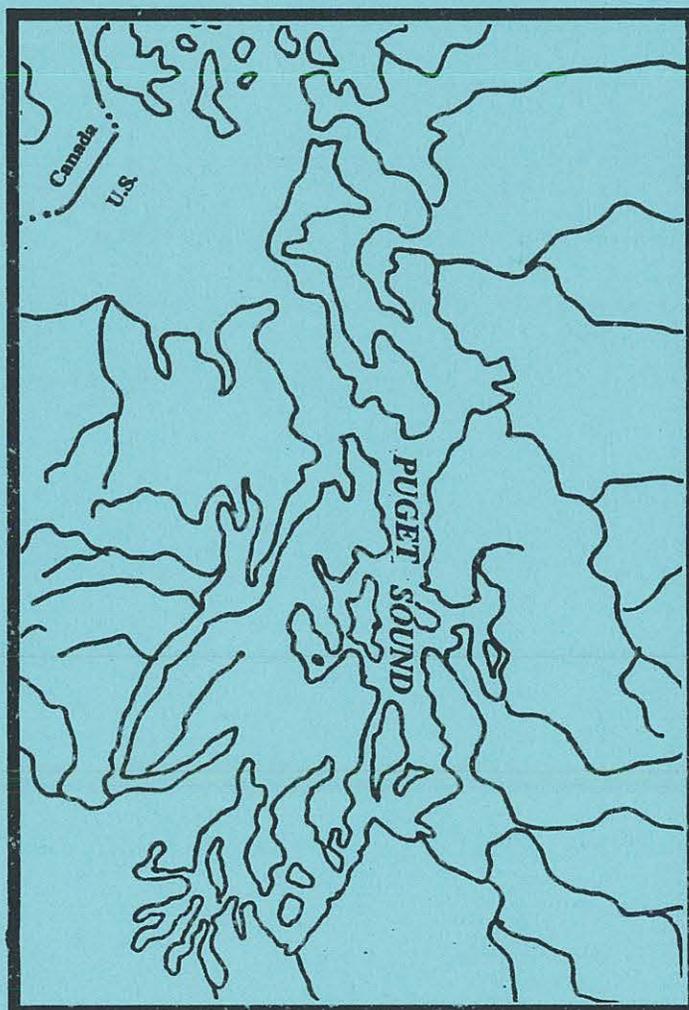




NOAA INVOLVEMENT IN PUGET SOUND

December 1989



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NOAA Estuarine Programs Office

NOAA INVOLVEMENT SERIES

The NOAA Estuarine Programs Office (EPO) is responsible for coordinating the estuarine activities of various parts of NOAA, including activities in estuarine research and assessment, fisheries research, coastal management and habitat conservation. EPO also is charged with the responsibility of coordinating NOAA estuarine activities with those of other Federal, State and local agencies. This EPO role was further enhanced when NOAA was assigned responsibilities in the National Estuary Program by Congress.

The NOAA Involvement Series outlines the activities of the agency in various estuaries around the Nation. It is intended to acquaint scientists, managers, and decision-makers with NOAA environmental missions, programs, and capabilities.

For more information about NOAA's activities in Puget Sound, contact Lt. Cdr. John A. Withrow, Northwest Regional Coordinator, NOAA, Office of the Chief Scientist, 1825 Connecticut Avenue, NW, Washington, DC 20235; (202) 673-5330 or FTS 673-5330.



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U.S. DEPARTMENT OF COMMERCE

Robert A. Mosbacher, Secretary

National Oceanic and Atmospheric Administration

John A. Knauss, Under Secretary

NOAA Estuarine Programs Office

Samuel E. McCoy, Director (Acting)

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PUGET SOUND: AN ESTUARINE PROFILE

Resources and Issues

Puget Sound is the largest estuary on the West Coast. It is a marine transportation hub, a business center, the site of a large commercial and recreational fishery and a popular area for marine-oriented recreational activities. In 1988 the population of the Puget Sound area was nearly 3 million. Most of the State of Washington's population growth since 1980 has occurred in the Puget Sound area. By the year 2000, it is estimated the area's population will reach 3.6 million. These forecasts also suggest that by 2000, 15 percent of the land in the area will be in intense urban or rural nonfarm use--most of this in the central Puget Sound region.

Along with this development will come increased environmental pressure which will affect the Sound itself. Toxic contaminants represent the most acute and greatest long-term threat to the habitats and biological resources of the Sound. Toxicants reach the marine waters of Puget Sound from many sources, but the principal known sources are municipal and industrial point source discharges, stormwater runoff, pesticides from nonpoint sources, and unpermitted discharges of wastewater. Such contaminants bind to particles and are largely retained as sediments in Puget Sound rather than being flushed to the open ocean. These substances tend to persist in the environment; contamination is not easily reversed.

Because of the significance of Puget Sound and its potential for pollution impacts, it was among the original designees in the U.S. Environmental Protection Agency's National Estuary Program. Prior to that time, the legislature of the State of Washington finding that "Puget Sound and related inland marine waterways ... represent a unique and unparalleled resource" and that "the utilization of the ... resource carries a custodial obligation of preserving it" created a Puget Sound Water Quality Authority "to develop a comprehensive plan for water quality protection ... " (1989 Puget Sound Water

Missions of NOAA in the Sound

Quality Management Plan, iii). It is the Authority which has responsibility for creating the management plan required under the National Estuary Program. The major biological problem indicators identified in May 1988 are shown in Table 1 while the planning area is depicted in Figure 1.

