STRATEGIC PLAN

WESTERN FISHERIES RESEARCH CENTER

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CENTER STRATEGIC PLAN

MISSION

The Western Fisheries Research Center (WFRC) will carry out research and provide technical assistance to support the best possible stewardship of the Nation's natural resources, emphasizing fish populations and aquatic ecosystems of the West.

PURPOSE

The strategic plan will serve as a roadmap to:

- Chart science directions for the future;
- Allow the Center to adapt to changing circumstances and environments;
- Provide areas of focus and guidance on where to expend time and fiscal resources; and
- Result in decisions and actions.

INTRODUCTION

The Center's mission and internal strategies step down from U.S.Geological Survey (USGS) and Bureau Program strategic plans, Bureau initiatives, *market-driven* science needs and priorities of WFRC clients [including the Department of the Interior (DOI) bureaus], and emerging science needs in the West. Our mission includes research, inventory, monitoring, tool and technology development, and information synthesis and transfer. The Center's strategic goals are ecosystem and process understanding in support of USGS missions in the West. The WFRC seeks collaborative opportunities for interdisciplinary research within the organization. WFRC possesses specialized disciplinary expertise and facilities for directed studies of freshwater and estuarine systems ecology; fish physiology and disease; genetics and molecular biology; DOI trust species and environmental interactions; aquatic invasive species; and Geographic Information Systems and decision support.

Vision

The most recent Strategic Plan for the WFRC was completed in August 1997. It occurred at a critical juncture in the history of federal research with respect to organizational changes within the Department including the establishment of the National Biological Survey (later Service) and merger of that organization into the USGS (Biological Resources Division, BRD). The strategic plan provided a comprehensive description of the Center's capabilities and vision for "good science, well managed." This vision for science and management is still relevant however with changes that include the addition of USGS Guiding Principles (http://training.usgs.gov/leadership/guidprinc.html):

Good science is:

- Innovative: reflecting a culture of creativity;
- Useful: relevant to the resources and their managers;
- Accurate: objective and replicable;
- Timely: responsive to the needs of effective resource stewardship; and
- Effectively delivered: findings will be reported through appropriate outlets.

Science well-managed will mean:

- Collaboration with resource managers will be sought out in project conception and development;
- Proposals and projects will be peer and policy reviewed per USGS directives;
- Funding will follow scientific excellence and conservation need;
- Collaboration will be valued and sought;
- Excellence will be rewarded in career development;
- Each member of the WFRC community will understand the Center's scientific mission;
- Each participant will be valued for their contribution(s) toward achievement.

The goal of the WFRC is that all employees maintain a high degree of integrity, the foundation of USGS Guiding Principles. **Guiding principles** mean that WFRC employees will:

- Be respectful: honor the roles and responsibilities of others and treat each other with dignity;
- Be accountable: take personal responsibility, reward desirable behaviors and results, be decisive and consistent, hold others accountable, communicate clear expectations for the job;
- Communicate: be a good listener, be honest with the message you deliver, admit when you are wrong, be flexible;
- Encourage: nurture and challenge, provide a safe and rewarding environment, provide clear directions;
- Focus: strive toward WFRC vision/mission, accept change, be resilient, think beyond your own discipline; and
- Collaborate: work as a team, coordinate with others, keep others informed.

With these practices in play, the employees of the Center at all levels will have opportunities to develop intellectual and professional diversity for multi- and interdisciplinary approaches to conservation problems, and would be recognized for doing so. The Center will continue to be known for "making a difference" with the natural resources community at a practical level. The quality of WFRC science and its scientific reputation will attract the brightest and best to work at the Center or collaborate with its scientists.

History

In 1997, core competences and scientific resources were described for Fish Health, Fish Ecology, and Aquatic Ecosystems:

- ***Fish Health***, including research on infectious diseases, the physiology and etiology of disease, the role of stress, and the ecological and management implications of disease in fish cultural systems and natural ecosystems. Microbiology and molecular genetics contribute heavily to this research.

- ***Fish Ecology,*** including population ecology, genetics (molecular to population levels), physiological and behavioral ecology, and desert fish conservation ecology. Imperiled or ESA (Endangered Species Act) listed species are particularly critical.

- ***Aquatic Ecosystems,*** including the study of rivers, riparian areas and estuaries; research on habitats and aquatic resources; and the effects of aquatic contaminants on fish and other aquatic resources.

Since 1997, the Center's scientific core capabilities have changed with an increased attention to aquatic invasive species. Our scientific resources (Appendix 1) and affiliations with major universities remain intact although there have been shifts with time in project emphases and greater attention to our relationships with BRD Cooperative Fish and Wildlife Research Units and DOI Cooperative Ecosystem Studies Units. Center strategic planning workshops were held in April 2002 and October 2004. The Columbia River Research Laboratory conducted extensive planning between July and September 2003 and produced an internal document (December 2003) for the lab. In all instances, collaborative efforts within the Center and with other parts of USGS have been emphasized. Identification of WFRC stakeholders and knowing their needs, and the need to diversify our customer base are key strategic issues. The previous planning recognized that there are unmet customer needs for fisheries and aquatic ecosystem science in the West but that the Center does not have the capability or geographic presence to address all of their needs. Significant geographic focus areas for possible expansion in the most recent planning included the Columbia River Eastside (east of the Cascades) and the San Francisco Bay/Delta area. More recently, aquatic issues in Clark County, Nevada, are emerging with increasing concerns about water availability.

Bureau relationship

The long-term goals of the WFRC are consistent with strategic guidance provided by the National Research Council in its review of the Bureau "*Future Roles and Opportunities for the U.S. Geological Survey*" (2001). In that document, reviewers describe a natural progression of USGS science activities away from natural resource inventories and habitat and population studies toward ecosystem research. Center strategy reflects the increasing need for interdisciplinary science and ecosystem approaches.

The WFRC receives its appropriated funds through the Fisheries: Aquatic and Endangered Resources, Invasive Species, and Contaminants programs (Appendix 2 and http://usgs.gov

intranet). Bureau-funded science directions and opportunities for the WFRC are determined by national programmatic and regional science initiatives. These include initiatives such as the "Science on the DOI Landscape", Priority Ecosystem Studies, "Crosscuts" (e.g., Klamath Basin, Columbia River Salmon and Steelhead, and Invasive Species), Geographic Focus Areas (Puget Sound, Great Basin, Upper Columbia Basin, and Ridge-to-Reef), and USGS "Science Thrusts" (Water Availability for Ecosystems, and Environmental Landscape Monitoring). Short-term research and technical assistance objectives of the Center are also possible through competition in BRD cyclical programs (i.e., Science Support Program, Quick Response Program, Offshore Environmental Studies Program, Park Oriented Biological Studies, Natural Resources Research Program, etc.).

Strategic plan drivers

Short-term Center strategic goals (18 months) reflect planning to strengthen internal scientific and management relationships. Planning objectives include evaluation of core missions, workforce needs, directions and funding sources through program and budget development. Major drivers for this planning include: workforce planning; USGS Fundamental Science Practices, emergency and safety operations; USGS geographic focus areas; changing science needs of our reimbursable clientele; reorganization of the Bureau, and need for science accountability.

Long-term Center strategic goals (5 years) are categorized under DOI Strategic Plan mission areas for Resource Protection, Resource Use, and Serving Communities and Bureau strategic goals for Customer, Program, People, and Operations. In each instance, the planning emphasis is on performance and accountability. The Center welcomes this emphasis and, for its planning purposes defines "science" as the sum total of its administration, facility, and research functions. Scientific excellence and relevance in fisheries disciplines are this Center's major drivers and these attributes reflect the expertise and scientific capability it brings to aquatic science in the West. To achieve the long-term science objectives of the Region, our long-term strategic goals must address new facility requirements in key locations such as the Columbia River Basin, Marrowstone Island, and central California.

Charting the future

The timing of this strategic planning is just as pivotal, if not more critical, today than it was in 1997. Many of the funding and organizational challenges identified remain as we enter another period of Bureau change in a "less for less" environment. Ultimately, a Bureau Planning Committee (BPC) will be the responsible authority for science decision-making and fund flow. Program Coordinators will be responsible for presenting Center plans and proposals to the BPC. Regional Executives, Center Directors, and Project Managers will have input through BASIS+, annual reviews, and other methods of information delivery. This management reflects increasing attention to science quality and performance by USGS, the Office of Management and Budget, and Congress (e.g., GRPA and PART reviews). BASIS+ will be the main tracking tool (i.e., a typical task is 3-5 years) and management decision tool for Center allocation (e.g., task continuations, new starts, or redirections). Our strategic plan, in concert with evaluations of our

progress, must reflect our knowledge and ability to address the most urgent fisheries and aquatic resources issues and needs in the West.

Science directions and strategic actions

This strategic plan is based on current research, science directions, workforce demographics, and staffing requirements. Center staff provided input (Appendix 3) and information was taken from BASIS+, previous strategic plans and workshops, USGS program plans and review documents, Congressional directives, and partner meetings. Four areas are the focus of Center planning: (1) Science Directions, (2) Communicating Science, (3) Administration, and (4) Facilities – Operations and Maintenance.

Strategic directions, rather than *strategic actions*, are described for Center science directions. Specific actions in the Center planning are noted, where feasible; however, based on the organization's reliance on a reimbursable customer base, if the planning was to be realistic, it had to be flexible in approach to adapt to the market-driven priorities of this clientele. Strategic actions are identified within Administrative and Facility sections as they represent more directly manageable entities based on the consistency of their funding. It is our goal to take an "adaptive management" approach to this plan by revisiting it regularly and modifying or updating it as necessary.

EXPECTED OUTCOMES AND OUTCOME MEASURES

The vast geography of the American West encompasses numerous ecosystems with a diversity of natural resources. In the Pacific Northwest the river systems, coastal and marine environments, and forests are conspicuous features. In the arid interior, forests and shrub lands dominate. Deserts compose much of the Southwest and Great Basin, interrupted by the Colorado River and smaller springs and streams. These environments provide immense value to humans in the form of water, environmental services, aesthetics, and fundamental life support.

Entire ecosystems are changing quickly in the West as a result of human activity. Some are in serious decline and are under pressure from development, grazing, mining, harvest, and invasive species. As a result some species, such as salmon, are in serious decline. Natural resource managers face major dilemmas and often do not have adequate biological information to make informed decisions. Fisheries, aquatic resources and ecosystems – the focus of WFRC science – pose some of the greatest challenges of all.

The ultimate goal of the activities of the WFRC is providing DOI and other resource managers with the scientifically reliable information they need to manage fishery and aquatic resources. The products of WFRC science contribute to our understanding of the dynamics of key populations and the productivity of aquatic systems where they live. This knowledge and understanding (*science outcomes*) contributes materially to our quality of life and provides an information base and technologies needed to support sound management and resource conservation (*management outcomes*). The science is relevant to resource management and, crucial to the survival of many species (*natural resource outcomes*). To achieve these outcomes, the WFRC conducts research and communicates research findings to decision makers and

resource managers. The Center develops innovative sampling techniques and strategies, analytical and predictive models, GIS and decision support technologies, and assists in risk assessments and the evaluation of restoration, rehabilitation, and recovery efforts. Program output measures are in the number of internal reports, scientific publications, synoptic reviews, presentations, training sessions, workshops, technical assistance meetings, thematic maps, databases, websites, models, and other scientific products.

The complexity of these outcomes requires a multifaceted approach to document the utility of the scientific products. Measures include:

- Number of sites or species where WFRC scientific data and information were used to assess, mitigate, or restore a species or environment;
- Number of Citations referenced in the Science Citation Index or Federal Register;
- Provision of funds for research projects from resource management and regulatory agencies and Bureaus; and
- Evidence that private citizens and non-governmental organizations find the information useful.

The FAER Strategic Plan 2005-2009 provides a detailed analysis of possible outcomes and measures for the six programmatic goals it describes. These outcomes and measures have direct application to the fisheries and aquatic resource and ecosystem research performed by the WFRC.

SCIENCE DIRECTIONS

Background

Core science areas are described which will serve as the foci for expenditures of appropriated and reimbursable funds. The areas reflect scientific strengths of the Center and increasing emphasis on long-term science needs of DOI in terms of priority ecosystems and ecological relationships. With time, the long-term goal is to increase base resources and build stability in these areas such that reliance on reimbursable support will play a much more supplementary role in WFRC and Bureau goals. Entering into this 5-year planning cycle, the Center's unique strengths (core capabilities) are notable in fish health and disease, genetics and molecular biology, fish movements and migrations (biotelemetry applications), desert fish ecology, and population analysis of threatened and endangered species. Emerging areas of scientific excellence with opportunity for integrated USGS science include watershed and estuarine ecology, decision support technology, next generation tools for water management and ecosystems, evaluation of restoration, effects of genetically modified organisms/genomics, and invasive species.

The Center's traditional focus on natural resources will continue to include Pacific salmon and other anadromous fishes; Western trout and resident riverine species; desert and inland fishes; and aquatic ecosystems and their resources. Our strong role in addressing the science for recovery of imperiled species and restoration of their habitats will also be maintained. Increased emphases will be ecosystems including Pacific Northwest estuaries, Western watersheds, and

aquatic invasive species. Program and budget development priorities will focus on Puget Sound, Columbia River estuary, San Francisco Bay/Delta; Klamath and Columbia basins; and marine ballast water invasions, respectively. These activities and related facility requirements will be conducted in coordination with appropriate Program Coordinators to secure Bureau approvals.

Resource management agencies have developed in-house capabilities to undertake surveys or laboratory procedures that have traditionally involved WFRC and BRD scientists. Accordingly, this strategic planning anticipates decreased emphasis on hatchery diseases of salmon and trout; monitoring of contaminant residues in tissues; and less effort on genetic stock identification. WFRC research will continue to address new tools and technologies, protocol development and testing, and provision of technical assistance.

During the next five years, WFRC research will organize into the following disciplinary foci:

A. Disease Ecology

Strategic Goals: FAER 2 & 6; Invasive Species 1, 2, & 4; Contaminants 1 & 3

Historically, WFRC fish health research had its origins in studies of the infectious diseases of hatchery fish (primarily salmon and trout) reared by federal, state and tribal facilities in the Pacific Northwest. Today, the basic and applied research is focused on the distribution and severity of infectious diseases affecting both wild and hatchery fish. Project areas include: (1) development of rapid and sensitive methods to detect causative agents and diagnose disease in hatchery and wild fish species; (2) improved epidemiological understanding of aquatic animal disease including identification of strains and critical ecological factors (e.g., temperature, contaminants, stressors) that affect the host-pathogen relationship; and (3) development of novel methods to control losses from fish diseases including new generation vaccines and ecological modification. A research emphasis in the application of the molecular biological tools to fish health and disease including: construction of genomic libraries, cloning, sequencing, phylogenetic analysis, standard and quantitative polymerase chain reaction assays, random-amplified polymorphic DNA fingerprinting, ribonuclease protection assays, DNA probes, DNA microarrays and qPCR assays for gene expression, monoclonal antibodies, *in situ* histochemistry, recombinant DNA expression systems, synthetic peptides, and genetic immunization. During the past decade, these tools were increasingly applied to developing understanding about the biological basis of disease in aquatic systems.

Center strategic directions are based on the premise that disease is a natural component of aquatic ecosystems. Ecosystems are dynamic and thus many environmental factors influence and modulate the impacts of disease in biological populations and communities. In the next decade, Center research will pursue ecosystem approaches to management needs concerning disease origins and effects on key species of concern in their natural habitats. At the same time, the Center's role in aquaculture, both public and private, will increasingly be one of technical assistance and support rather than directed studies. Exotic pathogens, particularly in DOI aquaculture programs for conservation, will receive priority consideration at the WFRC. However, the Center's foci will be on natural systems including: (1) disease pathways and effects at all levels of biological organization, and the (2) prevention, mitigation and control of diseases affecting aquatic species. These foci reflect strategic shifts in current program emphases

from hatchery-reared to wild fish, increasing attention to marine fish and ecosystem processes, and a need to better understand the effects of multiple environmental stressors, including global change, on the health of aquatic animal populations.

State-of-the-art equipment is being acquired to support "next generation" tool development and research directions (e.g., flow and solid phase cytometers, quantitative PCR machine, microarray printer, hybridization station and reader). In addition to the Center's Biolevel-3 Containment Laboratory, newer facility improvements include the installation of a zebrafish research facility. Finally, additional equipment and facility modifications that are needed include equipment to control delivery of chemicals for research on multiple stressors (e.g., contaminants, pesticides, flame retardants, endocrine disrupters, etc.) and improvements to effluent treatment, containment, and temperature control at our Marrowstone Marine Field Station.

- ***Epidemiology of important diseases***. Research on bacterial and viral pathogens in salmon and trout and other key DOI species will continue. There will be an increasing emphasis on the integration of infectious disease issues in integrated studies in Puget Sound (e.g., Pacific herring, Pacific surf perch, Pacific sandlance, and rockfish) and the Klamath Basin (e.g., Lost River and Shortnose suckers and coho salmon). The established program for investigating localized and regional epidemiology of infectious hematopoietic necrosis virus (IHNV) uses genetic typing and molecular tools to characterize virus isolated from Pacific salmon and trout. This program involves collaboration with state, federal, and tribal fish health researchers, and provides them with information to support fish health management decisions and policies. Rapid assessment tools for the identification of Bacteria Kidney Disease will be developed for Great Lakes managers.

Special science priorities and research directions in the next five years will address molecular functional response of aquatic organisms to disease and multiple stressor effects:

- ***Molecular immunology***. A major thrust will be to describe the molecular basis of pathogenesis for a range of viral, bacterial, protozoan and fungal pathogens. Zebrafish will be used to investigate the genetic basis of disease and immunological response of fish. The increasing use of zebrafish in biological research has resulted in (1) a large number of mutant strains having specific gene deletions, and (2) ready access to the zebrafish genome sequence, which, in combination, will lead to the development of a broad range of gene expression assays. As an example, the WFRC has employed a viral model using zebrafish challenged with spring virema of carp virus to approximate a natural infection in cyprinids. In the future, other pathogen models are anticipated. A standard salmonid model and one, or more, appropriate marine fish models (e.g. herring, rockfish), along with the ancillary biological and molecular tools (e.g. established cell lines, antibodies, gene expression arrays) are anticipated.

