Coastal resource managers in the Pacific Northwest face a suite of issues. Some are common to managers in Washington, Oregon, and northern California but may not require a uniform solution across state lines. Some issues in common are control of shellfish harvest (both recreational and commercial), public access to estuarine waters and beaches, disposal of dredged materials, control of nonpoint source pollution, and other water quality issues. Other issues, such as control of invasive nonnative species in estuarine waters and marine oil spill response, are not only held in common but shared between or among the states and require joint or coordinated programs or policies.

Seven management topics or issues that are either common or shared among the states and agencies of the Pacific Northwest are discussed in this chapter. The topics were chosen primarily for their timeliness and their relevance to PNCERS research.

Sources: Hildreth et al., 1989; Hildreth, 1991

Managing the recreational use of estuarine resources is approached slightly differently in each state. For example, recreational harvest of shellfish is closely regulated in Washington and tracked through permits, while in Oregon no permits are required and recreational harvest is not formally reported. Common management issues related to recreational use of estuaries are physical access to recreational resources (that is, boating facilities, shoreline availability), public health concerns (are the resources safe to eat?), and user conflicts. From a technical
perspective, other common concerns are monitoring recreational use and tracking recreational harvest.

**Clamming**

**Washington**

Washington’s approach to recreational shellfish harvest management has changed significantly over the years. For example, open season for razor clams, once nine months long, with digging permitted every day, currently runs for as few as 15 to 35 days of harvest a year. Each beach is managed as a separate entity with individual open seasons, whereas previously all the major beaches on the coast had the same seasons. Harvest seasons are established by the Washington Department of Fish and Wildlife based on detailed population analyses, tribal allocation (the Quinault Tribe at Grays Harbor, for example), and testing for marine toxins by the Washington Department of Health Recreational Shellfish Program. Additionally, socioeconomic concerns are taken into consideration and public meetings are held to collect input.

**Oregon**

Before September 1993, the Oregon Health Division was responsible for opening and closing bays to recreational and commercial harvest. That responsibility now rests with the Oregon Department of Agriculture. Oregon’s major bays are classified as “conditionally approved” for shellfish harvest, pending monthly monitoring of water quality and shellfish condition under Interstate Shellfish Sanitation Program guidelines. Cooperative monitoring efforts have been coor-
ordinated to ensure that this frequency is met and to conduct intensive and sanitary surveys.

The Oregon Department of Environmental Quality periodically samples water in the three Oregon estuaries where most of the commercial and recreational shellfish harvesting occurs. Tillamook Bay is sampled 10 times a year, Yaquina Bay once a year, and Coos Bay, including South Slough, 5 times a year. The state Department of Agriculture and county health departments monitor these bays in months when the Department of Environmental Quality is not monitoring. The Department of Environmental Quality also monitors water quality in the Umpqua, Nehalem, and Netarts Bays on a monthly basis.

No licenses or permits are required for recreational shellfish harvest in Oregon.

**Crabbing**

**Harvest Regulations—Washington**

As with clams, a license is required for recreational harvest of crabs in Washington. Shellfish (and seaweed) may not be taken from private beaches without permission of the owner or lessee. (Most of Puget Sound and Hood Canal beaches are privately owned.) On public beaches, harvest must be within public beach boundaries. Daily limits apply for all public beaches and all shellfish. Private tideland owners and lessees are exempt from personal daily use limits when taking clams, oysters, and shellfish from their own tidelands.

Recreational harvest of Dungeness and red rock crab is open year-round (except Puget Sound) for ring nets, star traps, collection by hand, dip nets, SCUBA, or any hand-held instrument that will not penetrate the shell. Pot seasons vary, depending on location, and daily limits vary, depending on species and area.

Recreational crabbers are required to record their catch of Dungeness crab in much the same way that those who catch salmon or halibut do. The reporting requirement for Dungeness crab is designed to give state fisheries managers a more accurate picture of the recreational harvest and provide for more equitable allocation among sport, commercial, and tribal fishers.

**Harvest Regulations—Oregon**

No licenses or permits are required to harvest crabs (or other shellfish, except abalone) in the “marine zone,” which includes the marine waters of the Pacific Ocean, coastal bays, and beaches. Waters are open all year, 24 hours a day, except in special closed areas (for example, intertidal marine gardens, subtidal research reserves, intertidal research reserves, habitat refuges) and shellfish preserves. Both Yaquina Bay and Netarts Bay have been designated as shellfish preserves. Harvesting or collecting clams is prohibited in posted shellfish preserves, al-
though special collection permits may be issued for scientific and educational purposes.

