Announcement M13AS00014: Hurricane Sandy Coastal Recovery and Resiliency - Resource Identification, Delineation and Management Practices

Agreement: M14AC0007: Maryland Cooperative Agreement

Maryland Department of Natural Resources, Maryland Geological Survey; Conversion of Maryland's Offshore Mineral Resources Data for GIS Applications and Baseline Acoustic Seafloor Classifications of Offshore Borrow Areas

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Summary Report

Cooperative Agreement Outputs including Project Deliverables:

Van Ryswick, S.M., Connallon, C.B., and Murphy, A., In Preparation, Conversion of Maryland's Offshore Mineral Resources Data for GIS Applications and Baseline Acoustic Seafloor Classifications of Offshore Borrow Areas: BOEM/Maryland Cooperative Agreement Technical Report.

The task of assessing and responsibly managing offshore resources is largely aided by the availability of high quality, and continuous data, from which coastal geologists can make interpretations and provide guidance for resource management. For over thirty years the Maryland Geological Survey (MGS) has been collecting data from Maryland's coastal region, ranging from the near-shore littoral zone, to as far as ~38 km (~23.5mi) offshore, on the inner continental shelf (**Figure 1**). These data, which include side scan sonar, seismic, vibracore, and seafloor classification data, are used to map areas of potential sand and gravel resources, manage offshore habitat, and to track the changes to these resources over time. In a continuing effort to better characterize Maryland's Atlantic coastal geology, geologists at the MGS have compiled these data into a geodatabase for use in a GIS. The datasets contain about 580 square kilometers of side scan mosaics, 1505 meters of core data from 310 cores, 1366 kilometers of analog seismic records, and 3250 kilometers of digital seismic records. The compiled GIS database improves the capability for Federal and State agencies and localities to plan for cost-effective coastal protection and restoration projects.

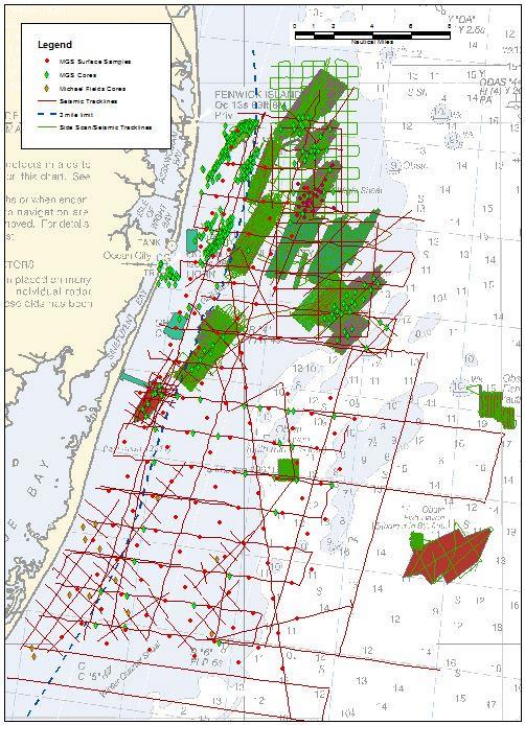

Figure 1. Map of the Maryland Geological Survey digital data inventory including sonar, seismic, core and grab samples.

The most useful product for acoustic seafloor classifications is the side scan sonar backscatter. Varying seafloor components such as texture, hardness, and benthic habitat affect the reflectivity of the acoustic signal. In the years since the MGS collected and initially processed many of their side scan survey data, advances in software for processing side scan data have advanced, allowed for the creation of more detailed side scan sonar mosaic rasters. In 2015-16, geologists at the MGS reprocessed side scan datasets using Sonar Wiz 5 to produce updated GeoTiff rasters (**Figure 2)**. All of the updated rasters are now processed with the same settings, using a spatial resolution of 0.5m, allowing for comparison of all associated mosaic datasets.