- ***Effects of multiple stressors***. Resource managers have identified a need for improved understanding of the effects of multiple anthropogenic stressors on aquatic organisms. Controlled experiments at the WFRC will focus on: (1) the immunological response of key aquatic organisms exposed to multiple stressors (e.g., hypoxia, endocrine disrupting chemicals, hatchery effluents, etc.), virulent pathogens (e.g., viral hemorrhagic septicemia virus (VHSV), viral erythrocytic necrosis virus (VEN), and *Ichthyophonus hoferi*), and the resulting disease process (es). The effects of endocrine disrupting chemicals on salmon, forage fish, and other organisms in estuarine and coastal waters of the Pacific Northwest will be examined. Delayed or prolonged immunosuppression of subclinically infected fishes resulting from low dissolved oxygen may occur over a longer time frame such that pathogen-related epidemics may occur weeks or months after the low dissolved oxygen event (e.g., Hood Canal, Upper Klamath Lake, Lower Klamath Basin). Risk assessment models will be developed to determine if anthropogenic contaminants disrupt natural mechanisms of disease resistance that increase mortality and risk to populations of key species.

- ***New and emerging diseases***. Research will focus on developing improved understanding of the natural and anthropogenic factors affecting the emergence and spread of new diseases. An area of emphasis will be on the delineation of natural and anthropogenic pathways of potential pathogens into freshwater, estuarine, and coastal marine habitats. A goal of the research will be the prevention of epizootics associated with the release of pathogens into aquatic and marine environments from manageable sources such as ballast water, hull transport, or urban runoff.

Technical Assistance

The WFRC has a strong commitment to provide technical assistance to DOI bureaus, tribal and state agencies, and the private sector. Assistance is in form of technical support, laboratory services, education and training, technology transfer, and rapid response concerning fish disease and other health issues. Activities include: reference laboratory services for disease outbreaks and diagnostic activities; identification of novel fish pathogens isolated by biologists at federal, state, tribal, or private sector facilities; development of new diagnostic methods for emerging diseases of hatchery and wild fish; wet lab disease challenges and testing of treatment regimes; sponsorship of symposia and meetings; and response to information requests and technical review. Highlighted areas include:

- ***IHNV database***. Expansion of the IHNV database is an ongoing effort within the WFRC and web-enablement is being facilitated by NBII. Once this is in effect it will provide feedback to our partner agency colleagues regarding IHNV in Puget Sound as well as the Columbia River Basin and coastal watersheds.

- ***Integrated fish health program in Klamath Basin***. Improved understanding of environmental influences on disease processes will be used, in concert with resource managers and water regulators, to facilitate the management and control of diseases in aquatic ecosystems.

- ***Genomics workshop***. The WFRC will lead an interagency planning workshop on genetically modified organisms in FY 2007. An outcome of the workshop will be a funding initiative for USGS and other federal agencies (OFAs).

B. Watershed Ecology

Strategic Goals: FAER 1, 3, 4, 5 & 6; Invasive Species 2, 4, 5 & 6; Contaminants 2 & 3

Watersheds are natural hydrological units that form the basis for the management of river systems. The ecology of watersheds is driven by component physical and biological processes that drive the structure and function of river systems and their native biota, including resident fish and salmonids. Since watershed ecosystems are strongly driven by physical constraints, geomorphic processes, and hydrology, they are ideal systems for the integration of USGS expertise across disciplines. WFRC watershed ecology research focuses on quantifying the effects of natural and anthropogenic disturbances on taxa or communities, assessing the status of restoration actions conducted by management agencies, and predicting future conditions.

- ***Large rivers***. The Columbia and Klamath basins were identified in the Director's Annual Guidance for FY 04 as USGS priority areas. They will continue to be an emphasis of the Center's Large Rivers research. USGS research in the Columbia Basin has been client-driven and, has focused on juvenile Pacific salmon passage through or around hydroelectric dams, evaluation of rearing or spawning conditions for salmonids, development of habitat and energetic models, and other types of research that support Interior and other federal agency needs. Research on other species of interest include white sturgeon, lampreys, bull trout, and to a lesser extent, other native and non-native fishes. Future research priorities include continued monitoring and assessment of fish passage, issues related to species-habitat relationships, and interdisciplinary modeling studies.

- ***Coordination***. WFRC research in the Klamath Basin and other watersheds focuses on threatened and endangered species, habitats, and behaviors. Center goals include the development of integrated assessment tools and quantitative models through multi- and interdisciplinary research and monitoring with many partners. This collaborative approach is meant to encourage emerging science and technical issues from headwater to basin scales to be addressed (e.g., drought, climate change, invasive species, dam removal, habitat restoration, population recovery, and effects of multiple stressors). The Center's participation in the Pacific Northwest Aquatic Monitoring Program (PNAMP) is evidence of its leadership in the coordination of interagency conservation science.

- *"**Next Generation" tools***. The Center will continue to develop "next generation" tools needed for ecosystem management and restoration projects by DOI and other agencies in the West. This Bureau priority "science thrust" will guide Center science activities and directions with respect to landscape processes and ecosystem function, aquatic-terrestrial interactions (watershed connections), population and community analyses, and predictive approaches in response to fishery population and habitat needs. Priority study areas

include the Muddy River, NV; Klamath River, OR; Sacramento-San Joaquin Delta, CA; and Columbia, Skagit, and Elwha Rivers, WA. Field studies that characterize fish populations or communities, their life history and ecological relationships, contaminant body burdens, and habitat conditions, will be conducted within the Center's watershed missions in the West.

C. Coastal and Marine Ecology

Strategic Goals: FAER 1, 3, 4, 5 & 6; Invasive Species 3, 4, 5 & 6; Contaminants 3

Major threats to coastal and marine areas include pollution, invasive species, aquaculture, land use and development, habitat alteration, and climate change. These threats are greatly exacerbated by the rate of development and population growth in coastal areas. Within the Pacific Northwest, USGS is focusing on the system-wide effects of urbanization on Puget Sound's nearshore zone including watershed and marine influences. The nearshore provides critical habitat for many fish populations (salmon, trout, shad, and charr), several of which are endangered or listed as of special concern. Center research is focusing on DOI trust resources and forage species in coastal waters. Forage fish are an important component of the nearshore ecosystems that sustain species of interest. Their intermediate position in coastal food webs makes them indicators of ecosystem health. Investigations will establish the ecological importance of estuaries and nearshore waters to juvenile Chinook salmon, Pacific sandlance, Pacific herring, and surf smelt. Analysis of age and growth in juvenile Chinook salmon will determine the spatial and temporal significance of these habitats, differences in dependencies by various life history types, and guide restoration efforts in the nearshore. Priority Puget Sound study areas include the Nisqually, Green/Duwamish, Skagit, and Elwha rivers. Determining environmental influences on forage fish recruitment will be important to their status and trends and their impact on other fishes, birds, and marine mammals of Puget Sound.

<u>Puget Sound initiative</u>

The USGS is participating in the Coastal Habitats in Puget Sound (CHIPS) as part of the implementation of USGS's Puget Sound Initiative. This interdisciplinary research is focusing on the physical, chemical, biological, and socioeconomic processes that influence the distribution, production, and interactions of valued ecosystem components such as forage species (i.e., Pacific herring and aquatic macroinvertebrates), Pacific salmon and bull trout, and eelgrass in the Puget Sound nearshore. The research is focused on estuarine productivity and understanding the ecological effects of urbanization and coastal restoration on habitat utilization by key species in estuarine food webs. Three estuarine study areas, a mid-Sound urban gradient, Skagit River Delta, and lower Elwha River, were selected for initial investigations beginning in FY 06.

WFRC research outside the CHIPS is market-driven and based on existing partnerships and reimbursable agreements. In the next five years, it is expected that increased CHIP's funding and continued reimbursable projects with DOI partners, tribes, and OFAs will support WFRC projects as follows:

- ***Other large river deltas***. Collaborative research with the Skagit River System (Tribal) Cooperative will be conducted to determine the importance of pocket estuaries and the estuarine delta as rearing habitats for juvenile Chinook salmon in Skagit Bay and to test whether these habitats are limiting the productivity of the salmon population. The WFRC objectives are to determine the proportions of juvenile salmon rearing in various deltaic habitats and their residency and growth in these habitats. Pilot studies will examine the feasibility of implementing similar efforts in the Snohomish and Nisqually rivers to assist salmon restoration in other parts of Puget Sound (with Nisqually and Tulalip tribes, NOAA Fisheries, U.S. Fish &Wildlife Service).

- ***Trophic cascades in Hood Canal, WA***. Virulent pathogens are endemic and ubiquitous in populations of wild fishes from Puget Sound and Hood Canal. Preliminary studies indicate that epidemic diseases can result shortly after application of nominal stressors such as hypoxia to chronically–infected individuals. Resulting fish kills could be much more extensive than the kills currently reported. WFRC scientists are working in a multi-disciplinary effort with the USGS Water Discipline to characterize such extended effects. If additional funds for Hood Canal become available, WFRC research (laboratory, field, and modeling) would be expanded to investigate potential trophic cascades. Trophic cascades are large-scale effects on the community structure and function, mediated by predator-prey and other ecological relations among species. They result from changes in the abundance or size of key predator or prey species.

Columbia River Estuary

Large river estuaries provide an important biophysical link between watersheds draining continental land masses and the marine ecosystem and are especially vulnerable to disturbances occurring upriver of the estuaries. Healthy estuarine ecosystems cannot be achieved without healthy watersheds and river systems. Consequently, research occurring in estuaries must be strongly coordinated with research in the associated watersheds. WFRC is proposing and participating in multidisciplinary work with other USGS disciplines and OFAs to address ecological questions in large rivers and estuaries.

- ***Lower Columbia River Estuarine Research Program*** (LCREP). Hatchery practices and transportation of juvenile salmon and steelhead in the Columbia River have concentrated fish use of the estuary because hatchery salmon are of uniform size and have a shorter estuarine residence than did historic wild populations. Furthermore, the estuary has a reduced carrying capacity due to loss of habitat from development and flow regulation. The effects of this habitat alteration are being investigated with OFAs and universities through the LCREP (an outcome of a USGS-NOAA Workshop on Contaminants) and Estuarine Classification System. These efforts are designed to develop monitoring protocols to evaluate current conditions and estuarine restoration. Currently, WFRC objectives reflect habitat characterization in support of the classification scheme and identification of habitat restoration needs with respect to access, residence, and growth in natural and restored habitats by migratory salmon. Another species potentially impacted by dredging and flow management in the lower river is the Dungeness crab and its study reflects a potential area of expansion for WFRC investigators.

- ***Crims Island restoration***. The WFRC is conducting monitoring to evaluate the restoration of 625 acres of tidal marsh and swamp habitat on Crims Island in the lower Columbia River. Objectives are to :(1) describe seasonal patterns of habitat use and environmental preferences of juvenile salmon and other fishes in existing backwater and tidal marshes; (2) describe juvenile salmon food habits and preferences and invertebrate community structure in reference habitats; and (3) describe detrital pathways, aquatic productivity, and potential productivity at reference sites prior to restoration. Two years of pre-construction sampling have been completed and post-construction evaluation monitoring will begin in 2006 and is projected to continue through 2011.

<u>California coast</u>

The goal of the Dixon Duty Station is to conduct scientific investigations to better understand and predict responses of freshwater/estuarine fish populations and communities exposed to environmental perturbations of natural or anthropogenic origin in California and adjacent States. To address this goal, researchers at the Dixon Duty Station conduct field studies that characterize fish populations, their life histories and ecological relationships (including reproduction, age-and-growth, food habits, predator-prey interactions, and movement patterns), contaminant body burdens, and habitat conditions. Results are used to generate cause-effect hypotheses for testing in controlled laboratory experiments. Other goals are to develop procedures to facilitate ecological measurements (e.g., measuring water quality conditions in salmonid redds), and to conduct short-term fishery studies with fast turn-around times that address high-priority information needs (e.g., field surveys to detect threatened and endangered species, measuring toxic responses in contaminant-exposed fish populations) of client bureaus such as NPS, FWS, and BOR in California.

Key internal and external drivers that are most likely to influence the strategic direction of WFRC in California include availability of reimbursable funds, Departmental/Administrative initiatives, USGS integrated science (e.g., CALFED), and emerging science issues.

- ***San Francisco Bay/Delta***. A major strategic action will be establishing a greater WFRC presence in central California and CALFED in FY 07. The initial emphasis will be on integrated research with the Water Discipline to address information needs for research, synthesis, and modeling for managing water and aquatic habitats, understanding fish movements and migrations, and determining the effects of multiple stressors on aquatic organisms. Delta smelt and Pacific salmon, and possibly green sturgeon, will be the focus of initial field, laboratory and modeling investigations. Center resources in Seattle, CRRL, and Dixon will be drawn upon initially to develop reimbursable programs with WRD. The ideal nucleus for building a significant program includes a fisheries ecologist/modeler and a highly skilled telemetry technician/fish biologist. These individuals would work on local, Delta/Bay modeling issues and larger, life cycle models for salmon and delta smelt. Funding for the positions would come through CALFED (WRD) initially with some internal leveraging.

- ***Contaminants in rockfish***. Rockfish comprise 95% or more of the fish community assemblage living around offshore oil and gas platforms in the Southern California Bight. Studies of rockfish have focused on habitat usage, recruitment, and productivity around these structures. Research has shown that the oil and gas platforms can provide significant habitat for the conservation of some species. Once recruited to these habitats, many species have relatively narrow home ranges, and because they have great longevity, they are excellent integrators of environmental conditions over long periods of time. Beginning in FY 07, the WFRC will enter into cooperative research with the Minerals Management Service, Columbia Environmental Research Center, and the University of California, Santa Barbara, to study environmental contaminants in rockfish. The outlook is to extend these studies into health assessments for key species including effects of multiple stressors.

Technical assistance and support

Products that will be developed are GIS packages and outputs, reports, and peer-reviewed publications. GIS products will facilitate inter-agency and interdisciplinary information dissemination and integration. Reports will focus on disseminating data and results quickly to interested parties. Peer reviewed publications will highlight scientific findings and bolster project support. We will work directly with various stakeholders to assist them in using the science products.

D. Threatened and Endangered Species

Strategic Goals: FAER 1-6; Invasive Species 1- 6; Contaminants 2 & 3

Natural resource managers consistently rate endangered species and habitat issues as their highest management priorities. During the past 100 years, human activities have contributed to the extinction of 40 taxa of North American fishes. Today, the status of hundreds more are considered of to be threatened, endangered, or of special concern. As listings increase, evidence of recovery or improving status remains limited to a handful of species. Factors that threaten fish in the West include water availability and development that has altered the natural hydrology and temperature regimes of watersheds. Habitat degradation from agriculture, mining, industry and urban development also poses a serious threat to many species. Harmful exotic species are being introduced and native fishes transplanted beyond their natural range. Several species have declined, at least in part, due to over harvest.

In the West, more than one-half of all threatened and endangered species occur in the Great Basin and southern desert. In the Pacific Northwest, relatively large numbers of salmonids (salmon, steelhead, trout, and charrs), catostomids (suckers), and other fish species (e.g., sturgeons and lampreys) are of growing concern. The Center will continue to evaluate status and provide guidance for habitat conservation plans, recovery plans, population viability analyses, limiting factor determinations, and develop genetic and molecular tools. Studying factors that affect population fitness, recruitment, and survival is an important element. Systematic research evaluates species relationships using morphological and molecular techniques. Modeling of populations and community interactions helps forecast species abundance, elucidate predator-

prey and habitat relationships, and guide recovery in an adaptive management framework. Key focus areas in the next 5 years include the Columbia, Skagit, and Elwha rivers (WA); Klamath Basin, OR and CA; Muddy River and Lake Tahoe, NV; the Salton Sea, CA; and various other watersheds in central/southern California. New tools, such as offshore acoustic arrays to monitor fish movements and survival, may be useful in answering important questions about the distribution and survival of fishes along the continental shelf. For example, much is known about spatial and temporal mortality factors of anadromous salmonids in freshwater, but little is known about where or when mortality occurs in the estuaries and oceans.

Whenever possible, the WFRC will focus on threatened and endangered species that inhabit lands managed by DOI agencies or species in which DOI has unique trust responsibilities. In many cases, our involvement in these types of studies will require long-term commitment (5+ years) to data collection to allow for a detailed understanding of the species of interest and their environment. For some research, shorter studies will suffice and investigators will make sure these studies fit well into an overall research strategy. Currently, the WFRC has many staff with extensive experience working with threatened and endangered species. Additional expertise in the fields of biostatistics, genetics, and population dynamics is required to enable the Center to respond more effectively in the future to threatened and endangered species issues.

Specific examples of potential focus areas and research on particular species include:

- ***Great Basin and Mojave Desert***. The highest incidence of federally listed threatened and endangered species occurs in the southwest desert. Many are endemic forms living in isolated springs and fragmented habitats. For these populations, the primary cause of decline has been habitat alteration and invasion of non-native species. Important issues are managing these endemic forms under altered water volumes and flows, controlling or extirpating non-native species, and restoring aquatic habitats. The proliferation of development in the Mojave Desert has taxed water resources there, and now there is a plan for trans-basin pipe lines to convey water from the Great Basin Desert south to Las Vegas (Clark County). This plan, along with pumping water from the carbonated aquifer in the Mojave Desert, could negatively impact 12 federally listed fishes, 6 fishes of special concern, and numerous endemic invertebrates, several of which are also federally listed. Not only is water volume an issue, but also changing temperature regimes, since many of these endemic forms are thermophilic and restricted to narrow temperature ranges. Determining the flow and temperature required for individual endemic species for each life history stage are basic research needs. This new information can help insure their persistence.

