

WASHINGTON'S OCEAN ACTION PLAN:

Enhancing Management of Washington State's Ocean and Outer Coasts



Volume 1: Final Report of the
Washington State Ocean Policy Work Group

**THE OFFICE OF THE GOVERNOR
OLYMPIA, WA**

DECEMBER 31, 2006



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OPWG Final Report

Editor

Jennifer Hennessey

Main contributors

Heather Ballash, Michele Culver, Kathleen Drew, Sarah Dzinbal, John Hansen, Marc Hershman, Dick Larman, and Brian Lynn.

Graphics and layout

Carey Floyd, Olympic Coast National Marine Sanctuary

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Ocean Policy Work Group Participation (January – December 2006)

OPWG Work Group Membership

Kathleen Drew – Governor’s Office (Chair)
Heather Ballash - CTED
Al Carter – Gray’s Harbor Co. Commissioner
Rep. Maralyn Chase
Michele Culver – Dept. of Fish & Wildlife
Ashley DeMoss – State Parks
Mike Doherty – Clallam Co. Commissioner
John Dohrman – Puget Sound Action Team
Sarah Dzinbal – Dept. of Natural Resources
Marc Hershman – University of Washington
Sen. Ken Jacobsen
Eric Johnson – Washington Public Ports Assoc.
Dick Larman - CTED
Brian Lynn – Dept. of Ecology
Kevin Ranker – San Juan Co. Commissioner
Jim Skalaski – OFM
Sen. Dan Swecker
Megan White – Dept. of Transportation
Stu Trefry - Washington Conservation Commission

Additional OPWG Participants

Brad Ack – Puget Sound Action Team
Phil Anderson – Dept. of Fish & Wildlife
Jacqueline Brown Miller – Governor’s Office
Leslie Emerick – Dept. of Health
Jim Fox - IAC
Doug Fricke – Washington Trollers Assoc.
George Galasso – Olympic Coast National Marine Sanctuary
Curt Gavigan – Senate Committee Services
Jennifer Hagan – Northwest Indian Fisheries Commission
Jennifer Hennessey – Dept. of Ecology
Michael Moore – Pacific Merchant Shipping Assoc.
Guy McMinds – Quinault Indian Nation
Mike Racine
Steve Robinson – Northwest Indian Fisheries Commission
Karen Terwiliger – House Democratic Caucus
Stu Trefry – Dept. of Ecology
Gordon White – Dept. of Ecology
Gary Wilburn – Senate Democratic Caucus
Jim Woods – Makah Tribe



UW School of Marine Affairs Graduate Researchers

Corrina Chase
Tyler Davis
Phebe Drinker
Amy Embree
Alex Erzen
John Hansen
Katrina Hoffman
Ruth Howell
Dianna Jones
Jennifer Kassakian
Katrina Lassiter
Kate Litle
Sarah McAvinchey
Petra MacGowan
Marnie Meyer
Theresa Mitchell
Morgan Neal
Kendra Nettleton
Mela O'Haleck
Maggie Ostdahl



Acronyms

CTED	Washington State Department of Community Trade and Economic Development
CZMA	Coastal Zone Management Act
DNR	Washington State Department of Natural Resources
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
JSOST	Joint Subcommittee on Ocean Science and Technology
NOAA	National Oceanic and Atmospheric Administration
OCNMS	Olympic Coast National Marine Sanctuary, or the Sanctuary
OFM	Office of Financial Management
OPWG	Washington State Ocean Policy Work Group
SIMOR	Subcommittee on Integrated Management of Ocean Resources
State Parks	Washington State Parks and Recreation Commission
USACE	United States Army Corps of Engineers
USCOP	United States Commission on Ocean Policy
US EPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
WDFW	Washington State Department of Fish and Wildlife



Acknowledgements

Thanks to all the members and observers on the Ocean Policy Work Group for their active participation. The University of Washington School of Marine Affairs students provided incredible assistance to work group subcommittees with their tremendous background research. In particular, many thanks go to the hard work, excellent contributions, and tireless energy of John Hansen and Professor Marc Hershman. Thanks to outreach hosts for organizing valuable outreach meetings and to the many community participants for their active involvement. The final report was greatly enhanced by the generous and exquisite layout work of the Olympic Coast National Marine Sanctuary's graphic artist, Carey Floyd. Finally, thanks to the many people who reviewed drafts of the final report and provided feedback and research guidance. Special thanks to the following people for their assistance:

Outreach Hosts

Clallam County Commissioner Mike Doherty (Forks, La Push, Neah Bay, and Port Angeles)
Mack Funk, Port of Ilwaco, and Cathy Russ, Pacific Economic Development Council (Ilwaco)
Gray Harbor County Commissioner Al Carter and Gary Nelson, Port of Grays Harbor (Westport and Ocean Shores)
San Juan County Commissioner Kevin Ranker (Friday Harbor)

Research Assistance

Department of Archaeological and Historical Preservation - Rob Whitlam
BEACH Program – Jessica Archer & Lynn Schneider
DNR - Carol Cloen, Sarah Dzinbal, & Peter Leon
Ecology - Julia Bos, Carrie Byron, Amy Jankowiak, Andrew Kolosseus, Ron McBride, Valerie Partridge, Don Bales
Makah Tribe – Nate Pamplin
Olympic Coast National Marine Sanctuary -
Barbara Blackie, George Galasso, Bob Steelquist
WDFW – Dan Ayres, Mel Stanley, Are Storm, Jennifer Whitney

Photo credits

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Executive Summary

Ocean resources are making waves in the headlines. In summer of 2006, scientists discovered an extensive collection of deep-sea corals just off Washington's coast and within the Olympic Coast National Marine Sanctuary.* Many of the corals appeared damaged or destroyed - scientists suggested fishing disturbance as a likely cause. Unfortunately, much of the news indicates troubling signs for oceans. The *Seattle Post-Intelligencer* reported that researchers conducting annual West Coast counts of seabirds, fish, and other marine animals found sea life unusually scarce in 2006 – for the second year in a row.† The *National Geographic* featured an article in July 2006 entitled, "Our Coasts in Crisis," detailing the many threats our ocean and coastal resources face. Finally, accumulating evidence suggests that Washington's outer coast is developing a periodic "dead zone" – an area of water with low oxygen that can suffocate marine life.§

Washington's character, quality of life, and economic viability rely, in part, on its outer coast and ocean resources. These majestic and significant resources maintain cultural identities, provide recreational opportunities, sustain our economy and coastal communities, inspire the general public and researchers alike, and supply valuable food. Habitats on outer coast and ocean are some of the highest quality and most diverse in the state. Our rocky coastlines, sandy beaches, inland bays, estuaries, offshore islands, and open-ocean are home to a stunning array of wildlife. Washington's outer coast and ocean are home to some of the best quality marine resources left in our state – the need to protect, understand, and manage them appropriately is of paramount importance.

- Fishery landings in Washington's outer coast ports produced over \$44 million in ex-vessel revenue in 2005.
- Oyster aquaculture in Willapa Bay and Grays Harbor accounts for over two-thirds of the state's oyster production – with a value of \$13.9 million in 2005.
- Ocean and coastal resources support a wide array of recreational and cultural activities that attract numerous tourists. Over half of the state's residents visit a beach at least annually. Tourism is one of the largest employers on the outer coast, providing between 9 and 17 percent of the jobs.
- In 2005, over 10,000 ships, tankers, barges, or carriers passed through the Strait of Juan de Fuca.

* Welch, Craig. June 27, 2006. "Colorful coral seabeds a 'breathtaking' discovery." *Seattle Times*.

† Kay, J. *San Francisco Chronicle*. In: June 30, 2006. "Annual count shows scarcity of sea life." *Seattle Post-Intelligencer*.

§ Peninsula Daily News. July 30, 2006. "Marine 'dead zone' killing fish, crabs."



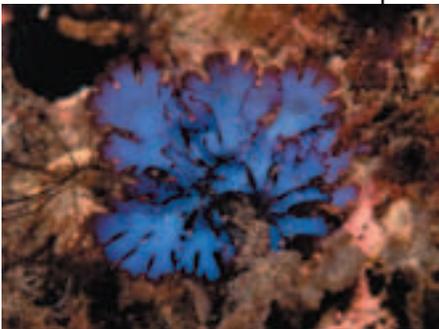
With its high population and highly urbanized areas, the Puget Sound tends to have greater problems with water pollution, stormwater runoff, and toxic sediments. However, Washington's outer coast is not immune from marine resource issues that require research and management. Researchers found more aquatic invasive species, such as *Spartina* (a foreign salt marsh grass) and the European green crab, in Willapa Bay than in sites studied in Puget Sound. Toxic algal blooms routinely pose threats to human health and commercial and recreational shellfish harvesting. Coastal hazards such as flooding, erosion, tsunamis, and landslides put lives, property, and coastal infrastructure at risk.

The state must respond to emerging ocean resource issues as well. During July 2006, for example, tribal fishermen frequently hauled up dead crabs in crab pots, observed unusual numbers of dead fish washed up on beaches, and found deepwater fish in shallow tide pools. Researchers discovered the possible cause - low oxygen in the water on the outer coast. This suggests a new and possibly growing seasonal water quality problem that requires greater monitoring and research.

Ocean and coastal resources face increasing pressures from human uses. Impacts from development, population growth, pollution, climate change, and over-use of resources can cause populations of species to decline and degrade the habitats upon which they rely. These impacts can also threaten human health, safety, property, and livelihoods. To preserve and enhance our quality of life, Washington needs to protect and restore our ocean resources and create sustainable coastal communities.

A few years ago, two national, blue-ribbon commissions - the Pew Commission and the U.S. Commission on Ocean Policy - provided voluminous recommendations on improving management of our oceans and coasts. In response to these efforts, the Governor's Office established the Washington State Ocean Policy Work Group in 2005 to: 1) summarize the status of Washington's ocean resources and their value to the state's economy, cultural identity, and quality of life and 2) provide recommendations for improving protection and management of the state's ocean resources.

Given the significant efforts of groups such as the Puget Sound Partnership, the Ocean Policy Work Group chose to not duplicate work and instead focused its efforts on Washington's outer coast and straits. A few issues overlap with the work of these other groups, which requires on-going coordination between the resource issues that these groups have in common.



Values of Ocean Resources

Washington's ocean resources provide many benefits to our state's economy, quality of life, and culture, including:

- Employment & Economy
- Fisheries & Aquaculture
- Tourism & Recreation
- Marine Transportation & Ports
- Cultural & Historical Preservation
- Research & Education
- Human Health & Biodiversity
- Offshore Energy & Minerals
- Aesthetics and other non-market values



What is the State of Our Ocean Resources & Coastal Communities?

Oceans and coasts are dynamic places. Currents, tides, storms, waves, and eddies shape the ocean and coastal environment. Washington's coast is geologically active and presents many natural hazards such as landslides, erosion, earthquakes, flooding, and tsunamis. Any future climate changes will also impact ocean resources and coastal communities with higher sea levels, more frequent flooding, greater wave energy and erosion, and altered chemistry of the ocean.

Fragmented research and lack of monitoring has resulted in gaps in our understanding and prediction of ocean processes limiting the effectiveness of resource management. The state needs coordinated, prioritized research and increased monitoring to better understand and predict how the ocean and its resources behave, to fully realize the ocean's influence on us and our influences on it, and to determine the best way to adapt our management of the ocean's precious resources.

Status of Coastal Communities

For thousands of years, area tribes utilized ocean and marine resources for subsistence, culture, and economy. Today, treaties preserve tribes' access to and continued reliance on these vital resources.

In the past, coastal communities relied heavily on natural resources to support their economy. These communities continue to make use of these natural resources, but tourism, recreation, and development constitute a growing part of their economy. However, many coastal communities are currently struggling with higher unemployment and lower incomes than the state average. Growing retirement populations are also reshaping coastal communities.



Status of Habitats

The outer coast and ocean has many diverse habitats including estuaries and bays, rocky intertidal, sand dunes, sand and gravel beaches, kelp beds, submarine canyons, coastal waters, and the continental shelf. Many of these habitats are protected as nature reserves, national wildlife refuges, national parks, and marine sanctuaries. Threats to habitats include development, climate change, invasive species, pollution, recreation, and resource extraction – their impacts can result in degraded or lost habitats and can even affect protected habitats.

Status of Species

Washington's outer coast and straits are home to an amazing variety of wildlife and plants - from Northwest icons such as orca whales and salmon to playful sea otters, colonies of seabirds, amazing invertebrates, and rare deep-sea corals. Some of the largest nesting colonies of seabirds in the nation are located in the islands off Washington's coast. Declining populations pose threats to many of our state's marine and ocean species. Many species are endangered or threatened including several stocks of salmon and many marine mammals. However, some marine mammal populations appear to be recovering after near extirpation at the beginning of the 1900s. Some stocks of commercially important fish appear to be healthy and sustainable, while others are currently considered depleted.

Key Recommendations

The Washington State Ocean Policy Work Group (OPWG) examined a wide range of ocean and coastal topics including: scientific research and monitoring, sustainable fisheries, education, ecosystem-based management, ocean energy, aquaculture, coastal hazards, erosion and sediment management, climate change, derelict fishing gear, oil spills, sustainable and resilient coastal communities, and how to effectively manage and govern ocean and coastal resources.

In developing their recommendations, the OPWG sought public input from coastal communities and stakeholders. Volume 1 of the final report summarizes the status and values of Washington's ocean resources and offers a highlight of the key recommendations for immediate action. Some of these key recommendations include:

- Establishing a collaborative governance process to continue coordinated management of ocean resource issues
- Prioritizing ocean research and monitoring by developing a strategic plan
- Increasing collection of groundfish and benthic habitat data
- Improving marine safety through better weather and ocean information by seeking support for Doppler RADAR and buoy sensors

- Conducting a detailed ecosystem assessment to facilitate ecosystem-based management
- Educating the general public and children about our ocean resources

In Volume 2 of the final report, the OPWG provides background on current state management and issues, summarizes public comments received, and presents over 50 recommendations for improving management, coordination, and financing of Washington’s ocean and coastal resources.

Goals for Washington’s Ocean & Coastal Resources

The Ocean Policy Work Group developed the following goals to broadly capture their work and recommendations:

1. **Manage the state’s ocean and coastal areas to protect valuable marine resources and maintain ecosystem health while ensuring the vitality of coastal communities**, through: effective, sustainable fisheries management; development of a state marine aquaculture policy; use of ecosystem-based management; and investigation of developing renewable ocean energy technologies.
2. **Protect the coastal environment and its communities from the threats of marine hazards**, such as storm surge and tsunamis, the effects of global climate change, and increased erosion, through improved research and management and increased planning efforts. Through state work, ensure continued coordination to prevent and manage pollution and marine debris.
3. **Enhance the sustainability and resiliency of outer coast communities** through appropriate economic development practices that honor the historical practices of the past, maintain present successes, and plan for future uses to maximize benefits to the state’s residents.
4. **Increase state attention on ocean-related scientific research and observation practices** that satisfy coastal management needs while furthering integrated and coordinated scientific knowledge of the state’s marine environment.
5. **Inform all state citizens of the vital importance of the state’s ocean resources** by collaborating on ocean literacy programs in state K-12 education and expanding public outreach on ocean issues.
6. Create a state interagency team on ocean policy to **coordinate state policy and consult and collaborate with tribes, local government, ports, and interested citizens**.



