

U.S. Fish and Wildlife Service

Fisheries Collaboration with National Wildlife Refuges

FY2011-FY2012 Progress Report



S.C. Lohr, M.L. Koski, and T.A. Whitesel

**U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office
Vancouver, WA 98683**

On the cover: Cutthroat trout collected in Guano Creek, Hart Mountain National Antelope Refuge. (Photo: B. Willis.)

The correct citation for this report is:

Lohr, S.C., M.L. Koski, and T.A. Whitesel. 2014. Fisheries Collaboration with National Wildlife Refuges, FY2011-FY2012 Progress Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA. 167 pp.

FISHERIES COLLABORATION WITH NATIONAL
WILDLIFE REFUGES
FY2011-FY2012 PROGRESS REPORT

Study funded by

U.S. Fish and Wildlife Service
Fisheries Operating Needs System
A-206, A-226, A-234, A-270

and authored by

S.C. Lohr
M.L. Koski
T.A. Whitesel

U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office
1211 SE Cardinal Court, Suite 100
Vancouver, WA 98683

Final
October, 2014

Disclaimers

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

The mention of trade names or commercial products in this report does not constitute endorsement or recommendation for use by the federal government.

FISHERIES COLLABORATION WITH NATIONAL WILDLIFE REFUGES FY2011-FY2012 PROGRESS REPORT

S.C. Lohr, M.L. Koski, and T.A. Whitesel

*U.S. Fish and Wildlife Service
Columbia River Fishery Program Office
1211 SE Cardinal Court, Suite 100
Vancouver, WA 98683*

Executive Summary – The missions of National Wildlife Refuges (NWRs) and the Columbia River Fisheries Program Office (CRFPO) share several complementary elements concerning aquatic species and habitats. The goal for CRFPO activities with NWRs in FY2011 and FY2012 was to conduct cooperative work in an efficient and effective manner to conserve aquatic resources. Objectives were to: 1) Provide a forum to promote effective information exchange and coordination among NWRs, CRFPO, Fisheries, and other Service programs; 2) Assist in the development of Comprehensive Conservation Plans (CCPs) for various NWRs; 3) Conduct field-based activities contributing to conservation of aquatic resources at NWRs; and 4) Provide non-field-based technical assistance on aquatic resources for NWRs. For Objective 1, the CRFPO organized and hosted workshops that were attended by 39 individuals in FY2011 and 40 in FY2012, 7 and 6 NWRs in each year, respectively, and 4 U.S. Fish and Wildlife Service programs in each year. Notes and actions items were developed for each workshop. For Objective 2, the CRFPO conducted various CCP development activities for six NWRs in FY2011 and five NWRs in FY2012. For Objective 3, three projects consisting of field-based activities contributing to conservation of aquatic resources at NWRs were conducted during FY2011 and FY2012. These were: Restoration monitoring at Bandon Marsh NWR; Post-construction assessment of fishes, habitats, and tide gates in sloughs on the mainland of Julia Butler Hansen NWR; and Fish and aquatic habitat surveys at the Sheldon-Hart Mountain NWR Complex. For Objective 4, the CRFPO provided non-field-based technical assistance consisting of long-term activities (e.g., assessment of aquatic habitat restoration concepts at NWRs, which spanned FY2011 and FY2012) and short-term activities (e.g., reviews of literature and regulatory documents, which typically concluded in a matter of days or less).

Page intentionally left blank

Table of Contents

List of Tables	iv
List of Figures	iv
Introduction.....	1
Relationship to the Fisheries Program Strategic Plan	3
Approach.....	4
Objective 1: Provide a forum to promote effective information exchange and coordination among NWRs, CRFPO, Fisheries, and other Service programs.....	5
Objective 2: Assist in the development of CCPs	5
Objective 3: Conduct field-based activities contributing to conservation of aquatic resources at NWRs	5
Objective 4: Provide non-field-based technical assistance on aquatic resources for NWRs	5
Products.....	6
Objective 1: Provide a forum to promote effective information exchange and coordination among NWRs, CRFPO, Fisheries, and other Service programs.....	6
Objective 2: Assist in the development of CCPs	7
Objective 3: Conduct field-based activities contributing to conservation of aquatic resources at NWRs	10
Restoration monitoring at Bandon Marsh NWR	10
Post-construction assessment of fishes, habitats, and tide gates in sloughs on the mainland of Julia Butler Hansen NWR	11
Fish and aquatic habitat surveys at the Sheldon-Hart Mountain NWR Complex	13
Objective 4: Provide non-field-based technical assistance on aquatic resources for NWRs ...	14
Long-term activities.....	14
Short-term activities	14
Conclusions.....	15
Acknowledgements.....	16
Literature Cited	17
APPENDIX A: 2011 NWR-FISHERIES WORKSHOP AGENDA, NOTES, ATTENDEES, ACTION ITEMS, AND PRESENTATIONS.....	19
APPENDIX B: 2012 NWR-FISHERIES WORKSHOP AGENDA, NOTES, ATTENDEES, ACTION ITEMS, AND PRESENTATIONS.....	88

List of Tables

Table 1. Number of individuals by USFWS program and office that participated in annual workshops during 2011 and 2012.....6

Table 2. NWR and summary of tasks conducted by the CRFPO for development of CCPs during FY2011 and FY2012 (year of task).....9

List of Figures

Figure 1. Locations of National Wildlife Refuges in Idaho, Oregon, and Washington within the general geographic area of responsibility of the CRFPO (green circles) and outside the general area of responsibility (blue circles).....8

Figure 2. Examples of fish species found at Bandon Marsh NWR, juvenile coho salmon (left) and coastal cutthroat trout (right). (Photo by M. Hudson).....11

Figure 3. Examples steel top-hinged tide gates (left) and aluminum side-hinged tide gate with self-restraining assembly to hold door fully open (right). (Photo by J. Johnson).....12

Figure 4. Examples of aquatic habitat in the lower open valley portion (left) and canyon portion (right) of the Virgin Creek watershed at Sheldon NWR. (Photo by B. Willis and S. Lohr).....13

Introduction

The U.S. Fish and Wildlife Service (USFWS) is increasing interaction and collaboration among its programs, which is reflected in various plans. For instance, the Pacific Region Fisheries Program Strategic Plan supports cross-program collaboration to provide varied expertise for aquatic habitat conservation and management issues (USFWS 2008; see Regional Objectives 2.1-2.4 relative to cross-program collaboration), and the National Wildlife Refuge (NWR) System has committed to working with programs throughout the USFWS and other conservation partners to achieve shared conservation goals (USFWS 2011). Capitalizing on diverse expertise and achieving shared conservation goals among programs, including associated field stations and other partners, ultimately improves efficiency of the USFWS, potentially allowing the USFWS to expand conservation delivery.

The Columbia River Fisheries Program Office (CRFPO) has a history of working with NWRs on aquatic resource issues, primarily within its geographic area of responsibility (i.e., the Columbia River basin below McNary Dam, waters in Oregon excluding the Klamath River basin, and small tributaries of Willapa NWR; see Figure 1). This work history has contributed to the missions of both the CRFPO and NWRs. The mission of the CRFPO is to:

- Assist in the status review of imperiled natural stocks;
- Evaluate management measures for recovery;
- Assist in recovery efforts for imperiled stocks; and
- Work to prevent the need for future listings under the Endangered Species Act (ESA).

The mission of the NWR system is: “To administer a network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” The mission, as well as administrative processes and guidance for determining management direction of NWRs, was included in the National Wildlife Refuge System Improvement Act of 1997, which amended earlier legislation. The legislation mandated that wildlife and wildlife conservation must come first in administering the system. Several policies and Director’s Orders have been developed to assist in complying with the provisions of the legislation.

In applying NWR policies and orders, overall management direction and specific activities on each NWR, or individual management units of a NWR, are determined by several factors. The foremost factor is that management achieves the purposes for which a NWR or unit was established, and in so doing, contributes to fulfilling the NWR System mission. Implicit within fulfilling the NWR System mission is the maintenance and, where appropriate, restoration of biological integrity, diversity, and environmental health of NWRs, as well as management of legislatively mandated trust species. Trust species include migratory birds, inter-jurisdiction fish, some marine mammals, and species listed under the federal ESA. The relations among NWR purpose, NWR System mission, directives, and how legislative mandates influence

management goals, objectives, and strategies are described in Comprehensive Conservation Plans (CCPs) developed for each NWR.

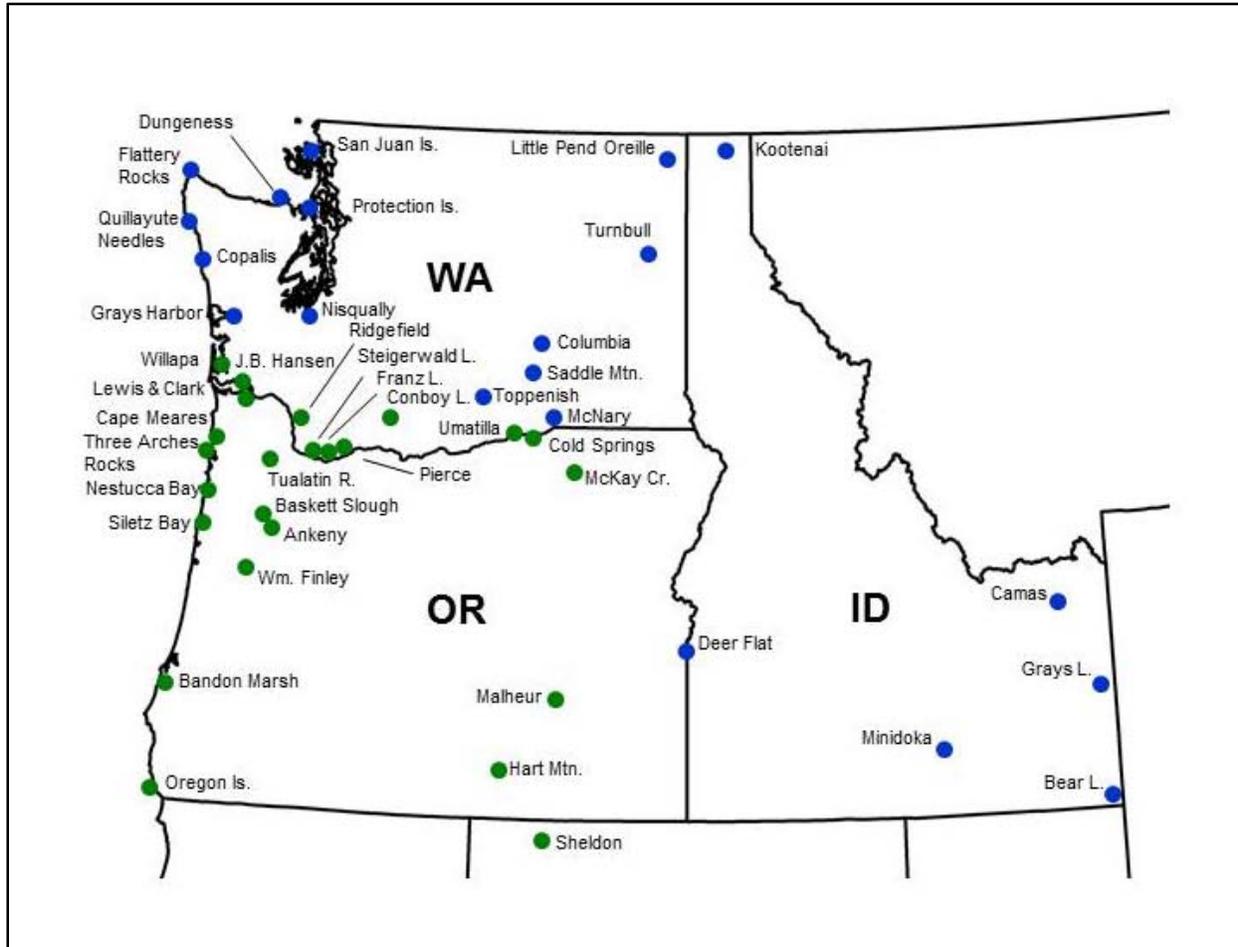


Figure 1. Locations of National Wildlife Refuges in Idaho, Oregon, and Washington within the general geographic area of responsibility of the CRFPO (green circles) and outside the general area of responsibility (blue circles).

The missions of NWRs and the CRFPO share several complementary elements. These concern aquatic species and habitats that may be subject to the purposes for which a NWR was established as well as the maintenance and potential restoration of biological integrity, diversity, and environmental health. Thus, the CRFPO and NWRs have sought to promote effective information exchange between programs, as well as other USFWS programs, to increase opportunities for collaborative work. This Annual Report describes the CRFPO collaborative activities with NWRs during FY2011 and FY2012. The goal of the activities was to conduct cooperative work with NWRs and other Service programs to conserve aquatic resources. Objectives were to: 1) Provide a forum to promote effective information exchange and

coordination among NWRs, CRFPO, Fisheries, and other Service programs; 2) Assist in the development of Comprehensive Conservation Plans; 3) Conduct field-based activities contributing to conservation of aquatic resources at NWRs; and 4) Provide non-field-based technical assistance on aquatic resources for NWRs.

Relationship to the Fisheries Program Strategic Plan

Implementation of this project demonstrates application of the Pacific Region's 2009-2013 Fisheries Program Strategic Plan. The following National goals (NG) and Regional objectives (RO) have been addressed by this project during FY2011 and FY2012, and brief descriptions from the CRFPO perspective and examples (in parentheses) are provided.

NG1 Open, interactive communication between the Fisheries Program and its partners.

RO1.1 Develop and maintain relationships with partners throughout the Pacific Region.

- Project encouraged collaborative partnerships with NWRs in Region 1 and maintained partnerships with NWRs individually (e.g., for specific projects or issues) and collectively (e.g., 2011 and 2012 workshops).

RO1.2 Implement a means of providing feedback to ensure the long-term success of partnerships.

- Feedback was encouraged through annual workshops where topics varied based on a variety of ongoing or recent activities and feedback (e.g., 2011 and 2012 workshops).

RO1.3 Improve data collection and management and internal and external reporting to reduce redundancy and improve access and usefulness for ourselves and our partners.

- Fisheries technical assistance and data are often identified as aquatic resource needs of NWRs. Data, assessments, and recommendations were provided to NWRs to the extent possible (e.g., Sheldon-Hart Mountain aquatic survey).

NG2 America's streams, lakes, estuaries, and wetlands are functional ecosystems that support self-sustaining communities of fish and other aquatic resources.

RO2.3 Coordinate with Service NWRs and NFHs to identify and implement opportunities for increasing the quantity and improving the quality of aquatic and riparian habitat.

- Assisted in evaluating conceptual plans to restore aquatic habitat on NWRs, made recommendations on improvements to project, and assisted with developing environmental compliance documents (e.g., review of BPA/COE actions on NWRs in lower Columbia River; Post Office Lake draft EA).

- RO2.4 Expand opportunities to connect people with nature, engage citizen scientists and volunteers, and temporarily employ youth in the aquatic habitat conservation and monitoring programs and activities we lead or support.
- Employed two college students on field crew to conduct aquatic surveys (e.g., Sheldon-Hart Mountain aquatic survey).
- NG3 Self-sustaining populations of native fish and other aquatic resources that maintain species diversity, provide recreational opportunities for the American public, and meet the needs of tribal communities.
- RO3.1 Collaborate with Ecological Services (ES) Program, National Oceanographic and Atmospheric Administration Fisheries (NOAA Fisheries) and others, to recover fish and other aquatic resource populations protected under the ESA.
- Participated on multi-agency technical teams to provide technical assistance in developing long-term management plans for NWRs where listed species occur (e.g., extended teams for CCPs).
- RO3.2 Maintain healthy, diverse, self-sustaining populations of fish and other aquatic resources
- Participated on multi-agency technical teams to provide technical assistance in developing long-term management plans for NWRs (e.g., extended teams for CCPs at Malheur, Tualatin, and Oregon Coast NWRs).

Approach

To promote effective information exchange, NWRs and the CRFPO held an initial workshop in 2005 that informed the CRFPO of aquatic resource issues and needs at NWRs, informed NWRs about fisheries expertise at the CRFPO and results of ongoing work, and explored possibilities for cooperative efforts. Outcomes of the workshop (USFWS 2005) were identification of contacts for issues concerning CRFPO work with NWRs (i.e., at CRFPO, Regional Office—Fisheries, NWR—Supervisor, NWR—Branch of Biology), and commitments from the CRFPO to assist with development of CCPs, work with NWRs to determine fisheries needs, and jointly pursue funding (e.g., proposals submitted for Cross Program Recovery (CPR) funds, entered into the Fishery Operational Needs System (FONS)) for needs that cannot be addressed with existing resources.

The initial workshop and its outcomes established an overall approach to address the goal of conducting cooperative work with NWRs to conserve aquatic resources and associated objectives of this project, which, in addition, has encouraged direct communication between the CRFPO and individual NWRs.

Objective 1: Provide a forum to promote effective information exchange and coordination among NWRs, CRFPO, Fisheries, and other Service programs

With the exception of 2006, workshops have been held annually since 2005 (see USFWS 2007; 2008, 2009a, 2009b; Lohr et al. 2012b). A central focus of the workshops has been to provide a forum to discuss aquatic resource issues and needs at NWRs as well as present results of ongoing fisheries work. The workshops also provide opportunities to consider various topics (e.g., regional and national initiatives, resource assessments by other agencies or universities) and engage additional USFWS programs. Extensive notes summarizing presentations and discussion are taken, and action items are generated at or after workshops to address aquatic resource needs and initiatives. Workshops are scheduled in the spring to reduce conflicts with the typical field season, and topics often are at the request or suggestion of participants.

Objective 2: Assist in the development of CCPs

The CRFPO has contributed to the development of CCPs for all NWRs that have requested Fisheries assistance. Most often, CRFPO personnel have conducted various tasks as a member on an extended planning team. These tasks include: Literature search and review to provide technical information pertinent to aquatic resources, issues and species; Assistance in the crafting of objectives, habitat attributes, management strategies, and rationale; Technical review of drafts; and Participation in team meetings and briefings.

Objective 3: Conduct field-based activities contributing to conservation of aquatic resources at NWRs

At the 2005 workshop, the CRFPO committed to work with NWRs in determining fisheries needs and likely actions necessary to address them. Overall, past experiences have found that most fishery needs and associated actions can be placed in one of three categories: 1) Requiring expertise beyond that at the CRFPO or outside its purview, for which suggestions on accessing appropriate expertise may be made; 2) Requiring extensive field-based activities; and 3) Requiring technical assistance without field-based activities (see Objective 4, below).

Examples of field-based activities contributing to conservation of aquatic resources include assessments of habitat restoration actions on targeted habitat attributes and aquatic species, and also relatively broad-scale inventories for the presence and distribution of aquatic habitats and species. Because the costs of conducting such activities typically exceed existing resources of NWRs and the CRFPO, funding is pursued internally (e.g., through CPR, FONS, Inventory & Monitoring Initiative) and externally (e.g., U.S. Army Corps of Engineers).

Objective 4: Provide non-field-based technical assistance on aquatic resources for NWRs

Non-field-based technical assistance includes a suite of activities such as providing information concerning aquatic resources, reviewing permitting or other documents, and participating on technical advisory groups. Because these activities do not incur the costs typically required for extensive field work, the CRFPO attempts to fulfill these needs to the greatest extent possible with existing personnel and funds.

Products

Activities and associated products for addressing each of the four project objectives during FY2011 and FY2012 are discussed below.

Objective 1: Provide a forum to promote effective information exchange and coordination among NWRs, CRFPO, Fisheries, and other Service programs

The CRFPO organized and hosted workshops on May 5, 2011 and May 2, 2012. During FY2011 and FY2012, a total of 39 and 40 individuals, respectively, participated in the workshops, which included 4 USFWS programs (Table 1). For the Fisheries Program, representatives from each Fishery Resource Office (i.e., CRFPO, Idaho, Mid-Columbia, and Western Washington), Abernathy Fish Technology Center, and Regional Office attended. For the Refuge Program, representatives from seven NWR units attended in FY2011 and six NWR units in FY2012, in addition to the Regional Office, which included the Regional Supervisor, Branch of Biology, and I&M Initiative. Ecological Services and Water Resources also were represented during both years.

Table 2. Number of individuals by USFWS program and office that participated in annual workshops during 2011 and 2012.

Program/office	Year	
	2011	2012
Fisheries		
CRFPO	11	12
Fishery Resource Office/Fish Technology Center	4	5
Regional Office	1	5
Refuges		
NWRs	13 (7) ¹	11 (6) ¹
Regional Office	5	3
Ecological Services	3 ²	3 ²
Water Resources	1	1
Public³	1	0
Total individuals	39	40

¹ Number of NWR units represented in parentheses (NWR complexes were considered a single unit).

² Included an individual in a joint Ecological Services-Fisheries position.

³ An interested private citizen was invited.

The agenda, notes, list of attendees, actions items, and presentations made by USFWS personnel have been compiled for each workshop (see Appendix A and Appendix B for FY2011 and FY2012, respectively). The goal and objectives for each workshop are presented here.

2011 Workshop Summary

Goal—Provide a forum to promote effective information exchange and coordination among NWRs, CRFPO, PFW, Fisheries, and other Service programs.

Objectives—

1. Update NWRs about results and activities by the CRFPO and other Fisheries Offices to address aquatic resource issues and needs.
2. Identify and discuss aquatic resource issues and needs at NWRs and updates on management planning.
3. Provide information on status and results of programs and activities of regional or broader interest.
4. Present Fisheries Project Leaders' initiative to develop long-term aquatic monitoring program at NWRs.
5. Explore additional possibilities for cooperative efforts among NWRs, Fisheries, PFW, and others.
6. Develop action items.

2012 Workshop Summary

Goal—Provide a forum to promote effective information exchange and coordination among NWRs, Fisheries, PFW, and other Service programs.

Objectives—

1. Update NWRs about results and activities by Fisheries to address aquatic resource issues and needs.
2. Identify and discuss aquatic resource issues and needs at NWRs and updates on activities.
3. Provide information on status and results of programs and activities of regional or broader interest.
4. Explore additional possibilities for cooperative efforts among NWRs, Fisheries, PFW, and others.
5. Develop action items.

Objective 2: Assist in the development of CCPs

The USFWS Division of Refuges has developed a systematic approach for the comprehensive conservation planning process (USFWS Manual 602 FW 3), including preplanning, adoption of a final plan, implementation, and plan review and revision. Because time necessary to produce a final CCP may be several years, the CRFPO assisted with various tasks for CCPs at various

stages of development (i.e., ranging from preparation for preplanning to review of public drafts) during FY2011 and FY2012. Work by the CRFPO related to CCP development was conducted for six NWRs in FY2011 and five NWRs in FY2012 (Table 2).

Table 2. NWR and summary of tasks conducted by the CRFPO for development of CCPs during FY2011 and FY2012 (year of task).

NWR	Tasks
Columbia NWR	Reviewed and commented on draft CCP relative to aquatic resources and Crab Creek; coordinated review with staff at Mid-Columbia FRO (FY2011).
Hart Mountain NAR	Initiated literature review for upcoming biological and management review in preparation for CCP (FY2012).
Malheur NWR	<p>Reviewed and commented on preliminary alternatives, goals, objectives, strategies, and rationale; crafted description of desirable habitat attributes for redband trout; provided supporting technical literature (FY2011).</p> <p>Reviewed and commented on alternatives, goals, objectives, strategies, and rationale; attended briefing on administrative draft; crafted text describing approach for incorporating river habitat restoration into CCP; provided additional technical literature and review (FY2011).</p> <p>Reviewed and assisted in revision of alternatives, goals, objectives, strategies, and rationale (FY2011).</p> <p>Reviewed and commented on administrative draft (FY2011).</p> <p>Reviewed public draft (FY2012).</p>
Oregon Coast NWR	<p>Provided information and technical literature concerning status and life-histories of salmonids pertinent to the Oregon Coast (FY2011).</p> <p>Attended briefing on administrative draft; provided comments (FY2012).</p> <p>Provided text and comments concerning Chapter 4 Biological Environment (FY2012).</p> <p>Reviewed public draft (FY2012).</p>

Table 2. Continued.

