University of Washington

Washington Sea Grant 2018–2022 Strategic Plan

February 1, 2018–January 31, 2022

I. Vision, Mission and Values

Vision

Washington Sea Grant (WSG) envisions healthy, productive and resilient coastal and marine ecosystems that sustain Washington's rich cultural and maritime heritage, vibrant coastal communities, clean waters and beaches, prosperous fisheries and aquaculture, diverse wildlife and an engaged public.

Mission

The WSG mission is to help people and marine life thrive by supplying research, technical expertise and educational activities that support the responsible use and conservation of ocean and coastal ecosystems.

Values

To accomplish its mission and achieve its vision, WSG adheres to a set of core values focused 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 longstanding significance, and balances its investments among promising and proven researchers. Facilitating practical and collaborative solutions to today's ocean and coastal issues, WSG serves as an unbiased broker of scientific information and real-world expertise.

Cross-cutting principles

WSG endorses and is committed to pursuing activities that advance the two cross-cutting principles identified in the National Sea Grant Program 2018–2021 Strategic Plan:

- Cultivate partnerships by integrating the expertise and capabilities of partners from the international, federal, tribal, and state communities and from academia, nongovernmental organizations and industry.
- Enhance diversity and inclusion by seeking and welcoming diverse perspectives in order to improve cultural understanding and enable the network to pursue its vision and mission effectively and efficiently.

II. Program Setting

Coastal Washington is a study in contrasts — geographic, ecological, social and cultural. Shorelines vary from Puget Sound's protected deep-water fjords and inlets to

the Pacific coast's mixture of islands, estuaries, rocky cliffs and headlands, and cobble and boulder fields and beaches.

PACIFIC COAST

- About 590 miles of shoreline
- Two large shallow coastal estuaries and the Columbia River
- Five Pacific coastal counties with a total population of 198,000
- Four Pacific coast and four Columbia River treaty tribe co-managers
- Natural resource-based economies supporting shipping, fisheries and tourism
- Small ports and fishing towns with multigenerational fishing families and limited access to goods, services and infrastructure
- Federally protected land and water — Olympic Coast National Marine Sanctuary, Olympic National Park and the Olympic National Forest

PUGET SOUND BASIN

- Nearly 2,500 miles of shoreline
- Estuary draining more than 10,000 streams and rivers
- Twelve coastal counties are home to nearly five million, two-thirds of state total
- Sixteen treaty tribes co-manage marine resources
- Major corporate headquarters, manufacturing facilities, technology startups
- Four of the state's six largest cities and the third-largest U.S. container port
- Population growth posing significant challenges to water quality, natural habitats, biological diversity

Small fishing towns, tribal lands and misty rain forests distinguish Washington's 590 miles of **Pacific coast**. It is a region of low population densities, small ports, natural resource-based economies and multigenerational fishing families, and it has limited access to goods, services and infrastructure. Marine waters support shipping operations, commercial and recreational fisheries for both shellfishes and finfishes, and wildlife viewing and other tourist opportunities. Pacific coastal and Columbia River tribes, which rely on traditional and evolving uses of these resources, play a leading role in their management. The Olympic Peninsula and adjacent marine areas lie largely under federal protection through the Olympic Coast National Marine Sanctuary, Olympic National Park and the Olympic National Forest.

By contrast, the **Puget Sound Basin**, with 2,500 miles of shoreline, is home to nearly five million people, more than two-thirds of the state's population, and economic growth is projected to drive it as high as 6.1 million by 2025. The Sound region contains four of the state's six largest cities, and together the ports of Seattle and Tacoma compose the third-largest U.S. container port. Major international corporations like Amazon, Costco, Microsoft and Starbucks are based along Puget Sound, together with large manufacturing facilities and proliferating technology startups. Growth poses significant challenges to water quality, natural habitats and biological diversity.

With such a disparity in habitat, population density and resources, the Pacific coast and Puget Sound Basin have distinctive and sometimes unique needs that must be addressed in WSG strategic planning.

