COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
U.S. HOUSE OF REPRESENTATIVES

HEARING CHARTER

The Federal Ocean Acidification Research and Monitoring Act: H.R. 4174

Thursday, June 5, 2008
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building

Purpose

On Thursday, June 5, 2008 the Subcommittee on Energy and Environment of the Committee on Science and Technology will hold a hearing on H.R. 4174, the Federal Ocean Acidification Research and Monitoring Act.

The purpose of the hearing is to receive testimony on H.R. 4174, legislation introduced by Rep. Tom Allen of Maine on November 14, 2007. The Committee will also examine the current status of science on ocean acidification and research and monitoring activities focused on ocean acidification and its potential impacts on marine organisms and marine ecosystems.

Witnesses

Dr. Richard A. Feely, Supervisory Chemical Oceanographer, Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration. Dr. Feely will discuss the quantification of oceanic uptake of carbon dioxide and NOAA's monitoring program; major research issues to be addressed including the relationship between the ocean acidification process and carbon cycling processes in the ocean.

Dr. Joan Kleypas, Scientist, Institute for the Study of Society and Environment, National Center for Atmospheric Research. Dr. Kleypas will discuss the impacts of ocean acidification on marine life and marine ecosystems, particularly on coral reef ecosystems.

Dr. Scott Doney, Senior Scientist, Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution. Dr. Doney will discuss the gaps in our understanding of ocean acidification and the implications of ocean acidification for marine resource management. Dr. Doney will also discuss current interagency efforts and federal programs addressing ocean acidification.

Dr. Ken Caldeira, Scientist, Department of Global Ecology, Carnegie Institution for Science of Washington. Dr. Caldeira will discuss the ongoing changes in the global carbon cycle and its relationship to ocean acidification including the research and modeling efforts needed to better understand ocean acidification and to project its impacts and develop strategies for adaptation and mitigation.

Mr. Brad Warren, Director, Productive Oceans Partnership Program, Sustainable Fisheries Partnership. The Sustainable Fisheries Partnership provides policy and technical guidance to seafood suppliers and producers. The Productive Oceans Partnership Program was formed to address the issue of ocean acidification. Mr. Warren will discuss the potential impacts of ocean acidification on the world seafood industry and the steps the Partnership is recommending to deal with the problem of ocean acidification.

Background

What is Ocean Acidification?

Ocean acidification is the process by which the pH of seawater is being lowered through the absorption of carbon dioxide (CO_2) from the atmosphere. Atmospheric concentrations of CO_2 have increased over the past 200 years from a pre-industrial level of about 280 parts per million to 379 parts per million in 2005.[1] The concentration of CO_2 in the atmosphere would be much higher if not for the absorption of CO_2 by the oceans. The oceans have absorbed about 50 percent of the carbon dioxide (CO_2) released over the past 200 years due to human activities resulting in chemical reactions that release carbonic acid and lower ocean pH. The Royal Society of London released a report in 2005 of the consequences of ocean acidification and indicated that the increase in acidity could be as high as 30 percent over the last 200 years.[2]

Impacts of Ocean Acidification

While oceanic absorption of CO_2 has reduced the atmospheric concentration of CO_2 and therefore limited the greenhouse effect, acidification of the oceans may have negative consequences for sea-life that uses calcium carbonate to grow shells and other physical structures. A growing number of studies have demonstrated adverse impacts on marine organisms, including a decreased rate at which reef-building corals produce their skeletons; reduction in the ability of marine algae and free-swimming zooplankton to maintain protective shells and exoskeletons; and reduced survival of larval marine species, including commercial fish and shellfish. As ocean pH decreases, the amount of available calcium carbonate decreases. Many marine organisms require calcium carbonate to produce their shells and exoskeletons. Calcifiying organisms include coral, mollusks, echinoderms and crustaceans.

The U.S. is the third largest seafood consumer in the world - total consumer spending for fish and shellfish is approximately $60 billion per year. Coastal and marine commercial fishing generates as much as $30 billion per year and nearly 70,000 jobs. The organisms likely to be impacted by ocean acidity include both commercially important groups (e.g. clams, oyster, crab, shrimp, and lobster) and organisms that serve as primary food sources for other commercially important species. Healthy coral reefs are the foundation of many of these viable fisheries, as

[1] Intergovernmental Panel on Climate Change. 2007. "Working Group I: The Physical Science Basis of Climate Change." Fourth Assessment Report. Chapter 2, p. 137.
[2] The Royal Society 2005, Science Policy Section, "Oceanic acidification due to increasing atmospheric carbon dioxide, www.royalsoc.ac.uk

well as the source of tourism and recreation revenues. Changes to the stability of coastal reefs may reduce the protection they offer to coastal communities against storm surges and hurricanes. Many fisheries are also under stress from over fishing, pollution, diseases, and changes in water temperature.

Changes to the ocean's chemistry can be so long-lasting that they are basically irreversible once begun. According to the Royal Society of London's report[3], it would take ten thousand years for the oceans' pH to return to their pre-industrial level. Chemical additives to the ocean to restore pH are unproven and could have many unintended consequences to ocean ecology and climate.

