

University of Washington

Washington Sea Grant

2014-2018

Strategic Plan

February 1, 2014 – January 31, 2018



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I. SUMMARY

For more than 40 years, Washington Sea Grant (WSG) has served the Pacific Northwest and the nation by funding marine research and working with communities, managers, businesses and the public to strengthen understanding and sustainable use of ocean and coastal resources. Based at the University of Washington (UW), WSG is part of a national network of 33 Sea Grant colleges and institutions located in U.S. coastal and Great Lakes states and territories. The National Sea Grant College program is administered by the National Oceanic and Atmospheric Administration (NOAA) and funded through federal-state partnerships.

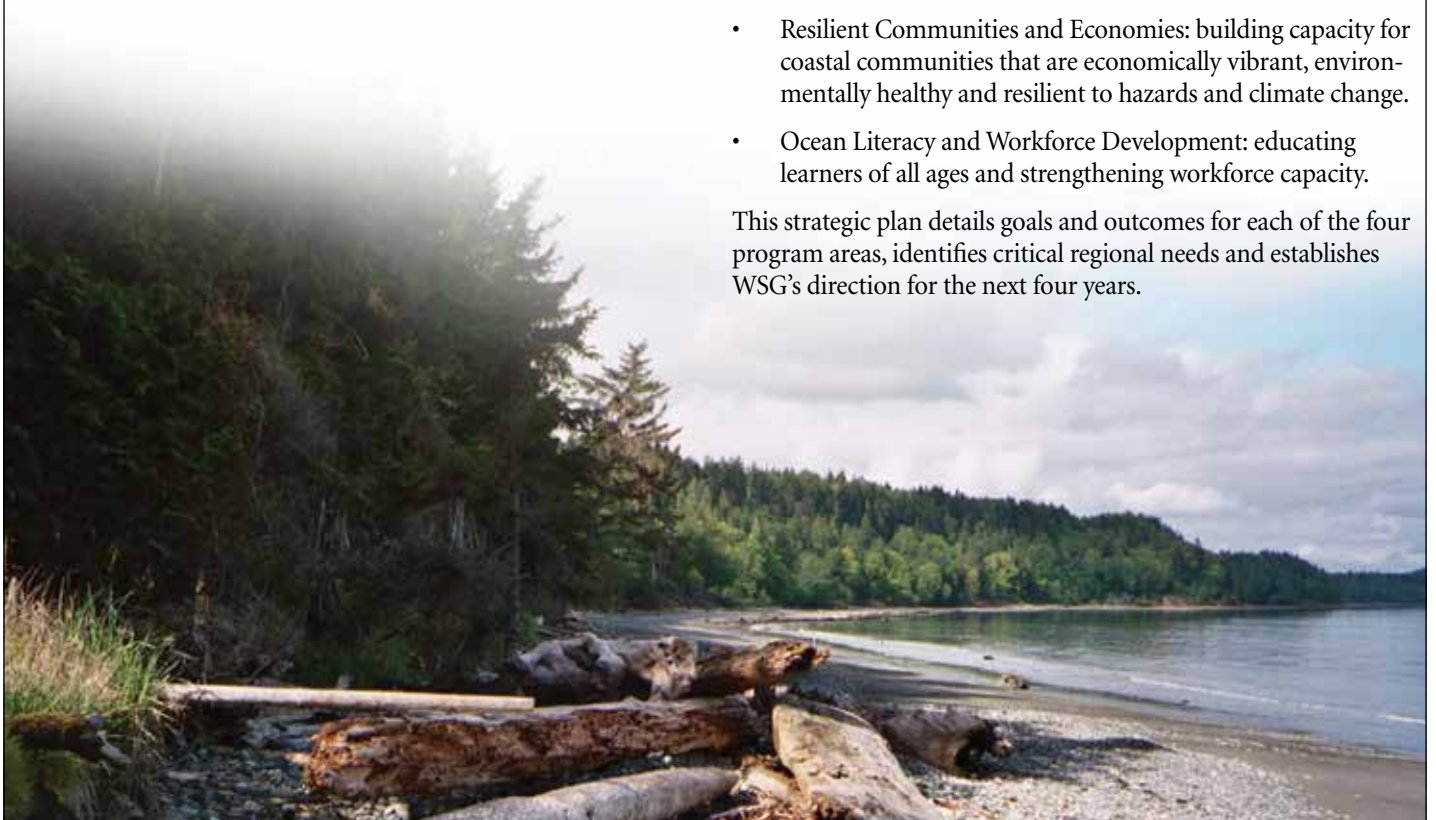
WSG operates within an extremely diverse and productive ocean and coastal region. Large communities with diversified urban economies rim the densely populated Puget Sound basin. In contrast, Washington's Pacific coast is an area of low population densities, tribal lands, small ports and natural resource-based economies. Given these differences, separate state governance approaches have developed for Puget Sound and Washington's Pacific coast. WSG is involved in implementing the Puget Sound action agenda to restore and protect Puget Sound. WSG is also a member of the state interagency caucus established to implement an action plan for improving protection and management of Washington's Pacific coastal and ocean resources. On a wider regional scale, WSG actively collaborates with NOAA's Western Region, the five other Pacific Sea Grant programs and the West Coast Governors Alliance on Ocean Health.