Crabs may be taken using crab rings, pots, or baited lines (limited to three per person). Dungeness crabs may be taken in bays, estuaries, beaches, tide pools, piers, and jetties all year. Ocean harvest of Dungeness crab is closed August 15 to November 30.

**Harvest Regulations—Humboldt Bay, California**

Recreational harvest of Dungeness crab (*Cancer magister*) in Humboldt County is open from about the first of December to the end of July. Commercial harvest of Dungeness crab is prohibited in Humboldt Bay.

**Public Access and Recreation**

Public access to coastal waters, beaches, and shores for recreation is recognized nationally as one of the principal issues for coastal management programs. The National Coastal Zone Management Act, as amended, encourages states to adopt coastal management programs that, among other things, will “provide for . . . public access to the coast for recreation purposes.”

California’s 1976 Coastal Act protects access rights to coastal beaches and tidal lands, bays, harbors, inlets, and estuaries, and the right to public access is codified in the state constitution. Additionally, at the local level, California’s coastal program is structured so that state Coastal Act policies designed to protect and enhance public access are implemented through the local coastal programs.

In Washington, efforts to increase and broaden public access are paid for through the Aquatic Lands Enhancement Account, a special fund derived from income produced on state-owned aquatic lands. The Washington Department of Natural Resources uses this income to help local governments purchase beach access points, build boat ramps, and create shoreline walks, boardwalks, and other facilities on the beach. Washington’s Seashore Conservation Act of 1967 (amended in 1988) explicitly dedicates Washington State ocean beaches to public recreation.

With 2,200 miles of inland marine shoreline, Puget Sound has public access sites occupying some 425 miles of shoreline, or about 19 percent. However, since only half of that public shore has access from the uplands, the public has real access to about 10 percent of the inland marine waters of Puget Sound.

In Oregon, the public’s right to beach access for recreational purposes is established in state law (the Beach Bill). This law specifies that along the ocean shore, the “wet sand beach” up to the ordinary high tide line belongs to the public and that, in addition, the public has a perpetual recreational easement to use the “dry sand beach” landward
of ordinary high tide to a “line of vegetation” specified in law or the 16-foot elevation line. The recreational easement applies even where the dry sand area is privately owned by upland property owners. This right is managed and protected by the Oregon Parks and Recreation Department. The Division of State Lands shares management jurisdiction over beaches, including estuaries.

Public access to beaches and waters of Oregon estuaries is less clear-cut and is provided for primarily through the statewide planning program goals and guidelines and through local comprehensive plans and implementing ordinances that are required to ensure public access.

Commercial oyster culture is a significant source of income for estuaries in each of the three states. Willapa Bay in Washington is one of the leading oyster producers in the nation. Tillamook Bay, Coos Bay, Winchester Bay, Yaquina Bay, and Netarts Bay are significant producers for Oregon. Humboldt Bay produces 95 percent of the oysters sold in California.

Commercial growers and resource managers in Washington, Oregon, and California have similar concerns: water quality, threatened habitat, and conflicts over cultivation practices and their environmental effects, such as the introduction of nonnative species and the use of pesticides to control ghost shrimp. Each state has developed its own approach to dealing with these problems.

**Washington**

Washington State is the leading producer of farmed shellfish in the United States. The annual wholesale value of commercial clam, oyster, and mussel production in Puget Sound alone is between $30 and $50 million. In 1995, oysters contributed approximately $3.3 million in Grays Harbor County (Grays Harbor) and $12 million in Pacific County (Willapa Bay). Nearly 10,000 acres of privately owned or leased tidelands in Willapa Bay produce about 3 to 4 million pounds a year—about 15 percent of the national oyster crop, most of which is shipped as freshly opened (shucked) oysters.

**Oregon**

Commercial aquaculture along coastal Oregon is devoted solely to the cultivation of mollusks, chiefly oysters and mussels, the latter of which are grown only in Winchester Bay on the Umpqua River. Currently, oysters are under cultivation on Coos Bay, Winchester Bay, Yaquina Bay, Tillamook Bay, and Netarts Bay on privately held lands and state-leased lands.
Estuary Management in the Pacific Northwest

Acreage of state-leased lands in Oregon is reported as follows:

- Tillamook: 4,461 acres
- Netarts: 213 acres
- Yaquina: 519 acres
- Coos: 240 acres
- Total: 5,433 acres

Until the early 1990s, oysters were produced primarily on state-leased lands. Acreage of port- and county-leased lands was not available for all estuaries. One report estimates there are 1,585 acres of port and county oyster-growing land in Coos Bay that produced 38,086 gallons/333,253 pounds of oysters in 1995.