  Invasive species are another threat to fishes of the Mojave and Great Basin deserts. Species already established in these two deserts that are thought to have caused native fish decline include crayfish, blue tilapia, green sunfish, convict cichlids, mosquitofish, guppies, sailfin molly, shortfin molly, brook trout, and kokanee. Research is required on their life history, population dynamics, and habitat use so that we can develop strategies to control or extirpate these species. Since non-native fishes are most successful in disturbed or man altered habits, potential means of control are through habitat restoration based on habitat conditions that favor native species over non-natives. Another method

of control is disruption of non-native fish life history patterns such that they are eliminated. Most of the listed species are on public lands (National Wildlife Refuges, Bureau of Land Management, and State control land), and these would have the highest priority for recovery-focused research. Research aimed at habitat restoration and non-native species control would also be used to obviate future listing of species of special concern.

- ***Salton Sea pupfish***. Investigators at the Dixon Duty Station are recognized experts on desert pupfish ecology and effects of environmental contaminants on threatened and endangered fish and aquatic resources. In FY 06, the Imperial Irrigation District (IID) requested a proposal from the WFRC to participate in the Salton Sea Baseline Selenium Monitoring Program. The purpose of the monitoring program is to characterize physical and chemical baseline conditions in IID drains, with emphasis on selenium concentrations in water, sediment, dietary components of desert pupfish, and in tissues of surrogate fish species such as western mosquitofish or sailfin molly, if mosquitofish are not available. In conjunction with laboratory toxicological studies, the field data collected are intended to facilitate management actions to protect desert pupfish populations and habitat in IID drains. It is a multi-year monitoring project (2005-2009) with fieldwork in the southern region of the Salton Sea. Data collection involves water and sediments to monitor conductivity, temperature, dissolved oxygen, pH, and water depth and sediment redox potential. Sample collections for this task will begin in April 2005 and end in January 2009. Contaminant analyses for the water samples include total recoverable selenium and total suspended solids; for sediment samples total selenium, particle size, and total organic carbon, will be measured. Intensive monitoring effort at seven drains on two occasions will occur during the last thee years. The intensive monitoring will consist of analyzing water samples for dissolved selenium, selenate, selenite, and organic selenium, and collecting samples of potential pupfish forage organisms (detritus, filamentous algae, phytoplankton, zooplankton, and macroinvertebrates such as midge larvae) and adult western mosquitofish for analysis of moisture content and total selenium. Once a year sediment redox potential will be measured and sediment samples will be collected for analysis of particle size, total organic carbon, and total selenium.

- ***Bull trout.*** In the last five years, WFRC research has addressed several issues regarding endangered bull trout in the intermountain west. These studies include: (1) documenting the swimming performance of bull trout relative to size and water temperature; (2) parameterizing and developing a bioenergetics model for bull trout; (3) documenting the movements and distribution of adfluvial bull trout in the Cedar River watershed; (4) documenting the population status of bull trout in Beulah Reservoir in southeastern Oregon; and (5) developing criteria for the operation of horizontal flat plate fish screens to allow safe passage of bull trout and other fishes. This body of research has addressed the needs of many agencies, including the USDA Forest Service, the U.S. Fish and Wildlife Service, the U.S. Bureau of Reclamation, the Oregon Department of Fish and Wildlife, the U.S. Army Corps of Engineers, and the Seattle Public Utilities District. Future areas of research relevant to bull trout that the WFRC could play a major role in would include further documentation of the performance of bull trout (e.g., volitional

swimming performance, culvert passage), physiological responses of bull trout to a variety of stressors (particularly thermal insults) species interaction studies, and the responses of bull trout to changing environmental conditions (e.g., urban runoff and global warming).

- ***Lampreys*.** Lamprey populations are in decline. These fish are an important resource to Native Americans; however, little research was conducted on them prior to the 1990s. Research on lampreys, species of special concern in the western U.S., has been conducted for over a decade at the Columbia River Research Laboratory. During this time, we have addressed many topics of interest to various management agencies, including: (1) swimming performance of lampreys; (2) routine and active rates of oxygen consumption for determination of metabolic rates; (3) physiological responses of lampreys to exhaustive stress; (4) passage related issues for lampreys at dams; (5) early life history and development studies; (6) movements and distribution of adult Pacific lampreys in the John Day River; (7) larval and juvenile lamprey identification techniques; (8) responses of lampreys to pheromones; and (9) passage characteristics of lampreys at Willamette Falls dam. Recently, the Columbia Basin Lamprey Technical Workgroup, of which the CRRL is a member, identified several areas of research to address critical gaps in our knowledge and management concerns. These include studies on: lamprey status (abundance and distribution); biology/ecology; population delineation (genetics); passage (specific to anadromous fish); population dynamics (predictive analyses); limiting factor analysis (responses to stressors, habitat alterations, etc.); and restoration activities. All species of lampreys, including the anadromous species (Pacific lamprey, *Lampetra tridentata* and river lamprey, *L. ayresi*) and the resident species (western brook lamprey, *L. richardsoni*), will be considered in WFRC planning.

- ***Pacific salmon***. Pacific salmon populations continue to decline throughout their range. Much more is known about the freshwater phase of their life cycle compared to the ocean phase. Study of the seaward migration and survival of juvenile salmon in estuaries and the nearshore marine is needed for salmon restoration in the Pacific Northwest. Recent applications of new tools along the coast of Washington, British Columbia, and Alaska have enabled researchers to quantify migration routes, rates, and survival of juvenile salmonids during emigration and seaward migration. The Pacific Ocean Shelf Tracking (POST) project (www.postcoml.org) is deploying a system of arrays of hydrophones in rivers and along the coast to describe the routes of migration and spatial/temporal mortality of several stocks of salmon from the Fraser River, B.C. The arrays are able to detect tagged fish of any species. Preliminary results show differences in mortality rates among Canadian stocks during the in-river as well as the ocean phases of their migrations. The WFRC is exploring potential applications of this technology for tracking salmon from the Columbia River, Puget Sound, and other Pacific Coast systems. As a starting place, the Center may be able to partner with OFAs and others for pilot POST applications to Columbia River salmon. The arrays already installed by the POST project are available for use by any research organization.

  WFRC studies on threatened and endangered Pacific salmon will continue to be major drivers of landscape and process-oriented USGS Integrated Science (e.g., CHIPS),

Science Thrusts (e.g., Water Availability for Ecosystems), and Focus Area studies (Integrated Environmental Monitoring) in the Pacific Northwest. During FY 05, the Center developed an ecosystem research plan for the nearshore marine environment of Puget Sound. The planning recognized the unique roles of the USGS and its cooperators in developing information about larger-scale processes and their ecological significance on the seaward migration and restoration of Puget Sound salmon. The proposed research represents more geographic, taxonomic, and ecological process coverage than currently possible within the CHIPs project. Future USGS planning, in collaboration with NOAA Fisheries, on the nearshore marine environment is expected to further address salmon recovery needs in Puget Sound.

Technical assistance and support

There will be high demand for WFRC technical assistance and support in the next five years. Because the southwest desert is the fastest growing region in the U.S., while having the highest incidence of federally listed species, there will be increasing pressure for scientific advisement on U.S Fish and Wildlife Service recovery plan preparation and revision, biological assessments, biological opinions, Section 7 Consultations, and recovery and technical working group involvement. The WFRC provides similar technical support for NOAA Fisheries Technical Recovery Working Groups and ESA permitting, U.S. Fish and Wildlife Service recovery planning for endangered suckers, and other Threatened and Endangered species.

E. Aquatic Invasive Species

Strategic Goals: FAER 1 - 6; Invasive Species 1 - 6; Contaminants 1 - 3

According to Executive Order 13112, an "invasive species" is defined as a species that is :(1) nonnative (or alien) to the ecosystem under consideration; and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. WFRC strategic goals include: (1) develop methods and technologies to prevent the introduction of invasive species; (2) identify and report new invasions; (3) determine effects of invasive species and susceptibility of habitats to invasion; (4) provide approaches to contain and reduce populations of invasive species; and (5) restore native habitats and species. Potential customers, partners, and cooperators include the U.S. Department of Homeland Security, the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, other bureaus within the U.S. Department of the Interior, and various state and local agencies with responsibilities related to plant and animal inspection and husbandry, boating and harbor operations, pest control, and associated activities.

Invasive species research by WFRC will specifically address information needs related to ballast water concerns in the Puget Sound vicinity. However, if reimbursable funding is available, the research may address other associated issues such as negative ecological interactions or pathological consequences involving Threatened and Invasive species, anadromous fishes, and other high priority fisheries resources in aquatic systems located elsewhere in the western United States.

Four broad areas of new or expanded research on prevention and control of aquatic invasive species were identified during a hearing held by the House Subcommittee on Environment, Technology, and Standards on June 20, 2002. First was the need to better understand the pathways through which invasive species are introduced into new ecosystems and the relative risk posed by these pathways. Second was the need for an improved understanding of the vulnerability of ecosystems to invasion, the "invasibility" of species (i.e., the likelihood that a species will become invasive once it is introduced) and the ecological impacts of alien species on native species. Third was the need for research to support the development of interim and final standards for treatment of ship-related pathways such as ballast water disposal and marine fouling organisms that colonize hulls. Lastly, was research needed to develop and deploy cost-effective ballast water control technologies, and to support a program to test, compare, and certify different technologies. Research conducted by WFRC over the next five years will address some of these research needs by developing and testing innovative technologies and procedures for detecting and preventing entry of aquatic invasive species, and managing and controlling invasive species once they have arrived in the new ecosystem.

- ***Ballast water***. Ballast water is perhaps the most important pathway whereby aquatic invasive species are introduced into U.S. waters. Research and development of ballast water treatment technologies by WFRC will continue in cooperation with state, federal, and non-governmental organizations in laboratory and field experiments ranging from bench- and meso-scale studies to shipboard trials. Detection of invasive species in ballast water will be aided by microarray analyses with genetic probes developed for representative species from marine and coastal waters of Puget Sound known to be invasive when transported to new geographic locations. Ballast organisms are sampled in tanks while ships are at sea and at major ports around the Pacific Rim. Viral and bacterial components of ballast water will be investigated using solid phase laser scanning cytometry technology. Research will emphasize ecological pathways and risk assessments assisted by Geographic Information System (GIS) technology for monitoring and mapping the spread of invasive species and vulnerability of habitats. Technical assistance in certification testing by Washington State cooperators is one goal of the Center's prevention research.

- ***Other invasion pathways***. In addition to studies on ballast water, other pathways by which aquatic invasive species can enter U.S. waters must be investigated. Pathways that potentially present significant threats include additional ship vectors (e.g., hull fouling and equipment), the seafood industry (e.g., diseases and parasites brought in as hitchhikers on imported seafood), species brought over as pets (e.g., aquarium trade), species used in aquaculture, and species used in research (e.g., biosupply houses and scientists). Research on these pathways is needed to characterize the relative risks of different pathways as well as identify new pathways, thus enabling optimal use of resources in controlling invasion. WFRC will conduct studies on these non-ballast water pathways by seeking reimbursable funds from DOI clients and other sources.

- ***Invasion processes***. The vulnerability of ecosystems to invasion and the "invasibility" of species can be investigated through ecological and biological surveys and research. Effective monitoring of ecosystems can enable early detection and rapid response to

aquatic invasive species, and help to indicate if control methods and technologies are working. WFRC will conduct studies on ecosystem vulnerability to invasion and the invasibility of species by seeking reimbursable funds from DOI clients and other sources.

- ***Columbia River***. Management and control of invasive species in the Columbia River and other estuarine and coastal waters is another issue that we would like to address. Invasive species in the estuary include numerous invertebrates, crabs, clams, and fish such as the American shad and banded killifish. American shad are suspected of being a vector for the pathogen *Ichthyophonus* and may thereby have facilitated the decline of Pacific herring along the west coast. An understanding of the habitat is crucial to understanding why invasive species are successful and how they spread. We propose to use habitat classification tools such as remote sensing and GIS to identify pathways of introduction, model spread, identify impacts to the food web, and determine the extent that invasive species displace economically important native species. USGS can provide the multidisciplinary expertise to understand the role of modified habitats, sediment dynamics, and water quality in the colonization and spread by invasive species. This work would closely tie with other work at WFRC including the GAP, the PNAMP Estuary Subgroup, ballast water studies, and eel grass studies.

Facilities

Additional investments in facilities will be needed to support the increasing USGS role in developing and assessing prevention technologies, rapid assessment of new invaders, modeling and forecasting, and the development of innovative control methods[1]. A treatment protocol for ballast water meeting U.S. Coast Guard prevention standards for microbes and plankton will be available at the end of FY 07 and will be based on the work of WFRC, its cooperators, and other organizations.

COMMUNICATING SCIENCE

Communication strategic goal

Make WFRC science available and understandable to all interested and intended audiences. Data and information will continue to be disseminated through conventional scientific outlets and to the public through web-based delivery systems that support visualization technologies.

A. Geographic Information Systems

It is imperative that our GIS capability receives greater consideration in the years ahead. GIS products deliver scientific information over multiple spatial scales and enable the synthesis of complex scientific information by managers and the public. Products such as interactive, internet-based decision support systems will use information and models to improve the process of decision-making. Spatial modeling and simulation tools will allow structured problem

[1] The draft Five Year Program Plan for the USGS Invasive Species Program (September 17, 2004) notes the need for facilities improvements for mescosm studies of ballast water treatment effectiveness and other strategic directions.

definition, visualization of data, and the ability to examine many different management scenarios. Strategically the Center will focus on two geographic areas for growth in the immediate future: the Columbia River Basin and Puget Sound. Both of these areas have significant resource management challenges that require our best science to guide decision makers in the governmental, private, and public sectors.

A Columbia River basin-wide suite of USGS data, incorporating an Internet map-serving tool, will be strategic priority. This will facilitate regional scientific and management access to USGS data and make geospatial analysis readily available. A common GIS framework will provide a foundation from which cooperator partnerships will be established for additional scientific analysis or data collection needs for natural resource management within the Upper Columbia Plateau and adjacent areas. This approach will also give online access to USGS tools such as Streamstats. Current Center applications to be placed on the web include Lower Columbia Basin water quality risk assessment, Bonneville Reservoir exotic species modeling, John Day Reservoir digital atlas modeling, and Hanford Reach habitat modeling.

Puget Sound's coastal habitats will be classified as part of the Center's Estuarine GAP (Gap Analysis Program). The Gap analysis is evaluating the diversity of aquatic species and their habitats to identify gaps in their distribution and protection. GIS technologies are being used to store, manage, and disseminate data on commercially and recreationally important species over the Internet. Initial efforts are focusing on indicator species for various community types, keystone species, or species listed under the ESA but formerly abundant in the Skagit Delta Whidbey Basin. Future efforts will include model development in order to describe aquatic species-habitat affinities and interactions and conduct a Gap analysis. The Gap analysis consists of: (1) summarizing the reported status of aquatic biodiversity for target species; (2) determining the known and predicted occurrence and distribution of key fish, mammal, invertebrate, and plant species and their habitats; and (3) determining the representation of those species in protected areas.

Puget Sound focus areas will include: (1) working with NBII to develop a GIS capable of storing, managing, and disseminating aquatic GAP data via the Internet; (2) identifying and obtaining permission to access existing data sets from federal, state, county, and city agencies; Indian tribes; universities; and non-governmental organizations working in the region; and (3) developing a database of aquatic resource data for the Puget Sound. For example, physical characteristics of Puget Sound may be available from GD, water characteristics from WRD, ancillary data layers, such as LIDAR, from the Mapping, and vegetation information from Biology. Validation of the Puget Sound Gap may involve development of field sampling plans to acquire critical data, development of species-habitat models, field sampling to test model predictions, and disseminating the results. The final GAP analysis product will be made available to the public on the NBII FAER node and linked to the Center's enterprise GIS.

B. Center Website

Three phases to the development of an effective, functioning Center website are envisioned. Prior to any action being taken on changing the physical appearance of the existing site, an oversight committee will be formed to develop what our Web presence should look like and

what financial requirements are needed. This will require input from all the field stations as to what data they have and how they would like it presented.

- ***Short-term actions***. The focus of the short-term objectives will be on cleaning up and enhancing the current web site, reorganizing the staffing component involved with Web related actions, tracking web usage, planning the development of the website based on the results of the tracking, and expanding the scope of the current site. Cleaning up the current site will involve a thorough review of each of the site's current pages, checking the accuracy of information, and taking steps to prepare and insert new or supplemental information. These actions should be conducted in conjunction with the Committee's planning to ensure that all preliminary steps fit into the more current global plan. A Center Webmaster/programmer position will need to be filled.

- ***Medium-term actions***. The focus of medium-term objectives will be on the integration of preliminary design and technology with final website planning efforts. Working examples include the linkages of the CRUISE project or GAP project information to our site. An active database will be developed to house detailed information concerning the various scientists and projects to be presented. The database will allow active searching capabilities and true indexing of all data. Developing this concept of serving up database information will require a database administrator. Additional hardware will be required as well as potential increased personnel costs. We will attempt to share these costs with partners/projects and should be able to incorporate their data into the database design and service their web requirements.

- ***Long-term actions***. Long-term objectives will always be predicated on funding and the robustness of the Center website. Other USGS collaborations are possible and may require a move away from the NAT WEB design towards a fully independent web site served up at the facility and maintained by our personnel. This would require additional full time web programmers, database administrators, and web security staff as dictated by the DOI. Our current physical location for the servers would be inadequate and equipment upgrades required. At this point, the committee must determine whether it is in the Center's best interests to serve its own website or to have our information served by another location--one that has already developed their database design and information structure. This could result in a substantial cost savings and, depending on the agreement, could still provide us with substantial web flexibility.