At the same time, Washington is united by a unique heritage and legal framework that is key to determining coastal community needs and priorities. Twenty-four of its 29 federally recognized Indian tribes and two intertribal commissions serve and support co-management of coastal and marine resources. In addition to playing an important cultural role, tribes conduct research, regulate fisheries and work government-to-government with state and federal agencies. Further complicating marine resource management in Washington are state laws passed in the 1890s that have allowed the sale of 60 percent of all public tidelands to private owners. This has encouraged shellfish culture but created unresolved land-use conflicts and issues of public access to shorelines and tidelands. Such complexity calls for a comprehensive, ecosystem-based management approach that integrates ecological, social, economic and institutional perspectives and recognizes their strong interdependencies. Since its inception, WSG has strategically invested in research, outreach, education, communications and partnerships to address unique regional challenges and opportunities.

III. About Washington Sea Grant

For more than 45 years, WSG has served the Pacific Northwest and the nation by funding high-quality marine research and working with communities, managers, businesses, educators and the general public to advance regional 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–university partnerships.

WSG's location at the UW provides access to one of the nation's largest research universities and a leading recipient of federal science support. As one of 11 core units within the UW College of the Environment, WSG draws on the college's academic strengths in fisheries, marine science, engineering and policy. WSG also works with many other colleges and departments in the UW system, as well as other academic and research institutions throughout the Pacific Northwest, to support both faculty and students.

WSG Advisory Committee

At all levels, WSG relies on an engaged and active advisory committee that provides ideas, perspective, feedback and direction on the implementation of WSG's mission. The committee's membership represents program partners and stakeholders. Committee members are listed at wsg.washington.edu/about-wsg/advisory-committee/

Working with a broad range of organizations focused on use and conservation of the marine environment and its resources, WSG supports the needs of an even larger set of stakeholders. Among WSG's primary partners are institutions of higher learning, NOAA and other federal and state agencies, local and tribal governments, nongovernmental organizations, K-12 educators and students, industries and businesses, news media and, most importantly, the public.

WSG works locally, regionally, nationally and internationally:

- Each year, thousands of boaters, volunteers, shellfish gatherers and residents of all ages learn about water quality, seafood safety, environmental stewardship, and marine and coastal ecosystems through WSG outreach.
- WSG leads a diverse partnership to improve sea level rise estimates and assist Island County, the City of Tacoma and salmon restoration projects in planning for potential impacts.
- As part of the interagency State Ocean Caucus, Washington Coastal Marine Advisory Council, and Puget Sound boards and planning committees, WSG is shaping marine resource management discussions, such as Washington's marine spatial plan, in state agencies and stakeholder groups.
- Jointly funded liaisons with NOAA's Pacific Marine Environmental Laboratory and the Northwest Fisheries Science Center facilitate public understanding of ocean acidification and tsunami hazards and develop tools for incorporating social wellbeing into marine ecosystem decisions.
- Working with West Coast Sea Grant programs, WSG has built its capacity to address aquatic invasive species, and is now enlisting volunteer monitors to detect and prevent the spread of European green crab in Puget Sound.
- For more than two decades, WSG has led collaborative research and outreach to prevent thousands of seabirds from drowning in the fishing gear of fleets ranging from the Southern Hemisphere to the Bering Sea.

WSG functional organization

WSG organizes its activities around four core functions: research, outreach, education and communications. The integration of these four core functions is key to carrying out WSG's mission.

