


U.S. Geological Survey (USGS) Western Region Coastal and Ocean Science

USGS Western Region Coastal and Ocean Science is interdisciplinary, collaborative, and integrates expertise from all USGS Disciplines, and ten of its major Science Centers in Alaska, Hawai'i, California, Washington, and Oregon. The scientific talent, laboratories, and research vessels in the Western Region and across the Nation, strategically position the USGS to address broad geographic and oceanographic research topics. USGS information products inform resource managers and policy makers who must balance conservation mandates with increasing demands for resources that sustain the Nation's economy.

This fact sheet describes but a few examples of the breadth of USGS science conducted in coastal, nearshore, and ocean environments along our Nation's West Coast and Pacific Islands.



Pacific Islands Ecosystems Research Center

Pacific Islands Water Science Center



Alaska Science Center

Western Fisheries Research Center
Washington Water Science Center
Forest and Rangeland Ecosystem Science Center
Oregon Water Science Center

Western Ecological Research Center
Pacific Coastal and Marine Science Center
California Water Science Center

The U.S. Geological Survey (USGS), the Nation's largest water, earth, biological, and geographic science agency, studies the coasts of the western United States, including Alaska and Hawai'i. USGS scientists conduct research, monitor processes, and develop information about coastal and ocean ecosystems, species, geologic hazards, and energy and mineral resources. This information helps decision-makers address the use and protection of national coastal and ocean environments.

Understanding Ecosystems and Predicting Change



From Ridge to Reef: Multidisciplinary Analysis of Linked Terrestrial and Marine Ecosystems in Hawai'i and the Pacific Islands

In response to concerns about the health and decline of tropical reef ecosystems, the USGS is developing new modeling, monitoring, and mapping technologies to understand how changes in coastal watersheds affect nearshore reefs. Changes in surface-water and groundwater availability and sediment dynamics are being studied to document landscape-scale effects of variable land-use practices, climate change effects, and invasive species on reef health and productivity.

Coastal Habitats in Puget Sound: USGS Science in Support of Ecosystem Restoration

The cumulative effects of urbanization in Puget Sound (for example, over-harvesting, dredging, diking, filling, industrial waste discharges, deforestation, and paving) have resulted in serious ecosystem decline. These stressors have led to increased toxic loadings, declines in fish and wildlife populations, habitat loss, and eutrophication, motivating large-scale preservation, restoration, and clean-up activities. USGS science on hydrological, biological, and geological processes, as well as development of decision-support tools, supports the data and information needs of State, local, Tribal, and Federal managers in their efforts to restore nearshore habitats and ensure a sustainable environmental and economic future.



Ecosystem and Coastal Wetlands of the San Francisco Estuary

The San Francisco Bay Estuary has been greatly modified by human activity. The reduction of wetlands, input of pollutants, introduction of exotic species, development of large urban areas, and regional demand for freshwater resources from northern California has resulted in extreme resource management and restoration challenges. The USGS has studied this coastal ecosystem since 1968 and currently is leading two large wetland restoration projects in habitats critical for fish and wildlife, including conservation of food webs and water quality for endangered species. USGS studies are focused on the key ecological processes associated with sediment transport into wetlands of concern and the use of dredged materials to speed the restoration process. USGS studies also are providing important insights into how climate change, including accelerated sea-level rise and increased water temperature, will change and potentially stress key estuarine habitats.

Climate Variability and Change in Coastal and Ocean Environments

Coastal Erosion

The USGS conducts the National Shoreline Change Assessment, documenting long-term coastal change. The USGS also models and forecasts storm surge and coastal inundation, phenomena that will grow in importance as sea level rises. New work along Alaska's Arctic coast documents extremely rapid shoreline retreat because of wave attack events associated with diminished ice cover and decreased bluff stability from permafrost melting.



Marine Mammal and Sea Ice Relationships

The USGS provides science results for the Endangered Species Act and other important policy decisions. As an example, populations of several key Department of the Interior (DOI)-managed species are strongly affected by characteristics of sea ice. In part because of projected sea ice loss, the polar bear is now listed as "Threatened," and the status of the Pacific walrus is in review. The USGS continues to develop modeling and forecasting approaches to understand the complex relationships of polar bears, walrus, and other species to sea ice under present and future climate conditions.



Energy and Minerals

Outer Continental Shelf Oil and Gas

The Santa Barbara Channel has and will continue to be a DOI focus due to ongoing offshore oil and gas production in Federal waters (Minerals Management Service), the Channel Islands National Park (National Park Service), the presence of endangered species (U.S. Fish and Wildlife Service), and numerous other Federal, State, and local stakeholders. USGS work includes comprehensive sea-floor mapping, studies of rockfish ecology in relationship to oil and gas platforms and natural reefs, contaminants in fish, and natural oil and gas seeps on the sea floor. Proposed oil and gas leases off the vast coastline of Alaska also require USGS studies that provide critical scientific information on the geologic framework and marine ecosystem.

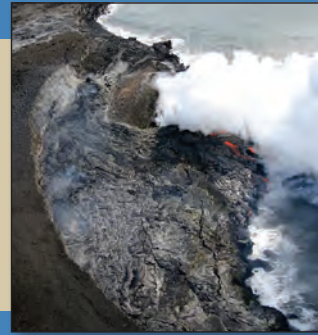
A Global Inventory of Natural Gas Hydrate Occurrence

Natural gas hydrate occurs worldwide in oceanic sediment of continental and insular slopes and rises of active and passive margins, in deep-water sediment of inland lakes and seas, and in polar sediment on continents and continental shelves. The USGS scientific studies provide essential information for understanding the role of hydrates in global climate change and as a potential energy resource.

