the two groups. The coefficient of variation increased more dramatically over the course of the evaluation in both weight and length in the automatic belt feeder group than was observed in the hand fed group. Results from this study will help inform which early rearing feed method will be employed at the American Falls Fish Hatchery and other Idaho Department of Fish and Game hatcheries.

Sensitivity Of Exploitation Estimates To Tag Loss Estimation Methods In Idaho Sport Fisheries

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The objective of this study was to evaluate the sensitivity of exploitation estimates to tag-loss estimation methods for six species of sport fish in Idaho. A discrete tag loss model and four instantaneous tag loss models were evaluated using both empirical data and a simulation approach. Empirical exploitation estimates were similar for most species using the discrete model and all four forms of the instantaneous tag-loss models. Maximum differences among estimators were less than 2% for five species, however, exploitation estimates differed by as much as 17% for walleye *Sander vitreus* depending on the choice of the tag-loss model. The discrete estimator of tag loss, which was computationally much easier to implement than the instantaneous models, resulted in exploitation estimates that were similar to or more accurate than the instantaneous models in the simulation. Exploitation in the simulation was underestimated by more than 1% at a minimum and greater than 14% at maximum when tag loss was not accounted for. These results suggest that regardless of the choice of tag-loss estimator, an attempt should be made to account for tag loss even for species that are expected to have a relatively small average time-at-liberty and relatively low tag loss over the duration of the study.

If You Build It Will They Come? And Other Kevin Costner Based Inferences On The White Sturgeon Of The Kootenai River.

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The abundance of wild Kootenai River White Sturgeon (*Acipenser transmontanus*) has been declining over the last 40 years due to a number of anthropogenic causes. The construction of Libby Dam has contributed to this trend through downstream habitat degradation as well as by altering historic flow and temperature regimes. Currently, many White Sturgeon migrate out of Kootenay Lake into the river to spawn over clay shelves low in the river instead of moving further upstream to spawn in more suitable gravel and cobble habitat further upstream. In recent years, efforts have been made to enhance the migration corridor habitat and flows to entice adult sturgeon to spawn in the more suitable, upstream habitat. In this study we begin to evaluate the effectiveness of these actions in terms of spawner migration movements. Migration movements were monitored from 2005 to 2017 using a passive array of 82 VEMCO VR2W receivers found throughout Kootenay Lake and Kootenai River. We found that both flow and temperature were significant drivers of migration behavior. Additionally, we found migration corridor habitat improvements were positively correlated with upstream sturgeon movements. We also developed a simple 1-D random-walk simulation model using spatially explicit migration movement probabilities that were estimated from a multi-state recapture model. This exercise indicated that increasing upstream migration in areas further from the spawning grounds (e.g. Kootenay Lake) would result in a significant increase of spawners moving onto the spawning grounds. Future work will attempt to integrate our telemetry data with similar simulation approaches to evaluate the effectiveness of potential management actions aimed at increasing adult spawning migrations in the Kootenai River.

Using Tiger Muskellunge To Improve Size Structure Of An Overabundant Brook Trout Population

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Naturally-reproducing trout populations in high mountain lakes (HMLs) do not always provide desirable sport fisheries. Naturally-reproducing Brook Trout *Salvelinus fontinalis* can be especially prone to overabundance, due to early age-at-maturity, high reproduction rates, and low rates of mortality, which can then lead to poor growth rates and poor overall size structure. However, growth rates can sometimes be improved if abundance is reduced enough to increase forage availability in HMLs. In an effort to decrease abundance and improve size structure of an overabundant wild Brook Trout population in a HML in central Idaho, we stocked Tiger Muskellunge Esox lucius x Esox masquinongy (TM), a reproductively sterile predator, on three occasions over a 15- year period. Brook Trout abundance was significantly reduced immediately following each stocking event, but increased again 3-4 years following each event. In years when Brook Trout abundance was reduced, size structure improved significantly. From 2002 to 2016, mean Brook Trout TL increased 71 mm, mean relative weight increased from 78 to 95, and proportion of Brook Trout > 250 mm increased from 0.07 to 0.78. In addition to improving Brook Trout size structure, TM grew extremely well and provided a unique opportunity for anglers to catch trophy-size fish throughout the 15-year study period. These results show that, under the right conditions, TM can be an effective management tool to improve fishery quality in HMLs with overabundant, stunted trout populations.

