



Salmon in the City: Merging Science and Policy

University Place
310 SW Lincoln Street
Portland, OR
October 14, 2010

Schedule of Speakers

Start Time	Speaker – Affiliation
9:00	Mike Reed - City of Portland, Introduction and Welcome
9:10	Tom Friesen - Oregon Department of Fish and Wildlife
9:35	Roger Tabor - U.S. Fish and Wildlife Service, Fisheries Division
10:00	Break
10:20	Mark Celedonia - U.S. Fish and Wildlife Service, Fisheries Division
10:45	Alan Yeakley - Professor of Environmental Sciences, Portland State University
11:10	Carl Schreck - Professor and Leader of the Oregon Cooperative Fish and Wildlife Research Unit and Department of Fisheries and Wildlife, Oregon State University
11:35	Ian Waite - USGS Oregon Water Science Center
12:00	Lunch
13:10	Derek Booth - Affiliate Professor for the Civil and Engineering and Earth and Space Sciences Departments, University of Washington, President of Stillwater Sciences Consulting
13:35	Nat Scholz - NOAA, Northwest Fisheries Science Center
14:00	Eric Strecker - Principal with Geosyntec Consultants
14:25	Break
14:45	Joe Richards - Water Resources Engineer
15:10	Ben Meyer - Chief of the Willamette River Habitat Branch
15:35	Panel Discussion
16:30	Salmon-Safe Wine Reception Featuring Tye Wine Cellars

Version: October 7, 2010

<p>Tom Friesen</p> <p>Tom Friesen is the manager of ODFW’s Willamette Basin Research, Monitoring, and Evaluation Program in Corvallis. He was the principal investigator for the City of Portland’s four-year study of fish, habitat, and invertebrates in the lower Willamette River (the “Willamette Fish Study”), and currently serves as a member of the Portland Harbor Expert Panel on Chinook habitat restoration. Tom has published a number of journal articles on various aspects of Willamette Basin fish biology and behavior. He is a graduate of Oregon State University.</p>	<p>Diets of Juvenile Chinook Salmon and Potential Competitors in the Lower Willamette River</p> <p>Co-authors: Tom Friesen, John Vile, Martyne Reesman</p> <p><u>Abstract</u> We characterized the diets of introduced and anadromous fish in the lower Willamette River to determine if dietary overlap occurs between naturally produced (“wild”) Chinook salmon and either introduced species or hatchery salmon. Diet similarities could suggest competition for food resources and have management implications for threatened and endangered species. Daphnia were the most important prey item for both Chinook and coho salmon, occurring in 65 percent of samples collected and composing >80 percent of their diets by weight. The amphipod <i>Corophium</i> spp. and insects (both aquatic and terrestrial) were also common in salmon diets. We found no significant diet overlap between juvenile salmonids and introduced species. Daphnia were important prey for smallmouth bass (46 percent of all prey items), but fish and crayfish composed nearly all (97 percent) of their diet by weight. Yellow perch and smallmouth bass generally had more diverse diets than juvenile salmon, and unlike salmon, did not specialize on particular taxa. Diets of wild and hatchery Chinook salmon did overlap significantly, though wild fish exhibited a more selective feeding behavior and consumed larger amounts of prey. In terms of competition for food, introduced resident fishes and hatchery salmon do not appear to adversely affect juvenile wild salmon. The current high abundance of prey items, especially daphnia, likely precludes competition even if diet overlap does occur. In a resource-limited environment, smallmouth bass and hatchery salmon (both Chinook and coho) would be most likely to compete with wild Chinook salmon. The lower Willamette River clearly provides important food sources for outmigrating salmon.</p>
<p>Roger Tabor</p> <p>Fish biologist with the U.S. Fish and Wildlife Service out of the Washington Fish and Wildlife Office in Lacey Washington; I have worked on a</p>	<p>Effects of Artificial Lighting on Juvenile Salmonids: A Review of Research in the Lake Washington Basin</p> <p>Co-Authors: Mark Celedonia and Gayle Brown</p> <p><u>Abstract</u> Artificial nighttime lighting is a ubiquitous feature of urbanized areas. However, its effect on aquatic systems is often overlooked. Light intensity levels are an important component of fish</p>

