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ABSTRACTS

Show Me the Data: Explaining Science with Pictures
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Graphics can help convey scientific ideas more efficiently than words, to broad audiences. They help make science more accessible by increasing readership and information retention, and reduce messaging noise. We will cover some examples of science visualization, along with a few tips and tools to entice even the most ardent non-artists to embark on this visual journey.

How to Tell and Share Your Story Digitally
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With handheld devices capable of shooting, editing and distributing high definition video, audio, photographs and graphics, everyone has the ability to connect their work to the constituents to whom it matters. Telling your story in an age where newspapers, television and radio presences are shrinking is more important than ever. We will discuss the tools and techniques to improve your storytelling for the press and through social media.

Live Streaming Demonstration
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The most powerful tool in your social media arsenal is the live stream. Social media platforms like Twitter and Facebook put limits on how much of your audience you can reach with a single post. But live streaming has no limits. Learn how, with a very simple and inexpensive setup consisting of an Android or iPhone, a tripod and a simple microphone, you can reach more than half a million people by live streaming your work.

Using Models to Address Data Gaps Related to the Invertebrate Host of the Salmonid Parasite Cerantonova shasta

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Infectious diseases caused by parasites that have life cycles involving multiple hosts are often poorly understood. However, models can be useful tools for improving our understanding of complex systems. Salmonid population declines in the Klamath River, CA have been attributed to Ceratonova shasta, a myxozoan parasite that alternately infects Manayunkia speciosa (freshwater polychaete) and salmonids (obligate hosts). There is interest in using flow manipulation as a tool to mitigate the effects of disease on salmon by reducing polychaete host abundance in the Klamath River. However, water is a limited and contentious resource in the Klamath River Basin, so evaluating the efficacy of actions that alter water availability is not only warranted, but necessary. The aims of this study were to predict the distribution of polychaete hosts in three sections of the Klamath River's infectious zone, a section of river characterized by elevated densities of C. shasta. Two-dimensional hydraulic models (2DHM) were developed for each of three river sections using topographic survey data, water surface elevation profiles, stage-discharge relationships, and spatial maps of substrate. The 2DHMs were used to describe hydraulic variation (predict depth, velocity, and shear stress) and stratify polychaete sampling locations across gradients of depth and velocity within substrate classes. Benthic samples collected in July 2012 were used to build predictive models of polychaete distribution. Our results show that polychaete distribution is associated with substrate, as well as depths and velocities predicted from the 2DHMs during the previous water year's peak discharge. We evaluated model performance against independent datasets collected in other water years, including a high magnitude flood. Our results suggest that manipulating the hydrograph may influence distribution of polychaete hosts. This in turn may influence C. shasta prevalence in polychaetes and risk of infection in salmonids. Our study provides a tool that allows us to predict how polychaete distribution may respond to flow modification at the study sites and evaluate the potential efficacy of proposed flow management scenarios to affect polychaete hosts.

A Clackamas Bull Trout Reintroduction Update at the End of Phase One

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A reintroduction of bull trout to the Clackamas River was initiated by the U.S. Fish and Wildlife Service and Oregon Department of Fish and Wildlife in 2011, and the sixth consecutive year of transfers concluded in 2016. A total of 2,835 individuals have been translocated, among those 2,382 juveniles age one and two, 370 subadults, and 83 adults. Donor stock for the project has been comprised of wild fish from tributaries of the Metolius River and Lake Billy Chinook in central Oregon. Bull trout have been documented spawning in several tributaries of the upper Clackamas River each year since the reintroduction began and redd counts have continued to increase annually. PIT tag histories suggest over 60% of adult-aged fish migrating past arrays in a key spawning tributary in 2016 were out planted as juveniles, providing strong evidence for juvenile survival to maturity. While too soon to state overall project success, preliminary indicators provide reason for optimism. This presentation will provide a brief summary of project results to date.

Incorporating Climate Science and Uncertainty: Oregon's Strategy for Non-Game Fishes

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Climate change will most certainly impact all native fish species in Oregon; however, the degree to which a species is vulnerable is uncertain. Recognizing the potential for impacts, there is a need to incorporate potential climate effects into the management and conservation of these species. To more adequately manage the needs of native non-game fish species in the face of a changing climate, the Oregon Department of Fish and Wildlife (ODFW) is developing a more quantitative, transparent, and adaptive modeling approach to research and monitoring. The new approach uses knowledge of the limiting factors, threats, and the magnitude of their effect on persistence to categorize habitat for protection or provide restoration guidance. For Oregon's native non-game species, historic and contemporary data are being used to model vulnerability to environmental change as a function of climate sensitivity, exposure to threats, and adaptive capacity. Rarity and traits-based approaches were used based on the premise that rarity (e.g., species range size and climate sensitivity) and traits (e.g., life history, morphology, and behavior) are indicators of vulnerability to environmental change or other stressors. The exposure to threats such as land development, habitat fragmentation, and climate change within and around the species' range will then be evaluated. A number of different climate scenarios and projections will be incorporated to give a range of plausible futures and uncertainties for these species. Using these results, species status will be categorized based on taxonomy, functional diversity, rarity, geography, and exposure. Knowledge about the effects of climate change on species and their habitats will help ODFW better manage the species in their charge and

develop tools to better respond to habitat mitigation needs at the appropriate spatial and temporal scales.

Developing a Statewide eDNA Monitoring Program for Aquatic Species

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ODFW's fish monitoring programs provide information that is critical for conservation and harvest management in Oregon. A number of tools have been identified as having high potential to help ODFW improve the cost effectiveness and value of information provided by ODFW's monitoring as well as expanding the scope of the monitoring to species not currently covered. The use of environmental DNA (eDNA) is one of the tools that shows considerable promise.

eDNA has become the focus of significant attention given the potential to more cheaply and rapidly gather information about a target species than traditional methods. However, eDNA is currently being broadly applied with, in many cases, little understanding of how to interpret the resulting data. This poses problems in making the correct decisions about land-use, instream activities, or species management.

In the absence of supporting information, the utility of information gathered from eDNA sampling is somewhat limited. A positive result may not be informative of distribution or abundance of species as we do not yet know the relationship between where/when/and how much DNA is shed by the animal/s and the subsequent recovery of DNA. Similarly, without supporting information, a negative result cannot be taken as proof of the absence of a species. The presence of eDNA in a given sample of water is influenced by both biological processes (production by the target organism and consumption by bacteria) and physical processes (transport, storage, and degradation). The utility of eDNA as a statewide monitoring tool will be influenced by the degree to which temporal and spatial factors influence these processes, and therefore the need to also measure co-variates.

Our goal is to use eDNA to measure presence/absence and abundance (or biomass) of fish species in Oregon. To achieve this, we first need to understand how to interpret the detection or non-detection of eDNA in a water sample. Our initial focus will be on understanding the relationship between the production of eDNA (fragment size, concentration) and the detection of eDNA in different environments.

Trask River Dam Removal

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ODFW recently removed a high priority fish passage barrier, East Fork of the South Fork Trask Rover Dam. This presentation will provide the context, background, construction and evaluation of this highly successful fish passage restoration project.

Current Status of Gender And Race/Ethnicity Diversity Of Faculty And Scientists In Our Fisheries Workforce

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Fisheries science faces unprecedented challenges due to complex environmental issues from the overexploitation and degradation of freshwater and marine ecosystems worldwide. These challenges demand a transdisciplinary approach with multifaceted management decisions and novel perspectives, which professionals from varied backgrounds, perspectives, skills and experiences can provide. Yet the workforce is strikingly not diverse. Structural inequity of gender and race/ethnicity in science and biases against those groups, may negatively affect the advancement of the science and management of fisheries. Here, we provide an examination of the status of gender and race/ethnicity diversity of faculty and scientists in fisheries. We focus on diversity in academia and also for Federal employees.

Got Lamprey??? A Study Designed to Examine Predation Potential of Larval Lamprey by Various Native and Exotic Species

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Lamprey species, an eel-like jawless fish, has been around on earth for at least 450 million years. Pacific Lamprey, Entosphenus tridentatus, in particular is considered to be a very important species culturally (by the Pacific Northwest tribes) and ecologically and is declining in abundance and distribution throughout its range. While countless studies have examined salmon predation in the Pacific Northwest, little is known about predation on Pacific Lamprey, except through anecdotal accounts and a few studies (whose primary focus were salmon predation). Pacific Lamprey, an anadromous species that travel long distances between the ocean and freshwater streams, face many threats throughout its life history. Pacific Lamprey are known to hold high lipid content and contain 4-5 times higher caloric value per weight compared to salmon. This high food value is likely to make it a preferred prey of many predators, excessive predation of lamprey could pose a potentially serious threat to its recovery. Pacific lamprey have an extensive larval stage in freshwater lasting 3-8 years and elevated abundance of exotic and some native species may be contributing significantly to reduced

lamprey abundance during their downstream migration. Our study examined predation rates of larval lamprey by 10 species (six native and four non-native species) in a confined tank environment [100(L)x113(W)x40(D) cm; 460 L of 15 C° well water with 15 L/min flow rate]. The predator species we examined include Northern Pike Minnow (two size groups), Rainbow Trout Fry, Chinook Fry, sculpin, Chiselmouth, Redside Shiner, Smallmouth Bass (two size groups), Channel Catfish, Bullhead, and Common Carp (two size groups). The larval lamprey were separated into four size classes: 20~30 mm (YOY size group), 30~60 mm (small size group), 60~90 mm (medium size group) and 90~140 mm (large size group). For each experiment, we used three to six predator fish of one species (similar size classes) and added two larval lamprey from each size group per each predator fish to track size class preference. YOY and small size groups were all Pacific Lamprey, whereas medium and large size groups were composed of 50% Pacific Lamprey and 50% Western Brook Lamprey to track species preference by predators. Duration of each experiment was five days, the first half of which was conducted with 4cm of fine sediment present, while the latter half was conducted using no fine sediment. Density of larvae in fine sediment cover at the start of each experiment was maintained at 64 lamprey/m2 (relatively high density) regardless of total larval lamprey number by adjusting the surface area of fine sediment in the tank; fine sediment covered 1/3 of the bottom for three predator fish (=24 larvae) and 2/3 of the bottom for six predator fish (=48 larvae). Survival rates were examined after two nights and four nights to compare predation of various size classes and species of lamprey with and without the fine sediment.

Density-Dependence Versus Density Independence Mechanisms Driving Stream-Living Cutthroat Trout Populations

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Quantifying the dynamics of natural populations is a central question in ecology. Density-dependent processes, including competition and predation, and density-independent processes have been proposed as the main forces that drive population abundance. However, few studies have documented the relative importance of these drivers due to statistical uncertainties at the population-level and logistical issues of maintaining continuous long-term studies. Here, we present information from 30 years of continuous annual surveys of Cutthroat Trout (Oncorhynchus clarkii) populations in two stream reaches from the HJ Andrews Experimental Forest, OR. Stream-living organisms are ideal for hypothesis-testing about drivers of population regulation because they experience significant environmental variation and their patchiness allows for small-scale population differentiation. We used model selection and information-theoretic approaches to contrast multiple hypotheses including density dependent and density independent factors. Our results will provide insights about the importance of different drivers of population regulation under future potential scenarios of climatic variability.

How Much Do We Really Know About Coldwater Refugia and Behavioral Thermoregulation?

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The persistence of salmonids in a warmer future may depend largely on their ability to behaviorally thermoregulate and escape heat stress. A growing body of research has documented both anadromous and resident salmonids behaviorally thermoregulating by moving to coldwater refugia, patches of habitat that are weakly coupled with prevailing thermal regimes and remain suitably cool during summer. This cool-seeking thermoregulation occurs in both juvenile and adult salmonids throughout their native range, even at the northern extent. Despite the ubiquity of thermoregulation and its clear significance for conservation, our understanding of this behavior remains quite limited. In this talk we summarize the current state of knowledge and outline key areas for future research. We state a need for integrative work that: (1) describes patterns of behavioral thermoregulation across taxa and watersheds, (2) quantifies the effects of thermoregulation on individual fitness and population productivity, (3) explores how seasonal refuge use affects broader ecological phenomena such as species interactions, pathogen dynamics, and nutrient cycling, and (4) reveals how watershed alteration (including restoration) mediates the capacity for fish to benefit from thermoregulation.

CRITFC's Tribal Workforce Development Program

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The tribes of the Columbia River Basin are investing in tribal youth - encouraging and preparing them to step into their roles as the care takers of their cultural and natural resources. CRITFC's Tribal Workforce Development Program will share strategies to increase the number of tribal members pursuing degrees in fisheries and natural resources and ultimately enter the workforce.

Angler Preference Surveys: Findings and Perspectives From Northeast Oregon

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Angler preference surveys have been used by the ODFW La Grande Fish District over the past decade to gather information from anglers to guide recreational fishery management. Specific information gathered in these surveys include angler satisfaction with the fishing experience at specific water bodies, angler rating of specific attributes of a fishery including fish size, quality and catch rate, fish species preference for specific waters, motivations for fishing and degree of

support for specific management actions. Angler catch data has also been collected. Documenting and understanding angler satisfaction at specific water bodies has been a useful tool to help identify where fishery management/restoration actions should occur and provide support for acquiring resources. Methods and results of these rather informal surveys will be presented to demonstrate their utility. A significant finding from these surveys has been the strong preference by anglers for stocked trout fisheries that provide the opportunity to catch smaller numbers of larger fish over larger numbers of smaller fish.

Strategic Culvert Replacement: A Catalyst for Habitat Enhancement, Community Development and Strategic Culvert Replacement: A Catalyst for Habitat Enrichment, Community Development and Improving Socio-Ecological Resiliency

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Over 300 passage barrier culverts have been identified in the watersheds of the Tillamook and Nestucca estuaries on Oregon's North Coast. These collectively impede access to hundreds of miles of habitat for anadromous fishes and other aquatic wildlife. Many of these culverts also are undersized and/or in poor condition making them susceptible to catastrophic failure. This can result in direct mortality of aquatic wildlife, impair water quality and threaten public health and safety. A safe and reliable road system also is an essential component of maintaining and enhancing the economy of this rural area. The Salmon SuperHwy is a landscape-scale, strategic approach to address barrier culvert replacements in these basins in a manner that maximizes benefits and minimizes costs. It is a collaborative effort among numerous non-governmental organizations, private individuals and businesses and state, federal and local agencies. Data from previous comprehensive assessment and prioritization efforts were used to identify a subset of approximately 100 barriers whose replacement would reconnect a vast majority of historically accessible habitats in these basins, at a fraction of the cost of replacing all previously identified barriers. Within this subset, there are several groups of barriers that collectively affect entire sub-watersheds. In my talk I will introduce the Salmon SuperHwy project and discuss a vision of strategic culvert replacement as a catalyst for additional habitat enhancements, community development and improving socio-ecological resiliency. I will focus on Patterson Creek - a small, direct-to-bay tributary to Tillamook Bay as a case study. The headwaters of this small watershed are on state forest land and its lower reaches flow through the small town of Bay City before merging with the saline waters of the bay. Despite being impaired by eight passage barrier culverts on its mainstem and major tributaries, the stream continues to support small runs of several anadromous fishes, including federally threatened Oregon Coast Coho. I will report on baseline studies conducted to facilitate replacement of all barrier culverts in the watershed and associated in-stream and riparian enhancement and education and outreach opportunities. I believe such projects can be a mechanism to jump-start community development efforts that benefit humans, the environment and the creatures we share it with and, in turn, improve the capacity of our communities and adjacent ecosystems to respond to perturbations or disturbance by resisting damage and recovering quickly.

Anadromous Fish Reintroduction Planning Effort for Upstream of Chief Joseph and Grand Coulee Dams

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Millions of anadromous fish used to migrate into the Upper Columbia (UC) River watersheds to access spawning and rearing habitat in Canada, the Spokane River, the Sanpoil River, and the many smaller tributaries throughout the region. In the 1800's, fisheries at the mouth of the Columbia River and habitat destruction decimated many of these fish runs. The lack of passage facilities at Grand Coulee Dam and Chief Joseph Dam were the final act that extirpated what was left of salmon, steelhead and lamprey in the Columbia River upstream of those dams. In the last decade or so, interest in exploring a reintroduction above those dams has been rekindled by native American tribes (U.S.) and First Nations (Canada). Fish passage and reintroduction of anadromous salmonids into the UC blocked area is being pursued via 3 pathways; 1) Columbia River Treaty (as part of Ecosystem-based Function'), 2) NPCC/BPA, as part of the Northwest Power Act and BPA mitigation and 3) Individual Tribes, First Nations, and UCUT are funding portions of the work with non-BPA dollars. The 15 Tribes Coalition process outlined a 4 phase approach (Phase 1 was largely adopted by NPCC 2014 F&W program amendment).

Phase 1. Pre-assessment planning: many tasks, including habitat, donor stock, and risk assessments.

Phase 2. Experimental pilot-scale salmon reintroductions and interim passage facilities

Phase 3. Construct permanent juvenile and adult passage facilities and supporting propagation facilities. Implement priority habitat improvements.

Phase 4. Continued monitoring, adaptive management and habitat improvements.

The Upper Columbia United Tribes, as well as individual member tribes such as the Colvilles and Spokanes and Canadian First Nations are jointly working on portions of Phase 1, specifically the habitat, donor stock and risk assessments. For the habitat assessment, data collection and modeling are being used to determine the quantity of suitable habitat for various species of anadromous salmonids. This presentation will report initial findings of the Intrinsic Potential model and the Ecosystem Diagnosis and treatment model. Risk and donor stock assessments are also underway. The risk assessment includes genetic, ecological, demographic and disease risks of various donor stocks under 3 different reintroduction strategies (volitional passage, transplanting adults, and releasing hatchery juveniles). Results may not be available at the time of this presentation, but concepts and draft evaluations will be presented.

Chinook Spawner Abundance and Distribution in the John Day Basin

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We have been monitoring three distinct populations of wild spring Chinook salmon in the John Day River basin since 2000 to provide status and trend information that will help assess the long-term effectiveness of habitat restoration projects in the basin. Each fall, we conduct a census of redds within the basin, surveying all stream reaches that are known or believed to host spawning activity. Through the past sixteen years, redd counts have ranged from 746 to 2,195 (1,817 to 7,808 estimated spawners). We have observed similar trends of a decline followed by an increase in the Mainstem, Middle Fork, and North Fork populations; however, the Mainstem redd count is beginning to outpace the North Fork as the more productive population. Covariation among redd counts from the greater northeast Oregon region suggests a large-scale environmental effect is occurring across these populations. In addition, smaller-scale environmental changes, habitat degradation, and density-dependence affect the abundance and distribution of redds among John Day Chinook populations.

How Genomics Has Changed Our Understanding of Ceratonova shasta In the Klamath River

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Our understanding of myxozoans as a group and of Ceratonova (Ceratomyxa) shasta as a species has changed dramatically in the past decade. The confirmation that myxozoans are parasitic cnidarians has caused us to re-examine their evolutionary relationships. At the species level, we have discovered that C. shasta is comprised of several genotypes with differing host specificity. Just as the distribution of the parasite is defined by the range of its invertebrate host, the distribution of C. shasta genotypes in the Klamath River is defined by salmonid species composition as well as by anthropogenic factors such as stocking policies and construction of barrier dams. Some of the host relationships appear to be exclusive; for example, genotype 0 is detected in native trout and steelhead and genotype I is detected in Chinook salmon (with occasional detections in sockeye), while genotype II, although predominant in coho salmon, is detected more broadly across species. Distribution of genotype I is limited to downriver of Iron Gate Dam, while the other genotypes are distributed throughout the river. Sequencing of the parasite genome was initiated to identify targets for molecular assays that will allow us to directly test for the presence of the different genotypes, to better understand the factors related to their host specificity, and to investigate the molecular basic of virulence differences between genotypes.

Pacific Lamprey: Keeping the 450 Million Year Tradition Alive and Strong in the Upper Columbia

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Pacific Lamprey, Entosphenus tridentatus, is a species of great cultural and ecological value in the Pacific Northwest. The ancient eel-like fish is declining in abundance and distribution throughout their range, including the Columbia River Basin. The Yakama Nation Fisheries has led adult lamprey reintroduction projects throughout the Yakama Nation Ceded Lands between 2012-2016, with reintroduction focusing in the Yakima, Wenatchee, and Methow subbasins, areas where Pacific Lamprey are extirpated or functionally extinct. Successful spawning of reintroduced fish has been documented in all of the translocated streams within the Yakima Subbasin through sampling of larval lamprey and the use of parentage genetics analysis. More recently in 2016, young of the year larvae were also found in extirpated areas within the Wenatchee and Methow subbasins; genetic analyses are pending to confirm their parental source. The number of larval Pacific Lamprey and its distribution within the Yakima Subbasin has increased steadily since reintroduction began in 2012. However, Pacific Lamprey still face many threats within the Upper Columbia Basin and Columbia Basin at large. Adult passage rates are still low (~50%) at many of the large hydroelectric dams as well as at smaller diversion dams. Passage rates of juvenile lamprey at large hydroelectric dams are largely unknown, and entrainment of larval lamprey in irrigation diversions is a serious threat to their early life history, especially in some of the Upper Columbia tributaries where diversions are abundant. The specific threats and issues that lamprey face have become clearer over the years, partly as a result of the translocation success. As a result of partnership and collaboration, various efforts are underway to mitigate and reduce the existing threats for Pacific Lamprey, such as through the implementation of adult passage structures at dams (vertical wetted wall structures installed recently), reduction of ramping rates at irrigation diversions, and larval lamprey salvage and rescue efforts within these diversions. Intense and extensive monitoring is also being undertaken to better understand status and trend, changes in distribution, and their population dynamics. Artificial propagation work began in 2012 and plans are underway to outplant these larvae in 2017 in select locations in the Upper Yakima and Naches subbasins. Lamprey can easily take a backseat to salmon in terms of management priority (in the day to day decisions as well as long term planning), so collaborative efforts among all stakeholder agencies is vital to improve the conditions drastically for the Pacific Lamprey species.

Emergence Timing, Threshold Traits and Life History Variation in Chinook Salmon

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Genetic and environmental variation are well known factors affecting life history variation in Chinook Salmon. Two of the major axes of life history variation in Chinook Salmon are the age and seasonal timing of smolting and maturation. Both smolting and maturation are developmental processes that regulate the timing of entry and exit from the ocean. Ocean entry and exit are the key transitions that define the anadromous life history of salmonids. Smolting and maturation may both be described as quantitative threshold traits (Roff 1996). The traits are binary (smolt = yes or no, mature = yes or no) but there appears to be a quantitative distribution of physiological characters (size, growth or adiposity) that relates to the initiation of the developmental process (smolting or maturation). The developmental process is triggered when the physiological character crosses a threshold. The threshold is a theoretical concept that has not been defined biologically, but there is empirical data that appears to support the concept in many taxa.
We conducted an experiment to explore the role of emergence timing and concomitant entry into the seasonal photoperiod cycle on life history variation and quantitative thresholds in Umatilla Fall Chinook Salmon. First feeding fry were ponded into 3 different photoperiods, matching light cycles representative of 15 Dec (early), 1 Mar (mid) and 15 May (late), and then maintained on a normal seasonally changing photoperiod. In addition, two different feeding treatments (Hi and Lo) were initiated for fish under each photoperiod cycle, resulting in 6 experimental groups. Fish were examined monthly to assess smolting and early male maturation. Differences in photoperiod at emergence resulted in significant life history differentiation. Fish ponded at an early photoperiod tended to smolt within 6 months post-ponding and a significant number of males matured within the 1st year of rearing. In contrast, fry ponded under a late photoperiod did not smolt as under-yearlings and no males matured in the 1st year. These data directly show that life history variation occurs due to variation in photoperiod at emergence. Moreover, the data supports the existence of thresholds for the initiation of developmental traits as all fish were of the same age and sizes and growth rates were matched through the feeding treatments. Fish were of the same size and same age but they smolted or matured depending on the photoperiod cycle they had received, suggesting that the threshold for development differed among experimental groups.

Streamflow Restoration: Techniques and Tools in Whychus Creek, McKay Creek and the Upper Deschutes

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Fish need flows, but how do we get them? Many stream reaches in the west are over-appropriated and suffer from low streamflows at certain times of the year. Water trusts use a

variety of tools to work with irrigators to secure flow back instream for fish and wildlife purposes. These tools include instream leases, instream transfers, conserved water projects and management agreements. Approaches need to be tailored to be successful in a wide variety of ecological and socio-political contexts. The DRC will share its experience designing and implementing these tools to restore flows in Whychus Creek, McKay Creek and the Deschutes River.

Lessons from Teaching Multicultural Perspectives in Natural Resource Management

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Oregon State University requires all undergraduates to take a course in Difference, Power and Discrimination, ideally related to their major. The Fisheries and Wildlife Department offers Multicultural Perspectives in Natural Resources to fulfill this requirement, attracting 60 on campus students per year and over 100 Ecampus students. Over the years we have learned some important lessons about teaching diversity to undergraduate natural resource majors. This presentation will provide those insights, and engage the audience in at least one of our most powerful teaching activities.

Isolation, Migration, and Local Recruitment Drive Persistence of Cutthroat Trout Despite Rainbow Trout Invasion

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All cutthroat trout shared a common ancestor around two million years ago in the present-day Great Basin and have since evolved into numerous highly diverse subspecies distributed from Alaska to New Mexico. Despite wide geographic distribution all are threatened by non-native invasions, hybridization, and loss of life history diversity. The upper Snake River basin, ID contains highly diverse evolutionary lineages of cutthroat trout with increasingly rare migratory life histories, making them a conservation priority. We analyzed 67 SNPs to describe hybridization and evaluate the influence ancient hydrogeological connections and contemporary connectivity on the genetics of Yellowstone cutthroat trout in seven tributaries near American Falls Reservoir. We detected cutthroat trout in all but one site despite significant historical stocking of rainbow trout. Many low-elevation sites near the reservoir contained Yellowstone cutthroat trout in sympatry with early-generation hybrids and rainbow trout yet contained no physical barriers to admixture. A posteriori assignment tests suggested that migrants from a nearby headwater population and possibly recruitment by local-origin cutthroat trout with fluvial or adfluvial life histories drive persistence in these sites. In contrast, hybridization was rare or absent in headwater populations and was associated with complete or

apparent physical isolation. We also compared genetic diversity of our samples with Yellowstone basin Yellowstone cutthroat trout and Bear River Bonneville cutthroat trout to examine possible historical gene flow resulting from hydrogeological connections during the Pleistocene. Multivariate analysis showed that most genetic variation among individuals was explained by divergence of Yellowstone basin Yellowstone cutthroat trout from our samples and Bear River Bonneville cutthroat trout, which supports recent mtDNA studies and a possible change in taxonomic nomenclature. Our results indicate that, due to relative isolation and downstream emigration, headwater populations are critical to the persistence of cutthroat trout and thus loss of such populations would likely threaten the subspecies throughout the region. Management actions to reduce threats from established, nonnative rainbow trout populations will likely have to be multifaceted and may include a combination of targeted removal of rainbow trout and hybrids and the use of physical barriers to prevent further dispersal.

An Evaluation of Three Spring Chinook Salmon Genetic Pedigrees In The Upper Willamette River, Oregon

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Salmon migration and spawning behavior are often negatively affected by the construction and operation of large dams used for hydroelectric or flood control purposes. Therefore, the viability of many salmon populations are often contingent upon the intervention of management agencies to facilitate dispersion above these migration barriers. Yet, the efficacy of releasing salmon into historical spawning habitat located above these dams is largely unknown. However, genetic monitoring programs allow researchers to utilize the powerful method of parentage analysis to evaluate and quantify the population viability of reintroduced salmon. Here, we first discuss how parentage analysis has enabled the reconstruction of genetic pedigrees to estimate population productivity for spring Chinook salmon released above high-head dams located on the South Fork McKenzie, North Santiam, and South Santiam Rivers. Second, we synthesize and present results from the large body of pedigree data that has been collected across these three sub-basins over the last decade. Third, we compare and contrast the three sub-basins across time to identify important patterns and discuss these results. Overall, the findings of this review highlight the utility of using reconstructed pedigrees to inform conservation management and demonstrate the usefulness of examining population productivity metrics at a broader spatiotemporal scale.

Population Recovery: Guidelines Translated Into Quantitative Metrics

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How many fish does it take to recover a population? Recovery plans typically provide

guidelines for what recovery should look like. Yet, often it isn't obvious to those tasked with recovery what information is needed, how information is to be collected and what is success. If recovery of ESA-listed species are tied to minimum viability standards included in Salmonid Recovery Plan(s), then plan guidelines form the basis for development of quantitative measures to gauge progress and/or attainment of recovery objectives. Guidelines for salmonids prioritize population viability analysis, which requires credible abundance information that is often unavailable and viability analysis is sensitive to assumptions (Winter-Run Chinook example discussed). An alternative approach using trends in effective population size (Ne) and compilation of hatchery fish presence (pHOS) provides a means to measure recovery performance. A layperson's description of effective population size will be provided along with how the metric is measured. The relationship of Ne to viability will be discussed using examples from Chinook Salmon, Rainbow Trout and Delta Smelt, with specific quantitative metric thresholds associated with recovery plan guidance provided. Measurement of the fraction of adult spawners in-river that originated from a hatchery (pHOS) and the implications for population recovery given associated metric thresholds will also be discussed. The presentation closes with descriptions of some important misalignments between policy (guidelines) and biological reality.

Aquatic Invasive Species Prevention: Watercraft Inspection and Permits

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The introduction and spread of Aquatic invasive species (AIS) drastically alter an eco-system, by destroying or at the very least disrupting at the very lowest level of the food web, creating condition so that water cannot be used for fish and wildlife, livestock, humans, to create power and irrigation. Once AIS are established in a system it could cost millions, if not billions of dollars just to control; often with very little chance of eradication or restoration to pre-introduction conditions.
Prevention is the least expensive and the most effective way of preventing AIS from entering the state. The watercraft inspection program is the first line of defense against the introduction of AIS species such as quagga and zebra mussels and to help contain the spread of AIS species that may be established in some areas of the state but at this time not statewide.

Are Recent Increases in Columbia Basin Natural-Origin Steelhead Adult Return Abundance A Response To Restoration Actions?

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Actions to improve freshwater habitat quantity and quality are widely recognized as essential to recovering Columbia Basin salmon populations listed under the Endangered Species Act. Efforts to quantify the effectiveness of these actions in improving salmon abundance and productivity are increasing, but still rare. A number of agencies and organizations have been collaborating to recover threatened steelhead populations in many tributaries upstream of Bonneville Dam with many hundreds of reach-specific habitat actions implemented regionally over the past 15-25 years. We analyzed estimated adult steelhead return abundance data sets for several of these streams dating back to the mid-1980s. An increase in adult steelhead return abundance is apparent in all streams for the most recent seven return years when compared to prior years. However, the proportionate increase is more pronounced in some tributaries relative to others. The proportionate increase is especially pronounced in the Yakima River Basin where steelhead kelt reconditioning (short-term artificial rearing of post-spawned fish for the purpose of sexual rematuration and repeat spawning) is being combined with habitat actions to achieve restoration goals. This talk is intended to be a technical dialogue discussing whether we may be seeing an adult fish response to concerted regional efforts to improve habitats and fish runs and to solicit input on where to take this analysis from here.

Columbia Habitat Monitoring Program (CHaMP) Lessons Learned

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CHaMP is a habitat monitoring program that assesses fish habitat status and trends as well as the effectiveness of habitat restoration actions. CHaMP uses multiple scales of assessment from field data collection to model development. CHaMP has methods for translating reach level estimates into basin and population totals. This talk will synthesis the developments and lessons learned within CHaMP over the past five years.

Oregon Spotted Frog Biology, Threats, and Conservation Strategies

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Recent federal listing of the Oregon Spotted Frog (OSF) and subsequent law suits related to this species have thrust the frog into the public spotlight. Understanding the basic biology and ecology of the species is critical but often neglected in discussions. Measures proposed for conservation impact rivers, farmers, and fish. Oregon Spotted Frogs are highly aquatic, requiring different habitat for breeding, summer foraging, and winter survival. These needs pose different threats at different times of the year. As with many species, OSF evolved unique survival strategies that may not be well suited to altered ecological landscape, changing climate conditions, and introduced predators and pathogens. We present data from nearly 20 years of monitoring a once robust population of OSF in Sunriver, a site adjacent and connected to the Deschutes River, with observations of impacts from hydrological manipulation and the recent introduction of bullfrogs. Sunriver's unique weir-controlled hydrology may have contributed to OSF success and may hold important information for conservation efforts elsewhere in the Deschutes Basin.

Successes and Opportunities for Warner Sucker Passage

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River Design Group, Inc. (RDG) is collaborating with local and regional organizations to address Warner sucker (Catostomus warnerensis) passage in the Warner Basin. The Warner sucker is endemic to the Warner Valley, an endorheic subbasin northeast of Lakeview, Oregon. Stream modifications largely for irrigation development, as well as impacts from non-native fish species, have affected the distribution of this federally threatened fish species. RDG assisted the Lake County Umbrella Watershed Council, U.S. Bureau of Land Management, and private landowner with the design and installation of a technical fishway to provide fish passage around an irrigation diversion. RDG and Oregon Department of Fish and Wildlife (ODFW) have monitored fish ladder hydraulics and sucker movement through the fish ladder. Lessons learned from project monitoring will be used in future Warner sucker fish passage designs. Project collaborators are currently reviewing fish passage designs for four additional obstructions on Twentymile Creek, Deep Creek, and Honey Creek, the three primary Warner sucker streams in the Warner Valley.

Shifting Age Class of Summer Steelhead Smolts In The South Fork John Day River

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The John Day River basin supports wild populations of ESA listed Mid-Columbia River summer steelhead, and also resident trout (both Oncorhynchus mykiss). Juvenile summer steelhead exhibit variability in age at which smoltification occurs. According to scale samples collected at the South Fork John Day rotary screw trap (2005 to 2015), steelhead predominantly emigrate at Age-1 and Age-2. From 2005 to 2010, approximately 75% of captured migrants were Age-2 compared to 18% being Age-1. Starting in 2011, we observed a shift in these age classes towards a higher proportion of Age-1 fish. Age data during the migratory years of 2012 to 2014 showed nearly equal proportions of Age-1 and Age-2 migrants, while in 2015 the age structure returned to previous levels. We attempt to explain this change by analyzing basin-scale total biomass of juvenile steelhead as a possible limiting factor influencing the shift in age structure. We also analyzed condition factor, abundance, stream temperature, and stream flow to evaluate their effects across the age groups.

Occurrence and Implications of Toxic Contaminants in Oregon's Aquatic Environments

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More than 80,000 different chemicals are in use in the United States. Although they have intended beneficial uses, when they reach the environment, they may become pollutants potentially affecting aquatic life and human health. In 2007, the Oregon Legislature funded the Oregon Department of Environmental Quality to begin the Statewide Water Quality Toxics Monitoring Program with the goals of characterizing the presence and concentration of chemicals of concern and identifying potential sources of these chemicals. To achieve these goals, DEQ developed a monitoring plan that used a rotating basin approach to conduct a reconnaissance sampling of each basin on a five-year cycle. Samples were cleaned and prepared for analysis following Oregon Health Authority guidelines. DEQ analyzed samples for over 400 unique chemicals and detected chemicals. The largest variety of chemicals was detected in the Willamette Basin. Statewide results indicated a number of exceedances to Oregon Health Authority consumption guidelines. These exceedances occurred both on the coast and inland and were not limited to piscivorous or predator species. These results will help inform the public and fisheries managers of potential pollutants. In some cases, a change in the cleaning guidelines may reduce potential risks to the public. DEQ plans to continue tissue sampling in 2016 with a focus on crayfish, while 2017 sampling will return to finfish sampled from lakes around the state.

Improving Biodiversity to Build Resilient Urban Ecosystems

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Portland, Oregon is the largest city in the Columbia River Basin. It separates itself from other basin cities not only by size, but by salmon. The rivers and streams that flow through the city provide habitat to all 15 of the basin's ESA-listed fish populations. That distinction has driven Portland to focus on how it can help state and federal agencies tasked with recovery improve the trajectories of these fish toward delisting. This presentation will describe how the city incorporates the restoration of biodiversity into its public works projects, and how that model has not only improved fish habitat and production, but created stronger and more elastic ecosystems designed to better withstand future growth and climate change.

Catch Rates, Apparent Survival, Growth, and Species Composition of Juvenile Endangered Suckers in Upper Klamath Lake: 2001-2015

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Upper Klamath Lake populations of Lost River and Shortnose Suckers are decreasing because adult mortality, which is relatively low, is not being balanced by recruitment of new suckers into known adult spawning aggregations. Age and size composition data indicate that most adult suckers that join annual spawning aggregations were spawned around 1991. The causes of juvenile sucker mortality are unknown. We compiled and analyzed catch, length, age, and species data on juvenile suckers from Upper Klamath Lake from seven prior studies conducted between 2001 and 2015 to look for annual variation in apparent production, survival, and growth. Despite several relatively high production years, juvenile suckers appeared not to survive to adulthood. The combined evidence from several studies by USGS and Oregon State University indicates that years of relatively high age-0 sucker production occurred in the late 1990s through 2000 or 2001, in 2006, and in 2011. Relatively high growth rates for both species in 2006 indicate that it was a year of favorable conditions for age-0 suckers. However, in 2007, a high rate of decline in the proportion of nets to capture age-1 suckers and low overall catch rates of older juvenile suckers indicated that high rates of mortality, emigration, or both occurred through the second year of life. Using the same gear in another water body, catch rates for juvenile suckers declined much less rapidly, indicating that reduced selectivity alone could not explain the pattern in Upper Klamath Lake. Furthermore, Shortnose Suckers made up the majority of age-1 and older suckers identified to species, which may indicate that they have higher survival than juvenile Lost River Suckers.

Forensic Science and Fisheries: Genetics as a Fishery Law Enforcement Tool

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Forensic science plays a unique role in the management of recreational and commercial fisheries. Legal requirements imposed at the local, State, and Federal levels guide programs aimed at sustainable use, as well as programs that address ecological and conservation concerns. Genetics is increasingly being used as a tool in fisheries research and management, including those activities aimed at enforcement of fishery laws and regulations. Scientists at the US Fish and Wildlife Service's National Fish and Wildlife Forensic Laboratory in Ashland, OR use genetic techniques to provide scientific testing and expert testimony as requested by the courts. Forensic genetic analyses are used in wildlife crime prosecutions to determine the identity of an evidence item, or to establish a link between the evidence, a crime scene, and a suspect. This talk will present an overview of how genetics techniques are being used to address fisheries crimes on regional, national, and international levels to answer questions related to species and stock identification, geographic origin, and individual matching.