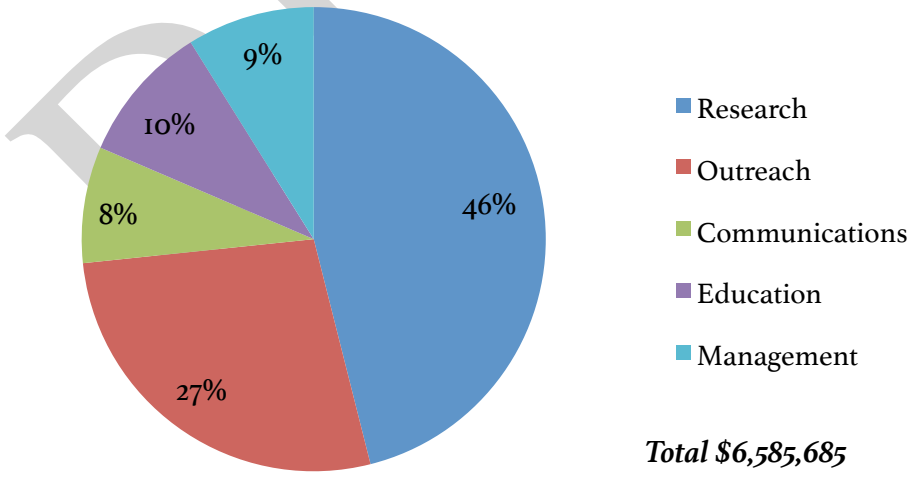
Research sponsored by WSG combines scientific excellence and a focus on issues and opportunities faced by ocean users and managers in Washington and the Pacific Northwest. In a highly competitive selection process, top priority goes to projects that build regional scientific capacity and provide knowledge for use in the marine and coastal environment. From uncovering ocean acidification's effects on mussel threads and salmon olfactory function to investigating the recovery of coastal transportation systems after a tsunami, WSG supports a mix of basic and applied research. In addition, each WSG research project must include an outreach plan for making the results available to broader audiences who can use them. In 2016, the WSG research portfolio included 34 ongoing projects supporting more than 100 investigators, 66 institutions and about 60 graduate and undergraduate students.

Outreach experts provide technical assistance and connect marine and coastal constituents to the best scientific information available. WSG specialists work in a broad range of topic areas, including aquaculture, 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 resilience.

By engaging learners of all ages, WSG's *education* activities enhance the public's understanding and stewardship of marine resources and provide professional development opportunities that nurture and encourage ocean-related careers. WSG supports informal educational programs for K-12 students, including an annual science camp and a statewide ocean-sciences tournament for high school students. WSG also presents undergraduate, graduate and postdoctoral students with opportunities to compete for many different fellowship programs that expand horizons and enhance future careers. In addition, WSG-funded projects explore maritime workforce development and provide training for undergraduate, graduate and postdoctoral investigators.

Maintaining the program's commitment to providing unbiased, science-based information, WSG *communications* keeps the public up to date on current research and technology and supports marine user needs for the latest news on relevant issues. The team maintains the WSG website and social media channels, produces publications and materials supporting the range of WSG activities, and proactively responds to media inquiries about Sea Grant outreach and research. Using a variety of communications platforms, WSG works to translate technical and scientific findings into useful information for a broad set of constituents.

2016–2017 Washington Sea Grant Funding by Core Function



Total $6,585,685

Developing the plan

In developing this strategic plan, WSG relied heavily on information provided by its staff, advisory committee, researchers and constituents. More than 450 respondents to an online survey provided feedback. The advisory committee, staff and researchers met repeatedly over a six-month period to review the planning process and recommend program priorities and implementation strategies. Finally, the WSG plan has been structured to align with and contribute to the National Sea Grant College Program strategic plan.

IV. WSG Critical Program Areas

The 2018–2022 WSG Strategic Plan represents a balanced and realistic approach to investing in research, outreach, education, communications and partnerships. It 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 critical program areas were identified for WSG for 2018–2022. These critical program areas 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 2018–2021 Strategic Plan.

Healthy Coastal Ecosystems

Washington is located in one of the world's most productive marine regions. Its bountiful resources support tribal and commercial fisheries, sportfishing and recreational boating, tourism and wildlife viewing, and maritime transportation. Coastal estuaries and Puget Sound support rich eelgrass beds and mudflats, providing valuable nursery grounds for fish and shellfish.

Despite these riches, Washington faces numerous obstacles to maintaining and restoring healthy coastal ecosystems. In the past, heavy industries spilled creosote, lead, PCBs and other toxins. Logging, farming and urban growth have damaged sensitive watersheds, smothering salmon redds and oyster beds in runoff sediment. Hydro-electric dams choked off salmon runs so vast they once seemed indestructible. The Salish Sea's iconic resident killer whales, which depend on declining salmon and are burdened with some of the highest PCB levels recorded in any animal, are listed as endangered. The native Olympia oyster, an early economic mainstay, has been severely depleted by overharvesting, degraded water quality and the invasion of non-native species.

