# PRELIMINARY ANALYSIS OF DOWN-CORE BIOTIC ASSEMBLAGES: BOB ALLEN KEYS, EVERGLADES NATIONAL PARK, FLORIDA BAY

by

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## INTRODUCTION

A series of short piston cores (< 2m) were taken from eleven stations in Florida Bay in May, 1994 by researchers from the U.S. Geological Survey (St. Petersburg, FL., Woods Hole, MA., and Denver CO.) in cooperation with South Florida Water Management District, and the Everglades National Park, and the National Oceanic and Atmospheric Administration (NOAA). Core 6A from Bob Allen Keys (25° 1.391" N, 80° 39.41" W) penetrated 172 cm of Holocene sediments in 0.6 m of water on a grass covered mud bank, approximately 1.75 miles (2.82 km) east of the water monitoring station on the southern end of the Bob Allen Keys (Figure 1). Core 6A was sampled for particle size, insoluble residue, water content, loss on ignition, $Pb^{210}$, $Ra^{222}$, and paleontologic analyses. Here we present the results of the preliminary paleontologic analyses of the biotic components from core #6A.

The Everglades/Florida Bay ecosystem has formed over the last 5000 years at the southern tip of peninsular Florida. Here it has been influenced by Atlantic, Caribbean and Gulf of Mexico waters, and by tropical and subtropical climatic regimes. This location ensures that over time the ecosystem has undergone climatic changes on both a seasonal and long term basis, and that it has been subjected to many major storms. Additionally, in the last century, the hydrologic regime of the region has been altered profoundly through construction of a canal system to control flooding in southern Florida. This system regulates the timing and amount of freshwater flow into Florida Bay. Recently, algal blooms, seagrass, and sponge die-offs, and declining numbers of shellfish, have been reported in Florida Bay; although it has been assumed that these changes have resulted

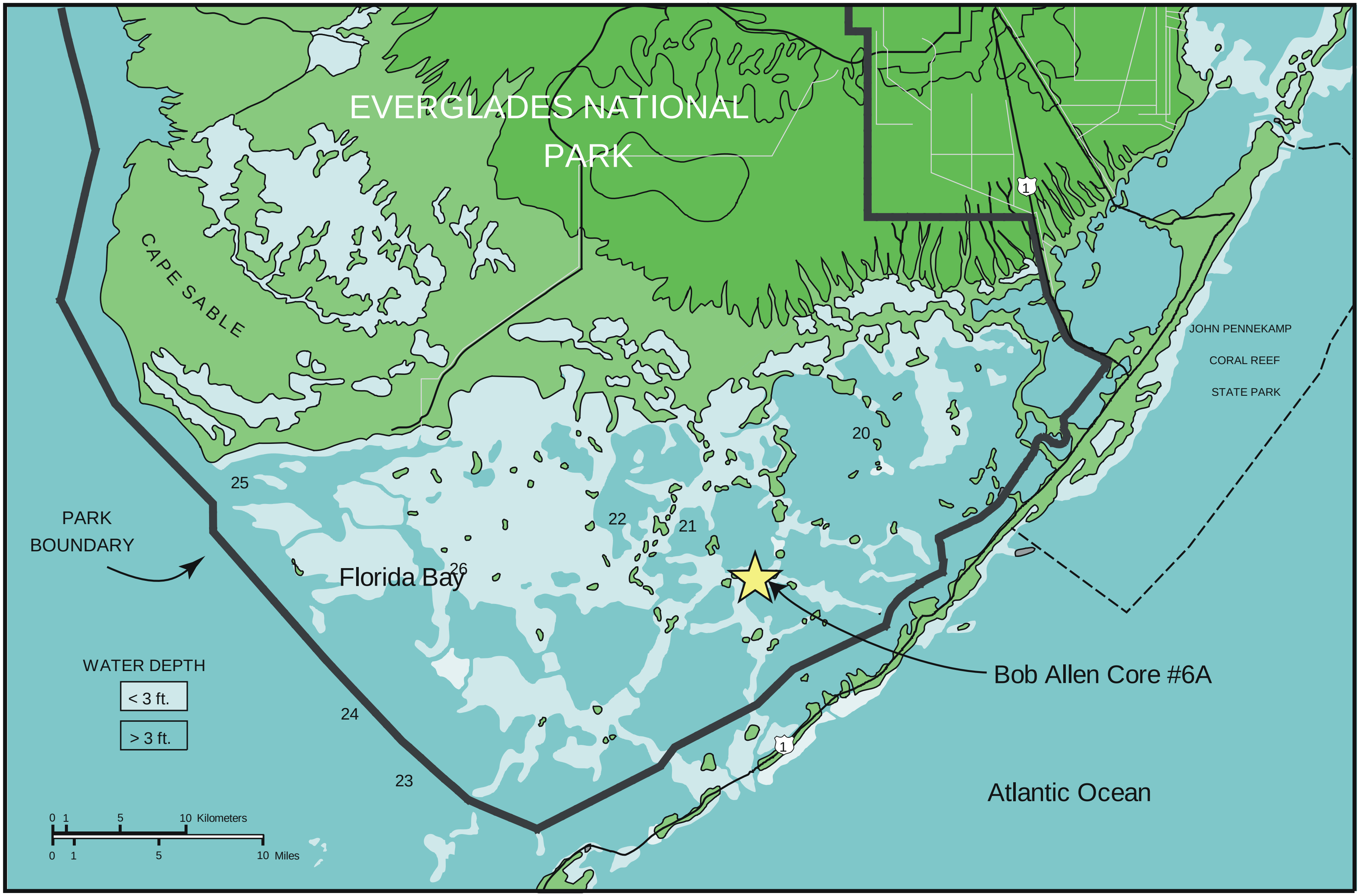



Figure 1. Map of Florida Bay showing the location of the Bob Allen Core #6A.

from human alteration of freshwater flow into the bay, this assumption has not been rigorously tested.

The research described here is part of a project designed to examine the history of the Everglades/Florida Bay ecosystem over the last 150 years and to test assumptions of cause and effect. The purpose of the project is two-fold; first, to determine the characteristics of the ecosystem prior to significant human-induced alteration, including the natural range of variation in the ecosystem. This information will establish a baseline for restoration of the system. Second, the project aims to establish the extent, range, and timing of changes to the ecosystem over the last 150 years, and to determine whether these changes correlate with human alteration of the environment, or meteorological patterns, such as precipitation and major storms, or a combination of factors.

## ACKNOWLEDGEMENTS

We would like to thank our colleagues at South Florida Water Management District (SFWMD), National Oceanic and Atmospheric Administration (NOAA), Everglades National Park (ENP), and Florida Geological Survey (FGS) for their cooperation and assistance in this investigation. This manuscript benefited greatly from the helpful comments of our reviewers, Eugene A. Shinn (USGS, St. Petersburg) and Thomas M. Scott (FGS, Tallahassee). Charles Holmes (USGS, Denver) assisted in the collection and preparation of the cores and provided the age model used in this study. The following people (USGS, Reston) assisted in the preparation of the samples for analysis: Nancy Durika, Thomas Holtz, and Lauren Hewitt. Robert Stamm (USGS, Reston) assisted in the preparation of the illustrations.

## METHODS OF INVESTIGATION

The Bob Allen Core #6A was sampled over 2 cm intervals for and paleontologic analyses (benthic foraminifers, ostracodes, mollusks, pollen, and dinocysts). Selected samples were disaggregated in distilled water. The material greater than 63 μ was analyzed for calcareous fossils. Palynomorphs (pollen and dinoflagellate cysts) were recovered from acid-insoluble residues from samples collected for isotopic analysis; these samples were treated with warm KOH for 2-5 minutes, given ultrasonic pulse treatment for 5 seconds, acetolysed, and sieved between 8- and 150-micrometer mesh.

Calcareous fossil samples were selected for preliminary evaluation of the down-core variability of the faunal assemblages and to determine the feasibility of using environmentally sensitive species to document the history of Florida Bay. Seventeen sediment samples were analyzed for benthic foraminiferal assemblages (Table 1); seventeen for mollusks (Table 2); and twenty-two for ostracodes (Table 3). All of the specimens were picked from the >125 μ size fraction for benthic foraminifera, from the >850 μ fraction for molluscs, and from the >180 μ fraction for ostracodes. In the few samples where benthic foraminifera and mollusk specimens were very abundant (>100 specimens) strews were picked using a random number selection method to determine which equi-area squares on a 45 square, rectangular picking tray would be picked. Picking of the sample was complete when the faunal count reached 100 and the remaining specimens in that square were picked. The species counts from all samples were then standardized by calculating relative abundance (% occurrence) in the sample. Benthic foraminiferal species were identified using the taxonomy of Loeblich and Tappan (1988), ostracodes using Keyser (1975a, 1975b, 1977) and mollusks primarily using Abbott (1968,

