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

HIGHLIGHTS

2005

Northwest Fisheries Science Center

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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 freshwater 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.

Message from the Science Director

As 2005 comes to a close, I would like to share with you some of the notable activities and accomplishments of NOAA's Northwest Fisheries Science Center. I am proud of what Center scientists achieved during this challenging and productive year, and appreciate the hard work and dedication of our many collaborators. As one of the three NOAA Centers of Excellence investigating the critical connections between oceans and human health, staff led a comprehensive water quality and seafood safety sampling effort following the Hurricane Katrina disaster. We conducted an unprecedented number of stock assessments to determine the status of West Coast groundfish. We also continued to make advances towards an ecosystem approach to managing our living marine resources, particularly through our recent scientific efforts to inform policy decisions affecting cleanup 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 improved observations to better understand and improve the condition of living marine resources and their ecosystems, and I look forward to continuing our efforts in 2006.

Sincerely,

Usha Varanasi

Usha Varanasi

Conserving and managing living marine resources requires an ecosystem approach that is tailored to the individual ecosystem, changes in response to different conditions, and considers social and economic variables as well as environmental factors. 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 tools and models in five primary areas:

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

What follows are some of the Center's 2005 accomplishments in each of these areas.

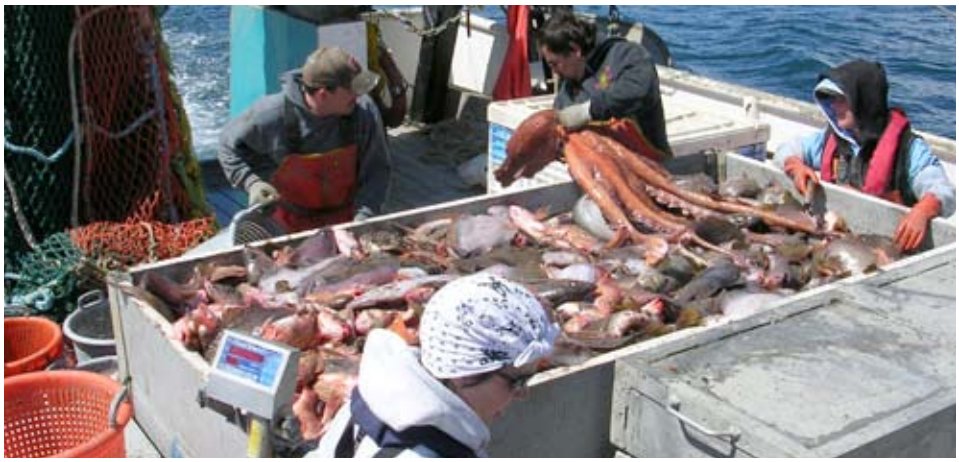
Status of Stocks

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 2005 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 two intensive coastwide groundfish surveys: a Pacific hake acoustic survey conducted jointly with Canada from Pt. Sur, CA to the Alaska-Canada boundary and a bottom trawl survey from Cape Flattery, WA to the Mexican border. These surveys provide critical information about the distribution, abundance, and age structure of groundfish populations, and serve as the basis for stock assessments. In 2005, the Center coordinated an unprecedented 23 stock assessments of West Coast groundfish species in cooperation with the Southwest Fisheries Science Center and others. This represented a substantial increase in the number of assessments that historically have been completed and reviewed in a single year and is the result of moving to a biennial stock assessment and management cycle. To facilitate this process, we also developed a new stock assessment model that streamlines the review of each assessment.



Above: Scientists sorting the catch during groundfish survey.

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 2005, 60 observers monitored 8 groundfish fisheries, including limited entry bottom trawl, at-sea hake trawl, sablefish fixed gear, and nearshore live rockfish. This year, observers used an innovative advanced technology on the program's shore-based hake vessels. The electronic monitoring system, which integrates video, GPS, and winch and hydraulic sensors, helps the Center improve documentation of fishing practices and holds promise for wider applications in monitoring fishing activities.

Created Standardized Genetic Database to Support Chinook Salmon Management

Center scientists continued to lead a multi-agency effort to standardize the collection of genetic data for Chinook salmon. Center scientists led nine West Coast genetic laboratories in the development of a template for a central genetic database. This database will facilitate the sharing and exchange of data on Chinook salmon from southern California to northwest Alaska. The team of state, federal, tribal and academic scientists agreed on a standard set of genetic markers, generated shared sample data, and validated methods and individual laboratory protocols. The standardized Chinook salmon genetic database will be useful in a wide range of conservation, restoration, and management applications, including adult harvest management and further research in areas of forensic science and marine mammal feeding ecology.

Above: Sampling coho salmon to estimate reproductive success.