Exploring the Mechanics of a Flared Preopercle In Sculpins

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Defensive structures in fishes come in a wide variety of shapes and sizes, but are often derived from modifications of the bony elements of the fins into rigid spines (e.g., Siluriformes, scorpaenids) or modification of the scales into spines or scutes (e.g., Acipenseriformes, dasyatids). Another evolutionary source of material for defensive structures is the cranial bones which, especially in the fishes historically classified in Scorpaeniformes, may bear sharp, spiny processes. One group of fishes, the cottoids, possess modified preopercle bones that bear at least one but often several large, sharp projections. Though remarkable in both their size and diversity, the function and deployment of these spines has historically received little scientific study. To characterize the mechanism(s) by which sculpins "flare" their preopercular spines, we used high-speed filming and dissection to develop a hypothesis of muscle activation and bone movement, then used 3D models of movement and placement of the bones, as well as electric stimulation of muscles to test our hypothesis. Our results show that the flaring of the preopercle can be achieved through contraction of the levator arcus palatini muscle. Flaring can also be achieved by retractive movement of the basibranchial bones, which apply lateral force to the preopercles via the hyoid series. Together with the infraorbital series, these bones form a rigid brace around the flared preopercle, which may serve to increase the structural integrity of its

flared position, with clear implications for its putative use as a predation deterrent.

Round Butte Dam Forebay Flow Evaluation, Lake Billy Chinook, Oregon

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Complex reservoir currents may influence out-migrant juvenile salmonids navigating dammed river reaches during downstream migration. The three tributary arms of Lake Billy Chinook, Oregon, (the Metolius, Deschutes, and Crooked Rivers) converge in a primary mixing zone immediately upstream of Round Butte Dam and its associated forebay. Located within the Round Butte Dam forebay, the Selective Water Withdrawal (SWW) intake structure (completed in 2009 as part of a FERC re-licensing condition) was designed to reorient surface currents within the Round Butte Dam forebay toward the intake structure to attract out-migrant salmonids into the fish entrances. Fish attraction flows are described as a zone of influence where flow is directed toward the SWW fish entrances at higher velocities and in a more organized field than under background reservoir conditions. The attraction flows vary continuously as generation changes because fish collection is tied to power generation. To assess the influence of SWW operations on forebay flow conditions we deployed acoustic Doppler current profilers (ADCP), two stationary and one mobile, during the two-month (April - May, 2015) primary salmonid out-migration season. Using a horizontal ADCP mounted to the surface intake gates (i.e., fish entrances), we determined the zone of influence has a maximum range of approximately 370 feet, at 10 feet in depth, during peak generation discharge scenarios. The zone-of-influence range directly correlates with generation discharge through the SWW surface intake and is highly sensitive to fluctuations in discharge. Additionally, sustained wind events in the forebay vicinity have a substantial impact on the zone of influence. Due to the orientation of the reservoir walls and the SWW surface intake entrances, westerly and southwesterly winds tend to increase the range of the zone of influence, while easterly and southeasterly winds tend to decrease the range. Wind-induced currents are most prominent within 10 feet of the surface but are detectable down to 20 feet in depth.

Thermal Benefits: An Overlooked Component of In-Stream Habitat Restoration

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In the Pacific West, summer water temperatures in 99% of streams have increased by

0.1°C/decade since the mid-1960s. Global climate change models agree that stream temperatures will continue to increase in the foreseeable future. Much of the Pacific West now exhibits thermal impairment of waterbodies, and temperature-sensitive taxa such as Pacific salmonids already encounter thermal barriers that impede migrations, forcing range contractions. These impacts are not limited to salmonids, but rather extend to include additional important fishes such as herring and lamprey. Currently, temperature mitigation efforts focus on maintaining or restoring riparian buffers to augment stream shading and reduce accretion of additional thermal load. While effective at buffering streams from warming effects of solar radiation, shading does little to cool water that is already warm. Roads, urban development, and agricultural uses can logistically limit practical riparian buffer widths and function. Moreover, imperiled fish stocks may not be able to wait the decades necessary for the functional benefits of riparian plantings to be realized. As a result, there is a compelling need for techniques that effectively promote in-stream cooling. One mechanism proposed to cool stream water is forcing the water to infiltrate the channel bed and interact with hyporheic substrate. During summer months, ground temperatures underneath the stream bed are substantially cooler than stream water temperatures. When warm stream water is forced into interstitial spaces between stream bed substrate, this water interacts with particles that are cooler than the water itself. Rate of water cooling depends on the temperature differential between the water and hyporheic substrate, as well as the spatiotemporal dynamics of this water-substrate interaction. Spatially longer hyporheic path lengths and temporally longer residence times are generally associated with cooler upwelling zones. When they promote deep downwelling, habitat structures show demonstrable temperature-moderating effects. If accomplished on a sufficiently large spatial scale, techniques making use of such structures have the capacity to lower in-stream water temperatures downstream of the placement. We hypothesize that thermal impairments can be addressed by local increases in exchange between surface and subsurface waters. Consequently, we analyzed series of temperature data associated with different types of restoration projects, and undertook a synoptic review of published data to determine differences in temperature above, below, and through reaches that received restoration treatments. Findings from this study could inform management of temperature problems in salmonid streams in places where competing interests such as agricultural land uses, and physical constraints like roads might preclude conventional responses to temperature issues.

The Complexities of Managing Water Quality with Hydropower Operations at the Pelton Round Butte Project

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The Pelton Round Butte Project is a three dam complex owned and operated by Portland General Electric and the Confederated Tribes of the Warm Springs Reservation of Oregon on the Deschutes River in central Oregon. Round Butte Dam, the upstream most dam was completed in 1964 creating Lake Billy Chinook (LBC) at rkm 177. LBC is fed by three tributaries the Crooked, Deschutes, and Metolius Rivers, and each are characterized by groundwater inputs of different temperatures. Cold dense Metolius River water fills the bottom of the reservoir while

Crooked and Deschutes water fills the reservoir from the surface down. Prior to 2009 the reservoir had exclusively deep (hypolimnetic) water withdrawal, altering discharge temperatures down the lower Deschutes River with cooler water discharged in the spring and warmer water discharged in the fall than would have occurred naturally. Additionally, surface currents in Lake Billy Chinook moved upstream in the Metolius Arm, so that out migrating salmon and steelhead smolts could not locate the fish collection facility in place in Round Butte Forebay. Consequently, downstream fish passage was lost in the late 1960s. In 2009 a selective water withdrawal (SWW) tower and fish collection facility was completed in Round Butte Dam forebay. The SWW was designed to address two goals of the Project's (2005) FERC license. The first goal was to allow for surface water withdrawal mixed with deep water withdrawal to modify temperatures downstream of the project at rkm 161, patterning seasonal temperature cycling that would occur without the dams in place. The SWW was also expected to help meet dissolved oxygen and pH targets in the Deschutes at rkm 161. Since SWW discharge temperature cycling has more closely followed predicted without project temperatures. The SWW was also designed to create attraction surface currents for migrating smolts. Following SWW salmon and steelhead smolts are being passed downstream, though numbers are lower than license goals. Targeting each water quality criteria at rkm 161 while meeting requirements of the new license has proven challenging.

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2017 OREGON CHAPTER AMERICAN FISHEREIS SOCIETY ANNUAL MEETING
COMMITTEE POSTER SESSION
NATIVE FISH COMMITTEE

The Native Fish Committee of the Oregon Chapter American Fisheries Society (OCAFS) is the most popular and active committee in the Chapter. The goal of the Native Fish Committee is to emphasize native fish, their protection and restoration and enhance our membership's and society's understanding of the species. To accomplish this, the Native Fish Committee:

is available to the OCAFS for native fish issues that arise throughout the year. This includes coordinating with the Legislative Committee to identify pertinent issues.

provides opportunities for OCAFS members and others to learn about native fish of Oregon.

recognizes fish biologists within the State of Oregon that are outstanding in the field of native fish conservation.

expands our taxonomic understanding of native fishes within Oregon.

identifies conservation data gaps associated with native fishes in Oregon.

identifies native fishes issues to elevate to the OCAFS for action.

The primary reason behind the popularity of the Native Fish Committee is because their members are actively involved in an issue in which they have passion. Annual activities include the Nongame Native Fish Workshop and the selection of the OCAFS Native Fish Conservationist of the Year. The annual Nongame Native Fish Workshop features a nongame native fish species in Oregon for a field orientated 24-hour workshop. Featured past species were Modoc and Warner suckers (2013), Blitzen River Whitefish and Borax Chub (2014), the sculpin species of the Necanicum River (2015), and the Umpqua Dace, Chub, and Pikeminnow (2016). Oregon Fisheries Biologists achieving the recognition of Native Fish Conservationist of the Year are Oregon Department of Fish and Wildlife's Paul Scheerer (2015) and U.S. Bureau of Land Management's Jimmy Leal (2016).

To Evaluate a Predator: Potential Compensatory Responses of Piscivores in the Columbia and Lower Snake Rivers from 1990-2016

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Since 1990, the Northern Pikeminnow Management Plan (NPMP) has applied targeted removal fisheries in the Columbia and lower Snake Rivers to reduce predation on out-migrating juvenile Pacific salmon and steelhead (Oncorhyncus spp.) by restructuring populations of northern pikeminnow (Ptychocheilus oregonensis). From 1990-2016, the Oregon Department of Fish & Wildlife collected biological data from northern pikeminnow, smallmouth bass (Micropterus dolomieu), and walleye (Sander vitreus) in an effort to assess potential compensatory mechanisms that may dampen the presumed benefits of the NPMP. Piscivorous predators were collected in three separate areas (forebay, mid-reservoir, and tailrace) of Columbia and lower Snake River reservoirs, on a rotating three year basis. Additionally, ODFW collected northern pikeminnow at John Day and The Dalles Dams annually from 2006-2016 for the same purpose of evaluation. Though targeted removals of larger individual northern pikeminnow may increase survival among migrating juvenile salmonids, compensatory responses by remaining northern pikeminnow or other predatory fishes may offset the net benefit of removal. To evaluate this hypothesis, we compared data from our time series to assess potential compensatory responses of salmonid predators to sustained removals of northern pikeminnow in the form of changes in 1) abundance 2) condition; 3) consumption; and 4) population size structure.

Potential Effects of Alkaline pH on the Migratory Behavior of Reintroduced Juvenile Anadromous Fish

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In 2009, Portland General Electric constructed a $90 million Selective Water Withdrawal Tower in Central Oregonâ€™s Round Butte Dam complex in an attempt to aid the downstream migration of juvenile Chinook salmon (Oncorhynchus tshawytscha) and steelhead (Oncorhynchus mykiss) through Lake Billy Chinook. The tower was designed to create an artificial current in the epilimnion of Lake Billy Chinook to help guide juvenile anadromous fish through the reservoir. However, total migration of juvenile salmon and steelhead from their planted headwaters (the Crooked, Deschutes, and Metolius Rivers) through the reservoir since their reintroduction in 2010 has been unexpectedly low. Data collected by the Deschutes River Alliance (DRA), accompanied by available literature, suggests that the alkalinity of the reservoirâ€™s epilimnion may influence juveniles to preferentially avoid the surface current by spending time in a water zone with a more neutral pH. As a result, juvenile fish may be exposed to a variety of negative stressors including membrane degradation, increased parasitic load, more time spent in the reservoir, and even a higher amount of predation by other fish. This poster illustrates the potential effects of high pH on juvenile salmon and steelhead, and how pH may be a key to discovering why ongoing migration success of juvenile salmon and steelhead through Lake Billy Chinook is low.

The Goldilocks Fallacy: Searching for The Perfect River

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Channel relocation and reconstruction have become common place, perhaps even a bit pedestrian, in Pacific Northwest stream restoration. In the past, we often strove to increase available aquatic habitat by lengthening a channel, decreasing the spacing between pools, changing the channel width, or adding large wood. As a stream restoration community, we were historically very channel-centric with much of our design time dedicated to calculating the perfect channel size not too big, not too small, but just right. Our goal was to create the ideal transport channel to pass water, sediment, organics, and species while neither appreciably

aggrading nor degrading. We dialed in the stream slope, cross-sectional area, and roughness to achieve a state of perceived channel bliss. When the newly minted channel adjusted during high flow events, and those changes were not anticipated, we scratched our heads and wondered which parameter we got wrong.

Nowadays, we are more likely to work not only in the channel, but on the floodplain as well. We've raised stream beds, added side channels, alcoves, seasonally inundated wetlands, and large wood to floodplains as well as channels, thus recognizing that a stream system functions over a whole host of flows and that flow diversity often improves biodiversity. Yet we still struggle to determine if we should construct one, two, three, or, even more revolutionary, perhaps no channels? Is five too many, is one is not enough? What is just right?

In 2013, an update to the Channel Evolution Model was developed by Cluer and Thorne the Stream Evolution Model -- which included a significant addition of the zero-stage channel. The zero-stage channel acknowledges the work of Walter and Merritts from 2008, that perhaps our view of a single-thread channel is really based on previously modified stream systems, and that prior to European settlement streams were more likely small anabranching channels within extensive vegetated wetlands. Somewhat in parallel, Pollock and others in 2014 developed a similar stream evolution approach, but added a twist to the zero-stage channel systems that could have one channel, multiple channels, or no channels at all. Unfortunately, the stream evolution diagram with this important detail did not make it into the final manuscript; however, the authors identified the very issue that the stream restoration community is now facing what is the right number of channels in a channel/floodplain reconstruction design?

This talk will review our current understanding of various channel planforms and will propose a way forward for restoration designers who are struggling with the how many channel conundrum.

The Oregon Chapter of the American Fisheries Society: Maintaining the Legacy

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The Oregon Chapter of the American Fisheries Society (ORAFS) is a 53 year old, non-profit organization comprising about 482 active members and is one of the largest and most active chapters of AFS! ORAFS has earned AFS's prestigious Outstanding Chapter Award 13 times since 1992, including the past two consecutive years, 2014-2015. The mission of ORAFS is to: improve the conservation and sustainability of Oregon fishery resources and their aquatic

ecosystems for long-term public benefit by advancing science, education, and public discourse concerning fisheries and aquatic science and by promoting the development of fisheries professionals. To achieve this mission, ORAFS works to: 1) develop programs that advance understanding of fishery science and responsible stewardship of fishery resources, including hosting high-quality annual meetings and workshops; connect members with opportunities to participate, and communicate; 2) advocate policies and laws that benefit the conservation and sustainability of fishery resources and aquatic ecosystems (including through use of a Legislative Liaison); 3) increase awareness, understanding, and appreciation of fishery resources; 4) promote development of fishery and aquatic science students; 5) support and encourage development of professional members; 6) maintain an active and diverse membership; maintain and manage ORAFS finances and investments to promote fiscal responsibility. Significant opportunities and challenges lie ahead as ORAFS plans for the future. Some opportunities include casting a broader net to include, recruit, and retain diversity (by gender, ethnicity, and profession) in ORAFS. Some challenges include achieving more and sustained involvement from these diverse groups, staying active in legislative issues, use of appropriate and cost effective venues for annual meetings, maintaining financial sustainability, and identifying future expenditures that support the ORAFS mission.

Incorporating New Technologies into ODFW's Research and Monitoring

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ODFW's mission is to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations. For fish, this represents >70 native species and subspecies. Assessing the status, limiting factors, threats, and effects of management on so many species across a large landscape poses challenges. For the limited number of species that are currently monitored, new technologies such as eDNA, remote sensing, and genome sequencing have potential to provide similar types of data more cheaply and with less risk to field staff, or to provide new types of data that are potentially more informative to managers. For species that have less monitoring, new technologies have the potential to allow ODFW to gain useful information on distribution and threats within a limited budget. There are several challenges to incorporating these technologies at a large scale. One is integrating these technologies into an existing infrastructure, or in some cases building an entire infrastructure for data collection, storage, analysis, and dissemination. Another is providing assurance to stakeholders that new data streams are sufficiently resolved and cost effective to be feasible and useful for decision making. Additionally, there may be need to reassess current processes with

multiple partners regarding long running datasets and the potential to switch metrics. Last, because many new technologies require specialized training there are challenges associated with training or recruitment. This talk will explore how ODFW is considering incorporating several new technologies into its overall strategy for RME.

Incorporating Climate Change into State Fish and Fishery Management

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Climate change will likely result in changes in the distribution and persistence of some fish species in Oregon. Incorporating climate change poses challenges to managers and scientists given the range of effects on different species derived from the range of possible scenarios associated with climate projections. Thus, there is uncertainty in deciding what to do (and when) and deciding what not to do. While there have been significant advances in climate science and analytic methods incorporating climate projections into biological models, there remain several difficulties in determining the best path forward. These include difficulties in conveying the uncertainty in a meaningful and digestible way, the need to provide certainty in the path forward against the recognition that model results may change as science advances, having limited understanding of how organisms may adapt to changes, and regulatory restrictions. This talk will explore possible ways to address these difficulties through research, monitoring, and decision-making processes that can account for climate change.

Oxbow Conservation Area Dredge Mining Restoration: Restoring a Landscape for Tribes

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The Confederated Tribes of Warm Springs (Tribes) acquired the Oxbow Conservation Area on the Middle Fork John Day (MFJD) River in 2001 to protect and restore critical habitat for Spring Chinook salmon (Oncorhynchus tshawytscha), summer steelhead (O. mykiss), and Pacific Lamprey (Entosphenus tridentatus). This 1,022-acre property was homesteaded in the 1880's for cattle ranching. About 200 acres of the property were dredged mined in the early 1940s, which washed away soils, destroyed floodplains, straightened channels, and split flows. Since acquisition by the Tribes, solutions for restoration had been sought. The Tribes used an

extensive list of partners to achieve the technical and financial support to complete this project. The project goal was to restore the physical and biological attributes of the site to benefit anadromous fish. In order to restore over two miles of river and the confluences of two tributaries, the project was completed in five phases over six years (2011-2016). Overall, about 200,000 cubic yards of earth were moved, 2,500 whole trees were used for instream large wood structures, and 25,000 trees were planted. A monitoring and maintenance plan accompanies project to track the many physical changes and vegetative responses over time. Since 2011, the property has seen a significant increase in spring Chinook spawning, with averages shifting from 13% to 25% of the total MFJD River spawning. Continued monitoring and maintenance of the project is planned for the next 5 to 10 years.

Early Phenotypic Differences as A Predictor for Juvenile Chinook Salmon Downstream Migration?

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The timing of juvenile salmonid downstream migration may be influenced both by natural life history characteristics and environmental rearing conditions. The goal of this study was to determine whether phenotypic traits expressed early in life correlated with juvenile downstream migration patterns expressed later in life. Specifically, we separated juvenile Chinook salmon based on natural emergence timing prior to the onset of feeding. At 53 mm, we used VIE to identify groups and combined groups into replicate rearing tanks. Subsequently, we implanted PIT tags and recorded group codes once fish reached a mean of 81 mm. Finally, we released fish in the upper McKenzie River in May 2016, above Leaburg Dam. Release sites were both above and below the confluence of the South Fork McKenzie River. Fish detections occurred at either of three locations, including Leaburg, Walterville, or Willamette Falls juvenile bypass. To date, we've detected 60% of fish, with the majority detected shortly after release. Variation across groups was 54-64% based on emergence timing. Detection of juvenile downstream migration will continue through Spring 2017. As many as 40% of fish released may still be rearing in upstream habitat and could migrate in the spring as yearlings. Results from this study may provide valuable information on how early phenotypic traits affect migration patterns expressed later in life.

Waterfowl Conservation in the Flood-irrigated Working Lands of the Warner Valley

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The Southern Oregon Northeast California (SONEC) waterfowl priority region consists of a discrete landscape predominantly defined by Pleistocene Lake floodplains under managed flood-irrigation. Overwintering birds in southern North America are critically reliant upon this region during spring migration (Miller et al 2005). During this migratory staging, the birds are almost exclusively utilizing flood-irrigated pasture and haylands (Fleskes and Battaglia 2004). The overwhelming threat to this wetland resource is conversion away from flood to sprinkler irrigation, often incentivized by government programs under the premise of water conservation. Rates of conversion in the Intermountain West averaged more than 120,000 acres per year from 1995-2010 (Maupin et al 2014). In response, the SONEC partnership has established a conservation delivery framework for collaborating with private landowners in priority basins to refurbish their flood-irrigation infrastructure in the historical floodplains to maintain the land use.

In appreciation of the surrogate floodplain functions that flood-irrigation maintains, such as aquifer recharge, stream thermoregulation, and sustained late season flows, addressing the lateral infrastructure was relatively ineffective when incised streams were draining the systems. Additionally, opportunities for implementing fish passage and screening invited broader collaboration. In Lake County, the SONEC partnership continues working closely with the Watershed Council and SWCD to implement total stream and floodplain restoration on working lands.

As with many rural communities, private landowners in the Warner Valley are cautious to collaborate with government and non-governmental organizations, particularly when operations may be encumbered by regulatory policy and public funding constraints. Establishing a foundation of trust and appreciation for respective stakeholder values is necessary for developing conservation momentum and achieving desired outcomes. The Lake County partners have been working with Warner Valley landowners to establish that conservation foundation and initiate restoration efforts. The SONEC partnership is poised with a suite of program outreach and funding to supplement existing support for Warner Valley producers and complement ongoing restoration planning and delivery in the valley.

This presentation will summarize our regional working wetlands and floodplain conservation program. Through the application of science and consideration of socioeconomic factors, the SONEC partnership employs biologists tasked with landowner outreach and enrollment into beneficial Farm Bill programs. Those programs are in turn used to leverage additional state and federal funds for maximizing conservation and restoration opportunities on working lands in this resource-rich landscape. The SONEC partnership's role in the Warner Valley will be discussed specifically.

Grande Ronde Chinook Life Cycle Models: Analyzing Short and Long term Effects of Habitat Restoration Strategies

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Life cycle models capable of integrating across life stage specific capacities and survivals are key tools for evaluating short term risks and longer term recovery probabilities. Life cycle models for four Grande Ronde Chinook populations have been developed incorporating empirical relationships for three sequential tributary life history stages including parameter uncertainty and annual environmental variation. Threatened spring Chinook salmon populations in Northeast Oregon have complex life histories with survival impediments throughout the life cycle. Spawning and early juvenile rearing occurs in high elevation headwater streams in the Blue and Wallowa Mountains. Juveniles rear for about 18 months prior to seaward migration and utilize diverse freshwater life histories. Freshwater habitat impacts vary considerably across the four populations and include anthropogenic changes to habitats used for spawning, juvenile rearing, downstream overwintering and outmigration. Out-migrating smolts and returning adults from Grande Ronde basin populations are also subject to impacts in the main-stem migration corridor as well as year to year environmental fluctuations there and during ocean residency. Ongoing or potential management actions include efforts to restore and protect tributary habitat, improve smolt and adult dam passage survival, improve in-river migration conditions, and reduce predation. We also incorporate the ability to evaluate alternative assumptions regarding the influence of hatchery supplementation, ongoing in three of the populations. There are significant differences in egg-to-parr, parr-to-smolt, smolt migration and smolt-to-adult survival rates between populations, resulting in varying potential responses to specific actions. Strong density dependent effects at relatively low spawner abundance levels are evident, especially Catherine Creek and Upper Grande Ronde. Late summer parr size appears to be a strong driver in survival and length is strongly correlated with summer parr density in these populations. The Grande Ronde Life Cycle models are based on empirically derived smolt and adult production relationships for each population. The life stage production relationships were explicitly formulated to link to measures of habitat conditions during the freshwater life stages. General guidance for prioritizing stream restoration efforts highlights the importance of strategies that build from current strong-holds, and directly consider underlying landscape processes. The models are designed to analyze time specific sequencing effects in habitat implementation, including realistic lags in realizing the benefits of actions such as riparian restoration. As a result, the models can be used in conjunction with strategic evaluation and planning exercises (e.g., ATLAS) to evaluate the impacts of different implementation strategies on short term quasi-extinction risks and longer term recovery progress.

My Wild Idea to Save Salmon and Steelhead Is to Close All Hatchery Augmentation Programs

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It is a common assertion that reducing or eliminating hatchery augmentation programs is necessary to save natural-origin salmon and steelhead populations. To examine its validity, we compiled information from published empirical studies and refined a retrospective analysis of Upper Clackamas River steelhead population census data to determine whether a notable decline in natural-origin winter steelhead spawner abundance during adult return years 1972-1998 was caused by hatchery fish presence. Our literature review indicated relatively weak evidence for a generalizable negative effect of hatchery fish on salmon and steelhead production. Furthermore, published papers concluding either positive effects or no detectable effect of hatchery fish outnumber those that purport a quantified negative impact. However, numerous papers provided theoretical, mechanistic explanations for negative effects of hatchery salmon and steelhead, appearing to be the basis for inference that hatchery fish impair wild fish. We also noted a number of cases where impacts of fisheries management (e.g. sanctioned harvest fisheries) or hatchery practices (e.g. timing and location of broodstock collection) were not differentiated from potential impacts of hatchery-origin fish, thereby inflating the apparent effect of hatchery fish presence. In corroboration with most studies that attempted to directly quantify hatchery fish impacts on wild fish production, we were unable to quantify a negative effect of hatchery steelhead on winter steelhead returns in the Upper Clackamas River. Winter steelhead abundance did not rebound after exclusion of hatchery fish began in return year 2001, as would be expected if hatchery fish were suppressing wild fish production. Instead, fluctuations in natural-origin winter steelhead abundance were correlated with other nearby winter steelhead stocks, indicating that environmental factors common to the region were responsible for the observed decline, 1972-1998. In summary, the currently available literature as well as our own novel analysis did not support the notion that closing fishery augmentation programs is a useful solution for â€œsavingâ€ salmon and steelhead in the Pacific Northwest.

Oxbow Conservation Area Dredge Mining Restoration: Phases 3 - 5, Planning and Construction

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The Oxbow Conservation Area, located on the Middle Fork John Day River and owned by the

Confederated Tribes of Warm Springs, has been a site of ongoing river restoration activities since 2008. Phases 3 - 5 of the Middle Fork John Day Oxbow project, from 2013 to 2016, have been a collaborative design effort between Reclamation, the Confederated Tribes of Warm Springs, and Inter-Fluve. Dredge mining in the 1930's and 1940's fundamentally disturbed the floodplain in this reach, and the Middle Fork was channelized on the north side of the valley. Phases 3-5 involved reconstructing a meandering channel within the disturbed floodplain, increasing the channel length through the area affected by dredge mining by 30 %, from 4550 ft. to 5950 ft. Over 500 pieces of large wood, along with over 1500 pieces of small habitat wood, were installed to provide cover for rearing juvenile salmonids and to encourage the scour and maintenance of constructed pools. Ruby Creek, an important cold-water tributary entering the project area from the south which had been annually disconnected from the mainstem in the summer by going subsurface through course dredge spoils, was reconstructed through the project area. Five separate alcoves were constructed to provide high flow refuge and additional cover and habitat. Temperature will be monitored in the alcoves to determine if they also provide thermal refuge during the summer.
Phase 3 construction, in the summer of 2014, involved placing the river into bypass channels on three separate occasions, while rescuing fish from dewatered portions of the mainstem. 5600 fish, mussels and lamprey (including 325 Chinook salmon and 277 steelhead) were rescued in 2014. In 2016, Phase 5 construction dewatered over half of mile of active channel over the course of two days. The fish salvage event involved 66 volunteers and rescued 23,674 fish, frogs, mussels and lamprey (including 1971 Chinook salmon and 1195 steelhead).

West Coast Salmon Climate Vulnerability Assessment

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Climate change will likely create winners and losers, meaning that some species or populations will do better in a warmer climate, while others will not. Cold-water fishes in the continental US are generally expected to contract in abundance or distribution with climate change. However, the specific environmental factors and life stages that will be most affected vary across each species' range. Identifying the most vulnerable life stage helps conservation planning and prioritization of restoration actions. To provide a broad-scale perspective on the relative vulnerability to climate change among all ESA-listed Evolutionarily Significant Units of Pacific Salmon, we conducted a Climate Vulnerability Assessment. Using an expert-based scoring system analyzed using a logic model, we ranked ESUs into 4 vulnerability bins. Six ESUs ranked Very High in climate exposure (i.e., standardized change in 4 marine and 4 freshwater environmental factors), and one ranked Very High in species sensitivity. The most vulnerable ESUs were from the Central Valley, California, Willamette Valley, Oregon, and Snake River, Idaho. We used a cluster analysis to identify ESUs with similar patterns in their vulnerability, and to identify the factors with the most influence on final ranks. Exposure to flooding, sea level rise and upwelling were the most variable factors related to final exposure rank. All 5 life stages

examined were at high or very high risk in some ESUs. Similarly, 4 external sensitivity attributes explored (cumulative life cycle effects, external stressors, hatchery impacts, and current population viability) caused very high vulnerability in the Central Valley, northern California/southern Oregon coast Chinook and coho, followed closely by northern spring Chinook and Idaho sockeye. These results will help identify the most limiting factors related to climate change when making decisions in biological opinions and other management actions.

Ribbongrass and Yellowflag Iris Control on the Metolius River

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Since the fall of 2013, the Oregon Department of Agriculture has been conducting herbicide treatments on the Metolius River near Camp Sherman for the Forest Service in an effort to control both Ribbongrass and Yellowflag iris. In this powerpoint presentation, Mike will describe the brief history of the project, it's challenges, and some lessons learned.

Can We Have Our Cows and Our Chinook Too? Reintroducing Grazing After 14 Years of Riparian Recovery on A Tribal Conservation Area

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Healthy salmon streams and cattle grazing are often viewed as mutually exclusive, due to the well-documented tendency for season-long grazing in riparian zones to damage habitat beyond its capacity for quick recovery. However, common approaches to maintaining aquatic habitat while allowing grazing, such as fencing riparian zones, have proven expensive and time-consuming. Such approaches may also reduce available forage and encourage overuse of uplands. Further, important salmonid habitat is often located on private lands, where voluntary exclosure of livestock is unpopular and thus less commonly-implemented than on federally-managed lands. Long-term success in salmon conservation where ranching and wild salmon overlap requires an approach that does't set up the problem as Fish Vs. Cows and works with the local way of life, not against it, to achieve conservation goals. An emerging strategy for grazing management in riparian zones allows for use of the riparian area by producers, while maintaining a functioning riparian area. Here, we present early results from a test of this riparian grazing strategy in the upper John Day basin, on the Confederated Tribes of Warm Springs Forest Conservation Area (FCA), where cattle ranching remains a core component of the economy. This area supports threatened mid-Columbia summer steelhead and wild spring Chinook. We sought to investigate whether allowing cattle into a riparian area that had regained some resilience after 14 years of cattle exclosure would impede the continued recovery trajectory. We assessed riparian area function by monitoring soil health, riparian vegetation, streambank stability, and in-stream habitat characteristics. Early results after three years of grazing indicate that carefully managed and well-timed grazing in a partially recovered riparian area may be compatible with continued recovery of the area, and its ability to provide high-

quality aquatic habitat for anadromous fish.

Riverscape Genetics: A Practical Guide for Methodology and Analysis of Spatial Genetic Structure in Freshwater Systems

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Traditional population genetics analysis evaluates genetic differences among groups of individuals and considers the effects of distance or simple characterization of potential barriers. Genetic variation of organisms in complex landscapes, seascapes or riverine systems, however, may be shaped by many forces. Recent research has linked habitat heterogeneity and landscape or oceanscape configuration to genetic structure and diversity by integrating theory and methods from landscape ecology, population genetics, and spatial statistics, in an approach known as landscape or seascape genetics. The hydrogeomorphic and spatial properties of riverine systems, described collectively as riverscape, present unique challenges. Studies that may be described as riverscape genetics have linked temperature, stream gradient, and confluences, to genetic variability. Lack of consistency in methodology has made comparisons across species and scales difficult. We provide a perspective on how riverscape genetics could be used to provide a more comprehensive conceptual and applied understanding of connectivity and dispersal in freshwater systems. We describe four thematic study objectives representing current and future research opportunities and describe a basic workflow for conducting riverscape genetics analysis. Although numerous methodological challenges remain, a riverscape genetics approach can enhance our understanding of habitat heterogeneity in shaping gene flow and spatial genetic structure. In turn those characteristics of populations are critical components for interpreting demographic and evolutionary consequences of habitat loss and fragmentation.

Whooshh - A Functional Tool for Upstream Reintroduction

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Watershed restoration plans have big challenges in their attempts to successfully reintroduce fish to viable upstream spawning habitats. Whooshh has developed a fish transport system (WFTS), a novel means to safely, timely, efficiently and effectively transport live migratory species through soft flexible tubes using localized pressure differentials in conjunction with a light water mist for lubrication. This is a highly adaptable system that presents a real, possible

solution to fish passage over or around dams and obstacles both small and large.
In 2014 and 2015, viability of the WFTS was demonstrated through on the ground testing/operations (WDFW and the Yakama Nations) and via physiological testing to establish the state of well-being of transported fish (Pacific Northwest National Laboratory and the Columbia River Research Lab).
In 2016, two important field tests were conducted. The first was the conclusion of a three year Yakama Nations' transport comparison study evaluating hand carriage verses WFTS transport of Chinook. This year the study included both the original 40 ft tube and a 1,100 ft tube study arm (sponsored and funded by the U.S. Bureau of Reclamation). The 1,100 ft transport was a historic first, the longest WFTS transport to date. Preliminary adult survival data suggests that the survival rates of WFTS transported fish are statistically indistinguishable from hand carriage transport regardless of tube length.
The second test was undertaken on the main-stem of the Columbia River at the Off-ladder Adult Fish Trap at Priest Rapids dam. This CRITFC Sockeye migration study consisted of ~900 Sockeye divided equally between non-WFTS (ladder passage only) and WFTS transported fish groups. The Sockeye were collected, sampled, and PIT tagged. Non-WFTS fish were returned to a raceway open to the upstream ladder whereas WFTS fish were transported through a ~100 ft Whooshh tube exiting into the same raceway as the non-WFTS fish. On the last day of sampling, 54 WFTS Sockeye were transported via a 180 ft tube directly over the dam into the forebay, bypassing the additional ladder passage. Migration tracking via PTAGIS collected PIT tag data was conducted. Both non-WFTS and WFTS Sockeye have been identified up the Columbia and into the Okanogan, Wenatchee, Entiat, Tumwater, Yakima and Methow Rivers. Sockeye have even made it as far as Lake Osoyoos in eastern British Columbia.
Preliminary analysis show that the migration times of the non-WFTS and WFTS transported Sockeye that exited into the raceway and continued up the ladder were nearly identical. In contrast, the migration times of WFTS Sockeye transported directly over dam, were reduced by greater than 10%; a finding that correlates with a reduction in migration times of greater than a day.
Updates of additional studies at the WDFW Washougal weir, at the Colville Nation Okanogan weir, and on the 2nd round DOE funded PNNL study will also be shared.

Diversity in The Water Resources Profession: A Transboundary Adventure
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Diversity in professional careers takes a variety of shapes depending on the local social, political, and cultural drivers. The water resources field is a great example of an increasing complexity when studying transboundary watersheds. This presentation will describe the experiences of personnel working on two distinct cases: an international case studying pollution transport and the impact on aquatic habitats in Israel-Palestine transboundary watersheds, and local case studying stream temperature changes in Oregon. In the Israel-Palestine case, the goal was clearly defined: to emphasize the benefits of collaborating as a diverse team consisting of Israeli and Palestinian academics, students, governmental and non-governmental officials, and

stakeholders. Besides the scientific results of a 3-year project, the project's team experienced a first-hand interaction with "different" team members. The team's dynamics fluctuated corresponding to the changing political situation as well as progress made on the research itself. In the Oregon case, the goal was a combination of moving targets: to restore tribal property, to improve Salmon habitat, to maintain funding, and to conduct a scientific research. Along this multi-year project, a team of committed members worked side by side with changing members. The team's dynamics changed corresponding to the progress made reaching the targeted goals and corresponding to the incoming and outgoing members. Although there were not strong political boundaries in this case, the background diversity of the team strongly affected the project, especially on funding and restoration progress.
On a personal level, my role on each team spread across the spectrum of an insider and outsider. As a "Palestinian citizen of Israel", I was able to provide perspective on the occasional misunderstanding and miscommunication on the language and cultural level, being well familiar with both sides. Nevertheless, as a "foreigner" studying a sensitive, highly important topic as salmon habitat in the northwest US, I was potentially tagged as a neutral team member. Besides the project goals and results, the success of each of the two projects depended on a professional team with diverse cultural, political, and social backgrounds.

Winter Steelhead Redd Density and Island Association

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There is a fairly large body of information on how juvenile salmonids use off-channel habitat associated with islands and bifurcated stream channels; however, information on how adult salmonids use island channel habitat is fairly sparse. The Oregon Department of Fish & Wildlife has conducted a census style redd survey for Winter Steelhead on a section of the Lewis and Clark River in Northwest Oregon since 2013. Our hypothesis was that Steelhead redd construction happened at a higher rate (redds-per-square meter) in the areas above islands compared to all other channel types. This seven mile section of stream is very complex, with a variety of gradients, multiple channels and valley types, and typically has 200-500 redds observed each season. Crews conducted a basic stream habitat inventory of the entire section of stream and flagged quadrants directly upstream of islands. From January through June, the project area was surveyed for Steelhead redds on a biweekly basis. We found that the areas above islands were used for redd construction at an overall rate of 1.7 times that of all the remaining habitat for the seven mile project area. The rates of use observed in above island areas (redds-per-square meter) ranged from 0 to 23 times that of all other channel types when stratified by survey reach. Additionally the redds observed just upstream of islands represented a higher proportion of the total cumulative number of redds early in the spawning season, then dropped, but remained just below 40% of the total number of redds observed throughout the season. We are currently working on expanding the number of sites in this study to include the entire Oregon coast, Umpqua basin, and lower Columbia River tributaries. This information about how adults interact with physical stream habitat may improve the performance of life cycle models, and may help guide restoration efforts in the future.

Using Underwater Video and Time-Lapse Photography To Illustrate And Document Salmonid Reintroduction Following Barrier Removal

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Documentation of fish passage success stories helps biologists, planners, and fish passage engineers to understand the dynamics of species recolonization following barrier removal (culverts, dams, etc). It is interesting to see which species return to previously blocked ecosystems, and how quickly they re-colonize. Short "success stories" also go a long way toward guaranteeing a stream of funding for undertaking these important projects. Equally as important, these success stories inspire both the practitioners and the general public to appreciate the resiliency of natural systems, and remind people of the high probability of restoring salmonids to previously blocked systems. The common framework for fish passage success stories include: the problem; the solution; and the outcome. Examples will be presented from northern California.

