



Preliminary Results from Benthic Infauna Monitoring at the Narragansett Bay National Estuarine Research Reserve



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INTRODUCTION

Several studies on benthic infauna have been conducted in Narragansett Bay (Rudnick et al. 1985, Frithsen 1989, Ellis 2002, Calabretta and Oviatt 2008), but not specifically in the Narragansett Bay National Estuarine Research Reserve (NBNERR) on Prudence Island. In addition, benthic infauna and sediment composition have been identified as a critical gap in the Reserve's Long-Term Monitoring Program (Raposa and Durant 2011). The goal of this project is to characterize the benthic infauna communities and describe sediment composition in three different habitat types around Prudence Island as the initial step for developing a long-term benthic macrofaunal monitoring program. When coupled with ongoing water quality monitoring at the Reserve, the new benthic monitoring program might be able to detect estuarine ecosystem changes in NBNERR waters over time and help identify the factors that are contributing to those changes.

METHODS

Study Sites

Samples were taken at the System-Wide Monitoring Program (SWMP) water quality stations (see map on left).

The stations represent a gradient in habitat types:

- salt marsh - Nag Creek
- shallow cove - Potter Cove
- open Bay waters - T Wharf

Within the study area (approx. 2000 m² / site; see images below):

- three 10 cm replicate cores were taken for benthic infauna (approx. core area = 0.02 m²)
- three adjacent cores for sediment analysis
- benthic replicates were preserved with 10% pH buffered formalin and stained with Rose Bengal
- sediment cores were also preserved until processed



Sampling at Potter Cove



Sampling at Nag Creek



Nag Creek



Potter Cove



T-Wharf

Benthic Fauna

In the lab, samples were sieved through :

- 500 μm mesh sieve for macrofauna
- 300 μm sieve for meiofauna (juvenile macrofauna, i.e., temporary meiofauna; Coull and Bell 1979)
- 45 μm sieve for microfauna

A Leica APO 8S microscope was used to identify all benthic macrofauna > 500 μm to the species level or to the lowest possible taxon.



Identifying

Sediment

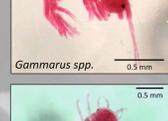
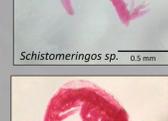
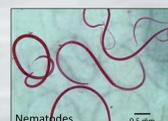
- To determine grain size composition (Wentworth 1922) the samples were sieved through:
 - 4 mm mesh sieve for pebbles
 - 2 mm mesh sieve for granules
 - 63 μm for sand
 - <63 μm for mud (silt +clay)
- After sieving and oven drying, the sediment was combusted following the loss-on-ignition procedure (LOI, Dean 1974):
 - to determine the total organic content of the sample
 - to calculate the percent contribution of each grain size class free of organic material.

RESULTS

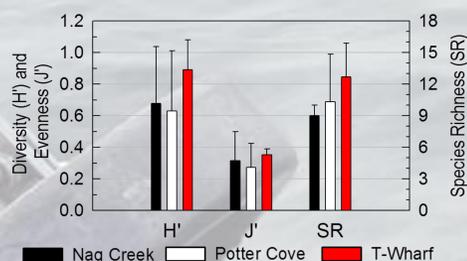
Species Composition

- Collectively, 1 anthozoan species, 7 species of polychaetes, 7 species of arthropods, and 10 species of mollusks were identified across the three sampling sites (image at right).
- Other taxa also present included nematodes, copepods, oligochaetes, ostracods, and amphipods.
- The nematodes, harpacticoid copepods, oligochaete worms, and the polychaete *Neanthes succinea* were found at all three sites .

- The only economically important species found were in open Bay waters (T—Wharf):
 - Northern quahog *Mercenaria mercenaria*
 - Long-neck clam *Mya arenaria*

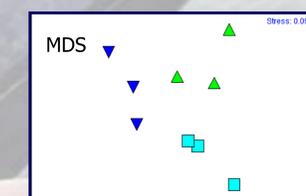
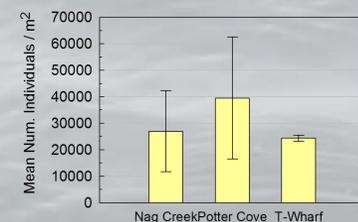
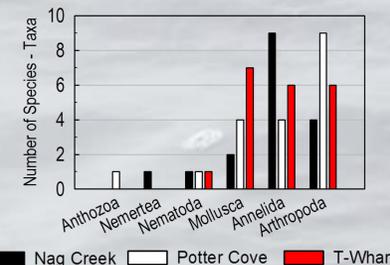


Community Parameters



- Species richness increased along the gradient of habitat types (image at left).
- High diversity (Shannon Diversity Index, H') and low evenness (Pielou's evenness, J') was characteristic of all three sites.

- Overall density (± standard error, image at right) was high at the shallow cove (Potter Cove) when compared with the other sites.



- Multidimensional scaling analysis (MDS, image at left) showed 3 distinct groups with a low Kruskal stress value of 0.09 indicating that the data were a good fit for the model.

- Significant differences in benthic community composition among the three sites were found based on ANOSIM (p=0.004, Global R=0.0704).

▼ Nag Creek ▲ Potter Cove ■ T-Wharf

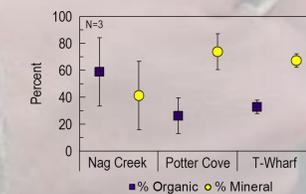
Mean dissimilarities using Similarity Percentages Analysis (SIMPER):

- Nag Creek and Potter Cove = 55.29%
- Potter Cove and T-Wharf = 58.72%
- T-Wharf and Nag Creek = 61.99%

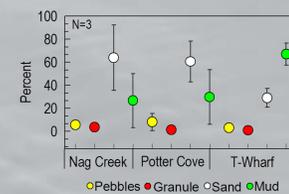
Mainly due to differences in spatial pattern of occurrence of: nematodes, amphipods, ostracods quahogs, polychaetes *Capitella capitata*, *Travisia carnea* quahogs, oligochaete worms, *Travisia carnea*

Sediment Analysis

- Nag Creek and Potter Cove were dominated by sand and to a lesser extent mud (see figure at right); whereas at T-Wharf, the opposite was found.
- Pebbles and granules contributed relatively little to the sediments at any station (< 8%).



- Percent organic content was higher at Nag Creek than T-Wharf and Potter Cove, which were similar to one another (see figure at left).
- It has been found that an increase in sediment organic content can reduce macrofaunal densities, decrease body size, and increase opportunistic species densities (Weston 1990).



CONCLUSIONS

These are some preliminary results of our first effort to document benthic infaunal communities and sediment composition in three different habitats around Prudence Island. Benthic communities in salt marsh, cove, and open water habitats differed in community structure during the winter of 2010. The results of the MDS analysis showed three very distinct groups highlighting the differences in habitats of the three sites studied. The analysis of the remaining 2010 samples will provide a more complete description of benthic communities and sediment composition in these three habitat types and will provide a baseline for annual monitoring moving forward.

ACKNOWLEDGEMENTS

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