California

Oyster growing is California’s oldest aquaculture industry. What began in the early 1850s as a transplant seed industry is today a valuable asset to the state’s economy. Current production is primarily in Humboldt Bay (Humboldt County), Drakes Estero (Marin County), Tomales Bay (Marin County), and Morrow Bay (San Luis Obispo County). The industry grows a variety of species, including Pacific, Kumamoto, European, and eastern oysters. The California Department of Fish and Game reports that 95 percent of the oysters sold in California are grown by two or three growers in Humboldt Bay.

Almost all of the oysters grown in California (98 percent) are Pacific oysters produced from hatcheries in Washington and Oregon and several small specialty hatcheries in California. Other varieties produced in California include the Miyagi variety of the Pacific oyster.

<table>
<thead>
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<th>Year</th>
<th>Grays Harbor</th>
<th>Willapa Bay</th>
<th>Washington State total (includes Puget Sound)</th>
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<td>Gallons</td>
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(Crassostrea gigas), the Pacific Kumamoto oyster (Crassostrea sikamea),
the European oyster (Ostrea edulis), and the eastern oyster (Crassostrea
virginica).

Oyster-growing areas are leased from the state through the Fish
and Game Commission or from local jurisdictions that have been
granted authority over state water bottoms.

Oil spills can have dramatic and significant adverse effects within es-
tuaries because of the high natural resource values, the broad areas of
potential exposure across mudflats and marshes, the low-energy wa-
ter environment, and the complex shoreline. Over time, a wide range
of technical measures to combat spills has become available, including
a variety of booms to prevent spread of surface oils into sensitive areas
and to concentrate and collect oil from the water’s surface for treat-
ment by relatively nontoxic chemical dispersants. However, estuary
managers have also learned that anticipation, contingency planning,
and preparedness are essential to prevent and reduce the damage.
Federal
The primary federal laws that address oil spills are the Clean Water Act; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Oil Spill Prevention and Response Act of 1990.

Under the National Contingency Plan, the EPA is the lead federal agency for oil spills occurring in inland waters, and the United States Coast Guard is the lead federal agency for spills in coastal waters and deepwater ports. The EPA requires owners and operators of certain oil spill facilities to prepare and implement spill, prevention, control, and counter-measures plans. The EPA conducts facility inspections and enforces the oil spill liability and penalty provisions of the Oil Spill Prevention Act. Under the federal Clean Water Act, the party causing a petroleum spill is responsible for cleanup costs.

Washington
The Department of Ecology is the lead agency for the state program managing spills. Its responsibilities include spill prevention, preparedness, response, and restoration.

Oregon
The Department of Environmental Quality (DEQ) is the lead agency for oil spills. Oregon’s prevention and preparedness program includes the following elements.

Vessel plans: Vessels traveling the Columbia and Willamette Rivers are required to carry spill response plans that provide clear instructions for dealing with a spill. DEQ reviews and approves the plans.
Facility plans: Certain facilities are also required to have spill response plans that are reviewed and approved by DEQ. There are 22 covered facilities in Oregon, mostly in the Portland area.

Geographic response plans: Geographic response plans detail geographic information, equipment requirements, location of resources, and the equipment and preferred response activities needed for particular sections of the Willamette and Columbia Rivers and the coast. Each plan is for a specific river segment and includes identification of aquatic and wildlife habitats and water withdrawal points and uses, resource protection and spill containment strategies, maps, location of necessary materials, and other information. Geographic response plans are developed cooperatively by government agencies, river users, and response providers. Some sections of the rivers do not yet have geographic response plans.

Drills: DEQ attends scheduled response and cleanup exercises as an observer or active participant.

California

The Office of Spill Prevention and Response, which is housed within the Department Fish and Game, is the lead state agency charged with oil spill prevention and response within California’s marine environment. The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990 established the Office of Spill Prevention and Response and provides the agency administrator with substantial authority to direct spill response, cleanup, and activities for assessing damage to natural resources.