Conclusion

Washington's ocean resources are essential to our culture, quality of life, and economic health. They provide abundant opportunities, yet face a myriad of threats. We have the chance to steer a better course for our oceans and ourselves. As we face new and emerging issues, managing our ocean resources effectively for the next century and beyond will take action including: a renewed commitment, new management paradigms, sustained research and monitoring, better coordination and cooperation, and planning. We must renew our vow to protect and restore Washington's ocean resources and create sustainable, resilient coastal communities.



Introduction

Legislative Charge

A budget proviso within the state budget (ESSB 6090) outlined requirements for the Governor's Office to report on state ocean policy activities and next steps. In August 2005, the Governor's Office initiated the Ocean Policy Work Group (OPWG) to carry out the budget proviso's requirements.

The OPWG contained representatives from Departments of Ecology, Fish & Wildlife, Natural Resources, Community Trade & Economic Development, and Health. Other participants included the Washington State Parks and Recreation Commission, Puget Sound Action Team, Olympic Coast National Marine Sanctuary, University of Washington's School of Marine Affairs, local county commissioners from Clallam, Grays Harbor, and San Juan counties, and stakeholders from sectors such as ports and fisheries. Observers from tribal interests also participated.

The budget proviso language required the following:

- By December 31, 2005, the governor's office shall identify the recommendations of the U.S. Commission on Ocean Policy appropriate for immediate implementation.*
- By December 31, 2006, the governor's office shall provide a report:
 - Summarizing the condition of the state's ocean resources and their contribution to the state's character, quality of life, and economic viability;
 - recommending improvements in coordination among state agencies and other jurisdictions;
 - recommending measures to protect and manage ocean resources;
 - recommending measures to finance ocean protection, management, and development programs; and
 - recommending legislation regarding ocean resources or policy.

To meet these criteria, this final report provides a summary on the state of Washington's ocean resources and the Ocean Policy Work Group's recommendations.



The final report summarizes the status of the Washington's ocean resources and their contribution to the state's character, quality of life, and economic vitality.

The final report also recommends measures to improve protection and management of the state's ocean resources.

* The Office of the Governor, Interim Report of the Washington State Ocean Policy Work Group. Action for Washington's Ocean: Initial Steps to Enhance Management of Washington State's Ocean and Outer Coasts. December 31, 2005.



According to two national commissions, our failure to properly manage ocean and coastal resources is costing us jobs, putting human health at risk, and threatening future sustainability of ocean ecosystems.

U.S. Commission on Ocean Policy and the Pew Oceans Commission

Recently, two major commissions released comprehensive reports on ocean policy in the United States. The last major examination of United States ocean policy occurred over 30 years ago with the Stratton Commission.

In 2000, the U.S. Congress established the U.S. Commission on Ocean Policy (hereafter, “USCOP” or “the Commission”). The USCOP consisted of top experts in ocean policy and management. They conducted extensive stakeholder meetings around the country and incorporated input from the nation’s governors and other stakeholders into their final report. Released in September 2004, the USCOP final report, *An Ocean Blueprint for the 21st Century*, contained over 200 recommendations on a wide array of issues to improve ocean resource management and policy. They concluded:

“Our failure to properly manage the human activities that affect the nation’s oceans, coasts, and Great Lakes is compromising their ecological integrity, diminishing our ability to fully realize their potential, costing us jobs and revenue, threatening human health, and putting our future at risk.”

Likewise, the Pew Ocean Commission Report[†], *America’s Living Oceans: Charting a Course for Sea Change*, provided an extensive review of ocean policy and coastal management. Their recommendations included focusing on ecosystem-based management, sustainable use of resources, establishing regional ocean governance councils, restoring fisheries, protecting coastlines and coastal waters, ensuring sustainable aquaculture practices, and increasing ocean research and education.

Federal Activities

Executive Branch

The Bush Administration released the U.S. Ocean Action Plan in December 2004 to respond to the USCOP report. The President also created a cabinet-level Committee on Ocean Policy[‡] to coordinate federal activities on ocean-related issues and collaborate with state, local, tribal, and other interested parties on ocean policy.

The Committee on Ocean Policy[§] established two subcommittees with specific directives:

- The National Science and Technology Council Joint Subcommittee on Ocean Science and Technology (JSOST) tasked with developing a plan to prioritize and implement ocean research by December 31, 2006.

- The Subcommittee on Integrated Management of Ocean Resources (SIMOR) created a work plan that focuses on supporting regional and local collaboration; facilitating use of ocean science and technology in ocean resource management by assisting JSOST and others; enhancing ocean, coastal and Great Lakes resource management to improve use and conservation; and enhancing ocean education.

To provide input to JSOST’s research priorities, SIMOR assembled a Federal State Task Team. Washington State is participating in the West Coast Region (California, Oregon, and Washington) Federal State Task Team to ensure the regional input incorporates our state’s ocean and coastal priorities. This is just one example of federal response to the USCOP and Pew reports. It emphasizes the importance of Washington’s involvement and input to ocean policy activities taking place now – and those that emerge in the future.

Congressional legislation

The Ocean Policy Work Group’s interim report provided an overview of several bills introduced in Congress directly responding to the USCOP and Pew reports. Issues included tsunami preparedness, marine debris, and ocean exploration. Since that time, some additional bills introduced would:

- Set up a national system for permitting and expanding finfish aquaculture, which the National Oceanic and Atmospheric Administration (NOAA) would administer.
- Allow leasing of certain federal waters for oil & gas in areas where it is currently covered by Presidential moratoria.

In addition, the Energy Act of 2005 became law. This law gave the Minerals Management Service authority to establish a program to lease federal waters for offshore renewable energy. Washington State has begun to offer input as Minerals Management Service proceeds with developing its program.

Around the country, states and regions initiated efforts to improve management of ocean and coastal resources. Federal agencies and Congress are also beginning to take action.



† The Pew Charitable Trusts funded this study and was not affiliated with the US Government.

‡ This committee is housed within the White House Council on Environmental Quality.

§ Committee on Ocean Policy information available at: <http://ocean.ceq.gov/>

Washington State responded to improve the health of its ocean and coastal resources with several new efforts including: West Coast Governors' Agreement on Ocean Health, Washington State Ocean Policy Work Group, and the Puget Sound Initiative.

photo credit Katrina Lassiter



State and Regional Initiatives

In light of the USCOP and Pew reports, many state and regional initiatives are reexamining ocean resources and policies and engaging in regional and federal activities including:[¥]

- Oregon Ocean Policy Advisory Council
- California Ocean Protection Council
- Alaska Ocean Policy Cabinet
- Hawaii Ocean & Coastal Council
- Massachusetts Ocean Management Initiative
- Florida Oceans and Coastal Resources Council
- British Columbia & Canada's Ocean Strategy
- Gulf of Mexico Alliance
- Gulf of Maine Council
- Great Lakes Commission
- New England Regional Ocean Council
- West Coast Governors' Agreement on Ocean Health

By facilitating partnerships at the state and regional level, these initiatives provide a way to maximize resources, prioritize issues of local importance, and assert a stronger stance on policy issues that have mutual agreement.

Washington's Initial Progress

West Coast Governors' Agreement on Ocean Health

On September 18, 2006, Governor Gregoire, along with the Governors of California and Oregon announced the West Coast Governors' Agreement on Ocean Health. The agreement launched a coordinated ocean and coastal collaboration among the three states. This collaboration will address key ocean and coastal protection and management issues in common including coastal water quality; ocean and coastal habitats; ecosystem-based management; ocean awareness and literacy; scientific information, research and monitoring; sustainable economic development; and reducing adverse impacts of offshore development.^Δ

Specifically, the states will call upon the President and Congress to fund nonpoint pollution programs and send a joint message to the President and Congress that repeats opposition to offshore oil and gas leasing, exploration and development. In addition, the collaborative effort will support development of a West Coast regional research plan. The governors directed their staffs and agencies to work with stakeholders and develop further recommendations to enhance the regional collaboration with more extensive recommendations due by Fall 2007.

[¥]For more details on these efforts, see the OPWG December 2005 interim report.
^ΔWest Coast Governors' Agreement on Ocean Health, September 18, 2006.

In the announcement of this regional agreement, Governor Gregoire listed the recent accomplishments of the multiple efforts in Washington to improve all of the state's ocean resources and marine waters. These efforts include: the Ocean Policy Work Group, the Puget Sound Initiative and Puget Sound Partnership, the Puget Sound Action Team, the Lower Columbia River Estuary Partnership, the Northwest Straits Commission, and the Governor's Salmon Recovery Office. Collectively, these efforts work to address the USCOP's call to action in one way or another.

The Ocean Policy Work Group

The Governor's Office initially formed the OPWG with input from Departments of Ecology, Fish & Wildlife, and Natural Resources, but the membership of the work group was much broader. Membership of the work group included Dept. of Community Trade and Economic Development, Office of Financial Management (OFM), Dept. of Health, State Parks and Recreation Commission, county commissioners, members of the State Legislature, and city, county, and port associations. In addition, tribal representatives served as observers. The work group remained flexible and open, with members determining their level of involvement. Some members were actively involved, while other chose to stay informed through updates on the work group. Additional parties contributed to work group efforts, especially for background research on policy issues of particular interest or expertise. The OPWG met about once a month and more frequently during the summer of 2006 to discuss potential recommendations.

The Governor's Office and OFM contracted with the University of Washington to aid research and drafting of the first two reports. Professor Marc Hershman, a former USCOP Commissioner, served as a member of the group. He led a group of students at the UW School of Marine Affairs, which provided valuable research and writing support for the group.

Convened in 2005, the OPWG first developed a scope and initial topics. The OPWG removed issues from the list that were deemed sufficiently addressed in state government already. The OPWG formed six subcommittees to work on identified policy topics with a chair of each subcommittee supervising research, drafting of policy memos, and progress toward recommendations. These topics included: sustainable fisheries, aquaculture, ecosystem-based management, ocean energy, coastal hazards, erosion and sediment management, climate change, ocean research and observing, ocean education, sustainable communities, and governance.

The OPWG established its geographic focus as the outer coast and open-ocean resources of the state including the outer coast of Washington, the Strait of Juan de Fuca, and San Juan Islands. Puget Sound estuary is an vital important state marine resource, but Washington's outer coast



photo credit Katrina Lassiter

The Ocean Policy Work Group conducted outreach meetings in coastal communities including:

***Forks
Friday Harbor
Ilwaco
La Push
Neah Bay
Ocean Shores
Port Angeles, and
Westport.***



has many distinct issues and needs. Additionally, the OPWG wanted to avoid duplicating efforts of the Puget Sound Partnership. The Puget Sound Partnership is currently examining marine resource issues and will be offering recommendations for improving management and restoring the health of Puget Sound. Some issues overlap between these efforts and future work of these groups must ensure continuing coordination. In addition, state, tribal, and local efforts must coordinate with broader regional and national efforts on related ocean resource issues.

During May and June 2006, the group conducted outreach to coastal communities including a wide array of stakeholders such as coastal tribes, fishing interests, non-governmental organizations, ports, aquaculture businesses, educational institutions, coastal industries, local government representatives, and the general public. The OPWG visited the following communities: Forks, Friday Harbor, Ilwaco, La Push, Neah Bay, Ocean Shores, Port Angeles, and Westport. Input gathered from coastal communities during these visits provided important guidance to the subsequent development of the recommendations.

The OPWG Final Report

This report contains two volumes with the following main sections:

Volume 1:

Introduction

State of Ocean Resources & Coastal Communities

As required by the budget proviso, this chapter summarizes the status of Washington State's ocean resources and coastal communities and their contribution to the state's character, quality of life, and economic viability.

Key Recommendations

Volume 2:

USCOP Recommendations

Many of the USCOP's recommendations apply to state management issues. This chapter provides a review of the recommendations applicable to state management. It also summarizes how the state currently manages the issues outlined in the "State of Ocean Resources & Coastal Communities" and issues for USCOP topics not specifically selected by the OPWG for further analysis or recommendations.

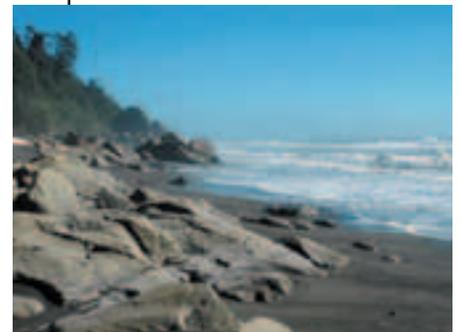
Public Comment Summary

The OPWG conducted outreach to coastal communities to gather input on ocean and coastal resource issues. This chapter offers a summary of comments received during outreach sessions.

Recommendations

Six recommendation chapters constitute the bulk of Volume 2. These chapters contain the OPWG recommendations and relevant background on the problems and management gaps the recommendations address. The OPWG chose to address issues under the following headings:

- Marine Resource Stewardship
- Coastal Vulnerabilities from Marine Sources
- Coastal Pollution
- Ocean Research, Observing, and Education
- Sustainable and Resilient Communities
- Governance



The State of Washington's Ocean Resources and Coastal Communities

Summary of the condition of the state's ocean resources and their contributions to the state's character, quality of life, and economic viability...

Overview

A large part of Washington's character is defined by its relationship with its marine waters. Prior to statehood, people relied on ocean and coastal resources for thousands of years. Today, Washington's beautiful rocky coastline, sandy beaches, inland bays, estuaries, and open-ocean attract not only tourists, but also provide important cultural resources; boost trade and recreation; supply food; support the economy of coastal communities; and host a variety of unique and important habitats and species.

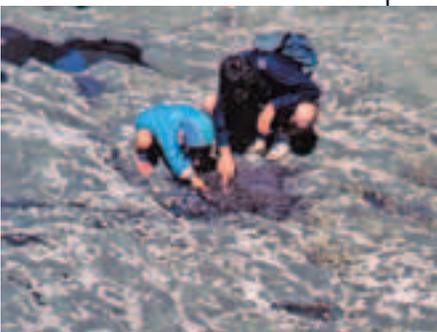
Over half of the state's residents visit a beach annually.¹ Nearly three out of four Washington households participate in recreational water activities.² Tourism is one of the largest employers on the outer coast providing between 9 and 17 percent of the jobs.³ Statewide shellfish aquaculture produced \$77 million in 2004 sales, accounting for 86 percent of the west coast production.⁴ In 2004, revenue from fish landings was over \$100 million statewide.⁴ Washington's 76 public ports handle 8 percent of the nation's exports and 6 percent of its imports.⁵ In 2005, over 10,000 ships, tankers, barges, or carriers with oil or hazardous materials passed through the Strait of Juan de Fuca.⁶

Washington's ocean resources are critical to maintaining our quality of life, economic viability, and inherent character. The outer coast represents some of the best quality ocean and coastal resources in the state. Yet, these resources face increasing pressures from human uses. Impacts from development, pollution, and over-use of resources can cause populations of species to decline and degrade the habitats upon which they rely. They can also threaten human health, safety, property, and livelihoods. To preserve and enhance our quality of life, Washington needs to protect and restore our ocean resources, and create sustainable coastal communities. First, we must understand the current condition of our ocean resources and coastal communities.