Table 1: Percent Abuncance of Benthic Foraminifers, Bob Allen Core 6A

| BA6A Sample (cm) | Miliolids | *Peneropolis* sp. | *Archais* sp. | *Elphidium* spp. | *Ammonia beccari* | *Ammotia* sp. | *Rosalina globularis* | *Goesella sp.* | *Miliolinella* sp. | TOTAL PERCENT | TOTAL COUNT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-2 | 80.00 | 1.43 | 1.43 | 17.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 70 |
| 8-10 | 78.26 | 10.87 | 0.00 | 8.70 | 0.00 | 0.00 | 0.00 | 2.17 | 0.00 | 100 | 46 |
| 18-20 | 72.00 | 8.00 | 0.00 | 14.00 | 2.00 | 0.00 | 0.00 | 0.00 | 4.00 | 100 | 50 |
| 28-30 | 87.27 | 3.64 | 0.00 | 5.45 | 0.00 | 0.00 | 1.82 | 0.00 | 1.82 | 100 | 55 |
| 38-40 | 80.95 | 2.38 | 2.38 | 14.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 42 |
| 48-50 | 52.86 | 0.00 | 0.00 | 40.00 | 4.29 | 0.00 | 2.86 | 0.00 | 0.00 | 100 | 70 |
| 58-60 | 40.59 | 0.00 | 0.00 | 42.57 | 16.83 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 101 |
| 68-70 | 36.07 | 0.00 | 0.00 | 60.66 | 3.28 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 61 |
| 78-80 | 75.00 | 0.00 | 0.00 | 25.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 40 |
| 88-90 | 73.47 | 0.00 | 0.00 | 26.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 49 |
| 98-100 | 61.11 | 0.00 | 0.00 | 33.33 | 5.56 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 36 |
| 108-110 | 69.44 | 0.00 | 0.00 | 27.78 | 0.00 | 0.00 | 2.78 | 0.00 | 0.00 | 100 | 36 |
| 118-120 | 20.51 | 0.00 | 0.00 | 73.08 | 6.41 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 78 |
| 128-130 | 72.73 | 0.00 | 0.00 | 24.24 | 3.03 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 33 |
| 138-140 | 50.00 | 3.13 | 0.00 | 28.13 | 18.75 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 32 |
| 148-150 | 26.03 | 1.37 | 1.37 | 61.64 | 6.85 | 0.00 | 2.74 | 0.00 | 0.00 | 100 | 73 |
| 154-156 | 28.07 | 3.51 | 0.00 | 33.33 | 28.07 | 1.75 | 0.00 | 0.00 | 5.26 | 100 | 57 |

Table 2: Molluscan Percent Occurrence

| Species | 0-2 cm | 8-10 cm | 18-20 cm | 28-30 cm | 38-40 cm | 48-50 cm | 58-60 cm | 68-70 cm | 78-80 cm | 88-90 cm | 98-100 cm | 18-110 cm | 118-120 cm | 128-130 cm | 138-140 cm | 148-150 cm | 156-158 cm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gastropods:** | | | | | | | | | | | | | | | | | |
| *Acteocina canaliculata* | | | 4.76 | | | | | | | 4.00 | 1.69 | | | | 3.85 | | |
| *Alabina* spp. | | | 3.81 | 2.00 | | 3.36 | | | | | | | | | | | |
| *Astraea* sp. | | 6.38 | 2.86 | | 2.50 | 0.84 | | | | | | | | | | | |
| *Bittium varium* | 4.17 | 6.38 | 4.76 | 10.00 | | 14.29 | | | | | | | | | | | 3.09 |
| *Bulla* sp. | | 2.13 | 0.95 | | | 0.84 | | | | | 1.69 | 1.69 | | | 3.85 | | 2.32 |
| *Caecum puchellum* ? | | | | | | | | | | | | | | | | | 0.77 |
| *Cerithidea* spp. | 4.17 | | | 18.00 | 1.25 | | | | | | | | | | 3.85 | | 3.47 |
| *Cerithiopsis greeni* | | | | | | 1.68 | | | | | | | | | | | |
| *Cerithium muscarum* | 4.17 | 23.40 | 38.10 | 4.00 | 2.50 | 0.84 | 3.70 | 10.71 | | | 3.39 | 3.39 | 2.94 | 9.09 | 15.38 | 12.50 | 7.72 |
| *Cerithium variabile* | | 2.13 | | | | | | | | | | | | | | | |
| *Crepidula* sp. | | 8.51 | 0.95 | 10.00 | 15.00 | 4.20 | | | | 4.00 | | | | | | 4.17 | |
| *Eupleura* ? sp. | | | | | 1.25 | 0.84 | | | | | | | | | 3.85 | | |
| *Hyalina* sp. | | | | | 1.25 | | | | | | | | | | | | |
| Marginellids | 4.17 | 4.26 | 2.86 | | 1.25 | 2.52 | | | | | 1.69 | | | | | | 1.93 |
| *Meioceras* sp. | | | | | | | | | | | | | | | | | 0.39 |
| *Mellanella* sp. | | 4.26 | | | | | | | | | | | | | | | |
| *Modulus modulus* | | | | | | | | | | | | | | | | | 0.39 |
| *Odostomia* spp. | | | 0.95 | 2.00 | 1.25 | | | | | | | | | | | | |
| *Oliva* sp. | | 6.38 | 2.86 | | | | | 10.71 | | | | | | | | | |
| *Olivella* sp. | | | | | 2.50 | | | | | | 1.69 | 1.69 | | | 3.85 | 8.33 | 4.25 |
| *Rissoina bryerea* | 8.33 | | | | 2.50 | 6.72 | | | | | | | | | | | 0.77 |
| *Rissoina cancellata* | | | 0.95 | | | | | | | | | | | | | | |
| *Urosalpinx* ? sp. | | | | | 1.25 | | | | | | | | | | | | |
| Vitrinellid | | | 0.95 | 2.00 | 1.25 | 1.68 | | | | | | | | | | | |
| Unidentified Gastro Frags | | | | | | | | | | | | | | | 3.85 | | 0.39 |
| **Pelecypods:** | | | | | | | | | | | | | | | | | |
| *Anomalocardia cuneimeris* | | | 3.81 | 2.00 | | 2.52 | 11.11 | | | 4.00 | | | | 6.06 | | | 0.39 |
| *Arcopsis adamsi* | | | | | | 0.84 | | | | | | | | | | | |
| *Brachiodontes* sp. | 45.83 | 14.89 | 12.38 | 34.00 | 36.25 | 12.61 | 48.15 | 3.57 | | | | | | | | 8.33 | 5.41 |
| *Chione cancellata* | 8.33 | 2.13 | 2.86 | 4.00 | 1.25 | 1.68 | | | | | 1.69 | 1.69 | 5.88 | | | 4.17 | 3.86 |
| *Cumingia tellinoidea* | | 2.13 | | | | | | 10.71 | | | 1.69 | | | | | | 1.93 |
| *Laevecardium* spp. | 8.33 | 2.13 | 1.90 | 2.00 | 1.25 | 7.56 | 3.70 | | | | | 5.08 | | | 15.38 | 16.67 | 5.79 |
| *Lima* sp. | | | | | 2.50 | | 3.70 | | | | | | | | | | |
| *Mysella* sp. | 4.17 | | | | 1.25 | 1.68 | | | | | | | | | | | 0.39 |
| *Nucula proxima* | | | | | | | | | | | | | | | | | 2.32 |
| *Parastarte triquetra* | | | | | | 2.52 | 7.41 | 17.86 | | 72.00 | 11.86 | 42.37 | 32.35 | 33.33 | 3.85 | | |
| Pectinid | | | | | | | 3.70 | 3.57 | | | | | | | | | |
| *Pinctada radiata* | | | | 6.00 | 2.50 | | | | | | | | | | | | 0.77 |
| *Pitar* sp. | | | | | 3.75 | | | | | | 8.47 | 6.78 | 8.82 | 3.03 | | | 12.74 |
| *Semele bellastriata* | | | | | | | | | | | | | | | | | 0.39 |
| *Tellina* spp. | 8.33 | | | | 7.50 | 0.84 | | | | | | | | | | | 2.32 |
| *Transennella* spp. | | 14.89 | 14.29 | 4.00 | 10.00 | 31.93 | 18.52 | 42.86 | 100.00 | 16.00 | 66.10 | 37.29 | 50.00 | 48.48 | 42.31 | 45.83 | 38.22 |
| Unidentified Pelecy. Frags. | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| **Total # of specimens** | 24 | 47 | 105 | 50 | 80 | 119 | 27 | 28 | 2 | 25 | 59 | 59 | 34 | 33 | 26 | 24 | 259 |
| **Total # of Sps. Groups** | 10 | 14 | 17 | 13 | 21 | 20 | 8 | 7 | 1 | 5 | 10 | 8 | 5 | 5 | 10 | 7 | 24 |
| | | | | | | | | | | | | | | | | | |
| Total Percent | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 3: Bob Allen Core #6: Ostracode species census data