WSG organizes its activities around four core functions: research, outreach, education and communications. Research sponsored by WSG combines scientific excellence and a focus on issues and opportunities faced by ocean users and managers in Washington and the Pacific Northwest. Outreach experts provide technical assistance and connect marine and coastal constituents to the best scientific information available. WSG education activities engage learners of all ages to enhance understanding and stewardship of marine resources and provide professional development opportunities to encourage recruitment to ocean-related careers. WSG communications keep the public informed about current research and technology and promote the understanding of relevant issues among marine resource users. Integration of these four core functions is key to effectively carrying out WSG's mission.

Through national and local strategic planning processes, four interrelated themes have emerged as critical program areas for WSG for 2014-2018:

- **Healthy Coastal Ecosystems:** understanding ocean and coastal environments and advancing ecosystem-based approaches to manage, protect and restore natural resources.
- **Sustainable Fisheries and Aquaculture:** facilitating sustainable use of living marine resources through science-based management and environmentally and economically responsible approaches.
- **Resilient Communities and Economies:** building capacity for coastal communities that are economically vibrant, environmentally healthy and resilient to hazards and climate change.
- **Ocean Literacy and Workforce Development:** educating learners of all ages and strengthening workforce capacity.

This strategic plan details goals and outcomes for each of the four program areas, identifies critical regional needs and establishes WSG's direction for the next four years.



II. VISION, MISSION AND VALUES

Vision

WSG envisions collaboration at all levels — local, state, regional, national and international — to restore and protect a healthy marine environment. Managers rely on science-based knowledge in making decisions that affect marine ecosystems. Communities prosper socially, culturally and economically from the benefits these ecosystems provide. Individuals take active roles in conserving and nurturing the natural marine environment for themselves and for future generations.

Mission

WSG is dedicated to improving the translation of research and scientific information into knowledge for use in the marine environment. WSG serves communities, businesses, managers and the people of Washington state, the Pacific Northwest and the nation by:

- identifying and addressing important marine issues;
- providing better tools for management of the marine environment and use of its resources; and
- initiating and supporting strategic partnerships within the marine community.

Through research, outreach, education and communication, WSG helps sustain economic development while encouraging ecosystem-based approaches to management of Washington's ocean and coasts.

Values

To accomplish its mission and achieve its vision, WSG adheres to a set of core values, focusing on excellence, innovation and societal impact. It seeks to forge tools, foster insights and build capacity for sustainable management and use of Washington's marine resources. In maintaining a portfolio of high-quality projects and activities, WSG addresses emerging issues as well as those of long-standing significance and balances support for proven researchers with investments in promising new investigators. The program emphasizes interdisciplinary approaches and activities that complement or leverage efforts of other ocean and coastal organizations. WSG builds credibility among user groups by serving as an unbiased broker of scientific information and does not act in a regulatory role or as a policy advocate.

Partnerships are a cornerstone of the Sea Grant model. WSG's affiliation with the UW provides ocean and coastal constituencies with access to active marine research, while helping the UW identify and address pressing local environmental problems. Through its partnerships within the UW and with the region's other leading research universities, other NOAA programs, tribes, nongovernmental organizations and public agencies at the local, state and federal levels, WSG accomplishes far more than it could independently. Such partnerships offer more than the sharing of limited financial resources and have proven to be highly effective in solving problems and creating opportunities. They also provide audiences and resources that WSG might not otherwise access. By working cooperatively with government agencies and stakeholder groups, participating in community projects and interacting directly with interested individuals, WSG staff members become aware of changing issues and understand better how to respond to evolving needs.



III.

PROGRAM SETTING

Coastal Washington is a study in contrasts — geographically, ecologically, socially and culturally. Shorelines vary extensively, from Puget Sound’s protected deep-water fjords and inlets to the Pacific coast’s mixture of islands, rocky cliffs and headlands, cobble and boulder fields, beaches and estuaries. Small fishing towns, tribal lands and misty rain forests distinguish Washington’s 500 miles of Pacific coast. It is a region of low population densities, small ports, natural resource-based economies and multigenerational fishing families and has limited access to goods, services and infrastructure. Coastal waters support commercial and recreational fisheries for shellfish and groundfish, shipping operations and wildlife-viewing and other tourist opportunities. Pacific coast tribes take an active lead and rely on traditional and evolving resource uses. The northwestern part of the state, including adjacent marine areas, is largely under federal protection through the Olympic Coast National Marine Sanctuary, Olympic National Park and Olympic National Forest.


By contrast, the Puget Sound basin’s 2,500 miles of shoreline is home to about 4.3 million people, almost two-thirds of the state’s population. The Sound contains four of the six largest cities in the state, and together the ports of Seattle and Tacoma make it the third largest U.S. harbor for container traffic. Major international companies like Amazon, Costco, Microsoft and Starbucks are headquartered in Puget Sound, and economic growth is expected to drive expansion of the region’s population to 5.2 million by 2025. The region also faces significant concerns about polluted waters, habitat loss and declines in native species.