Introduction to the Recovery Action Mapping Tool

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NOAA Fisheries developed the Recovery Action Mapping Tool (RAMT) to track the implementation of recovery actions for species listed under the Endangered Species Act. Recovery actions, taken directly from recovery plans, are standardized, mapped, and compiled into a spatial database. The web application enables users to interactively visualize data from the action spatial database in a map viewer. The RAMT web application provides the following functions: (1) Maps actions in a Geographic Information System, (2) Tracks action implementation, (3) Fulfills NOAA Fisheries' reporting requirements, specifically related to the Government Performance and Results Act, and (4) Enables the public and stakeholders to access real-time action data via an interactive web tool.
This presentation will be a quick overview of the tool's development and a live demonstration of the web map.

Focused Investment Partnerships (FIP) - Investing in Collaborative-Based Conservation

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The Oregon Watershed Enhancement Board (OWEB) made its first funding awards for the Focused Investment Partnerships (FIP) program in January 2016. A Focused Investment Partnership is an OWEB investment that addresses a Board-identified Focused Investment Priority of significance to the state; achieves clear and measurable ecological outcomes; uses integrated, results-oriented approaches as identified through a strategic action plan; and is

implemented by a high-performing partnership.

This innovative new program is intended to promote and facilitate collaborative, partnership-based approaches to conservation at the landscape-scale. OWEB looked to lessons learned from existing grant program offerings, trends in the conservation field in Oregon and beyond, and extensive public and stakeholder input to inform the design of the FIP program. The FIP program includes two grant offerings: partnership Capacity Building and Implementation initiatives. In its first offering, OWEB awarded eight partnerships a total of $1 million in Capacity Building funding to either enhance or create a strategic action plan. OWEB also awarded six other partnerships a total of just over $14 million for the first two years of six-year planned investments in conservation initiatives.
Among those six Implementation awards is the Deschutes Partnership and their FIP initiative Habitat Restoration for Anadromous Fish Reintroduction in the Deschutes. This initiative seeks to restore the physical and biological conditions necessary for successful reintroduction of salmon and steelhead into 226 miles of historic habitat in Whychus Creek, Metolius River, and Crooked River. The Deschutes Partnership exemplifies the principles of the FIP program and has shown great progress toward their initiative's desired ecological outcomes. This talk will review the FIP program, explore this approach to investing in basin-scale collaborative-based conservation, and discuss the potential for ecological uplift with this funding framework.

Assessing the Importance of Thermal Refuge Use to Migrating Adult Salmon and Steelhead

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Salmon populations require river networks that provide water temperature regimes sufficient to support a diversity of salmonid life histories across space and time. The importance of cold water refuges for migrating adult salmon and steelhead may seem intuitive, and refuges are clearly used by fish during warm water episodes. But quantifying the value of both small and large scale thermal features to salmon populations has been challenged by both the difficulty of mapping thermal regimes at sufficient spatial and temporal resolutions, and integrating thermal regimes into population models. We attempt to address these challenges by using newly-available datasets and modeling approaches to link thermal regimes to salmon populations across scales. We discuss the challenges and opportunities to simulating fish behaviors and

linking exposures to migratory and reproductive fitness. In this talk and companion poster, we describe an individual-based modeling approach for assessing sufficiency of thermal refuges for migrating salmon and steelhead in the Columbia River.

Development of an Inexpensive Scour Chain to Monitor Gravel Movement in Large Rivers

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Evaluation of gravel augmentation in large rivers downstream of dams presents a challenge. Deep water in combination with high water velocities and relatively stable flows limits the usefulness of traditional scour chains. On uncontrolled rivers, traditional scour chains are buried in the substrate during periods of low flow to a known depth and then recovered and measured when water recedes. This approach does not work when it is not possible to access the gravel bar to install or retrieve the chain. To evaluate movement of gravel added to the Klamath River downstream of Iron Gate Dam, we developed a scour chain that can be installed and measured from the shore, effectively reducing the need to enter the water in potentially unsafe conditions. This poster will present the design, installation, initial results of scour monitors installed on the Klamath River in June 2016. While these devices have worked essentially as planned and resulted in the collection of some interesting data, the poster will also present discussion and recommendations including: design updates to improve on specific issues, stream width limitations, initial placement difficulties, and selection of materials.

Evaluating Effectiveness of The Klamath River Coho Enhancement Fund in Benefitting Coho Salmon in The Klamath River

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PacifiCorp, which owns and operates the Klamath Hydroelectric Project, finalized a Habitat Conservation Plan for Southern Oregon Northern California Coastal Coho Salmon in 2012. As part of the conservation strategy within this Habitat Conservation Plan, the Klamath River Coho Enhancement Fund was developed to fund projects that will restore, enhance, and improve habitat, flows, and fish passage for Coho Salmon in the Klamath River and its tributaries downstream of Iron Gate Dam. The Coho Enhancement Fund sets aside $500,000 per year for projects that support the Habitat Conservation Plan conservation goals and objectives. Since its inception, PacifiCorp has provided over $4 million dollars in funding to support almost 50 projects ranging from watershed scale restoration planning and prioritization and water transaction funding to habitat restoration, off-channel pond construction, and gravel augmentation. This talk presents an overview of the Coho Enhancement Fund and discuss the different types of projects funded and how Coho Salmon benefit from these projects.

Influencing Success of Women and Minorities in Fisheries and Wildlife Professions
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I review the literature on forms of bias towards women and underrepresented minorities in the fish, wildlife and natural resources professions. I identify sources of bias and barriers in the development of students and employees in these professions. I review approaches that agencies and institutions have implemented that appear to have resulted in some successes with respect to increased employment of women and minorities. Finally, I provide an example of steps that the College of Agricultural Sciences at Oregon State University has taken to affect a cultural change within the college with respect to hiring and promoting a more diverse workforce.

Increasing Diversity Through Citizen Science: A Case Study in Stream Restoration
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Ecological restoration is a rapidly growing field in the environmental sciences and represents a major career opportunity for natural scientists. However, the field of ecological restoration lacks a diverse workforce that mainly reflects the low diversity of students in the Geoscience education pipeline. One strategy for increasing participation in geoscience and ecological restoration is to engage students in authentic, field-based research during critical formative times in their education. In this presentation, we discuss the use of citizen science as a means for increasing participation of underrepresented minorities through authentic field experiences and describe a citizen science program focused on stream restoration to illustrate how citizen science can contribute to both the scientific and societal goals of ecological restoration.

Lake Abert: The Lost Fishery Without Fish
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Lake Abert is one of Oregon's largest natural lakes at over 37,000 acres when full. It is a terminal hypersaline lake which historically hosted millions of migratory birds that sought out the lake for its abundant invertebrate food resources. It is one of the few inland lakes in Oregon with a significant commercial fishery (brine shrimp: Artemia). Despite the wildlife and commercial value of the lakes' resources, it receives no protection from desiccation associated with upstream water extraction. Although state agencies maintain that the current desiccation of the lake is associated with recent drought, two recently published studies indicate the lake is dry largely because of increased diversions from the Chewaucan River, the lakes' primary source of inflow. These diversions have increased since the 1990s as a consequence of conversion of hay crop to alfalfa, construction of impoundments, increased extraction of groundwater, and conservation programs that create ponded water to attract ducks. The putative conservation

measures include areas of the former Chewaucan Marsh. Prospects for restoration of flows to Lake Abert and the recovery of the brine shrimp fishery and waterfowl populations are addressed.

Genetic Monitoring and Evaluation of Chinook Salmon Reintroductions to A Mine-Influenced Watershed; Panther Creek, Idaho

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Mining for heavy metals during the 1940s-1960s within the Panther Creek watershed in Idaho profoundly affected water quality and eventually led to the extirpation of endemic Chinook salmon and steelhead populations. Efforts to improve water quality were initiated by the Blackbird Mine Group in 1995, and Chinook salmon have since been reintroduced to the river through the use of sporadic hatchery releases. In this study, we used genetic stock identification (GSI) to examine the origin of the extant Chinook salmon population in Panther Creek. We genotyped 804 Chinook salmon sampled during 2010-2015 at 298 SNPs and compared individuals to the Snake River Basin GSI baseline (v. 3.1). Results from GSI indicated that Panther Creek Chinook salmon assign to all six Snake Basin reporting groups, with 51% (417/804) of individuals assigning to a single reporting group at >80% probability. Individual assignments were predominantly to the Hells Canyon (265/417) and South Fork Salmon River (64/417) reporting groups, likely reflecting historical stocking with Rapid River and McCall Hatchery fish. Individuals also assigned to the Upper Salmon (49/417), Middle Fork Salmon (34/417), Chamberlain Creek (4/417) and Tucannon (1/417) reporting groups. We discuss how these findings have informed additional supplementation efforts recently implemented by the Shoshone-Bannock Tribes.

The Top Ten Reasons Groups Can't Solve Problems!

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We've all had to try and solve problems with others - colleagues at work, partners, spouses, neighbors, kids, dogs, etc. These interactions all have their own trials and tribulations, some successful while some probably not so much!
We've also had our share of task groups, advisory committees, collaboratives, self-directed teams, blue ribbon panels, endless committee assignments, etc. all essentially a group of well-meaning folks trying to solve a problem or complete a project.
The Cispus Workshop, a collaboration training for natural resource professionals, had its beginnings in the 70's developing ways to resolve problems in large groups. Interactions like:

educators and scientists, publics vs. agencies, interagency teams, citizen task groups, and interdisciplinary teams - all dealing with multiple parties and interests. As a result, we've developed some firm strategies and rules of conduct for successfully dealing with groups and the problem-solving elements they need in order to be successful.
In this article (and in the spirit of David Letterman) we will briefly discuss: The Top Ten reasons groups can't solve problems!

Timing and Composition of Lower Deschutes Hatchery-Stray Steelhead
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Steelhead spawning within the eastside tributaries of the Deschutes River are intercepted at weir traps on Bakeoven and Buck Hollow creeks as a part of an Oregon Department of Fish & Wildlife study funded by Bonneville Power Administration. In this presentation we examine the origin of the hatchery fish found spawning in these tributaries, and the role that environmental fluctuations may have on the run-timing and composition of the hatchery spawners. Since late in 2010, ODFW has been identifying hatchery steelhead in these tributaries through the use of Parentage Based Tagging (PBT), fin clips, and other tags including Coded Wire tags and PIT tags. The use of PBT has enabled the identification of a much greater proportion of hatchery spawners than any other method. PBT is a genetic identifier that can trace hatchery spawners to their parents from brood-stock at hatcheries; primarily from the Snake River basin. Genetic samples were processed by the US Fish and Wildlife Service, Abernathy Fish Technology Center to identify hatchery of origin. Identification of hatchery origin through these methods may provide insight into the mechanisms that influence hatchery steelhead straying into the Deschutes.

Characterization of Catherine Creek Juvenile Spring Chinook Salmon Overwintering Habitat: An Effort To Guide River Restoration
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We identified overwintering reaches and characterized microhabitat suitability for radio-tagged fall migrant spring Chinook salmon Oncorhynchus tshawytscha parr in lower Catherine Creek, northeast Oregon from 2009 to 2011. Primarily, fall migrant parr overwintered in portions of Catherine Creek between Union, OR and the mouth of Mill Creek (near Cove, OR) from October through February. To a lesser extent, lower reaches of Catherine Creek and portions of the Grande Ronde River were occupied. Within the identified overwintering reach, two distinctly

different reaches (moderate and low gradient), pertaining to microhabitat availability, were occupied. For both reaches, microhabitat use and availability univariate frequency distributions were significantly different for all variables, indicating nonrandom microhabitat use. Deep water and slow currents near large woody debris and the bank were most suitable throughout both overwintering reaches. Coarse substrates were most suitable in the moderate gradient reach, while fine substrates were most suitable in the low gradient reach. Principal component analyses indicated that depth, velocity, substrate, and distance to cover were important microhabitat variable combinations in determining overwintering habitat use in moderate gradient reaches, while depth, velocity, substrate, distance to cover, and distance to bank were most important in low gradient reaches. During the summer of 2012, extensive river restoration was implemented on a highly degraded portion of Catherine Creek downstream from Union, OR to increase habitat heterogeneity and complexity, and improve juvenile spring Chinook salmon rearing habitat. Subsequently, during fall and winter 2012, we conducted a post-restoration radiotelemetry study with the objective of documenting and characterizing overwintering occupancy of the restored reach of Catherine Creek. Parr occupancy (%) of the restored reach was lowest during 2012 (post-restoration) compared to 2009, 2010, and 2011 (pre-restoration). Detections per parr were considerably lower during 2012 (post-restoration), compared to 2009, 2010, and 2011 (pre-restoration). It is unclear why overwintering occupancy and occupancy duration were lower following restoration efforts; however, anecdotal observations suggested that implemented restoration techniques failed to create suitable overwintering habitat. During 2009 to 2011, overwintering parr typically occupied pools which formed when high energy spring flows abruptly encountered an obstruction (e.g., root wad) in the river thalweg that caused an abrupt change in flow direction. During 2012, analogous pools were absent from the restored portion of Catherine Creek. Results from this study have informed fish and river restoration managers which microhabitat variable combinations create suitable juvenile Chinook salmon overwintering habitat and which hydrologic conditions appear to be required to create overwintering habitat.

The Disneyland Theory: A Look at 4-years of Design and Construction on Catherine Creek

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Throughout a habitat restoration project there is a steady balance of design objectives, project constraints, and risk management that combine to form the final design. The question that often arises within the engineering realm throughout the design process is whether or not objectives should be maximized for habitat (e.g.: fish Disneyland), or to restore a project to historic conditions? Historic manipulation and management of the land and rivers has greatly degraded available habitat within the Catherine Creek basin in northeastern Oregon. What once was regarded as a fish factory for Chinook Salmon and steelhead is currently barely hanging on. Assessment of limiting factors shows that Catherine Creek has lost a significant portion of its functional habitat. Small improvements over the entire channel length could add up to a significant amount of habitat, but given the often-limited area of projects relative to the entire channel, the impact of each project must theoretically increase to generate the same amount of

habitat improvement for the basin. Maximizing the project for habitat in this way can lead to enhancement beyond some people's expectations. We examine four years of project design and construction on the Catherine Creek Rivermile 44 project and how reach scale master planning and setting lofty objectives have assisted in developing substantially more habitat than what was originally thought possible. Through land acquisitions, and a cohesive design team, over 3 miles of river have been enhanced to maximize habitat to offset large areas of degradation that persist within the watershed.

Influence of Land Use on Biological Indicators of Stream Water Quality in Mediterranean Chile

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Freshwater ecosystems worldwide have been progressively deteriorated during the past decades due to an increasing human pressure that has led to a decrease in aquatic biodiversity. Among the human activities of high impact on freshwater ecosystems is the land-use change, principally from native forests to agriculture and urban areas. We evaluated the impacts of human activities on stream water quality, according to physicochemical and biological indicators: fish and macroinvertebrate in 21 Mediterranean streams Chile. We found higher temperature in urban areas and agricultural, higher dissolved oxygen in native forest and higher conductivity and total dissolved solids in urban areas. The higher diversity and abundance of macroinvertebrates was recorded in streams with native forest (42 taxa), than agricultural (40 taxa) and urban areas (31 taxa). Nonetheless sensitive taxa, like Plecoptera, Ephemeroptera and Trichoptera were higher in native forest. Fish diversity and abundance was higher in agricultural and urban areas. However, fish richness intolerant to pollution was recorded in native forest, so native (Siluriforme: Diplomystes nahuelbutaensis) and exotic fishes (Salmoniforme: Oncorhynkus mykiss, Salmo trutta). These results suggest that different land use may account for variation of physicochemical and biological indicators in Meditteranean streams of Chile, can be used as rapid and effective tool for evaluate environmental quality.

Vulnerability Models for Salmon

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Species vulnerability models promise to provide a means to predict possible responses to environmental change, and the ability to systematically assess all freshwater fish species in Oregon. Vulnerability models include the expected exposure to an environmental threat, a species predicted sensitivity to that threat, and the expected adaptive capacity of a species. Generally exposure is quantified by combining distribution models of species occurrence

overlaid with predictions of the stressor. In this talk I will present a proposed model for coho.

Upper Deschutes Basin Study: Rebalancing Water Use in A Changing Climate

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Deschutes River basin stakeholders are in the midst of a Bureau of Reclamation Basin Study to find comprehensive and long-term solutions to rebalance instream and out of stream needs on a basin scale. While significant progress has been made restoring instream flows in some reaches in the Deschutes, resolving long-standing flow issues in the Upper Deschutes River, and reaching flow goals in all reaches, requires a high level of coordination amongst water interests and a unified strategy. The study is designed to develop solutions to meet instream, agricultural and municipal needs over the next fifty years under projected climate change scenarios.
The Upper Deschutes River Basin in central Oregon includes the Deschutes River above Lake Billy Chinook, the Crooked River, and Whychus Creek systems. Surface water in the Upper Deschutes River basin has been almost fully allocated since the early 1900s, primarily for agricultural uses. Prior studies assessed projected water supplies and demands and indicated an overall 230,000 acre-foot unmet annual average demand for agricultural, instream flow, and municipal needs, with instream needs being the majority of the unmet demand.
Building off of past efforts, the Upper Deschutes Basin Study will:
Develop a comprehensive analysis of water supply and demand for instream and out of stream uses, including the impacts of climate change
Analyze how existing operations and infrastructure will perform under the projected future water supply conditions and demand
Develop and evaluate options for addressing identified water imbalances
Complete analysis to compare relative cost, environmental impact, risk and stakeholder response
The 38-member Basin Study Work Group co-manages the study with the Bureau of Reclamation. These stakeholder plan to use the information generated to develop a long-term water management plan for the basin.

Sea-Level Rise and Salmon Habitats in Selected Oregon Estuaries

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Diadromous aquatic species that cross a diverse range of habitats face different effects of climate change in each environment. Anadromous salmonids utilize habitats throughout a river system; from tidally-influenced estuaries to steep headwater drainages. Examples of estuarine habitats include low marsh, brackish marsh and tidal freshwater habitats. While all of these habitats are used by salmonids, those areas closest to the freshwater ecotone tend to be used most often and contribute to the expression of life history diversity in juveniles. In the estuary, and freshwater ecotone, sea-level rise associated with climate change has the potential to

submerge existing complex habitats or to convert areas from tidal to sub-tidal. Conversely, it is also possible that increasing sea-level could result in greater habitat complexity in places lacking revetments or engineered constraints for flood water (such as tidegates, ditches, levees, or channel armoring) allowing tidal exchange in floodplain areas. We used LiDAR imagery to explore potential effects of sea-level rise on estuary, and low-freshwater habitat complexity, availability and distribution for Chinook salmon, steelhead, and Coho salmon in five Oregon estuaries. We mapped current mean high tide and scenarios of sea-level rise and assessed changes in estuary morphology. For each salmonid species, changes in the amount and complexity of estuarine edge habitats varied by estuary. Broadly speaking, the conservation implications of our work point to the preservation and restoration of upstream wetland areas as sea level rises and increased riparian buffers along stream corridors to increase shading during dry summer months.

Coho Salmon Factoid Hexaflexagon: English and Spanish version

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Understanding the needs and benefits of coho salmon (Oncorhynchus kisutch) can be daunting due to their complex life cycle, habitat variances, conservation needs, and ecological benefits. To facilitate the understanding of these complexities, the hexaflexagon will allow even the youngest students a simple yet dynamic way to learn more about these amazing fish. The simplicity of the completed hexaflexagon, with its pictures and short descriptions, allows it to be bilingual, with (for example) Spanish and English versions on opposing sides, broadening the audience even further.

Catherine Creek Restoration Corridor; A Large Scale Multi-Phase Project on Private Land

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In 2010, a large scale, multi-phased river restoration project, Catherine Creek RM 44, involving six landowners and seven regional natural resource agencies began when landowners contacted the Union Soil and Water Conservation District with streambank erosion concerns.
Encompassing 3.2 river miles the overall goal of the Catherine Creek 44 Project was to restore, enhance and protect natural channel function and processes that provide increased spawning and rearing habitat for ESA listed species. These species include spring/summer Chinook salmon, summer steelhead, and bull trout.
The Project was designed utilizing a multi-agency and disciplinary team comprised of basin partners. The project was constructed in four phases from 2012-2016. Project construction increased Catherine Creek channel length and number of large pools, increased large wood along Catherine Creek and within side channels floodplains, and wetland complexes, increased side channel, floodplain, and peripheral habitat, and increased the overall availability of off-channel rearing habitat.

Treatments varied by stream reach, landowner concerns and ecological or landowner constraints. Total habitat project metrics include:

Installation of 228 Large Wood habitat structures
Creation of 8 side channels
Creation of 2800 linear feet peripheral alcove habitat
Installation of 17 riffle complexes
Installation of 14 boulder complexes
Contiguous riparian planting along both sides of 3.2 mile reach

Additionally, large scale irrigation improvements were implemented by landowners and natural resource agencies to achieve a more efficient use of water during seasonal low flows and enhance hyporheic function, including:

Installation of over 11,000 feet of irrigation pipeline
Removal of four instream push up dams
Consolidation of four points of diversion into one
High efficiency on farm delivery systems
Late season leasing to protect water instream
Enrollment of landowners into irrigation water management planning

Project implementation and monitoring was funded by Oregon Department of Fish and Wildlife, Bonneville Power Administration, the Oregon Watershed Enhancement Board, the confederated Tribes of the Umatilla Indian Reservation, the Natural Resources Conservation Service and the U.S Fish and Wildlife Service.

At the Intersection of Science & Policy: International Shark Conservation & Management

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For the past few decades, global shark populations have been in a near constant state of decline, and extractive pressures from the world's fisheries continue to reduce shark populations in the world's oceans. Despite decreasing populations, sharks are still regularly targeted or caught as by-catch in the world's fisheries, and the ever-increasing market price of shark fins indicates that this trend is unlikely to stop anytime soon. As a result, numerous shark species have received attention from Regional Fisheries Management Organizations (RFMOs). Since as early as 1995, RFMOs have passed numerous measures focused on the conservation of shark species. Despite RFMO efforts, shark populations continue to decline. This may be because many of the conservation measures fail to take into account key life history and behavioral characteristics of sharks. Therefore, and in order to make conservation measures as effective as possible, a procedure for incorporating scientific findings into conservation measures has been

established. For more general shark-wide measures RFMOs should 1) identify key characteristics; 2) determine shared patterns; and 3) identify specific vulnerabilities to target with conservation measures. Species-specific measures should be used where RFMOs can 1) identify particularly distinct, vulnerable characteristics, and 2) identify specific avenues to address these vulnerabilities. RFMOs should strive to pass fewer, more effective conservation measures to ensure that fishers do not become overburdened by conservation and therefore unwilling to comply. Utilizing this procedure will help to ensure that conservation measures have the best chance at being effective, and therefore protective of global shark species, while not being overly burdensome on fishers.

Size matters: Evaluating Catch Rate of Hatchery Rainbow Trout Across Multiple Waterbodies

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The Oregon Department of Fish and Wildlife has been implementing a tag reward program in various waterbodies across the state. The primary focus of these projects has been to evaluate the relative catch of a variety of sizes of hatchery rainbow trout in fisheries across the state. . Results of these studies will help to inform potential management changes to increase catch rates and angler satisfaction. This presentation will provide an overview of where the current and future direction of the program.

Puget Sound Basin Thermalscape: An Updated Spatial Stream Network Model of Stream Temperature

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Climate change in the Pacific Northwest is predicted to increase air temperature, decrease winter snowpack, and contribute to the melting of alpine glaciers. All of these changes have the potential to decrease summer baseflows while concomitantly increasing stream temperatures in the Puget Sound Basin. Stream temperature is an important water-quality parameter in the Puget Sound Basin that affects biological processes including primary production, nutrient cycling, salmonid growth, development, and survival. Since the early 1990's the collection of continuous stream temperature data has proliferated because of the advent of inexpensive

data-logging thermistors. As a result of the increasing number of measurements, these data have been used to develop large- and small-scale spatial statistical network models that predict stream temperature across the landscape by accounting for spatial autocorrelation based on Euclidean distance (as the crow flies) and stream network distances. We present a spatial statistical network model based on the Northwest Stream Temperature Regional Model (NorWeST) but with additional stream temperature observations and additional landscape, hydrologic, and climatic predictors to predict the spatial distribution of stream temperatures, or thermalscape, of the Puget Sound Basin at a 1-km resolution. The present and future distribution of stream temperatures predicted by this model can help inform aquatic resource managers about the status and trend of a key limiting variable for the health and distribution of salmonids and other aquatic species.

Using Beavers and Beaver Dam Analogues for Restoration

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Beaver Dam Analogues (BDA), and the deliberate interaction with beavers for restoration benefit, is new to California. Scott River Watershed Council, under the direction of Dr. Michael Pollock, NOAA Northwest Fisheries Science Center, have implemented the State's first BDAs in a variety of geofluvial and water year conditions. This session will discuss BDA function, construction techniques, beaver interactions, and lessons learned over the first 3 years of the project.

Linking North Pacific Chinook Salmon Habitat Quality with Fish Production in A Changing Climate

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The U.S. Pacific Northwest is characterized by extensive upwelling and complex ocean dynamics. Large scale climatic patterns such as the El Niño Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) influence wind-driven upwelling and ocean temperatures, dissolved oxygen and salinity. These patterns largely determine habitat quality for species that use coastal waters for all or part of their lifespan. One such species is the Chinook salmon Oncorhynchus tshawytscha, which supports valuable recreational and commercial fisheries in the Pacific Northwest but is experiencing ecosystem-level declines. The goal of this study was to develop a dynamic index of habitat quality for Chinook salmon to examine and predict changes in habitat quality due to ENSO- and PDO-driven climate shifts. We compiled vertical profiles of water

temperature, dissolved oxygen, and salinity from several sites in the Pacific Northwest. These data were used to calculate a dynamic habitat quality index based on bioenergetics-based growth rate potential (GRP) of adult Chinook salmon in the North Pacific between 1952 and 2009. An age-structured matrix population model for salmon was modified to incorporate habitat quality and used to generate a yearly index of population abundance. Commercial salmon landings were compared to the indices of habitat quality and population abundance, and all three time series were analyzed for evidence of regime shifts. Indices of habitat quality and population abundance were both correlated with annual catch rates of adult salmon. Salmon GRP decreased by 57 percent after the El Niño event in 1987-1988 as compared to the years before the event. This event heralded the transition from a strong warm phase to a strong cool phase in both the ENSO and the PDO, also corresponded to a decline in salmon landings. We suggest that GRP can be used to capture the variability in climatic forcing of ecosystems, and is a measure of habitat quality that can be used directly to predict fishery production. An integrated, dynamic definition of habitat quality, such as GRP, is necessary to understand the impacts of climate oscillations on fishery production.

My Wild Idea is to Use Native Broodstock With More Aggressive Biting Behavior for Anglers to Catch More Hatchery Fish

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There are advantages of utilizing native brood for sport fisheries that have more aggressive traits. If we used hatchery genetics to produce fish that are better "biters", anglers would catch and remove more hatchery fish from the natural spawning grounds.

Irrigation Modernization to Meet Environmental and Agricultural Needs at Scale in Oregon's Deschutes Basin

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The Deschutes River and its tributaries have been almost fully allocated for human use, primarily for irrigated agriculture, since the early 1900s. Growing populations, shifting rural economies, and changing climate conditions have increased water demands for both instream and out-of-stream uses. These increased demands have created the potential for increased conflicts between exurban communities, rural agricultural landowners and environmental needs.
As in many locations across the western United States, agricultural water users in the Deschutes Basin store, release, and divert water through a system of up to 100 year-old reservoirs, canals, and laterals. Many of these canals and laterals were dug by hand, and up to 50% of the water diverted through these primarily open canals seeps into the porous volcanic soil before reaching

its destination, increasing diversion needs and leading to water management challenges for agricultural water users. Associated reservoir operations, diversion structures, and diversion operations have correspondingly limited stream function and aquatic populations throughout the region.
Upgrading this aging infrastructure provides the greatest opportunity to meet instream and out-of-stream needs along the Deschutes River and its tributaries. Historically, the traditional project-by-project approach to upgrading this infrastructure, whether through providing passage, adding fish screens, or piping open canals, has had limited success at scale. This project-by-project approach does not allow for coordinated efforts that potentially reduce implementation costs and improve outcomes for all interests.
Farmers Conservation Alliance (FCA) has partnered with seven irrigation districts in the Deschutes Basin to develop comprehensive modernization strategies that benefit agriculture, the environment, and local communities through its Irrigation Modernization Program. These strategies identify, as appropriate, opportunities to systematically replace open canals with pressurized pipes, add fish screens, eliminate fish passage barriers, and install in-conduit hydropower generation. They extend beyond coordinated engineering plans to recommend implementation options, outline potential funding sources, and identify agricultural, environmental, and community benefits. This comprehensive approach allows for designing. financing, and implemented interconnected projects at scale.
With irrigated agriculture as the primary water user in the western United States, irrigation modernization could meet instream and out-of-stream needs in water supply-limited systems.

Protecting Waters and Honoring Fish Through Collective Impact and Systems Thinking Models

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Fisheries and water resources create an expansive ecological and social network throughout the Northwest region. Scientists and community members alike protect the waters and honor the fish. As we face a changing climate (both environmental and political), the importance of integrated efforts by tribes, communities, agencies, and institutions is paramount. This session will 1) introduce the foundations of the collective impact and system thinking models, and 2) how we can enhance Oregon's ecosystem services and cultural resources through these practices.

Beaver Dam Analogs for Restoration of the South Fork of the Crooked River: A Preliminary Study

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Riparian systems throughout the West have been degraded by grazing, agriculture, impoundments, and extermination of beaver, with negative consequences for fish. Beavers were the original ecosystem engineers of North America. By retaining sediment and creating ponds and riffles, their dams promoted heterogeneity of fluvial processes and fish habitat. Restoration ecologists are looking to the beaver dam as a multifunctional tool aimed at mitigating anthropogenic effects of stream degradation. In this study, we are examining the effects of five artificially installed beaver dam analogs (BDAs) on the South Fork of the Crooked River, a stream that no longer supports anadromy due to completion of Prineville Reservoir in 1961. The South Fork is characterized by high temperatures, a lack of woody riparian vegetation, a lack of fluvial heterogeneity, and disconnection from its historic floodplain. Efforts to establish a self-propagating population of rainbow trout have been unsuccessful since the original population of native rainbows was eliminated from the drainage with rotenone in 1981. Here we report pre-BDA baseline data measurements of fluvial geomorphology, pool frequencies, stream temperatures, and soil moisture. We show that on-site upland vegetation can be used in lieu of willow to construct well-functioning BDAs in habitats where woody riparian vegetation is sparse, and we document extensive post-installation flooding using drone photos. Dam porosity diminished in the weeks following installation, most likely because holes were filled by aquatic vegetation, which means that fish passage will have to occur over or around the structures. Our future work will measure sediment accumulation and aggradation, success of riparian plantings, stream temperatures, dissolved oxygen above and below the project, fish passage, and fish populations.

Native Fish Communities of the Willamette River and Its Floodplain

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We have monitored native and non-native fish communities and river and floodplain habitat in the mainstem Willamette River (2011-2013) and the lower reaches of the Middle Fork Willamette, McKenzie, and Santiam Rivers (2015-2016). We have documented the distribution and abundance of 22 native fish species and 19 non-native species. Abundance and richness of native fish decreased longitudinally along the mainstem. Abundances in the McKenzie and Middle Fork were higher than that of the Middle Fork. Abundance and richness in the three tributaries were lower than these community measures in the upper Willamette River mainstem. Many of these non-native fish are warm-water species that may outcompete native species in warm habitats of the Willamette River. Over the last decade, the Willamette River has exceeded

the state temperature standard each year during summer for the entire length of the mainstem. Between 2008 to 2016, we sampled more than 80 sloughs in the floodplain along the mainstem river. In 2016, we sampled temperature and stable isotopes of water in 41 sloughs from the McKenzie River confluence to the mouth. 56% of the sloughs sampled were more than 2°C colder than the maximum mainstream temperature at the site (ODEQ cold water refuge standard). 33 of 41 alcoves had 2H and 18O proportions that were similar to those of mainstem river water and unlike groundwater. Water samples from the bottom of most alcoves were slightly more enriched than adjacent mainstem river water, indicating water in the alcove may have entered subsurface during the winter. Of the 8 alcoves with stable isotopes more enriched than river water, 6 were alcoves that were immediately downstream of gravel mining pits on the same floodplain. Pits and deep excavation in the floodplain upstream of alcoves and sloughs can interrupt hyporheic exchange. This does not necessarily mean that water quality is degraded but indicates that subsurface processes are altered. The major source of cold water in lateral floodplain habitats of the Willamette River is hyporheic exchange between the river and the floodplain. River channel dynamics are important processes that create and maintain cold water habitats in the mainstem Willamette River. However, lateral floodplain habitats during low flow comprise only 3% of the wetted habitat area of the Willamette River. Conservation and restoration strategies for the Willamette River must incorporate the entire river and its seasonally inundated floodplains.

Preliminary Report on the I-74 Bridge Replacement Mussel Relocation

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The I-74 bridge over the Mississippi River between Bettendorf, IA and Moline, IL crosses over a historic mussel bed, Sylvan Slough Bed, which is known to harbor at least 25 species, including three federally endangered species (Cumberlandia monodonta, Lampsilis higginsii, and Plethobasus cyphyus) as well as several state-listed species. Sylvan Slough is also a designated Essential Habitat Area for L. higginsii. IADOT, ILDOT, ESI, Stantec, USFWS, ILDNR, and IADNR worked together to devise a plan to minimize impacts to the mussel bed, and develop monitoring and mitigation designed to answer questions associated with relocation and recolonization. Although the area from which mussels were removed was limited to only direct impact areas in the densest portion of the mussel bed, this was one of the largest freshwater mussel relocations in the country. Approximately 140,000 mussels, representing 32 species,

were collected by divers, marked, and relocated between August 1 and October 31, 2016. Relocated mussels were placed into previously approved relocation areas to assess the effects of augmenting existing assemblages with relocated mussels. Relocation sites will be monitored on average once every three years for the next 10 years to assess the health and survival of relocated and resident mussels. Federally endangered species were placed in grids to facilitate future monitoring as well as collection for genetic swabs and future propagation. The construction site will also be monitored to determine the effects of work activity in areas where mussels were not relocated, and to assess recolonization of areas where mussels were removed. Additional mitigation will include a poolwide survey of Pool 15, experimental habitat creation for Cumberlandia monodonta, and development of an educational program focused on freshwater mussels.

Application of Unmanned Aerial Vehicles in River Restoration Design and Monitoring

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Unmanned Aerial Vehicles (UAVs) are becoming increasingly common in surveying applications to support natural resource related projects and research. Using relatively inexpensive hardware and software systems, qualified users are able to deploy UAVs to efficiently capture and process large amounts of point data to compile products such as high resolution georeferenced aerial imagery and digital terrain models (DTMs). Until recently, these products have typically been acquired using manned aircraft and expensive sensors, or time intensive field surveys that have resulted in high cost or precluded data collection at relatively small scale sites. Here we examine UAV data collection techniques and how acquired data are used to implement various river and stream restoration projects to enhance habitat for native fish and wildlife throughout Oregon.

Prospective Analyses of Experimental Hydrosystem Management Options on Snake River Spring/Summer Chinook Salmon and Steelhead

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Monitoring data collected over the past 15 years have shown that survival rates and abundance levels of Snake River spring/summer Chinook salmon and steelhead populations have been well below regional goals. To increase the likelihood of achieving these goals in the future, alternative hydrosystem management options that are different from those implemented in the past may need to be considered. To inform these considerations, we developed models that captured historical patterns of variability in demographic parameters for Snake River Chinook salmon and steelhead populations and applied these models in a prospective manner to evaluate the expected effects of alternative hydrosystem management actions. Results show that increases in the amount of voluntary spill at mainstem dams is expected to increase survival

and the likelihood of achieving regional survival goals. Treated as an adaptive management experiment, these actions are expected to demonstrate significant improvements in demographic rates with high power after three-to-four years of implementation. If implemented, ongoing monitoring efforts provide a framework for evaluating whether expected improvements are realized.

Seasonal Movements of Redband Trout in Klamath Lake

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Ecologists are increasingly able to describe spatial and temporal variation in water temperature across riverscapes, but our understanding of how fish integrate across this variation generally lags far behind. Upper Klamath Lake exhibits temperatures ranging from near freezing in winter to higher than 25° C in summer. In contrast, the lake's groundwater-dominated tributaries exhibit more stable, intermediate temperatures. We are studying how redband rainbow trout move among lake and tributary habitats during the course of the year and how this relates to their seasonal energy budget. We tagged 40 adult trout with temperature-transmitting radio tags in May 2016. All of our tagged fish emigrated from the lake by June 1st, moving to groundwater-influenced habitats including Pelican Bay and The Wood and Williamson Rivers, where temperatures ranged from 8-18° C. Our preliminary results indicate a double adfluvial migration, where fish migrate to tributaries first for refuge from summer heat stress, and again for spawning during winter. We hypothesize that fish fuel over-summer refuge use and winter spawning by feeding at high levels during spring and fall in the more productive lake habitats. This illustrates the potential shortcomings of conservation approaches that rank the value of habitats based on summer maximum temperatures.

Total Body Lipid in Juvenile Wild, Hatchery, and Wild Surrogate Chinook Salmon

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There is growing interest in hatchery rearing strategies to produce more wild like fish phenotypes. This study is part of our larger ongoing Wild Fish Surrogate Project at Oregon State University. The goal of the project is to develop alternative rearing strategies for

producing hatchery-origin spring Chinook salmon, Oncorhynchus tshawytscha, juveniles that reflect the migratory and fitness phenotypes of their wild counterparts. These wild fish surrogates are used for dam passage studies in place of conventionally reared hatchery fish. We have assessed different aspects of the rearing environment and natural life history of the fish, in producing wild fish phenotypes. Our current rearing protocol includes rearing at low density, feeding a low lipid diet, including structure in rearing tanks, and using natural growth adaptive feeding strategies. We continuously evaluate the effectiveness and phenotypic accuracy of our rearing protocol. In creating wild fish surrogates, evaluation of lipid content is an important consideration because condition factor and lipid content are correlated with the probability of downstream juvenile migration. We measured total body lipid content of hatchery fish and wild fish, collected at various locations throughout the Willamette River Basin, and compared these to the lipid content of fish reared at Oregon State University Fish Performance and Genetics Lab for use as wild fish surrogates. Wild fish had significantly lower lipid content than hatchery fish, but had much greater variation of lipid compared to hatchery and surrogate fish. Various capture locations of wild fish seemed to influence the variation in fish size, condition factor, and percent lipid, with fish that reared in reservoirs showing the highest lipid content and greatest variation. By targeting the lipid content of juvenile wild fish in the Wild Fish Surrogate Project, we are able to produce fish that are more phenotypically accurate and likely congruent with wild fish behaviors, including migration.

