# Proceedings of the Columbia River Estuary Conference on Ecosystem Restoration

## April 29-30, 2008
## Astoria, Oregon

August 2008

Sponsored by

Bonneville Power Administration, Columbia River Estuary Study Taskforce, Lower Columbia River Estuary Partnership, Northwest Power and Conservation Council, Oregon State Department of Land Conservation and Development, and U.S. Army Corps of Engineers, Portland District

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# Proceedings of the Columbia River Estuary Conference on Ecosystem Restoration

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Edited by

Gary E. Johnson, Pacific Northwest National Laboratory

G. Bruce Sutherland, Oregon Department of Environmental Quality (retired)

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# Preface

The 2008 Columbia River Estuary Conference was held at the Liberty Theater in Astoria, Oregon, on April 19-20. The conference theme was ecosystem restoration. The purpose of the conference was to exchange data and information among researchers, policy-makers, and the public, i.e., interrelate science with management. Conference organizers invited presentations synthesizing material on Restoration Planning and Implementation (Session 1), Research to Reduce Restoration Uncertainties (Session 2), Wetlands and Flood Management (Session 3), Action Effectiveness Monitoring (Session 4), and Management Perspectives (Session 5). A series of three plenary talks opened the conference. Facilitated speaker and audience discussion periods were held at the end of each session. Contributed posters conveyed additional data and information.

These proceedings include abstracts and notes documenting questions from the audience and clarifying answers from the presenter for each talk. The proceedings also document key points from the discussion periods at the end of each session. The conference program is outlined in the agenda section. Speaker biographies are presented in Appendix A. Poster titles and authors are listed in Appendix B. A list of conference attendees is contained in Appendix C. A compact disk, attached to the back cover, contains material in hypertext-markup-language from the conference website (http://cerc.labworks.org/) and the individual presentations.

Please contact Gary Johnson (503-417-7567) with comments or questions about the conference.

# Acknowledgments

The conference was sponsored by the Bonneville Power Administration (BPA), the Columbia River Estuary Study Taskforce (CREST), the Lower Columbia River Estuary Partnership, the Northwest Power and Conservation Council, the Oregon State Department of Land Conservation and Development, and the U.S. Army Corps of Engineers (USACE). The conference steering committee members were Cathy Tortorici (National Oceanic and Atmospheric Administration), Blaine Ebberts (USACE), Gary Johnson (Pacific Northwest National Laboratory [PNNL]), Chris Hathaway and Debrah Marriott (Estuary Partnership), Micah Russell (CREST), Ian Sinks (Columbia Land Trust), Steve Waste (Northwest Power and Conservation Council), and Tracy Yerxa (BPA). We appreciate the hospitality and assistance from the staff of the historic Liberty Theater: Rosemary Baker-Monaghan, Larry Bryant, and Paulette Mallory. The event was catered by Baked Alaska. Donna Silverberg moderated the conference. Bruce Sutherland was the conference note-taker. Mardy Tremblay (Estuary Partnership) helped with onsite registration and logistics. Kathi Ruiz (PNNL) coordinated conference logistics and designed the conference website. Thanks to Susan Ennor and Mike Parker for editing and document production support. We thank Councilwoman Joan Dukes for her welcoming remarks. We are especially grateful to the speakers and poster presenters who provided the high-quality content that was the centerpiece of the conference. Finally, we thank the attendees whose participation made the conference a success.

# Conference Agenda

| Day 1 - April 29, 2008 | | |
|---|---|---|
| **Introduction** | | |
| 8:45 | Opening Remarks, Guidelines, and Format | Gary Johnson and Donna Silverberg |
| 8:55 | Welcome | Joan Dukes |
| **Plenary Talks** | | |
| 9:00 | Where Salmon Gather: The Work of Estuarine Restoration | Glenn Lamb |
| 9:20 | Estuarine (and Other Ecosystems) Restoration Nationally | Kevin Brice |
| 9:40 | An Overview of Habitat Restoration in the Lower Columbia River and Estuary | Debrah Marriott |
| **Session 1: Restoration Planning and Implementation** | | |
| 10:20 | Ecosystem Restoration Approaches | Allan Whiting |
| 10:40 | Columbia River Estuary Restoration Project Funding and Implementation Considerations | Jeff Breckel |
| 11:00 | Project Development in the Lower Columbia River and Estuary | Evan Haas |
| 11:20 | Project and Program Decision-Making: Tools and Adaptive Management Frameworks | Blaine Ebberts |
| 11:40 | Speaker/Audience Discussion | |
| **Session 2: Research to Reduce Restoration Uncertainties** | | |
| 1:00 | The Columbia River and its Estuary: Physical Structure and Function | David Jay |
| 1:20 | Elevation of Tidal Wetland Plant Communities in the Columbia River Estuary | Amy Borde |
| 1:40 | Ecological Change and Resilience in Oregon's Salmon River and Columbia River Estuaries | Dan Bottom |
| 2:00 | Ecology of Juvenile Salmonids in Tidal Fresh and Estuarine Waters | Curtis Roegner |
| 2:20 | Resolving Uncertainty Necessary to Conduct Strategic | Charles ("Si") Simenstad |

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|---|---|---|
| | Restoration in the Columbia River Estuary to Support Recovery of Wild Salmon | |
| 2:40 | Speaker/Audience Discussion | |
| | **Session 3: Wetlands and Flood Management** | |
| 3:30 | Restoring Wetland Functionality | Paul Adamus |
| 3:50 | Teaching Environmental Science in the Field Brings Habitat Restoration to Life for Both Students and Teachers | Rob Stockhouse, students |
| 4:30 | Poster Session and Evening Social | |
| | **Day 2 - April 30, 2008** | |
| 8:00 | Review | Donna Silverberg |
| | **Session 3 cont'd** | |
| 8:20 | Hydrodynamic Modeling of Tidal Reconnection Restoration Projects: Uses and Limitations | Mike Ott |
| 8:40 | Levees and Dikes: Operations and Benefits | Dave Ambrose |
| 9:00 | Effects of Tidal Wetland Restoration on Floodplain Management: The Lower Grays River Experience | Ian Sinks |
| 9:20 | Speaker/Audience Discussion | |
| | **Session 4: Action Effectiveness Monitoring** | |
| 10:00 | Columbia River Estuary Restoration Monitoring: Synthesis and Gaps | Chris Hathaway |
| 10:20 | Toxic and Invasive Species: Implications for Habitat Restoration and Effectiveness Monitoring | Greg Fuhrer and Krista Jones |
| 10:40 | Restoration Effectiveness Monitoring in the Columbia River Estuary: Response in Fish Communities | Micah Russell |
| 11:00 | Evaluating Cumulative Ecosystem Response to Tidal Wetland Restoration Projects in the Columbia River Estuary | Heida Diefenderfer |
| 11:20 | Speaker/Audience Discussion | |
| 1:00 | Facilitated Session for Restoration Practitioners: Planning, Monitoring, Evaluating and Decision-Making | Donna Silverberg |

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|---|---|---|
| 3:00 | Climate Change Impacts on Columbia River Basin Fish and Wildlife | Robert Bilby |
| | **Session 5: Management Perspectives** | |
| 3:30 | Perspectives on Estuary Restoration: | Jim Geiselman, Doug Putman, Jim Ruff, Cathy Tortorici |
| | Speaker/Audience Discussion | |
| 4:25 | Closing Remarks | Gary Johnson |
| 4:30 | Adjourn | |

# Abbreviations and Acronyms

| | |
|---|---|
| BPA | Bonneville Power Administration |
| ARA | Adamus Resource Assessment |
| CEEEP | Columbia Estuary Environmental Education Program |
| CLT | Columbia Land Trust |
| CRE | Columbia River estuary |
| CREST | Columbia River Estuary Study Taskforce |
| DSL | Division of State Lands (OR) |
| EPA | Environmental Protection Agency |
| FCRPS | Federal Columbia River Power System |
| F&WP | Fish and Wildlife Program (NPCC) |
| ISAB | Independent Scientific Advisory Board |
| ISRP | Independent Scientific Review Panel |
| LCFRB | Lower Columbia Fish Recovery Board |
| LCREP | Lower Columbia River Estuary Partnership |
| MeDEP | Maine Department of Environmental Protection |
| MSL | Marine Sciences Laboratory |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NPCC | Northwest Power and Conservation Council |
| NWFSC | Northwest Fisheries Science Center |
| ODFW | Oregon Department of Fish and Wildlife |
| ODLCD | Oregon Department of Land, Conservation, and Development |
| OHSU | Oregon Health Sciences University |
| OSU | Oregon State University |
| PCB | polychlorinated biphenyl |
| PNNL | Pacific Northwest National Laboratory |
| PSU | Portland State University |
| PVC | polyvinyl chloride |
| RM&E | research, monitoring, and evaluation |
| SWH | shallow water habitat |
| USACE | US Army Corps of Engineers |
| USFWS | US Fish and Wildlife Service |
| USGS | US Geological Survey |
| UW | University of Washington |

# Contents

# Introduction

## Welcome

*Joan Dukes (Northwest Power and Conservation Council)*

The Northwest Power and Conservation Council (Council) is an interstate compact made up of the states of Oregon, Washington, Idaho, and Montana. The states created the Council under the authority of the Northwest Power Act of 1980, a federal law. The Power Act gave the Council some very important planning responsibilities. For example, the Council's Columbia River Basin Fish and Wildlife Program (F&WP) directs funding to projects that mitigate the impacts of the federal hydropower dams on fish and wildlife. That funding is about $140 million per year. It is in that context—our fish and wildlife mitigation planning—that I welcome you to Astoria today.

The Columbia River estuary is a very important place for the fish and wildlife of the Columbia River basin. The estuary also is a vital part of the economy of the lower Columbia region, providing opportunities for commercial and sport fishing, tourism, and recreation. The estuary is an important place in the Council's F&WP, too, and that importance is growing. Just a decade ago, or perhaps a little longer, the Council pretty much disregarded the estuary in its fish and wildlife planning. At that time, the common wisdom was that because the Council's F&WP mitigates the impacts of hydropower, and because the estuary was well downriver from the first dam on the river—or the last, depending on your perspective—there were no impacts to mitigate. Today, thankfully, we know better.

The estuary remains very much a mystery, but thanks to the efforts of many people, policy-makers are beginning to get a clearer picture of the ecological processes—and therefore, the challenges and opportunities—in the estuary. The value of these conferences, besides providing a forum for exchange among scientists, is that non-scientists have the opportunity to interact with and learn from scientists, as well. The best environmental policy is informed by the best available scientific knowledge. By helping to inform policy decisions, the conference participants are helping improve the estuary habitat; improve fish production and survival; and improve our local economy.

Several types of projects are funded through the Council's F&WP in the estuary. The Select Area Fisheries Enhancement project provides commercial fishing opportunities while reducing fishing pressure on weak stocks in the mainstem Columbia. Two other projects are exploring aquatic and riparian habitats to better understand ecological relationships in the estuary. And the Council is funding a project to study specific habitat problems for chum and Chinook salmon in the Grays River watershed. In all, our program directs about $3 million a year to these efforts. That is a small, but significant, share of the total program funding. Hopefully, both the number of projects, and the funding will increase in the future. In closing, the future success of our fish and wildlife depends on improving and maintaining productive habitat in the estuary and on making credible, science-based policy decisions.

## Opening Remarks

*Gary Johnson (Pacific Northwest National Laboratory)*

The purpose of this conference is to exchange data and information on ecosystem restoration in the lower Columbia River and estuary, i.e., interrelate science and management. The conference's scope does not include channel deepening, dredge material disposal, and related topics (for information on these matters, see www.nwp.usace.army.mil). This is the fifth in a series of conferences/workshops about the estuary: 1) The Biological Integrity Workshop was held in Sandy, Oregon, in May 1999. That workshop included discussions about assessing the health of the estuary ecosystem. 2) The Habitat Conservation and Restoration Workshop was convened in Astoria, Oregon, in June 2001, to develop science-based criteria to identify and prioritize restoration projects in the estuary. 3) The Research Needs Workshop took place in Portland, Oregon, in April 2003, to identify gaps in the knowledge base for the estuary. 4) The Conference on Research, Monitoring, and Restoration in the Lower Columbia River, Estuary, and Nearshore Ocean was held in Astoria in April 2006. It covered a wide gamut of science from the lower Columbia River to the northeastern Pacific Ocean.

The 2008 conference format involves invited talks that synthesize information, facilitated speaker/audience discussion periods at the end of each session, and posters for project-specific data. Conference proceedings (notes, abstracts, PowerPoint presentations) will be made available in July 2008. We gratefully acknowledge the support and efforts of the sponsors, steering committee members, the session chairs, and the speakers. And, we especially appreciate the audience for attending the conference.