Given differences in habitats, population densities and resource issues, separate state governance approaches have developed for Washington’s Pacific coast and Puget Sound. The Washington State Ocean Caucus is responsible for implementing the Pacific coast’s Washington Ocean Action Plan by organizing across state agencies and consulting and collaborating with a broad array of governments and stakeholders. The effort is the basis for Washington participation in regional collaborations such as the West Coast Governors Alliance on Ocean Health (WCGA). The Caucus is also taking the lead for state coastal and marine spatial planning, establishing the Washington Coastal Marine Advisory Council in 2012 to provide more effective public input. Another Pacific coast entity, the Intergovernmental Policy Council, provides a forum for the four coastal treaty tribes and state and federal governments to discuss management issues and coordinate activities within the Olympic Coast National Marine Sanctuary.

The Puget Sound Partnership is the state agency charged with protecting and restoring Puget Sound and its diversity of life, while strengthening its role in the regional economy. One important responsibility is to serve as the regional salmon recovery organization for Puget Sound salmon species, contributing to the success of NOAA’s Puget Sound Salmon Recovery Plan. The Partnership works with local decision-makers, tribal and business leaders, scientists, environmentalists and the public to identify priorities and develop an action agenda for integrating the work of local, state and federal governments with private sector and citizen efforts to protect and restore Puget Sound. In addition, tribes, local governments and other state agencies, like the departments of Ecology, Fish and Wildlife, Health and Natural Resources, have key management and regulatory responsibilities affecting the health and use of Puget Sound resources.

Washington’s unique heritage and legal framework play central roles in shaping coastal development priorities and needs. The 29 federally recognized Indian tribes or nations in Washington serve as co-managers for coastal and marine resources and play an important cultural role. Individual tribes and intertribal councils conduct research, regulate fisheries and work government-to-government with state and federal agencies. The Northwest Indian Fisheries Commission acts as a central coordinating body for its 20 member tribes and provides support services, enabling the tribes to efficiently use the limited funds available for their natural resource management activities. The Columbia River Inter-Tribal Fish Commission, involving four member tribes, plays a similar role for the Columbia Basin. In addition, state laws passed in the 1890s allowed the sale of 70 percent of all public tidelands into private ownership, specifically encouraging shellfish culture but creating unresolved issues regarding public access of shorelines and tidelands.

The complexity of Washington’s current and future marine resource management needs calls for a comprehensive, ecosystem-based approach that integrates ecological, social, economic and institutional perspectives, recognizing their strong interdependencies. Since its inception, WSG has strategically invested in research, outreach, education, communications and partnerships to address unique regional challenges and opportunities.



IV. ABOUT WASHINGTON SEA GRANT

Established in 1968, WSG began as an experiment in effective investment of federal resources to meet local needs. In 1971, it earned UW one of the first national Sea Grant College designations. Today, WSG is part of a national network of 33 Sea Grant programs administered by NOAA, an agency of the U.S. Department of Commerce. This network provides a strong national system of research, outreach, education and communications programs in every coastal and Great Lakes state and in Puerto Rico and Guam.

WSG's location at the UW provides access to one of the nation's largest research universities and a leader among public universities in receipt of federal research support. WSG is one of 13 core units within the College of the Environment and draws on the college's academic strengths in fisheries, marine science, engineering and policy. WSG also works with numerous other colleges and departments within the UW system and with other academic and research institutions throughout the Pacific Northwest.

As a state entity, WSG is involved in major initiatives targeting Puget Sound and Washington's Pacific coast. WSG works with the Puget Sound Partnership to provide technical assistance on water quality and other marine issues and to establish programs that engage citizens in restoration and scientific data collection to support information needs. WSG also is a member of the State Ocean Caucus and is involved with other state agencies in implementing the action plan to enhance management and policies for Washington's ocean and Pacific coast.

On a regional scale, Sea Grant programs in Washington, Oregon and California collaborate with NOAA's Western Region (NOAA West) in its efforts to better integrate and coordinate the agency's ongoing activities and communications in the nine Western states. WSG also partners directly with NOAA facilities, including the NOAA Fisheries Northwest regional office and science center and the Coastal Services Center, to address priority regional needs in fisheries, coastal hazards and tidal energy. A new, jointly funded WSG liaison with Pacific Marine Environmental Laboratory will facilitate efforts on critical regional issues like ocean acidification and tsunami warnings. Finally, WSG is engaged with federal and state partners to implement the West Coast Governors Alliance on Ocean Health action plan, particularly in the areas of research, education and sustainable communities.

Nationally and internationally, WSG activities contribute to meeting the goals of the national Sea Grant strategic plan. In this way, local needs receive national attention and national commitments are fulfilled at the local level. Issues are addressed through participation in national strategic initiatives and through cooperative efforts among interested state programs. For example, the Washington, Oregon and two California Sea Grant programs are collaborating with Florida and Great Lakes programs and a Canadian agency on a project to assess pathways for introduction of aquatic invasive

species through classroom specimen releases. WSG also is partnering with other West Coast Sea Grant programs on social science research and projects to improve understanding of climate change impacts and enhance working waterfronts. On an international level, WSG applied research is reducing the impacts of fishery operations on seabird populations in the Southern Hemisphere.

At all levels, WSG relies on an engaged and active advisory committee that provides ideas, perspective, feedback and direction on implementation of the WSG mission. Membership of the WSG Advisory Committee is representative of program partners and stakeholders and is listed online at wsg.washington.edu/about.html. WSG works with a broad range of organizations concerned with the use and conservation of the marine environment and its resources. In addition, WSG supports the needs of an even larger set of stakeholders, including the faculty, staff and students at UW and other institutions of higher learning; NOAA and other state and federal agencies; local and tribal governments; nongovernmental organizations; K-12 administrators, schools, teachers and students; industries and businesses; the news media; and the public. In 2011, over 700 partners and stakeholder groups were involved in WSG programs and activities.