<p>variety of fish studies in the Lake Washington Basin over the past 17 years.</p>	<p>behavior and predator-prey relationships. Therefore, the addition of artificial lighting may have important consequences for some fish. In this presentation, we review research efforts on this issue in the Lake Washington basin, which includes the greater Seattle urban area. Key salmonid populations in this basin include sockeye salmon, which support a large fishery and Chinook salmon, which are part of the listed Puget Sound ESU. Artificial nighttime lighting in urbanized areas can occur in two forms: direct lighting and reflected light off of clouds. Direct lighting tends to be intense but occurs over a localized area; whereas reflected lighting is less intense but covers a large area. After emerging from their redds, sockeye salmon fry migrate quickly to Lake Washington and generally migrate at night. During this migration, they are vulnerable to predation from trout, juvenile coho salmon, and sculpin. We conducted experiments on predation by sculpin because they are numerous and easy to work with under controlled conditions. Results of laboratory feeding trials in tanks indicated sculpin predated on sockeye salmon fry primarily under very low light conditions. However, experiments in the field and in artificial streams demonstrated that increased light conditions alter the behavior of sockeye salmon fry by delaying their migration and thus, increasing their vulnerability to predation by sculpin. Lake Washington supports a large population of cutthroat trout, which are an important predator of juvenile sockeye salmon. Mazur and Beauchamp of the University of Washington found predation of sockeye salmon by cutthroat trout increased during cloudy nights when light levels were higher. Juvenile Chinook salmon are present in the littoral zone of Lake Washington from January to June and their behavior may be influenced by numerous light sources around the lake. We conducted an experiment on the shoreline of Lake Washington in February when juvenile Chinook salmon were < 55 mm. Results indicated juvenile Chinook salmon were strongly attracted to lighted areas. As part of a tracking study of Chinook salmon smolts (June 2007 and 2008), we documented their nighttime distribution. At all four study sites with strong, direct lighting, Chinook salmon were strongly attracted to areas with intense lighting. Predation of Chinook salmon near these light sources has not been documented but we hypothesize that their attraction to these lights will make them more vulnerable to predators. Overall, artificial nighttime lighting appears to have profound effects on the behavior of juvenile salmonids which may result in increased predation.</p>
<p>Mark Celedonia</p> <p>Mark has over 10 years of professional experience in fisheries and aquatic</p>	<p>Responses of Juvenile Chinook Salmon to Overwater Structures in a Heavily Urbanized Waterway</p> <p>Co-Author: Roger Tabor</p>

