ABSTRACTS

NWFSC Watershed Program Open House

Museum of History and Industry
2700 24th East, Seattle, Washington 98112
October 28, 2010

8:40 – 9:00 **Getting scientifically ready for the removal of the Elwha River dams – last call for baseline data.**

G. Pess, M. Liermann, J.R. McMillan, K. Denton, S. Morley, T.R. Bennett, T. J. Beechie, P. Hicks (NOAA Restoration Center), M. McHenry (Lower Elwha Klallam Tribe), M. Elofson (Lower Elwha Klallam Tribe), R. Moses (Lower Elwha Klallam Tribe), R. Peters (USFWS), J. Duda, (USGS), S. Brenkman (National Park Service), K. Mayer (WDFW), M. Gross (WDFW), and M. Zimmerman (WDFW)

Abstract – In September of 2011, a 2.5 year deconstruction of two long-standing, high-head dams will begin on the Elwha River of the Olympic Peninsula. Over the past decade, a variety of ecosystem related information (e.g., fish, riparian, in-stream habitat, and stream productivity) has been collected in the Elwha River basin to establish baseline conditions prior to one of the largest watershed and salmon restoration projects in North America. The design of these studies is based upon the geomorphic template of the watershed, as different channel types are expected to respond differently to the large amount of sediment that will be released as a result of dam removal. For example, we anticipate that floodplain channels will attenuate the impacts of sediment and provide biological refuges after dam removal. We present an overview of the main questions and study designs being examined by a collaborative group of scientists from several state, federal, and tribal organizations. We also provide examples of existing baseline data collected for fish, in-stream habitat, and stream productivity. Lastly, we discuss some of the future opportunities and constraints related to data collection in the Elwha River and nearby reference watersheds. Our ultimate goal is to quantify the ecological "signal" following dam removal in the Elwha River basin, in order to better tell the story of this unique watershed restoration and share critical findings with other dam removal projects.

Notes:

9:00 – 9:20 **Comprehensive monitoring of the Qwuloolt levee breach restoration in the Snohomish estuary.**

C. Rice, T. Zackey (Tulalip Tribes), J. Hall (Hall and Associates Consulting, Inc.), J. Chamberlin (Fish Ecology, NWFSC), H. Imaki, P. Roni, G. Hood (Skagit River System Cooperative), L. Tear (Fish Ecology, NWFSC), A. Portinga (Fish Ecology, NWFSC), and C. Crandel (Fish Ecology, NWFSC)

Abstract – The Qwuloolt restoration site is approximately 142 hectares (360 acres) of former estuarine wetland that will have tidal inundation returned in late 2012 through levee breaching. The broad, long-term goal of the project is to transform the site into a self-sustaining, vegetated estuarine wetland that maximizes the modern, natural ecological potential of the site. Monitoring of the Qwuloolt site and adjacent reference sites includes measurement of controlling abiotic attributes (topography and sediment dynamics, hydrology, and chemical contamination), and biota (vegetation, fishes, macroinvertebrates, and birds) with the ultimate priority on evaluation of biological response to the restoration. Data collection began in summer of 2009 and is ongoing. Initial results show clear contrasts in hydrologic and geomorphic conditions, and in the taxonomic composition of biological assemblages among project and reference sites. These data provide a basis for rigorous comparisons of project conditions before and after levee breach. To put Qwuloolt in an ecosystem context and add value to the monitoring effort, data from the project are being integrated with other projects in the Snohomish River estuary, including system-wide monitoring of juvenile Chinook salmon, and hydrodynamic modeling.

Notes:

9:20 – 9:40 **Drivers of temporal variation in growth, movement, and survival of coastal cutthroat trout.**

T. Buehrens, P. Kiffney, G. Pess, T.P. Quinn (UW-SAFS), and T. Bennett

Abstract – Numerous studies have attempted to correlate growth and survival of stream resident salmonids with abiotic environmental characteristics, such as temperature, flow, and season, or physical habitat quality, such as habitat depth, area, and availability of cover. Other studies have related growth and survival to biotic factors such as densities of potential intra- and interspecific competitors, and individual attributes such as size, and condition. Determining the relative importance of abiotic and biotic factors can be difficult without experimental manipulation of fish densities or environmental conditions. Our study took advantage of a colonizing coho salmon population to determine the relative importance of competitor densities and environmental and physical habitat variability on the growth and survival of an existing population of resident coastal cutthroat trout. In 2003 fish passage facilities were completed at the Landsburg Diversion Dam on the Cedar River, WA restoring access to 33 kilometers of upstream habitat for coho and chinook salmon for the first time since 1901. Coho salmon abundance and spatial distribution have quickly increased leading to increased juvenile salmon densities and the potential for growing competition with cutthroat trout. We conducted a multi-year mark-recapture study of coastal cutthroat trout using passive integrated transponder (PIT) tags with the objective of characterizing patterns of growth, movement and survival at a range of temporal and spatial scales. Here we report preliminary results from analysis of trout mark-recapture data. Insights from this study will improve our understanding of the role of interspecific competition relative to abiotic factors on the performance of stream fish communities.

