

*National Marine Fisheries Service  
National Oceanic and Atmospheric Administration  
U.S. Department of Commerce*



*From expanding  
groundfish surveys to  
celebrating 70 years  
of fisheries science...*



*...see what we have done this year.*

**Highlights  
2002**

# Message from the Science Director



*As 2002 closes and we welcome in a new year, I would like to share some of the activities and accomplishments of NOAA Fisheries' Northwest Fisheries Science Center. It has been a challenging year and I am extremely proud of what Center scientists and staff have accomplished. I am also thankful for the hard work and dedication of our collaborators in academia, state and tribal governments, as well as industry and non-profit organizations. These partnerships have helped leverage the Center's resources and expertise to ensure that our efforts are as wide-reaching as possible. The West Coast is facing a number of critical challenges, including increasing coastal populations, a slowing economy, and climate change. In light of these and future challenges, I am committed, and look forward, to continuing our research to better understand and help improve the condition of living marine resources and their ecosystems.*

*Sincerely,*

*Usha Varanasi*



Center scientists sampling invertebrates

## **Who We Are and What We Do**

The Northwest Fisheries Science Center (NWFSC or Center) studies living marine resources (e.g., salmon, groundfish, 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, Idaho and Montana, where anadromous fish, like salmon, go. This is a large area and an important responsibility. The Center seeks to better understand living marine resources and their ecosystems to assist resource managers in making sound decisions that build sustainable fisheries, recover endangered and threatened species, and sustain healthy coasts. The Center's 300 scientists and staff conduct research in 5 primary areas:

- Status of Stocks,
- Impacts of Human Caused Stress/Risks,
- Ecosystem and Climate Change,
- Recovery and Rebuilding, and
- Innovation and Technology.

What follows are some of the Center's 2002 accomplishments in each of these areas.



Center scientist working on a vaccine to control a pathogen affecting salmon

## Status of Stocks



Stock assessments determine the state or health of fish and marine mammal stocks. Center scientists integrate information from a variety of sources (e.g., observers, resource and habitat surveys, and fishermen, in the case of groundfish stock assessments), analyze the information, and draw scientific conclusions from the results. These assessments are used by managers to identify and guide the monitoring and rebuilding of overfished and threatened fish and marine mammal stocks, and set biologically sustainable harvest levels for healthy fish stocks.

### ***In 2002 we:***

#### ***Expanded Groundfish Surveys***

The Center conducts groundfish surveys along the entire U.S. West Coast, from the Canadian to Mexican border, to target important species. These surveys provide information about distribution, abundance, and age structure of groundfish populations. In 2002, the Center expanded its annual series of slope species surveys from Cape Flattery, WA to the Mexican border (previous surveys ended at Morro Bay, CA). Center scientists planned a new Pacific whiting acoustic survey, which will be conducted jointly with Canada, in 2003, to improve timeliness of stock assessments for this species and are currently planning resource surveys in untrawlable habitat, which requires that acoustic and other techniques be used. Increasing the number and frequency of surveys will improve our ability to track trends in the abundance of key groundfish species.

#### ***Strengthened Observer Program***

The Center coordinates the West Coast Groundfish Observer Program. As part of this program, observers are placed on commercial fishing vessels to monitor and record catch data and collect critical biological data. In 2002, the Center added approximately 20 observers to its Observer Program

in California, Washington, and Oregon ports, bringing the total number of observers to about 40 coastwide. Observers improve our understanding of fishing activities and help the Center provide accurate accounts of total catch, bycatch, and discard associated with different fisheries and fish stocks.

#### ***Improved Stock Assessments for Marine Species***

Center scientists increased the number of stock assessments they conducted and improved the certainty of the information they use in their assessments. Center scientists completed stock assessments for Pacific whiting and canary and yelloweye rockfish, updated the stock assessment for sablefish, and coordinated rebuilding analyses for widow and darkblotched rockfish.

#### ***Led the Evaluation of Southern Resident Killer Whales***

There has been growing concern in the region about the declining number of killer whales that inhabit Washington's Puget Sound and Strait of Juan de Fuca in the summertime. To address this concern, NOAA Fisheries formed a team of scientists from its three West Coast science centers, which was chaired by a NWFSC scientist, to review the status of the southern killer whale stock. The team evaluated whether these whales were a distinct population of the global killer whale species, why the whale population has been declining, and estimated the risk of extinction for this stock. NOAA Fisheries' managers used the team's report to determine that the southern killer whale stock should be listed as depleted under the Marine Mammal Protection Act, but that it should not be listed under the Endangered Species Act at this time.



Southern resident killer whales

## Human Caused Stress/Risks



Humans affect the environment around them and as a result living marine resources face a number of risks, from toxic chemicals in sediments to hydropower systems and physically degraded habitats. Each life stage (e.g., egg, juvenile, or adult) and species is affected differently.