| Depth | *Actinocythereis* cf. *subquadrata* | *Actuticythereis laevissima* | *Aglaicypris* sp. | Cytherelloidea | *Cytheromorpha paracastanea* | *Cytherura elongata* | *Cytherura fiscina* | *Dolerocypris* sp. | *Loxoconcha matagordensis* | *Loxochoncha* spp. | *Malzella floridana* | *Neonesidea* sp. | *Paracytheroma repexa* | *Paracytheroma stephensoni* | *Peratocytheridea bradi* | *Peratocytheridea setipunctata* | Propontocypris | Proteoconcha | *Puriana* spp. | *Reticulocythereis floridana* | *Triangulocypris laeva* | *Xestoleberis mixohalina* | *Xestoleberis* spp. | ?Microcythere | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | x | | x | | | | | 20 | | 16 | x | | x | x | 6 | | | | x | x | | x | | 67 |
| 10 | | x | x | x | | | x | | 9 | x | 5 | x | x | | | 4 | | | | x | | | x | | 32 |
| 20 | | | | x | | | x | | 3 | | 7 | x | x | x | | 6 | | | | | x | 3 | x | | 37 |
| 30 | | | x | | | | | | 7 | x | 8 | x | x | x | | 1 | | | | | x | 9 | x | | 45 |
| 40 | | x | x | x | | | | | 8 | | 6 | x | | x | | | | | | x | x | 2 | x | | 41 |
| 46 | | x | | x | | | | | 12 | | 7 | x | x | | | 11 | | | | x | x | 3 | x | | 44 |
| 50 | x | x | | | | | x | | 8 | x | 7 | x | x | x | x | 9 | | | 3 | | x | 1 | x | | 63 |
| 56 | | | | | x | | x | | 14 | | 13 | x | x | x | x | 19 | | | 5 | | x | 3 | x | | 74 |
| 60 | x | | x | x | | x | x | | 9 | | 8 | x | x | | x | 9 | | | 3 | | x | | x | | 54 |
| 66 | | | x | | x | x | | | 15 | | 7 | x | x | | | 9 | | | 1 | | x | | x | | 60 |
| 70 | x | | x | x | x | | | | 11 | | 5 | | x | x | | 13 | x | | 1 | | x | 4 | x | x | 55 |
| 76 | | | x | | | | x | x? | | | 1 | | | | | 13 | | | | | x | 3 | | x | 26 |
| 80 | | | | | | | | | 3 | | | | | | | 2 | | | | | x | | | | 7 |
| 86 | | | | | | | | | | | | | | | | 5 | | | | | | | | | 8 |
| 90 | | | x | | x | | x | | 2 | | 3 | | x | | | 1 | | | | | x | | x | | 18 |
| 100 | | | | | x | | x | | 3 | | 7 | | x | | | 3 | | | | x | x | 2 | | | 29 |
| 110 | | | | | | | | | 1 | | 3 | | x | | | 3 | | | | | x | 1 | | | 15 |
| 120 | | | x | | x | | x | | 4 | | 1 | | x | | | 3 | | x | | | x | | | | 16 |
| 130 | | | x | | | | | | | | 1 | | | | | 2 | | | | | | | | | 4 |
| 140 | | | | x | x | | x | | 1 | | 1 | | | | | 2 | | | | | x | 1 | x | | 14 |
| 150 | | | | | | | | | | | 2 | | | | | 6 | | | | x | | 6 | | | 18 |
| 158 | | x | | | | | | | | | 5 | | | | | 4 | | | | | x | 4 | | | 22 |

1984), Warmke and Abbott (1961), Perry and Schwengel (1955), and Andrews (1971). Turney and Perkins (1972) molluscan faunal lists for Florida Bay were utilized.

Pollen and dinocyst assemblages from eighteen sediment samples from the core were analyzed. Three hundred pollen grains were counted for each sample to provide relative abundance of pollen taxa; these data were used to establish the amount of temporal variability in the pollen record of terrestrial vegetation. Dinocysts were sparse in all samples. Slides were examined until 300 dinocysts were counted or until the slide had been completely studied.

## FAUNAL AND FLORAL ANALYSES

Data from the five biotic groups were compiled after the independent analyses were complete. All additional biotic elements present in the core also were noted but not analyzed, including serpulids, echinoids, and macro-plant material. Environmental parameters are interpreted on the basis of known present-day ecological requirements for the species discussed.

Benthic Foraminifera: Nine species or species groups (spp.) of foraminifera have been identified in the preliminary analysis of the samples from Bob Allen Core #6A (Table 1). Most samples are dominated by a diverse assemblage of miliolids, common in warm water shelfal (>500 m) depositional environments. The remainder of the fauna can be divided into two assemblages, a high diversity assemblage and a low diversity assemblage. The high diversity assemblage is dominated by two taxa, miliolids and *Elphidium* spp., common Gulf Coast and southeastern Florida taxa. Other common taxa in this assemblage include *Peneropolis* sp., *Archais* sp. and *Miliolinella* spp., which are common indicators of normal marine conditions in warm, subtropical to tropical environments. *Peneropolis* sp. and *Archais* sp. are commonly associated with reef and carbonate bank depositional environments (Lidz and Rose, 1989). This assemblage is present in the upper samples from 0- ~40 cm and the lower samples from ~138-158 cm in Bob Allen Core #6A (Figure 2). The low diversity assemblage is dominated by miliolids, *Elphidium* spp. and *Ammonia beccarii*. This low diversity, high dominance assemblage is typical of stressed environments in the Gulf Coast region. It has strong similarities with the *Ammonia-Elphidium* predominance facies (Poag, 1981) common to the middle and outer reaches of estuaries, bays and lagoons of the Gulf Coast region; this facies is associated with marginal marine salinities and low sedimentation rates. This assemblage is present in the middle part (samples from ~40- ~138 cm) of Bob Allen Core #6A (Figure 2).

Mollusks: The forty-two species or generic groups of mollusks that have been identified from Bob Allen Core #6A are listed in Table 2. *Transenella* spp. is present in all but two samples at values of greater than 10% molluscan faunal abundance. The patterns of abundance of key mollusc groups are shown on Figure 3. The fauna can be divided into three assemblages. The upper assemblage (samples from 0- ~60 cm core depth) is relatively diverse (8-21 species or species groups present in each sample), and is dominated by *Brachiodontes* sp., *Transenella* spp., and species in the Cerithiidea family. This upper assemblage is indicative of fluctuating salinities and the presence of grass beds. The middle portion of the core (samples from ~68- ~130 cm) is represented by a relatively low diversity molluscan assemblage, composed primarily of *Transenella* spp. and *Parastarte triquetra*. Polyhaline conditions and the near absence of grass are indicated by the middle assemblage. The lower assemblage (samples from ~138-158 cm core depth) is represented by only three samples, therefore it is difficult to detect patterns, but this assemblage appears to have affinities with the uppermost assemblage. Grass and sandy substrates seem to have been available for occupation during deposition of this portion of the core. *Transenella* spp., *Laevicardium* spp., *Pitar* sp., and *Cerithium muscarum* are the dominant molluscan components. The lowermost sample in the core (156-158 cm) is the most diverse (24 species or species groups are present in the one sample) and the number of individual specimens is quite high (more than twice as high as any other sample); this may represent a shell lag deposit.

Ostracodes: Twenty-four of the more common and diagnostic ostracode taxa that were recovered from the Bob Allen Core #6A samples are shown in Table 3. The down-core patterns of species abundances, given as a percentage of the total ostracode assemblage, are shown for 10 species in Figure 4. A high diversity assemblage, relative to the lower portion of the core, is found in samples between ~18 and ~70 cm. This assemblage reflects the influx of various euhaline species typical of salinities above 30 ppt; preliminary interpretation of this interval suggests that salinity was higher during deposition of this interval than in the remainder of the core. Many of these euhaline species have their first stratigraphic appearance in the core between ~48 and ~70 cm. Below about ~74 cm, the most common species are *Peratocytheridea setipunctata, Malzella floridana,* and *Loxoconcha matagordensis,* three species that can tolerate a wide range of bottom water environments and salinity regimes.

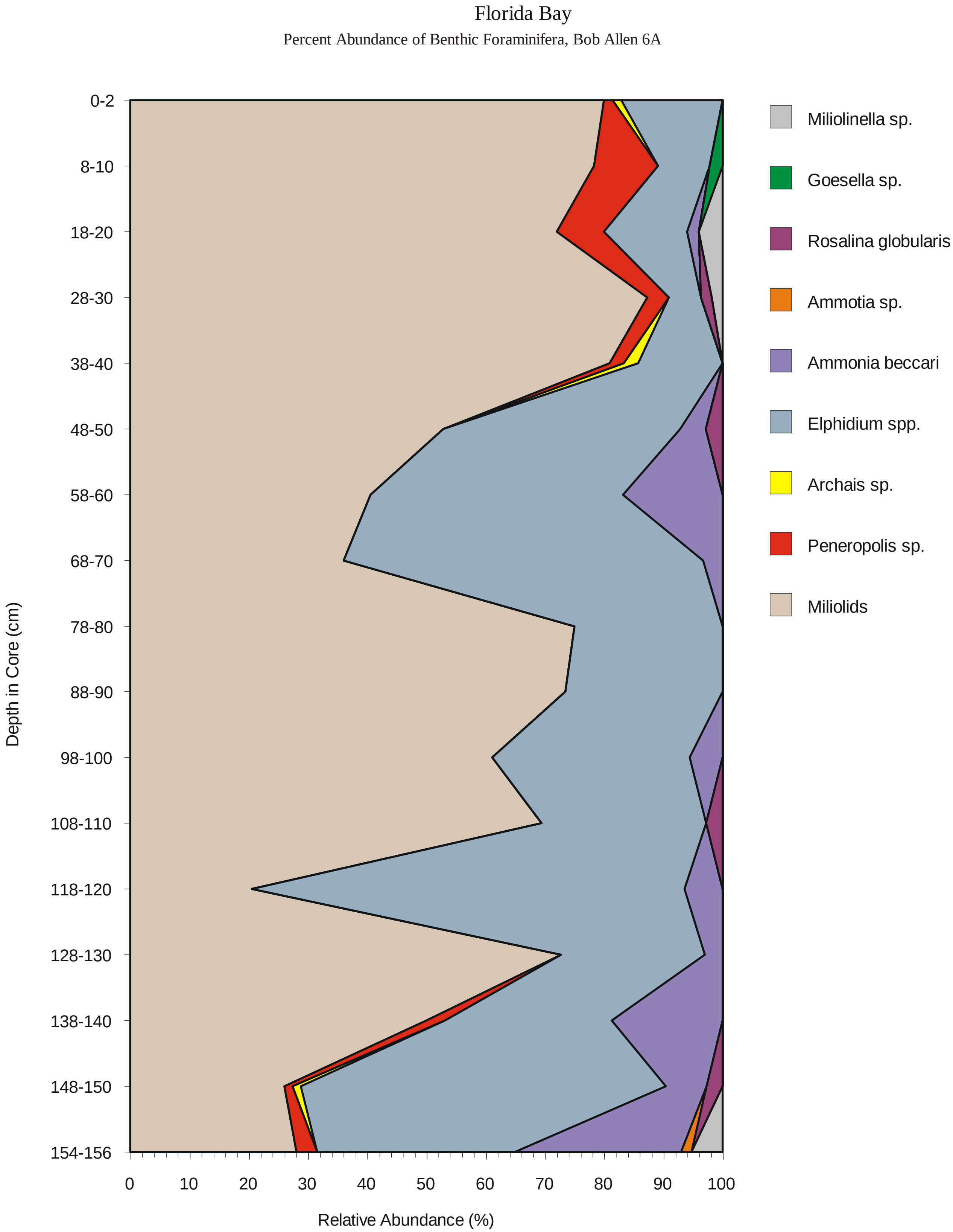



Figure 2. Plot of the relative abundance of benthic foraminifera taxonomic groups at sampled horizons within the Bob Allen Core #6. Note Y-axis is not to scale. Higher relative diversity of upper (0-50cm) and lower (138-156cm) portions of the core over the middle part of the core (50-138cm) is illustrated. The high diversity and presence of *Peneropolis* sp. indicates normal marine salinities and the presence of seagrass. The dominance of *Ammonia beccarri* and *Elphidium* sp. indicates widely fluctuating salinity conditions.

