Committee on Resources,

Subcommittee on Fisheries Conservation, Wildlife & Oceans

fisheries - - Rep. Wayne Gilchrest, Chairman
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Witness Statement

Testimony on Development of Coastal and Ocean Observing Systems
and
Ocean Exploration
Presented to the House Resources Subcommittee on
Fisheries Conservation, Wildlife and Oceans,
House Science Subcommittee on Research,
and the
House Science Subcommittee on Environment, Technology, and Standards

Introduction

Good afternoon. My name is Fred Grassle and I am the Director of the Institute of Marine and Coastal Sciences at Rutgers University. I would like to thank each of the chairs for the opportunity to provide remarks on the establishment of an Integrated Coastal Ocean Observing System, an Ocean Observatories Initiative, and the development of an Ocean Exploration Program. I would also like to recognize two New Jersey legislators who have been effective supporters of coastal and ocean research, Representative James Saxton the former Chair of the House Subcommittee on Fisheries Conservation, Wildlife and Oceans, and Representative Frank Pallone who serves on the same committee. Their continuing strong support has ensured that robust science programs are in place to support informed management of our coastal and ocean resources.

My remarks focus on the need for a national network of linked and coordinated ocean observing systems and observatories and recommendations on how such a network should be established. I will also comment on the emerging Ocean Exploration and Census Of Marine Life Programs, and make suggestions for advancing these programs. The basis of my remarks stems from my involvement in development of one of the world's first undersea observatories, participation in national efforts to construct a network of ocean observatories, and my roles as Principal Investigator for the inaugural expedition of the Ocean Exploration Program and Chair of the Steering Committee for the Census of Marine Life.

Rationale for a National Network of Coastal Ocean Observing Systems

More than half of all Americans live within the coastal zone, i.e. within 50 miles of ocean. The ocean is our common source of enjoyment and common responsibility. Fish stocks, once thought to be inexhaustible, are being depleted and, in some areas, fishing gear damages bottom habitats. Uses of the sea bed for oil and gas production, sand and gravel mining, and telecommunications cables are increasing. Periods of oxygen depletion are common, and the number and types of harmful algal blooms have increased during the last 25 years. High levels of contaminants are found in coastal sediments, affecting bottom life, and causing our ports and harbors to seek expensive means of disposal of dredged material. More than 95% of the Nation's foreign trade moves by sea. Continuous observations are needed to ensure safe and efficient operations of

the Nation's congested ports.

A sustained, nationwide network of linked and coordinated regional ocean observing systems is needed to:

- improve weather and ocean forecasting in coastal regions
- predict effects of climate change on coastal populations
- improve safety and efficiency of marine operations, including search and rescue, swimming, boating, fishing, transportation, and naval warfare
- improve public awareness and scientific understanding of processes affecting coastal habitats and their living marine resources
- provide more effective means for monitoring and evaluating the efficacy of environmental policies for coastal ecosystems
- foster science-based management of coastal marine ecosystems and their natural resources

Scientists, managers, and the public are often not well-equipped to make decisions about marine ecosystems, especially in environments where visibility is poor and a commonsense approach literally depends on access to the latest methods for sampling and sensing the marine environment. Marine environmental issues would be less complex and easier to solve if the marine information base on ecosystems, habitats, and patterns of change were as readily available as for terrestrial environments. The ability to address complex issues and find solutions suffers from the compartmentalization of marine science disciplines and methodologies, and a lack of integration with the disciplines of resource economics and environmental management. Many marine issues, such as fisheries management, the siting of reserves, protection and restoration of habitats, human health (hazardous spill response, harmful algal blooms), safety (vessel traffic control, search and rescue, storm surge prediction), and waste disposal, require resolution through more accurate, comprehensive, and timely information.

All aspects of ocean ecosystems are presently under-sampled. Decisions are made about sampling designs for research and monitoring without an adequate spatial or temporal context. Technological advances in observation, modeling, and data assimilative methodologies enable us to enter a new era in oceanography, that of the well-sampled ocean. New remote sensing and autonomous systems now allow us to sample the ocean at time and space scales never before achieved, and parallel computing algorithms can generate forecasts of the ocean in real time. Data assimilation schemes allow us to constrain the model forecasts with observations, thereby increasing their utility in practical applications. Researchers at LEO-15, the undersea observatory located off the coast of New Jersey, have led the nation in the development of these coastal ocean observation and modeling systems.

At LEO-15 it has been possible to make many continuous measurements throughout the year for four years, but the intense sampling effort needed to achieve a well-sampled ocean can now only be achieved through intensive bursts of activity in a 30 km by 30 km research area in which real-time ocean currents are observed from shore via an existing medium-range high-frequency radar (CODAR). Regional-scale, ocean surface current data acquired through a long-range (200 km), high-frequency radar system would provide one of the most important data sets needed to improve vessel traffic safety and management of harbor activities.