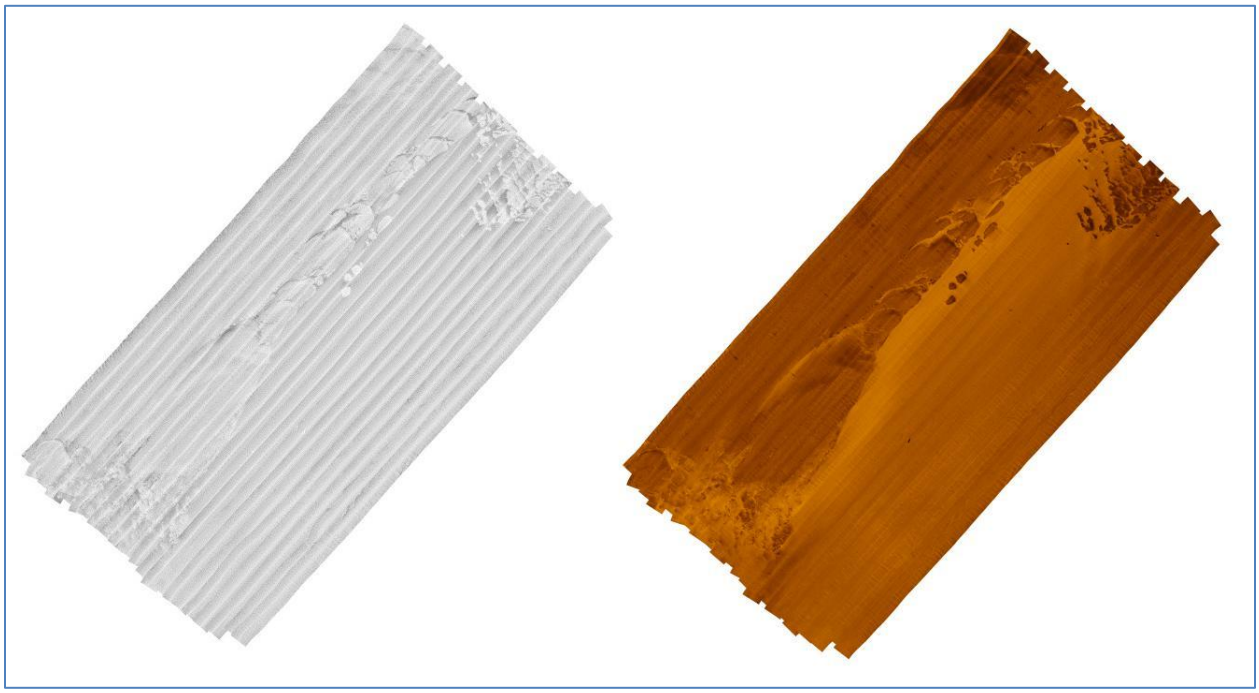

Figure 2. An example of a side scan sonar GeoTiff raster processed in 2008 (left) and the same data reprocessed in 2015 (right).

Bottom sediment composition is influenced by bottom geomorphology, water depth, substrate composition and biologic activity. The interaction of these factors with water column energy, such as waves and currents, determines in part the seafloor surface composition. Sediments often range from mud and muddy sand, to coarse sand and gravel over an area of a few meters. Geologists at the MGS classified the seafloor for most of Maryland's inner continental shelf, using mosaic rasters from two nearshore OCS blocks, and a Z-shaped area to the east, which was compiled using NOAA side scan data **(Figure 3)**. The data were classified using Image Classification in ArcGIS Spatial Analyst, which extracts information classes from the multiband mosaic raster image to produce a raster image that represents bottom classes using graded colors. Geologists at MGS performed two supervised classifications to create rasters with four and six classes based on training sample signature files. By comparative analysis of the four and six class rasters, MGS identified seven major acoustically distinct bottom classes. These types were correlated with bottom grab samples and bathymetry to produce a map of the seven bottom classes, based on dominant sediment types **(Figure 3).**

MGS digitized the seafloor bottom types as a polygon shapefile in ArcGIS to indicate the areas of distinct bottom classes. Each class was then classified based on the Federal Geographic Data Committee (FGDC) Coastal and Marine Ecological Classification Standard (CMECS) substrate classification for unconsolidated mineral substrate. The resulting Substrate Sub Group bottom class map contains seven bottom classes that comply with the FGDC and CMECS standard**.** The area displayed in grayscale in Figure 3 was surveyed by USGS in 2014, and the backscatter classification is pending from USGS.