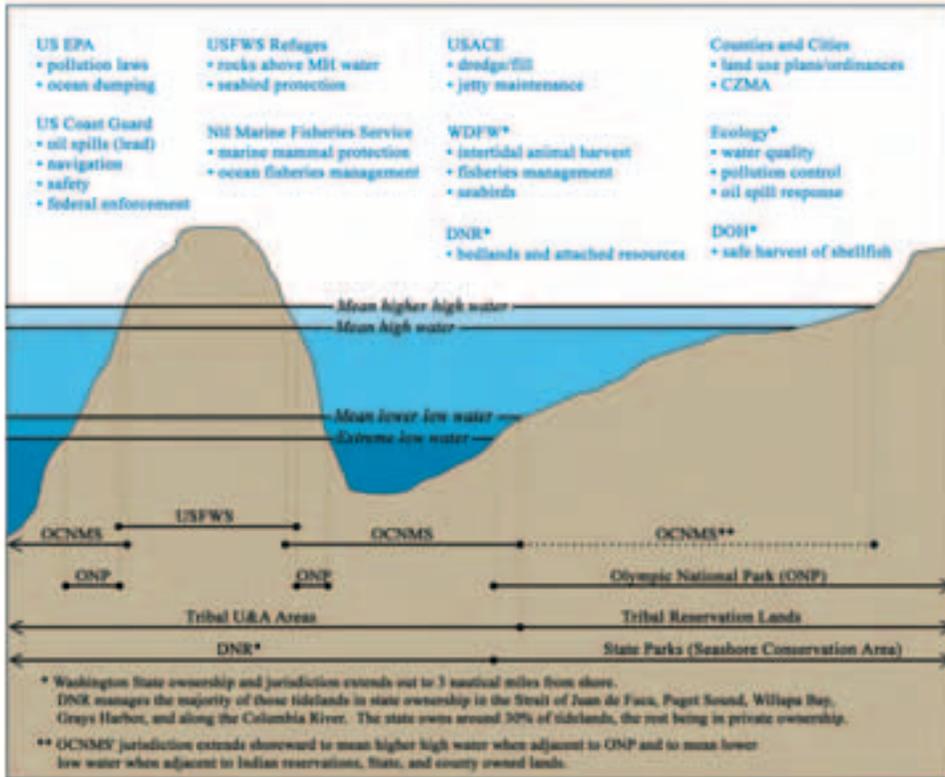
Geographic Scope

One of the Ocean Policy Work Group's tasks is to analyze the condition of ocean resources, their contributions to the state's character, quality of life, and economic viability. As mentioned in the introduction, the geographic areas covered in this analysis and the policy recommendations that follow focus on the outer coast of Washington, the Strait of Juan de Fuca, and San Juan Islands. This includes the

Washington's ocean resources are critical to maintaining our quality of life, economic viability, and inherent character.



estuaries of Grays Harbor, Willapa Bay, and the Lower Columbia River. The state's ownership extends out from the mean high tide line to three nautical miles. In the Strait of Juan de Fuca, state ownership extends to the international boundary with Canada.* The federal boundary of the United States' Exclusive Economic Zone (EEZ) extends from three nautical miles out to 200 nautical miles off the coast. Under the Ocean Resources Management Act (ORMA), however, Washington asserted the state's interest in the management of the EEZ.



Historical and traditional knowledge are important factors in assessing ecosystem health.

Figure 1: Jurisdictions and Authorities Along Washington's Outer Coast
 Source: Olympic Coast National Marine Sanctuary
 For acronym definitions, see page 2.

Historical Context

In order to understand the present, we must understand the past. This is true for assessing the status and trends of our ocean resources and coastal communities. While extensive oral and traditional ecological knowledge exist, no compiled studies currently offer an easy way of sharing and incorporating this necessary information into this assessment. Furthermore, it is difficult to compare to present day research methods to these other data sources. Incorporation of oral and traditional knowledge would be valuable to any further coastal and ocean ecosystem assessments.

* Some areas of privately owned tidelands extend out to extreme low tide. The state and local governments retain regulatory jurisdiction over these areas, even though they are not in state ownership.



Currents, eddies, waves, tides, and storms play a large role in shaping the ocean environment. Summertime winds drive the upwelling of nutrients along Washington's coast. These nutrients support abundant and diverse marine life.

Academic institutions, industry, and federal agencies conduct considerable research. This research lacks coordination with state and local efforts. Additionally, scientific research is often fragmented and changes focus frequently to study individual problems. Very few long-term monitoring programs exist to provide a broad picture of species abundances, habitat quality, and the status of other important resources.

Given these constraints, the remaining sections of this chapter provide: 1) the environmental conditions that shape Washington's coast and ocean resources; 2) a summary of the status of Washington's ocean resources and coastal communities; and 3) the value of these resources to the state's economy, quality of life, and character.

Environmental Conditions

Oceans and coasts are dynamic places. Physical and geologic processes shape the environmental conditions along Washington's outer coast. These environmental conditions provide important context for understanding our ocean resources and management issues.

Physical processes

Currents, eddies, waves, tides, and storms play a large role in shaping the ocean environment. In the North Pacific Ocean, the large, clockwise-moving North Pacific Gyre circulates cold, sub-arctic surface water eastward. This water divides into two currents at the North American continent: 1) the northward-moving Alaska Current and 2) the southward-moving California Current. Off the Washington coast, the California Current flows southward at the water's surface.⁷ Deeper in the water, the California Undercurrent runs northward.⁸ Seasonal and periodic changes in wind and weather patterns can cause currents to shift or even reverse direction. In the wintertime, the northward Davidson Current and the deep southward Washington Undercurrent form.⁸ Currents also carry nutrients and species that move with currents such as larvae and algae (phytoplankton).

During the summer months, changes in our local wind patterns create upwelling of nutrients from deep in the ocean.⁹ These nutrients provide an important base for the ocean food web. As a result, these areas often support a diverse array of marine life and provide good fishing opportunities. However, upwelling can also bring low dissolved oxygen closer to the water's surface.

Local underwater topography such as submarine canyons and banks can create eddies or large-scale circular water movements. Eddies are another source for concentrating nutrients and providing rich feeding and fishing areas. The Juan de Fuca Eddy (also called the Tully Eddy) sits off the Strait of Juan de Fuca.⁸ This area is traditionally a rich fishing

ground utilized by Native American tribes such as the Makah, as well as commercial fishers.¹⁰ However, recent research indicates the Juan de Fuca Eddy may be a point of origin for biotoxins that make shellfish unsafe for human consumption.¹⁰

Other ocean processes such as waves, tides, and storms literally shape the coastline. Their physical impact results in erosion and sedimentation of our beaches and form rip currents. Along the coastline, unique plants and animals are adapted to deal with these forces.

Climate changes

Climate variability and change influences physical dynamics of ocean currents and biological productivity - the most well known being the El Niño and La Niña cycle. These cycles are short-scale climate shifts that disrupt oceanic and atmospheric conditions in the Pacific for six months or two years. El Niño events result in warmer than average waters and decreased coastal upwelling. Conversely, La Niña events have cooler than average ocean temperatures and increased upwelling.^{7,9}

The “Pacific (inter)Decadal Oscillation” or “PDO” is a long-scale climate shift that lasts two to three decades. The PDO alternates between a trend with relatively cooler ocean temperatures in the Gulf of Alaska and Bering Sea and relatively warmer temperatures in the California Current, or the reverse trend with relatively warm temperatures in the north and cooler temperatures in the south.^{7,11}

Scientific evidence and agreement for human-induced climate change is well established. The rapid rise in greenhouse gasses such as carbon dioxide from burning fossil fuels is already causing a variety of changes such as diminished glaciers, decreased ice extent, and increased surface temperature. Climate change could potentially cause dramatic changes to our oceans and coasts including rising sea levels, warming ocean temperatures, and altering the pH of the oceans. As will be discussed later, climate change poses a unique challenge for marine resource planning and management.

Whether warm or cool, short or long, climate shifts can influence the biological productivity of our oceans. Decreased upwelling is often associated with warmer coastal temperatures. Less upwelling means fewer nutrients for plankton, the basis of the marine food web. Thus, a decline in plankton can cause declines in other marine species. As a result, understanding changes in climate and other physical processes is important to properly managing our living ocean and coastal resources.

Geological processes

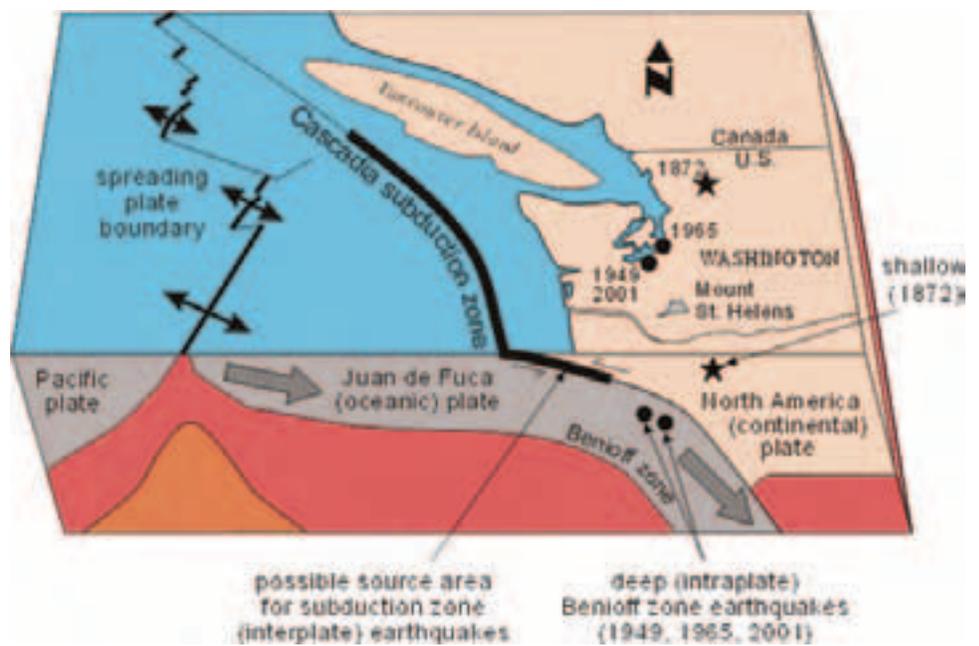
Earthquakes, volcanoes, glaciers, and plate tectonics have shaped Washington’s coastal landscape. Many of these geological processes

Whether warm or cool, short or long, climate shifts can influence the biological productivity of our oceans.



continue today, making the coastal region particularly active and susceptible to hazards such as earthquakes, tsunamis, landslides, erosion, and flooding.

The earth's crust is made of plates. As these plates move, they collide, separate, subduct under, or rub against one another. Washington is at the junction of two of these large plates: the North American (continental) plate and the Juan de Fuca plate. These plate movements and forces also formed the nearby Olympic Mountains. As the Juan de Fuca plate subducts under the continental plate, it causes earthquakes throughout the region, which can trigger tsunamis.² In the past, large subduction earthquakes occurred anywhere from every 200 to 1,000 years.¹² The last large earthquake was in 1700 and created a tsunami felt in Japan.¹²



Washington's coast is geologically active and susceptible to hazards such as earthquakes, tsunamis, landslides, and erosion.

Figure 2: Plate Movements in the Pacific Northwest

Source: Washington State Department of Natural Resources, Division of Geology and Earth Resources, <http://www.dnr.wa.gov/geology/hazards/eqakes.htm>. Adapted from The Pacific Northwest Seismic Network and United States Geological Survey at: <http://www.pnsn.org/CascadiaEQs.pdf>



Beginning 1.5 million years ago, glacial episodes also played an important role in Washington's outer coast geology.² During the maximum of these events, glaciers covered the northern third of Washington State. Glaciers scoured out landforms and deposited rocks. These processes resulted in different geology for Washington's northern and southern coast regions.

In the northern region, glaciers left rugged and rocky materials and unconsolidated sand and gravel.² Sea stacks, rocky outcrops, and islands are common. These form important nesting habitat for many

species of seabirds. Most northern beaches are narrow and rocky surrounded by high-forested bluffs. This area is closer to the Juan de Fuca plate. Basalts erupt below the sea surface and, in places, lava forces to the surface.² The harder rocks in this area are more resistant to erosion than farther south along the coast.

The northern coast, however, has experienced localized erosion problems. Dams on the Elwha River and local shoreline modification reduced sediment supply to Ediz Hook and caused accelerated erosion.¹³ In order to fix the problem, the city of Port Angeles and Army Corps of Engineers spent \$7.8 million dollars to restore and protect the beach on Ediz Hook.^{13,14} A long-term solution will occur when the Elwha Dams are removed - restoring the natural sediment supply.

The southern region of Washington's coast is a broad coastal plain with wide, sandy beaches, dunes, and extensive lowlands. Geologically, the sandy beaches and dunes are a result of melted glacial runoff that brought sand to the coast. Historically, much of the sand on the southern beaches came from the Columbia River and with northward drift of currents the sand was deposited on the southwest coast of Washington State.² Dams, jetties, and other alterations to the Columbia River have decreased the amount of sediment leaving the River and supplying Washington's beaches. As a result, some beaches and bluffs in this area are currently eroding.

Erosion in Westport has cost \$8 million in repairs since 1993.² Over the past 40 years, Cape Disappointment State Park has lost about 260 acres of land and Westhaven State Park has lost over 200 acres of land.² Shoreline modification such as armoring with bulkheads and riprap can increase erosion processes and reduce beach height and width.²



Washington's outer coast contains diverse habitats that support a wide array of marine wildlife.

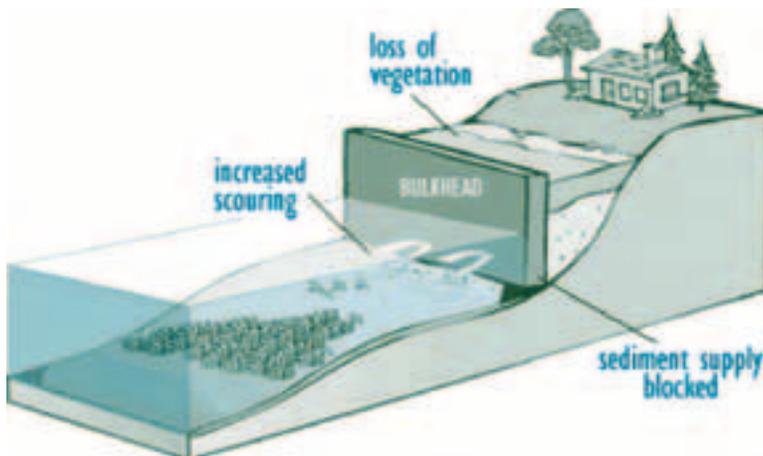


Figure 3: How Bulkheads Influence Erosion
Source: Washington State Department of Ecology



Recognizing the importance of these coastal habitats, state, and federal agencies set aside many areas of Washington's coast into parks, wildlife refuges, and sanctuaries.

National Wildlife Refuges*

***Copalis
Destruction Island
Dungeness
Flattery Rocks
Grays Harbor
Protection Island
Quillayute Needles
San Juan Islands
Willapa***

**** This list only contains refuges in the areas covered by the report.***

The percent of total shoreline modification has reached 24 percent in Grays Harbor County and 21 percent in Pacific County.¹⁵ While this remains low compared to Puget Sound, the impacts on erosion and sediment processes are still great.

Coastal areas are popular places to live, yet they also present hazards to the communities. Many coastal areas have unstable bluffs and are subject to landslides. Other coastal communities developed in floodplains, such as Aberdeen and South Bend. Washington is one of the most flood-prone states with 25 presidential disaster declarations for flooding between 1971 and 2001.² The statewide flooding in 1995-96 exceeded \$500 million in damages.² Between 1995 and 1998, the state experienced six federally declared disasters.² Due to the hazardous nature of our state's coastal areas, appropriate planning, management, and mitigation are essential.