<p>ecology applied research investigations. He is currently a Biologist with the U.S. Fish and Wildlife Service in Lacey, Washington, where he has worked since 2002. From 2004 through 2009 he worked in Lake Washington conducting acoustic tracking studies on juvenile Chinook and coho salmon, and predators such as smallmouth bass, northern pikeminnow, and sculpin. Mark has broad experience in many aspects of fisheries and aquatic ecology, including population assessment, habitat selection, predation and bioenergetic modeling, watershed ecology, biotic integrity, wetland ecology, and hatchery reform. Mark has a B.S. in Mechanical Engineering from Kettering University, and a Master's degree in Environmental Studies from The Evergreen State College. He is an AFS Certified Fisheries Professional, and is President-Elect of the AFS Washington-British Columbia Chapter.</p>	<p><u>Abstract</u> Determining how overwater structures influence fish behavior and survival is critical for mitigating negative impacts and designing more fish-friendly structures. From 2001-2008, we evaluated the influence of overwater structures on threatened Chinook salmon juveniles in Lake Washington, Washington. Chinook salmon responses to overwater structures were dependent upon life history stage (fry or smolt), diel period, smolt migratory phase (active migration or holding), turbidity, and general shoreline orientation (near-shore or off-shore). Structure attributes such as width, height above water surface, proximity to other structures, presence of macrophytes, and water depth and light level beneath the structure also appeared to influence fish behavior, particularly with regard to smolts. Juvenile Chinook salmon generally avoided areas directly beneath overwater structures regardless of life history stage or migratory phase; this was particularly evident at night. However, a distinct zone around structure edges often provided preferred daytime habitat for fry (5 m zone) and holding (not actively migrating) smolts (20 m zone). Smolts often used deeper water when holding near structure edges than when holding in areas where no structures were present. This affinity for deepwater structure edges appeared stronger when turbidity was low, and when smolts were more shoreline oriented. Actively migrating smolts usually moved around structures along the perimeter, which often forced these fish into deeper water. These fish seemed more inclined to move directly beneath narrow, elevated structures. Neither fry nor smolts were attracted to structures at night, except when artificial lighting was present. The consequences of these behaviors are uncertain. Structures may provide beneficial habitat and a source of cover to fry and holding smolts. However, this may come at a cost, particularly when structure-oriented predators (e.g., smallmouth bass) are present. In addition, structure-induced migrational delay could contribute to greater residualism and reduced survival at ocean entry. Further study is needed to evaluate the ultimate consequences of these behaviors on fish survival and fitness.</p>
<p>Alan Yeakley</p> <p>J. Alan Yeakley is a Professor of Environmental Science at Portland State University, in Portland, Oregon. He holds a Ph.D. in environmental science from the University of Virginia, where he was a presidential fellow. Alan was a</p>	<p>Urban and Rural-residential Land Use Effects on Salmonids in Oregon</p> <p>Co-Authors: Many past and present members of the Independent Multidisciplinary Science Team2 (IMST), State of Oregon.</p> <p><u>Abstract</u> The IMST advises the State on matters of science related to the Oregon Plan, which has the mission of restoring native fish populations and the aquatic systems that support them to productive and sustainable levels that will provide substantial environmental, cultural, and</p>

<p>post-doc with the School of Ecology, University of Georgia, before obtaining a faculty position at PSU.</p> <p>Dr. Yeakley's research interests span ecosystem ecology and watershed hydrology, with a focus on riparian processes and urban ecology. He has published articles in a variety of ecological science journals such as <i>BioScience</i>, <i>Ecosystems</i>, <i>Ecology</i>, <i>Biogeochemistry</i> and <i>Landscape Ecology</i>. He helped found the environmental science and management (ESM) undergraduate and masters programs at PSU and the Urban Ecosystem Research Consortium of Portland/Vancouver. Alan is also lead PI of a newly funded ULTRA-Ex grant from NSF that is investigating how feedbacks between governance and biophysical systems affect the resilience of urban socioecological systems in Portland-Vancouver.</p>	<p>economic benefits. We review the primary findings of an IMST report that has spanned several years and IMST Team members, past and present, in the making. This “urban report” of the IMST had the over-arching goal of addressing the effects of urban and rural-residential land use on wild salmonid populations and watershed health in Oregon. More specifically, the IMST urban report addressed the following questions: (1) How does urbanization alter aquatic ecosystems and what are the implications for salmonid rehabilitation? (2) What is the current state of knowledge for rehabilitating adverse ecological effects associated with rural-residential and urban development? (3) How might Oregon accomplish the mission of the Oregon Plan in the face of an increasingly urbanized landscape? (4) What are the major research and monitoring needs for urban and rural-residential landscapes? We discuss the major findings in response to each of these questions in this presentation.</p>
<p>Carl B. Schreck</p> <p>Dr. Carl Schreck graduated from the University of California, Berkeley, in 1966 with an A.B. in Zoology. He received his MS from Colorado State University in 1969 in Fisheries Science and his Ph.D. in 1972 in Physiology and Biophysics and Fisheries Science.</p>	<p>Contaminants, the Urban Footprint and Salmonids</p> <p><u>Abstract</u> Urbanization results in a variety of contaminants that find their way into urban watersheds through runoff from compacted surfaces, household sewage, landfill leachate, direct application to the landscape, and industrial effluents. Less obvious but very extensive are the liberation of volatile compounds to the atmosphere that can have far distant effects. Many of the compounds liberated into the environment by all of these routes are endocrine disrupting substances (EDCs). EDCs interfere with normal endocrine function such that physiological</p>

After receipt of his Ph.D. he taught at Virginia Polytechnic Institute and State University before becoming the Assistant Leader of the Oregon Cooperative Fish and Wildlife Research Unit through the U.S. Fish and Wildlife Service and an Assistant Professor at Oregon State University. He was made Leader of that Unit after 2 years and still serves in that capacity for the Biological Resources Division, U.S. Geological Survey where he is a senior scientist. He is also a full professor in the Department of Fisheries and Wildlife at OSU. His research has focused primarily on salmonids where he applies environmental physiology and behavior to address environmentally relevant questions.