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act also created the Marine Facilities Division in the California State Lands Commission. The goals of the Marine Facilities Division are to ensure the safe and pollution-free transfer of crude oil and product between tank vessels and land-based facilities; to adopt marine terminal regulations that ensure the best achievable protection of public health and safety and the environment; and to coordinate with federal, state, and local agencies having similar goals, to maximize the use of limited agency resources while preventing overlap.

Estuaries are important ports for ships that transport a variety of goods into and out of the region. The relatively shallow channels in Pacific Northwest estuaries require ongoing dredging to maintain adequate channel depth, which can lead to issues of placement or disposal of the
dredged material. The following federal laws and agencies pertain to dredged material:

- The Clean Water Act governs discharges of dredged material into “waters of the United States,” defined as all waters landward of the baseline of the territorial sea. Section 404 of the act requires a permit for the discharge of dredged or fill material into U.S. waters. Section 401 requires state certification that any federally permitted project discharging into U.S. waters will not violate state water quality standards, which are based on federal water quality criteria.

- The National Environmental Policy Act usually functions as an umbrella authority assuring that all applicable environmental requirements are complied with for federal dredging projects.

- A Rivers and Harbors Act Section 10 permit is required for any dredging activity in navigable waters, regardless of the location of the disposal site.

- On the federal level, the Army Corps of Engineers and the EPA share the responsibility for regulating the discharge of dredged material. The EPA retains oversight authority regarding the Corps’ decision to issue a permit and may veto permit approval if it concludes that the discharge of dredged or fill materials would have an “unacceptable adverse effect” on municipal water supplies, shellfish beds and fisheries, wildlife, or recreational areas.
**Washington**

Review and approval of dredging activities in Washington State is managed under policies and guidelines established by a coordinated state and federal consortium designated as the Dredged Material Management Program. This program consists of representatives from two state agencies (the Department of Ecology and the Department of Natural Resources) and two federal agencies (the U.S. Army Corps of Engineers and the EPA). The policies and guidelines under which the Dredged Material Management Program manages dredging activities are contained in guidance manuals specific to discrete water bodies—for example, Puget Sound, Grays Harbor, Willapa Bay, and the lower Columbia River.

In Washington State, the Departments of Ecology, Natural Resources, and Fish and Wildlife share the regulation of dredged material. The Department of Ecology is authorized to certify under the Clean Water Act Section 401 that a proposed discharge will comply with state water quality standards. The Department of Ecology may apply any requirement or policy of state law that protects aquatic habitat. Where the state has no jurisdiction—for example, tribal lands and military installations—the EPA provides Section 401 certification.

**Columbia River**

Dredging projects in the Columbia River estuary are particularly challenging because of the large size and complex jurisdictional relationships between two states, federal agencies, and local governments. The U.S. Army Corps of Engineers maintains the federal navigational channel in the Columbia River from the mouth of the Columbia (river mile -3) upriver to McNary Dam (river mile 292). Disposal of dredged materials is carried out within the estuary by placement in designated sites (for example, Rice Island) and in the “flow lane,” as well as in the ocean.

**Oregon**

As in Washington, the EPA regulates ocean disposal of dredged material. The Oregon Division of State Lands administers the state’s Removal-Fill Law that regulates dredging and dredged material disposal in state waters and sets strict standards for resource protection. The Division of State Lands also administers the requirement for mitigation of dredge or fill in intertidal areas as called for in each coastal comprehensive plan.

Local government shoreland zoning ordinances, provided for in the comprehensive plans, dictate that when dredging or filling is permitted in tidal marshes or flats, its “effects must be offset by creating or improving another part of the estuary. Mitigation and restoration
sites are lands that have potential, if modified, to create, restore or enhance biological or habitat values. Breaching of dikes to restore tidal action is a typical mitigation technique.”

The Department of Environmental Quality is the agency for certifying under the Clean Water Act’s Section 401 that a proposed discharge will comply with state water quality standards. The department certifies and may use any requirement or policy of state law that protects aquatic habitat to condition the Section 401 certification.

