

National Benthic Habitat Studies: Atlantic

SUMMARY:

As coastal populations increase in size, the uses of the sea floor become more diverse and intensive. A knowledge of sea floor characteristics and processes is required for successful management of many activities, including: (1) commercial and recreational fishing, including aquaculture (2) regulating sanctuaries and marine protected areas, (3) engineering projects such as burial of fiber optic and electric power cables and oil and gas pipelines, and siting of offshore wind farms, (4) mining of sand, gravel and other minerals, (5) prospecting for biopharmaceutical compounds, (6) disposal of dredged materials from harbors, (7) ecotourism such as whale watching, (8) navigation and the transport of goods, and (9) military operations. In response to this growing need to manage and protect seabed environments, habitats, and fish stocks, the goals of this project are (1) to determine the distribution and movement of geological materials, structures, and processes that are the framework of habitats, (2) to map the location and character of benthic habitats, (3) to assess the impact of habitat disturbance by fishing gear, (4) to identify the processes and time periods required for the recovery of disturbed habitats, and (5) to establish a geology-based benthic habitat classification system. Habitat geoscience, as pursued by this project, addresses these needs by studying the distribution of geologic materials of the seabed, the geologic processes (e.g. sediment movement and deposition) that form the seabed, and the interplay of geologic factors and species behavior that gives rise to biological habitats in general and to specific habitats (Essential Fish Habitats) deemed essential to the success of managed fishery species. The project relies on the collaboration of benthic ecologists and fisheries biologists from the Departments of Interior and Commerce and from universities.



benthic image

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DESCRIPTION:

A workshop in April 2001 (Barnes and Valentine, 2001) attended by scientists from ten Federal agencies identified the following national goals for the National Benthic Habitat Studies Project: 1) Mapping and characterizing benthic habitats at appropriate scales and resolutions, 2) Understanding geologic processes and environmental and human-induced change, 3) Developing a sea floor and habitat classification, 4) Extrapolating results from regional to national settings, 5) Developing prediction and modeling capabilities, 6) Publishing results as maps and reports; disseminating information through web sites; and managing data effectively, 7) Providing information and advice to management agencies, and 8) Facilitating intra- and interagency and international collaboration on benthic habitat research. The project will address these goals through discussions and collaboration with: DOI (BRD, MMS, FWS, NPS); NOAA (NMFS, NMSS, NOS, NURP); regional Fishery Management Councils; and with the Geological Survey of Canada (GSC) and Department of Fisheries and Oceans of Canada (DFO). Objectives, briefly summarized: Task 1. Habitat Classification and Process Studies of New England Benthic Habitats (Valentine): The New England Fishery Management Council, NOAA Fisheries, and NOAA Sanctuaries have placed emphasis on the role of habitats in the management and research of fisheries and marine protected areas. The task (1) develops interpretive maps showing surficial geology, sediment dynamics, and seabed habitats in Stellwagen Bank NMS off Boston, MA, (2) conducts topical studies to understand the role of geological processes in the function of habitats, and (3) develops a geology-based marine sublittoral habitat classification for the Gulf of Maine, the mid Atlantic, and eastern Canada with collaboration from GSC and DFO geologists and biologists. Task 2. Geologic and Biologic Studies of Georges Bank, New England Shelf, and New Jersey Shelf Benthic Habitats (Valentine): This task conducts joint studies with NMFS' Habitat Research Program and the Canadian Geological Survey (1) to compile geologically-based interpretive maps of this region (based on the habitat classification developed in Task 1) showing the distribution of EFH for managed fisheries species and important associated species, and (2) to assess the effects of natural disturbance, fishing gear disturbance, and invasive species on benthic habitats and to determine habitat sensitivity and recovery rates. Task 3. Geology of Shelf-edge Habitats of the Northern Gulf of Mexico (Scanlon): Objectives are (1) to map substrate, geologic features, and habitats in and near Madison-Swanson and Steamboat Lumps MPAs, (2) to analyze relationships between sea-floor geology and associated benthos, (3) to provide a basis for management and regulatory decisions, and (4) to contribute to NOAA's identification of EFH. These objectives are carried out in collaboration with scientists from NMFS, NOAA Sanctuaries, and FSU. Task 5 Regional Mapping in the Gulf of Maine # Bottom Stress Distribution and Variability (Butman): Bottom stress

exerted by currents and surface waves controls the frequency and extent of bottom sediment resuspension and transport. The task develops maps of bottom stress on tidal, event, and seasonal times scales to determining the effect of bottom stress on sediment transport and biologic habitats. Task 6. Deep-water Coral Habitats of the Eastern and Southern U.S. (Scanlon): This task (1) compiles existing knowledge of the distribution of deep-water corals off the eastern and southern United States in an easily accessible GIS database and (2) relates the distribution of deep-water corals to regional geology and oceanographic conditions as a basis for predicting coral occurrences in as yet unexplored regions.