# Plenary Talks

## Where Salmon Gather: The Work of Estuarine Restoration

*Glenn Lamb (Columbia Land Trust)*

**Abstract**

Throughout the millennia, the Columbia River has significantly shaped the very geologic structures of the Columbia River estuary, even in ways we don't often consider. The great places of the estuary have provided amazing benefits—to environment, to community, to economy. And yet, in the last year we have seen some of the greatest conflicts in the estuary in my lifetime, concerning allocation of salmon, placement of energy facilities, and the sources and solutions to toxins found in the river.

In the face of these challenges, we have great hopes as we come together to review progress toward accomplishing our plans, to review results of our monitoring and research, to check on the status of our on-the-ground work, to examine the adequacy of our policies, and to begin to create new plans, looking ahead. We each have our small part in this big movement of estuarine restoration.

That is the challenge before us—to restore the great estuary, but in so doing, to restore the relationships between us all, so that with newly recreated estuarine bounty we won't be required to have armed guards at hearings that allocate our last fish or consider the latest controversial land use proposal. Our work, and this conference, is important because it is the healing of not only the places—places where salmon gather—but also the healing between us all that our coming together can promote

## Estuarine (and Other Ecosystems) Restoration Nationally

*Kevin Brice (U.S. Army Corps of Engineers)*

**Abstract**

Ecosystem restoration (estuarine and other ecosystems) has become one of the three main missions within the U.S. Army Corps of Engineers, Civil Works (Corps), including navigation and flood control. Additionally, other federal agencies have ecosystem restoration authorities and responsibilities. The Corps plays a major role in most of the large-scale ecosystem restoration activities nationwide. From the Florida everglades, Mississippi and Missouri Rivers, San Francisco Bay, Puget Sound, to the mighty Columbia River and estuary the Corps has brought its expertise in planning, engineering, and ecosystem sciences. The Corps has national authorities and funding from Congress to accomplish its ecosystem restoration missions. Here in the Northwest, the Corps also has specific funding and authorities for restoration efforts specific to the Columbia River. The Portland District has worked with many of their regional partners to ensure that sound planning, engineering, and scientific basis guide our ecosystem restoration efforts. The District's work with regional partners on evaluating the Cumulative Response to Ecosystem Restoration has proven to be cutting-edge science both regionally and nationally.

Environmental Principles and guidance from Headquarters have been embraced, and the District is developing an adaptive management plan to ensure that we capture the lessons learned and continue to use ecosystem sciences to ensure the sound use of public funds. We continue to work with our regional partners in our development and application of the ecosystem adaptive management plan.

## An Overview of Habitat Restoration in the Lower Columbia River and Estuary

*Debrah Marriott (Lower Columbia River Estuary Partnership)*

**Abstract**

The lower Columbia River and estuary is a geographically diverse, dynamic environment in which to implement habitat restoration projects. Habitat restoration faces a variety of challenges, including securing necessary funding and ensuring there is the capacity to identify and implement specific restoration projects. Despite these challenges, significant restoration efforts have been undertaken in the region.

Important habitat restoration drivers in the lower Columbia River and estuary include the Federal Columbia River Power System Biological Opinion (FCRPS BiOp) and the Columbia River Estuary Endangered Species Act (ESA) Recovery Plan Module for Salmon and Steelhead developed by the National Marine Fisheries Service (NMFS). In addition to these regional plans, other entities are implementing restoration projects in the context of their organizations' specific objectives and management plans.

Many organizations, including federal, state, and local governments, tribes, and non-profit organizations, are actively involved in restoring the estuarine ecosystem. Restoration activities are geographically diverse, occurring from Bonneville Dam to the mouth of the Columbia River. Types of restoration activities currently being implemented in the estuary include conservation, creation, enhancement, restoration, and protection. While much restoration has already occurred, more can be done to increase the value of future restoration activities.

The 2008 Columbia River Estuary Conference provides an opportunity to discuss not only the significant achievements of the past, but also approaches to ensure that future restoration continues to be successful, and results in improvement of the habitat in the lower Columbia River and estuary. The conference will focus on five areas related to habitat restoration: Restoration Planning and Implementation, Research to Reduce Restoration Uncertainties, Wetlands and Flood Management, Action Effectiveness Monitoring, and Policy Implications.

# Session 1
# Restoration Planning and Implementation

## Ecosystem Restoration Approaches

*Allan Whiting (PC Trask and Associates, Inc.)*

**Abstract**

Multiple tools exist for conducting ecosystem restoration project planning, design, and implementation in the Columbia River estuary. Approaches to estuary restoration continue in the form of antiquated tide gate replacement, dike removal, and protection. Over the last few years, groups such as the Army Corps of Engineers, Columbia River Estuary Study Taskforce (CREST) and the Columbia Land Trust (CLT), along with their multiple funders, have successfully implemented estuary projects based on willing landowners or areas that have already been secured for ecological protection. While these projects have proven valuable for the estuarine ecosystem, few of these opportunities ("low-hanging fruit") remain in the system. Outreach conducted by the Estuary Partnership suggests that opportunities for restoration and enhancement also are limited by organizational and technical capacity to implement the scale of restoration projects needed for significant ecological benefits to the estuary.

Recent investigations are underway that could provide additional estuarine restoration tools for future project development consideration. Theses project include pile structure removal, sediment "scrape-down," and intertidal wetland creation in the main stem of the lower river. The common theme throughout these project types is the management of sediment processes contributing to tidal wetland formation and function. This includes investigation of processes and functions on existing sites formed passively from dredged material placement. Monitoring results from these projects have considerable implications for future sediment management in the region.

The presentation will characterize the status of estuarine restoration in the region through a variety of approaches currently being explored in the Columbia River estuary. It also will touch on the importance of monitoring and unique partnerships that provide the basis for adaptive learning and its implications for future restoration project design considerations.

| Questions and Answers |
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| **Q:** What does "scrape down" mean?<br>**A**: In the Bay Delta project in California, areas with sediment buildup were scraped down to elevation levels, which exposed the native seed bank and allowed the site to return to a more normal state. |
| **Q:** Is sediment accreting in the estuary or is it sediment starved?<br>**A:** We really don't know. We do know that the sediment budget has been negative for some years now and the physical processes have changed. |
| **Q:** How can we find more opportunities for restoration?<br>**A:** Collaborate with communities to determine what new opportunities exist. An example is the Skamokawa Slough project. |
| **Q:** What parameters are important to monitor?<br>**A:** Depth, salinity, and vegetation. |

## Columbia River Estuary Restoration Project Funding and Implementation Considerations

*Jeff Breckel, Steve Manlow, Bernadette Graham-Hudson (Lower Columbia Fish Recovery Board)*

**Abstract**

Adequate and sustained funding is critical to efforts to restore the Columbia River estuary. However, restoration needs far outweigh available resources and competition for limited funding is increasing locally, regionally, and nationally. Successful restoration of the estuary depends on the coordinated and effective implementation of a complex array of activities and actions by federal and state agencies, tribes, local governments, non-profit organizations, communities, and business and environmental interests. All of these activities and actions will require funding and in many instances may even compete for the same funding. Just as with implementation of activities and actions, securing the needed funding resources and ensuring their effective use will require the coordination and cooperation among the parties working to achieve estuary restoration. It will also require that we look at how we fund estuary restoration in a comprehensive or holistic manner. In our presentation, we discuss the key elements of a funding strategy and the partnership needed to implement it. We examine key questions such as

- Why should estuary restoration be funded?
- What needs to be funded?
- What are our priorities?
- Who should fund restoration efforts?
- What do we need to do to secure needed funding?

Many of the considerations we discuss are applicable not only to the overall funding of estuary restoration, but also to individual activities and actions. We also believe that these basic funding considerations will be useful to policy-makers, managers, scientists, engineers, and restoration practitioners.

| Questions and Answers |
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| **Q:** What are one or two areas where we are not working cooperatively, i.e., areas for improvement?<br>**A:** Monitoring is one example. Mostly it has been done in a piecemeal fashion. Habitat restoration is another. We have tended to tackle the easy, feel-good projects without thinking strategically about how to integrate restoration projects with land management across the board. Research is another example where we need to direct our efforts to answer critical questions. |
| **Q:** Is there an organizational structure for sharing data?<br>**A:** We need to have a better way to ensure good communication, although we do not want to expand bureaucracies. |

## Project Development in the Lower Columbia River and Estuary

*Evan Haas (Lower Columbia River Estuary Partnership)*

**Abstract**

Developing restoration projects in the lower Columbia River and estuary is a vital, yet potentially challenging undertaking. Given the increased attention the estuary is receiving, as well as the possibility that increased funding will be available for restoration projects in the future, there is a need to ensure a ready supply of restoration projects for implementation. Habitat restoration projects can be developed in response to funding opportunities ("opportunity driven") or strategically planned in a broader context. Both approaches are valuable and can lead to beneficial restoration projects. In the future, it may be desirable to prioritize the strategic development of projects in an ecosystem context and focus on those areas where restoration is most necessary and likely to succeed.

Regardless of the approach taken, the phases of developing and implementing projects are the same: planning, implementation, effectiveness monitoring, data management and dissemination, and adaptive management. In addition, all projects in the lower Columbia River and estuary face a variety of challenges and constraints. Restoration practitioners can learn valuable lessons both when projects progress according to plan, as well as when projects face unexpected setbacks. The restoration completed at Fort Clatsop is an example of a project that encountered challenges, but was still successfully implemented.

This presentation will discuss approaches to developing restoration projects, steps involved in project development, lessons learned during the development process, and the successful restoration at Fort Clatsop.

| Questions and Answers |
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| **Comment:** Limited outreach and limited organizational capacity can limit our ability to move forward. |
| **Q:** How widely has the restoration project evaluation tool been used?<br>**A:** It has not been implemented yet in a wide way. Last year, the estuary partnership had a project with CLT to test it. Also, PC Trask has used it some as an outreach tool. |
| **Comment:** The prioritization is a powerful tool that needs to be refined, updated based on new data, and implemented. It could be very valuable in our future efforts. |

# Project and Program Decision-Making: Tools and Adaptive Management Frameworks

*Blaine Ebberts (USACE), Ronald Thom, Heida Diefenderfer (PNNL), Doug Putman (USACE)*

**Abstract**

With the reality of limited funding, the planning, implementation, and monitoring of restoration projects must be efficient. Projects exhibiting the highest probability of being successful, and which directly target the goals for restoration programs while minimizing cost, must be given the highest priority for implementation. However, even with the highest priority project there are uncertainties. Hence, it is important to monitor the effectiveness of these projects in meeting their goals and to learn from them to improve future projects. Under programs funded by the Corps of Engineers, Bonneville Power Administration (BPA) through the Lower Columbia River Estuary Partnership (LCREP), and others, a framework to improve decision-making for ecosystem restoration is emerging. This framework draws on a set of seven building blocks: 1) a report on an ecosystem-based approach to habitat restoration projects; 2) extensive research by the National Oceanic and Atmospheric Administration (NOAA) and the University of Washington on salmonid use of shallow water habitats in the lower estuary; 3) a conceptual model; 4) a set of monitoring protocols; 5) a research program on assessing the cumulative effects of restoration projects on the ecosystem; 6) a reference site characterization study; and 7) a habitat monitoring program. Taken as a whole, these building blocks provide a strong set of the key elements to improve decision-making on what, where, and how to restore habitats. The emerging framework draws upon each of these elements in an integrated manner, while being grounded in the realities of what agencies can implement within existing jurisdictions.

| Questions and Answers |
|---|
| **Q:** Who is going to fund adaptive management? Who is going to fund corrective actions? How do you go back and fix unsuccessful projects? |
| **A:** We need to learn from the unsuccessful projects and make improvements to the design of future projects; the idea is that we need to learn from our successes and failures. |

## Audience Discussion – Session 1

1. Up to now, we have focused on the low-hanging fruit with respect to projects. We need to do a better job of prioritizing by adaptively managing our work.
2. How can small organizations plug into the larger picture, meet larger goals and yet stay local? There are many groups doing work. How can local groups fit and connect with the larger body of organizations?
3. We need to make the highest and best use of people and organizations involved in the work. No one can do it all. How do we share responsibilities among entities? We need to have a good sense what each can do and how the job can be done most effectively. This is key to making progress.
4. Lower priorities should not be forsaken, but tools can help identify how to best allocate resources. A low ranking does not mean a project is unimportant, but it helps us see to fit it in and manage expectations.
5. We need to prioritize by biological importance. For a variety of reasons, some projects might not be as feasible as others. We need to maintain and refresh a living, ongoing project list. We have to bring all our skills together and work with all parties to ensure the support of local communities and take advantage of local capacities. We need to convene conversations at the local level (e.g., community groups) as well as higher levels.
6. It is critical to bring local groups into the discussion and pay attention to local needs and interests.
7. If indeed there are fewer and fewer potential tidal reconnection projects, then we may need another tool box (i.e., protocols) to help identify future tidal restoration sites.
8. What will be the shift in strategy given fewer tidal reconnection projects? What is the next phase for ecosystem restoration in the lower river and estuary?
9. More work is being focused on tributary watersheds. Also, the easier projects are being replaced by larger, more complex projects that need more planning, engineering, capacity, and cooperation and take more time to pull together. In the past we might have been able to do a project such as tide gate replacement for $8000; now projects are costing $200,000 and up. Larger project areas typically mean more of an engineering challenge, more of a challenge coordinating with local communities. We need to match the funding program to the work that needs to be done.
10. To follow up, maybe it's not so much a shift away from tidal reconnection projects as it is a shift in focus. Infrastructure, e.g., dikes and levees, is deteriorating. Removing dikes can affect people and communities. We need to engage local groups if we want their commitment. Backlash from the effects of projects can be a serious setback.
11. We have a long list of tasks, but we need someone to lead the charge so that tasks can be parceled out among those who can do the job best. We need to identify the important steps and who is going to take them.