Notes:

9:40 – 10:00 **Movement and residency of juvenile Chinook salmon in natural and hydraulically altered estuary channels.**

D. Rudy, C. Greene and E. Beamer (Skagit River System Cooperative)

Abstract – Tidal channels are considered critical rearing habitat for juvenile Chinook salmon as they transition from freshwater to saltwater. In many estuaries, tidal channels have been hydraulically modified via diking and tide gates to reduce tidal influx, and the effects of these hydraulic alterations on channel use by Chinook remains unknown. In this presentation, I discuss the results of several studies within two channel systems of the Skagit River estuary: channels along Swinomish Channel that have been used in a before-after control-impact (BACI) design to examine replacement of a traditional flap gate with a self-regulating tide gate (SRT), and tidal channels in the South Fork that have been subject to diking but are unobstructed for much of their length. The BACI design revealed substantial differences in density inside and outside of the tide gate relative to a reference site, even after SRTs had been installed. To test whether these density differences constituted changes in movement and residency, we monitored PIT tagged fish introduced into channels. Our observations indicated that Chinook rear in a single channel for up to several weeks in the unobstructed South Fork systems, while just a few days in the Swinomish tide gate system. Furthermore, the SRT site had much lower incidence of repeated use than sites in the South Fork. Our findings suggest that while SRTs can improve habitat use compared to traditional flap gates, they nevertheless represent a significant movement barrier when compared with more natural systems.

Notes:

10:20 – 10:40 **Results of a long-term PIT-tagging study in the East and West Twin Rivers, Washington.**

T. R. Bennett, P. Roni, K.P. Denton, G.R. Pess, R. Moses (Lower Elwha Klallam Tribe) and M. McHenry (Lower Elwha Klallam Tribe).

Abstract – Since 2004 NOAA Fisheries, the Lower Elwha Klallam Tribe, and Weyerhaeuser have PIT tagged approximately 22,000 juvenile coho salmon (*Oncorhynchus kisutch*) in the East and West Twin rivers of the Olympic Peninsula to determine growth, migration timing, overwinter survival, and smolt-to-adult survival. Over the last seven years, several patterns have emerged, including 1) there are two distinct peaks of juvenile outmigration; one in the fall and one in the spring, 2) the fall outmigrants are consistently smaller at tagging than the spring outmigrants, and 3) the fall outmigrants appear to return the following fall and winter as adults. In addition, while the adult return is mostly two and three year old fish, up to 19% can be four, five, and six year old fish. These results highlight the need to determine why smaller juveniles leave in fall, i.e. is it due to favorable physiological conditions, or is it due to unfavorable abiotic conditions such as habitat quality or stream flows, and to more closely examine life history patterns and age structure of the escapement through other methods such as otolith microchemistry and microstructure analysis.

Notes:

10:40 – 11:00 **Evaluating flow-related impacts to salmon populations in the context of regional climate variation.**

C. Greene, T. Beechie, D. Arthaud (NMFS Regional Office), J. Morrow (NMFS Regional Office), and H. Imaki

Abstract – In North America, climate change is predicted to impact freshwater systems already stressed by extractive water use. Because both land and water is affected by climate, climate change will likely have both a direct impact on freshwater systems as well as an indirect impact through increased water use. This situation complicates our understanding of the impacts of climate on anadromous species, which are subject to climate-induced variation in both freshwater and marine environments. To explore the potential pathways of climate effects on these species, we investigated two scenarios for detecting various impacts of recent climate variation: 1) comparisons among systems with biological monitoring at multiple life stages, and 2) comparisons among systems in which only adults were monitored. We investigated the influence of both regional climate metrics (El Nino, Pacific Decadal Oscillation, and upwelling) and local environmental characteristics (natal stream flow, local air temperature) upon survival of Chinook salmon populations. We used structural equation modeling to evaluate the pathways by which climate most directly impacted salmon populations, and found strong correlations with stream flow that were detectable even in systems that were not well monitored at all life stages. In some systems, anthropogenic modifications to flow regimes were often much greater than direct effects of climate variation, suggesting that there is strong potential to improve productivity via flow restoration. These findings also suggest that strong covariation among salmon populations across regions of western North America may be due to correlated climate effects on stream flow in addition to oceanographic variation.