Dr. Schreck is a nationally recognized scientist and teacher. He has received numerous national awards including the Presidential Meritorious Professional Service Award from the White House 2007/08, the Secretary of the Interior's Meritorious Service Award, and the Educator of the Year Award and Award of Excellence from the American Fisheries Society. He has also mentored about 80 M.S. and Ph.D. programs.

processes such as reproduction can be impaired. Such contaminants include historic and contemporary pesticides, pharmaceuticals and other health care products, heavy metals, and plasticisers. While exposure of fish in urban settings is easily understood, I will present results of studies suggesting that the urban footprint may also have profound impact on salmonid fishes even in distant, "pristine" locations such as high elevation lakes in National Parks.

<p>He served on the Governor’s Coastal Salmon Science Team and is now serving his second 4 year term as a member of the IMST for the State of Oregon,. He has been elected Co-Chair of the IMST for the last five years.</p>	
<p>Ian Waite</p> <p>Ian Waite has been a research ecologist for the USGS Water Resource Discipline since 1992. Ian’s research interests include: better understanding of how complex mixtures of natural and anthropogenic factors cloud our interpretation of stream bioassessments, improving our understanding of habitat requirements and tolerances of macroinvertebrates, application of multivariate statistics in aquatic ecology and issues of invasive species in aquatic systems. Ian has a Bachelor’s in Natural Resources (fisheries) from Univ. of Michigan, a Master’s in fisheries biology from Humboldt State Univ. and a Ph.D. in entomology from Univ. of Idaho.</p>	<p>Effects of urbanization on biological communities: are flashy flows or water quality the main culprit?</p> <p><i>Abstract</i> From late 2000 through summer 2004, the U.S. Geological Survey’s National Water Quality Assessment Program (NAWQA) sampled 28 to 30 streams in ten regions with various amounts of urbanization to investigate effects of urbanization on aquatic biology (fish, macroinvertebrates, and algae), habitat, and water chemistry. The watersheds fall along an urban land use gradient index (Urban Intensity Index, 0 to 100, lowest to highest) based on land use and census data developed separately for each region. Results from the Willamette Valley will be the focus for this presentation, results from the other regions used for comparison. Watershed areas range from 13 to 96 square kilometers and contain greater than 20 percent of the Willamette Valley ecoregion. Streams were sampled twice for water chemistry – once during high sustained flow, and once during summer low flow. Fish and macroinvertebrates showed a linear decrease in numbers, quality and diversity as urban intensity increased, with no detection of a threshold. Population density and the urban intensity index were highly correlated with fish and macroinvertebrate assemblage patterns among sites. Variables that seemed to be important in explaining the decline in biological assemblages were water temperature, dissolved oxygen, stream gradient, total concentration of pesticides and indices of toxic contaminants. In the Willamette Valley, agricultural and urban land uses had similar impacts to the stream biota, however, higher concentrations of herbicides were generally found in streams with significant agricultural land use and higher amounts of insecticides in urban areas. Some of the other nine urban study areas are had similar patterns of biotic respond to those found in the Willamette Valley yet some areas had stark differences in response.</p>

Derek B. Booth

Derek B. Booth (PhD, PE, PG) is the Senior Geologist and President of Stillwater Sciences, a 60-person environmental consulting firm in California, Oregon, and Washington. He is also an Affiliate Professor at the University of Washington and the Senior Editor of *Quaternary Research*, an international scientific journal of the last two million years of earth and human history. He has studied geomorphology, hydrology, and watershed management for the past 30 years, first with the U.S. Geological Survey, with the Basin Planning Program for King County (Washington), as a full-time University of Washington research professor in the departments of geology and civil engineer, and now in private practice. His publications include over 40 peer-reviewed articles, 26 USGS-published geologic maps, and more than a dozen book chapters, almost entirely focused on geomorphology, rivers and streams, and stormwater. He was a member of the City of Portland’s Independent Science Panel in 2003, is on the City’s current North Reach Science Panel, and was coauthor of the National Research Council’s report on NPDES stormwater

The National Research Council’s review of stormwater permitting – is there a regulatory path to healthy urban streams?

