Effects of nutrients on the abundance of *Spartina alterniflora* in Sandy Point Saltmarsh

Simon Bishop
Department of Biology and Environmental Science Major: Marine Biology
Dr. Jean-Paul Simjouw

Abstract

Spartina alterniflora is one of the major plants found in New England salt marshes. However, its location is limited due to the nutrients available as well as competition with other salt marsh plants. This project set out to determine whether in Sandy Point salt marsh the nutrient levels in the sediment have a correlation with the abundance of *Spartina alterniflora*. For this experiment a porewater sampler (peeper) was created to allow for the measurement of the porewater in the sediment in locations where *Spartina alterniflora* was abundant, semi abundant and non-existent. Alongside each of the peepers two cores were taken to help verify the results of the peeper. Each core was spun down in a centrifuge to separate out the porewater. Ammonia levels of the porewater samples were tested using an eXact® Eco-Check Advanced Photometer whereas the sulfide levels were tested using a LaMotte Sulfide Test kit and the salinity was determined using a hand refractometer. The collected data showed that areas abundant with *Spartina alterniflora* had lower concentrations of ammonia. Areas without *Spartina alterniflora* had higher pH levels. However, the experiment was inconclusive as to a correlation. More data would be needed in order to determine whether there is a correlation between the nutrient levels and *Spartina alterniflora*.

Introduction:

Salt marshes reside along many parts of the Connecticut coastline providing important habitats for both marine and terrestrial species as well as act as filters for pollutants (Beck et al. 2001). The plant species that reside in salt marshes are affected in their zonation by many factors including salinity (Bradley and Morries, 1990), competition (Bertness, 1991) and the availability of nutrients (Kiehl et al. 1997). *Spartina alterniflora* is one of the major salt marsh plants in New England salt marshes (Bertness 1991) and is limited due to nutrient levels (Kiehl et al. 1997). Many of the plants in a salt marsh, such as *Spartina* ***alterniflora*****, obtain nutrients from the porewater, which is the water that resides between the sediment particles. Studies have shown ammonia (Bradley and Morries, 1990) sulfides (Bradley and Morries, 1990) and salinity (Parrondo et al. 1978) have effects on the growth of *Spartina alterniflora*. This experiment was done to determine whether these nutrient levels correlate to the abundance of *Spartina alterniflora* in Sandy Point salt marsh. Sandy Point is a *Spartina* dominated salt marsh in West Haven, CT (Fig. 1).**

Figure 1: Sandy Point Salt Marsh West Haven, CT (Image from Google Maps)

Figure 2: Sandy Point salt march location.

Methods and Materials

Peeper Porewater Collection

To collect the data for this experiment a porewater sampler, a peeper, was built (Fig. 3). A peeper allows for the nutrient and ion concentrations of the porewater to be determined by allowing for the equilibrium to occur between the deionized water in the peeper and the porewater. To create this peeper we used 4, 15 cm long 12.7 mm pieces of PVC pipe spaced with 25 mm between each tube. Between each pipe was used tile cement to eliminate space and create structure to the peeper. The pipes were placed between two pieces of Plexiglass 12.7 cm wide and 22.9 cm long. On each side of the tubes were cut a 10.2 cm long 1 mm wide slit to allow for the exchange of porewater. Inside each PVC tube was placed 25 ml of deionized water in dialysis tubing tied at each end with string to prevent leakage. Each peeper was placed into the ground, using a shovel to create a space to allow for the deionized water to equilibrate with the porewater for one week. Peeper samples were collected by removing the dialysis tubing and placing it into 500 mL plastic containers with caps to be transported to the lab for testing.

Figure 3. Porewater sampler (peeper) used during the experiment.

Abundance

Locations were chosen where no *Spartina alterniflora* was growing, at the border of growth and no growth and where there was growth. At each sample site a quadrat was used to determine the abundance of *Spartina alterniflora* within a 1 m^2 around the peeper. 20-25 plants for samples with *Spartina alterniflora* 12-15 for samples with some *Spartina* and 0 for samples with no *Spartina*. These are the abundance numbers used for each of the sample sites.

Table 1. Abundance of *Spartina alterniflora* at each peeper location.

