NOAA Fisheries Service | National Oceanic & Atmospheric Administration | U.S. Department of Commerce

HIGHLIGHTS

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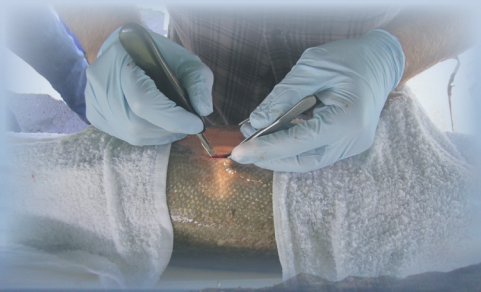
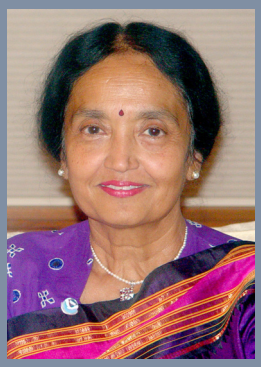
Northwest Fisheries Science Center



2006

Message from the Science Director



I would like to share with you some of the notable activities and accomplishments of NOAA's Northwest Fisheries Science Center in 2006. I am proud of what Center staff achieved during this challenging and productive year, and appreciate the hard work and dedication of our many collaborators. As one of the three NOAA Center's of Excellence investigating the critical connections between oceans and human health, staff continued a comprehensive effort to assess water quality and seafood safety following the Hurricane Katrina disaster. We also celebrated the Montlake Laboratory's 75th anniversary and continued to make advances in the science to support an ecosystem approach to managing our living marine resources, particularly through our recent scientific efforts to inform policy decisions affecting restoration of the Puget Sound. The West Coast continues to face critical challenges, including building sustainable groundfish fisheries, recovering endangered and threatened salmon and steelhead populations and conserving the endangered Southern Resident killer whale population. I am committed to supporting sound, innovative research and advanced observations to better understand living marine resources, their ecosystems, and human dynamics.

Sincerely,

Usha Varanasi

Usha Varanasi

Who We Are and What We Do

The Northwest Fisheries Science Center (NWFSC or Center) conducts research to help conserve and manage living marine resources (e.g., marine fish, salmon, and killer whales) and their habitats in the Northeast Pacific Ocean—primarily off the coasts of Washington and Oregon and in rivers and streams in Washington, Oregon, and Idaho where anadromous fish, like salmon, go. The Center's research assists resource managers in making sound decisions that build sustainable fisheries, recover endangered and threatened species, sustain healthy ecosystems, and reduce human health risks with biological and socioeconomic analyses.

Conserving and managing living marine resources requires an ecosystem approach. This approach changes according to different conditions and considers multiple social and environmental factors that exist both inside and outside the specific ecosystem of study. To improve knowledge of ecosystems in the Pacific Northwest, we study organisms, their environments, and processes, such as environmental variability. In support of ecosystem science, Center scientists and staff conduct field and laboratory research and develop technologies and analytical models in five primary areas:

- Status of Stocks
- Human-caused Stress/Risks
- Ecosystem Observations and Climate Variability
- Recovery and Rebuilding, and
- Innovation and Technology

What follows are some of the Center's 2006 accomplishments in each of these areas.

Status of Stocks

Stock assessments and status reviews determine the status of fish and marine mammal populations by integrating a broad array of information, including biology, population dynamics, environmental conditions, and risk factors. These assessments are a critical tool used by managers to set biologically sustainable harvest levels for healthy fish stocks and to guide the monitoring and rebuilding of overfished or threatened fish stocks and depleted marine mammal populations.

In 2006 we:

Collected Critical Data on West Coast Groundfish

The West Coast groundfish fishery includes some 80 commercially fished stocks off Washington, Oregon and California and supports millions of dollars in economic activity. Center scientists conducted the ninth in a series of intensive coast-wide groundfish bottom trawl surveys from Cape Flattery, WA to the Mexican border. Preliminary data revealed an elevated catch of canary rockfish in canyons near Astoria, OR and Mendocino, CA as well as a reduced catch in the region off the Oregon coast where large anoxic areas were observed in 2006. This year the bottom trawl survey also included a seabird survey and inventory of West Coast corals. These surveys provides critical fishery-independent information about the distribution, abundance and age structure of groundfish and other populations, and serve as the basis for stock assessments of commercially important species.

