

The Delaware Bay Benthic Mapping Project

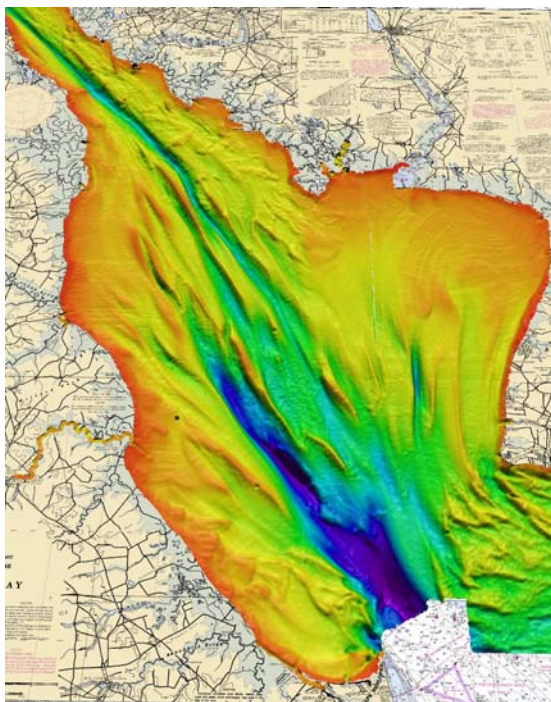
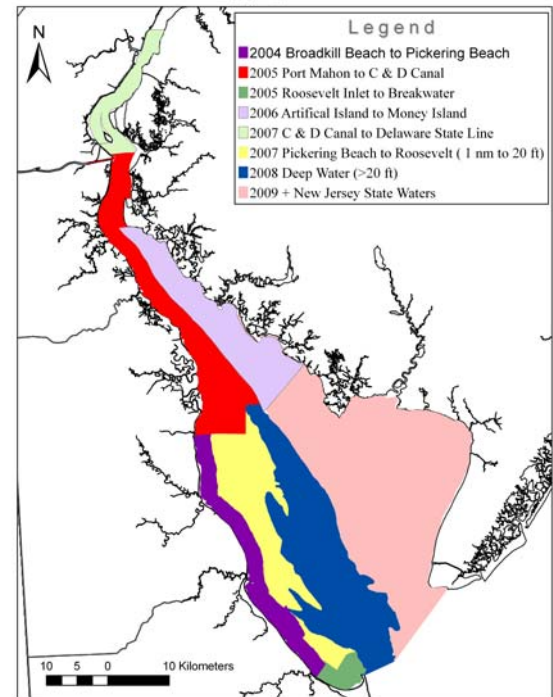
Understanding the Significance of Delaware's Most Important Resources

The Coastal Program of Delaware's Division of Soil and Water Conservation (DNREC), the University of Delaware, Partnership for the Delaware Estuary, and the New Jersey Department of Environmental Protection have partnered and are carrying out a bottom and sub-bottom imaging project to identify and map the benthic habitat and sub-bottom sediments of Delaware Bay and River. This project was initiated to better understand the distribution of bottom sediment types, habitat, biodiversity, and most importantly, human's impact on the bay bottom and it's living resources.

This project integrates the use of three types of acoustical systems: Roxann seabed classification system, chirp sub-bottom profiling, and multi-beam bathymetric mapping. Verification of the acoustic data with bottom and sub-bottom sediments is performed through the collection of grab and core samples and underwater video images.

Now having completed its third year of an expected seven year timeline, 245 square miles of bay bottom has been mapped, covering approximately 35% of the total area. We have gained a greater understanding of the local and region sediment distribution patterns and transport pathways, in addition to an enhanced awareness of the local and regional habitat patterns for several species of interest within the Delaware Estuary.