WSG Functional Organization

WSG organizes its activities around four core functions: research, outreach, education and communications. Integration and management of these four core functions is key to effectively carrying out WSG's mission. Spending on core functions and management is depicted in Figure 1.

Research sponsored by WSG combines scientific excellence with a focus on the issues and opportunities facing ocean users and managers. WSG research investments are guided by the need to maximize productive use of marine resources while preserving and, if necessary, helping to restore the essential qualities of healthy ecosystems. Highest priority is given to projects that build regional scientific capacity and provide knowledge for use in the marine and coastal environment. From the discovery of rare deep-sea glass sponge reefs off the coast of Washington to the design of habitat-friendly seawalls on Seattle's urban waterfront, WSG supports a mix of basic and applied research. In addition, WSG supports communications training for scientists, and research projects must include outreach plans for translating research results for broader audiences. In 2012, the WSG research portfolio included 36 ongoing projects supporting 120 investigators, 32 research institutions and about 50 graduate and undergraduate students.

Outreach efforts are primarily the responsibility of WSG Marine Advisory Services. Staff work individually and in teams, engaging marine and coastal constituents with program-generated infor-

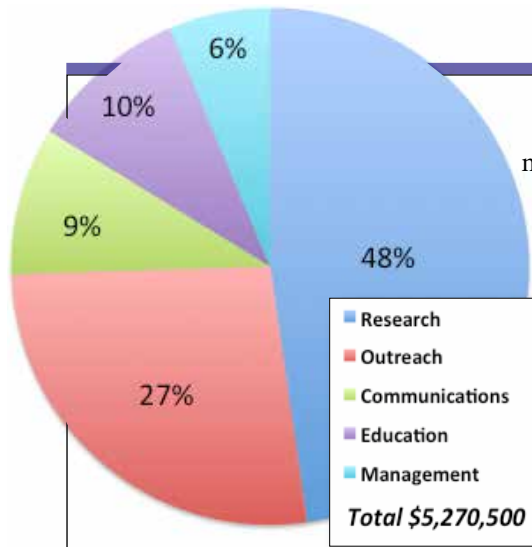


Figure 1. 2011-2012 Washington Sea Grant Funding by Core Function

mation. This network of campus- and community-based outreach specialists carries out research and shares university resources and their own expertise with the public and ocean and coastal user groups. WSG specialists work in a broad range of topic areas, including aqua-

culture, fisheries, water quality, habitat restoration, citizen science, aquatic invasive species, community sustainability, coastal development and management, marine operational safety and technology, oil spill prevention and hazard resiliency.

WSG *education* projects provide opportunities for learners of all ages to improve ocean literacy and maintain a vibrant marine-related workforce in Washington and the Pacific Northwest. WSG supports informal educational programs for K-12 students including an annual science camp and the region’s ocean sciences competition for high-school students. WSG also presents undergraduate, graduate and postdoctoral students with opportunities to compete for many different fellowship and internship programs that expand their horizons and enhance future careers. In addition, WSG research projects provide training for undergraduate, graduate and postdoctoral investigators.

As unbiased brokers of information, WSG *communications* keep the public informed about current research and technology and help communities, businesses, agencies and individuals better understand and manage marine resources and the environment. The communications team maintains a publications database, produces and distributes informational brochures, pamphlets and books, creates public exhibits and responds to media inquiries about Sea Grant activities and research. It maintains the WSG website and produces publications and other materials in support of all the other WSG program areas — helping translate technical and scientific findings into useful information.

Opportunities and Challenges

Many internal and external factors — including those identified by staff, the Advisory Committee and stakeholders during the strategic planning process — affect WSG’s performance as an organization. The public increasingly values the marine and coastal environment and offers strong positive encouragement to WSG as a program that addresses real problems. Regionally, WSG involvement with the Puget Sound Partnership, Puget Sound State Caucus, Washington State Ocean Caucus, NOAA West, the Northwest Straits Commission and West Coast Governors Alliance on Ocean Health have provided new opportunities for WSG services and expertise.

WSG’s range of capabilities, enhanced by a diverse and expert staff, gives the program the flexibility to engage in and respond to key marine issues and problems in the region. The program has earned credibility with its constituencies through its 40-year track record of accomplishment and by carefully adhering to its important role as a translator and neutral broker of scientific information. It also gains recognition and appreciation through its ability to connect one of the nation’s foremost research universities to local communities and user groups.

Some factors, however, challenge WSG’s ability to carry out its mission. These include the rapidly evolving nature of ocean and coastal issues and the demographics of user groups. WSG must work continuously to understand growing and diversifying constituencies, track and evaluate program impacts and assess and adjust priorities to meet changing coastal needs. Often the challenge is to identify real opportunities in areas where WSG has not traditionally had a presence. In 2010, NOAA Coastal Services Center partnered with WSG to improve coastal resiliency on the Olympic Peninsula, supporting a fellowship and new specialist on coastal hazards. The initiative has encouraged important partnerships with communities, tribes and academic institutions in the area and improved local capacity to address issues ranging from coastal erosion to tsunami debris.