# Session 2
# Research to Reduce Restoration Uncertainties

## The Columbia River and Its Estuary: Physical Structure and Function

*David A. Jay (Portland State University)*

**Abstract**

Cameron and Pritchard defined an estuary as a semi-enclosed coastal body of water in which fresh and salt water mix. Mixing of salt and freshwater is accomplished largely by the tides. With this definition, the Columbia River estuary extends from the head of the tide (at Bonneville Dam) seaward to the Columbia River plume. To comprehend such an extensive system, we must subdivide it. One boundary is easy to define—Bonneville Dam separates the river basin from its estuary. The remaining boundaries are mobile and elusive. The tidal-fluvial regime extends seaward from Bonneville Dam to the head of salinity intrusion. The salinity intruded part of the estuary is bounded by two sets of density fronts, one at the entrance and one at the salinity intrusion limit. These fronts play a vital role in the system—sands, for example, are only exported to the shelf when high flows collapse the embracing fronts to one set at the entrance. Waters passing between the entrance jetties are still estuarine, and final mixing with ocean waters occurs in the coastal ocean. The Columbia River buoyant plume is, therefore, a vital part of the estuary. It has four components: a lift-off zone (coincident with the fronts at the estuary entrance), the tidal plume, the near field, and the far field. Again, density fronts serve as boundaries. The most logical seaward boundary for the estuary is the front separating the near field and far field. This contribution uses remote-sensing images and other observations to explain estuary structure and function.

| Questions and Answers |
|---|
| **Q:** Do you expect a big spring snow melt this spring?<br>**A:** A big spring freshet is possible, but reservoir capacity will dampen the effect. |
| **Q:** Is the tidal amplitude increasing from California to the Aleutians? What is the mechanism for the increase in tidal amplitude?<br>**A:** Yes, but sea level is not changing much because the continent is rising. The mechanism has to do with the interaction between the large-scale wind field and the tidal field. Tidal amplitudes are getting smaller in areas of the southern hemisphere. |
| **Q:** Are the effects of diking on floodplain reduction on a par with the effects of flow regulation?<br>**A:** We examined the effects of diking and flow regulation on the amount of shallow water habitat (SWH). The current amount of SWH is about one-third of historical levels and is due more to diking than flow regulation. |

## Elevation of Tidal Wetland Plant Communities in the Columbia River Estuary

*Amy B. Borde, Kathryn L. Sobocinski, Heida L. Diefenderfer, Shon A. Zimmerman, and Ronald M. Thom (Pacific Northwest National Laboratory)*

**Abstract**

Land elevation and water level are primary factors controlling the structure of wetland systems, habitat functions, the effects of disturbances, and the conditions necessary for restoration. Until recently, elevation data collected from tidal wetland plant communities in the Columbia River estuary have been limited. Most information gathered to date has been specific to project sites, and often was not published in the available literature. The data presented here are derived from 23 natural sites and 4 restored sites. Data were collected through several programs spanning the estuary from the mouth to near Bonneville Dam and have been merged for analysis and synthesis. The elevation data were collected in combination with quantitative vegetation surveys of the relative cover of all species present at a given site. Water level sensors were placed at a subset of sites, which allowed the calculation of inundation frequency and duration, mean tidal levels, and potential access opportunities for juvenile salmonids. The results to date indicate that tidal wetland plant communities in the Columbia River estuary (CRE) exist within a very narrow elevation band that changes with distance from the mouth as tidal amplitude decreases and overall land elevation increases. These results are critical to understanding the processes that drive the structure and potential function of existing tidal wetlands in the CRE and thus serve as a basis for planning future restoration actions. As more data are collected through these and other studies a common, accessible database could improve future resource management decisions and restoration planning.

| Questions and Answers |
|---|
| **Q:** You mention reference areas. Are these places that will be periodically monitored?<br>**A:** Some of our reference sites are part of the Estuary Partnership's Ecosystem Monitoring Program and, hopefully, they will be monitored periodically over the long term. Others are part of the Reference Site Study and we hope to obtain at least one year of monitoring data at each site. |
| **Q:** What monitoring is being done at the reference sites?<br>**A:** Channel morphology, elevation, substrate, sedimentation, channel depth, and vegetation. |

## Ecological Change and Resilience in Oregon's Salmon River and Columbia River Estuaries

*Daniel L. Bottom (NOAA Fisheries), Kim K. Jones (Oregon Department of Fish and Wildlife), Charles A. Simenstad (University of Washington)*

**Abstract**

Restoration of Pacific Northwest estuaries is receiving increasing attention, particularly as a method to promote recovery of at-risk salmon populations. While most projects assume that estuaries are highly resilient and will respond favorably to restoration, the few monitoring programs that have evaluated

results usually have targeted site-specific effects rather than population- or ecosystem-scale responses. Recent studies in Oregon's Salmon River and Columbia River estuaries provide an interesting contrast in ecosystem and population resiliencein response to human disturbance. In the Columbia River estuary, main-stem dams, tideland dikes and levees, and salmon hatchery programs have modified disturbance processes, eliminated a large proportion of the estuarine floodplain and wetland habitats, altered estuarine food webs, and reduced salmon productivity and life-history diversity. In contrast, removal of dikes and tide gates from most Salmon River wetlands has rapidly restored characteristic vegetation and food webs and expanded juvenile life-history diversity in the Chinook salmon population. While restorative measures in Salmon River have reinforced ecosystem and population resilience, it is unclear whether the Columbia River has crossed an ecological threshold that will assist future estuary and salmon recovery.

| Questions and Answers |
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| **Q:** Have you overlaid ocean productivity on the data from the Salmon River estuary; i.e., how did ocean conditions affect the results?<br>**A:** It is difficult to separate this from the hatchery influence. Coho have not been very resilient, so they cut off the hatchery to benefit wild fish. |
| **Q:** Has Chinook production increased as a result of the undiking?<br>**A:** We focused on the diversity data, not adult return rates. It may be too early for this. But, this is part of the point—our thinking is skewed toward "numbers;" the populations that provide species diversity, even if low in numbers, are important. |
| **Q:** Regarding the "hump" diagram of life-history diversities, is it confounded by hatchery production of fish with certain life histories; i.e., isn't the hump hatchery fish?<br>**A:** Yes, hatchery production influences the hump. Furthermore, the hatchery fish are mostly types that migrate directly to the ocean without much rearing in the estuary. |

## Ecology of Juvenile Salmonids in Tidal Fresh and Estuarine Waters

*G. Curtis Roegner (NOAA Fisheries) and Kathryn Sobocinski (Pacific Northwest National Laboratory)*

**Abstract**

The lower Columbia River and estuary encompass a diverse continuum of tidal freshwater and saline environments used by migrating juvenile salmon. For the last several years we examined the role of shallow water environments on aspects of salmon ecology, including migration timing, spatial and size distributions, diet, relation to the non-salmonid fish community, stock identification, and hydrology. Habitats investigated ranged from main-stem sites in estuarine and tidal freshwater zones to marsh, scrub-shrub, and forested wetland sites. Most salmonids sampled were subyearling Chinook and chum salmon. Chum salmon were fry migrants that were abundant primarily during March through May. We sampled Chinook salmon year-round at main stem sites, with peak abundance in March through July. Few Chinook were found in wetland habitats between June and October, however, sampling upstream of Vancouver, Washington, showed Chinook occupying shallow-water areas in November and December. Size data indicate Chinook fry dispersed in April and May, although some fry were captured as late as July in tidal freshwater sites. Mean sizes of salmon increased from tidal freshwater to estuary sites, suggesting both growth during migration and continued entry of smaller individuals from upriver. Most juvenile Chinook salmon in the main-stem river fed on adult insects and epibenthic amphipods, while

insects were the primary prey in wetland habitats. Genetic stock identification indicated salmon originated from a diversity of lower and upper Columbia Basin Evolutionary Significant Units. These patterns of habitat use suggest restoration of shallow water sites would benefit subyearling Chinook and chum salmon from a variety of sources.

| Questions and Answers |
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| **Q:** Regarding beach versus purse seines to capture juvenile coho salmon, why were there small numbers of coho in the beach seines?<br>**A:** We don't know for sure. The coho were not found in the beach seines, but were found in the purse seines used in the deeper water. |
| **Q:** Were the chum fry from production below Bonneville Dam or were some from the upper river?<br>**A:** We don't know for sure. Some may be moving downstream and grazing. |
| **Q:** Is there a plan to do more genetics work on the fish captured during research?<br>**A:** Yes, we want to do more genetic stock identification. |

## Resolving Uncertainty Necessary to Conduct Strategic Restoration in the Columbia River Estuary to Support Recovery of Wild Salmon

*Charles ("Si") Simenstad (University of Washington), Dan Bottom (NOAA Fisheries), and David Teel (NOAA Fisheries)*

**Abstract**

The current opportunistic, haphazard approach to restoration and preservation of juvenile salmon habitat in the Columbia River estuary would contribute significantly to salmon recovery if the estuarine migrations and habitat requirements of at-risk populations were distributed uniformly in time and space. To the contrary, emerging information suggests that neither the spatial-temporal occurrence of migrating salmon nor the organization of estuarine ecosystems is homogeneous throughout the system. We argue that a spatially explicit restoration and/or preservation strategy is required to meet spatially unique habitat requirements of particular endangered and/or threatened salmon populations and must be considered in conjunction with the already-marginalized capacity for naturally varying ecosystem processes to restore and sustain viable salmon habitat along the varying hydrogeomorphic reaches of the estuary. Strategic planning for juvenile salmon habitat restoration and protection must account for the spatial organization in timing, genetic structure, and life-history diversity of juvenile salmon populations from disparate basins, and for the ecosystem structure and processes immediately below their point of estuarine entry. Whether continued constraints on natural ecosystem processes, such as regulated river flow, will limit the contributions of estuarine restoration and preservation remains highly uncertain. Regardless, the present ad hoc approach to restoration will only magnify this uncertainty.

| Questions and Answers |
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| **Q:** What can give us the biggest bang for the buck?<br>**A:** Restoring resilience. We need a long-term sustainable investment in planning and efficiency. |
| **Q:** Is strategic planning possible with existing tools and resources?<br>**A:** In the main stem we are getting close to having enough information. A complete historic habitat reconstruction is nearly done. This along with continued monitoring will fill many of the gaps. We understand some of the concepts now. |
| **Q:** How should the strategic planning be done?<br>**A:** It should be done at the community level, government level, and all levels. As an example, in the California Bay Delta project, early on people said "no way" to the proposed management activities, but over time the mood has changed and they have made tremendous progress. |

## Audience Discussion – Session 2

1. We are not doing a good job in addressing the management of Columbia River flows. The discussion seems to be leading to the point that flow regulation has an important effect on habitat in the lower river and estuary. We need to include flow regulation in the discussion.
2. Dealing with flow changes must be part of long-term planning.
3. It is critical that we spend our dollars and management resources effectively if we are to go forward.
4. Individual projects are important, but what's really important are habitat mosaics. We need to be restoring larger parcels over longer periods of time.
5. It's an interesting convergence of factors that will present challenges for us; e.g., critical salmon stocks, climate change, loss of players. If we are starting to look at more complex projects with many variables, then we have to work with communities better. How do we make those connections and how do we communicate that out to the world? Also, how do we make these points at the policy level? Who has the lead at the policy level?
6. Mitigation sites need to be part of the whole planning picture rather than just doing mitigation independently.
7. Mapping out fish life histories is really important and needs to be communicated to planners.
8. This all gets at how we measure restoration success. From a fisheries point of view, how are going to conduct long-term monitoring to really understand whether we are being successful?
9. It's important to recognize how complex and long-term the monitoring needs to be in order to know if restoration is being successful. One just can't check and see if fish are present and call it good.
10. What are the other management problems out there? What about liquified natural gas? What do managers worry about? What are the management questions and implications of ecosystem restoration? Why are we doing it? **A:** This will be addressed in Session 5 tomorrow.