NWR	Tasks
Sheldon NWR	Reviewed public draft (FY2012).
Tualatin NWR	Reviewed and commented on preliminary alternatives, goals, objectives, strategies, and rationale; provided technical literature concerning fish distribution and aquatic habitats pertinent to the Willamette River Valley (FY2011). Provided comments concerning angling (FY2012).
Willapa NWR	Provided text and supporting technical literature concerning species and strategies for developing plans for reintroductions (FY2011). Reviewed public draft (FY2011).
Willamette Valley NWR	Reviewed public draft (FY2011).

Objective 3: Conduct field-based activities contributing to conservation of aquatic resources at NWRs

Three projects consisting of field-based activities contributing to conservation of aquatic resources at NWRs were conducted by the CRFPO during FY2011 and FY2012. These were: Restoration monitoring at Bandon Marsh NWR; Post-construction assessment of fishes, habitats, and tide gates in sloughs on the mainland of Julia Butler Hansen NWR; and Fish and aquatic habitat surveys at the Sheldon-Hart Mountain NWR Complex. The former two were ongoing projects initiated in earlier years and continued during FY2011 and FY2012, whereas field activities for the latter project were conducted during FY2011 and a final report was completed during FY2012. The need for information that these projects have generated was identified by NWRs during the initial workshop (USFWS 2005). Brief summaries of the projects are presented here along with citations of reports containing project details and findings.

Restoration monitoring at Bandon Marsh NWR

Large-scale tidal marsh restoration, entailing dike and tide gate removal, culvert upgrades, channel and wetland construction, and infrastructure upgrades, was conducted at the Ni-les'tun

Unit of Bandon Marsh NWR. All activities were completed by summer 2010 except removing the dike and tide gates, which was completed in August 2011. The goal of the monitoring project is to assess changes in the aquatic species community before and after habitat restoration by addressing four objectives—1) Describe and compare fish species community within and among restoration areas and reference areas before and after construction; 2) Describe and compare fish species distribution within and among restoration areas and reference areas before and after construction; 3) Describe and compare fish species relative abundance within and among restoration areas and reference areas before and after construction; and 4) Collect invertebrates to archive from restoration areas and reference areas before and after construction.

To characterize conditions before habitat restoration, fish (Figure 2) typically were collected on one or two occasions per season during November 2007-March 2010 (Hudson et al. 2010). Fish were collected once per season during October 2010-June 2011, which was considered an interim period for restoration and occurred during FY2011 (Silver et al. 2012). Since completion of final construction activities (i.e., removal of the dike and tide gates), fish were collected during six occasions during December 2011-September 2012, FY2012 (Hudson et al. 2013). Prior to receiving funding from Region 1 Refuge I&M Initiative during FY2011 and FY2012, the project was largely funded by other internal sources (e.g., Challenge Cost Share, Cross Program Recovery). The project will conclude at the end of FY13, after which a final report will be completed comparing fish distribution and communities before and after construction.



Figure 2. Examples of fish species found at Bandon Marsh NWR, juvenile coho salmon (left) and coastal cutthroat trout (right). (Photo by M. Hudson)

Post-construction assessment of fishes, habitats, and tide gates in sloughs on the mainland of Julia Butler Hansen NWR

The NWR has been working with the U.S. Army Corps of Engineers (Corps) for several years on modifications to tide gates for improving aquatic habitats and fish access to sloughs while maintaining adequate habitat conditions for the endangered Columbian white-tailed deer. For instance, the Corps replaced a series of steel top-hinged tide gates (Figure 3) on the largest slough of Tenasillahe Island with aluminum side-hinged gates fitted with orifices in 2007, and on the Mainland Unit, installed aluminum side-hinged gates fitted with self-restraining assemblies to hold gates fully open before closing on three sloughs in 2010 and two sloughs in 2011. The goal of the monitoring project was to assess effects of the tide gates on fish communities and aquatic habitat by addressing three objectives—1) Assess the periods, frequency, and duration that tide gates (as presently configured, after modifications, and newly installed) are conducive to passage by juvenile and adult salmonids; 2) Describe presence, distribution, and biological characteristics (e.g., species, size) of fish inhabiting sloughs at Julia Butler Hansen NWR (pre-and-post construction) and compare to that observed at reference sloughs; and 3) Characterize habitats of sloughs at Julia Butler Hansen NWR and compare to that observed at reference sloughs (pre-and post-construction). The overall approach was to collect information for at least two years characterizing the pre-construction period and for two years characterizing the post-construction period.



Figure 3. Examples steel top-hinged tide gates (left) and aluminum side-hinged tide gate with self-restraining assembly to hold door fully open (right). (Photo by J. Johnson)

The assessment of tide gates at Tenasillahe Island was completed during 2005-2009 (Poirier et al. 2006; Johnson et al. 2007 a, b; Johnson et al. 2009a), prior to FY2011 and FY2012, as was collection of all pre-construction data for tide gates at the Mainland Unit and the first year of post-construction data for the three tide gates that were installed during 2009 (Johnson et al. 2009b, 2011). Thus, FY2011 encompassed the second year that post-construction data was collected for these tide gates and the first year for the two tide gates installed in 2010, whereas FY2012 was the second year for post-construction data collection for the latter tide gates. The project was funded by various sources of the Corps (e.g., Columbia River Channel Improvement Project, Section 526 of the Water Resources Development Act of 2000). The project concluded

at the end of FY12, and a final report will be completed comparing tide gates, fish characteristics, and aquatic habitat before and after construction.

Fish and aquatic habitat surveys at the Sheldon-Hart Mountain NWR Complex

Information on the current status of fish species and aquatic habitats at the Sheldon-Hart Mountain NWR Complex was identified as an immediate need during the initial NWR-CRFPO workshop (USFWS 2005) primarily to contribute to preparation of the CCP for Sheldon NWR, which was scheduled to begin in 2007. Although the project was not implemented until 2011, information it generated is pertinent to actions identified in the CCP for Sheldon NWR (USFWS 2012) and preparation of the CCP for Hart Mountain National Antelope Refuge. Preplanning for the Hart Mountain NAR CCP began in 2012, and when completed, will replace the existing Comprehensive Management Plan (USFWS 1994). The goal of the survey project was to establish a baseline of fish community and habitat information for the watersheds of the primary streams supporting native fish at each refuge by addressing four objectives—1) Document fish species present; 2) Determine the watersheds that were occupied by these species; 3) Describe distribution of fish within the watersheds; and 4) Characterize aquatic habitat. In addition, we sought to establish and use a systematic, quantitatively rigorous, sample framework and approach that can standardize future assessments of changes in fish occupancy, fish distribution, and aquatic habitats.

All field activities for the project were conducted during FY2011, which included a systematic survey for fish among three predetermined areas (upper, middle, and lower areas) of each watershed and associated characterization of habitat (Figure 4). Analyses of data and the final project report were completed during FY2012 (Lohr et al. 2012). Tissue from a subsample of trout collected in the Virgin Creek and Guano Creek watersheds was preserved for genetic analysis in the future to determine the prevalence of hybridization. The project was funded by the Region 1 Refuge I&M Initiative.



Figure 4. Examples of aquatic habitat in the lower open valley portion (left) and canyon portion (right) of the Virgin Creek watershed at Sheldon NWR. (Photo by B. Willis and S. Lohr)

Objective 4: Provide non-field-based technical assistance on aquatic resources for NWRs

Non-field-based technical assistance during FY2011 and FY2012 consisted of long-term and short-term activities. Long-term activities were those with continuing tasks that spanned both fiscal years and often led to additional tasks. Short-term activities were those tasks that typically concluded within a matter of days or less.

Long-term activities

The CRFPO engaged in two long-term activities with NWRs: 1) review of conceptual salmon habitat restoration projects in the lower Columbia River, and 2) development of a long-term aquatics monitoring program for climate change at NWRs in Region 1. For review of conceptual salmon restoration projects, Bonneville Power Administration (BPA) and the Corps developed conceptual projects at NWRs to assist in meeting obligations of the Federal Columbia River Power System Biological Opinion (BiOp), and requested the USFWS to review the conceptual projects to evaluate their feasibility for implementation. Development of a long-term monitoring program at NWRs responded to a Fisheries Project Leaders initiative.

For the first long-term activity, the USFWS convened a review team with representatives from Ecological Services, Fisheries, Migratory Birds, and Refuges to develop an approach to evaluate the conceptual projects. The team considered four factors in evaluating the conceptual projects: 1) Estimated time needed for project implementation, 2) Relative cost for project implementation, 3) Likelihood of successful implementation, and 4) Relative benefits to salmonids. Fisheries crafted a method to categorize (low, medium, high) anticipated benefits of a project for salmonids relative to existing conditions at a site and nature of the benefits (e.g., unrestricted access to high quality habitat). In FY2011, the team produced a report and presented it during briefings with the Region Director and Deputy Regional Director. The BPA and Corps selected two of the conceptual habitat restoration projects at NWRs (i.e., Post Office Lake at Ridgefield NWR and Karlson Island at Lewis and Clark NWR) to further develop for implementation, and the CRFPO assisted with planning (e.g., evaluating design alternatives, assisting with draft environmental assessments) during FY2012.

Secondly, to develop of a long-term aquatics monitoring program for climate change at NWRs, the CRFPO conferred with Fisheries Project Leaders on an initial proposal description and presented it at the NWR-Fisheries workshop during FY2011 (see Appendix A). The CRFPO made a presentation of the concept at the annual meeting for the Region 1 I&M Initiative, and feedback also was sought from personnel from the USGS Amphibian Research and Monitoring Initiative. In FY2012, a draft proposal was developed (see Appendix B) by representatives from each Fishery Resource Office, and review by Fisheries Project Leaders and NWRs was planned for FY2013.

Short-term activities

Short-term activities during FY2011 included:

- Meeting with NWR planners working on the Willamette Valley Conservation Study Area (WVCSA), a project of America's Great Outdoors Initiative (AGO), to discuss fishery and aquatic issues in the Willamette Valley.
- Performing a cursory culvert and stream channel assessment and hydrologic and basin summary for Risk Creek, adjacent to Julia Butler Hansen NWR, to assist in a potential culvert-replacement project.
- Participating in meeting of water quality assessment needs for the Wapato Lake Unit of Tualatin NWR.
- Providing technical review of proposals by the Lower Columbia Fish Enhancement Group to conduct stream and groundwater assessments for developing salmon restoration actions at Pierce NWR, and participating on associated field tour of the NWR by the Lower Columbia River Fish Recovery Board.
- Submitting comments to the Corps on the draft Environmental Assessment for constructing an island for Caspian tern nesting at Malheur NWR.

Short-term activities during FY2012 included:

- Participating in various meetings to support the WVCSA (e.g., interagency meeting to identify issues, overview of AGO and progress on WVCSA, climate change vulnerability analysis for the Willamette Valley).
- Performing a hydrologic and basin summary for Gibbons Creek to assist in potential stream and wetland habitat restoration at Steigerwald NWR.
- Providing literature review and comments concerning estuarine habitat-salmonid relations to NWR planner to assist in land protection planning for Bandon Marsh NWR.
- Submitting proposal for Abernathy Fish Technology Center to conduct genetic analyses of trout tissue collected at Sheldon and Hart Mountain NWRs.
- Assessing stream ecosystem attributes with analysis of functional feeding group ratios for aquatic macroinvertebrates, collected in the Donner und Blitzen River, to assist researcher at Utah State University on a paper for Malheur NWR.

Conclusions

There was extensive collaboration between the CRFPO and NWRs on conservation of aquatic resources during FY2011 and FY2012. The other three Fishery Resource Offices in Region 1 participated in the annual workshops, highlighting overall healthy collaboration between the Fisheries Program and NWRs. During the period addressed by this report, the CRFPO was involved in seven CCPs, which not only provided a means for Fisheries input into NWR planning, but also encouraged cross-program interactions that fostered professional relationships. Field-based activities, which have been made possible through various funding sources, have generated information for assessing the efficacy of habitat restoration actions and establishing baselines, both of which will improve our knowledge base and management of aquatic resources by the USFWS. Conducting non-field-based activities have provided fisheries technical assistance to a substantial variety of issues, which has supported the missions of Fisheries, Refuges, and the USFWS overall.

Acknowledgements

We would like to thank the numerous individuals who have contributed to and supported collaborative work described in this report, namely personnel of the R1 National Wildlife Refuge System, Branch of Refuge Biology, Branch of Inventory and Monitoring, NWR complexes and individual units in Washington, Oregon, and Idaho; R1 Fishery Resources, Idaho FRO, Mid-Columbia River FRO, Western Washington Fisheries, CRFPO; R1 Water Resources; and many others.

Literature Cited

- Hudson, J.M., S.M. Castle, J.R. Cook, B.P. Silver, S. Lohr, and T.A. Whitesel. 2010. Pre-restoration monitoring at Bandon Marsh National Wildlife Refuge. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Hudson, M., B. Silver, S. Lohr, and T. Whitesel. 2013. Restoration monitoring at Bandon Marsh National Wildlife Refuge annual summary report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Johnson, J., J. Poirier, R. Horal, and T.A. Whitesel. 2007a. Lower Columbia River Channel Improvement: Assessment of Salmonid Populations and Habitat on Tenasillahe and Welch Islands. 2006 Project Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Johnson J., J. Poirier, and T.A. Whitesel. 2007b. Lower Columbia River Channel Improvement: Assessment of Salmonid Populations and Habitat on Tenasillahe and Welch Islands. 2007 Project Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Johnson J., S. Ennis, J. Poirier, and T.A. Whitesel. 2009a. Lower Columbia River Channel Improvement: Assessment of Salmonid Populations and Habitat on Tenasillahe and Welch Islands. 2008 Project Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Johnson J., J. Poirier, S. Ennis, and T.A. Whitesel. 2009b. Julia Butler Hansen National Wildlife Refuge: Assessment of Fishes, Habitats, and Tide gates in sloughs on the Mainland. 2007, 2008 Progress Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Johnson J., J. Poirier, and T.A. Whitesel. 2011. Julia Butler Hansen National Wildlife Refuge: Assessment of Fishes, Habitats, and Tide gates in sloughs on the Mainland. 2010 Progress Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Lohr, S., J.M. Hudson, M. Koski, and T.A. Whitesel. 2012a. Fish and Aquatic Habitat Surveys at Sheldon-Hart Mountain National Wildlife Refuge Complex. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Lohr, S., M.L. Koski, and T.A. Whitesel. 2012b. NWR-CRFPO Workshop 2010: A report on a workshop between National Wildlife Refuges in Region 1 and the Columbia River Fisheries Program Office, April 28, 2010, Vancouver, Washington. 2010 Workshop Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.

- Poirier J., R. Horal, R. Sollee, S. Gainer, S. Lohr and T.A. Whitesel. 2006. Lower Columbia River Channel Improvement: Assessment of Salmonid Populations and Habitat on Tenasillahe and Welch Islands. 2005 Project Report. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.
- Silver, B.P., J.M. Hudson, S. Lohr, and T.A. Whitesel. 2012. Bandon Marsh National Wildlife Refuge Interim Monitoring. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.
- U.S. Fish and Wildlife Service. 1994. Hart Mountain National Antelope Refuge (NAR) Comprehensive Management Plan and Environmental Impact Statement. May 1994. U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.
- U.S. Fish and Wildlife Service. 2005. NWR-CRFPO Workshop 2005: A report on a workshop between national Wildlife Refuges in Region 1 and the Columbia River fisheries Program Office, July 20, 2005, Vancouver, Washington.
- U.S. Fish and Wildlife Service. 2007. NWR-CRFPO Workshop 2007: A report on a workshop between National Wildlife Refuges in Region 1 and the Columbia River Fisheries Program Office. April 25, 2007. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.
- U.S. Fish and Wildlife Service. 2008. Pacific Region: Fisheries Program Strategic Plan.
- U.S. Fish and Wildlife Service. 2009a. NWR-CRFPO Workshop 2008: A report on a workshop between National Wildlife Refuges in Region 1 and the Columbia River Fisheries Program Office. May 1, 2008. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.
- U.S. Fish and Wildlife Service. 2009b. NWR-CRFPO Workshop 2009: A report on a workshop between National Wildlife Refuges in Region 1 and the Columbia River Fisheries Program Office. May 14, 2009. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.
- U.S. Fish and Wildlife Service. 2011. Conserving the Future: Wildlife Refuges and the Next Generation. October 2011.
- U.S. Fish and Wildlife Service. 2012. Sheldon National Wildlife Refuge Final comprehensive Conservation Plan and Environmental Impact Statement. Prepared by U.S. Fish and Wildlife Service, Sheldon-Hart Mountain National Wildlife Refuge Complex, Lakeview, Oregon, August 2012.

**APPENDIX A: 2011 NWR-FISHERIES WORKSHOP AGENDA, NOTES,
ATTENDEES, ACTION ITEMS, AND PRESENTATIONS**

NWR-FISHERIES WORKSHOP AGENDA
May 5, 2011
Columbia River Fisheries Program Office
1211 SE Cardinal Court, Suite 100
Vancouver, WA 98683

Goal: Provide a forum to promote effective information exchange and coordination among NWRs, CRFPO, PFW, Fisheries, and other Service programs.

Objectives:

1. Update NWRs about results and activities by the CRFPO and other Fisheries Offices to address aquatic resource issues and needs.
2. Identify and discuss aquatic resource issues and needs at NWRs and updates on management planning.
3. Provide information on status and results of programs and activities of regional or broader interest.
4. Present Fisheries Project Leaders' initiative to develop long-term aquatic monitoring program at NWRs.
5. Explore additional possibilities for cooperative efforts among NWRs, Fisheries, PFW, and others.
6. Develop action items.

10:00-10:05 Welcome and overview of workshop (Sam Lohr)

1. Activities and Fisheries results for aquatic resource issues and needs at NWRs

10:05-10:15 Construction for Ni-les'tun Unit tidal marsh restoration, Bandon Marsh NWR (Roy Lowe)

10:15-10:45 Pre-restoration monitoring at Bandon Marsh NWR (Mike Hudson)

10:45-11:15 Post-construction assessment of fishes, habitats and tide gates in sloughs on the mainland unit of Julia Butler Hansen NWR (Jeff Johnson)

11:15-11:45 Fishery issues at Kootenai NWR (Mike Faler)

11:45-12:00 Questions and discussion concerning morning presentations

12:00-1:00 Lunch

2. Aquatic resource issues and needs at NWRs

1:00-1:30 Aquatic resource issues and needs at the Inland Northwest NWR Complex (Jerry Cline, Dianna Ellis, Dan Matiatos)

1:30-2:00 Aquatic resource issues and needs at Umatilla, McNary, Cold Springs, and McKay NWRs (Lamont Glass)

2:00-3:00 Open discussion of new NWR issues and needs, updates on previous issues and needs, CCP schedules and progress, upcoming work, etc. at each NWR

3:00-3:15 Break

3. Programs and activities of regional or broader interest

3:15-3:45 Stream flow response to climate (Tim Mayer)

3:45-4:15 NWRs regional inventory and monitoring program (Kevin Kilbride)

4:15-4:45 Fisheries initiative to develop long-term aquatic monitoring program at NWRs (Tim Roth/Brad Thompson)

4:45 Wrap-up

NWR-FISHERIES WORKSHOP NOTES
May 5, 2011

Construction for Ni-les'tun Unit tidal marsh restoration, Bandon Marsh NWR (Roy Lowe)

Roy discussed the various components and challenges encountered for construction for the tidal marsh restoration project at the Ni-les'tun Unit. Major components included: Raising two sections of an adjacent road to an elevation of eight feet to avoid inundation; Boring to locate a major power line under the Coquille River and burying it along the road to avoid bird strikes; Installing two large culverts under the road, one of correct size to convey Fahys Creek and the other to serve as a tunnel for visitors; Constructing new tidal channels with log placements, designed by Ducks Unlimited, and filling old ditches; and Reconstructing an appropriate channel for Fahys Creek where it had been channelized and routed around an old cranberry bog, and planting over 10,000 shrubs and trees. Also, the coastal program addressed two fish passage barriers upstream the refuge in Fahys Creek. Challenges included: Instability of initial boring for the powerline; Encountering a spring during installation of a culvert; Avoidance of disturbing very old archeological sites for which one included bones; and Salvaging hundreds of newts, juvenile coho salmon and cutthroat trout when the marsh was dewatered for construction. Final steps are to remove the dike and tide gate, which had to be postponed a year until this August. Rogue brewery is honoring the project by producing restoration redd ale.

Questions/discussion—

Q What was the source of funding?

A There were several sources such as ARRA, OWEB, New Carissa oil spill, and a transportation highway bill.

Q How was the fisheries work funded?

A Some was from OWEB and there were other small funding initiatives here and there, like challenge cost share.

Q Were many partners involved?

A Yes, there was an overall total of 32, which included 6 universities and 2 tribes.

Pre-restoration monitoring at Bandon Marsh NWR (Mike Hudson)

Mike presented information on pre-restoration monitoring at Bandon Marsh NWR, which began in fall 2007. Work at Nestucca Bay NWR in 2006 served as a pilot for testing some of the sampling methods used at Bandon Marsh. Objectives were to describe fish community composition, species distribution, and relative abundance within and among restoration and reference sites before and after construction of the restoration project. In addition, aquatic invertebrates have been collected and archived for pre- and post-construction comparisons. Fish are collected with overnight hoop netting, primarily in channels at the restoration site, seining at reference and Coquille River sites, and backpack electrofishing at the cranberry bog site upstream along Fahys Creek. Fahys Lake, located off of the NWR, was sampled with a variety of gear in spring and summer 2009 to document species present. Overall results were that salmonids were found in all areas, with coastal cutthroat trout found only in diked areas within Fahys and Redd creeks; Fahys Creek supports multiple size classes of cutthroat trout and large juvenile coho salmon; non-native fishes were only found in diked areas, three species were

collect in Fahys Lake (cutthroat trout, sculpin, and stickleback); ecological classification indicated that cutthroat trout and coho salmon have a higher combined frequency of occurrence and relative abundance in the creeks. Post-restoration sampling will be adjusted to accommodate the new tidal channels that will be inundated once the dike is removed in late summer. The plan is to identify sample reaches with GRTS points and use a rotating panel of reaches. This has been a mutually beneficial partnership between the NWR and Fisheries where funding has been provided by NWRs and we are providing standardized sampling for long-term assessment and monitoring.

Questions/discussion—

Q Can you tease out non-native fish component during pre-construction versus post-restoration?

A Yes, I expect to address this with further analysis of the data. So far, non-natives were only found in the diked areas. Bass were stocked in Fahys lake, but we did not encounter any there. It will be interesting to see what happens to non-native fish once the dike is removed.

Q An observation is that it is hard to gauge success of a project if there is no pre-restoration monitoring. Were there targets or expectations from this project?

A Yes, expect to see improvements in fish distribution and assume there will be benefits to birds.