Unlike the home institutions of many Sea Grant programs, UW is not a land grant college. While the UW is among the nation’s premiere institutions in the marine sciences, its public outreach programs are limited, and the UW lacks a county-based extension infrastructure. As a result, WSG is an unusual program within the university and must work to ensure that potential investigators, partners and constituents are aware of its applied research and outreach focus. Although the situation has created some challenges for public recognition and understanding of WSG, it also has provided incentives for development of a network of strong partnerships and cost-effective operation to enhance the delivery and reach of WSG services.

Another continuing challenge is posed by funding constraints for the program at both federal and state levels. Constituents routinely indicate strong support for ongoing WSG activities and offer suggestions for new initiatives and expanded operations. However, as marine environmental problems have multiplied over the past decade, program revenue has been stagnant. Federal support has declined in spending power, and WSG has become increasingly reliant on state and other sources of income to maintain its programs.

In developing this strategic plan, WSG relied heavily on information provided by its staff, Advisory Committee and constituents. Feedback on program priorities and implementation strategies was received through staff interviews with key constituents, meetings with the research community and almost 250 respondents to an online survey. The Advisory Committee and staff met several times over a nine-month period to contribute to the planning process and make recommendations. Finally, the WSG plan has been structured to align with and contribute to the National Sea Grant College Program strategic plan.

V. WSG CRITICAL PROGRAM AREAS

The 2014-2018 WSG strategic plan represents a balanced and realistic approach for investing in research, outreach, education, communications and partnerships that builds on existing capabilities to address unique challenges and opportunities at the university, community, state, regional and national levels. Through the strategic planning processes at the national and state level, four interrelated topics have emerged as critical program areas for WSG for 2014-2018. They respond to issues of major importance to WSG constituents and partners, including NOAA, the National Sea Grant Office, research scientists and WSG stakeholders throughout the Pacific Northwest. They also reflect ongoing WSG programs and the expertise of WSG specialists and are directly aligned with focus areas identified in the NOAA National Sea Grant College Program 2014 – 2017 Strategic Plan.

The strategic plan is designed to take advantage of the organization's strengths in integrated research, outreach, education and communications. In each of the four areas, WSG has identified goals and strategies. The goals are broad and speak to long-term national priorities to which WSG's efforts contribute. The strategies are expressed as outcomes to meet national Sea Grant requirements.



Healthy Coastal Ecosystems

The state of Washington is located within one of the world's most productive ocean and coastal regions, providing a bounty of resources that support tribal and commercial fisheries, sportfishing and recreational boating, tourism and wildlife viewing, maritime transportation, alternative energy and habitat for a diversity of organisms. Puget Sound is the second largest estuary in the United States, hosting hundreds of species of fish and invertebrates. Rocky northern shores support prolific assemblages of marine animals and plants, while coastal islands support one of the largest concentrations of seabird nesting sites in the contiguous United States. The southern coast contains three of the largest coastal estuaries along the West Coast, supporting rich eelgrass beds and mudflats and providing valuable nursery grounds for fish and shellfish. Thirty marine mammal species inhabit the state's marine waters. Seven salmonid species spawn in coastal river systems. In 2007, WSG researchers discovered glass sponge reefs, once thought to be extinct, in deep waters near Grays Canyon.

Despite these riches, Washington faces numerous obstacles to maintaining and restoring healthy coastal ecosystems. There is growing recognition of the need for ecosystem-based management that is place-based, explicitly accounts for the interconnectedness within and among systems, and integrates ecological, social, economic and institutional perspectives.¹ But our limited knowledge of ecosystem structure and function, together with our limited capacity to understand and prioritize threats and grasp their social impacts, hampers our ability to effectively manage our environment.

As a result, the health of regional natural resources has suffered. Species that have been under management scrutiny for decades are experiencing unprecedented declines. Half of Washington's 32 salmon and steelhead populations are listed as threatened or endangered. Some stocks of Puget Sound herring have dropped by as much as 90 percent in recent years, while 14 of 17 species of rockfish in the Sound have declined. In 2006, Washington's resident orca whale population was listed as endangered. All of these animals play important ecological and economic roles, and many are cultural icons in the Northwest.

These ecological changes are occurring in the context of complex, interrelated environmental changes and stressors. The Washington coast is especially vulnerable to ocean acidification, in large part due to strong seasonal upwelling that brings acidic waters onto the continental shelf. Such changes in ocean chemistry could interfere with shell development in marine organisms, disrupting

Washington's shellfish aquaculture industry, as well as food-web dynamics affecting many species. Both harmful algal blooms and hypoxia events continue to cause mortality in local species and impact the state's fishing and aquaculture industries. Aquatic invasive species also pose a serious biological threat to coastal ecosystems.

Meanwhile, as more individuals make coastal Washington home, they make changes — removing trees, constructing homes and businesses, adding roads and parking lots, clearing out streams and using concrete or rocks to harden shorelines. Past development activities have significantly altered the natural structure, functions, processes and aesthetics of Washington's shorelines. Loss of habitat is a major contributor to species decline, and salmon recovery is a primary driver of habitat management decisions in Washington. Public interest in and support for habitat protection have grown, but new approaches are needed, including protection of existing shoreline, enhancement and rehabilitation of already modified habitats, and development of strategies to inform local restoration projects.