Notes:

11:00 – 11:20 **Predicting natural channel types in the Columbia River basin.**

H. Imaki, T. Beechie and J. Buffington (USFS)

Abstract – Geomorphic-based channel typing is one simple and comprehensive approach used to describe physical channel potentials, associated biota, and can serve as a powerful tool for stream restoration. We developed GIS data and methodology to describe natural channel types at a reach scale (~ 200 m) across the entire Columbia River basin (668,000 km^2). We evaluated the roles of slope, discharge, valley confinement, sediment supply, and sediment caliber in controlling channel patterns. We used readily available geospatial data sets to calculate reach slopes and valley confinement, and to develop landscape-level surrogates for discharge, sediment load, and sediment caliber. Using linear discriminant analysis, we most accurately distinguished floodplain channel patterns--such as straight, meandering, island-braided, and braided,--using a model that included all variables except valley confinement (73% overall accuracy). Our model most clearly identified braided and straight channels on an axis of relative shear stress, with straight channels consistently having higher shear stress than their upstream neighbor and braided channels consistently having lower shear stress than their upstream neighbor. Most models poorly predicted island-braided channels. Additionally, we were able to predict mountain channel types such as cascade, step-pool, plane-bed, and pool-riffle with channel slope and bankfull width threshold (less than 8 m). Our channel type dataset serves as a basin-wide restoration planning and prioritization tool for conservation and restoration practitioners.

Notes:

11:20 – 11:40 **Methods for successful establishment of cottonwood, willow, and red osier dogwood along an incised stream in semiarid eastern Oregon, USA.**
J. Hall (Hall and Associates Consulting, Inc.), M. Pollock, and S. Hoh (John Day Fossil Beds National Monument)

Abstract – The rapid downcutting and lowering of the stream bed associated with channel incision lowers water tables in adjacent floodplains and results in significant loss of riparian vegetation. Bridge Creek is a heavily incised subwatershed of the dry interior Columbia River basin that has been designated as a restoration priority within the John Day Subbasin Plan. We are currently testing several planting strategies within incised Bridge Creek reaches to develop methods for the successful establishment of riparian vegetation in this degraded watershed. We tested an alternative approach to irrigation by using motorized augers to plant live stakes of black cottonwood, willow, and red osier dogwood on streamside terraces up to 2 meters above the base stream elevation where lowered water tables can be penetrated. Given the harsh environmental conditions and herbivore pressures presented within Bridge Creek, we also tested the efficacy of a number of common tree shelter products (e.g., plastic and mesh tree shelters) and fence cage designs. Our results indicate that live stake plantings can achieve survival rates of 70 – 90% if they are 1) planted in auger holes that reach the water table and 2) protected with vented plastic tree shelters. In addition, we tested drip irrigation methods in high terraces where motorized augers could not reach water tables and have observed survival rates over 75%. The results of this ongoing study are being used to develop a planting strategy that can be used in combination with hydrologic and geomorphic restoration to restore incised reaches within Bridge Creek.

Notes:

1:00 – 1:20 **Restoring salmon in a changing climate.**

T. Beechie, H. Imaki, J. Greene, A. Wade (UC Santa Barbara), H. Wu (University of Montana), G. Pess, P. Roni, J. Kimball (University of Montana), J. Stanford (University of Montana) and P. Kiffney

Abstract – To facilitate evaluation of restoration options given potential climate change, we developed a suite of questions that focus analyses on (1) local habitat factors limiting salmon recovery, (2) predicted local effects of climate change on stream flow and temperature, (3) the ability of restoration actions to ameliorate climate change effects, and (4) whether restoration actions increase habitat diversity and salmon population resilience. We mapped predicted stream flow and temperature changes throughout the Pacific Northwest, and reviewed literature on habitat restoration actions to determine the degree to which they either ameliorate a climate change effect or increase habitat diversity and resilience. Predicted future flow regimes indicate a shift from mainly snowmelt and transitional regimes to predominantly rainfall-dominated. Summer low flows are predicted to decrease by 35-75% west of the Cascade Mountains, whereas highest monthly averaged flows are predicted to increase by 10-60% across most of the region. Stream temperatures are predicted to increase by an average of 2°C in most rivers by 2030-2069 and ~3.2°C by 2070-2099. We offer two decision support processes to illustrate how to use predicted climate change effects and our synthesis of restoration action effectiveness to evaluate (1) whether climate change should alter the types or priority of restoration actions in a salmon habitat restoration plan, or (2) whether a specific restoration project is likely to be ineffective in climate altered future. Actions that restore watershed and ecosystem processes are most likely to sustain salmon populations in a climate altered future because they allow river channels and riverine ecosystems to evolve in response to shifting stream flow and temperature regimes.