Abstract

At the request of US EPA, the National Research Council recently completed a two-year review of the current NPDES (National Pollutant Discharge Elimination System) process for municipal, industrial, and construction stormwater permits. The final report (*Urban Stormwater Management in the United States: National Academies Press, Washington, DC, 2009, 598 pp.*) carried a number of recommendation relevant to those communities and regions attempting to protect stream resources, particularly biological resources, from the ever-expanding influence of urban development. This has particular implications for the Oregon Plan, because NPDES stormwater permits are one of the few regulatory vehicles for reducing the impacts of human settlements on salmonids. In other words – if this mechanism doesn’t work, we may have no credible alternatives that do.

Chief amongst the NRC recommendations are:

- Stormwater management should be based on watershed boundaries, not political boundaries. A greater emphasis should be placed on flow-based metrics rather than just chemical ones.
- Watershed models are useful tools for predicting and mitigating downstream impacts from urbanization, but they are incomplete in scope and cannot define definitive causal links between polluted discharges and downstream degradation – the interactions are too complex to reliably model.
- Stormwater control measures can only be successful when part of an integrated system implemented at multiple scales within a watershed. Nonstructural stormwater measures, such as product substitution, better site design, downspout disconnection, conservation of natural areas, and watershed and land-use planning, can dramatically reduce the volume of runoff and pollutant loads. In particular, EPA should be more vigorous in regulating the national availability of products that contribute significantly to stormwater pollution.
- Present funding levels are insufficient; greater federal financial resources will be needed to support effective state and local efforts to regulate stormwater. In its present form,

<p>permits, “Urban Stormwater Management in the United States” (National Academies Press, 2009).</p>	<p>the NPDES regulatory approach has not (and likely will not) control the impairment of waterbodies from stormwater.</p>
<p>Nat Scholz</p> <p>Nat is a research zoologist with NOAA's Northwest Fisheries Science Center in Seattle. The Center is the headquarters for NOAA's fisheries research in the Pacific Northwest. For the past decade, he has been leading the Ecotoxicology group that studies the impacts of toxic chemicals on the health of coastal watersheds and embayments. He holds a masters degree from Boston University's marine program and a doctorate in zoology from the University of Washington.</p>	<p>Urban streams as experimental settings for understanding the current and future impacts of urban runoff on salmon</p> <p><i>Abstract</i> This presentation will profile recent NOAA research on toxic urban runoff and associated impacts on the health and viability of salmon during resident freshwater life stages. Priority scientific objectives include: 1) clarification of the role of toxics in stormwater as a limiting factor for regional salmon conservation and recovery; 2) development of more sophisticated ecological forecasting tools that combine life cycle models with GIS-based analyses of changing land cover and land use; 3) delineation of the cascading indirect effects of non-point source pollutants on freshwater communities; 4) analyses to determine the interplay between regional climate change and urban development as current and future drivers for toxic terrestrial runoff; 5) monitoring of freshwater and marine indicator species to assess stormwater impacts and the effectiveness of pollution reduction strategies; and 6) targeted new research to identify cost effective mitigation strategies that work and can be implemented at the local level (e.g., by municipalities). Finally, new scientific findings must be translated and communicated effectively to natural resource managers, educators, and local communities.</p>
<p>Eric Strecker</p> <p>Eric Strecker is a Principal Engineer with Geosyntec Consultants. He has almost 25 years of experience in stormwater and watershed management. He is a Principal Investigator for the International BMP Database as well as other Water Environment Research Foundation and National Cooperative Highway Research Program Applied</p>	<p>Urban Stormwater Receiving Water Impacts and the Ability of BMPs to Mitigate Them</p> <p><i>Abstract</i> Our understanding of the impacts of urban runoff on receiving waters physical integrity, water quality and biology, including Salmonids, has increased significantly. In addition our understanding of the ability of stormwater Best Management Practices (BMPs) to mitigate these impacts has also increased. This paper will present a brief overview of impacts of urbanization on stream systems. The paper will present in more detail our knowledge of the ability of BMPs to mitigate the impacts. Urbanization can significantly alter the hydrology of urban streams, including changes to runoff volumes and rates, evapotranspiration, and deep</p>