The Effects Of Adult Ladder Passage At Lower Granite Dam On Snake River Salmonid Migration

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Snake River adult salmonids *Oncorhynchus* spp. are listed under the Endangered Species Act and are subject to biological sampling for research and recovery objectives. Lower Granite Dam is the last dam these fish must ascend during their homeward migration and has an adult fish ladder equipped with a trapping system to facilitate these objectives. In 2016, a change in ladder operation allowed a rare opportunity to evaluate how different passage routes through the Lower Granite Dam adult ladder affect salmonid migration upstream into Snake River tributaries. This study examined five years of PIT tag data from upstream tributaries to compare homeward migration success by passage route for five salmonid runs. During 2016, trapped, shunted, and "free passage" routes through the Lower Granite Dam adult ladder were examined. This study also compared trapped and shunted routes of adult passage for four others years, 2012-2015. Homing success did not differ between trapped and shunted fish under standard ladder operation for all runs across years 2012-2016. Hatchery- and wild-origin summer-run Chinook Salmon were the only runs that exhibited significantly higher homing success rates for free passage fish. Additionally, for wild spring-run and hatchery summer-run Chinook salmon, trapped fish that took over 15 hours to transit through the adult ladder had significantly lower homing success compared to free passage fish. This study suggests continued free passage ladder operation in subsequent years to increase the sample size necessary for a robust recommendation and modification to trapping operations to reduce transit time should be considered.

Genomes Enlighten Phenotypic And Life History Diversity In Salmonids

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Salmonids have considerable ecological, economic and social value, and have sustained native people of western North America for millennia. Anadromous salmonid species have experienced dramatic long-term declines in abundance due anthropogenic impacts, yet a broad portfolio of phenotypic diversity in natural organisms can buffer against exploitation and increase species persistence in disturbed ecosystems. Until recently, reference genomes have been lacking that would enable association mapping to determine the genetic basis of phenotypic variation in natural populations. However, genome assemblies have been released for *Oncorhynchus mykiss* and *O. kisutch* in the last 1.5 years. The first reference genome assembly for Chinook salmon was also just released (2.36 gigabases), with most of the assembly anchored to chromosomes (72.6%) and annotated to enable association mapping of life history variation and phenotypic traits. We demonstrate how these new genomic resources may enlighten our understanding of phenotypic traits in salmonids and assist with conservation and monitoring efforts.

Temporal And Spatial Trends Of Macroinvertebrate Assemblages On The Henry's Fork Of The Snake River

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Henry's Fork of the Snake River is known internationally as a premier wild-trout fishery, marked by its abundant macroinvertebrates and prolific hatches. Macroinvertebrates, while important to the local fishing-based economy, are also indicators of water and habitat quality. This study analyzed a preexisting set of macroinvertebrate data collected in each of 15 individual years between 1992 and 2017 from 11 sampling locations distributed along the river from headwaters to confluence with the main Snake River. Though the samples were taken in different months, by different people, with different motivations, the use of a standard Hess sampler was consistent across all sampling. We used linear regression to analyze spatial and temporal trends in HBI, percent EPT, and diversity. No significant trends were observed in any of the three metrics over time except for trends attributed to bias from different sample locations and months across years. It was evident that the discrepancies in sampling times of year and locations made it difficult to analyze this data set for temporal trends. However, two very popular fishing locations were sampled were sampled consistently across years, and analysis of these two sites showed no significant temporal trends, indicating no immediate cause for concern with the health of the macroinvertebrate populations in these locations. Alternatively, strong spatial trends were observed in HBI and percent EPT; as distance from the headwaters increased, HBI increased while EPT decreased. This is to be expected from the river continuum concept: water and habitat quality decrease with distance from the headwaters, leading to greater abundance of species with higher tolerance scores and lower relative abundance of EPT taxa. Although we found no significant temporal trends, anglers have reported seeing changes in hatch species, numbers, and timing. One explanation for this could be the change in spring-time temperature, which has increased 1.5 degrees F per decade over the past 40 years. Further analysis of temporal trends would require data with standardized sampling times and locations. In 2015 we began a new process of macroinvertebrate sampling using a consistent time of year and a select number of representative sites.

Mapping The Foodscape For Drift-Feeding Salmonids Identifies Spatial And Temporal Scales Of Resource Exploitation

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The predominant paradigm of energy intake for stream-dwelling salmonid fishes is that they acquire energy by maintaining a foraging position in the stream current and capture invertebrates drifting past their feeding stations. As visual predators, salmonids are commonly thought to be diurnal foragers, feeding during daylight hours when drift can be observed and targeted in the water column. However; some studies suggest that salmonids may acquire energy using alternative feeding modes, such as benthic and surface feeding, which could comprise a significant component of their energy budget. The degree to which salmonids acquire energy through different foraging modes is largely unknown. In this study, research was conducted in three 1st order streams in the Portneuf River of southeastern Idaho that contain genetically pure populations of cutthroat trout. We used a video camera and computer software to monitor foraging effort throughout a summer-fall growing season. Recordings were set to film an entire day, for 10 minutes of each hour, beginning sequentially after the original time of submersion, and an infrared light source was used to observe and record nocturnal foraging behavior. We intend to look for departures from the drift-foraging paradigm in wild fish populations to quantify the proportion of foraging effort directed to benthic versus drift-feeding. Specifically, we are looking at the proportion of food acquired from the drift, benthos, or by nighttime foraging. Our aim is to have a better understanding of foraging behavior to better understand how food availability may limit the abundance of salmonids in streams.