Observers collect biological data from catch on a West Coast groundfish trawler.

Improved Observer Program using Advanced Technology

The Center leads the West Coast Groundfish Observer Program. As part of this program, observers are placed on commercial fishing vessels to monitor and record total groundfish catch, bycatch, and discard data associated with different fisheries. In 2006, observers worked closely with industry to increase the information collected in the at-sea hake fishery. Observers also monitored the limited entry bottom trawl and fixed gear fleets, and used an innovative electronic monitoring system on shore-based hake vessels. The electronic monitoring system, which integrates video, GPS, and winch and hydraulic sensors, helps improve documentation of fishing practices and enhances the scientific collection of groundfish catch and bycatch data.

Human-caused Stress/Risks

Humans are an integral part of ecosystems, and affect their surrounding environment, and as a result living marine resources face a number of risks from habitat degradation to hydropower systems. Each life stage and species can be affected differently.

In 2006 we:

Led a Collaborative Effort to Advance Ecosystem Approaches for Puget Sound

Center scientists coordinated and led a collaborative effort involving 12 regional agencies, 30 authors, and over 100 scientists to develop a report (Sound Science) about the Puget Sound ecosystem and ways that science can inform recovery decisions. Sound Science highlights likely key threats facing the Sound in the future, identifies gaps in scientific knowledge, and advances the new ecosystem approach to managing the Sound's resources. As the first collaborative report to take an ecosystem view of the Puget Sound, the Center's leadership in this effort will help support several ongoing regional initiatives, including Governor Christine Gregoire's initiative to restore Puget Sound by the year 2020 and the development of a comprehensive ecosystem plan to be developed by the Puget Sound Partnership.

Evaluated Juvenile Salmon Passage along Columbia River and Estuary

Salmon migrating through the Columbia River hydropower system encounter a number of dams during their upstream and downstream migrations. In 2006, the Center, working with regional fishery managers, developed a much-needed juvenile salmon passage model (COMPASS) to help better assess future effects of the hydropower system on the survival of migrating smolts. In addition, the Center surgically-implanted new miniature acoustic tags, developed with Battelle Laboratories over the past five years, to successfully generate the first survival estimates of spring and fall juvenile Chinook as they migrate from Bonneville Dam to the mouth of the Columbia River. The new generation tag addressed a critical data need for salmon survival information during passage through the lower Columbia River and the estuary downstream from the hydropower system. Moreover, the COMPASS model will serve as a foundation for future passage modeling of juvenile salmon in the Columbia River and will be a cornerstone for water and salmon management in the Pacific Northwest.

Scientists improve salmon passage at Bonneville Dam.

Analyzed Socioeconomic Impacts of Fishing and Whale Watching Industry

Social scientists study the human dimension of ecosystems to better understand people and how they depend on and potentially impact marine resources. In 2006, Center scientists initiated a large-scale survey of the whale-watching industry to help generate a sociocultural description of the unique relationship between whale-watching vessels and the endangered Southern Resident killer whales in the Puget Sound. Working jointly with the Alaska Fisheries Science Center as part of a national effort, Center scientists also conducted a community profiling project of 125 communities engaged in fishing activities along the West Coast and North Pacific. The Center's efforts will help decision makers consider socioeconomic impacts to human communities while setting sustainable harvest levels for overfished stocks and minimizing the effects on fishing communities.

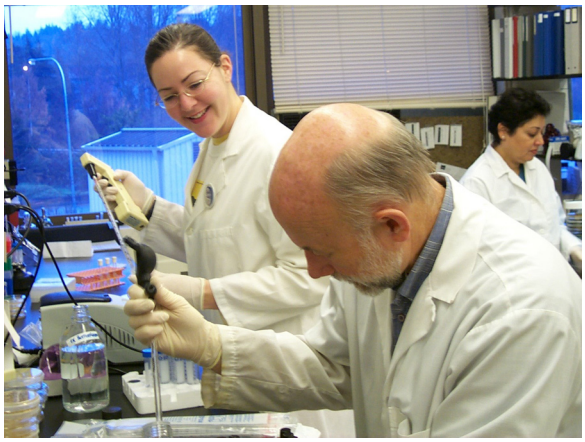
Ecosystem Observations & Climate Variability

Living marine resources in the Pacific Northwest use and depend on a variety of environments from freshwater streams and rivers to estuaries and the ocean. Center scientists conduct research to better understand how natural environmental fluctuations impact species, how resources respond to natural disasters, and how changes in the oceans can lead to effects on human health.