Post-construction assessment of fishes, habitats and tide gates in sloughs on the mainland unit of Julia Butler Hansen NWR (Jeff Johnson)

Jeff noted earlier work assessing fish and aquatic habitat relative to new, unrestrained tide gates installed on Tenasillahe Island as part of the Corps channel improvement project. Findings included that: tide gates were closed 80% of the time blocking fish passage, non-native fish made up half of the species in gated sloughs, water temperature was higher and dissolved oxygen lower in gated versus reference sloughs, and few salmonids used gated sloughs, but those that did remained for extended periods and exhibited high growth. The Corps has more recently installed self-restrained tide gates (i.e., equipped with a mechanism to hold gates open longer than unrestrained gates) on a number of sloughs on the mainland portion the NWR. Jeff present initial post-construction findings for two sloughs with new self-restrained tide gates compared to two reference sloughs without gates. For fish accessibility through the tide gates, four species of juvenile salmonids (Chinook, coho, chum and steelhead) were collected entering a gated slough compared to two species (Chinook and coho) entering a reference slough. For presence and distribution of salmonids and other species, no salmonids were collected during pre-construction sampling, but were collected in almost all reaches later. Eight of 17 species were native in the gated sloughs whereas 8 of 10 species were native in the reference. Water temperature range and dissolved oxygen in newly-gated sloughs appeared to be approaching that in reference sloughs. Self-restrained tide gate design appears better for fish and aquatic habitat than the design used on gates at Tenasillahe Island. Plans are to continue monitoring the new gates.

Questions/discussion—

Q Is water velocity being measured at the tide gates?

A Some point measurements have been taken.

A comment is that we are learning a lot about the area and realize how complex fish presence can be. Ellison Slough is considered a control because it does not have a direct connection with

the Columbia River, however, there is a network of ditches which has allowed salmon access to Ellison.

Fishery issues at Kootenai NWR (Mike Faler)

Mike discussed three fishery issues at Kootenai NWR, burbot, habitat and redband trout in Cascade Creek, and habitat and bull trout in Myrtle Creek. The University of Idaho had received funding to work on early rearing of burbot and ways to encourage juveniles to feed. The plan was to conduct the work in two completely isolated, fishless ponds at the NWR, however, the ponds were not suitable due to the presence of bullhead and yellow perch. Ponds on private land ultimately were used by the University. Perch were later found in a pond supplied with pumped water. For Cascade Creek, habitat issues are under sized culverts at a road crossing and a structure for water diversion that is also a fish passage barrier. Genetics of redband collected from Cascade Creek indicate a low level of introgression with cutthroat trout, and that allele frequencies were more similar to native redband than hatchery rainbow trout stocked in the basin. The lower portion of Myrtle Creek is affected by backwater from the river, and habitat farther upstream on the NWR has been simplified (i.e., loss of sinuosity and structure) due to being pushed to the side of the area. There is an unscreened diversion providing water to NWR ponds. Angling also is allowed in Myrtle Creek. Seining and electrofishing resulted in the collection of bull, brook, and rainbow trout, as well as hybrids, in reaches above the river's influence. Fishing is allowed on Myrtle Creek. Recommendations include: not using existing ponds for burbot rearing, experimentation or production; replacing the undersized culvert on Cascade Creek, and consider maintaining the diversion structure to prevent further hybridization of redband trout; install a rotary drum screen on the diversion in Myrtle Creek, improve habitat by adding boulders, large wood, and riparian vegetation, and instituting angling gear restrictions and posting information on fish species identification.

Questions/discussion—

Q Did you see cutthroat trout and where did they and brook trout come from in the streams?

A Cutthroat likely have access from upstream areas in Cascade Creek, and from both upstream and downstream in Myrtle Creek. There are brook trout in a lake on the National Forest above the falls in Myrtle Creek.

Q Would it be possible to rotenone the ponds to get rid of bullhead and perch for work with burbot?

A Yes, but there are otters and herons, which would be a concern. Also, there is some overland flow among ponds at times.

Q How did the FRO work get started at the NWR? How was it funded?

A There was a FONS for the burbot work and some habitat work on Deep Creek. The NWR requested assistance with generating information about the other streams to help in developing their CCP. The work took a few days and the FRO did it without any special funding.

Fisheries initiative to develop long-term aquatic monitoring program at NWRs (Tim Roth/Brad Thompson—moved from 4:15 to over lunch)

Brad Thompson provided background about the Fishery Project Leaders' meeting and initiative to develop a long-term aquatic monitoring program at NWRs to assess the effects of climate

change. There is an overall desire to increase coordination among Fishery Offices, and need for NWRs to address climate change. Thus, getting NWRs and FROs together to develop a regional program would be advantageous. Tim Roth went over the brief write-up of the initiative (appended below), and noted that Richard Hanna, while the Fishery ARD, challenged FROs to chart their future. The initiative is a response to it. It primarily is a joint effort, intended to be developed using existing resources. If there is buy-in, all FROs would be involved.

Questions/discussion—

Comment The Regional Climate Change Board should be tied in.

Comment Should not re-invent the wheel if there is an existing group in the Service looking at this.

Comment Not sure why the focus is just NWRs, where would these be?

Discussion Focus is on NWRs for now and they are located throughout the region. It would be difficult to extrapolate climate change data from a single NWR to a broader scale. May be able to look at distribution of NWRs across climate gradients and track climate effects across a wider range. First steps are to nail down the questions of interest to both programs and find out what is being done to address them.

Discussion Relative to the national NWR I&M program, climate change, invasive species, and lack of information specific to these are big topics. Though not in R1, the national program is funding pilot projects to generate info on these topics. If NWRs see value in info that could come from this initiative, then it could be developed and proposed as a pilot project at the national level. An important aspect of this approach would be to describe how the proposal would help contribute to a toolbox for the future.

Discussion Timing is good for this. In Idaho, tribes have been collecting info on invertebrates in the Kootenai River for the past few years. They and the state are interested in changes since Libby Dam was built in 1972 (e.g., declines in bull trout, cutthroat trout, burbot). Tribe is also doing some restoration work involving Rosgen approach to streams.

Discussion There could be potential for assessment and collaboration with Water Resources. They are conducting a water resource inventory at NWRs and assessing needs. Much of the effort is to identify sites with long-term water data and likely reflective of potential climate change effects. The data primarily are physical and chemical variables.

Discussion At the division chief level of the I&M program, people are concerned about how all the programs are going to integrate. For example, USGS has a regional-based amphibian monitoring program lead by Michael Adams. Michael will be meeting with I&M program next month and it may be an opportunity to bounce the fishery initiative off him for feedback.

Discussion You should consider including fish health labs in the initiative. They have been working with tribes, NWRs, have their own funding, and a national data base of areas etc. where they have collected fish samples. Paul Heimowitz should also be included for the AIS program. Tim R. noted that fish health labs have been included. The labs and others are interested in stressors upstream, and climate change will affect factors downstream (e.g., sea level rise, ocean

acidification). The more info we have, the better, and we should have a cohesive approach to take care of our (Service) lands first. Our interests are ecosystems relative to climate change, but you have to start somewhere and NWRs are our lands.

Discussion Some CCPs (e.g., at Little Pend Oreille) are coming up for revision. The initiative can plug into CCP review and I&M needs. Fisheries and ES personnel should be involved early on with CCP revisions. Some NWRs have step down FMPs, new ones could help meet I&M needs. Land management research and demonstration (LMRD) areas were recommended by the NWR “promises” team, may think about how to do one for fisheries.

Brad summarized several issues:

- All offices have some ongoing I&M activities that the programs should be continuing (i.e., keep doing what we are doing).
- Support participation on CCP extended teams among programs, which allows familiarization about issues specific to individual NWRs.
- For the NWR-Fisheries I&M initiative, may be able to consider NWRs as GRTS points on the landscape for sampling. The needs are for coordinated communication among offices and programs to determine if programs have mutual questions concerning monitoring and climate change, and then develop the monitoring program.
- Contact Brad and Tim with ideas and questions, and let us know if you are interested in continuing this discussion.

(Description of initiative distributed at the workshop)

Initiative to develop a long-term monitoring program at Pacific Region National Wildlife Refuges to assess the impacts of climate change on NWR aquatic resources

Fisheries Project Leaders in R1 (i.e., from Abernathy Fish Technology Center, Columbia River Fisheries Program Office, Idaho Fishery Resource Office, Mid-Columbia Fishery Resource Office, and Western Washington Fisheries Office) identified three new areas of emphasis during their recent Project Leaders' coordination meeting in February 2011. The three areas were: 1) To evaluate potential climate change impacts on National Fish Hatchery programs and operations; 2) To develop and implement long-term monitoring of key aquatic species; and 3) To assist R1 NWRs to design and implement an aquatic monitoring program for evaluating the impacts of climate change. All areas are intended to support actions in the Service's Strategic Plan for Responding to Accelerated Climate Change, namely those addressing a better understanding of the status and trends of aquatic species and their habitats relative to climate change, potential adaptation strategies, and inventory and monitoring.

At NWRs, climate change may affect suites of aquatic species directly by creating conditions that exceed physiological tolerances or produce incompatible disturbance regimes, as well as indirectly by altering processing rates of nutrients or creating conditions conducive to establishment of invasive species. Advantages of having a long-term aquatics monitoring program are that results would provide an early indication of climate change effects on aquatic species, detect changes in status of currently present non-native species indicative of climate change or other stressors, allow detection of new invasive species, and provide early warning and/or assessment of these conditions so that adaptive management strategies can be considered in a timely manner. Because aquatic communities reflect the integration of prevailing physical and biotic conditions through time, indices derived from various attributes of communities (e.g., species richness, species relative abundance, ecological and physiological traits of select taxa) are appropriate indicators of biotic integrity and health of aquatic communities.

Fisheries proposes to work with Refuges convene a multi-station workgroup to assist in developing a long-term aquatic resources monitoring program for R1 Refuges, using existing fiscal resources for initial program design. The joint Fisheries and Refuges workgroup would work to identify key issues necessary to begin designing a regional monitoring program. In addition, the workgroup would develop a list of proposed species and/or biological communities to monitor that would ultimately be agreed upon by Fisheries and Refuges to achieve mutual long-term aquatic resource monitoring and assessment goals. Depending upon the outcome of the monitoring program design, geographic scope, sampling time frames, and sampling expertise and/or equipment necessary to implement the agreed upon monitoring program, Fisheries would work collaboratively with Refuges to train Refuge personnel for sampling program implementation. Fisheries would help implement specific sampling and technical assessment portions of the program as funding is available.

Examples of the types of issues to consider in developing a regional aquatic monitoring program for Refuges include geographic scope, aquatic species/communities to monitor,

representativeness of refuges and aquatic communities chosen for long-term study, periodicity of monitoring, etc. Initial strawman thoughts on geographic scope, representativeness, and refuge aquatic community types include the following bullets as a starting point for discussion:

- Which individual refuges are more appropriate than others on which to conduct an aquatics monitoring program (infrastructure, staff personnel, logistical ease of sampling)?
- What aquatic habitat types are of primary interest and are they representative of types found at other refuges (unique versus common aquatic habitats and associated biological communities)?
- Does the following adequately characterize major aquatic habitats found at refuges in R1—west of Cascades (coastal estuary, adjacent to large river, valley streams); east of Cascades (adjacent to large river, relatively small tributary, closed basin stream/river/lake)?
- What suites of aquatic taxa are of primary interest (e.g., fish, amphibians, insects, mussels, benthic invertebrates, others)?
- What types of information are currently being collected at or near a refuge characterizing physical and chemical conditions (e.g., water chemistry, temperature, flow, operation of infrastructure, etc.) and biological attributes (e.g., species composition, distribution, abundance, etc.)?

Aquatic resource issues and needs at the Inland Northwest NWR Complex (Jerry Cline, Dianna Ellis, Dan Matiatos)

Managers for each of the three NWRs in the complex made presentations focused on aquatic resources.

- Dianna described the physical setting of Kootenai NWR—about 2,700 acre area, located along the floodplain of the Kootenai River in northern Idaho; river flow is regulated by Libby Dam in Montana; and dikes and water pumps are along the river from Bonners Ferry to Canada. The NWR was established in 1964 for waterfowl. For aquatic resource issues—burbot spawn in the mouths of Myrtle and Deep creeks (not a listed species, but there is a conservation agreement); fishing has been allowed in Myrtle Creek since 1965; bull trout were observed by NWR in Myrtle Creek during 2004-2005 (may have moved in from the river or perhaps are resident fish); Cascade Creek (tributary to lower Myrtle Creek) has two culverts under a county road and diversion supplying water to ponds, below which is a braided channel influenced by backwater; and lower Myrtle Creek, which has a TMDL (e.g., for sediment) and is used for spawning by burbot and also kokanee. Additional issues for Myrtle Creek are that it is the main drinking water source for Bonners Ferry, assessment by a hydrologist is needed to determine if and how to restore habitat, as well as water rights and screens on pumps for pond management.

Questions/discussion—

Q What is the distance of Myrtle Creek between the river and the waterfall on the National Forest?

A It is 6.5 km. For bull trout, critical habitat extend up to the falls and fish are thought to reside in plunge pools., which forms a barrier at times, tructure

- Jerry described the physical setting of Little Pend Oreille NWR—about 41,000 acre area in the mountains and forest of northeast Washington. The NWR was established in 1939 for migratory birds and other wildlife. There are three lakes with about a total of 120 acres that are formed by small dams and stocked with rainbow trout for angling. Two are only open to fly-fishing and there are catch-and-release regulations in some. McDowell Lake has been treated to eliminate tench. There are about 30 miles of perennial streams (e.g., Little Pend Oreille River, and Bear Creek), all of which are open to angling. The NWR had been subject to grazing, haying, and crop production. The Mid-Columbia FRO conducted a habitat assessment in streams during 1997, and found that most reaches did not meet INFISH standards for water temperature, some met large wood and sediment, and most met bank stability. The NWR needs assistance to conduct a habitat assessment for comparison with the earlier one. The CCP was completed in 2000 and plans are to start revising it in the next four years. For aquatic habitat management and issues—grazing was eliminated five years ago, culverts have been replaced with bridges, there has been work on riparian plantings and fixing road surfaces. Stream bank stability is still a problem in some areas.

Questions/discussion—

Q What fish species are present?

A Westslope cutthroat trout, brown trout, brook trout, introduced rainbow trout, and redband trout. There is no fish reproduction in the lakes. Also, there are no bull trout due to dams in the river downstream of the refuge.

- Dan described the physical setting of Turnbull NWR—about 18,000 acres set in the scablands of eastern Washington surrounded by forest. The NWR was established in 1939, and wetlands that had been drained were restored. There 17 water control structures on the NWR and dikes to manage wetlands for waterfowl. In the early 1990s, brook stickleback appeared on the NWR and their abundance has taken off. The major concern is that with the high biomass of stickleback, they may be competing with waterfowl and native amphibians for invertebrate prey. The NWR is attempting to control stickleback with water management, however, they have been found in isolated wetlands. Thoughts are that herons may be responsible for stickleback in the isolated wetlands.

Fisheries research needs for: Hanford Reach NM, McNary NWR, Umatilla NWR (Lamont Glass)

Lamont discussed fishery research needs for three NWRs in the Mid-Columbia Complex. The CCPs for McNary and Umatilla NWRs have objectives to protect and potentially enhance backwater sloughs and other shallow water habitats to benefit listed salmonids by providing juvenile rearing habitat. A major question is whether benefits of restoring rearing habitat for juvenile salmonids outweigh potential negative effects of predation in the areas because they are close to bird colonies. The NWR wants to contribute to salmon recovery, but has a need for funds to look at the question and also how best to improve habitat that has aquatic vegetation. The Corps also is encouraging dispersal of bird colonies among several areas to lessen predation on juvenile salmon. Working groups developing plans and associated NEPA documents for dispersing bird colonies over the next year would benefit from participation from fisheries. over the would benefit from A small population of mussels have been found at the Hanford Reach NM and effects of flow fluctuations from Priest Rapids Dam is a concern. A question is what potential exists to enhance or restore mussel habitat in the reach. At Saddle Mountain, ponds receive irrigation return water and there are questions about what freshwater species are present, and if fish are present, do they contain elevated levels of contaminants from the irrigation water. The ponds presently are closed to fishing.

Questions/discussion—

Q What is going on at McKay NWR? Bull trout historically were in creeks draining out of the Blue Mountains and could be entering the reservoir, for which climate change could be an issue.

A McKay is in the early stages of developing a CCP. The state fish biologist has not been concerned about bull trout possibly being in the creek.

Q How is McKay managed? Tagged bull trout have been seen downstream of the dam.

A Water levels vary a lot and it is discharged from the bottom, which creates a cold release that could attract bull trout.

Q Is there info on bird diets and bull trout.

A There are reports by OSU with colonial bird diet information. Others noted that PIT tags from bull trout in the Walla Walla River have turned up on bird islands.

Stream flow response to climate (Tim Mayer)

Tim presented an assessment of how effects of climate change on streams (i.e., earlier runoff, decreased baseflow, increased water temperatures and winter flooding) may vary by stream type based on elevation and geology. The two stream types are groundwater-dominated streams (relatively stable flows influenced by groundwater) and surface-dominated streams (highly variable flows influenced by rain or snowmelt). Records from 27 streams in southern Oregon and northern California were used in the analyses. For changes in runoff timing and baseflow, groundwater streams show subtle signs of earlier timing due to snowmelt in their basins and resulting in overall lower baseflow into the summer. For water temperature, groundwater streams were consistently cooler than surface-dominated streams and cool groundwater may make these streams less sensitive to warming air temperatures. For increased risk of winter flooding, groundwater-dominated streams may be less sensitive due to more stable flows. Overall, groundwater-dominated streams appear less sensitive to effects of climate change and could be basins for cold water refuges in restoration strategies.

Questions/discussion—

Q On what data were the assessment based?

A Discharge and temperatures were mostly from USGS gaging stations.

Q Were the basins selected for the assessment intended to control for differences in land uses?

A Most basins were not affected by flow regulation. Some had diversions, but it had not changed recently in the flow records. We did not account for land uses in the assessment, but differences among stream types were consistent. I think there are effects from land uses, but am not sure how to account for it.

Q It looks like groundwater-dominated streams are higher in elevation than surface-dominated streams.

A This is largely a function of Oregon Cascades and geology. Things are different around Puget Sound.

Q Are there efforts to identify and map groundwater-dominated streams.

A Not really. Best thing to do is analyze station records, so it is difficult to judge it for streams without gages. There are coarse-scale maps for the baseflow index, but there is a lot of interpolation so that the maps are not good locally. There is work to see if geology can be used.

NWRs Inventory and Monitoring Program Overview (Kevin Kilbride)

Kevin introduced the I & M Program and how its strategic plan and operational blueprint respectively describe the program's long-term development and initial structure and tasks. The program has six objectives for the NWR System:

- increase resilience by informing planning and management;
- assess vulnerability to climate and non-climate stressors;
- assess vulnerability to increases in weeds, pests, and pathogens;
- detect shifts in biomes, species ranges, extinction rates, and phenology;
- assess vulnerability to sea level rise and ocean acidification; and
- assess vulnerability of Arctic and other high-latitude resources.

Staffing proposed for FY2010 includes 10 FTEs for the national office (Fort Collins) and 6 in each of the Regions. Region 1 presently has a program coordinator and data manager, as well as

three zone biologists stationed at NWRs and each affiliated with LCCs (i.e., located at Nisqually NWR, Turnbull NWR, and Hawaiian and Pacific Island NWRC and affiliated with North Pacific LCC, Great Northern and Great Basin LCCs, and Pacific Islands LCC, respectively).

Documents, databases, and calendar of activities can be found at the Region 1 I&M Program sharepoint site (<http://sharepoint.fws.net/Programs/nwrs/IM/R1/>).

Major activities in R1 during have been to:

- Conduct refuge I&M reviews (Malheur and Ridgefield NWRs) and enter results in a database (PRIMR);
- Contract hydrogeomorphic models for four NWRs in FY2011;
- Develop water quality assessment tools with USGS;
- Contract water resource inventory and assessments (WRIAs) for five NWRs in 2011;
- Organize and hold 2-day workshop on sea level rise (held February 2011 in Newport, Oregon);
- Support NWR I&M projects (37 proposals received in R1); and
- Work with prototype NWR habitat management database.

Questions/discussion—

Q Is there any ongoing data collection in the program?

A Much of the emphasis has been on building the program, data management tools, conducting reviews, and capturing existing information. Refuge-specific projects will receive funding this year and staff will be on the ground.

Q How many of the 37 proposals the program received dealt with fish?

A About 3-4.

Q Would the Fisheries initiative to develop a long-term aquatic monitoring program at NWRs be appropriate for the I&M RFP?

A Probably would be more appropriate as a pilot project for the National I&M Team.

Q Are we re-inventing the wheel or using tools similar to those developed by the National Park Service?

A The NPS system is being used, and we are looking down the road to identify our specific needs.

Q How does prioritization work for the NWR-specific scale?

A That has yet to be determined. Our plan is to develop a prioritization approach and share it. So far, the National Program has provided general guidance, and we are trying to get specifics.

Wrap-up

Doug Spencer announced that outreach to local governments and groups has begun for the Willamette Valley Conservation Study Area.

2011 Attendees

Linda Beck	Malheur NWR
Jodi Bush	Western Washington FWO ES
Alex Chmielewski	Ridgefield NWR
Jerry Cline	Little Pend Oreille NWR
Patty Crandell	Abernathy Fish Technology Center
CalLee Davenport	OFWO
Joel David	Julia Butler Hansen NWR
Dianna Ellis	Kootenai NWR
Joe Engler	RO Refuges
Mike Faler	Idaho FRO
Larry Fishler	CRFPO
Bob Flores	RO Refuges
Lamont Glass	Umatilla, McNary, Cold Springs, McKay NWRs
Randy Hill	Ridgefield NWR
Amy Horstman	OFWO/CRFPO
Mike Hudson	CRFPO
Jeff Johnson	CRFPO
Rich Johnson	RO Fisheries
Jeff Jolley	CRFPO
Melissa Kennedy	CRFPO
Kevin Kilbride	RO Refuges I & M
Marci Koski	CRFPO
Lisa Langelier	Inland Northwest NWR Complex
Sam Lohr	CRFPO
Roy Lowe	Oregon Coast NWR Complex
John Magera	Atwater Prairie Chicken NWR
Irene Martin	Interested Public
Dan Matiatos	Turnbull NWR
Tim Mayer	RO Water Resources
RD Nelle	Mid-Columbia FRO
Ron Rhew	CRFPO
Brian Root	Refuges I & M
Tim Roth	CRFPO
Joe Skalicky	CRFPO
Doug Spencer	Willamette Valley NWR Complex
Shawn Stephensen	Oregon Coast NWR Complex
Erin Stockenberg	RO Refuges I & M
Brad Thompson	Western Washington FWO Fisheries
Tim Whitesel	CRFPO

Action Items

The following are action items resulting from the 2011 NWR-Fisheries Workshop. Some are activities for ongoing projects and assistance that Fisheries has been engaged with NWRs during the past, as well as needs for which resources and plans have yet to be developed.

