Program Directory:

Research, Outreach and Education

2008-2009

Washington Sea Grant
University of Washington

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Contents

About this Directory

This document contains brief descriptions of current Washington Sea Grant (WSG) research, outreach and education projects for the 2007 – 2010 funding cycle. Through the national and local strategic planning processes, conducted in 2008 and 2009, four interrelated topics have emerged as critical program areas: Living Marine Ecosystems; Ocean and Coastal Environmental Health; Changing Ocean and Coastal Communities; and Ocean Literacy and Workforce Capacity. These program areas comprise the headings under which individual projects can be found. Additional information is available through the WSG Web site (*wsg.washington.edu*) or from the project leaders and investigators. Contact information for project leaders and investigators is contained in the back pages of this directory and on the WSG Web site.

Introducing Washington Sea Grant

For more than 40 years, Washington Sea Grant has served Washington, 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, WSG is part of a national network of 30 Sea Grant colleges located in every coastal and Great Lakes state and in Puerto Rico. The Sea Grant 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. Washington's ocean coast is an area of low population densities, tribal lands, small ports and natural resource-based economies. By contrast, larger communities with diversified urban economies rim the densely populated Puget Sound basin. WSG participates in numerous federal, state and local programs pertaining to these marine and coastal environments. It is involved in implementing the Puget Sound Partnership's Action Agenda to restore and protect Puget Sound. WSG is also a member of the State Ocean Caucus, established to implement an action plan for improving protection and management of Washington's ocean and coastal resources. On a larger, regional scale, WSG is actively collaborating with NOAA's Western Region, the six West Coast Sea Grant programs and the West Coast Governors' Agreement on Ocean Health.

WSG Core Programs

WSG organizes its activities around four core programs: Research, Outreach, Education and Communications.

Research sponsored by WSG combines scientific excellence and a focus on problems and opportunities faced by ocean users and managers in Washington and the Pacific Northwest. It maximizes the productive use of marine resources while preserving and, if necessary, helping to restore the essential qualities of a healthy marine 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's portfolio includes a mix of basic and applied research. WSG selects, funds, oversees and manages marine-related projects carried out by academic and research institutions throughout Washington. While smaller program development projects are funded on a continuing basis, most research projects are funded through a rigorous, competitive process that WSG conducts on a biennial basis.

Outreach efforts are a central component of WSG Marine Advisory Services (MAS). Outreach staff works individually and in teams, reaching out to marine and coastal constituents with program-generated information. MAS campus- and community-based specialists conduct research and share university resources and their own expertise with the public and state and local user groups. They work in a broad range of topic areas, including aquaculture, fisheries, water quality, marine operational safety, aquatic invasive species, coastal economic development, shoreline and coastal land use, oil spill prevention and marine technology training. Current outreach efforts addressing these topics are described in this program directory's pages.

Education provides learning opportunities for students of all ages to improve ocean literacy and maintain a vibrant marine-related workforce in Washington and the Pacific Northwest. The program presents undergraduate, graduate and postdoctoral students with opportunities to compete for fellowship and internship programs that will expand their horizons and enhance future careers. WSG also supports informal educational programs for K-12 students. It works closely with educators and technical experts to disseminate information on marine resources and the environment. Many WSG research projects involve the training of undergraduate and graduate students, as well as postdoctoral investigators.

Communications develops products to help agencies, organizations, businesses, schools and individuals better understand and manage marine resources and the environment. As unbiased brokers of information, WSG Communications keeps the public informed about current research and technology and promotes the understanding of marine issues among industry, educators and marine resource users. The Communications office 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 Web site and produces publications and other materials in support of all the other WSG program areas — helping translate technical and scientific findings into useful information. Communications has shared its expertise with the Puget Sound Nearshore Partnership, NOAA's Northwest Fisheries Science Center and the University of Washington's College of Ocean and Fishery Sciences, helping them inform their constituents about important marine issues.

Integration of these four core programs is key to effectively carrying out WSG's mission: "Improving the translation of research and scientific information into knowledge for use in the marine environment."

Critical Program Areas

Living Marine Ecosystems

Understanding the marine environment and conserving marine resources while providing for sustainable use and ensuring healthy populations in the future.

Glass Sponge Reef Habitat in the Pacific Northwest

H. Paul Johnson, School of Oceanography, University of Washington

R/NP-6

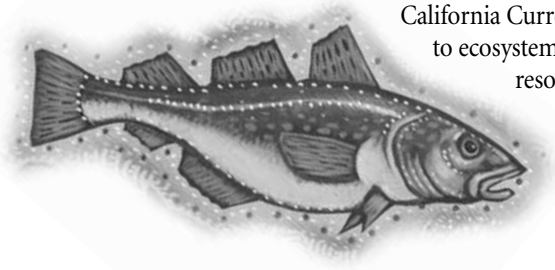
Glass sponge reefs have recently been discovered in deep waters near Grays Canyon off the Washington coast. Little is known of these habitats, long inaccessible to humans. This project is using sophisticated imaging technologies to create maps and oceanographic profiles of the sponge reefs and their inhabitants, which can include commercially important shrimp and rockfish.

Research Plan for the California Current Large Marine Ecosystem

Michelle Wainstein, Penelope Dalton and Raechel Waters, Washington Sea Grant, University of Washington

R/R-3

The coasts of Washington, Oregon and California share the large-scale climatic and nearshore oceanographic processes of the California Current Large Marine Ecosystem (LME). In order to develop ecosystem-based management approaches, research must be coordinated at a scale that mirrors that of the dominant ecosystem. Sea Grant programs on the West Coast have developed a regional marine research plan for the California Current LME to aid in the transition to ecosystem-based management of marine resources. The product of extensive stakeholder input, this plan will also be used to leverage funding for high-priority research needs.



Culturing Native Marine Shellfish: Effects of Life History Parameters on Sustainability

Carolyn S. Friedman and Brent Vadopalas, School of Aquatic and Fishery Sciences, University of Washington; Jonathan Davis, Taylor Resources, Inc.; Don Rothaus and Robert Sizemore, Washington Department of Fish and Wildlife

R/A-85

This research focuses on the dynamics and potential effects of interactions between farmed and wild populations of geoduck clams. The study is examining genetic differences between the two groups and comparing their reproductive and life history parameters. Results will enable state and tribal workers to sustainably manage wild geoducks, helping to ensure that stocks of these shellfish will remain abundant for harvesters in the future.