NOAA's involvement in Puget Sound predates modern environmental problems. Two of the predecessor agencies of NOAA, the Weather Bureau and the U.S. Coast and Geodetic Survey, had activities in the region in the late 1800's. In 1898 the Survey opened its first permanent office in Seattle, making that office the headquarters for work being done along the Washington and Alaskan coasts.

Today NOAA maintains both a scientific and a physical presence in Puget Sound. As the Nation's leading earth systems agency, it is involved in research and monitoring activities that deal not only with environmental problems but also with services that support the coastal ocean community.

NOAA programs in Puget Sound have addressed a number of the problems indicated in Table 1. Substantial effort has been devoted to mitigating the effects of coastal development on habitats of estuarine-dependent fish. Contaminant levels in sediments and bottomfish and the temporal trends of these levels is another area of NOAA emphasis. NOAA research has developed an understanding of the processes controlling the input, transformation and fate of toxic contaminants entering the Sound. NOAA collects and archives the long-term environmental data needed for assessment of environmental change, including satellite-derived information. NOAA provides both general and special weather forecasts critical to the daily life of commerce, agriculture, and business in the Sound and it archives long-term weather data essential to a variety of scientific and business uses. NOAA maintains and updates the nautical charting data base necessary for all maritime uses of the Sound. Figure 2 shows the organizational structure of NOAA. All of the major line organizations of the agency have one or more offices located in the Puget Sound area.

The sections which follow outline some of the activities that comprise NOAA's involvement in Puget Sound.

TABLE 1

BIOLOGICAL PROBLEM INDICATORS IN PUGET SOUND

- Histopathological abnormalities in bottomfish (e.g., liver lesions) and other organisms
- Degradation of benthic communities
- Chemically contaminated tissue
- Bacterial contamination of shellfish
- Plankton blooms
- Paralytic shellfish poisoning
- Fish kills
- Declining fish stock
- Sporadic reproductive failures in harbor seals (e.g., premature births, pup mortality)

Source: State of the Sound 1988 Report (Puget Sound Water Quality Authority, 1988)

The overall finding from the National Benthic Surveillance Program for the years 1984-86 indicated that the highest concentrations of most sediment-associated contaminants were present in the highly urbanized areas and that contaminants were bioavailable to marine species ... Of all the sites sampled, the most contaminated sites were located in San Diego Bay (CA), Commencement Bay (Tacoma, WA), Elliott Bay (Seattle, WA), and San Pedro Bay (Los Angeles - Long Beach, CA).