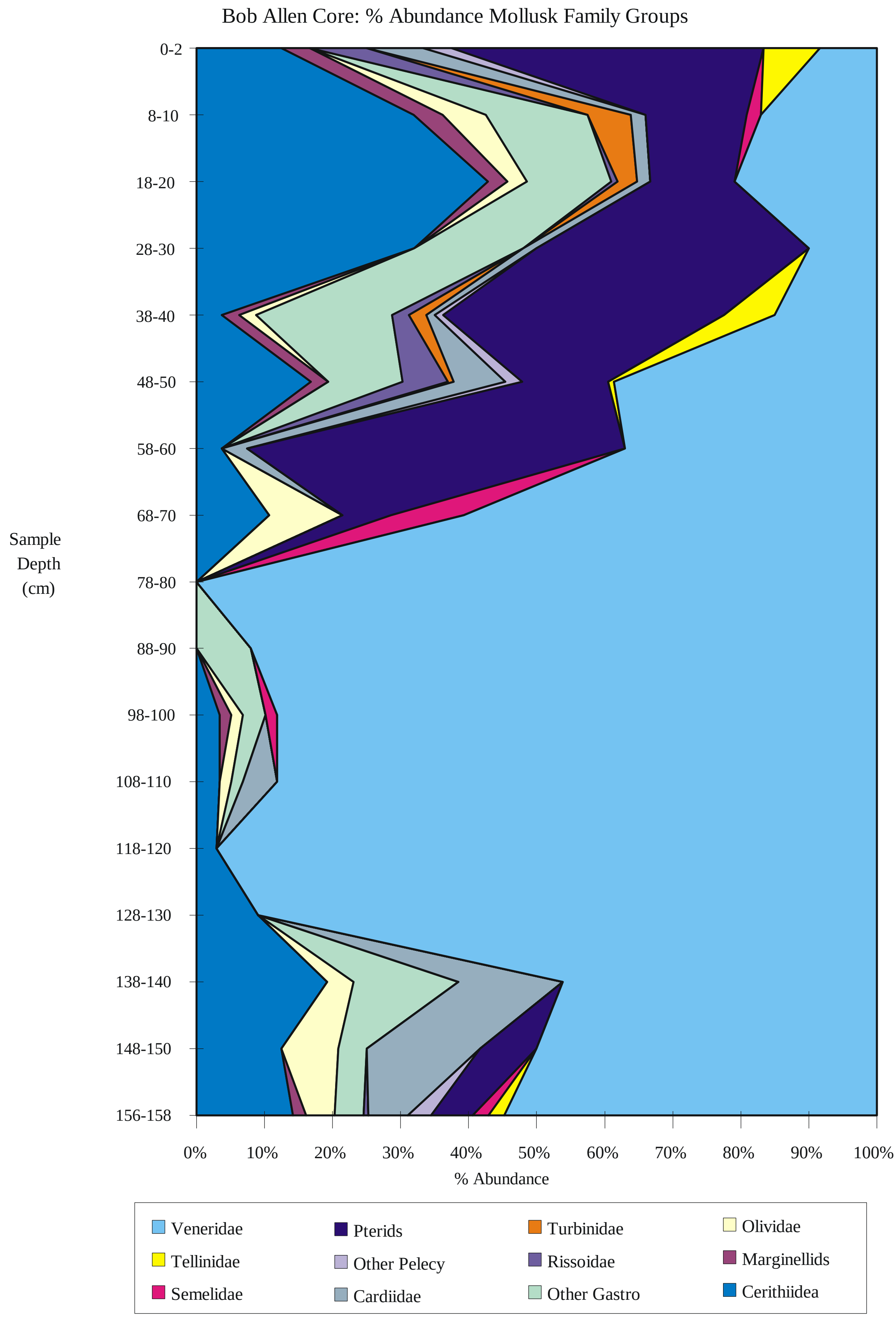



Figure 3. Plot of the relative abundance of mollusk taxonomic groups at sampled horizons within Bob Allen Core #6A.The majority of the mollusks are euryhaline and tolerant of a wide range of salinities. (Note: Y-axis is not to scale.)

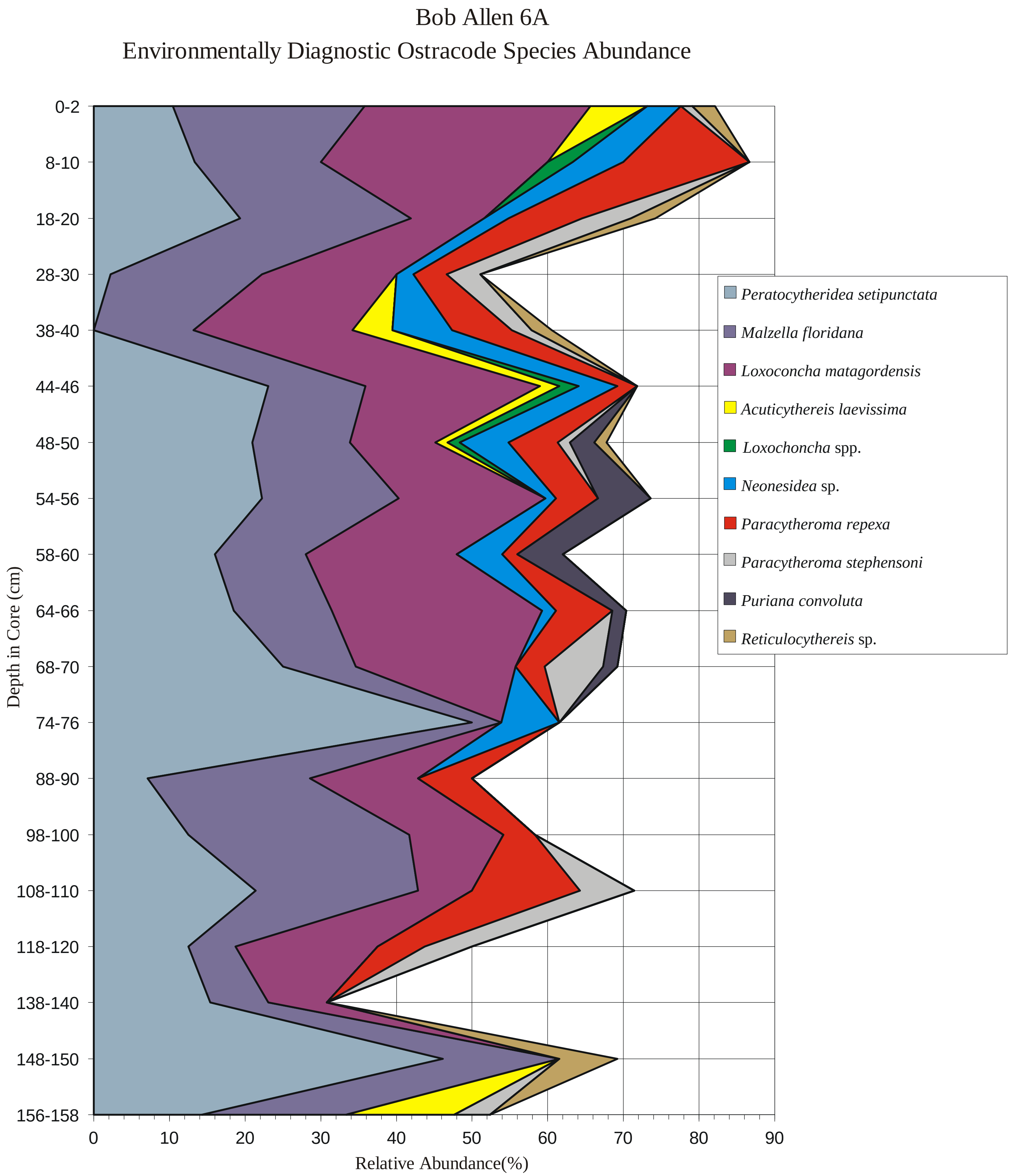



Figure 4. Plot showing relative abundance of environmentally significant ostracode taxa at sampled horizons in the Bob Allen Core #6A. Note Y-axis is not to scale. *Puriana convoluta*, *Loxochoncha* spp., and *Paracytheroma stephonsoni* indicate euhaline conditions (30-40 ppt). *Peratocytheridea setipunctata* dwells in sandy substrates. The remainder of the taxonomic groups are tolerant of a wide range of salinities (20->40 ppt).