START DATE OF PROJECT:

October 1, 2002

END DATE OF PROJECT:

September 30, 2009

TOPIC:

Develop and Maintain Databases, GIS, and Decision Support Systems, Domestic Resource Studies, Offshore - Marine, Lacustrine

APPROACH:

Project goals are achieved through collaboration with federal agencies, particularly NOAA (Fisheries, Sanctuaries, Ocean Exploration, NURP), regional Fishery Management Councils, Geological Survey of Canada, and academic institutions in Florida, Connecticut, Rhode Island, Maine, and New Brunswick, Canada. Studies include seabed and habitat mapping, identification of Essential Fish Habitat for managed species, delineation of habitat reserves, the role of geological processes in the function of habitats, the effects of disturbance on habitats and their recovery rates, and development of a geology-based benthic habitat classification. Cooperators include government geologists and biologists and academic biologists. Data collection requires the sharing of equipment and personnel among collaborators, as no one agency has the capability singly to address the integrated geological/biological approach to research topics addressed by this project. The project is developing a new field of marine research, habitat geoscience, that employs a variety of methods to acquire biological and geological data, including sidescan sonar, multibeam sonar, and biological sampling systems, and it has developed an innovative video/photo/sampling system that is being adopted by other agencies and foreign research institutions. The integration of geological and biological observations of the study regions has produced a benthic habitat classification system and relational database that will be an essential basis for seabed management and research. Scientific results are provided to Fishery Management Councils, NOAA agencies, scientists, and the public for their use. FUTURE PLANS: Task 1 Habitat Classification and Process Studies on New England Benthic Habitats. FY2006-2008: complete a series of 18 quadrangle maps that synthesize and classify the surficial geology, sediment dynamics, benthic habitats, and topographic imagery of the Stellwagen Bank NMS region (3,760 sq km) at a scale of 1:25,000. Task 2 Geologic and Biologic Studies of Georges Bank Benthic Habitats. FY2006-2008: A) complete maps that synthesize and classify the surficial geology, sediment dynamics, benthic habitats, and topographic imagery of the Great South Channel region of Georges Bank (740 sq km) at a scale of 1:25,000. B) complete studies on distribution and effects of an aggressive invasive colonial tunicate (*Didemnum* sp.) on benthic habitats of the Georges Bank fishing grounds. Task 3 Geology of Shelf-edge Habitats of the Northern Gulf of Mexico. FY2006 (final year): A) report on sea level history of the region, pending successful dating of rocks collected in FY05 from paleoshoreline features in NE Gulf of Mexico. B) report on sediment thickness and depositional history of the outer continental shelf in Steamboat Lumps and Madison-Swanson MPAs. Task 5 Regional Mapping and Geological Habitats in the Gulf of Maine # Bottom Stress Distribution and Variability. FY2006: develop bottom stress maps for Massachusetts Bay as a precursor for compiling regional stress maps for the Gulf of Maine in FY2007. Tasks 6 and 7 Deep-water Coral Habitats of the Eastern and Southern United States. FY2006: A) finish deep-water coral database development and expand database from Gulf of Mexico to U.S. Atlantic margin. B) report on how distribution of deep-water corals in the Gulf of Mexico relates to sea floor geology. FY2007: expand database to Puerto Rico and U.S. Virgin Is. B) report on how distribution of deep-water corals off eastern U.S. relates to sea floor geology.

IMPACT/RESULTS:

Geologic materials and processes are the framework of benthic biological habitats. Reports and maps derived from this project contribute to defining Essential Fish Habitat (EFH) for managed species and to developing management strategies that will preserve biodiversity and promote a sustainable fishery. More accurate stock assessments based upon improved understanding of fisheries habitats leads to better conservation and management of fishery resources and the economic benefits derived from them. The assessment of potential damaging effects to habitats (including fragile structure-forming species such as deep-water corals) by fishing activities, natural events, and invasive species leads to improved habitat management and maintenance of biological productivity. The project is instrumental in developing a new field of marine research, HABITAT GEOSCIENCE, that employs a variety of methods (including sidescan sonar, multibeam sonar, and various geological and biological sampling systems) to acquire geological and biological data. It has developed an innovative video/photo/sampling system that has been adopted by other agencies and foreign research institutions. The project fosters close collaboration among federal agencies (DOI, DOC), as no one agency has the capability singly to address the integrated geological/biological approach that is required to pursue habitat research. The Sustainable Fisheries Act of 1996 (Magnuson-Stevens Fisheries Conservation and Management Act) mandates the designation of EFH for all managed species. The strategies for characterizing and classifying sea floor habitat developed in this project will be a model for

identifying EFH over large areas of the continental shelf, and for managing the Nation's Marine Protected Areas. NMFS and regional Fishery Management Councils are utilizing results of ongoing research in the New England and Gulf of Mexico regions to aid in the development of fishery management policies. They depend on projects such as this one as a primary source of benthic habitat information. A wide variety of accessible products are used to present research results in paper and cd-rom formats, including reports, digital maps and databases, and web sites. Outcome Statement: The USGS# National Benthic Habitat Studies # Atlantic project has produced the first high resolution maps of the seabed for a 2000 square mile area off Boston, Massachusetts, including Massachusetts Bay and the Stellwagen Bank National Marine Sanctuary. The maps are based on full coverage multibeam sonar surveys supported by sampling and video imagery of the seabed. The region is heavily utilized, and the maps have become the required framework for commercial, scientific, and management activities. They are used 1) to select corridors for a fiber optic cable and a gas pipeline, 2) by recreational and commercial fishermen who target specific types of seabed for fishing, 3) by the whale watching industry to educate tourists, 4) by state and federal authorities who survey and preserve historic shipwrecks discovered during the mapping, and 5) by Stellwagen Bank NMS and the New England Fishery Management Council to plan habitat research and management projects.

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RELATED:

- ◆ [Valentine, P.C., 2004, USGS National Geologic Studies of Benthic Habitats, Northeastern United States: Marine Nuisance Species, colonial tunicate, Didemnum sp.](#)
- ◆ [Valentine, P.C., 2001, USGS National Geologic Studies of Benthic Habitats, Northeastern United States: Stellwagen Bank National Marine Sanctuary Region, off Boston Massachusetts](#)
- ◆ [Valentine, P.C., 2004, USGS National Studies of Benthic Habitats, Northeastern United States: Seabed analyses of the Stellwagen Bank NMS region](#)