**California**

Port development in California (including dredging to maintain ship channels or filling water areas to increase land for port terminals) is subject to the regulatory, planning, or technical consultation authorities of the following agencies:

- California Coastal Commission (California Coastal Act; Coastal Zone Management Act)
- California Department of Fish and Game (California Fish and Game Code)
- State Coastal Conservancy (Public Resources Code, Division 21; Coastal Zone Management Act)
- State Water Resources Control Board and regional water quality control boards (Clean Water Act; Porter-Cologne Water Quality Control Act)
- State Lands Commission (Public Resources Code)

The Coastal Conservancy is designated as the state’s coordinator for urban waterfront development. In this role, and through its resource enhancement and public access programs, the Coastal Conservancy has been involved in port affairs, including mitigating the impacts of dredging on fish and wildlife, developing facilities for commercial fishing, and working to obtain public access to coastal waters through port properties. The Coastal Conservancy has developed a regional mitigation bank along Humboldt Bay to offset the impacts from an industrial area.

**Federal**

The Clean Water Act of 1972 and the Safe Drinking Water Act of 1974 are the main statutes regulating water quality in the United States. Both are administered by the EPA. Recent amendments to both acts, including the creation of the National Estuary Program as part of the 1987 Clean Water Act amendments, further direct the EPA and state agencies to manage watersheds in a more comprehensive manner and im-
prove interagency coordination. This includes working with other state agencies to identify and assess nonpoint sources of pollution.

Around some estuaries of the Pacific Northwest, activities that significantly affect water quality, such as livestock grazing, forest practices, and agriculture, are regulated by other agencies, such as the Bureau of Land Management, the U.S. Forest Service, and the U.S. Department of Agriculture.

**Washington**

In Washington State, the Washington Department of Ecology is the lead agency responsible for programs delegated under the federal Clean Water Act. The Department of Ecology establishes state water quality standards apart from federal EPA standards, issues permits for point-source discharge activities, certifies federally licensed and permitted activities to ensure compliance with state standards, identifies water quality limited water bodies (303[d] list), and establishes total maximum daily loads for pollutants violating state standards on the 303(d) list.

The Washington Department of Health has assumed primary enforcement and monitoring responsibility under the federal Safe Drinking Water Act. In implementing this program, the department depends on regulations established by the EPA.

Water quality in Washington State is regulated and managed primarily through the Water Pollution Control Act, the Dairy Nutrient Management Act, the Puget Sound Water Quality Protection Act, and the Shellfish Protection Districts Act. Water quality is also addressed in the Shoreline Management Act.
Oregon

The Department of Environmental Quality is the lead agency responsible for programs delegated under the federal Clean Water Act. DEQ certifies that federally licensed and permitted activities comply with state water quality criteria under Section 401 of the Clean Water Act and administers the National Pollutant Discharge Elimination System’s (Sections 301 and 402) discharge permit program. Under this program, the Department of Environmental Quality develops water quality standards that protect specified beneficial uses for water bodies and identifies waters that do not meet state water quality standards (303[d] list).

The Department of Environmental Quality also works with the Oregon Department of Forestry to minimize adverse impacts from forestry practices on water quality and with the Oregon Department of Agriculture to address impacts to water quality from agricultural prac-

tices. This cooperative effort is particularly important in an area such as Tillamook Bay, where approximately 40 square miles (104 square kilometers) of agricultural lowland supports about 28,600 dairy cattle.

California

The State Water Resources Control Board and the nine regional water quality control boards have primary responsibility in California for the protection of water quality.

The Porter-Cologne Water Quality Control Act, which established
nine regional boards and the state board, is the principal law governing water quality regulation in California. The act applies to surface waters, wetlands, and groundwater and to both point and nonpoint sources of pollution. The following are its main provisions:

- The quality of all the waters of California shall be protected.
- All activities and factors affecting the quality of water shall be regulated to attain the highest water quality within reason.
- California must be prepared to exercise its full power and jurisdiction to protect the quality of water in the state from degradation.

An implementation plan is required under California’s Porter-Co-Logne Water Quality Control Act and 40 CFR §130.6 for inclusion in the Basin Plan. The first sediment total maximum daily load and implementation plan adopted by the North Coast Regional Water Board was for the 73,223-acre Garcia River watershed in Mendocino. With the exception of the sediment-reduction effectiveness monitoring, as described in the Garcia Implementation Plan (Garcia Monitoring Plan), monitoring by landowners is on a voluntary basis.

The Clean Water Act of 1972 gave the State Water Resources Control Board and the EPA the authority to establish total maximum daily load under Section 303(d).