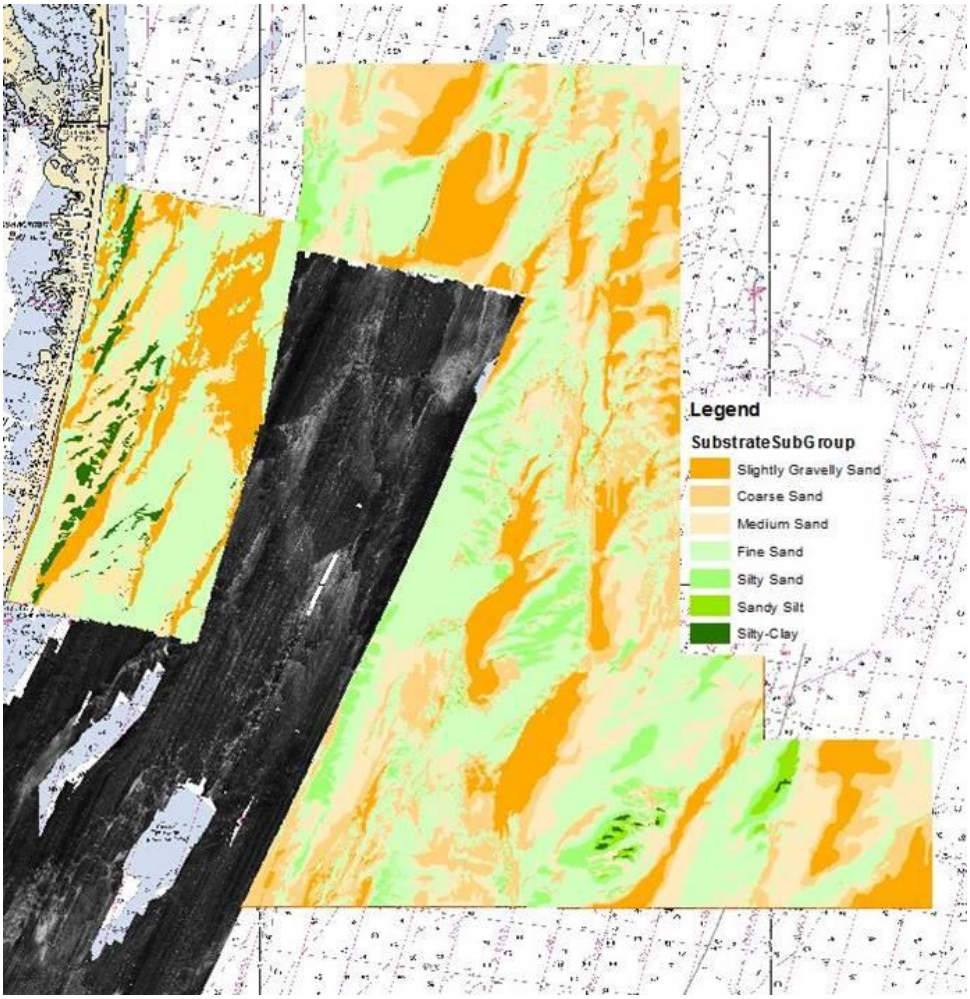

Figure 3. Bottom Classification map shows near-shore Ocean City Blocks 1 & 2 (left). "Z" shaped image (right) represents the NOAA collected, MGS reprocessed & classified block. The gray scale image shows the USGS surveyed backscatter (pending seabed classification from USGS).

Areas where MGS can upgrade, update, or fill in data gaps include spatial or coverage gaps as well as temporal gaps. Some spatial zones in the geodatabase are lacking, these include bottom classification for areas where USGS backscatter coverage is not available (Little Gull Bank, Great Gull Bank) and to the north of the OCS blocks to the Delaware state line. Filling in these areas of incomplete seabed classification data will ensure continuous coverage. MGS shoal sand volumetric estimations are now 15-20 years old, and may not reflect present volumes and locations of those resources. A refined, more representative estimate of Maryland's offshore sand resources could be calculated with a greater degree of precision and spatial accuracy. Seismic and core data for Maryland's more southern shoals have large areas of spatial gaps as compared to Maryland's more northern shoal field surveys. A more accurate analysis of offshore sand resources and volumetric estimations in some areas could prove useful in the planning of operations for Maryland beach replenishment. Updating areas of incomplete or out of date data would improve the utility of our coastal dataset, and ensure that our data reflect the present conditions of Maryland's offshore resources.

Figure 4: Geologist at MGS educates children and families about sand resources through an interactive exhibit.

Associated Cooperative Agreement Outputs (Presentations):

"Baltimore Rocks" Community Outreach:
http://www.baltimoresun.com/news/maryland/baltimore-city/bs-md-ci-geoscience-open-house-20151031-story.html

On October 31, 2015, as part of the "Baltimore Rocks" community outreach in conjunction with the kickoff of the Geologic Society of America National Convention, MGS manned an educational booth which included sieving sand from Ocean City, MD. A key topic of discussion during the interaction with the children and their parents was the importance of sand resources for uses such as beach replenishment.

Acoustic Seafloor Mapping of Baltimore Harbor:

On November 5, 2015 MGS conducted a GSA Field Trip "Acoustic Seafloor Mapping of Baltimore Harbor" which demonstrated all of the acoustic systems used in seafloor mapping projects and their importance in mapping resources and habitats. There were 12 participants on the trip from across the country with various professional backgrounds, including Paul Knorr from BOEM.

Associated Cooperative Agreement Outputs (Web Served Databases):

Maryland's Offshore Mineral Resources GIS Databases:

Maryland iMAP GIS Data Portal: http://imap.maryland.gov/Pages/default.aspx

Federal Data Repository: http://www.data.gov/

Mid-Atlantic Regional Council on the Ocean (MARCO): http://midatlanticocean.org/data-portal/

A primary goal of the cooperative agreement was to improve the capability for Federal and State agencies and localities to plan for cost-effective coastal protection and restoration projects utilizing marine mineral resources on Maryland's OCS in a manner that is protective of the environment. Providing easy access to available datasets for stakeholders to utilize for future planning and assessments is key to fulfilling this goal. The database of over thirty years of data will be accessible through Maryland's iMAP GIS data portal, the Federal Data Repository, and MARCO.