Rutgers' Long-term Ecosystem Observatory (LEO-15) off the coast of New Jersey has made continuous measurements in the near-shore zone publicly available in near real time through the Internet. For the first time, these measurements have been extended to include images of sea surface currents in the New York Bight to the edge of the continental shelf. By Sunday, July 15, scientists at Rutgers University will produce

a 3-day forecast of ocean circulation for the entire shelf region from Long Island to below Delaware Bay. Reports of these coastal conditions are being carried, along with the weather, by local news stations. Through the National Ocean Partnership Program (NOPP) and other federal and state sources of support, the Rutgers LEO system and similar systems developing in every region of the country are ready to coalesce into a sustained, integrated, nationwide system. A sustained network of linked and coordinated regional ocean observing systems will provide a new way of looking at, working in, and understanding the ocean.

The extension of the LEO-15 observatory to the entire New Jersey continental shelf can serve as a useful model for constructing a national network of observing systems in two ways. First, we should establish a series of shore stations equipped with new, long-range, high-frequency radar systems to continuously map surface current flows for the coastal ocean. Common standards and protocols have already been worked out by users of this equipment. Data should be made available in real-time on the World Wide Web, and when assimilated into existing hydrodynamic models, can be used to forecast the three-dimensional circulation on the continental shelf. A combination of satellite observations of sea surface temperature, surface roughness, primary productivity (at 30-m resolution when a new Navy-sponsored, hyperspectral ocean color satellite is launched), and high-resolution bathymetry and side-scan sonar will provide an enhanced context for ocean sampling. The proposed modeling and measurement system will provide regional perspectives for policy, planning, and economic analysis, and it is the rationale for development of a national network of high-frequency radars, buoys, bottom observatories, and autonomous glider vehicles. Regional-scale, real-time data will further aid search and rescue efforts by using CODAR surface currents to predict locations of vessels in distress, and inform cleanup efforts with trajectories of spills of hazardous material.

Secondly, intensive observatory facilities involving all scientific disciplines are needed where long-term experiments and sustained time series observations can be conducted and new ideas tested. New and substantial infrastructure is needed to enable exciting scientific discoveries such as those envisioned by the Census of Marine Life program. These sites will be the proving grounds for development and validation of new technology for use by the observing system network: samplers, sensors, robotic controls, data processing systems, and autonomous underwater vehicles. Scientific validation is required before information generated from new technology will be accepted by the general public. The National Science Foundation has played a major role in the development of the LEO observatory and should continue to play the leading role in the development of intensive observatory technologies, including deep-sea and deep-earth observatories linked to shore by underwater cables.

A nationwide network of regional coastal ocean observing systems should:

- measure a common set of parameters using uniform methods and protocols, which can be regionally and locally enhanced
- be based on sound science
- respond to the information needs of diverse user groups that depend on the coastal ocean for work, security, recreation, and research (e.g., facilitate safe and efficient marine operations, ensure national security, support management of living resources and marine ecosystems, ensure a sustainable food supply, mitigate natural hazards, and ensure public health)
- be cost-effective and capitalize on existing infrastructure (e.g., autonomous undersea vehicles, gliders, cabled observatories, satellite remote sensing, CODAR technology)
- provide continuous, long-term, and real-time observations and predictions of ocean events and phenomena on a timely, integrated, and sustained basis
- provide a source of data and information that increases public awareness of the status and importance of the Nation's coastal oceans

Consideration must be given to the administration of the national coastal ocean observing system and what body will be responsible for establishing standards and protocols to govern the system. Given that a variety of federal agencies will be involved in the observing network, I recommend that the National Ocean Research Leadership Council (NORLC), the organization created to implement the National Oceanographic Partnership Program (NOPP), be responsible for coordinating system activities, and approving standards and protocols for administering the system. This recommendation is in accord with the plans for implementation in "Toward a U.S. Plan for an Integrated, Sustained Ocean Observing System" submitted to Congress on 20 April, 1999, in response to a request from Representatives James Saxton and Curt Weldon, and with the subsequent NORLC Report "An Integrated Ocean Observing System: A Strategy for Implementing The First Steps of a U.S. Plan" completed December 24, 1999. On May 22, 2000 the NORLC approved the NOPP Interagency Ocean Observation Office, "Ocean.US," with a charter to develop a national capability for integrating and sustaining ocean observations and predictions.

Coastal ocean observing systems should be organized regionally. The Committee might consider establishing a federation of seven regional observing systems: Northeast, Southeast, Gulf of Mexico, West Coast, Hawaii, Alaska, and the Great Lakes. Representatives from each of these regions, drawn from academic and research institutions, and state and local governments could serve as an advisory council for the NORLC.

A single entity should be charged with providing technical assistance to the regional systems in the management, archiving, and analysis of data. One candidate is NOAA's National Ocean Service (NOS) which has a strong track record in linking science to management products and services. New approaches are developing to bridge the gap between data providers and data users at NOS' Coastal Services Center, NASA's Earth Science Applications Center, and in the NOPP-sponsored Ocean Biogeographic Information System, a component of the Census of Marine Life Program.