C. Information and Outreach

The Center needs to clearly communicate strategic directions and research programs to all audiences. Better communication among scientists and managers will improve decisions concerning resource conservation and aid in setting research priorities. Communication will also increase recognition of the WFRC as an important source of science-based information about fisheries and aquatic ecosystems in the West. Center strategies for enhanced visibility and coordination include: developing relationships with appropriate Program and Regional Coordinators; arranging site visits with USGS Leadership Teams; demonstrating leadership in the organizing and conducting technical meetings, workshops, and symposia; preparing

informative briefing materials (e.g., USGS fact sheets, Congressional briefing materials); and developing information transfer and outreach programs (e.g., websites, responses to information requests, participation in appropriate events).

Target audiences:

- External audiences comprised of stakeholders, potential customers, and the general public.

- External audiences at both regional and national levels to inform and promote scientific collaborations.

Effective communication is likely to garner support for our work from other federal agencies, state and local governments, academia, non-governmental organizations, international agencies, the public, and Congress. Employees should be encouraged to proactively seek a wide variety of communication opportunities. We must nurture a culture in which communications are valued equally with science, where both are seen as necessary to fulfilling the mission of the Center.

The following ***strategic actions*** are suggested to help us effectively communicate our mission, programs, capabilities, and relevance to external audiences:

- ***Develop a comprehensive outreach and communications plan for the center.*** The key to developing an outreach plan is to build a communications calendar listing specific opportunities Center staff can use to reach potential audiences (for example, see Appendix 4). In addition, completion of an event evaluation sheet will provide the Center a means to evaluate the effectiveness of its participation in events. A key aspect of a common communications planning process is recognition that we cannot participate in every event or take every outreach opportunity. Selection should be strategic and based on local interest, targeted audiences, and potential impact, rather than cost or tradition alone.

  Opportunities for communicating with the media and with Congress are driven by less predictable processes, making them more difficult, but not impossible, to plan far in advance. Budgets must include resources for planned efforts as well as funds set aside for unplanned but worthwhile opportunities.

- ***Develop and implement an annual publications plan.*** Communicating our science to the widest audience possible is of increasing significance in a “less for less” environment. To increase the Center’s visibility to persons outside the scientific community and prepare for future Congressional visits, the development of an Annual Publications Plan (Appendix 5) is necessary. The Plan will outline short-term, long-term, and on-going publication needs, including fact sheets, brochures, briefing materials, displays, power point presentations, posters, and educational materials. The content of our general information products will be scientific in nature and will require editing based on the target audiences.

- ***Implement peer and policy review of outreach material.*** A Center-level guiding document must exist to implement peer and policy review. Review is required for all products disseminated by USGS regardless of media, including oral presentations, administrative reports, and web content. Products are reviewed for scientific quality and for issues and wording potentially in conflict with USGS, Departmental, and Administration policy. Documentation is required, including resolution of any policy issues and Office of the Regional Executive approval signature, before products may be released for dissemination.

- ***Provide employees with tools needed to communicate effectively.*** Effective external communications and customer engagement rely heavily on three things: first, the employees' knowledge, understanding, and support of the Bureau and Center's research must be established. The delivery of a communications plan will be central to getting the message to the employees. Second, employees need a robust and accessible toolkit (text, photos, illustrations, slide sets, exhibits, templates); guidelines (message expression; communication policies, tips, and techniques); and information on the needs and interests of the target audience (customer feedback, customer research). Third, the value of these tools is significantly enhanced when employees consult with Regional Communications staff. The roles and capabilities of Bureau communications staff are outlined in Appendix 6 (Toolbox to be used by employees when creating outreach and communication products).

- ***Ensure accountability for communications performance.*** Accountability may be best implemented by ensuring inclusion of their communications responsibilities within their position descriptions and performance plans. Science staff responsibilities differ by individual, but every project proposal should include a statement of planned communication of results and relevance to non-technical audiences.

- ***Create incentives to encourage and empower employees to communicate science.*** Historically, our organization has not valued excellence in communication of science activities equally with excellence in science. Such a culture change requires that positive reinforcement for high-quality and high-impact contributions be provided. Clear and consistent guidelines must be established and publicized on how communications efforts contribute to an individual's annual performance evaluation and their opportunity for promotion, regardless of the system under which they are evaluated.

MANAGEMENT AND ORGANIZATION

Organizational structure and staffing

The organization structure of the WFRC is shown in Figure 1. Geographic locations of the laboratories and field stations are shown on the cover of this document. Since 1997, a field station was added in Klamath Falls, Oregon and a Duty Station in Twisp, Washington.

Workforce planning

The Center's core competences will continue to reflect our strengths in fish health, fish ecology, and aquatic ecosystems, with developing areas in geospatial technologies. Changing science quality policies, USGS restructuring, business practices, and increasing facility demands are major drivers for workforce change. Scientific expertise may be acquired through existing skill sets in other USGS disciplines, through federal hires, or via cooperative agreements or other contractual arrangements.

Emerging science areas that will require new disciplinary expertise and reliance on other parts of the USGS include: (1) basin-wide ecosystem research that includes human dimensions and resource valuations (Columbia and Klamath basins); (2) next generation tools for water and ecosystem management; (3) integrated science in Puget Sound including marine fish health; (4) effects of multiple stressors at individual, population, and community levels; (5) and aquatic invasive species. The address of new and integrated science areas will include the need for additional expertise in fields of aquatic and marine ecology, fish population dynamics, geospatial analysis, microbiology, fish physiology, and aquatic toxicology. Traditional science areas will continue to require hires of fishery biologists and technicians for data collection and analysis. Expanded USGS science in coastal environments will ideally involve an owned research vessel with minimal personnel requirements for a boat operator. USGS policies and practices indicate the need for a safety officer and statistician as well as additional administrative support staff. Some disciplinary areas, such as fish genetics and geospatial analysis, will be developed through additional academic training for advanced degrees by existing Center staff. For scientific hires, the Center management approach will be to fill new positions with post-docs or recent PhDs under conditions of term employment. If FTEs are limiting, appropriate skill sets will be acquired through the Cooperative Fish and Wildlife Research Unit, the Cooperative Ecosystem Studies Unit at the University of Washington, or through other kinds of contractual agreements.

In FY 04 the Center FTE allocation was 154 and in FY 05 it was 164. The FTE requirement is expected to increase and level out at 170 FTE in FY 05 and beyond. Due to the reimbursable nature of approximately 2/3 of the Center's research, a large number of Term employees are utilized. Many Term employees have worked on different Center projects for several terms and have developed skill sets essential to our mission. Beginning in FY 03, a series of targets for increasing the number of Permanent federal employees within the organization was established with approval from the REX. Since then, there has been a net increase of 6 Permanent positions, far below the 19 total positions anticipated in our 5-year plan. Retirements, transfers, and personnel issues have contributed to our problems in meeting planned targets. With increased numbers of FTEs and expansions in the total numbers of Term and Temporary employees, declines in contract employees can be expected. The rise and fall of employees in each category will relate to performance periods associated with reimbursable agreements so as to minimize impacts on the continuity of existing study teams.

The WFRC completed a Workforce Analysis in October 2004 (the relationships described below remained the same in FY 05). During the peak field season in FY 04, the Center workforce was comprised of 64 Permanent, 80 Term, and 41 Temporary federal employees. Seventy-five contract employees were employed from the private sector. Other workforce members included

Student Contracts (3), University Employees (13), Volunteers (31), and 2 USGS emeritus scientists. One Fishery Biologist was detailed to the Western Regional Office. Several scientists are co-located with the Center including 2 employees from other BRD cost-centers (FRESC and ASC), 1 from NBII, and 1 from NOAA. The percent composition of the workforce was 63:37 (roughly 2:1) with respect to numbers of males and females employed. A similar pattern occurred in FY 05.

As of September 24, 2004, 169 federal employees were employed by the Center. This number consists of 35 Scientists/Principal Investigators, 67 Biologists, 43 Biotechnicians, 17 Administrative Staff, and 7 Facility Staff. Seventeen employees have supervisory responsibilities (they are distributed in Center headquarters, laboratories and field stations in Seattle, Nordland, and Cook, WA; Klamath Falls, OR; Davis, CA, and Reno, NV). With respect to organizational structure, the following management metrics can be described: *professional: technical* (total = 145 employees, ratio = 1:4); *IT: employee* (total = 169 employees, ratio = 1:80); and *supervisory: employee* (total = 169 employees, ratio = 1:10); administrative/staff (total = 169 employees, ratio = 1:10). The distribution of *Permanents/Terms/Temporary* employees is 64/72/33 with respect to individual employees, or roughly 1.0/1.1/0.5.

A relatively large number of Term and contract personnel are employed to address the Center reimbursable research program. At present, the *Temporary: Contract* employees is slightly less than 1:2 and a greater use of Temporary employees can be reasonably expected during the Plan period. This anticipated use reflects increased FTE allocations and cost considerations associated with federal versus contract hires. A continued reliance on Terms will enhance workforce flexibility while allowing management evaluations of scientific potential should Permanent employment opportunities arise. A contract workforce of 40-50 employees in technical and administrative support roles is likely into the foreseeable future.

The scientific leadership of the Center (i.e., Center Directorate and Section/Field Station Leaders) is all male. Conversely, the supervisors of administrative staff within the Center are all females. The ratio of males: females in the *Scientist/Principal Investigator* category is 23:12, or roughly 2:1. Five female scientists are currently recognized for their potential and are being encouraged or nominated by their supervisors, or the Center Directorate, for increased leadership training opportunities or details within the greater organization to further their USGS experience. The racial composition of the federal staff is predominantly Caucasian with only 1 African American, 1 Hispanic, and 2 Asian employees.

Funding

The WFRC budget was approximately $17 million in FY 05. Funds consisted of about $3.6 million for Science and $1.1 million for Facilities from our initial USGS appropriation. An additional $850,000 was received from USGS for Deferred Maintenance, DOI Cost Share, and BRD cyclical funds. The remaining funding came from reimbursable agreements with DOI bureau and OFA partners.

An analysis conducted in FY 04 for USGS Headquarters indicated a funding ratio for WFRC of 1.2 for Cost of Permanent Salaries: Total Base Funding. The Center's total requirement for

federal salaries is over $7 million annually. Thus, base funding for the Center's permanent workforce continues to be a major issue. Facility and salary shortfalls, are charged to our reimbursable customers but this reliance on outside sources of revenue continues to impact this Center's ability to fully address its missions as well as those of the greater USGS.

ADMINISTRATION

Operations Strategic Goal: *Continuously improve operational processes and practices to efficiently and effectively support our people, programs, and customers*. The success of Center activities depends on partnerships at all levels, from universities and local and state governments, to other federal agencies and stakeholders.

Adapting to changing business practices and Bureau planning requirements continues to increase local administrative and, to a lesser degree, scientific workloads, in support of programmatic needs above the Center-level. The impact of the short-term drivers is the recognition that reimbursable funding, at levels approximating $12 million per annum, will continue to the major force behind the financial health of the Center. Financial stability will require constant attention to be our internal goals for a greater diversification of Center funding sources. This diversification will drive shifts in program emphasis and core missions, possible changes in required expertise, and continual refinement in staffing as it relates to federal and contractual workforce planning. USGS IT security requirements have driven major changes in Center policy and practice.

A. Operational Process and Practices

Ensure customer satisfaction and improve the efficiency of the Bureau's administrative and science support and programmatic activities through streamlining, quality improvements, new technology, and cost effective measures.

The Directorate, in consultation with senior staff representing technical, administrative and facility functions of the Center, guide internal management. An emphasis on continual training in USGS scientific and financial management systems assures common services rates are accurate, defensible, and meet the administrative and programmatic needs of the Center and Bureau while addressing key elements of Government wide Management Reform (Strategic Planning of Human Capital, Competitive Sourcing, Financial Management Improvements), Activity Based Cost Management, E-Gov Initiatives, and Information Security.

B. Funding Science and Staff

A continuing reliance on reimbursable funding in support of Center missions and DOI priorities is anticipated. The realities of Center finances (66% reimbursable and 34% base) impose significant challenges with respect to developing a core aquatic ecosystem research program. Ideally, core science areas and core research staff would be base funded and supplemented by reimbursable projects only if they advanced USGS science missions. Realistically, the Center will continue the tradition of studies that involve the conduct of in-depth scientific investigations

to understand and predict responses of fish populations exposed to environmental perturbations of natural and anthropogenic origins.

Specific strategic actions are described below:

- ***Facilitate the sound management of the Center's financial resources by encouraging greater participation in budget planning and execution processes.*** Administrative staff will: (1) conduct annual budget planning meetings with Center managers and budget staff to ensure Center-wide approach to common services budget development and develop out-year appropriated budget estimates; (2) Provide greater financial transparency to science managers through budget reporting mechanisms; (3) Provide concise updates regarding financial management system and other USGS requirements related to reimbursable agreements as needed to assist science staff complete budgets and responses to customers; and (4) Assist scientists and customers to ensure that reimbursable agreements contain the required elements to facilitate approval and implementation of agreements in a timely manner.

- ***Foster greater understanding of administrative processes and performance indicators through innovative communications and informal training opportunities.*** Administrative staff will: (1) conduct annual administrative workshops to provide continual training of administrative staff on changing policies and practices, share cost effective approaches to performance of work, promote creative problem solving and value-added processes, and identify new technologies that streamline administrative or science support activities; (2) provide annual training in BASIS+ budget development, narratives, products, and reports to scientific staff or their science support staff; and (3) identify cost effective strategies to meet reporting requirements for customers without requiring more administrative time (e.g., detailed documentation required for invoices to many customer).

- ***Promote internal and external customer satisfaction by improving communication center-wide.*** Administrative staff will: (1) encourage Center-wide management team meetings that would include communicating/publicizing the business and strategic plans to the staff, spell out what short and long term goals are for the Center, discuss what successes have been made or opportunities for improvement, and give recognition publicly when earned; and (2) conduct Administrative team meetings regularly with open discussions on administrative challenges and successes. When necessary, accountable action items will be assigned to be achieved during the interim between meetings.

- ***Meet the administrative and programmatic needs of the Center and Bureau while addressing key elements of Government wide Management Reform.*** Administrative staff will: (1) manage FTE allocations to maintain staffing at appropriate levels; (2) assure compliance with Government Performance Results Act (GPRA), with emphasis on (a) systematic analyses and investigations delivered to customers; and (b) workshops and training provided to customers, the critical product areas identified for BRD; (3) fully utilize the USGS Budget and Science Information System Plus to

capture project work plans, project budgets and account and funding information. Full utilization requires adequate training in BASIS+ to appropriate personnel and providing contacts at each laboratory and field station for guidance in its use and to assure the inputted data in the system is updated regularly providing accurate, up-to-date reporting in all areas; and (4) assure compliance with the Center's Peer and Policy Review of Science Products/Project Management Standard Operating Procedures.

C. Information Infrastructure

Ensure sufficient data integration and access to satisfy both internal and external partners. The IT Specialist will develop a five-year rotational plan to upgrade computer needs of all scientific and administrative staff. The IT Specialist insures USGS security policies and practices are followed at the Center. Enterprise system development will include the IT Specialist in program planning and development activities to assure that IT hardware and software needs are met. Annual budgetary requirements are clearly articulated and contained in the Center Common Services rate development.

- ***Find innovative solutions and overcome barriers to communication between, and within, Center offices.*** Administrative staff will: (1) maximize use of communication tools, such as Center website, Quickplace, and Sametime to facilitate timely and efficient exchange of information and data, room scheduling, and to replace outdated means of information sharing; and (2) contract qualified webmaster services for web-page development and design for the Center website.

D. Working Capital Funds

Working Capital Funds are created and funded to support facility, research vessel, and scientific instrumentation requirements to maintain a state-of-the-art fishery research organization.

- ***Recognize opportunities to spread capital equipment costs across fiscal years.*** Administrative staff will: (1) develop investment plans to establish working capital funds for center-wide and/or cost center needs such as replacement copiers and computers on a cyclic schedule, vessels, publications, and scientific equipment as identified; (2) identify sources of seed funds and ongoing contributions to working capital funds; and (3) evaluate investment plans annually during third quarter to determine adequacy of funding and to strategically address future facility, research vessel, and scientific instrumentation needs.

People Strategic Goal: *Ensure strategic management of human capital to attract and retain a diversified, quality workforce with the skills and talent that enhance our programs and serve our customers*. Center long-term goals address skills, USGS rewarding environments, flexibility, and organizational leadership.

A. Employee Development

Enhance science, technical, and administrative skills of the USGS workforce. The Center is a strong advocate of employee development and training and strives to meet the 40-hour minimum annual training requirement of the Bureau. Continuous learning (on-the-job training, work study student programs, and academic training) is recognized in the context of planning for succession and goals for scientific excellence. The use of employee detail assignments within the Center and other offices of the USGS are valued for skill building and developing employee understanding about how the USGS works. Center supervisors will work with employees, as appropriate, in the development of Individual Development Plans (IDP).

The review of our research scientists is an essential process for the U.S. Geological Survey (USGS). The panel review process evaluates the research work and contributions of our scientists, focusing on the demonstration of excellence in our scientific pursuits, the leadership we provide in this work, and the impact it has on science and its applications. Consistent, objective, and fair reviews are a critical requirement for maintaining the vitality of the USGS Research programs and they provide an incentive for high quality scientific productivity.

- ***Recognize training and career development as a strategic activity necessary to our future success.*** Administrative staff will: (1) enhance science, technical and administrative skills of the USGS workforce by providing employee development opportunities for permanent and term employees; (2) identify employee development opportunities, which may include training courses, seminars, workshops, tuition reimbursement, cross-training within the Center and details to other stations or Centers; (3) offer opportunities for advancement within the Center in order to retain highly motivated, effective, well-trained employees; (4) identify, and budget for, training that would enhance areas of expertise where skill-gaps exist; and (5) solicit feedback from employees regarding success of employee development measures.

