Diatom Distribution And Abundance As Affected By Environmental Conditions In Southwest Louisiana Coastlines

McNeese STATE UNIVERSITY
Department of Biology & Health Sciences

Kristina Regmi
Mentor: Dr. Melba Horton
Mcneese State University

Sea Grant

Introduction

The coastal areas of Southwest Louisiana are constantly subjected to flooding with the consequent displacement of residents. Re-establishment of coastal landscape in the entire Louisiana area is now of prime significance. Diatoms can reportedly increase sediment cohesion by excreting extracellular polymeric substances. Their diversity and distribution is therefore a key factor in understanding the role that they play in the ecosystem. This research is focused on identifying the various species of diatoms and how their distribution and abundance in the different coastal areas of Southwest Louisiana are affected by changes in environmental conditions as a baseline for future research and for coastal restoration.

Objectives

The primary objectives of this research are to:

- Isolate diatom cells from sediments
- Identify each cell to the Genus level of classification and,
- Determine the effect of salinity, pH, and temperature on the distribution and abundance of diatoms in the coastlines of Lake Charles, Hackberry, and Cameron.

Methods

- Diatom samples from sediments were collected from a specific location of Lake Charles (30^0 14' 16" N, -93^0 14' 20" W), Hackberry (30^0 0' 38" N, -93^0 20' 31"W) and Cameron (29^0 49' 5" N, -93^0 20' 44"W) using plastic cores with the transect and quadrat method. (Fig.1)
- In each site, a transect line was laid parallel to the shoreline with five quadrats deployed at ten meter interval.
- Five replicate samples were then collected from each quadrat.
- During each sampling, the pH, salinity, and temperature of the water were measured using a digital pH meter, salinometer, and thermometer, respectively.
- The collected diatoms were isolated from sediments, cleaned, and their organelles removed by oxidation with H_2SO_4.
- Each species found was identified at the genus level by comparing the shape and size of the frustules, the structure of the raphe, and other specialized structures associated with the particular genus as described in the taxonomic guide used.
- Subsequently, the numbers of cells in each genera were counted using light microscopy.

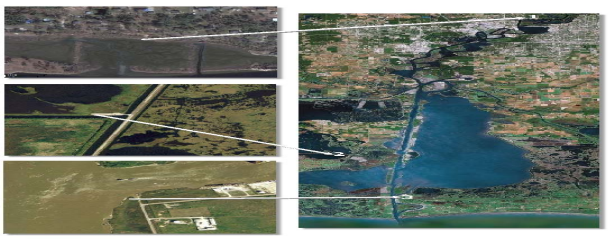

Fig.1:Location of the mudflat sampling sites along the coastal areas of the Calcasieu Ship Channel in Southwest, Louisiana as indicated by numbers: **1** = Lake Charles (30° 14'16"N, -93°14'20"W), **2** = Hackberry (30°0'38"N, -93°20'31"W), and **3** = Cameron (29° 49' 5" N, -93°20'44" W).

References

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- Frithjof A.S, Sterrenburg. "Cleaning Diatom Samples." "Web".
- Pullan, Martin. *ADAIC Diatom Image Database*. Program documentation. "Web".
- Stidolph, Stuart R. *A method for cleaning diatom samples and the preparation of select and strew mounts* 26.1 (1982): 10-19.

Acknowledgements

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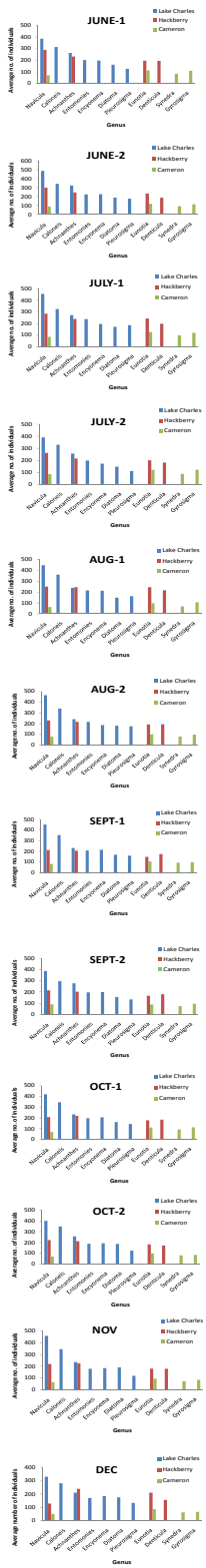

Fig 2: Abundance and distribution of diatoms in Lake Charles, Hackberry and Cameron.