Estimating Population Growth and Interspecies Interaction Parameters with Spatial Replication

Jennifer Ruesink, Department of Biology, University of Washington, in support of Kevin See, Sea Grant/NOAA Fisheries Fellow in Population Dynamics

E/I-15

Understanding the effects of biotic and abiotic factors on the growth rate of a population of a particular species can help managers make informed decisions to maintain the health and viability of that population. This project will design methods for incorporating spatially replicated data to estimate these factors, enhancing the precision of estimates and potentially accelerating the response time of managers in identifying potential threats. The project will provide researchers and managers with an understanding of the potential benefits of spatial replication and covariance within a larger population and the relative effects of other species on a focal species. The model and methods developed will be used in estimating community population dynamics parameters in West Coast groundfish populations.

Educational Activities and Technical Support for Shellfish Growers

Teri L. King and Steve Harbell, Washington Sea Grant

Washington state's shellfish industry leads the nation in bivalve production and is considered by many to be the most technologically advanced in the world. To deal with increasing environmental, health and regulatory issues, growers need the latest information to remain competitive and economically viable. WSG field agents work in the Hood Canal and Grays Harbor areas, in the heart of the shellfish industry. Their activities include hosting an annual conference for shellfish growers, sharing information on aquatic nuisance species and coordinating research on a variety of environmental and water quality issues facing the industry.

Evaluating Pacific Groundfish Schooling Behavior and Untrawlable Refuges Using Multi-Species Mixture Models and Data from Autonomous Underwater Vehicles

Andre Punt, School of Aquatic and Fishery Sciences, University of Washington, in support of James Thorson, Sea Grant/NOAA Fisheries Fellow in Population Dynamics

E/I-17

Management of the seven overfished Pacific groundfish stocks is inhibited by difficulties in standard stock assessment methods that may be caused by fish aggregation and habitat-selective behaviors. This project will develop an individual-based model of Pacific groundfish to aid in evaluating future Pacific groundfish management proposals. The model will be used to estimate the precision and accuracy of alternative index standardization methods and autonomous underwater vehicle (AUV) sampling when applied to habitat-selective or schooling species.

An Individual-based, Quantitative Genetic Model for Investigating Local Adaptation and Population Viability in Connected Populations of Sockeye Salmon

Lorenz Hauser, School of Aquatic and Fishery Sciences, University of Washington, in support of Jocelyn Lin, Sea Grant/NOAA Fisheries Fellow in Population Dynamics

E/I-18

Intraspecific diversity affords species a buffer against environmental disturbance. Population structure is an important determinant of such diversity, and microevolutionary forces (such as selection, migration and inbreeding) will determine the distribution of diversity within and among populations. This project will study how interactions among salmon populations may affect this microevolutionary balance. A model will be developed to determine how microevolutionary changes translate to changes in observable traits and to simulate effects of those changes on reproductive output.

State of the Oyster Study

Teri L. King, Washington Sea Grant

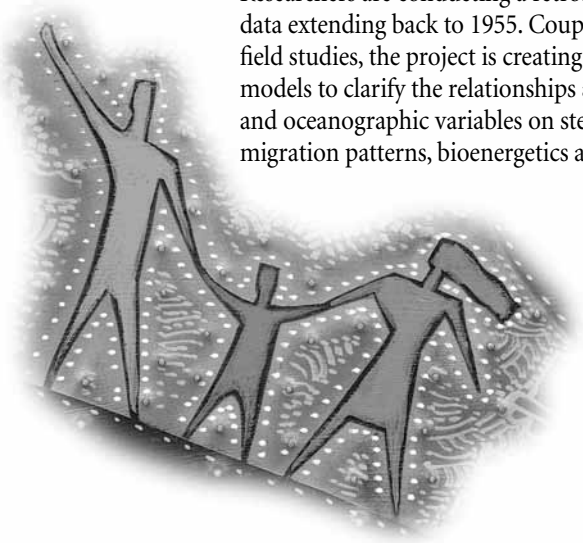
Since 1987, the State of the Oyster Study (SOS) has engaged citizens in the monitoring of edible shellfish. Waterfront property owners in Puget Sound and Hood Canal collect oyster and clam samples from their beaches at specific times during summer months. WSG arranges for laboratory testing of the samples, which are analyzed for the presence of harmful bacteria or for bacterial indicators of fecal contamination. WSG then helps participants interpret their test results and, if needed, works closely with them to identify and remedy the sources of observed contamination. Through the years, the SOS project has helped waterfront residents on more than 300 Washington beaches learn what makes for safer oysters and clams and how to minimize fecal contamination in their waters.

Climate-Change Effects on Steelhead in North Pacific Marine Ecosystems

Katherine Myers and Nancy Davis, School of Aquatic and Fishery Sciences, University of Washington; Masa-aki Fukuwaka, Fisheries Research Agency, Hokkaido National Fisheries Research Institute; Nathan Mantua, JISAO/ School of Marine Affairs Climate Impacts Group, University of Washington

R/F-160

Steelhead is a salmonid species on which millions of state and federal dollars are being spent for protection and restoration of stocks in the North Pacific Ocean. How are climate-induced changes in ocean conditions and food webs affecting steelhead growth and survival? Researchers are conducting a retrospective analysis of data extending back to 1955. Coupled with additional field studies, the project is creating a suite of maps and models to clarify the relationships among biological and oceanographic variables on steelhead distributions, migration patterns, bioenergetics and growth.



Locating the Genomic Regions Underlying Adaptive Divergence in Chinook Salmon Life History Traits

Kerry Naish, School of Aquatic and Fishery Sciences, University of Washington, and Ruth Phillips, School of Biological Sciences, Washington State University

R/B-51

The study uses advanced technologies to identify genes associated with the timing of Chinook salmon runs that are locally adapted to conditions in their natal streams. In the process, researchers will shed new light on the adaptive divergence of life-history traits among Chinook populations in the Pacific Northwest. As a tool for measuring the genetic diversity of evolutionarily important traits, this methodology will assist conservation programs with their efforts to protect biodiversity in freshwater and marine environments.