Evaluating Early Rearing Feeding Techniques On Hatchery Rainbow Trout

Eric Pankau*, Kevin Yelton and Paul Martin
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During the early rearing stages of Rainbow Trout production, many fish production facilities utilize either automatic belt feeders or manual hand feeding techniques. Individual facilities may prefer one method over the other based on time and labor availability, ease of use or observed performance of fish. The purpose of this study was to see if observable trends in size variation of a population could be identified using these two feeding methods during early rearing of triploid Rainbow Trout. In the spring of 2017, an experiment was implemented on a unique lot of triploid Rainbow Trout at the American Falls Fish Hatchery. Study group populations were of equal numbers, with one group being fed using 12-hour duration belt feeders and the other group via hand feeding multiple times a day. Feed rates for both control and treatment groups were equivalent throughout the entire evaluation period. This evaluation began when fish reached an average weight of around 0.5 grams per fish and continued until average weight was approximately 13 grams per fish. Individual total fish length and weight samples were collected on a bi-weekly basis during this growth period. This trial was replicated on another unique lot of triploid Rainbow Trout several months later. Trends in variation within length and weight samples were analyzed for this evaluation. Initial results indicate a practical difference in the change in amount of variation within both weight and length observed between the two groups. The coefficient of variation increased more dramatically over the course of the evaluation in both weight and length in the automatic belt feeder group than was observed in the hand fed group. Results from this study will help inform which early rearing feed method will be employed at the American Falls Fish Hatchery and other Idaho Department of Fish and Game hatcheries.

Impact Of Lost Floods On Fish And Food Webs In A Regulated River Floodplain

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The Snake River and a suite of floodplain springbrooks located on the Shoshone-Bannock Tribes' Fort Hall Reservation in southeastern Idaho, represents one of the few intact river-floodplain ecosystems remaining in the region. However, regulation of the Snake River's flow and overdraft of groundwater for agriculture appears to have reduced scouring floods originating from the Snake River and decreased flows in the floodplain springbrooks. There have been associated accumulations of fine sediment and dense beds of macrophytes in the springbrooks and a commensurate loss of the gravel habitats that sustain important prey taxa for trout. In 2015-2016, we conducted a study to seasonally examine food webs within floodplain habitats and determine if resident populations of fishes, and in particular Yellowstone cutthroat trout, rainbow trout, and their hybrids, are experiencing food resource limitation linked to reductions in hydrologic scour. In one springbrook reach located near the springbrook's origin, we observed that the majority of annual trout production was derived from only two prey items: Chironomidae and Amphipoda. However, the rates of consumption required to sustain this trout production, in addition to the production by Paiute sculpin and Utah suckers, appeared comparable to the production by the benthic invertebrate community, implying that annual production of fishes in this location was limited by the supply of prey. Furthermore, a twenty-fold increase in trout biomass during winter spawning migrations to this location caused a relative increase in prey demand by the trout population during a period when prey production was only a quarter of what occurred annually. Moreover, three-quarters of aquatic insect consumption by trout occurred while emerging, suggesting that vulnerability may mediate availability of these prey. Based on these initial findings, our working hypothesis is that changes in benthic habitat mediated by decreases in hydrologic scour have altered the quantity of, and access to, prey items important to trout, which hold consequences not only for the production of these fish, but also for the stability and resilience of their populations.

Contemporary Genetic Structure Of Wild Steelhead In The Snake River Basin

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Historic patterns of dispersal leave their signature in the genetic structure of populations across a landscape. Genetic divergence between populations will become positively correlated with geographic distance when dispersal is restricted by the landscape; a pattern known as isolation by distance. These historic signatures of genetic structure can be disrupted by natural and anthropogenic factors that alter dispersal and gene flow. Here we examine contemporary patterns of genetic structure of wild adult steelhead in the Snake River Basin using returns to PIT-tag arrays between 2010 and 2015. For this analysis we genotyped 6,566 wild adult steelhead at 185 single nucleotide polymorphisms, and grouped individuals into 32 collections based on array location and genotypic differentiation. We detected a signature of isolation by distance across all collections in the Snake River basin. However, collections from the upper Salmon River exhibited unexpectedly small levels of genetic differentiation for their geographic isolation. A phylogenetic analysis clustered the collections from the upper Salmon River with collections from the upper Snake River below Hells Canyon Dam. This result mirrors the history of the hatchery populations in the upper Salmon River, which were founded with broodstock trapped at Hells Canyon Dam. When we equated the geographic location of the upper Salmon River collections to Hells Canyon Dam we observed a pattern of isolation by distance indistinguishable from that observed when these collections were removed from analysis. We will present a case study illustrating the effects of these contemporary patterns of isolation by distance on the genetic stock assignment of wild adult steelhead returning to Hells Canyon Dam.

