Florida Bay and the entire south Florida ecosystem have undergone a number of dynamic changes over the last century. During the 1930s, dramatic declines of large areas of seagrasses, algal blooms, and diminishing numbers of shellfish and game fish focused public attention on the plight of Florida Bay. Periods of hypoxia and anoxia have been recorded since the 1950s, and these elevated salinities may be responsible for the extensive seagrass mortality during the 1980’s. Changes in salinity and seagrass distribution, and the impact of these changes on fisheries and recreation, point to the need for a comprehensive evaluation of the Florida Bay. To establish sustainable restoration goals for the Florida Bay ecosystem requires an accurate understanding of the natural patterns of change that exist within the physical, biological, and chemical components of the system, and the effects of taphonomic processes. Paleoecologic time series, linked to modern analog data, provides essential historical information to those responsible for restoration.

Methods

Modern Sampling: Bay

A total of 50 surficial sediment samples from 30 sites were collected for Florida and Biscayne Bay. These sites were sampled biostratigraphically, from the Florida Bay samples collected via snorkeled and Biscayne Bay samples collected using an Eckman grab sampler. Multiple samples were collected from some sites due to the spatial variability in substrate ranging from stony carbonate mud to densely vegetated mud. In addition, environmental variables such as depth, latitude, water temperature, seagrass presence, and water clarity are measured.

Cluster Analysis

Cluster analysis are applied to faunal and floral data in two forms: relative abundance of species grouped into faunal groups (9-split), and relative abundance of species grouped into sample groups (2-ensemble). The cluster analysis provide us with results that have no statistical significance, however it is used to define groupings which may be responsible for the extensive seagrass mortality during the 1980’s. The methods are used primarily to define distinct groups of species (biofacies) and to indicate environmental relationships controlling the faunal and floral distributions.

Paleoenvironmental Proxies

Pie charts

Modern Fossil Distributions

Other data include modern biofacies distributions and niche areas are used to indicate the distribution of modern analogs. This is particularly useful for interpretation of past foraminiferal and molluscan assemblages. In addition, a marine fauna associated with low density seagrass substrate is used to define groupings which may be responsible for the extensive seagrass mortality during the 1980’s. In addition, the use of total environmental relationships controlling the faunal and floral distributions.

Long-Term Patterns (2,500 BP - A.D. 1900):

- A gradual increase in average salinity has occurred
- Amplitude and frequency of salinity change increases
- Algal blooms increase with the increase in nutrient inputs and water clarity
- Seagrass presence
- Sea-level rise and increased turbidity due to increased nutrient inputs
- Productivity assemblage related to high organic input
- Seasonal salinity
- Post 1940 the amplitude and frequency of change in seagrass distribution increases
- “Disturbed” conditions by the end of the 20th century

Short-Term Patterns (A.D. 1900 - Present):

- Moderate and frequent changes in seagrass distribution
- Post 1940 the amplitude and frequency of change in seagrass distribution increases
- “Disturbed” conditions by the end of the 20th century

Vegetational Patterns in the Everglades

Vegetation changes over the last 10,000 years primarily reflect local responses to specific environmental changes. These include changes in hydrologic input to future control practices, increased nutrient inputs and their pathways, changes in water temperatures and salinities near surface waters, and near Florida Bay, salinity increases due to reduction in freshwater flow, as well as natural sea-level rise.

Summary of Results for Bay COREs

Salinity:

- Modern: Site 11 (July) 20.0, Site 13 (Feb., grass) 20.0, Site 13 (July, mud) 20.0, Site 8 (February) 20.0
- Modern: Site 3A (February) 20.0, Site 5 (February) 0.0, Site 3 (July) 0.0, Site 8 (July) 0.0, Site 13B (February) 0.0, Site 8 (February) 0.0, Site 5 (July) 0.0
- Modern: Site 11 (July) 20.0, Site 13 (Feb., grass) 20.0, Site 13 (July, mud) 20.0, Site 8 (February) 20.0

Modern Fossil Distributions

Cluster Analysis of Modern Benthic Foram Data

Cluster Analysis of Modern Mollusc Data

Modern Floral Distributions

Cluster Analysis of Modern Benthic Foram Data

Cluster Analysis of Modern Mollusc Data

Modern Fossil Distributions

Cluster Analysis of Modern Benthic Foram Data

Cluster Analysis of Modern Mollusc Data

Modern Flora and Fauna

Cluster Analysis of Modern Benthic Foram Data

Cluster Analysis of Modern Mollusc Data

Modern Flora and Fauna