Nonpoint Source Pollution

Estuaries are especially vulnerable to nonpoint source pollution that can result from water-based or land use activities, including atmospheric deposition; surface water runoff from agricultural lands, urban areas, and forest lands; subsurface or underground sources; and discharges from boats or other marine vessels. Nonpoint source pollution may include sediment, chemicals, toxics, nutrients, debris, and pathogens that rainwater and snowmelt pick up and carry into the nearest body of water. Although degradation from any single activity or site usually will not violate water quality standards, the cumulative effects of all the activities in a basin can be significant and result in water quality violations.

Federal

Congress amended the Clean Water Act in 1987 to establish the section 319 Nonpoint Source Management Program to help focus state and local nonpoint source efforts. Under Section 319, state, territories, and Indian tribes receive grant money that support a wide variety of
activities, including technical and financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects.

Also added to the 1987 Clean Water Act reauthorization was Section 518. This section authorized the EPA to treat federally recognized Indian tribes in the same manner as states and to grant up to one-third of 1 percent of national 319 grant funds to tribes.

The Coastal Nonpoint Pollution Control Program was adopted as part of the 1990 amendments to the Coastal Zone Management Act (Coastal Zone Act Reauthorization Amendments, Section 6217). Jointly administered by the EPA and NOAA, the program is intended to protect coastal waters from nonpoint source pollution. With the program, Congress directed states with approved coastal programs to implement nonpoint source pollution control measures to protect coastal waters.

A central purpose of the Reauthorization Amendments Section 6217 is (1) to prompt coastal states to evaluate how their nonpoint source water pollution control programs are protecting coastal waters, (2) to enhance cooperation between land and water use management agencies, and (3) to ensure that enforceable mechanisms exist where voluntary efforts are not sufficient to restore and protect coastal waters.

The Coastal Nonpoint Pollution Control Program requires that states implement an extensive set of nonpoint source control management measures addressing such activities as forestry and agricultural practices, marinas, urban activities, hydromodification, and wetland protection. States must implement measures where necessary to meet water quality standards.

**Washington**

Washington’s Department of Ecology is the lead agency for nonpoint water pollution prevention. WDOE has enforcement capability under the state Water Pollution Control Act when needed for correcting particularly difficult nonpoint water pollution problems. Rules to protect water quality from forest practices are jointly adopted by the Department of Ecology and the Forest Practices Board.

Using Section 319 funds, Washington has organized a cooperative watershed-based forest management program. To reduce stream sediment, the program has modified some areas of timber harvest to leave a wider stream buffer, take a smaller percentage of trees, provide sediment traps, and implement erosion control measures.

**Oregon**

The Department of Environmental Quality is responsible for maintaining water quality in state waters. The department regulates most activities that would affect water quality, including construction of new
sewage treatment plants. It is also responsible for regulating nonpoint source pollution (such as agricultural runoff) and hazardous waste disposal.

The Coastal Nonpoint Pollution Control Program is a comprehensive control program for nonpoint sources of pollution that encompasses the entire range of coastal salmonid species in Oregon. Implementation involves a host of state agencies, including the Department of Land Conservation and Development, the Department of Environmental Quality, the Oregon Department of Agriculture, the Oregon Department of Forestry, the Division of State Lands, the Oregon Department of Fish and Wildlife, the Water Resources Department, the Oregon Department of Transportation, and the State Marine Board. Management measures included in the Coastal Nonpoint Pollution Control Program are comprehensive in scope, covering agriculture, forestry, urban areas, marinas and recreational boating, channel modification, dams, stream bank and shoreline erosion, wetlands and riparian zones, and identification and protection of critical coastal areas.

Oregon has identified 10 program elements that categorize the efforts and capabilities necessary for an effective program of watershed management and control of nonpoint pollution: standards, assessment, coordinated watershed planning, education, demonstration projects, technical assistance, cost-share assistance, stewardship, watershed enhancement projects, and enforcement. The state’s nonpoint pollution projects are targeted to address needs related to these 10 major program elements.

**California**

California’s Coastal Nonpoint Pollution Control Program was developed by the California Coastal Commission and the State Water Resources Control Board pursuant to Section 6217 of the Coastal Zone Act Reauthorization Amendments. The reauthorization amendments expanded the partnership between the State Water Resources Control Board and the regional water quality control boards for reducing polluted runoff to include the California Coastal Commission.

The state and regional boards have numerous nonpoint source pollution-related activities, including problem monitoring and assessment, planning, financial assistance, and regulatory and nonregulatory management. Regional water boards regulate any discharge of materials that could affect water quality under the authority of the Porter-Cologne Water Quality Act.
Aquatic nuisance species (that is, nonindigenous species, nonnative species, invasive species) pose a significant threat to the ecosystem health and economic wealth of Pacific Northwest estuaries. Invasive species management has evolved into a truly shared issue among the three states and with British Columbia because how this problem is managed in each estuary will have a significant impact on all the others.