Goal 1: Ocean and coastal resources are managed using ecosystem-based approaches.

Outcomes

- 1.1 Research and programs that build knowledge of ocean and coastal ecosystems and the value of ecosystem services.
- 1.2 Enhanced capacity for incorporating social, economic and cultural considerations into ecosystem-based management.
- 1.3 Improved understanding and technologies to effectively conserve protected species and rebuild depleted marine populations.
- 1.4 Information and approaches for addressing environmental stressors like ocean acidification, harmful algal blooms, hypoxia and aquatic invasive species.

Goal 2: Ocean and coastal habitats are protected, enhanced and restored.

Outcomes

- 2.1 Improved understanding of ecosystem services provided by ocean and coastal habitats and the environmental and societal implications of habitat alteration, degradation and restoration.
- 2.2 Effective approaches and technologies to protect, enhance and restore habitat function and support the recovery of species that rely upon it.

1. 2005 Consensus Statement on Marine Ecosystem-based Management available at http://www.compassonline.org/sites/all/files/document_files/EBM_Consensus_Statement_v12.pdf

Sustainable Fisheries and Aquaculture

Sustainable¹ seafood harvesting is a vital part of Pacific Northwest culture and commerce. From tribal fleets exercising their treaty rights, to oyster farms in South Puget Sound, Washington's people are intertwined with its living marine resources. A 2007 NOAA report found that 40 communities in the state were significantly engaged in or dependent upon commercial fishing. Although only a fraction of the regional economy as a whole relies on the fishing industry, certain localities like Westport, Bellingham and Neah Bay are highly dependent. The Washington fishing communities identified in the 2007 report range from urban centers like Seattle to rural areas with populations of fewer than 500 people. More than half of the state's fishing communities have fewer than 5,000 residents.

From an economic perspective, Washington's living marine resources sector — commercial fisheries, aquaculture, and seafood businesses — tops the national rankings with a value of \$1.2 billion, accounting for more than a half a billion dollars in wages and almost 10,000 jobs. This distinction is due in large part to the state's role as homeport to the North Pacific fishing fleet, the largest fishing enterprise in the nation. The rankings also reflect coastal marine ecosystems that provide diverse habitats and support numerous species of fish, crab, oysters and other wildlife. Commercial fishery landings in the state totaled more than 221,000 metric tons in 2011, worth nearly \$320 million. Washington's waters also support a vigorous aquaculture industry. Washington leads the country in production of farmed clams, oysters and mussels with an annual value of over \$107 million. In addition, the state has a long-standing tradition of recreational and subsistence harvest. Residents and visitors purchase 300,000 licenses each year to harvest clams and oysters, providing more than \$3.3 million in state revenue.

Despite their value, the state's fishing and aquaculture industries face multiple challenges. In recent years, some fisheries have faced severe conservation restrictions, including closures of ocean salmon fisheries. In 2011, eight species in the West Coast groundfish fishery were managed under rebuilding plans due to overfishing. While management action to establish a new catch share program in the fishery has been contentious, it appears to be enjoying early success in reducing waste and improving revenues. The aquaculture industry also faces intensifying challenges from environmental stressors such as ocean acidification and harmful algal blooms. For example, in recent years, Washington shellfish hatcheries have experienced significant losses and have altered management practices to compensate for changing environmental conditions. For both healthy and at-risk populations, improved understanding of population dynamics and environmental factors enhances the ability to sustainably manage living marine resources.

1. Sustainability is defined as meeting current needs without compromising the ability to meet future needs, taking into account economies, societies and the environment. Adapted from United Nations General Assembly (1987) Report of the World Commission on Environment and Development: Our Common Future and United Nations General Assembly (2005) 2005 World Summit Outcome.

Meanwhile, the fishing and aquaculture industries face an economically competitive environment. In 2011, more than 90 percent of seafood consumed in the United States was imported. In Washington, local commercial fishermen search for marketing strategies and product niches that can sustain their industries. Shellfish aquaculture is confronted with use conflicts, environmental concerns, shoreline development issues and a lack of data to evaluate economic benefits and trade-offs.

Safety also remains a challenge for commercial fishing. Twenty-six percent of the nation's fishing fatalities from 2000 to 2009 occurred in the Seattle-based Alaska fisheries fleet. In 2009, six Columbia River tribal fishermen lost their lives in fishing operations. Many deaths in commercial fishing are preventable. Fishing operations can be made more efficient and profitable with relevant, targeted and accessible training opportunities. Finally, there is a need to improve the safety and quality of seafood products, which requires research, technical assistance and public outreach. Strong consumer demand exists for safe, high-quality seafood from sustainable sources, with important implications for human health and commercial profitability.

Goal 3: Aquaculture operations and shellfish harvests are safe, environmentally sustainable and support economically prosperous businesses.

Outcomes

- 3.1. Improved scientific basis for marine aquaculture operations, particularly for shellfish, to address coastal development, natural resource conservation and vulnerability to environmental change.
- 3.2. Information, tools and expertise that support sustainable operations, particularly for shellfish aquaculture and harvest.
- 3.3. Approaches to ensure the safety and quality of wild-harvested shellfish and cultured products.