1. CRFPO and Bandon Marsh NWR to continue assessment of physical and biological attributes of Bandon Marsh to characterize post-construction conditions. Incorporate new tidal channels into project's sample design.
2. CRFPO to continue assessment of fish passage, fish community, and aquatic habitats at Julia Butler Hansen NWR for year two to characterize post-construction conditions for evaluation of tide gate installations and modifications on the Mainland Unit.
3. IFRO and Kootenai NWR to continue working together to collect information on fish presence and assess habitat in Myrtle Creek and other areas of the NWR.
4. CRFPO and other FROs continue to develop Fisheries initiative of a long-term aquatic monitoring program at NWRs—attend upcoming meetings with I&M Program to discuss concepts and data collection with others (e.g., USGS Amphibian Research and Monitoring Initiative, Zone Biologists, Water Resources).
5. MCFRO to work with Toppenish NWR on assessment of steelhead use.
6. Little Pend Oreille NWR requests MCFRO assistance on upcoming CCP revision and stream habitat assessments.
7. Fisheries to work with McNary and Umatilla NWRs—on identifying funding sources to assess benefits of providing or enhancing shallow water rearing habitat for juvenile salmon relative to risk of avian predation; participating on Bird Work Groups; and Hanford Reach NM to assess mollusk habitat and fish presence and contaminant levels in ponds at Saddle Mountain.
8. CRFPO to provide fishery information and assist with land use planning for the Willamette River Conservation Study Area.
9. NWRs, CRFPO, and other Service programs continue to work together to evaluate progress and feasibility of habitat restoration actions at NWRs in the lower Columbia River considered by the U.S. Army Corps of Engineers and Bonneville Power Administration to benefit listed salmon and steelhead.
10. CRFPO fisheries assistance for National Wildlife Refuges
 - Continue providing assistance for CCP development, technical support, and general surveys to address aquatic resource issues to the greatest extent possible with existing resources.
 - Continue to work with NWRs to develop FONS and other proposals for resources to address aquatic resource issues and needs.
11. CRFPO will organize the annual workshop for spring 2012.

**Workshop Presentations by
Service Personnel**

**Presentation: Construction for Ni-les'tun Unit tidal marsh restoration, Bandon Marsh
NWR. Presented by Roy Lowe**







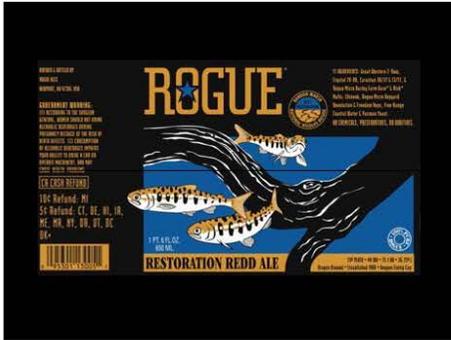












Presentation: Pre-restoration monitoring at Bandon Marsh NWR. Presented by Mike Hudson.



Restoration Benefits

- Coastal Cutthroat Trout
- Coho and Chinook salmon and steelhead
- Other native aquatic species

Restoration Benefits

- Native species collected
 - Coastal cutthroat
 - Steelhead
 - Coho
 - Chinook
 - Cottids
 - 3-spine stickleback
 - Shrimp
 - Shiner perch
 - Gunnel fish
 - Pacific giant salamander
 - Rough-skinned newt
 - Red-legged frog
 - Mink
- Nonnative Species Collected
 - Mosquito fish
 - Brown bullhead
 - Smallmouth bass
 - Largemouth bass
 - Bluegill
 - Bullfrog
- Reference Sites
 - Eulachon
 - American shad
 - Crab
 - Jellyfish

Objectives

- Describe fish species community within and among restoration sites and reference sites before and after construction
- Describe fish species distribution within and among restoration sites and reference sites before and after construction
- Describe fish species relative abundance within and among restoration sites and reference sites before and after construction
- Collect invertebrates to archive from restoration sites before and after construction

Objectives

- Describe fish species **community** within and among restoration sites and reference sites before and after construction
- Describe fish species **distribution** within and among restoration sites and reference sites before and after construction
- Describe fish species **relative abundance** within and among restoration sites and reference sites before and after construction
- Collect invertebrates to archive from restoration sites before and after construction

Objectives

- Describe fish species **community** within and among restoration sites and reference sites before and after construction
- Describe fish species **distribution** within and among restoration sites and reference sites before and after construction
- Describe fish species **relative abundance** within and among restoration sites and reference sites before and after construction
- Collect invertebrates to archive from restoration sites before and after construction

Objectives

- Describe fish species **community** within and among restoration sites and reference sites before and after construction
- Describe fish species **distribution** within and among restoration sites and reference sites before and after construction
- Describe fish species **relative abundance** within and among restoration sites and reference sites before and after construction
- Collect invertebrates to archive from restoration sites before and after construction

Study Area



Methods – Hoop Netting

- Double hoop net with wings
- Nets set overnight (21 hours on average)
- Sampling occurred once per season fall 2007 through winter 2008-2009 and twice per season spring 2009 – spring 2010



Methods - Seining

- Unbagged, 15.2 m long, 1.8 m deep, 0.6 cm mesh seine
- One end of net held at bank, while the other was pulled out in a wide arc and towed back to the bank
- Sampling occurred on same schedule as hoop netting beginning fall 2008 in the mainstem Coquille River and fall 2009 at REF-1



Methods - Electrofishing

- Smith-Root LR-24 backpack electrofisher
- Sampling conducted moving upstream with one electrofisher and two netters
- Completed twice a year, once in spring and once in fall, beginning fall 2007



Methods - Invertebrates

- Three replicate drift samples collected in five reaches delineated by fish sampling sites
- Boat drifts (4) and set drifts (6)
- Sampled once a year in spring



Methods - Biodiversity

- All species encountered during pre-restoration monitoring were ecologically classified according to average relative species abundance and percent frequency of occurrence
 - Based on Olmstead-Tukey's test (Sokal and Rohlf 1969)
 - Allows an ecological and quantitative classification of the species in each area (Gonzalez-Acosta et al. 2005)
 - Analysis results in the division of species present into four ecological categories
 - Dominant, common, occasional, and rare
- Biodiversity was quantified and reported in terms of alpha diversity (Simpson Diversity Index), an index of species richness
 - Alpha diversity was compared using ANOVA within section (Fahys Sections 1-6, Redd, Reference, and Mainstem) among seasons (all years pooled)

Methods – Fahys Lake



Methods – Fahys Lake

- Sample sites haphazardly chosen to document fish occupancy
- Hoop nets, gill nets, minnow traps and electrofishing
- Spring and summer 2009



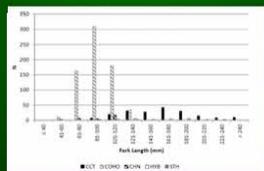
Results – Species collected

- Native species collected
 - Coastal cutthroat
 - Steelhead
 - Coho
 - Chinook
 - Cottids
 - 3-spine stickleback
 - Shrimp
 - Shiner perch
 - Gunnel fish
 - Pacific giant salamander
 - Rough-skinned newt
 - Red-legged frog
 - Mink
- Nonnative Species Collected
 - Mosquito fish
 - Brown bullhead
 - Snowmouth bass
 - Large-mouth bass
 - Bluegill
 - Bullfrog
- Reference Sites
 - Eulachon
 - American shad
 - Crab
 - Jellyfish



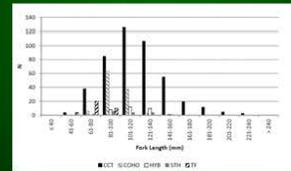
Results – Length frequency

- Length frequency analysis of salmonid species captured across all hoop netting efforts in sections 1-4 in Fahys Creek



Results – Length frequency

- Length frequency analysis of salmonid species captured across all electrofishing efforts in sections 5-7 in Fahys Creek

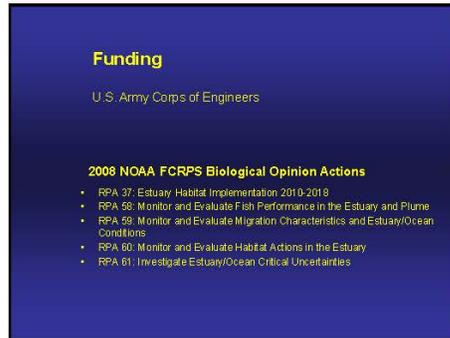
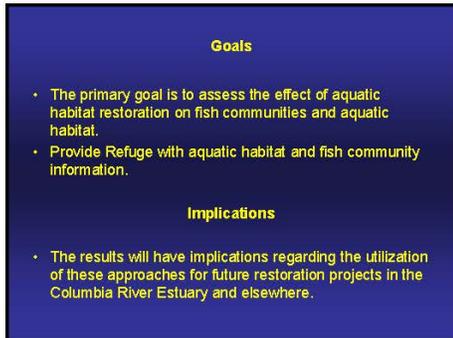
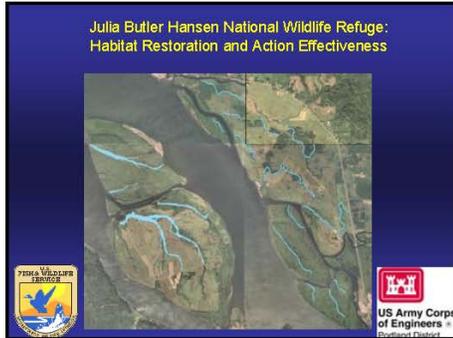


5/17/2011



5

Presentation: Post-construction assessment of fishes, habitats, and tide gates in sloughs on the mainland unit of Julia Butler Hansen NWR. Presented by Jeff Johnson.





Objectives and findings

- Assess fish passage at tidegates.
 - Passage opportunities remain limited into gated sloughs
 - Gates continue to block passage by >80% (closed)
- Describe fish community
 - Few salmonids in gated sloughs
 - Non-native species accounts for ~50% of richness in gated sloughs
- Characterize habitats in treatment sloughs and compare it to that observed at the reference sloughs.
 - Gated sloughs more limiting than reference sloughs (high temperature and low Dissolved Oxygen).
 - No effect of gate replacement on water temperature.
- Describe the movement of juvenile salmon in and out of the sloughs as well as their residence in and use of the sloughs.
 - Few salmonids captured entering gated sloughs, but some remained in or near the sloughs for extended time.
 - Few salmonids in gated sloughs but growth rate very high

Mainland JBH

• Julia Butler Hansen Columbian White-tailed Deer National Wildlife Refuge Section 536 Habitat Restoration Project Lower Columbia River and Estuary.

- Install or replace tide gates
- More "fish-friendly" gate

Mainland Conditions (Pre-construction)

- Flood control levee
- 8 Sloughs
 - 4 with tide gates (red)
 - 4 closed (black)
- Existing tide gates
 - Top-hinge aluminum
 - Top-hinge steel
 - Top-hinge wood
 - Side-hinge aluminum w/cam-float system to allow inflow
- Problems:
 - Flooding
 - Fish passage
 - Aquatic habitat quality

Restoration Plan

- Goal:
 - Improve fish passage
 - Improve aquatic habitat
 - Improve drainage
- 2009 actions
 - Replace gate at Brooks Slough
 - Install gates at Hampson and Winter Sloughs
 - Repair culvert at W201+30
- 2010 actions
 - Replace gate at Duck Lake
 - Install gate at Indian Jack Slough

Restrained Side-Hinge Tide Gate

- Side-hinge
 - Hydraulic piston restrained
 - Float system trigger
- Operating principles:
 - Opens up to 70 degrees
 - Locks open, allowing exchange of water
 - Closes at pre-defined slough water elevation

Project approach: Assess effects of restoration actions on JBHNWR



Before-after-control impact monitoring (BACI) of habitat and fish community
 Treatment vs. Reference
 Treatment vs. Control
 Before and After restoration

Reference Sloughs (Blue)

Control Sloughs (Ellison)
 *closed

Reach selection
 *Random, spatially balanced
 *Minimum 3 reaches per slough
 *25 or 50 meter reaches

Objectives

1. Assess fish accessibility through tide gates (trapping, tagging, interrogating)
2. Describe the presence and distribution of salmonids and other fish species inhabiting treatment and reference sloughs (seine collections)
3. Characterize aquatic habitats in treatment and reference sloughs



Obj. 1) Assess fish accessibility through tide gates



- *Trap nets set up stream of tide gates to capture fish entering slough
- *Winter slough, 2010
- *Trap nets set at mouth of reference sloughs to capture fish entering slough
- *Steamboat, 2010
- *Individual salmon tagged (PIT) and released at capture site.
- *PIT antenna maintained at mouth of slough to provide data on residence time.

Obj. 1) Assess fish accessibility through tide gates



- *Salmon captured entering -2010
- *Chinook, Coho, Chum and steelhead captured entering Winter Slough.
- *Chinook and Coho captured entering the Reference Slough.

	TSS/100r	Ck/hour
Steam	191	1.4
Winter	167	2.9

*Average of 5 days, paired sampling



Obj. 2) Describe the presence and distribution of salmonids and other fish species inhabiting treatment and reference sloughs



- *Seine hauls and hoop net sets performed at sample reaches
- *5 seine hauls at each site



Obj. 2) Presence and distribution of salmonids



- One year post-construction
- *Reference - 8 of 10 species native
- *Treatment - 8 of 17 species native
- *Chinook, Coho and Chum were captured in Winter and Hampson sloughs
- *Salmon in all but one reach pre-construction
- *None captured pre-construction

Total salmon captured in sloughs

	Reference	Treatment
Chinook	62	324
Coho	18	36
Churn	0	2

* But also more salmon captured in Ellison Slough (closed sloughs).



Obj. 3) Characterize aquatic habitats in treatment and reference sloughs

Year	Median Daily Temp. range	Year	Median Daily Temp. range
2007		2010	
Hampson	1.4	Hampson	1.96
Winter	N/A*	Winter	2.39
Hunting	0.2**	Hunting	3.07
Steamboat	3.95	Steamboat	3.80

Winter vs reference - not different
 Hampson vs Hunting - not different

* Logger lost
 ** Logger became buried in sediment

Obj. 3) Characterize aquatic habitats in treatment and reference sloughs

Year	DO%	Year	DO%
2008		2010	
Hampson	54.1	Hampson	79
Winter	54.7	Winter	89
Hunting	83.3	Hunting	80
Steamboat	98.2	Steamboat	77

2010 = no significant differences among treatment and reference sloughs

There was an increase in %DO on both Winter and Hampson Sloughs after construction

- Summary**
- More salmon captured entering Winter Slough than captured entering Steamboat (reference slough).
 - Remained for up to 30 days posttagging in Winter.
 - Juvenile salmon found throughout newly-gated sloughs.
 - But salmon (24) were also found in Ellis on, a closed slough (?).
 - Water quality in newly-gated sloughs appears to be approaching that of reference sloughs.
 - Temperature and dissolved oxygen.
- Future**
- Currently collecting post-construction data
 - First year post at 2010 sites and second year at 2009 sites
 - Continue work in 2012. (pending funding)

Presentation: Fishery issues at Kootenai NW. Presented by Mike Faler.

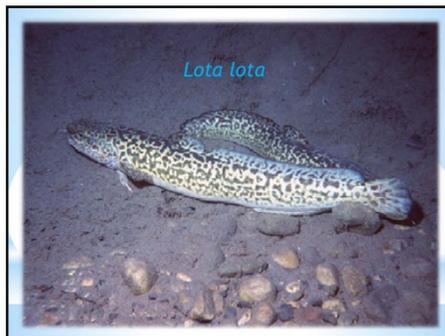
Fishery Issues at Kootenai NWR

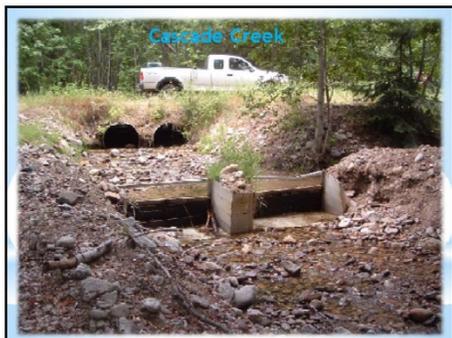


Primary Focus Areas

- Extensive rearing ponds for burbot (*Lota lota*)
- Cascade Creek -- Native redband rainbow?
- Myrtle Creek - sport fishery, diversion, habitat, bull trout

Lota lota





**Cascade Creek Fish Samples
(Rainbow Trout)**

Stream Section	Number Collected	Mean Length (mm)
Eastern Diversion	18	98
Northern Diversion	3	104
Upper Reach	14	92

Cascade Creek *O. mykiss* Genetics

- 10 samples, 16 alleles examined/ sample
- 50% of samples were identified as >F1 rainbow/cutthroat hybrids
- Introgression levels in the hybrids were low (~3%)
- Each hybrid sample contained only 1 cutthroat allele
- The remaining samples were indicative of pure *O. mykiss*
- They had allele frequencies more similar to native redbands than hatchery RBT





Myrtle Creek Fish Samples

Stream Section	Species	Number Collected	Mean Length (mm)
Upper	Rainbow Trout	5	117
	Bull Trout	2	270
	Mountain White Fish	4	175
	Northern Pike/minnow	1	235
	Longnose Dace	18	93
	Sculpin	2	86
Middle	Rainbow Trout	6	112
	Brook Trout	1	105
	Rainbow x Cutthroat Hybrid	9	89
	Brook x Bull Hybrid	1	195
	Longnose Dace	16	70
	Sculpin	20	71

Recommendations Burbot

1. At this time we do not recommend that any existing ponds on the Refuge be used for burbot rearing, experimentation, or production.
2. We do encourage the Refuge to consider construction of special ponds for such purposes if funding could be obtained and all the requirements and restrictions of the Refuge could be met.

Recommendations Cascade Creek

Road Culvert

1. Replace twin culverts with a bottomless arch or bridge of sufficient size to pass high runoff in Cascade Creek.

Water Diversion ?????

Connectivity to Myrtle Creek

1. If passage is provided, continued hybridization with other stocks is inevitable. If passage is not provided, the population may revert to a pure redband strain, but will be susceptible to stochastic events.

Recommendations Myrtle Creek

Water Diversion

1. Install a rotary drum screen of appropriate mesh size to reduce or eliminate the entrainment of juvenile salmonids.

Habitat

1. Strategically place large boulders, root wads, logs, etc., in the middle reach to influence sinuosity and pool development during bankfull flows.
2. Enhance riparian habitat (woody vegetation) along the middle and lower reaches where feasible.

Recommendations Myrtle Creek

Bull Trout

1. Gear restrictions, such as the use of single barbless hooks on artificial flies and lures would make releasing bull trout much less stressful when caught and should cause less injury.
2. Post information along the stream and in the visitors center on how to correctly identify bull trout from other similar trout species, encourage fisherman to not remove fish from the water whenever feasible, and reduce the amount of handling as much possible.



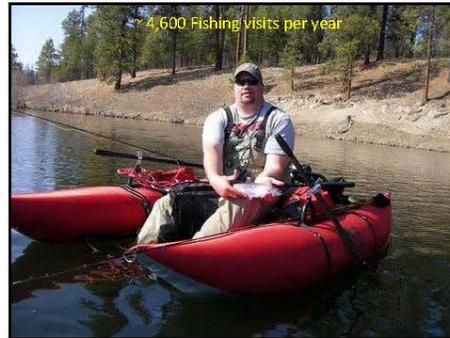
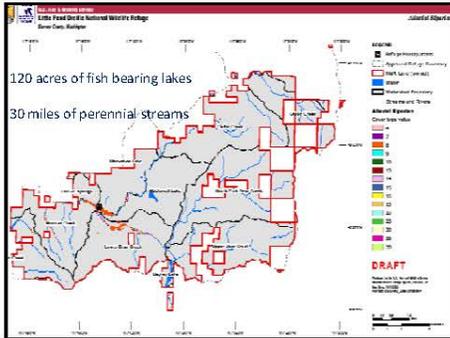
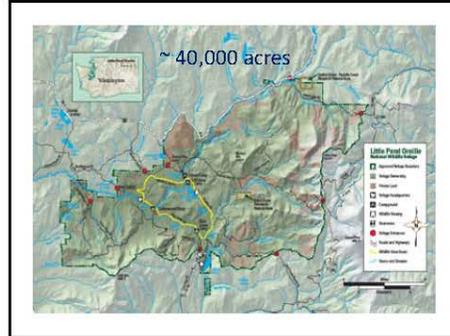
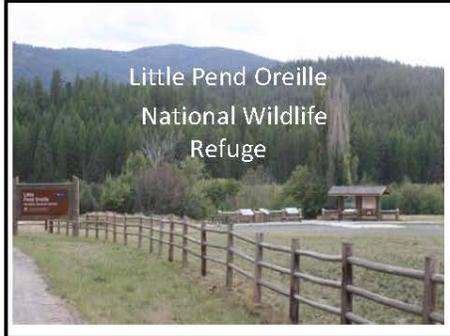
**Presentation: Aquatic resource issues and needs at the Inland Northwest NWR Complex—
Kootenai NWR. Presented by Dianna Ellis.**

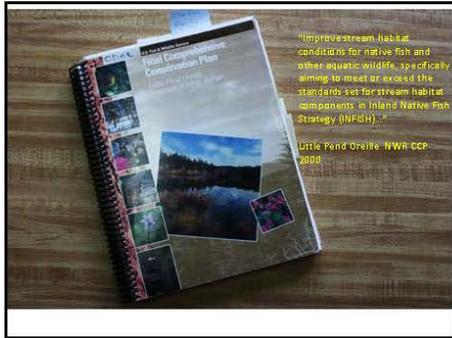
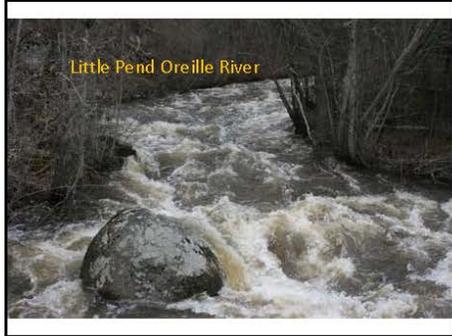


5/17/2011



**Presentation: Aquatic resource issues and needs at the Inland Northwest NWR Complex—
Little Pend Oreille NWR. Presented by Jerry Cline.**





Results of previous fish habitat assessments: 1997

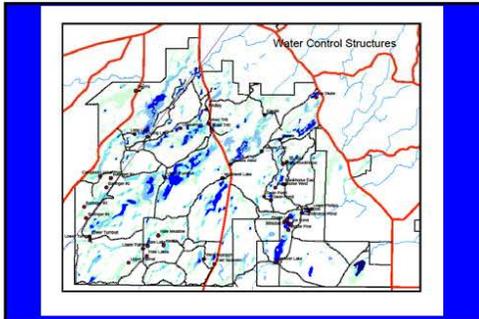
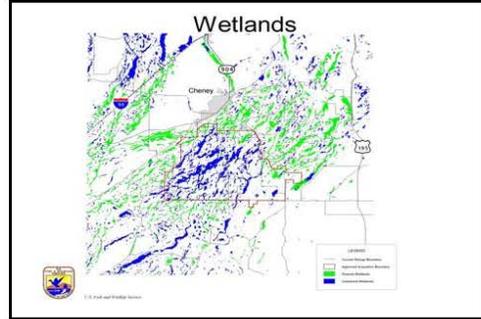
Parameters not meeting INFSHS:

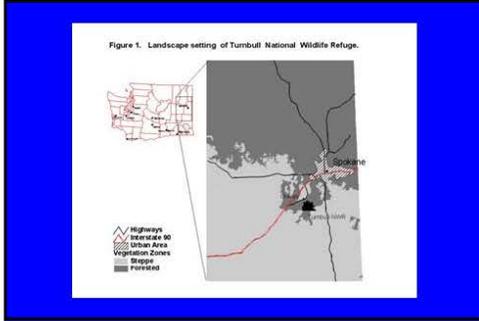
Parameter	Does it meet standards
Water temperature	Some
Adult holding habitat	None
Spawning/rearing	None
Pools per mile	None
Bank stability	Most
Sediment in riffles	Some
Large woody debris	Some





**Presentation: Aquatic resource issues and needs at the Inland Northwest NWR Complex—
Turnbull NWR. Presented by Dan Matiatos.**





Presentation: Fisheries research needs for Handord Reach NM, McNary NWR, and Umatilla NWR. Presented by Lamont Glass.