State of Habitats

A habitat is a local environment utilized by animals and plants for food, shelter, and reproduction. Each habitat type contains a range of specific and unique physical, biological, and chemical characteristics.

Habitat types

Washington's outer coast and ocean hosts a wide variety of habitats. These habitats include:

1. ***Estuaries and Bays*** - These waters are mixing zones for freshwater from rivers and saltwater from the ocean. The rich nutrients in estuaries make them one of the most productive ecosystems on earth.² Estuaries include deltas, salt marshes, and mudflats. They are especially important rearing grounds for juvenile fish, wintering grounds for waterfowl, and foraging for shorebirds.
2. ***Rocky Intertidal*** - These areas have hard rock outcroppings where little sediment accumulates. Tidepool species inhabit this area, such as: lichens, sea anemones, hermit crabs, limpets, starfish, sponges, scallops, mussels, and seaweed. One study indicates Washington's intertidal areas, invertebrates and algae, are among the most diverse of any similar intertidal sites along the West Coast of the continental U.S.¹⁶
3. ***Exposed Sand and Gravel Beaches*** - A variety of materials make up Washington's beaches: fine sand, mud, cobble, or gravel. The beach composition depends on the source of sediment, distance of the beach from source, and exposure to wave energy.² These areas are home to a variety of coastal plants and many burrowing worms, crustaceans, and shellfish. Some fish use these beaches to lay their eggs.

4. **Sand Dunes** – These dynamic, yet fragile systems are found mostly on the southwestern coast. Construction and vegetation removal can easily damage dunes. This community includes hardy plants such as morning glory, American dune grass, and seashore lupine. It is an important habitat for plovers (shorebirds), voles, rabbits, osprey, and eagles.

5. **Continental Shelf** – This relatively flat and shallow area of the ocean floor extends from the high tide line out to a water depth of approximately 600 feet. The continental shelf hosts several habitats depending on the substrate, or seafloor, materials including rocky (boulders, reefs, or cobble), sandy, or muddy areas. A variety of bottom fish, crabs, worms, sea pens, sea cucumbers, octopus, and even deep-sea corals find homes in these areas. At a depth of 15 to 90 feet deep, giant kelp beds fasten themselves to the seafloor and create habitat for fish, sea otters, and urchins.

6. **Coastal and Open Ocean Waters** - Coastal and open waters over the continental shelf make up 7 percent of the world's oceans, but are responsible for 90 percent of the fisheries.² These areas have high productivity due to large concentrations of plankton and upwelling. Species often distribute themselves by water column depth. Some prefer to feed or grow in the upper area of water that receives lots of light. Others live in deeper, colder, and darker waters farther off the coast. Pacific herring, anchovy, and sardine prefer deeper waters, while salmon migrate throughout the waters. Birds such as shearwater, scoters, cormorants, western grebes, loons, gulls, and albatross feed in these areas. Many marine mammals migrate through these waters including whales, porpoises, dolphins, and seals.

7. **Canyons** – Special biological communities also live within submarine canyons, including the walls, beds, seafloor, and any outcrops or landslide morphology, such as slump scarps and debris fields.⁷ The major submarine canyons off Washington's Coast are Grays, Astoria, Quinault, Juan de Fuca, and Nitinat.

8. **Continental Slope/Basin** – This is where the continental shelf gives way to much deeper waters - 600 feet or deeper. Here, most marine species have unique adaptations to handle the high pressure of such deep waters. This area extends out beyond the western boundary of the EEZ.⁷

Protected Habitats

Recognizing the importance of these habitats, state, and federal agencies made many areas of Washington's coast into parks, refuges, and sanctuaries. These resource management tools provide a wide range of public access and resource protection.

Threats to habitats include development, pollution, fishing gear, invasive species, climate change, recreation, logging, agriculture, and aquaculture.



The coast has several national wildlife refuges established to protect important wildlife habitat. Some along the outer coast are closed to the public to protect nesting and breeding grounds for nearshore islands. Others, such as Grays Harbor and Dungeness National Wildlife Refuges are open to the public for waterfowl and shorebird viewing.

Other federal areas include the Olympic Coast National Marine Sanctuary (OCNMS or the Sanctuary) and Olympic National Park. OCNMS covers 3,310 square miles of marine waters along the northern Washington coast. The Sanctuary's purpose is to protect marine resources through education, research, and compatible uses. The Olympic National Park covers not only the Olympic Mountains, but also includes a narrow strip of 60 miles along the northern coastline providing public access points to beaches and trails.¹⁷

At the state level, the Washington State Department of Natural Resources operates several aquatic reserves, which protect other critical habitats along the coast, and many state parks are located on the outer coast. The State Parks and Recreation Commission oversees the Seashore Conservation Area on the outer coast ocean beaches.

Habitat losses

Despite habitat protections, human activities continue to alter wetland, estuaries, forests and other ecosystems at a rate between 30,000 and 80,000 acres per year.² More than half of the state's tidal flats and intertidal areas have been lost to dams, channelization, and canals since 1850.² With the exception of research on the extent of kelp and eelgrass, many of the outer coastal habitats do not have long-term monitoring to assess their status and trends.

According to research by the Washington State Department of Natural Resources (DNR), kelp bed population in the Strait of Juan de Fuca appeared stable over a period from 1989-2000.¹⁸ However, one bed of concern is north of Protection Island near Port Townsend. The area of kelp decreased from 181 acres in 1989, disappeared completely in 1997, and reestablished to 39 acres in 2000.¹⁸ Together, DNR and the Olympic Coast National Marine Sanctuary, conduct the annual, on-going kelp survey. In the San Juan Islands, DNR noted sharp declines in eelgrass in several shallow embayments – some of which are herring spawning sites.¹⁹

Threats to habitats

Densely developed urban areas such as the Puget Sound tend to sustain larger habitat losses. However, common coastal and ocean resource uses on the outer coast can also lead to habitat degradation or loss. Threats to habitats include development, pollution, fishing gear, invasive species, climate change, recreation, logging, agriculture, and



aquaculture.

Development results in direct habitat loss. It also increases impervious surfaces, like concrete, which degrade habitat through increased water flows and polluted runoff. Shoreline modification usually increases with increasing development.

Use of fishing gear such as bottom trawls can damage sensitive species and habitats on the ocean floor. For example, researchers recently discovered extensive deepwater corals in the Olympic Coast National Marine Sanctuary, many of which appeared damaged, possibly by fishing gear.²⁰ The Pacific Fisheries Management Council restricts the use of bottom trawl fishing gear in some areas along the Washington Coast.²¹ Derelict, or abandoned, fishing gear also impacts aquatic life. This gear often continues to ensnare and kill fish, marine mammals, and seabirds until it is identified and removed. Thousands of crab pots and fishing nets remain in Washington's waters.*



Derelict or abandoned fishing gear often continues to ensnare and kill fish, marine mammals and seabirds until it is identified and removed.

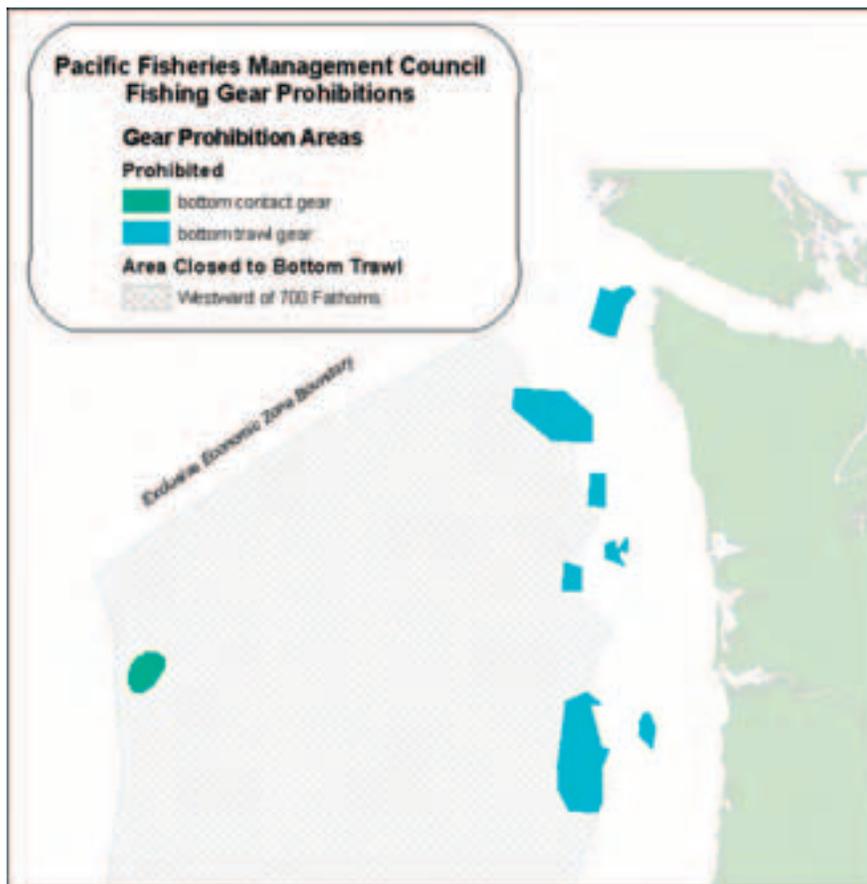


Figure 4: Pacific Fisheries Management Council Fishing Gear Prohibitions
Source: NOAA's National Marine Fisheries Service, Northwest Regional Office, 2006
Data available online at: <http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/Groundfish-Closed-Areas/Index.cfm>

*The Northwest Straits Commission's Derelict Fishing Gear Removal webpage indicates over 2,500 derelict gear targets in its database. See: <http://www.nwstraits.org/PageID/188/default.aspx>.



Many of the state's endangered and threatened species rely on ocean and coastal habitats.

The introduction of invasive aquatic species by ballast water from ships or aquaculture can also degrade habitat. One example on the outer coast is infestation of a cordgrass, *Spartina*, in Willapa Bay.²² This infestation started at 800 acres in 1984 and by 2005 grew to 7000 acres.²² This infestation is converting valuable aquaculture tide flats to salt marsh. Last year, the Department of Natural Resources treated nearly 80 percent of the infestation. The use of more effective treatment methods by the state to control the infestation may finally be paying off.²³

Climate changes can cause changes in population and distribution for species that form the foundation of certain habitats. Furthermore, climate change can be a conduit for increasing the spread of disease and aquatic invasive species - both of which alter habitat composition and quality. The Department of Natural Resources' study of kelp bed canopy cover indicated a relationship with the El Niño cycle. During the 1997 El Niño event, kelp cover decreased 32 percent throughout the study area.¹⁸ Losses were significantly higher in bull kelp along Washington's outer coast at 75 percent. The following year, total kelp increased by 87 percent and outer coast bull kelp increased by 423 percent.

Other coastal activities can damage habitats. The popularity of coastal areas for recreation can injure sensitive habitats and species through over-use and over consumption. Logging, agriculture, and aquaculture may impair habitats by altering or reducing available habitat, introducing competing species, influencing coastal processes, and/or degrading water quality.

State of Species

Washington's outer coast is home to an amazing variety of wildlife and plants - from Northwest icons such as orca whales and salmon to playful sea otters, colonies of seabirds, fascinating invertebrates, and rare deep-sea corals.²⁴ Washington's coastal waters are home to over 100 species of marine birds and shorebirds.²⁵ Some of the largest nesting colonies of seabirds are located in the islands off Washington's coast.²⁶ Due to a series of threats many marine and ocean species face declining populations. Some marine mammal populations, however, appear to be recovering after nearly being eliminated at the beginning of the 1900s. Some previously overfished stocks have recovered or are rebuilding.

Endangered & Threatened Species

Congress established the Endangered Species Act in order to conserve and restore populations on the verge of extinction. However, increasing human impacts such as pollution, habitat loss, and declining prey populations have caused the list to swell. At least forty-seven of the

state's endangered and threatened species rely on coastal and ocean habitats. In Washington, state and federal authorities identified an additional 146 species of concern - 37 percent of which rely on marine and estuarine habitats.²⁷

Commercial whaling throughout most of the 1900s caused dramatic reductions in whale populations such as the blue, fin, sei, and humpback – all endangered. For example, researchers estimate the sei whale population around 60,000 before commercial whaling. Currently, the sei population shows no sign of recovery with an estimated population of 56 animals.^{28,29} Since banning commercial whaling in the 1970s, many other whale populations appear to be slowly recovering.^{29,30} Yet, most populations remain well below their pre-harvest populations.³⁰ Continuing impacts to whales include ship strikes, fishing gear entanglement, and noise pollution.

Recent additions to the endangered and threatened species list include Washington's southern resident orca, or killer whale, population (endangered) and several local runs of salmon (endangered and threatened). Orcas in Washington's waters have some of the highest concentrations of toxins accumulated in their bodies.² This, along with vessel traffic, development, and lack of prey, such as salmon, are thought to be contributing factors in their population's decline. Between 1996 and 2001, the population decline from 97 to 79 members.³¹ Recently, the population increased slightly to 90 southern residents in July 2005.²⁹ Salmon runs face declines due to a host of impacts such as loss of habitat and harvest.²

An additional 50 species are state candidates* including: herring, western grebe, Brandt's cormorant, common murre, Pacific herring, Pacific cod, Pacific hake, northern abalone, and several species of rockfish. Many sensitive coastal and aquatic plants are also threatened and endangered.



*These state candidate species are not on the federal endangered or threatened species list. Rather, they are of federal concern or not listed at the federal level. The table indicates species that are listed as threatened or endangered at either the state or federal level.

Table 1, below, lists 47 endangered, threatened, or sensitive species (state and/or federal list) that rely on ocean and coastal habitats.