Trial Number	# of *Spartina* alterniflora
Trial 1 With *Spartina*	25
Trial 1 With Some *Spartina*	17
Trial 2 With Some *Spartina*	14
Trial 1 With No *Spartina*	0
Trial 2 With No *Spartina*	0
Trial 3 With No *Spartina*	0

Sediment Porewater Collection

After the week, core samples were next taken to each peeper to compare the data from the peeper (Fig. 4). Core samplers were 5 cm diameter 30.5 cm long pieces of acrylic plastic. Cores were collected by pushing the plastic into the ground. When removed the exposed end was plugged with a rubber stopper and when taken out the bottom that was pushed into the sediment was capped until each core could be processed. Each core was sectioned into 4, 5 cm segments which were transferred into individual 25 mL sterile centrifuge tubes.

Figure 4. The coring locations in relation to the peeper and the type of location the peepers were placed in.

Porewater analysis

Peeper samples were poured into 60 mL syringe from the dialysis tubing then filtered into a 25 mL sterile centrifuge tube using a 0.45µm Restek™ syringe filter with Luer-Lok™ Cellulose acetate. If the sample could not be tested right away it was stored in the freezer until testing. The core samples were centrifuged at 1000 rpm for 30 minutes to allow for separation of the sediment and porewater. After 30 minutes any water was poured off into sterile 60 mL syringes with filters. The samples were filtered using 0.45µm Restek™ Syringe Filters with Luer-Lok™ Cellulose acetate into 25 mL sterile centrifuge tubes for storage in the freezer until the sample could be tested for nutrients. Small samples of porewater were tested for ammonia, salinity, sulfide, then pH depending on the amount of water collected. To test for ammonia an eXact® Eco-Check Advanced Photometer was used. The sulfide was determined using a LaMotte Sulfide Test kit. The salinity was determined using a hand refractometer.

Results

The value < 0.01 ppm was the value given by the eXact® Eco-Check Advanced Photometer when the value obtained was out of its lower range of measurement (Table 2). Sulfide levels for the experiment were low, < 0.2 ppm, for all but 3 samples of which 2 were 0.2 ppm and one was 0.5 ppm of sulfide. The samples that were not <0.2 ppm were found in samples without *Spartina alterniflora*. The value < 0.2 ppm was used for tests that were of a lighter color than the lowest range of the LaMotte test kit which was a value of 0.2 ppm. The pH levels were obtained for 2 samples without *Spartina alterniflora*. The pH levels were 7.8 for one sample at a 5cm depth and 8.1 for 5, 10 and 15 cm depth for another sample without *Spartina*.

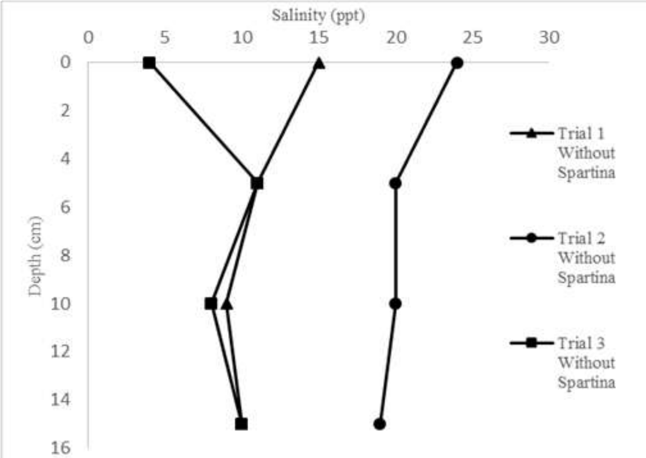

Figure 5. Salinity versus Depth of peeper samples without *Spartina alterniflora*.

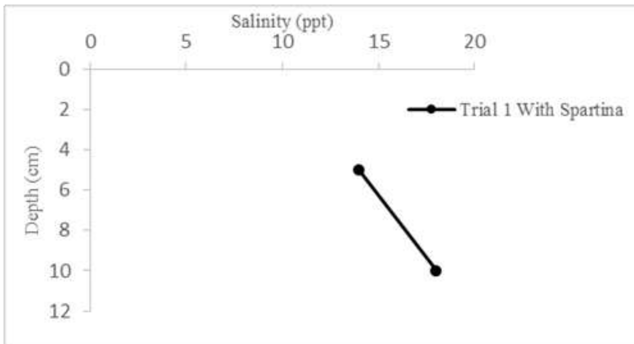

Figure 6. Salinity versus Depth of peeper samples with *Spartina alterniflora*.