Hanford Reach NM

- What are the impacts of the fluctuating water levels from the operation of Priest Rapids Dam on mollusc populations?
- What is the potential to enhance or restore mollusc habitat on the Hanford Reach?
- What freshwater species are present in the Saddle Mountain Ponds?
- Do fish species in the Saddle Mountain or WB-10 ponds exhibit any unusual contaminant loads from residing in irrigation return water?



**Presentation: Streamflow response to climate as influenced by geology and elevation.
Presented by Tim Mayer.**

Streamflow Response to Climate as Influenced by Geology and Elevation

- Authors:
 - Tim Mayer, US Fish and Wildlife Service
 - Seth Naman, NOAA Fisheries

Presented at the Columbia Fisheries Office May 5, 2011

Warmer temperatures, reduced snowpacks, earlier snowmelt and more winter rain v snow will lead to:

- Earlier timing of snowmelt runoff
- Decreased summer/fall baseflows
- Increased water temperatures
- Increased winter flooding

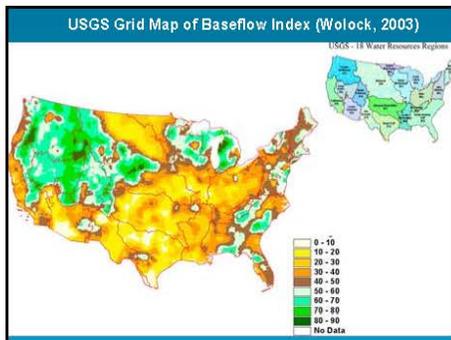
Purpose of Study

To consider how climate change impacts to streams vary for different stream types, as defined by elevation and geology.

Focus on the Pacific Northwest.

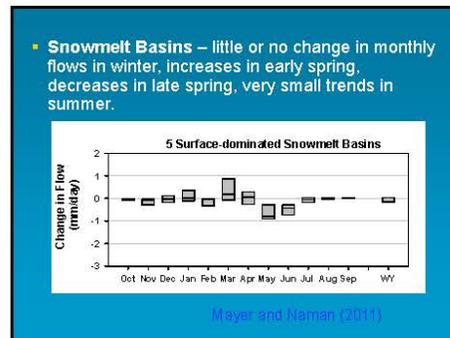
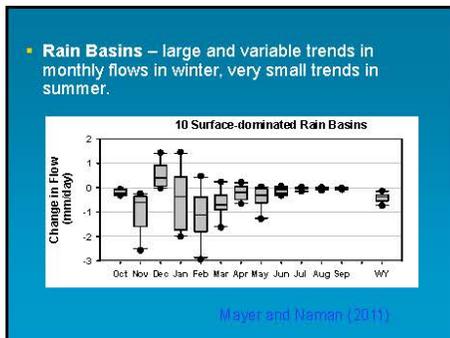
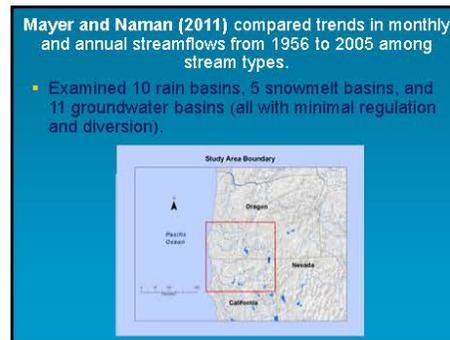
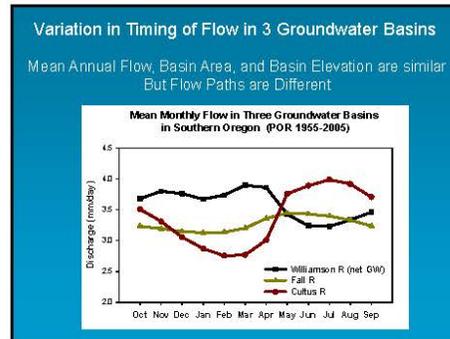
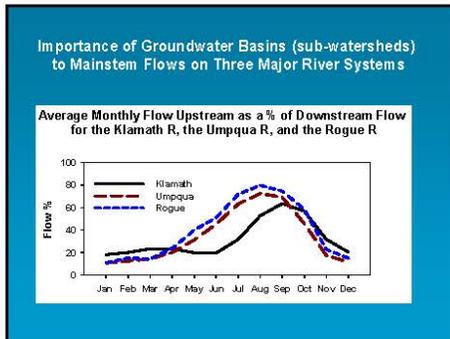
Surface-dominated and Groundwater-dominated Flow Regimes

River	Type	Elev (m)	Annual Pcp (cm/yr)	Annual Runoff (cm/yr)
Little R, OR	Surface Rain	800	156	89
Salmon R, CA	Surface Snowmelt	1300	141	83
McCloud R, CA	Groundwater	1900	143	87

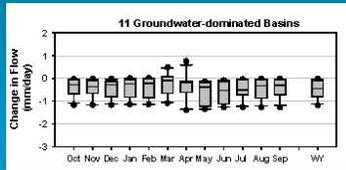


Stream Types and Summer Streamflow

Contrast in summer flows in two Oregon rivers



- Groundwater Basins – more uniform trends (mostly declines) in all months, less of a decline or even increases at some sites in Mar/Apr, relatively large declines in summer/fall flows in comparison to surface-dominated streams.

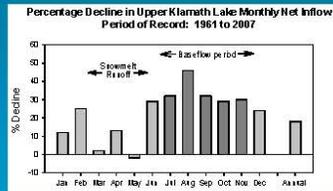


Mayer and Naman (2011)

“...absolute decreases in July-September baseflows are significantly greater, by an order of magnitude, in groundwater basins compared to surface-dominated basins...”

Mayer and Naman (2011)

Relative Changes in Upper Klamath Lake Monthly Net Inflows



Stream Types and Climate Change Impacts

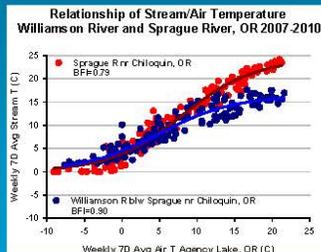
Warmer Water Temperatures?



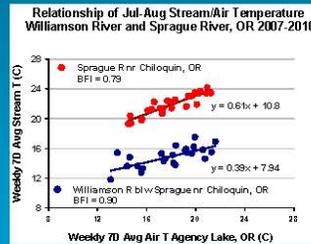
Groundwater-dominated stream

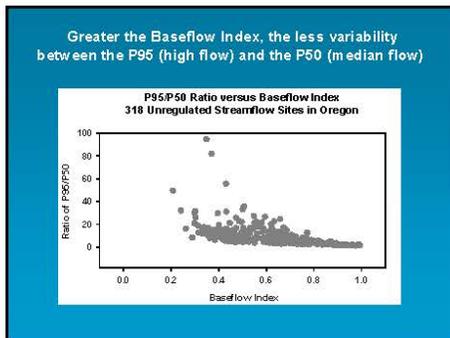
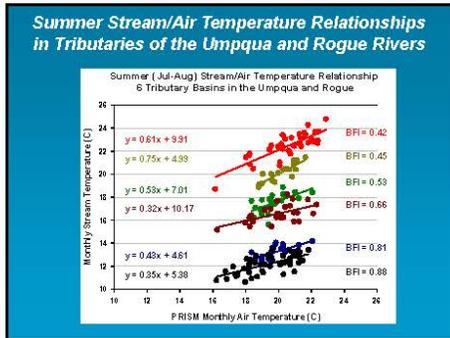
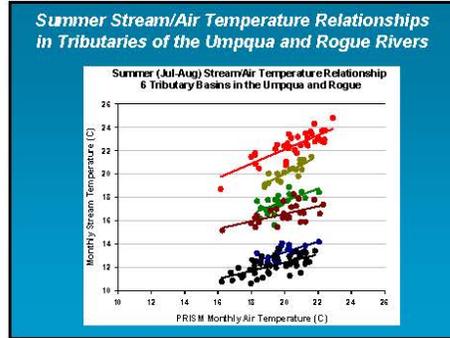
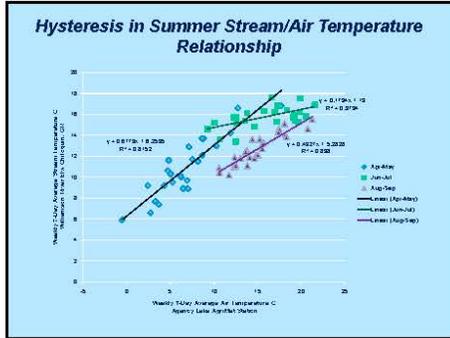
Surface-dominated stream

Stream/Air Temperature Relationship



Summer Stream/Air Temperature Relationship





Potential Climate Change Impacts to Groundwater-dominated Streams

- Changes in timing and baseflows**
 - Groundwater basins show some indication of earlier timing of snowmelt runoff due to reduced snowpack but timing changes are more subtle and spread out. The effects of reduced snowpacks are extended into summer, resulting in larger absolute decreases in summer baseflows.

Potential Climate Change Impacts to Groundwater-dominated Streams

- **Warmer water temperatures**
 - Summer water temperatures are considerably cooler in groundwater-dominated streams and these systems may be less sensitive to increasing summer air temperatures than surface-dominated streams.

Potential Climate Change Impacts to Groundwater-dominated Streams

- **Increased winter flooding risks**
 - May be less sensitive to increased flooding because flows are more stable and streamflow generation processes are different.



Questions?

Olympic Nat Park



Crater Lake Nat Park



Mt Rainier Nat Park

Presentation: NWRS I&M Program overview. Presented by Kevin Kilbride.

U.S. Fish & Wildlife Service

NWRS I&M Program Overview

National Wildlife Refuge System

U.S. Fish & Wildlife Service

"What matters most is what gets done on the ground."

Fred Pavaglio

National Wildlife Refuge System

U.S. Fish & Wildlife Service

NWRS Mission

...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

National Wildlife Refuge System

U.S. Fish & Wildlife Service

What are the Goals of the System?

- A. Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- B. Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life-history needs of these species across their ranges.

National Wildlife Refuge System

U.S. Fish & Wildlife Service

Goals of System (Cont.)

- C. Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts
- D. Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation)
- E. Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats

National Wildlife Refuge System

U.S. Fish & Wildlife Service

NWRS I&M Program Documents

- **Strategic Plan** for Inventories and Monitoring on National Wildlife Refuges: Adapting to Environmental Change
 - Long-term program development (2012 and beyond)
- **Operational Blueprint** for Inventories and Monitoring on National Wildlife Refuges: Adapting to Environmental Change
 - Initial structure and priority tasks (FY2010-11)

Finalized January 2011

National Wildlife Refuge System

U.S. Fish & Wildlife Service

NWRS I&M Program Objectives

- Increase the resilience of existing protected areas by informing refuge planning and management and the future growth of the Refuge System.
- Assess the vulnerability of the NWRS related to broad-scale climate and non-climate stressors: water shortages, changes in precipitation patterns, changes in fire risk, contaminants, and land use changes.
- Assess the vulnerability of the NWRS to increases in weed species and changes in insect pests and disease pathogens.

National Wildlife Refuge System

U.S. Fish & Wildlife Service

NWRS I&M Program Objectives (cont)

- Detect shifts in biomass and species ranges, elevated extinction rates, and changes in the timing of migrations and other phenological phenomena. Inform and evaluate adaptation strategies at multiple spatial scales.
- Assess the vulnerability of the NWRS coastal and marine resources to sea level rise, rising ocean temperatures, and ocean acidification.
- Assess the vulnerability of the NWRS Arctic and other high-latitude resources, including ice-dependent species.

National Wildlife Refuge System

U.S. Fish & Wildlife Service

I&M Program Phases

- Phase 1 (FY2010 and 2011)
 - \$12M for FY2010
 - \$8M for FY2011?
- Phase 2 (2012 and beyond)
 - \$100M budget?
 - \$45M staff (280 FTEs w/ > 200 in field)
 - \$55M for I&M activities

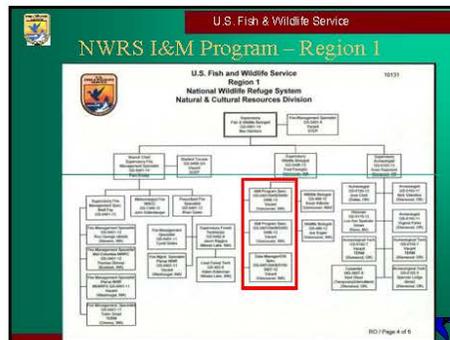
National Wildlife Refuge System

U.S. Fish & Wildlife Service

I&M Program Staffing Proposed for FY2010

- Hiring 38 FTEs
 - 10 National Office
 - 48 Regions 1-8 (6/region)

National Wildlife Refuge System



U.S. Fish & Wildlife Service

Zone I&M Biologists

- **Brian Root @ Nisqually NWR**
– North Pacific LCC (West side)
- **Jenny Barnett @ Turnbull NWR**
– Great Northern and Great Basin LCCs (East side)
- **Jared Underwood @ Hawaiian and Pacific Islands NWRC (Pacific Reefs NWRC)**
– Pacific Islands Climate Change Cooperative (PILCC)

National Wildlife Refuge System

U.S. Fish & Wildlife Service

R1 I&M Budget – FY 2010

- Salaries for 3 Zone I&M biologists, I&M Coordinator, Data Manager, and I&M Specialist
- Office set-up, vehicles, IT and survey equipment, Fire program shared position, PCS
- Funded contract with Water Resources to conduct WRIA (GIS Specialist)
- Funded 4 Hydrogeomorphic Modeling Projects (James Campbell, Conboy, Nestucca, Camas)
- Funded contract to develop the Refuge Habitat Management Database

Spent/Obligated – 99.9%

National Wildlife Refuge System

U.S. Fish & Wildlife Service

Region 1 Approach

National Wildlife Refuge System

U.S. Fish & Wildlife Service

Region 1 Additional Priority Work Activities FY 2011

- I&M (Blueprint) projects to be supported with National and Regional funds during FY2010
 - Coordinate/communicate with LCCs
 - Support other priority tasks in Operational Blueprint: Fire Effects Monitoring, Invasive Species Mapping
 - Update I&M Glossary – handbook & database
 - Staff Recruitment – Feb 2011
 - Support Refuge Health program
 - Development of **Wetland Quality Assessment Tools**

Source: See Region 1 Work Plan – FY2011

National Wildlife Refuge System

U.S. Fish & Wildlife Service

NWRS and Region 1 I&M SharePoint Sites

- Documents: Policy, Workplans, Monitoring Plans, Reports, Assessments, Meeting Notes, etc...
- Databases: main distributions site of Refuge I&M database
- Calendar of Activities (webinars, meetings, milestones, etc.): Main and LCC specific
- Intranet & Internet Links
- <http://sharepoint.fws.net/Programs/nwrs/IM/R1/>

National Wildlife Refuge System

U.S. Fish & Wildlife Service

NWRS and Region 1 I&M SharePoint Sites

- **Main Site**
 - <http://sharepoint.fws.net/Programs/nwrs/IM/R1/default.aspx>
- **LCC Sub-sites**
 - <http://sharepoint.fws.net/Programs/nwrs/IM/R1/INLCC/default.aspx>
 - <http://sharepoint.fws.net/Programs/nwrs/IM/R1/NPLCC/default.aspx>
 - <http://sharepoint.fws.net/Programs/nwrs/IM/R1/PICCC/default.aspx>

National Wildlife Refuge System

U.S. Fish & Wildlife Service

Supporting Refuge I&M Projects

- Zone I&M Biologist emailed RFPs to Refuge Project Leaders – mid-March
- Received 37 proposals (\$1.4M) from all CCs
- Reviewing proposals based upon RFP criteria and other factors
- Funding
 - Equity across zones
 - Contingent upon available funding and final budget for program

National Wildlife Refuge System

U.S. Fish & Wildlife Service

Refuge Habitat Management Database

- National I&M Program Pilot Project Prototype database has been tested by small user group.
- User friendly, form driven data entry – user manual available
- Designed for use from a refuge/complex LAN
- No additional hardware/software requirements
- Beta version for testing - Spring 2011
- Facilitates implementation of CCPs and HMPs
- Automates preparing AHWPs
- Provides a 21 Century approach to the Annual Narrative

National Wildlife Refuge System

U.S. Fish & Wildlife Service

Refuge Habitat Management Database - Benefits

- Facilitates developing refuge I&M plans
- Promotes communication among staff members about habitat management actions and desired outcomes
- Networking with other refuges about their habitat management and I&M activities (share adaptive management knowledge)
- Provide data to complete RAPP
- Provides information to conduct Wildlife and Habitat Management Reviews

National Wildlife Refuge System

U.S. Fish & Wildlife Service

Questions?

National Wildlife Refuge System

**APPENDIX B: 2012 NWR-FISHERIES WORKSHOP AGENDA, NOTES,
ATTENDEES, ACTION ITEMS, AND PRESENTATIONS**

NWR-FISHERIES WORKSHOP AGENDA
May 2, 2012
Columbia River Fisheries Program Office
1211 SE Cardinal Court, Suite 100
Vancouver, WA 98683

Goal: Provide a forum to promote effective information exchange and coordination among NWRs, Fisheries, PFW, and other Service programs.

Objectives:

1. Update NWRs about results and activities by Fisheries to address aquatic resource issues and needs.
2. Identify and discuss aquatic resource issues and needs at NWRs and updates on activities.
3. Provide information on status and results of programs and activities of regional or broader interest.
4. Explore additional possibilities for cooperative efforts among NWRs, Fisheries, PFW, and others.
5. Develop action items.

9:00-9:05 Welcome and overview of workshop (Sam Lohr)

1. Activities and Fisheries results for aquatic resource issues and needs at NWRs

9:05-9:35 Fish and aquatic habitat surveys at Sheldon-Hart Mountain NWR Complex (Lohr)

9:35-10:05 Bull trout snorkel surveys in Myrtle Creek, Kootenai NWR (Mike Faler)

10:05-10:35 Fishery work on steelhead at Toppenish NWR (RD Nelle)

10:35-11:05 Bandon Marsh NWR, final restoration activities (Roy Lowe) and initial post-restoration monitoring (Mike Hudson)

2. Programs and activities of regional or broader interest

11:05-11:35 Groundwater control of summer stream temperature in the Pacific Northwest (Tim Mayer)

11:35-12:00 Questions and discussion concerning morning presentations

12:00-1:00 Lunch

3. NWR activities affecting aquatic resources

- 1:00-1:30 Estuary restoration at Nisqually NWR (Jesse Barham)
- 1:30-2:00 America's Great Outdoors Initiative, Willamette Valley Conservation Study (Steve Smith)
- 2:00-4:00 Round table (updates and discussion of aquatic issues and needs at each NWR, Fisheries' initiatives, other Service programs, etc.)
- 4:00 Wrap-up

NWR-FISHERIES WORKSHOP NOTES
May 2, 2012

Fish and aquatic habitat surveys at Sheldon-Hart Mountain NWR Complex (Lohr)

Sam presented results from the fish and aquatic habitat survey that was conducted at Sheldon-Hart Mountain NWR Complex during summer 2011. Basic fish and habitat surveys were identified as an aquatic resource need for the Complex during the initial NWR workshop in 2005, and the I&M Program provided funding in 2011. The goal was to establish baseline fish community and habitat information in four watersheds at the NWRs by addressing four objectives: 1) determine fish species present, 2) determine watershed occupancy by fish species, 3) describe fish distribution with watersheds, and 4) characterize aquatic habitats. Methods consisted of identifying three tiers within each watershed (i.e., representing lower, middle, and upper areas) and sample reaches within tiers using a GRTS approach, then electrofishing the top seven reaches conducive to sampling and characterizing habitat in the seven reaches. Alvord chub and trout were found in the lower tier of the Virgin Creek watershed; Sheldon tui chub were found in the lower and middle tiers of the Fish Creek watershed; and trout were found in all three tiers of the Guano Creek watershed. Time constraints prevented surveying Rock Creek, but trout were found by spot-sampling Willow Creek in the upper tier. Tissue was collected from a subsample of trout in Virgin and Guano creeks for later genetic analysis to determine presence of hybrids (cutthroat-rainbow trout). The project established a systemic sampling approach that can be repeated in the future.

Questions/discussion—

Q There was no mention of spawning habitat for trout in the presentation.

A The reaches sampled in the lower tier of Virgin Creek contained gravel suitable for spawning.

Q Would aquatic resources look differently if horses were not present.

A Yes, especially in Fish Creek. Horse use was evident in many of the areas.

Q Was stream condition assessed?

A Yes, habitat was characterized based on channel dimensions, substrate, habitat type, and riparian vegetation. The crew noted beaver activity at a couple of reaches in the Virgin Creek watershed.

Q Is there enough data to do a before and after stream assessment if horses were removed?

A Reaches we sampled could be revisited after horses are removed. However, our approach was primarily focused on broadly assessing fish and their distribution. A more intense approach specific to the effects of horses would be more appropriate

Bull trout snorkel surveys in Myrtle Creek, Kootenai NWR (Mike Faler)

Mike presented results of Idaho FRO snorkel surveys for bull trout in Myrtle Creek and genetic work on redband-rainbow trout from Cascade Creek. Because earlier fish surveys found bull trout, brook trout, and hybrids of the two species in Myrtle Creek, the NWR wanted to know if bull trout spawning occurs in the stream. Day and night snorkel surveys were conducted on several dates during September 2011 to potentially observe bull trout spawning. A total of five subadult and adult bull trout were observed, with four of them observed during night surveys. No individuals exhibited spawning coloration and no juvenile bull trout were observed. Plans

are to expand the period of surveys to August-October, continue day and night surveys, and focus on the upper stream reach where bull trout have been observed. In Cascade Creek, there are two undersized culverts just upstream of a diversion structure the NWR uses to supply water to ponds. The structure is a barrier to fish passage. The NWR has questions about whether native redband trout persist in Cascade Creek. Earlier genetics work found evidence of hybridization with cutthroat and hatchery rainbow trout, but introgression levels were low and results primarily were indicative of native redband trout. The recent redband trout assessment found that Cascade Creek is one of only a few streams with pure redband trout in northern Idaho, the fish are worthy of protection, and that the structure needs to be considered relative to the risk of isolation versus risk of hybridization.

Questions/discussion—

Q Does the timing of spawning surveys in Myrtle Creek correspond with timing that staging and spawning occurs in other streams in the lower Kootenia River basin?

A Yes, expanding the timeframe in Myrtle Creek will include additional months so that periods with changes in water temperature, which may influence fish, are more likely to be included.

Q Did the idea of determining the population in Cascade Creek and possibly establishing captive brood come up during the redband assessment workshops?

A The workshops just concluded and the ideas were handled there.

Q For Myrtle Creek, has the area been logged and are brook trout present at the NWR.

A Yes to both, brook trout are also in a lake upstream of Myrtle Creek Falls on the National Forest.

Q What are the quantified benefits of allowing public fishing on the NWR?

A It provides recreational opportunity to the public. Fishing is only allowed on Myrtle Creek and restricting it to artificial lures with barbless hooks has been recommended but not approved. Bull trout have been caught on the NWR, and there will be a self-service creel survey beginning soon.

