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

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Introduction

Salt marshes reside along many parts of the Connecticut coast line 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 (Morris and Bradley 1991), competition (Bertness 1991) and the availability of nutrients (Kiehl et al 1997). Many of the plants in a salt marsh, such as *Spartina alterniflora*, obtain some their nutrients from the pore water, which is the water that resides between the sediment particles. *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 1997). Studies have shown ammonia (Bradley and Morris 1991), sulfides (Bradley and Morris 1990) and salinity (Parrondo et al 1978) have effects on the growth of *Spartina alterniflora*. Since hydrogen sulfide, ammonia and salinity have been shown to have an effect on *Spartina alterniflora* growth 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 (Figure 1).

Figure 1. Sandy Point Salt Marsh West Haven, CT as seen from Google Maps.

Figure 2. Sandy Point salt march location photo.

Materials and Methods

Peeper Pore Water Collection

To collect the data for this experiment a pore water sampler, a peeper, was built. A peeper allows for the concentrations of the pore water to be determined. 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 pore water. Inside each of 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 for one week to allow for the deionized water to equilibrate with the pore water. 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. A picture of one of the pore water sampler (peeper) used during the experiment.

Abundance

Each sample site before the cores and peeper were removed a quadrat was used to determine the abundance of *Spartina alterniflora* within a 1 m^2 around the peeper. Table 1 has the abundance numbers that were used for each of the trials.

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

Abundances	
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 Pore Water Collection

After the week core samples were taken next to each peeper to compare the data from the peeper. Core samplers were 5 cm diameter 30.5 cm long pieces of acrylic plastic which were pushed into the ground to obtain each core and when removed the exposed end was plugged with a rubber stopper and when taken out the bottom that was pushed into the soil was capped until each core could be processed. Each core was cut into 4, 5 cm segments which were placed into 25 mL sterile centrifuge tubes.

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

Pore water analysis

Peeper samples were processed with a syringe and filter with the water poured into them from the dialysis tubing then filtered into a 25 mL sterile centrifuge tube for storage in the freezer until the sample could be tested. In the lab the core samples were centrifuged at 1000 rpm for 30 minutes to allow for separation of the soil and pore water. After 30 minutes any water was poured off into sterile 100mL syringes with filters. The samples were filtered into 25 mL sterile centrifuge tubes for storage in the freezer until the sample could be tested for chemical levels. Small samples of pore water 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

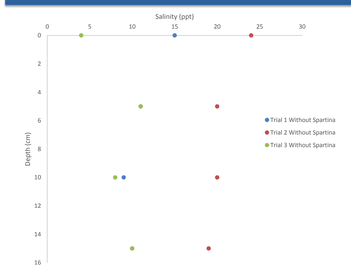

Figure 5. Graph of Salinity versus Depth of peeper samples without *Spartina alterniflora*.

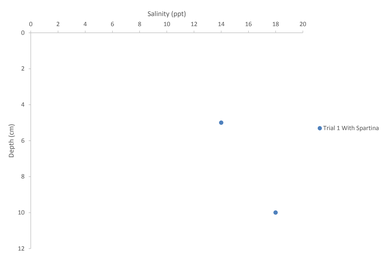

Figure 6. Graph of Salinity versus Depth of peeper samples with *Spartina alterniflora*.

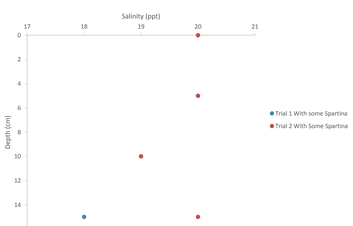

Figure 7. Graph of Salinity versus Depth of peeper samples with some *Spartina alterniflora*.

Table 2. Values obtained for NH_4 for each peeper sample.

Peeper Samples for NH_4	Depth (cm)	Trial 1 NH_4 (ppm)	Trial 2 NH_4 (ppm)	Trial 3 NH_4 (ppm)
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
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	

Table 3. NH_4 levels for the core samples taken with each peeper sample.

Depth	Amount of Spartina alterniflora	Concentrations (ppm)
0	Without	4.06
5		3.78
0	Without	1.78
5		2.95
0	some	1.11
0	Without	3.38
5	Without	2.21

Discussion

Many of the core samples after centrifuging yielded no water to test therefore no data for those cores was obtained. 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. Sulfide levels for the experiment were low, < 0.2 ppm, for all but a few samples. 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. Based upon the concentrations of NH_4 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 backs this up with the core near the peeper with some abundance of *Spartina* had lower NH_4 concentration than the areas without *Spartina*. A study in 2009 had similar results in that concentrations of NH_4 were lower in areas with Spartina Alterniflora than in areas without (Wang 2009). Based upon the data, areas with *Spartina alterniflora* growth have a lower concentration of NH_4 in the pore water than those without *Spartina* and areas with some growth have levels that fall between high growth and no growth.

Conclusion

Based upon the results obtained during this experiment it is inconclusive as to whether sulfide, or salinity, have an effect on the abundance of *Spartina alterniflora* at Sandy Point salt marsh. Ammonia it is possible 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 longer time for each trail might help to limit this problem. Also salt water with a salinity similar to that of the pore water to be collected could be used instead of deionized water.

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