Biomonitoring of Submerged Aquatic Vegetation in New Jersey Coastal Bays

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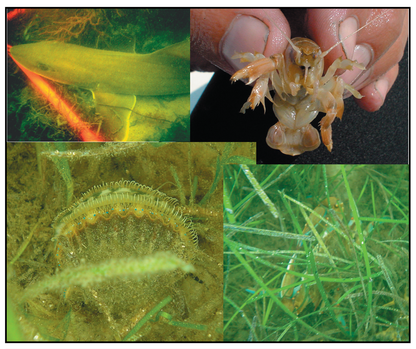
A series of studies has been conducted since 2000 to monitor demographic changes in submerged aquatic vegetation (SAV) beds in the Barnegat Bay-Little Egg Harbor Estuary. Two SAV species in the estuary (*Zostera marina* and *Ruppia maritima*) provide essential benthic habitat for both finfish and shellfish populations. They also function as important primary producers. The Barnegat Bay-Little Egg Harbor Estuary contains approximately 75% of New Jersey's seagrass habitat. Historical surveys of SAV in the estuary from 1968 to 1999 have been brought into a Geographic Information System and analyzed for changes in the area and boundaries of the beds. A loss of roughly 2000 ha was noted between 1987 and 1999 or around 25% of the SAV habitat in the estuary. Due to differences in sampling methods between surveys, this loss could not be directly attributed to any change in SAV bed size. In order to further elucidate SAV bed boundaries, the Barnegat Bay National Estuary Program funded a 2003 remote sensing SAV survey conducted by the Center for Remote Sensing and Spatial Analysis at Rutgers University. This project provided information on Tier 1 monitoring objectives for SAV habitat. In 2004, a SAV study was conducted to assess the condition of seagrass beds in Little Egg Harbor (39º35'N, 74º14'W) and to provide baseline data for further work on seagrass distribution in the system. Two disjunct seagrass beds in Little Egg Harbor, covering a total area of ~1700 ha, were sampled at ten equally spaced points along six, east-west trending transects in spring, summer, and fall (June-November) of 2004. During this period, 180 seagrass samples were collected at 60 transect sites, together with an array of water quality measurements. Results of this Tier 2 study indicate that both aboveground and belowground biomass of seagrass peaked during June-July and declined significantly into the fall months. Mean aboveground biomass ranged from 18.22-106.05 g dry wt m-2, and mean belowground biomass, from 50.48-107.64 g dry wt m-2. Biomass values were greatest along the northernmost sampling transect than transects farther to the south. They were also greater at interior sampling sites within the seagrass beds than along the bed margins. Mean seagrass blade length was consistent over the study period, averaging 32.8-34.0 cm. The percent cover of seagrass, which ranged from 21-45%, peaked in June-July at the time of maximum seagrass biomass. The percent cover of macroalgae was lower than that of seagrass, averaging 13-21%, with maximum cover occurring in August-September. Most of the macroalgal species collected in the seagrass beds were red algae, although the dominant species was typically the green seaweed, *Ulva lactuca*. No brown tide (*Aureococcus anophagefferans*) blooms were recorded during 2004, and phytoplankton abundance did not appear to cause shading problems for seagrass in the system over the six-month study period. However, benthic macroalgal blooms were observed in the seagrass beds, most notably *Ulva lactuca*. These blooms blanketed parts of the seagrass beds and appeared to degrade them over extensive areas. Nutrient enrichment, elevated turbidity levels, and prop scaring are anthropogenic factors that may significantly impact seagrass beds in Little Egg Harbor during the growing season.