Fishery work on steelhead at Toppenish NWR (RD Nelle)

RD presented background about water management at Toppenish NWR and upcoming work focused on Mid-Columbia steelhead. Toppenish NWR is located in southeast Washington along the lower Yakima River. It consists of several wetland units that receive water diverted from Toppenish Creek and associated tributaries. Primary issues are juvenile steelhead use of the wetland units, possible entrainment and stranding of steelhead in the wetland units, and potential benefits or detriments of the units for fish. To improve management of steelhead and contribute to the CCP for the NWR, Mid-Columbia FRO and NWR has initiated a project with the objectives to determine: 1) residence time of juvenile steelhead on the wetland units; 2) survival of smolts entrained in the units; 3) travel times of juvenile steelhead through the units; and 4) use of the units by adult steelhead. The approach will be to PIT tag juvenile steelhead and monitor fish movement with a series of eight full duplex arrays at the NWR. The work is being coordinated with the Yakama Nation, who will be operating a rotary screw trap and PIT tag array in the mainstem of the creek. The tribe will be tagging 4,000 steelhead a year through 2018. For status of the project, materials for the arrays were purchased last year and antennas will be constructed and installed by summer-fall 2012.

Questions/discussion—

Q CRFPO has developed a GIS-based movement database tool for bull trout that may be useful for analyzing the type of data the project will be generating.

AFTC also can assist with PIT tag arrays.

A Appreciate offers of assistance and are looking for new tools.

Q How much coordination has occurred with the tribe?

A There has been several meeting and they seem interested in working with the Service.

Q Have there been any efforts to screen the diversions.

A Yes, one has been installed, but there are management issues with it. The NWR is working with NOAA-Fisheries on its operation.

Q Are there lamprey in the area?

A No evidence of lamprey since none have turned up sampling. The tribe is considering a release of lamprey in some streams, and RD expects that Toppendish Creek will be included.

Q For fish tagging at the rotary screw trap, do we know what proportion 4,000 is of the total and whether you get a bigger bang for the buck in tagging more fish?

A We don't know the proportion, this is going to be a pilot test this year and we will see how well it goes.

Q Are there other actions being considered to protect fish other than screening?

A There may be opportunities to look at outlets from the wetlands to assist stranded fish in getting out.

Bandon Marsh NWR, final restoration activities (Roy Lowe) and initial post-restoration monitoring (Mike Hudson/Brook Silver)

Roy provided background and an update about the Bandon Marsh tidal restoration project that was completed last summer. Mike and Brook Silver summarized some initial observations from fish monitoring that followed completion of construction. Overall, the project entailed a variety of activities resulting in the restoration of tidal influence to about 400 acres of historically diked pastures and re-construction of Fahys Creek that had been channelized around a cranberry bog. Much of the preconstruction monitoring focused on numerous archeological sites on the unit, establishing surface elevation tables (SETs) to measure changes in marsh surface elevation, and birds. The Siletz Tribe and CRFPO have been involved in fish monitoring. In 2009, work began on filling 15 miles of ditches, replacing them with 5 miles of historic and re-constructed tidal and stream channels with 500 pieces of large wood, installing appropriate size culverts, re-constructing and elevating much of a 3.5 reach of road, and about 13,000 plantings on 5 acres of the former cranberry bog. Several hundred juvenile coho salmon and coastal cutthroat trout were salvaged during construction, as well as over 5,000 rough-skinned newts. Placing an overhead powerline underground added about a year to the project. Ducks Unlimited worked on design and contracting for the project for a total of about 11 years. The dike separating the marsh from the Coquille River was removed during a two-week period in August 2011, providing access for the Coquille Tribe's ceremonial canoe to an area that had not been accessible by boat for 142 years. The dike breach was timed with an incoming tide to minimized sediment levels in the river. Birds were quick to use the restored area. Two projects to improve fish passage were conducted off of the NWR in Fahys Creek, one provided access at a culvert under Highway 101 and the other farther upstream at the site of an old mill dam.

Mike noted that the year delay in completing construction allowed time to set up a sampling frame to accommodate the new tidal channels, which consists of a GRTS approach using rotating panels. Previously, juvenile coho were widely distributed and cutthroat trout were primarily in beaver ponds, now apparent searun cutthroat trout, smelt, anchovy, flounder, and shrimp have been observed at the restoration site. Brook noted that during the most recent trip in January, starry flounder were in Red Creek, smelt larvae were collected for the first time, and coho salmon fry were collected in a side channel.

Questions/discussion—

Q What have been the local views on the economic relations of the project?

A Total cost of the entire project was about \$10M, with about half of that for all the work associated with the road (improvements, increase elevation, burying the powerline, etc.). Most of the contractors had local employees who had not had projects for a long time, so the economic benefit was high.

Q Have there been any noticeable changes in vegetation related to saltwater?

A We expect to see that in about three years based on what we saw at the Little Nestucca River project.

Groundwater control of summer stream temperature in the Pacific Northwest (Tim Mayer)

Tim presented his recent work on stream temperature relative to groundwater conditions in the region. Up to 102 stream temperature sites from throughout the Pacific northwest were used to investigate questions about factors controlling thermal regime and thermal sensitivity of stream temperature. Question 1—what is the relationship between stream and air temperature and is it constant throughout the year? Non-linear regression produces the best fit of relationship, but stream temperature is less sensitive to higher summer air temperatures due to evaporative cooling. Question 2—what is vulnerability of summer stream temperature to warming air temperature? Projected 2.7°C increase in air temperature by 2050 is associated with 1.2°C increase in water temperature with a large range in stream temperature projections. Vulnerability is related to initial stream temperature as much as to stream sensitivity. Question 3—can August stream temperature be determined by August air temperature regionally? Air temperature explains water temperature on a site basis, but many other landscape and stream characteristics influence the relationship to the extent that there is no regional relationship. Question 4—what other landscape factors and channel characteristics are important? The ratio of August stream temperature to air temperature can be used to account for air temperature effects and plotted against other factors. August air temperature, baseflow index (BFI), stream slope and length, and percent forested area account for 72% of August stream temperature variance. BFI and slope explains 40% of the variance in August stream/air temperature ratio. Question 5—what information does summer stream/air temperature ratios provide? Ratios vary systematically with landscape and stream characteristics (e.g., ratio of 1.0 for streams with moderate BFI and not very steep or short; ratios > 1.0 along the coast; ratios around 0.5 characteristic for streams with high BFI). Streams that vary from expected ratios may indicate response to unique conditions or potential restoration needs. Conclusions—stream thermal regime closely related to air temperature; stream thermal sensitivity to air temperature is less during summer; stream thermal sensitivity and temperature in summer are less for groundwater-dominated streams; some

regional variability in summer stream temperature is relation to stream slope and length; and temperature ratios can be used to assess stream temperature conditions.

Questions/discussion—

Q Relative to the large range in stream temperatures observed, did you include streams on both sides of the Cascades and also block data according to stream order?

A Yes, the 102 temperature sites were throughout the northwest so both sides of the mountains were represented. Stream slope and length, which are related to stream order, have a large effect on stream temperature.

Q Why were stream/air temperature ratios used rather than residuals to explain some relationships?

A Ratios may be more familiar to people, residuals were used in the analyses to explain the other landscape and channel factors.

Q Did your data include relative humidity or include it as a covariate in analyses?

A No, stream temperature data and estimates from PRISIM were used for site information.

Q For temperatures, which originally may have been collected at 1-hour increments, could there be a time lag that is missed when using means?

A There's been some work on the best measurement interval to use and that is what the 7-day average is based on.

Q It would be good to evaluate stream temperature relative to fish distribution because it is hard to apply regional models due to a lot of variability. Examples of increasing stream temperature with elevation are the Umatilla and Klamath rivers.

A I have not observed that in our data, air temperature is the typical surrogate for water temperature. Places where stream temperature increases with elevation could be influenced by lakes or meadows, and perhaps groundwater inputs in the downstream reaches of rivers.

Q Concern that sensitivity is not evident across the 102 sites but is evident when using ratios, wondering if blocking by or using a ratio filter on stream order would change things?

A Vulnerability does not describe sensitivity, there was no relationship when sensitivity was inspected based on stream order.

Q Was anything done using depth to width ratios or looking at amount of water diverted and return flows?

A No, really do not have regional information on depth/width ratios and diversions. Could look at stream discharge, but it does not scale very well.

Q Big worry is increases in summer maximum temperature, what about effects on winter minimum temperature, which could affect the conditions for an organism to transform into the next life-history stage?

A The expectation is to see increases in air temperature, so winter temperatures could be more sensitive.

--Potential effects could be on animals that need certain conditions to transform, or winter conditions could become more conducive to growth. These effects could be very important if they alter timing of events and a migratory window is missed.

Discussion of the initiative to develop a long-term monitoring program at Pacific region NWRs to assess the impacts of climate change on aquatic resources

Sam summarized the discussion from the previous meeting with the main point being to further engage NWRs to identify mutual questions around which a monitoring program can be designed. A brief document describing the basic components of a monitoring program from Fisheries perspective was developed and sent to NWRs with questions intended to encourage discussion and input during the workshop.

Howard summarized that the impetus of the initiative was from desires of the RD and ARDs of how the Service could best stand up LCCs and use monitoring at NWRs focused on climate change. Initial discussion with Kevin Kilbride explored the possibility of how to take advantage of ongoing monitoring of physical attributes, and possibly biological monitoring, at NWRs that could contribute to a long-term aquatic monitoring program. The Fisheries Project Leaders thought a good approach would be to start a pilot project at a few NWRs and potentially include more NWRs over time. The need is how to identify NWRs for a pilot project to begin monitoring, but also keeping other NWRs of the system in mind.

Erin described the I&M program, which is conducting Water Resource Inventory and Assessments (WRIAs) that will take recommendations on aquatic species as well as provide assessment of water quality and quantity issues and needs. The Program is also conducting I&M Reviews at NWRs throughout the region, which involve cataloging previous, ongoing, and planned surveys into a database, all to support goals, objectives, and associated actions identified in CCPs. Reviews for 25 NWRs should be completed by 2013 and an additional 35 NWRs will be completed later. All materials from the reviews and information for the database are available on the I&M sharepoint site.

Major points made by several individuals during the ensuing discussion included:

- The long-term aquatic monitoring program should be designed to address NWR I&M needs and specific NWRs that overlap with needs of Fisheries. A question would be whether there are multiple NWRs that have the same needs so that a NWR-specific issue or question can be addressed across the NWR system and a broader landscape.
- The point is not to reinvent the wheel, but to synchronize monitoring of physical aspects in aquatic habitats with biological monitoring. Places that have had a lot of physical information collected might be the best places to just start the program by filling in gaps for biological information. Another way of looking at it is to ask what Fisheries can provide.
- Sounds like chicken and egg deal with LCCs. We need to mesh network of NWRs with biological needs, and address these without building a new system—just see if we can say something across the system.
- Bodies to conduct surveys are most often lacking.
- Perhaps Fisheries can best help with a roving crew among FROs to conduct aquatic surveys at NWRs using a rotating panel design, and then FROs can assist with the analyses of data.
- Fisheries can really contribute to NWR needs by helping with acquiring basic inventory and baseline information.
- Another way Fisheries can help is to provide guidance on sample design.
- Overall, intent of approach is for Fisheries to provide assistance regularly and regionally, incorporate consideration of climate change effects, and use long-term sites to assess changes. That approach is the maturation of the I&M Program.

- Two important things that the Nisqually restoration program had was extensive inventory information and sustained funding.
- Farther from restoration you go, the tougher it is to get funds.
- Perhaps a good approach to move forward would be to interview NWRs and fill out a table describing resources, CCP issues, feasibility and desirability of conducting long-term aquatic monitoring.

Fisheries will consider points of the discussing and be in touch with NWRs with proposal of next steps.

(Description of initiative and questions distributed prior to the workshop)

Initiative to develop a long-term monitoring program at Pacific Region National Wildlife Refuges to assess the impacts of climate change on aquatic resources

April 25, 2012

Fisheries Project Leaders identified three areas of emphasis during their coordination meeting in 2011. One area of emphasis was to assist R1 National Wildlife Refuges to design and implement an aquatic monitoring program for evaluating the impacts of climate change, which is supportive of the Service's Strategic Plan for Responding to Accelerated Climate Change. Based on initial discussion between Fisheries and Refuges, a necessary step for collaboratively developing an aquatic monitoring program is to facilitate coordinated communication among offices and programs to determine if there are common issues concerning monitoring and climate change. If so, then a monitoring program can be designed to address the issues common to Refuges and Fisheries.

The intent of this document is to assist in determining what questions may be shared between the programs. The approach is for Fisheries to articulate an overall goal of the monitoring program, describe basic questions that can be answered to address the goal, and provide examples of variables that potentially can be used as metrics in the design. The hope is that this approach results in a starting point that will encourage dialog between the programs, and lead to articulation from Refuges' perspective so that the concept of an aquatic monitoring program can be further evaluated and developed. In addition, questions are included that we would request Refuges to consider and be prepared to discuss at the upcoming workshop.

A. Overall goal—Design a monitoring program to evaluate effects of climate change on aquatic resources. An assumption is that the design will include establishing permanent monitoring sites that are surveyed at some predetermined frequency (e.g., 1-, 2-, 5-year interval).

B. Basic questions and associated variables

1. How do physical attributes vary through time? The selection of physical attributes should be based on their expected effects from climate change and biological relevance. Likely continuously collected variables would include water temperature, precipitation, stream discharge, and water levels in lakes/ponds/tidal areas; thus generating data to assess potential changes in timing, frequency, and magnitude over time. It may be appropriate to use some variables being measured by others in the proximity of survey sites, but not at a refuge.

2. How do biotic attributes vary through time? The primary biotic attributes of interest are Fisheries' trust species (e.g., listed and imperiled aquatic organisms), and could include other taxa potentially affecting trust species (e.g., non-native invasive fish through interspecific interactions or aquatic invertebrates through food availability). Because aquatic assemblages and communities reflect the integration of prevailing physical and biotic conditions through time, indices derived from assemblage metrics such as species richness, relative abundance, Index of

Biotic Integrity, and ecological/physiological traits of select taxa would be the main variables of interest.

C. Analysis: The main analyses are presently envisioned to focus on detecting and describing potential temporal changes in physical and biotic attributes, and assessing whether these are associated with the influence of climate change. Additional questions can be developed to address spatial aspects of monitoring (e.g., by incorporating comparisons among refuges, areas off refuges, etc.) and possibly coordinating with ongoing monitoring activities by others.

D. Questions: We request Refuges to consider the following questions prior to the upcoming May 2, 2012 Workshop in Vancouver, WA, so that a roundtable discussion can be held. This will assist with assessing the desire and feasibility of our programs to jointly design an aquatic monitoring program.

1. Please describe the goals, basic questions, and variables of an aquatic monitoring program from Refuges' perspective.
2. What specific issues should be focused on at your refuge in designing a monitoring program?
3. Who should be on a workgroup to further develop the monitoring program?
4. Are there specific refuges that should serve as pilot sites?
5. Given the large geographic scale of climate change, what should be the scope of the monitoring program (e.g., all R1 (four states and Pacific Islands), three mainland states, specific area of a basin, or area including R1 and beyond)?

Estuary restoration at Nisqually NWR (Jesse Barham)

Jesse presented various aspects of the restoration project in the estuary at Nisqually NWR and discussed findings of monitoring physical and biological responses. In 1904, construction began on dikes that isolated 21 miles of historical tidal channels and sloughs from Puget Sound. Nisqually Tribe had restored some channels adjacent to NWR. The CCP was approved in 2005 and included restoration of the estuary, which was based on public comments, modeling physical conditions, Delta-wide fish study, vegetation and wetland analyses. The restoration project entailed removing dikes to restore tidal influence to 760 acres with multiple points of connectivity, a setback levee to protect 250 acres of freshwater habitat, large wood placement, plantings, and a boardwalk. Construction was completed in 2009 at a cost of \$9M. Monitoring and research for the project is being conducted in partnership with the USGS and Nisqually Tribe using an overall approach of processes, habitat structure, and function. These are linked to opportunity, capacity, and realized function of restored estuarine habitat relative to Chinook salmon for assessing biological responses of the project. Early restoration monitoring indicates that for processes, tidally-influenced hydrology and associated channel development are progressing, which have provided juvenile Chinook salmon the opportunity to access the habitat. Vegetation is responding to the restored hydrologic and sedimentation regime, and is providing Chinook salmon rearing capacity through sources of invertebrate prey and suitable habitat. Catch and diet information indicate that juvenile Chinook salmon are using the restored habitats and feeding there. Future analysis, such as using otoliths, will investigate factors related to realized function such as juvenile fish growth and residency. Lessons learned: protecting areas from irreparable development is essential; large-scale restoration is a long-term process with partnerships, planning and assessment, fundraising, implementation, and monitoring and adaptive management; and interdisciplinary research is necessary to understand processes and habitat and biological responses.

Questions/discussion—

Q Who is funding the monitoring?

A There has been a variety of sources. EPA provided \$600K and there is a Washington State Program, too. Since the project was so large, some adjacent drainages provided funds coming from the Salmon Recovery Fund. Some funds for the otolith work were contributed by the Tribe. We expect funds to run out next year, but it has been sufficient for three solid years of monitoring work.

Q Have you seen any evidence suggesting that juvenile salmon over-summer at the restoration site?

A Not sure, beach seining is conducted near-shore and fyke nets target emigrating smolts during March-August.

America's Great Outdoors Initiative, Willamette Valley Conservation Study (Steve Smith)

Steve presented ongoing work that refuges is conducting on the Willamette Valley Conservation Study Area (WVCSA). The WVCSA is one of two projects selected by the Governor of Oregon as top priorities to pursue under the America's Great Outdoors Initiative, which is intended to promote conservation and provide the public opportunities to recreate and connect with the outdoors. The study addresses current limitations of refuges in the Willamette Valley (i.e., they

cannot meet demands for public use, enabling legislation narrowly focuses on wintering Canada geese, all authorized land has been acquired, and there is no authorization to expand stewardship of refuge boundaries) while the refuges have the capacity to manage lands. The scope of the WVCSA is the Willamette Valley below 1,500 feet in elevation, and the goal is to evaluate landscape strategies that: support traditional agricultural and forestry land uses, are voluntary and non-regulatory, contribute to land and water health, provide public access, support local economies, and include community and partner priorities. The Service has held several open houses where partners and landowners were asked whether the Service should increase involvement in land management within the study area, about their views on the Service's role, and about support for protection of their lands. Tools available through the initiative are land easements, fee title, and restoration and management. Concepts for the WVCSA are to use various existing plans and data and locally-developed solutions and priorities. A question for Fisheries is what types of strategies can be applied to conserve fish and also provide public use. Aquatic habitat in the valley is estimated to have undergone a 80% reduction in stream length and 90% reduction in connectivity compared to historic conditions. Some plans have identified anchor habitats (e.g., cold water refugia), conservation opportunity areas, and perhaps areas that may be important for lamprey (tribal areas or west side of valley). The study is authorized to look at 250K acres, and help is needed on how to address fishery issues and public use.

Questions/discussion—

Q Many of the partners involved in the WVCSA (e.g., ODFW) are also involved in the Pacific Lamprey Conservation Initiative, so they know specifics for lamprey. Has a climate change overlay been considered?

A Yes, ideal is to have the science incorporated in planning from the start, want to be able to think about things that help preclude the need to list species, and potential effects of agriculture and water use. The Oregon Department of Agriculture and grass seed industry will be dealing with water quality issues and regulations.

C The Coastal Cutthroat Trout Conservation Initiative might be a good place to start because they are widely distributed in the valley. It would also be good to see how National Fish Passage Program and Fish Habitat Action Plan may line up with the salmon and steelhead plan, and then look at how these layer on the AGO needs.

Round table (updates and discussion of aquatic issues and needs at each NWR, Fisheries' initiatives, other Service programs, etc.)

Ridgefield NWR Complex: Alex mentioned two ongoing projects (Post Office Lake, Campbell Lake) for which the Corps of Engineers are developing designs at Ridgefield NWR. Post Office Lake is isolated from the Columbia River by a culvert with a closed tide gate and there are multiple breeches developing on the adjacent levee. The plan is to remove the tide gate and reconnect the lake to the river. There are concerns with likely reductions in the lake that provides habitat for thousands of geese and ducks. The adjacent landowner, whose property could be flooded at times, is also working with a mitigation banker on conservation designs. Campbell Lake is open to the Columbia River via a relatively long channel (Campbell Slough), and the Corps is looking at possible habitat activities for salmon. A graduate student will be working on aquatic invertebrates at both Post Office and Campbell lakes this summer. At Steigerwald NWR, the Corps has also started to evaluate restoration potential of reconnecting

Steigerwald Lake to the Columbia River and addressing issues with the Gibbons Creek diversion structure. The issue of the Corps receiving credit under the FCRPS BiOp for upper Columbia basin salmon stocks that do not spend time in the lower Columbia River where these types of habitat projects are conducted was discussed.

Sheldon-Hart NWR Complex: John mentioned that the Sheldon CCP is wrapping up, and they are starting up work on the Hart Mountain CCP with preliminary meetings. Roads, campgrounds, and grazing will be major issues, as well as identifying habitat restoration opportunities that may exist. ODFW wants to complete genetic work on fish tissue collections. Another aquatic consideration is Warner Pond, which is an isolated lake that is stocked with rainbow trout. At Sheldon, the NWR is coordinating with NDOW on potential habitat restoration plan for Virgin Creek for when feral horses and burros are removed and also on the condition of Catnip Reservoir and the Lahontan cutthroat trout that have been introduced there.

Oregon Coast Complex: Roy noted that a draft CCP for Bandon Marsh, Siletz Bay, and Nestucca Bay NWRs is scheduled for completion by late summer and should be available to the public shortly later. A land protection plan for Bandon Marsh is being prepared separately from the CCP. The LPP would include authorization for expanding the refuge by up to 4,500 acres further upstream, of which 2,200 acres are the main focus for possible tidal restoration. There has been a lot of concern and opposition by some of the public. At Siletz Bay, there is an ODOT project with the opportunity to restore tidal influence to 5-10 acres by removing dikes. A primary concern is the effect of climate change on several factors affecting the NWRs. Shawn and Dave crafted comments and responses to questions on the Aquatic Monitoring Program document and provided them to Sam. Their perspective was to look at Bandon Marsh and Oregon Islands NWR as an integrated system based on nutrient and energy flow and movement of aquatic taxa among marine, estuarine, and freshwater habitats. Most relevant questions concern salinity and acidification effects on food webs that support fish and birds, specifically to gain a better understanding of salinity gradients in the estuary and effects on benthic and planktonic species at the base of the food web. Obtaining baseline data and changes over time are important for pH gradients and buffers, including influence of the river, in the estuary and near-shore areas. Also, an inventory of the biota, so that community metrics can be characteristics, in the estuary and marsh are needed. Climate change effects on the basin and forest may also interact, such as through sediment loading, which could be influenced by forestry practices and affect the estuary.

Willapa NWR Complex: Will said that the Willapa NWR CCP was completed last year, and that they are starting designs for the first phase of the project in the south bay that will be restoring tidal influence by removing dikes. A small dike is being removed as part of a land exchange on the Tarlatt Unit. For riparian work, The Nature Conservancy is decommissioning roads on their holdings adjacent to the NWR. Marie has retired, but is continuing to monitor mussels as a volunteer. Will passed around photos of mussel conglomerates that Marie recently observed. The NWR will be re-surveying Omera Creek where western brook lamprey was earlier introduced. About 10 acres were treated for Spartina stands. There are Japanese eelgrass concerns. The NWR received I&M funding for the south bay restoration project. Salmonid spawning surveys were conducted in Risk Creek at Julia Butler Hansen NWR. For climate change, a major

concern in Willapa Bay is acidification and its effects on oysters. A need from Fisheries is assistance with survey methods.