Human-caused Stress/Risks

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

In 2005 we:

Evaluated Juvenile Salmon Passage through Snake River Dams

Salmon migrating through the Columbia River hydropower system encounter a number of dams during their upstream and downstream migrations. In response to a federal district court ruling for additional summer spill on the lower Snake and Columbia Rivers, the Center acted quickly to evaluate passage behavior and estimate relative survival of juvenile Chinook salmon as they migrated past two dams on the Snake River. Center researchers tagged 4,400 salmon with radio transmitters and acoustic tags and tracked the juveniles as they moved downstream through Lower Monumental and Ice Harbor Dams. The Center's data on salmon passage and survival provided critical scientific information needed to help NOAA address highly contentious issues surrounding the costs and benefits of summer spill.

Estimated Effects of Hatchery Fish on Wild Populations

Hatcheries have the potential to assist in the conservation of wild stocks, but they also pose some risks. Understanding the relative fitness, homing, and spawning patterns of hatchery fish is critical to determining the extent to which hatcheries enhance or threaten the survival of wild populations. In 2005, Center scientists continued to conduct important research on the relative reproductive success of hatchery and wild Chinook, coho, and steelhead that spawn together in the wild. The Center partnered with state scientists to measure the changes in run timing of coho salmon returning to spawn at Minter Creek since the start of the hatchery program, and to determine how these changes affect reproductive success in the wild. Scientists also collaborated with tribal and state biologists to determine how well hatchery-reared Chinook salmon in the Yakima River minimize straying by returning to their release sites, and how choice of spawning habitat compares between hatchery and wild salmon. This research will help Center scientists better evaluate the risks and benefits of hatchery production.

Assessed Toxic Contaminant Exposure in Juvenile Salmon

Thirteen major groupings of salmon populations are endangered or threatened in the Columbia River Basin. Habitat degradation, including exposure to chemical contaminants, is thought to have contributed to the decline of these stocks. In collaboration with the Lower Columbia River Estuary Partnership, US Geological Survey, Bonneville Power Administration and others, we monitored contaminant concentrations in water, bottom sediments, and in juvenile Chinook salmon along the Columbia River and from local hatcheries. Preliminary results indicated that toxic chemicals, including flame retardants and estrogenic compounds, are widespread in this system and that salmon are exposed to and accumulate a wide range of these compounds. In addition to contaminants, juvenile salmon experience other stresses, such as passage through dams during their out-migration. Based on chemical contaminant data and information on other stressors, the Center and its collaborators developed population models to determine the potential impacts of multiple stressors (toxics and dam passage) on salmon health and survival. This new modeling framework enables us to provide better management advice for listed salmon. This approach also has applications for other species, including marine mammals and humans.

Ecosystem Observations & Climate Impacts

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 living marine resources, how resources respond to natural disasters, and how the oceans, through living marine resources, affect human health.

In 2005 we:

Addressed Health and Seafood Safety Risks in Response to Hurricane Katrina

Hurricane Katrina brought about one of the worst environmental catastrophes in recent history. Major concerns included risks to human health through possible consumption of contaminated seafood and exposure to pathogens from poor water quality, as well as risks to the health of living marine resources. The Center has a long history, dating back to the 1989 EXXON Valdez oil spill, of providing expert technical assistance during emergency responses that impact living marine resources. Because of this expertise, and our recent designation as a NOAA Center of Excellence in Oceans in Human Health, we played a key role in NOAA's assessment of the impacts of the Katrina disaster and recovery of the Gulf of Mexico ecosystem. The Center provided an early assessment of toxic contaminants in seafood and microbial loads in water and seafood and will continue to provide periodic assessments in 2006.

Evaluated Effects of Predicted Global Climate Change on Salmon Recovery

Environmental conditions are not static; they change with time. These changes can impact the effectiveness of salmon recovery efforts. Climate change and human population growth are two factors that could have a large effect on these recovery efforts. Center staff and collaborators from Snohomish County and the University of Washington are investigating how the predicted effects of global climate change may impact the recovery of endangered and threatened Chinook salmon populations in Puget Sound. Integrating three critical models on salmon production, hydrology, and climate, the Center and its partners showed that global climate change has potentially dramatic ecosystem level effects, which negatively impact salmon. Importantly, this model shows that these effects can be partially mitigated by proposed salmon recovery actions. Center scientists and regional decision makers will work collaboratively to use these results in evaluating salmon recovery efforts in Puget Sound.

Above: Scientists sample fish and water quality post-Hurricane Katrina.