Steelhead Time Travel: Using Previously Collected Tissues To Validate Wild Steelhead Scale Ages With Parent Based Tagging

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Population age structure is an integral part of anadromous salmonid management and is commonly assessed using scale samples. The practice of PIT tagging out-migrating smolts has been used to determine the length of time anadromous fish spend in the salt water portion of their life cycle and can be used to asses accuracy of salt water age determinations. However, restrictions placed on sampling ESA listed species and the complications involved with obtaining known age samples from the freshwater portion of anadromous fish makes total age validation extremely difficult for wild fish. In this study we used known wild steelhead (*Oncorhynchus mykiss*) ages to assess scale ageing accuracy and precision. Scale and tissue samples were collected from wild juvenile and adult fish. Genetic analysis was used to match samples with their parents providing a brood year and known age which was then used to validate scale age. We correctly assigned ages to 92.6% of the 81 known age juvenile steelhead samples and 89.5% of the 19 known adult steelhead samples. Although each reader had some bias, age estimates were unbiased when all agers were combined and our combined average absolute error was 0.08. In conclusion, we found that our accuracy added a level of credibility to our freshwater age assignments, as to warrant future use in fisheries management decisions and reporting. We also recommend a protocol stipulating at least two independent readers per sample, combined with a review to resolve differences in age assignments among those readers. This accuracy and precision lends power to stock assessments, ESA reporting, and other management objectives.

Evaluating Potential Harvest Effects On Burbot *Lota lota* In The Kootenai River, Idaho

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Burbot (*Lota lota maculosa*) were once abundant in the Kootenai/ay River Basin in Idaho, Montana, and British Columbia where they provided important commercial, recreational, and cultural fisheries throughout the basin. However, cumulative effects of purported over-exploitation and the completion of Libby Dam in Montana in 1972 resulted in the entire fishery collapsing and being closed to harvest by 1992. Until recent years, the population was considered functionally extinct. Conservation aquaculture efforts by the University of Idaho Aquaculture Research Institute and the Kootenai Tribe of Idaho, in conjunction with largescale mitigation efforts and long-term monitoring and evaluation have revealed key insights into the current status of the species in the Kootenai River basin. Although recruitment failure persists at this time, all other indicators suggest that the population is increasing due to the release of hatchery-reared burbot and restoration targets should be met by 2019. As such, managers have begun discussing a harvest fishery. We developed a Leslie matrix model to evaluate the potential for a harvest fishery and to identify key uncertainties to better inform future management actions. Despite its simple framework, our model incorporates both observation and process errors in order to make meaningful inference on different harvest and hatchery strategies. Results from sensitivity analyses indicated that the model was most sensitive to changes in hatchery release numbers, age-specific survival, fishing mortality level, and density dependence, and less sensitive to initial population abundance. Results from the model suggest that the population could withstand 10-15% annual fishing mortality without compromising restoration targets. Furthermore, increased hatchery production could allow for slightly increased harvest; however, the per-unit return gradually diminishes. Critical uncertainties that remain are (1) realistic levels of fishing mortality, and (2) whether or not the density-dependent response will be present. These unknowns will be quantified in the coming years. Based on results from the model, Idaho Fish and Game intends to scope (for public comment) opening a harvest Burbot fishery in the Kootenai River in January 2019.

Population Demographics Of Utah Chub In Henrys Lake, Idaho

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Utah Chub *Gila atraria* are native to the upper Snake River, Idaho and Wyoming, and the Lake Bonneville basin, Utah. However, Utah Chub have been illegally introduced into Henrys Lake, Idaho. Utah Chub were first sampled in Henrys Lake in 1993. The presence of Utah Chub in Henrys Lake has raised concern as Henrys Lake supports a trophy salmonid fishery. The primary concern is that Utah Chub have been known to reach high densities and compete with sport fish such as Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri*. Unfortunately, little is known about the population dynamics of Utah Chub in Henrys Lake. Therefore, Utah Chub (n = 363) were sampled using experimental gill nets during April, 2016. Length and weight were measured, and pelvic fin rays were removed to estimate age structure, growth, and mortality. Age-structured models were constructed to evaluate suppression scenarios. These data will provide fisheries managers with a foundational understanding of the population dynamics of Utah that can be used to guide management decisions and actions in Henrys Lake.