# Session 3
# Wetlands and Flood Management

## Restoring Wetland Functionality

*Paul R. Adamus (Oregon State University)*

**Abstract**

Most tidal wetland restoration projects aim to restore salmon habitat. Many have succeeded spectacularly in achieving that objective. But when may we assume what is good for salmon will be good for other resources and specific functions? Or for "overall" wetland functionality (whatever that means) ? I provide examples from published research as well as from our conceptual understanding of natural succession, biogeochemical processes, and landscape ecology.

Almost nobody has time or budget to monitor all functions at sites they are restoring. However, Oregon has a standardized protocol for estimating relative levels of 12 functions of tidal wetlands. It projects the before-and-after effects of restoration alternatives. The estimates are coarse and not intended to substitute for detailed biological surveys and measurements of functions when project budgets allow. The protocol is based partly on data I collected with a field crew from 120 reference wetlands on the Oregon coast in 2003 (see: http://oregonstate.edu/~adamusp/HGMtidal/).

What drives most wetland functions is hydrology—the frequency, duration, extent, depth, and timing of flooding. This influences fish access while often having a different effect on use by other animals and plants. To better address hydrology, NOAA funded a joint research effort by University of Oregon and Oregon State University to develop sensors for remotely determining when and where a tidal wetland floods. So far, our testing of this "iButton" technology has yielded promising results. We are conducting a more comprehensive field evaluation this year at six Oregon sites, including Blind Slough on the lower Columbia River estuary.

| Questions and Answers |
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| **Q:** How are they going to waterproof the assessment tool, called the "ibutton?"<br>**A:** We have tried various solutions including plastic bags and balloons but so far polyvinyl chloride (PVC) pipe seems best. We still have work to do to make this functional. There's a thermal effect when the tube is in air. |
| **Q:** Have you been able to place economic values on the 12 wetland factors?<br>**A:** It is dangerous to do that. People have tried, but I haven't done it. It is better if you use relative values; for example, comparing one tidal marsh to another. Landscapes are a good comparative tool. |
| **Q:** Have you made an effort to calibrate your tool for the Columbia River estuary?<br>**A:** Not yet, although CREST has a couple of proposals that have not been funded to date. |

# Teaching Environmental Science in the Field Brings Habitat Restoration to Life for Both Students and Teachers

*Rob Stockhouse, Jeff Rooklidge, Rob Dalton and Allan Whiting, with students from Wahkiakum and Naselle/Grays River High Schools in Washington State*

*Columbia Estuary Environmental Education Program (CEEEP), Wahkiakum Community Foundation*

**Abstract**

Engaging students in environmental science can be a challenge for a teacher in a classroom setting. But bringing them out to do hands-on work brings science alive in ways that inspire students and teachers alike. This presentation will provide history and data on curriculum used in the Wahkiakum High School's Award Winning Environmental Education Class and the Wahkiakum Community Foundation's companion summer program that employs students to do hands-on habitat restoration work.

First, students will present a background on their first summer project along Nelson Creek in 2005. The first summer program, funded by the LCREP, brought together seven students and their teacher for a six-week program of assessing the stream, building baseline monitoring information, and inviting community partners to participate. With the hands on instruction of Allan Whiting, from CREST at that time, the students learned high-quality habitat assessment protocol and continue those high standards now.

The presentation will then review projects done over the ensuing years and present relevant data for projects not only on Nelson Creek, but also Duck Creek, further up the Elochoman River from Nelson Creek, and then on Birnie Creek in "downtown" Cathlamet. The Birnie Creek project, funded by a Community Salmon Fund grant, gave students and teachers a true hands-on experience removing Japanese Knotweed with injection guns and Aquamaster as trained by Ron Crockett who developed both products.

Dr. Rob Stockhouse, retired botany professor from Pacific University, and Director of all aspects of the CEEEP activities for two years, will give an overview of how the hands-on approach is the best way to teach science to students. Through his position at Pacific University, CEEEP students are able to gain college science credit, as well as science credit at their high schools.

Teachers Jeff Rooklidge and Rob Dalton will discuss the benefits of taking students into the field day after day to work in habitat restoration as an ideal way to build an ongoing sense of accomplishment, understanding of science, and awareness of the importance of work ethics and productivity. Students will illustrate that by giving them full projects to complete over the summer, they learn to work at habitat restoration in a step-by-step manner. During the school year, students monitor for fish, test water quality and temperature, and develop ongoing data from the spawning season. Students will discuss how they plant native trees and shrubs on sites worked on during the summer. They will describe each project and how it has made a difference to fish, habitat, and their awareness of the need for balance in the environment. Teachers will give an overview of how the work experience helps give the students

information on considering studying for a degree in science and helps spread awareness in the community of the importance of hands-on habitat experiences for the young.

Community partners, such as DeBriae Logging and Hancock Forest Management, actively engage with the students to give them experience with and information about forest practice standards. Students will report on their time learning about forestry as part of their curriculum.

Allan Whiting, currently with PC Trask and Associates, will present his views on the capacity for students to conduct high-quality scientific work that delivers valuable data for scientists in the estuary to honor and combine with their own.

## Hydrodynamic Modeling of Tidal Reconnection Restoration Projects: Uses and Limitations

*Michael E. Ott (U.S. Army Corps of Engineers)*

**Abstract**

The use of hydrodynamic modeling to assist in planning, engineering, and constructing tidal reconnection and other ecosystem restoration projects can be useful and enlightening. Hydrodynamic models are tools that are useful in determining which alternative best meets a project's objective. Although they are useful, they are costly and can be time consuming. A basic understanding of the system and strategically placed instrumentation can provide a wealth of information for planning and scoping an ecosystem restoration project. A general understanding of the site and a solid data set can provide the framework for decisions such as: is a hydrodynamic model necessary? If so, how robust must the model be?

| Questions and Answers |
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| **Q:** How difficult is it to populate the model with data? In situations without data, how do you do it?<br>**A:** We have to keep the end goal in mind and identify the exact data needed to build the model. |

## Levees and Dikes: Operations and Benefits

*David Ambrose (Clatsop Soil and Water Conservation District)*

**Abstract**

Dikes and diking districts are an integral part of the socio-economic fabric of Clatsop County. Other than forestland, diked areas of the Columbia River estuary provide the most productive agricultural land in Clatsop County. The presentation will give a brief history of the development of dikes and an overview of the extent of diked lands in Clatsop County's estuarine area. The diked lands will then be described in terms of their economic value. A description of the state of repair of the diked areas will follow with a discussion of the challenges faced by landowners in the diking districts. Descriptions of

significant efforts to reconnect the diked lands with their estuarine habitat will be discussed. The talk will conclude with an assessment of the future of diked areas and what form future efforts at wetland and estuarine restoration could take.

| Questions and Answers |
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| **Q:** For the diking districts classified as inactive, is it because a) no one is in charge, or b) they are restoring to wetlands? Also, warmer climate and less water imply decreasing levels for 100-year floods. How is this being handled?<br>**A:** Inactive areas are those where the owners haven't kept up with regulations by the Corps. They often have no directors, no meetings, and no money. They can't get them functioning properly without Corps help. There is a lot of trepidation about what can be done. At present, there is no effort to get funding for these places. |
| **Q:** The question was framed around getting funding to keep these dikes functioning. Is there a concentrated effort to fund buy-backs, levee set-backs, etc., instead of trying to protect the land from flooding?<br>**A:** The families have been there a long time. I'd be interested in your ideas on how they can be convinced to give up their land. |

## Effects of Tidal Wetland Restoration on Floodplain Management: The Lower Grays River Experience

*Ian A. Sinks (Columbia Land Trust)*

**Abstract**

Restoring intertidal wetland habitat within the Columbia River estuary is a priority for restoring floodplain and habitat function, including habitat for listed salmonid species. Levee modification and removal are one of the most effective actions to accomplish these goals. Restoring tidal wetlands can also support a number of community goals including flood attenuation and sediment trapping.

In 1998, the Columbia Land Trust began its first conversations with community members within the Grays River watershed located in Wahkiakum County, Washington. It was clear from these conversations that the Grays River was a very dynamic river experiencing increased sediment loading, that declining salmon populations were impacting the historic fishing economy, that there was concern that salmon listings under the ESA were likely to have an impact on land use regulation, and that inactive or unproductive agricultural ground within the floodplain was being sold for residential uses. Based on this feedback, Columbia Land Trust began a conservation effort that has resulted in the protection of approximately 930 acres, 425 acres of which have had restoration treatments completed.

A central element of this conservation effort is the 163-acre Kandoll Farm restoration project. This project involved the removal of tide gates, levee breaches, filling of drainage ditches, construction of set-back flood protection, and revegetation. A significant amount of monitoring is being implemented by partners to evaluate the effectiveness of restoration treatments and to guide future stewardship activities.

This presentation will provide a broad overview of the Grays River watershed, a summary of watershed issues the Land Trust and other groups are working to address, an overview of the Grays River tidal restoration projects completed by the Land Trust, lessons learned from project effectiveness

monitoring and other monitoring efforts (i.e., the Cumulative Effects Study), and a more in-depth review of hydrologic modeling completed for the project as a result of two years of dynamic river flood events.

| Questions and Answers |
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| **Q:** With changes in tidal inundation, is Knot Weed coming in?<br>**A:** Yes it is and others such as Purple loosestrife may be coming too. |
| **Q:** How did the community react to the flood problems?<br>**A:** Not very well. They tried to work with folks, but the flood issue really made things difficult. |
| **Q:** Was the road at Kandoll built up to standards?<br>**A:** There were no Corps standards so it was just built up to Section 404 requirements. |
| **Q:** With sediment accretion will it eventually become an upland?<br>**A:** There is an increase in sedimentation, but it may be offset by other changes. |

## Audience Discussion – Session 3

1. Finding out where tide gates should be placed can make a big difference in a project's success. As an example, Grizzly Slough works well as a result of putting the tide gate at the bottom of the slough. When done right, many positive benefits can accrue.
2. Trust is a critical issue for property owners. While there may be new opportunities, property owners' fears have to be overcome. In some cases, dikes are being built up and the stakes are becoming higher. Getting people to the table for discussions is a big issue. Also, we need money for local programs and/or workshops for these conversations.
3. When the flooding occurred in 2005, lots of people were working together to discuss needs. It is possible to get folks together, but it takes resources especially funding. How do we get the funds?
4. We are learning a few things about working with communities. We need to be better able to use our tools to help answer questions and to get the local community involved from the very beginning. It is also very important not to move too fast.
5. People really need to talk to land owners one-on-one. Land owners have lots of concerns that need to be addressed by working closely with them. This approach can also generate new, useful ideas.

# Session 4
# Action Effectiveness Monitoring

## Columbia River Estuary Restoration Monitoring: Synthesis and Gaps

*Chris Hathaway (Lower Columbia River Estuary Partnership)*

**Abstract**

To date, over 100 habitat restoration projects have been implemented in the lower Columbia River and estuary. Restoration activities include dike breaches, tide gate replacements, easements, property acquisition, riparian vegetation plantings, and cattle exclusion fencing. Often, a project is considered a success when it is completed on time and within budget. Yet, long-term "effectiveness monitoring" is needed to assess whether restoration activities were ecological successes, meaning that they successfully improved habitat and overall ecosystem health. Such information is essential for evaluating the performance and functional benefits of individual and multiple restoration projects and facilitating improvements in project design and management. Presently, effectiveness monitoring tends to occur at few restoration sites and typically for one to two years following restoration. To expand the number and duration of effectiveness monitoring efforts in the lower river, several agencies and organizations are currently planning or initiating effectiveness monitoring programs. These programs will benefit from work by the NMFS and the Pacific Northwest National Laboratory (for the U.S. Army Corps of Engineers), which identified a suite of "core" metrics for monitoring the effects of restoration activities in the lower river. These core metrics include hydrology, water quality, elevation, landscape features, vegetation, and fish and each core metric has an associated monitoring protocol. As effectiveness monitoring of restoration projects increases in the lower river, we hope to monitor a range of restoration activities in the different geographic reaches of the lower river using core metrics and protocols whenever possible and applicable. Furthermore, a data management framework for reporting and sharing effectiveness monitoring data will be essential.

| Questions and Answers |
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| **Q:** When will the results of the reference site study be ready?<br>**A:** It will take a couple of years to get the results, but we recognize that we need to get the information out as soon as possible to help decision-makers. Preliminary results will be reported in 2009 followed by a full report in 2010. |
| **Q:** Are there guidelines on the types of sites that will require intensive versus extensive monitoring?<br>**A:** Not specifically, but material is available to help make such a determination (contact Blaine Ebberts (USACE) or Tracy Yerxa (BPA) to get the Federal Estuary Research, Monitoring, and Evaluation Plan). |

# Toxic and Invasive Species: Implications for Habitat Restoration and Effectiveness Monitoring.

*Gregory J. Fuhrer (U.S. Geological Survey) and Krista Jones (Lower Columbia River Estuary Partnership)*

**Abstract**

The abundance and distribution of contaminants and invasive species in the lower Columbia River and estuary have important ramifications for restoration activities, including site selection and restoration effectiveness monitoring. Several studies have revealed that contaminants (e.g., organochlorine pesticides, polychlorinated biphenyls [PCBs], and mercury) are widespread throughout the lower river and its tributaries and in the food web. Other contaminants, such as polybrominated flame retardants, which are likely endocrine disruptors, are being detected in increasing quantities in water, sediment, and aquatic life in the Columbia River and its tributaries. To date, the relative importance of contaminants in relation to other factors affecting habitat structure and function (e.g., water velocity, temperature, salinity, vegetation, and sediment) are poorly known. Site selection and effectiveness monitoring typically do not include an assessment of contaminants. Yet, habitats being restored in the lower river are subject to inputs of legacy and emerging contaminants that can have lethal or sublethal effects on salmon and other sensitive species.