Benthic Mapping Area Timeline



Existing Information Needs:

Identify Essential Fish Habitat

- + ID preferred sedimentary environments
- + Mapping Oyster Beds and habitat
- + Information for Horseshoe Crab Habitat Management

Identify Important Locations for Marine Protection Areas

Evaluate Benthic Habitat Damage

- + trawl, dredge, and anchor scaring

Identification of Sand Resources for Beach Replenishment

Monitor Dredge Sites

- + recovery rate, infilling material

Emergency Response

Artificial Reef Monitoring

Sediment Dynamic of Delaware River and Bay

Storm Assessment

75°45'0"W 75°44'0"W 75°43'0"W 75°42'0"W 75°41'0"W 75°40'0"W 75°39'0"W 75°38'0"W 75°37'0"W 75°36'0"W 75°35'0"W 75°34'0"W 75°33'0"W

39°28'0"N
39°27'0"N
39°26'0"N
39°25'0"N
39°24'0"N
39°23'0"N
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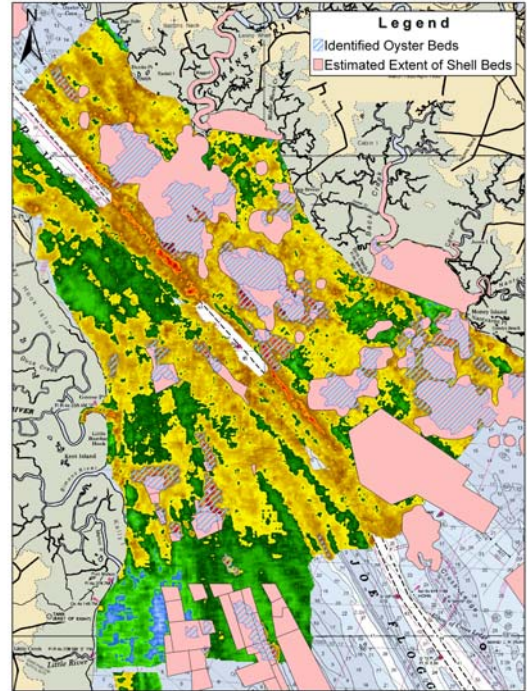
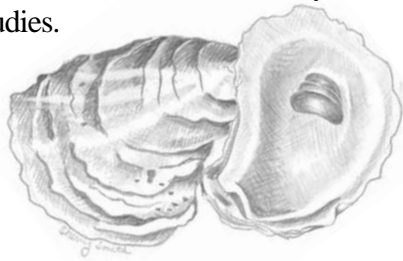
Applications of Benthic Mapping

1. Mapping the Habitat and Distribution of American Oysters (*Crassostera virginica*) in the Upper Delaware Bay

The decline of the oyster industry along the mid-Atlantic region has initiated Delaware in an attempt to assess the status of oyster habitat in the Upper Delaware Bay. Utilizing several remote sensing data collecting techniques resulted in the construction of the first oyster habitat maps in the Delaware Bay's history.

As shown in the figure to the right, the estimated extent of shell beds derived from dredge surveys (pink polygons) has a distinct offset compared to the actual extent mapped out through the use of the Roxann seabed classification system.

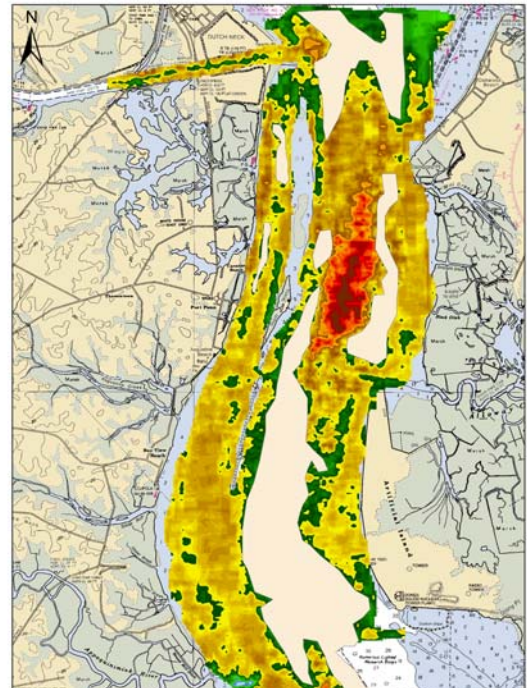
The full integration of this data allowed, for the first time, a comprehensive spatial assessment of current oyster bottom conditions which will greatly improve the capabilities for the regional management of shellfish resources in the bay, especially with respect to evaluating site placement of shell for restoration and the role of oyster dredge data in distribution and habitat studies.