*—National Benthic Surveillance Project:
Pacific Coast (NOAA, December 1988)*

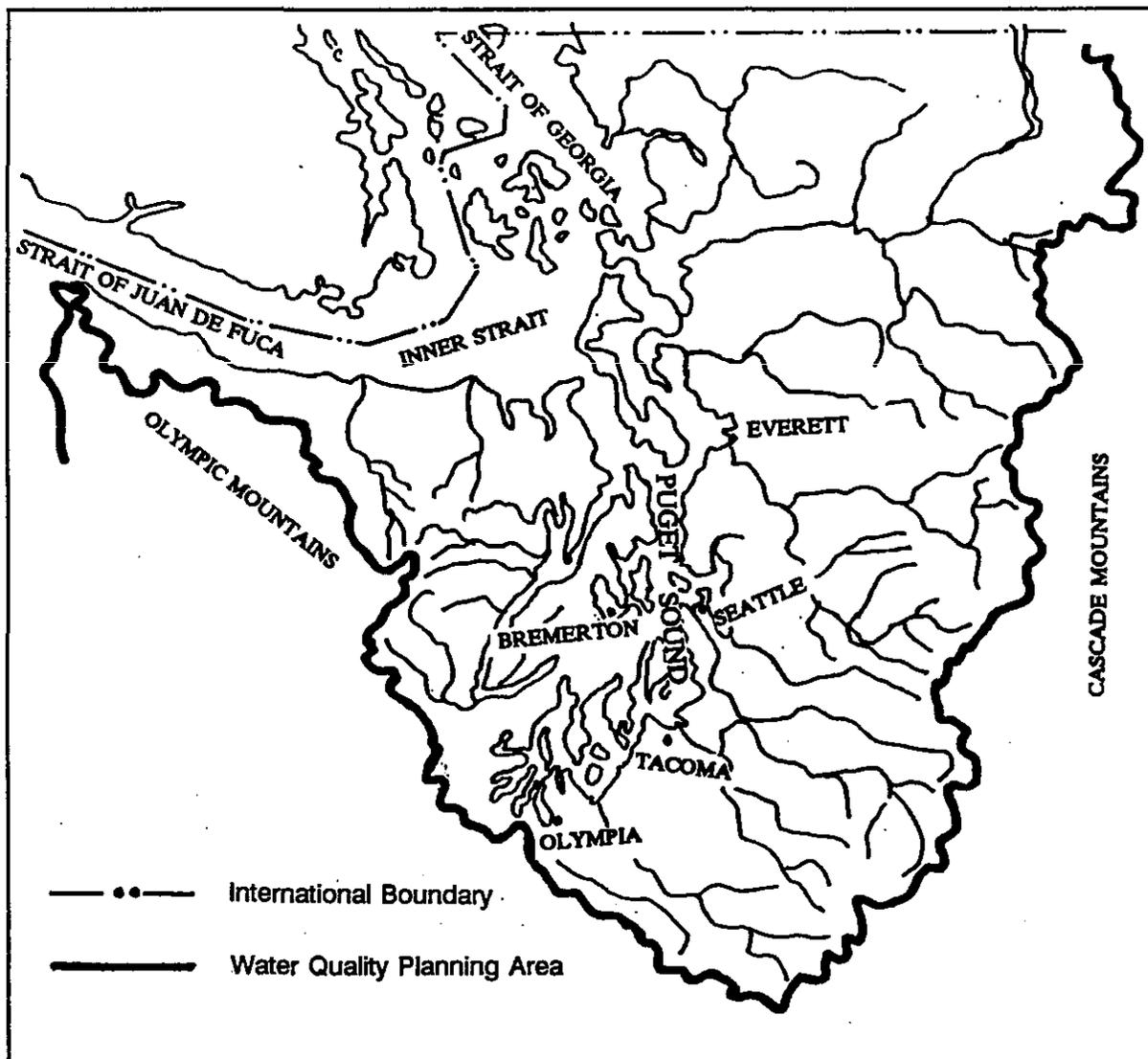


Figure 1. Puget Sound Water Quality Planning Area

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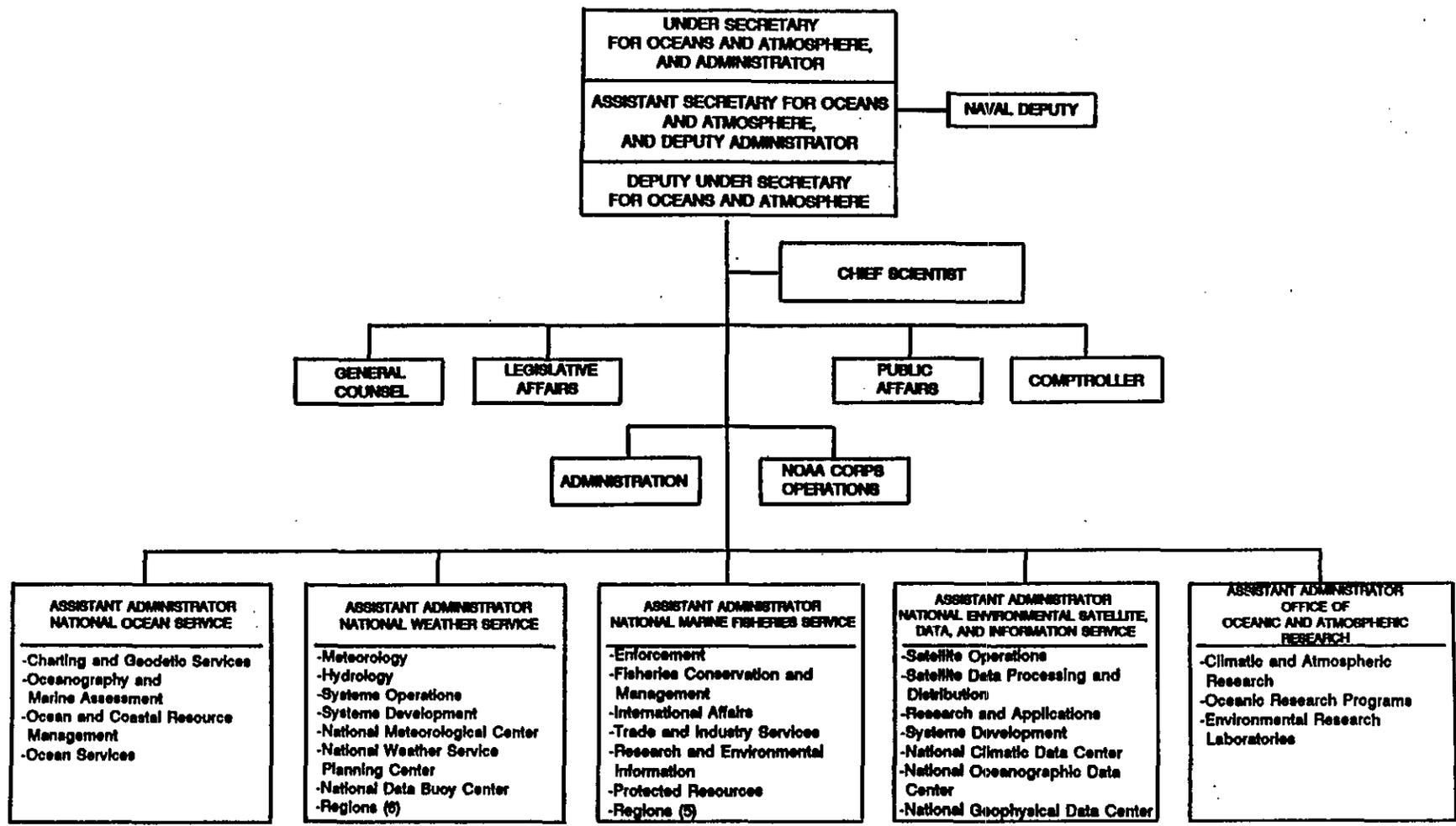


Figure 2. NOAA Organization Chart

NOAA INVOLVEMENT IN: ESTUARINE ASSESSMENT

Environmental Description

The development and assessment of available information is the essential first step in describing the health of an estuarine system. NOAA has taken the lead in developing both the data bases on which assessment depends and in developing an understanding of the principal processes. NOAA also sponsors a number of efforts designed to characterize different aspects of Puget Sound and to disseminate this information to decision-makers.

To characterize the present status of an estuary, existing data on the physical and chemical environment, on the resident biota, and on weather must be collected and analyzed.

Nautical Charts

In the area of physical characterization of Puget Sound, NOAA, and its predecessor agencies, funded nautical charting projects back to the 1800's. Today these tasks are handled by NOAA's National Ocean Service. Natural changes to bathymetry, dredging, and improvements in charting technology require that nautical charts of the Sound be continually updated. In addition to use in revised published charts, the raw digital bathymetric data are archived by NOAA at the National Geophysical Data Center in Boulder, Colorado. Data in this form can be readily applied to computer analyses such as circulation models.