Natural Hazards

Coastal and Marine Catastrophic Hazards

The 2004 Sumatra earthquake and Indian Ocean tsunami are sober reminders of the deadly effects and relationships between earthquakes, tsunamis, and coastal change. All United States coastlines, and especially those in the Pacific Northwest, southern Alaska, and Hawai'i, are vulnerable to these natural hazards. The USGS is an acknowledged national leader in mapping and monitoring offshore earthquake and tsunami sources (faults, landslides, and volcanoes) and in generating science-based models, assessments, and forecasts to aid in public safety and hazard mitigation.



Role of the Environment in Human Health

Pollution and Waste Disposal

A major research focus is to improve our understanding of processes that transport sediments and pollutants through the coastal ocean off major metropolitan areas such as Los Angeles, San Francisco, and Seattle. The Los Angeles shelf is heavily affected by human activities and studies in the area highlight USGS capabilities. The bottom sediments within this urban ocean are heavily polluted by DDT/DDE that was released from waste disposal outfalls. These and other persistent organic compounds bioaccumulate in coastal food webs and in many fish, seabirds, and other apex predators. Bacteria and other pollutants are discharged into the coastal waters and may threaten human and biological health. Understanding the fate, transport, and effects of pollutants in coastal ecosystems is essential for effective resource management.

Disease Transmission

USGS is collaborating with Asian colleagues in a broad geographic study of avian influenza. Scientists use satellite tagging to determine how migrations of Asian and North American birds are transmitting this disease. Genetic analyses provide evidence of interbreeding between some species of Asian and North American birds and this interbreeding of migratory birds may transfer influenza viruses between continents. These studies are important to assess the likelihood that migratory birds could carry highly pathogenic avian influenza viruses from Asia to North America, and to identify where in North America such viruses may first arrive.



Water Resources

Coastal Watersheds

Coastal watersheds have significant effects on the coastal ocean. USGS research in watersheds monitored by more than 1,100 streamgages provides important information on freshwater discharge, sediment, contaminant, carbon, and nutrient loads and their effects on marine habitats and food webs. Recent studies include investigating the effects of wild fires on coastal/ocean health, determining terrestrial influences on harmful algal blooms, and assessing the effects of dam removal. As a specific example, two dams on the Elwha River in northwest Washington will be removed beginning in 2012. This removal will release massive amounts of sediment to the fluvial and coastal systems downstream. USGS mapping, monitoring, and modeling investigations in the Elwha watershed and nearshore provide essential information to understand likely impacts on important salmon habitat, beaches, shellfish fisheries, and kelp beds.



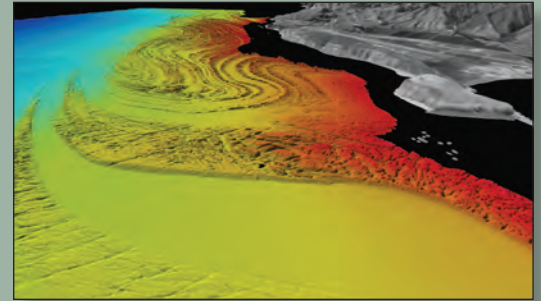
Data Integration and Evolving Technologies

Genetics and Molecular Ecology

USGS researchers use molecular and genetic approaches as critical tools for investigating managed populations and physiological effects of environmental change. For example, non-lethal genetic techniques were developed to discriminate gender in Chinook salmon in the Columbia River. This method has been useful in studies of the reproductive capacity of endangered stocks as well as the intersex issues related to chemical pollution. The USGS uses cutting edge molecular genetic markers in conservation biology research (for example, marine mammal, bird, fish, and plant studies); disease ecology studies (for example, immunology and pathogen effects); marine ballast water investigations; and in a host of other applications. Genetic data and analysis are key in all endangered species designations.

Seafloor Mapping

The USGS collaborates with numerous local, State, and Federal agencies to produce high-resolution sea-floor maps for diverse user needs. Mapping data are used to characterize benthic habitats; for fisheries management including designation of marine protected areas; to provide baselines for monitoring environmental change (for example, effects of rising sea level); to develop sediment and contaminant budgets and understand coastal processes and erosion; to develop circulation and sediment transport models, including inundation from storm surge and tsunamis; to document potential earthquake and tsunami sources; to conduct site evaluation of coastal and offshore infrastructure; and to understand geologic history and change.



Providing Science for State, Regional, National, and Global Issues

Why USGS?

- Alaska, Hawai'i, Washington, Oregon, and California coasts contain more than 75 percent of the Nation's coastline, extending from the arctic to the tropics and including a tremendous diversity of natural resources and ecosystems. The use of, competition for, and natural threats to resources in the coastal region will challenge the Nation's ability to sustain its economy, safeguard its national security, maintain its quality of life, and protect its natural environment.
- As the Science and Research arm of the DOI, the USGS plays a critical role in providing science products that inform the Minerals Management Service, National Park Service, and U.S. Fish and Wildlife Service in their execution of management responsibilities for DOI lands, trust resources, and species.



- Beyond DOI, USGS Science in the Western Region coastal and ocean environments supports a vast array of Federal, State, and local governments as they face the challenges of dealing with rapidly changing climates, expanding populations, and increased demands on the coastal and marine natural resources.
- The USGS provides a multidisciplinary, holistic approach to understanding marine ecosystems, and collecting and synthesizing important information about the physical, chemical, and biological/ecological processes for the Nation.

For more information:

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