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 shellfish aquaculture and

food web dynamics, which can affect many species. Both harmful algal blooms and hypoxic events continue to cause mortality in local species and damage 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, building homes, paving roads and parking lots, filling in streams, and using concrete and 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 the protection of intact shorelines, the enhancement and rehabilitation of already modified habitats, and the development of strategies to inform local restoration projects.

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 limited knowledge of ecosystem structure and function, together with limited capacity to understand and prioritize threats and grasp their social impacts, hampers collective ability to effectively manage the environment.

GOALS

Goal 1: Ocean and coastal resources are managed by applying sound science, local and traditional knowledge and ecosystem-based approaches.

Goal 2: Ocean and coastal habitats, ecosystems and living marine resources are protected, enhanced and restored.

APPROACH

- Investment in research projects that enhance understanding of social and ecological systems in Washington, including research on ocean and coastal habitats, ecosystems and living marine resources, and the social, economic and cultural connections critical to ecosystem-based management.
- Outreach programs to engage scientists, managers.
- Programs that provide critical information to inform and improve resource management, conservation and restoration.

OUTCOMES

- Improved understanding of ocean and coastal ecosystems, habitats and living marine resources.

[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

- Enhanced information and capacity to address social, economic and cultural considerations in ecosystem-based management.
- Information and approaches to address environmental stressors like ocean acidification, harmful algal blooms, hypoxia and aquatic invasive species.
- Improved understanding and technologies to effectively conserve protected species and rebuild depleted marine populations.
- Effective approaches and technologies to protect, enhance and restore ecosystem function and services.

Sustainable Fisheries and Aquaculture

Seafood harvesting is a vital part of Pacific Northwest culture and commerce. From tribal fishermen exercising their treaty rights to oyster farmers in South Puget Sound, Washington's people live lives intertwined with marine resources. In 2007 NOAA tallied 40 communities in the state that were significantly engaged in or dependent upon commercial fishing, finding some like Westport, Bellingham and Neah Bay to be highly dependent. The fishing communities identified by NOAA ranged from urban centers like Seattle to towns with fewer than 500 people, and more than half had fewer than 5,000 residents.

From an economic perspective, Washington's living marine resources sector — commercial and recreational fishing, aquaculture, and seafood processing and sales — leads the nation with total annual revenues of more than $8 billion, providing more than 15,000 jobs and over $1 billion in wages. 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. Washington's waters also support a vigorous aquaculture industry, producing more farmed clams, oysters and mussels than any other state. The rankings reflect diverse coastal marine habitats and this diversity also has supported a long-standing tradition of recreational and subsistence harvest. In 2015 residents and visitors purchased 192,000 shellfish harvesting licenses and 322,000 combined shellfish and fishing licenses, injecting more than $12 million into state coffers.

Despite their value, the state's fishing and aquaculture industries face many challenges. In recent years, some fisheries have undergone severe conservation restrictions, including closures of ocean salmon fisheries. In January 2017 NOAA declared disasters in six Washington fisheries, including coastal salmon and Dungeness crab fisheries and several tribal salmon fisheries in Puget Sound. While coastal stocks of canary rockfish and petrale sole have rebounded, a few groundfish populations in the Pacific fishery have yet to be rebuilt.

The aquaculture industry also faces challenges from environmental stresses such as ocean acidification and harmful algal blooms. Some regional shellfish hatcheries 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.

Meanwhile, the fishing and aquaculture industries face an economically competitive environment. The share of imported seafood consumed in the United States has climbed steadily, from 56 percent by volume in 1990 to 96 percent in 2013. In Washington, commercial fishermen seek marketing strategies and product niches that can sustain their industries. Shellfish growers face use conflicts, environmental concerns, shoreline development issues and a shortage of data on economic benefits and trade-offs.