Likewise, invasive species are widespread in the lower river, accounting for over 20% of species found there. Restoration activities often include invasive species removal in order to reestablish native vegetation. The location of a restoration site relative to invasive species populations in the surrounding landscape can determine whether nearby populations will (re)colonize restored sites. Restoration activities also may contribute to the spread of invasive species by transporting species between sites on equipment or increasing hydrologic or habitat connectivity between previously isolated habitats. Restoration effectiveness monitoring can facilitate the detection of invasive species and feed into ongoing site management.

Restoring habitats in the lower river presents many challenges. We can meet these challenges effectively by balancing contaminant effects on biota and pressures from invasive species with the structural requirements necessary for healthy habitat. This level of understanding may contribute to informed selection of candidate sites for restoration and assessments of the effects of contaminants, invasive species, and habitat on aquatic biota before and after restoration activities.

| Questions and Answers |
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| **Q:** By focusing on contaminants of most concern, are we missing others that could be important?<br>**A:** Yes, we need to address that. |
| **Q:** Have you looked at recontamination of restoration sites? Should we be screening sites on the basis of contamination?<br>**A:** There apparently is no prescreening going on. This needs to be done during site prioritization. |
| **Q:** Even if you start up with a clean site, can you get a resuspension of contaminants?<br>**A:** Studies of uptake of contaminants by juvenile salmon have been undertaken. We need to be concerned about restoring sites that may end up hurting fish. |
| **Q:** Funding is a critical issue. Contaminant monitoring is very costly. Are there a few contaminants that could be monitored as indicators of possible public concern?<br>**A:** The US Geological Survey (USGS) has some funding to do six sites using lipid bags, which remain in the water for a period of time and thus act as a good screening tool. This approach may be applicable. |

## Restoration Effectiveness Monitoring in the Columbia River Estuary: Response in Fish Communities

*Micah Russell (Columbia River Estuary Study Taskforce )*

**Abstract**

CREST has played an important role in spearheading multiple estuarine restoration projects throughout the Columbia River estuary. Working with several different partners and funders, CREST has recognized the importance of long-term monitoring to demonstrating the structural and functional success of these projects. In response to this need, CREST initiated an effectiveness monitoring program in 2004 at several restoration sites throughout the estuary.

Primarily guided by Monitoring Protocols for Salmon Habitat Restoration Projects in the Lower Columbia River and Estuary to maintain consistency among the various groups engaged in monitoring activities, CREST field staff have gathered multiple levels of pre- and post-restoration project data, as well as reference site data, including hydrology, water quality, topography, vegetation, and fish communities. It is hoped that this information will justify more numerous and larger-scale restoration projects, as well as contribute to regional efforts to assess the cumulative effects of restoration across the estuary.

CREST has been especially active in performing salmonid monitoring, increasingly on behalf of other researchers. These activities have included the use of trap nets, seines, smolt traps, pit tags, and radiotelemetry, dependent on project objectives and characteristics of the site. CREST also has participated in studies of salmonid prey use, prey availability, and genetics. CREST will give an overview of successes and lessons learned from fish monitoring in Grays Bay and Chinook Bay, Washington, and Youngs Bay, Oregon. This talk will be given from the perspective of on-the-ground practitioners with resources that fluctuate according to grant funding.

| Questions and Answers |
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| **Q:** What numbers of yearlings are we seeing?<br>**A:** Coho and steelhead in the teens. |
| **Q:** Which subyearlings are staying for awhile?<br>**A:** Chinook do stick around in the tributaries. Coho get in wetland areas and linger. Chum move through fast. |

## Evaluating Cumulative Ecosystem Response to Tidal Wetland Restoration Projects in the Columbia River Estuary

*Heida L. Diefenderfer, Gary E. Johnson, Amy B. Borde, Ronald M. Thom (PNNL), John R. Skalski (UW), Blaine D. Ebberts (USACE), G. Curtis Roegner (NOAA Fisheries), Earl M. Dawley (NMFS-retired), and Micah Russell (CREST)*

**Abstract**

The methods used to assess cumulative impacts of ecosystem degradation also can contribute to assessing outcomes of ecological restoration. The body of knowledge developed as a result of the National Environmental Policy Act may be applied to restoration at landscape scales; beyond the presumption of additive effects, these techniques acknowledge alternate modes of accumulation (e.g., synergistic effects from multiple pathways). The restoration of tidal wetlands for salmon habitat in the 235-km tidal portion of the Columbia River, through multiple hydrological reconnection projects, provides a case study to evaluate cumulative effects using new and existing methods. We are developing a levels-of-evidence framework and analytical methods for evaluating the effectiveness of the federal restoration program. This involves testing spatial and temporal patterns of cumulative effects using a hydrodynamic model, standardized restoration project monitoring data, and indicators of salmon habitat opportunity and capacity. A base model in the geographic information system (GIS) is used to track stressor reduction. In 2005 to 2008 field studies, baseline and post-restoration data were collected on restoration and reference sites representing brackish marsh and tidal freshwater swamp— habitat types that have sustained substantial areal losses. Three kinds of restoration actions were implemented: tide gate replacements, culvert installation, and dike breaches. The meta-analysis will include data from modeled site clusters as well as field-collected data from three types of sites: paired habitat (swamp and marsh), paired restoration and reference, and a time series. Data from remote sensing, field collecting, and modeling include wetted area, connected channel edge, sediment accretion rate, water level and temperature, vegetation-elevation relationships, organic matter and nutrient flux, fish species composition, and salmonid prey availability.

| Questions and Answers |
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| **Q:** Mitigation may be viewed as contributing to a net benefit because it's intended to offset an impact. Where does mitigation fit into the cumulative effects discussion?<br>**A:** The timelines for mitigation and impacts are different. It takes years or decades to see the real effects of a restoration project intended to mitigate some impact, while the impacts are typically immediate. The real question is whether the cumulative effects of restoration will out weigh the degradation. |
| **Q:** There's concern that when restoration options are presented, folks might use or interpret them as mitigation. Does this reduce the opportunities for restoration?<br>**A:** In the last two years, there has been a number of mitigation bank projects approved while some Columbia Land Trust projects were not approved. New mitigation projects may come along that do not fit into restoration plan, but they move forward because there is more money available; the new mitigation projects are thus out-competing restoration projects because mitigation pays much more than appraised value. |

## Audience Discussion – Session 4

1. The take home question here is how can we make information more digestible, so it can be used by the restoration community and the public?
2. Adaptive management is a one way to take lessons learned and feed the information back to decision makers and the public. Unfortunately adaptive management is frequently underfunded, e.g., not more than a couple of years and thus we can have years of monitoring data that are not readily available. Of course, another issue is underfunded monitoring to begin with.
3. There's been little mention of free market forces. Mitigation banks are not going away. We need more partners; therefore, include the mitigation and business communities. Mitigation brings in partners with more money, so it is attractive to those who want to get their money's worth out of their property. It is unfortunate because in some cases mitigation interferes with restoration objectives. There needs to be a way to get more partners involved with restoration projects so that costs can divided up among a larger group of parties.
4. There's never going to be certainty. Also, it would be good if we could deal with the issue of accountability.
5. Recovery planning and the BiOp used an ecosystem approach. There can be a trade-off within the salmon life cycle. The primary metric, though, is survival. This is the common currency across tributary habitat, the hydrosystem, hatcheries, and harvest. But measuring the survival benefits of restoration in the estuary is difficult and has not been accomplished. How can we advance on this? How do we create an approach to bridge the gaps? Many people are skeptical about our ability to monitor the survival benefits of restoration. Two points are relevant here. a) Indeed, the incremental, site-specific effects on survival are problematic, and b) however, reach survival estimates are possible and are being made that might be applicable here. Maybe reach survival would provide an indirect but more practical way to look at survival.
6. The ultimate goal is to be able to show direct correlations of survival to projects, but the scale of the CRE makes this very difficult so we may need to look to indirect evidence.
7. So far, nobody seems surprised by the habitat changes we have been seeing. Is it really true that vegetation and fish are reacting the way we expect?
8. For some places, effects are occurring but we are not seeing all we hoped for. In other areas it is still too early to assess. It also depends on where the site is in the salmon migration corridor.
9. In the Nisqually area, dikes were removed and plant species have come back naturally in a year.

10. You can't really demonstrate the fish survival improvements that might result from restoration. This is a problem with the current BiOp. Some agencies are not willing to accept that the projected survival benefits will be real.
11. The BiOp dictates that we have to measure survival, but maybe survival is the wrong "currency" for the estuary. However, if you can improve life-history diversity, habitat connectivity, etc., then we should be able to make the case that our efforts are showing success, especially if we use a levels-of-evidence approach.
12. Survival is the only measure we can rely on. Other metrics don't do it. Performance standards in the BiOp will always be based on survival.
13. Maybe there could be other performance standards besides survival.
14. We need to tie the free market approach and the strategy of grabbing the low-hanging fruit together. There are opportunities, but funding remains a big issue. Land owners want dollar values in contrast to what we consider highest and best use. If we could pay market values for land that would be ideal, but restoration dollars cannot match market dollars. As a result mitigation is attractive to private parties. It would be helpful to quantify economically the value of ecological services.

## Facilitated Session for Restoration Practitioners: Planning, Monitoring, Evaluating, and Decision-Making

The following 18 issues within six topical areas were identified for group discussion:

- Funding
  - Cash flow management
  - Unified application for common funding sources
  - Funding cycles
  - Explain funding need to policy-makers
  - Reporting project success for continued funds
- Regulatory and/or Permitting Issues
  - Getting through regulatory issues (permitting)
  - Regulatory law enforcement to support restoration
- Data
  - Data management
  - Lack of central repository for data management
- Outreach
  - Translation of regional level priorities to local action
  - Assistance between ecological desires and engineering products
  - Tools to engage communities
  - Public relations outreach and/or education to landowners
- Monitoring
  - Water quality monitoring

- Ecosystem monitoring

- Technical Assistance
  - Technical applications effectiveness, pre-monitoring

- Adaptive Management
  - Take advantage of previous work and fold it into other restoration projects
  - Adaptive management for restoration projects.

## Discussion

**Comment**: When we started work on the estuary 8 to 10 years ago, we were short on information. Now we can begin to see the ties between upriver issues that have been studied much longer and estuary issues, but the estuary is different and we still need to know more about how it fits into the larger picture.

### Regulatory/Permitting

- The Oregon Division of State Lands asked what kind of permitting issues exist. They have a streamlined permitting process, but what more is needed to enhance the process?
- The State of Washington Department of Natural Resources has a well laid out process that is streamlined and simplified including a simplified process for Section 7 approval.
- Little staff time is available at the Oregon Division of State Lands (DSL) to come out and look at questionable practices. It is also difficult to know to whom to talk. A large staff turnover has slowed response time and law enforcement staffing in not adequate.
- There are complaints that the types of mitigation are not right. The process needs to be managed better and better guidelines are needed.
- Why not facilitate permitting by putting applications on the internet? This would be less adversarial and large groups like this one could provide a peer review. It's important that we identify issues early and get feedback to the applicant. Not all of the burden of proof should be required of the applicant
- Better agency coordination would be helpful.
- The DSL process could show how something fits in and thus lessen the duplication of effort.
- Different applications may be subject to different rules, so it adds to the level of complexity of the permitting process.

### Outreach and Monitoring Issues

- It would be good to have more flexible grants that can better address regional priorities. If an area is of high priority, we should be able to invest in it by having grants that allow us that latitude. Also, grants should be designed to allow more time for monitoring.
- We should consider monitoring as a tool to engage communities by allowing them to see the results of the work that is occurring.