Evaluating Air Exposure Effects On The Survival And Fitness Of Yellowstone Cutthroat Trout

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In recent years, concerns have been raised regarding the practice of exposing fish to air during catch-and-release angling. Concerns with exposing fish to air vary from increased mortality to a decline in reproductive success. The purpose of this study was to evaluate the effects of air exposure on survival and fitness of Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri*. This study was conducted on a tributary of the South Fork Snake River (SFSR) from May through October, 2016, and May through September, 2017. Pre-spawn fish were sampled at a velocity-barrier weir. While the gills remained underwater, each fish was measured, tagged with a passive integrated transponder (PIT) tag, a tissue sample was taken, and then hooked through the lower jaw with a circle hook. Fish were then played to simulate angling. After angling, fish were randomly assigned an air exposure treatment of 0, 30, or 60 s. An additional treatment group was added during 2017 sampling in which the fish was not played or exposed to air (nf). After treatment, fish were released upstream. In total, 1,519 fish were sampled (0 s, n = 485; 30 s, n = 494; 60 s, n = 534) in 2016. In 2017, 744 fish were sampled (0 s, n = 167; 30 s, n = 205; 60 s, n = 197; nf, n = 177). Two fixed PIT-tag antennas located downstream of the weir were used to detect fish as they out-migrated to the SFSR. We detected 215 tagged fish out-migrating (0 s, n = 55; 30 s, n = 74; 60 s, n = 86) in 2016 and 314 tagged fish (0 s, n = 71; 30 s, n = 92; 60 s, n = 87; nf, n = 64) in 2017. Additionally, age-0 fish (2016, n = 2,924; 2017, n = 1,492) were collected and tissue samples were taken for parentage analysis to evaluate the effects of air exposure on fitness. Results of this study will provide insight on how air exposure influences survival and fitness of Yellowstone Cutthroat Trout.

Research Efforts To Evaluate An Expanding Walleye Population In Lake Pend Oreille

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Walleye were first documented by IDFG in the Pend Oreille River in 2005 and were initially documented in Lake Pend Oreille in 2006, during the first year of the Lake Trout suppression netting program. Lake Trout suppression activities on Lake Pend Oreille have suggested that walleye densities are increasing, although walleye are not a targeted species. Beginning in 2011, we implemented a Fall Walleye Index Netting (FWIN) protocol to specifically evaluate trends in walleye catch rates and population characteristics and have continued this program on a three year cycle. Walleye catch rates (CPUE) in FWIN surveys have increased from 1.4 fish/net 2011 to 4.3 fish/per 2017, suggesting walleye densities have increased. Walleye are voracious predators and may pose a direct threat to Kokanee recovery efforts. These trends justify further research into the role walleye play in the Lake Pend Oreille food web and fishery. To address walleye food habits, we began removing stomachs in winter 2016 during Lake Trout suppression efforts and continued by removing stomachs during the 2017 FWIN. We have also tagged 450 walleye with T-bat anchor tags, primarily during a two-week targeted walleye netting effort to evaluate angler exploitation and any basic movements beyond tagging locations. Additionally, we've implanted 25 walleye with Lotek dual radio/acoustic (CART) tags and will determine spawning sites and basic post-spawning habitat selection. This research is designed to provide basic walleye life history characteristics in Lake Pend Oreille and will provide a starting point from which more detailed research questions can be evaluated and may eventually provide necessary details for potential management actions.

Species Composion, Abundance And Distribution Of Tropical Fish In Barney Hot Springs And Barney Creek, Idaho

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Barney Hot Spring is a popular recreation site located in the Little Lost River drainage, Idaho. Over the years people have released their aquarium fish in the spring pond, and a few species have established self-sustaining populations. Our objectives were to determine the abundance and species composition of tropical fishes in Barney Hot Spring and to determine the downstream extent of tropical fish species in Barney Creek. We sampled fish in the spring pond using seine nets and baited minnow traps. We estimated abundance of each species using a Peterson estimate. Fish in Barney Creek were collected by backpack electrofishing; sites were selected in a systematic random design. At each site, we completed a single pass of a 100-m reach. We collected Amelanic Convict Cichlids *Amatitlania nigrofasciata*, Mozambique Tilapia *Oreochromis mossambicus*, Zebra Mbuna *Maylandia zebra*, and Green Swordtails *Xiphophorus hellerii* in Barney Hot Spring and Barney Creek. The population estimate of tropical fish in Barney Hot Spring came out to 12,043 fish. The patterns we observed suggest that fish distribution is largely concentrated near the spring because we see a dramatic decline in densities about 200-m from the spring out flow. Below that point we also observe a decline in species composition with no Zebra Mbuna. This may be correlated to decreasing stream temperature. No native fish species were found in any portion of Barney Creek and was largely fishless until Moffett Creek, the fishless sections was roughly 2-km before native fish were found. Based on these patterns, we assume that the tropical fish community does not interact with the cold-water community further downstream in the drainage. However, the tropical fish could be influencing other native species in Barney Hot Spring and Barney Creek, including Columbia spotted frogs which we observed in both waterbodies.