Notes:

1:20 – 1:40 **Evaluating urban stream restoration approaches in the City of Seattle (Piper's Creek).**

S. Morley, P. Roni, K. Hanson, A. Godersky, T. Leavy (USFWS), R. Peters (USFWS), P. Bakke (USFWS), and M. Koehler (SPU)

Abstract – Relatively little scientific research or monitoring has occurred in the Northwest United States or elsewhere on the biological effectiveness of restoration efforts in heavily urbanized watersheds. With the overarching goal of improving ecological health of its urban creeks, the City of Seattle is testing innovative approaches to stormwater management. We report on pre-project monitoring data collected for a large-scale Natural Drainage System (NDS) planned for the Pipers Creek basin in North Seattle. Our selection of study parameters was guided by specific project goals, and includes measures of channel morphology, contaminant loading, and in-stream biota. We found that the biological health of Pipers Creek is poor compared to forested streams in the Puget Sound region, but comparable to other urban streams in Seattle. Juvenile salmonids densities are low and dominated by cutthroat trout (*Oncorhynchus clarki*); scores for the Benthic Index of Biological Integrity (B-IBI) range from poor to fair; and diatom assemblages are composed of a high proportion of species tolerant of high nutrient levels, organic enrichment, and sedimentation as compared to forested reference streams. Results from heavy metal sampling were inconsistent. Zinc concentrations in soil, black fly larvae, and mayfly nymphs collected from Pipers Creek study reaches were significantly higher than for forested streams. We did not detect any differences in copper concentrations between urban and non-urban streams. We hypothesize that following project completion, stream biological health will improve relative to current baseline conditions and treated reaches will begin to more closely resemble forested streams.

Notes:

1:40 – 2:00 **Estimating adult salmon escapement on the Elwha before, during, and after dam removal.**

K. Denton, M. Liermann and R. Moses (Lower Elwha Klallam Tribe)

Abstract – Redd counts have traditionally been used by the Washington Department of Fish and Wildlife and the Lower Elwha Klallam Tribe to enumerate the ESA listed summer Chinook salmon (*Oncorhynchus tshawytscha*) and winter steelhead (*O. mykiss*) in the Elwha River. In addition to these efforts, a broad consortium of groups have recently implemented a multi-beam SONAR project and a resistance board weir in an attempt to census all populations in the river and improve accuracy leading up to dam removal in the fall of 2011. SONAR and the resistance board weir are important tools in the Elwha because visibility and geographic constraints will limit the utility of traditional redd surveys during and after dam removal. We have also performed correlation analyses between run sizes of Chinook and winter steelhead in the Elwha and area rivers to predict our ability to accurately detect population increases of various sizes after dam removal. Initial summer Chinook estimates based on SONAR are roughly 1.5 to 2 times the redd-based estimates, although their confidence intervals overlap. Population trends for summer Chinook in the Elwha track well with area rivers and we are confident in our ability to detect a range of population growth rates following dam removal. Unfortunately, winter steelhead population data is intermittent on the Elwha, and poorly correlated with nearby rivers, although we will now be able to track the population using the coordination of the weir and sonar. Successful monitoring of the Elwha River salmon and steelhead population status and trends is essential to evaluating the success of the Elwha dam removal project.

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2:00 – 2:20 **The effectiveness and role of different juvenile enumeration methods in a "real-world" monitoring scenario.**

J. McMillan, G.R. Pess, M.C. Liermann, J.R. McMillan, K. Denton, S. Morley, T.R. Bennett, T. J. Beechie, and D. Hernandez

