Phytoplankton Abundance and Diversity through a tidal sequence and a transect of the Charleston Harbor

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Abstract

This independent research project was done to further understand and explore phytoplankton concentrations and diversity throughout Charleston Harbor. During this study concentration and diversity were measured through a tidal cycle on both sides of the harbor as well as on a transect through the harbor. In the chlorophyll graph from both sides of Charleston Harbor an inverse relationship was present until time 4 when high tide started to approach and both sides show a decrease in chlorophyll. In the chlorophyll graph from the transect of the Charleston Harbor point three had an increased chlorophyll concentration which we predicted because of its position at the mouth of the Harbor. In our diversity graphs from the Mt. Pleasant and James Island sides of the Harbor we found that on both sides phytoplankton were most diverse with high tide approaching and midway through the tidal cycle. In the diversity graph from the transect of the Charleston Harbor we found points 2 and 3 on the map to have a high diversity since they were at the mouth of the Harbor.

Introduction

The topic of our independent research project is to measure phytoplankton diversity and abundance in different areas of the harbor. One study done on this subject involved testing for chlorophyll a concentration during tides when a front was coming (Pinckney&Dustan, 1990). The study concluded that the most chlorophyll a was found on the incoming flow from the Cooper River Bridge (Pinckney&Dustan, 1990). Other research done analyzed the patchiness of plankton as you exit the Charleston harbor, finding that due to incoming flow from three different rivers in the area plankton are found in different concentrations along the water's path of flow. These two studies helped us to choose sampling spots and predict the data we expect to collect.

Questions

1)Where will Phytoplankton be most abundant in a tidal sequence on each side of the Charleston Harbor?

2)Where will Phytoplankton be most diverse in species number in a tidal sequence on each side of the Charleston Harbor?

3)Where will Phytoplankton be most abundant through a transect of the Charleston Harbor?

4)Where will Phytoplankton be most diverse in species number through a transect of the Charleston Harbor?

Tidal Sequence of Sides of Charleston Harbor

Predictions

❖We hypothesize that phytoplankton will be most abundant on the side of the Charleston Harbor where there is incoming flow.

❖We hypothesize that phytoplankton will be most diverse on the side of the Charleston Harbor where there is incoming flow.

❖We hypothesize that abundance will have an inverse relationship between the sides of the Charleston Harbor.

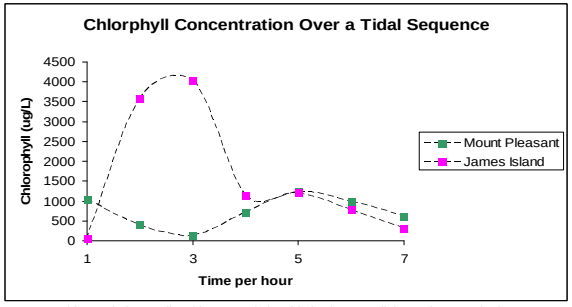
Materials/Methods:

❖Sampled 5 liters of water through a phytoplankton net (size) into sampling jars in 2 locations (refer to points on map) per hour between 7:30 am and 1:30 pm

❖Obtained surface water for Chlorophyll analysis, temperature, and salinity

❖Filtered 50 ml of surface water and obtained Chlorophyll concentration through the use of a fluorometer

❖Obtained diversity using species guide and 4 samples per time under a microscope at 40x magnification.



In this graph the predicted inverse relationship is shown until time 4 (11:30am) where both graphs decrease. This could be because high tide is approaching allowing low nutrient ocean water to enter both sampling areas.

Species

Dinoflagellates:

A: Akashiwo sanginea

B: Ceratium Furca

C: Ceratium Fuscus

D: Ceratium longipes

E: Prorocentrum lima

F: Prorocentrum micans

G: Protoperidinium

H: Unknown species

Diatoms:

1: Asterionella

2: Chaetoceros

3: Coscinodiscus

4: Ditylum

5: Eucampia

6: Nitzchia

7: Odontella

8: Pleurosigma

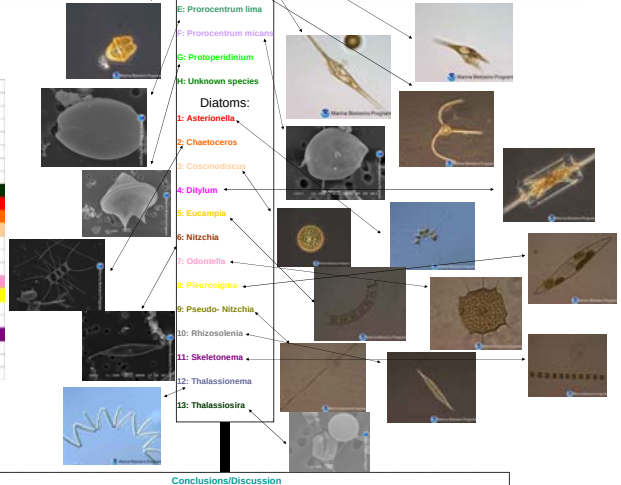
9: Pseudo- Nitzchia

10: Rhizosolenia

11: Skeletonema

12: Thalassionema

13: Thalassiosira



Mount Pleasant Species List

James Island Species List

As time increase and high tide approaches the most species are found in the midway stage of the tide with 10 species in Mount Pleasant and in James Island species stay around an average of 7.14, finding the only species of diatoms in the midway times between time 3 (9:30 am) and time 5 (11:30) that also appear to be area specific.

Transect of Charleston Harbor

Predictions

❖We hypothesize that phytoplankton will be most abundant at the mouth of the Charleston Harbor

❖We hypothesize that phytoplankton will also be most diverse at the mouth of the Charleston Harbor.

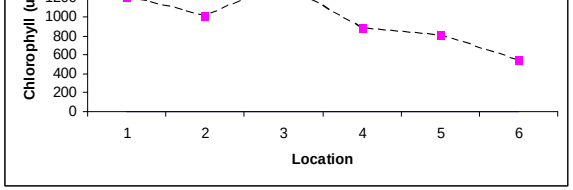
Materials/Methods

❖Sampled 5 liters of water through a phytoplankton net (size) into sampling jars in 6 locations (refer to points on map) between the hours of 2pm and 5pm through the use of a boat.

❖Obtained surface water for Chlorophyll analysis. Obtained temperature and salinity from CTD data.

❖Filtered 50 ml of surface water and obtained Chlorophyll concentration through the use of a fluorometer

❖Obtained diversity using species guide and 6 samples per time under a microscope at 40x magnification



In this graph the predicted height in abundance near the mouth of the Charleston Harbor is shown, with a decrease as locations reach farther out into low nutrient ocean water.

Transect Species List

This chart shows the predicted high diversity in locations 2 and 3 around the mouth of the Charleston Harbor.

Conclusions/Discussion

We found that tides and location in the Charleston Harbor have impacts on Phytoplankton abundance and diversity. When it comes to sides of the harbor, the side with the incoming flow from the river systems are going to have higher abundance at low tide, whereas the side with the outgoing flow from the river system will have a low abundance at low tide, with a decrease in both areas between the middle of the tide and high tide. The location with the highest was found at the mouth of the Harbor where all water is flowing out of the harbor, which was expected. Diversity was found to be highest at the mouth of the harbor as well. In the middle of the tidal cycle diversity was found to be the highest overall where dinoflagellates were only found. Dinoflagellates also show a trend of being area and time specific, maybe from salinity or temperature change. This could be inspiration for future research.

Bibliography

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Photos from NOAA phytoplankton ID guides, part of the Marine Biotoxins Program