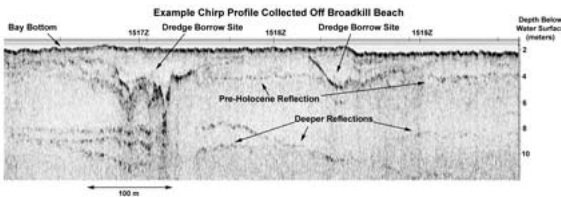
2. Evaluating Short-Nose and Atlantic Sturgeon Habitat

As the pressures of commerce push for a deeper navigational channel and increased maintenance dredging, there is a strong drive to understand the preferred habitat of Short-nose and Atlantic sturgeon in the lower Delaware River. The sturgeon's affinity for the several regions along the Delaware River, within the navigational channel, are not well understood and could be associated with areas of groundwater discharge (shown highlighted in the figures at the right).

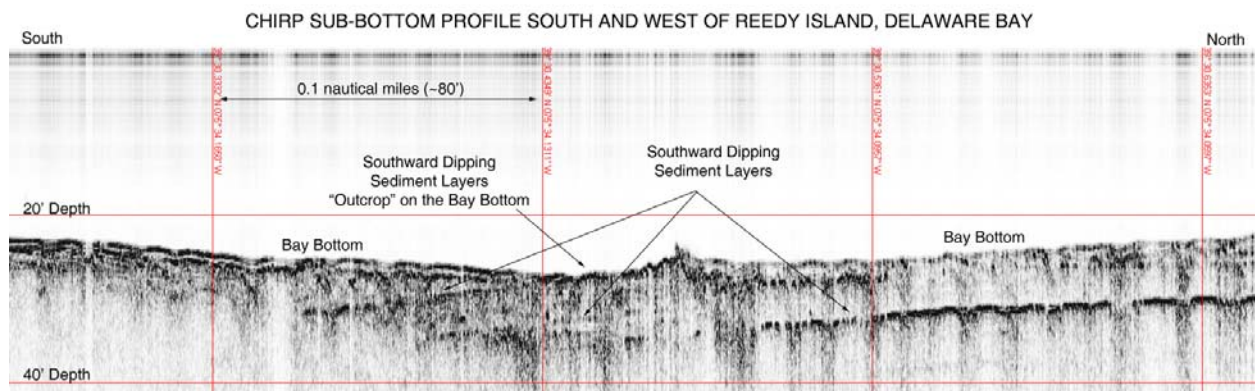
The Delaware State University Aquatic Science Department's tracking and recapture data is being integrated to identify specific areas and the key habitat characteristics which the sturgeon require. Now with a migration of the salt line up the river their preferred habitat is migrating upstream as well. Climate change and anthropogenic impacts have caused these endangered species to become models for what can be done to preserve the legacy of biodiversity in the Delaware Estuary.



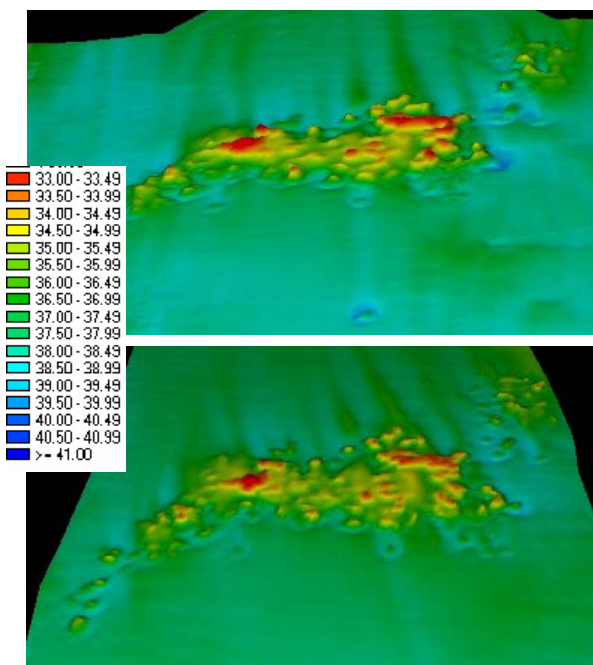
3. Locating Potential Barrow Sites of Beach Replenishment