- Pre- and post-project monitoring is critical. We need to prioritize parameters and recognize that things like survival are very different from other types of monitoring.
- There is not only the issue of getting monitoring information to the people but getting them involved in the monitoring. The most important issue though is baseline monitoring.
- We need better ways to engage the public.
- There is a lack of attention to the public in much of our project work. We need to have better ways to engage students and local schools, which will in turn reach their parents.
- Schools are a big part of the community. Getting them involved is very important.
- Watershed councils are getting pushed into project management and moving away from stakeholder involvement. As a result, sustaining membership is difficult. People are getting tired, especially when it is hard to see how they fit into the larger picture. Using volunteers and students is good, but it takes a lot of time and management, especially working with students.
- Using hazard mitigation plans and identified safety issues may be a way to engage public. If projects are addressing known safety issues, then they become part of the larger solution.
- The BiOp staff recognizes the need to coordinate efforts. It is pushing to advance tools that facilitate engagement. As an example, protocols for data gathering can help make it easier for local communities. The staff can also provide more access to data and better demonstrate how local data fits into the larger picture.
- Perhaps we could better engage the community with tool kits. It is a struggle to find sites for students to work on. Some things are not realistic, so we have to be more creative in finding ways to engage them.
- The project we saw yesterday is a good example. What made it successful? They had good sites. They did a lot of ground work that could be built into getting support for grants, but it took a lot of effort to get it up and running and to manage it.

### Data Management

- Public availability is very important.
- It is hard to find the time and motivation to make sure reporting gets done. Small projects tend to fall through cracks.
- We can't find the time and the funding to get data managed in a way that will make it useful.
- It is very difficult to find the data on line. For it to be useful, it has to be easily accessible.
- We might want to consider something like Wikipedia—a self-managed database.
- We need an information exchange base to track data and keep track of opportunities.
- The Estuary Partnership can post reports on its library web page.
- The Northwest Environmental Data network, an executive summit on data management strategy, is studying this issue. A web portal access seems to be the best idea thus far.

- We need a standard data dictionary.
- There are some new tools coming out that may help us reach these goals.
- Practitioners need data tools to help analyze the data and make sense out of them so they can be shared with the public in a way that is accessible to them.
- Our quest for accountability has gone amok. Many people are bogged down with reporting. We need to devise a project inventory for large-scale monitoring.
- A network of permanent sites should be set up for long-term monitoring. This might help get funding directed at critical long-term projects. Developing a baseline could help lessen the reporting requirements on smaller projects.
- We should be able to use new protocols to make data more compatible but we need help getting there.

### Technical Assistance

- Watershed councils don't have the expertise and frequently have to hire consultants. Would it be possible to have regional funding established to fund regional experts who could then assist local groups? What kind of funding would it take? Who would they work for?
- On more complicated projects, a technical advisory committee is usually set up. This group can be helpful in resolving technical needs.
- Planning assistance for the states is available from the Corps of Engineers.
- Perhaps we could develop an on-call technical assistance contract that could be available to local groups and also provide expertise to agency staff.

## Climate Change Impacts on Columbia River Basin Fish and Wildlife

*Robert E. Bilby (Independent Scientific Advisory Board)*

**Abstract**

The Pacific Northwest has warmed about 1.0°C since 1900, an increase greater than the global average. Over the next century, temperature in the region will increase at a rate of 0.1-0.6°C/decade with increases in winter precipitation and decreases in summer. These changes will have a profound impact on the aquatic habitats in the Columbia River basin, including reduced snow pack, earlier snow melt runoff, and higher water and air temperatures. Alterations in species ranges in the basin have already been noted with shifts generally poleward or upward in elevation. These changes will accelerate with impacts exacerbated by habitat fragmentation caused by a combination of changing climate and increasing human activity within the basin. Increases in fire frequency and more widespread insect outbreaks have been observed over the last 50 years. Hydrology and water temperature changes will negatively impact tributary habitats and especially affect salmonid fishes. In contrast, flow in the mainstream Snake and Columbia rivers has been so modified by hydrosystem operations that hydrologic effects related to climate change are likely to be minor. Estuary habitats may be affected by sea level rise and an upstream

extension of the salt wedge during spring. Ocean conditions also will be affected with a delay in the onset of spring coastal upwelling, altered thermal regimes throughout the North Pacific Ocean and ocean acidification. These changes have the potential to alter marine primary and secondary production, thereby reducing the survival and productivity of Columbia River salmon populations. Mitigating actions that may help reduce the impacts of climate change exist. However, to be effective these actions must be applied in a timely manner at the correct locations. Therefore, climate change needs to be incorporated into basin fish and wildlife planning.

| Questions and Answers |
|---|
| **Q:** Upwelling and the plume are critical to salmon habitat and survivability. Predicated changes could affect this relationship. In addition, future snowpack forecasts suggest that current dam operations might not be able to function. How should we do long term water planning?<br>**A:** High winter flows, lower summer flows could mean lower flows in the main stem in late summer and this will be very critical. Some of the tributaries such as the Yakima could change even more dramatically. River-specific hydrographs will change. Not sure how we should deal with this. |
| **Q:** Will there be a regional impetus to adjust the flood control regime, the reservoir rule curves?<br>**A:** Don't know. As scientists, we report problems but don't make operational policy. |
| **Q:** What are some mechanisms to convert or adjust land use practices?<br>**A:** There are some tools currently available and others coming on that will help protect high value property. See the Independent Scientific Advisory Board (ISAB) report. Better land use planning and market-based tools could help. |

# Session 5
# Management Perspectives

## Estuary and Ocean Mitigation and Adaptive Management Strategies for the FCRPS BiOp and Columbia Basin Fish and Wildlife Program

*Jim Geiselman (Bonneville Power Administration)*

**Abstract**

Several recent reviews by the ISAB and/or Independent Scientific Review Panel (ISRP) have identified the critical importance of the Columbia River estuary habitats for juvenile and adult salmonids and our need for supporting scientific data. Improvements in estuary habitat conditions to increase juvenile and adult survival are key strategies of the FCRPS BiOp, ESA Recovery Planning, and the integrated Columbia F&WP funded by BPA rate payers. In addition, extensive research, monitoring, and evaluation (RM&E) in the estuary and ocean is identified as a key strategy to support ongoing planning and adaptive management of these actions. The habitat improvement and RM&E strategies for the FCRPS BiOp will be briefly discussed with an emphasis on key policy issues. Recognition of the multiple regional efforts taking place in the estuary that will need collaborative and coordinated planning and implementation processes will be highlighted.

## Valuing the Columbia River: The Balancing Act

*Cathy Tortorici (National Marine Fisheries Service)*

**Abstract**

The Northwest Region of the NMFS conserves, protects, and manages Pacific salmon, groundfish, and marine mammals and their habitats under laws such as the ESA, the Magnuson-Stevens Fishery Conservation and Management Act, and the Marine Mammal Protection Act. Our agency also works in the non-regulatory arena to provide technical assistance and facilitate conversations about how best to manage our trust resources.

Our Northwest Fisheries Science Center (NWFSC) plays a key role in generating research that we rely upon, along with other best available science, to develop policy about how best to manage our trust resources and this important ecosystem. The targeted research being conducted by our NWFSC and others on fish use and ecosystem processes in the Columbia River estuary continues to be translated into on-the-ground restoration work and included in the "regulatory" documents NMFS produces (e.g., recovery plans, ESA Section 7 consultations).

Policy-related issues facing management of the Columbia River estuary include valuing the "ecosystem services" it provides and emphasizing the value of this estuary from the ecological and socio-

economic standpoints in the context of the Columbia River basin. (Ecosystem services are goods and services that are traditionally viewed as free benefits to society, or "public goods"—fish and wildlife habitat and diversity, watershed services, carbon storage, and scenic landscapes, for example. Lacking a formal market, these natural assets are traditionally absent from society's balance sheet; their critical contributions are often overlooked in public, corporate, and individual decision-making.) This is increasingly important in the context of long-term environmental issues like climate change, continued actions like dredging, and the potential future development of liquefied natural gas plants, housing developments, and port development.

## Habitat Restoration in the Lower Columbia River and Estuary under the Council's Fish and Wildlife Program

*James D. Ruff (Northwest Power and Conservation Council)*

**Abstract**

As part of the habitat strategies identified in the Council's 2000 Columbia River Basin F&WP, the estuary is an important ecological feature that is negatively affected by upriver management actions and local habitat changes. For example, the storage, release, and impoundment of water in upstream storage projects has altered the natural hydrograph and water temperatures of the Columbia River and changed the characteristics of the estuary.

The Council's F&WP acknowledges that less is known about the potential for habitat improvement in the estuary than is known about the potential for improvement in other parts of the Columbia River basin. However, there are indications that substantial habitat improvements are possible and that these improvements may benefit most of the anadromous fish populations. Accordingly, the Columbia River estuary is included as one of the planning units in the F&WP, and sub-basin plans have been developed and incorporated into the F&WP for both the estuary and the Lower Columbia River reach below Bonneville Dam. (The freshwater plume and the ocean itself are also identified as important habitats for salmon and are addressed in the Ocean Conditions section of the F&WP.)

In 2003, the Council adopted Mainstem Amendments to the F&WP. These amendments included a measure to identify, protect, and restore ecosystem functions in the Columbia River estuary and near-shore ocean discharge plume that are affected by actions taken upstream within the Columbia River hydrosystem. This includes evaluating flow effects, river operations, and habitat changes in the estuary, as well as local effects from activities such as dredging and pollution from urban areas. The goal of this measure is to better understand and improve the relationship between the estuary and near-ocean plume characteristics and the productivity, abundance, and diversity of salmon and steelhead populations that migrate through and/or use these habitats. The 2003 amendments also call on the federal action agencies to manage river flows, consistent with the mainstem plan's flow and reservoir operations to protect, improve, and expand the spawning, rearing, and resting habitat in the mainstem Columbia River and estuary.

The Council's F&WP is currently undergoing an amendment process during 2008. I will summarize the relevant Program recommendations the Council has received from the salmon managers and other parties concerning the Lower Columbia River and estuary areas.

## Policy Implications: U.S. Army Corps of Engineers, Portland District

*Douglas A. Putman (U.S. Army Corps of Engineers)*

**Abstract**

Ecosystem restoration (estuarine and other ecosystems) has become one of the three primary missions of the U.S. Army Corps of Engineers Civil Works Program (Corps). The Portland District uses several Corps authorities to develop and implement ecosystem restoration projects in the Lower Columbia River estuary. These include the Section 536, Lower Columbia River Ecosystem Restoration Program, the ongoing Lower Columbia River Ecosystem General Investigation Study, and theColumbia River Channel Improvement Project. Primary constraints include the institutional requirements of sponsorship/cost-sharing and annual project funding as well as the identification of suitable sites. Planning principles are used to ensure that appropriate, cost-effective projects are undertaken. The results and findings of ongoing research are used to ensure that the best science is applied in the planning, engineering, and construction of restoration projects. Application of data/information to our projects is being institutionalized and improved as the Portland District develops its Adaptive Management Plan to make better use of existing data, capture experience, and share this with our partners and sponsors. The Corps has participated in inter-agency coordination with state, federal, tribal, and nongovernmental organizations for many years and is continuing to develop these relationships. The Portland District Outreach Program will further strengthen these relationships and provide a mechanism to help facilitate the development of realistic requirements and programmatic BiOps to streamline the processes required to get from planning to functioning restoration projects on the ground.

### Audience Discussion – Session 5

1. There's some advantage to the position we're in now, because we have an opportunity to pioneer solutions and set the example with ecosystem restoration.
2. The emphasis on climate was good. We need to be treating system as a whole; we need to understand physical processes and system science in order to see the big picture. Also, sediment management is huge. A higher level of thinking is necessary, e.g., systems science in the Chesapeake Bay. We need to be taking a more general approach to the problems.

# Closing Remarks

Gary Johnson closed the conference, thanking the conference sponsors, organizers, speakers, and audience. The next Columbia River Estuary Conference will be in 2010; theme to be determined.

# Appendix A

# Speaker Biographies

# Appendix A
# Speaker Biographies

## Paul Adamus

**Oregon State University (College of Oceanographic and Atmospheric Science [COAS] & Adamus Resource Assessment, Inc. (ARA)**

Paul Adamus is currently preparing Oregon's standardized protocol for assessing wetland functions, under contract to the Oregon Department of State Lands and with participation by the Corps of Engineers, EPA, National Resource Council Service, and other users. The protocol will be used for measuring ecosystem services credits as part of wetland banks, and for recommending mitigation ratio adjustments that account for functions of specific sites. As part of the research faculty at Oregon State University, Dr. Adamus also supervises graduate students in ecological and geomorphic studies of wetlands and has published over 100 scientific articles and reports on wetlands and wildlife ecology. He previously worked for 10 years under contract to EPA's National Wetlands Research Program at its Corvallis Laboratory.

## David Ambrose

**Clatsop Soil and Water Conservation District (SWCD)**

David Ambrose has worked with Clatsop SWCD for the past seven years as its project manager and technical resource. He has conceived and managed a variety of habitat restoration and water quality improvement projects for the District. Through his work with individual agricultural producers, landowners, and diking districts, he has gained an intimate knowledge of the functioning of the numerous dikes in Clatsop County. David has a Bachelor of Science degree in Mechanical Engineering and spent several years in designing and building agricultural machinery in the Third World.