Goal 4: Fisheries are safe, responsibly managed and economically and culturally vibrant.

Outcomes

- 4.1. Improved understanding of environmental factors that affect fisheries and fishery resources.
- 4.2. Tools and approaches to improve effective fisheries management, productivity and ecological sustainability.
- 4.3. Training, expertise and information that support maritime safety, product quality and safety, and vibrant and resilient fisheries.

Goal 5: Seafood consumers understand the health benefits, safety and environmental sustainability of their seafood choices.

Outcomes

- 5.1. Improved understanding of the human health benefits and hazards of seafood.
- 5.2. Training, expertise and information for retail markets and subsistence and recreational consumers to enhance safe and sustainable seafood choices.

Resilient Communities and Economies

Since 1980, Washington state's population has grown by 2.6 million to 6.7 million in 2010. It is expected to reach 8.8 million by 2040. Nearly seven out of 10 residents live in the state's 15 coastal counties, with the vast majority living in the large Puget Sound urban centers. Washington's ocean economy was worth about \$7 billion and employed 150,000 residents in 2009, with marine tourism and transportation the largest sectors. Recreational boat sales in Washington reached \$375 million in 2011, and the Puget Sound region has the highest per capita boat usage in the country. However, increasing population and regional economic trends have put pressure on many traditional maritime sectors, creating conflict with waterfront development for other purposes. At the same time, some smaller coastal communities are losing resource-based employment and are considering ways to generate new economic activity.

Despite geographic, economic and cultural differences between Puget Sound and Washington's Pacific coast, both regions must balance the need to maintain traditional, sustainable uses of marine resources with emerging demands. For example, the failure to adequately consider salmon recovery in coastal decision-making is viewed by Washington tribes as an abrogation of their treaty rights.

New ocean and coastal uses, such as wave and wind energy and ocean net-pen aquaculture, also create unique information requirements that must be addressed and incorporated into place-based, coordinated planning.

In addition to changing the economic landscape, rapid growth and development of coastal communities has added stress to local coastal ecosystems. Washington has lost an estimated 70 percent of its estuarine wetlands, and in Puget Sound, more than 700 miles of shoreline are armored — with about two miles added each year. The rate of land conversion into impervious surfaces in this region ranged as high as six percent between 2001 and 2006. The quality of water resources has greatly suffered as well. About one-third of Washington state's waters are too contaminated to meet state water quality standards, and more than 60 percent of water pollution comes from stormwater and other small, dispersed sources. In order to preserve the services provided by coastal ecosystems and watersheds, planners need accurate information to make science-based decisions; communities need sustainable, low-impact alternatives when considering development approaches; and residents need best practices for stewardship of local water resources.

Coastal Washington is also susceptible to a diversity of natural hazards ranging from more common threats like flooding, landslides and erosion to rare but potentially catastrophic events like earthquakes and tsunamis. Mountainous coastal topography and location on the windward coast of the Pacific Ocean combine to give the Pacific Northwest the stormiest coastal waters in the nation. Unique and incompletely understood marine geological features increase the likelihood of undersea earthquakes and tsunamis.

Meanwhile, changing climatic conditions pose an increasing threat to regional coastlines and communities. A 2009 report on Washington climate-change impacts predicts that climate change is likely to stimulate a number of other regional environmental impacts, including warmer temperatures, higher precipitation extremes, decreased snowpack, shifts in seasonal stream flows, lower summer hydropower production, higher risk from forest fires and increased coastal erosion. Washington state is coming to terms with coastal hazards, climate change and associated community vulnerability. The needs for credible information and strategies for more effectively adapting and responding to climate-driven changes and hazards are obvious and immediate.

Goal 6: Coastal communities and economies are vibrant and resilient.

Outcomes

- 6.1. Research and programs to improve understanding of the needs, challenges and opportunities facing coastal economic sectors.
- 6.2. Technical assistance, training and information services to support traditional and emerging marine-related economies.
- 6.3. Integration of Washington's unique tribal and regional maritime heritage into activities to support coastal communities.

Goal 7: Coastal communities engage in comprehensive planning and sustainable development.

Outcomes

- 7.1. Improved coastal management and encouragement of sustainable development practices through investments in research and new approaches.
- 7.2. Partnerships, training programs and tools to support state and local coastal and shoreline planning needs.
- 7.3. Expertise to facilitate and balance multiple demands for ocean and coastal resources while preserving sustainable existing uses.

Goal 8: Coastal water resources sustain human and ecosystem health.

Outcomes

- 8.1. Approaches for addressing toxic, nutrient and pathogen contaminants in water supplies and the impact of human activities on water quality and quantity.
- 8.2. Technical assistance for and engagement of coastal residents, vessel operators and businesses in programs and best practices to reduce pollution and protect marine water quality.

Goal 9: Communities prepare, respond and adapt to coastal hazards and climate change.

Outcomes

- 9.1. Improved understanding of coastal hazards and climate change and their implications for coastal communities, marine businesses and ecosystems.
- 9.2. Enhanced information networks and partnerships, and delivery of technical assistance and information to assess vulnerabilities and improve capacity for responding and adapting to coastal hazards and climate change.