Trapping Monkeys: Is An Obsession With Natal Habitat Sabotaging Salmon Recovery?

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Indigenous people reportedly catch monkeys using a tethered coconut or jar filled with rice or other delicacies. Monkeys reach in, grab the food, and are trapped because the hole will not pass a closed fist. Monkey trapping and the associated "Einstellung effect" might be useful metaphors for decades of anadromous fish recovery efforts. Monkeys are not trapped by anything physical, rather by an idea, unable to see that a principle which formerly served them well (tightly holding onto food) has become lethal. Similarly, the Einstellung effect describes how preconceptions and prior experiences may blind humans to more effective approaches. Conserving and restoring natal fish habitat has been an important principle of fisheries management since the initial watershed restoration projects began in the 1930s. The fisheries literature is flush with examples of degraded habitats restored to support viable fish populations. Although natal habitat restoration can be effective for species residing entirely in freshwater, those habitats represent only a portion of the continuum of diverse and interconnected habitats linking anadromous fish to the ocean and back again. This paper examines whether Snake River anadromous fish recovery efforts are holding too tightly onto natal habitats as the solution, perhaps with minimal effort to restore other, equally essential migratory and estuarine habitats? Since 2000, all subsequent NOAA Biological Opinions, for example, have focused on natal habitat restoration to mitigate expanding outside-basin mortality. Recent news releases suggest some entities are continuing to tightly grasp natal habitat restoration as the solution for salmon recovery. This paper will examine trends in anadromous fish populations in both altered and intact habitats and assess the effectiveness of natal habitat restoration efforts in the Snake River basin. The author will also attempt to answer the question: is an obsession with natal habitat making monkeys out of us?

Use Of Water Withdrawals From Spring Valley Reservoir To Improve Juvenile Steelhead Rearing Habitat

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In 2015 and 2016, we conducted a pilot study to evaluate if water withdrawals from Spring Valley Reservoir, a headwater impoundment in the Potlatch River watershed, could be used to improve downstream juvenile steelhead rearing habitat. We evaluated the response of habitat conditions to water withdrawals using a BACI design. The treatment reach covered 16 km downstream of the reservoir in Spring Valley Creek and Little Bear Creek. We assessed changes in steelhead habitat by monitoring changes in wetted area, pool density, flow, water temperature and dissolved oxygen pre and post withdrawals. Continuous data loggers located every 2 km were used to monitor flow, water temperature, and dissolved oxygen, while wetted area and pool density was quantified for a 200 m reach directly upstream and downstream of each data logger. We assessed potential benefits to juvenile steelhead production due to the water withdrawals using a life cycle model simulation. In 2015, we allowed the treatment reach downstream of the reservoir to reach summer base flows before beginning withdrawals. At this point, the stream flow was intermittent. In 2015, water withdrawals (up to 1.0 cfs) re-watered 8 km of stream establishing 100% connectivity in the 16 km treatment reach. The wetted stream area increased by 71% and 28% in the meadow and canyon reaches respectively, while pool density increased by 117% and 86%. In 2016, water withdrawals began before the treatment reach became intermittent. Withdrawals never exceeded 0.5 cfs and were able to maintained 100% connectivity throughout the treatment reach. During water withdrawals in both 2015 and 2016 water temperature never exceeded 19° C and DO never dropped below 6mg/l. Preliminary results from life cycle model simulations predict, with the increase of perennial wetted habitat in the study reach, we could produce an additional 2600 juvenile steelhead annually with the annual water withdrawal. These results show that water withdrawals from a headwater reservoir can be a highly effective technique to augment downstream flow conditions and improve juvenile steelhead rearing conditions and production.