## Robert Bilby

**Weyerhaeuser Co.**

Robert Bilby has conducted research on stream ecosystems, salmon, and the effects of forestry on both since 1975. He currently is the Chief Environmental Scientist for Weyerhaeuser Company and is responsible for coordinating company environmental research efforts. Prior to assuming his current position, Bilby managed the Environmental Forestry Research Program in Weyerhaeuser's Western Forestry Research Program. From 1998 through 2000, Bilby managed the Watershed Processes program

at the NMFS's NWFSC in Seattle. He is an affiliate faculty member at the University of Washington's School of Aquatic and Fisheries Science and College of Forest Resources. Bilby's research has included investigation of the role of large wood in streams and the impact of forestry on this material, response of stream trophic systems to disturbances, relationships between habitat characteristics and salmon productivity, and the contribution that spawning salmon make to the nutrient capital and productivity of streams. He received a B.S. in zoology from the University of Rhode Island and a Ph.D. in aquatic ecology from Cornell University. He is currently a member of the Independent Scientific Advisory Board.

## Amy Borde

**Pacific Northwest National Laboratory, Battelle Marine Sciences Laboratory**

Amy Borde is a senior scientist at the Pacific Northwest National Laboratory in Sequim, Washington, with over 10 years of experience in coastal ecology and restoration. Her research has included assessment, restoration, and monitoring of eelgrass meadows, tidal marshes, and tidal freshwater swamps. She also has led several large national-scale reviews on wetland functions and restoration-related issues for NOAA and EPA. In the Columbia River estuary she has been involved in multiple estuary-wide studies focused on tidal wetland habitats for BPA, the Corps, and the Estuary Partnership. These studies range in scope from planning and prioritizing restoration projects to monitoring the effectiveness of restoration actions. Currently, she is leading a study to evaluate conditions at a suite of reference sites representing all types of tidal wetland habitat of the Columbia floodplain below Bonneville Dam. Previous habitat evaluations include eelgrass assessments at various locations near the mouth, 23 tidal freshwater wetland sites throughout the estuary, and 4 restoration sites. She also is a primary contributor to the estuary restoration monitoring protocols for habitat restoration resulting from the 2000 NOAA BiOp on operation of the FCRPS.

## Dan Bottom

**National Marine Fisheries Service, Northwest Fisheries Science Center**

Dan Bottom joined NOAA Fisheries in 1999 to develop an estuarine research program for the NWFSC. Since that time, he has worked with other federal, state, and university researchers to design and implement studies of salmon habitat associations and life histories in the Columbia River estuary and of the effects of wetland restoration projects in Oregon's Salmon River estuary. Dan previously worked as a project leader for the Oregon Department of Fish and Wildlife (ODFW) for more than 20 years, conducting fisheries research in stream, estuarine, and ocean environments. From 1997 through 1999, he served as the ODFW's monitoring coordinator for the State's salmon restoration initiative (the Oregon Plan for Salmon and Watersheds). Dan received a B.A. in botany from Duke University in 1972, and his M.S. in Marine Studies from the College of Marine Studies, University of Delaware in 1975.

## Jeff Breckel

**Lower Columbia Fish Recovery Board**

Jeff Breckel serves as the Executive Director of the Lower Columbia Fish Recovery Board (LCFRB). State law established the 15-member Board in 1998 to provide local governments, tribes, and interested citizens with an active role in salmon and steelhead recovery efforts in the lower Columbia River region. The region encompasses all or portions of Clark, Cowlitz, Lewis, Skamania, and Wahkiakum counties. The Board is responsible for coordinating fish habitat restoration and preservation efforts, coordinating the development and implementation of a regional fish recovery plan, leading watershed planning activities, and promoting public understanding and participation in recovery efforts. From 1988 to 1998, Mr. Breckel served as the senior policy advisor to the Department of Ecology and the Governor's Office on issues related to nuclear waste management and disposal, Hanford cleanup activities, and commercial radioactive waste disposal. In this capacity, he served as the state liaison to such organizations as the National Governors' Association, the Western Governors' Association and the National Association of Attorneys General. Mr. Breckel was a member of the U.S. Department of Energy's Environmental Management Advisory Board and the EPA's National Advisory Committee on Federal Facility Environmental Restoration. He also served as the chair of the Northwest Low-Level Waste Interstate Compact. Mr. Breckel served as Executive Director of the Oregon and Washington Columbia River Gorge Commissions from 1978 to 1987. This bi-state program was responsible for overseeing the management and protection of the natural, scenic, and cultural resources of the Columbia Gorge. As Director, he oversaw the development and implementation of resource management plans by state and local governments and played a central role in the development of the Columbia River Gorge National Scenic Area Act. Mr. Breckel received a Bachelor of Business Administration degree from the University of Washington in 1972.

## Kevin Brice

**U.S. Army Corps of Engineers, Portland District**

Kevin Brice has been the Deputy District Engineer for Programs and Project Management in the Portland District since May 2007. In this position, Brice provides District leadership in establishing and maintaining processes to manage scope, quality, cost, budgets, and schedules of all District projects. He manages and directs all civil works programs management activities, including program and budget development, preparation for Congressional testimony, oversight of program execution and reprogramming actions. He is responsible for all civil works planning functions for the District, including plan formulation, economics, and environmental resources. Brice retired as a lieutenant colonel after 21 years of military service. While in the military, Brice had several assignments with the Corps of Engineers, including the Deputy District Commander for the Portland and Europe districts; Project Engineer and Field Inspector at the Elk Creek Resident Office in Portland District, and Chief of Dredging Operations in Portland District. He served the Corps during deployments to Operation Joint Endeavor in

Bosnia and to the Exxon Valdez Oil Spill in Alaska. Upon retiring from the military, Brice was a Building Code Enforcement Program Manager and Building Official in Washington County, Oregon, before returning to the Corps of Engineers as a civilian. Brice was the Chief of the Business Management Division at Northwestern Division before taking his current position with Portland District. Brice graduated from the University of Wisconsin-Platteville with a Bachelor of Science degree in civil engineering in 1978. He received his Master of Science degree in civil engineering from Oregon State University in 1987. Brice is a registered Professional Engineer in Wisconsin and Oregon and a member of the Society of American Military Engineers.

## Heida Diefenderfer

**Pacific Northwest National Laboratory, Battelle Marine Sciences Laboratory**

Heida Diefenderfer is a restoration ecologist with the Coastal Assessment and Restoration technical group at the U.S. Department of Energy's Pacific Northwest National Laboratory in Sequim, Washington. She has conducted research there since 2000, focusing on coastal restoration prioritization, planning, and assessment. During that time, she has contributed to design, implementation, and monitoring of eelgrass, marsh, and swamp restoration for the Columbia Land Trust, Corps of Engineers Portland District, Natural Resources Conservation Service, NOAA Restoration Center, Port of Astoria, and Washington State Department of Transportation. She also has led development of national coastal restoration planning documents for the Corps of Engineers Institute for Water Resources and the NOAA Coastal Services Center. In projects for the Corps and Bonneville Power Administration, Dr. Diefenderfer is a primary contributor to both restoration monitoring protocols and the monitoring and evaluation plan guiding assessment of estuarine salmon habitat restoration following the 2000 NOAA BiOp on operation of the FCRPS. Heida earned a Ph.D. from the University of Washington in 2007.

## Blaine Ebberts

**U.S. Army Corps of Engineers, Portland District**

Blaine Ebberts, after being discharged from the US Army in the late 1970s, spent three years working for Greenpeace during which he boarded a Russian whaling vessel in the North Pacific Ocean. Blaine spent three years at the National Marine Mammal Laboratory in Auke Bay, Alaska, where he was a research biologist. Blaine began working for the US Army Corps of Engineers in 1992 on fish passage issues at Columbia River hydroelectric facilities. Among other achievements, he led development of high flow outfalls for juvenile fish passage. Blaine has been technical lead of the estuary research program and working on ecosystem restoration projects since 2003. Blaine received a B.S. in Biology with an emphasis in marine biology from Oregon State University.

## Greg Fuhrer

**US Geological Survey, Oregon Water Science Center**

Biography not available.

## Jim Geiselman

**Bonneville Power Administration, Division of Fish and Wildlife**

Jim Geiselman leads the development and implementation of BPA strategies for Monitoring RM&E under the FCRPS BiOp and the Columbia Basin Fish and Wildlife Program. He also is the RM&E Committee Lead for the Federal Caucus and BPA's representative on the Steering Committee of the Pacific Northwest Aquatic Monitoring Partnership and the Planning Group of the Northwest Environmental Data-Network. Jim has worked at BPA for 23 years and his prior academic experience includes a BS degree in Water Resources Engineering and an MS degree in Bio-Resources Engineering, both from Oregon State University.

## Evan Haas

**Lower Columbia River Estuary Partnership**

Evan Haas is a Habitat Restoration Coordinator with the LCREP. In this role, he works on reviewing, implementing, and coordinating habitat restoration projects in the lower Columbia River and estuary. Evan previously worked for Herrera Environmental Consultants and in the Salmon Recovery Division at NOAA Fisheries, where he focused on salmon recovery planning efforts in the Willamette/Lower Columbia recovery domain. Evan holds M.P.A. and M.S.E.S. degrees from Indiana University, Bloomington, Indiana, and a B.A. in Biology from DePauw University, Greencastle, Indiana.

## Chris Hathaway

**Lower Columbia River Estuary Partnership**

Chris Hathaway has been with the LCREP since 1998 and is currently the Director of Stewardship and Technical Programs. He oversees the Estuary Partnership's education, volunteer, water trail, and stewardship activities as well as the Estuary Partnership's habitat restoration and monitoring programs. During his time with the Estuary Partnership, he has served in a variety of different roles working primarily on the stewardship side of the organization. Chris has a Master's degree in Water Resources Management from the University of Wisconsin-Madison, and degrees in English and Political Science

from the University of Oregon. He grew up in Portland, Oregon, and spent many days in his youth water skiing, swimming, and sailing on the lower Columbia River.

## David Jay

**Associate Professor, Portland State University, Department of Civil and Environmental Engineering**

David Jay conducts research in the Colombia and other river estuary and coastal systems, focusing on physical processes, human impacts, and climate change. He has been involved in every major ecosystem study of the Columbia estuary since 1976. He has observed and modeled the tides, estuarine circulation, salinity intrusion, turbidity maximum processes, and human alterations of the Columbia estuary, and described Columbia River plume circulation and mixing processes. His modeling of Columbia river estuary shallow water habitat has played a major role in defining estuarine restoration for the system. Dr. Jay has a PhD in Physical Oceanography from the University of Washington and an MS in Marine Environmental Studies from Stony Brook University.

## Gary Johnson

**Pacific Northwest National Laboratory**

Gary Johnson is a Research Scientist with the Marine Sciences Laboratory (MSL) in Sequim, Washington. The MSL is part of the Pacific Northwest National Laboratory, operated by Battelle under contract to the U.S. Department of Energy. Gary received a B.A. in Mathematics/Marine Biology from the University of California at Berkeley in 1976 and a M.S. in Biological Oceanography from Oregon State University in 1981. His research interests include data and program integration in the Columbia River estuary and juvenile salmonid passage at surface flow outlets.

## Krista Jones

**Lower Columbia River Estuary Partnership**

Krista Jones is the Monitoring Coordinator for the LCREP. She works with local, state, and federal agencies to coordinate and implement the Estuary Partnership's Ecosystem Monitoring Project. Before joining the Estuary Partnership, Krista worked with the research group, Eco-metrics, Inc., where she investigated floodplain hydrology patterns and prepared a "river vision" document for the Confederated Tribes of the Umatilla Indian Reservation outlining river management needs for sustaining tribal food resources. Krista also ran a project for the State of Georgia Legislature that quantified the impacts of the reduced riparian buffer widths on trout populations. Krista has Bachelor's and Master's degrees in Ecology. She received her Master's degree in stream ecology from the University of Georgia in 2002.

## Glenn Lamb

**Columbia Land Trust**

Glenn Lamb has been active with Columbia Land Trust since its founding in 1990, serving at various times as President, Vice-President, and Secretary, and since 1999 as Executive Director. Glenn is inspired by the many private landowners throughout the northwest that have worked with land trusts to place their land in conservation, and believes that we all have much to learn by listening to the challenges and opportunities facing private landowners. Glenn graduated from the University of Rochester, New York, with degrees in Natural Resource Management and Sociology, and has a Master's degree in urban planning from the University of Oregon. Glenn has previously worked for county and city parks departments. He has served on the board of the national Land Trust Alliance, Washington State Parks Foundation, the LCREP, the Chinook Trail Association, the Vancouver Rotary Club, and Habitat Partners, and he volunteers in the Big Brother Big Sister program (has been with little brother Mitchell for 9 years!). Glenn is married to Sue Knight, and together they enjoy running, skiing, hiking, and traveling around the great Northwest.