Monitoring A Fish Pathogen to Inform Management and Models: A Three-Pronged Program for Ceratonova shasta In the Klamath River

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Ceratonova shasta causes enteronecrosis in juvenile salmonids in the Pacific Northwest of North America and is associated with population-level impacts in the Klamath River, California. This myxozoan parasite cycles between two hosts and two spore stages: actinospores develop in freshwater polychaete worms, then infect salmonids in which they form myxospores. In response to the high prevalence and severity of C. shasta-infection in Klamath salmonids, we developed a parasite monitoring program to track C. shasta's spatial and temporal abundance. Our three-pronged approach includes sentinel fish exposures, invertebrate host sampling and molecular quantification of parasite DNA in river water. In 2006, we established 5 mainstem index sites, that span 240 river kilometers, and 4 sites in tributaries. Whereas polychaete sampling occurs quarterly (once each season), fish exposures occur primarily during juvenile

outmigration, and water samples are collected weekly year round. Each prong of the program provides unique but complementary data. Sentinel fish provide metrics of prevalence of infection and disease severity (percent mortality and time to death). Polychaete sampling provides host density and infection level data. Direct, regular measurement of waterborne parasite stages provides higher resolution surveillance and is a pragmatic alternative to host sampling, and facilitates semi-real-time reporting via weekly, online updates. In addition, our decadal dataset is aiding identification of the primary biotic and abiotic drivers of host-C. shasta interactions in the Klamath River. Long-term surveillance of C. shasta has revealed significant variation associated with parasite abundance in water, and prevalence and severity of infection in its hosts over 10 years. For example, in 2015 mortality in sentinel Chinook salmon was a record 90.5%, polychaete host densities were an order of magnitude higher than in previous years, and spore abundance in water samples was 25 times higher than the previous year, and an order of magnitude higher than the previous maximum of ~100 spores/L in 2007-9. These data are informing model development (epidemiological and predictive) and management strategies (e.g. pulse flow events).

The Persistence and Characteristics of Chinook Salmon Migrations to the Upper Klamath River Prior to Exclusion by Dams

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Using the accounts of early explorers, ethnographers, images from pioneer photographers, and information from archaeologists, anthropologists, magazines, newspapers, and government reports, we have updated the historical record of Chinook salmon migration past the current location of Iron Gate Dam. The updated record is conclusive that salmon historically migrated to the Klamath Upper Basin. Reports to the contrary may have been during periods of intermittent interruption of salmon runs. Examined in total, the updated record now provides a glimpse of the character of historical runs. Most of the observations of returning adult salmon occurred in the fall, but they were recorded during all seasons of the year, suggesting that runs were seasonally diverse and consisted of various salmon life histories. The majority of accounts indicate that Chinook salmon were abundant and provided robust in-river Tribal and recreational fisheries upstream from IGD. In addition, runs were prolific enough to support four general fishing areas that included small scale commercial harvest at least through 1911. The greatest focus of adult Chinook salmon was in the Sprague River in the fall and was associated with significant harvest. This analysis also resolves the question of when historical migrations of Chinook salmon to the Klamath Upper Basin ceased. While salmon runs were impacted by an

1889 dam at Klamathon, California, by exploitation by in-river fisheries supporting canneries, by abusive mining practices, and by other destruction of their habitat, we found that migrations persisted into the Klamath Upper Basin through the fall of 1912, when they were completely excluded by an early phase of the construction of Copco 1 Dam. Blocked migrations to historical habitats are now slated to be reversed either through fishways or dam removal. As managers consider habitat restoration, reintroduction, and associated monitoring plans for Chinook salmon upstream from the current location of IGD and in the Klamath Upper Basin, they will likely look to the historical record for guidance. Our review substantiates the historical persistence of salmon, their migration characteristics, and a broad population baseline that will be key to future commercial, recreational, and Tribal fisheries in the Klamath River and beyond.

Evaluating Feasibility of Winter-Run Chinook Reintroduction Upstream of Shasta Dam, California

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The Shasta Dam Fish Passage Evaluation is an effort to determine the feasibility of successfully reintroducing Chinook salmon into habitats upstream of Shasta Dam on the Sacramento River in northern California. The Bureau of Reclamation in cooperation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Water Resources, California Department of Fish and Wildlife, U.S. Forest Service, and the California State Water Board developed a fish passage pilot plan. The pilot plan describes three to five years of studies designed to inform a feasibility determination.
Reclamation's 2009 Central Valley Project water operations biological opinion from NMFS predicted increased future temperature related survival effects on ESA listed salmonids and called for a phased evaluation of the feasibility of reintroduction. NMFS identified winter-run Chinook as the top priority for reintroduction at Shasta due to their endangered status and limited freshwater range, spawning only in a confined reach of the Sacramento River immediately below Keswick Dam. A completed habitat evaluation of the mainstem McCloud and upper Sacramento rivers estimated the current habitat quality and spawning habitat potential. The habitat information forms the foundation for studies to determine survival and spawning success for fish transported to these rivers, migratory timing down the rivers to the confluence with Shasta Lake, juvenile collection options near the river/lake confluence, and survival and migratory patterns within Shasta Lake for potential in-lake juvenile fish collection. Low winter-run abundance and concerns over low survival in drought conditions resulted in the loss of the only approved source of test fish so a winter-run captive broodstock program was re-initiated at Livingston Stone National Fish Hatchery to provide a source of test fish for the

program. Collaboration with local stakeholders is ongoing and is critical to successfully carrying out this evaluation. Pilot reintroduction and testing of pilot juvenile collection devices planned for 2017 may be delayed as we continue to assess level of significance of environmental effects in response to stakeholder comments.

Forest Service Aquatic Invasive Species Monitoring in the Pacific Northwest

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The Pacific Northwest Region of the U.S. Forest Service monitors for aquatic invasive species (AIS) in wadeable streams on Forest Service land in Oregon and Washington. Using visitor use as a measure of risk to AIS, most of the high risk/high use sites on Forest Service land are not covered by this monitoring. The high risk sites are predominately on lakes and rivers (non-wadeable waters). Non-wadeable waters are currently not sampled by the Forest Service in a consistent manner. A pilot project has begun to use a multiple species eDNA methodology called massively-parallel barcode sequencing (MP-eDNA) that enriches genome-scale targets from dozens of species simultaneously, and then use DNA sequencers to directly screen for the presence, abundance, and genetic variability of target species. In preliminary tests, organelle genomes were identified and assembled for fish (salmonids) and trees from 48 samples simultaneously. The method can be scaled to dozens of aquatic species from 96 water samples simultaneously, for nearly the same cost of a single-species qPCR assay. This project will target the focal invasive species identified by the Forest Service in high use lakes and rivers.

Coos Watershed Association Outreach Program Provides Reciprocal Benefits for Student Participants and Coho Life Cycle Monitoring

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Citizen Science is a critical component of Coos Watershed Association's (CoosWA) Life Cycle Monitoring Project (LCM). Sustained collaborative alliances with AmeriCorps, Oregon Institute of Marine Biology and Southwestern Oregon Community College provide essential survey and sampling effort for the project. Despite the fact that coho salmon seasonal life history and LCM study methods do not directly overlap with academic calendars, CoosWA has had notable success in recruiting dedicated college students and recent graduates for internships, many of whom volunteer for multiple seasons. Equally, these internships provide valuable work experience and references for people entering the natural resource field. CoosWA works with

interns and volunteers year-round, with increased participation from high school students during the summer months, when AFS Hutton interns and CoosWA youth watershed program participants provide vital field work capacity for PIT mark recapture efforts. Our intern and volunteer program continues to grow and improve each year, providing win-win benefits to everyone involved: hands-on fish sampling and surveys provide education, job experience, stipends, professional references and fun for our interns while making the monitoring and research of the LCM project possible.

Geospatial Tools to Assess Risks of Reintroducing Anadromous Salmonids Above Grand Coulee Dam

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Reintroducing anadromous salmonids into the upper Columbia River Basin is an exciting but challenging prospect. Efforts are currently underway to evaluate risks associated with reintroducing Chinook, Sockeye, Coho, and Steelhead above Grand Coulee Dam (blocked area). Concerns related to disease, resident/donor stock interactions, competition for food and space, and predator/prey relationships must all be evaluated in order to determine which stocks should be reintroduced, and the safest release locations. The risks of reintroduction are being evaluated collaboratively by state, federal, and tribal governments through a series of workshops. The ability to quantitatively assess risks to resident and anadromous fish species requires a set of tools that can query and display existing or potential habitats, and analyze potential interactions between native and nonnative fishes throughout a stream network. Toward this end, we are developing GIS-based tools that predict where fish habitats exist under a range of flow conditions, quantify potential interactions between native and nonnative fishes, and rank potential reintroduction sites based upon multiple factors.

Upper Snake River Climate Change Vulnerability Assessment

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The climate around the Upper Snake River Watershed (USRW) of Idaho, Nevada, Oregon, and Wyoming is changing. Upper Snake River Tribes (USRT) Foundation member tribes have noticed

shifts in species and habitats driven by increasing temperatures and changing precipitation patterns. Such changes have resulted in: drying sagebrush steppe habitat, extended wildfire seasons, less precipitation falling as snow, earlier spring run-off, low summer river flows, higher water temperatures, reduced flow from springs/seeps, proliferation of invasive weeds, and less productive rangelands. To better understand these changes, USRT and the Burns Paiute Tribe, Fort McDermitt Paiute-Shoshone Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes collaborated with Adaptation International, University of Washington (UW), and Oregon State University (OSU) to complete a climate change vulnerability assessment. The collaborative assessment expressly considered the species, habitats, and resources that are important and valuable to USRT member tribes. Climate change impacts to these resources have the potential to affect tribal members' culture, spirituality, and lifeways. OSU developed temperature and precipitation projections for the USRW using two representative concentration pathway (RCP) trajectories: RCP 4.5 and 8.5. Projections indicate that under RCP 8.5, temperatures will increase throughout the 21st century in the USRW by as much 10.9° F. Precipitation projections are less certain, but it is likely that increases will be seen in the Snake River Plain, with decreases in the mountainous regions of the USRW. Through collaborative workshops, webinars, and site visits to tribal reservations, a set of shared tribal concerns were identified and analyzed by UW to develop a climate change vulnerability index (CCVI). The CCVI results suggest that certain shared tribal concerns, such as North American beaver (Castor canadensis) have low vulnerability to climate change, while others, including Chinook salmon (Oncorhynchus tshawytscha) and redband trout (Oncorhynchus mykiss gairdneri), are extremely vulnerable to climate change.

Lamprey Phylogeny and Distribution in the Willamette National Forest

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Past efforts by the United States Forest Service (USFS) and the Bureau of Land Management (BLM) to characterize the distribution of fishes across the Willamette National Forest (WNF) have been biased towards the detection of salmonids, leaving is with a limited understanding of historic and present distribution of non-salmonid native fishes. Given the addition of Pacific lamprey (Entosphenus tridentatus) to the Interagency Special Status / Sensitive Species Program (ISSSSP) in 2015, and also that the phylogeny and distribution of brook lamprey (Lampetra spp.) remains unresolved, additional data is needed evaluate potential impacts to lamprey populations from USFS/BLM resource management and habitat restoration activities. In 2015, we initiated a project with the objectives of: (1) determine the distribution of lampreys across federally managed lands within the Middle Fork Willamette sub-basin, Oregon, USA; (2) develop a protocol to assess reach-level occupancy of larval lampreys; (3) identify landscape-level and reach-level variables associated with lamprey; and (4) describe the morphological and genetic variability of lampreys across the project area. We expanded this effort in 2016 to federally managed lands within the North Santiam sub-basin and the McKenzie sub-basin. Using a

general random tessellation stratified (GRTS) sampling regime, we targeted perennial stream segments of 100m with an average slope less than 2.5%, along with all floodplain habitat. We used a backpack electrofisher to assess lamprey occupancy at three reaches (20 x bankfull width) within each sub-watershed. In addition to collecting voucher specimens and tissues samples of lampreys, in 2016 we included all non-salmonid fishes we encountered. To date we have sampled 113 reaches from 50 sub-watersheds across the Willamette National Forest. Lamprey occupied 23% of all sampled reaches. In 2017 we will continue our effort in the Coast Fork and South Santiam sub-basins.

The Resurgence and Ecology of Sand Rollers in the Snake River and Their Possible Implications to Chinook Salmon

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The recent resurgence of the endemic Sand Roller Percopsis transmontana in the lower Snake River prompted us to investigate their seasonal habitat use, ecology, and diet in Lower Granite Reservoir. From November 2014 to October 2015, Sand Rollers were present along shorelines with peak abundance being observed during spring, coincident with the timing of Chinook Salmon rearing in shoreline habitats. Habitat analyses showed that Sand Rollers were more likely to be present in shorelines at temperatures 18.4°C, and were found over a range of substrates with the lowest odds of fish presence being associated with riprap and the highest being associated with silt. Similar to Chinook Salmon, the most important prey for Sand rollers were Chironomids, the opossum shrimp Neomysis mercedis, zooplankton, and Americorophium spp. The overlap in spring habitat use and prey importance between Sand Rollers and Chinook Salmon may create competition for these resources. However, Sand Rollers may have a beneficial effect on Chinook salmon by relieving predation pressure from smallmouth bass. The cause of the recent Sand Roller population resurgence in the Snake River is currently unknown, but it adds to the complexity of an already novel food web within the reservoir.

Creating New Paradigms for Collaborative Research, Education and Outreach in Coastal Systems

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The Marine Studies Initiative at Oregon State University is much more than a new OSU building - it is a vision of collaborative research, education and outreach that will connect agencies, communities, and educational institutions from Astoria to Brookings. We are gathering input from all Oregonians on ways to create a hub for coastal systems research, training and

collaborations, connecting land and sea. Our scope is global, but with an emphasis on the Pacific Northwest and its unique ecosystems and natural resources. We envision a new interdisciplinary system of learning and science communication that reaches beyond OSU, such as workshops and classes where students and non-students alike are instructed by faculty, agency scientists, and community experts. I will introduce our ideas for "Food from the Sea", a Center of Excellence that connects a broad range of people that work with fish and fisheries from ocean and freshwater habitats to the dinner table. There are opportunities for AFS members to add their ideas to the planning for the Marine Studies Initiative right now, and I look forward to speaking with you!

Oregon's Marine Species: Diversity and Spatio-Temporal Variability
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Oregon's marine environment serves as home to a great diversity of colorful, interesting, and culturally, economically, and ecologically important fishes. From offshore pelagic species traveling long distances and only transiently visiting our shores to sedentary species with minute home ranges, Oregon's marine species represent a phylogenetically diverse group of animals. We'll discuss this diversity generally, but will also focus on recent analyses we've conducted on both the spatial and temporal variability we've observed in Oregon's nearshore and estuarine fish communities.

Bringing Nature
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The need for creative instruction, and the ability to put students virtually in the active classroom, has been magnified with the creation of the OSU's Department of Fisheries and Wildlife online B.S. degree. Creating virtual classrooms and virtual field experiences to enhance the learning experience of our students, whether they're sitting at a desk here in Oregon or somewhere across the country, requires innovation and application of new technologies. For this presentation we'll showcase some of the approaches we're taking from video tutorials on how to complete a laboratory to 3D imaging and virtual reality, in order to ensure that our eCampus students receive the quality education for which our program is renowned. Suggestions for new approaches or creative opportunities are welcome!

Using Mesocosms to Assess Movement, Survival, and Health of Hatchery-Raised Juvenile Lost River Suckers in Upper Klamath Lake

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The recovery of endangered Lost River suckers (Deltistes luxatus) is one of the highest priorities for the U.S. Fish and Wildlife Service in the Upper Klamath Basin. For this long-lived species, research has identified a senescing adult population, and little or no recruitment of juvenile suckers into the adult population. Despite successful reproduction by adults each spring, juvenile suckers fail to survive past one or two years of age. Many factors are suspected to contribute to the poor survival of juvenile suckers including poor water quality during the summer, parasites, interactions with non-native species, exposure to toxic microcystins, and the loss of accessible wetland habitat. In 2016, we conducted a study using antenna-integrated mesocosms in three locations within Upper Klamath Lake to monitor the vertical movement, survival, and health of PIT-tagged suckers. Temperature, pH, dissolved oxygen concentrations, un-ionized ammonia concentrations, and microcystins were monitored at each site from July 11 to September 21, 2016. Movement patterns of suckers among five antennas were used to determine the date of mortality for each fish, and to assess how juvenile suckers responded to stratified water-quality conditions. Known fate models were used to investigate the extent to which water-quality contributed to variation in survival of juvenile suckers. Field necropsies and histology were conducted on moribund suckers to determine the cause of death. Survival and growth were greatest at the Rattlesnake Point site, intermediate at the mid-North site, and lowest at the Fish Banks site.

A Bull Trout Sanctuary in Crater Lake National Park: Preliminary Planning for Reintroduction in the Upper Klamath River Basin

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The U. S. Fish and Wildlife Service's Bull Trout Recovery Plan recommends eradicating nonnative Brook Trout and establishing new Bull Trout populations in historically-occupied streams or other suitable cold-water habitats in the Upper Klamath River Basin. This year, the Klamath Bull Trout Technical Team began a process to evaluate and prioritize streams in which such a strategy could be implemented. We will review the basin-wide planning and prioritization effort and then focus specifically on the challenges and opportunities of reintroducing Bull Trout to a

renovated sanctuary habitat in Annie Creek within Crater Lake National Park. Annie Creek ranks as a strong candidate for reintroduction based on documented historical distribution of Bull Trout, pristine protected habitat inside the National Park, and recent success of Brook Trout removal and Bull Trout restoration in the adjacent Sun Creek watershed. Natural migration barriers in the system will allow short-term establishment of resident Bull Trout in the federally-protected headwaters, while longer-term restoration activities and habitat improvements occur on private ownership downstream. Thus, Bull Trout reintroduction in Annie Creek will form one component of an integrated, watershed-scale effort by multiple partners to conserve native fish.

Increasing Awareness of the Battle Between Parasitic Copepods and juvenile Chinook Salmon

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The parasitic copepod, Salmincola californiensis, specifically parasitizes salmonids and is endemic to the Willamette River Basin but little information is known about the parasite. While juvenile Chinook Salmon spend time in reservoirs, they become heavily infected by these parasites. Recent research has shown that infection by these parasites has the potential to be detrimental to the overall survivability of juvenile Chinook Salmon as they move to the ocean. Swimming endurance is hindered, there is lowered survivability of juveniles after transport, and there is strong evidence to suggest disease transmission. Further investigations into the impact these parasites have on endangered juvenile Chinook Salmon are strongly encouraged.

Full-Sibling Reconstruction in a Middle Columbia River Subbasin to Characterize the Migratory Life Cycle of Pacific Lamprey

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Pacific lamprey (Entosphenus tridentatus) is an imperiled species within the Columbia River Basin and much of the biological information that is key to the success of conservation efforts is uncertain or absent. Specifically, biological information on size-at-age of larvae and age of

migrating juveniles are critical to understanding the population dynamics of this species. This information is challenging to collect as the diminutive size of larvae has precluded conventional means of tracking movement of early life stages. However, recent development of genetic markers (>300 SNPs) has created opportunity to use parentage analysis as a way to infer the ages of offspring, regardless of small larval size, that are assigned to known single parents or parent pairs. Thus far, the use of parentage analysis to infer offspring ages has been applied successfully to locations where adults have been translocated far upstream in the interior Columbia River. Ideally, however, we would need this kind of biological information across other sites that are widely distributed throughout the Columbia River basin because there may be factors that cause life stage development and timing of migration to vary across this geographic range. This study represents a unique opportunity to expand on this biological information within a subbasin in the middle Columbia River (Fifteenmile Creek, Oregon) in which there has been minimal manipulation. A proportion of adults (~10-15%) that volitionally migrated to this subbasin were collected for genetic analysis over a period of multiple years (2011-2015). Further, we have collected a set of larvae and juveniles that outmigrated from this subbasin during the spring of 2016, and sets of larvae that were collected by electrofishing in 2012 and 2014. Parentage analysis was used to assign candidate offspring to the adults that were collected from previous years and we estimated age (1-year-old) of a single larva that assigned to a single parent. The 377 ammocoetes that were collected in the screw trap in 2016 were estimated to represent 206 effective breeders (95% C.I. 168â€"249). This estimate of effective breeders is small relative to the numbers of adult spawners that are estimated to migrate into Fifteenmile Creek each year (range 1,600 to 3,200) based on mark/recapture. Finally, six full sibling families were recaptured across years and can provide growth and origin information for these families. Based on the lengths of recaptured full-sibling families, we hypothesize that most of the ammocoetes that were outmigrating from the basin in 2016 were progeny that were more than 5 years old and predated our parent baseline. This study will continue in future years, and data generated from it will be used to characterize the migratory life cycle of Pacific lamprey.

Parentage Based Tagging for Addressing Conservation and Management of Steelhead in the Columbia River basin

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Since 2008, cooperating state, tribal, and federal agencies have genetically sampled and genotyped steelhead broodstock at all hatcheries in the Snake River Basin in Idaho, Oregon, and Washington. This regional implementation of Parentage Based Tagging (PBT) has resulted in the

genetic tagging of >95% of the hatchery smolts produced in the Snake River (~12 million smolts per year). This accounts for ~61% of the hatchery steelhead that are released in the entire Columbia River basin each year. The Idaho Department of Fish and Game and the Columbia River Inter-Tribal Fish Commission are committed to using PBT technology to complement existing mechanical tagging evaluations, or in some cases replace mechanical tags for assessments where their use may have limited precision or uncertain accuracy. This poster provides examples of current sampling programs that are in place throughout the Columbia River basin that utilize the Snake River PBT baseline to address conservation and management questions throughout the region. Collaborative efforts are currently underway to extend this technology throughout the Columbia River Basin.

Tracking Salmonid Hatchery Stocks with Parentage Based Tagging Technology in the Columbia River Basin

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Parentage-based tagging (PBT) is a large-scale tagging technology for monitoring and evaluating salmonid hatchery stocks. Implementation of PBT involves annual sampling of hatchery broodstock to create a parental genotype baseline. Offspring produced by these parents can be non-lethally sampled either as juveniles or adults, and then genotyped to be assigned back to their parents; thus identifying their age and hatchery of origin. A large-scale demonstration of PBT is currently being applied to Chinook salmon and steelhead hatcheries in the Snake River basin, Idaho (2008-present), and efforts to expand annual tissue collection to Chinook salmon, steelhead, and Coho salmon hatcheries above Bonneville Dam began in 2012. Applications using the PBT baseline have only recently begun as the time it takes for tagged offspring to return to the basin is ~2-5 years after broodstock (i.e., parents) are spawned annually. Thus far, PBT has been applied for: characterization of stock composition in fisheries, estimation of stock-specific abundance and run-timing at dams, identification of physically unmarked hatchery fish, estimation of proportion of hatchery fish on spawning grounds, and identification of stocks using thermal refugia during migration. Adopting PBT more broadly in the Columbia River basin would allow the ability to track millions of hatchery fish and the opportunity to address a variety of parentage-based research and management questions.

Dynamics of Endangered Sucker Populations in Clear Lake Reservoir, California

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Lost River Suckers and Shortnose Suckers are long-lived endemic fishes of the Upper Klamath Basin, and both species are listed as federally endangered. Populations in Upper Klamath Lake, Oregon have received the most research and conservation attention, but populations in Clear Lake Reservoir, California are also imperiled. Results from a research and monitoring program for the Clear Lake populations that began in 2004 are beginning to reveal the factors that are hindering recovery of these populations. Spawning migrations into the only spawning tributary were monitored by remotely detecting PIT-tagged fish as they ascended the creek in the spring. Relating the timing and magnitude of the detections to reservoir water level and instream flows showed that both reservoir water level and instream flows exerted strong control on the migrations. Spawning was impeded by low water levels because creek access was limited, and the lowest instream flows were insufficient for spawning regardless of water level. Capture-recapture modeling based on PIT tag encounters showed that annual survival of both species in Clear Lake was lower overall and more variable than for spawning adults in Upper Klamath Lake. Monitoring for sucker PIT tags on breeding colonies of piscivorous waterbirds at Clear Lake revealed that large numbers of suckers were being consumed in years with successful nesting. Estimated minimum waterbird predation rates on suckers were higher in years with large and successful nesting colonies of pelicans and cormorants, and annual survival estimates from capture-recapture models were correspondingly lower in those years. The population of Lost River Suckers in Clear Lake is probably the most imperiled population of either species in the Upper Klamath Basin. Recovery of Clear Lake sucker populations depends on striking the right balance between the needs of downstream irrigators and the needs of the suckers for spawning and survival.

Crane Prairie Reservoir Fish Management: Balancing Conservation and Recreational Fisheries Goals

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Crane Prairie Reservoir is a 4,960 surface acre impoundment on the Upper Deschutes River in central Oregon created in 1922. The Oregon Department of Fish and Wildlife (ODFW) immediately began stocking the reservoir with hatchery fish. Primary species stocked include both rainbow and brook trout along with kokanee. Present stocking is limited to rainbow trout. The fishery is also supported by an adfluvial population of native redband trout. For many decades Crane Prairie Reservoir supported an extremely popular recreational fishery, renowned for producing trophy size rainbow trout. Illegal introductions of non-native fish began in 1953 with tui chub, followed by largemouth bass in the late 1970s and three spine stickleback in 1994. Brown bullhead, black crappie and bluegill are also present. Competition with non-native species resulted in a declining rainbow trout fishery. Continued use of a domestic rainbow trout

stock was thought to be contributing to the decline. In response, ODFW began developing a locally adapted native redband trout broodstock in 1998. A trap and weir was operated on the upper Deschutes River from 1998-2006. Fish were spawned on site and fertilized eggs transferred to Fall River Hatchery for incubation and rearing. First generation offspring were released into Crane Prairie Reservoir as fingerling at a rate equal to the Oak Springs rainbow trout stock. A significant improvement in the quality of the fishery was observed and the Cranebow stock became very popular with anglers. Continued operation of the trap indicated 28% of the captured adults in 2006 were Cranebow stock. Concerns with genetic impacts to the native redband trout population resulted in discontinued use of diploid Cranebows. A triploid Cranebow stock was developed in attempt to retain fishery performance while minimizing impacts on native redband trout. Performance of the hatchery stocking program and status of native redband trout were monitored via annual gill net inventories, creel surveys and redd surveys. Results from 2014-2016 indicate the rainbow trout population is dominated by native redband tout. Oak Springs and triploid Cranebow hatchery stocks are surviving and contributing to the fishery at similar rates. Observed redband trout redds during Upper Deschutes River surveys from 1995-2016 range from 584 to 1419 with a mean of 910, indicating a robust population. Angling regulations promote conservation of native redband trout through catch and release while providing a consumptive fishery for hatchery trout.

Reintroduction of Chum Salmon to Oregon Tributaries to the Columbia River

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Historically, chum salmon Oncorhynchus keta represented a significant portion of the salmon and steelhead returns to the lower Columbia River, with peak returns in 1928 estimated at over a million chum salmon. Beginning in the 1800s, changes to land use significantly degraded the habitats with which chum salmon are associated. Coupled with harvest rates > 80%, by the 1940s, over 90% of chum salmon populations were extirpated. In Oregon, recovery efforts began in earnest in 2012 with the initiation of the Chum Reintroduction Project. Since that time, a broodstock has been established, baseline data on habitat and fish distribution were collected, experimental reintroductions were conducted, restoration projects have been identified and initiated, and limiting factors research has been initiated. In this presentation, I describe (1) the ODFW adaptive management approach to achieving recovery goals, (2) returns from broodstock releases, and (3) reintroductions from 2013, 2014, and 2015. Preliminary results from reintroductions indicate adult outplanting and onsite incubation of eyed-eggs are viable techniques, although the efficacy of each depends on characteristics of the reintroduction site. As such, the Oregon approach to recovery includes employing a suite of reintroduction techniques in habitats spatially arranged throughout the lower Columbia River in an effort to spread risk and encourage adaptation to diverse environments.

Development of a Water Sampling Protocol for Monitoring and Management of *Ichthyophthirius multifiliis* in the Klamath River

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Ichthyophthirius multifiliis (Ich) is a ciliated protozoan that infects freshwater fishes in aquaria, hatcheries, and wild rivers. Ich infections have resulted in mortality events of pre-spawning salmon in the Klamath River, CA. The long term goal of this project is to describe and mitigate the occurrence of Ich outbreaks in the Klamath River through the development of an improved monitoring protocol. Currently Ich is monitored through lethal sampling of migrating adult salmon. This method is time intensive and imprecise. Ich has a waterborne infective stage, and so should be detectable in filtered water samples: an approach we have used successfully with another salmon parasite with a waterborne infective stage present in the Klamath River, Ceratonova shasta. Molecular quantification of Ich in water samples using qPCR could be an effective method for early detection of parasite levels above a disease threshold. At this point in the project we have demonstrated that Ich can be detected in 1L water samples collected in the Klamath River. We have begun to establish the relationship between the levels of Ich detected in water samples and observed salmon infection levels. This work is being undertaken in collaboration with Yurok tribal biologists and the CA-NV Fish Health Center, USFWS.

Juvenile Coho Movements and Habitat Connectivity in Lowland Tide Gated Streams of Coos Bay, Oregon

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Since the recognition of the diversity of juvenile life histories of Oregon coast coho salmon (OC) populations in lowland tidal streams there has been a growing interest and concern in how to restore and manage highly altered lowland tidal habitats. As evidence of the fundamental and ubiquitous nature of migratory coho rearing strategies increases, quantifying this component of the population remains a challenge in these highly simplified yet daily and seasonally dynamic systems. Mark recapture methods utilizing PIT tags provide data for metrics of growth that have been shown to be a suitable measure for survival of OC coho. Since 2008 Coos Watershed Association (CoosWA) has recaptured 1977 tagged coho in 3 lowland tidal basins that interact with the Coos Bay estuary. Metrics of coho growth across multiple temporal and special scales within the study streams will be analyzed and results compared to previous work in a regional headwater stream and local unregulated (not tide gated) lowland stream. Future management and restoration of connectivity in tidally influenced rearing habitat also presents challenges. Migratory passage windows at two fish friendly Muted Tide Regulated (MTR) tide gates in Coos Bay will be compared to standard top hinge tide gates. Current CoosWA PIT monitoring of fish passage at study stream tide gates will provide crucial population closure at the stream estuary ecotone for mark resight survival analyses and explicitly assess fish behavior and passage at tide

gates.

Historical Geospatial Reconstruction of Fluviodeltaic Environments of the Silvies River and Malheur Wildlife Refuge

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The Silvies River in southeastern Oregon supports a regionally significant population of native redband trout. It flows into Malheur Lake and Wildlife Refuge through a fluviodeltaic system comprised of two main distributaries, the East and West Forks of the Silvies River. Like other valley floors in the region, this system has experienced significant land-use changes associated with agricultural development over most of the mid-20th century. These changes coincide with the introduction of warmwater native fish, such as smallmouth bass and yellow perch. The goals of this study were to assess historical geospatial changes in the fluviodeltaic system of the Silvies River and to relate these changes to potential patterns of land use and irrigation development. This project was undertaken in a seminar by senior undergraduate students in the Environmental Sciences Program at the Oregon Institute of Technology. Students learned multiple modes of digital aerial photo analysis, including indexing, scanning, georeferencing, and vector digitizing. Students georeferenced a series of 1954 aerial photos to 2011 orthophotos, then developed and overlayed vectors illustrating changes in key fluviodeltaic features. Overall, significant differences in fluvial features and hydrologic processes were evident, including several types of natural channel meandering processes, channelization, draining of oxbows and other backwater environments. These changes may serve to bolster channelized flow but reduce habitats associated dispersed shallow ponding.

Demand for Watershed Groups

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Diversity, once it is acknowledged and tolerated, and in any life pursuit, can play a very significant role in the development of a society, an organization or a community. Nonetheless in the professional career development. I have first come across the complexity of the issue in transboundary watersheds through my research assistantship in the Transboundary Freshwater Dispute Database (TFDD) in Oregon State University (OSU). This time added a lot to my experience, knowledge and understanding of the subject, which lead me after that to conduct my master research in the Applied Economics program on the demand for nonprofit organizations (NPO) in watershed basins. Watershed NOP's are arranged to improve water quality and protect endangered species, in my research, I account for diversity, political opinion and views, and race as factors that affect the demand for watershed NPO's, and I account for the number of endangered species in a watershed, in addition to the specie type (salmon vs. eels, anadromous vs. catadromous). Another interesting element about this research is that NPO's,

even though they are privately organized, they use public money for their project functioning, which arises the question if this money is efficiently and fairly allocated to the whole society to achieve the best outcomes considering the different factors of income, population, race, endangered species, etc. My presentation will describe this relationship between the demand for watershed NPO's and other factors that include diversity, race, social differences, political views and endangered species, and it's going to have the personal element of a women-economist who would like to enter the conversation and give it broader perspectives, and new conclusions of the economics view point of today's social problems. It is also going to encounter for the common pool aspects of getting funds from public to solve societal problems. I have crossed the seas some years ago and came to Oregon. I came joining my husband, but also searching for new adventures, and examining the true factors of every person's life and goals. I have concluded that despite our differences, we all share collective concerns, dreams and targets. As an economist, I attain my role in this society also as a woman, who seeks to challenge the common perceptions about economist, and approve that economics is also a moral social science, and with some tweaks to it can include all distinct elements of the society such as race, gender, social differences, and more.

Hutton Junior Fisheries Biology Program - Diversifying Natural Resources on the Oregon Coast

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The American Fisheries Society Hutton Junior Fisheries Biology Program is an opportunity to increase diversity in the natural resources field. The Bureau of Land Management, United States Forest Service, Oregon Department of Fish and Wildlife, and Coos Watershed Association have jointly hosted several Hutton Interns since 2014. Students work with fish biologists, and also get to shadow other natural resource professionals such as wildlife biologists, hydrologists, geologists, foresters and ecologists. While the Hutton program is intended to increase exposure to women and minorities in the fisheries field, another benefit may be to provide opportunity to other underrepresented groups, such as low income families.

Fish Field of Dreams: If You Blow It Up, Will They Come? Juvenile Salmonids in the White Salmon River Following Dam Removal

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Condit Dam, at river kilometer 5.3 on the White Salmon River, Washington, was breached in 2011 and removed completely in 2012 allowing anadromous salmonids access to habitat that was blocked for nearly 100 years. A multi-agency workgroup concluded the preferred salmonid restoration alternative was natural recolonization with monitoring to assess efficacy, followed by

a management evaluation five years after dam removal. Limited monitoring of salmon and steelhead spawning has occurred since 2011, but no monitoring of juveniles occurred until 2016. During 2016, we operated a rotary screw trap at river kilometer 2.3 (3 kilometers downstream of the former dam site) from late March through May, and used backpack electrofishing during summer to assess juvenile salmonid distribution and abundance. The screw trap captured steelhead Oncorhynchus mykiss smolts, parr, and fry, and coho O. kisutch smolts and fry. We estimated the number of steelhead smolts at 3,851 (SE = 1,454) and coho smolts at 1,093 (SE = 412). Steelhead and coho smolts tagged with PIT tags were subsequently detected downstream at Bonneville Dam on the Columbia River. Few Chinook salmon O. tshawytscha fry were captured, possibly a result of trap location, or effects of a December 2015 flood. Sampling in Mill, Buck, and Rattlesnake creeks (all upstream of the dam site) showed that juvenile coho were present in Mill and Buck creeks suggesting that spawning is occurring there. We compared O. mykiss abundance data in sites on Buck and Rattlesnake creeks to pre-dam removal data. During 2016, age-0 O. mykiss were more abundant in Buck Creek than in 2009 or 2010, although age-1 and older O. mykiss abundance was similar. In Rattlesnake Creek, age-0 O. mykiss abundance during 2016 slightly exceeded the mean abundance from 2001 - 2005, although age-1 and older O. mykiss abundance was lower than 2001 - 2005. These efforts also provided for genetic samples to investigate parental and ESU stock origin. Juvenile salmonid sampling efforts during 2016 have shown that natural spawning is producing steelhead and coho smolts, coho are colonizing some tributaries, and these efforts have provided the first post-dam juvenile abundance estimates. We hope to continue to monitor abundance trends, distribution, and life history patterns of recolonizing salmonids in the White Salmon River to assess natural recolonization and inform management decisions.

A Web-Based Graphical User Interface for a Linked Foraging and Bioenergetics Model of Juvenile Chinook salmon growth in reservoirs

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Models can be great tools for exploring and expanding our understanding of fish ecology and ecological processes, allowing us to visualize and understand potential impacts of specific human actions on water management. We recognize, however, that developing a user-friendly interface for complex mechanistic models able to translate science to a diverse audience can be challenging. To meet this challenge, we present a user-friendly web-based interface for a linked foraging and bioenergetics model of juvenile Chinook Salmon, intended to inform reservoir management effects on juvenile growth and behavior. Originally coded in Python 3.0, we are working as a collaborative computer science and fisheries science team to develop this web-based graphical user interface (GUI). The interface will make this model available and accessible to researchers, managers, stakeholders, and students. The interface runs in any web browser,

and guides users through parameter selection and input, running the model and outputting graphics and tables without the need for coding experience or local installation of software. The current interface will be on display during the poster session for open testing and a discussion on user preferences.