- ***Provide Research Grade scientists greater opportunity to prepare for the research grade review process; reduce the impact that changing administrative policies have on scientific staff that detract from scientific pursuits.*** Administrative staff will: (1) provide an RGE "toolbox" to assist scientists with their research grade and peer reviews; (2) ensure that all research grade scientists are notified of upcoming panel reviews at least 2-months in advance, with follow-up reminders; (3) provide all research grade scientists with a knowledgeable RGE point-of-contact; (4) provide administrative assistance to science staff in order to minimize administrative tasks and increase time available to focus on scientific work (e.g.,. assisting with input into BASIS+, budget management and reports, personnel, and procurement); (5) Recognize changes in USGS and/or customer requirements and identify need for workload management and teamwork to accomplish increasing diversity and number of reporting requirements; and (6) Assist with budget preparation, budget management and billing documentation for reimbursable agreements

- ***Recognize the importance of institutional knowledge in maintaining a successful and proficient organizational unit.*** Administrative staff will: (1) create a staffing plan that encompasses all support staff who are essential to Center-wide operations for

consideration of permanent employment; and (2) manage an appropriate support staff to scientific staff ratio; employ flexible staffing approaches to meet seasonal increases on workloads.

- ***Assess and identify a Center-wide staffing plan that encourages equitable use of available FTE.*** Administrative staff will: (1) develop a Center-wide approach to managing FTE ceilings; (2) Encourage greater use of technical services contractors across the Center to alleviate the current unbalanced approach; and (3) implement a strategy that would result in an increase in the overall FTE allocation to the Center.

B. Reward System

Reinforce strategic directions through the reward system. The Center will reward scientific and administrative excellence using all of the administrative tools and procedures at its disposal. Assessing and rewarding performance will be achieved through standard avenues such as the RGEP process, performance reviews, and DOI awards policies.

Criteria used to reward individuals for science accomplishments will include: productivity of science products and technical services; communication of knowledge to appropriate audiences; natural resource management impacts; service to institutions or organizations external to the Center and USGS; and participation and effectiveness of team efforts, including contributions from research support staff and administrative staff.

Criteria used to reward individuals for administrative accomplishments will include: productivity and accuracy in accomplishing assigned administrative support responsibilities; creativity and motivation in identifying and developing innovative solutions to administrative challenges to increase efficiency and effectiveness; participation in local, Center, Regional or other USGS team efforts; effective communication within the organization, and with vendors and funding agencies.

- ***Actively promote a rewarding work environment that encourages creativity and innovation.*** Administrative staff will: (1) communicate the variety of rewards that are available for managers and supervisors to reward their staffs; maximize the use of non-monetary and honor awards as cost-effective measures; (2) communicate the reward system, and the criteria used to reward individuals, as incentives to junior staff; (3) develop WFRC certificates of appreciation and other non-monetary rewards; (4) develop an awards budget for awards ceremonies, monetary awards, and other rewards, in out-year budgets; (5) ensure public recognition of honor awards by conducting annual awards ceremonies at each cost center; (6) use expanded training opportunities as an alternative to monetary, non-monetary, or honor rewards; (7) hold Center-wide meetings that include junior scientists' participation in presentations; and (8) evaluate customer service satisfaction through WFRC surveys, which also serve as a venue to convey ideas.

C. Flexibility.

Achieve human resources flexibility to meet changing needs. The Center will utilize innovative solutions regarding job sharing, alternative work schedules (e.g., compressed work schedules), telecommuting (e.g., flexi place), career and retirement planning, wellness and fitness programs, parental leave, child care, dual career situations, and a safe and drug-free environment. The Center will utilize alternative resources such as technical support services, internships, and student contracts to meet seasonal workforce fluctuations or to assist research and administration when cost efficiencies are achieved.

- ***Provide an environment of open communication and shared knowledge. Promote work schedules that meet life situations within bounds of job requirements. Provide a creative and desirable work environment for all staff while meeting the requirements of the agency.*** Administrative staff will: (1) invite human resource specialist to provide workshops on recruitment strategies, staffing, and benefits; (2) invite contracting officer to provide workshops on intern programs, student services contracts and other alternatives to employee recruitment; (3) identify "wellness coordinator" collateral duty position to promote a wellness/fitness program for the WFRC; (4) hold on-site retirement planning courses every five years; (5) submit Western Region technical support services contract documentation for competition and award. Final award due prior to April 1, 2006; (6) identify positions that meet the criteria for telecommuting on a regular and irregular basis and set goals for number or % of employees who take advantage of flexibility options; and (7) identify positions that are suitable to contracting options and acknowledge the limitation of contract employees in administrative positions where access to secure systems are required to accomplish the work.

D. Leadership

The Center supports the USGS Leadership Program vision to create a leadership-centered culture that emphasizes the importance of people in the USGS to ensure high-quality science for the benefit of society. The goal of the USGS is that all employees maintain a high degree of integrity guided by principles of respect, accountability, communication, understanding differences, encouragement, focus, and collaboration. These are behaviors that foster a high performance environment, increase productivity, and attract and retain high quality employees. Center employees are progressively encouraged, or are nominated for USGS leadership training and workshops and networking awards, as appropriate to Center missions, succession goals, and recognition of leadership potential by senior staff. Core leadership qualities are developed in areas of: knowledge, communication, teambuilding/teamwork, personnel development, problem solving/critical thinking, strategic thinking and direction setting, customer service, and business management. Measures of success are determined by participation in training and continuous learning at all levels within the organization and their impacts on Center strategic missions.

- ***Foster visionary leadership and management professionalism*.** Administrative staff will: (1) provide employee development funds for 20 hours annual leadership training for all supervisors and managers; (2) identify needs and budget for leadership training in

out-year budgets; (3) identify and facilitate teambuilding exercises for supervisors and managers; and (4) ionduct annual on-site training in communication strategies.

FACILITIES – OPERATIONS AND MAINTENANCE

Facilities

The Seattle Laboratory of the WFRC is a state-of-the-art facility for fish health and ecology that includes over 16,000 square feet of dry laboratory space. Additionally, there are 9,000 square feet of wet lab space supplied with 20 individual bays containing a total of more than 300 tanks of various sizes. The laboratory effluent is treated with chlorine gas. Within the dry lab complex is a restricted access Biocontainment Level 3 laboratory for working with exotic fish pathogens. The dry lab has a cold laboratory (4°C), walk-in cold storage (4 and -20°C), microscopy rooms, and an animal care facility meeting NIH guidelines. The laboratory is equipped with ultracentrifuges, refrigerated centrifuges, refrigerated microfuges, PCR machines, complete microarray, DNA sequencer, peptide synthesizer, DNA synthesizer, electrophoresis and gel equipment, spectrophotometers, luminometer, fluorometer, flow cytometer, solid-phase cytometer, scintillation counter, ultrafreezers, DNA and image analysis capabilities, as well as other types of equipment commonly found in modern biology laboratories. The WFRC marine field station at Marrowstone Island consists of a four-acre property that is equipped with 9,000 square feet of wet laboratory facilities with high-quality, temperature-controlled, pathogen-free seawater supplied to several hundred tanks of various sizes. For more information see http://wfrc.usgs.gov.

The Five (5) Year Facilities Strategic Plan identifies facility support necessary to enable high quality research at the WFRC. This plan is a living document to be updated annually in response to emerging issues and changes in the WFRC mission.

Strategic direction

The Facilities Strategic Goal is to optimize facilities location, distribution, and use to reduce costs while ensuring program effectiveness and a quality work environment. The role of the Facilities organization at the WFRC encompasses many tasks that are vital to the continued operations of the WFRC including safety and environmental management.

Key internal drivers relate to the mission of WFRC and to adapt to changes in science mission such as:

- New Facility Planning
- Facility Improvements
- Equipment Maintenance
- Repair or Replacement
- WFRC Field Station Support
- Safety and Environmental Management
- Chemical and Hazardous Waste Management
- Security

Key external drivers that impact the Facilities organization are HQ and Regional mandates. A few examples of current mandates are:

- USGS Facilities Maintenance Management System
- Environmental Management System
- External Safety and Environmental Audits
- Regional or HQ Request for Information
- Deferred Maintenance/Capital Improvement Projects
- Facility Budget Activity Reporting
- BASIS+ Reporting and Tracking
- Security Mandates
- Flat or Declining Budgets

Short-term goal

Within Facilities there are responsibilities that have not been adequately resource loaded. The short-term goal will be to prioritize these responsibilities and provide the appropriate resources. Under tight budget constraints these responsibilities may need to be performed where duties crosscut other disciplines. This may include some combination of Sub-Region and WFRC support.

Responsibilities include but are not limited to:

- New Facility Planning
- Field Station Technical Support
- Deferred Maintenance and Capital Improvement (DMCI) Projects
- Occupational Safety and Health
- Safety and Environmental Documentation/Review/Training
- Safety and Environmental Training Records and Self Audits
- Environmental Management System
- Facility Maintenance Management System
- Design and Construction Management
- Capital Improvements and Cyclical Maintenance
- Discharge Permits and Recordkeeping
- Security and Keycard Control Access
- Maintenance and Operations
- Laboratory and Custodial

Areas of responsibilities that are under funded or staffed

- ***Occupational Safety and Health (OSH) and environmental management.*** The current staffing of Collateral Duty Safety Officers (CDSOs) has been inadequate to handle the numerous requests by OSHA, USGS-HQ, Regional, and other outside agencies. Safety has outgrown the original 10 percent status of the CDSOs and the WFRC should consider making this position as full time.

The Safety and Occupational Health (SOH) Specialist would revise, update, review, and recertify all safety and environmental documentation and coordinate all required safety training. The SOH will keep maintain all safety and environmental training records, chemical inventories, lead safety teams, perform inspections, develop and maintain the Environmental Management System (EMS) plan, maintain and manage hazardous waste storage sites, keep inventory of wastes and disposal, perform safety and environmental self audits, and promote safety and environmental awareness at all sites.

- ***USGS Facilities Maintenance Management System (Maximo).*** WFRC Maximo implementation is scheduled for the end of 2005. This will require facilities staff to maintain and input data into the USGS Web-based system. The facilities maintenance system will be linked with HQ to provide needed information at the HQ level and to ensure a workable system at the local level. Within the next five (5) years most USGS facilities will be using the Maximo system to predict facility funding. This requirement is driven by the Department of the Interior and remains a top priority within the USGS facility community.

- ***Environmental Management System (EMS).*** The WFRC has begun implementation of the EMS at the Seattle Laboratory and CRRL. There will be a need to coordinate, maintain, and update information in the system and establish immediate and long-term Environmental goals. Site-specific EMS teams are typically made up of 4-5 members who meet on a quarterly basis. Full implementation of EMS will require record keeping, investigation of improvement areas, and reporting. The EMS implementation is currently understaffed, unfunded and will need resources to meet this mandate.

- ***Marrowstone Marine Field Station (MMFS) O&M Support Service Contract***. The science mission at the MMFS is expected to grow and the facilities organization will need to adapt to the changes. Currently the support service contract provides day to day Operations and Maintenance with critical systems managed from the Seattle Laboratory. As the mission at MMFS evolves there may be a need to move from Seattle technical support to a stand-alone Facilities organization on site similar to CRRL and the Seattle Laboratory.

- ***Klamath Falls, Dixon, and Reno Field Station Support***. Field stations that are located in lease space receive Maintenance and Operation support from the Lessor. Small tenant improvements, equipment fabrication, small hazardous waste disposals, safety and environmental requirements can be coordinated within the Facilities organization.

<u>New facilities</u>

The Columbia River Research Laboratory (CRRL) is currently planning for a new facility because it has outgrown the current site. A new facility will enable CRRL staff to conduct and perform state of the art research, and properly mitigate health and safety concerns at the current facility. New facilities will allow collaboration with regional scientist and serve the needs of the Department of Interior, and other government agencies in the region. In FY 2005, the WFRC

will contract with GSA to perform a Feasibility Study to further develop the program, survey potential sites, and develop a more detailed estimate of cost.

The Klamath Falls Field Station (KFFS) relocated into new GSA lease space in May 2005. The new space doubles the office space and expands the warehouse storage space. This increase in space will accommodate the recent growth in their research program and allow for future growth. KKFS expects to grow to 35-40 personnel in FY 2005. Although the GSA lease provides for much of the tenant improvements, in the future there may be a need to modify the space to meet mission requirements. Future expansion is possible in Southtowne Business Park and could be negotiated with GSA. Coordination at the WFRC level will be provided by the Facilities organization.

Long-term goals

As in the past, Facilities will continue to provide quality products and services in a timely manner. Procedures will be streamlined and routine maintenance performed consistently to prevent disruption of ongoing science. WFRC Facility funds will be actively managed and projects completed on time and within budget. The Facilities infrastructure improvements will be completed behind the scenes and appear seamless to the end user. Safety policy, implementation, training, record keeping are to be tailored to meet the specific individual project needs. Facility deficiencies are to be identified and prioritized based upon mission need and resources available.

- ***Strategic Actions.*** In order to meet the increasing need for Facility support there will need to be a change in the current workforce profile. The WFRC needs a flexible Facility organization that is knowledgeable of its unique science facility requirements. Additional human and fiscal resources will be required to adequately deal with HQ and Regional mandates and administrative overheads.

- ***Evaluations.*** The USGS conducts both internal and external reviews by USGS and non-USGS Facility specialist to evaluate our Facility organization activities. The USGS-WFRC goal is to seek an independent external review of ongoing facility program about every five years, combined with annual internal management reviews. The evaluations will be used to: improve the accountability and quality of the facility programs; identify and address gaps in the facility program; redirect or reaffirm facility program directions; identify and provide guidance for development of new programs; and reward and/or motivate managers and facility staff.

FUNDAMENTAL SCIENCE PRACTICES

A strong commitment to the use of peer and policy review to assure that science quality is expressed in policies of OMB, DOI and USGS. The new Center policy (see Standard Operating Procedure - Peer and Policy Review of Science Products/Project Management, 2005) implements review practices, in accordance with these policies, at the science center level. Under this policy all research is to be reviewed at the proposal stage, as interim reports are produced, and upon

completion of the final manuscript, report, or finalization of other science products. Both within the scientific community, and to the public at large, peer and policy reviews set an unambiguous standard of USGS scientific credibility. Our Center philosophy is that peer and policy reviews are fundamental science practices that improve the quality and relevance of scientific research. The independence and rigor of science quality reviews constitute a critical aspect of project management and accountability at the WFRC.

Purpose

A strong commitment to the use of peer and policy review to assure that science quality is expressed in policies of the Department of the Interior, U.S. Geological Survey, and its disciplines. This policy implements review practices, in accordance with these policies, at the science center level. Under this policy all research is to be reviewed at the proposal stage, as interim reports are produced, and upon completion of the final manuscript, report, or finalization of other science products. Both within the scientific community, and to the public at large, peer and policy reviews set an unambiguous standard of USGS scientific credibility. Our Center philosophy is that peer and policy reviews are fundamental science practices that improve the quality and relevance of scientific research. The independence and rigor of science quality reviews constitute a critical aspect of project management and accountability at the WFRC.

Elements of peer and policy review

The reputation of the USGS science for excellence and objectivity is our most important asset. It brings authority to our data and findings; it creates long-term credibility; it attracts the best scientific minds as researchers and collaborators; it strengthens our organization with a shared ideal. Protecting and enhancing this asset requires clearly articulated, bureau-wide fundamental science practices; a shared understanding at all levels of the organization that the health and future of the USGS depends on following these practices; and the investment of budget, time, and people to ensure that both the reputation and the quality are maintained.

The key operational components of WFRC's peer review policies are outlined below. These issues are fully developed and integrated into the Center policies and procedures described herein. They are intended to be rigorous in application to all aspects of (1) planning and conducting data collection and research; and (2) review, approval, and release of WFRC information products. The WFRC policies are consistent with bureau-wide practices; thus, approval of our products reflects "bureau approval", and thus they shall carry no disclaimer that suggests they do not meet USGS standards of scientific excellence and objectivity.

Peer review of science proposals and products:

- A Center-level guiding document must exist to implement peer review policy for proposals and science products.
- All study plans and proposals must be peer reviewed.
- All science products must be internally and externally peer reviewed prior to their release from the WFRC.
- The Center Director is the responsible party.

- External peer review of study plans for reimbursable agreements must meet the minimum WFRC peer review requirements.
- Elements of internal peer review:

Element	Study Plans & Proposals	Agency Products	Journal Products
The review is coordinated/conducted independently from authors/investigators.	X	X	X
Comments are compiled and transmitted to the authors.	X	X	X
Proposals are in standard format that facilitates review and BASIS+ entry. (Appendix A).[2]	X		
A proposal's budget must be reviewed by the AO or her/his designee	X		
At least 6 reviewers are designated. The Peer Review Coordinator will select 3 of the reviewers, one of whom must be from outside BRD to complete the proposal or product peer review. In no case may all reviewers be from the same organizational entity.	X	X	X
Center Director approval and BASIS+ entry required for proposed project to begin.	X		
Standard review format for reviewers.	X	X	X
Revision by authors to account for reviewer comments.	X	X	X
Center Director approval required for product release.	X	X	X
Steps must be documented and files preserved according to USGS records policy.	X	X	X
BASIS+ Entry must be completed.	X	X	X

Policy review:

- Policy review is required for all products disseminated by USGS regardless of media, including oral presentations, administrative reports, and web content.
- Products are reviewed for issues and wording potentially in conflict with USGS, Departmental, and Administration policy.
- Review takes place above the level of the author, but authors should identify policy concerns.
- The USGS delegated approving official is within the Office of the Regional Executive (REX). This office will manage a review and certification process that requires documentation that all science products receive policy reviews at the Center level.
- Policy-sensitive issues will be resolved before products are released for dissemination.
- Documentation is required, including resolution of any policy issues and Office of the Regional Executive approval signature, for any released products.