<p>Research Projects that focus on the effectiveness of BMPs. He was awarded the State of the Art in Civil Engineering Award by ASCE for his efforts on the BMP Database. He has worked on numerous stormwater master plans for municipalities and large scale developments, BMP designs, TMDL implementation plans and has provided expert support for litigation. He has Fisheries Science and Environmental Resources Engineering degrees from Humboldt State University and a Master’s Degree in Water Resources Engineering from the University of Washington. He likes to fish -a lot.</p>	<p>infiltration. To date most of the focus has been on runoff volumes and rates with more recent attention to increasing deeper infiltration as well. However, there has been a general lack of considering the overall water balance when selecting and designing BMPs to address physical stream impacts. Emphasis on infiltration can lead to groundwater recharge that is higher than natural for example. This can particularly occur when irrigation is considered (often ignored). Also discussed are strategies for addressing stream integrity, including consideration of the appropriate mix of on-site, regional, and instream measures that should be considered based upon a watersheds and stream conditions. Water quality is also a major factor for the ability of urban streams to support salmonids. The author will present performance data from recent efforts such as the International BMP Database (www.bmpdatabase.org) and Northwest compilations (WashDOT “BMP Effectiveness Assessment for Highway Runoff in Western Washington, 2008”) and compare the observed water quality results of BMPs to salmonid tolerance levels. Finally, suggestions regarding the importance of consideration of the appropriate unit processes to consider for both flow management and treatment of runoff will be suggested.</p>
<p>Joseph G. Richards</p> <p>Joe Richards is a senior water resources engineer with 18 years of professional experience in the Pacific Northwest, Asia, and Central America. He has worked in consulting, international development, public and private sector engineering, construction and project management. Joe has an MBA from the University of Oregon and is the founding principal of Richards Engineering, LLC. He has completed stream restoration projects in all of Portland’s watersheds and currently assists the Bureau of Environmental Services (BES) with project delivery, staff</p>	<p>Urban Stream Restoration and the Portland Experience</p> <p><i>Abstract</i></p> <p>The importance of urban watershed management and stream restoration are explored in the context of regulatory drivers and the Portland experience. Implementation of the Clean Water Act is considered with regards to the evolution of public works agency mission, staffing needs and organizational structure. Local project experience in Johnson Creek, the Columbia Slough and Tryon Creek are presented to illustrate the unique nature of urban stream restoration design and the leadership role of the public works agency in the urban context. An overview of City of Portland Stream Restoration Best Practices is presented to illustrate BES institutional knowledge and the ongoing process of planning, financing, designing, permitting, constructing, monitoring and maintaining stream restoration projects.</p>

<p>augmentation, and capacity building in stream restoration. He possesses in-depth knowledge of the effects of urbanization on natural systems and strives to implement balanced solutions that achieve habitat level improvements in restoration design. Joe lives in Portland Oregon with his wife and two children; he is an avid cyclist, snowboarder and yoga practitioner.</p>	
<p>Ben Meyer</p> <p>Ben Meyer is a fishery biologist with the Habitat Conservation Division of the National Marine Fisheries Service (NMFS). He has worked for NMFS for 29 years, the last 17 dealing with habitat issues and salmonids listed under the Endangered Species Act. Currently he is Chief of the Willamette River Habitat Branch, overseeing NMFS's response to activities proposed under the Clean Water Act, Endangered Species Act, Magnuson-Stevens Act, and Rivers and Harbors Act.</p>	<p>The Good, the Bad, and the Ugly: A Prognosis of Urban Habitat.</p> <p><i>Abstract</i> An examination of the question: Is it possible to significantly improve habitat for salmon in an urban environment or is it just a waste of time?</p>