The Influence of Hatchery-Origin Strays on the Genetic Composition of Chinook Salmon in the Grays River, Washington

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The Grays River, Washington supports a population of tule fall-run Chinook Salmon Oncorhynchus tshawytscha that were listed as Threatened under the U.S. Endangered Species Act in 2005. Habitat degradation, past harvest practices and impacts from hatchery programs were all identified as having contributed to the decline of this population. In 2016, the National Marine Fisheries Service expressed concern over potential impacts to tule fall-run Chinook Salmon from the Select Area Bright (SAB) hatchery program, managed by the Oregon Department of Fish and Wildlife (ODFW). This program uses broodstock derived from Rogue River fall-run Chinook Salmon to produce approximately 1.4 million smolts that are acclimated to and released from two locations of the lower Columbia River (LCR). The SAB program is intended to support commercial and recreational fisheries, but some adults escape fisheries and stray into LCR tributaries, including the Grays River. Genetic analyses of juvenile Chinook Salmon sampled from the Grays River in 2007 and 2008 found that 33% and 64% of samples assigned to the Rogue River Chinook Salmon stock in the lower and upper reaches of the river, respectively. Since that time, the Washington Department of Fish and Wildlife has documented a substantial increase in the number of Chinook Salmon marked with left ventral fin clips â€" the mark used by the SAB program â€" at their weir on the Grays River, leading to speculation about the spawning success of these stray fish. In order to evaluate genetic ancestry of naturally spawned Chinook, we use the Genetic Analysis of Pacific Salmon (GAPS) baseline and genotypic data from 13 microsatellite loci for adult and juvenile Chinook Salmon sampled from the Grays River from 2008-2015. We assigned samples to their most likely population of origin and inferred levels of introgression from the SAB program as evidenced by juveniles with mixed ancestry. We discuss our findings in the context of past and present SAB program management and the conservation of Grays River Chinook Salmon.

Synthesizing the State of the Science for Cold Water Refuges and Thermal Diversity in the Willamette River Basin

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Multiple regulatory, management, and conservation organizations would like to protect and increase thermal diversity and cold water refuges (CWR) for spring Chinook salmon (Oncorhynchus tshawytscha), winter steelhead (O. mykiss), and other fishes in the Willamette River basin of northwest Oregon. The Oregon Department of Environmental Quality regulatory standards define cold water refuges as portions of a water body where or times during the diel temperature cycle when the water temperature is at least 2 degrees Celsius colder than the daily maximum temperature of the adjacent well-mixed flow of the water body (OAR 340-041-0002(10). Cold water refuges are considered critical fish habitats because main channel temperatures often exceed those that protect cool water fishes. This inter-disciplinary study is synthesizing current and emerging science related to thermal diversity and CWR. This effort will develop conceptual frameworks for understanding how geomorphic, hydrologic, and riparian vegetation processes create CWR as well as when, where, and how the thermal mosaics and CWR influence cold water native fishes in the Willamette River. Here, we share some of the emerging stories from this synthesis effort, including (1) the types and numbers of features supporting cold water refuges are greatest along the upper Willamette River from Eugene to Corvallis, but then decrease downstream, (2) thermal conditions vary greatly seasonally and spatially, and (3) protecting and enhancing thermal diversity and CWR is constrained by other factors, such as dam operations, gravel trapping, revetments, and climate conditions. Information resulting from this collective effort will be used in collaboration with the habitat restoration community in the Willamette River basin to identify actions at the site and reach scales to protect, enhance, and restore this important habitat.

Intensively Monitored Watersheds: What have we learned, what does the future hold?

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To fully understand the value of Intensively Monitored Watersheds (IMWs), we should ask, What Does the M in IMW Mean? Is it for Monitoring, Management, Manipulation, or Modeling I would suggest that all of these interpretations and applications of IMWs are appropriate, and necessary.
The most important take home message from implementing IMWs for the last decade are that ecosystems can be manipulated, fish and habitat changes are detectable and attributable to the

restoration actions and learning from these experiments can be shared and applied across the region.
IMWs demonstrate a direct, design based inference linkage between restoration actions and fish population response, but perhaps more importantly, IMWs provide excellent support for model-based inference as to this linkage.
The current IMW Network coverage is fairly good with respect to representation by ecoregion, restoration type, and by species, so the design of additional large-scale restoration experiments should take into consideration the work currently underway.
The management of the current network of IMWs should consider the value each contributes and thus, should weigh the learning opportunities each presents in making decisions about continuing, expanding or curtailing each individual project.

Selection of Candidate Odorants as Migratory Cues for Olfactory Imprinting and Homing in Salmonids

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The importance of olfactory cues in aquatic species has been extensively studied across a suite of ecologically relevant behaviors including identification of conspecifics, foraging and avoidance of predators. In addition to these behaviors, olfactory cues have been found to play a critical role in habitat recognition and site fidelity across a number of species.
Pacific salmon are known for their extensive spawning migrations in which adults return from the ocean to their natal streams to spawn. The use of olfactory cues by salmonids in identifying natal streams in freshwater has been extensively studied, with evidence demonstrating imprinting of odors within the olfactory landscape occurring at critical developmental periods. Salmonids are able to detect different classes of chemical compounds such as amino acids, bile acids, prostaglandins and inorganic salts at relatively low concentrations. While these compounds do exist in freshwater systems, identifying definitive odor candidates that may serve as persistent cues over spawning migrations remains to be determined.
Relatively recent work has demonstrated the potential role of dissolved free amino acids as a migratory cue. Here we focus on identifying ideal candidate odors that may serve as appropriate olfactory cues in homing to natal streams in Pacific salmon. We examine the process of selecting the most suitable compounds to serve as homing cues to not only increase imprinting effectiveness but to also be incorporated into hatchery water to reduce straying thereby minimizing interactions between hatchery and wild salmonid populations.

Impacting Fisheries Policymaking with Science

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The development of sound natural resource policy starts with good science. But whose job is it to ensure that scientific understanding is effectively conveyed in the hectic and often highly political world of state policymaking? And how can that be best accomplished? Please join Erik Kancler, legislative liaison to the Oregon Chapter of the American Fisheries Society, in a conversation about ORAFS' current efforts to impact key state-level policy discussions on issues such as suction dredge mining and hatchery practices.

Atlas: Strategic Prioritization of Habitat Restoration Actions Based on Research Evidence and Local Consensus

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BPA has worked collaboratively with partners in the Grande Ronde and Clearwater Subbasins to develop and implement a strategic, evidence-based Atlas habitat restoration prioritization framework to maximize biological benefit and the return on the financial investment for Endangered Species Act listed fish species. Atlas scopes, maps, and prioritizes hundreds of restoration opportunities throughout a watershed for implementation during a 10 - 20 year period.

NOAA Fisheries Education Programs that Impact Underserved Populations

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Underserved communities are often most vulnerable to the environmental hazards within NOAA's purview, indicating a growing need to develop culturally relevant materials. To meet these needs, the NOAA Education community is producing a coordinated portfolio of educational products, programs, and services targeting underserved audiences.
NOAA also recognizes that diversity brings a wider variety of perspectives and approaches to leadership, policy, strategic planning, problem solving, and decision making. NOAA is committed to strengthening the pool of candidates from underrepresented groups who are trained and graduate with degrees in disciplines that support NOAA mission.

Lamprey Detection and Distribution in the Willamette National Forest

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Pacific lamprey (Entosphenus tridentatus) were added to the U.S. Forest Service (USFS) and Bureau of Land Managements (BLM) Interagency Special Status / Sensitive Species Program (ISSSSP) in 2015. In addition, the phylogeny and distribution of brook lampreys (Lampetra spp.) remains unresolved. Additional data is needed evaluate potential impacts to lamprey populations from USFS/BLM resource management and habitat restoration activities. Beginning in 2015, we set out to: (1) determine the distribution of lampreys across federally managed lands within the Middle Fork Willamette sub-basin, Oregon, USA; (2) develop a protocol to assess reach-level occupancy of larval lampreys; (3) identify landscape-level and reach-level variables associated with lamprey occupancy at the sub-watershed level; and (4) describe the morphological and genetic variability of lampreys across the project area. In 2016 we expanded our effort to include the North Santiam and McKenzie sub-basins. Using a general random tessellation stratified (GRTS) sampling regime, we targeted 100m perennial streams segments less than 2.5%, along with all floodplain habitat. We used a backpack electrofisher to assess lamprey occupancy at three reaches (20 x bankfull width) within each sub-watershed, by focusing on detection at the patch-level (depositional micro habitat). Up to 15 lamprey specimens (larval, transforming, or adult Lampetra spp.) were retained from each site for genetic and morphological characterization. In 2016 we also retained six whole specimens per subwatershed and tissue samples for all non-salmonid fishes captured.

Assessing Effectiveness of Predator Control Using Tiger Muskellunge on Northern Pikeminnow in Lakes and Reservoirs

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Northern pikeminnow (Ptychocheilius oregonensis) are a primary predator on juvenile salmonids in the Pacific Northwest. Man-made reservoirs have increased the size of Northern Pikeminnow populations, which in turn threaten salmonid reintroduction projects. In an effort to reduce the predation effects of northern pikeminnow on juvenile salmonids, tiger muskellunge (northern pike Esox lucius x muskellunge E. masquinongy) have been stocked in various lakes and reservoirs in Washington State since 1988 to serve as an apex predator and reduce the population's size of northern pikeminnow. This presentation will discuss the background of tiger muskellunge stocking into two reservoirs in southwest Washington and the resulting impacts to the food web of these waters.

Juvenile Migration Behavior of Hatchery Reared Steelhead from an Integrated Broodstock fed a Standard Lipid vs. Low Lipid Diet

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Recently the role of hatcheries in salmon and steelhead management has increased from just providing fish for sport and commercial fisheries to being used as a tool for species conservation. One critical uncertainty in hatchery management is the relationship between fish diet and migration behavior. Recent research suggests that traditional diets high in lipid levels may significantly contribute to a migration behavior whereby salmon and steelhead do not migrate to the ocean upon release. Instead they remain in freshwater (residualism) causing size-based competition for food, predation on wild juvenile salmonids, and disruption of breeding patterns. It is thought that lean fish are more likely to migrate from the freshwater environment due to their higher energetic needs, whereas fatter fish are more likely to remain in freshwater due to their lower energetic needs. To examine this hypothesis we PIT tagged 750 fish from each diet type and monitored migration behavior from release at Abernathy Fish Technology Center (rkm 5) to a screw trap operated by WDFW and a PIT tag antenna array near the confluence of Abernathy Creek and the Columbia River. Migration timing and travel time were similar between fish fed a standard lipid diet and those fed a low lipid diet with most fish migrating within a week of being released and at night. Unlike migration timing and in contrast to our initial hypothesis, the number of fish that migrated out of Abernathy Creek was much higher for fish fed a standard lipid diet (553 of 749 fish tagged; 74%) than those fed a low lipid diet (444 of 745 fish tagged; 60%). This result correlated with initial tagging data that found fish fed a standard lipid diet were also larger in size than those fed the low lipid diet. Logistic regression confirmed that fish length and not diet type was most important for fish migration. We recommend that studies involving diet and migration behavior take into account body size differences in study design due to its large role in fish behavior.

Coho Salmon Spawner Mortality in Western US Urban Watersheds: Bioinfiltration Prevents Lethal Storm Water Impacts

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Adult coho salmon (Oncorhynchus kisutch) return each fall to freshwater spawning habitats throughout western North America. This migration coincides with increasing seasonal rainfall, which in turn increases stormwater runoff, particularly in urban and urbanizing watersheds in the Pacific Northwest because of the land cover characteristics of these basins (e.g., increasing impervious surfaces with increased urbanization). For more than a decade, field assessments in urban streams in the greater Seattle area have shown that adult coho are dying prior to spawning, often at rates exceeding 50% of the entire fall run. Such high levels of mortality are a significant concern for the long term conservation and recovery of wild coho, particularly those distinct population segments vulnerable to ongoing and future development pressures in the Pacific Northwest. Although indirect evidence from forensic investigations and geospatial land use analyses has implicated toxic runoff as causing the mortality syndrome, this had not been directly demonstrated. Thus, we exposed otherwise healthy coho spawners to undiluted stormwater collected from a high traffic urban arterial (i.e., highway runoff) and highway runoff that was first pre-treated via bioinfiltration through experimental soil columns to remove pollutants. Results revealed that untreated highway runoff collected during nine distinct storm events over three seasons was universally lethal to adult coho relative to unexposed controls. The mortality syndrome was prevented when highway runoff was pretreated by soil infiltration. The findings demonstrate that exposure to urban stormwater is sufficient to cause the adult coho mortality syndrome. However, although the causal chemical stressor(s) have not yet been identified, conventional green stormwater infrastructure (GSI or LID technologies) can effectively protect adult spawners from the acutely toxic effects of highway runoff. Finally, integration of these types of infrastructure may p**r**otect salmonid habitat in urban watersheds.

Correlating the Sublethal Neurotoxicity of Carbaryl with Behavioral Impairments in Salmonids

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Foraging habitat of Coastal Cutthroat Trout (Oncorhynchus clarkii clarkia), which inhabit Willapa Bay, Washington, were historically contaminated with carbaryl seasonally. Salmonids, such as Cutthroat Trout, forage throughout the estuary in the summer months when carbaryl, a carbamate insecticide, was applied to oyster beds during low tide to control burrowing shrimp populations. Previously proposed for listing under the Endangered Species Act, this population of Coastal Cutthroat Trout was potentially exposed to sublethal concentrations of carbaryl transported off-site from oyster beds via tidal activity. On the day of spray, carbaryl has been measured in the estuarine water column at concentrations >1,000 ppb. Previous studies determined Cutthroat Trout do not show an olfactory response to carbaryl, do not avoid carbaryl-containing water, and that short-term carbaryl exposure rapidly (< 2 hrs) depresses brain and muscle acetylcholinesterase activity in a dose-dependent manner (IC50s of 213 ppb and 185 ppb, respectively) for approximately two days. Sublethal, neurotoxicity bioassays with behavioral assessment endpoints were utilized to determine the impacts of environmentally relevant carbaryl concentrations on the swimming behavior of Cutthroat Trout as well as their vulnerability to predation. Results indicate salmonids' swimming performance and ability to avoid predation are significantly affected at carbaryl concentrations 750 ppb and 500 ppb, respectively. Therefore, carbaryl applications in the estuary may impair the behavioral performance of exposed Cutthroat Trout and increase their vulnerability to predators.

Monitoring Oregon's Marine Reserves: Initiating a Long-Term Ecological Data Set Despite the Inevitable Advancements in Technology

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Establishment of Oregon's Marine Reserves began in 2010, with the fifth and final reserve implemented in early 2016. The Oregon Department of Fish and Wildlife's (ODFW) long-term ecological monitoring of the reserves focuses on four core monitoring tools: video lander, hook

and line, remotely operated vehicle (ROV), and SCUBA. Establishing methods for long-term data collection with these tools is a priority for ODFW's ecological monitoring team. During the initial learning-and-adapting phase of establishing these data sets, video based monitoring tools have evolved with advancements in camera technologies, becoming more compact and cost effective at collecting higher resolution imagery. Further, new technologies have allowed for additional data to be collected during surveys and these enhancements have addressed some of the important metrics with which reserves are evaluated. Most recently, ODFW is evaluating the benefits and challenges of adding stereo-video capacity to the lander, ROV, and SCUBA tools to increase the capacity to obtain fish size distributions inside and outside marine reserves. However, addressing comparability of data sets before and after the upgrades has proven challenging. The trade-offs of altering the tools and methods in an increasingly long-term data set must be carefully considered within Oregon's monitoring program and at a broad scale for compatibility with other efforts along the west coast.

Wild Ideas to Save Salmon: Why This Type of Session; Session Ground Rules; and Expectations for Success

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The Oregon American Fisheries Society annual meeting is a time when biologists can come together, leaving their agency/company affiliation behind, and openly discuss questions and assumptions concerning fisheries management. This first presentation will introduce a different type of session for the annual ORAFS meeting. We will talk about the need for this type of session, the ground rules and expectations of the session, and the general signs that will indicate if the session is successful. The audience will be encouraged to be active participants in the session discussions.

Success through Collaboration: An Overview of the Warner Basin Passage and Screening Program

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Limited water in the eastern Oregon desert means that Warner Basin streams are a critical water source to both irrigators and native fish. The low lying portions of the of the Warner Basin provide the most fertile agricultural land in the area (primarily hay and beef production), as well as stream reaches critical to fish migrating from the large lakes in the valley upstream to high quality spawning and rearing habitats. Irrigation diversions exist on all of the major streams in the basin. More than 10 diversions in the lower basin provide water to irrigators and have been identified as fish passage barriers that lack screens on the associated ditches. Irrigation diversions and ditches have been identified as a primary threat to fish recovery in the basin. For the last decade, the Warner Basin Aquatic Habitat Partnership (WBAHP) has both independently and collaboratively worked to restore passage and connectivity for aquatic species in the

Warner Basin, specifically for Warner Sucker, Warner Lakes Redband Trout, and other native fishes. In that time, passage has been restored and screens have been installed at several locations in the basin, with several more currently in the design and planning stages. The key to bringing this vision together is building relationships with the local ranching communities of Adel and Plush, Oregon. Recently, through communication and actions, the WBAHP has built relationships and trust with the local landowners. In the last five years, the Lake County Watershed Council, Lakeview SWCD, and BLM have worked hard to improve these relationships by collaborating with landowners on ideas to put restoration actions on the ground, where ranchers can experience improved irrigation efficiency while also providing fish passage and screening. An overview of the passage and screening program in the basin will be presented, including the obstacles faced and how they are being overcome.

Using Pre and Post Brook Trout Removal Biomass Estimates for Determining Recovery Rate of Bull Trout in Crater Lake National Park

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Non-native brook trout (Salvelinus fontinalis) removal projects were performed in Sun Creek within Crater Lake National Park to benefit native bull trout (Salvelinus confluentus) over two decades. Restoration monitoring efforts have been conducted meticulously over this time and annual counts of bull trout via snorkel surveys suggest that the bull trout population in Sun creek has reached equilibrium. The purpose of this study was to model trout biomass estimates pre and post non-native trout removal to determine whether a bull trout carrying capacity has been reached in Sun Creek. While an assumed equilibrium has been reached, results suggest estimates of trout biomass pre non-native trout removal are significantly higher than estimates of bull trout biomass post non-native trout removal. Certain biologically accepted hypotheses could account for the difference seen in pre and post trout removal biomass estimates (self-thinning), and this method has proved useful for prioritizing allocation of resources for monitoring restoring populations of fish.

Diamond Lake and Tui Chub: Using the Past to Inform the Future

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Diamond Lake (Douglas County, Oregon) has supported a productive and economically important trout fishery since rainbow trout (Oncorhynchus mykiss) were first stocked in the

1900's. However, illegally introduced tui chub (Gila bicolor) have disrupted the popular trout fishery and adversely impacted water quality on multiple occasions leading to rotenone treatments of the lake in 1954 and 2006. Following the 2006 treatment, trout fishing productivity returned to pre-infestation levels but golden shiner (Notemigonus crysoleucas) were re-discovered in the lake in 2008, and in 2015 a single tui chub was collected during fall sampling. In an attempt to control potential tui chub population growth, the Oregon Department of Fish and Wildlife (ODFW) initiated invasive species control measures. Two seasonal employees were hired and stationed at Diamond Lake with the purpose of collecting and removing as many cyprinids as possible and providing an initial assessment of tui chub numbers in the lake. Through trap-netting (24h sets, N=49), approximately 20,000 golden shiner and 24 tui chub were collected during June and July 2016. Tui chub lengths ranged from 127-229mm TL and on average the proportion of golden shiner to tui chub collected per net set was approximately 800:1. In addition to increased sampling efforts, ODFW stocked roughly 15,000 tiger trout (Salmo trutta — Salvelinus fontinalis, μ=127mm FL) into the lake in 2016. The ODFW also plans to stock triploid brown trout (Salmo trutta, 15,000 in 2017, μ=127mm FL) along with continued stocking of tiger trout at Diamond Lake into the foreseeable future. Tiger and brown trout have been found to be effective predators of cyprinids and stocking both will provide an opportunity to analyze and compare their predatory behaviors through diet analysis which in turn will be used to refine future stocking of piscivorous fish at Diamond Lake. Initial findings indicate a need for continued sampling and removal efforts along with stocking of piscivorous fish species at Diamond Lake to help inhibit tui chub population growth.

Monitoring Anadromous Fish Populations Using Environmental DNA

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Environmental DNA (eDNA) allows for the detection of organisms without requiring sampling of living organisms themselves. The first generation of eDNA science has shown that DNA from organisms can be extracted from many different sources in the environment and identified taxonomically. The next generation will use this information for environmental management. To do this, we need to test whether eDNA can give us quantitative information because it is very useful to know if a population of a species is large or small, and growing or declining. eDNA has yielded quantitative information in controlled experiments in the lab and in ponds, but whether eDNA can render reliable quantitative information in flowing streams and near-shore marine systems is still an open question. Fish excrete mucus, skin cells, gametes, urine and feces into water. DNA can be captured from the water using filters and quantified using species-specific PCR primers and probes with quantitative real-time PCR or digital PCR. We tested the ability of eDNA to produce useful quantitative information for monitoring eulachon and Pacific salmon populations in Northern Southeast Alaska and Oregon anadromous streams. We quantified eDNA concentrations contemporaneously with a mark-recapture project to estimate eulachon abundance in the Chilkoot River, with daily weir counts of adult and juvenile salmon in Auke

Creek, and in the Columbia River. Our preliminary results from three years of monitoring suggest that eDNA not only reliably assesses species presence, but may be an affordable means to monitor culturally and biologically important aquatic and marine resources when researchers are interested in an index of abundance or information about phenology. Given adequate calibration, eDNA-based methods could be used on large spatial or long temporal scales to monitor fish populations at a fraction of the cost of traditional methods.

How the Endangered Species Act and Ecotoxicology Are Changing Water Quality Management in Oregon

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Conserving the ecosystems on which endangered and threatened species depend, and providing a program to conserve those species, are among the primary purposes of the Endangered Species Act (ESA). But while exposure to toxicants in their habitat is known to be harmful to the health of ESA-listed salmon and steelhead, measuring that exposure as ecological risk at the population or community level is a challenge. Recent research has greatly improved our understanding of how toxicants enter aquatic habitats through diffuse, non-point sources like stormwater runoff, and are then spread widely across the landscape with potent ecological consequences. It is also showing us how controlling those sources through use of green infrastructure, or low-impact development, may be more possible and less expensive than was previously thought. This presentation will explain how sources of surface runoff that have a connection to Federal funding or permit authorities may be required to come into full compliance with the ESA, and how that process can help to accelerate adoption of better surface runoff management for the benefit of ESA-listed species and the larger aquatic community.

Portland Harbor Superfund Site: After 16 years of Study, What is Next?

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Portland Harbor is located in the lower 12 miles of the Willamette River in Portland Oregon. This portion of the river is an active harbor in an urban area with many historical and ongoing industrial operations along the shoreline. In addition to being Oregon's major port, the river supports other uses including fishing, recreation, and habitat for aquatic and terrestrial ecosystems. Native Americans have been using the resources of Lower Willamette River for thousands of years and the river is a significant part of their culture.
Contamination in the harbor reflects historical activities in and around the harbor for the past 100 years. The most significant problem seen today is the presence of persistent organic contaminates such as polychlorinated biphenyls (PCBs), pesticides, dioxin/furans and polyaromatic hydrocarbons (PAHs). Many of these compounds degrade very slowly and in aquatic systems some of these compounds will biomagnify in the food web causing adverse risk

to higher trophic level species including humans that consume fish from the harbor.
Due to the concern about contamination in the river EPA conducted a Preliminary Assessment of the Portland Harbor in the late 1990's. Based on the results of that study, EPA placed the site on the National Priorities List (NPL) in December 2000. This marked the beginning of a sixteen year process of in-river data collection (sediment, water, and biota), assessment of risks to humans and ecological receptors, and evaluation of engineering actions, institutional controls, and natural processes to reduce chemical-related risks to acceptable levels. After significant input from the public, Tribal Governments and resource agencies the EPA issued a Record of Decision (ROD) for the site in January 2017. This talk will describe the major underpinnings of the ROD and discuss technical approach selected by EPA to clean up Portland Harbor.

Hexavalent Chromium in the Columbia River from Hanford Activities

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The Hanford Site produced plutonium for nuclear weapons from 1944 until late 1980's. In1989 the site transitioned to a cleanup that will continue into the 2060s to 2070s. Nine nuclear reactors and four processing plants were built on 586 square miles of shrub-steppe dissected by fifty miles of the Columbia River. Early efforts to dispose of hazardous wastes included pouring it into trenches, holding ponds, dry wells or releasing it directly into the river. During operation 444 billion gallons of contaminated liquids were disposed of directly in the soil; one million gallons of high-level waste leaked from underground tanks while 56 million gallons of high level waste remains in aging underground tanks.
As river water was drawn to cool nuclear reactors, hexavalent chromium (Cr(VI)) as sodium dichromate was added to inhibit corrosion in aluminum process tubes. This cooling water was discharged to earth basins and would have contained Cr(VI) at 350 to 700 µg/L. Unintentional spills contributed Cr(VI) in the soil. A recent report by the US Geological Survey verified plumes of Cr(VI) either approach or seep into the Columbia River, in addition to other contaminants. In 2010 it was estimated the Cr(VI) plume covered 1905 acres (at or above 10 µg/L).
Cr(VI) is mobile and toxic to aquatic organisms. Lamprey, sculpin and mussels are of particular concern to the Trustee Council, as well as salmon eggs and alevin in redds and river spawning beds. Chromium does not biomagnify in aquatic food chains, although more studies are needed regarding transfer of chromium in terrestrial food chains. The EPA sets water quality criteria standards for Cr(VI) for aquatic life at 16 µg/L (acute exposure) and 11 µg/L (chronic exposure). Several contaminated springs and seeps along the river bank are monitored. Aquifer tubes installed adjacent to the shore monitor many locations near known groundwater plumes. In 2008 DOE initiated a study of possible upwelling in deeper waters. This work documented widespread occurrence of groundwater upwelling from the 100-B/C Area to the 300 Area, in nearshore areas on both sides of the river and also mid-river. Cr(VI) was the most common contaminant. The highest observed Cr(VI) concentration was 331 ug/L at 100-D Area, and at 100-K the highest concentration (44 ug/L) occurred mid-river.
Initial attempts to reduce Cr(VI) to insoluble and less toxic trivalent chromium by cultivating certain bacteria in the soil, and again by injecting sodium dithionite as a reductant, did not

provide lasting results. Currently five pump-and-treat facilities operate along the river corridor with a focus on removing chromium from the groundwater. A new type of resin that strips out more hexavalent chromium is being used at Hanford's pump-and-treat facilities, reducing the time plants must be taken offline. Both in the B/C and the D/DR reactor areas, Cr(VI) contaminated soil was excavated and DOE is determining whether that is sufficient.

Collaborating to Develop a Watershed Action Plan

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The Partnership for the Umpqua Rivers (PUR), is a non-profit, non-governmental 501(c)(3) voluntary corporation with a mission to maintain and improve water quality and fish populations from source to sea in the streams of the Umpqua River Basin in Southwest Oregon. PUR works with others in the basin including the Oregon Department of Fish and Wildlife, the Cow Creek Band of Umpqua Tribe of Indians, the U.S. Bureau of Land Management, and other private and public entities to plan and implement projects on a variety of land ownerships. In 2016, PUR worked with these and other partners to develop a watershed action plan (Plan) for the West Fork Cow Creek Watershed. The focus of the Plan is to direct restoration project funding to recover or restore native fish populations in the watershed. West Fork Cow Creek is a tributary of Cow Creek, which is a tributary of the South Fork Umpqua River. The watershed includes about 55,194 acres in Douglas County, Oregon. No major highways or population centers occur in the watershed, although an extensive network of both paved and unpaved logging roads is present. In addition to West Fork Cow Creek, the watershed includes a number of fish-bearing streams, many of which support anadromous salmonids. The first step in developing the Plan was to hold a workshop with partners in spring 2016 to construct a framework for scoring and ranking potential restoration projects. The framework included metrics for native fish species potentially enhanced, amount and type of habitat enhanced or made available, and relative difficulty of site access. Implementation strategies and estimated costs were also integral to scoring projects. The second step in developing the Plan was to collect information on current habitat and fish presence throughout the watershed to inform the scoring of metrics included in the framework. Field surveys were conducted in summer 2016 to collect instream and riparian habitat information at 50 sites throughout the watershed, to collect fish by electrofishing or snorkeling at 16 sites and to collect environmental DNA samples at 18 sites. PUR and partners then worked together to develop a list of potential restoration projects throughout the basin. Workshops with partners were held in fall 2016 to utilize all available information to score potential projects. Participants then placed each project into one of three tiers based on the distribution of final scores. This project serves as an example of how a collaborative effort among public and private entities can lead to restoration of habitat for native fish species across a moderately sized fifth field watershed.

Salmon After a Century: Success of the 2016 Inaugural Fishery in the Malheur River, Oregon

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Chinook salmon and steelhead were extirpated from the Upper Malheur River in 1919 with the construction of the Warm Springs Dam. All anadromous life histories remaining in the Malheur River and other Upper Snake River tributaries were later extirpated by the construction of the Hells Canyon Complex on the Snake River. In 2016, 200 adult Chinook salmon were released in the Upper Malheur River for a joint tribal and public fishery, the result of successful negotiations between the Burns Paiute Tribe and the Oregon Department of Fish and Wildlife. The goal of this presentation is to share the success story of this unique fishery from the tribal perspective, lessons learned from monitoring the first salmon in the river in nearly one hundred years, and surprises along the way. The feasibility study supporting this effort was presented to ORAFS in 2010.

North Warner Multi-Ownership Forest Health Restoration Project

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A healthy forest is a key contributor to a highly functioning watershed. Ultimately precipitation captured in the top of the watershed affects the health of everything within it. Forest landscapes within the Warner Basin are suffering from unhealthy overstocked forests from decades of fire suppression, which increases risk of large-scale disturbance such as wildfire or insect and disease.

Within the North Warner Multi-Ownership Forest Health Project, private landowners and agencies are working across ownership boundaries to promote forest health, fire resiliency, watershed restoration, and wildlife habitat restoration. This landscape is unique due to the extensive stands of old legacy ponderosa pine mixed with aspen, meadows and streams. The goal of the partnership is to collaborate across ownership boundaries to implement forest health and watershed treatments with a goal of creating a seamless, healthy forest landscape resilient to natural disturbance. The partnership includes 13 private landowners, 8 federal, state, and county agencies, and 7 non-governmental partners.

In 2016, a multi-resource forest inventory was completed on 32,100 acres of private land. This included basic forest health attributes, as well as aspen and mountain mahogany condition, noxious weeds, juniper, shrub, etc. This inventory allows partners to prioritize stands for forest health treatment based upon density of conifers, surface fuel loading, and relative risk of disturbance, and to provide private landowners with recommendations for forest health treatment options. The partners are now actively working to gain funding for implementation in 2017.

Identification, Prevention, and Management of New Zealand Mudsnails (Potamopyrgus antipodarum)

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The New Zealand mudsnail (Potamopyrgus antipodarum) is a tiny invasive snail that was introduced on fishing gear, and represents a growing threat to our fish habitat in Oregon and nationwide. They can occur at very high densities (up to 500,000/m2 has been recorded), they have been shown to outcompete other aquatic grazers, and are a poor food choice for fish. The NZ mudsnail is still only limited to sections of the Deschutes, Rogue, Owyhee-Malheur, Columbia, and coastal basins. The good news is Oregon has many more rivers that can be protected from the NZ mudsnails, such as the Umpqua, McKenzie, John Day, and the Willamette. Scientists, survey crews, fish hatchery operators, fire fighters, boaters, and anglers can all prevent the additional spread and impact of NZ mudsnails by following simple prevention and decontamination practices. In this presentation we will review current research on the impact and spread of NZ mudnsails and summarize the current best practices in prevention and decontamination techniques. Specifically we provide tools for taking a HACCP approach (Hazard Analysis and Critical Control Point Planning) to preventing NZ mudsnails and specific control strategies for a variety of control points. When you act to prevent NZ mudsnails, you will also be preventing other invasive species and pathogens such as aquatic plants, chitrid fungus, whirling disease, and Viral Hemorrhagic Septicemia. Join us to find out how easy it is to prevent the spread and impacts of these damaging invaders.

Applying MMIs at High Resolution: An Investigation of Spatial Patterns and Temporal Variation Within an Oregon Watershed

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Like many inland waters worldwide, streams and rivers of the Western U.S. are faced with a multitude of challenges stemming from past land use practices and changing future conditions. To address these issues, the USEPA has developed empirical tools for evaluating instream conditions and monitoring the status of our freshwater resources over time. These efforts have

made substantial progress in integrating quantitative methods into multimetric indices (MMIs) used for national and regional assessments and have provided an enhanced understanding of condition patterns across the broader landscape. To examine the extent of spatial and temporal variability not captured by the sparse distribution of sample sites used in these large-scale assessments, we applied two existing MMIs to inter-seasonal fish and macroinvertebrate data from the Calapooia Basin in Oregon's Willamette Valley. Our chosen indices revealed a high degree of variation in biotic condition within our study area. With notable exceptions, indices were seasonally robust, indicating potential flexibility for scheduling sampling. An increased understanding of condition patterns occurring at fine spatial scales and the natural and anthropogenic effects influencing them can help guide and prioritize restoration and management.

Oregon's Pesticide Water Quality Monitoring and Stewardship Programs

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This presentation will provide a summary of how Oregon agencies work together to address potential water quality impacts from pesticides used in the state, and the tools used to assess and respond to pesticides in surface and groundwater. The presentation will highlight the recently-expanded Pesticide Stewardship Partnership Program as a collaborative, voluntary approach for monitoring and reducing pesticides in Oregon waters. Relevant surface water pesticide monitoring data findings and analyses will be presented, with a focus on the pesticides determined to be of greatest concern to aquatic life and human. Information will also be provided on the Program's stewardship technical assistance grant projects and legacy pesticide waste collections, which are intended to reduce pesticide contaminant risks in Oregon's waters.

Genetic Monitoring of Sockeye Salmon Reintroductions: Informed Opportunities and Adaptive Management

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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 91% of the returns originated from the LBC population, and 14 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.

Honoring the Culture and Science of Native Freshwater Mussels, Salmon, and Indigenous Peoples

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In the Pacific Northwest, native freshwater mussels are a traditional First Food of Indigenous cultures. The current status and trend, and ecology of mussel populations remain largely unexamined in the Columbia River Basin. Freshwater mussels are long lived (decades) and are known to have co-evolved life histories whereby parasitic mussel larvae are dispersed by host fishes. Less is known about the host-parasitic relationship, status and trend of populations for PNW taxa than eastern taxa. Current distribution and abundance of mussels in much of the Columbia River appears to be reduced based on Traditional Ecological Knowledge. A distinction between the Eastern taxa and PNW taxa is the pulse of nutrients by anadromous fishes into the basin. In this film is the beginning of a study interweaving Western and Indigenous Science examining nutrient recycling from local dead chinook salmon (Onchorhynchus tshawytcha) by western pearlshell (Margaritifera falcata) mussels in the Salmon River basin, Idaho.

Recovering Stream Flows, Passage and Fish in the Lostine River

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Chinook salmon were nearly extirpated in the 1990s from the Lostine River in NE Oregon. Historically, irrigation withdrawals severely dewatered reaches of the Lostine River, precluding adult Chinook migration to spawning grounds above flow-impaired reaches. Fears of an impending ESA crisis similar to that witnessed on the Klamath in 2001 prompted Lostine irrigators, the Nez Perce Tribe and The Freshwater Trust to seek a cooperative solution to instream flow and fish passage issues. Thirteen years later, the Columbia Basin Water Transactions Program continues to fund the Lostine Minimum Flow Agreement, which compensates irrigators to maintain minimum stream flows during critical migration periods. Through a combination of restoration and hatchery supplementation, the Lostine River Chinook population is largely recovering, though more remains to be done. Active, real-time monitoring of adult Chinook passage continues to inform flow-passage relationships and guide flow and habitat restoration efforts, including those of the Grande Ronde Model Watershed.
Several irrigation diversion structures on the Lostine compound the passage issue, especially at low flows. Managers are working in partnership with ditch companies to eliminate partial barriers by replacing antiquated, deteriorating diversion structures with fish friendly roughened riffles. Building on the success of the City of Lostine Diversion project in 2012, the uppermost anthropogenic barrier on the Lostine was rectified at the Sheep Ridge Diversion in 2016. Partnership is vital to these projects as implementers continue to incorporate irrigation efficiencies, habitat elements, and effectiveness monitoring to compliment minimum flow agreements.
In 2015, the Lostine Minimum Flow Agreement evolved to incentivize long-term water management solutions and higher minimum stream flows for fish. Additional compensation for meeting more rigorous streamflow targets in 2015, 2016 and 2017 is deposited into a shared account managed by a stakeholder group comprised of representatives from five different irrigation canal companies. The stakeholder group has the authority to decide how to spend and leverage these funds for water management planning efforts or irrigation efficiency infrastructure projects that have the ability to increase the reliability of water supplies for farms and fish into the future. Cooperative agreements such as the Lostine Minimum Flow Agreement paired with active habitat restoration can be a model for sustainable solutions to increasingly complex water management issues involving ESA-listed fish species.

NOAA Fisheries Western Regional Action Plan
Michelle McClure
NOAA

To manage the natural resources in the California Current ecosystem and the freshwater systems connected to it, decision-makers need information about which species will be affected and how, and which approaches will best reduce the impacts on human and natural communities while maintaining a healthy ecosystem. NOAA Fisheries' Northwest and Southwest Science Centers recently developed a Science Action Plan to identify key efforts we can make to provide that information.
To manage the natural resources in the California Current ecosystem and the freshwater

systems connected to it, decision-makers need information about which species will be affected and how, and which approaches will best reduce the impacts on human and natural communities while maintaining a healthy ecosystem. NOAA Fisheries' Northwest and Southwest Science Centers recently developed a Science Action Plan to identify key efforts we can make to provide that information. We identified specific actions to address each of the National Climate Science Strategy's objectives, highlighting seven priority actions: 1) Create a West Coast Climate Committee (WC3) to coordinate and evaluate regional science activities and coordinate with the Regional Office West Coast Region Climate Team. 2) Build scientific expertise in all areas (e.g. field, 'omics, modeling, MSE, economics, etc.) to address ongoing and anticipated climate variability impacts; 3) Evaluate all data collection efforts to address climate change in a coordinated manner. 4) Conduct Management Strategy Evaluations (MSE) for hake, albacore and sablefish. 5) Develop full life-cycle models for salmon & sturgeon to link freshwater, estuary and ocean habitats. 6) Use the California Current Integrated Ecosystem Assessment as a tool for implementing EBFM. 7) Expand delivery of Fisheries' climate-related communications to stakeholders.

Place-Based Education in the Deschutes Watersheds

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In this presentation, Place-Based Education in the Deschutes watersheds, I will share some of our local stories about interdisciplinary education activities. My presentation aligns closely with the Oregon Environmental Literacy Plan's goals to develop environmentally literate youth and will interest many conference participants with current information about effective watershed education methodology, interdisciplinary activities, examples of effective partnerships, and regional watershed curricula. As our program is interdisciplinary, we guide students to connect to their watershed not just through science but also with art, writing, environmental exploration, and music. For the science-based components of our program, I will share examples of the activities that allow students and teachers to accomplish Next Generation Science Standards. I also plan to provide attendees with information about our inclusive approach to engaging a wide diversity of students with a variety of learning styles, interests, backgrounds, ethnicities, and socioeconomic status.