Table 1: Endangered and Sensitive Species in Washington State

Endangered, Threatened and Sensitive Species in Washington State

Current through July 1, 2006

Source: Washington State Department of Fish and Wildlife

<http://wdfw.wa.gov/wlm/diversity/oc/soc.htm>

COMMON NAME	SCIENTIFIC NAME	ANIMAL TYPE	FEDERAL STATUS	STATE STATUS
NELUTIAN CANADA GOOSE	BRANTA CANADENSIS ZELUCKOVAIA	Bird	Federal Concern	Threatened
AMERICAN PERIGRINE FALCON	FALCO PERGRINUS ANATUM	Bird	Federal Concern	State Sensitive
AMERICAN WHITE PELICAN	PELICANUS ERITHRODIPTERUS	Bird	none	Endangered
ARCTIC PERIGRINE FALCON	FALCO PERGRINUS TUNDRAE	Bird	Federal Concern	State Sensitive
BALED EAGLE	HAGADIFUS LEUCOCEPHALUS	Bird	Threatened	Threatened
BLACK RIGBT WHALE	BALAENA GLACIALE	Mammal	Endangered	Endangered
BLACK ROCKFISH	SEBASTES MELANOPS	Fish	none	Candidate
BLUE WHALE	BALAENOPTERA MUSCULUS	Mammal	Endangered	Endangered
BROWN PELICAN	PELICANUS OCCIDENTALIS	Bird	Endangered	Endangered
BULL TROUT	SALVELINUS CONFLUENTUS	Fish	Threatened	Candidate
BULL TROUT (COLUMBIA BASIN)	SALVELINUS CONFLUENTUS	Fish	Threatened	Candidate
BULL TROUT (COASTAL/PUGET SOUND)	SALVELINUS CONFLUENTUS	Fish	Threatened	Candidate
CHINOOK SALMON (LOWER COLUMBIA)	ONCORHYNCHUS Tshawytscha	Fish	Threatened	Candidate
CHINOOK SALMON (PUGET SOUND)	ONCORHYNCHUS Tshawytscha	Fish	Threatened	Candidate
CHINOOK SALMON (SNAKE R. FALL)	ONCORHYNCHUS Tshawytscha	Fish	Threatened	Candidate
CHINOOK SALMON (SNAKE R. SPILL)	ONCORHYNCHUS Tshawytscha	Fish	Threatened	Candidate
CHINOOK SALMON (UPPER COLUMBIA, SP)	ONCORHYNCHUS Tshawytscha	Fish	Endangered	Candidate
CHUM SALMON (HOOD CANAL, BL)	ONCORHYNCHUS KETA	Fish	Threatened	Candidate
CHUM SALMON (LOWER COLUMBIA)	ONCORHYNCHUS KETA	Fish	Threatened	Candidate
COLUMBIAN WHITE-TAILED DEER	ODOCOLEUS VIRGINIANUS LEUCURUS	Mammal	Endangered	Endangered
COMMON LOON	CAVUS IMBER	Bird	none	State Sensitive
FIN WHALE	BALAENOPTERA PHYSALIS	Mammal	Endangered	Endangered
GRAY WHALE	ESCHIRCHUS ROBUSTUS	Mammal	none	State Sensitive
GREEN SEA TURTLE	CHELONIA MYDAS	Reptile	Threatened	Threatened
HUMPBACK WHALE	MEGAPTERA NOVAFANGIAE	Mammal	Endangered	Endangered
KILLER WHALE	ORCINUS ORCA	Mammal	none	Endangered
LEATHERBACK SEA TURTLE	DERMOCHELUS CORNICIA	Reptile	Endangered	Endangered
LOGCRAWLER SEA TURTLE	CARETTA CARETTA	Reptile	Threatened	Threatened
MARBLED MURRELET	BRACHYRAMPHUS MARMORATUS	Bird	Threatened	Threatened
OLYMPIC MUDMINNOW	NOEMILINA MELBIE	Fish	none	State Sensitive
OREGON SILVERSPOT BUTTERFLY	SPHYRIA ZEPHYRUS HIPPOCITA	Butterfly	Threatened	Endangered
PERIGRINE FALCON	FALCO PERGRINUS	Bird	Federal Concern	State Sensitive
SEA OTTER	ENHYDRA LUTREUS	Mammal	Federal Concern	Endangered
SEA OTTER	ENHYDRA LUTREUS	Mammal	none	Endangered
SEI WHALE	BALAENOPTERA BOREALIS	Mammal	Endangered	Endangered
SHORT-TAILED ALBATROSS	PHOEBASTRIA ALBATRUS	Bird	Endangered	Candidate
SLENDER-BILLED WHITE-BREASTED NUTHATCH	SYTA CAROLINENSIS ACLEZATA	Bird	Federal Concern	Candidate
SNOWY Plover	CHARADRIUS ALLEMANINI	Bird	Threatened	Endangered
SOCKEYE SALMON (JETTE LAKE)	ONCORHYNCHUS NEBKA	Fish	Threatened	Candidate
SOCKEYE SALMON (SNAKE R.)	ONCORHYNCHUS NEBKA	Fish	Endangered	Candidate
SPERM WHALE	PHYSETER MACROCEPHALUS	Mammal	Endangered	Endangered
SPOTTED OWL	STRIX OCCIDENTALIS	Bird	Threatened	Endangered
STEELHEAD (LOWER COLUMBIA)	ONCORHYNCHUS MYKISS	Fish	Threatened	Candidate
STEELHEAD (MIDDLE COLUMBIA)	ONCORHYNCHUS MYKISS	Fish	Threatened	Candidate
STEELHEAD (SNAKE RIVER)	ONCORHYNCHUS MYKISS	Fish	Threatened	Candidate
STEELHEAD (UPPER COLUMBIA)	ONCORHYNCHUS MYKISS	Fish	Endangered	Candidate
STELLER SEA LION	EUMETOPUS JUBATUS	Mammal	Threatened	Threatened

Ballast water is one main way invasive species are introduced to coastal waters. Ships take in ballast water for stabilization. To take on new cargo in a new port, ships release ballast water, along with any organisms, even bacteria or viruses, into the surrounding water.



Table 2: Species of Concern in Washington State: State Candidates



Species of Concern in Washington State: State Candidates

Current through July 1, 2005

Source: Washington State Department of Fish and Wildlife

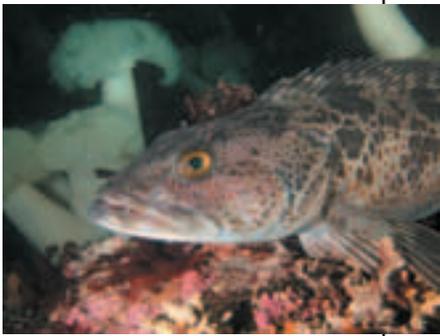
COMMON NAME	SCIENTIFIC NAME	ANIMAL TYPE	FEDERAL STATUS	STATE STATUS
BOCACEDY ROCKFISH	SEBASTES PAUCISPINIS	Fish	none	Candidate
BRANDT'S CORMORANT	PHALACROCORAX PENICILLATUS	Bird	none	Candidate
BROWN ROCKFISH	SEBASTES ALBOCICATUS	Fish	Federal Concern	Candidate
CANARY ROCKFISH	SEBASTES FINNICEI	Fish	none	Candidate
CASCADE TORRENT SALAMANDER	RHYACOTRITON CASCADAE	Amphibian	none	Candidate
CAMPBELL'S AUNTLET	PSYCHROMAPHUS ALUTICUS	Bird	Federal Concern	Candidate
CHINA ROCKFISH	SEBASTES NEBLUCHUS	Fish	none	Candidate
COHO SALMON (LOWER COLUMBIA/WY WA)	ONCORHYNCHUS KISUTCH	Fish	Candidate	none
COLUMBIA TORRENT SALAMANDER	RHYACOTRITON AZERI	Amphibian	Federal Concern	Candidate
COMMON MURRE	URIA ANICE	Bird	none	Candidate
COPPER ROCKFISH	SEBASTES CAURIVUS	Fish	Federal Concern	Candidate
DUNN'S SALAMANDER	PSEPHODON DUNNI	Amphibian	none	Candidate
EULACHON	THALASSEUS PACIFICUS	Fish	Candidate	Candidate
GOLDEN EAGLE	AGUIRA CHRYSAETUS	Bird	none	Candidate
GREENTRIPE ROCKFISH	SEBASTES BONGATUS	Fish	none	Candidate
HARBORQUIN DUCK	HISTORONCUS HISTORONCUS	Bird	none	none
KEENE'S MYOTH	MYOTH AZENI	Mammal	none	Candidate
LOGGERHEAD SHRIKE	LAMUS LUDOVICIANUS	Bird	Federal Concern	Candidate
MAKOH QUEEN CHARLOTTE COPPER	TYCALINA MARIPOSA CHARLOTTENSIS	Butterfly	Federal Concern	Candidate
MERLIN	FALCO COLUMBARIUS	Bird	none	Candidate
NEWCOMB'S LITTORINE SNAIL	ALGAMORPHA SUBROTUNDATA	Mollusk	Federal Concern	Candidate
NORTHERN ABALONE	HALIOTE KAMTICHAUSANA	Mollusk	Federal Concern	Candidate
NORTHERN GOSHAWK	ACRIPTER CENTES	Bird	Federal Concern	Candidate
OLYMPIA OYSTER	OSTREA LURIDA	Mollusk	none	Candidate
OREGON VESPER SPARROW	POCETTES CAMPANELUS AFFINIS	Bird	Federal Concern	Candidate
PACIFIC COD (SAC PUGET SOUND)	GADUS MACROCEPHALLUS	Fish	Federal Concern	Candidate
PACIFIC HAKE (C. PUGET SOUND)	MERLUCCIVUS PRODUCTUS	Fish	Federal Concern	Candidate
PACIFIC HARBOR PORPOISE	PHOCOENA PHOCOENA	Mammal	none	Candidate
PACIFIC HERRING (CHERRY POINT)	CLupea PALLASII	Fish	Candidate	Candidate
PACIFIC HERRING (DISCOVERY BAY)	CLupea PALLASII	Fish	Candidate	Candidate
PACIFIC TOWNSEND'S BIG-EARED BAT	CORYTHORHINUS TOWNSENDII TOWNSENDII	Mammal	Federal Concern	Candidate
PREATED WOODPECKER	DRYOCOPUS PREATIUS	Bird	none	Candidate
PUGET BLUE	PIZELUS SCAROIDES BLACKMORII	Butterfly	none	Candidate
PURPLE MARTIN	PROCELA SUBIS	Bird	none	Candidate
QUILLBACK ROCKFISH	SEBASTES MANIGER	Fish	Federal Concern	Candidate
REDSTRIFE ROCKFISH	SEBASTES PROMICER	Fish	none	Candidate
RIVER LAMPREY	LAMPRETA AYRESII	Fish	Federal Concern	Candidate
SHARPTAIL SNAIL	CONUS TENNIS	Gastropod	none	Candidate
TIGER ROCKFISH	SEBASTES NIGROCONCTUS	Fish	none	Candidate
TOWNSEND'S BIG-EARED BAT	CORYTHORHINUS TOWNSENDII	Mammal	Federal Concern	Candidate
TUFTED PUFFIN	FRATERELLA GIBBATA	Bird	Federal Concern	Candidate
VALLEY SILVERSPOT	SPHYRIA ZEBENE BEDNARI	Butterfly	Federal Concern	Candidate
VAN DYKE'S SALAMANDER	PSEPHODON VAN DYKEI	Amphibian	Federal Concern	Candidate
VAUX'S SWIFT	CHAETURA VAUXII	Bird	none	Candidate
WALLEYE POLLOCK (S. PUGET SOUND)	THYRACRA CHALCOGRAMMUS	Fish	Federal Concern	Candidate
WESTERN GREBE	ALOPIPHORUS OCCIDENTALIS	Bird	none	Candidate
WESTERN TOAD	BUFFO BOREAS	Amphibian	Federal Concern	Candidate
WIDOW ROCKFISH	SEBASTES ENTOMIAS	Fish	none	Candidate
YELLOWTAYE ROCKFISH	SEBASTES BLIBBIMBUS	Fish	none	Candidate
YELLOWTAIL ROCKFISH	SEBASTES FLAVIVUS	Fish	none	Candidate

Harbor seal counts in Washington have tripled since surveys began in 1978.

Fish populations

Several factors cause fish populations to vary including ocean conditions, predator and prey populations, and the amount of harvest and bycatch from fisheries. In the past 20 years, populations of many West Coast marine fish declined dramatically including commercially important cod, rockfish, and walleye pollack.³²

Researchers found that four Pacific herring stocks have declined so much that they risk significant loss of genetic diversity or even extinction.²⁷



In the past 20 years, populations of many West Coast marine fish declined dramatically including commercially important cod, rockfish, and walleye pollack.

The Washington Department of Fish and Wildlife (WDFW) indicates very limited and sporadic research for coastal herring populations.³³ This limited information suggests relatively high herring abundance.

The National Marine Fisheries Services recently declared six species of West Coast groundfish overfished. As a result, fisheries were significantly reduced in order to allow the populations to rebuild. Since these species of groundfish grow more slowly and mature later than other fish species, rebuilding populations may take 50 years or more.⁷ Some information indicates northern groundfish populations off Washington may be larger than southern populations off Oregon and California.

The 2005-updated NOAA list of overfished species on the West Coast included: bocaccio, canary rockfish, darkblotched rockfish, cowcod, yelloweye rockfish, and Pacific ocean perch.³⁴ Lingcod and Pacific whiting, previously considered overfished, have recovered over the past few years – much more rapidly than expected.⁷ Black rockfish, lingcod, and shortspine thornyhead are no longer subject to overfishing. Several previously unknown populations are not considered overfished including starry flounder, blackgill rockfish, gopher rockfish, California scorpionfish, and kelp greenling.³⁴

While many Columbia River salmon runs are threatened or endangered, the north coast rivers (Quillayute, Hoh, Queets, and Quinault) and south coast rivers continue to produce some of the healthiest natural runs of salmon and steelhead in the state.⁷ The tribes and state co-manage the in-river fisheries for these runs of salmon.

A recent status report on albacore tuna indicated the stock is fairly healthy, but fisheries are catching higher amounts than what would yield a sustainable fishery over the long-term.⁷ An international commission manages halibut catches for the U.S. and Canada. While this fishery is considered stable, a significant increase in fishing effort on Washington's north coast has resulted in shorter seasons. For example, the 2005 season was just 9 days long. For more information on the management of these fisheries and their detailed status, see Appendix E.

Seabirds

Washington's outer coast is important for many species of seabirds. Yet, research indicates oil spills and warming ocean temperatures may be causing more seabird deaths.³⁵ During a 2004-2005 survey, two percent of the dead seabirds found were oiled.³⁶ While this may seem small, it is two times as many oiled birds than are typically found in the survey. Since most oiled birds were found on the same part of Washington's southern coast in the same month, researchers think the cause was an unidentified offshore oil spill.³⁶

In the spring of 2005, these same surveyors found an unusually high number of seabird deaths all along the west coast, which researchers think may be linked to warming ocean temperatures.³⁵ In particular, researchers found large numbers of dead Brandt's cormorants and common murrelets washed up near Ocean Shores.³⁵ That year, researchers also witnessed the latest start for breeding among murrelets on Tatoosh Island in over 15 years of monitoring.³⁵ One potential cause is stress from starvation, which is thought to cause decreased breeding and increased bird deaths.

Shellfish

Little is known about populations such as pink shrimp and crab, but they are thought to be stable. Other commercial and recreational shellfish populations such as razor clams, geoducks, and oysters also managed by the state and coastal tribes and are considered stable.

Aquatic Invasive Species

Exotic species are from other parts of the country and world; they are not native to Northwest habitats. In marine environments, shipping and aquaculture often transport and introduce exotic species. These exotic species sometimes thrive in their new environment and aggressively colonize and establish themselves. This process turns mere foreign species into invasive species. Invasive aquatic plants and animals pose problems for populations of native species by out-competing them for food resources, introducing diseases, and changing habitat structure.

In 2000, the Department of Natural Resources headed up a research investigation of exotic species in three marine regions of the state. They found 15 exotic species in each of the Elliott Bay and Totten/Eld Inlet regions, and found 34 in Willapa Bay.¹⁸ Despite its lower overall development, Willapa Bay actually appeared the most affected by exotic species introductions. According to the researchers, commercial aquaculture was possibly responsible for introducing 35 of the 40 exotic species.¹⁸ Ship-fouling, solid ballast, and ballast water were possibly responsible for introducing 28 of the exotic species.¹⁸ Clearly, aquatic invasive species are a problem for all of Washington's marine and ocean environments. In Volume 2, the chapter "U.S. Commission on Ocean Policy Recommendations" contains a discussion of ballast water management and current studies in Washington.