Populations and Spatial Dynamics of Endangered Baleen Whales in the North Pacific

Glenn VanBlaricom, Washington Cooperative Fish and Wildlife Research Unit, School of Aquatic and Fishery Sciences, University of Washington, in support of Amanda Bradford, Sea Grant/NOAA Fisheries Fellow in Population Dynamics

E/I-13

Baleen whale populations worldwide were dramatically reduced by commercial whaling practices in the 19th and 20th centuries. This project will examine the dynamics of severely depleted populations of baleen whales in the North Pacific in order to establish a quantitative framework for evaluating the recovery potential of these populations. The frameworks will be applied to data on western gray whales and Sea of Okhotsk bowhead whales, both of which are at high risk of extinction.

Recovery and Performance of Complex Marine Exopolymers in the Cold

Jody Deming, School of Oceanography, University of Washington

R/B-50

Exopolymers are naturally occurring compounds that, at sub-zero temperatures, function as enzyme stabilizers and protect cells against damage from freezing. This project is recovering exopolymers produced by a marine bacterium in sea ice, using innovative techniques that, unlike previous methods, will not alter the structure or properties of these compounds. This technological breakthrough should advance our understanding of sea-ice communities and has considerable potential for applications in the biotechnology field.

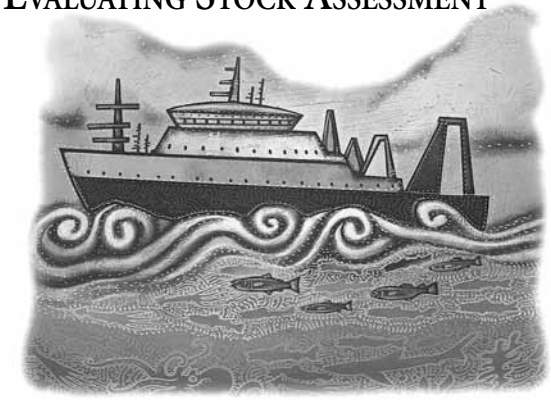
A Spatially Explicit Assessment of Bering Sea Snow Crab

James Anderson, School of Aquatic and Fishery Sciences, University of Washington, in support of James Murphy, Sea Grant/NOAA Fisheries Fellow in Population Dynamics

E/I-8

Snow crab populations in the Bering Sea have declined and recolonization by newly settled snow crab may be hampered by high rates of cod predation. This project will produce estimates of snow crab demographics and predation pressure, using data from the National Marine Fisheries Service and Alaska Department of Fish and Game. It will examine size ranges of snow crab consumed by various size classes of predators and develop estimates of local spatial and temporal variation in predator intensity. The information should help resource managers' efforts to reestablish snow crab populations throughout the Bering Sea.

Evaluating Stock Assessment



Methods and Management Strategies for Spatially Heterogeneous Fish Stocks

Ray Hilborn, School of Aquatic and Fishery Sciences, University of Washington, in support of Carey McGilliard, Sea Grant/NOAA Fisheries Fellow in Population Dynamics

E/I-14

Many fish stocks are patchily distributed in the world's oceans — a fact that is often overlooked by resource managers when setting catch quotas. For this project, methods for assessing and managing patchily distributed fish stocks will be developed and tested. The sensitivity of these models to variables such as marine protected areas and sites unreachable by conventional trawl gear will be evaluated, and the effectiveness of several strategies for managing large-scale and small-scale fisheries will be analyzed.

Larval Rockfish Dispersal Rates from Oceanography, Genetics and Otolith Marks

Lorenz Hauser, School of Aquatic and Fishery Sciences, University of Washington; Misuhiro Kawase, School of Oceanography, University of Washington; Raymond Buckley and Larry LeClair, Washington Department of Fish and Wildlife

R/F-161

Currently, scientists are uncertain about the abilities of isolated marine protected areas (MPAs) to bolster fish populations beyond their boundaries by export of fish larvae. This project is conducting genetic analyses through the studies of otoliths (ear bones) of rockfish from an artificial reef in Puget Sound and combining these data with oceanographic models of local current patterns to further understand and predict dispersal patterns within and beyond the reef. Insights into the relationship between physical environment and larval behavior could greatly assist resource managers in improving the effectiveness of future MPA designs.

Pacific Whiting Plant Monitor Training

Pete Granger, Washington Sea Grant

In 2008, shoreside processors of Pacific whiting in Washington, Oregon and California were subject to new federal catch reporting requirements. Seasonal observers now are needed to monitor whiting and bycatch landings, correctly identifying bycatch species, monitoring landing weights and ensuring accurate reporting of catch data. Working with NOAA Fisheries' Northwest Regional Office, WSG is coordinating training of observers in the processing plants.

Geochemical and Ecological Consequences of Disturbances Associated with Geoduck Aquaculture Operations in Washington

Glenn VanBlaricom, David Armstrong and Tim Essington, School of Aquatic and Fishery Sciences, University of Washington (R/GD-1a), and Jeffrey Cornwell and Roger Newell, Horn Point Marine Laboratories, University of Maryland (R/GD-1b)
R/GD-1a and R/GD-1b

As part of a large-scale multidisciplinary study funded by the state of Washington, researchers will address several of the most pressing issues regarding the effects of geoduck aquaculture on the Puget Sound ecosystem: the effects of aquaculture structures on communities of plants and animals in or on Puget Sound beaches; the potential of these structures to change the behavior or movements of salmon and other commercially and ecologically important fish and shellfish; whether disturbance during geoduck harvesting affects communities of plants and animals and subsequent recovery of the ecosystem; if such disturbance during harvesting alters the physical and chemical properties of Puget Sound beaches. Researchers will investigate ecosystem-level effects on an array of organisms, throughout the geoduck culture cycle. The project will examine initial conditions, and patterns of recovery following activities such as installing structures or harvesting clams and comparing the changes associated with culture activities to those of storms and other naturally occurring disturbances. Research findings will provide the scientific foundation for policy decisions that balance the needs and concerns of shellfish growers, environmental groups and property owners.