***In 2002 we:  
Began Evaluating Potential Delayed Effects of Juvenile Salmon Passage through the Columbia River Hydropower System***

Salmon migrating through the Columbia River encounter a number of dams. While some salmon experience direct effects (e.g., mortality), others may experience indirect or delayed effects that impact their future survival. Center scientists completed their first full year of testing to evaluate the potential for delayed effects. After smolts passed through the hydropower system, they were reared for up to 6 months in saltwater to observe their mortality and evaluate their immune system function. Center scientists found that the

smolts' passage history through the Columbia River related to differences in their mortality and immune system function. As this research progresses, it will help fishery managers modify existing hydropower operations.

***Completed Studies on Riparian Buffers***

The state of vegetation near streams and rivers is integral to stream ecosystem health. Center scientists documented changes in stream productivity associated with different riparian buffer widths, as well as different species composition within the stream. One study in particular examined the effects of decadal climate change on riparian buffers and stream productivity; it is one of the few studies demonstrating climate effects on stream systems. These studies will help managers determine how wide riparian buffers need to be to protect streams and salmon from human disturbance.



Center scientists snorkeling to evaluate salmon abundance and distribution in a freshwater stream

## Ecosystem & Climate Change



Living marine resources in the Pacific Northwest use and depend on a variety of ecosystems from freshwater streams and rivers to estuaries and the ocean. Knowledge of these systems, however, as they apply to marine fish, salmon, marine mammals, and their prey, is currently very limited.

### ***In 2002 we:***

#### ***Discovered a Potential Initiation Site for Harmful Algal Blooms***

A team of scientists from the Center and the University of Washington are gaining a better understanding of toxic algae that threatens the livelihoods of coastal communities along the Washington coast. In a recently published study, Center and University of Washington scientists provide evidence showing that an important source of *Pseudo-nitzschia*, the algae that produce the neurotoxin domoic acid, may be located off the tip of Cape Flattery in the Juan de Fuca eddy. Harmful algal blooms have been responsible for beach closures and the loss of millions of dollars in revenue in coastal communities. This study, and current studies by the Center and its collaborators, will give managers vital information to help predict harmful algal blooms before they hit the coast, greatly reducing the impact these blooms have on coastal communities and the region.

#### ***Conducted Critical Surveys to Develop A Better Understanding of Estuarine and Ocean Environments***

Center scientists conducted a number of critical surveys along the Pacific coast, as well as in specific areas, such as the Columbia River plume and Heceta Bank, off central Oregon. Scientists collected juvenile salmon to assess their abundance, distribution, growth, and

health. Scientists also collected samples of pelagic fish (salmon predators) and zooplankton (salmon prey). Information collected from these surveys will enable scientists to develop a better picture of how, when, and to what extent juvenile salmon use estuarine habitats, and how changes in climate and ocean conditions affect juvenile salmon growth and survival.



Center scientists sampling fish in estuaries



Over the past several decades, certain fish stocks have become depleted and, in some cases, are in danger of extinction. Recovering and rebuilding these stocks is important for biological, economic, cultural, and recreational reasons.

***In 2002 we:***

***Successfully Reared, for the First Time, Yelloweye Rockfish in Captivity***

Center scientists developed new culture techniques to successfully rear yelloweye rockfish eggs through their sensitive larval phase. This is the first time that this species has been reared in captivity beyond 30 days. Yelloweye rockfish stocks are severely depleted with rebuilding plans that are estimated to take from 40-170 years using current management approaches. The successful culture of yelloweye rockfish larvae will help us learn more about the biology of these fish and help managers evaluate different strategies that can assist in the rebuilding process.

***Provided Scientific Leadership for Salmon Recovery***

Center scientists are directly involved in recovery planning efforts on the West Coast; they chair Technical Recovery Teams (TRTs) that are providing the scientific underpinning for salmon recovery efforts. TRTs are assessing factors responsible for salmon decline and assisting in the development of recovery plans. This year, two TRTs completed draft population viability documents. These documents describe key parameters related to population viability (abundance, productivity, spatial structure, and diversity) and are a critical step in developing delisting goals—when will listed salmon populations no longer be threatened or endangered?

## Recovery & Rebuilding

This year, Center scientists also completed several critical projects to assist TRTs and aid in salmon recovery, including:

- A draft analysis of historical populations of chinook and chum salmon and steelhead, in cooperation with members of the Willamette/Lower Columbia River TRT. This analysis will help scientists develop delisting criteria for endangered and threatened salmon populations.
- The first iteration of a habitat-specific fish production model for Puget Sound chinook salmon. This model will eventually enable scientists to estimate changes in salmon survival with changes in habitat quality and quantity. This information will help scientists better understand the relationship between habitat and fish survival and production, and identify the most beneficial restoration strategies.
- A web-based salmon database. This database is currently available online to Center scientists and consolidates existing data from hundreds of sources into a consistent database that is geospatially linked.