Increases in marine mammals

In the late 1800s, the fur trade drove the over-harvest of seals and otters. Unfortunately, researchers lack studies of marine mammal populations from this period, which makes it difficult to measure recovery against historic populations. In general, populations appear to be recovering. Harbor seal, northern elephant seal, and California sea lion populations

Invasive aquatic plants and animals pose problems for populations of native species by out-competing them for food resources, introducing diseases, and changing habitat structure.



On the outer coast, protecting good water quality and preventing degradation is imperative to recreation and commercial interests. Clean water is an important part of habitat quality and vital for wildlife populations.



are all increasing in the state.³⁷ Since 1970, the number of sea otters, which were reintroduced after localized extinction, steadily increased. Between 2000 and 2004, the population counts ranged from 504 and 743 sea otters.³⁸ While historic otter populations are unknown, researchers estimate the habitat could handle between 1,300 and 2,700 otters.³⁸

Harbor seal counts in Washington have tripled since surveys began in 1978.³⁹ The bulk of harbor seal population growth occurred in the San Juan Islands and the Strait of Juan de Fuca.³⁹ Researchers estimated the West Coast population of California sea lions at more than 161,000 in 1994.⁴⁰ California sea lions eat a variety of fish, including salmon, which has caused conflicts with managing endangered salmon runs. Steller sea lions and the northern fur seal have stable populations, which means the populations are neither increasing nor decreasing significantly.³⁷ Some research suggests that these increasing marine mammal populations consume a larger amount of available prey populations, but it is uncertain how large of an impact they have.*

State of Water and Submerged Lands

Clean water is critical to maintaining our coastal and ocean resources. Water quality determines whether we can eat the fish we catch, swim in the water, or dig shellfish. On the outer coast, protecting good water quality and preventing degradation is imperative to recreation and commercial interests. Clean water is an important part of habitat quality and vital for wildlife populations. The less developed outer coast contributes less pollution from runoff and industrial sources than Puget Sound. As a result, Washington's ocean and nearshore waters benefit from generally good water quality. Occasionally outer coast beaches are unsafe for swimming and some fish and shellfish are unsafe to eat. These and other indicators point to some signs of water quality problems; humans cause some, while others occur naturally.

Impaired Waters

Most waterways eventually discharge into the ocean. Thus, polluted rivers and streams can translate into polluted marine waters. The state tracks polluted waterways through a listing process with the Environmental Protection Agency (EPA) called the 303(d) list. The state monitors pollution levels to determine which waterways do not meet federal water quality standards. In coastal watersheds for the area of interest, there are 241 impaired waterways (Table 3).

* U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. March 1997. Investigation of Scientific Information on the Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-28.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. February 1999. Report to Congress: Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and West Coast Ecosystems.

Table 3. 2004 Impaired Waterways on Washington's Outer Coast and Straits [i]

Watershed Name	Number of impaired waterways (303(d) list Category 5)	Major contaminants for listing
Grays/Hochman	36	Persistent Bioaccumulative Toxins, temperature, pesticides, fecal coliform
Willapa	67	fecal coliform, temperature, dissolved oxygen, pesticides
Lower Chehalis	8	various pesticides
Queets/Quinalt	5	Temperature
Soleduc	51	temperature, dissolved oxygen, and pH
Lynn/Hoko	16	temperature, fine sediment, and fecal coliform
Ebeha/Dungeness	26	fecal coliform, temperature and dissolved oxygen
Quilcene/Snow	29	fecal coliform, temperature, dissolved oxygen, pesticides
San Juan	3	fecal coliform
Total	241	

ⁱ Washington State Department of Ecology, Water Quality Assessment 2002/2004, <http://www.ecy.wa.gov/programs/wq/303d/2002/2002-index.html>. Accessed on April 25, 2006.

Bacterial pollution from sources such as sewage, sewage overflows, and animals such as livestock, wildlife (e.g. deer, elk, raccoon), and domestic pets (cats and dogs) can cause beach closures for swimming and digging shellfish. The locations of closures usually indicate chronic bacterial pollution problems. The Washington State Departments of Health and Ecology put a permanent advisory against swimming at Hollywood Beach near Port Angeles due to chronic sewage and stormwater overflows.⁴² Overall, most other outer coast beaches are deemed safe for swimming. Since bacteria fluctuate with rain and other conditions, constant monitoring and, sometimes, temporary advisories are necessary.

The Department of Health, WDFW, and coastal tribes also monitor shellfish for pollution such as bacteria, chemical contamination, and biotoxins such as paralytic shellfish poisoning and domoic acid. Department of Health closes beaches for shellfish harvest when eating them can cause health problems. Out of over 53 public beaches along the outer coast and straits, 4 beaches are closed due only to pollution and 4 are closed to both pollution and biotoxins.⁴³

Excessive human inputs of nutrients and low mixing of water in estuaries can lead to low oxygen conditions, also called hypoxia. Low oxygen can lead to death of animals unable to escape to a more favorable environment. Hood Canal is the most recent and local example of hypoxia.

Washington's outer coastal estuaries tend to be well mixed and have



Some algae in the ocean release chemicals that are toxic to wildlife and humans causing sickness and even death. Often these harmful toxins accumulate in shellfish.



Four of the largest spills in Washington history have occurred in the straits or along the outer coast.

fewer nutrient inputs. Thus, hypoxia is less likely to occur on the outer coast. However, Oregon's coast experienced a temporary zone of low oxygen for the past five years (since 2002) that resulted in fish and invertebrate die-offs.⁴⁴ In the summer of 2006, researchers discovered similar patterns of low oxygen off of Washington's coast. Fishermen with the Quinault Indian Nation reported hauling up crab pots with dead crabs.⁴⁵ Others reported finding large numbers of dead fish washed up on beaches and deepwater fish trapped in tide pools.⁴⁵ Researchers believe this may be an indication of changing circulation patterns in the ocean related to climate change.⁴⁴ Yet, inadequate monitoring of the state's outer coast waters means the state lacks a clear understanding of how severe this problem is and what is causing it.

Harmful Algal Blooms

Some algae in the ocean release chemicals that are toxic to wildlife and humans causing sickness and even death. Often these harmful toxins accumulate in shellfish. While researchers are uncertain of the exact causes or origins of harmful algal blooms, their impact on coastal resources is clear.

Tribal communities and coastal economies sustain severe damage from algal bloom-related beach and harvest closures. In 1991, the closure of Washington State beaches to recreational and commercial shellfish harvesting resulted in a \$15-20 million revenue loss to local fishing communities.¹⁰ The commercial Dungeness crab industry lost half of their income in 1998 due to harvest closures.¹⁰ The Quileute and Hoh tribes and the Quinault Indian Nation depend on this fishery for employment. The entire razor clam harvest of the Quinault Indian Nation, which they depend on for both subsistence and commercial revenue, was also lost in the fall of 1998.¹⁰

The frequent presence of harmful algal blooms causes the state to close recreational shellfish harvesting on the outer coast from April 1 through October 31.¹⁰ In the Strait of Juan de Fuca, more frequent monitoring allows the Washington State Department of Health to issue closures based on actual toxin levels rather than for the entire six-month period.⁴⁶ While there is evidence of toxic blooms occurring as early as 1793*, researchers believe impaired coastal water quality and climate change may exacerbate the frequency and extent of harmful algal blooms.† Additionally, new research indicates the Juan de Fuca Eddy as a potential source for harmful algal blooms.†

* Northwest Fisheries Science Center, Red Tides: West Coast newsletter on marine biotoxins and harmful algal blooms. Winter 1999. "Red Tide" a long-time West Coast problem that's not going away soon". Available at: <http://www.orhab.org/outreach/RedTides99.pdf>.

† Institute of Ocean Sciences. May 2004. The Big Eddy proceedings of the Western Juan de Fuca Ecosystem Symposium. Sidney, British Columbia. Published April 2005 by Canadian Parks and Wilderness Society, British Columbia Chapter.

Oil spills

Major oil spills remain a risk to water quality and wildlife.

Since 1964, Washington has had at least 47 oil spills of 10,000 gallons or more.⁴⁷ The largest spill was near Cape Flattery in 1972, spilling 2.3 million gallons of oil.⁴⁷ Four of the largest spills in Washington history have occurred in the straits or along the outer coast.⁴⁸

The Strait of Juan de Fuca is a busy thoroughfare for shipping to and from Puget Sound, local oil refineries, and British Columbia. In 2005, over 10,000 ships, tankers, barges, or carriers with oil or hazardous materials passed through the Strait of Juan de Fuca.⁶ Recreational and fishing vessels are another major source of spills. Vessels used for passengers, recreation, or fishing, accounted for 30 percent of all reported and investigated spills between 1993 and 2005.⁴⁹

As part of the designation process for the Olympic Coast National Marine Sanctuary, state agencies, tribes and other parties directed the Sanctuary to adequately address the risk of oil spills. The Sanctuary attempts to reduce risk of oil spills by instituting a voluntary avoidance zone for transit through its sensitive waters. During 2005, the Sanctuary achieved 97 percent compliance with avoiding this zone from the 7000 potentially hazardous ships plying its waters. Currently, a rescue tug is stationed nine months of the year in Neah Bay to respond to vessel spills and distress calls. In Volume 2, Recommendation Chapter 3 – Coastal Pollution reviews Washington's management of oil spills in more detail.

Contaminated sediments

Toxic and persistent chemicals, not only contaminate the water, but also the aquatic sediments beneath the water's surface. Even after removing a source of pollution, sediments retain the chemicals. Sediments remain a source of pollution for the food chain until they are cleaned up. Puget Sound's historical industrial centers contain the majority of Washington's contaminated sediments. However, the outer coast also has a few areas with contaminated sediments. According to the Department of Ecology, the outer coast contains seven sites with contaminated sediments, primarily due to industrial sources.⁵⁰ Of these sites, two require "no further action" and work has yet to begin on two of the sites.⁵⁰ The investigation and cleanup process is underway for the remaining sites.

Table 4. Contaminated Aquatic Sediments on Washington's outer coast and straits[i]

Site	Location	Area (acres)	Cleanup Status	Cause of Contamination
Gray's Harbor Paper Co.	Gray's Harbor	N/A	No Further Action	Wood/timber/paper
Gray's Harbor Shipyard Berg Marine	Gray's Harbor	N/A	Not Started	Industrial
Pacific Wholesale	Raymond	N/A	Not Started	Leaking underground storage tank
Paksoen Boatyard	Gray's Harbor	0.25	Cleanup Monitoring	Industrial
Port Angeles Harbor	Port Angeles	100	Initial Investigation	Wood/timber/paper
Rayonier Mill	Port Angeles	12	Remedial Investigation	Wood/timber/paper
Russell's Orcas Landing	Orcas Island	12	No Further Action	Not available

[i] Washington State Department of Ecology, Toxics Cleanup Program, June 2003. Sediment Cleanup Status Report. Publication #: 05-09-092.

Pollution pumped into the air can accumulate in marine waters by rain and snow. Once air pollution accumulates in marine waters, it can build up in marine organisms and aquatic sediments.



For thousands of years, tribes in the area utilized ocean and coastal resources. These resources not only provided subsistence, but also played an integral role in their culture, ceremonies, and economy.



Air Pollution

Pollution pumped into the air can accumulate in marine waters by rain and snow.² At Cheeka Peak Observatory on Cape Flattery, researchers detected air pollution from local, regional, and even global sources.⁵¹ The researchers attributed the likely sources to ships that pass through the Strait of Juan de Fuca and along the Pacific Coast; automobiles from populated areas east of Cheeka Peak (Seattle, Vancouver, Victoria); local and long-range biomass burning (e.g. Asia); and pesticides.⁵¹

Once air pollution accumulates in marine waters, it can build up in marine organisms and aquatic sediments. For example, mercury can accumulate in fish and often originates from atmospheric sources such as burning coal. Chemicals associated with automobile emissions have risen in aquatic sediments at four out of ten monitoring stations in Puget Sound.⁵² While similar data is not available for the outer coast, this demonstrates the influence of air pollutants on marine sediments. The good news is Washington's air is getting cleaner. At the same time, automobiles are the largest source of emissions in the state and their numbers continue to rise. Additionally, ship traffic in the area is projected to continue increasing.⁵³

State of Coastal Communities

Indian Tribes

For thousands of years, tribes in the area utilized ocean and coastal resources. These resources not only provided subsistence, but also played an integral role in their culture, ceremonies, and economy. Tribal diets consisted primarily of the abundant shellfish, groundfish, halibut, salmon, and marine mammals on the coast. Coastal tribes were skilled at building ocean and river canoes and plank houses out of cedar. Reeds, grasses, and bark were tightly woven into baskets, capes, and mats. Kelp strips were dried for fishing lines.

Today, several tribes on Washington's outer coast depend on these same resources, especially shellfish, crab, fish, and timber. The tribes of the Hoh, Makah⁵⁴, Shoalwater, Quileute⁵⁵, Jamestown S'Klallam⁵⁶, Lower Elwha Klallam, and the Quinault Indian Nation⁵⁷ are all located on Washington's outer coast or along the straits. Yet, ocean resources are also important for many other tribes in the state that rely on migratory species, such as salmon. Tribal timber and salmon harvest were valued at \$71.2 million and \$6.8 million in 1997.² Many coastal tribes hunted whales and seals. In 1999, the Makah Tribe reestablished its hunt for gray whales to preserve and restore cultural traditions and for subsistence.⁵⁴ Litigation prevented the Makah Tribe from exercising its treaty rights since the 1999 hunt.⁵⁸ Currently, the Makah Tribe is waiting for NOAA Fisheries Service to evaluate their request for a limited waiver of the Marine Mammal Protection Act in order to hunt whale again.⁵⁸

Many tribes in Washington have treaty rights to fish and hunt in their usual and accustomed grounds.* Court cases interpreted this to mean half the catch of salmon and similar amounts of other resources such as albacore, halibut, urchin, shellfish, and Pacific whiting.² Each tribe is a sovereign entity and thus, Washington has a government-to-government relationship on issues of mutual concern. Tribal fisheries management includes hatcheries, habitat protection and enhancement, harvest management, and enforcement.² In 2004, the outer coastal tribes combined released over 6 million hatchery salmon. Of these, the Quinault Indian Nation released the most - 3.6 million.⁵⁹ The Lower Elwha Klallam Tribe has been involved with planning for dam removal in order to reestablish the natural flow and habitat for salmon and other resources.

Other Coastal Communities - social and economic status

Usually, coastal communities contribute more to economic growth and have a larger population than other areas. United States coastal lands make up less than 25 percent of the total land area, but contain over half of the total population.⁶⁰ In 2000, coastal nearshore areas generated more than \$1 trillion, one-tenth of the nation's Gross Domestic Product (GDP).⁶⁰ While Puget Sound communities tend to follow this trend with a large population and robust economy, the reverse is true for Washington's outer coastal communities. Compared to the state, the outer coast has generally slower population growth and depressed local economies.

The population in the Washington's outer coastal communities is growing at a slower pace than the state population, with the exception of Jefferson and San Juan counties, which grew faster at times (see Figure 5). Pacific County actually lost population for a few years until it grew slightly in 2003. Generally, these coastal populations have a larger percent of retirees (people over the age of 65) than the state average.⁶¹ As mentioned above, the outer coast is also home to several tribal nations, especially along the northern coast and straits. The total coastal population in the five coastal counties listed in Figure 5 is nearly 200 thousand.



The per capita income for most communities on Washington's outer coast lagged behind the 2003 state average. Most outer coastal counties also have higher poverty rates than the state average.