Abstract – Monitoring the distribution, abundance and diversity of juvenile coho and Chinook salmon and steelhead in the Elwha River basin will be important to assess recolonization of anadromous salmonids after dam removal. Snorkeling, backpack electrofishing, and seining have all been successfully used to monitor juvenile salmonids. However, the effectiveness (e.g., accuracy and bias of fish counts) of each method can vary in relation to stream and fish population characteristics, which could influence our ability to detect and quantify recolonization. Here we compared the ability of each method to enumerate juvenile coho and Chinook salmon and steelhead in stream habitat units with a gradient of characteristics or "sample abilities." The "sample ability" of a given unit was ranked on a scale of one (being hardest to survey) to five (easiest) for each method according to several habitat variables (e.g., cover, substrate). Preliminary results revealed two notable patterns. First, snorkel counts were 2 to 4 times greater than electroshocking or seining in the same habitat units. Second, differences in electrofishing and seining counts relative to the snorkel counts increased with increasing difficulty in the sample-ability of the habitat unit. Third, seining captured a significantly higher proportion of juvenile Chinook relative to electroshocking, while seining and electrofishing captured similar numbers of juvenile coho and steelhead. In sum, each method produced equal estimates of presence/absence and species diversity, but when stream visibility and depth were adequate snorkeling consistently produced the greatest counts of juveniles and the greatest diversity in size.

Notes:

2:40 – 3:00 **Evaluation of riparian management regimes for conservation of wood recruitment to streams.**
M. Pollock, T. Beechie, and H. Imaki

Abstract – Quantifying the attributes of undisturbed late-successional forests is a crucial problem in the restoration and management of forest and stream ecosystems, driving both the evaluation of current forest conditions and the setting of stand management targets for specific points in the future. We identified 117 undisturbed, mature (average age = 113 yr) Douglas-fir dominated riparian and upland stands from existing forest inventories across western Washington and Oregon for the purpose of establishing reference conditions for such stands. We did this to establish quantitative metrics for the size and abundance of live and dead trees, and to assess whether there were any important quantitative differences between upland and riparian forests. Though mature upland and riparian Douglas-fir dominated forests are structurally similar in many ways, the riparian stands have taller, larger diameter Douglas-fir trees in the overstory, and fewer small diameter Douglas-fir live trees and snags in the understory. Both riparian and upland forests have abundant large diameter (> 50 cm) live trees (175 and 70 TPH, respectively) and large diameter snags (29 and 33 TPH, respectively). Species composition is remarkably similar in both upland and riparian stands, with > 88% of all trees consisting of three species of conifers; Douglas-fir, western red cedar and western hemlock. The overstory is almost entirely Douglas-fir and the understory is dominated by western hemlock and western red cedar. Collectively, our data suggest that mature riparian and upland Douglas-fir dominated forests have well-developed late successional structural characteristics in terms of abundant large trees in the overstory, abundant large snags, a well-developed understory of shade-tolerant trees, and canopy gaps.

Notes:

3:00 – 3:20 **Modeling the relationship between habitat and fish: common problems and some solutions.**
M. Liermann

Abstract – The analysis of the relationship between fish and habitat is often complicated by a number of statistical issues. These include highly variable fish counts with many zeros, low R-squared values, spatial and temporal auto-correlation, non-linear relationships, and many co-linear potential predictor variables. In this talk I illustrate some of these issues and demonstrate potential solutions using examples based on ongoing fish-habitat studies in the Pacific Northwest rivers. I discuss how the solutions depend on the specific goals of the statistical inference. In particular is the focus on prediction or understanding of the processes, what spatial and temporal scales are of interest, and who the audience is.

Notes:

3:20 – 3:40 **Empirical estimates of Chinook salmon egg-to-fry survival and spawning habitat conditions in the upper Yakima Basin.**

P. Roni, C. Johnson (WDFW), and G. Pess

Abstract – Egg-to-fry stage survival is thought to be one of the key factors limiting production of endangered Chinook salmon (*Oncorhynchus tshawytscha*). Unfortunately, few empirical estimates of Chinook egg-to-fry survival exist and those that do are from a small number of redds ($n < 15$). We initiated a multi-year study in 2009 to examine the effects of stream reach and spawning habitat conditions on egg-to-fry survival in more than 80 artificially constructed redds in 9 reaches of the Yakima River. We collected gametes from 9 different male and female pairs and placed 100 eggs in three artificial redds at three sites in each of the 9 study reaches over a three-week period. We also measured scour, gravel composition, and infiltration of fines into artificial redds. Egg-to-fry survival averaged 69 percent (S.E = 2.53) and ranged from 0 to 99%. While small differences in survival were detected among reaches, the male-female pair explained most of the variation in egg-to-fry survival. Fine sediment levels in artificial redds varied from 0.5 to 35% percent and was only weakly correlated with survival ($R^2 = 0.05$). The winter of 2009/2010 was an unusually mild winter with no high flows resulting in little to no scour at our sites. Our preliminary results suggest that parental fitness plays an important role in egg-to-fry survival at least under the favorable flow and incubation conditions such as those observed in the first year of our study. We are conducting additional years of sampling to examine the interannual variation in egg-to-fry survival.

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