[2] Exceptions to WFRC standard format requirements relate to proposals associated with reimbursable funded agreements that often have their own formatting requirements including forms that may need to be completed.

Policy review is concerned with integrity, objectivity, impartiality, and adherence to publication standards. WFRC science products are policy neutral but policy relevant. Oral presentations and administrative reports are considered separately but each still must obtain a policy review before release, even if limited in the case of the former. Internal newsletters are required to meet the same standards as other publications but like oral presentations, their approval occurs at the Center level.

Ultimately, the concern of policy review is that release of information should not cause conflict with USGS, Departmental, or Administration policy. This requires, therefore, that persons conducting reviews be cognizant of issues and concerns at this level of detail. It is USGS policy to identify and resolve issues of a potentially sensitive nature during review of publications, abstracts, and oral presentations. Policy-sensitive issues are defined as "those that have implications on current policy or involve matters of national interest, security, or potential commercial gain." The Klamath and Columbia River basins reflect areas within the WFRC geographic scope where fisheries and aquatic ecology issues could be politically charged.

The BASIS+ task as the fundamental unit of science

The basic unit of science at the WFRC will be the Task as currently documented in the BASIS+ Project substructure. The BASIS+ Task is a distinct area of inquiry with objectives that can be achieved in one to five years, carried out under the direction of a Principal Investigator, and involving one to several collaborators and/or support staff. The Task will be the fundamental unit of science recognized for review, funding, administrative, and reporting purposes throughout the Center and the USGS. The Task is the level at which the work of all Centers is annually planned and made available to the world in BASIS+. Some base-funded science at the WFRC, such as pilot-scale studies, short-term experiments, or emergency response carried out for partner agencies will be grouped in a single Task entitled "Technical Assistance and Support." A Subtask is defined as a specific study being conducted under a Task. For example: Under the Task entitled "Parasitology" there could be a Subtask entitled "Whirling disease in rainbow trout." The peer review policy is consistent for Tasks and Subtasks. The reputation of the USGS science for excellence and objectivity is our most important asset. It brings authority to our data and findings; it creates long-term credibility; it attracts the best scientific minds as researchers and collaborators; it strengthens our organization with a shared ideal. Protecting and enhancing this asset requires clearly articulated, bureau-wide fundamental science practices; a shared understanding at all levels of the organization that the health and future of the USGS depends on following these practices; and the investment of budget, time, and people to ensure that both the reputation and the quality are maintained.

The key operational components of WFRC's peer review policies are outlined below. These issues are fully developed and integrated into the Center policies and procedures described herein. They are intended to be rigorous in application to all aspects of (1) planning and conducting data collection and research; and (2) review, approval, and release of WFRC information products. The WFRC policies are consistent with bureau-wide practices; thus, approval of our products

reflects “bureau approval”, and thus they shall carry no disclaimer that suggests they do not meet USGS standards of scientific excellence and objectivity.

KEY CHALLENGES

Moving the Center’s science agenda forward in the directions described will require building Bureau support and approval at all levels of the organization. The science directions described are purposefully broad in order to maintain maximum flexibility in our ability to address Center missions in a “Less for Less” USGS environment. Program and budget development will require our selection of 2 or 3 of the most prospective growth areas for management attention. Initial possibilities include aquatic invasive species, Integrated Fish Health in the Klamath Basin, and Water Availability for Ecosystems. Bureau approval for initiatives or Congressional add-ons for these initiatives will require close coordination with Western Region REX for Water and Biology and appropriate Headquarters staff. Significant work in each area has begun.

A “Less for Less” USGS environment provides an unfortunate, but realistic, planning stage for this 5-year horizon. Other factors that influence our planning and expectations for this period include the likelihood that:

- The WFRC will continue to rely heavily on reimbursable funds;
- Federal FTE ceilings will continue to be restrictive and, with outsourcing requirements, there will be an increasing reliance on contract employees;
- USGS and OFAs will continue to face uncertain budgetary futures and this will impact funding stability at the Center;
- Current facilities may limit growth and funding opportunities;
- Rescissions to the USGS appropriation are likely; and
- USGS reorganization may change the organizational composition of the WFRC.

Unlike the situation in 1997, WFRC science is focused almost exclusively of fisheries and aquatic ecosystems in the West. Key challenges remain though, and can be expected to affect the Center ability to address this plan’s strategic goals and directions:

- ***Level and declining base budgets***. These will influence the Center’s ability to address USGS and WFRC missions in the West. A “Less for Less” environment and potential for permanent rescissions in the federal government, will make “management by attrition” the norm, further restricting our disciplinary, geographic, and taxonomic coverage.

- ***Financial health metrics***. The WFRC is approaching a 30% base: 70% reimbursable funding model. The Center is a model for reimbursable funding and flexible workforce. The sustainability of the model, administrative workload it produces, and effects on professional staff development and morale, pose significant issues. Financial health metrics must be developed, monitored, and reported to all cognizant authorities.

- ***Partnerships***. USGS ecological research in Puget Sound will require a strengthened relationship with NOAA Fisheries and expansion in study area boundaries to include the nearshore marine. In this way, WFRC process studies will be more relevant to the life

histories and interactions of key species and the management needs of the Region. This will take an increased commitment on the part of the Center and Region to become a fuller participant in the ecosystem planning underway by NOAA.

- ***USGS fund redirections***. Workforce and strategic planning have identified critical scientific, IT, and administrative positions needed at the WFRC. The ability to fill key positions is unlikely when budget decisions are being mandated without consideration of scientific impacts, science priorities, and requirements for administrative oversight. The WFRC faces a $250,000 redirection of base funds to the Klamath Basin in FY 07 in addition to that imposed on the Bureau in FY 05.

- ***Rescissions and uncontrollables***. Management flexibility at the Center level is further reduced by annual reductions in base and shortfalls in its Uncontrollables allocation.

- ***DOI cost share***. The current cost share requirement is arguably a detriment to USGS's stated goals of being the science agency for DOI bureaus. The cost share requirement does not reward organizations that competitively seek and obtain reimbursable work. The requirement is especially restrictive to the smaller (base funded) BRD cost-centers in the West where most public lands are located.

- ***Facility needs***. A new science facility is needed in the Columbia River Gorge and improvements are needed at Marrowstone Island. In the first instance, safety and health issues, as well as capability-imposed and crowding limitations, are products of working in the existing structure. In the second instance, improvements at the Marrowstone Marine Field Station are needed to build the experimental capacity needed to conduct intermediate scale ballast water experiments and handle associated effluents. A research vessel will also be needed to cost-effectively conduct the seasonal process studies that must be undertaken by the USGS in Puget Sound. Funding limitations can be expected to impact any planning and decision-making regarding these requirements.

- ***Elevating fisheries, aquatic resources, and aquatic ecosystem research priorities DOI for the West***. The reimbursable funding history of the WFRC with OFAs provides ample demonstration of the relevance of the Center's research to resource managers and regulators in the West. Historically, the FWS issues have revolved around surveys, hatcheries and genetic issues, and habitat characterizations. More recently the organization has developed in-house capabilities to address such concerns. Ecosystem-level and process studies are more appropriate for USGS interdisciplinary science and DOI support.

- ***Center mission creep***. Other BRD cost-centers in the West are beginning to fund fishery scientist positions and undertake aquatic resource and ecology projects on DOI trust species (e.g., bull trout). Since this disciplinary research area has traditionally belonged to the WFRC, other Centers should at least consult the WFRC to seek its interest (e.g., right of first refusal) prior to seeking other means of having the work performed.

WFRC PARTNERSHIPS

For more than five decades the Western Fisheries Research Center (WFRC) has worked with partners to provide research findings to managers of aquatic resources. Those partners form an extended family, a network of clients, colleagues, co-investigators, and customers. Our partners include numerous clients in other Department of Interior agencies such as the U.S. Fish and Wildlife Service, the U.S. Bureau of Reclamation, and the National Park Service. But there is much more--we have partners in other federal agencies, state agencies, and universities. The extended family includes tribal governments, and non-government organizations such as the Nature Conservancy and the Lower Columbia River Estuary Program.

Contributing to partnerships

The WFRC brings to its many partnerships expertise, research capabilities, and an unbiased approach to conducting and reporting results. Of course, some of our partners are our customers and provide funding that enables WFRC scientists to conduct studies. However, most resource managers also bring insight and relevance to problems with endangered or invasive species not always apparent to scientists. And of course, partners bring natural resource problems and questions that challenge the research scientists.

How partners benefit the resource

Our partners use the results of science to benefit the resource. For example, the WFRC has a long history of developing new diagnostic tests for fish diseases. Our partners in the U.S. Fish and Wildlife Service use these tests to diagnose fish diseases at National Fish Hatcheries to minimize disease in hatchery-raised fish released to the wild. Our partners at the Bureau of Reclamation in the Klamath Basin of Oregon use the results of studies by WFRC scientists to understand the impacts of water management and poor environmental conditions on two endangered sucker species in Upper Klamath Lake and its tributaries.

For a full list of our Partners see Appendix 7.

APPENDIX 1. WFRC CORE COMPETENCIES

CORE COMPETENCY: FISH HEALTH

The WFRC was founded as a fish disease research institution. The Fish Health program has continually grown and improved since the 1930s, with completion of a new $10 million dollar research laboratory in Seattle in 1994. Disease is a significant aspect of both hatchery and wild fisheries management, and is a major concern of partner bureaus (FWS; BOR), states and tribes, and private sector aquaculture. As management of wild populations becomes more and more intensive (e.g. barge transport of out-migrating salmon on the Columbia River; captive rearing of ESA listed salmon stocks) fish health research will remain critically important. Molecular immunology and disease ecology in wild fish populations represent current strategic growth areas. Research on hatchery-reared salmon and trout will be increasingly reduced to reflect changing priorities and roles in technical assistance.

Fields of expertise:

- ***Infectious diseases***. Focus will be on the detection and control of viral, bacterial, and parasitic diseases of salmon and trout. Viral research programs exist for infectious hematopoietic necrosis (IHN) and viral hemorrhagic septicemia (VHS), each of which has major implications for conservation and aquaculture of salmonids. Other work will address bacterial kidney disease (BKD) in salmonids, and epizootics (e.g. endangered suckers and salmon in the Klamath Basin). Disease in non-salmonid fish and other aquatic species will be undertaken as conservation issues arise (e.g., forage fish in Puget Sound).

- ***Physiology of disease***. The physiology of disease at the molecular, cellular, and tissue levels will strengthen studies of disease etiology and development of diagnostic tools. These studies complement additional physiological studies conceived from a population and ecosystem perspective.

- ***Stress***. Environmental stress often precedes disease, both in the wild and in cultural systems. Stress from contaminants (e.g. oil spills), fish passage (e.g. descaling and nitrogen supersaturation), hypoxia, or thermal impacts will be linked to vulnerability to disease and predators in such highly impacted systems as the Columbia River, Klamath Basin, Hood Canal, and San Francisco Bay/Delta. Stress in aquatic organisms can be used to develop environmental indicators, for example through measurement of stress proteins, and often is critical in the management of ESA listed species.

Scientific resources

The WFRC is fortunate in having fish health laboratory facilities that are among the newest and best in the nation. A state-of-the-art fresh water wet lab and animal room (zebrafish colony) are located at the Seattle Laboratory, completely climate controlled and automated for disease challenges and studies in physiology and pathology. The nation's only biosafety level III disease containment laboratory for fish is also part of this facility. A second fresh water wet lab is

maintained at the CRRL, and the BRD's only marine wet lab-at Marrowstone Island in Puget Sound-is equipped for research on marine species and marine stage anadromous fish. In addition, the Center cooperates with numerous federal, state, and tribal hatcheries for health and disease studies in intensive cultural settings. The Center maintains fully equipped laboratories for each of the following disciplines:

Molecular Biology

- Genetics of both fish and fish pathogens
- Polymerase chain reaction (PCR) amplification
- Genetic probes and markers
- Development of genetic and subunit vaccines
- Recombinant DNA technology
- RNase protection technology
- Cloning and sequencing technologies

Virology

- Pathogen detection and isolation
- Monoclonal antibody technology
- Differentiation of isolates and strains with molecular techniques
- Live challenge capability, including biosafety level III containment
- Infection control technology development for hatcheries, aquaculture, and wild populations
- Landscape/ecosystem scale pathogen strain differentiation and management
- Fish and mammal cell lines

Bacteriology

- Isolation, culture and identification methodologies
- Waterborne laboratory challenge systems, including containment
- Broodstock segregation methods development
- Epizootic investigation capability
- Dietary, immunological and disinfection control procedure development for hatcheries and aquaculture

Immunology

- Serology
- Mono- and polyclonal antibody technology
- Antibody screening
- Antigen screening
- Immunological diagnostic test development capability
- Assays for humoral and cellular immune response

Histopathology

- Tissue storage, sectioning and preparation
- Light microscopy

- Electron microscopy (University of Washington collaboration)
- State-of-the art histological photography
- Interpretation expertise

Stress Biochemistry

- Effects of elevated stress on immune response/disease resistance
- Wet lab stress trials (e.g. physiological response to gas supersaturation)
- Wet lab nutrition trials (e.g. immunomodulators as dietary supplement)
- Wet lab respiration/swimming chambers
- RIA, ELISA and radioligand receptor assays to measure hormone levels
- Developmental biochemistry (e.g. immune/endocrine interactions during maturation)
- Non-lethal physiological assessment

Purposes and collaborations

Fish health investigations are initiated by partner agency information needs (FWS; states; tribes; BPA; COA and others). Issues include disease outbreaks at hatcheries, infections in wild fish (particularly if ESA species are involved) and stress to fish in ecosystems highly impacted by humans (e.g., bull trout). Epizootiological and physiological projects-besides advancing these scientific disciplines in general provide specific recommendations to conservation agencies for addressing problems affecting wild stocks. Partner collaboration leads to development of specific responsive projects, often followed by development of a technology such as a diagnostic test. The WFRC often serves a research and development role, developing a new methodology and placing it in the partner agency through technology transfer with center-supplied training to partner personnel. The FWS is the Center's most important partner for development of new molecular tools and the training of fishery managers in their applications. Methods developed by the Center are in widespread use by the fisheries community. The Fish Health Section has an excellent international reputation, and international collaborations are frequent.

CORE COMPETENCY: FISH ECOLOGY

Originally driven mainly by issues tied to declining salmon, the Center's ecological capability began with studies in fish population dynamics. Work has since expanded into population genetics, as genetic diversity issues and hatchery supplementation impacts were recognized as critical issues. The definition and management of critically declining or listed populations-now including steelhead and bull trout-will require ongoing ecological studies at the Center's Seattle and Columbia River facilities. Research on fish passage in highly altered river systems will be critical-knowledge will be needed concerning behavioral ecology (predator/prey interactions; competition; habitat selection) and physiological ecology (dissolved gas impacts; developmental physiology of smolts). Native fishes of the arid interior West are particularly vulnerable to extinction; many are endemic species in isolated spring systems with very restricted distribution, and are members of naturally small fish communities. Water diversions, human alteration of severely restricted habitat, and invasion of non-indigenous fishes have placed many of these species at risk. Strategic growth areas include increasing emphasis on Pacific Northwest estuaries, large rivers, work in smaller watershed tributaries, evaluation of restoration, and aquatic invasive species.

Fields of expertise

- ***Population ecology of cold waters species***. Work will address life history strategies and migration/movements in large Western river and tributary systems such as the Columbia, Klamath, and Sacramento/San Joaquin; estuaries such as Puget Sound, and the Columbia River estuary, and smaller watersheds like the White Salmon and Wind Rivers. Age structures and recruitment/mortality are key data required for Population Viability Analyses (PVA) under the ESA. A critical, but not yet understood aspect of salmon population dynamics occurs in juvenile rearing habitats such as estuaries. Other work will address fresh water habitat alteration and effects of harvest on population size and structure.

- ***Population genetics***. Genetic effects of fish translocation and hatchery supplementation on wild population structure will be critical elements of WFRC research and, increasingly technical assistance. Other studies will address genetic isolation resulting from river impoundment, and the genetic implications of threatened and endangered species management actions. The WFRC also has substantial capability to develop genetic conservation tools in high demand by fishery managers, for example non-lethal genetic markers for run or gender identification and assessment of genetic diversity (e.g., charr of the Northeast Pacific). Population genetics combines the laboratory disciplines of molecular and microbiology with field studies and ecological expertise.

- ***Behavioral ecology***. Many fish conservation issues have a behavioral basis. For example, introduced exotic predators such as the smallmouth bass and native predators such as northern squawfish, thrive in reservoirs on the Columbia River and prey on juvenile salmon artificially concentrated by dams. Habitats have been severely altered in general, and behaviors such as migrations, spawning, and intraspecific competition often must be understood by managers for conservation actions to have a hope of success. Studies will also address the behavior-mediated effects of decades of inter-basin fish transport, genetic alterations, and community composition. Hatchery/wild behavioral issues are extremely controversial, and objective information is required to support the improved use of hatcheries for conservation of declining wild stocks. Integrated science in Klamath Basin is addressing water quality effects on the distribution and movement behavior of endangered suckers in Upper Klamath Lake.

- ***Physiological ecology***. Center research, primarily at the CRRL, will link physiological processes to practical ecological issues and fishery management strategies in Columbia River and Klamath River basins. Developmental physiology in young salmonids ("smoltification") can have a defining influence on ecological and population processes such as migration, mortality due to predation, and susceptibility to disease. High dissolved gasses (100 to 130 percent saturation) caused by reservoir spill can be a major source of trauma for ESA listed wild stocks and in-stream aquaculture operations. Both endocrine and immune systems in fish are affected by water temperature (elevated in impoundments), diet, contaminants, and other environmental stress, also affecting populations and their management.