Tides and Currents

NOAA maintains continuously recording tide gauges at several locations in the Sound. The tide data are used to track sea level changes over long periods, as well as to determine marine boundaries and provide tidal protection. The predictions are published annually by NOAA in Tide Tables, West Coast of North and South America.

National Ocean Service of NOAA has obtained the most comprehensive set of current meter data for the Sound. This data has been the basis for a number of studies of circulation. Updated tidal current predictions resulting from these observations are published annually in Tidal Current Tables, Pacific Coast of North America and Asia.

**Benthic
Surveillance and
Mussel Watch**

The National Status and Trends Program (NS&T) was initiated by NOAA in 1984 to describe the current levels and trends of selected contaminants in fish, shellfish, and sediments at coastal sites around the country. The program is currently the only national effort to collect consistent information on contaminant levels and fish diseases at selected sites throughout the Nation's coastal and estuarine environments using standard procedures with a high degree of quality assurance. Products of the NS&T program include research reports and national data bases that aid in the prediction of trends in pollutant levels and their effects on living marine resources.

The NS&T program has two major field sampling components: Benthic Surveillance and Mussel Watch. For the Benthic Surveillance program, sediments and bottomfish are sampled and analyzed for contaminants and diseases at 50 sites around the U.S. Fish collected are histologically examined for tissue abnormalities. Sediments are analyzed for metals, organic contaminants, total organic carbon, and grain size. For the Mussel Watch program, mussels or other suitable bivalves and sediments are analyzed for contaminant loads at 150 sites nationwide. Mussels were selected as subjects for study because of their sedentary nature and because they filter food and associated contaminants from the water column. The sampling sites in the Sound for both the Benthic Surveillance and Mussel Watch programs are shown in Figure 3.

In December 1988 NOAA's National Ocean Service, Office of Oceanography and Marine Assessment issued a report entitled National Benthic Surveillance Project: Pacific Coast. Part 1: Summary and Overview of the Results for Cycles I to III (1984-86). Among the most contaminated sites it listed were Elliott Bay and Commencement Bay in the Sound.

Weather

The National Weather Service (NWS) of NOAA analyzes continuous real-time data from land stations, ships, buoys, aircraft, and satellites with sophisticated computer techniques and trained professionals to provide a series of services and forecasts for the United States and adjacent ocean areas. Besides long- and short-range weather forecasts for the general public, NWS provides special predictions for agriculture, aviation, and marine uses, as well as