Connecting Efforts to Achieve Cultural Diversity in AFS Programs at Multiple Scales

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The theme of this Oregon Chapter AFS meeting of increasing the diversity and inclusion in the fisheries profession provides a forum to begin to examine the challenges we have as a professional society to engage and increase the diversity of participants and leaders in aquatic resource conservation. Recent important reports and studies, such as Green 2.0 and studies by Arismendi and Penaluna have documented the lack of cultural, gender and racial diversity in the

leadership of conservation organizations and academic programs. What steps can we make to be better informed and sensitive to the needs and values of others and benefit from synergy and communications? I provide an overview of some of the activities conducted at different scales within AFS to increase inclusion of diverse points of view. One such program for early recruiting, the Hutton Junior Fisheries Biology Program, is coordinated through the AFS office and a large committee of AFS members. This 15 year program's vision and goals are to stimulate interest in careers in fisheries science and management among groups underrepresented in the fisheries professions, including minorities and women through paid summer internships for high school students. In Oregon, several outstanding mentors have participated including Stephanie Messerle, Karla Cottom, Jeff Jackson, and Ed Hughes, Jonas Parker, Tom Walker, Wendy Short, Brett Blundon and Nikki Swanson. Several AFS sections provide leadership through the Governing Board to address inclusion, especially the Equal Opportunity Section that provides travel awards for underrepresented students to attend annual meetings, and manages the selection of recipients of the Emmeline Moore Prize to recognize long term leadership by members in diversity and human rights. The Education Section sponsors a mentoring event at annual meetings to increase networking. The Hutton Committee and EEO Section have sponsored workshops at annual meetings focused on conversations regarding diversity and inclusion. Within AFS chapters, programs for mentoring of students through scholarships and other activities are key factors in engagement and retention of undergraduate and graduate students. In addition to AFS, similar efforts to promote diversity are underway in other natural resource professional societies, governmental and non-governmental agencies. We appear to lack a structure for tracking and communicating successes and impediments across these efforts. Clearly there is need to better connect the different efforts to improve communications and synergy. I propose potential ways to stimulate engagement, and communications within and among the programs, and form stronger networks for AFS and others with similar goals to increase our collective effectiveness.

Reintroducing Salmon Above Dams: Benefits and Challenges to Fish Rearing in Reservoirs

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Recovery plans for threatened or endangered salmon species increasingly call for reintroductions above high-head dams that have blocked fish from historic spawning and rearing habitat. The large, deep reservoirs that salmon are exposed to at some point during their early life-history represent a completely novel habitat type and understanding how reservoir-rearing juvenile salmon interact with this environment is important to any restoration program, especially when designing effective downstream passage around dams. Research conducted on juvenile Chinook salmon rearing in several Willamette Valley Project reservoirs revealed several unexpected results. Over 90% of juveniles produced above dams entered reservoirs as fry and most of these fish reared in the reservoir for approximately 6 months

before outmigrating in the fall. However, some fish never left the reservoir, adopting an adfluvial life-history strategy whereby they spent 5-6 years in a reservoir before returning upstream to spawn. Growth rates of juvenile Chinook salmon rearing in reservoirs were very high, approaching 1 mm/d in some reservoirs. Juvenile Chinook salmon rearing in reservoirs were very susceptible to parasitic copepod infestation. The proportion of juvenile Chinook salmon infested ranged from 70-100% in reservoirs compared to 20 m). Predation risk by piscivorous fish species varied by reservoir, with some containing a diverse suite of native and invasive predator species and other containing very few potential predators. Reservoirs can provide both benefits and challenges to rearing juvenile Chinook salmon that managers need to be aware of if reintroduction efforts above dams are to succeed.

Make Beaver Great Again vs Sanctuary Streams for Beaver - Moving beyond Politics to Utilize Beaver in Salmon Conservation

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Recovery is a goal long supported by Oregon AFS as well as many other conservation organizations. But, over the last twenty years, the complexity of beaver ecology and management issues has resulted in slow progress characterized by a frustrating array of stalled initiatives, unhelpful rules, and inadequate guidance. But, even to an entrenched Fish Curmedgeon, recent developments in restoration science, agency actions, and a growing, widespread appreciation for the positive benefits beaver offer hope that the pace and direction of beaver restoration is about to improve substantially.
This presentation will briefly recap earlier efforts to improve beaver management, but the focus will be on recent developments. For example, the December 2016 release of NOAA Fisheries Recovery Plan for Oregon Coast Coho, Response to Comments, #2 Beaver is particularly helpful: http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/oregon_coast/oc_coho_response_to_comments.pdf.

Building on What We Have Learned about Toxics in the Columbia River: Pathways, Pseudo-persistence, and Unknowns

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The Columbia River basin holds environmental and cultural significance for all who call it home; the approximately 8 million people living in the basin who depend on its resources for their health and livelihood, as well as hundreds of fish and wildlife species, including thirteen stocks of threatened and endangered salmonids, which rely on the ecosystem for food, security, and habitat. With growing scientific concern about ecosystem health, scientists are trying to increase

public awareness about the presence of contaminants in the environment and their potential to affect fish, wildlife, and humans.
Building on previous contaminant studies and to help water managers and policy makers shape future sampling efforts and toxic-reduction activities, the USGS performed a reconnaissance study to assess contaminant concentrations contributed directly to the Columbia River through wastewater-treatment-plant effluent and stormwater runoff from adjacent urban environments from nine cities in Oregon and Washington. Many contaminant classes were analyzed including pharmaceuticals, personal care products, plasticizers, PCBs, flame retardants, legacy compounds, currently used pesticides, and mercury. More than 80 percent of the contaminants analyzed from many of these classes were detected. Despite the differences in location, population, treatment type, and plant size, detection frequencies were similar for many of the compounds detected. Ultimately these results can be used to emphasize to residents that their actions affect the ecosystem that they live inâ€"what goes down the drain eventually reaches the river.
Even with our improved understanding of contaminants and their effects in the Columbia River Basin, much research is still needed to address the unknowns and effectively develop reduction and restoration activities to protect the ecosystem we all call home.

Grande Ronde Fish Habitat Program: The Evolution of Fish Habitat Restoration in the Grande Ronde Basin from 1984-2016

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The Oregon Department of Fish & Wildlife's Grande Ronde Fish Habitat Program is funded by the Bonneville Power Administration to implement fish habitat restoration on private property as partial mitigation for impacts to ESA listed salmon and steelhead from operation of the Federal Columbia River Power System. The program's riparian restoration efforts first began in 1984 in the Joseph Creek subbasin, a tributary to the Grande Ronde River in Northeast Oregon. Since then, the focus for restoration efforts has expanded to include the Upper Grande Ronde, Catherine Creek, and Wallowa subbasins.
Over the last 32 years, the Grande Ronde Fish Habitat Program has evolved its restoration approaches and techniques used. This evolution, specifically relating to protection, project prioritization, and restoration techniques, has resulted in more successful habitat restoration in the Upper Grande Ronde Basin. For instance, the program increased the time in which projects are under an easement, as well as adopting a ridge-top to ridge-top view for protection. The program has worked with basin partners to prioritize restoration areas based on biological data which has resulted in a more strategic, rather than more opportunistic projects. Restoration actions now look to address the processes and functions within riverine systems, and not just a singular symptom. Tools used to address process and function have matured from just riparian fencing to the reconstruction of multiple fish habitat components, including complete floodplain and channel construction as necessary.

Aiding Adult Pacific Lamprey Passage at Low-Elevation Dams in the Umatilla River, Oregon

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Re-connecting habitats is critical to the recovery of any imperiled species. For example, within just the first 50 km of the Umatilla River in northeastern Oregon, U.S.A., adult Pacific lamprey are obstructed by seven low-elevation dams that prevent them from reaching spawning habitat in the drainage. We prioritized these impediments for improvement and worked with state and federal partners to provide passage routes for lamprey at six of the seven most egregious structures. Post-improvement monitoring was conducted using both radiotelemetry, visual counts, and PIT tag detection. At 3-Mile Falls Dam, the lowest obstacle in the drainage, lamprey use of a lamprey-specific passage structure (LPS) increased steadily since its installation in 2009 and in the past few years the LPS has accounted for over 70% of lamprey passage over this obstacle. Complete removal of the dam at Boyd's Diversion, the next obstacle upstream improved lamprey passage from 25% to 96%. In general, less dramatic improvements in passage efficiency were observed at structures where less costly improvements were made. This work represents a first attempt to address lamprey passage basin-wide in order to achieve recovery of this species, that is of great cultural importance to the Confederated Tribes of the Umatilla Indian Reservation.

Salmon Recovery: Growing Threats and Growing Collaborative Efforts in the Willamette River

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Floodplain habitat function and connectivity is a limiting factor noted in the Upper Willamette River Recovery Plan for the Chinook salmon and steelhead listed as threatened under the Endangered Species Act (ESA) since 1999. We have continued to learn about the floodplain habitat role for these species since the Recovery Plan was written in 2010. We also know more about the timing of Chinook juvenile rearing, thanks to extensive ODFW efforts which showed they are present year round, using the river as more than a migration corridor. Generally, juvenile steelhead are more abundant in the main channel sites, yet they have been observed in seasonal floodplains. Juvenile Chinook are more likely to be present in the mainstem from late fall through late springtimes when the floodplain is more likely to connect the river to the adjacent land. The life history pathways present in the floodplain include the emergent fry in the upper reaches to varying numbers of subyearling smolts, fall-winter migrants and yearling smolts in the lower tributaries and mainstem reaches.
We know more about the importance of floodplain connectivity. Defining the floodplain quite concisely as the flat land directly adjacent to the river in the Willamette River Report Card, masks the elements the report card tracks such as floodplain forests and channel area. Floodplain inundation substantially increases the total habitat availability, and shallow areas with low

velocity flow are particularly favored by overwintering juvenile salmonids. Forests and floodplain channels provide refuge and also affect temperatures during low flow summer and fall periods. In contrast, developed floodplain elements, such as mines, farm fields, revetments, intakes, outfalls, roads and other impervious developments all change the floodplain habitat-forming processes.
Restoration actions are catching up by removing barriers to the floodplain, and planting forests and other native plants adapted to the Willamette Basin climate. Major restoration efforts have come through the combined efforts in part due to the Willamette Project Biological Opinion and only because of the generous funding from Meyer Memorial Trust, OWEB, and BPA. Ongoing changes to the floodplain, as well as expected future changes in hydrology and climate, will pose challenges to recover salmonid habitat-forming elements in the floodplain.

Modelling Juvenile Chinook Salmon Foraging and Bioenergetics to Understand Reservoir Rearing

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In the Pacific Northwest, large dams and their reservoirs alter the life history patterns of anadromous juvenile salmonids by providing conditions which lead to growth rates exceeding those observed in upstream reaches. We have expanded and combined mechanistic models of visual foraging and bioenergetics to predict growth conditions for juvenile salmon under different management and climatic scenarios. Opportunities for foraging by the fish constrain maximum consumption, and are informed by field measurements of temperature, light and zooplankton abundance across depths. We explore how observed differences in juvenile Chinook Salmon size could be explained by the physical and biological conditions found within upper Willamette Basin Reservoirs during normal operation and drought years. While some reservoir conditions are highly conducive to early summer growth, reservoirs may become ecological traps in late summer, before fall drawdowns that encourage downstream passage through the dams. This model is intended to inform reservoir management effects on juvenile growth and behavior and will be hosted online, available for future hypothesis testing and generation.

The Reintroduction of Coho Salmon to the Yakima Basin

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Coho Salmon were essentially extirpated from the Yakima River by the mid-1980s with counts at

Prosser Dam totaling only 18 (likely hatchery-origin) fish in 1988. The Yakama Nation initiated a hatchery-planting program in the mid-1980s and a Coho Re-Introduction Study in the mid-1990s with an objective to restore natural populations of coho to native habitats. Development of an in basin brood stock was the first and most vital step in the recovery study. Donor stocks from Lower Columbia River Hatcheries with wide range of genetics were introduced into the Yakima Basin. Adult coho returning from these releases were spawned and reared at the Prosser Fish Hatchery. Beginning in 2012, 50% of all returning adults were of Yakima Basin parentage. The 5 year coho escapement into the Yakima River has averaged nearly 9,041 fish, with a record run in 2014 of nearly 25,000. A natural run of coho to the Yakima River has been re-established, with moderate returns ranging from 300-1000 over the past 10 years.
In the first phase of the project we demonstrated that it is possible to reestablish a natural population using a non-native out of basin stock. The in basin coho smolts, have showed higher smolt to smolt survival rates than that of the newly imported out of basin smolts derived from lower Columbia River Hatcheries. They have continued to perform equally or outperform the out of basin coho smolts each year for the past 11 years.
The second phase of the project began in 2008 and we are now testing individual recovery techniques for tributaries. These have included, Pit tagging and releasing late summer coho parr into tributaries to test overwinter survival and habitat conditions, releasing adult coho directly into spawning habitat in tributaries, and using mobile acclimation of smolts in upper reaches of tributaries.
The final phase of the project, full reintroduction, is planned to begin in 2018. A new coho facility called the Melvin R. Sampson Coho Supplementation Facility will be constructed for this purpose.

Bioaccumulation and Ecological Effects of Contaminant Stressors in Columbia River Aquatic Food Webs

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The Columbia River receives effluent containing complex mixtures of contaminants of emerging concern (CECs), which accumulate in bed sediments and may damage aquatic resources. Several interdisciplinary studies have been carried out in recent years to assess impacts of different classes of CECs at several levels of the food web in the Columbia River Basin. The ultimate goal of these studies is to determine whether exposure to and uptake of these contaminants is linked to detrimental biological endpoints in fish and wildlife. Organisms studied include species of ecological and cultural importance such as largescale sucker (Catostomus macrocheilus), Pacific lamprey (Entosphenus tridentatus), white sturgeon (Acipenser transmontanus), and osprey (Pandion haliaetus). Chemical concentrations increased in largescale suckers along an exposure

gradient towards the urbanized downstream sites. Biomagnification was shown to occur, and environmental quality benchmarks were exceeded in some cases. Biomarker results showed that bioaccumulation caused negative effects in some organisms. Legacy compounds and CEC concentrations were nearly an order of magnitude higher in white sturgeon than those measured in largescale sucker. Concentrations exceeded human health cancer-screening levels for several chemicals in sturgeon fillet samples. Flame retardants, pesticides, industrial, and personal care compounds were measured at levels of concern in tissues of larval and adult Pacific lamprey and should be considered as a possible factor in the precipitous reduction in returns of this culturally and ecologically important species. Contaminant levels will be compared between species in the context of the trophic level of the organism and chemical properties of the compounds. These studies provide information about distributions, bioaccumulation, trophic transfer, and effects of CECs on key species and food webs.

The Deschutes Partnership: Combining Land Conservation, Streamflow Enhancement, and Stream Restoration for Landscape-Scale Change

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This session examines lessons learned by The Deschutes Partnership over nine years of formal collaboration toward a specific conservation outcome: restoring the habitat necessary to support the reintroduction of salmon and steelhead into 220 miles of Central Oregon streams. A nationally recognized model for collaboration, the collective efforts of
The Deschutes Partnership have brought efficiency, focus and leverage to bear in increasing the pace and scale of watershed restoration work. This program examines the reasons behind the Deschutes Partnership's success, as well as the challenges presented by maintaining partnerships over the long term.

A Programmatic Approach: Evaluating the Effects of Aquatic Invasive Macrophyte Control on ESA-listed Salmonids and Their Habitat

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Aquatic invasive macrophytes are capable of causing extinction of native plants, reducing biodiversity, competing with native organisms for limited resources, and altering ecosystem processes. Recent initiatives to better understand and address aquatic invasive macrophyte impacts to Endangered Species Act (ESA)-listed fish and their habitat have highlighted the complexity of the programs and the regulatory environment in which they operate. As a result, NOAA's National Marine Fisheries Service (NOAA Fisheries) and stakeholders (e.g., United States Department Agriculture and United States Fish and Wildlife Service), propose to develop a more holistic and comprehensive approach to aquatic invasive species control that links data and

decisions. We propose a new process for planning and regulatory compliance that could streamline the existing process and manage the on-going, expanding, and challenging issues facing invasive macrophyte control. The current control programs are based on a species-by-species approach. The new aquatic macrophyte approach proposes one comprehensive ESA Section 7 Programmatic that incorporates all current and potential future control activities. This shifts the focus from a particular plant species to treatment methods used to control multiple invasive species (e.g, chemical, mechanical, physical, and biological). This type of program-level consultation process: (1) provides a new adaptive frame-work for prescribed management actions, (2) has the potential to streamline the existing regulatory process, and (3) decreases the time to implementation. A programmatic approach to aquatic invasive species control is a prudent step forward to help better inform management actions, minimize future risk to listed species and their habitat to help meet ESA-listed species recovery goals and objectives.

Harnessing the Power of Diversity and Inclusion: Strategies and Initiatives Across NOAA Fisheries, West Coast Region

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Recent initiatives by the United States Department of Commerce have highlighted the importance and dedication to recruit, retain, and develop a diverse, high performing workforce that draws from all segments of society and values fairness, diversity, and inclusion. NOAA Fisheries remains committed to providing equal opportunity to all applicants and current employees and fostering and supporting a diverse workforce where all employees feel included, connected, and engaged in its mission of promoting job creation, economic growth, sustainable development, and improved standards of living for all Americans. NOAA Fisheries supports diversity and inclusion throughout its workforce via numerous programs such as student internship programs, career development and leadership programs, and specific policies/plans such as its Federal Equal Opportunity Recruitment Program Plan. We provide examples across NOAA Fisheries West Coast Region (WCR) of existing and new strategies, initiatives, programs and policies that support the mission of a diverse and inclusive workforce across NOAA line and staff offices and science centers. We provide information on new efforts such as the WCR Diversity and Inclusion Cross-divisional Team, who's overarching mission is to Create an organization where fairness, diversity, and inclusion are valued and where every employee has the opportunity to reach their fullest potential [NOAA Fisheries Diversity and Inclusion Plan 2016-2021]. These types of efforts ensure coordination, communication, information sharing, and collaboration on Diversity and Inclusion efforts across WCR offices, divisions, cross-divisional teams, and key staff.

Programmatic Approach to Evaluating Salmon Habitat Improvement Efforts in the Columbia Basin at the Project Scale

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In their recent review of research, monitoring, and evaluation projects, both the Northwest Power and Conservation Council and the Independent Scientific Review Panel recommended that the Bonneville Power Administration (BPA) and its partners develop a consistent, rigorous, and cost-effective approach for evaluation of salmon habitat restoration actions implemented under the Council's Fish and Wildlife Program. In response to this, a programmatic action effectiveness monitoring (AEM) program for evaluation of habitat restoration actions in the Columbia River basin was developed. Here we describe the basic approach being used to evaluate new and completed barrier removal, instream habitat improvement, floodplain, riparian planting and fencing projects, and examples of results from project monitoring. A multiple before-after-impact-control (MBACI) design is being used to evaluate a subset of new actions and an extensive post-treatment (EPT) design for actions implemented prior to 2014. Habitat, fish, and macroinvertebrate data are being collected using protocols consistent with those of the Salmon Recovery Funding Board and the Columbia Habitat Monitoring Program. More than 80 projects have been sampled since the program began in 2014, with several additional projects planned for inclusion in the program in 2017. As an example, we provide preliminary results from monitored of floodplain projects. Monitoring of floodplain projects has shown an increase in available off channel habitat and improved habitat quality using habitat suitability index
(HSI) modeling. Preliminary results from macroinvertebrate sampling illustrate the availability of food resources for salmonids at floodplain restoration sites. Innovative techniques to improve the accuracy of hydraulic modeling around large woody debris jams will be presented. We close with recommendations for future programmatic project-effectiveness monitoring efforts.

The Interactive Effect of Salinity and Temperature in the Nile Tilapia

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Global climate change is altering the environment of aquatic species in a variety of ways that strongly influence the physiology of these species1. Physiological studies are crucial to predicting how species will respond2. Most physiological studies focus solely on one stressor. However, to best understand how an organism will respond to external perturbation, multiple stressors and their interactions must be studied. In order to discover the interactive effect of

salinity and cold temperature. Nile tilapia provide an ideal model to study the combined effect of temperature and salinity as it inhabits freshwater systems that are vulnerable to sea level rise, and because of the large amount of genetic information available for this species3. The biogeography of tilapia may change as sea level rises rendering their current niche uninhabitable. To predict whether tilapia and other freshwater species will exhibit a shift in distribution, we need to better understand how the severity of salinity and temperature stress, separately and in combination, will affect such species.
Nile tilapia (Oreochromis niloticus) were subjected to a 1 hr stress treatment where salinity and temperature were manipulated. Treatments were either 22 c or 14 c, and varied salinities of 0ppt, 16ppt, or 34ppt. All fish survived the treatments. Tissues were then collected, and assayed using flow cytometry and western blotting for PCNA and p53.

Modeling the Effects of Control Efforts on a Population of Common Carp (Cyprinus carpio) in a Shallow Eutrophic Desert Lake

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The introduction of Common Carp (Cyprinus carpio; hereafter carp) into North American waterways has led to widespread alteration of aquatic ecosystems. An example of this alteration can be found in Malheur Lake, located on Malheur National Wildlife Refuge (MNWR) in Southeastern Oregon. Invasion of carp in this system is hypothesized to be responsible for the loss of aquatic vegetation as well as declines in waterfowl productivity. Over the past 65 years, efforts to remove carp and restore the aquatic ecosystem have included eight rotenone treatments, each of which led to an immediate decline in the carp population, inevitably followed by a rapid rebound in the abundance of carp in subsequent years. Accordingly, MNWR sought to identify new alternatives to control carp and better understand their population dynamics. Therefore, we developed a novel carp population dynamic model, which was then used to explore the efficacy of alternative control measures (commercial fishing, electroshocking eggs, and avian predation) that target multiple life stages. Similar to previous studies, preliminary model results suggest that there is no single removal method that when implemented would decrease the overall carp biomass below the desired threshold (100 kg/ha) due to compensatory responses in demographic rates (i.e. growth, mortality, and recruitment). However, a combination of two removal methods (0.6643; commercial fishing and electroshocking eggs) was able to reduce the carp biomass below the desired threshold. Therefore, our preliminary results indicate that decreasing the carp biomass below the threshold critical to initiate ecological restoration at Malheur Lake is possible; however it would come at a significant investment to the MNWR. Collectively, the preliminary results of these model simulations represent a realistic assessment of multiple factors that influence the success of carp

control on the MNWR, and the ability to use carp control as a means of restoring the aquatic system to pre-invasion conditions.

Using Environmental Metabarcoding to Detect Multi-Taxa Aquatic Biodiversity in Streams
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Aquatic biodiversity is highly imperiled worldwide, with many species already known to be threatened, extirpated, or extinct. Current monitoring of stream-living animals is mainly focused on evaluating listed species without much attention paid to other species that are less-charismatic, cryptic, or rare, but have biodiversity value. However, many aquatic species from multiple taxa warrant monitoring by managers, but due to logistical and financial reasons this has become an overwhelming task. Hence, there is a need for a rapid and accurate assessment of aquatic species from multi-taxa in actual streams, including fishes, amphibians, crustaceans, and insects. We collected various volumes of water at five different sites along a stream to understand 1) how the aquatic assemblage changes moving upstream, especially on a stream that has an impassable dam midway upstream where workers pass upstream native fishes only; 2) how detection is influenced by the volume of filtered water; and 3) how detection is affected by taxon-specific primers from different mitochondrial genes. We used high-throughput sequencing of PCR products to demonstrate that eDNA reads can shift moving upstream depending on the species. By using multiple genes, we find improved differentiation among similar species because several gene sources offer multiple opportunities for genetic variation. Our study demonstrates that environmental metabarcoding can be used as a qualitative and quantitative proxy for aquatic assemblages in streams. This analysis can be used to make informed management and conservation decisions for a wide range of taxonomic groups in aquatic ecosystems, including endangered, rare, and cryptic species. Ultimately, this will allow for data-driven prioritization of conservation actions for all aquatic species.

Invasive Aquatic Plants: Who, Where, and What to do, An Overview
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Aquatic plants are known to provide important habitat for fish and wildlife as well as contribute to overall ecosystem functions by cycling nutrients, stabilizing sediments, and improving water clarity. Excess growth of non-native species, however, can result in deleterious effects on aquatic ecosystems, recreation, and aesthetics. In the Pacific Northwest, a number of aquatic plants have established in our lakes, reservoirs, rivers, and estuaries that are non-native and impacting a

variety of resources. This presentation will provide an overview of the pathways of introduction, commonly encountered invasive aquatic plants (emergent, submersed, and floating-leaved), and common control options including physical, mechanical, biological and chemical control options.

Whychus Creek Habitat Restoration at a Watershed Scale - Opportunities and Challenges

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Whychus Creek historically provided some of the best spawning, rearing and migration habitat for wild salmon and steelhead upstream of the Pelton Round Butte Dams. However, more than 100 years of human manipulation including berming, channel straightening and irrigation diversion development has resulted in degraded fish and wildlife habitat along with connectivity issues (e.g. fish passage barriers) throughout the watershed. Addressing habitat deterioration and fragmentation is critical for the long term success of the anadromous fish reintroduction program.

The Upper Deschutes Watershed Council along with local partners including the Deschutes Land Trust and Deschutes National Forest have been working on these problems since 2007 using a programmatic approach toward habitat and connectivity restoration to increase the pace and scale of developing and implementing restoration projects along Whychus Creek.

This approach allows habitat to be restored at a watershed scale more efficiently and provides more opportunities for reintroduced salmon and steelhead spawning and rearing once they re-enter Whychus Creek. The restoration approach can also be considered holistic as dynamic channel formation, floodplain connectivity at or below bankfull flows, sediment sorting and deposition, shallow groundwater levels and healthy riparian plant community establishment are considered equally important alongside channel and instream habitat construction and development.

While this approach provides a broad range of benefits, it also provides some challenges. These types of process based restoration projects tend to see the greatest changes in their first few years of evolution. With increased pace of restoration, changes and opportunities to maximize lessons learned from one project may not be fully realized before the next project is implemented. In addition more traditional monitoring protocols are not always applicable, realistic or cost effective in these types of very complex dynamic systems with multiple feedback loops. Determining effective ways to measure outcomes based on project goals and objectives continues to evolve.

Inclination Angle and Intensity of Magnetic Fields in Hatchery Environments and Navigation Implications for Salmonids

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During migration, salmonids derive positional information from two magnetic elements (inclination angle and intensity) and actively use this geomagnetic signature to change their global orientation relative to their destination. This research attempts to quantify the different magnetic fields to which juvenile salmonids may be exposed in a hatchery environment, and compares them to the magnetic field in an ambient environment. These findings are relevant to understanding marine migratory distributions of salmonids and are applicable to their management as a valuable commodity and resource. Measurements of the inclination angle and intensity were recorded the egg incubation stacks, indoor and outdoor tanks, raceway, and transportation trailer. Magnetic measurements taken in this study were measured using a magnetometer at the Oregon Hatchery Research Center. Our results showed that the ambient magnetic field is distorted in both the hatchery rearing environments (incubation stacks, tanks, and raceway) and the transportation trailer, with significant differences observed in the trailer, raceway, and indoor tank. In the behavior study by Putman, Meinke, and Noakes (2014), a change in behavior of juvenile steelhead trout (Oncorhynchus mykiss) occurred in an environment where the ambient field was distorted. Based on our findings, as well as the results from the behavior study in Putman, Meinke, and Noakes (2014), we suggest that the rearing environments of hatchery fish might alter the orientation of salmonids to the ambient field and thus affect juvenile survival capabilities, as well as straying rates of adults.

Distribution and Fate of the Antidiabetic Drug, Metformin, in the Columbia River

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Metformin (1,1-dimethylbiguanide)the most commonly prescribed anti-diabetic drug,

worldwide has been widely observed in surface waters at relatively high concentrations (Î¼g L-1) compared to trace contamination by other pharmaceuticals and personal care products (PPCP). Metformin targets the mitochondria, where it affects cellular energy sensing; it is unusual among drugs in that it is not altered in its chemical form by the human body and is thus excreted largely intact, contributing to its relatively high concentrations in waterways. This is problematic because recent studies have shown that metformin has endocrine disrupting effects in fathead minnows, making it a contaminant of emerging concern. To better understand the potential threat to ecosystems and fish populations from metformin, we are conducting a study to characterize the distribution, degradation, and lower trophic effects of metformin and its primary breakdown product, guanylurea, in the Columbia River and estuary. We will describe the study goals and discuss preliminary results from this work, including the development of analytical methods to measure metformin either (1) at low levels (by high performance liquid chromatography coupled to tandem mass spectrometry) or (2) inexpensively, but at higher throughput (by ion pair high performance liquid chromatography). Laboratory experiments conducted using a solar simulator revealed that metformin does not undergo degradation by photolysis. An expected rise in cases of type II diabetes (>350 million people by 2030) means that levels of metformin in aquatic systems are also likely to increase; it is thus critical to identify ecological effects associated with exposure to metformin so that negative effects can be mitigated.

Growth of Individual Chinook and Steelhead Juveniles and the Efficacy of In-stream Habitat Restoration

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In-stream habitat restoration effectiveness studies primarily rely upon the observation of occupancy of restored habitat relative to unrestored habitat. Multi-year data in the Entiat River, Washington, USA, show increased occupancy by young-of-the-year Steelhead Trout and Chinook Salmon in pools formed by restoration structures compared with unrestored pools, but the effects can be small, inconsistent and limited. Furthermore, quantification of distribution patterns does not address whether traits correlated with the overall fitness of individuals (e.g., growth, survival) are enhanced by their occupancy of restored habitat. We used mark/recapture assays to show that growth of young-of-the-year Chinook and steelhead is improved by restored habitat in the Entiat River. Comparison of growth rates in Chinook Salmon among habitats was limited by low numbers of recaptured individuals in unrestored habitat. To solve this problem, we present a mathematical model with which we show a growth benefit to residency in restored habitat. Growth analysis is important to the evaluation of restoration efficacy because it can occasionally detect benefits when abundance data are inconclusive and can also prevent overconfidence in occupancy data when differences among habitats are observed.

Caudal Fin differences Between Juvenile Wild, Hatchery, and Surrogate Chinook Salmon

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Hatcheries in the Pacific Northwest have released millions of salmon to mitigate effects from hydroelectric dams and commercial fishing. However, juvenile salmon released from hatcheries show significantly different phenotypic traits compared to naturally-reared salmon, including differences in behavior, physiology, and morphology. These differences are problematic for researchers working with threatened or endangered species, since acquiring large numbers of hatchery salmon is easier and more practical than working with wild fish. The goal of the Wild Fish Surrogate Project is to develop altered hatchery rearing protocols to produce juvenile salmonids that display characteristics more similar to wild salmonids. Morphological differences such as fin condition may be easily observed between hatchery and wild salmon, but these differences can be difficult to quantify. In this study, we measured surface area and lengths of caudal fins in juvenile wild, hatchery, and surrogate Chinook salmon to create a method for quantifying differences in fin quality. We determined that juvenile Chinook salmon reared in the surrogate experimental environments had caudal fins more similar to the naturally-reared Chinook salmon. Surrogate and naturally-reared juveniles generally possess caudal fins with larger surface areas, longer caudal lobes, and greater symmetry between dorsal and ventral lobes than the caudal fins of juvenile hatchery Chinook salmon.

Use of Parentage Based Tagging for RM&E of tribal conservation Efforts to Restore Pacific Lamprey in the Interior Columbia River

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Pacific lamprey Entosphenus tridentatus is an imperiled species within the Columbia River basin

and translocation strategies (i.e. transfer of fish from areas of moderate abundance to sites with low abundance) are being employed by the tribes to boost Pacific lamprey numbers in interior Columbia basin streams. Typically, translocation strategies are used as a last resort measure, however, Pacific lamprey is an important cultural resource for the tribes and the seriousness of the decline of this species in the Columbia River has prompted this measure be used in concert with habitat restoration and artificial propagation. It is critical to have a means for research, monitoring, and evaluation of these conservation actions to ensure they are effective in achieving restoration goals for the species (i.e., fish are successfully spawning and producing volitional out-migrating juveniles). Information on juvenile Pacific lamprey, however, is challenging to collect as the diminutive size of larvae precludes conventional tagging methodologies with which to track movement of early life stages, and the fish lack scales and fin rays' structures typically used to obtain individual age information in other fish. Recent development of genetic markers specific to Pacific lamprey (>300 SNPs) and the ability to extract DNA from very tiny tissue samples has created opportunity to use parentage analysis as a way to infer the ages of offspring and to relate this information to morphometric measures, sampling locations and juvenile life stage. Since 2013, nearly all outplanted adults from each of three Columbia River tribal programs involving translocation into tributaries of the interior Columbia basin distributed across Idaho, Oregon, and Washington, have been tissue sampled and genotyped for creation of a regional implementation of Parentage Based Tagging (PBT) database. This effectively genetically tags >95% of all progeny produced by the outplanted adults (total N=6,475), which we estimate could comprise 10% or more of the total larval production from spawners in the interior Columbia River basin during 2013-2016 (~56,000 estimated adults passed above John Day Dam). This powerful PBT technology provides the opportunity for future recaptures of progeny of these translocations at older life stages, possibly even returning adults. Numerous juvenile sampling programs are now in place throughout the streams and rivers receiving translocated adults and at Columbia River mainstem dams, and we have already documented the reproductive success of multiple groups of outplanted adults across release years by identifying their offspring through parentage analysis. Data generated from this ongoing study may be used to adaptively manage conservation efforts being employed for this species, and further characterize the migratory life cycle of Pacific lamprey.

A Contemporary Approach to Headcut Restoration

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I will be presenting a relatively new technique for eliminating head cuts in low gradient, depositional valleys and restoring the hydrological processes within them. Traditional head cut stabilization has focused on placing a hard structure at the head cut face in an attempt to prevent the mechanical failure at this location and arrest the head ward migration of the incision. The presented technique uses valley forming processes to reverse the degradation process and restores meadow hydrology.

Stepping out of the Mold: Restoration Design that Reestablishes the Dynamic Nature of Streams

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While process-based river restoration provides the largest hydrogeomorphic and habitat benefits (Cluer and Thorne 2013, Kondolf 2009, Montgomery 2008, Pollock et al. 2014), relatively few restoration projects are designed to account for and promote watershed processes. Traditionally, stream restoration projects have included form-based approaches that involved bank stabilization, habitat structure placement, and grade-control, which were engineered to efficiently transport bankfull flow and sediment by maintaining a balanced single-thread channel pattern, profile and dimension. While this approach may be necessary in project areas constrained by infrastructure, it can limit habitat development in unconstrained areas. In contrast, the intent of process-based restoration is to reestablish natural channel processes such deposition, substrate sorting, avulsion, and scour that allow the system to be dynamic and more resilient. Restoring these processes provides complex, diverse aquatic and terrestrial habitat and encourages continual development of this habitat as the system responds to watershed disturbances. Examples of recent process-based restoration projects along Whychus Creek will be shown to illustrate these points, provide design techniques, and share some of the challenges of this approach.

Implications of Expanded Sport Harvest Following Dam Removal on the Hood River: Results and Management Strategies

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Initiated in 1996, creel surveys have been conducted annually by the Oregon Department of Fish and Wildlife (ODFW) to estimate the sport harvest of Hood River hatchery winter steelhead and spring Chinook salmon. Results are used to determine if yearly harvest and spawner escapement goals established by the Revised Master Plan for the Hood River Production Program (HDR|FishPro 2008) are achieved and ultimately to provide fisheries managers sufficient information to balance harvest, broodstock collection, and spawner escapement objectives. With the removal of Powerdale Dam in 2010, the fishable area available to sport anglers increased from the lower 4.5 miles of the Hood River below Powerdale Dam to the entire 12 miles of the mainstem Hood River and the lower 0.5 miles of the West Fork Hood River, providing new and expanded angling opportunities. Our data suggests the hatchery

winter steelhead exploitation rate increased slightly (7.1% above previous average) since the expansion of the harvest area, while the exploitation rate of hatchery spring Chinook salmon (adults + jacks) increased from 13.1% to 36.8%, with the majority of harvest occurring within the newly accessible West Fork Hood River. Given the increased rate of spring Chinook salmon harvest coupled with recent poor ocean conditions and subsequent low adult return forecasts, co-managers ODFW and the Confederated Tribes of the Warm Springs Reservation, Oregon (CTWSRO) may have difficulty setting appropriate harvest levels concurrent with broodstock collection and spawner escapement objectives. We will present a sliding scale that associates the variation of Passive Integrated Transponder (PIT) tag detections against standards based on past interrogation and harvest rates that can be used to estimate spring Chinook escapement to broodstock collection sites. Taking advantage of real-time PIT tag interrogation data will allow managers to better predict the number of fish available for broodstock collection and ensure sufficient levels of natural production.

Exploring the Fishes, Character and Deep History of the North Fork Pit River, California

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The North Fork Pit River is the historical outlet of Goose Lake and, as such, forms the northernmost headwaters of the Sacramento River Drainage. Goose Lake itself has not overflowed since the late 1800's. This project, initiated in 2016, is a collaboration between the Pit River Tribe and Western Fishes with the goal of establishing the historical, current and potential fish fauna of the North Fork Pit River to aid with management and promote greater awareness of the role the river has played in tribal life. The project combines current fish surveys with examination of historical records from earlier surveys, museum records, and travelers' diaries. The second primary goal of the project is to survey and document traditional ecological knowledge (TEK) of fishes and ecological conditions, both in the local tribal community and inferred from ethnographic accounts, language and traditional stories.

Native fishes include Pit-Klamath Brook Lamprey, Entosphenus lethophagus; Sacramento Pikeminnow, Ptychocheilus grandis; Hardhead, Mylopharodon conocephalus; Northern Roach, Lavinia mitrulus; Pit-Goose Tui Chub, Siphateles thalassinus; Speckled Dace, Rhinichthys osculus; Western Sucker, Catostomus occidentalis lacuanserinus; Pit Sculpin, Cottus pitensis; and Redband Trout, Oncorhynchus mykiss ssp..