Commercial fishing, especially in tribal fisheries, has become much safer in recent years, thanks in part to WSG's training and outreach efforts. But it can and should be safer yet. Many deaths in commercial fishing are preventable. Relevant, targeted and accessible training can also make fishing operations more efficient and profitable. Finally, there is a need to maintain the safety and quality of seafood products, which requires research, technical assistance and public outreach. Consumer demand is high for safe, high-quality seafood from sustainable sources, and filling that demand can advance both human health and commercial profitability.

GOALS

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

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

APPROACH

- Proven programs aimed at supporting sustainable fisheries and aquaculture range from training in at-sea safety, first aid, marine technology and product handling to working with fishermen to develop business plans and develop direct marketing.
- Technical assistance and research projects on aquaculture products and techniques.

OUTCOMES

- Improved scientific and technical support for marine aquaculture operations to address coastal development, environmental impacts, natural resource conservation and vulnerability to environmental changes.
- Information, tools and expertise that support sustainable aquaculture operations and shellfish harvest.
- Improved understanding of environmental factors that affect fisheries and fishery resources.
- Tools and approaches to improve fisheries management, productivity and ecological sustainability.
- Training, expertise and information that support maritime worker safety, product quality, and vibrant and resilient fisheries.

- Approaches to ensure the safety and quality of wild-harvested and cultured seafood products.

Resilient Communities and Economies

Between 1980 and 2015, Washington's population grew by more than three million people to over seven million. State forecasters expect it to reach nearly nine million by 2040. Nearly seven out of ten residents live in the state's 15 coastal counties, the vast majority in the large Puget Sound urban centers. The Puget Sound region has the highest per capita boat usage in the country, and Washington's recreational boat sales totaled $228 million in 2015. At the same time, increasing population and regional economic trends have put pressure on many traditional maritime sectors, creating conflict with waterfront development for other purposes. In addition, some smaller coastal communities are losing natural resource-based employment and seeking ways to generate new economic activity.

Despite their geographic, economic and cultural differences, the Puget Sound region and Washington's Pacific coast must balance the traditional, sustainable uses of marine resources with emerging demands. For example, Washington tribes view the failure to adequately consider salmon recovery in coastal decision-making as a violation of their treaty rights. Existing and potential new ocean uses such as wave and wind energy require adequate information to address anticipated impacts for and incorporation into the state's upcoming marine spatial plan.

In addition to changing the economic landscape, the 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. More than 600 miles of Puget Sound shoreline — 26 percent of the total — are armored, and another mile gets encased each year. The extent of impervious surface in the Puget Sound Basin grew by nearly 10,000 acres from 2006 to 2011. These surfaces shed more than 370 billion gallons of stormwater runoff each year. More than 60 percent of water pollution comes from stormwater and other dispersed sources.

Not surprisingly, water quality has suffered. About one-third of Washington's waters are too contaminated to meet state water quality standards. Planners need accurate information to make science-based decisions and preserve the services provided by coastal ecosystems and watersheds. 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 wide range of natural hazards, ranging from relatively frequent threats such as flooding, landslides and erosion to rare but potentially catastrophic events such as earthquakes and tsunamis. The mountainous coastal topography and location on the windward coast of the Pacific Ocean combine to give the Pacific Northwest the nation's stormiest coastal waters outside Alaska.

Meanwhile, changing climatic conditions pose a growing threat to the region's coastlines and communities. The 2015 report on Climate Change in Puget Sound from

UW's Climate Impacts Group catalogs a sobering list of impacts that climate change is expected to visit on Washington, 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 need for credible information and strategies for more effectively adapting and responding to climate-driven changes and hazards is obvious and immediate.

GOALS

Goal 5: Coastal communities and maritime sectors pursue development and planning that improve environmental, economic, social and cultural wellbeing.

Goal 6: Communities prepare, respond and adapt to coastal hazards and climate change.

Goal 7: Coastal water resources sustain human and ecosystem health.

APPROACH

- Support efforts toward long-term sustainability and resilience in coastal communities by documenting important relationships between people and marine resources, examining use conflicts and management needs, and providing technical information and training for coastal professions.
- Fund research aimed at breakthroughs in knowledge and new approaches to address environmental and economic challenges in coastal communities and assist in adapting to change.
- Monitor evolving coastal community needs through resident outreach specialists.
- Integrate information gained from proven programs and new initiatives on emerging issues to build knowledge for use by businesses and communities in solving problems and planning ahead.