Current Federal Research and Monitoring Programs on Ocean Acidification

Although there are projects being funded through several federal agencies and some initial workshops and meetings have been organized to identify key research areas, there is no coordinated plan of research in place with identified funding to ensure that all aspects of ocean acidification are being monitored and explored to provide a comprehensive picture of this phenomenon. H.R. 4174 is intended to provide a statutory structure to ensure ongoing coordination of the relevant agencies to develop a comprehensive federal research, monitoring and assessment program to address the impacts of ocean acidification. A few of the recent activities undertaken by federal agencies are provided below.

NSF, NOAA, NASA, and USGS have been working to develop and coordinate individual agency programs on ocean acidification. These efforts also involve the academic research community and international partners. Japan, Korea, Canada and the European Union are also developing research and monitoring efforts to better understand ocean acidification. The agencies produced a workshop report: *Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers: A Guide for Future Research*. NSF supported a workshop convened by Scripps Institution of Oceanography in October 2007 to discuss potential ocean acidification research projects and to identify key gaps in knowledge about ocean acidification and its potential impacts.

Through these efforts the following key research and monitoring needs have been identified: **Monitoring** of the changing ocean chemistry and biological impacts at selected coastal and open-ocean monitoring stations, including satellite-based monitoring to characterize reef habitats and to detect changes in surface ocean chemistry in response to ocean acidification; **Research** to understand the species-specific physiological response of marine organisms to ocean acidification and develop environmental and ecological indices that track marine ecosystem responses to ocean acidification; **Modeling** to predict changes in the ocean carbon cycle as a function of CO_2 and climate-induced changes in temperature, ocean circulation, biogeochemistry, ecosystems and terrestrial input; and to determine impacts on biological systems; **Technology development** and standardization for carbonate chemistry measurements on moorings and autonomous floats; and **Analysis** of social and economic implications of ocean acidification and **development of adaptation strategies** to help society cope with and respond to climate-induced changes in marine ecosystems.

[3] The Royal Society 2005, Science Policy Section, "Oceanic acidification due to increasing atmospheric carbon dioxide, www.royalsoc.ac.uk

There are several federal monitoring and research projects underway. The National Science Foundation recently awarded a grant through its Biocomplexity in the Environment area to support deployment of the first buoy to monitor ocean acidification in collaboration with scientists at NOAA's Pacific Marine Environmental Laboratory in Washington and scientists at several universities. The buoy was launched in the Gulf of Alaska last year and will measure air-sea exchange of carbon dioxide, oxygen and nitrogen gases and it will measure pH of surface seawater.

In 2005, NSF and NOAA collaborated on a cruise to collect field data on ocean acidification in the Pacific Ocean from the southern to the northern hemispheres as part of a long-term, cooperative hydrographic study. The results indicated decreases in pH and increases in dissolved inorganic carbon, both indicators of ocean acidification.

NSF is also supporting individual extramural academic research projects on ocean acidification topics through several of its directorates and programs. For example, Dr. Victoria Fabry is leading a team to study a species of marine snail to determine how changes in seawater chemistry may impact its ability to extract calcium from seawater to form its shell and other impacts on its physiology.

H.R. 4174: *The Federal Ocean Acidification Research and Monitoring Act*

Section by Section

Section 1. Short Title and Table of Contents
Provides the short title of the legislation: The Federal Ocean Acidification Research and Monitoring Act of 2007.

Section 2. Findings and Purposes
Designates the purposes of the legislation: to provide for development of an interagency monitoring and research plan; establishment of an ocean acidification program at NOAA; assessment of the impacts of ocean acidification; and research on adaptation strategies.

Section 3. Interagency Committee on Ocean Acidification
Establishes an interagency committee on ocean acidification chaired by NOAA and designates the membership of the committee to include representatives from the National Science Foundation, the National Aeronautics and Space Administration, the US Geological Survey, US Fish and Wildlife Service, the Environmental Protection Agency, the Department of Energy and other Federal agencies. The section directs the committee to oversee the development of a plan to be submitted to Congress to coordinate federal efforts to understand ocean acidification and its potential impacts on marine ecosystems and to develop adaptive strategies to conserve marine organisms and marine ecosystems. Requires a report to Congress within 2 years of enactment and every 3 years thereafter of the progress of research and monitoring activities and recommendations for addressing impacts of ocean acidification.

Section 4. Strategic Research and Implementation Plan
Directs the Committee to develop a strategic research and implementation plan for coordinated federal activities within 18 months of enactment. Establishes criteria and topics to be included in the interagency program and requires the plan to include goals, priorities, and guidelines for coordinated research over a 10-year period. Requires the Committee to consider and utilize other relevant reports and studies in developing the research plan.

Section 5. NOAA Ocean Acidification Program
Directs the Secretary to establish an ocean acidification program within NOAA to implement activities consistent with the strategic research and implementation plan. Requires the program to provide grants through a competitive, merit-based process.

Section 6. Definitions
Defines the terms Committee, Ocean Acidification, Program, and Secretary.

Section 7. Authorization of Appropriations
Authorizes appropriations that escalate each year beginning in fiscal year 2009 at a funding level of $6 million through fiscal year 2012 when the funding level reaches $30 million. The authorization is permanent at a level of $30 million thereafter. The section also directs the Secretary to distribute sixty percent of the funds to agencies other than NOAA to carry out the purposes of the Act and directs that at least fifty percent of all funds be used for competitive grants.