Table 4 - Percent Abundance of Pollen - Bob Allen Core 6A

| Scientific name | Common name | 0-2 cm | 2-4 cm | 10-12 cm | 20-22 cm | 30-32 cm |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Trees and shrubs** | | | | | | |
| *Acer* | Maple | 0.00 | 0.00 | 0.38 | 0.00 | 0.00 |
| *Alnus* | Alder | 0.58 | 0.00 | 0.76 | 0.00 | 0.00 |
| *Avicennia* | Black Mangrove | 0.00 | 0.53 | 0.76 | 0.00 | 0.45 |
| *Betula* | Birch | 0.00 | 1.06 | 0.76 | 0.00 | 0.00 |
| *Bursera simbaruba* | Gumbo Limbo | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Carya* | Hickory | 2.92 | 1.06 | 1.91 | 0.00 | 1.35 |
| *Castanea* | Chestnut | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Casuarina* | Australian pine | 8.77 | 5.85 | 4.20 | 8.62 | 3.60 |
| *Celtis* | Hackberry | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Conocarpus* | Buttonwood | 0.00 | 0.53 | 0.00 | 0.00 | 0.00 |
| *Corylus* | Hazelnut | 0.58 | 0.53 | 0.38 | 0.69 | 0.45 |
| *Diospyros* | Persimmon | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Fagus* | Beech | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Fraxinus* | Ash | 0.00 | 0.53 | 0.38 | 0.00 | 0.00 |
| *Ilex* | Holly | 0.58 | 0.00 | 0.38 | 0.34 | 0.00 |
| *Juglans* | Walnut | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Liquidambar* | Sweet gum | 0.58 | 0.00 | 0.00 | 0.00 | 0.45 |
| *Liriodendron* | Tulip Tree | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Magnolia* | Magnolia | 0.00 | 1.06 | 0.00 | 0.00 | 0.00 |
| *Melaleuca* | Melaleuca | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Myrica* | Wax Myrtle | 1.17 | 1.06 | 1.15 | 0.34 | 0.00 |
| *Nyssa* | Gum/Tupelo trees | 0.00 | 0.00 | 0.00 | 0.00 | 0.45 |
| *Ostrya/ Carpinus* | Ironwood | 0.00 | 0.00 | 0.00 | 0.34 | 0.00 |
| *Palmae* | Palms | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pinus* | Pine | 52.63 | 64.36 | 67.56 | 63.79 | 77.93 |
| *Quercus* | Oak | 23.39 | 14.36 | 8.40 | 7.93 | 8.56 |
| *Rhizophora* | Red Mangrove | 0.00 | 1.60 | 1.91 | 0.69 | 0.45 |
| *Robinia* | Locust | 0.00 | 0.00 | 0.00 | 0.00 | 0.45 |
| *Salix* | Willow | 0.58 | 0.00 | 0.38 | 0.00 | 0.00 |
| *Schinus* | Pepper tree | 0.00 | 1.06 | 1.15 | 0.00 | 0.00 |
| TCT* | Cypress | 0.00 | 0.53 | 0.00 | 2.07 | 0.00 |
| *Tilia* | Basswood | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Ulmus* | Elm | 1.17 | 0.53 | 0.00 | 0.00 | 0.00 |
| | | | | | | |
| **Herbaceous plants** | | | | | | |
| Asteraceae | Aster family | 1.17 | 1.06 | 4.20 | 5.86 | 0.45 |
| *Camellia* | Tea, oilseed | 0.00 | 1.06 | 0.00 | 0.69 | 0.00 |
| Chenopodiaceae/Amaranthaceae | Pigweed/Goosefoot | 1.75 | 0.00 | 3.44 | 0.69 | 4.05 |
| Cyperaceae | Sedge family | 0.00 | 2.13 | 0.38 | 0.69 | 0.00 |
| *Decadon* | Lythraceae | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ericaceae | Heath family | 0.00 | 0.00 | 0.00 | 5.86 | 0.00 |
| Euphorbiaceae | Euphorb family | 0.58 | 0.00 | 0.00 | 1.03 | 0.00 |
| Gentaniaceae | Gentian family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leguminosae | Legume family | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 |
| Poaceae | Grass family | 0.58 | 0.00 | 1.15 | 0.00 | 0.45 |
| Rubiaceae | Buttonweed family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Sagittaria* | Arrowhead | 0.00 | 0.53 | 0.38 | 0.00 | 0.00 |
| *Typha* | Cattail | 0.58 | 0.00 | 0.00 | 0.00 | 0.90 |
| Vitaceae | Grape family | 0.58 | 0.53 | 0.00 | 0.34 | 0.00 |

* Taxodiaceae/Cupressaceae/Taxaceae

Table 4 - Percent Abundance of Pollen - Bob Allen Core 6A

| Scientific name | Common name | 40-42 cm | 50-52 cm | 60-62 cm | 70-72 cm | 80-82 cm |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Trees and shrubs** | | | | | | |
| *Acer* | Maple | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Alnus* | Alder | 0.33 | 0.33 | 0.33 | 0.00 | 0.67 |
| *Avicennia* | Black Mangrove | 0.33 | 0.00 | 1.00 | 0.33 | 0.00 |
| *Betula* | Birch | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 |
| *Bursera simbaruba* | Gumbo Limbo | 0.00 | 0.66 | 0.00 | 0.00 | 0.33 |
| *Carya* | Hickory | 0.66 | 1.33 | 0.66 | 0.67 | 1.00 |
| *Castanea* | Chestnut | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Casuarina* | Australian pine | 7.31 | 3.65 | 4.65 | 2.67 | 3.00 |
| *Celtis* | Hackberry | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Conocarpus* | Buttonwood | 0.33 | 0.33 | 0.00 | 0.00 | 0.00 |
| *Corylus* | Hazelnut | 0.33 | 0.66 | 1.33 | 1.00 | 0.00 |
| *Diospyros* | Persimmon | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Fagus* | Beech | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Fraxinus* | Ash | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 |
| *Ilex* | Holly | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Juglans* | Walnut | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Liquidambar* | Sweet gum | 0.33 | 0.00 | 0.33 | 0.00 | 0.33 |
| *Liriodendron* | Tulip Tree | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Magnolia* | Magnolia | 0.00 | 0.00 | 0.33 | 0.33 | 0.00 |
| *Melaleuca* | Melaleuca | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Myrica* | Wax Myrtle | 0.33 | 0.33 | 0.66 | 1.33 | 0.00 |
| *Nyssa* | Gum/Tupelo trees | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 |
| *Ostrya/ Carpinus* | Ironwood | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 |
| *Palmae* | Palms | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 |
| *Pinus* | Pine | 75.75 | 70.43 | 71.10 | 86.67 | 82.67 |
| *Quercus* | Oak | 6.64 | 6.64 | 5.32 | 2.33 | 4.67 |
| *Rhizophora* | Red Mangrove | 0.66 | 1.00 | 0.33 | 0.00 | 0.67 |
| *Robinia* | Locust | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 |
| *Salix* | Willow | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 |
| *Schinus* | Pepper tree | 0.00 | 0.00 | 0.00 | 0.00 | 0.67 |
| TCT* | Cypress | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 |
| *Tilia* | Basswood | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Ulmus* | Elm | 0.33 | 0.33 | 0.66 | 0.33 | 0.00 |
| | | | | | | |
| **Herbaceous plants** | | | | | | |
| Asteraceae | Aster family | 2.66 | 5.65 | 4.65 | 1.67 | 1.33 |
| *Camellia* | Tea, oilseed | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Chenopodiaceae/Amaranthaceae | Pigweed/Goosefoot | 2.99 | 5.98 | 4.65 | 1.00 | 1.67 |
| Cyperaceae | Sedge family | 0.33 | 0.66 | 0.33 | 0.33 | 0.00 |
| *Decadon* | Lythraceae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ericaceae | Heath family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Euphorbiaceae | Euphorb family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Gentaniaceae | Gentian family | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 |
| Leguminosae | Legume family | 0.00 | 1.00 | 0.00 | 0.67 | 0.67 |
| Poaceae | Grass family | 0.66 | 0.00 | 1.66 | 0.33 | 0.33 |
| Rubiaceae | Buttonweed family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Sagittaria* | Arrowhead | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Typha* | Cattail | 0.00 | 0.66 | 0.00 | 0.00 | 0.00 |
| Vitaceae | Grape family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