In 2006 we:

Addressed Health and Seafood Safety Risks in the Aftermath of Hurricane Katrina

Hurricane Katrina brought about one of the worst environmental catastrophes in recent history. Major concerns following the disaster included risks to human health through consumption of contaminated seafood. Scientists from the NWFSC's West Coast Center of Oceans and Human Health continued year-long surveys of water, sediments, and seafood for presence of pathogens, toxins, and contaminants in the Gulf of Mexico. State-of-the art analyses detected a range of compounds; however none were present at levels that posed a threat to human health. Initial surveys on white shrimp in nearshore areas indicated a short-term exposure to low levels of oil or other petroleum-derived products, but these levels had diminished by spring 2006. The capability to detect even slight perturbations in the ecosystem and document the safety of seafood was instrumental in maintaining public confidence and keeping the $700 million fishery open.



Analyzing seafood samples after Hurricane Katrina.

Developed Ocean Index Tool for the California Current Large Marine Ecosystem

We know that the state of the ocean when salmon first enter it is critical to fish survival, but we have few tools to predict ocean survival, until now. Over the past decade, the Center has been monitoring the coastal ocean environment off the Washington and Oregon coasts, its interaction with the California Current, and how it affects the abundance, growth, distribution and survival of salmon. As a result, scientists have discovered many critical links between the physical conditions in the ocean (i.e., sea-surface temperature, salinity, and upwelling strength) and how biological communities respond to those conditions (i.e., changes in predator and prey abundance and diversity). In 2006 the Center developed an ocean index that combines oceanographic data with biological indicators to predict changes in adult salmon populations from the Columbia River basin and coho salmon from the Oregon coast. This index will help inform regional managers of salmon recruitment one year in advance for coho and up to two years in advance for Chinook. This year's index predicted average ocean conditions (but vastly improved over the poor conditions observed in 2005) for juvenile salmon, and low adult returns to Columbia River and Oregon coastal rivers over the next two years.

Provided Rapid Detection Tool for Harmful Algal Blooms in Shellfish

Harmful algal blooms can seriously affect human health and coastal community economies, yet the timing, occurrence and toxicity of these events are only beginning to be understood. Center scientists are working collaboratively with the Quileute and Quinault tribes, NOAA Ocean Service, and the National Center for Coastal Ocean Science to help rapidly detect the harmful algal toxin domoic acid in seawater and shellfish. This method provides much improved sensitivity to measure domoic acid at levels far below those currently used to close shellfish beds or suspend crab harvesting. As a result of this collaborative research and collection of real-time data, resource managers will have the ability to issue early public health warnings to human populations at the greatest risk of exposure. Such early warnings will allow for selected beach closures or targeted shellfish harvest, estimated to save tribes, recreational and commercial fishers up to $20 million annually.

Tribal members measure contamination levels in shellfish.

Hosted "One-NOAA" Workshop to Evaluate Unusual Ocean Conditions off West Coast

Scientists observed two unusual ocean conditions off the West Coast in 2005 that generated a great deal of media attention: a winter-like physical state that persisted through early summer, and a biological response as if the ocean had been hit by a significant El Niño event, including massive bird deaths, low plankton abundance, and poor salmon survival. To better understand the possible causes and consequences of these ocean conditions, the Center hosted a workshop attended by a mix of atmospheric scientists, biological and physical oceanographers, and climate and ocean modelers from across NOAA, NOAA Fisheries, and our academic partners. Workshop participants aimed to fill in data gaps in our understanding of climate and ecosystems to explain the recent events, and addressed the ability to predict such events in the future. The results of the workshop, including detailed observations of the 2005 ocean conditions and potential atmospheric, oceanographic and biological linkages, will be disseminated in a scientific report and technical manuscripts.