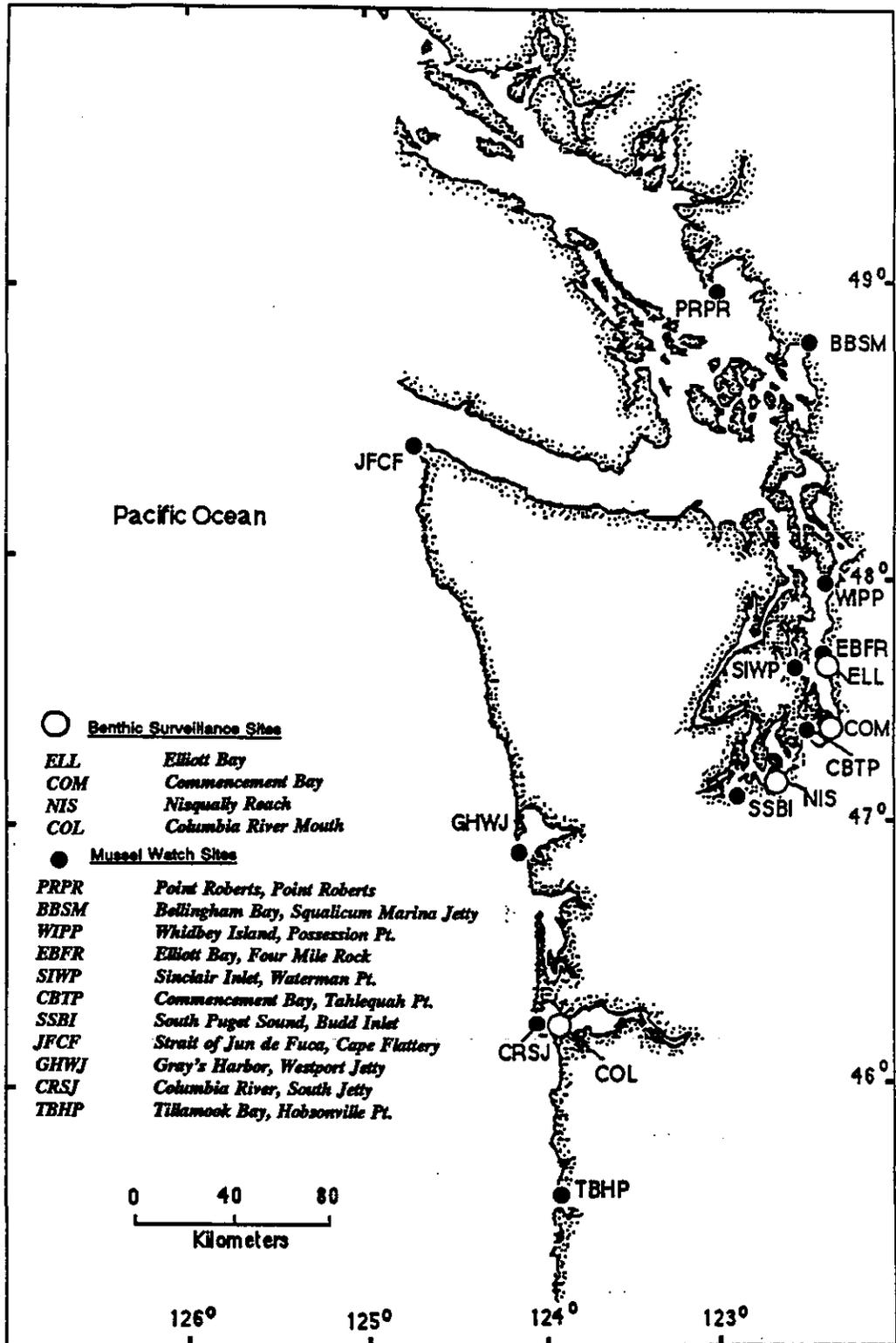


Figure 3. National Status and Trends Sampling Sites in Puget Sound and the Adjacent Coastal Ocean

forecasts and warnings for air pollution, wave height, river levels, and sea ice. NWS is headquartered in Silver Spring, Maryland, with an extensive network of forecast offices across the country.

There are two major NWS offices in the Puget Sound area with the lead office [Weather Service Forecast Office (WSFO)] located in Seattle. This and other NWS observational facilities in the Puget Sound area are shown in Figure 4.

Data Bases and Information

The National Ocean Service's Office of Oceanography and Marine Assessment has developed a number of data bases and products which are of importance to decision-makers, scientists and businesses involved in the coastal oceans and estuaries such as Puget Sound. Some of these are listed below.

Ocean Circulation

The National Coastal Ocean Circulation Program provides its users with reliable information about currents and water levels. The program's data and information products are used for efficient pilotage, docking and undocking of ships and recreational craft, rapid cleanup of oil and hazardous material spills, effective search and rescue operations, developing port and harbor engineering plans, and, when coupled with water quality or sediment transport models, various environmental assessment applications.

National Estuarine Inventory

The National Estuarine Inventory (NEI) is the framework of NOAA's efforts to assess the health of 92 of the Nation's estuaries, including Puget Sound. It identifies all large- and medium-sized estuaries within the contiguous U.S.; compiles a data base of their important physical, hydrologic, biological and economic characteristics; and specifies the estuarine drainage area as the spatial unit by which data is compiled. The 92 estuaries account for approximately 90 percent of the estuarine surface area along each of the three regions of the U.S. and 90 percent of the freshwater inflow. The National Estuarine Inventory Data Atlas has been produced to illustrate characteristics of the estuaries. Volume 1, Physical and Hydrologic Characteristics, was completed in November 1985; Volume 2, Land Use Characteristics, was completed in early 1987. Other products and programs stemming from the NEI framework are described in the items which follow.

