

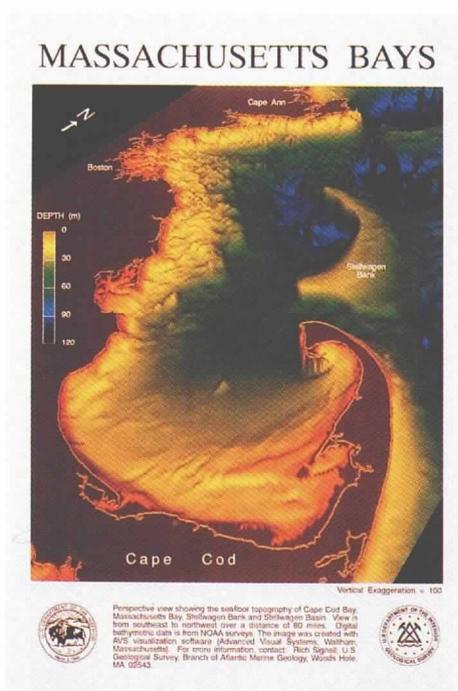
# WORKING TO PROTECT BIODIVERSITY: STELLWAGEN BANK NATIONAL MARINE SANCTUARY

By Anne Smrcina

AT THE STELLWAGEN Bank National Marine Sanctuary, protecting marine biodiversity while supporting sustainable uses is a multipronged effort involving research, education, and enforcement. Located on the NE Atlantic continental shelf at the mouth of Massachusetts Bay and Cape Cod Bay (Fig. 1), Stellwagen is one of 12 National Marine Sanctuaries (NMSs) established and maintained by the National Oceanic and Atmospheric Administration (NOAA) (U.S. Department of Commerce) for stewardship of significant natural and historical resources. On Atlantic, Gulf, and Pacific coasts, the 12 Sanctuaries are as diverse as the species they contain, including extensive coral reefs, deep submarine canyons, productive bank environments, and many other historic resources and coastal habitats. With its high productivity, importance as a fishing ground for New England groundfish and bluefin tuna, and the presence of great whales, Stellwagen Bank offers a rich mix of species and stewardship challenges.

The mixture of species at Stellwagen has changed many times over the years—often through natural causes, sometimes through human interactions. For example, whale populations in the area declined because they were hunted for their blubber and baleen. Another example is the decline in groundfish. As the abundance of groundfish and flounders has declined during the past three decades, dogfish and skate abundance has increased. The proportion (by weight) of dogfish and skate in survey catches has increased from

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*Fig. 1: A three-dimensional view of Stellwagen Bank and adjacent areas created by the U.S. Geological Survey from NOAA bathymetric data using a computer visualization program. This and other mapping efforts are an essential part of research on the rich mosaic of habitat types on the Bank.*

roughly 25% in 1963 to nearly 75% in recent years (NOAA, 1995). As the numbers of commercially important groundfish diminish, these other species are being targeted. These changes raise important ecological and economic questions. Will these new target populations exhibit similar declines? What is the role of the Bank's rich benthic communities in the food webs and nutrient cycles that sustain these fisheries? What is the im-

port of current and future management strategies on these interactions and the biodiversity that sustains them? Is it possible to conserve biodiversity, preserve ecosystem function, and sustain economic uses?

Research and monitoring are essential tools that provide the information necessary to meet these challenges. At Stellwagen, some of the most important information has come from efforts to map the distribution of habitat types. This is an important step towards mapping the distribution of the area's biodiversity at a number of levels. The results show the wide range of habitats that can be found in a relatively small area—habitats that include boulder fields, coarse sand and gravel fields, fine sand waves, and muddy basins. This kind of information on the distribution of habitats (and their associated populations, species) within the Sanctuary will aid current and future decision making on how to manage multiple uses of different areas. It also allows the Sanctuary to serve as a cost-effective laboratory for testing ideas, techniques, and management strategies applicable to the Gulf of Maine and Atlantic Canada region.

Mapping efforts in the Sanctuary have been underway over the past two years. In a long-term study involving multi-beam side-scan sonar surveys, direct sampling, video imaging, and other techniques, the U.S. Geological Survey is building a wealth of information that will eventually provide a fine-scale, digital database of Stellwagen Bank and adjacent areas. These data will allow construction of computer generated images similar in detail to aerial photographs of land masses. Researchers with the National Undersea Research Center at the University of Connecticut, Avery Point

(NURC-UCAP) are using this information in related studies to define each of these benthic habitats and their role in supporting groundfish populations. The mapping of physical and biological resources is critical to effective use, and stewardship, of Stellwagen's rich benthic biodiversity.