Advanced Understanding of Ecology of Harmful Algal Blooms

Harmful algal blooms can seriously affect human health and coastal community economies, however the timing, occurrence and toxicity of these events are not yet well understood. Center scientists are working collaboratively with an international, multi-disciplinary team from the University of Washington, Department of Fisheries and Oceans Canada and others to develop predictive models of harmful algal blooms. Thus far, this team has successfully identified a potential source of *Pseudonitzschia*, the alga that produces the neurotoxin domoic acid, and correlated storm activity with the arrival of toxic blooms along the West Coast. The use of drifter buoys to track blooms has also provided insight into the conditions that favor the movement of blooms toward the shore, where shellfish beds may be contaminated. The biophysical models resulting from this collaborative research will give managers vital information to help predict algal blooms before they hit the coast, potentially reducing the impact on local communities and other coastal regions around the world affected by similar toxic events.

Monitored the Status of the California Current in Pacific Northwest

Center scientists are monitoring oceanographic and biological conditions of the California Current as part of a new "Pacific Coast Ocean Observing System (PACOOS)" program to determine how ocean conditions affect species distributions along the west coast. We measure a range of variables, such as sea surface temperature, to assess the state of ocean conditions and then combine these data with data on juvenile salmon prey species (e.g., copepods) to predict changes in populations of adult salmon. In 2005, the Center developed a northern copepod index, based on 10 years of oceanographic data, to predict coho salmon returns. This index helps inform regional managers of salmon recruitment one year in advance. This year's index, which reflected unusual spring and early summer conditions off the Washington and Oregon coasts, predicted very low survival of juvenile salmon and thus poor adult returns for 2006.

Left: Scientist deploying a drifter during a research cruise.

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.

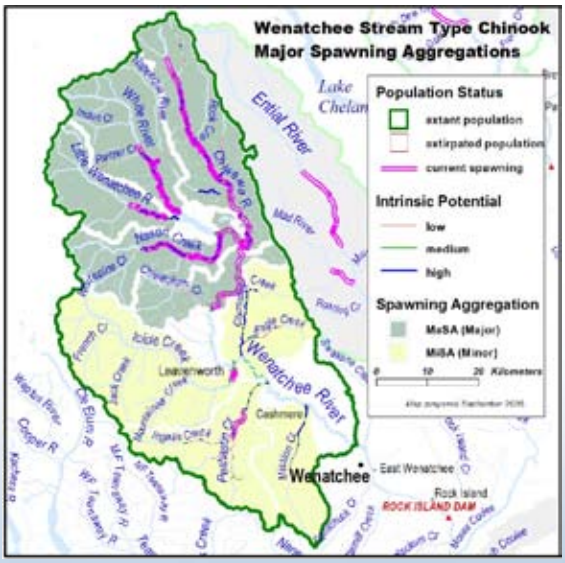
In 2005 we:

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 2005, following in the footsteps of TRTs in Puget Sound and in Willamette/Lower Columbia River, the Interior Columbia River TRT completed a draft population viability document. 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 in 2006. These goals are also useful in determining when listed salmon populations will no longer be considered threatened or endangered.

Developed an Economic Framework for Salmon Critical Habitat Designations

Under the Endangered Species Act, the designation of critical habitat requires NOAA to balance biological benefits of species conservation with economic costs. Working with biologists and decision makers at the Northwest Regional Office, the Center developed an innovative framework for measuring these benefits and costs. This new approach was successfully applied to critical habitat designations for 12 West Coast salmon and steelhead populations, and the team's distinguished efforts were recognized with a Department of Commerce Silver Medal.



Above: Wenatchee Spring Chinook major and minor spawning aggregations.

Hosted a Symposium to Define Complex Conservation Units for Salmon

More than a decade ago, Center scientists defined what constitutes a salmon population. This definition was used to evaluate listings under the Endangered Species Act. Since that time, science has progressed and the agency has encountered more complex management questions. In response to these challenges, the Center sponsored a symposium to review salmon biology and evolutionary biology to provide an opportunity for a public discussion of various approaches to defining complex conservation units of salmon that might 1) contain hatchery fish or 2) contain anadromous (ocean-going) and resident life history forms. Both of these issues are incredibly relevant to NOAA Fisheries Service as it considers proposed changes to the ESA listing status of salmon and steelhead. A panel of renowned scientists reviewed and summarized the state of the science on the advantages and disadvantages of alternative approaches to defining complex conservation units of salmon and suggested new biologically-based approaches that provide alternative management options.

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 2005 we:

Used Underwater Vehicles to Map Untrawlable Seafloor Habitat

Scientists have traditionally used fishing methods such as bottom trawls to monitor and assess the status of resident groundfish populations. In rocky habitat or areas that are protected from bottom contact fishing, scientists can use autonomous underwater vehicles (AUVs) as a non-extractive, deep-sea research tool. In collaboration with Woods Hole Oceanographic Institute and Oregon State University, Center scientists employed an AUV off the Oregon and California coast and combined the data from these surveys with other mapping tools to develop integrated, large-scale, and detailed habitat maps of the sea floor and its associated groundfish populations. The AUV-acquired data will help improve our understanding of the distribution of fish and structure-forming invertebrates (such as sponges and corals) and provide critical baseline maps for areas proposed for habitat protection.