* Taxodiaceae/Cupressaceae/Taxaceae

Table 4 - Percent Abundance of Pollen - Bob Allen Core 6A

| Scientific name | Common name | 90-92 cm | 100-102 cm | 110-112 cm | 120-122 cm | 130-132 cm |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Trees and shrubs** | | | | | | |
| *Acer* | Maple | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Alnus* | Alder | 0.67 | 0.33 | 0.33 | 0.00 | 1.33 |
| *Avicennia* | Black Mangrove | 0.00 | 0.00 | 1.00 | 0.33 | 0.00 |
| *Betula* | Birch | 0.33 | 0.33 | 0.67 | 0.33 | 0.00 |
| *Bursera simbaruba* | Gumbo Limbo | 0.00 | 0.33 | 0.33 | 0.00 | 0.00 |
| *Carya* | Hickory | 0.00 | 0.00 | 0.00 | 0.00 | 0.67 |
| *Castanea* | Chestnut | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 |
| *Casuarina* | Australian pine | 6.33 | 5.67 | 4.67 | 5.02 | 5.00 |
| *Celtis* | Hackberry | 0.00 | 0.33 | 0.00 | 0.33 | 0.00 |
| *Conocarpus* | Buttonwood | 0.33 | 0.00 | 0.00 | 0.33 | 0.00 |
| *Corylus* | Hazelnut | 1.00 | 0.33 | 0.33 | 0.33 | 0.00 |
| *Diospyros* | Persimmon | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 |
| *Fagus* | Beech | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Fraxinus* | Ash | 0.00 | 0.33 | 0.00 | 0.00 | 0.33 |
| *Ilex* | Holly | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 |
| *Juglans* | Walnut | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Liquidambar* | Sweet gum | 0.67 | 0.00 | 1.00 | 0.00 | 0.00 |
| *Liriodendron* | Tulip Tree | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Magnolia* | Magnolia | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| *Melaleuca* | Melaleuca | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Myrica* | Wax Myrtle | 1.00 | 0.67 | 0.33 | 1.00 | 1.33 |
| *Nyssa* | Gum/Tupelo trees | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Ostrya/ Carpinus* | Ironwood | 0.00 | 0.33 | 0.33 | 0.00 | 0.67 |
| *Palmae* | Palms | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pinus* | Pine | 77.67 | 83.33 | 78.67 | 78.93 | 71.67 |
| *Quercus* | Oak | 3.00 | 3.00 | 4.67 | 7.02 | 8.00 |
| *Rhizophora* | Red Mangrove | 1.33 | 0.00 | 1.33 | 0.33 | 0.33 |
| *Robinia* | Locust | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Salix* | Willow | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Schinus* | Pepper tree | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TCT* | Cypress | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 |
| *Tilia* | Basswood | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Ulmus* | Elm | 0.00 | 0.00 | 0.67 | 1.00 | 0.67 |
| | | | | | | |
| **Herbaceous plants** | | | | | | |
| Asteraceae | Aster family | 0.00 | 1.67 | 1.67 | 3.01 | 2.00 |
| *Camellia* | Tea, oilseed | 0.67 | 0.00 | 0.33 | 0.00 | 0.00 |
| Chenopodiaceae/Amaranthaceae | Pigweed/Goosefoot | 2.33 | 1.00 | 1.33 | 0.00 | 4.67 |
| Cyperaceae | Sedge family | 0.00 | 0.33 | 0.00 | 0.67 | 0.33 |
| *Decadon* | Lythraceae | 1.00 | 0.33 | 0.00 | 0.33 | 0.33 |
| Ericaceae | Heath family | 0.33 | 0.00 | 0.00 | 0.33 | 0.00 |
| Euphorbiaceae | Euphorb family | 0.33 | 0.00 | 0.33 | 0.00 | 0.33 |
| Gentaniaceae | Gentian family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leguminosae | Legume family | 1.00 | 0.00 | 0.67 | 0.00 | 0.00 |
| Poaceae | Grass family | 0.00 | 0.33 | 0.00 | 0.00 | 0.33 |
| Rubiaceae | Buttonweed family | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Sagittaria* | Arrowhead | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| *Typha* | Cattail | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 |
| Vitaceae | Grape family | 0.33 | 0.00 | 0.33 | 0.00 | 0.33 |

* Taxodiaceae/Cupressaceae/Taxaceae

Table 4 - Percent Abundance of Pollen - Bob Allen Core 6A

| Scientific name | Common name | 140-142 cm | 150-152 cm | 154-156 cm | |
|---|---|---|---|---|---|
| | | | | | |
| **Trees and shrubs** | | | | | |
| *Acer* | Maple | 0.00 | 0.00 | 0.00 | |
| *Alnus* | Alder | 0.00 | 0.00 | 0.00 | |
| *Avicennia* | Black Mangrove | 0.00 | 1.01 | 0.00 | |
| *Betula* | Birch | 0.33 | 0.67 | 0.67 | |
| *Bursera simbaruba* | Gumbo Limbo | 0.33 | 0.00 | 0.00 | |
| *Carya* | Hickory | 0.00 | 0.00 | 0.33 | |
| *Castanea* | Chestnut | 0.00 | 0.00 | 0.00 | |
| *Casuarina* | Australian pine | 3.31 | 3.36 | 1.67 | |
| *Celtis* | Hackberry | 0.00 | 0.34 | 0.00 | |
| *Conocarpus* | Buttonwood | 0.00 | 0.00 | 0.00 | |
| *Corylus* | Hazelnut | 0.33 | 0.34 | 1.00 | |
| *Diospyros* | Persimmon | 0.00 | 0.00 | 0.00 | |
| *Fagus* | Beech | 0.00 | 0.00 | 0.00 | |
| *Fraxinus* | Ash | 0.00 | 0.00 | 0.33 | |
| *Ilex* | Holly | 0.33 | 0.67 | 0.33 | |
| *Juglans* | Walnut | 0.00 | 0.00 | 0.00 | |
| *Liquidambar* | Sweet gum | 0.00 | 0.00 | 0.33 | |
| *Liriodendron* | Tulip Tree | 0.00 | 0.00 | 0.33 | |
| *Magnolia* | Magnolia | 0.66 | 0.00 | 0.00 | |
| *Melaleuca* | Melaleuca | 0.00 | 0.00 | 0.00 | |
| *Myrica* | Wax Myrtle | 1.32 | 1.34 | 4.33 | |
| *Nyssa* | Gum/Tupelo trees | 0.00 | 0.00 | 0.67 | |
| *Ostrya/ Carpinus* | Ironwood | 0.00 | 0.00 | 0.00 | |
| *Palmae* | Palms | 0.00 | 0.00 | 0.00 | |
| *Pinus* | Pine | 83.44 | 83.56 | 78.00 | |
| *Quercus* | Oak | 3.97 | 5.37 | 5.67 | |
| *Rhizophora* | Red Mangrove | 0.99 | 0.00 | 0.33 | |
| *Robinia* | Locust | 0.00 | 0.34 | 0.00 | |
| *Salix* | Willow | 0.00 | 0.00 | 0.33 | |
| *Schinus* | Pepper tree | 0.00 | 0.00 | 0.00 | |
| TCT* | Cypress | 0.33 | 0.00 | 0.00 | |
| *Tilia* | Basswood | 0.00 | 0.67 | 0.00 | |
| *Ulmus* | Elm | 0.00 | 0.00 | 0.33 | |
| | | | | | |
| **Herbaceous plants** | | | | | |
| Asteraceae | Aster family | 2.65 | 1.34 | 1.00 | |
| *Camellia* | Tea, oilseed | 0.66 | 0.34 | 0.00 | |
| Chenopodiaceae/Amaranthaceae | Pigweed/Goosefoot | 0.00 | 0.00 | 1.33 | |
| Cyperaceae | Sedge family | 0.66 | 0.34 | 0.00 | |
| *Decadon* | Lythraceae | 0.00 | 0.00 | 0.00 | |
| Ericaceae | Heath family | 0.00 | 0.00 | 0.67 | |
| Euphorbiaceae | Euphorb family | 0.33 | 0.00 | 0.67 | |
| Gentaniaceae | Gentian family | 0.00 | 0.00 | 0.00 | |
| Leguminosae | Legume family | 0.00 | 0.00 | 1.33 | |
| Poaceae | Grass family | 0.33 | 0.00 | 0.00 | |
| Rubiaceae | Buttonweed family | 0.00 | 0.34 | 0.00 | |
| *Sagittaria* | Arrowhead | 0.00 | 0.00 | 0.00 | |
| *Typha* | Cattail | 0.00 | 0.00 | 0.00 | |
| Vitaceae | Grape family | 0.00 | 0.00 | 0.33 | |

* Taxodiaceae/Cupressaceae/Taxaceae

Pollen: Pollen assemblages were dominated uniformly by *Pinus* (pine) pollen, with *Quercus* (oak) pollen ranking second in abundance (Table 4). Pollen of *Casuarina* (Australian pine) introduced to the Caribbean and Florida between 1850 and 1910, also is common throughout most of the section, although it decreases in abundance near the bottom of the core. Other taxa present in low abundances throughout the core include *Carya*, *Myrica*, *Rhizophora*, *Avicennia*, *Ulmus*, *Fraxinus*, and members of the Chenopodiaceae/Amaranthaceae, Asteraceae, and Poaceae (see Figure 5). Only minor down-core variations exist in the pollen assemblages, with a subtle change at ~80 cm in the core. Below that point, *Pinus* pollen is slightly more abundant, *Carya* pollen decreases in abundance, and *Myrica* pollen increases in abundance. Also, several taxa are only present below that point, including *Ostrya/Carpinus*, Euphorbiaceae, Ericaceae, and members of the Taxodiaceae/ Cupressaceae/ Taxaceae.