Nonnative species can be introduced to coastal estuaries a number of ways. Organisms can “hitchhike” on boats, cars, trucks, and ships from one water body to another. Planktonic larvae can travel on ocean currents. Some species now considered invasive are thought to have arrived on the wooden hulls of ships. Other nonnative species were likely introduced in the early twentieth century as a result of the growth of the oyster industry, transported to the region in oyster seeds.

Today, the most significant pathway is through ballast water from large ships plying the ocean trade. An estimated 50,000 commercial vessels enter U.S. waters from foreign ports each year. The largest of these vessels are capable of holding between 20 and 50 million gallons of ballast water. In U.S. ports alone, ships discharge ballast water at a rate of 2.4 million gallons an hour. In a UC Davis study, ballast water sampled from 160 ships in Coos Bay, Oregon, held more than 400 species.

While invasive species number in the hundreds on the West Coast, prevention, control, and eradication efforts are directed primarily at zebra mussels, European green crab, Chinese mitten crab, and nonnative cordgrass (*Spartina*). These are priority species on many lists because of the potential economic and ecological impact that their establishment poses.

Three invasive species that are in various stages of becoming established in Pacific Northwest estuaries are *Spartina*, European green crab, and Chinese mitten crab.

**Spartina**

*Spartina* is a smooth cordgrass species that aggressively colonizes mudflats and salt marshes, displacing native plant and animal species and altering the ecological landscape by transforming mudflats into salt marshes. At least four *Spartina* species are present on the West Coast—*Spartina densiflora* (Chilean native), *Spartina alterniflora* (East Coast native), *Spartina anglica* (a hybrid English-East Coast U.S. species), and *Spartina patens* (East Coast native). *Spartina alterniflora* is present in the estuaries in Washington, Oregon, and California and is the main focus of control eradication efforts on the West Coast.
European Green Crab (*Carcinus maenas*)

*Carcinus maenas* was discovered relatively recently in Pacific Northwest coastal estuaries. Its present range on the West Coast is thought to be from Monterey Bay, California, to British Columbia, Canada. Green crabs were first found in Washington and Oregon estuaries (in Tillamook Bay, Winchester Bay [Umpqua River], Coos Bay, and Yaquina Bay) in 1998 and in British Columbia in 1999. Research data strongly suggest that the introductions to Oregon, Washington, and British Columbia occurred through larval transport via strong ocean currents associated with the unusually large El Niño events of 1997 and 1998.

Chinese Mitten Crab (*Eriocheir spp.*)

Chinese mitten crabs are burrowing crabs native to the Yellow Sea estuaries and coastal rivers of China and Japan. They live in freshwater but spawn in the sea. They were first collected by commercial shrimp trawlers in southern San Francisco Bay in 1993. Since then, mitten crabs have spread rapidly in California. In the summer of 1998, as many as 30,000 adult mitten crabs a day migrated downstream and clogged the fish filtering and trash screens at the U.S. Bureau of Reclamation pump stations in Tracy, California, which provide water for southern California. If the crabs were to become established in the Columbia River system, managers expect a similar situation.

Federal

At present, no single federal agency has clear authority over all aspects of invasive species management. Under a 1999 executive order, however, federal agencies were required to collaborate in developing a National Invasive Species Management Plan (January 2001) that is to be biennially updated. These efforts were coordinated by the interagency Invasive Species Management Council and the council’s advisory committee. Council members include the Secretaries of State, Treasury, Defense, Interior, Agriculture, Commerce, and Transportation and the administrator of the EPA.

Regional efforts

Aquatic Nuisance Species Prevention Program

In 1999, the Bonneville Power Administration, recognizing the potential impact to its operations on the Columbia River, funded the Aquatic Nuisance Species Prevention Program with the goal of developing a coordinated plan for the Columbia River basin. The program, carried out by the Pacific States Marine Fisheries Commission, focuses on zebra mussels and Chinese mitten crab.
Columbia River Aquatic Species Nuisance Initiative
Created to address the issue of invasive species in the Columbia River, the Columbia River Aquatic Species Nuisance Initiative is a joint effort of the Ports of Portland and Astoria and Oregon Senator Ron Wyden.