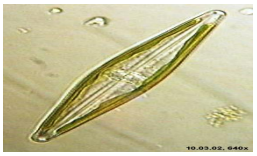

Fig.7: *Navicula*, the most common diatom species in coastlines of Lake Charles, Hackberry and Cameron.

Results

- Results showed that the three coastal areas vary significantly in salinity ($p<0.05$) and diatom composition and abundance ($p<0.05$).
- Highest number (1600-1990) was obtained in Lake Charles, followed by Hackberry (800-950) and lowest in Cameron (332-433). (Fig.6.)
- On the contrary, highest salinity range of ~12-20 ppt was obtained from Cameron, lowest in Lake Charles at~3-7 ppt and Hackberry at ~4-9 ppt.(Fig.3)
- The pH values (~6-8) did not show a significant change over time for all the three sites ($p>0.05$).(Fig.4)
- The water temperature decreased over time, from ~32 ^oC in June to ~15°C in December but the difference between sites was not statistically significant ($p>0.05$)(fig.5)
- *Navicula* was the most commonly distributed genus in all three sites. Eleven different genera were identified in these coastlines with Lake Charles having the highest diversity.(Fig.2)
- Salinity significantly influence diatom distribution and abundance while pH and temperature did not show the same effect .

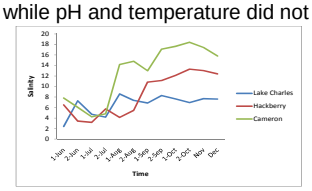

Fig.3: Salinity measurements of the three sites, Lake Charles, Hackberry and Cameron from June to December 2009.

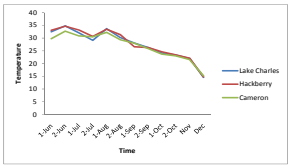

Fig.4: Temperature measurements of the three sites, Lake Charles, Hackberry and Cameron from June to December 2009.

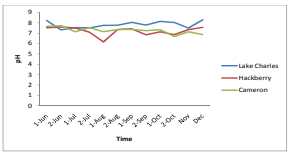

Fig.5: pH measurements of the three sites, Lake Charles, Hackberry and Cameron from June to December 2009.

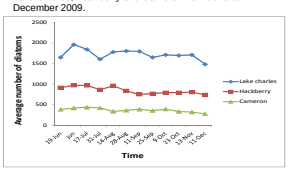

Fig:6 Average number of diatoms counted from Lake Charles, Hackberry and Cameron from June to December. 2009

Discussion

The influence of salinity on diatoms has been reported in previous studies. Interestingly, in this study, the species of diatoms distributed in the study sites seem to be more adapted to lower salinity. This implies that during rainy season wherein coastal waters become less saline, the abundance of diatoms can be predicted. Surprisingly, the abundance and diversity in the different areas remained relatively the same despite temperature changes coupled with seasonal variation. It can only be speculated that majority of the species have developed strong adaptation to temperature variations which is a common phenomenon in this part of the region. Given the role that diatoms play in the estuarine environments, this would have important implications for fishery management and coastal conservation. The abundance and diversity of diatoms in Lake Charles, for example, suggest the potential of high productivity in the area. On the other hand, careful cautionary measures need to be considered in Hackberry and Cameron as the low values might be indicative of serious environmental conditions. The wide distribution of *Navicula* in all the sites is an indication that the species is highly- adaptive to environmental fluctuations. More studies can then be conducted using this species to elucidate some aspects of diatom physiology that may have important ecological implications.

Conclusion/Recommendation

The distribution and abundance of diatoms in Southwest Louisiana coastlines are affected by salinity. The wide distribution of *Navicula* is indicative of the species' potential use for further studies to fully understand diatom physiology and ecology.

Given the role that diatoms play in the formation of coastal landscapes, it is therefore imperative that long term monitoring of its abundance and the changes of environmental conditions particularly salinity should be conducted in the different coastal areas so that proper restoration measure can be implemented if deemed necessary.