Ocean Exploration

As Committee members are aware, $4 million was appropriated in FY 2001 to initiate an Ocean Exploration Program at NOAA. This appropriation was provided to implement recommendations from the report on "Discovering the Earth's Final Frontier: A U.S. Strategy for Ocean Exploration," produced by a national panel convened by a Presidential Executive Order. I had the privilege of serving on this panel and am thoroughly familiar with the rationale for the report recommendations. Four challenges were highlighted as the most significant gaps in our knowledge of the oceans including: 1) mapping at new scales, 2) exploring ocean dynamics and interactions at new scales, 3) developing new technologies, and 4) reaching out in new ways to stakeholders. The report set forth a variety of exploration priorities including: Voyages of Discovery, Tools for Probing the Ocean, Data Management and Dissemination, Education and Outreach, and Capital Investment.

With the FY 2001 support, NOAA has organized expeditions to identify new species that may hold potential economic benefits, evaluate potential new energy or food resources, explore submerged cultural resources, and evaluate the effect of sound on marine resources and ecosystems. In September, I will help lead one of these expeditions known as Deep East. Deep East will feature mapping of deep sea corals in the offshore canyons and seamounts off Georges Bank, seafloor processes in the Hudson River Canyon, and biological and geochemical interactions at the Blake Ridge off Georgia. I will serve as the principal investigator for Leg 2, which is associated with the Hudson River Canyon.

Hudson Canyon extends over 400 nautical miles seaward from the New York-New Jersey Harbor across the continental margin to the deep North Atlantic ocean basin. Although it is the largest submarine canyon on the Atlantic continental margin of North America, and lies directly offshore of America's largest metropolitan area, Hudson Canyon remains to be explored with integrated high-resolution mapping and direct observations and sampling.

Submarine canyons are conduits for the transport of sediments including pollutants between land and sea, a process complicated by the interaction of down-slope movement and cross-slope flow of deep ocean currents. Low-resolution side-scan sonar (GLORIA), and medium-to high-resolution seismic reflection, echo sounding, and magnetic profiles (USGS, 1991), reveal that Hudson Canyon is susceptible to mass transport of materials down-canyon, and may thus concentrate pollutants and other materials in the canyon axis and on the continental rise. Evidence for high species abundance comes from surveys supported by the Minerals Management Service (MMS) involving quantitative analysis of box cores recovered from sediments of the continental slope and upper rise between water depths of 1,500 m and 2,500 m at 10 stations off New Jersey and Delaware. The survey also revealed remarkable biodiversity at these depths. Studies on the Hatteras slope similarly suggest that sediments of the middle to lower slope are the recipients of down-canyon transport.

A series of drill holes on the outer continental shelf, slope, and rise off New Jersey by the Deep Sea Drilling Program (Legs 11, 93, and 95) and the Ocean Drilling Program (Legs 150 and 174) established the sequence and ages of sedimentary strata, and revealed a massive bed of methane gas hydrates extending beneath the Hudson Canyon region. The presence of methane gas hydrates beneath this region opens new avenues for discoveries of processes involving the role of fluid pressure (confined gas and water) beneath the seafloor, which relate to geologic hazards (slumps and tsunamis) and climate change (methane release); the probable occurrence of chemosynthetic organisms (macrofauna and microbes) at cold seeps that relate to biodiversity and to sources of new pharmaceutical and industrial products; and to methane itself as an energy resource.

Relationship of Ocean Exploration to the National Undersea Research Program

To advance the Ocean Exploration Program, NOAA has created a new office, the Office of Ocean Exploration. In some respects, this action duplicates activities conducted by an existing program that is renowned for its exploratory achievements and hallmark record of safety with the conduct of undersea operations--the National Undersea Research Program (NURP).

NURP is organized on a regional basis with six centers serving undersea science needs in the Northeast and Great Lakes, Mid-Atlantic Bight, Southeast Atlantic and Gulf of Mexico, Caribbean, West Coast and Alaska, and Hawaii. NURP has developed rigorous procedures with respect to peer review and undersea operations, and has well-established mechanisms for communicating with the ocean science community. Existing regional infrastructure at the six NURP Centers provides local links to the science community, knowledge of advanced undersea sampling and sensing platforms, and experience with the conduct of undersea operations. I believe that it is important for NOAA to ensure that NURP be closely involved with the administration of the Ocean Exploration Program. Such integration can ensure safe field operations, foster a process wherein exploration programs can advance quantitative science investigations, avoid duplication of effort, and reduce costs.

Summary

In closing, I would like to thank Chairman Gilchrest, Chairman Ehlers, Chairman Smith, and members of the Committees for the opportunity to comment on ocean observing systems, observatories, and ocean exploration. These are good ideas that merit strong consideration for authorizing legislation. I will be pleased to respond to any questions that the Committees may have at this time. Thank you.

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