Dinocysts: *Spiniferites* spp. and *Polysphaeridium zoharyi* (Rossignol) Lentin & Williams dominate the samples from Bob Allen Core #6A (Table 5). Specimens of the genus *Spiniferites* comprise 27-73% of the dinocysts in the individual samples. Consistent identification of the individual species of this genus is precluded by the preservation in the samples and by the state of the taxonomy of the genus; *S. mirabilis*,(Rossignol) Sarjeant, *S. ramosus*,(Ehrenberg) Mantell, *S. scabratus*, (Wall) Sarjeant, and other forms are present. *Polysphaeridium zoharyi* constitutes 20-62% of the dinocysts in the individual samples. Other taxa present include: *Linuglodinium machaerophorum* (Deflandre & Cookson) Wall, *Nematosphaeropsis rigida* Wrenn, and *Operculodinium* spp. A single specimen *Quinquecuspis concreta* (Reid) Harland (included in the counting category

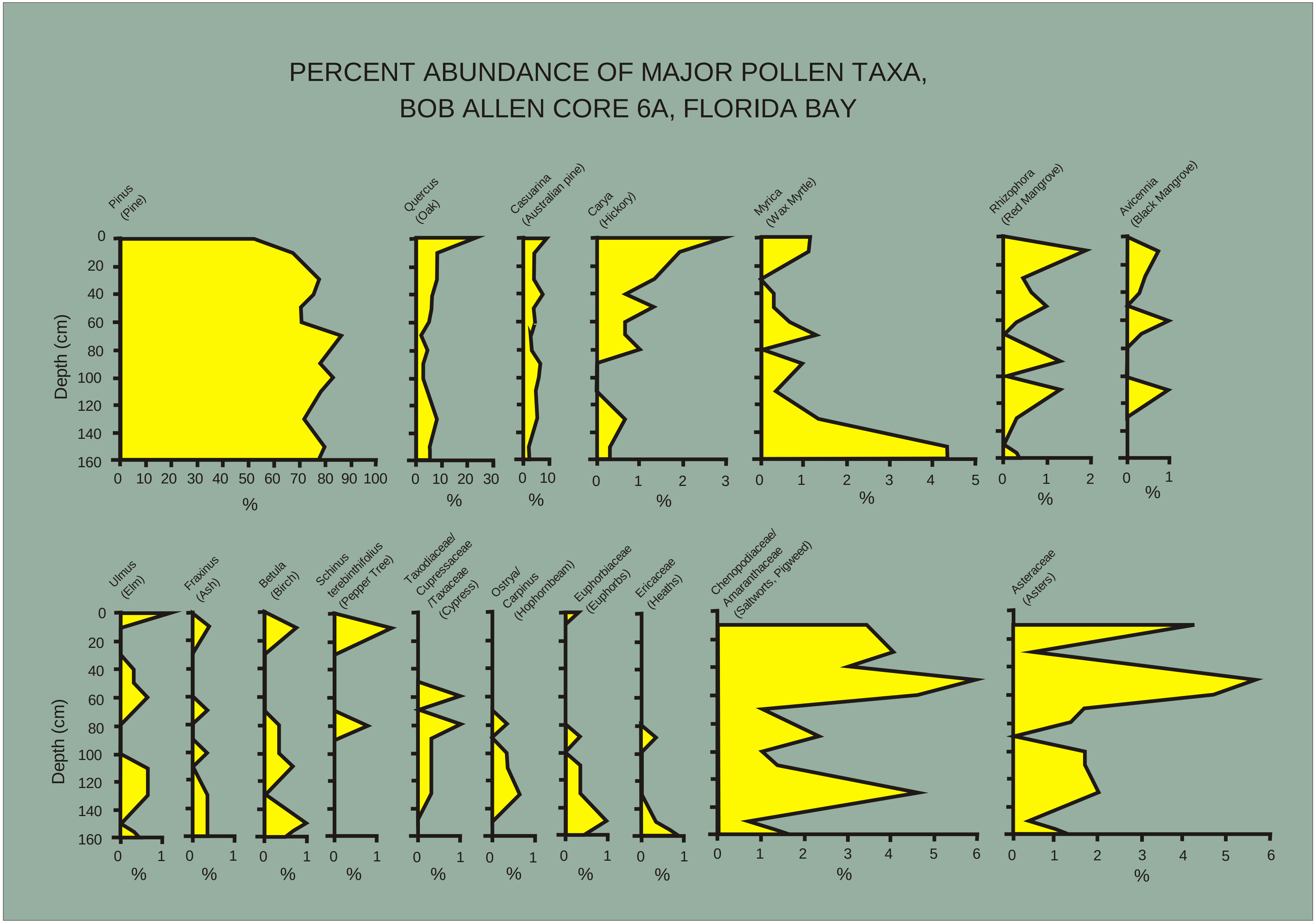



Figure 5. Plots showing relative abundance of major pollen taxa in the Bob Allen Core #6A.

"other" for the sample at 150-152cm) is the only representative of the family Congruentidaceae. Dinocysts are more abundant (more specimens per slide) in the samples 80-132 cm than in the samples above and below this interval.

Samples from 2-72 cm are dominated by *Spiniferites* spp. and contain low, but fluctuating, abundances of *P. zoharyi* (Figure 6). The samples from 80-122 cm, *P. zoharyi* occur in approximately equal proportions. In the four samples below 130 cm, the dinocyst assemblage is dominated by *Spiniferites* spp.

Table 5: Bob Allen Core 6A
Dinocysts

| Sample | Depth (cm) | n* | *Polysphaeridium zoharyi* | *Spiniferites* spp. | *Lingulodinium machaerophorum* | *Nematosphaeropsis rigidia* | *Operculodinium* spp. | other |
|---|---|---|---|---|---|---|---|---|
| P 55-1 | 0-2 | | | | | | | |
| P 55-2 | 2-4 | 36 | 25.0 | 61.1 | 2.8 | 5.6 | 0.0 | 5.6 |
| P 55-6 | 10-12 | 33 | 6.1 | 69.7 | 3.0 | 12.1 | 9.1 | 0.0 |
| P 55-11 | 20-22 | 55 | 47.3 | 40.0 | 3.6 | 1.8 | 7.3 | 0.0 |
| P 55-16 | 30-32 | 45 | 24.4 | 73.3 | 0.0 | 0.0 | 2.2 | 0.0 |
| P 55-21 | 40-42 | 61 | 8.2 | 78.7 | 3.3 | 3.3 | 6.6 | 0.0 |
| P 55-26 | 50-52 | 48 | 22.9 | 60.4 | 0.0 | 7.2 | 10.4 | 0.0 |
| P 55-31 | 60-62 | 39 | 15.4 | 74.4 | 0.0 | 0.0 | 10.3 | 0.0 |
| P 55-36 | 70-72 | 52 | 25.0 | 65.4 | 0.0 | 3.8 | 3.8 | 1.9 |
| P 55-41 | 80-82 | 203 | 51.2 | 40.9 | 2.5 | 3.0 | 0.5 | 2.0 |
| P 55-46 | 90-92 | 300 | 40.7 | 50.7 | 3.7 | 1.7 | 3.3 | 0.0 |
| P 55-51 | 100-102 | 300 | 61.7 | 27.3 | 4.0 | 2.3 | 4.7 | 0.0 |
| P 55-56 | 110-112 | 138 | 39.9 | 50.7 | 3.6 | 1.4 | 2.9 | 1.4 |
| P 55-61 | 120-122 | 300 | 44.0 | 46.3 | 4.3 | 2.7 | 2.0 | 0.7 |
| P 55-66 | 130-132 | 253 | 27.7 | 62.8 | 1.6 | 3.2 | 4.0 | 0.8 |
| P 55-71 | 140-142 | 57 | 26.3 | 54.4 | 3.5 | 5.3 | 8.8 | 1.8 |
| P 55-76 | 150-152 | 49 | 20.4 | 59.2 | 0.0 | 8.1 | 10.2 | 2.0 |
| P 55-80 | 154-156 | 44 | 11.4 | 75.0 | 2.3 | 0.0 | 9.1 | 2.3 |

n*=number of specimens counted; if no entry, insufficient specimens present for count

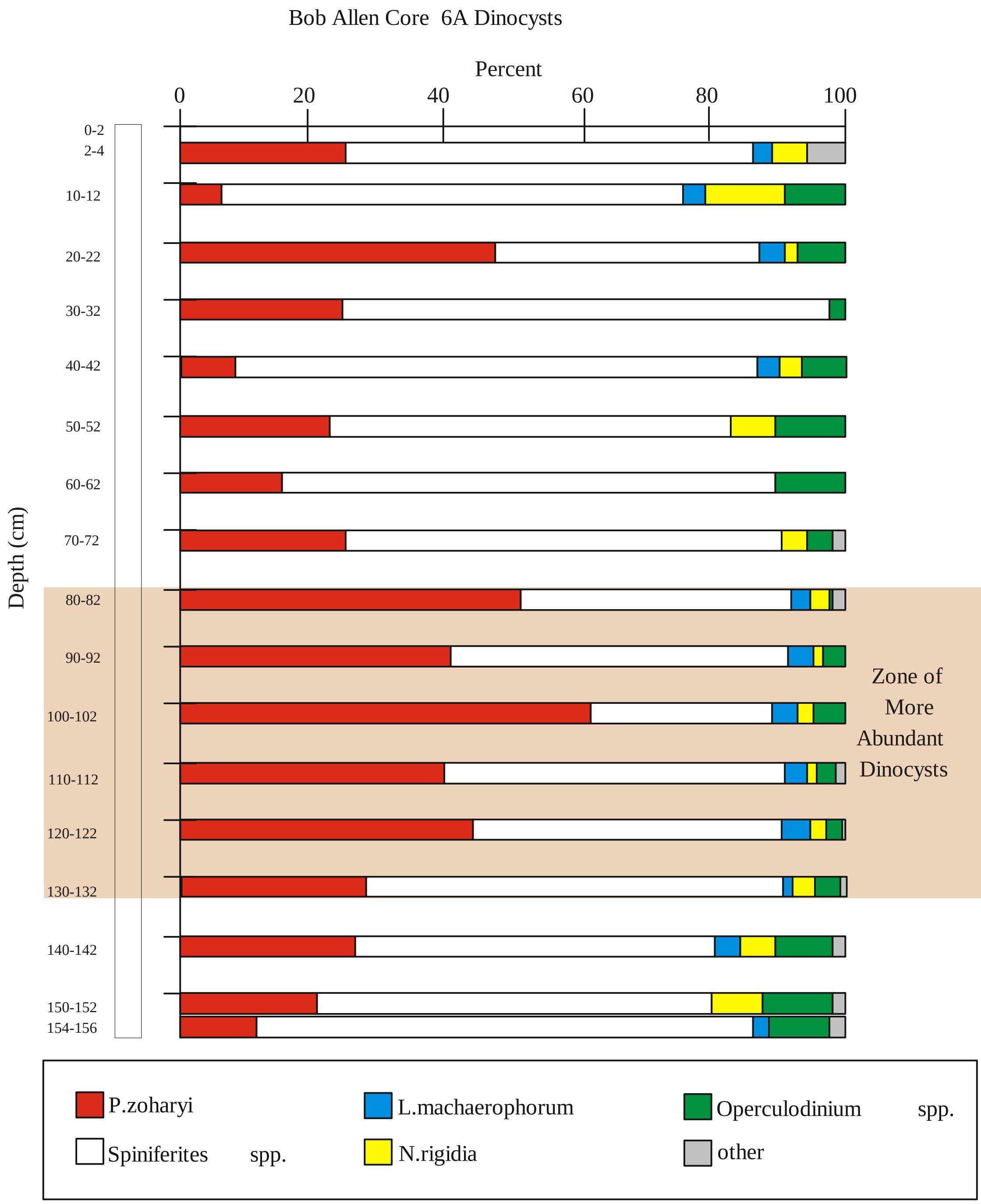



Figure 6. Bar chart showing relative abundance of dinocyst taxonomic groups at sampled horizons in the Bob Allen Core #6A. A zone of more abundant dinocysts (>400 cysts per gram of sediment) exists from 80-132cm in the core. The sample from 0-2cm contains too few dinocysts for meaningful study and is not included in the analysis.