Ocean Literacy and Workforce Development

Despite the geographic proximity of Puget Sound residents to the coast, a 2006 public opinion poll revealed that most people in the region know very little about this central environmental feature in their lives — its resources, industries or declining health. Washington is not unique in this regard. An American Academy of Arts and Sciences survey found widespread public concern for the health of the ocean and coasts, but only 31 percent of respondents recognized that their personal behaviors had an impact. Two pivotal national commissions have called out the importance of strengthening the nation's ocean awareness and ensuring a knowledgeable marine workforce. In response, the ocean education community established the Essential Principles and Fundamental Concepts of Ocean Literacy, currently being considered for inclusion in the K-12 Next Generation Science Standards.

An ocean-literate person is defined as someone who *understands* ocean science, can *communicate* about the ocean and is able to make *informed decisions* regarding the ocean and its resources. Ocean literate individuals understand the essential connection between the health of the ocean and the health of humans. In 2011, however, the Ocean Project determined that the public's awareness and understanding of ocean threats such as climate change and pollution is still low when compared to its initial survey in 1999. Also in 2011, the President and the National Ocean Council called for improved understanding and increased ocean and coastal literacy as one of the priority objectives in the draft National Ocean Policy Implementation Plan.

In Washington state, the Puget Sound Partnership Action Agenda includes directives to develop and enhance education and outreach programs that contribute to an increase in ocean awareness, education and stewardship. In addition, the West Coast Governors Alliance on Ocean Health established an Ocean Awareness and Literacy Action Coordination Team specifically to address ocean literacy issues along the Pacific Coast. Ocean-related education for learners of all ages is essential to strengthen local, regional and national appreciation for the importance of the oceans and coasts and to improve scientific literacy.

Broad public awareness of ocean and coastal matters supports Washington's ocean economy, which relies on a diverse and well-trained workforce that is capable of dealing with the complexity of marine resource issues. The importance of workforce recruitment cannot be underestimated — nationally the ocean sector sustains one out of six American jobs, and 20 percent of the economy is based on ocean-related activities. In 2008, NOAA Fisheries estimated that it faced a shortage of up to 180 qualified scientists for stock assessment work alone over the next 10 years. However, many students are not choosing ocean-related careers. This recruitment shortfall is driven in part by the underrepresentation of ocean content in state education standards and limited educational opportunities for engagement in marine sciences.

Goal 10: The public is ocean literate.

Outcomes

- 10.1. Programs, resources and expertise that promote ocean literacy through science-based traditional and new media, educational opportunities for students and outreach events for learners of all ages.
- 10.2. Strengthened citizen science and stewardship through volunteer training, technical assistance and collaborations among citizens, researchers and managers.

Goal 11: The future workforce is skilled in disciplines critical to coastal and ocean economies and ecosystem health.

Outcomes

- 11.1. Programs for K-12 youth, including those in tribal and underrepresented communities, that enhance ocean literacy and provide a pipeline to marine-related careers.
- 11.2. Diverse fellowships, classes and other professional development opportunities for college students and recent graduates to build a skilled workforce.

VI. PROGRAM IMPLEMENTATION AND EVALUATION

The long-term vision and direction set by this strategic plan will guide WSG's development of a four-year federal omnibus proposal, including selection in 2013 and 2015 of competitively funded research projects. Building on the plan, the WSG 2014-2018 omnibus proposal will outline research, outreach, education and communications functions designed to ensure progress in fulfilling Sea Grant's state and national missions.

Separate but complementary processes are used to implement and evaluate components of the WSG program. Within the framework of the strategic plan, outreach, education and communications staff systematically assess their efforts and, if needed, refocus their programs so they result in positive impacts and align with national, state and university priorities. The consideration of constituent needs, inclusion of affected target audiences, appropriate choice of teaching and facilitation techniques, and relevant methods of evaluation ensure that WSG programs are successful and relevant.

Research projects are administered through a rigorous, competitive biennial process by which WSG selects, funds, oversees and manages marine-related projects carried out by academic and research institutions throughout Washington. This peer review process relies on independent experts, primarily from outside Washington, to assess scientific merit and a WSG staff and advisory committee evaluation of the contribution to regional and local needs.

A four-step process is followed for selecting WSG research projects:

1. A call for preliminary proposals is widely distributed across the state and a WSG preliminary proposal panel reviews all complete submissions. Full proposals are requested for highly rated projects.
2. Full proposals are distributed to external peer reviewers, whose evaluations are included in the considerations of a scientific review panel. The panel recommends projects for funding. The WSG Advisory Committee and staff provide further input on priorities for funding among recommended projects.
3. The director selects research investments for national concurrence and inclusion in the WSG omnibus proposal.
4. The National Sea Grant Office reviews the omnibus proposal and its elements to ensure that all requirements have been met. Contingent on federal approval and availability of funds, the omnibus proposal is implemented and research grants are awarded.

Project evaluation criteria are used to ensure selection of pre- and full proposals that combine scientific excellence with societal relevance. For details on criteria for a particular call for proposals, see wsg.washington.edu.



A publication of the University of Washington pursuant to National Oceanic and Atmospheric Administration Award No. NA10OAR417005. The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies. Projects and programs described in this publication receive funding from a variety of organizations, including NOAA and other federal agencies, the State of Washington, the University of Washington, private foundations and other sources.

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Produced by Washington Sea Grant

WSG-PM 13-02

Printed on recycled paper.



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