Chirp sub-bottom profiling is being used to reassess the location and quality of the sand stock in bay barrow sites used for beach replenishment. The ultimate goal is to identify sand resources for beach replenishment that satisfies grain size and volume requirements while minimize the impact upon ecologically rich areas of biodiversity. The chirp data is also being used to: provide constraints on recent geologic setting of the Bay, monitor dredge site recovery, and identify relict oyster beds deposits.



4. Utilizing High Resolution Bathymetry to Evaluate Sediment Movement and Human Impacts on the Bay



Detailed bathymetry data that is collected with a Reson 8124 multibeam is used to image and evaluate a variety of topics within the bay. These include: image areas of intensive commercial fisheries dredging to evaluate benthic damage and recovery potential, image artificial reefs to evaluate their effectiveness and longevity, and map area particularly susceptibility to erosion and deposition to evaluate sediment transport in the bay and tidal creeks. The bathymetric surfaces, shown at left, of the Bower's artificial reef show a ~0.5 meter to ~1 meter decrease in depth over a six month period (from top to bottom). This results in less exposure of the artificial reef surfaces, which minimizes the reef's effectiveness as potential habitat.



What does the Future Hold?

With an integrated scientific approach, Delaware hopes to fill many of the existing data gaps that exist in the background information necessary to successfully manage this important resource. The Project will continue to map the entirety of the State of Delaware waters in the Delaware Bay and River through 2009, and will incorporate additional projects to map smaller inland bays and waterways into the larger effort to understand the states submerged resources. Through identifying and mapping the benthic habitat and sub-bottom sediments of the Delaware Bay, and supplying this information in GIS format, decision makers and stakeholders will have access to critical data that will allow them to successfully manage and conserve Delaware's coastal zone.



Partners in Mapping

University of Delaware Geosciences Department
Delaware Fish and Wildlife, Fisheries Section
Delaware Shoreline and Waterway Division
Delaware State University Aquatic Sciences
Partnership for the Delaware Estuary
New Jersey Department of Environmental Protection
(Coastal Management Office)



Publications

- Wilson, B.D. 2007. Bottom Sediment Mapping of the New Jersey Central Delaware Bay Oyster Beds. Final Technical Report for the Partnership for the Delaware Estuary and the New Jersey Coastal Management Office. 67 pp.
- Wilson, B.D. and Madsen, J. A., 2006. Acoustical Methods for Bottom and Sub-bottom Imaging in Estuaries: Benthic Mapping Project to Identify and Map the Bottom Habitat and Sub-Bottom Sediments of Delaware Bay. *Sea Technologies* 47(6): 43-46.
- Wilson, B.D., Madsen, J. A., Bruce D., 2006. Mapping the Distribution and Habitat of Oysters in Delaware Bay. 26th Annual ESRI International Users Conference Technical Papers. 39 pp.
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- Wilson, B.D. 2006. Bottom Sediment Mapping of the Central Delaware Bay Oyster Beds: The New Jersey Pilot Area Result. Final Technical Report for the Partnership for the Delaware Estuary and the New Jersey Coastal Management Office. 40
- Madsen, J., 2004, Benthic and Sub-Benthic Mapping of Delaware's Coastal Areas for Natural Resource Management – Pilot Study, Technical Report, Submitted to DNREC, Dover, DE, 51 pp.
- Sommerfield, C.K. and Madsen, J.A., 2003, Sedimentological and Geophysical Survey of the Upper Delaware Estuary, DEL-SG-04-04, University of Delaware Sea Grant College Program, 126 pp.
- Madsen, J. and Sommerfield, C., 2003, Application of side-scan sonar, sub-bottom and echo-sounding techniques to study sediment deposition and erosion in estuaries: Results from the lower Delaware River and upper Delaware Bay, Technical Papers, U.S. Hydrographic Conference, 7 pp.

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