## Innovation & Technology

Living marine resources are challenging to study because they live in a world of water and in the case of salmon, can migrate thousands of miles. Innovations can lead to new or better ways to conduct research and understand species and their habitats. Center scientists develop and apply technologies, techniques, and tools to support conservation and recovery of the Pacific Northwest's living marine resources.

### ***In 2002 we:***

#### ***Applied PIT-tag Technology to Adult Salmon***

The passive integrated transponder tag (PIT tag) is a small device, about the size of a grain of rice, with a computer-chip that is inserted into the body cavity of juvenile salmon. Electronic systems, set up at dams, detect PIT tags in juvenile salmon as they move downstream and send information to a centralized database so that scientists can learn more about fish passage and survival. For the past few years, Center scientists have been working on a way to apply PIT-tag technology to detect adult salmon migrating upstream. This year, a prototype adult system was installed and evaluated at several Columbia River dams. These adult detection systems will provide critical information regarding salmon migration behavior, passage, and survival.

#### ***Continued Development of Acoustic Technologies***

Center scientists continued to develop and use acoustic (sonar-based) technologies that use high-frequency sound pulses to measure groundfish abundance and map their distribution. Scientists have traditionally used

capture gear (e.g., nets) to measure fish abundance, but these technologies do not work everywhere and can miss important information. Acoustic technologies are improving our understanding of groundfish stocks and are enabling us to study groundfish in many more areas of the ocean.

#### ***Began Testing New Hatchery Raceways***

Center scientists, as part of a cooperative study with the Washington Department of Fish and Wildlife, are testing, at production scale, natural rearing enhancement raceways (NATURES)—hatchery raceways enriched with cover, structure, and substrate to provide salmon with a more “wild-like” environment—at western Washington hatcheries. These tests will help determine NATURE's effects on the survival of salmon once they are released from hatcheries. Recent research by Center scientists suggests that rearing fish in NATURES increases post-release survival of hatchery fish. Development and testing of NATURES and its application to hatcheries are critical to the development of strategies that will aid in salmon recovery.



PIT tag



A strong infrastructure is critical to ensuring that the Center can provide the science that is needed to conserve and manage living marine resources and their ecosystems.

***In 2002 we:***

***Established a New "Science for Ecosystem-based Management" Initiative***

The Center established a new initiative on the science for ecosystem-based management. This initiative includes staff from across the Center who will provide scientific advice on the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function in the environments in which fish and fisheries exist. For example, as part of this initiative, scientists will examine how to define and bound ecosystems, the impacts of climate on ecosystems, and what types of and how much habitat plants and animals within identified ecosystems need.

***Started a Series of Program Reviews to Evaluate and Improve the Center's Science***

The Center has started a series of external program reviews to evaluate the quality and appropriateness of its science in five major areas: hatchery science, watershed ecology, ocean and estuarine ecology, recovery planning, and groundfish. The first of these reviews, on the Center's salmon hatchery and marine enhancement/aquaculture programs, was completed in September 2002.

***Completed Construction of the New Captain R. Barry Fisher Building in Newport, Oregon***

In October 2001, the Center began constructing a new research building to house a number of its research activities that are based out of Newport, Oregon. The building was completed in October 2002, and is dedicated to Captain Barry Fisher, in memory of his commitment to fisheries research, cooperation, and education.

## Operations

***Continued Support of Diversity and Educational Opportunities***

Center staff participated in local outreach events, including technology seminars and career fairs. The Center also continued to work with the Northwest Indian College on the development of the National Indian Center for Marine and Environmental Research and Education, and continued to participate in internship programs with local high schools and undergraduate institutions.

***Celebrated 70 years of Science***

On May 23 and 24, 2002, the Center celebrated the 70<sup>th</sup> Anniversary of its Montlake Facility in Seattle, WA. This facility is the oldest fisheries research facility on the West Coast and has a rich history of accomplishments. Attending this memorable event were a number of Agency officials, including Department of Commerce Deputy Secretary Sam Bodman, NOAA Fisheries Deputy Assistant Administrator Rebecca Lent, and NOAA Fisheries Northwest Regional Administrator Bob Lohn; honored guest speakers, including two former Center directors, Lee Alverson and William Aron, as well as Bill Nye, "The Science Guy," and partners from academia, tribal governments, and the wider scientific and management community. During this event, Center scientists gave presentations highlighting the Center's past and present work and provided tours of its research facilities.

***Provided scientific leadership and support to NOAA Fisheries***

NWFSC staff often serve as experts on national committees and teams. Two noteworthy examples of Center staff involvement this past year include, Conrad Mahnken's leadership to develop and implement an agency aquaculture initiative and Tracy Collier's service on the NOAA team that assisted with clean-up efforts after the massive oil spill in Spain.

***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](http://www.nwfsc.noaa.gov) or better yet, come visit us. To arrange a visit or obtain additional information, please call 206-860-3200.*