Spatial changes in epiphytic growth on *Zostera marina* in the Barnegat Bay – Little Egg Harbor Estuary

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Introduction

Seagrass provides critical habitat and nutritional sources for estuarine organisms. As a major primary producer, seagrass is greatly affected by nutrient levels and light intensity. The sensitive vegetation serves as an indicator of overall ecosystem condition and health. Growth can be adversely affected by attached epiphytes attenuating sunlight necessary for photosynthesis. Nutrient input, particularly nitrogen, stimulates epiphytic algal growth. The highly eutrophic Barnegat Bay – Little Egg Harbor Estuary is nitrogen enriched, derived from the heavily developed northern area of the Barnegat Bay (BB) watershed. Little Egg Harbor (LEH), located in the southern perimeter of the estuary, is farther removed from the developed northern watershed, creating a north-south gradient in nitrogen concentration. This project is part of a larger study to assess the impacts of eutrophication on seagrass habitat in the BB-LEH system. The purpose of this study is to determine if this nutrient gradient in the estuary affects epiphytic growth on seagrass.

H_0: No statistically significant difference exists between epiphyte-seagrass biomass in BB and LEH.

H_1: A statistically significant difference exists between epiphyte-seagrass biomass in BB and LEH.

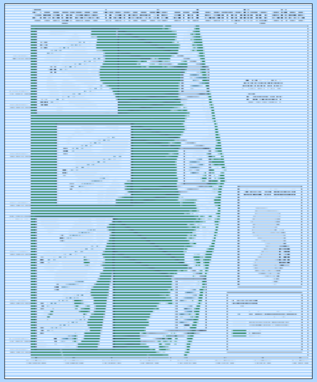

Figure 1. Map of transects in BB-LEH Estuary. 1-6 are located in LEH, 7-12 are located in BB.

Methods

Seagrass samples were collected twice at 120 sampling sites in BB-LEH during 2 periods (June, period 1; July, period 2) in 2009. Samples were collected at 10 sites along 12 fixed transects in 4 seagrass beds, 2 in BB and 2 in LEH (Figure 1). At each site a diver collected seagrass by hand to minimize damage to blades. Samples were gently sieved to remove sediment and stored in plastic bags on ice before transport back to the Rutgers University Marine Field Station. There the 5 longest blades from each sample were cut at the sediment line. Both sides of each blade were independently assessed for epiphyte growth. Visual estimates of epiphyte coverage were determined and recorded. Epiphytes were scraped off of both sides of the 5 blades comprising each sample and placed in the oven at 60°C for 48 hours. The blades and epiphytes were weighed and the dry weight biomass of each sample recorded to the fourth decimal place. Data were analyzed using standard statistical (ANOVA) tests.

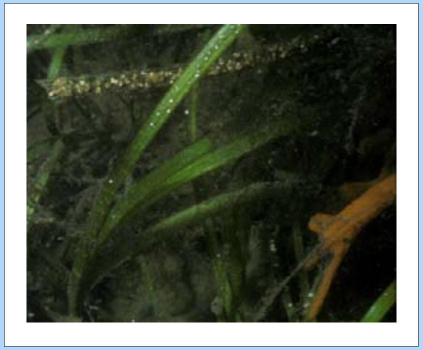

Figure 2. Picture of *Z. marina* with epiphytes. Common overgrowth included macroalgae, calcarious tubeworms, blue mussels, and orange sheath tunicate.

Results

695 epiphyte biomass values and 720 seagrass biomass values were recorded(Figures 3 and 4). 25 seagrass samples lacked epiphytic overgrowth. It is instructive to compare the epiphyte biomass values recorded during the two sampling periods (Figure 5). Slightly higher values of epiphyte biomass were recorded during period 2 than period 1, with median values of 0.0046 g and 0.0076 g, respectively. However, a paired T-test revealed no statistically significant difference (P = 0.94). A linear regression analysis of natural log transformed epiphyte biomass values vs. seagrass blade biomass values indicates a log transformed coefficient statistically different from zero (Figure 5). A two-factor ANOVA was then applied to test for statistical significance between biomass values of the samples collected in BB vs. LEH. A plot of the ratio of epiphyte biomass/seagrass biomass values vs. transect (Figure 6) shows that no statistically significant difference (F = 1.48, DF = 722) exists between the biomass samples collected along transects in BB and those collected along transects in LEH (Table 1).