Developed an Innovative Spawning Detection Method

Center scientists developed a new tool to detect spawning by individual salmon in the natural environment, which has proven to be an exceedingly difficult aspect of salmon biology. The implantation of special tags (electromyogram transmitters) into maturing female Chinook salmon allowed researchers to detect spawning events from changes in the female salmon's muscle activity. As part of this study, Center scientists also improved upon conventional tagging techniques by placing transmitters between the skin and muscle instead of directly inside the body cavity, where tags can interfere with salmon reproduction. The Center's efforts in developing this innovative technology will improve our ability to quantify spawning ability, frequency, and timing of intensively monitored salmon populations, such as those listed under the Endangered Species Act.

Left: Biologists surgically implant electromyogram transmitters in Chinook salmon.

Investigated Role of Hormone in Growth and Survival of Coho Salmon

After years of study it is still unclear what factors cause salmon mortality in the ocean and poor adult returns. Scientists have suggested that growth rate (not necessarily size) during the summer of ocean entry may be crucial for salmon survival. Center scientists tested this hypothesis by measuring blood levels of the hormone insulin-like growth factor (IGF-I) in juvenile coho salmon off the Oregon and Washington coasts in the summer for several years (2000-2004). We found that IGF-I levels are positively and significantly correlated to adult salmon survival, confirming that summer growth may play an important role in regulating salmon populations. Therefore, it is likely that plasma IGF-I levels in juvenile salmon will be a useful tool for predicting salmon survival and adult returns.

Co-chaired Electronic Tagging Workshop to Improve Stock Assessments and Applications for an Ecosystem Approach to Management

Tagging technology has great potential to improve our understanding of movement, habitat use and survival of fish. Over 80 scientists attended an electronic tagging technologies workshop, co-chaired by the Center and Southwest Fisheries Science Center, to help improve stock assessments and advance the agency's goal of taking an ecosystem approach to management. Workshop participants facilitated the transfer of innovative tagging technologies within the NOAA Fisheries Service scientific community and identified present and future needs for technology improvement and data management. The results of the workshop will be disseminated in a scientific report and recommendations will be provided to the agency's Advanced Technologies Working Group.

Above: Testing growth hormone levels in captured coho salmon.

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 2005 we:

Strengthened Center Research Programs

The Center expanded its highly successful internal grants program, which provides scientists with funding opportunities for cutting-edge research. In its fifth year, the program created a separate track to promote career development of junior scientists and set a new record for the number of awards (14) and amount ($400K) funded. In addition, the Center's newly formed Research Planning Team initiated a process to improve Center planning, programs and operations. The team developed an online survey and conducted focus groups and systematic reviews of the scientific literature to help determine Center-wide and constituents' research priorities. This prioritization exercise will inform our research planning process and ensure that future research efforts are forward thinking and well integrated. We also completed a program review on the applications of biotechnology in ecosystem science; this review marked the end of a series of external program reviews to evaluate the quality and appropriateness of the Center's science in a number of areas. 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. This year we also launched a new 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.

Provided a Mentoring Program and Other Human Resources Tools

Training the next generation of scientists is a critical Center goal and a vital element in building a workforce for the future. In 2005, the Center launched a mentoring program. The Center also improved its administrative functions and infrastructure to ensure that the Center's scientific workforce is productive and high performing by creating an internal Standard Operating Procedures database. This database greatly facilitates staff accessibility to all Department, Agency and Center policies, procedures, and guidelines and allows staff to spend more time fulfilling key scientific responsibilities.

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 in Seattle, WA, and the Seafest celebration in Newport, OR to promote environmental literacy and stewardship. Center staff also provided over 50 students with educational and career opportunities to help increase interest in careers that support NOAA's mission. We were also the NOAA coordinating office for the American Association for the Advancement of Science ENTRY POINT! Program, and through this program provided 12 internship opportunities for students with disabilities.

Improved Safety and Operations

The Center implemented several improvements to safety, energy efficiency, and security facility-wide. The Center conducted several hazardous material remediation activities, updated emergency plans for all research stations, and trained over 150 Center staff in the proper shipment of hazardous materials. Staff took steps toward disposing of unused and outdated IT equipment in an environmentally responsible manner, effectively recycling over 2,000 pounds of electronic waste in 2005. The Center also improved web security, created an online publications database, and provided new wireless access capability on the Montlake campus.

Received Recognition for Achievements

Many staff received awards this year in recognition of their hard work and accomplishments. The awards included a NOAA Distinguished Career Award; a Presidential Early Career Award for Scientists and Engineers; a Department of Commerce (DOC) Silver Medal; ten NOAA Bronze Medals; two NOAA Administrator Awards; and five Seattle Federal Executive Board Awards for Public Service.

Left: Staff delivering educational program at Seafest.

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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