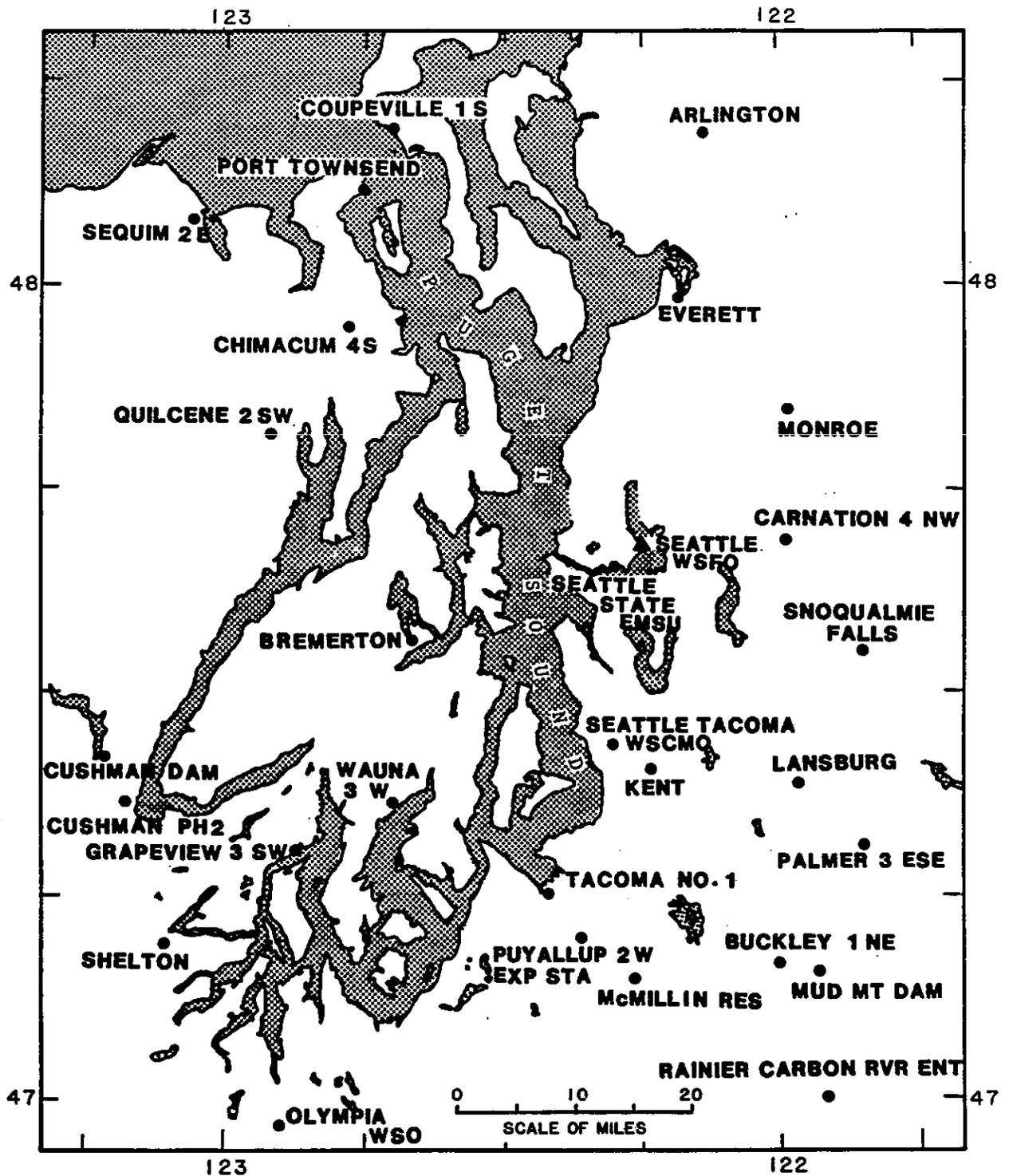


Figure 4. Locations of Seattle Weather Service Forecast Office (WSFO) and Climate Reporting Stations Surrounding Puget Sound

**National Estuarine
Inventory (cont.)**

National Coastal Pollutant Discharge Inventory (NCPDI). NCPDI is a data base and computational framework containing discharge estimates for all point, nonpoint, and riverine sources of pollutant discharges into the estuarine, coastal, and oceanic waters of the contiguous U.S. (excluding the Great Lakes). Pollutant discharge estimates are for 18 pollutants in the following 9 major categories: wastewater, oxygen-demanding materials, particulate material, nutrients, heavy metals, petroleum hydrocarbons, chlorinated hydrocarbons, pathogens and sludges. The most recent data summary for Puget Sound was published in August 1988 in National Coastal Pollutant Discharge Inventory: Estimates for Puget Sound.

National Coastal Wetlands Data Base. NOAA is developing a national coastal wetlands data base through use of a systematic grid sampling procedure on wetlands maps produced for the National Wetland Inventory of the U.S. Fish and Wildlife Service. Fifteen habitat types are recorded by 45-acre cells on 1:24,000-scale wetland maps. Acreage estimates and color maps for one or several maps can be produced. Grid-sampled data can be intersected with digitized boundaries, such as counties and estuarine drainage areas, as defined in the National Estuarine Inventory, to produce acreage summaries and maps for specific units of interest. Grid sampling for the West Coast, including Puget Sound, was completed in 1988. Prior to beginning its wetlands data base, NOAA examined existing state and local wetland inventories and summarized the distribution for four wetland types--salt marsh, fresh marsh, tidal flat, and swamp--in the coastal counties of 22 coastal States, including Washington. This work was described in a January 1986 NOAA publication entitled An Inventory of Coastal Wetlands of the United States.

National Shellfish Program. This program compiles nationwide information on the classification of shellfishing areas and is an important component of the National Estuarine Inventory data base. Estuarine waters are classified by states, predominantly on the basis of coliform bacterial levels, as "approved," "prohibited," "conditionally approved," or "restricted." Beginning in 1986, NOAA, in cooperation with shellfish-producing States, began to identify the pollution sources of areas that are limited to the harvest of shellfish.

**National Estuarine
Inventory (cont.)**

Additional information on the administration of State shellfish programs, status of growing waters, and trends in classification have been added. The latest data to be published and analyzed for the West Coast, including Puget Sound, is Quality of Shellfish Growing Waters on the West Coast of the United States (December 1989).

Living Marine Resources Project. This project is designed to develop information on the distribution and abundance of living marine resources in the Nation's estuaries. The information will be developed for approximately 150 species and will initially be organized by three salinity zones depicted for each estuary in Volume 1 of the National Estuarine Inventory Data Atlas, plus additional estuaries of biological importance. Data is being collected through literature reviews, consultation with local and regional fisheries experts, and scientific input from NOAA and the U.S. Fish and Wildlife Service. The project is being conducted in three phases. Phase 1 will cover the West Coast including Puget Sound; phase 2, the Gulf of Mexico; and phase 3, the East Coast. A preliminary component of phase 1, which was to assess the overall feasibility of the project, was completed in 1986 and is discussed in a NOAA report entitled National Estuarine Inventory, Living Marine Resources Component, West Coast. Additional data for species in Puget Sound were made available in 1988.

Shoreline Characterization Data Base. This is a project to develop information on shoreline characteristics for each of the 92 estuaries in the National Estuarine Inventory, including Puget Sound. The project identifies 8 shoreline types, dredged channels, and dredged-material disposal sites from NOAA nautical charts and estimates of the extent of each shoreline type along the estuary. These data will eventually be integrated into an estuarine classification scheme to explore the relationships between estuarine habitats and their susceptibility to anthropogenic inputs.

NOAA INVOLVEMENT IN: ESTUARINE RESEARCH

The review and synthesis of data gathered in the assessment phase of NOAA programs helps to identify areas where additional research is needed to support management decisions. NOAA's present and planned scientific research activities in Puget Sound deal mainly with water quality and the effects of both physical transport and contaminants on living marine resources. However, through the NOAA National Sea Grant College Program, research into topics in the governing and management of estuarine areas is also supported.

Marine Environmental Research

The Pacific Marine Environmental Laboratory (PMEL) conducts interdisciplinary scientific investigations in oceanography, marine meteorology, and related subjects. Current PMEL programs focus on climate, marine observation and prediction, marine resources and marine environmental assessment. PMEL complements its research efforts through two cooperative institutes, one of which is the Joint Institute for Study of the Atmosphere and Ocean of the University of Washington.