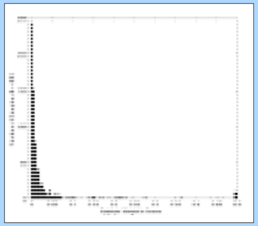

Figure 3. Histogram of epiphyte biomass.

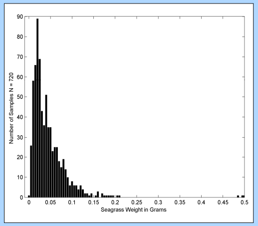

Figure 4. Histogram of *Z. marina* biomass

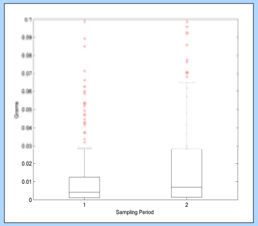

Figure 5. Boxplot of epiphyte biomass vs. sampling period. Period 1 median = 0.00469, period 2 median = 0.00765

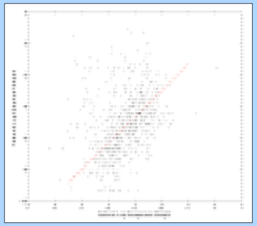

Figure 6. Natural log transformed epiphyte biomass vs. blade biomass. The slope is statistically different than zero.

Discussion

Seagrass leaves in BB-LEH are colonized by a variety of organisms. Epiphytic overgrowth on seagrass leaves can be detrimental because it obstructs sunlight available to the leaf surface of the seagrass host. BB-LEH is a highly eutrophic system subject to nutrient enrichment, and the objective of my study was to examine the abundance of epiphytes along a nutrient gradient in an estuary.

Epiphytic biomass was higher in July than June, which was expected because of greater nutrient inputs and more favorable light and food conditions. However, epiphytic biomass difference between the two periods was not significantly different. In addition, no statistical difference existed between epiphyte-seagrass biomass at sites in BB vs those in LEH, indicating that greater nutrient inputs in the northern perimeter of the estuary did not directly affect the magnitude of epiphytic growth. Instead, epiphyte biomass changes may be more closely related to the influence of conditions in proximity to Barnegat Inlet and Little Egg Inlet (Figures 1 and 6). This may result from higher nutrient concentrations flushing through the Intracoastal Waterway to the ocean via the inlets, higher salinity conditions more favorable for epiphytic settlement on the seagrass in these areas, and greater water clarity because of lower turbidity. Further research is necessary to identify the factors responsible for observed temporal and spatial epiphytic trends on seagrass in the estuary.

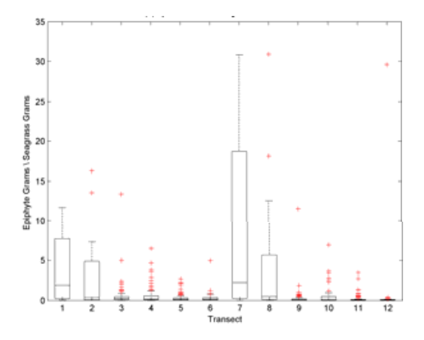

Figure 6. Boxplot of epiphyte – seagrass ratio vs. transect. Transects 1, 7, and 8 are located near inlets.

Transect	1	2	3	4	5	6	7	8	9	10	11	12
Median	.024	.007	.012	.009	.005	.005	.016	.033	.008	.002	.001	.001
Stdev	.398	.115	.073	.049	.029	.024	.599	.428	.085	.055	.007	.052

Table 1. Transects and epiphyte biomass medians with standard deviation.

Acknowledgements

Gregg Sakowicz, Gina Petruzzelli, Chris Huch, and Caitlin Kennedy for their assistance in the field and in lab. Dr. Mike Kennish for guidance throughout the project. Scott Haag for statistical analysis.