## Debrah Marriott

**Lower Columbia River Estuary Partnership**

Debrah Marriott is Executive Director of the LCREP, a position she has held since the program was initiated in 1995. Using a collaborative process of local individuals and key stakeholders, the Estuary Partnership developed the first two-state comprehensive management plan for the lower 146 rivers miles of the Columbia. She integrated a comparative risk analytical process for decision-making in the national estuary program to expand integration science and policy. The Estuary Partnership is now implementing the plan focused on restoring habitat, reducing toxic and conventional pollution, and providing applied outdoor learning programs to young students. Debrah previously served with the Maine Department of Environmental Protection (MeDEP), serving as the Director of the Bureau of Land Quality, then Deputy Commissioner, and concluded her tenure as Acting Commissioner. Among her major projects were supervising the Casco Bay Estuary Program and chairing its Management Committee; assisting in the Maine Environmental Priorities Project, a comparative risk assessment effort; chairing the Governor's Task Force that re-worked the state's development siting law; and overseeing development of the state's vehicle emission testing program. She used the state's first regulatory negotiation process in a rule-making effort and participated in shifting the agency from strictly command and controls to include pollution prevention and environmental outcomes with a focus on continuous improvement of processes and responsive customer service. Prior to her appointment at the MeDEP, Debrah served as Planning and Community Development Director for the City of Lewiston, Maine. During her tenure, she managed the development of a Comprehensive Land Use Plan and Unified Development Ordinance. Debrah holds degrees in Geography from the University of Oregon and the University of Maine. She completed work

in the MIT-Harvard Program in Dispute Resolution. She is a member of the American Institute of Certified Planners.

## Michael Ott

**U.S. Army Corps of Engineers, Portland District**

Michael Ott is currently a hydraulic engineer with the US Army Corps of Engineers, Portland District. He has worked on a wide range of projects ranging from sediment transport below Mount Saint Helens to ecosystem restoration in the Columbia River estuary. Most of his work has focused on ecosystem restoration near levees that require several limitations to restoration activities. Michael incorporates a multi-disciplinary approach to restoration applying a variety of methods such as GIS, theoretical hydrology and hydraulics, as well as empirical data results. Michael's education is in Civil Engineering from Portland State University.

## Doug Putman

**U.S. Army Corps of Engineers, Portland District**

Doug Putman is currently the program manager for the U.S. Army Corps of Engineers' Lower Columbia River Ecosystem Restoration Program, manages an on-going Lower Columbia River Ecosystem Restoration General Investigation Study, and is the project manager of several restoration projects in the Lower Columbia River as well as several ecosystem projects in other regions. Projects include riparian restoration at the Sandy River Delta, Crims Island tidal connection and revegetation project, and an upcoming construction tide gate retrofit and tidal reconnection project at the Julia Butler Hanson Columbia White Tailed Deer National Wildlife Refuge. Doug is also the project manager for several Columbia River Fish Mitigation research project in the Lower Columbia River. He received a Bachelors of Science Degree in Civil Engineering in 1984 and a Master's of Science Degree in Civil Engineering in 1985 from Oregon State University.

## Curtis Roegner

**Northwest Fisheries Science Center, NOAA Fisheries**

Curtis Roegner is a biological oceanographer interested in the structure and functioning of marine and estuarine ecosystems. His active research program focuses on juvenile salmon ecology, estuarine hydrology, larval recruitment and the ecology of benthic invertebrates, and the restoration of estuarine and tidal freshwater habitats. Longstanding interests include benthic-pelagic coupling by bivalve molluscs, estuarine-ocean exchange of phytoplankton and invertebrate larvae, and the influence of hydrodynamic processes on the growth and distribution of organisms. Curtis has been a Research

Fisheries Scientist with NOAA Fisheries since 2001. Prior to that, he worked in Research Associate positions at the University of Washington (1999-2001) and the Oregon Institute of Marine Science, University of Oregon (1996-1999). He has a MS in Marine Science from the College of William and Mary (1990), and a PhD in Oceanography from Dalhousie University in Canada (1996).

## Jim Ruff

**NW Power and Conservation Council**

Jim Ruff re-joined the Council staff in March 2006 as the Manager for Mainstem Passage and River Operations. He is responsible for strategic development and monitoring implementation of mainstem fish passage, estuary, water quality, predation, and climate change measures in the Council's Columbia River Basin Fish and Wildlife Program. He also analyzes the potential impacts and costs of major power system operations and proposed operational actions and changes on salmon, steelhead, and resident fish. From 1999 to 2006, Jim was Chief of the FCRPS Branch in the Hydropower Program at NMFS. His branch was responsible for all salmon passage, flow and spill operations, juvenile fish transportation, survival, water quality, and related RM&E issues associated with the 14 major mainstem federal hydroelectric projects of the Columbia and Snake river system, including review of related activities under the ESA. The branch also provided biological and engineering expertise for review and approval of fish passage facility designs and operations at the FCRPS dams, including coordination of operations at those projects with related Canadian and non-federal hydropower projects. Prior to working at NMFS, Jim was a senior hydrologist for 15 years with the Northwest Power Planning Council in the Fish and Wildlife Division. Before that, Jim was a planning engineer for the Oregon Water Resources Department responsible for supervising development of river basin water use policies, plans, and hydrologic studies. He began his career as a water quality planner and environmental engineer for the Wisconsin Department of Natural Resources conducting policy and technical water quality studies for the state's water quality management program. Jim has a Master of Science degree in Water Resources Management from the University of Wisconsin in Madison and a BS in engineering from Georgia Institute of Technology in Atlanta. He has been a registered Professional Hydrologist with the American Institute of Hydrology since 1989 and is a member of the American Water Resources Association.

## Micah Russell

**Columbia River Estuary Study Taskforce**

Micah Russell began with CREST as their Biologist/Ecologist, and has now taken the position of Director in his second year. While with CREST he has overseen and contributed to a variety of project types throughout the Columbia River estuary, serving multiple jurisdictions. These project have involved habitat restoration, invasive species mapping/treatment, restoration effectiveness monitoring, environmental planning, and community natural resource policy. Prior to joining CREST, Micah worked for a variety of entities in Hawaii and Oregon in conservation biology, natural resource planning, and

science education. Micah has a Bachelor's degree in Environmental Biology from Pacific University (Forest Grove, Oregon, 2002) and a Master's degree in Oceanography and Coastal Science from Louisiana State University (Baton Rouge, LA, 2005).

## Donna Silverberg

**DS Consulting**

Donna Silverberg, owner and principal of DS Consulting, has been in the field of mediation, facilitation, and consensus building involving local, state, federal and tribal governments, non-profit organizations, businesses, and the public since 1988. Her work has covered a wide range of issues: endangered species, health care, water resource/quality, human resources, including non-profit planning and management, public health, land-use, and cross cultural. She has facilitated numerous discussions about the Columbia River including LCREP's Science to Policy Workshop and Toxics Summit and the Columbia River Regional Forum. She is a member of the California State Bar, the Association for Conflict Resolution, the US Institute for Environmental Conflict Resolution's Roster of Mediators, and she served on the Oregon Mediation Association board from 1998-2005, three years as President. She served as Governor Kitzhaber's Special Assistant on Dispute Resolution for Natural Resource issues, Acting Director of the Oregon Dispute Resolution Commission (ODRC) and Manager of the ODRC's Public Policy Dispute Resolution Program. She started DS Consulting in 1998.

## Charles "Si" Simenstad

**University of Washington, Wetland Ecosystem Team**

Si Simenstad is a Research Professor and Coordinator of the Wetland Ecosystem Team in the School of Aquatic and Fishery Sciences, at the University of Washington. He holds B.S. (1969) and M.S. (1971) degrees from the School of Fisheries at the University of Washington. As an estuarine and coastal marine ecologist, Si has studied ecosystems throughout the Pacific Northwest and Alaska for over 30 years. Much of this research has focused on the functional role of estuarine and coastal habitats to support juvenile Pacific salmon and other fish and wildlife, and the associated ecological interactions that are responsible for enhancing their production and life-history diversity. He led the National Science Foundation-supported Columbia River Estuarine Turbidity Maxima/Land-Margin Ecosystem Research program. Si's recent research has integrated ecosystem interactions with applied issues such as restoration, creation, and enhancement of estuarine and coastal wetland ecosystems, and ecological approaches to evaluating the success of coastal wetland restoration at ecosystem and landscape scales in the Columbia River estuary and elsewhere.

## Ian Sinks

**Columbia Land Trust**

Ian Sinks has been with Columbia Land Trust since 1998, first as a volunteer and board member and as a staff member since 2000. The Columbia Land Trust is a private, non-profit organization dedicated to working with willing landowners to conserve important habitats and landscapes within the lower Columbia River region. To date, the land trust has conserved over 7,000 acres in both Oregon and Washington. As Conservation Director for the Land Trust, Ian is responsible for both land acquisition and stewardship of conserved lands. One of his focus areas has been working with partners and community members to protect and restore intertidal habitats within the Columbia River estuary.

## Robert Stockhouse II

**Pacific University, Department of Biology**

Robert Stockhouse is a biology professor interested in wetland monitoring and restoration, riparian restoration, ecology, and research methodology in organismal and environmental biology. His recent courses covered these subjects as well as plant systematics and general botany. Concurrent with teaching Biology at Pacific University, he has monitored various sites in Oregon with students. Some highlights include monitoring hydrology, invertebrate populations, vascular plant transects, herbaceous cover, woody cover, woody debris, bird census data, amphibian and reptile populations, and panoramic photographic stations at the Claremont Mitigated Wetland, Hillsboro Landfill, and the Fernhill Wetlands Mitigation Bank. He has a BS in Botany (1969) and a Ph.D. in Plant Systematics (1973) from Colorado University.

## Cathy Tortorici

**National Marine Fisheries Service**

Cathy Tortorici has worked for the Federal Government (EPA) and NOAA Fisheries (NMFS) for over 17 years. While at EPA, she worked as the Missouri River Coordinator on water resource/Big River issues, and held a number of different positions within EPA Region VII including Total Maximum Daily Load Coordinator and Wetlands Enforcement Coordinator. Now with NMFS, Cathy is the Branch Chief of the Oregon Coast/Lower Columbia River Branch. The Branch addresses restoration, regulatory, research, and monitoring activities of coastal systems at the local and regional scale. Cathy has Bachelor's and Master's degrees in Biology. She received her Master's degree in entomology from the University of Kansas in 1985.

## Allan Whiting

**PC Trask and Associates, Inc.**

Allan Whiting is Senior Ecosystem Planner with PC Trask and Associates, Inc. He possesses a wide range of natural resource planning and management expertise with a particular emphasis on ecosystem restoration. His recent experience includes working closely with local jurisdictions and organizations in the development and implementation of over a dozen estuarine restoration projects in the Columbia River estuary. In addition, Allan has led a number of effectiveness monitoring activities to track the ecological changes of restoration projects over time. Allan is also skilled at flood hazard mitigation and wetland planning, including wetland functional assessments, delineations, and compensatory mitigation. Allan has a Master's degree in Community and Regional Planning with an emphasis on watershed planning from the University of Oregon.

# Appendix B

# Conference Posters

# Appendix B

# Conference Posters

| Lead Author | Subject |
|---|---|
| Brenneis, Val | Distribution of Invasive New Zealand Mudsnail in the Lower Columbia River |
| Johnson, Amber | Habitat Appraisal and Barter Approach |
| Johnson, Gary | Research, Monitoring and Evaluation for the Federal Columbia River Estuary Program |
| Jones, Krista | The Lower Columbia River Estuary Partnership Ecosystem Monitoring Program |
| Judd, Chaeli | Innovative Techniques in Restoration |
| Lilly, Lori | CREST Restoration Project Overview |
| Marcoe, Keith | Addressing Bathymetric Data Gaps in the Columbia River Estuary |
| Morace, Jennifer | Contaminant Sampling 2004-05 for Salmon and Water |
| Needoba, Joe | Towards an in Situ Biogeochemical Observation Network for the Columbia River Estuary |
| Nilsen, Elena | Pharmaceuticals and Personal Care Products as Toxics |
| Simenstad, Si | Columbia River Estuary Ecosystem Classification |
| Sobocinski, Kathryn | Ecosystem Monitoring: Tidal Freshwater Emergent Vegetation |
| Wallace, Sarah | Developing a Pile Structure Removal Program for the Lower Columbia River Estuary (LCRE) |
| Weitkamp, Laurie | Sampling Juvenile Salmon in the Lower Columbia River Estuary: A Critical Link Between Freshwater and Marine Environments |

# Appendix C

# Conference Attendees

# Appendix C

# Conference Attendees

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