

# Hard-Bottom Sampling Methodology and Characterization of a "Sponge Garden" in the Broadkill Slough as Part of the Delaware Estuary Benthic Inventory

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## Hard-bottom Benthic Communities in Delaware Bay

One goal of the Delaware Estuary Benthic Inventory (DEBI) project was to determine the best sampling methods for hard bottom communities. Such communities and habitats have long been known to be present in the lower part of the bay, but are poorly characterized by conventional, bottom-grab sampling:

- Recognized, distinct hard bottom communities
- Poorly known distribution
- May have ecological function much greater than bottom area suggests
- Not sampled by conventional grabs and cores, and an oyster dredge (right) gives poor spatial resolution and has an unknown sampling efficiency
- Need to try multiple sampling methods on same communities and bottom types

## Sampling Gear and Study Sites

Over four days of sampling in July 2008, we compared results and samples returned from an oyster dredge and two epibenthic sleds (photographed below) with those from direct diver observations and a grab with a down-looking video camera. In all we sampled at eight sites on the Delaware side of the lower estuary chosen from published studies, thesis reports and unpublished species records.

- Sites of previous studies:
  - Maurer and colleagues, early 1970's, e.g. from Haines' 1978 thesis (right)
  - Miller and Hauser, 1999-2001, MS thesis 2002
  - Additional sites from Amos' collecting in the 1950's (see Miller and Gardiner poster on historical collections of benthic invertebrates; this meeting).

## Preliminary Results

By the numbers:

- 4 days on the water (tracks and sampling sites on chart above)
- 4 types of sampling gear
- 12 crew, scientists and students
- 4 divers on 2 sites, 5 dives total (top center photographs)
- 8 different stations
- 5 grabs
- 3 sleds tows
- 23 dredge hauls

Based on our initial findings, we focused our effort in the South Broadkill Slough where dredging revealed a notable area with large, bright yellow boring sponges, *Cliona celata*, in the massive, gamma growth form (see photographs at right). Sponges were dredged from approximately 8 m depth over a region at least 0.8 nautical miles (1.5 km) in length along the axis of the slough. In that area, SCUBA divers (center, top) were able to retrieve sponge samples (in blue buckets, bottom-right, and artfully arranged on deck, middle-right) and characterize the three-dimensional structure and spatial arrangement of the "sponge garden." They reported that individual sponges were as tall as 30-40 cm and spaced about 1-2 m apart on the muddy sand bottom.

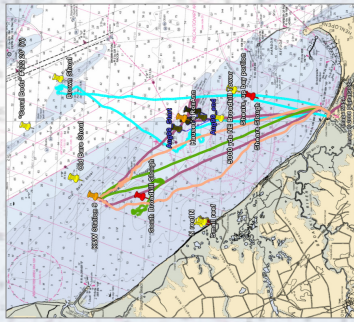
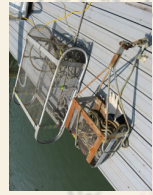
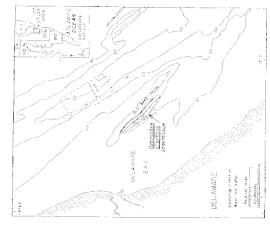


Photo by U.S. Fish and Wildlife Service

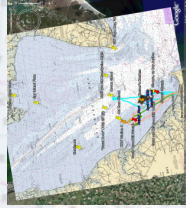
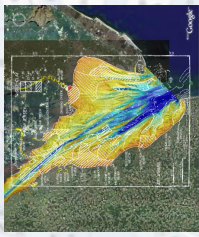


## Significance of the "Sponge Garden" and Other Findings

We found:

- Conch (whelks), hermit crabs, rubbery byzoan, *er celera* (in buckets, right)
- Nodules of *Sabella* and *Hydroides* (in hand, below)
- Sand dollar beads of keyhole sand dollar, *Melitta quinquesperforata* on Brown Shoal (right)
- Sponges in Broadkill Slough
  - Boring sponge, *Cliona celata*, massive gamma growth form (photographs at left)
  - Sponge every 1-2 m, up to 30-40 cm high
  - Found at depth of about 8 m (20')
  - Over at least 0.8 nautical mile (1.5 km) along channel of Broadkill Slough

Our observations add to the list of hard bottom communities documented and accurately located in the Delaware Estuary, and we propose that these methodologies will aid in ground truthing ongoing and future acoustic bottom mapping from both surface vessels and autonomous underwater vehicles. In general, hard bottom communities are less sampled and studied in the Delaware Estuary compared with easier to sample and more prevalent soft bottoms. However, future integrated efforts to assess biotic diversity, map benthic habitats and assess their functional roles are warranted because the complexity and productivity of these habitats are believed to be very important for the estuary ecosystem as a whole and finfish and shellfish in particular.



## Future Work

Visibility from both the diver reports (30-50 cm at slack high water) and grab-mounted video further suggests that imaging with an ROV would also be effective at characterizing the areal extent of the sponge garden, its habitat structure and use by other species.

These field efforts have benefited from the analysis of historical collections of benthic invertebrates (above graphics) and see Miller and Gardiner poster, this meeting), and future efforts will be coordinated with AUV-based geoaecological mapping work planned for the upcoming 2009 and 2010 field seasons (see Raineault, Trembanis and Miller poster at this meeting).

## Acknowledgements

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