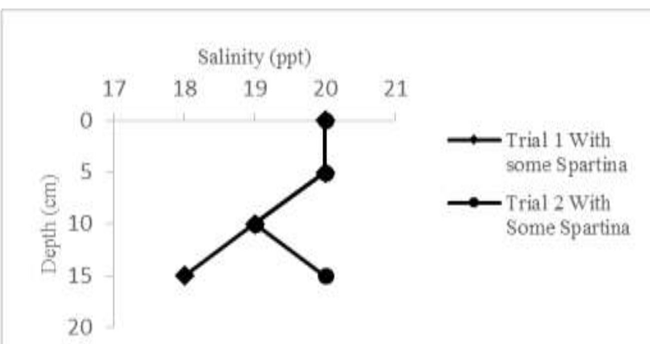

Figure 7. Salinity versus Depth of peeper samples with some *Spartina alterniflora*.

Table 2. Values obtained for NH_4 for each core.

Depth	Amount of *Spartina alterniflora*	NH_4 Concentrations (ppm)
0	Without	2.94
5		3.02
0	Without	1.59
5		2.27
0	Without	3.38
0	Without	2.13
0	Some	1.11

Table 3. NH_4 levels for the peeper samples.

Peeper Samples for NH_4	Depth (cm)	Trial 1 NH_4 (ppm)	Trial 2 NH_4 (ppm)	Trial 3 NH_4 (ppm)
Spartina	0	-		
	5	0.16		
	10	0.77		
	15	-		
with some *Spartina*	0	< 0.01	0.03	
	5	< 0.01	< 0.01	
	10	< 0.01	< 0.01	
	15	< 0.01	< 0.01	
Without *Spartina*	0	< 0.01	0.08	< 0.01
	5	0.45	< 0.01	< 0.01
	10	< 0.01	0.14	< 0.01
	15	0.75	< 0.01	< 0.01

Discussion

Based upon the concentrations of ammonia in the peeper samples in comparison to the abundances the areas with some *Spartina alterniflora* growth have the lowest levels where as the higher levels were in areas without *Spartina* growth. The data from the core samples collaborates with the core near the peeper with some abundance of *Spartina* had lower ammonia concentration than the areas without *Spartina*. A study in 2009 had similar results in that concentrations of ammonia were lower in areas with *Spartina alterniflora* than in areas without (Wang et al 2009). Areas with *Spartina alterniflora* growth have a lower concentration of ammonia in the porewater than those without *Spartina* and areas with some growth have levels that fall between high growth and no growth. This is possibly due to the Spartina alterniflora up taking the ammonia (Morris and Dacey 1987). The pH levels without *Spartina alterniflora* were basic this is possibly due to the higher ammonia levels in the sediment since ammonia is a base.

Conclusion

The results of this experiment are inconclusive as to whether sulfide, or salinity, have an effect on the abundance of *Spartina alterniflora* at Sandy Point salt marsh. It is possible ammonia has as effect on the abundance of *Spartina alterniflora* though more data is needed to determine this. Different sites with *Spartina* growth as well as other abundances of *Spartina* would also help in determining a correlation. There were also discrepancies between concentrations in the peeper and concentrations obtained through the cores. A suggestion for a future work includes using a longer time for each trail which might help to limit the differences between the cores and the peeper. Also salt water with a salinity similar to that of the porewater to be collected could be used instead of deionized water. Using salt water might allow for a faster equilibrium time thus speeding up the process of gathering data.

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Biography

Simon Bishop is a senior perusing an undergraduate degree at the University of New Haven in marine biology with a minor in environmental science. He is an active member in the gaming club and spends his free time playing various games. Simon also is an Eagle Scout out of Troop 10 from Honeoye Falls, NY. After college Simon is preparing to look for a job in marine conservation.