Cultured - Wild Interactions: Disease Prevalence in Wild Geoduck Populations

Carolyn L. Friedman and Brent Vadopalas, School of Aquatic and Fishery Sciences, University of Washington

R/GD-2

A lack of baseline information on geoduck health and condition hinders the management of this resource. Without prior knowledge of parasites and disease prevalence, it can be difficult to identify the causative agent of an epidemic. Baseline data provide information of possible pathogens and insight into whether the initial outbreak or re-emergence of a disease is related to an endemic or newly introduced parasite. In this five-year project, funded by the state of Washington, researchers will characterize parasites and other disease organisms associated with geoducks and determine their prevalence in three wild populations representing southern Puget Sound, Hood Canal and the Strait of Juan de Fuca. Animals will be collected during summer and winter to detect both warmwater and coldwater infectious organisms.

Resilience of Soft-Sediment Communities after Geoduck Harvest in Samish Bay, Washington

Jennifer Ruesink and Micah Horwith, Department of Biology, University of Washington

R/GD-3

Commercial geoduck beds share waters with soft-sediment tideflats and eelgrass meadows — two habitat types that host diverse communities of plants and animals. This project, funded by the state of Washington, will explore changes in the habitats within and nearby a commercial geoduck bed during the geoduck aquaculture cycle, from harvesting the clams through the reseeding of a new crop and the removal of protective PVC pipe. Detailed surveys before and after these events, both inside and outside the geoduck bed, will produce data on initial impacts on and rates of recovery for eelgrass meadow and soft-sediment invertebrate communities. The project will offer insights into interactions between commercial geoduck aquaculture practices and local marine habitats.

Community Engagement for Effective Watershed Stewardship in the Oakland Bay Watershed

Teri L. King, Washington Sea Grant

This project seeks to increase levels of voluntary implementation of best management practices on private lands to improve the health of the Oakland Bay watershed. Employing principles of social marketing, it will help the Squaxin Island Tribe identify key issues and obstacles to behavior change, especially among livestock owners and septic system users — the major identified contributors of nonpoint pollution within the watershed. WSG is providing nearshore discovery walks, septic socials and other public venues with teachable moments that will lead to documented behavior change.

Developing Genomic Biomarkers for Assessing Fish Reproductive Health

Graham Young and J. Adam Luckenbach, School of Aquatic and Fishery Sciences, University of Washington; Fred Goetz, Great Lakes WATER Institute, University of Wisconsin-Milwaukee; Penny Swanson, Northwest Fisheries Science Center, NOAA Fisheries Service

R/B-49

While migrating through urban waterways and nearshore environments, salmon are exposed to environmental estrogens, low oxygen concentrations and other contaminants and conditions that can inhibit reproduction. This project is identifying an array of genes in salmon that might serve as markers of such exposures. Fisheries researchers and managers can use the resulting bioassessment tools to evaluate relationships among specific environmental conditions and contaminants and the reproductive health of Puget Sound salmon stocks.

Re-Colonization of the Upper Cedar River by Anadromous Salmonids

Thomas Quinn, School of Aquatic and Fishery Sciences, University of Washington

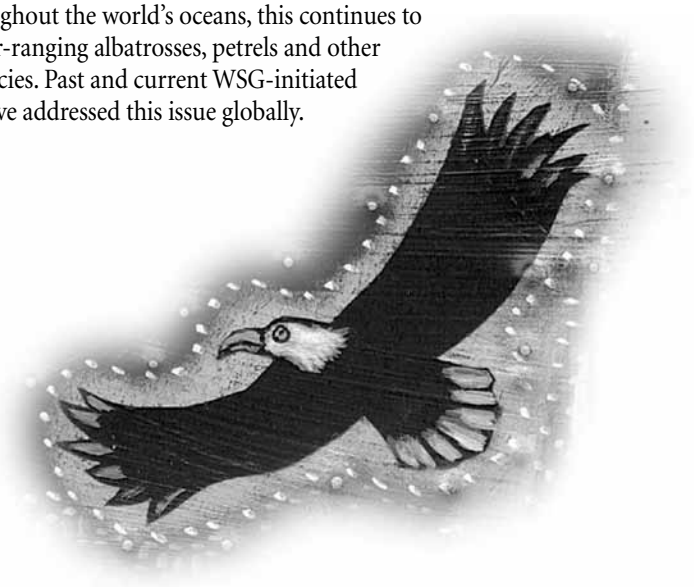
R/F-159

Recent dam modifications have allowed coho and Chinook salmon to re-colonize the upper Cedar River watershed. For the past three years, data have been collected on all salmon entering the watershed. From these and other data, project team members are exploring the origins of the fish that come back to the upper Cedar River — whether they are returning generations or a constant influx of strays from populations below the dams — and how traits such as body size and spawning date affect the reproductive success in this re-colonization event. The results will shed light on the factors spelling success or failure in salmon re-colonization efforts.

Reducing Seabird Mortality in Fisheries

Edward F. Melvin and Troy Guy, Washington Sea Grant

Seabird avoidance measures developed and tested by WSG have dramatically reduced seabird mortalities in Alaska longline fisheries. These measures have been incorporated into regulations in the North Pacific. On the West Coast, these measures are studied with cooperation from tribal and non-tribal longline fishermen. On an international level, WSG is promoting a coordinated effort to curb the accidental capture of seabirds. Few countries require seabird avoidance measures and, in the extensive longline and trawl fleets throughout the world's oceans, this continues to threaten far-ranging albatrosses, petrels and other seabird species. Past and current WSG-initiated projects have addressed this issue globally.



Ocean and Coastal Environmental Health

Assessing and addressing the effects of human activities, including contamination, habitat loss and aquatic invasive species, to protect and maintain ecosystem health.