Marine Assessment

Marine environmental assessment at PMEL emphasizes understanding the complex physical and geochemical processes that ultimately determine the health of marine systems and their ability to assimilate contaminants. Included are studies of the geochemistry of trace metals and organic compounds, distribution of hydrocarbons and synthetic organics, coastal and estuarine circulation, and transport processes. The focus of these studies is the Pacific Northwest.

Pollutant Fate and Effects

In response to the Marine Protection, Research and Sanctuaries Act of 1982 and the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978, PMEL has addressed environmental concerns associated with marine disposal and transport of municipal and industrial wastewater and the reaction of marine systems to the continuous influx of contaminants. PMEL, working in Puget Sound-Strait of Juan de Fuca, has been examining the role of suspended particulates in transporting contaminants and in removing them

from marine systems. Researchers have been investigating the mechanisms by which heavy metals and organic pollutants partition between water and particulates and are subsequently buried in sediments or advected from the estuary. As these processes become better understood, the long-term effect of chronic, low-level input of pollutants on marine resources will be assessable.

Estuarine Circulation and Transport

PMEL is adding to the knowledge base concerning the replacement of bottom water in Puget Sound. PMEL studies have shown that increased bottom-water inflow during spring and fall starts before minimum neap tides and is an effect of variations in the horizontal density gradient at the mouth of the estuary, caused by salinity variations outside the mouth.

During 1988, the study of the estuarine transport of trace metals moved from the field into the laboratory. Experiments were performed using ambient Puget Sound seawater to study the rate of conversion of dissolved manganese (Mn) to particulate Mn. The kinetic data obtained will be incorporated into a laterally averaged model of Puget Sound to provide an understanding of the role of Mn oxide surfaces relative to toxic trace metals, which in turn will lay the foundation for models attempting to describe the transport and fate of particulate-reactive toxic trace metals such as lead (Pb).

Modeling

PMEL has taken a lead role in bringing together an international group of modelers and field oceanographers to discuss the state of knowledge of physical processes in the region, ongoing and planned modeling efforts, and potential collaboration. Among the models PMEL has developed for its research in Puget Sound are a turbulence closure model, a channel tide model, and a laterally averaged hydrodynamic model.

Fisheries

Scientists from the Northwest Fisheries Center, working in cooperation with researchers and managers in NOAA and other agencies, have played an important role in understanding the impacts of pollution on living marine resources. They have also provided the scientific information required for making decisions relating to conservation, management and development of marine fishery resources, and for the protection of marine mammals and endangered species.

Biological Effects of Pollution

For the last decade NOAA scientists in the Northwest Fisheries Center have been investigating the effects of pollution on marine fish and shellfish in Puget Sound. Beginning in the 1970's the NOAA team initiated surveys of most of the bays and waterways near population centers in the Sound. This work has had a profound effect on how pollution problems in the Sound are viewed and studied.

Researchers from the Northwest Fisheries Center have studied the nature and extent of pollution, and its biological effects, at 20 sites along the Pacific coast, including Puget Sound. A portion of this work was conducted as part of the Benthic Surveillance Project of NOAA's National Status and Trends Program (see p. 8). Employing uniform sampling procedures and state-of-the-art analytical methods, a comprehensive data base was developed which included detailed information on the distribution of a variety of chemical contaminants. These contaminants included selected aromatic hydrocarbons, polychlorinated biphenyls, organochlorine insecticides, and metals in surface sediments and in liver tissue, bile, and stomach contents of selected bottom-feeding fish. Also documented were the prevalences of a variety of presumptive pollution-related liver and kidney lesions in the same target fish. Northwest Fisheries Center scientists have also identified additional sensitive chemical and biological indicators of pollutant exposure for use in assessing environmental quality of estuarine coastal areas. For example, data collected from field and laboratory studies demonstrated that ovarian maturation in female English sole residing in polluted areas was inhibited and fish that did mature often failed to spawn.

Other studies undertaken at the Northwest Fisheries Center have led to significant advances in methodology in analyses of organic contaminants in sediments and in tissues of marine fish and invertebrates and the development of biomarkers. These include: assessment of the uptake and effects of toxic chemicals in estuaries on downstream juvenile salmon; development of analytical methods for measuring tributyltins and surveys of tributyltin contamination in marine sediment and biota; development of biomarkers of early biochemical changes (e.g., DNA damage) in

Inventory of Living Marine Resources

fish due to exposure to toxic chemicals; and development of bioassays for measuring the sublethal toxic effects of contaminated marine sediment.

Data on the abundance, distribution and life histories of living marine resources residing in, or depending on, West Coast estuaries, including Puget Sound, are compiled by Northwest Fisheries Center biologists as part of NOAA's Living Marine Resources Program (see p. 13). To date, information has been collected and synthesized for 47 species of fish and shellfish in 32 West Coast estuaries.

Sea Grant

The National Sea Grant College Program is the extramural research and technology transfer arm of NOAA's Office of Oceanic and Atmospheric Research. The University of Washington is one of the network of 29 university programs that conduct research, education and training, and advisory services projects. Among the research projects currently being funded by Washington Sea Grant that specifically deal with Puget Sound are a study of noxious phytoplankton blooms and marine salmon culture, modeling tidal circulation and transport in the central Sound, and models of water-quality governance. The findings from other supported research will also be significant to understanding species or processes in the Sound.