Willamette Valley NWR Complex: Jock said that most aquatic issues deal with fish entrapment and water management at the NWRs. At Ankeny NWR, Oregon chub previously were estimated at about 90,000 individuals, but the pond was over topped earlier this year. They will be sampling this year to determine if non-native fish are now present. Oregon chub have blinked out in a pond at W.L.Finley NWR. Bull frogs also were present, but now are gone as well. They are not certain about the cause of losing chub and bull frogs, but believe that there may have been a problem with low dissolved oxygen.

Nisqually: Jesse said that monitoring at Nisqually NWR with their partners will be continuing this summer. There is a University of Washington graduate student, Si Simenstad's, presently working on a project at the NWR. There is really no information on fish in Black River at Grays Harbor NWRs.

Partner for Fish and Wildlife Program: CalLee said that there are 37 ongoing projects in Oregon, which includes seven focal areas. Of the total, 22 projects address stream or riparian areas, and 15 are upland projects in Douglass County and southern Oregon. The program is working a lot with NRCS in southern and eastern Oregon. They are also working on a CCA for sage grouse on BLM lands in Harney County.

Wrap-up

2012 Attendees

Jesse Barham	Nisqually NWR
Jock Beall	Willamette Valley NWR Complex
Don Campton	RO Fisheries
Mike Carrier	RO Fisheries
Alex Chmielewski	Ridgefield NWR
Gail Collins	Sheldon-Hart Mountain NWR Complex
Julie Collins	RO Fisheries
CalLee Davenport	OFWO
Mike Faler	Idaho FRO
Vicki Finn	RO Fisheries
Larry Fishler	CRFPO
Bridgette Flanders-Wanner	RO Refuges
Bob Flores	RO Refuges
Jana Grote	RO Fisheries
Baker Holden	Western Washington FWO Fisheries
Amy Horstman	OFWO/CRFPO
Mike Hudson	CRFPO
Jeff Jolley	CRFPO
John Kasbohm	Sheldon-Hart Mountain NWR Complex
Marci Koski	CRFPO
Sam Lohr	CRFPO
Roy Lowe	Oregon Coast NWR Complex
Tim Mayer	RO Water Resources
Damien Miller	Willamette Valley NWR Complex
RD Nelle	Mid-Columbia FRO
Doug Olson	CRFPO
William Ritchie	Willapa NWR
Tim Roth	CRFPO
Howard Schaller	CRFPO
Chris Seal	Willamette Valley NWR Complex
Brook Silver	CRFPO
Greg Silver	CRFPO
Joe Skalicky	CRFPO
Steve Smith	Willamette Valley NWR Complex
Shawn Stephensen	Oregon Coast NWR Complex
Erin Stockenberg	RO Refuges I & M
Chris Swenson	RO Coastal Program
Chris Taylor	AFTC
Brad Thompson	Western Washington FWO Fisheries
Tim Whitesel	CRFPO

Action Items

The following are action items resulting from the 2012 NWR-Fisheries Workshop. Some are activities for ongoing projects and assistance that Fisheries has been engaged with NWRs during the past, as well as needs for which resources and plans have yet to be developed.

1. CRFPO work to secure resources necessary for conducting genetic analyses of trout tissue samples collected from individuals in Virgin Creek at Sheldon NWR and Guano Creek at Hart Mountain NWR, and incorporate genetics relations into results of surveys conducted in 2011.
2. IFRO continue to assess possible bull trout spawning in Myrtle Creek at Kootenai NWR and expand the time period in which to conduct snorkel surveys.
3. MCRFRO construct and install PIT tag arrays at Toppenish NWR to assess movement of steelhead.
4. CRFPO and Bandon Marsh NWR to continue assessment of physical and biological attributes of Bandon Marsh to characterize post-construction conditions.
5. CRFPO and other FROs continue to develop Fisheries initiative of a long-term aquatic monitoring program at NWRs and engage NWRs.
6. CRFPO to provide fishery information (e.g., lamprey and coastal cutthroat trout conservation initiatives, National Fish Passage Program, National Fish Habitat Action Plan) and assist with land use planning for the Willamette River Conservation Study Area.
7. NWRs, CRFPO, and other Service programs continue to work together to evaluate progress and feasibility of habitat restoration actions at NWRs in the lower Columbia River (e.g., Post Office Lake, Campbell Lake, Gibbons Creek/Steigerwald Lake) considered by the U.S. Army Corps of Engineers and Bonneville Power Administration to benefit listed salmon and steelhead.
8. CRFPO fisheries assistance for National Wildlife Refuges
 - Continue providing assistance for CCP development (e.g., Hart Mountain NWR), technical support, and general surveys to address aquatic resource issues to the greatest extent possible with existing resources.
 - Continue to work with NWRs to develop FONS and other proposals for resources to address aquatic resource issues and needs.
9. CRFPO assist Willapa NWR with aquatic survey methods.
10. CRFPO will organize the annual workshop for spring 2013.

**Workshop Presentations by
Service Personnel**

**Presentation: Fish and aquatic habitat surveys at Sheldon-Hart Mountain NWR Complex.
Presented by Sam Lohr**

Fish and Aquatic Habitat Surveys at the Sheldon-Hart Mountain National Wildlife Refuge Complex

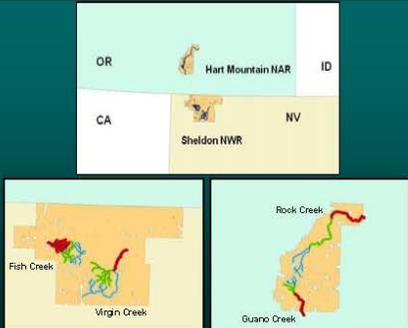
S. Lohr, M. Hudson, T. Whitesel, M. Koski



Acknowledgements: Sheldon-Hart Mountain NWR Complex R1 I&M Program Field Crew



Ben Willis Cory Stratton



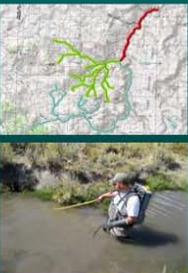
Goal: Establish a baseline for fish community and habitat information in watersheds supporting native fish

Objectives

- Determine fish species present
- Watershed occupancy by fish species
- Describe distribution of fish within watersheds
- Characterize aquatic habitat

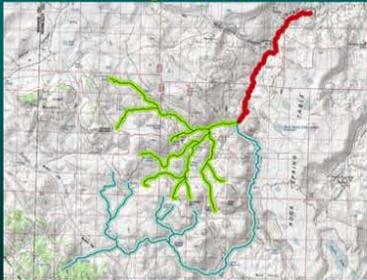


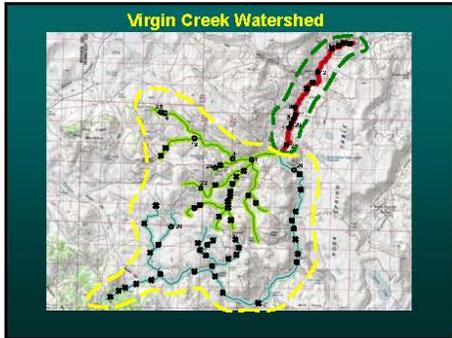
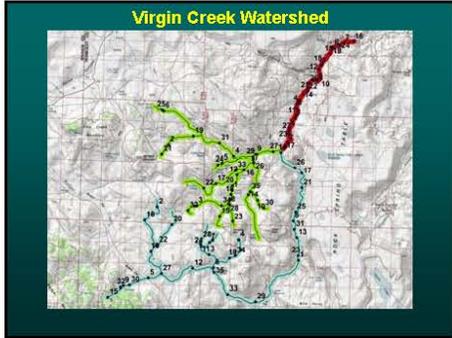
Methods



- Developing sample framework
 - NHD used in GIS to bound watershed
 - Identify sample reaches using GRTS design and three stream tiers per watershed
- Surveying for fish
 - Electrofish seven "viable" reaches per tier
 - Collect trout tissue
- Characterizing habitat
 - transects (channel, bank, riparian attributes)

Results—Virgin Creek Watershed

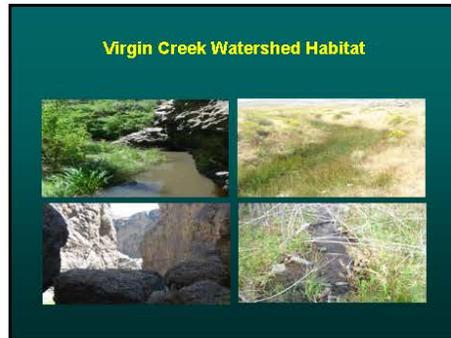
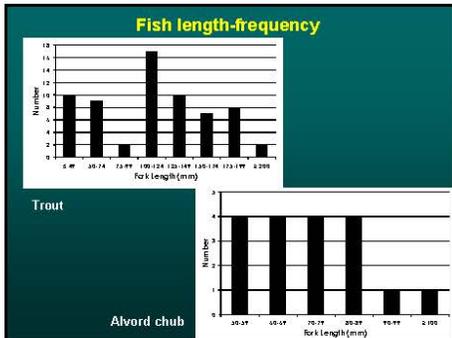


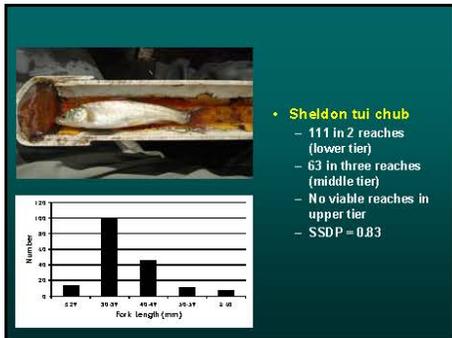
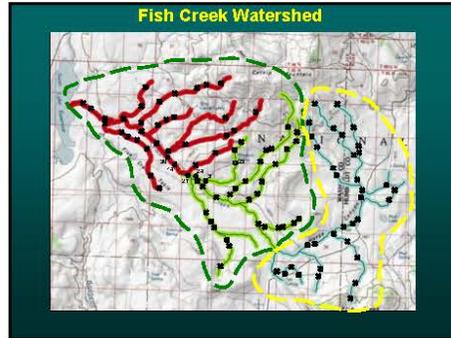
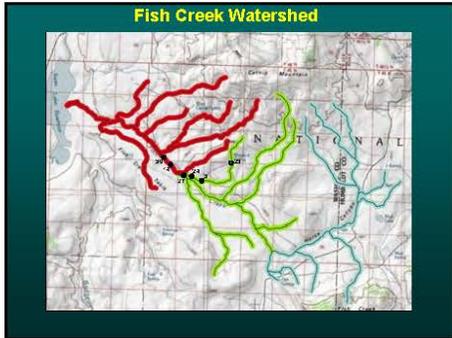
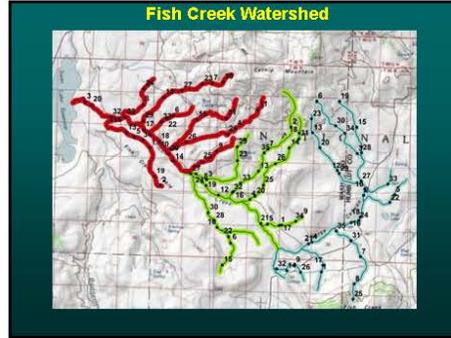
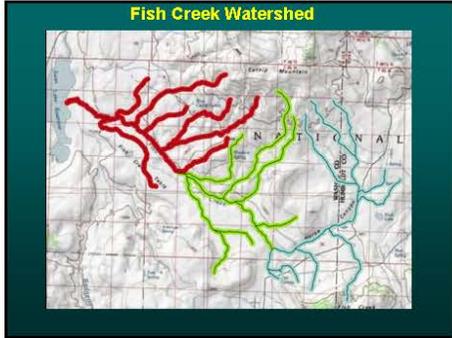



- **Trout**
 - 65 in 5 reaches (lower tier)
 - SSDP = 0.31
 - Post hoc certainty 93% middle, 68% upper tiers
 - Tissue samples (n = 38)

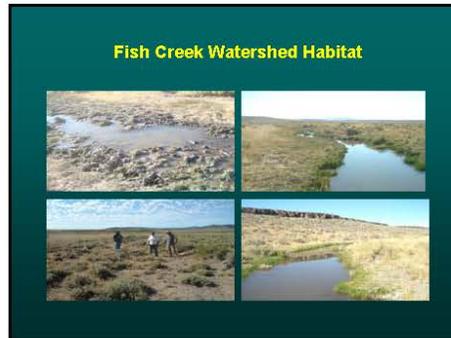


- **Alvord chub**
 - 18 in 2 reaches (lower tier)
 - SSDP = 0.13
 - Post hoc certainty 72% middle, 57% upper tiers
 - One reach sympatric





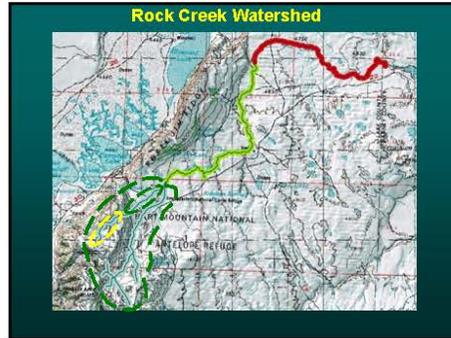
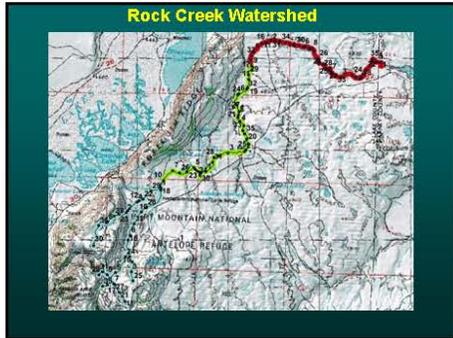
- Sheldon tui chub
 - 111 in 2 reaches (lower tier)
 - 63 in three reaches (middle tier)
 - No viable reaches in upper tier
 - SSDP = 0.83





- **Trout**
 - 27 in 2 reaches (lower tier)
 - 61 in 6 reaches (middle tier)
 - 13 in 2 reaches (upper tier)
 - SSDP = 0.50
 - Tissue samples (n = 65)



- **Willow Creek**
 - Spots sampled two areas
 - 11 trout below canyon (61,204 mm FL)
 - No trout above canyon
 - Each area encompassed survey reaches

Conclusions-Recommendations

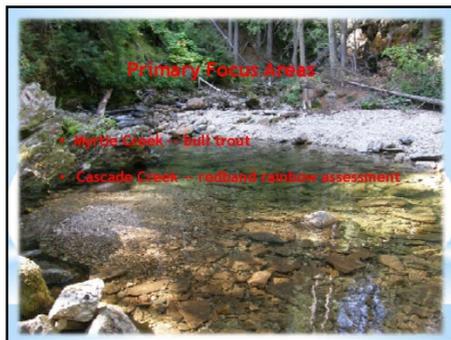
- Established baseline for fish presence, occupancy, distribution, and aquatic habitat in three of four watersheds
- Baseline established during season with most restrictive conditions
- Recommend monitoring physical variables predicted to be affected by climate change (e.g., water temperature, flow)
- Recommend conducting genetic analysis of trout tissue samples to inform development of management objectives and possible actions

5/3/2012



6

Presentation: Bull trout snorkel surveys in Myrtle Creek, Kootenai NWR. Presented by Mike Faler





Snorkel observation summary of all species in Myrtle Creek, Kootenai National Wildlife Refuge, September, 2011.

Dates Sept. 1, 13, 14, 27, and 28, 2012	Species	Juvenile < 75 mm	Sub Adult or Adult 76-200 mm	Adult > 200 mm	Total
	Rainbow Trout	212	117	3	332
	Bull Trout	0	3	2	5
	Brook Trout	10	11	11	32
	Cutthroat Trout	0	1	1	2
	Mountain Whitefish	16	9	2	27
	Kokanee	0	17	0	17
	Dace	70	-	-	70
	Sculpin	3	-	-	3
	Redside Shiner	6	-	-	6

Paired comparisons of Day/Night Snorkel Surveys in Myrtle Creek, Kootenai National Wildlife Refuge, September, 2011

Dates Sept. 13, 14, 27 & 28, 2011 Day/Night	Species	Juvenile < 75 mm	Sub Adult or Adult 76-200 mm	Adult > 200 mm	Total
	Rainbow Trout	101 / 17	61 / 23	0 / 0	162 / 40
	Bull Trout	0 / 0	1 / 2	0 / 2	1 / 4
	Brook Trout	2 / 2	5 / 5	4 / 0	11 / 7
	Mountain Whitefish	15 / 12	15 / 0	0 / 0	30 / 12
	Kokanee	0 / 0	4 / 7	0 / 0	4 / 7
	Dace	0 / 70	-	-	0 / 70
	Sculpin	0 / 3	-	-	0 / 3

Where do we go from here?

- Expand survey periods to start in mid August, and continue into late October. This will cover the entire time periods when bull trout spawning has been observed in the Northwest. Cooler water temperatures in October may trigger spawning activity.
- Continue both daytime and nighttime surveys to maximize bull trout observations, and for comparative purposes.
- Limit snorkel surveys to the upper stream reach since no bull trout have been observed in the lower 2 reaches.





Cascade Creek *O. mykiss* Genetics

- 10 samples, 16 alleles examined/ sample
- 50% of samples were identified as >F1 rainbow/cutthroat hybrids
- Introgression levels in the hybrids were low (~3%)
- Each hybrid sample contained only 1 cutthroat allele
- The remaining samples were indicative of pure *O. mykiss*
- They had allele frequencies more similar to native redbands than hatchery RBT

Cascade Creek *O. mykiss* Redband Assessment

- One of a few isolated pockets in North Idaho that contain pure redband strains (Boundary and Upper Callahan)
- Cascade Creek Redbands are worthy of protection
- Weigh the risks of isolation against the risks of intrusion/hybridization.

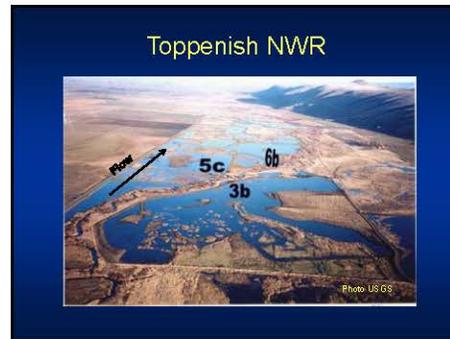


Presentation: Toppenish National Wildlife Refuge manages for steelhead. Presented by RD Nelle.

Toppenish National Wildlife Refuge Manages for Steelhead

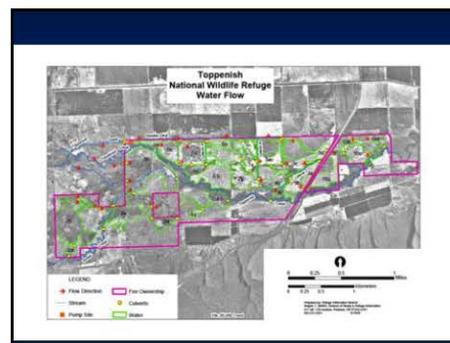
R.D. Nelle
Mid-Columbia River Fishery Resource Office
Leavenworth, WA

Shannon Ludwig
Toppenish National Wildlife Refuge
Toppenish, WA

Issues

- Juvenile steelhead use of Refuge wetland units
- Entrainment and stranding in series of wetlands
- Benefits –rearing

Goals

- Improve management of steelhead
- Toppenish NWR Comprehensive Conservation Plan (CCP)



Photo USGS Photo USGS Photo USGS

Objectives

- Determine residence time of juvenile steelhead on TNWR wetland units
- Survival of smolts entrained in Refuge wetlands
- Determine travel times of juvenile steelhead through wetland units
- Document use of Refuge wetlands by adult steelhead.

Yakama Nation Fisheries Screw trap mainstem PIT array



Yakama Nation Fisheries

PIT tag 4,000/ year steelhead through 2018



Propose

- Series of Full Duplex PIT tag arrays at TNWR
- Monitor arrays



Status

- 2011 purchased materials to construct arrays
- 2012 Spring/Summer – construct antennas
- 2012 Summer/Fall- install arrays
- Monitor arrays

Toppenish Refuge



Photo USGS



Photo USGS



Photo USGS



Presentation: Bandon Marsh NWR, final restoration activities. Presented by Roy Lowe.













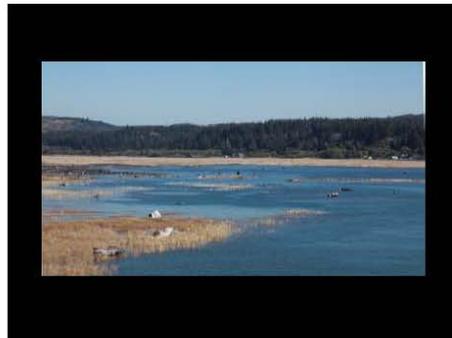








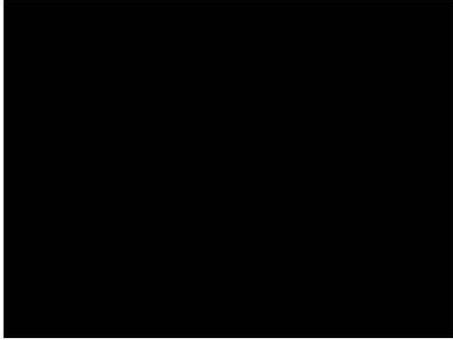












**Presentation: Presentation: Bandon Marsh NWR initial post-construction monitoring.
Presented by Mike Hudson and Brook Silver.**



5/3/2012



**Presentation: Groundwater control of summer stream temperature in the PNW.
Presented by Tim Mayer.**

Groundwater Control of Summer Stream Temperature in the PNW

– Tim Mayer, US Fish and Wildlife Service



Presented at the
Columbia River Fisheries Program Office
Vancouver, WA
May 2, 2012




Purpose of Study

To investigate the factors that control summer stream T thermal regimes and thermal sensitivities.

Focus on the Pacific Northwest.

- Thermal Regime – spatial and temporal pattern of stream T
- Thermal Sensitivity – sensitivity of stream T to air temperature increase.





- Need to understand the controls of thermal regimes and stream sensitivities across the region to develop habitat and natural resource management strategies, anticipate stream responses to climate change, and identify conservation and restoration priorities.

