

The Massachusetts Seafloor Mapping Cooperative

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The Massachusetts Office of Coastal Zone Management (CZM) is leading an effort to map the Commonwealth's seafloor environment. CZM, in partnership with the United States Geological Survey (USGS) Woods Hole Science Center, initiated the Massachusetts Seafloor Mapping Cooperative in 2003 to address the need for acquiring datasets on the spatial distribution of benthic resources to help resource management. The goal of the cooperative is to produce high-resolution maps and geospatial data of surficial geology and topography of the seafloor in Massachusetts.

The character of the seafloor is mapped by collecting and interpreting multiple data sets. Acoustic – or sonar – systems, including swath bathymetry, sidescan sonar, and sub-bottom profiling, are used to map the physical structure of the seafloor. Seafloor topography (depth) is measured from swath bathymetry. The type and distribution of seafloor sediments are determined from backscatter intensity of the sidescan sonar. The thickness of sediment is determined through a sub-bottom profile, which emits sound through the water column and into the seafloor. Acoustic data are validated by collecting photographs, video, and sediment samples of the seafloor. The acoustic and groundtruth data are combined in a GIS (geographic information system) to facilitate data interpretation, map production, and data distribution.

From 2003-2007, approximately 1,450km² (560mi²) of the seafloor was mapped from the northern border of Massachusetts to northern Cape Cod Bay and eastern Cape Cod. Maps and geospatial data are available for the North Shore (Gloucester to Nahant), Boston Harbor, and eastern Cape Cod. The publication of seafloor mapping data for Ipswich Bay (Cape Ann to Salisbury) is in preparation, and mapping cruises were recently finished for the South Shore (Duxbury to Hull) and northern Cape Cod Bay.

Our lecture will describe the development of the Massachusetts Seafloor Mapping Cooperative, technologies and techniques employed to accomplish regional mapping, mapping results and future plans, and the use of data to advance our capabilities to classify and delineate seafloor bottom types. A standardized approach to name and map seafloor habitats is among the many needs to improve ocean management. In response to this need, CZM is evaluating existing and new approaches to fully use the acoustic data collected as part of the mapping cooperative to inform a process to classify and delineate seafloor habitats.

Current investigation includes several GIS/remote sensing-driven semi-automated classification techniques to create a seafloor map showing surficial geological habitat. Maps are based on a combination of physiographic data (bathymetry and derivatives including slope; orientation; curvature and relative position including Bathymetric Position Index; and terrain variability including rugosity, Terrain Ruggedness Index, and fractal dimension) and lithologic data (sidescan sonar interpretations and derivatives). These parameters are intersected using various techniques including map algebra, multivariate statistics, and supervised classification routines, all common to landscape ecology and terrestrial image classification.

The Massachusetts seafloor mapping program is a success story in partnership, funded by a combination of state, federal (USGS and NOAA), and private sector contributions, while effectively leveraging expertise and technology within state and federal agencies. Moreover, the seafloor mapping data are providing unparalleled views of the underwater world, inspiring a greater appreciation of the diversity of estuarine and marine habitat and life, and stimulating better stewardship for the ocean environment.