Washington Sea Grant has also commissioned a series of books to provide citizens and government agencies with useful information on various aspects of Puget Sound. Seven titles in the series are available at libraries and from the University of Washington Press, while an eighth title, on commercial fishes, is in preparation. The authors, dates of publication and titles of the published works are:

- Angell, T. and K. C. Balcomb III, 1982. Marine Birds and Mammals of Puget Sound.
Bish, R. L., 1982. Governing Puget Sound.
Burns, R., 1985. The Shape and Form of Puget Sound.
Chasan, D.J., 1981. The Water Link: A History of Puget Sound.
Cheney, D. P. and T. F. Mumford, Jr., 1986. Shellfish and Seaweed Harvests of Puget Sound.
Downing, J., 1983. The Coast of Puget Sound: Its Processes and Development.
Strickland, R.M., 1983. The Fertile Fjord: Plankton in Puget Sound.

Library Services

Administered by the National Oceanographic Data Center of the National Environmental, Satellite, Data, and Information Service, the NOAA Library in the Western Regional Center in Seattle contains information and source materials which support the research of all of NOAA's major components in the region. The collection includes materials on physical and coastal oceanography, marine pollution, geochemistry and marine meteorology. There are over 9,000 books and technical reports in the collection, 41 microfilm periodicals and 230 current serial titles.

West Coast Fleet

The Pacific Marine Center, located in Seattle, supports NOAA's West Coast fleet of research and survey vessels. Nine of the twelve ships of the NOAA West Coast fleet have their port on Lake Union. These vessels are the working platforms used by various NOAA components and academic institutions for hydrographic and bathymetric surveying and conducting oceanographic and fishery research throughout the Pacific Ocean.

NOAA INVOLVEMENT IN: ESTUARINE MANAGEMENT

Coastal Zone Management

NOAA is an active participant in dealing with the marine environmental problems in the Sound. Having completed the assessment and research phases of its scientific missions, the agency, by virtue of its legislated responsibilities, participates in activities which bear on the management of the estuary and the coordination of information and activities which may affect that management. NOAA's programs encourage wise management of the Puget Sound estuarine resources. NOAA administers programs and grants that help manage marine fisheries, protect valuable marine and estuarine habitats, and balance coastal development and conservation activities. In addition, NOAA personnel and offices engage in a variety of coordination and advisory activities.

The NOAA National Ocean Service's Office of Ocean and Coastal Resource Management administers three programs authorized by the Coastal Zone Management Act. These are the Coastal Zone Management Program, the Coastal Zone Management Interstate Grants, and the National Estuarine Research Reserve System. Coastal zone management programs are comprehensive State resource management programs, developed with technical assistance from NOAA, and approved by the U.S. Secretary of Commerce. Twenty-nine State and territorial coastal programs have been approved, among them, the State of Washington.

Coastal management programs recognize that estuaries and related wetlands are complex natural systems which are an integral part of the value of the coastal zone. These programs provide practical, day-to-day management and improvement of estuarine and nearshore coastal resources. Program activities include: habitat protection through permitting and reduction of nonpoint source pollution by both structural and land-use control means; habitat restoration; development of site-specific land and water management plans; and coordination of Federal, State, and local governments and resources agencies. A major goal of coastal management is to preserve important estuarine and wetlands areas through acquisition or dedication, or to protect them by

Habitat Conservation Policy

minimizing the adverse impacts from coastal activities. NOAA has participated in developing the Washington Coastal Management Program and implementing its application in Puget Sound. To carry out its responsibilities under the Puget Sound Water Quality Management Plan, the Program is utilizing 1988 Coastal Zone Management grant funds to complete and implement State watershed plans for the protection of both commercial and recreational shellfish resources.

The National Marine Fisheries Service (NMFS) in 1983 adopted its Habitat Conservation Policy. This policy emphasizes the importance of habitat conservation for management of fishery resources; calls for improved coordination of NMFS management and research activities; and directs the agency to work more closely with partners and constituents.

NOAA's Habitat Conservation Policy is vigorously applied in Puget Sound by the Northwest Fisheries Center. The policy encourages greater participation by the Regional Fishery Management Councils and State fishery agencies in habitat conservation. The Policy contains twelve implementation strategies which include: assisting the State of Washington in managing anadromous fishery habitats; aiding developers in pre-permit application planning; and communicating habitat conservation information to the public. Pre-application permitting has accelerated the permit process by exposing potential habitat impacts early. NOAA staff also recommend modification in the project design that will reduce adverse impacts and, therefore, save the applicant time and money.

Review and Participation

NOAA scientists actively participate in the Environmental Protection Agency's Puget Sound Estuary Program (PSEP). PSEP combines a near-term search for solutions to current problems, together with longer-term research and monitoring, to improve predictive capabilities. PSEP was created to strengthen the collective regulatory, research, and resource management efforts of the many agencies having responsibilities in the Sound. NOAA is also represented on the Monitoring and Research Committees of the Water Quality Authority.

Many of the individual components of NOAA are frequently called upon to use their expertise in reviewing and making recommendations for action on

**NOAA INFORMATION ASSISTANCE
IN THE PUGET SOUND REGION**

General Queries:

Jean Davis
Constituent Affairs Specialist
Office of Legislative Affairs
Bin C15700/NOAA Bldg. 1
7600 Sand Point Way, NE
Seattle, WA 98115-0070
(206) 526-6725
(FTS) 392-6725

Martha Thayer
NOAA Seattle Library
National Oceanographic Data Center
Bin C15700/NOAA Bldg. 3
7600 Sand Point Way, NE
Seattle, WA 98115-0070
(206) 526-6241
(FTS) 392-6241

Database Queries:

Sidney Stillwaugh
Liaison Officer
National Oceanographic Data Center
Bin C15700/NOAA Bldg. 1
7600 Sand Point Way, NE
Seattle, WA 98115-0070
(206) 526-6263
(FTS) 392-6263