Recovery & Rebuilding

Over the last several decades certain living marine resources have become depleted and, in some cases, are in danger of extinction. Recovering and rebuilding these populations are important for ecological, economic and cultural reasons.

In 2006 we:

Continued our Scientific Leadership for Salmon Recovery

Center scientists are directly involved in salmon recovery efforts on the West Coast. Recovery plans are being developed for 17 listed salmon and steelhead populations in four geographic domains under the Center's jurisdiction. Center scientists chair the Technical Recovery Teams (TRTs) in each of these domains and Center staff conduct many of the technical analyses that support recovery planning. In 2006, the Willamette/Lower Columbia River TRT released an updated document of population viability goals for listed populations in their domain. This document describes key parameters related to population viability (abundance, productivity, spatial structure, and diversity) and is a critical step for developing biological recovery goals. These goals are also useful in determining when listed salmon populations will no longer be considered threatened or endangered.

Used Captive Broodstock Technology to Aid in Recovery of Listed Salmon

Many recovery efforts for ESA-listed stocks of Pacific salmon include the use of Center-developed captive broodstock technology, where fish are reared in specialized freshwater and marine systems to ensure high survival and production of eggs, smolts, and pre-spawning adults. This year, in collaboration with the US Fish and Wildlife Service, Bonneville Power Administration, state agencies and tribes, the Center helped reduce the extreme risk of extinction for Redfish Lake sockeye salmon and rebuild core genetic populations of Snake River Chinook salmon. Approximately 1,000 adults and 150,000 progeny from Snake River sockeye and Chinook salmon were provided to Idaho and Oregon for use in recovery efforts.

Created Salmon Habitat Database to Evaluate Restoration Efforts

Sockeye salmon from Center broodstock released into Redfish lake, ID.

Across the Pacific Northwest, public and private organizations are working to improve stream and riverine habitat conditions for threatened and endangered salmon. However, there is little or no knowledge of the links between these restoration actions and the resulting response in the targeted species. After 15 years of work, Center scientists and their collaborators with the National River Restoration Science Synthesis developed a database of over 23,000 spatially-referenced restoration activities in 35,000 locations in Washington, Oregon, Idaho and Montana. Following data validation and agreements for inter-agency data sharing, this Center database will address the critical need for a regional monitoring program to evaluate the effectiveness of restoration actions.

Innovation & Technology

Center scientists develop and apply new technologies, techniques, and tools to support management, conservation, recovery, and rebuilding of the Pacific Northwest's living marine resources.

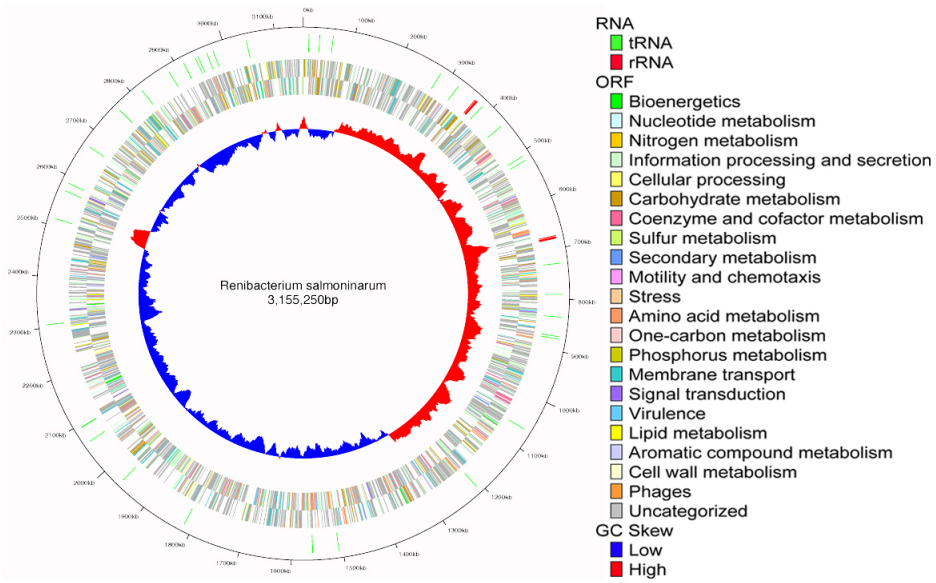
In 2006 we:

Developed Model to Support Ecosystem Approach to Management in California Current

Scientists continued to develop an ecosystem model (Atlantis) of the California Current marine ecosystem. The model's structure includes biological information on predator-prey relationships among 54 groups of primary producers, consumers, and habitat-forming species (i.e., kelp, corals) in over 60 different spatial zones. Together with temperature, salinity and other oceanographic information, the model will help scientists better understand the impacts of climate change and help decision makers develop fisheries management alternatives that incorporate an ecosystem approach.

Published First Genome Sequence of a Fish Bacterial Pathogen

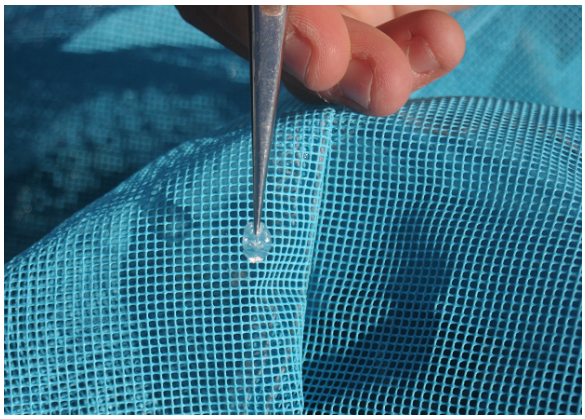
Bacterial kidney disease (BKD) is a serious problem in the cultured broodstocks of ESA-listed salmon and hatchery-raised fish in the Pacific Northwest. In an effort to manage the disease with therapeutic treatments and vaccines, Center scientists began sequencing the genome of the pathogen that causes BKD, *Renibacterium salmoninarum* in collaboration with the USDA National Center for Cool and Coldwater Aquaculture and Oregon State University. Using bioinformatics approaches to analyze the *R. salmoninarum* genome, scientists successfully identified an enzyme that allows the pathogen to attach to and invade salmon cells. Scientists also discovered a non-toxic drug phenyl vinyl sulfone, which shows promise for its ability to inactivate the enzyme and is currently being tested for its ability to control and prevent BKD in salmon.



Complete genome map of *Renibacterium salmonarum.*

Used Chemical Signals and Genetics to Understand Killer Whale Diet

Top marine predators such as killer whales integrate chemical signals from the prey they consume, and these signals reveal information about the prey species and regions from which prey were taken. In Northern Pacific killer whales, scientists measured such tracers (i.e., stable isotope ratios, persistent pollutants, and fatty acid profiles) in blubber samples from three groups, or ecotypes. They found that the "offshores" prey on long-lived, high tropic level marine fish—a diet that is distinctly different from the "resident" and "transient" ecotypes. Moreover, scientists confirmed that the North Pacific offshores forage as far south as California, providing further evidence for classification into a distinct ecotype. Another study genetically analyzed prey remains and scat samples from Southern Resident killer whales (SRKW), and determined that Chinook salmon are an important part of the SRKW diet while they inhabit Puget Sound. The Center's effort provides further insight into the diet and feeding ecology of North Pacific and the ESA-listed Southern Resident killer whale populations.



Collecting fish scales from fine mesh nets after a killer whale predation event.

Our Facilities, Operations, and Staff

Scientists and staff are the heart of the Center and are its most important asset. Adequate facilities and a strong infrastructure are critical to supporting the high-quality work of Center scientists and staff, ensuring that the Center provides the science needed to conserve and manage living marine resources and their ecosystems.

In 2006 we:

Strengthened Center Research Programs

The Center continued its highly successful internal grants program, which provides scientists with funding opportunities for cutting-edge research. In its sixth year, the program set a new record in proposals received, offered a formal mentorship program to improve grant-writing skills, and funded 10 awards totaling $417K. In addition, the Center's newly formed Research Planning Team (RPT) continued its efforts to improve Center planning, programs and operations. The RPT completed a survey of nearly all scientific staff to quantify areas of Center expertise in scientific disciplines, species, and geographic area; conducted focus groups to help determine Center-wide research priorities; and began drafting a research plan. The Center also continued its seminar series "Monster Seminar Jam" to provide training to Center scientists and facilitate interactions with other scientists in the Region, and also completed the second year of its joint seminar series with the University of Washington to address topics related to oceans and human health. The Pacific Northwest is unique in having a NOAA funded Oceans and Human Health Center located at the NWFSC and a NSF/NIEHS funded Center at the University of Washington.

