Diatoms as Indicators of Environmental Change in Florida Bay

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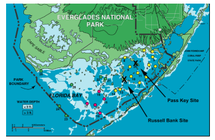
Why Diatoms?

- Siliceous “shell” or valve preserves well in aquatic sediments
- Species identification is based on valve morphology
- Species distributions related to water quality variables such as salinity and nutrient concentrations

Approach:

- Examine diatoms in sediment cores and modern surface sediment samples and vegetation samples
- Relate modern diatom species distributions to variables such as salinity, seagrass cover, and nutrients
- Use modern information to interpret downcore changes

Study Area



The map of Florida Bay shows core sites (arrows) and the 26 modern monitoring sites (circles)

Methods

Core analyses:

- Cores collected from mudbanks
- Cores dated by radiometric techniques including PB-210. See Robbins et al. for details
- Diatoms extracted from sediment cores by a series of sediment digestions in hydrogen peroxide, hydrochloric acid,and nitric acid, followed by rinses
- Diatom extract permanently mounted on microscope slides in Naphrax® media
- Diatoms identified at 100X magnification with a light microscope

Modern diatom analyses:

- Surface sediment samples collected from 26 monitoring sites(see map)
- Sub-aquatic vegetation samples (mainly seagrass) collected from the 26 sampling sites
- Diatoms extracted from sediment and vegetation samples by a series of acid digestions and then mounted in Naphrax® media
- Diatoms identified at 100X magnification (see above)

Acknowledgements

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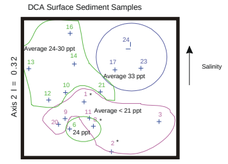
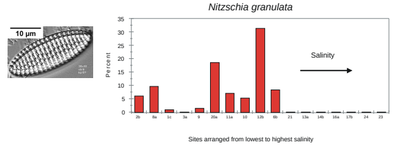
Modern Diatom Distributions



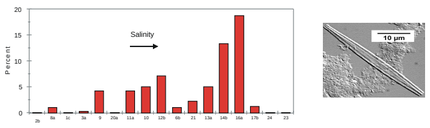
Detrended correspondence analysis of 17 of the 26 sampling sites. This analysis separates sites based on the surface sediment diatom assemblages at each site. Sites close together have similar diatom species abundances. The purple circle shows higher salinity sites, pink low salinity sites, and green average salinity sites.

Nitzschia granulata



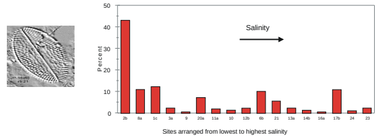
Nitzschia granulata is a species found growing on bottom sediments at intermediate and lower salinity sites in Florida Bay.

Synedra sp. A



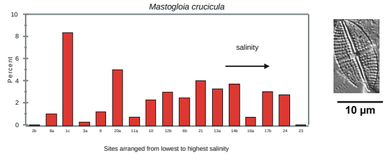
Synedra sp A is found at average to higher salinity sites in Florida Bay.

Cocconeis placentula var. *euglypta*



Cocconeis placentula var. *euglypta* is an epiphytic species typical of lower salinity sites in Florida Bay.

Mastogloia crucicula

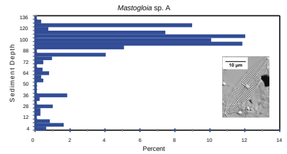


Mastogloia crucicula is an epiphytic species common at many sites in Florida Bay.

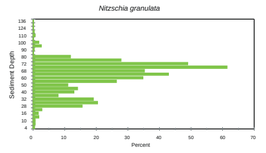
Russell Bank Core 19A Diatoms

The following diagrams show the individual stratigraphies for select taxa from Russell Bank core 19A. Sediment depth is indicated on the left; the oldest (core bottom) samples are at the top of each diagram and the youngest (core top) at the bottom.

Mastogloia sp. A is fairly abundant in the bottom portion of the core. This species does not commonly occur in any of the modern samples analyzed to date. The decrease in this species and other *Mastogloia* species suggests that major changes occurred after about 1920.



Nitzschia granulata shows a marked increase beginning around 1920 until about 1950. This taxa occurs in modern samples with average salinities between 8 and 24 ppt. This suggests that during this time, Florida Bay experienced periods of low to average salinity.



Cocconeis placentula var.*euglypta* is a common epiphyte in Florida Bay, and is more prevalent at the less saline sites studied. It is common in the Russell Bank core between 1949 and 1972, and this suggests that water was at least periodically brackish during this time period. Its presence also suggests tha there was a high percentage of sub-aquatic vegetation cover.

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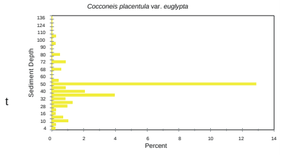
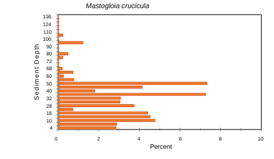
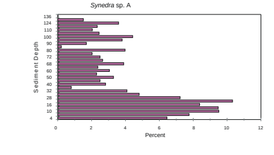


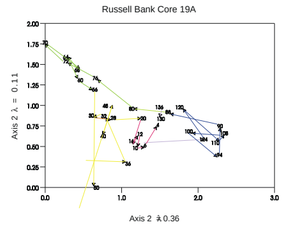
Mastogloia crucicula is another common epiphyte in Florida Bay. The peaks in abundance suggest that sub-aquatic vegetation increased between 1949 and 1970.



Synedra sp. A is common throughout the core, but increases in abundance around 1972. This species was found at average to higher salinity sites, so its increase suggests higher salinity after 1972.



Russell Bank Core 19A Diatom Assemblages



A detrended correspondence analysis of the Russell Bank diatom samples.

This is a multivariate ordination technique that separates samples based on the abundances of the most common taxa.

The analysis shows that the samples fall into five zones. The colored lines show the trajectory of samples in the ordination space from the bottom sample(oldest) of the core to the top sample (youngest) analyzed. The different colors indicate the five zones.

Zone Characteristics

Zone 1 : 1882 -1888 Higher salinity

Zone 2 : 1888 -1921 Bare sediment substrate common (few epiphytic diatoms)

Zone 3: 1921 -1949 Major change in diatom assemblages; bare sediment substrate available. At least periodic lower to average salinity

Zone 4: 1949 -1972 Increase in sub-aquatic vegetation cover, lower salinity

Zone 5: 1972 -1992 Higher salinity

Conclusions

- Diatom assemblages from Russell Bank Core 19A suggest that there have been fluctuations in salinity over the last 100 years. Diatom inferences suggest periods of high salinity between 1882 -1888, and 1972 -1992. Low salinity periods occurred between 1949 and 1972.
- The lack of epiphytic diatoms between 1890 and 1921 suggest that bare sediment was the main substrate during this period. Bare sediment was also available for diatom colonization between about 1921 and 1972.
- Diatom data suggest that seagrass was most common between 1950 and 1972.
- These findings are in general agreement with other studies of fossil indicators of salinity and seagrass cover from Russell Bank sediment cores