Macroalgae Composition

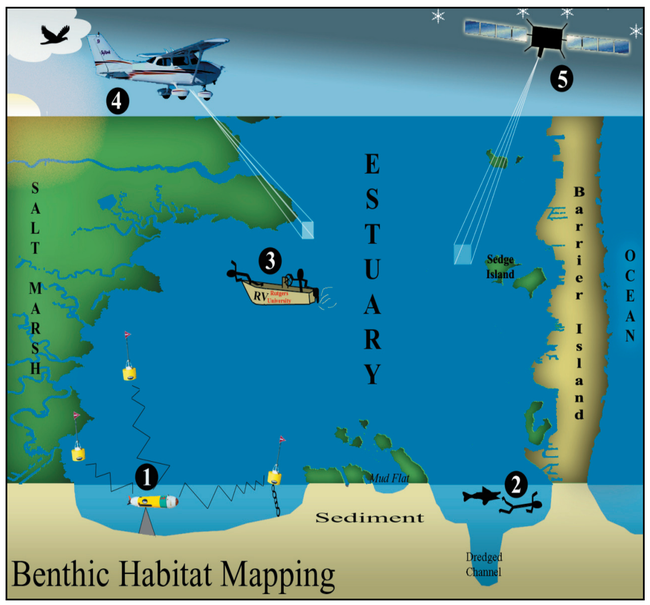
Thirty-two (32) macroalgae species were found during the study period, with the majority being red algae (19) . Fewer species of green algae (11) and brown algae (2) were collected. The most common species was the green seaweed, *Ulva lactuca*, which was found in 59% of the samples, followed by the three red seaweeds, *Spyridia filamentosa* (55%), *Gracilaria tikvahiae* (30%), and *Champia parvula* (23%). Several other species occurred in at least 10% of the samples: two greens, *Ulothrix flacca* and *Enteromorpha intestinalis*, and four reds, *Ceramium deslongchampsii*, *Ceramium cimbricum*, *Ceramium strictum* and *Neosiphonia harveyi*. Only two species of brown algae were recovered, and they were very infrequent. There were several species of two red genera, *Polysiphonia* (4) and *Ceramium* (4), and in both cases some samples contained fragments that could not be identified to species. The average number of species per sample was 3.1, but there was a high degree of variability (SD = 1.6).

Because the samples were analyzed on the basis of presence or absence, there is no information on biomass. For example, a small fragment of a Ceramium species is equivalent to a relatively large individual of *Lomentaria baileyana* or *Ulva lactuca*. The vast majority of the species found were either ephemeral (e.g., most of the green algae) or small epiphytic species (e.g., the majority of the red algae). There were some relatively large species such as *Codium fragile*, *Gracilaria tikvahiae,* and *Lomentaria baileyana*.

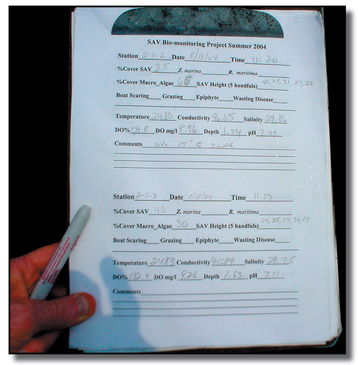


Benthic Macrofauna

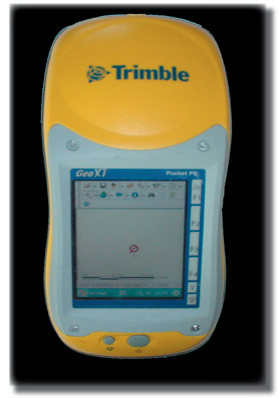
SAV serves as critical habitat for numerous estuarine organisms, including many ecologically and commercially important species.



Benthic Habitat Mapping within the JCNERR involves the inclusion of several research projects into a common Geographic Information System to create a more complete picture of the benthic habitat. Data are collected by means of: (1) REMUS; (2-3) *in situ* data collection; (4) aerial photography; and (5) satellite imagery.



Field Sampling Data Sheet



Global Positioning Systems

Field Sampling

A 0.5-m quadrat placed to the north of the PVC pipe was used to asses percent cover of SAV by species and percent cover of macroalgae. SAV destructive sampling was not performed in the quadrats nor was it repeated in the same location during the same season, due to potential human impacts. Areas of similar SAV percent cover as those of the quadrat area were sampled within 1 meter south of the PVC stake. A core sample (deep enough to extract all belowground rhizomes) was collected, with special care taken not to cut the aboveground SAV. Each sample was placed in a mesh bag, labeled, rinsed (to remove sediment and detritus), and transported back to Rutgers University Marine Field Station (RUMFS). In the laboratory, the sample was sorted according to SAV species. For each species, leaf width and height were measured for five randomly chosen plants. Leaves were examined for the presence of epiphytes. The leaves, sheaths and stems, and belowground portions of the plant were then separated and wrapped in aluminum foil. Each sample was then placed in a drying oven at 50-60 °C for 24-48 hours or until the plant material had completely dried. The biomass of these samples was assessed with a scale that is accurate to the third decimal point.

Transect Design

Each bed was divided into equal segments based on the total north to south length divided by three. For each segment, a randomly placed starting point was placed on the eastern boundary of the SAV bed delineated in the Tier 1 monitoring effort of 2003 . From this starting point, the SAV bed was divided into 10 equally spaced sampling points along a transect from east to west until the western edge of the bed was reached according to the 2003 Tier 1 monitoring. These permanently located sampling points were marked with a GPS-located PVC stake. For each sampling period, there was a total of 10 samples per transect, one transect per segment, three segments per SAV bed, and two SAV beds. Therefore, a total of 60 samples were collected per sampling period, which began on June 1, August 1, and October 1. This sampling design yielded a total of 180 samples.