Although many of the interactions between Stellwagen's benthic biodiversity and commercially important fisheries are still uncertain, the benthic communities are clearly very important to a number of fisheries species that feed on benthic organisms (Fig. 2). Understanding the distribution and dynamics of these communities is therefore an essential step in understanding changes in fisheries stocks. Other fisheries-related research in the Sanctuary is currently targeted at providing data on location and productivity of sensitive breeding and juvenile nursery areas to fisheries managers.

Pelagic species, such as tuna and marine mammals, are important resources within the Sanctuary. Existing management strategies for these species (e.g., Marine Mammal and Endangered Species Acts, International Convention for the Conservation of Atlantic Tunas) that must be woven into other management efforts (e.g., groundfish) for a comprehensive plan for the Sanctuary. "Our task is three-fold," reports Stellwagen Bank NMS manager Brad Barr. "First, we must insure that management is effectively implemented



Fig. 3: With a population of only 320, the right whale is the most endangered of the great whales. The loss of genetic diversity is a threat to the species' survival. Research, education, and enforcement in the Sanctuary focus on protecting these and other cetacean visitors.

and enforced, then evaluate the efficacy of management strategies and recommend changes to those agencies with regulatory jurisdiction when necessary, and finally, make sure that users and the public are aware of management measures so that they can assist in implementation."

"Our work involves much more than just protecting the invisible box that defines the Sanctuary," notes Barr. "If we only protect the species in the short time they are present in the Sanctuaries, we are not doing our jobs. We have to look at the entire range of each species for any management solution to make sense."

That range may entail enormous dis-



Fig. 5: High school students gain research experience through the Aquanaut Program supported by NOAA's National Undersea Research Program at the University of Connecticut, Avery Point (NURP-UCAP). Students assist in studies of Stellwagen Bank biodiversity by recording data on the number and location of groundfish species.

tances. The humpback whale, one of 12 species of marine mammals that visit the waters around Stellwagen Bank, migrates to warm Caribbean waters in the winter. In an effort to assist conservation efforts in the region, Sanctuary manager Barr serves as an advisor to a sibling sanctuary at Silver Bank in the Dominican Republic, and the Stellwagen Bank Sanctuary education effort is looking into ways to assist its brethren down south. The right whale is another cetacean visitor to Stellwagen Bank and the most endangered of the great whales, with an estimated population of 320 (Fig. 3).

The habitat mapping and trophic web research at Stellwagen has been a focal point for education and participation at the Sanctuary. The Sanctuary is developing a CD-ROM that examines the intricate Stellwagen Bank food web for use in museums and schools (Fig. 4). In addition to other programs, NURC-UCAP brings its "Aquanaut Program" out to the bank, allowing high school students to conduct research using submersibles, remotely operated vehicles, and other state-of-art equipment (Fig. 5). Their work is providing additional baseline data on the distribution and content of benthic habitats, and helping managers to understand the acoustic environment of the Sanctuary.

#### Reference

National Oceanic and Atmospheric Administration (NOAA), 1995: Status of the Fishery Resources off the Northeastern United States for 1994. NOAA Technical Memorandum NMFS-NE-108. □



Fig. 2: NMFS considers the Atlantic cod overexploited in the Gulf of Maine and Georges Bank. Research in the Stellwagen Bank National Marine Sanctuary is looking at the relationship between benthic habitat conditions and groundfish recruitment and growth.

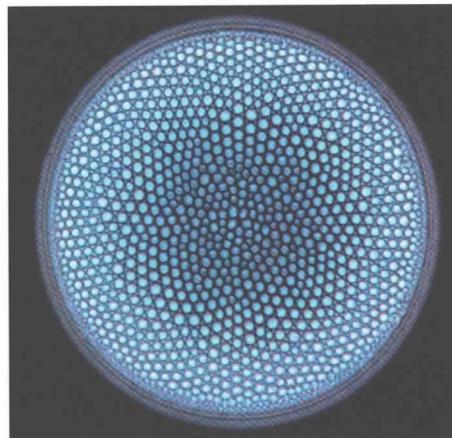


Fig. 4: From phytoplankton (*Coscinodiscus* diatom, pictured) to the great whales, the extensive variety of living things present at the Stellwagen Bank National Marine Sanctuary will be covered in a new CD-ROM on the food web, presently under development with Boston University's Graduate Program in Science Journalism.