Puget Sound Ambient Noise and its Relation to the Ecology of Marine Mammals

Peter Dahl, Applied Physics Laboratory, University of Washington

R/Ac-15

This project is characterizing underwater ambient noise in Puget Sound, focusing on the acoustic environment to which Washington's endangered southern resident killer whales and other marine mammal populations are exposed. Acoustic data from the Puget Sound seabed are being interpreted with respect to environmental conditions and noise contributions associated with commercial shipping and recreational boating. This work will further our knowledge of ambient noise in habitats of endangered and other sensitive species, while providing better tools for the management of the marine environment.

Simple Techniques Program for Hood Canal Watershed Residents

Teri L. King, Washington Sea Grant

In the Simple Techniques program, citizen involvement and awareness are key elements for keeping Hood Canal healthy. Through this state-funded program, WSG leads a series of septic socials and community clinics. Micromesh screens are distributed to capture food waste in kitchen sinks, preventing its flow into septic systems and into Hood Canal. About 2,000 property owners around the lower portion of Hood Canal participated in the project, and most have indicated that they would continue to use the screens. Research suggests that micromesh screens potentially reduce the nitrogen load in Hood Canal by 75.2 kg each year. Held in conjunction with other regional events, garbage-grinder round-ups also contribute to nitrogen reductions.

CVA Boater Pump-out Project

Dan Williams and Eric H. Olsson, Washington Sea Grant

Working with the Washington State Parks and Recreation Commission and the Puget Soundkeeper Alliance, WSG is conducting a two-phase education and awareness program to increase recognition of the federal Clean Vessel Act pump-out symbol and promote the use of boat pump-out facilities throughout Washington. Initially, the project is identifying target audiences, designing and producing information materials and promotional items, establishing a Web site and conducting surveys to be used to refine and evaluate the campaign. The campaign will be extended into eastern Washington waters, ultimately reaching operators of 25,000 boats and 50 percent of the state's marinas.

Scales of Residence-Time Variation in Northwest Estuaries

Jennifer Ruesink, Department of Biology, University of Washington, and Neil Banas and Miles Logsdon, School of Oceanography, University of Washington

R/ES-67

Driven by small-scale tidal currents, patterns of flushing and retention (or residence time) can affect such things as nutrient loading, plankton distribution and oyster growth in coastal estuaries. By understanding these patterns, scientists can more accurately predict how long pollutants may be held in the marine environment and the degree that nutrients and other materials from outside a bay might support the carrying capacity for natural populations and farmed species of fish and invertebrates. For this project, researchers are using high-resolution modeling technologies and data from field studies of oyster growth and environmental and biological conditions in two Washington estuaries. Their findings may have broader applications in estuaries throughout the Northwest.

Small Oil-Spill Prevention Education

Eric H. Olsson, Washington Sea Grant

Small oil spills add up, and their cumulative effects are particularly harmful to the marine environment. Unlike large, catastrophic spills that draw media attention, public concern and rapid response, small oil spills are rarely reported and seldom cleaned up. Often they occur in fertile nearshore marine habitats that are extremely vulnerable to pollution. WSG's small oil-spill prevention education program emphasizes direct interaction with vessel and marina operators and others to provide safe and practical alternatives to spill-prone practices. The program targets commercial fishing and recreational boats, ferries, ports and marinas to promote innovative waste oil reduction and recycling, as well as sound maintenance and operating practices. WSG plays an active role in the Clean Marina Washington program, encouraging boaters to "leave a light boatprint."

HAB Formation by a Motile Alga in Dynamic Estuarine Environments

Daniel Grünbaum, School of Oceanography, University of Washington

R/B-52

This project is investigating the functional biology and oceanography of harmful algal blooms (HABs) caused by *Heterosigma akashiwo,* an actively swimming alga. Innovative observation techniques are being used to quantify how algal swimming responses vary with genetic strain, physiological state and environmental conditions. Observed cell behaviors will be integrated with oceanographic circulation models to predict their effects on timing, location and severity of toxic blooms. This research will yield new methods for understanding the factors favorable to HAB formation and predicting the effects of future environmental changes.

Slick-forming Algae: Growth, Genetics and Toxicity

Rose Ann Cattolico, Department of Biology, University of Washington

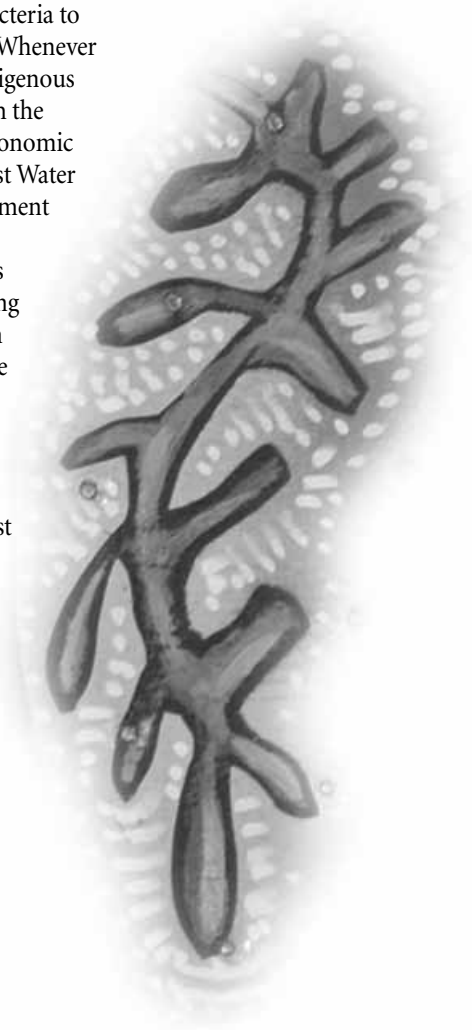
R/B-48

By predicting the location, timing and severity of highly localized HABs, scientists can help reduce the danger these occurrences pose to fish, invertebrates and humans. This project employs laboratory research and modeling technologies to identify environmental conditions that drive the formation of toxic algal blooms. Molecular "bar-coding" will help identify specific strains of algae that pose the largest economic and ecological risk.