102 Stream Temperature Sites in the Pacific Northwest



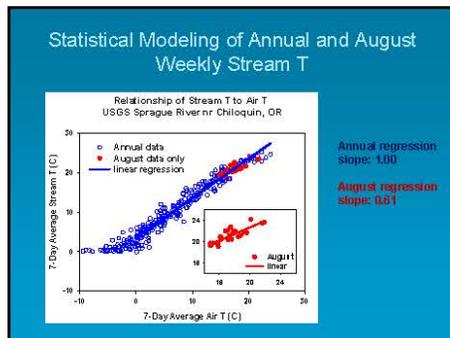
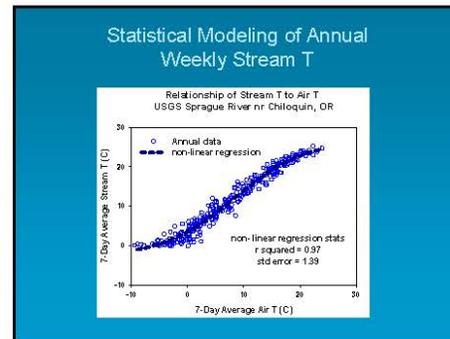
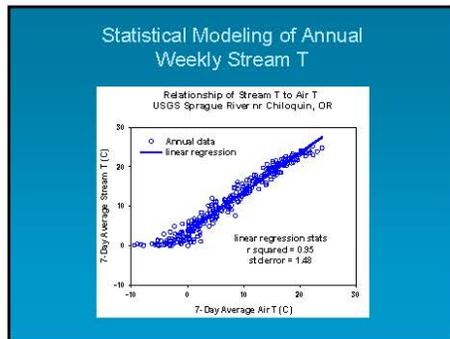
Factors



- Climate conditions
 - Air temperature, solar radiation, evaporation
- Landscape controls
 - elevation, latitude, morphology, geology, forest cover, relief, aspect, and area of the basin
- Stream channel characteristics
 - the stream discharge and the channel length, slope, width, depth, sinuosity, incision, substrate, and complexity

- Question: *What is the relationship of stream T to air T and is it constant throughout the year?*

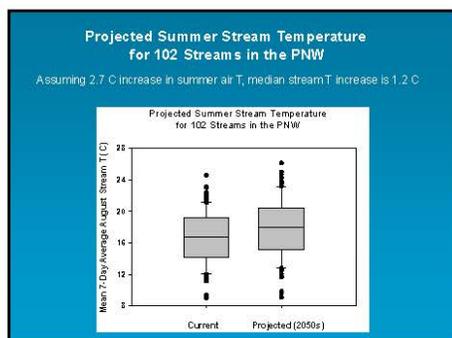




- ### Regression Results for 77 Streams in PNW
- Annual stream T/air T relationship data is best fit with a non-linear logistic function (Mohseni eqn)
 - Linear regression stats
 - mean $r^2 = 0.93$ mean standard error = 1.18C
 - Non-linear regression stats
 - mean $r^2 = 0.94$ mean standard error = 1.12C
 - Linear regression slope of annual data is greater than for August data only.
 - Mean annual regression slope = 0.65 °C/C-1
 - Mean August regression slope = 0.47 °C/C-1

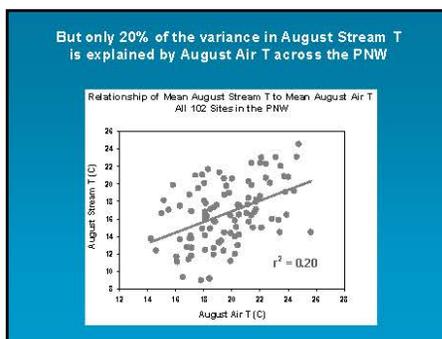
- Question: *What is the relationship of stream T to air T and is it constant throughout the year?*
 - Answer: *94% of the variability in annual weekly stream T and 68% of the variance in August weekly stream T is described by air T. Stream sensitivity to increasing air T decreases or flattens out at higher air T. Streams are not as sensitive to warmer air during summer due to the effects of evaporative cooling.*
-

- Question: *What is the vulnerability of summer stream T to warming air T?*
-



- Question: *What is the vulnerability of summer stream T to warming air T?*
- Answer: *Median increase in stream T is only 1.2 C but the range of current or projected stream T is large across the region. The vulnerability of a stream is related to the initial stream T as much as the sensitivity of the stream.*

- Question: *Can August stream T be determined from August air T regionally?*
- Consider: *For individual sites, air T describes much of the variance in annual and August weekly stream T.*



- Question: *Can August stream T be determined from August air T regionally?*
- Answer: *Air T explains much of the variability in stream T at any on individual site but the relationship is site-specific and can't be applied across the region. Variability in the relationship is due to other landscape factors and stream characteristics.*



Question: What other landscape factors and stream channel characteristics are important?

**Stream Channel Slope
Stream Channel Length
Basin Forested Area**

Stream T varies with air T and with other landscape factors and stream channel characteristics.

Mathematical swap for plots:
Calculate a stream T/air T ratio to account for air T effects and plot this ratio against other independent factors.

$$\text{Ratio} = \frac{\text{Average August Weekly Stream T}}{\text{Average August Weekly Air T}}$$

For the 102 sites, this ratio averages 0.85 °C°C⁻¹ and ranges from 0.50 °C°C⁻¹ to 1.26 °C°C⁻¹.

August Stream T/Air T ratio for 102 Sites in PNW

Ratio is negatively related to Baseflow Index and Stream Channel Slope, meaning the stream T is cool for the given air T as BFI or Stream Slope increase.

Ratio is positively related to Stream Channel Length, meaning the stream T is warm for the given air T as Stream Length increases.

Question: What other landscape factors and stream channel characteristics are important?

Answer:

August Air T, Baseflow Index, Stream Channel Slope, Stream Length, and %Forested Area explain **72%** of the variance in August stream T (thermal regime) at the 102 sites across the region.

Baseflow Index and Stream Channel Slope explain **40%** of the variance in August stream sensitivity (regression slope of August stream T/air T regression) at the 102 sites across the region.

Question: What information do the summer Stream T/air T ratios provide?

Answer: Summer stream/air temperature ratios at sites appear to vary systematically with the landscape and stream characteristics. Sites with ratios that deviate from the expected values may indicate a response to unique environmental conditions or point to potential restoration needs.

Examples

- Generally, for streams that are not very steep or short and have a moderate baseflow index, the ratio seems to approach 1 °C°C⁻¹, meaning the August stream temperature equals the August air temperature at the site.
- Stream sites along the coast had ratios > 1. Warmer inland?
- Streams with very high BFI (spring-fed streams or highly groundwater-dominated streams) had ratios close to 0.5 °C°C⁻¹.
- Streams with steep channels and short lengths had lower ratios (0.6 °C°C⁻¹ to 0.9 °C°C⁻¹) and those with low gradient channels and longer lengths had higher ratios (> 1 °C°C⁻¹).

General Conclusions

The stream thermal regime is very closely related to air temperature throughout the year.

The stream thermal sensitivity to increasing air temperatures in summer is less than at other times of the year.

Summer stream temperatures and sensitivities are considerably less in groundwater-dominated streams.

Some of the regional variability in summer stream T is also related to stream slope and length.

Summer stream T/air T ratios can be used to quickly assess stream temperature conditions at a site.



Olympic Nat Park



Crater Lake Nat Park



Mt Rainier Nat Park

Questions?

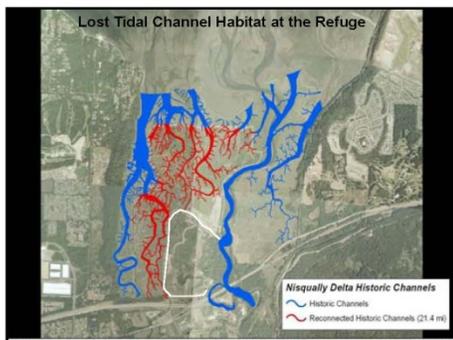
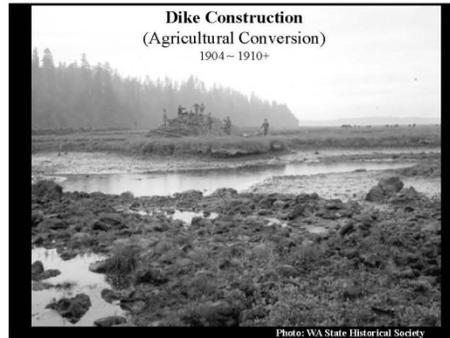
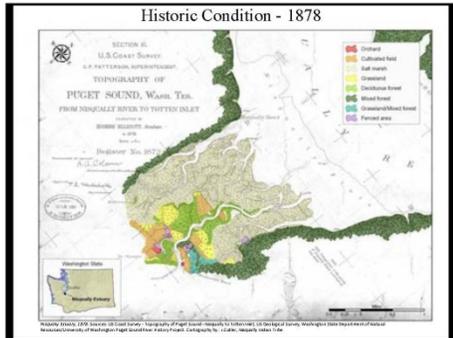
Presentation: Restoration and response of the Nisqually Estuary. Presented by Jesse Barham.

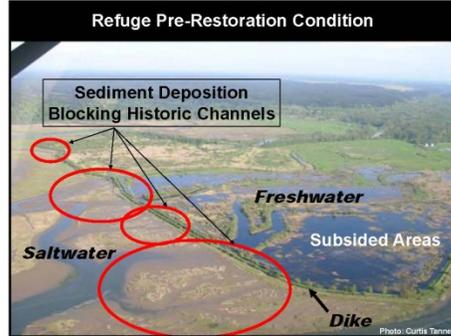
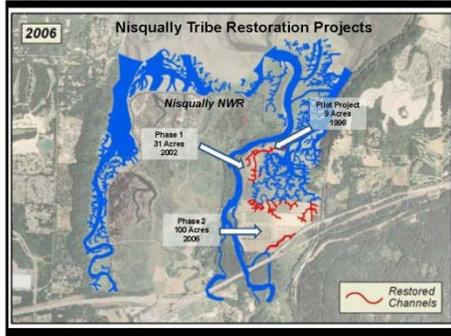
Restoration and Response of the Nisqually Estuary

May 2, 2012

Jeese Barham – (NWR Restoration Biologist), Jean Takekawa (NWR Manager), Christopher Ellings – (Nisqually Indian Tribe), Kelley Turner (USGS WERC), Steve Liske (DU)







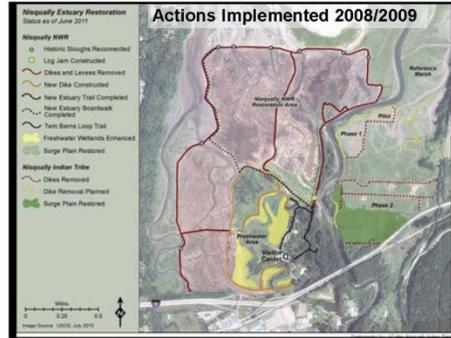
Summary of the Comprehensive Conservation Plan
 Nisqually National Wildlife Refuge

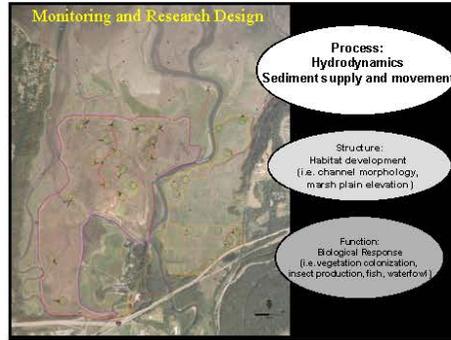
Four Alternatives Considered

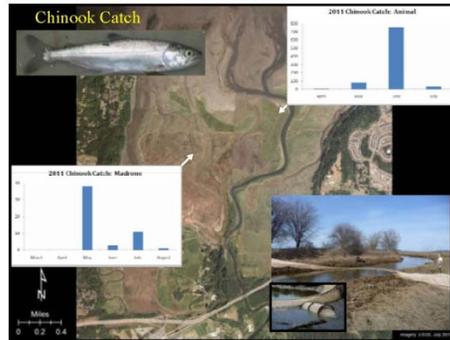
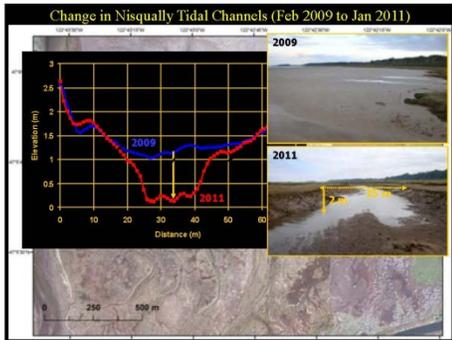
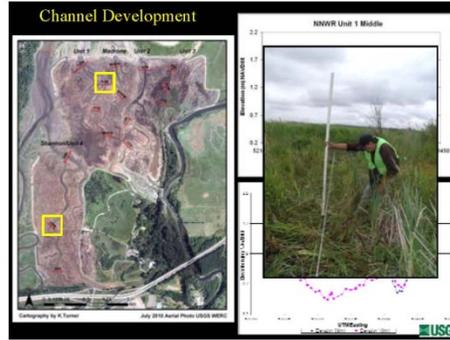
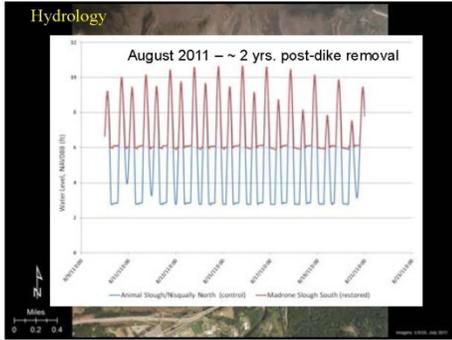
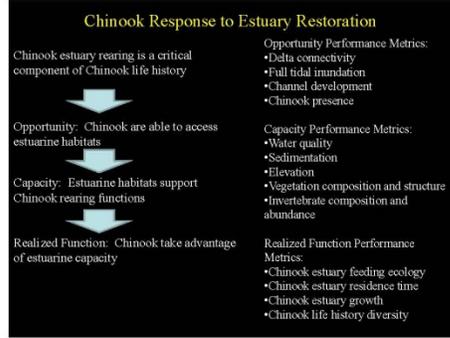
Preferred alternative based on:

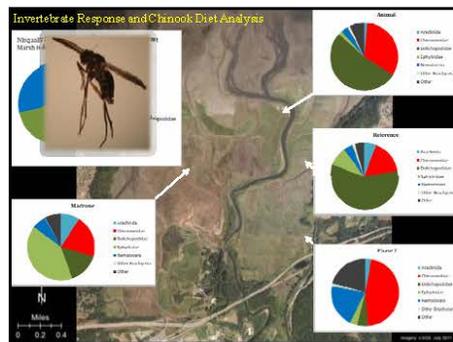
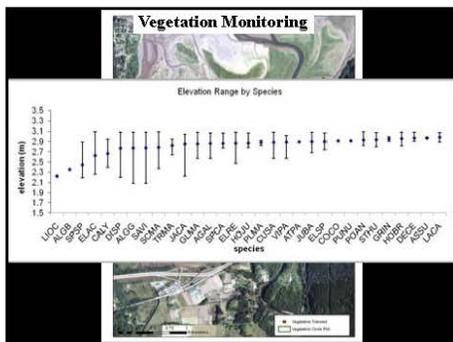
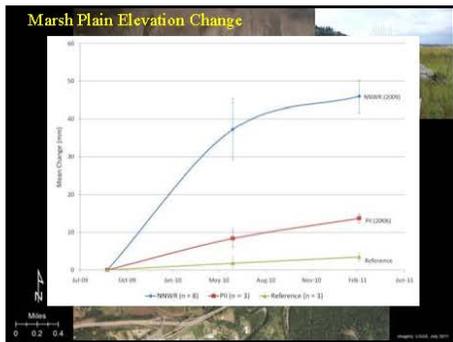
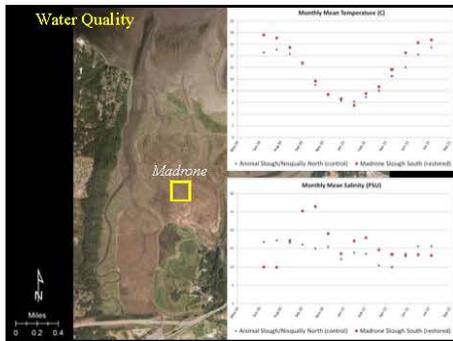
- public/stakeholder comments
- hydro/sediment/salinity modeling
- Delta-wide fish study
- waterfowl use/habitats
- vegetation mapping
- local/regional analysis of wetland habitats

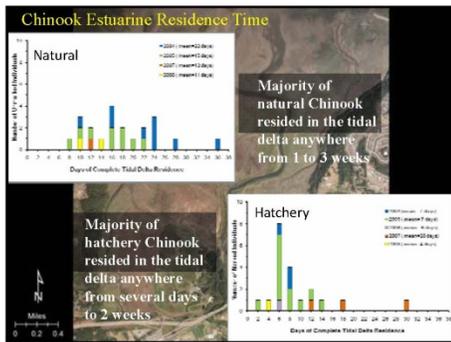
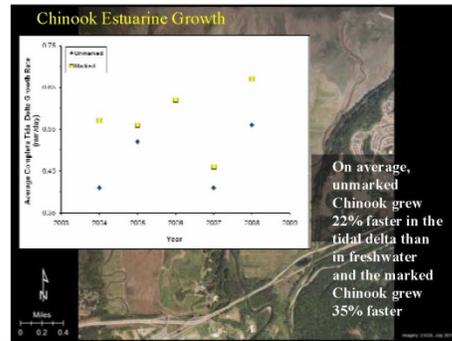
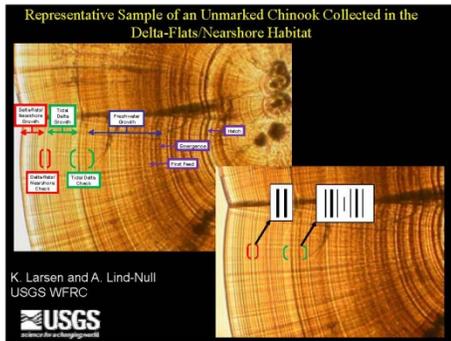
Approved March 2005











Summary of Early Restoration Monitoring Results

- Opportunity:**
 - Restoration area tidal channel development and tidal connectivity are progressing
 - Chinook are accessing restored sloughs
- Capacity:**
 - Vegetation colonization is occurring slowly and is highly dependent on sedimentation rates and the resulting elevation of the restored habitat
 - The restoration area provides suitable habitat and prey resources for Chinook rearing
- Realized Function:**
 - Chinook are feeding on insects and other invertebrates produced in the restored estuary
 - A large component of Nisqually Chinook rear in the estuary for several weeks and grow rapidly. Future analysis will determine the impact of restoration on growth, residency, and life history diversity.

Nisqually Estuary Restoration and Research: Lessons Learned

- Protecting large river deltas from irreplaceable development is vital!
- Large scale restoration of a complex system is a long term process involving but not limited to:
 - Partnership building
 - Planning and assessments
 - Fundraising
 - Implementation
 - Monitoring and adaptive management
- Interdisciplinary research is necessary in order to understand habitat forming processes and their impact on habitat development and biological response.

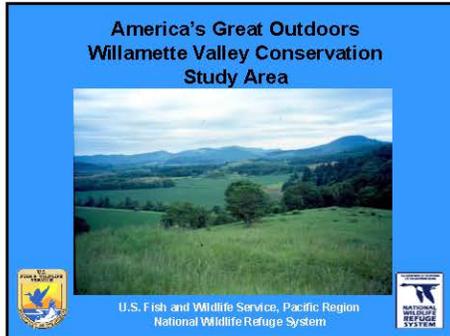
Project Partners

Additional funding and support for this project provided by the following organizations and individuals

- Grag and Carol James
- Richard Leeds and Anne Kroeker
- National Fish and Wildlife Foundation
- National Oceanic and Atmospheric Administration
- Nisqually River Council
- Larry and Marg O'Neil
- Pierce County Lead Entity
- Puget Sound Nearshore Ecosystem Restoration Project
- Puget Sound Partnership
- South Sound Deschutes Salmon Recovery
- South Sound - Kennedy-Goldsborough Salmon Recovery
- U.S. Army Ft. Lewis
- U.S. Environmental Protection Agency
- U.S. Geological Survey
- Washington State Department of Fish and Wildlife
- Estuary and Salmon Restoration Program
- Washington State Recreation and Conservation Office
- Salmon Recovery Funding Board
- Puget Sound Acquisition and Restoration Funds
- West Sound Watershed Council

Contractors: Nutter Corporation of Vancouver, WA
Geoengineers of Tacoma, WA

**Presentation: America's Great Outdoors—Willamette Valley Conservation Study Area.
Presented by Steve Smith.**



Current Limitations

- Existing refuges cannot meet demands for public use,
- Enabling legislation was narrow in focus (Wintering Canada Geese),
- Willamette Valley Refuge Complex has acquired all land authorized by Congress,
- No authorization to expand "stewardship" or refuge boundary.



Key Question?

#1: Should the FWS Increase NWR Land Management Involvement in the Willamette Valley?

If No – See Ya & Good Luck!!

If Yes -

**OPEN HOUSE
LISTENING SESSIONS**

OBJECTIVES:

- FWS present brief information overview on AGO,
- Develop questions that solicit public response to potential FWS role(s),
- Have landowners present to support protection of their lands.

AGO/NWR Implementation Tools

Easements:

- Support Traditional Economies & Lifestyles,
- Protect Rare & Declining Species and Habitats,

Fee Title Lands:

- Provide Outdoor Access – Support Local Economies,
- Specific Needs for Recovery of Listed Species

Restoration and Management:

- Use Private Contractors - Jobs
- Increasing NWR and Partners F&W capacity – O&M

Landscape Strategy Planning Concepts

Use Existing Plans and Data

- Recovery Plans (FWS & NOAA Fisheries)
- Willamette Sub-Basin Plan (BPA/Oregon)
- Oregon Conservation Strategy (ODFW)
- Benton County Habitat Conservation Plan
- Local Open Space/Park Plans
- Willamette River Planning Atlas
- Willamette Partnership – Ecosystem Markets

Landscape Strategy Planning Concepts

Local Solutions and Priorities

- Landowner Input
- Public Listening Sessions (Open House)
- Working Lands Concepts
- Outdoor Access and Education

GIS Analysis

- Identify Multiple Value Properties
- Display Ranking Priority Factors

Options Available to FWS

Establish a new NWR "Stewardship" Boundary that allows:

- FWS to hold easements,
- Acquire Lands in fee title,
- Increase capacity of PFW Program,
- NWR Restoration, Management and Law Enforcement

FWS is authorized to consider acquiring an interest in up to 250,000 acres to meet AGO goals

AGO Focus Habitats



Oak Savanna



Oak Woodlands

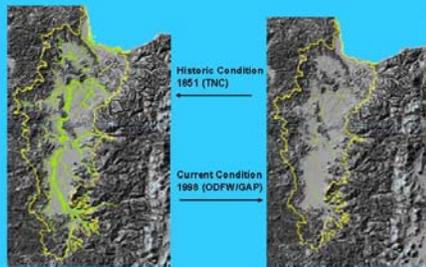


Grasslands



Riparian/Floodplain

Riparian/Floodplain Habitat



Specific Plans and Data

- Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead
- Willamette River Habitat Protection and Restoration Program
- Willamette River Planning Atlas (Versions 1 & 2)
- Oregon Chub Recovery Plan
- Bull Trout Recovery Plan



Floodplain Associated Wetlands



Associated Priority Species

- Migratory birds (waterfowl, waterbirds, shorebirds)
- Reptiles and amphibians
- Native Fish (Oregon chub, Trout, Steelhead, Salmon, Lamprey)

Floodplain Habitats



Hardwood Forests

- Aquatic & Terrestrial Habitat Complexity
- Source of large wood recruitment



Neo-tropical birds

- Migration Corridors
- Nesting/Foraging Habitat

Questions to Resolve



#1 Priority Locations

- Focus on Mainstem?
- Add Tier 1 to Natal Tributaries?
- Lamprey Conservation?

#2 Population Estimates

- Is this possible or creditable?
- Target for Sport Fishery?

Red = 100% riparian habitat
Blue = 50% riparian habitat

Fisheries Input Needs

- FWS Fisheries Strategy for Willamette Basin
- Focal Species



- Recreation Objectives
- Contact for WVSA Team

**U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office
1211 SE Cardinal Court, Suite 100
Vancouver, WA 98683**



October 2014