*These areas are generally referred to as Usual and Accustomed Areas.



Washington's outer coast contains many important archaeological and historical resources.

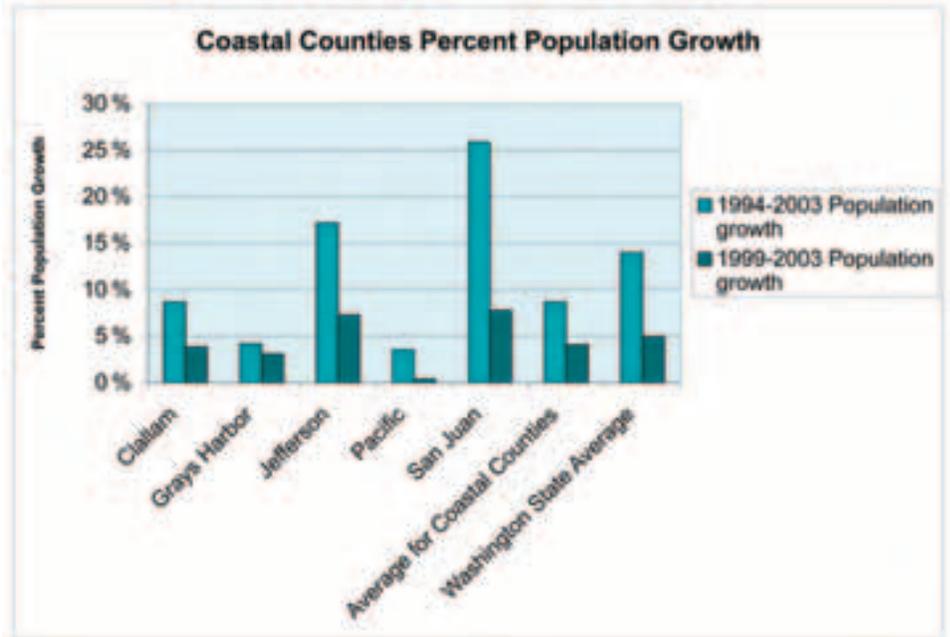


Figure 5: Population growth in coastal counties between 1994 - 2003⁶²
 Source: U.S. Department of Commerce

Much of the local coastal economies rely on tourism and recreation, fishing, agriculture, and to a lesser extent, timber. San Juan and Clallam counties are particularly popular places for retirees and tourists. Thus their local economies are partly driven by transfer payments from sources such as investments, pensions, and social security.

One measure of economic strength is per capita income. The per capita income for most communities on Washington's outer coast lagged behind the 2003 state average of \$33,254. Per capita income in Pacific County is 29.6 percent below the state average and in Gray's Harbor County it is 29.4 percent below the state average.⁶² Of the counties included in this report, the only county above the state average was San Juan County with a per capita income 18.1percent higher.

As expected, most coastal counties also have higher poverty rates than the state average.⁶¹ Again, San Juan County is the only county whose poverty rate is less than average. Yet, San Juan County is increasingly unaffordable for working families – earning the lowest housing affordability index for any county in the state.⁶³

Cultural Resources

Cultural resources are generally divided into two categories: archaeological and historical resources. People have lived in the lands that now comprise Washington for approximately 12,000 years.⁶⁴ Many of these people chose to live near the ocean. As a result, Native American archaeological sites are particularly abundant on Washington's outer coast. These include: shell middens, pictographs,

petroglyphs, burial grounds, and wet sites. Wet sites are located in intertidal or wetland areas that preserve submerged items such as basketry, hair, and wood.⁶⁴ The Ozette site is a well-known example of a wet site. It stretches a mile-long and is one of the best preservations of a Native American village and associated artifacts. The Makah tribe developed a nationally recognized cultural center, which displays some of Ozette's 300 to 500 year-old artifacts.⁶⁵

Burial sites are sacred and important places. One such example is the Lower Elwha Klallam Tribal village burial site, which dates back to 2,700 years ago.⁶⁶ The Washington State Department of Transportation uncovered the large site during construction. Archaeologists excavated over 335 intact burials and 13,000 artifacts.⁶⁶ As a result of these finds, the state halted work in December 2004 and decided to move the project elsewhere.

Historical resources include buildings, structures, sites, districts, and objects that provide an important link to the past. However, historical resources also encompass cultural landscapes that were important to any group or historic theme.⁶⁴ Cultural landscapes may convey important spiritual beliefs for Native Americans or may be places with significant natural features.⁶⁴ Washington's outer coast is home to many important historical places such as Fort Columbia State Park, the original campsite of Lewis and Clark's expedition in 1805. Over 180 shipwrecks are located in the waters of the Olympic Coast National Marine Sanctuary.²⁵ Other examples of important historical places include: light stations along the coast from Grays Harbor to Destruction Island to Clallam Bay; military installments such as Fort Worden; buildings like the Port Angeles courthouse; and historic districts such as the Oysterville Historic District.

Values of Resources

Employment & Economy

The U.S. ocean economy contributes \$117 billion to the economy and over two million jobs.⁶⁰ In Washington, our ocean resources play an important role in providing jobs and supporting the economy. Ocean resources support jobs in fisheries, aquaculture, tourism, trade, and shipbuilding. Tourism is the largest sector in many of the communities. However, the economy of many coastal communities is distressed. The December 2005 unemployment rates for Clallam (5.8), Grays Harbor (7.4) and Jefferson (7.0) counties were above the state average of 5.3 percent.⁶⁷ As mentioned earlier, the average earnings per person are also well below the state average.

Fisheries & Aquaculture

Fisheries and aquaculture are vital and valuable uses of our ocean

In Washington, our ocean resources play an important role in providing jobs and supporting the economy. Ocean resources support jobs in fisheries, aquaculture, tourism, trade, and shipbuilding.



resources. They provide food, jobs, and support other parts of coastal economies. In 2004, fishing, aquaculture, seafood processing, and hatcheries generated \$31.5 million in wages for Grays Harbor, Pacific, and Jefferson counties.⁶⁸

2005 Washington Coastal Fishery Ex-Vessel Revenue

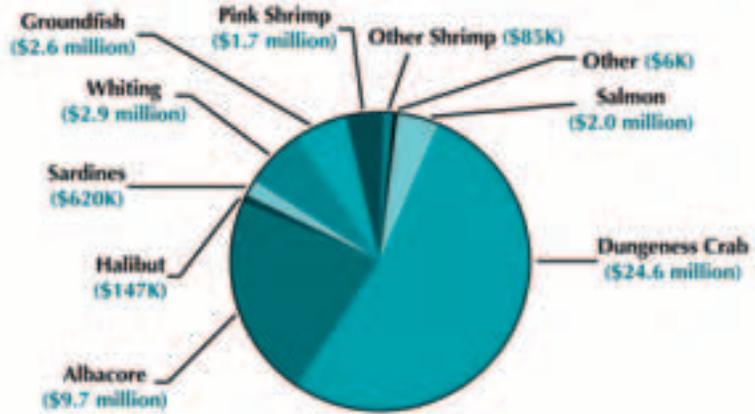


Figure 6
Source: WDFW

2005 Washington Coastal Fisheries Landings (percent of pounds landed)

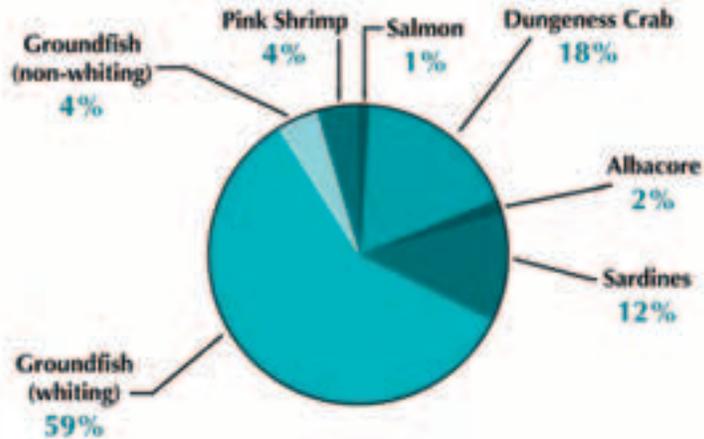


Figure 7
Source: WDFW

Fisheries

Fisheries are an integral part of Washington's ocean economy. In 2004, revenue from fish landings was over \$100 million.⁴ Yet, declines in harvest result in economic, social, and cultural hardships for coastal communities and tribes. Declining salmon runs over the past 20 years have cost an estimated 72,000 jobs and more than \$500 million across

Fishery landings in Washington's outer coast ports produced over \$44 million in ex-vessel revenue in 2005.



the Northwest.⁶⁰ In 2000, salmon declines resulted in a 90 percent reduction in average fishing related personal income for coastal counties in Oregon and Washington.⁶⁹ Washington's ocean salmon catch had an ex-vessel value of \$1.3 million in 2005.⁷ Over the past three years (2003-2005), ex-vessel values of Washington landings of salmon have been the highest since 1992, but are still 83 percent below the 1979-1990 average of \$7.5 million.⁷

Due to the need to rebuild certain overfished rockfish populations and the fact that overfished rockfish and other healthy stocks of groundfish use the same habitats, the Pacific Fishery Management Council has significantly reduced the overall groundfish fishery.⁷ This included a fleet reduction in 2003, which bought out 91 fishing vessels and their permits up and down the West Coast.²¹ Harvest in some West Coast ports was reduced by half.⁶⁹ The decline in the groundfish fishery has had significant economic and social ramifications on Washington's coastal communities.

An international commission manages halibut. Due to increased participation in the recreational halibut fishery on Washington's north coast, the overall quota is met quicker and the season has shortened significantly.

Other commercially and recreationally important fisheries include spiny dogfish, arrowtooth flounder, albacore tuna, sablefish (blackcod), and halibut. Recently, the return of Pacific sardines has spurred an emerging purse seine fishery.⁷

Shellfish fisheries

One of the most important commercial fisheries in Washington is Dungeness crab, which has an average ex-vessel value of \$19.9 million.⁷ The main areas for landing this coastal fishery are Ilwaco, Chinook, Westport, Tokeland, and La Push.⁷ The crab landings reached a high of 25 million pounds in 2004-2005, but usually average around 9.5 million pounds annually.⁷ In 2005, the crab catch brought in \$24.6 million in ex-vessel revenue.⁷⁰

The commercial razor clam fishery in the state dates to the early 1900's. The commercial fishery is now held only at Willapa Spits.⁷ Five ocean beaches are managed for recreational razor clam harvest from October through May. The recreational harvest generates an estimated 240,000 digger trips per season.⁷ An older economic assessment estimated the recreational razor clam harvest generates \$25 per digger trip.⁷¹ The outer coast tribes also harvest razor clam and are allowed up to 50 percent of the total amount in their usual and accustomed harvest areas. The Quinault Indian Nation manages the only commercial razor clam fishery that is utilized for human consumption.



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Washington's coastal and ocean resources support a wide variety of recreational activities: fishing, boating, wildlife watching, shellfish harvesting, surfing, sailing, diving, camping, hiking, and much more.

The state also runs a wild stock geoduck fishery, which earns on average \$8 million annually in revenue.⁷² Washington State Department of Natural Resources (DNR) auctions the right to harvest quotas of geoducks in water depths between eighteen and seventy feet. The Legislature appropriates revenue from this fishery to a number of state agencies and provides grants to local governments for a variety of aquatic resource management and enhancement projects and provides grants to local governments. Currently, WDFW allocates 2.7 percent of the commercial biomass for each of six geoduck management regions for total fishing effort each year. This amount is split equally between the state and the treaty tribes.

Only five of the geoduck management regions are fished—the San Juan Management Region has recognized beds of geoducks, but not at surveyed commercial densities. Of the other regions, the Strait of Juan de Fuca Region accounts for about 12 percent of the total state harvest—approximately 280,000 pounds of geoduck per year.⁷³ The majority (85 percent) of the geoducks harvested are in the Hood Canal, Central Puget Sound, and South Puget Sound Regions.

Other important shellfish fisheries include spot shrimp, a relatively new, developing industry, and pink shrimp, a well-established fishery. Over 5.2 million pounds of shrimp were harvested in 2005 for a value of \$3.4 million.⁷⁰ The outer coast accounted for over 81 percent of the total shrimp harvest in the state, while 11 percent of the shrimp were harvested in the Strait of Juan de Fuca.⁷⁰

Finally, sea urchin, sea cucumber, squid, and octopus make up smaller fisheries. The urchin fishery brought over 400,000 pounds worth just over \$300,000 in 2005 - 75 percent harvested from the San Juan Islands and 16 percent from the Strait of Juan de Fuca.⁷⁰

Aquaculture

Aquaculture is one of the state's oldest industries. Shellfish aquaculture produced \$77 million in sales in 2004, accounting for 86 percent of the West Coast production.⁴ Pacific oyster production in Willapa Bay and Grays Harbor had a value of \$13.9 million in 2005. This area typically accounts for over two-thirds of the state's production of oysters.⁷

As of 2003, Washington had eight licensed and operating finfish, net pen aquaculture sites located in the state's marine waters. These operations produce about 12 million pounds of farmed fish, mostly Atlantic salmon, worth an estimated \$40 million annually.⁷⁴ The state's finfish aquaculture industry is one-tenth that of British Columbia's finfish aquaculture industry.⁷⁴

Tourism & Recreation

Washington's beautiful and relatively pristine outer coast attracts local state residents and tourists from around the world. Our coastal and ocean resources support a wide variety of recreational activities: fishing, boating, wildlife watching, shellfish harvesting, surfing, sailing, diving, camping, hiking, and much more. Nearly three-quarters of Washington households participate in recreational water activities.² Over half of the state's residents visit a beach annually.⁷⁵ Washington's state parks are popular recreation destinations receiving 58 million visitors in 2000, a 40 percent increase over 1990.^{*76} The numerous ocean-side parks and campgrounds are among the most popular state parks in Washington.

Recreational divers and anglers total 800 thousand trips per year across the whole state.² In 2005, over 90 thousand ocean angler trips were taken on vessels off the Washington coast.⁷ This was a decrease of 17 percent from the previous year, but well above the annual effort levels from 1994 through 2000.⁷ The proportion of angler trips on charter vessels increased slightly to 35 percent in 2005, but remained lower than previous years.⁷ Harvesting clams and oysters is another popular recreational activity. In 2005, the San Juan Island area generated over 22,000 recreational trips, the second highest of any managed area.⁷⁷ The Strait of Juan de Fuca area generated over 2,800 trips.

In 2001, over half the state's population participated in wildlife-related recreation such as hunting, fishing, and wildlife watching.⁷⁸ Wildlife watching is growing in popularity with 2.4 million participants in Washington supporting more than 21,000 jobs – second only to Boeing in the state.⁷⁹ Over \$1.7 billion is spent annually in the state on wildlife watching activities such as food, lodging, transportation, and equipment.⁷⁹

Washington's outer coast and straits provide prime areas for wildlife watching. Whale watching in the San Juan Islands has steadily increased over the past 20 years. Lime Kiln Point/Whale Watch State Park receives nearly 200,000 visitors annually.⁸⁰ Over 73 commercial whale-watch vessels from U.S. and Canadian companies operate in the area.⁸⁰ Grays Harbor National Wildlife Refuge hosts up to one million shorebirds that stop to rest and feed during their migration.⁸¹ In 2004, people made over 21,000 visits to this refuge spending a total of \$315,000.⁸¹

Besides providing enjoyment, tourism, and recreation also help drive the local economy. Direct travel-related spending in Washington totaled over 11 billion dollars in 2004.⁸² Tourism is one of the largest employers on the outer coast providing between 9 and 17 percent of the jobs.⁸²

Ship-building and marine transportation provide important economic contributions and mobility to coastal communities.