OUTCOMES

- Activities to support community development and resilience acknowledge and protect Washington's unique tribal cultures and regional maritime heritage.
- Information and approaches from natural and social science research improve coastal management and encourage sustainable development practices.
- Research, partnerships, technical assistance, and training programs and tools to support state and local economic development and planning needs.
- Engagement of managers and stakeholders facilitates and balances multiple demands for ocean and coastal resources while preserving existing sustainable uses.
- Improved understanding of coastal hazards and climate change and their implications for coastal communities, marine businesses and ecosystems.

- Enhanced partnerships, technical assistance and information to assess vulnerabilities and improve capacity for responding and adapting to coastal hazards and climate change.
- Approaches to address toxic, nutrient and pathogen contaminants and the impact of human activities on water quality and quantity.
- Coastal residents, vessel operators and businesses use best practices to reduce pollution and protect marine water quality.

Ocean Literacy and Workforce Development

Ocean-related education is essential to build scientific literacy and help learners of all ages appreciate the importance of ocean and coastal resources and ecosystems. Despite strong physical and cultural ties to the coast, most Washington residents know very little about the sea and its vulnerabilities. In 2014 an extensive national survey found that people were inspired by the ocean but largely unaware of issues that affected its health or linkages with climate and other environmental changes. The survey suggested informed individuals were more likely to support policies promoting healthy oceans, and that public understanding was critical to conservation and sustainable use. High-level government commissions and task forces since 2004 have called for strengthening ocean literacy through formal and informal education about the ocean and coasts. They define an ocean-literate person as one who understands ocean science, can communicate about the ocean and is able to make informed decisions regarding the ocean and its resources.

Washington's ocean economy relies on a well-trained workforce capable of dealing with the complexity and diversity of its marine sector. In 2012 maritime industries injected $15 billion in revenue and nearly $15 billion in indirect and induced output into Washington's economy, and they supported more than 57,000 direct and 90,000 indirect jobs. Sustaining and replenishing this workforce is essential to the wider economy. Nationally the ocean sector supports one in six American jobs and 20 percent of all economic activity. But these industries face a looming workforce crisis. Washington's maritime workforce is older than the national average, and more workers now retire or quit the sector than enter it. NOAA has projected a shortage of 180 qualified professionals in fish stock assessment alone by 2018. These recruitment shortfalls reflect limited scholastic opportunities in marine sciences and the underrepresentation of ocean content in state education standards. Many students, teachers and guidance counselors are unaware of the rewarding careers and exciting challenges the sea offers.

In addition to education and training for undergraduate and graduate students, opportunity exists to engage students and parents earlier in the education process. According to a 2011 study, more than 75 percent of college students majoring in science, technology, engineering and math (STEM) decided to pursue their majors by the time they were in high school; 21 percent nurtured STEM interests from middle school or earlier.

GOALS

Goal 8: An ocean-literate public that is informed by lifelong formal and informal opportunities that reflect the range of diversity of our communities.

Goal 9: The future workforce is diverse and skilled in disciplines critical to coastal and ocean economies and ecosystem health.

APPROACH

- Harness public interest in seafood, recreational activities and coastal experiences to improve ocean literacy and promote sustainable ocean use.
- Invest in volunteer training, technical assistance and collaboration among citizens, researchers and managers.
- Support research and education projects that develop workforce capacity and establish pipelines to maritime careers.

OUTCOMES

- Science-based traditional and new media, educational opportunities for students and outreach events promote ocean literacy for learners of all ages.
- Rigorous citizen science and stewardship programs improve ocean literacy, promote sustainable ocean and coastal use, and contribute to regional science and management needs.
- Programs for K-16 youth, including those in tribal and underrepresented communities, that enhance ocean literacy and provide a pipeline to marine-related careers.
- Increased awareness, learning opportunities and career pathways encourage employment and promote diversity in maritime sectors.
- Diverse fellowships, classes and other professional development opportunities for college students and recent graduates build a skilled workforce.