Celebrated 75 Years of Innovative Science

VADM Lautenbacher dedicates historic marker for Montlake's 75th anniversary.

The year 2006 was a milestone for the Center's Montlake Laboratory. Over 200 staff and scientists celebrated our 75th anniversary together with keynote speaker VADM Lautenbacher, NOAA officials, and other federal, state, and local partners. The event's festivities included the dedication of a commemorative geodetic marker, an interactive science fair focusing on technology past and present, and an awards ceremony highlighting our staff's recent achievements, including special recognition from Washington State Governor Christine Gregoire.

Developed New Bioinformatics Capability

Over the past 20 years, extraordinary advances in our knowledge of gene structure and function in many organisms have occurred, resulting in the rapid growth in genetic databases to store, share and retrieve this complex biological information. In 2006, the Center established a bioinformatics core laboratory to advance our capability for biological computational analysis. The Center's Bioinformatic Workgroup Cluster and XRAID system is easily expandable and allows scientists to access over 200 bioinformatics-related programs from their desktop computers via the intranet. The system is currently being used to analyze DNA and proteins from entire genomes of bacteria and fish, as well as data from innovative bioassessment tools that monitor fish health.

Hosted a Series of Science Symposia

The Center hosted a series of Center-wide science symposia in 2006, including our 4th biennial Watershed Program Open House; Symposium on Evolutionary Change and Salmon; and 1st biennial Center-wide Science Symposium. We also hosted two international conferences, the 3rd Symposium on Stock enhancement and Sea Ranching, and the Southern Resident Killer Whale Symposium (together with Washington Department of Fish and Wildlife and Department of Fisheries and Oceans Canada). Presentations and posters at these events showcased the innovative research being conducted by NOAA scientists, helped keep staff and stakeholders abreast of current NOAA research priorities, and fostered valuable collaborative opportunities.

Improved Safety and Operations

The Center implemented several improvements to safety, energy efficiency, and security facility-wide. The Center established a comprehensive field safety program with training for over 200 Center staff, conducted several upgrades to the electrical and heating system at the Montlake campus, and responded to a human health concern from molds with planning and construction of a new modular building to be completed in 2007. Over 40 staff also participated in the Center's new advanced small boat training, the first of its kind in NOAA. The Center also improved computer security patching, created two new equipment reservation systems and an image library, and expanded wireless access capabilities at the Manchester Research Station.

Received Recognition for Achievements

Many staff received awards this year in recognition of their hard work and accomplishments. The awards included a Presidential Early Career Awards for Scientists and Engineers for the second year in a row, a Department of Commerce (DOC) Gold Medal, two DOC Silver Medals, ten NOAA Bronze Medals, a NOAA Distinguished Career Award, a NOAA Administrator Award, two NOAA Corps Director's Ribbons, and a University of Washington DO-IT (Disabilities, Opportunities, Internetworking and Technology) Trailblazer Award.

Strengthened Educational and Diversity Opportunities

Our staff participated in local outreach events and career fairs, including the annual NOAA Science Camp, NOAA Earthweek Community Fair, Salmon Homecoming, Water for Life Festival, and NOAA Kids' Day in Seattle, WA to promote environmental literacy and stewardship. Center staff also provided over 75 students with educational and career opportunities to help increase interest in careers that support NOAA's mission. We also received recognition for serving as the NOAA coordinating office for the American Association for the Advancement of Science ENTRY POINT! Program, and through this program provided 10 internship opportunities for students with disabilities.

Staff delivering educational program at NOAA Kids Day.

Learn More & Come See us in Action

Sharing our work with other scientists, with policymakers, and with the public is important to us. To learn more about what we do, please visit our website at www.nwfsc.noaa.gov. To arrange a visit or obtain additional information, please call 206-860-3200.

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