Estimating Capture Efficiency of Oncorhynchus mykiss Using CHaMP habitat Metrics

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The Columbia Habitat Monitoring Program (CHaMP) has sampled juvenile Oncorhynchus mykiss and habitat features in the John Day River Basin since 2011. In 2016, using habitat and mark-recapture data, we modeled our site-level capture efficiency to move from a two-pass mark-recapture electrofishing protocol to a single-pass electrofishing protocol. Capture efficiency was estimated for each site with mark-recapture data collected in 2015 or 2016 from 14 sites in the Middle Fork John Day River (MFJD) and 14 sites in the South Fork John Day River (SFJD). We then used habitat metric data from the same sites to determine which metrics could predict capture efficiency. We ran a correlation matrix with variables that potentially impacted capture efficiency to remove auto-correlated variables. We used the remaining five metrics in separate binomial logistic regressions for sites in the SFJD and MFJD. The best fit model for the MFJD included percent boulder and conductivity, while the SFJD model included mean pool depth and mean fork length. Both models were validated using a jackknife technique and the estimated capture efficiencies were used to predict abundance at sites where the single-pass sampling protocol was implemented in 2016.

Improving the Next Generation of IMW Experimental Designs

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In the consortium of Intensively Monitored Watersheds (IMWs), and in the stream restoration field in general, we are charged with answering the question Does Restoration Work?. This presentation will outline guidelines and methods that demonstrate how to design and monitor a stream restoration experiment to achieve the highest probability of detecting an impact based upon the local environment variability and resources available. The materials presented here are intended for the community of stream restoration professionals who are not well versed in the complex field of statistical mathematics, but appreciate the fact that to show restoration impacts, one must successfully incorporate and manage many different factors. To demonstrate these experimental design principles, fisheries data from the Middle Fork of the John Day Intensively Monitored Watershed (MFIMW) are incorporated into various restoration scenarios and each scenario will be discussed regarding its potential for causal inference and its power to detect restoration impacts.

Many times, watershed scale restoration designs do not go as planned. Locations and times of restoration implementation change, control sites may become altered, and changes or errors in the monitoring regime may occur. These circumstances are shared by many professionals participating in the IMW program, and finding the most robust experimental design that can withstand these situations is critical to retaining maximum probability of detecting a restoration effect. To elucidate these challenges, simulations of various experimental designs undergoing commonly found situations are discussed and the best design strategies will be delineated. This work is intended to inform the next generation of watershed scale restoration experiments. Strengthening our designs against the effects of changing circumstances is critical towards maximizing our ability to detect restoration effects. Furthermore, we must continue to empower our professionals towards this goal as well. Increased participation in the experimental design

process will more effectively incorporate input from ground level situations because the people involved will have direct knowledge of why design and implementation is so critical to strong causal inference. Designing the next generation of IMW must involve empowering and integrating in the process the people who will be carrying it through.

Heat Shock Proteins Associated with Anoxia Tolerance in Embryos of the Annual Killifish, Austrofundulus limnaeus

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The annual killifish, Austrofundulus limnaeus is native to vernal bodies of water in northern South America. These killifish are adapted to survive unpredictable periods of aridity via a form of dormancy known as embryonic diapause. Diapausing A. limnaeus embryos have the capacity to withstand a myriad of inauspicious conditions such as excessive temperature, fluctuating salinity, UV exposure, anoxia, and desiccation. Organisms adapted to survive extreme thermal insults often rely on the expression of heat shock proteins (HSPs) that support normal cellular function when exposed to stressful conditions. Previous investigations have alluded to a possible novel pattern of HSP expression in A. limnaeus embryos. We hypothesize that HSP much like in response to heat stress play a significant role in the survival of A. limnaeus under anoxic conditions. Using high-throughput RNA sequencing, we profiled the transcription of 43 unique HSP-encoding genes in embryos of A. limnaeus. We explored stages of development when the embryos enter diapause as well as return to normal development. Furthermore, we exposed all stages to periods of anoxia before returning them to normoxia. We find active HSP transcription during diapause and throughout development as well as in response to anoxia exposure. Both scenarios are known to have suppressed transcriptional activity. Heat shock proteins provide support in many cellular stress pathways that provide whole-animal physiological adaptions. In understanding the mechanism to which up-regulation of HSP gene expression during dormancy aids in A. limnaeus survival could provide a better understanding of how animals might exist in habitats that stretch their physiological limits.

Jellyfish blooms off Oregon and Washington: Modeling Impacts Upon Salmon Production and Evaluating the Evidence

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Jellyfish may play a role shaping energy flow through pelagic food webs by diverting plankton production away from higher trophic levels. Off Oregon and Washington, scyphozoan jellyfish attain high biomasses during summer months, but their abundance is variable from year to year. Do large jellyfish blooms have an observable impact on the rest of the ecosystem? Sensitivity analyses with an end-to-end ecosystem model of the Northern California Current were used to examine the potential effects of increased jellyfish production upon higher trophic levels. These analyses suggest that salmon, in particular, are sensitive to jellyfish blooms. Although jellyfish and young salmon feed at different trophic levels and have little diet overlap, they may be indirect competitors for plankton production. Pelagic surveys off Oregon and Washington were used to examine the relationship between the abundance and spatial distribution of the dominant jellyfish (Chrysaora fuscescens) and juvenile salmon feeding success and survival. Examination of oceanic juveniles showed that salmon stomachs were less full at locations with higher C. fuscescens biomass. Further, there was a significant, negative correlation between C. fuscescens abundance in the year of juvenile ocean entry and the strength of adult salmon returns to the Columbia River in subsequent years.

Yakama Nation Lake Cle Elum Sockeye Project

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The Yakama Nation (YN) participated in the completion of feasibility study of fish passage at Cle Elum Lake dam. YN worked on developing the Master Plan for reintroduction of anadromous fish above the reservoirs. The effort is part of a Bureau of Reclamation (BOR) led cooperative investigation with the YN, state, other federal agencies that studied the feasibility of providing fish passage at Cle Elum Lake dam, one of the five large storage dams of the Yakima Project. The dams: Bumping, Kachess, Keechelus, Cle Elum, and Tieton, were never equipped with fish passage facilities. Four of the five reservoirs were originally natural lakes and historically supported Native American fisheries for sockeye salmon and other anadromous and resident fish. Of these Cle Elum has the best habitat above the reservoir for this fish passage project. The YN project goal of collecting 1,000 to 10,000 adults annually to be transferred directly to Cle Elum Lake. After a minimum escapement threshold is reached (80,000 at Bonneville), adult trapping would commence at the Priest Rapids Dam Off-ladder Adult Fish Trap (OLAFT) with a minimum collection of 1,000. The co-managers prefer a mix of Okanogan and Wenatchee stocks when relocating adults to initiate the reintroduction. We believe the reintroduction plan should utilize all potential donor stocks to maximize the chance of success in reestablishing sockeye in an area that has been absent of anadromous sockeye salmon for over 100 years. The two donor stocks exhibit different life history and migration behavior patterns. This genetic and phenotypic diversity is a desirable attribute that allows natural adaptation/selection processes to determine which donor stock is a better fit to the current Yakima Basin environment.

Crooked River Floodplain Restoration: Merging Infrastructure with River Restoration

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The City of Prineville is currently completing a large infrastructure improvement project that will treat wastewater from the City as well as result in improved floodplain function and riparian and instream habitat in the Crooked River. Due to increased residential growth in 2004-2005, the City determined that the existing wastewater treatment lagoons should be replaced with a $62 million mechanical treatment plant. This cost would have doubled existing monthly rates and increased System Development Cost to a point where development was hindered. In 2007, Staff and council began investigating opportunities to utilize the natural environment to treat wastewater at a much-reduced cost.
In 2011, the City partnered with the Crooked River Watershed Council (CRWC) and Anderson Perry and Associates (AP) to work on a project to use artificial wetlands to treat wastewater while at the same time restoring ~1.75 miles of the Crooked River adjacent to the wetlands that would then benefit from the hyporheic flow from the treated wastewater. The resultant project has created 120 acres of wetland habitat, restored 1.75 miles of riparian and instream habitat on the Crooked River (11 acres), created 38 acres of new floodplain habitat, and has the potential for up to 3 cfs of instream flow to the project reach. Restoration activities included construction of ~3,500' of side channel habitat including ~38,000 cy of excavation, 6 wood habitat structures, 3,000' of large wood bank structures, and the planting of 7,000 plants.
Civic Improvements include reduced future treatment costs from $62 million to $4.75 million while recreational opportunities include over 5.4 miles of new loop and out and back hiking trails, 3.25 miles of which will be paved for use year-round. This project is a prime example of the merging of infrastructure and restoration that can take place to improve habitat as well as the bottom line for many communities in Oregon.

Geomagnetic Orientation Aids in Vertical Migration of Emergent Juvenile Chinook Salmon (Oncorhynchus tshawytscha)

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Recent studies have demonstrated that salmonids use geomagnetic information to guide their migrations across ocean basins. This ability has been observed in adults and juveniles, but the degree to which geomagnetic cues influence early life history stages is unknown. After

absorbing their yolk sac beneath gravel, juvenile salmonids engage in swim-up behavior, in which they emerge from the stream bed. Vertical magnetic orientation has been documented in other taxa, thus, it is conceivable that geomagnetic orientation could play a role in these vertical migrations. To test this hypothesis, we compared the swim-up responses of emergent juvenile Chinook salmon exposed to a reversed vertical field to those tested in ambient conditions at the Oregon Hatchery Research Center. Individuals exposed to ambient conditions traveled higher in vertical test columns compared to counterparts in a reversed field. This evidence suggests that salmonids derive three-dimensional information from magnetic fields and use this information early in their development.

Assessing Passage Success of Warner Suckers at a Newly Constructed, Sucker-Friendly Fishway in Southeastern Oregon

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The Warner Sucker (Catostomus warnerensis) is endemic to the Warner Valley, an endorheic subbasin in southeastern Oregon and northwestern Nevada. The Warner Sucker was federally listed as threatened in 1985 due to habitat fragmentation and threats posed by piscivorous non-native game fishes. Recent recovery actions have focused on improving or providing passage at aging irrigation diversion dams that are common on tributaries in the subbasin. In 2015-2016, we assessed passage success and fishway flow velocities and patterns at a newly constructed sucker-friendly fishway on Twentymile Creek. The new fishway is 57 ft long with ten pools, has 0.5 ft weir drops for redband trout passage, 1 ft square orifices for Warner Sucker passage, and a cobble floor. It was designed for a passage period of April-June, maximum orifice velocity of 4 ft/s, a range of flows between 35-148 cfs, minimum pool depth of 4 ft, and a slope

Downstream Rearing Juvenile Chinook Salmon in the Upper John Day River

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There is ample evidence indicating that juvenile Chinook salmon in some tributaries of the Columbia River Basin, such as the Willamette and Snake Rivers, follow a variety of temporal patterns of migration between their natal reaches and the estuary. Juvenile fish that leave their natal reaches early in their first spring of life and occupy nursery habitats further downstream may represent a significant portion of the smolts entering the river's migration corridor. The John Day sub-basin has no history of hatchery influence and no dams blocking adult access to historic spawning areas; therefore, in the absence of these human impacts, it is expected that

Chinook salmon early life history patterns observed in this river may help unravel the complex life history of this species in the Columbia Basin. In the upper John Day River, the Oregon Department of Fish and Wildlife (ODFW) has reported juvenile individuals moving out of their natal reach during their first spring after emerging from the gravel. Though spring conditions may be favorable for these early downstream migrants, warm water temperatures and low discharge lead to inhospitable conditions during the summer. The objectives of our study were to estimate the abundance of this early migratory life history pattern, determine where early migrants find thermal refuge in the upper basin, and assess the costs and benefits of the downstream rearing (DSR) pathway compared to the natal reach rearing (NRR) pathway. We captured fish in the river using rotary screw traps and a fish screen bypass trap, and PIT tagged 5,600 DSR fish and an additional 1,000 NRR fish. We tracked their movements throughout the Upper John Day River using a series of antenna arrays, and made multiple pass snorkel counts to estimate abundance and identify distribution in tributary streams. Our preliminary results indicate that 9% of the marked DSR fish moved into tributaries within the study area following the first peak in water temperatures. We observed Chinook salmon only in the lower reaches of smaller river tributaries, but in the largest tributary these fish were found up to 44 river kilometers upstream of the confluence with the mainstem. Our results also revealed DSR fish were more than 50% longer than NRR fish in the spring, but this size difference was greatly reduced by the end of summer. Spring PIT tag detections at the Columbia dams will give us a first glance at differences in relative survival rates among the life history pathways observed in our study system. The study will continue for a second year into 2018.

ESA Recovery Plans and the Need for Action Measures Concerning Contaminants

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Contaminants are insufficiently recognized as population regulatory factors in species recovery planning. Contaminants can be disruptive to many physiological processes essential for survival and/or successful reproduction. Fishes are exposed to contaminants even in our most â€œpristineâ€ waters such as those at high elevation in western U.S. national parks. The urban environment can also expose fishes to contaminants from unexpected sources. I base these contentions on my personal research, including new data on endocrine disrupting compounds. My review of numerous plans for recovery of ESA-listed fishes of a variety of species suggest that they: (1) tend to present strategies rather than actual tactics for recovery, (2) pay only lip service to the importance of the role of contaminants as population regulatory factors, and (3) never present any implementable actions to eliminate this threat.

Holistic Watershed Restoration, Collaboration on a Landscape Scale affecting Aquatic Habitat to Forest Health

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The Warner Basin Restoration Collaborative has found great success in strategically planning ridge top to ridge top restoration efforts in South Central Oregon. This partnership approach to addressing large landscapes on private and public land has provided opportunities to address limiting factors associated with the unique landscapes ranging from conifer forests, to high desert sage steppe, giving way to interconnected stream networks that reach vast marshy wetlands, and shallow alkali lakes. These diverse environments provide quality habitat for Warner sucker, redband trout, sage grouse, mule deer and dozens of migratory water bird species. Holistic restoration planning through local, state and federal partnerships has led to opportunities that cross jurisdictional boundaries and are unique in that they come alongside working landscapes to achieve balance and compromise for the private landowner and natural resources. Limited water in the eastern Oregon desert means that Warner Basin watersheds are a critical water source to both native species and the farmers and ranchers that have generationally managed these landscapes. This discussion will focus on the quality partnerships that have formed in Lake County to focus on restoring the physical and biological conditions necessary for successful watershed restoration of key habitats.

Understanding the Feeding Ecology of Juvenile Rockfishes in Oregon's Estuaries

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Estuaries are thought provide greater food resources for juvenile fishes compared to other habitats. Higher growth rates have been reported for juvenile fishes in estuarine habitats compared to coastal habitats, potentially due to the high abundance of prey. Multiple species of rockfish (Sebastes spp.), which make up important commercial and recreational fisheries, utilize Oregon estuaries during their early life. This utilization gives rise to the hypothesis that these estuaries function as nursery habitat for rockfishes, playing a significant role in rockfish settlement and recruitment and are therefore important for population productivity. Although juvenile rockfish abundances have been found to differ between Oregon estuaries, other life history traits such as age, growth, settlement date, and feeding ecology have not been fully evaluated. With large dietary variations found for juvenile rockfishes in nearshore and offshore environments, further investigation into feeding ecology in Oregon estuaries is necessary to evaluate habitat quality of these potential nursery areas. Feeding ecology will be assessed in this study using stomach content and stable isotope analyses. This work will (1) Determine the dominate prey resources and Carbon and Nitrogen isotopic ratios for juvenile black rockfish (S. melanops) in Alsea, Yaquina, and Nehalem estuaries, and (2) Examine if feeding ecology differs among estuaries and between eelgrass and dock habitat types.

Freshwater Mussels as Ecosystem Engineers: Small Creatures, Big Impacts

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Although freshwater mussels (Mollusca: Bivalvia: Unionidae, Margaritiferidae) can dominate the aquatic biomass, their cryptic nature means that their powerful contributions to key geomorphic processes in healthy streams are often overlooked. Mussel aggregations (beds) can create hotspots of nutrient recycling and storage, influence nutrient availability, and increase the production of emerging aquatic insects. Mussel bed density and diversity further influences the species composition of both benthic macroinvertebrates and the algae on which many invertebrates graze, by increasing substrate heterogeneity and providing habitat patches. Mussels use their muscular foot to burrow into the substrate and can move both vertically and horizontally; this burrowing activity helps mix sediments and increase bioturbation. Mussel beds can also influence local flow perturbation and sediment transport. Species that are more active burrowers may decrease sediment stabilization during high flow events, while deep burrowers can help compact and stabilize sediments. Differences in mussel diversity, distribution, assemblage composition, and species-specific aspects of burrowing activity, filter-feeding rates, and shell size, morphology, and texture mean that mussel impacts on stream biogeomorphology differ within and between watersheds.

The Minam River: Characterizing a Reference Watershed and Implications for Restoration

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Upper Grande Ronde River, which is home to ESA listed Snake River Spring/Summer Chinook salmon and steelhead, was selected for a comprehensive aquatic habitat monitoring beginning in 2011. This watershed has undergone significant habitat alteration in the form of timber harvest, road building, cattle grazing, mining, fish passage barriers, and substantial irrigation withdrawal. With the myriad of human influences impacting stream habitats there is little unaltered habitat remaining where baseline/reference condition data can be gathered. In attempt to better understand the linkages between habitat characteristics in NE Oregon streams and anadromous salmonid populations, we chose to look to neighboring watersheds for reference conditions. The Minam River, a wild and scenic river, flows through the Wallowa-Whitman National Forest and Eagle Cap Wilderness Area in northeastern Oregon. The protected status of the Minam River provides a stark contrast to the current and historical agricultural, grazing, and logging use in the upper Grande Ronde and Catherine Creek basins, and therefore represents the best available reference condition for anadromous salmonids. To this end, we had two major objectives 1) establish monitoring sites in the Minam River watershed to serve as habitat reference reaches for current and future habitat conditions in Catherine Creek and the Upper Grande Ronde River, and 2) identify key limiting factors, quantify responses to

management actions and provide guidance for implementation of future management actions. Data analyzed from the Minam River provides benchmarks for current restoration efforts in the upper Grande Ronde River by increasing large woody debris, but also increasing large pool area and frequency.

Using Genetics to Compare Olfactory Imprinting Ability Between Hatchery and Wild Salmon from the Pacific Northwest of the USA

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Understanding the underlying mechanisms for juvenile salmonid imprinting can have important management implications. In this study, the expression of certain genes relevant to olfaction and imprinting were measured from the brains of migrating juvenile Chinook salmon (Oncorhynchus tshawytscha) from the Willamette River basin in Oregon. NR1 (an essential subunit of the N-methly-D-aspartate receptor linked to olfactory memory) and TRHa and TRHb (part of the thyrotropin releasing hormone of the endocrine system and tied to juvenile imprinting in salmonids) were chosen as candidates to represent olfactory imprinting ability in migrating juvenile salmon. These were selected based on previous work conducted on both juvenile and adult chum salmon in the Ueda lab at Hokkaido University, Japan. Natural-origin fish were compared to hatchery-origin fish to see if there was a difference between the two group's genetic expression levels in the brain. Any observed differences may have implications for the salmon's ability to imprint on its natal streams as a juvenile, and therefore its ability to home and reproduce as an adult. To assess gene expression, entire brains were extracted from each head and immediately processed to extract genetic material (hatchery n=6, wild n=5). Because there are no available Chinook salmon primers for the genes in question, O. keta primers for NR1and O. nerka primers for TRHa/b were successfully used. Following RT PCR, quantitative PCR was conducted in triplicate to later be compared to the results of the housekeeping O. tshawytscha gene, Beta actin. There were differences observed between the two groups in all cases. In the NR1 trial, hatchery-origin fish expression on average was lower than wild-origin fish expression and the same pattern held true for TRHa and TRHb. In follow-up work, larger sample sizes and specimens collected from identical reaches of the river on the same day to decrease the potential effects of environmental variables will be conducted. In addition, based on previous work from the Ueda lab, it would be beneficial to conduct a time-series analysis to compare expression levels of the two groups as they move downstream at multiple sampling points.

From Surplus to Bonus: How Unplanned Reintroductions Informed Salmon Recovery Efforts in the Willamette River, Oregon

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Natural-origin spring Chinook Salmon Oncorhynchus tshawytscha were largely extirpated from the upper Willamette River, Oregon, by the 1970s. They are back. Beginning in the early 1990s adult hatchery-origin salmon in excess of broodstock needs were outplanted above high-head dams in the upper basin with the express purpose of providing marine-derived nutrients to those reaches, and specifically to provide a prey base for native fish. Unexpectedly, many salmon successfully spawned and enough offspring survived downstream passage at the dams (without the benefit of actual passage structures) that substantial numbers of natural-origin adults returned in some cases. I present a history of outplanting efforts in the upper Willamette River, four case studies, and a summary of challenges posed for converting the process of outplanting hatchery fish into targeted reintroduction of wild fish.

A Few Cadmium-Treated Fish Affect Group Dynamics and Social Behavior in Zebrafish

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In social animals, a few individuals can profoundly influence the behavior of the majority. Such effects occur as a result of robust, healthy individuals, and could also be induced by contaminated individuals. Here, we asked whether pollutants could affect the sensory systems of a few treated fish that then influence the group responses and social behavior of a larger group of untreated fish. We found that groups containing contaminated individuals were more likely to stay in the vicinity of a novel stimulus than were control groups, even though most of the group members had not been exposed to the pollutant. Delving deeper into the underlying behavioral mechanisms, we found that contaminated fish exhibited more aggressive and investigatory behavior and responded less to a moving visual stimulus in an optomotor assay. Weak displays of social behavior (advances, mouth contacts), but not more active behavior (chases), were detected in pairs containing contaminated versus control fish. Thus, a few contaminated individual can have profound effect on the social behavior and group responses of a larger uncontaminated group.

We Aren't Saying You Didn't Work Hard to Get Here: Common Misconceptions of Diversity, Equity, And Inclusion Education

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This talk will provide an introduction into the theories and research of ideas of power, place, and belonging and how they reflect upon the Oregon Chapter of the American Fisheries Society. We will explore common misconceptions of Diversity, Equity, and Inclusion (DEI) education programs as they pertain to the fisheries profession. Using a holistic approach, this talk will break down common barriers to engaging in meaningful conversation around issues of diversity. This talk will introduce the Human Diversity External Committee, and provide a start to the continued conversation.

The Fish Biodiversity of Gabon's Central Ogooué River: Discovery and Assessment

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West Central Africa harbors one of the richest, yet least known fish faunas in the world. In 2014, we assessed the fish biodiversity of a stretch of Gabon's Ogooué River (the 4th largest in Africa by discharge) that had not been visited by ichthyologists in nearly 150 years. The sampling region included the Rapids of Doum, which the Ramsar Convention designated recently as a wetland of international importance, and which was the site of one of the earliest collections of African fishes by European scientists. Our rapid assessment collected nearly 3000 specimens and revealed a diverse assemblage of approximately 100 species, representing a 175% increase in the number of species confirmed from the region. Nearly 10% of these appear to be new to science. One enigmatic specimen from the expedition catalyzed the recognition of a new genus of electric elephantnose fishes (Cryptomyrus) in 2016. Principal coordinates analysis of the species captured at each of 31 sites revealed significantly different fish assemblages in large versus small rivers, highlighting the need to include diverse habitat types in management plans. Though illuminating, these results represent only a snapshot of diversity during one of the driest parts of the year. Understanding the full distribution, movement and habitat use of this marvelously diverse fish assemblage, and predicting the potential effects of mining, forestry and hydropower development will require further sampling during the rainier seasons.

Disentangling Indigenous Summer and Winter Steelhead Populations in the Hood River

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Both winter and summer steelhead are endemic to the Hood River subbasin and have separate protection considerations administered under the ESA. Wild populations of both migratory life history forms occur with some degree of presumed spatial separation and have either been or currently are subject to supplementation efforts. To better manage the subbasin hatchery programs, we have provided co-managers (Confederated Tribes of Warm Springs Oregon and Oregon Department of Fish and Wildlife) with annual estimates of wild steelhead smolt abundance since 1994. Unfortunately, no known morphological or behavioral mechanisms exist to predict run type of juvenile steelhead which is problematic in terms of evaluating the status of each population independently from both hatchery production and population recovery perspectives. Additionally, since the removal of Powerdale Dam (full upstream migration barrier) in 2010, adult sampling facilities have been relocated to the river forks and only capture a portion of the returning adult population, and are not operated year-round. As models are created and developed to assess adult returns, determining the relative proportion of emigrating winter and summer run smolts is essential towards understanding the contemporary status of both run types. Additionally, correctly identifying the run type of returning adults is vital to escapement modeling. We partnered with CTWSRO and CRITFC (Hagerman Lab) to employ genetic evaluation methods used to determine run type proportion for downstream migrant steelhead cohorts as well as adults of unknown run type. To date, run proportions for smolt outmigration years 2005 -2014 have been estimated as well as adults collected from the West Fork Hood River during 2013 -2015. The majority (80%) of smolt outmigration classes appeared to be comprised mostly of winter steelhead although the variability between years was somewhat high (SD = 0.137). For comparative purposes we calculated a winter-run specific SAR and found it was typically higher for wild fish than hatchery fish. Adult steelhead samples collected in the West Fork Hood River (presumed summer steelhead habitat) showed a mixture of winter and summer run fish with a moderately high degree of temporal separation. There was also a high level of error associated with assigning a morphology-based run type during field sampling. We will provide interpretation and discussion related to the initial results of the study which appear to carry important hatchery management and population recovery implications.

Beavers in an Urban Environment: First Year Results of a Three Year Study in the Tualatin River Basin, Oregon

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Beavers are increasingly recognized for their role in stream and floodplain habitat restoration. Numerous studies in rural and mountainous settings demonstrate that beaver activity can lead to sediment trapping, channel aggradation, increased habitat diversity, and other responses. Beaver activity is hypothesized to have similar effects in low gradient, urban streams where channels are incised, predominantly fine-grained, subject to flashy streamflows, and have minimal habitat diversity. However, few studies exist on the potential distributions of beavers, their dams, and associated effects in urban streams. Management agencies in populated urban environments are interested in the ability of beavers and their dam-building activities to address the impacts of hydromodifications as part of their stormwater management activities.
This study, conducted in collaboration with Clean Water Services, aims to estimate beaver dam distributions and quantify the effects that beavers have on hydrology, water quality, and geomorphology in the urban streams of the lower Tualatin River basin on the west side of Portland, Oregon metropolitan area. Preliminary accomplishments of this 3-year study include (1) modifications made to the Beaver Restoration Analysis Tool (BRAT) to estimate beaver dam building potential, (2) continuous measurements of water quality, water levels, and surface-groundwater interactions at locations upstream, in, and downstream of beaver-influenced reaches, (3) surveys of sediment deposition, and (4) hydraulic modeling of stream velocity and inundation patterns along a beaver-influenced reach.
Study results will contribute new insights and tools to help water managers meet their stormwater management requirements and assess how beavers might be used as part of an integrated approach to urban stream restoration.

Estimating C. shasta Infection Prevalence in Populations of Chinook Salmon Juveniles of the Klamath River

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High infection rates by the myxozoan parasite Ceratonova shasta have been documented in emigrating Klamath River juvenile salmon populations, and have been linked to population declines in fall Chinook Salmon. Fish that display clinical signs of C. shasta infection are likely more prone to mortality via increased susceptibility to other pathogens, to predation, and a compromised osmoregulatory system. For the last decade, a C. shasta monitoring program has successfully estimated weekly-stratified disease prevalence in outmigrating Chinook Salmon, and a concordant population monitoring program has estimated weekly-stratified Chinook

Salmon abundances. However, these estimates have not been previously combined to investigate the incidence of C. shasta infections at annual population levels. In this talk, we combine data from these Klamath River monitoring programs and present estimates of annual infection rates. We discuss methods for propagating estimation uncertainty from each weekly-stratified component, and implications for disease-related monitoring and inference.

Habitat, Water Conservation, and Fish Passage Projects in the Deschutes River Basin

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Since 2006 the Pelton Round Butte Habitat Fund has provided nearly 11 million dollars in partnership funding for 45 projects sponsored or managed by watershed councils , soil and water conservation districts, non-governmental organizations, state, federal and tribal agencies located in the Deschutes River Basin. Total cost for these projects is more than 60 million dollars. Projects have included fish passage improvements, barrier removals, diversion screening, large wood placement, habitat acquisition, stream channel reconstruction, riparian fencing, and planting. Altogether, these collaborative restoration efforts have improved habitat on 69 miles and restored or improved fish passage to 149 miles of stream habitat for anadromous salmonids in the Deschutes River Basin. In 2020, 5.8 million dollars will be added to the Pelton Fund for additional projects. The Pelton Water Fund is used to purchase or lease water rights and to implement irrigation efficiency projects that result in conserved water that is transferred to instream flow. The Deschutes River Conservancy negotiates and administers Pelton Water Fund projects, and to date nearly 60 cubic feet per second of water rights in the Deschutes River, Crooked River and Whychus Creek has been protected to enhance aquatic habitat. Adult steelhead, sockeye and spring Chinook salmon are now spawning in historic habitats for the first time in over 40 years. The long term goal is to establish naturally reproducing, self-sustaining runs.

The Pelton Round Butte Project- Balancing Water Quality, Fish Passage, Recreation and Hydropower Production on the Deschutes River

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The Pelton Round Butte Project includes a series of three dams and reservoirs constructed on the Deschutes River in Central Oregon between 1956 and 1954. Portland General Electric Company and the Confederated tribes of the Warm Springs Reservation of Oregon are co-owners under a new license issued by the Federal Energy Regulatory Commission in 2005. Lake Billy Chinook and Lake Simtustus are productive reservoirs which provide significant recreational opportunities. The project operates run- of -the river, with daily peaking generation at Round Butte and Pelton with a Reregulating Dam and reservoir that maintain steady flows in the lower

Deschutes Reservoir. In 2009, a selective water withdrawal (SWW) was constructed on the penstock at Round Butte Dam. The SWW has surface and bottom intakes which can be selectively blended to allow management of water temperature and water quality. State of the art fish passage facilites on the SWW allow reintroduction of salmon and steelhead into 300 miles of historic upstream habitat. We conduct extensive monitoring of water quality and fish populations in the tributaries, reservoirs and the lower river to evaluate project success. We continually work with regulatory agencies, stakeholders and the public to balance objectives of power production, water quality standards, fish passage and recreation.

Population Trends of the Western Pearlshell Mussel across Western Montana Watersheds and Future Conservation Measures

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The western pearlshell mussel (WEPE), Margaritifera falcata has experienced significant state-wide range reductions in the last 100 years and is now known from ~70 populations, of which, only ~20 are expected to be viable 100 years from now. The long-term declining status of the WEPE has led to its designation as the only Tier 1 invertebrate species listed in the State Wildlife Action Plan, a Species of Concern in Montana and a Sensitive Species in USFS Region 1. In a short-term trend analysis conducted in 2014, we re-evaluated 90% of the 88 distinct WEPE populations and viability status across 78 streams within western Montana. Nineteen streams (25% of the total occupied) that once contained WEPE populations prior to 2010 are now considered to be extirpated. Four of the 21 (19%) originally occupied 4th code HUC watersheds are now considered extirpated in the state. WEPE occupied streams in 13 of 21 watersheds (65%) are on a negative trend. The highest number of recently documented extirpations (six D-viability populations) were located within the Smith and Missouri River watersheds. While these short-term trends are alarming, the state conservation status of the WEPE remains imperiled (S2) and not critically imperiled (S1), because a 30% short-term loss had not been documented. Anthropogenic factors throughout western MT, such as dams, loss of native host fish, dewatering and past water quality issues have created isolated populations that are highly unlikely to naturally re-establish populations within previously occupied stream reaches. Therefore, the prudent path to stabilize loss of WEPE populations is to identify biotic/abiotic conditions that are allowing Montana's viable WEPE populations to persist, and augment similar streams containing non-viable populations with hatchery-propagated mussels. Propagation of mussels in hatcheries for conservation purposes has been used successfully for many Threatened and Endangered (T&E) species in the southeastern U.S. Additionally, reintroductions with propagated mussels into stream reaches where WEPE have been extirpated due to historical pollution events (Clark Fork River) or habitat degradation (Blackfoot River tributaries) that have improved or been restored to a degree which WEPE may now persist. We evaluate steps to achieve these conservation solutions, because human intervention is recommended to manage and restore populations of the imperiled WEPE.

Should I stay or should I go? - Movement Patterns of White Sturgeon in the Columbia River

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An extensive, long-term dataset of tagged White Sturgeon (Acipenser transmontanus) was used to examine sturgeon movements up and downstream within the Federal Columbia River Power System (FCRPS). This study used multi-state mark-recapture modeling with group and individual co-variates: 1) to determine directionality of sturgeon movement and 2) attempt to determine the individual and physical mechanisms driving directional movement between pools. While the FCRPS substantially limits inter-pool movement, some fish are nonetheless able to move between pools. Overall the large majority of tagged sturgeon are subsequently recaptured in the same pool as they were tagged in. However, a small number of fish move up or downstream with significantly more fish moving downstream. While the vast majority of fish were found to have moved only a single pool in either direction, some fish did move up to two pools up or downstream and some fish were caught multiple time in each of two pools. Distance between pools, pool size (area) and pool quality did not appear to have any impact on up or downstream movement probability. These results appear to indicate net downstream movement of sturgeon within the FCRPS though the physical and biological mechanisms driving such movement will require additional research.

Lessons Learned from Implementation of River and Stream Restoration Projects in Eastern Washington and Idaho

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In collaboration with project partners, Natural Systems Design recently assisted with design and implementation of two stream restoration projects in the Yakima River Basin on Ahtanum Creek and Toppenish Creek and a river restoration project on the lower Lemhi River in Salmon, ID. This presentation will discuss lessons learned for successful implementation of salmon and steelhead habitat restoration projects in dry intermontane sagebrush habitats (Eastern Cascades Slopes/Columbia Plateau and Middle Rockies). Topics will touch on three common challenges

encountered during construction in this ecozone: (1) vegetation installation, (2) materials sourcing (wood and plant), and (3) pile/post installation. Vegetation installation was challenged by one or more of the following: narrow construction window and timing of planting within short season, coordination and sequencing/integration with structure construction and grading, communication between contractor and planting crews, varying levels of contractor's technical expertise and project experience, and unclear design specifications. Sourcing of wood meeting specification proved challenging on all three projects. Wood sources tended be limited, transported over significant distances, and/or compromised by insects, fungus, and/or burn. Geotechnical investigations during the design phase were not conducted to determine feasibility for installation of piles/posts. Resistant layers specific to this ecozone were encountered on all three project sites that required contingency methods for pile/post installation and field modifications to ensure wood structure stability. This presentation will discuss these common challenges, how they were overcome to achieve the project goals for ecosystem restoration, and recommendations for successful implementation of future Eastern Cascade Slope/Columbia Plateau and Middle Rockies restoration projects. The importance of clear communication and bid documents will be emphasized throughout. Pre- and post- project drone videos and photos will be presented to highlight the habitat functions restored including reconnection of floodplains and historic side channels, riparian buffer development, and in-stream fish habitat/passage improvements.

Exploring the Use of Environmental DNA to Reduce Error in Salmon Redd Counts

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Annual redd counts are used to monitor the status and trends of salmonid populations, but methods to easily and reliably assess identification or species assignment errors are lacking. We explored whether environmental DNA (eDNA) analysis might prove useful for identifying and determining species of origin for redds. We collected eDNA samples from redds of Chinook salmon Oncorhynchus tshawytscha, redds of coho salmon O. kisutch, and areas of undisturbed gravel (n = 10, each), as well as from the water column adjacent to each of those sites (n = 30) in the Sandy River Basin, Oregon, USA during the fall of 2013. The concentrations of Chinook and coho eDNA were quantified within each sample using real-time PCR. Preliminary results suggest that recently created redds consistently contained high eDNA concentrations of the species which made the reddâ€"but not of the other speciesâ€"relative to the adjacent water column, with little overlap. Undisturbed gravel contained higher eDNA concentrations of both species than the water column, but with much overlap. This initial investigation highlights the potential value and some of the complexity of using eDNA analysis to indicate redd origin and could potentially lead to a tool for correcting error associated with visual redd counts.

Recolonization of the Little Sandy River by Steelhead and Salmon After Dam Removal

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Access to stream habitat is being restored for anadromous salmon and steelhead in various basins across the west. Barrier removal is accompanied by various management considerations, including whether newly reopened habitat should be left to be recolonized naturally, or whether it is best to "jump-start" it by planting fish. Such decisions are influenced by the proximity of a source population. We monitored the recolonization of a river with nearby populations of steelhead (Oncorhynchus mykiss), Coho Salmon (O. kisutch), and Chinook Salmon (O. tshawytscha) after the removal of a dam without fish passage. The Little Sandy River Dam was removed in 2008 after blocking fish passage for 100 years. The upstream 10 miles of accessible, high-quality steelhead habitat were allowed to be recolonized naturally. Smolt emigration and other fish captures were monitored using a rotary smolt trap at a site upstream of the dam beginning two years before dam removal and continuing to the present. Low numbers of steelhead smolts were produced by resident rainbow trout populations prior to dam removal. In the two years after dam removal, steelhead smolt numbers began increasing, presumably from juveniles which migrated upstream. Three years after dam removal, and the first year that steelhead smolts could be expected from recolonizing adults, the steelhead smolt population jumped to levels that might be expected in a fully-seeded river and have slowly increased since then. Coho fry were captured the spring immediately following dam removal, but coho smolt production as well as coho and Chinook fry captures have varied greatly. These preliminary results suggest that natural recolonization of stream habitat can happen very quickly after the removal of barriers, given favorable habitat and a nearby source population.

My Wild Idea to Save Salmon is to Remove Dams Throughout the Pacific Northwest that Block Fish Passage

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My wild idea to save salmon is to remove all dams throughout the Pacific Northwest and New England wherever there are diadromous fish populations. There are an estimated 85,000-90,000 dams throughout the United States, of which approximately 66,000 impound rivers (the rest are off channel storage). In Oregon alone, there are over 700 dams for irrigated agriculture, hydropower, navigation, water supply, recreation and flood control. In Washington, there are another 1,200 dams. Rivers are intricate and complex systems of flowing water, sediment movement and riparian vegetation that connect habitat from the mountains to the oceans. They are also essential for the numerous fish and wildlife species that have adapted to life on the beds and banks of rivers, in the water itself and in the riparian areas and wetlands along riverine systems. Dams drastically alter the flow of water both above where water is impounded and below, by changing the seasonal and annual flows, to highly regulated regimes. Dams alter the physical, chemical and biological aspects of rivers, changing water quality, nutrients,

sediments, and impeding or completely blocking the upstream and downstream movement of fish and wildlife species. In the case of salmon, dams have inundated spawning habitat, created deep pools of slow-moving warm water that produce habitat for predators, slow or completely block migration of juvenile and adult salmon, and expose fish to high water temperatures and disease. Since 1912, approximately 1,300 dams have been removed in the United States. While dam removal can be an expensive and long term project, the immediate benefits to fish and environmental restoration are invaluable. Rivers heal remarkably quickly and dam removal provides an amazing opportunity to restore a river's health, return it to its natural, free-flowing state, and restore native salmon and steelhead runs. Dam removals also restore the connections between marine and freshwater nutrients, sediment, and fish and wildlife species. We will look at some of the incredible results of dam removals and restoration of fish runs including salmon, wildlife species, and ecosystems in New England and the Pacific Northwest, including the Penobscot and Kennebec rivers in Maine and the White Salmon, Hood and Elwha rivers in the Pacific Northwest. This will be an interactive presentation and discussion with the audience.

