



Carbon Sequestration of Biofouling Communities in Barnegat Bay, New Jersey



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INTRODUCTION

The process of biofouling refers to small organisms attaching themselves to objects within the water column and ‘fouling’, or dirtying, this object [7]. Biofouling organisms include biofilms, barnacles, mussels, algae, and many other aquatic organisms. Fouling organisms follow patterns of succession when arriving on a surface [3,4,5].

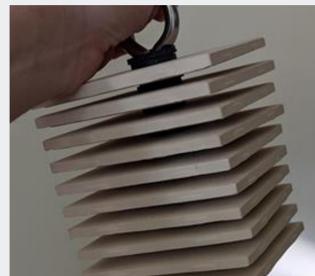


Image 1: Clean HDS, prior to deployment

These biofouling organisms act to remove carbon from the water column while growing [1]. Biofouling organisms, such as tunicates and barnacles, perform much carbon sequestration (removing carbon, holding in solid or liquid form) given their size, body plan, and filtration rates [2].

The objective of this study is to determine how much carbon can be sequestered by Barnegat Bay taxa observed on our Hester Dendy Samplers (HDS). This is important, especially today because of its potential implementation to slow climate change. Carbon sequestration is vital to evaluating the effects of climate change on estuarine carbon cycles.

METHODS

Site Set-up:

- Twelve Hester Dendy Samplers (HDS) deployed at Waretown Field Station in Barnegat Bay, New Jersey in April of 2021 on either side of dock, one meter apart

Time Frame/Collection:

- Three HDS collected for three month (mid-May, late-June, early-August)

Carbon Sequestration Analysis:

- Scrape HDS and take three samples from each sampler
- Take wet weight, dry in drying oven at 103°C, take dry weight, remove subsample of material for elemental analyzer, weigh remaining dry sample, muffle sample, weigh muffled sample
- **Ash-Free Dry Mass (AFDM):** Mass of sample after muffle
- Percent of material that was organic by:

$$\% \text{ Organic} = \frac{(\text{Dry Weight} - \text{AFDM Weight})}{\text{Dry Weight}} \times 100$$
- **Elemental Analysis:** To determine the amount of carbon and nitrogen in our subsamples, each is ground to a powder, placed in a vial and put in the Elemental Analyzer for analysis

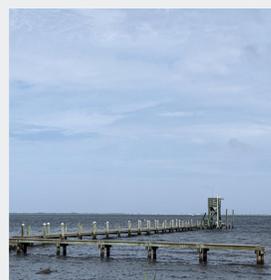


Image 2: Waretown Field Station dock in Barnegat Bay, NJ

RESULTS



Image 4: Plate from May 15th, 2021 collection



Image 5: HDS #8 collected on June 26th, 2021

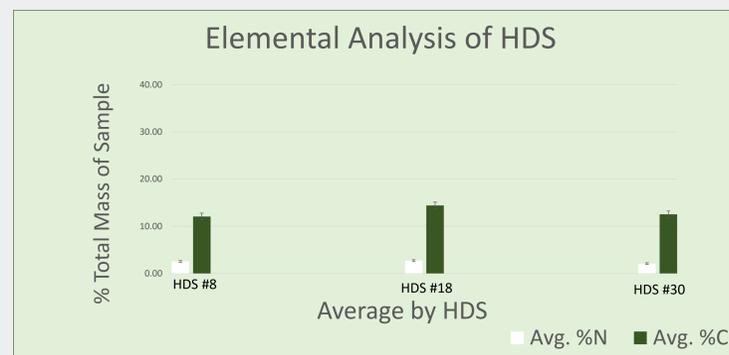


Figure 1: Percent carbon versus percent nitrogen per HDS for June collection

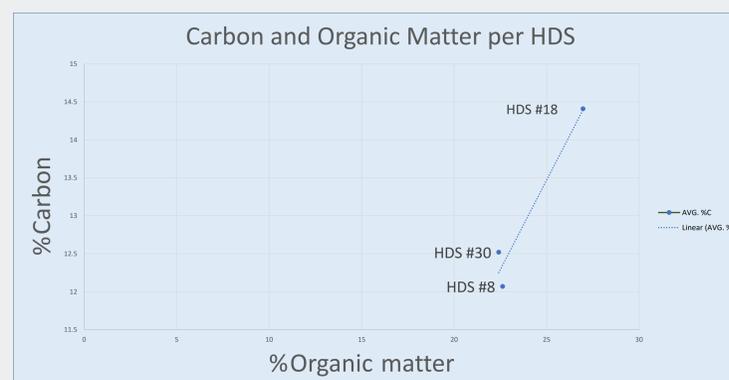


Figure 2: Percent organic matter (by AFDM) versus percent carbon per HDS in June



Image 3 (a-c): June subsamples being ground into powder (left), in vials (middle), and being weighed out for elemental analysis (right).

>**Note:** Samples for May were not analyzed for carbon sequestration. August samples await chemical analysis in lab.

- May ~ Light fouling; algae, tube worms, tunicates
- June ~ Heaviest fouling; algae, tube worms, crabs, shrimp
- August ~ Moderate fouling; algae, crabs, small fish

DISCUSSION

- Figure 1: In all June samples, average percent nitrogen made up below 10% of total mass of sample; average percent carbon made up slightly less than 20% of total mass of sample
- Figure 2: There is a positive correlation shown between percent organic matter in samples (calculated from AFDM) and percent carbon per sample
 - Describes how much of the overall material was carbon, so as fouling increases, there is more carbon present.
- **CONCLUSIONS:**
 - We did not see substantial differences in amount of carbon sequestered by HDS between samples based on location on the dock (whether on left or right side) for June collection
 - Approx. 12-15% of HDS fouled matter was carbon
 - More study must be done to determine if this is significant; as compared to other known carbon sequestering material (soil, trees, sea grass), this is relatively low
 - Should be compared with future monthly collections

FUTURE DIRECTIONS

- Conduct a year long study, returning each month to remove 3 HDS from each site for analysis.
 - Look at spatial variation of each taxa within the HDS
 - Compare successional patterns over time to carbon sequestration graphically

ACKNOWLEDGEMENTS & REFERENCES

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