Prevention of Non-Indigenous Species Introductions from Ships' Ballast Water

Russell P. Herwig, Washington Sea Grant

Ships' ballast water contains billions of organisms that range from microscopic viruses and bacteria to planktonic forms of invertebrates and fish. Whenever a ship empties its ballast tanks, the non-indigenous species in this water can be introduced, with the potential for considerable ecological and economic damage. In conjunction with the UW Ballast Water Research Team and the Washington Department of Fish and Wildlife, WSG is analyzing the zooplankton composition of ballast in ships that enter Washington ports and determining the efficacy of mid-oceanic exchanges — an intermediate measure that eventually will be replaced by shipboard treatment. To assist in the evaluation of technologies, the team is also developing sensitive methods to measure the viability of a wide range of organisms that must be eliminated by ballast water treatment.



Outreach and Education on Aquatic Invasive Species

Jeff Adams and Russell P. Herwig, Washington Sea Grant

Non-native plants and animals are continuously being introduced into aquatic systems. A small number will thrive, threatening personal property, livelihoods, coastal habitats and native aquatic life. Understanding pathways for aquatic invasive species (AIS) allows researchers and marine resource managers to prevent their spread, develop rapid response plans for unwanted arrivals and minimize the impacts of established AIS. Pet stores, seafood suppliers, schools, marine businesses and others play important roles. WSG and UW colleagues promote and support volunteer monitoring of AIS by citizen scientists and work with agencies at the state and regional levels to learn about introduction pathways and develop effective management strategies.

Habitat Modification Due to Sediment Gravity Flows: Elwha Dam Removal Baseline Study

Andrea Ogston and Charles Nittrouer, School of Oceanography, University of Washington

R/ES-65

This project is conducting baseline studies prior to the removal of the Elwha River dams on Washington's Olympic Peninsula. The dam removal provides a unique opportunity to explore sediment-transport mechanisms and seabed deposits resulting from concentrated flows of water and sediment from rivers. Project researchers are undertaking a combination of high-resolution seabed mapping, water-column profiling, time-series instrument deployment and seabed sampling as a baseline study, and will repeat the studies throughout the dam removal period. By evaluating the pathways that sediment takes to reach the seabed, researchers will gain a better understanding of the fate of nutrients and other chemicals bound to the sediment — an understanding that will help evaluate the impact of dam removal in the marine environment.

Ecology and Management of Marine Riparian Areas in Puget Sound

Jim Brennan, Washington Sea Grant

Working with the state's Aquatic Habitat Group, WSG staff is drafting a marine riparian guidance document for use by local jurisdictions as they update their Shoreline Master Programs and other planning elements for shorelines. When completed, the guidance document will provide recommendations for improved protection and management standards, particularly with respect to riparian buffers, for marine shorelines in Puget Sound. The project will aid in establishing a standard of practice that improves shoreline land-use practices, reduces degradation and loss of riparian and marine nearshore habitats and species and creates greater consistency among local shoreline management programs.

Integrating Intertidal Habitat into Seattle Waterfront Seawalls

Charles Simenstad, Jeffrey Cordell and Jason Toft, School of Aquatic and Fishery Sciences, University of Washington

R/ES-66

What are the ecological benefits of incorporating complex intertidal habitats into vertical seawalls along the Seattle shoreline? This project has enhanced seawalls with several different designs of specially constructed habitat test panels and troughs to increase complexity. This enhanced environment is being monitored for benefits to fish, marine invertebrates and plants and will help guide the upcoming reconstruction of the Seattle seawall and similar structures in aquatic settings.

Changing Oceans and Coastal Communities

Providing support to coastal communities for economically sound and environmentally sustainable management and development.

Managing Coastal Community Development

Katrina Hoffman and James Brennan, Washington Sea Grant

Communities, non-government organizations and coastal businesses in western Washington need sources of information to address long-range coastal futures issues. To meet this need, WSG incorporates training and outreach, network coordination and technical assistance to support shoreline and coastal planning. It continues the long-standing partnership with the Washington Department of Ecology on the Shoreline and Coastal Planners Group and encourages establishment of new partnerships to develop a coordinated network for providing technical assistance. WSG has co-located a coastal resources specialist at the Padilla Bay National Estuarine Research Reserve to facilitate collaboration with the Reserve's Coastal Training Program.

Intensive Technical Assistance Program for Fishermen

Pete Granger, Steve Harbell and Sarah Fisken, Washington Sea Grant, and John Nelson, Western Center for Risk Management Education, Washington State University Extension

As follow-up to the federal Trade Adjustment Assistance program, salmon fishermen who have been adversely affected by foreign competition and have applied for TAA benefits are eligible for an Intensive Technical Assistance (ITA) program delivered by WSG. ITA applicants are given more in-depth training in business management, direct marketing and financial planning as it pertains to their fishing businesses. WSG works with the U.S. Department of Agriculture and Alaska Sea Grant to deliver this program to tribal and non-tribal fishermen.

Sound Future Initiative

Penelope Dalton, Washington Sea Grant, and Linda Kirk Fox, Washington State University Extension

Although the majority of the region's citizens highly value Puget Sound, they do not recognize the danger it faces. Citizen education and outreach are central to protection and restoration of Puget Sound habitats and resources. The Sound Future initiative would leverage university assets to catalyze public involvement in the Puget Sound Partnership's Action Agenda. It would draw on and expand the proven technical expertise of WSG and Washington State University's Extension program, supporting a county-based volunteer network and encouraging development of citizen science programs.

Tracking Retail Boat Sales

Michelle Wainstein, Washington Sea Grant

WSG is partnering with the Washington Department of Licensing and the Northwest Marine Trade Association (NMTA) to provide access to data on boat sales in Washington. Monthly, quarterly and yearly reports help NMTA's boat-dealer members make more informed decisions about business operations, allowing them to redirect sales strategies and boost overall sales. State officials can use boat sales information to more accurately site pump-out stations for boaters' waste, target prevention program strategies for small oil spills and validate demand for new in-water moorage or dry-stack storage throughout Washington.

Crabber / Towboat Lane Agreement

Steve Harbell, Washington Sea Grant

Conflicts between ocean-going tugs and commercial crabbers in Washington, Oregon and California were a major problem in the late 1970s. Crab pots fouled tugs as they moved between coastal ports, and the loss of their gear was a severe economic loss for crab-boat owners. Sea Grant programs on the West Coast helped broker an agreement that provided navigable towboat and barge lanes through the crabbing grounds between Cape Flattery and San Francisco. WSG took a leadership role in the late 1990s that remains pivotal in saving these industries hundreds of thousands of dollars each year.

