



Current Effects on Larval Settlement and Benthic Organism Colonization of Different Substrates in South Carolina

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Background

Our initial goal with this experiment was to determine if there was a correlation between various flow rates and settlement of invertebrate organisms. As the project developed, we broadened our search to include investigating the settlements of different substrates, and overall bio-volumes of the various locations. Our four locations included: Patriot's Point, James Island Yacht Club (near shore and far from shore), and Bohicket Marina outside of Seabrook.

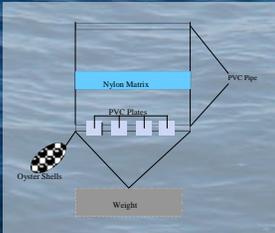
Questions

- Is there a correlation between current (flow rate), settling rates, and bio-volume?
- Is there a difference in the settling rate comparing oyster shells in the bag vs. PVC plates.

Material and Methods

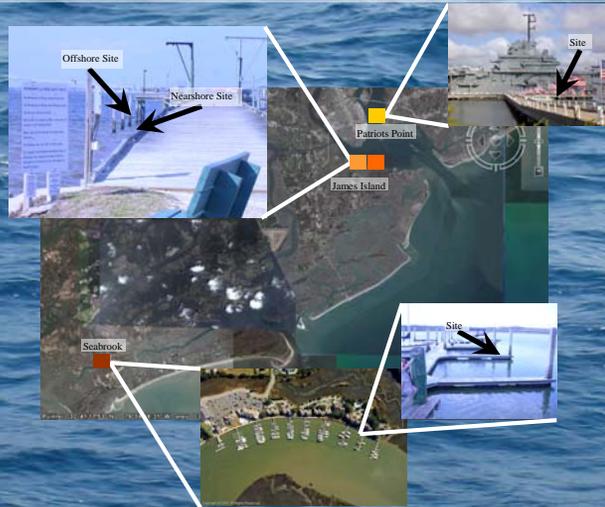
We used 3 different substrates for settlement. First was PVC tiles that measures (4in x 4in). Second was a nylon matrix filter. Third was a were cleaned oysters shells that were suspended in a mess bag. These apparatuses were hung at the four different locations (see figure right). The settlement structures were hung so they were constantly submerged under the water. After a period of 3 weeks we collected the oyster bags and apparatuses for analysis. The relative current for each site was determined by deploying a piece of chalk with a known mass in a mess bag for one tidal cycle. Then recovered and massed. The inferred current velocities is shown to right.

Settlement Structures



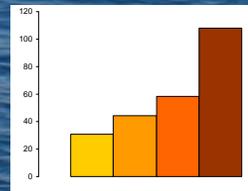
Acknowledgments

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 * both undergraduate authors contributed equally as part of a BIOL 342 project

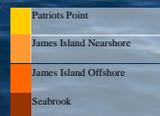


Results A

Flow Rates



Side walk chalk was deployed in mesh bags at every site. The change in mass was used to infer relative current Movements. The scale is in grams dissolved. The chalk was deployed for one tidal cycle on the same day for all four sites



Species Colonized

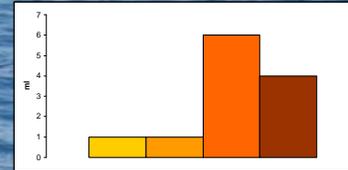
Palaemonetes vulgaris - grass shrimp
Alpheus heterochaelis - snapping shrimp
 Panopeidae spp. - mud crabs
 Caprella *equilibrata* - amphipods
 Caprella *scabra* - amphipods
 Astyris *lunata* - snail
 Costoanachis *lafresnay* - snail
 Clibanarius *vittatus* - hermit crab
 Mamocrophium spp.-amphipods
 Family *Stenothoea* spp.-amphipods
 Tubularia *Crocae*- hydrozoan
 Chthamalus sp.-Barnacle



Results B

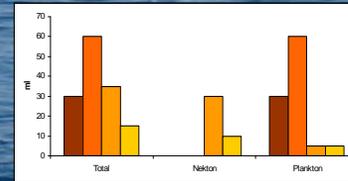
Patriots Point James Island Nearshore James Island Offshore Seabrook

Bio-volume Filter Material



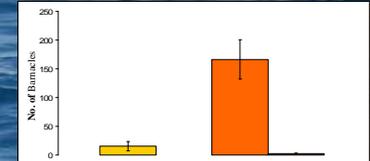
The higher water velocity sites have a higher the bio-volume. The Seabrook site may have been artificially suppressed due to hydroid growth.

Bio-volume on Oysters Bags



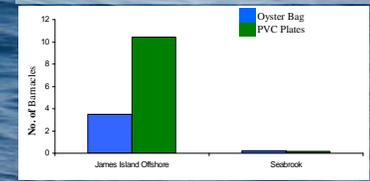
There was a positive correlation between and increase in flow rates and bio-volume. As well as an inverse correlation with macro invertebrates.

Barnacle Recruitment



James Island Offshore site had the largest number of settlements. The Seabrook site may have been artificially suppressed due to hydroid growth. Error bars indicate standard error. Data is not insignificant by Kruskal-Wallis test (.0350)

Barnacle Recruitment on Oysters vs. PVC



Our results were inconclusive as to what is the best substrate for settlement. It is unclear if the oysters would be more attractive to the organisms due to the substrate or the hydrodynamic conditions.

Conclusions

- There is a correlation between current velocity and bio-volume on both the nylon matrix and the oyster bags
- There was a higher bio-volume of macro invertebrates at the lower flow sites. There were several species of crab, shrimp and Gastropods found in the oyster bags.
- James Island offshore site had the most barnacle growth with is consistent with the idea that the higher current flow would result more larval settlement. The Barnacle growth at Seabrook may have been retarded by the rampant growth of hydroids.
- The larval barnacles did not show a clear preference of either the oyster or the PVC. This may have been due to the growth of the hydroid or the small sample size of this experiment.
- It was very interesting to note that the bio-volume in the nylon matrix and the bag of oysters seemed to be equally affected by the current flow even though they had very different micro hydrodynamic conditions
- Further research is needed to determine what substrates would be the best for barnacle recruitment. Another question to be answered is whether any difference between the oyster and PVC is due to hydrodynamics of the bag or the actual different substrate.