- ***Desert fish conservation ecology***. The Center's Reno Field Station is located within 500 miles of about half of all ESA listed fish species in the Nation, many of which are endemic populations in small, isolated spring systems. Research will address population declines caused by introduced exotic fish and other aquatic species, habitat alterations, and water diversions. PVA is being used to assess the most critical potential threats to species such as endangered cui-ui in Pyramid Lake, Nevada. Scientists at Dixon Duty Station are investigating the effects of environmental influences on desert pupfish in the Salton Sea.

Research resources

Tools available for studies in fish ecology include a combination of laboratory assets for specialized genetic, behavioral and physiological studies, and field capability such as boats, electroshocking gear, fish traps and marking technology. The CRRL is a national leader in the research, development, and use of fish geospatial and radio telemetry techniques for fish movement studies. This expertise is being transferred to field research in Klamath Basin, Independence Lake, and Puget Sound.

Geospatial Technology

- Geographic information systems
- Geographic positioning systems
- Hydroacoustics
- Radiotelemetry
- Depth radiotelemetry (e.g. for vertical distribution in response to gas supersaturation)

Instream Technology

- Approximately 40 research vessels
- Dive team
- Flow, temperature, and gas supersaturation measurements
- Hand-held and boat deployed electroshocking including large river capability
- Smolt tagging/marking
- Doppler current measurement
- Cooperative use of stream weirs in Northwest and Alaska for experimental returns
- Paired watershed designs for hatchery influence on behavior
- Aquatic invertebrate sampling
- Replicate enclosures for in situ testing of effects of non-natives on indigenous species
- Non-lethal capture/identification methods

Laboratory Capability

- Fresh and seawater wet labs
- Six replicate 12 x 1.2m constant flow artificial streams which can be equipped with natural substrate (e.g. predation, behavior, and competition studies)
- Complete genetics laboratory (e.g. for genetic markers development for run and gender discrimination)
- Stamina chamber testing capability (e.g. predator/prey studies)

- Otolith technology for growth, nutrition, and habitat use experiment
- Behavioral observations for hatchery domesticating selection (tank trials; videography)
- Hatchery partnerships for domestication investigations; sources of particular fish stocks
- Molecular biology and genetic application for developing rapid identification technologies for organisms transported in ballast water

Modeling

- Bioenergetics of fish growth
- Population viability analyses
- Modeling predation processes in large rivers
- Fish passage and survival at dams
- Mark-recapture technology
- Flow/habitat evaluations

Purposes and collaborations

Ecological research is a primary requirement of bureaus charged with restoring declining or ESA listed fish populations. All large western rivers draining to the Pacific (such as the Columbia, Klamath, Sacramento) have substantial unmet ecological research needs for salmonids. The BPA, BOR and COE, as the operators of diversion and power projects on the Columbia River, have a direct responsibility to mitigate such physiological impacts as gas bubble trauma and immunosupression, as they affect fish passage, transport, and instream population dynamics. Columbia River studies by the CRRL are closely coordinated with NOAA and FWS, and tribal authorities, the lead agencies for ESA issues. Throughout the Northwest, controversial issues surrounding the role of hatcheries in conservation and their effects on wild salmon genetics, make genetic investigations critical to hatchery operators (FWS, states, and tribes). In the interior west, where federal water projects affect endangered fishes (i.e. Truckee River/Pyramid Lake, the Klamath Basin, and at various National Wildlife Refuges) information generated by the Reno Field Station will continue to support species and habitat restoration actions for such species as Moapa dace, desert pupfish, lahontan cutthroat, and cui-ui. Overall the Center's ecological research is directly useful to partners in recovery plan development for a variety of species, hatchery management, fish passage, and in the development of biological opinions and population assessments.

CORE COMPETENCY: AQUATIC ECOSYSTEMS

Research to develop aquatic ecosystem understanding is a long-term goal of all WFRC research. To truly understand the factors affecting the health of fish and fish populations, entire ecosystems-sometimes including riparian and upland systems-must be better understood. Furthermore, the ecosystems themselves are highly valued by society and will be increasingly emphasized by the "adaptive management" approach to conservation at the watershed/landscape scale. The WFRC will emphasize the understanding of ecological processes and the development of predictive tools for aquatic systems, including river basins, riparian areas, wetlands, and estuaries. The Puget Sound nearshore, Upper Klamath Lake, and the mainstem Columbia River are current areas of research interest and potential growth. This will include participation in multi agency whole-ecosystem programs, and studies of process that involve

multiple components of an ecosystem (e.g. aquatic contaminants, including endocrine disrupters).

- ***Riverine ecology***. Most research projects on rivers such as the Columbia have in the past been narrowly defined by particular resource management needs such as fish passage. In the future, management agencies will seek multidisciplinary information on fish, wildlife, and habitats such as riparian areas. Future approaches will include "river normalization" in the Columbia Basin; system-wide management of ESA listed suckers, salmon, and steelhead in Oregon's Klamath basin, and integrated multi-agency management, monitoring, and research efforts to protect fish and aquatic resources in the San Francisco Bay/Delta. Substantial needs also exist in systems not traditionally served by the WFRC, such as the Lower Colorado, and inter-center collaborations are possible.

- ***Estuarine ecology***. Estuaries are critical juvenile rearing habitats for salmon, but are also foci for human development and subject to disproportionately high habitat impacts and pollution. Estuaries are under-researched, and will receive increasing emphasis by agencies driven by the ESA process (NMFS, BOR). WFRC will offer a critical research capability to these agencies, for example in use of estuarine habitats by out-migrating salmonids in the Skagit River Delta and Elwha River nearshore for feeding and staging through the analysis of otoliths.

- ***Contaminants.*** Environmental contaminants such as trace elements (including heavy metals), pesticides, petroleum and related petrochemical compounds pose a substantial threat to some aquatic ecosystems. Fish are vulnerable in rivers and lakes draining watersheds that support irrigated agriculture, mining, fossil fuel power generation, large municipal/industrial complexes, and other concentrated sources of anthropogenic activities. Managers require contaminant surveys and biomonitoring to detect the occurrence and bioaccumulation of suspected contaminants. Also needed are studies in aquatic ecotoxicology to detect and quantify fate and effects in the environment. Endocrine disrupters are a particularly significant issue requiring basic research now being undertaken by the WFRC. Contaminants in rockfish of the Pacific Coast and in desert fishes of the Salton Sea reflect new project areas.

- ***Aquatic invasive species***. The WFRC and its collaborators are addressing management and regulatory agency needs for preventing marine invasions in Puget Sound. Center scientists and university cooperators are addressing prevention and detection and control objectives. Increased effort is needed in the Columbia River and estuary and in the coastal Pacific Northwest. GIS mapping and predictive tools are needed for risk assessments and greater emphasis on understanding invasion processes that promote the establishment and spread of invasive species is expected. U.S. Coast Guard, EPA, Navy, FWS, NOAA, Northeast-Midwest Institute, and state officials need the information to understand ecosystem effects and to develop cost-effective and economical discharge standards.

Research resources

The resources available at the Center for ecosystem studies are substantially the same as those employed for fish ecology, described above. For contaminant studies, the Center's wet labs provide substantial capability for aquatic ecotoxicology experiments, including those involving endocrine disrupters. The Center maintains a complete self-contained portable 10 by 52 foot laboratory equipped for contaminants studies, which can be deployed at appropriate field sites for on-site toxicity testing.

Purposes and collaborations

The trend toward adaptive management of entire ecosystems will require research on how ecosystem dynamics affect critical living aquatic resources. Large river systems are now in need of such studies to support research needs expressed by BOR, COE, and BPA. In terms of large ecosystems with multiple collaborations, WFRC will emphasize the Columbia, Klamath, and Sacramento-Bay/Delta systems (e.g. CALFED, USGS Priority Ecosystem Studies). Management of salmon, lamprey, delta smelt, and sturgeon, by these entities and by NOAA will also require increased research in estuaries, where smolts first begin their marine life stage. Other aquatic ecosystems, such as the Salton Sea, will require coordinated investigations involving FWS and multiple BRD science centers and local/regional entities (e.g., Imperial Irrigation District). Multiple collaborators and partners are also involved in WFRC contaminants projects, such as FWS, BOR, NMFS, and the Water Resources Division of USGS. The California Department of Fish and Game and various regional Water Quality Control Boards have been involved in California contaminants issues, such as in the San Joaquin River system and Salton Sea, where large-scale fish and wildlife die-offs have indicated deteriorating ecosystem health.

APPENDIX 2. PROGRAM STRATEGIC DIRECTIONS

Goals: Fisheries: Aquatic and Endangered Resources (FAER) *Fiscal Years 2005-2009*

1: Diversity, life history and species interactions of aquatic organisms. Provide scientific information about the ***diversity, life history and species interactions*** that affect the condition and dynamics of aquatic communities.

2: Aquatic Organism Health. Provide scientific information about factors and processes that affect ***aquatic organism health*** in support of survival, protection, conservation, and recovery.

3: Aquatic species and habitat interactions. Quantify and describe functional relationships among ***aquatic species and habitats*** to provide information to conserve or restore aquatic community structure and function.

4: Aquatic species at risk. Provide science support for natural resource managers by investigating the factors that contribute to the conservation and recovery of ***aquatic species at risk***.

5. Restoration science for aquatic species and aquatic habitats. Develop research and technology tools to provide the scientific basis for developing adaptive management strategies and evaluating their effectiveness for ***restoration*** efforts to sustain aquatic resources.

6. Research support and technical assistance to aquatic resource managers. Provide ***research support and technical assistance*** to DOI bureaus, other federal and state government agencies, tribes, and non-governmental organizations to support natural resource management problem solving and decision-making.

Goals: Invasive Species Program *Fiscal* Years 2005 -2009

1. ***Prevention***. Conduct research and develop methods and technologies to prevent the introduction of invasive species.

2. ***Early detection and rapid assessment*** of new invaders. Identify and report new invasions and assess risks to natural areas and waters.

3. ***Monitoring and forecasting*** of established invaders. Assess changes in populations and distributions of established invaders.

4. Effects of invasive species. Determine ***effects of invasive species*** and susceptibility of habitats to invasion.

5. ***Control and management***. Provide approaches to contain, reduce, and eliminate populations of invasive species and ***restore habitats and native species***.

6. ***Information management***. Provide and coordinate the collection, synthesis, and accessibility of invasive species information.

Goals: Contaminants Program *Fiscal Years 2005 - 2010*

1. Toxicology and chemistry. Develop methods and generate information to **determine sources, fate, and effects** of environmental contaminants. ***Develop and standardize biomarkers, molecular biology methods*** and other analytical and toxicological assays.

2. Contaminated habitats. Develop the scientific basis for ***assessment, restoration and monitoring of habitats that are contaminated*** by mining, agriculture, urban wastewater, industry, and chemical control agents. Develop toxicological criteria to remediate or prevent contamination effects.

3. Integration of ecological stressors. Improve the scientific basis for ***evaluating the effects of multiple stressors*** at all levels of biological organization and at multiple temporal and spatial scales.

APPENDIX 3. WFRC STRATEGIC PLANNING TEAMS

1. Science Directions	**Team Leader**	**Team Members**
A. Disease Ecology	Jim Winton (Seattle)	Alec Maule (CRRL) John Hansen (Seattle) Dianne Elliot (Seattle) Paul Hershberger (MMFS) Mike Saiki (Dixon)
B. Watershed Ecology	Jim Petersen (CRRL)	Jeff Duda (Seattle) Noah Adams (CRRL) Scott Vanderkooi (Klamath) Barbara Martin (Dixon) Gary Scoppettone (Reno)
C. Coastal & Marine Ecology	Reg Reisenbichler (Seattle)	Paul Hersberger (MMFS) Gael Kurath (Seattle) Dennis Rondorf (CRRL) Theresa Liedtke (CRRL) Russ Perry (CRRL)
D. Threatened & Endangered Species	Gary Scoppettone (Reno)	Rip Shively (Klamath) Carl Ostberg (Seattle) Matt Mesa (CRRL) John Emlen (Seattle) John Beeman (CRRL)
E. Aquatic Invasive Species	Mike Saiki (Dixon)	Rusty Rodriquez (Seattle) Tim Counihan (CRRL) Dianne Elliott (Seattle) Pete Rissler (Reno) Patrick Connolly (CRRL)
2. Communicating Science	**Team Leader**	**Team Members**
Enterprise Systems	David Woodson (Seattle)	Jim Hatten (CRRL) Nancy Elder (Seattle) Mike Parsley (Seattle) Ken Tiffan (CRRL) Greta Blackwood (Klamath)
Center Website	Robin Salling & Jim Guyton (Seattle & CRRL)	David Woodson (Seattle) Debra Becker (Seattle
Information & Outreach	Debra Becker & Dena Gadomski (Seattle & CRRL)	Judith Maule (CRRL) Kim Larsen (Seattle) Charolotte Rasmussen (Seattle)

3. Administration	**Team Leader**	**Team Members**
Operations: A. Operational Practices B. Info Infrastructure C. Working Capital Fund People: A. Skills B.Reward System C. Flexibility D. Leadership	Liz Turpin (Seattle)	Michelle Beeman (CRRL) Judith Maule (CRRL) Debra Becker (Seattle) Tom Barr (Seattle) Mark Fabes (Reno)
4. Facilities	**Team Leader**	**Team Members**
Operations: A. Fac. Infrastructure B. New Facilities	Kyle Sato (Seattle)	Dennis Sitherwood (CRRL) Pat Graeber (Seattle) Georgia Fountain (Seattle) Jack Hotchkiss (CRRL) Joe Warren (CRRL)

APPENDIX 4. SAMPLE CALENDAR OF OUTREACH OPPORTUNITIES FOR THE WESTERN FISHERIES RESEARCH CENTER

Month	Title of Event	Laboratory or Field Station Participation
January		
February		
	AWSEM (Advocates for Women in Science, Engineering & Mathematics, Saturday Academy) educational activities at CRRL	Columbia River Research Laboratory (CRRL)
	Oregon Chapter, American Fisheries Society Annual Meeting	CRRL
	University of Washington, Fisheries Career Fair	Seattle Laboratory
March		
	High School Career Days (dates vary)	CRRL
April		
	Children's Clean Water Festival (exhibit on site in Portland)	CRRL
May		
	Salmon Education Event - Yakima River (sponsored by Benton Conservation District)	CRRL
	Sturgeon Festival - Water Resources Education Center, Vancouver	CRRL
June		
	Carson NFH Open House	CRRL
	Edmonds Waterfront Festival	Seattle Laboratory
	Explorando el Columbia Slough	CRRL
July		
	Low Tide Fest, Marine Science Center Fort Worden State Park	Seattle Laboratory
August		
	Evergreen State Fair, Monroe	Seattle Laboratory
	2005 - CRRL Open House	CRRL
September		
	Career Fair - Columbia Gorge Community College	CRRL
	Carson NFH Fishing Day	CRRL
	Commencement Bay Maritime Fest, Tacoma	Seattle Laboratory
	Nisqually Watershed Festival	Seattle Laboratory
	Puyallup Fair	WFRC all
	Salmon Homecoming Celebration, Seattle Aquarium	Seattle Laboratory
	Spring Creek NFH Open House	CRRL
	Wenatchee River Salmon Festival, Leavenworth National Fish Hatchery	Seattle Laboratory

October		
	Issaquah Salmon Days Festival	Seattle Laboratory
	Vernonia Salmon Festival	Seattle Laboratory
November		
	Pacific Marine Expo	Seattle Laboratory
December		

Other potential outreach:

- Develop long-term relationships with science teachers at local high schools through sabbaticals, and summer shadow programs leading to local science projects (times vary).
- Develop and encourage field trips for High School science students (times vary).
- Participate in high school shadow programs (times vary).
- Develop and encourage grade school field trips (times vary).
- Continue to support outreach with Mill A School -- field trip to lab, dissections with students; also support other potential outreach to local schools (has varied with staff availability and leadership).
- Encourage the use of Interns (times vary).

USGS Conference and Trade Show Program: http://internal.usgs.gov/toolkits/exhibits/schedules.html

APPENDIX 5. GOALS TO DEVELOP AND IMPLEMENT AN ANNUAL PUBLICATIONS PLAN

Short-term:

- Factsheets
  - Create four new fact sheets each year.
- Briefing Book
  - Create a Center Briefing Book in FY2005.
- Power Point Presentations
  - Create a folder on the common drive for filing Center presentations and making them accessible to all Center employees.
  - Inform employees of folder and purpose.
- Displays
  - Purchase a pop-up display for the CRRL.
  - Update the current Center display to reflect the current research focus of the WFRC.
- Education Materials
  - Create a coloring book to be used for school field trips.
  - Purchase a salmon model to be used for outreach events.
  - Inform employees of availability.
- Visual Identity
  - Purchase visual identity clothing for, males and females in XXL, XL, L, M, S, and XS. To be kept in a visual identity lending closet for outreach events. (1 set for the Seattle Laboratory and 1 set for the CRRL.)
  - Inform employees of availability.

Long-term

- Power Point Presentations
  - Create a presentation about the WFRC targeting local grade school and high school students.
  - Inform employees of availability.
- Education Materials
  - Create materials as needed.
  - Create a resin block – developmental life stages from egg to parr or from egg to fry to be used for outreach events. 1 each:
    - Steelhead
    - Chinook
    - Sturgeon
  - Inform employees of availability.