Ocean Literacy and Workforce Capacity

Educating students of all ages and strengthening workforce capacity.

NOAA Science Camp

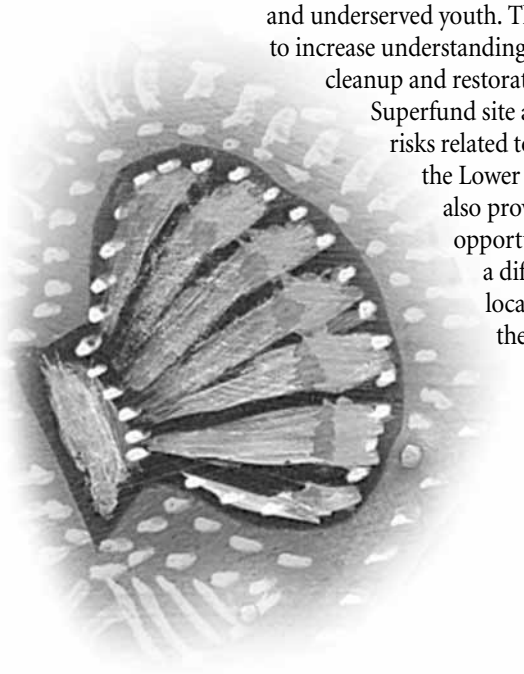
Julie Hahn, Washington Sea Grant

Held at NOAA's Seattle facility at Sand Point, five-day summer camp sessions offer opportunities for seventh and eighth graders to learn about marine sciences in a fun and stimulating environment. Participants are introduced to earth and ocean sciences and to science careers through hands-on activities emphasizing solutions to real-world problems. The camp brings NOAA scientists and staff together with educators and students to explore and solve an environmental mystery. Established in 2003, the camp is currently operated through a partnership between WSG and NOAA's Western Regional Center. Because of the continuing popularity of this program, two sessions of camp have been offered since 2007.

Duwamish Environmental Health and Justice Youth Corps

Linn Gould, Duwamish River Cleanup Coalition/ Technical Advisory Group

This project provides support to implement a bilingual (English/Spanish) science- and community-service-based educational program, the Duwamish Environmental Justice Youth Corps, for low-income and underserved youth. The goals of the program are to increase understanding of environmental science, cleanup and restoration in the context of the Superfund site and foster awareness of health risks related to exposure to contaminants in the Lower Duwamish Waterway. It will also provide positive and empowering opportunities for local teens to make a difference in improving their local environment and enriching their own communities.



Whatcom County Water Resources Education

Sue Blake, Washington Sea Grant

A unique cost-sharing partnership with WSG, Washington State University Extension and Whatcom County has produced a range of public education and applied research programs focused on local waters and watersheds. Beneficiaries of this partnership include the Whatcom County Marine Resources Committee, local outreach and education specialists, the Northwest Indian College and residents of the Lake Whatcom Watershed.

WOW: Marine Education Resources Database

Nancy Reichley, Washington Sea Grant

Washington on Water (WOW) is a unique Web-based resource center with regional scope and impact that will bring together K-12 educators, academia, government, businesses and nonprofit organizations in support of quality marine education. It provides Washington educators with a comprehensive and accessible source of information on regional marine science topics and opportunities for professional development and classroom support. WOW encourages a regional network of educators, scientists and field programs. The database includes Pacific Northwest regional education resources with clear connections to a coastal component of watersheds throughout Washington. Secondary emphasis is placed on access to national marine education that has relevance for the Pacific Northwest.

New Models for Solving Future Policy and Management Challenges in the Nearshore and Estuarine Environments

Tom Leschine and Terrie L. Klinger, School of Marine Affairs, University of Washington

E/MS-9

The Pew Ocean Commission and the U.S. Commission on Ocean Policy recommended new approaches to ocean governance that consider climate change and other future uncertainties. This project recruits graduate students within the School of Marine Affairs to develop case-study Master's theses that apply integrative approaches to address important policy and management questions for the region. The project goal is to develop a casebook that encourages a new model of analysis — one that is publishable and broadly applicable to difficult-to-resolve current issues in ocean governance.

Orca Bowl

Julie Hahn, Washington Sea Grant

This academic competition is designed to challenge and recognize high-school students' knowledge in science, math and technology in the context of the world's oceans. Students tackle questions in all areas of marine studies, facing rapid-fire short-answer questions and team challenges that test problem-solving skills. All students receive prizes for participation, with top awards that include scholarships and shipboard science experiences. The winning Orca Bowl team competes in the National Ocean Sciences Bowl finals, with support from the Consortium for Ocean Leadership.

K-12 Watershed and Estuary Education Project

Terrence Stevens, Padilla Bay National Estuarine Research Reserve

Through a partnership with WSG and the NOAA B-Wet program, the Padilla Bay National Estuarine Research Reserve is developing onsite, place-based education programs for students throughout northwest Washington. The project will offer teacher workshops on developing experiential, inquiry-based education programs and develop classroom materials.

Dean John A. Knauss Marine Policy Fellowships

Nancy Reichley, Washington Sea Grant

National Sea Grant fellowships provide one-year appointments in Washington, D.C., to graduate students in marine policy and science. The students work with executive agencies and congressional staff dealing with marine issues. These fellowships allow students to broaden their experience and knowledge in national environmental policy and to increase their chances of achieving their long-term educational and career goals. In turn, the students provide the executive and legislative branches with fresh perspectives and knowledge of current science

Marc Hershman Marine Policy Fellowships

Nancy Reichley, Washington Sea Grant

This nine-month fellowship places eligible graduate students or recent graduates with member agencies of the Washington State Ocean Caucus in Olympia, working on ocean and coastal science and management issues. The fellowship offers a first-hand experience in crafting marine and natural resource policies and enables fellows to share their academic expertise with state decision makers. In addition to WSG, the State Ocean Caucus includes members from the Governor's office, Department of Ecology, Department of Natural Resources, Department of Fish and Wildlife, Department of Health and Department of Community, Trade and Economic Development, as well as the State Parks and Recreation Commission and Military Department Emergency Management Division.