Fast, Cheap Sex: Next-Generation DNA Sequencing Lives Up To The Hype For Identifying And Developing Sex-Linked Markers

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The identification of sex-specific DNA markers are valuable for ascertaining mechanisms of sex determination and the evolution of sex chromosomes, for managing conservation and commercial broodstocks, development of Trojan Y technology, and in understanding the demographic history and phylogenetic relationships among populations. However, methods to identify sex-specific markers historically have been cost, time and labor intensive and have often failed to discover informative regions. Several recent studies have demonstrated the utility and substantial cost reduction of restriction-site associated DNA sequencing (RAD-seq) technology for resolving sex-determining systems and identifying sex-specific markers in a variety of organisms that lack visually heteromorphic sex chromosomes and that do not have reference genomes. We confirmed the utility of RAD-seq for three fish species of commercial or conservation significance: Burbot, Common Carp and Brook Trout. Of particular significance, we were able to identify SNP markers for each species, that could identify both the X and Y chromosomes.

Northern Pike Management In Lake Coeur d'Alene: Balancing Values And Ecology

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Adfluvial Westslope Cutthroat Trout in Lake Coeur d'Alene have declined in recent history. Predation by nonnative Northern Pike has been demonstrated to be a limiting factor for the recovery of certain Westslope Cutthroat Trout subpopulations. The majority of predation occurs during spring near tributary inlets as a result of spatial and temporal overlap between spawning Northern Pike and migrating Westslope Cutthroat Trout. We implemented a novel removal-translocation program in an attempt to mitigate for predation losses while simultaneously minimizing lost angling opportunity to increase public acceptance of this contentious management action. During early-spring of 2015–2017, we captured 577 Northern Pike from Windy Bay near the inlet of Lake Creek using sinking gill nets. Northern Pike were tagged and translocated to the northern portion of Lake Coeur d'Alene (~23 km from Windy Bay) where the risk to native fishes is lower and angler effort is higher. Here we report on project development, efficiency, and management implications of this program. We used successive depletion models to describe removal efficiency and estimate Northern Pike subpopulation size during each year. Catch-per-unit-effort decreased markedly within and among removal events and total abundance has been reduced by ~70% since 2015. Approximately 130 net nights of gill netting effort were required to index total Northern Pike subpopulation depletion (i.e., CPUE [16 consecutive net nights] = 0.0). In total, 71% of Northern Pike removed from Windy Bay were translocated, and average annual angler exploitation of translocated fish was 27%. Angler tag return information showed that around 97% of translocated Northern Pike were recaptured within 1 km of the release location, suggesting high fidelity of Northern Pike to their immediate environment. Results from this study provide evidence that localized suppression efforts can effectively mitigate Northern Pike occurrence and maintain opportunities for Northern Pike angling at-large.

Pacific Lamprey Historical Photo Search

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Prior to development of the Columbia River hydropower system, millions of Pacific lamprey migrated up the Columbia and Snake rivers to headwater tributaries to spawn. However, because accurate counts of lamprey were never undertaken, little historical information exists as to run sizes and which tributaries had lamprey populations. To help fill in this gap of knowledge, we are asking for your help to reconstruct the range and abundance of the species in the interior Columbia River basin. The project is compiling historical photographs, written accounts, newspaper articles, and other historical documents that show or reference Pacific lamprey in Washington, Oregon, Idaho, or British Columbia in an effort to reconstruct the range and abundance of the species in the interior Columbia River Basin. For the project to succeed we are asking the public to dive deep into their family photo albums for pictures of lamprey, often called "eels," and share them with the project. Employing both crowdsourcing and archival research methods, we aim to create an interactive historical range map and rough estimates of Pacific lamprey abundance at locations where historical photographs depict lamprey.

Testing the Effects of Nitrogen Addition to a Large Reservoir Using a Large Mesocosm Experiment

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The US Army Corps of Engineers and Idaho Department of Fish and Game recently adopted nitrogen (N) additions as a management tool for Dworshak Reservoir, Idaho. Observation studies have found that N additions favor the growth of desirable algae (ie edible to zooplankton), coupled with a decreased prevalence of toxigenic and inedible blue-green algae, and an increase in *Daphnia*. In order to confirm these results experimentally and refine application rates, we deployed nine mesocosms, constructed from semi-transparent polyethylene, with a 3 m diameter, 20 m deep, and an open bottom. We randomly assigned three replicates each of three treatments; a control (no N added), 1x (the same amount of N per surface area as the reservoir, and 3x (three times the N per surface area as the reservoir). We dosed the mesocosms weekly, on the same day the reservoir was treated, from June through September. We assayed primary production on a monthly basis, and temperature, dissolved oxygen, transparency, water chemistry, phytoplankton and zooplankton twice per month, coinciding with reservoir sampling. We will present the results of this experiment and discuss them in the context of reservoir management.