* In Washington, the attendance at state parks decline in 2001 compared to 2004 was 16 percent. State parks attributed the decline mostly to a temporary entrance/user fee, which the state revoked in 2005. See Washington State Parks and Recreation Commission: <http://www.parks.wa.gov/public.asp>.

Our quality of life, cultural values and identities, and state's character depend on preserving cultural resources such as archaeological and historical sites.



In 2004, travel spending resulted in earnings of \$66.8 million in Grays Harbor County and \$46 million in Pacific County.⁸² Visitor generated sales make up a larger percentage of tax collections in these counties than the state average.⁸²

Marine Transportation & Ports

Trade is vital to our state's economy. Washington is the fourth largest exporting state in the U.S.⁵ One out of four jobs in the state is tied to exports; 740,000 jobs depend on exports and 161,000 depend on imports.⁵ Washington-originated exports total \$34 billion and represent 39 percent of the state's overall trade.⁵

Marine shipping and ports handle much of our trade. Washington's 76 public ports handle 8 percent of the nation's exports and 6 percent of its imports.⁵ In 1997, this totaled over \$100 billion in goods.⁴ Over the next 20 years, international trade is expected to increase 5 percent per year.⁴ While the data on the expected growth is not available for outer coast ports, both Grays Harbor and Port Angeles continue to grow. An increase in barging, or short-sea shipping, between ports may help alleviate congested roads and rails from growing trade.⁵³ Other outer coast ports provide vital access to marine resources and trade connections for local industries such as fisheries and aquaculture.

Ship-building and marine transportation provide important economic contributions and mobility to coastal communities. Boat and ship-building generated \$2.3 million in wages for Jefferson and Pacific counties.⁶⁸ Wage data from this sector was not available for Grays Harbor or Clallam county, but they have four and six boat and ship-building establishments, respectively. The Westport Shipyard is the second largest employer in Grays Harbor, employing 450 employees in 2005.⁸³ Ferries provide critical transportation links in areas such as Grays Harbor, Port Angeles, and the San Juan Islands. Thus, Washington's ports and marine transportation comprise a key part of our economy.

Cultural & Historical Preservation

Our quality of life, cultural values and identities, and state's character depend on preserving cultural resources such as archaeological and historical sites.* These resources provide a sense of place, define local character and identity, educate about our state history, enhance community image, reflect local values, convey community pride, strengthen neighborhoods, and conserve resources.⁸⁴

* See previous section on cultural and historical resources for further discussion on the major types of these resources on the outer coast.

Cultural resources can produce economic benefit as well. According to recent research by the Travel Industry Association of America, tourists traveling to visit historical or cultural attractions spend more money and time at their destination than other types of tourists.⁶⁴ Visiting historical and cultural sites is the second most popular activity for vacationers.⁶⁴ In addition, historical and cultural preservation results in more employment and tax revenue than new construction, produces more jobs and business for local suppliers, and revitalizes central business districts.⁶⁴

Human Health & Biodiversity

The millions of species in our oceans play an important role in preserving human health and biodiversity. Seafood provides an important source of healthy protein for our population. Yet, chemical and biological contaminants can cause threats to human health from consumption of tainted seafood. Ocean resources are also the source of compounds for new pharmaceutical drugs, nutritional supplements, and other medical uses.⁶⁰ Marine organisms such as sponges, corals, mollusks, and algae have played an important role in the development of surgical implants, cancer and anti-inflammatory drugs with many new drugs and uses under development.⁶⁰ Researchers continue to discover new life forms in our oceans aiding further technological and biomedical advancements.

Offshore Energy & Minerals

Washington's ocean resources provide the potential to develop renewable sources such as wind, wave, and tidal energy. The Makah tribe is currently working with AquaEnergy on licensing a wave energy project. Wind energy potential is generally greater in offshore areas than on land.⁸⁵

Washington State law prohibits leasing state waters for oil or gas development. A federal moratorium currently prohibits oil or gas leasing or exploration in federal waters (from 3 to 200 nautical miles). Unless it is extended, this moratorium expires in 2012.

Gas hydrates, which form naturally at the edge of the continental shelf, are another potential, but volatile, energy source. Their use, however, is not yet economically or technologically feasible.⁶⁰

Other non-market values

Washington's incredible ocean resources do more than support the economy or provide a cornucopia of food. They are central to maintaining cultural values and identities. Oceans are places of magic and mystery. As the state Seashore Conservation Act describes, they provide "relaxation away from the pressures and tensions of modern life."^{*}

^{*} Revised Code of Washington: 79A.05.600.



The oceans provide a great frontier for scientists to continue making new discoveries and provide inspiration to the public.



Vast areas of the ocean remain unexplored and poorly understood. The oceans provide a great frontier for scientists to continue making new discoveries. Unique marine habitats and wildlife rely on a clean and healthy ocean. They also inspire the public and spark interest and curiosity that promotes learning.

Oceans absorb 1,000 times more heat than the atmosphere and twenty times more carbon than the earth's terrestrial areas.⁶⁰ They play a pivotal role in cycling of heat and water around the earth and regulating the earth's climate. Researchers predict the increasing concentrations of carbon dioxide in the atmosphere will cause oceans to absorb more carbon dioxide and result in more acidic oceans – likely resulting in reduced diversity and diminished wealth of ocean species. Significant changes may also occur to key earth processes such as ocean circulation, sea ice creation, and storm formation.

Protecting and Restoring Washington's Ocean Resources and Coastal Communities

Washington's ocean resources are vital to our culture, quality of life, and economic health. They provide abundant opportunities; yet face a myriad of threats. We have the chance to steer a better course for our oceans and ourselves. As we face new and emerging issues, managing our ocean resources effectively for the next century and beyond will take action and funding, including: a renewed commitment, new management paradigms, sustained research and monitoring, better coordination and cooperation, and planning. We must renew our vow to protect and restore our ocean resources and create sustainable, resilient coastal communities.

Key Recommendations

Based on public input and research, the Ocean Policy Work Group (OPWG) determined several issues and many ways to improve management of Washington's ocean and coastal resources. In Volume 2 of their final report, the OPWG provides a comprehensive list of over 50 recommendations including supporting background information. The following list contains the OPWG's priority recommendations for immediate attention and action. These recommendations will form the initial action plan of the new ocean policy team (See Recommendation 6-1 below).

Governance

Recommendation 6-1

Establish the WASHINGTON INTERAGENCY OCEAN POLICY TEAM

Initiate a clearly defined collaborative process involving core ocean and coastal state agencies, that includes regular consultation and collaboration with federal agencies, neighboring states and provinces, tribes, local governments, ports, industry, non-profit organizations, schools, colleges and universities and interested citizens.

This will allow Washington to appropriately address a wide range of ocean issues and enhance ocean and coastal management practices of the state. State and federal agencies have overlapping jurisdictions and multiple authorities on the outer coast. The state also needs an effective way to involve local stakeholders in ocean policy issues, which is currently lacking. Finally, significant ocean issues that require a collaborative approach, such as offshore aquaculture and renewable ocean energy technologies, are emerging. The Washington Interagency Ocean Policy Team would provide a way to meet these needs.

To achieve this goal, the Governor or her designee should convene the Washington Interagency Ocean Team. The team will include participants from key state agencies, local government, and tribes; invite other participants as necessary to ensure broad consideration and enhanced coordination of ocean and coastal issues; regularly consult and collaborate with federal agencies, neighboring states and provinces, tribes, local governments, ports, private sector and non-profit organizations, schools, colleges, universities, and interested citizens. The Team will also establish and implement the Washington Ocean Action Plan based on the recommendations of the Ocean Policy Work Group, which will include review of the Northwest Straits Commission's Marine Resource Committee model as a proven way to provide local constituents direct participation in these processes. The team's future work will also address funding and legislation recommendations in more specificity.



photo credit Katrina Lassiter

Ocean Research and Observing

Recommendation 4-1

Develop an ocean research, monitoring, and observing summary report and strategic plan which summarizes current and prioritizes future research, monitoring, and observing efforts.

Ocean research in Washington is fragmented and sporadic. The state lacks comprehensive monitoring of basic oceanographic conditions, ocean processes, and biological communities. This information would further our understanding of the status of our resources and allow us to accurately assess the impact of resource management decisions.

Recommendation 4-3

Pursue installation of Doppler RADAR facility on Washington's outer coast and promote placement of additional buoys and sensors on outer coast. Integrate observing networks.

Doppler RADAR would provide more accurate information on approaching weather systems, increasing marine and coastal safety. The nearest Doppler RADARs are located in Puget Sound and do not adequately cover the outer coast. Sensors placed on buoys offer another way to improve basic knowledge of Washington's ocean and coast. Only a couple buoys along Washington's coast currently provide information on basic oceanographic conditions such as current, wave height, and wind speed.

Sustainable Fisheries

Recommendation 1-1

Support groundfish management on a regional level, which could have a smaller geographic scope than West Coast-wide, by: 1) collaborating to increase data collection and analysis and 2) encouraging the Pacific Fishery Management Council to incorporate regional differences into fisheries management on the West Coast.

In order to effectively address the biological and ecological needs of specific fisheries, we must manage some of our fish stocks according to their smaller and distinct regional populations rather than based on the entire West Coast population. Some rockfish stocks, such as yelloweye rockfish, have populations that settle in specific areas as adults. Increased data collection and analysis will result in better understanding of Washington's groundfish populations. The state can then use this data to encourage and assist the Pacific Fishery Management Council in recognizing and incorporating regional differences in fisheries management decisions.



Recommendation 1-2

Collaborate on benthic habitat research efforts, including nearshore and shelf habitat characterization and mapping.

Currently, only limited research exists for identifying and mapping for Washington's outer coast and offshore benthic habitats. Understanding our benthic habitats with mapping efforts will establish a baseline of information on Washington's ocean resources and aid fisheries and other ocean resource management decisions.



Oil Spills

Recommendation 3-6

Maintain a year-round response and rescue tug at Neah Bay.

The state currently funds a response and rescue tug in Neah Bay for nine months of the year. This tug assists vessels that breakdown or that are involved in marine accidents. Given the tug's valuable role in preventing and responding to potential spills in a remote area of our coast, it makes sense to provide this service year-round.

Ecosystem-Based Management

Recommendation 1-6

Assess coastal and ocean resources and trends to facilitate an ecosystem-based approach in management of ocean and coastal resources. Develop performance measures and key indicators to evaluate progress toward ecosystem health.

In order to maintain a sustainable ecosystem, Washington must assess the various resources and trends of ocean and coastal systems. An in-depth ecosystem assessment of key resources and trends requires compiling more scientific data. It also involves selecting key ecosystem indicators, setting goals, and evaluating progress.

Ocean Energy

Recommendation 1-9

Integrate policy for marine and ocean renewable energy among state agencies. Interact with the Minerals Management Service on offshore energy issues. Evaluate potential impacts on existing uses and investigate developing comprehensive guidelines for renewable ocean energy such as through a Programmatic Environmental Impact Statement.

Energy developers, including public utilities, have recently submitted over a dozen applications to study areas throughout Washington's marine waters for tidal and wave energy development. Multiple



state agencies have authorities and interests related to permitting and locating these types of developments, yet little is known about their potential impacts. State agencies would benefit from coordinating on renewable energy scientific, technical, legal, and policy issues.

Climate Change

Recommendation 2-15

Improve state climate change coordination by elevating a lead agency or individual and clarifying roles and responsibilities.

Climate change will have dramatic impacts on Washington's coastal and ocean resources including rising sea-levels, increasing storm frequency and intensity, and changing biological productivity. Washington needs to increase coordination and cooperation between climate-related and resource management state agencies to improve planning and adaptation.

Ocean Education

Recommendation 4-5

Improve ocean literacy in Washington by developing an ocean education inventory and strategic plan.

By understanding their influence on ocean resources, children and adults will make informed and responsible decisions that, in turn, affect the state's future ocean health. Improved ocean education can also inspire student achievement in math and science fields and increase the workforce for ocean-related professional fields.

Recently the state collaborated with Pacific Education Institute, Olympic Coast National Marine Sanctuary, and Environmental Education Association of Washington by jointly submitting a grant proposal to the National Oceanic Atmospheric Association (NOAA) to develop a K-12 ocean curriculum. Also, the Seattle Aquarium recently received over half a million dollars to educate teachers on integrating ocean concepts into classroom instruction, to add classroom and field programs both in Seattle and at the Olympic Coast National Marine Sanctuary's Center in Port Angeles, and to produce an exhibit on ocean concepts.

Coastal Hazards

Recommendation 2-3

Address gaps in hazards research and planning. Advance baseline data and research on coastal hazards conducted by state agencies. Improve technical and financial assistance provided by state agencies to coastal communities for land-use planning.

Monitoring, research, and technical assistance are essential to planning appropriately which reduces communities' vulnerability to hazards and prevents future harm to lives, buildings, and public infrastructure.

Marine Debris - Derelict Fishing Gear

Recommendation 3-1

Establish a statewide program approach to identifying and removing derelict fishing gear.

Derelict fishing gear can ensnare marine life causing severe injuries or death. Often gear continues to entrap fish, crabs, seabirds, and marine mammals until the gear is removed from the marine environment. The Northwest Straits Commission developed a successful model of derelict fishing gear removal in the state and Washington Department of Fish and Wildlife operates a gear reporting hotline. Additionally, Department of Natural Resources' dive team provides some training for locals on removing derelict gear. A statewide program for identifying and removing derelict fishing gear could efficiently bring together these efforts and apply them to all of the state's marine waters.

Aquaculture

Recommendation 1-3

Organize a stakeholder process on all issues of finfish aquaculture through the William D. Ruckelshaus Center or other appropriate consensus facilitator.

Given the strong opposing views on finfish aquaculture, stakeholders should be brought together by a facilitator such as the William D. Ruckelshaus Center or other appropriate facilitator to gain input on the issues specific to offshore aquaculture development in order to inform state policy.

Erosion and Sediment Management

Recommendation 2-12

Conduct long-term sediment and erosion monitoring and support the Department of Ecology's Coastal Monitoring and Analysis Program.

In order to improve erosion and sediment management, the state is increasing participation in and support of the bi-state Lower Columbia Solutions Group to address erosion and sediment issues and begin developing a Regional Sediment Management plan (See Recommendations 2-9, 2-10, and 2-11).

If strengthened, the Department of Ecology's Coastal Monitoring and Analysis Program, could provide seasonal and long-term data on



coastal processes; assess impacts of climate change to these processes; document the effectiveness of dredge disposal sites at retaining sediment in the littoral cell; and provide a useful foundation for local communities and state managers to understand erosion and sediment processes.

Sustainable and Resilient Coastal Communities

Recommendation 5-1

Assist coastal communities in implementing high-impact projects that significantly improve the quality of life of their citizens.

Governor Gregoire's economic plan, *The Next Washington*,* highlights the importance of providing regional resources to support regional economic activity. Leverage the resources of CTED, other agencies, and communities to implement high-impact and high-priority community and economic revitalization projects through programs such as Community Action Teams in the Department of Community, Trade and Economic Development (CTED).



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