Benthic Indicators Derived from the 2008 Delaware Estuary Benthic Inventory (DEBI) Sampling

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Delaware Estuary Benthic Inventory (DEBI) Project

With the support of Regional Applied Research Effort (RARE) grants from EPA Regions 2 and 3, the Partnership for the Delaware Estuary, in conjunction with numerous governmental and academic partners, conducted the Delaware Estuary Benthic Inventory (DEBI) project. In the summer of 2008, extensive benthic community, sediment and water-column sampling was conducted at 230 stations throughout the Delaware Estuary.

Project goals:
- Obtain a comprehensive inventory of benthic communities for habitat assessment
- Determine the association of benthic communities with benthic habitat, sediment and water column attributes
- Develop Delaware Estuary Benthic Inventory (DEBI) project
- Obtain sediment and water column data to provide further assessment of the state of benthic communities and ecosystems
- Collect data in ways that allow comparison with recent federal (EPA and NOAA) and historical benthic surveys
- Like multiple sampling methods as needed to sample hard-bottom communities not well sampled by conventional gear (grabs and cores)

DEBI 2008 Sampling Design

With the assistance of Hal Walker and Charlie Strobel of EPA's Office of Research and Development, Advanced Ecology Division (Narragansett, RI), we developed a probabilistic sampling design where stations were randomly located within salinity zones and sediment types (white known):

- Salinity: tidal freshwater, oligohaline, mesohaline, and polyhaline
- Sediment: mud (silt and clay), mixed, and sand
- Nearshore (Delaware and New Jersey) and open bay zones received separate allocations of sites. Bottoms near the shoreline of the lower bay had been previously mugged by the DEBI, while those in the middle of the bay had not
- 250 stations were randomly chosen according to the criteria described above

On the Delaware Bay, aboard the R/V Lear:

- Two 6 in. Young grab samples were taken at each station
- One for sediments (silt-clay and TOC), metals, and PCBS (at selected stations)
- One for benthic community analysis: 0.5-mm sieved and preserved in formalin

Benthic Abundance and Biomass Data

Metadata, fields, and descriptors, and example:

- Station name, DE08-0500 (latitude, longitude and sampling data are in IES portal)
- TSN (Taxonomic Serial Number), 066662
- Highest taxonomic group, Annelida: Polychaeta
- Family, Spionidae
- Species (or lowest identification), Marenzelleria viridis
- Number in sample
- Ash-free dry weight, mg

Quick Facts:

- 3200 lines or species occurrence records from 231 stations
- 34 species (revised) and 235 TSNs
- 19 families and 8 phyla
- What was the most diverse site?
- What was the most commonly occurring species?
- What was the most abundant species?
- What species had the highest biomass?

Sampling Results by the Numbers

From July through September, 2008:

- 36 days on the water
- 320+ stations

DEBI Data Access from the Web and Future Work

Over the past year, the DEBI Work Group has strived to geo-reference these data in order to make them FGDC-compliant and to release them to interested users. We are pleased to announce that these data will be made available via the Partnership's web site:

www.delawareestuary.org/science_projects_baybottom_data.asp

In addition, it should also prove possible to compare indicators derived from the 2008 data with similarly formatted and electronically available data from federally funded studies (EMAP, MAIA, NC) from the 1990s through the 2000's, as well as other past surveys. Thus, in addition to the DEBI, we hope for the first time to be able to reveal trends in benthic communities in the Delaware Estuary.

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Utility for the Upcoming State of the Estuary Report

These data can be used to inform the first-ever use of benthic indicators in the SOTER report for the Delaware Estuary. As reviews of the two dozen SOTERs revealed that, when benthic indicators are used, there is a wide diversity of approaches ranging from simple species diversity, reference to sediment quality or toxicity (from metal or organic contaminants), supplemented with distribution maps of notable or foundational species (e.g., scallops, mussels), to sophisticated indices of benthic integrity (benthic IBI, Weisberg et al. 1987 Estuaries 20, 149), in a relatively few cases. Since the validation of benthic index for the middle Atlantic estuaries (and biogeographic provinces) is ongoing, we propose to use straightforward benthic metrics derived from DEBI community data for PDE reports.
Benthic Abundance and Biomass Data

Quick Facts:

- 3290 lines or species-occurrence records from 231 stations
- 244 species (or taxa) and 235 TSN’s
- 112 families in 9 phyla: Cnidaria, Platyhelminthes, Nemertina, Echiurida, Annelida, Mollusca, Arthropoda, Echinodermata, Chordata
- Five stations had 40 or more species: NJ08-0558 main channel near Cross Ledge (51 species), DE08-0620 (44), NJ08-0574 (42), DE08-0605 (41), NJ08-0567 (40)
- Mean species diversity, 14 species
- One station, DE08-0558 from near Christina River, had no organisms present
- Most surprisingly, a lone unidentified echiuroid (“spoon worm”) was found at station DE08-0626 at Slaughter Beach
- Horseshoe crabs were collected at five Delaware stations

Benthic Species:

- Five most diverse groups: polychaetes (27 families, 79 species), amphipods (15 families, 35 species), bivalves (17 families, 27 species), and gastropods (15 families, 25 species)
- Ten most common species occurrences: Cyathura polita\(^1\) (108 stations), Oligochaeta\(^2\) (100), Mediomastus ambiseta\(^3\) (96), Glycinde solitaria\(^4\) (94), Tubificoides\(^5\) spp. (92), Streblospio benedicti\(^6\) (89), Marenzelleria viridis\(^7\) (78), Leucon americanus\(^8\) (75), Acteocina canaliculata\(^9\) (73), Apocorophium lacustre\(^10\) (69)
- Highest abundance: 2853 Gemma gemma\(^11\) at NJ08-0551 near Nantuxent Creek (71,000 m\(^{-2}\))
- Highest biomass: 7.7 g of Corbicula fluminea\(^12\) at DE08-0504 near Marcus Hook (192 g m\(^{-2}\)), overall mean total biomass 0.30 g or 7.4 g m\(^{-2}\)
- Mean abundance 360 per grab, or 9000 m\(^{-2}\), highest total abundance 5691 or 142,000 m\(^{-2}\) at NJ08-0567 Egg Island Point (including 2228 Sabellaria vulgaris\(^13\) and 1575 Polydora cornuta\(^14\))

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\(^1\)Isopod, \(^2\)Oligochaete, \(^3\)Polychaete, \(^4\)Cumacea, \(^5\)Gastropod, \(^6\)Amphipod, \(^7\)Bivalve