Marine Invasive Species Team
The Marine Invasive Species Team, a collaboration of the Oregon and Washington Sea Grant offices, is a regionwide effort to provide managers, industry, local government, and the public access to research and expertise.

Pacific Ballast Water Group
Pacific Ballast Water Group members represent industry, state and federal government agencies, environmental groups, and others. The group, recognizing the need for cooperative efforts and a coordinated approach to ballast water management and the prevention of invasive species introduction, meets regularly to address discharge standards and specific issues that transcend traditional jurisdictional boundaries.

Western Regional Panel on Aquatic Nuisance Species
Formed under a provision of the National Invasive Species Act, the Western Regional Panel on Aquatic Nuisance species coordinates aquatic nuisance species programs and activities in the West.

Washington
Washington State’s Aquatic Nuisance Species Management Plan focuses on prevention of accidental introductions and also addresses intentional introduction for aquacultural, commercial, or recreational purposes. Aimed at implementing proven, feasible, cost-effective management practices, the plan depends on private, public, tribal government, and local government cooperation and federal funding through cost-sharing provisions of the 1996 National Invasive Species Act. In the plan, the Washington Department of Fish and Wildlife is named as the lead agency. Priority species include the European green crab, zebra mussel, Chinese mitten crab, Spartina alterniflora, and Spartina anglica.

Until recently, ballast water discharge was regarded as a federal matter in Washington State and was regulated under the Lacey Act. In the 2000 regular session the state legislature passed Substitute House Bill 2466, which requires ships to comply with the U.S. Coast Guard ballast water management program by July 2002 to control the introduction and spread of invasive species in Washington waters.
Oregon

The Oregon Aquatic Nuisance Species Management Plan, prepared in June 2001 by the Center for Lakes and Reservoirs at Portland State University with input from a variety of agencies and interest groups, establishes a system for ranking invasive species and lists a broad array of prevention, monitoring, control, educational, and research strategies. This comprehensive program envisions an annual implementation cost of $3 million.

The plan is based on a species classification system:

Class 1: Species not present in Oregon, species reported in limited populations, or species with high potential to invade or report. Includes Spartina alterniflora and Chinese mitten crab (Eriocherio spp.), which have been reported in limited populations.

Class 2: Species whose impact may be mitigated or controlled with appropriate management; species managed through actions that involve mitigation of impact, control of population size, and prevention of dispersal to other water bodies.

Class 3: Species that are established throughout Oregon with impacts but with no available or appropriate management techniques; species with low potential to invade or establish in Oregon. These species warrant future evaluation and research to ascertain the potential impacts, possible control, and dispersal prevention. Includes European green crab.

The Oregon plan is organized around five objectives:

Objective 1: Coordinate and implement a comprehensive management plan through the establishment of an Invasive Species Council

Objective 2: Prevent the introduction of aquatic nuisance species into Oregon by conducting risk assessment, identifying pathways, monitoring, and implementing a ballast water management program

Objective 3: Detect, monitor, and eradicate pioneering aquatic species

Objective 4: Where feasible, control established nonindigenous species that have significant impacts

Objective 5: Increase awareness about aquatic nuisance species risks and impacts
California

San Francisco Bay, a major national and international shipping port, is possibly the most invaded estuary in the world. It is the focus of control and management efforts in California and a living laboratory for invasive species scientists worldwide. A recent study on shipping patterns reported that nearly 4.6 million metric tons of ballast water were discharged into California ports between January 1 and August 31, 2000. Almost half of the ships discharging in California waters during that same period originated in Far Eastern ports (Japan, China, North and South Korea); 30 percent came from Mexican ports.

Invasive species research responsibilities beyond the ballast water program are shared by the California State Lands Commission, the California Department of Fish and Game, the State Water Resources Control Board, and the Board of Equalization. Among these responsibilities is research on the extent of current invasions and potential long-term management and control solutions.

The California Department of Fish and Game, Office of Spill Prevention and Response is responsible for conducting research to determine the location and extent of nuisance aquatic species populations in coastal and estuarine waters of the state.

The California State Lands Commission is responsible for developing and implementing the state’s Ballast Water Inspection and Monitoring Program and evaluating the effectiveness of the ballast water program.

The State Water Resources Control Board is responsible for conducting studies to evaluate alternatives for treating and otherwise managing ballast water to prevent the introduction and spread of nuisance aquatic species.