Adding Unmanned Aircraft Systems to the Monitoring Toolbox

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The Oregon Department of Fish and Wildlife (ODFW) is evaluating the utility of using Unmanned Aircraft Systems (UAS) to supplement long term monitoring and replace techniques that are dangerous, expensive, or impractical. ODFW relies on maintaining long term datasets on fish, wildlife, and their habitats for their successful management, however, the expense of using techniques like helicopter surveys continues to increase and the risks have also become more apparent. We present feasibility studies where we tested the use of UAS to complement or replace foot surveys in tidal mud flats, float surveys on large rivers, and helicopter surveys of large rivers. In addition UAS can inexpensively provide additional data such as georeferenced 3D digital surface maps and orthorectified photomosaics that allow for analysis that would have been impractical to conduct by other methods. We also discuss the hardware, software, and regulations involved in using UAS in natural resource monitoring.

Nutria Impacts and Future Range Expansion Due to Climate Change

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Nutria (Myocastor coypus) was introduced into Oregon from South America in the 1930s for fur farming. Escaped animals have established populations throughout western Oregon and Washington. Nutria cause economic and ecological harm through burrowing activities and

herbivory. In a revegetation study the Delta Ponds in Eugene, nutria consumed 100% of black cottonwood, 89% of red osier dogwood, and 70% of willow transplants that were unprotected. Minimum winter temperature was a good predictor of nutria distribution. Climate modeling using the A1B emissions scenario predicted a greater than 300% increase in suitable habitat for nutria in Oregon and Washington by the 2020s. Management of nutria in areas opened for colonization by climate change should include preventing movement into new watersheds and development of an early detection/rapid response plan for controlling population expansion and mitigating impacts.

Bedrock Trench Cutting: An Alternative Technique for Adult Fish Passage

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The West Fork Millicoma River (WFMR) subbasin is considered a critically important spawning and rearing habitat for Oregon Coast coho salmon and other aquatic species. Stulls Falls is a two-step falls at river mile 16 on the WFMR, with a total elevation differential of over 20 feet and nearly 60 miles of habitat with good intrinsic potential upstream for coho, fall chinook, and winter steelhead. The falls have always posed a notable restriction for adult fish passage and a significant migration delay for steelhead and coho. Numerous alterations were attempted on Stulls Falls since 1950, such as dynamite blasting and fishway construction. In 1952, ODFW constructed a fish ladder around the lower, taller falls, and a concrete weir was later constructed below the upper falls to improve fish passage. This weir failed during the 1996 flood while a bedrock plate collapsed into the main jump pool further impeding passage due to increased jump height and velocity at the falls. Since 1996, adult migratory passage has been further hindered numerous times by insufficient flow for coho and steelhead to pass over the upper falls during critical winter migratory periods.

The upper falls have always been a complete barrier to chinook migration, a significant obstacle to coho, and a limited obstacle to steelhead. CoosWA, ODF, and ODFW calculated a passage window for the upper falls using stream gauge data and hydraulic modeling. Chinook were unable to pass above the falls to spawn due to passable flows occurring less than 18% of the time, all of which occur outside their migratory period, and have not been reported upstream of the falls. Passable flows occurred less than 38% of the time for coho; however, they were often trapped in the pool below during low-flow years and forced to spawn by the hundreds in a small tributary downstream.

The project team recently implemented the cutting of 3 low-flow channels into the upper bedrock ledge to improve adult migratory passage through the upper falls. These new channels allow passage over a wider range of winter flows (especially flows less than 100 cfs) that have typically occurred during the recent winter migratory periods. In past years, observations in the pool below the upper falls often contained hundreds of salmonids, primarily coho, waiting for passable flows to move further up in the system to spawn. However since project completion, this pool has been relatively empty of salmonids as the new channels now provide routes

through the upper falls that are passable at a wider range of winter flows. During the 2016-17 spawning season, spot check surveys have been conducted upstream of the falls to determine if chinook successfully navigated over the falls. As of early November, 18 female chinook, 7 male chinook, and 22 chinook redds have been recorded up to 16 miles upstream of Stulls Falls. Additionally, over 150 coho were observed holding in deep pools nearly 13 miles upstream of the falls.

Full Reconnection of a Large-Scale Historic Oxbow Channel

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The East Fork Millicoma River (EFMR) is the largest tributary to the Millicoma River in the Coos River basin and has the potential to provide important habitat to fall chinook, chum, and coho salmon and steelhead trout, amongst other important aquatic species, but historic land practices formed poor aquatic habitat conditions. Wooden trestle bridges initially spanned tributary streams along the Weyerhaeuser Allegany Mainline, including two bridges spanning the EFMR at Mile 7 where a tight meander bend crossed under the road twice within 500 feet due to a resistant ridgeline. When the road was rebuilt in 1958, this ridgeline was blasted to create the Bypass Chute that channelized the entire flow of the EFMR, and the two bridges were buried with fill from the blasted ridge. This channelization reduced the effective stream reach from the 0.6 mile Oxbow to under 0.1 miles, over which the river drops roughly 20 feet in elevation. Since 1958, increased streamflow velocities over the stepped bedrock chute substantially impeded adult salmonids passage and truncated all juvenile passage through the chute where the habitat quality and quantity is greater in the 16 miles upstream of the Oxbow. Adult coho migrating upstream expended large amounts of energy attempting to pass the falls and typically experienced passage delay until higher, adequate stream flows occurred later in the season. Chinook generally have larger body size and moderately less swimming capability than coho. As a result of the Bypass Chute conditions, upwards of 90% of the adult chinook were restricted from passing through the chute.

In the mid 2000's, Coos WA, Weyerhaeuser, and ODFW began developing the EFMR Oxbow Reconnection restoration project to eliminate the passage barrier at the Bypass Chute for adult and juveniles. After 10 years of planning and monitoring, the EFMR Oxbow Reconnection was implemented in Spring/Summer 2016, which comprised of the $1.9 million construction of two concrete bridges in the location of the original trestle bridges, removal of roughly 60,000 cubic yards of fill, and an engineered channel plug to replace the old ridge removed in 1958 to return the entire flow of the EFMR into the 0.6 mile historic Oxbow channel. By returning the flow into the Oxbow, the barrier that existed from 1958-2016 was eliminated, and full fish passage was reestablished which is considered critical for increasing production and distribution of wild/natural salmon and steelhead in the upper reaches of the EFMR basin. Since a barrier removal of this type or magnitude is uncommon, the full salmonid response to passage restoration to a large quantity of habitat is unknown. A comprehensive monitoring program was recently developed to effectively detect the changes resulting from the EFMR Oxbow Reconnection project with the goals of documenting responses and the magnitude of those

attributes over the next six years.

Meta-Analysis of Studies of Herbicide and Pesticide Effect on Aquatic Life

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Herbicide and pesticide application, while often being an effective tool in terrestrial and aquatic management and restoration, may have detrimental impacts to aquatic ecosystems. While much investigation has been conducted; these topics appear to be sparsely considered by fisheries biologists. Our goal with this presentation is to synthesize the available herbicide and pesticide research into several digestable categories, and stimulate further inquiry by fisheries biologists who may not be familiar with these topics. This meta-analysis of herbicide and pesticide impacts, along with information from this session, will be the impetus for development of a White Paper by the Oregon Chapter of AFS.

Oregon Chapter AFS Natural Production Committee

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The Natural Production Committee is an external committee of the Oregon Chapter of AFS. This, and other, committees are staffed by volunteers that aim to support the Chapter and the Executive Committee. The Natural Production Committee assists the Executive Committee with review and comment on pertinent policy proposals, and also assists with development of "White Papers" outlining the available science for key management issues. During the 2017 Annual Meeting, the Natural Production Committee is helping convene a session on Pesticide and Herbicide use and impacts to aquatic ecosystems. This session may lead into the development of a White Paper on Pesticide/Herbicide Use and Impacts during 2017. The Natural Production Committee meeting immediately following this session will begin consideration of this White Paper.

The Hutton Junior Fisheries Biology Program

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The Hutton Junior Fisheries Biology Program is a summer mentoring program for high school students sponsored by the American Fisheries Society. The principal goal of the Hutton Program is to stimulate interest in careers in fisheries science and management among groups underrepresented in the fisheries professions, including minorities and women. Application to the program is open to all junior and senior high school students regardless of race, creed,or

gender. The program seeks to increase diversity within the fisheries professions, and qualified women and minority applicants are strongly encouraged to apply. Students accepted into the program are matched with professional mentors and enjoy a hands-on fisheries science experience in a marine and/or freshwater setting. Assignments are made with participating organizations within reasonable commuting distance from the students. During the summer, students work alongside their mentors, collecting samples and assisting with analyzing data. A scholarship is provided to students accepted into the Hutton Program.

River Diving

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Everyone wants stellar pictures of underwater fish however not many people have the equipment or skills necessary to procure them. This summer I embarked upon an exploratory campaign to get good pictures of freshwater fish in Oregon rivers. Salmonids were the main target, however I found myself seeking out sculpin, chub, shiners, and other native fish as they make excellent photographic subjects as well. I also found out what techniques worked well and which ones did not through trial and error. I will explain my approach, setup, photography techniques, helpful tips, and the resulting photographs from this summer's initial work.

A potential mechanism to account for domestication in hatchery-reared steelhead

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ABSTRACT

Adaptation to captivity (domestication) influences the reproductive success of hatchery-reared steelhead (*Oncorhynchus mykiss*), but the mechanism by which domestication occurs is not well understood. Size at release is positively correlated with probability of survival for hatchery-reared steelhead and viability selection after release is hypothesized to influence the effects of genetic adaptation to hatchery rearing. In this study we used a population with a known difference in fitness between hatchery and natural-origin fish to determine if family identity affects body size at release and if size selective survival occurs after release from the hatchery. Using data from two independent brood years we found strong effects of family identity on body size at release for hatchery-origin steelhead from the Hood River population. We then assessed the potential for size selective survival to occur by using scale analysis to back-calculate size at ocean entry for returning adults. We compared the distributions of back-calculated sizes from returning adults to the same cohort at release from the hatchery. We

repeated the size selective survival analysis using two brood years in the Hood River. In one year, weak size selective survival was observed (difference from mean smolt release length to mean smolt length for fish that survived was 1 cm) while in the second release year strong size selective survival occurred (difference of 4 cm). In the year with strong size selective survival the average hatchery fish length at release was smaller (18 cm mean length) than the year with weak size selective survival (21 cm mean length). Our results support the hypothesis that there is a genetic effect on body size at release and that size selective survival does occur after release in the Hood River steelhead population. Determining the mechanisms by which genetic adaptation to hatchery rearing occurs may provide information to reduce unwanted domestication effects while potentially increasing the reproductive success of hatchery-origin steelhead spawning in the wild environment.

The Stream Evolution Model -- Working with Nature to Restore Channel-Floodplain Connectivity

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The Stream Evolution Model (SEM) developed by Cluer and Thorne (2014), with additions to the model by Pollock and others (2014) that include the effects of beaver on stream evolution, expand the range of potential channel-floodplain configurations and restoration tools to be considered when designing restoration projects. They also illustrate how working with nature's river restorers can increase the effectiveness of a restoration project while accelerating recovery and potentially reducing cost.

The SEM shows that the common restoration practice of building habitat features in incised channels (SEM stages 2-4) does not restore the habitat or ecosystem benefits of a former floodplain-connected stream (SEM stage 0) because biophysical and geomorphic processes essential to supporting a diverse and resilient aquatic-riparian-floodplain ecosystem cannot operate effectively. Furthermore, designing channels that inundate the floodplain only once per year (or less frequently) prevents stream evolution processes from creating a more ecologically diverse and robust channel-floodplain system, which can be counterproductive in the long-term. Eco-physical processes are both affected by, and help drive, stream evolutionary stages. Historically, beaver played a significant role in alluvial valley processes and ecology, either by enhancing deposition or reversing channel incision following disturbance, which buffer morphological impacts of natural disturbances and thus maintain diverse habitats. Beaver extirpation, followed by floodplain development by European settlers, diminished habitat from pre-disturbance levels and led to incised channels becoming the norm. Given salmonid life cycles, recovery will be difficult without at least some stream reaches being restored to stage 0 -- a pre-disturbance morphology where streams inundate their floodplains multiple times per year. Beaver dams were pervasive in the historical range of salmonids and, in their natural or

analogue form, can be a powerful tool in incised channel restoration to stage 0.
This presentation will provide an overview of, and historical context for, the SEM. Examples of innovative restoration approaches will include working with nature's river restorers, as well as physical processes, to reconnect stream to floodplains thus building more resilient ecosystems.

Neomysis mercedis in a Lower Snake River Reservoir: Welcomed Guest or Unwanted Party Crasher?

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The opossum shrimp Neomysis mercedis has expanded its range from the lower Columbia River upstream 695 kilometers into Lower Granite Reservoir where it is now very abundant. We used beam trawls and vertical tow nets to collect mysids periodically from 2011 to 2014. Benthic densities in offshore habitats ranged from 19 to 145 mysids m-2 in shallow (2-12 m) water and from 3 to 48 mysids m-2 in deep (>12 m) water. Water velocity, depth, substrate, and seasonal interactions were important variables for explaining variation in Neomysis densities in offshore habitats. During spring, daytime densities in shoreline habitats.

Instant Gratification: Upper Klamath Basin Adfluvial Redband Trout Spawning Gravel Augmentation

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Upper Klamath and Agency Lakes support large bodied Redband Trout up to 850 mm in length, providing a world-class recreational fishery. These fish spawn in groundwater-dominated tributaries such as the Williamson River. Research in the 1970's identified spawning habitat, particularly the limited abundance of gravels, as a limiting factor for population productivity. To enhance the Redband Trout fishery, ODFW began gravel augmentation in 1975 by constructing a downstream U- shaped gabion on Spring Creek and adding 300 cubic yards of spawning gravel ranging in size from 3/8 to 2. Redd counts at the gabion immediately increased from zero to 62 in the spawning season of 1975-76. Results led to additional spawning gravel addition in Spring Creek and Williamson River until 1993. Redd counts in Spring Creek increased from an average of 87 redds annually from 1972-1974 to an average of 483 from 1996-2000. Despite the

success, gravel augmentation did not occur again until 2003. From 2003-2016 three spawning channels were constructed and spawning gravel was added to twenty-seven sites. All augmented spawning gravel sites were monitored extensively by standardized spawning surveys which determined utilization by adfluvial Redband Trout. Nearly all of the gravel augmentation sites were used extensively by adfluvial Redband Trout with 3,550 cubic yards of spawning gravel producing an estimate of over 25,000 redds from 1975 through 2016. Spring Creek showed the largest response with an increase of redds of 12 fold (87 to 1021). Sites that were heavily used tended to have existing redband trout spawning populations and were entirely or mostly groundwater driven. Reasons for the lack of use is not well understood at this time but could be related to water quality (nitrogen supersaturation), fish passage issues or very small population size. Problems with lack of utilization of constructed spawning channels were likely due to stream velocity due to inappropriate channel size. This study shows that introducing gravel can quickly increase the spatial extent of available spawning habitat, and that adfluvial trout will quickly make use of introduced gravels, particularly when they occur near existing spawning habitat and in areas with ideal thermal regime. Further studies will continue to identify and investigate the effect of spawning gravel augmentation. ODFW and Klamath Tribes have been conducting a full census of spawning habitat in the Williamson and Wood River systems since 2010. Long term monitoring has the potential to inform managers whether population productivity of adfluvial Redband Trout will increase. From these studies ODFW and project partners will continue to supplement spawning gravel and restore potential sites favorable to adfluvial Redband Trout. The project will also focus on increasing spawning habitat for various life histories of Chinook Salmon and Steelhead Trout once these species recolonize habitat in the Upper Klamath basin.

The Effect of Social Capital on the Underrepresented Minorities in Graduate Level Marine Science at the University of Washington

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The major focus of this research study is to explore how, or to what extent, social capital affects URM students in graduate level marine science programs at UW. In the academic context, social capital refers to the connections and support networks between peers, faculty, and administration. The primary hypothesis studied is that the inability to make these connections inhibits URM student participation in these programs. By placing attention on these underserved groups, this paper also investigates the cultural competency of faculty and administrative personnel. It has been shown that, possessing the awareness and understanding of differences within and between cultural groups is a key factor in enabling educators to be effective with students of diverse backgrounds (National Education Association, 2014). Despite UW's commitment to diversity, and compelling reasons to use the ideas and insights of URM students in the field of marine science, there continues to be a dearth of these individuals in UW's graduate level marine science programs. At the three current schools of marine science at UW's College of the Environment: Oceanography, Aquatic and Fisheries Sciences, and Marine and Environmental Affairs (SMEA), URM graduate enrollment is approximately 11.4% (GO-MAP,

2013). That amounts to roughly 1 graduate level URM marine science student for every 10 non-URM students, barely an image of diversity. Based on their ability to attract more URM students than the other graduate marine science programs at UW, this research study investigates the recruitment strategies at SMEA. In conjunction with existing literature on URM recruitment, the purpose of studying such strategies is two-fold: 1) to learn the aspects of recruiting methods that seems to attract URM students to their program and 2) Create a set of realistic recommendations that faculty and administrators can implement to bolster the amount of minority graduate students in their program. One of the major themes from the 2013 Diversity Report Follow-Up (Aisenberg, 2013) was the low enrollment of URM students at the graduate level. This invites a look at potential social factors, such as stigmas or stereotypes, which may get reinforced as URM students ascend the academic ladder, and begin noticing fewer of their peers. Understanding the role of these factors in the context of social capital and URM student representation graduate level marine science is the impetus of this study.

A New High Throughput DNA Sequencing Method to Confirm CRISPR/Cas9 Mutations in Danio rerio, Estrogen Receptor 1 (esr1) Gene

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The CRISPR/Cas9 system, an innovative method for genome manipulation, is being rapidly applied across organisms, including fishes, to understand basic physiology. One of the critical steps in this method is determining the genotype of the fish after genome modification, which causes random insertions/deletions (indels) in the targeted gene of interest. The purpose of this study was to utilize next generation amplicon sequencing, using the MiSeq Illumina platform, to confirm mutation in the esr1 gene of D. rerio CRISPR founder (Go) individuals. Two regions were targeted in esr1, an antisense target (T1) in exon 1 and a sense target (T2) in exon 3 to increase the likelihood of gene disruption. Potential Go fish were outcrossed with wild type individuals, embryos pooled, and DNA extracted. DNA from 47 individuals, including two wild type controls, was amplified and barcoded using a two-step polymerase chain reaction (PCR) procedure. T1 and T2 sites of esr1 were successfully amplified using target-specific primers during the first PCR step. In the second step, PCR products from each Go were uniquely barcoded using primers containing Illumina adaptor sequence. Amplicons were sequenced on the Illumina MiSeq platform using paired end 300bp reads. Reads were demultiplexed using a custom script, overlapped to form a single sequence using FLASH2, aligned to the reference using BWA, and the resulting BAM files were visualized using Geneious. Our results show that this mutation screening method is cost and time efficient in confirming CRISPR indels in the germ line of D. rerio, and produces high quality sequencing data without the need for cloning or additional sequencing steps.

Outcomes of Aquatic Invasive Species Management Efforts Help Determine the Cause Of Compensatory Population Growth

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Understanding density-dependent recruitment and mortality is fundamental to predicting population response to changes in abundance. These responses can be somewhat counterintuitive, as is the case with compensatory population growth (hereafter compensation). Compensation is when the removal of individuals from a population results in an increase in the population's recruitment rate. While compensation can be beneficial for the recovery of threatened populations of aquatic species, efforts to remove invasive species can be derailed when compensatory recruitment matches or exceeds removal rates. Given the potential for compensation to negatively impact aquatic restoration efforts, managers would benefit from greater understanding of the circumstances under which removal efforts result in increased recruitment. Further investigation into the relationship between compensation and removal success would also be beneficial, as not all removal efforts with evidence of compensation are unsuccessful. Therefore, we conducted a synthesis of efforts to remove unwanted aquatic animals in order to examine the broad-scale patterns of compensation and its impact on removal efforts. By drawing upon a wide range of removal efforts we can examine how variables relating to removal methods (technique, intensity), removal location (size of water body, connectivity) and the target species are related to compensation and removal success. We are also performing a secondary analysis of efforts to remove brook trout (Salvelinus fontinalis), the most common target species, to examine the role of removal location and technique independent of any species-specific factors. Our initial analysis shows a strong relationship between removal method and compensation, with compensation only resulting from physical removal efforts such as electrofishing and trapping. Although the response of a population to harvest appears to be very site specific, trends related to water body area and connectivity also appear to be related to likelihood of compensation. Ultimately, this analysis will provide insight into which easily accessible variables can be used to best predict the potential for compensation of invasive species populations targeted for removal.

Evidence The Upper Thermal Tolerance Limit Of Larval Pacific Lamprey Is Between 27°C and 31°C

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Pacific lampreys are a native, anadromous species that occurs in the Pacific Northwest. Various

threats have led to the apparent decline in their abundance and distribution. Changing climate conditions may be, or become, a significant threat to Pacific lampreys. Little information exists on the upper thermal tolerance limit of Pacific lampreys, especially the larval stage. We evaluated what water temperature is lethal to larval Pacific lampreys and whether sublethal water temperatures influence larval burrowing behavior. Larvae were collected from Cedar Creek (southwest Washington), when the water temperature was approximately 21°C, and then acclimated (at 21°C) to laboratory conditions. Acclimated larvae were gradually exposed to temperature treatments of 21°C, 24°C, 27°C, 30°C and 33°C. After being held in these treatments for 30 days, the survival rate was 100%, 100%, 100%, 0% and 0%, respectively. Although no mortality occurred, rearing for 30 days in the 27°C treatment did appear to influence the burrowing behavior of larvae. Acclimated larvae were also transferred directly to treatments of 27°C, 29°C, 31°C or 33°C. After being held in these treatments for seven days, the survival rate was 100%, 0%, 0% and 0%, respectively. Our findings suggest that larval Pacific lampreys can live for relatively long periods of time at temperatures up to 27°C, have a limited ability to tolerate temperatures from 27-31°C, and perish quickly at temperatures of 31°C or greater. This information may be used to help assess the vulnerability of larval Pacific lampreys to warm water and improve conservation efforts in a changing climate.

Integrating Chinook Salmon Spawning Migration Research and Fish Passage Restoration in the Lostine River

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Irrigation diversion structures in headwater streams can limit access to spawning habitat and, consequently, reduce individual fitness and population productivity. Environmental and biological factors can also influence the effects of these structures on salmon. Using radio telemetry techniques, we evaluated spring Chinook salmon spawning migration at diversion structures in the Lostine River (northeastern Oregon) from 2008 through 2016. Median duration of successful upstream passage at each monitored diversion (all years combined) ranged from 13 to 55 minutes, whereas median passage duration at a reference site with no structure was 10 minutes. Upstream passage success at the diversion structures ranged from 78 to 100%, and 13% of successful passages required multiple attempts. In comparison, upstream passage success at the reference site was 100% and required only single attempts. During this study, a diversion structure located downstream of critical spawning habitat was rehabilitated into a roughened channel, and median duration of successful passage at this site decreased from 81 to 33 minutes while passage duration at the reference site did not change. Overall, these empirical movement data provide a foundation for identifying problem areas and prioritizing and evaluating restoration efforts, including instream flow management.

Pacific Lamprey Translocation at Fall Creek

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The Pacific lamprey population in the Willamette River Basin has diminished substantially in the past several decades to historically low levels basinwide. Pacific lamprey are ecologically important to aquatic habitats and are critically important to the structure of the historical food web. In addition, Pacific lamprey are a significant cultural resource to many Native American tribes in the Pacific Northwest and the restoration and protection of the species is a high priority for tribes.

At Fall Creek Dam, an adult fish collection facility is in operation to enable fish passage past the dam. Streams that are known to sustain lamprey spawning have common habitat attributes observed in Fall Creek above the dam. Since 2013, lamprey have been translocated annually at a number of 240 individuals per year by the Tribes above Fall Creek Dam from Willamette Falls. This is a pilot project in an effort to seed the habitat above Fall Creek Dam with juvenile lamprey. Adult lamprey are attracted to spawning habitat through the detection of pheromones emitted by juvenile lamprey. Successful seeding and production of juvenile lamprey from translocated adults into the upstream habitats will create a pheromone attraction that is expected to result in an adult attraction into the tailrace of Fall Creek Dam. In 2015, we were contacted by biologists at Fall Creek Dam relaying they had adult Pacific Lamprey that had migrated upstream and into the collection facility. This is the first time this was observed since construction of the dam.

Henry Hagg Lake: A Tag Team Pilot Project

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Henry Hagg Lake (Hagg Lake) is a large flood control and water supply reservoir located in Washington County, Oregon. Hagg Lake also provides significant recreational benefits to a local population that exceeds two million people. ODFW stocks the reservoir annually with 80,000 rainbow trout to support a popular consumptive trout fishery. Nationally recognized as a smallmouth bass fishery, largemouth bass, crappie, perch, and catfish are also available. Little data exists assessing the public benefit of stocking Hagg Lake. Traditional creel surveys are typically expensive and often require a substantial personnel investment. In 2014, ODFW employed a cost effective alternative method developed by Idaho Fish and Game (IDFG), referred to as the Tag You're-It program, to collect data which enabled ODFW managers to assess harvest of stocked rainbow trout in Hagg Lake.

The Freshwater Habitat Committee Needs Your Input

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The poster will provide an overview of the objectives of the committee, what we have done in the past few years, and our focus for the near future.
There will also be a focus on how members can help improve discussions and provide information to our members through the OAFS's website and associated social media such as Facebook.
Increased member participation is the expected outcome.

Lessons in Beaver Based Restoration from the Bridge Creek IMW

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The Bridge Creek Intensively Monitored Watershed (IMW) project was launched in 2007 as a watershed scale restoration experiment designed to test whether encouraging beaver activity could improve habitat to the benefit of a threatened steelhead population. Currently in its 7th year of post restoration monitoring, the Bridge Creek project offers insight that can inform how beaver and beaver dam analog (BDA) structures influence fish habitat, and guide the design, implementation, and expectations for beaver based restoration projects.

Do Spatial and Temporal Trends Exist for the Relative Abundance of Pacific Lamprey in Spawning Ground Surveys and Dam Counts?

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Pacific Lamprey, a member of an ancient lineage of jawless vertebrates, is and has been an important source of tribal culture since time immemorial. It has only been relatively recent that lamprey have become the focus of fisheries scientists and managers interested in conserving them. Over the last few decades, declines of Pacific Lamprey along the Pacific Coast and particularly within the Columbia River Basin have sparked an increasing effort to study, monitor, and improve habitat and barrier passage. Monitoring for Pacific Lamprey in freshwater has

somewhat relied upon dam counts in the Federal Columbia River Power System, and yet other data exist. The Oregon Department of Fish and Wildlife (ODFW) has been conducting systematic salmonid spawning ground surveys on the Oregon Coast and up into the lower Columbia River since 1998. Supplemental to this effort, a considerable amount of information on Pacific Lamprey has also been collected since 2003. These data include the number and distribution of redds, site occupancy, and spawn timing of adult Pacific Lamprey. This information will be used as part of ODFW's status assessment for conservation planning for lampreys in Oregon. For this effort, we will: 1) determine whether dam counts correlate with estimates derived from redd counts and site occupancy; 2) explore the data for evidence of region- and time-specific trends in the relative abundance of Pacific Lamprey that could suggest lamprey returning to spawn in Oregon are exhibiting variable population spatial structure in space and time; and 3) investigate whether there is a relationship between annual lamprey escapement and potential host species (Coho and Chinook Salmon; and steelhead) abundance.

Using Historical Ecology to Guide Stream Habitat Restoration

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Restoration targets for stream fish habitats are frequently based on arbitrary or unstated assumptions about desired habitat conditions. The discipline of historical ecology involving reconstructions of watershed history using diverse information sources is one means for informing target conditions. Historical ecology also provides an instructive narrative of watersheds for understanding long-term trajectories in habitat conditions and land use legacies. We demonstrate the use of historical ecology in setting restoration targets and understanding fish-habitat relationships in the Upper Grande Ronde River, Catherine Creek, and the Minam River of Northeast Oregon. Using General Land Office (GLO) surveys, we estimated the degree of channel widening (a proxy for increasing width:depth ratios) from the 1800s to present. Restored channel width scenarios were used in a mechanistic water temperature model along with riparian restoration and climate change scenarios to evaluate the portions of habitable stream for ESA-listed spring Chinook Salmon (Oncorhynchus tshawytscha) and O. mykiss. When coupled with intensive riparian restoration, narrowing channel widths provided a substantial reduction in water temperature and an associated increase in stream length habitable to salmonids. We additionally supplemented a previous analysis of fish habitat conditions contrasting U.S. Bureau of Fisheries data from the 1940s with stream surveys from the 1990s. In our analysis, we found only a slight improvement to stream habitat conditions since the 1990s to 2010s. Sites with lower than expected large pool frequency were downstream of historical splash dam sites. Using structural equation modeling, we demonstrate these large pools' defined by the historical condition are critical habitat for O. tshawytscha, and that these habitats

are maintained by sufficient quantities of large woody debris. In summary, historical ecology is a practical means for setting restoration baselines and understanding the capacity for habitats to support aquatic life.

Using Genetic Pedigree Reconstruction to Estimate Effective Spawner Abundance and Infer Spawning Behaviors of Pacific Lamprey

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Redd surveys are a commonly used technique for indexing the abundance of sexually mature fish in streams; however substantial effort is often required to link redd counts to actual spawner abundance. In this study, we describe how genetic pedigree reconstruction can be used to estimate effective spawner abundance in a stream reach, using Pacific lamprey Entosphenus tridentatus as an example. Lamprey embryos were sampled from redds within a 2.5 km reach of the Luckiamute River, OR. Embryos were found in only 20 of the 48 redds sampled (suggesting 58% false redds), however multiple sets of parents were detected in 44% of the true redds. Estimates from pedigree reconstruction suggested that there were 0.48 (95% C.I. 0.29-0.88) effective spawners per redd and revealed that individual lamprey contributed gametes to a minimum of between one and six redds, and, in one case, spawned in patches that were separated by over 800 m. Our findings demonstrate the utility of pedigree reconstruction techniques for both inferring spawning-ground behaviors and providing useful information for refining lamprey redd survey methodologies.

Looking Back and Moving Forward, Professional Inclusion and Tribes

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In Oregon, Washington and Idaho there are 43 federally recognized tribes that have vast areas of shared traditional territories. Since the Boldt decision, states and federal governments have recognized these tribes as co-managers of natural resources. Over the past 40 years tribes have developed their Natural Resource programs, in parallel to other co-managers. As Tribal membership has failed to keep pace with western education, Tribal representation in professional groups has also lagged behind. Tribal specific scientific research is often under represented within professional groups and other scientific outlets. Inclusion of Indian people at a professional level has recently started to trend upward, but the western science dissemination model has really not grasped ahold of working with underrepresented Indian professionals. Currently there are very few natural resource Tribal specific professional groups, and most national professional groups have very few registered tribal people. Objectives of this talk are

to (1) discuss the historical context of Tribal rights and co-management; (2) discuss current representation of Indian professionals and Tribes; and (3) discuss possible ways of engagement and reciprocity with Tribal people.

Return to the River: Behavior and Spawning of Chum, Fall Chinook, and Coho Salmon on the Northern Oregon Coast

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This video expands on a film presented at ORAFS in 2016 (Journey's End), including new footage of underwater behavior and spawning activity of wild chum salmon (Oncorhynchus keta), fall Chinook salmon (Oncorhynchus tshawytscha), and coho salmon (Oncorhynchus kisutch) in natural habitats on the northern Oregon coast. Filmed with a GoPro Hero and Hero5 camera and edited in iMovie 11.

Tracking Oregon's Invasive Species with iMapInvasives

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The Oregon iMapInvasives program launched in 2010 as a central, statewide, online, GIS-based data management system to assist citizen scientists and natural resource professionals working to protect our natural resources from the threat of invasive species. A variety of types of information can be recorded and queried in iMapInvasives, including observations, surveys, and treatments for terrestrial and aquatic plants and animals. This data is being used across the state and beyond in invasive species management decisions and planning, including the early detection and management of aquatic invasive species.

Thermal Effects on Spawn Timing of Redband Trout in the Upper Klamath Basin

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Variation in the reproductive timing of Redband Trout (Oncorhynchus mykiss) has important implications for conservation of a world class fishery in a dynamic landscape such as the Upper Klamath Basin. Adfluvial Redband Trout are known to spawn in the tributaries of Upper Klamath Lake which vary in water temperature regimes influenced by groundwater inputs and snow melt hydrology. We investigated the distribution of spawn timing of adfluvial Redband Trout and the

temperature regimes of spawning reaches in tributaries of Upper Klamath Lake using temperature loggers placed in known and unknown spawning reaches. Multiple methodologies were used to determine spawning areas and timing. These included: bimonthly redd and area under the curve surveys throughout the duration of spawning, radio telemetry, PIT tag arrays and video weirs. We found that spawning reaches not heavily influenced by groundwater inputs showed peak spawning periods occurring in the spring, possibly attributed to suboptimal temperatures during late fall to winter. Groundwater dominated spawning reaches where water temperature exceeded 5° C in the late fall to winter showed a protracted spawning period with peaks in December or January which could possibly be attributed to more stable stream temperatures throughout the year. One large groundwater stream displayed a bimodal distribution with spawning documented 10 months of the year. These results demonstrate that adfluvial Redband Trout utilize the variation of thermal regimes within the Upper Klamath Basin to maximize their reproductive success. Future studies will investigate spawn timing on the Sprague River which consists of warm springs (14-17° C) but is largely influenced by snowmelt hydrology. A better understanding of how adfluvial Redband Trout utilize spawning habitat in the Upper Klamath Basin will assist in conservation efforts in the basin.

Strikes and Gutters, Ups and Downs: Monitoring Kokanee and Mysis Shrimp Populations in Wallowa Lake

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Kokanee populations are density dependent, therefore increases in length-at-maturity can signal a decline in abundance. Interspecific competition with non-native species, namely mysis shrimp and lake trout, can pose significant risks to the stability of kokanee populations. Wallowa Lake hosts a self-sustaining population of kokanee that has been a key recreational fishery and important component of the local tourism economy, despite stocking of mysis shrimp and lake trout between 1956 and 1967. After observing an increase in length-at-maturity, which corresponded with several state records and the current world record kokanee, during 2009-2010; fishery managers became concerned for the persistence of this population and fishery. From 2008 to 2016, annual kokanee abundance was monitored using mobile hydroacoustic surveys. Average length and age-at-maturity were estimated from kokanee recovered from spawning areas in the Wallowa River. Mysis shrimp densities were estimated annually from vertical tows of the water column at three fixed sites.
Kokanee abundance in Wallowa Lake increased from 267,000 in 2009 to 996,000 in 2012; but declined to just under 200,000 fish in 2016. Despite a recent decline in abundance, there has not been a compensatory increase in kokanee size. Hydroacoustic surveys indicated that 77-98% of rearing kokanee from 2013-2015 were under 200 mm (8 inches). Average length-at-maturity reached unprecedented highs in 2009 at 327 mm and declined to a low of 162 mm in 2014, showing only a slight increase to 218 mm in 2016. Otoliths collected from spawning fish indicated that age-at-maturity shifted to younger kokanee. Mysis shrimp densities reached a

high of 216 individuals/m2 in 2010 but sharply declined to 13 individuals/m2 in 2014, before increasing to 122 individuals/m2 in 2016. Although monitoring efforts have not yet documented evidence of a kokanee population crash, the goals of sustaining quality fishing opportunities are far from being reached. Mature fish that are small and young, even in periods of relatively low abundance, indicate limiting food sources in Wallowa Lake. While informative, monitoring efforts only address portions of the food web and more information is needed regarding lake trout abundance and predation. It is still undetermined whether the documented population response is part of ongoing population cycles, or a bellwether of future population instability.

Cascade Lakes Trout Stocking: Survival Using Two Different Release Methods and Survival of Two Stocks of Triploid Rainbow Trout

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We conducted two experiments aimed at improving survival of fingerling trout released into multiple Cascade Mountain lakes. The first experiment was designed to test a potential difference in survival of cutthroat, rainbow and brook trout released from a helicopter versus those released from a backpack. In 2011, fish allocations for 19 lakes were split into approximately equal numbers and differentially marked. During a one week period in July, approximately half of the fish were released from a helicopter and the other half were placed into plastic bags and carried into the same lakes in a backpack. During the summer of 2012, we sampled each lake using gill nets and angling gear to determine first year survival of the fingerling releases. We captured a minimum of 4 yearlings in 9 of the 19 lakes. Relative survival was 3.8 yearlings per 100 fish released by air stocking and 1.5 yearlings per 100 fish released by backpack stocking, however the difference was not significant (Pearson's r =0.04, p

Movements, Habitat Use, and Mortality of Bull Trout in the S. Fk. McKenzie River

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Bull trout have persisted in the S Fk McKenzie River despite a legacy of habitat alteration, fragmentation, and angling-related mortality. Information on movements, reach-scale habitat use, and sources of mortality has been and will continue to be essential for management of this bull trout population in the context of habitat modifications, structural and operational modifications at Cougar Dam, potential connectivity with other local populations of bull trout, and continued angling pressure. We began a radio telemetry study in 2014 to gain information

specific to subadult bull trout, implanting radio tags with 678-d expected lifespan into N = 27 bull trout in the 250â€"400-mm FL range and conducting weekly mobile tracking as well as operating fixed telemetry stations. Here, we present findings from this study, integrating data from annual spawning surveys, remote PIT tag interrogation, upstream passage efforts at Cougar Dam, and previous studies of juvenile outmigration from spawning reaches and movements of large adults to provide an assessment of movements, reach-scale habitat use, and sources of mortality in this population.