WSG Science Writing Fellowships

David G. Gordon and Dan Williams, Washington Sea Grant, and Deborah Illman, University of Washington

WSG Science Writing Fellows assist in the development of a variety of communication products about Sea Grant projects and issues in marine-related research, education and outreach. One Science Writing Fellow is selected for each of three quarters during the academic year. Upper division undergraduate and graduate students are eligible to apply and work closely with the WSG Communications program

Understanding Lummi Perspectives of Marine Resource Management and Marine Protected Areas

Patrick Christie, School of Marine Affairs, University of Washington, and Roberto Gonzalez-Plaza, Northwest Indian College

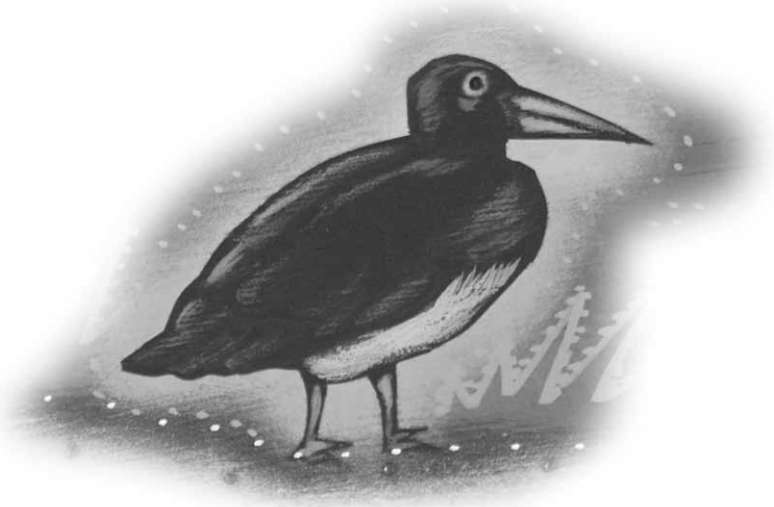
E/ES-12

This project is collecting data on Lummi Indian perspectives on emerging ocean and coastal management issues. It is fostering collaborative efforts among Lummi leaders and non-tribal marine policy makers to develop mutually acceptable policies for Puget Sound. The project has jointly hosted UW and Northwest Indian College courses, developing students' social science skills while building institutional bridges between native and non-native partners.

Citizen Science

Kate Litle, Washington Sea Grant

Public involvement in citizen science projects can increase knowledge, awareness and sense of place, inspiring behavioral change. Citizen science can also provide rigorous, cost-effective data collection for research, monitoring and management needs. WSG's citizen science program has gathered information from scientists, natural resource managers, citizen science practitioners and volunteers and convened a Citizen Science Advisory Panel to develop recommendations for advancing citizen science to meet Puget Sound Action Agenda goals. Building from this effort, the program will work to foster connections among scientists, managers, volunteer groups and others, provide consultation services for citizen science and develop resources to facilitate citizen science efforts linked to scientific research, monitoring and management needs.



Marine Safety and Technology Training

Sarah Fisken, Steve Harbell and Eric Olsson, Washington Sea Grant

West Coat and Alaska fisheries are the highest-risk fisheries in the country. Because of short seasons and competition for harvestable resources, fishermen face intense pressure to fish under adverse conditions. The pressure, combined with the severe ocean environment in the North Pacific, increases the threats to crews and their vessels. Port-based training for commercial fishermen improves their emergency preparedness and ability to effectively use new safety equipment. WSG offers classes and workshops that focus on vessel safety, maintenance and operations. The workshops also attract recreational boaters and others with close ties to the marine environment. WSG also hosts workshops and classes on marine refrigeration, corrosion, diesel engine troubleshooting, computers and navigation and other topics of interest to the owners and operators of vessels in Puget Sound and along the Washington coast.

Sustainable Seafood Retail Training

Pete Granger, Steve Harbell and Sarah Fisken, Washington Sea Grant

Sustainable fisheries management and catch methods, seafood handling and safety, and health issues are of great concern to consumers, most of whom get their information from the workers behind seafood counters. Based on a survey of meat cutters and seafood department managers in several local grocery chains, WSG designed a 12-hour retail seafood training program for apprentice meat cutters. The program is offered in conjunction with the Meat Business Apprenticeship Program of South Seattle Community College and the United Food and Commercial Workers International Union. The Alaska Seafood Marketing Institute has been a partner in the project.

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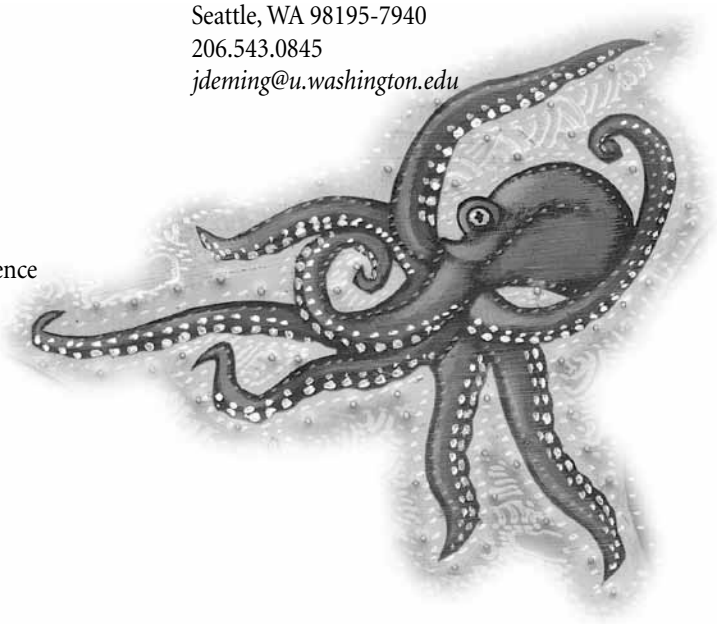

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