On-going:

- Factsheets
  - Review existing fact sheets annually and update as needed.
- Power Point Presentations
  - Prepare presentations as needed for specific outreach opportunities.
- Posters

    - Review posters for consistency with USGS publication standards (visual identity, peer review).
    - Work with science staff to update posters annually or for specific events.
- Displays
    - Insure that displays reinforce messages per WFRC Outreach Plan.
- Education Materials
    - Evaluate materials and revise and update as needed.
    - Develop an outreach distribution method (e.g., school tours, teacher workshops, classroom visits, educational events).
    - Develop an outreach materials distribution list (e.g., schools, newspapers, congressional offices.)
- Website
    - Provide information appropriate for a variety of audiences.
        - Lay audiences
        - Students
        - Scientists
        - Partner agencies and organizations
        - Elected officials and their staff
    - Review website narratives annually to ensure that they accurately reflect WFRC research.

APPENDIX 6. TOOLBOX TO BE USED BY EMPLOYEES WHEN CREATING OUTREACH AND COMMUNICATIONS PRODUCTS

Toolkit	Subject	Description of Site	URL
Audiovisual Products	Interim Guidelines for Audiovisual Products	Interim guidelines for the following audiovisual products: 35mm, 16mm, 70mm, film, videotape, motion picture, CD-ROM, and laser disc.	http://internal.usgs.gov/OUTREACH/audiovisual.html
Communication Specifications	Specifications and Templates	Electronic Communication, Exhibits/Displays/Presentations, Print Communication (Fact Sheets, Map Jackets, News Release, Report Manuscripts, Scientific Reports), Visual Identity Store.	http://internal.usgs.gov/visual/specs.html
Conference and Trade Show Program Toolkit	Role and Goals, Upcoming Bureau Shows, Policy, Exhibit Systems, Digital Resources, Templates, How To	Description of the USGS Conference and Trade Show program. Conference and Trade Show program schedules and reports. Information on exhibit structures. Samples of exhibits with contact information. Word document templates can be used for bios, Web site handouts, contact sheets, etc. Exhibits "How To" documents.	http://internal.usgs.gov/toolkits/exhibits/
Congressional Toolkits	109th Congress, U.S. House of Representatives 109th Congress, U.S. Senate	Committee and subcommittee members and contacts.	http://internal.usgs.gov/toolkits/congressional/
	USGS Congressional Communications Handbook	This handbook can be used as a guide and handy reference when dealing with Congress. Describes different types of congressional interactions and provides strategies and tips.	http://internal.usgs.gov/toolkits/congressional/
	Legislation of Interest to the USGS	Includes appropriates and authorization legislation	http://internal.usgs.gov/toolkits/congressional/
	Written Correspondence with Members, Staff, or Committees	Responding to letters from Members; writing to Members	http://internal.usgs.gov/toolkits/congressional/
	Meeting with Members or Staff	Holding courtesy visits and briefings	http://internal.usgs.gov/toolkits/congressional/
Exhibits	Interim USGS Exhibits Policy	The provisions of this chapter apply to exhibits and displays, regardless of their source of funding that are produced by or attributed to any office of the U.S. Geological Survey in any and all of its field offices.	http://internal.usgs.gov/OUTREACH/exhibits.html

News Releases	Guidelines for News Releases	What is “News”?, Formatting and Distribution, Writing Tips, etc.	http://internal.usgs.gov/OUTREACH/news-rel_policy.html#guidelines
Toolkit	**Subject**	**Description of Site**	**URL**
PLW	People, Land and Water Guidelines	What is People, Land and Water?, How to submit PLW articles, etc.	http://internal.usgs.gov/OUTREACH/plw.html
USGS DM 471 Chapter 3	Audiovisual Media and Publications	The provisions of this chapter apply to exhibits and displays regardless of their source of funding, which are produced by or attributed to any bureau or office of the Department and/or its respective field activities.	http://elips.doi.gov/elips/release/3267.htm
USGS DM 500.5	News Releases	News Release and Media Relations Policy	http://www.usgs.gov/usgs-manual/500/500-5.html
Visual Identity	Visual Identity Website	The Visual Identity System provides design solutions for all USGS science, communication, and identification products. This web site provides basic guidance for use of the U.S. Geological Survey Visual Identity System.	http://internal.usgs.gov/visual
Weekly Highlights	Weekly Highlights Guidelines	What is the Weekly Highlights?, How do I submit a Highlight?, etc.	http://internal.usgs.gov/OUTREACH/highlights.html
WFRC Peer Review SOP	Peer Review Policy	All products must go through the peer review process before release to the public sector.	This policy will be distributed to all Center employees by June 2005.

APPENDIX 7. LIST OF WESTERN FISHERIES RESEARCH CENTER PARTNERS

Federal Agencies

Bonneville Power Administration
National Oceanic and Atmospheric Administration
National Park Service
National Science Foundation
Northwest Fisheries Science Center (NOAA-Fisheries)
U.S. Army Corps of Engineers
U.S. Bureau of Land Management
U.S. Bureau of Reclamation
U.S. Department of Agriculture
U.S. Department of Agriculture - Agricultural Research Services Division
U.S. Department of the Navy
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Forest Service

State Agencies

CALFED
California Department of Fish and Game
City of Seattle - Seattle Public Utility
Idaho Fish and Game
Oregon Department of Fish and Wildlife
Oregon Watershed Enhancement Board
State of California
State of Montana
State of Nevada
State of Oregon
State of Washington
Washington Department of Ecology
Washington Department of Fish and Wildlife
Washington Governor's Salmon Recovery Office
Washington Interagency Committee for Outdoor Recreation

International Partners

Discovery Bay Marine Laboratory, Jamaica
FAO, United Nationals
Fisheries and Oceans, Canada
FRS Marine Laboratory, Scotland
Great Lakes Fishery Trust, U.S./Canada/Tribal
Helix Biotechnology, Belgium
Hokkaido University, Japan
Instituoto de Fomento Pesquero, Chile

Institut National de la RecherchA Agronomique, France
Instotuto Pirenaico de Ecologia, Spain
Kochi University, Japan
Ministry of Agriculture and Fisheries, New Zealand
Ministry of Agriculture and Fisheries, United Kingdom
Miyazaki University, Japan
National University, Taiwan
Nikon University, Japan
State Serum Laboratory, Denmark
The Danish Veterinary Institute
The Scottish Fish Immunology Research Centre
Tiawan National University, Tiawan
Tokyo University of Fisheries, Japan
ubo Akademi University, Finland
University of Chile
University of Regina, Canada
University of Tasmania, Australia
University of Tromso, Norway
University of Waterloo, Canada

Private Sector

Battelle
Biomed, Inc.
Clear Springs Foods, Inc.
Coastal net pen aquaculture industry
Columbia Basin Fish and Wildlife Authority
Columbia River Fish Farms
Imperial Irrigation District
Lewis County Public Utility District
Lower Columbia Fish Enhancement Group
Lower Columbia River Estuary Partnership
Northwest Marine Technology
Northwest Power and Conservation Council
Pacific States Marine Fisheries Commission
Portland General Electric
SERDP (Strategic Environmental Research and Development Project
Tacoma Power
Underwood Conservation District
Wind River Watershed Council

Tribal

Columbia River Intertribal Fisheries Commission

- Confederated Tribes and Bands Yakama Nation
- Confederated Tribes of the Umatilla Indian Reservation
- The Confederated Tribes of the Warm Springs Indian Reservation

- Nez Perce Tribe

Colville Tribe
Klamath Tribes
Kootenai Tribe of Idaho
Northwest Indian Fisheries Commission

- The Lower Elwha Klallam Tribe

Skagit System Tribal Cooperative
Warm Springs Umatilla Tribes
Yakama Nez Perce

Colleges and Universities

Berry College
Coop Units
Humboldt State University
Kansas State University (Coop Unit)
Michigan State University
Oregon State University
Peninsula College
Texas Tech University
University of California/Davis
University of Idaho
University of Illinois
University of Miami
University of Washington
Virginia Institute of Marine Sciences (College of William & Mary)
Washington State University
Wayne State University

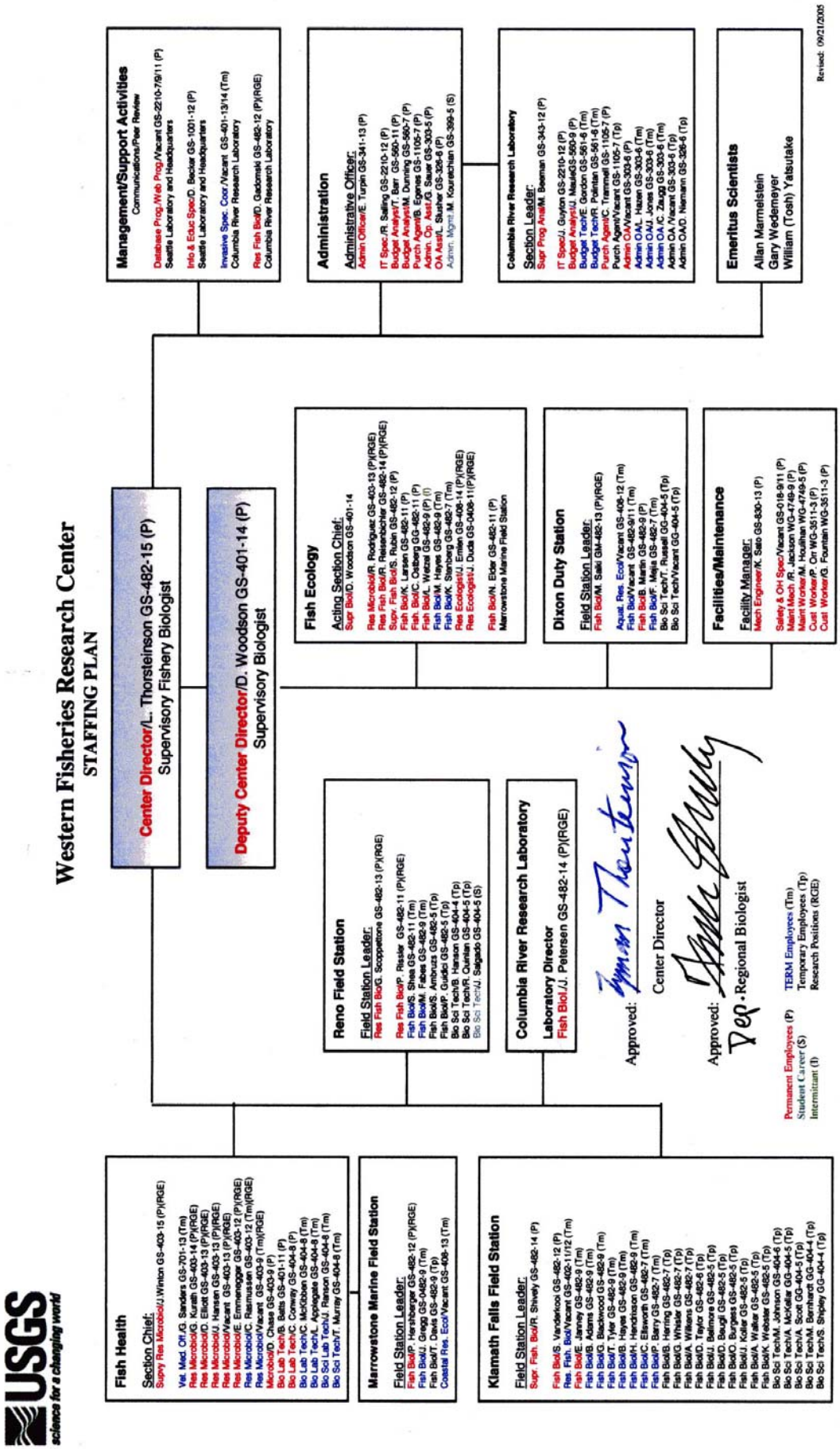

FIGURE 1. WESTERN FISHERIES RESEARCH CENTER STAFFING PLAN

USGS
science for a changing world

Western Fisheries Research Center
Columbia River Research Laboratory

Center Director/L. Thorsteinson GS-482-15 (P)
Supervisory Fishery Biologist

Laboratory Director/J. H. Petersen GS-482-14 (P)(RGE)
Supervisory Fishery Biologist

Facilities Support

Maint Worker/D. Sitherwood WG-4749-6 (P)
Bio Lab Tech/J. Warren GS-404-9 (P)

Passage and Survival

Section Leader:
Supvy Fish Biol./D. Rondorf GS-482-14 (P)(RGE)

Fish Guidance and Behavior

Project Leader:
Res Fish Biol/N. Adams GS-482-13 (P)(RGE)

Fish Biol/A. Braatz GS-482-9 (Tm)
Fish Biol/R. Burns GS-482-7 (Tp)
Fish Biol/K. Cash GS-482-11 (Tm)
Electron. Tech/S. Evans GS-856-11 (P)
Fish Biol/M. Farley GS-482-9 (Tm)
Fish Biol/T. Hatton GS-482-9 (Tm)
Bio Sci Tech/G. Hansen GS-404-7 (Tp)
Fish Biol/E. Jones GS-482-7 (Tm)
Fish Biol/M. Kritter GS-482-7 (Tp)
Bio Sci Tech/S. Lampson GS-404-6 (Tp)
Fish Biol/J. Lucchesi GS-482-7 (Tm)
Bio Sci Tech/C. Munz GS-404-5 (Tp)
Fish Biol/R. Newman GS-482-7(Tp)
Fish Biol/M. Novick GS-482-7 (Tm)
Fish Biol/J. Plumb GS-482-9 (Tm) (I)
Bio Sci Tech/A. Pope GS-404-6 (Tp)
Fish Biol/N. Popoff GS-482-7 (Tm)
Fish Biol/R. Reagan GS-482-9 (Tm)
Bio Sci Tech/J. Schei GS-404-7 (Tm)
Fish Biol/M. Sholtis GS-482-7 (Tp)
Bio Sci Tech/D. Shurtleff GS-404-7 (Tp)
Fish Biol/J. Sprando GS-482-7 (Tm)
Bio Sci Tech/N. Swyers GS-404-6 (Tm)
Bio Sci Tech/T. Wilkerson GS-404-7 (Tp)
Fish Biol/L. Wright GS-482-9 (Tm)
Fish Biol/N. Zorich GS-482-8 (Tp)

Fish Distribution and Passage

Project Leader:
Res Fish Biol/J. Beeman GS-482-12 (P)(RGE)

Fish Biol/L. Dingmon GS-482-7 (Tm)
Elec Tech/P. Haner GS-482-11 (P)
Fish Biol/H. Hansel GS-482-11 (P)
Fish Biol/S. Junke GS-482-9 (Tm)
Bio Sci Tech/B. Liedtke GS-404-9 (Tm)

Regulated River Ecology

Project Leader:
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Fish Biol/C. Frost GS-482-7 (Tm)
Fish Biol/J. Hardiman GS-482-11 (Tm)
Fish Biol/G. Holmberg GS-482-9 (Tm)
Fish Biol/A. Puls GS-482-9 (Tm)
Fish Biol/R. Reiche GS-482-7 (Tm)
Fish Biol/C. Walker GS-482-9 (Tm)

Migration Behavior in Regulated Rivers

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Fish Biol/A. Daniel GS-482-9 (Tm)
Fish Biol/I. Duran GS-482-9 (Tm)
Bio Sci Tech/L. Gee GS-404-7 (Tm)
Bio Sci Tech/J. Quenette GS-404-7 (Tm)
Fish Biol/W. Simpson GS-482- 7 (Tm)
Fish Biol/C. Smith GS-482-9 (Tm)

Fish Passage and Survival

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Fish Biol/S. Fielding GS-482-7 (Tm)
Fish Biol/G. Rutz GS-482-7 (Tp)

Permanent Employees (P)
Student Career (S)
Intermittant (I)
TERM Employees (Tm)
Temporary Employees (Tp)
Research Positions (RGE)

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Columbia River Research Laboratory

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Laboratory Director/J. H. Petersen GS-482-14 (P)(RGE)
Supervisory Fishery Biologist

Facilities Support

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Bio Lab Tech/J. Warren GS-404-9 (P)

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Supr Res Physiol./A. Maule GS-413-14 (P)(RGE)

Watershed Restoration Ecology
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Fish Biol/K. Martens GS-482-9 (Tm)
Fish Biol/S. Sauter GS-482-9 (Tm) (I)
Bio Sci Tech/S. Sebring GS-404-7 (Tm)

Twisp
Bio Sci Tech/R. Barabe GS-404-4 (Tp)
Bio Sci Tech/B. Fisher GS-404-6 (Tp)
Bio Sci Tech/N. Glaser GS-404-4 (Tp)
Bio Sci Tech/W. Tibbits GS-404-6 (Tp)

Habitat Modeling
Project Leader:
Geographer/J. Hatten GS-150-12 (P)

Geographer/T. Batt GS-150-9 (Tm)

Fish Performance and Physiology
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Bio Sci Tech/J. Hotchkiss GS-404-9 (P)
Bio Sci Tech/S. Lupes GS-404-9 (Tm)
Fish Biol/C. Magie GS-482-7 (Tp)
Fish Biol/R. Magie GS-482-7 (Tm)
Bio Sci Tech/J. Phelps GS-404-7 (Tp)
Fish Biol/G. Robertson GS-482-5 (Tp)
Fish Biol/C. Robinson GS-482-9 (Tm)
Fish Biol/B. Rose GS-482-7 (Tm)

Sturgeon Ecology
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Bio Sci Tech/E. Kofoot GS-404-9 (P)
Fish Biol/B. Van Der Leeuw GS-482-7 (Tp)
Fish Biol/C. Wright GS-482-7 (Tp)

Salmon Habitat Ecology
Project Leader:
Res Fish Biol/K. Tiffan GS-482-12 (P)(RGE)

Fish Biol/R. Garland GS-482-11 (Tm) (I)
Fish Biol/C. Haskell GS-482-9 (Tm)
Fish Biol/R. Koch GS-482-7 (Tp)
Fish Biol/T. Kock GS-482-9 (Tm)
Fish Biol/J. Kraut GS-482-7 (Tm)

Permanent Employees (P)
Student Career (S)
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Research Positions (RGE)

Revised: 09/21/2005