Modification In Diet Due To Inter-Cohort Competition At Low Population Densities In Steelhead (*Oncorhynchus mykiss*)

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Within a threatened population of steelhead (*Oncorhynchus mykiss*) inter-cohort competition has been demonstrated by which subyearling growth rates were negatively associated with densities of yearling fish. Surprisingly this occurs at lower population densities that one would expect given the lack of effect of intra-cohort interactions. To maximize energetic gain per unit of effort, fish are expected to select larger prey as they grow, but previous work in this system has also shown a delicate threshold at which large size becomes an energetic liability. To determine the relative role of inter-cohort competition and thermal stress on foraging decisions within this system, stomach contents of subyearling and yearling fish were sampled in early summer, late summer, and autumn. Diet samples were identified to the lowest practical level, and prey abundance and dry-mass were measured. We predict that yearling fish will have greater diversity of diet as greater bioenergetic needs pressure fish to consume less energetically efficient prey, supported by a greater overlap of diet items between yearling and subyearling fish, but that this relationship weakens with high temperatures. In subyearling fish, diversity of diet will decrease as greater yearling densities reduce drift foraging opportunity, causing a greater reliance on energetically poor prey. These findings will support that changes in allometric foraging behavior can occur at low population densities due to inter-cohort competition for resources.

P.S. I Love You…Yankee Fork Ps3: What's To Love (Or Not Love) About Pond Series 3 After Five Years

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Collaborative habitat rehabilitation in the Yankee Fork Salmon River watershed has led to half a dozen stream habitat projects being implemented in the drainage since 2012. But, what have we learned from the project that started it all? The Yankee Fork Pond Series 3 Side-Channel Project (PS3) was implemented in 2012, enhanced in 2016, and evaluated from pre-implementation through 2017. Many Yankee Fork projects implemented since then have benefited from the lessons learned from PS3. In this presentation, we will examine the project's outcomes using photo-point, stream temperature, fish population, and CHaMP (Columbia Basin Habitat Monitoring Protocol) data. We will also share powerful observational information about floodplain inundation and vegetation responses within the project area. In the habitat restoration/rehabilitation world, practitioners are often encouraged to steadily proceed with developing the next project before the current one is even finished. However, this postscript examination of PS3, demonstrates the value that perspective can add to the strategies we use to fix broken aquatic habitats.

Kootenai River White Sturgeon Aquaculture Program Update

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The Kootenai Tribe of Idaho started the Kootenai River White Sturgeon Aquaculture Program in 1990, to address persistent recruitment failure. Since 1990, several different rearing and release strategies have been used to promote post-release survival and growth. The presentation will provide a basic summary of current program specifics for annual year class production, and a general summary of program results to date.

Voluntary In-Hatchery Spawning By Kootenai River Burbot

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Hatchery-reared Burbot (*Lota lota maculosa*) originating from a donor population in Moyie Lake, British Columbia, have been released into the Lower Kootenai/ay Basin in Idaho and British Columbia since 2009. Hatchery-produced burbot are surviving and adapting to the current conditions of the Kootenai/ay River/Lake after release, therefore, the Kootenai Tribe of Idaho (KTOI) and fellow co-managers have decided to incorporate these sexually mature Burbot as brood-stock into the ongoing conservation aquaculture program. During January 2017, 120 adult Burbot were captured as part of the annual winter hoop-net surveys conducted by Idaho Department of Fish and Game (IDFG) and then transported to KTOI's Twin Rivers Hatchery. Upon capture, fish morphometrics were measured; PIT-tags were injected, or recaptured tags were recorded; and a fin clip was collected for parental-based genetic tagging to validate sex and determine hatchery/wild origin, year class, and release location. Upon arrival at the hatchery, Burbot were identified by PIT-tag; sexed using ultrasound; segregated by sex and size into tanks held at 4°C for 8 - 30 days depending on capture date. As part of a temperature effects study, Burbot were moved on February 8, 2017, just prior to the known Burbot spawning window, to an experimental design using 6-ft. diameter tanks with water temperatures of 2°C, 4°C, or 6°C (pre-Libby Dam winter temperature ranging up to post-Libby Dam winter temperatures, respectively). A total of 36 females and 45 males from the 2011-2014 year-classes were selected and used for the study. The sex ratio for each of three tank replicates for each of the three temperature treatments was 4 females:5 males. Within 48 hours, Burbot volitionally spawned across all treatments and continued to spawn over the next 18 days. Approximately 16,000,000 fertilized eggs were collected in total. Warmer water temperature did not inhibit spawning; however, egg survival at 6°C was < 1%, at 4°C was 49%, and at 2°C was 86%. In conclusion, hatchery-produced adult Burbot captured from the Kootenai River volitionally spawned in a hatchery setting and produced adequate numbers of fertilized eggs to contribute to the conservation aquaculture program.