## DISCUSSION

The data presented here show definitive evidence of down-core biotic changes. The benthic foraminifera, mollusk, and ostracode assemblages exhibit generally similar patterns of change at approximately the same depths in the core within the resolution of the sampling interval; this suggests environmental changes occurred that affected different components of the community. The pollen and dinocysts also show patterns of change that roughly correspond to that seen in the benthic invertebrate fauna. However, these results are only preliminary; denser sampling must be completed to resolve the details of the degree and timing of biotic changes within the Bob Allen Core #6A.

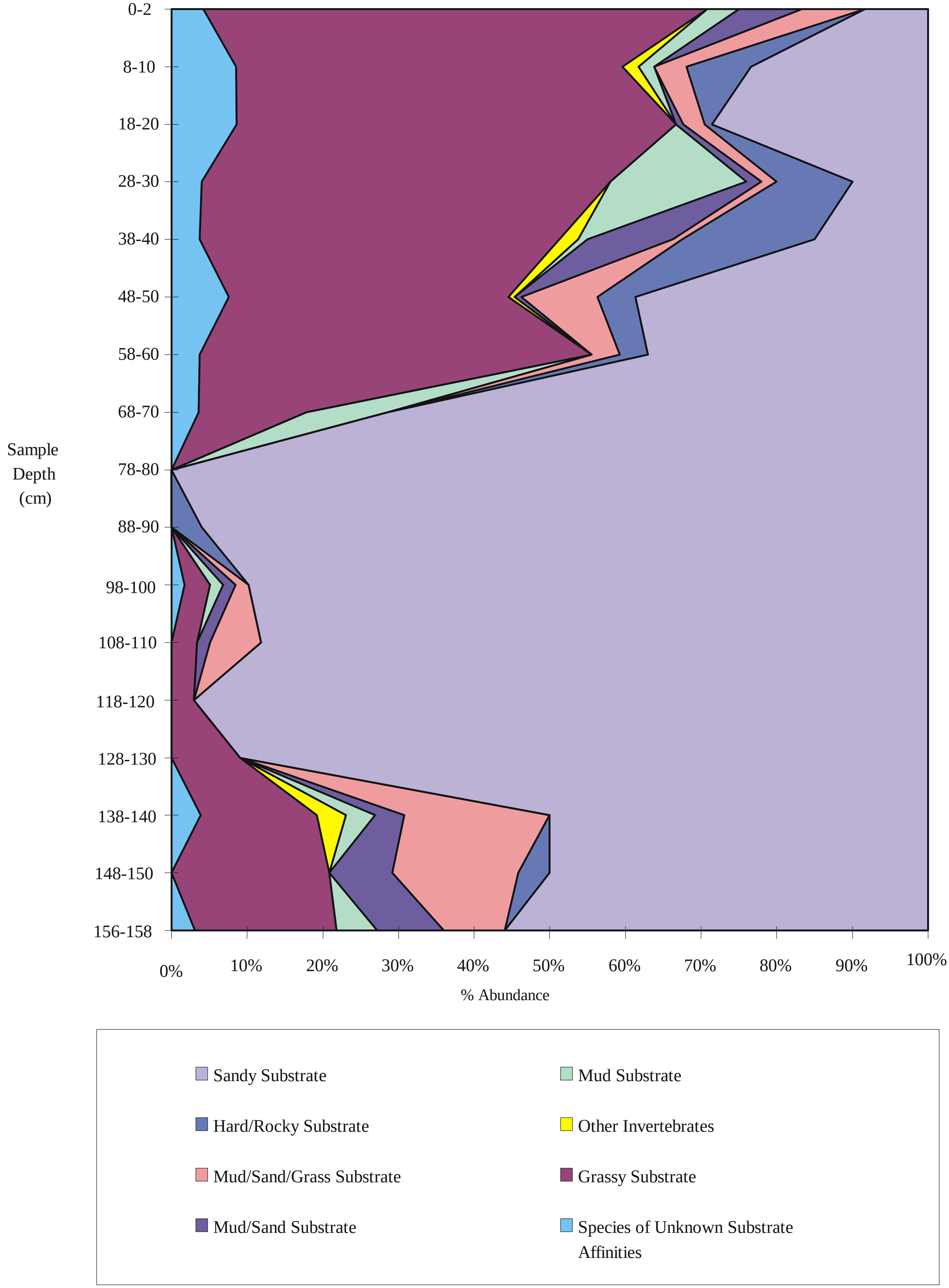
A preliminary chronology of the Bob Allen Core #6A has been developed using the data of Holmes et al., (1995); they found that down-core $^{226}$Ra activity correlates with the extracted $^{210}$Pb, therefore "the excess $^{210}$Pb is a simple exponential profile." By using this profile they have estimated that the rate of sediment accumulation is 0.84 +/- 0.05 g $cm^{-2}$ $yr^{-1}$ in Bob Allen Core #6A (Holmes, et al. 1995), which translates to 1.1 cm of sediment accumulation per year (Holmes, personal communication, 1995). Using this rate, the bottom of Bob Allen Core #6A at 158 cm represents the mid-1800's. An examination of the occurrence of the exotic pollen species *Casuarina* in the core is consistent with this depositional time frame. *Casuarina* is present to the bottom of the core, but in diminishing percentages. J. Bradshaw (personal communication, 1995) believes *Casuarina* was introduced to the Florida Keys and the Caribbean region by the mid-1800's. *Schinus* is present sporadically in the core, but *Melaleuca* is not present.

The upper portion of the core (0 to ~70 cm; present day to ~1931) contains a high diversity benthic faunal assemblage. Oscillations in the composition of the assemblages can be seen in this portion of the core (Figures 2, 3, 4). When the benthic foraminifera, mollusks, and ostracodes are grouped according to the known salinity preferences of living members of the groups, the patterns of oscillation are repeated. The same pattern is seen when the mollusks are categorized according to substrate preferences (Figure 7); a lot of oscillation occurs, but a grassy substrate appears to have been the most persistent substrate during this interval. This portion of the core contains a higher percentage of benthic faunal organisms known to prefer near normal marine salinities than the rest of the core.

The *Spiniferites*-dominated assemblage found in the upper part of the core (2-72 cm; ~1992-1929) compares with samples from present-day Florida Bay, except for the very restricted marine areas. Wall and others (1977) and Harland (1983) showed *Spiniferites*-dominated assemblages along Florida's Atlantic Coast, off the coast of equatorial Africa, and in the eastern Atlantic and parts of the Mediterranean. The *Spiniferites*-dominated assemblage may thus be related to influence from the Atlantic Ocean. The single sample at 20-22 cm, contains significant numbers of *Polysphaeridium zoharyi* and resembles dinofloras from very restricted-marine areas of present-day Florida Bay. Dinocyst recovery in these upper samples is quantitatively low. Dinocysts are present, but are completely overwhelmed by the terrigenous debris.

Below ~ 80 cm depth (~ 1939-1921), a subtle change in pollen assemblages occurs. Pine pollen becomes slightly less abundant above this point. The chenopod and amaranth families, and the aster family become more abundant, and several taxa present in low abundances disappear from the assemblage. Although the general character of the assemblage, representing a pine-dominated community, remains the same throughout the section, the subtle change noted at ~ 80 cm may represent 1) a response to minor changes

Figure 7. Plot of relative abundance or mollusks grouped according to substrate preferences at sampled horizons within the Bob Allen Core #6A. (Note: Y-axis is not to scale.)



in water availability, either through precipitation or fresh-water flow through the Everglades, or 2) natural variation of the assemblage through time.

The middle portion of the core (~70- ~130 cm; ~1927-1876) contains a low diversity benthic faunal assemblage. The distribution of faunal components in this portion of the core remains fairly steady, with only minor changes in the assemblages (Figures 2, 3, 4). The benthic foraminifera, mollusks, and ostracodes present are tolerant of a wide range of salinity conditions, indicating variable salinity in the polyhaline range (18-30 ppt). The majority of mollusks present (> 90%) live on sandy substrates (Figure 7). A dinocyst *Polysphaeridium zoharyi*-dominated assemblage is recognized from 80-122 cm. *Polysphaeridium zoharyi* is dominant today in warm shallow-water, highly fluctuating environments that could be characterized as either hypo- or hypersaline; the common factor is abnormal and (or) highly variable salinity (Morzadec-Kerfourn, 1983; Bradford and Wall, 1984). Subtle changes can be seen down-core below 80 cm in the record of terrestrial pollen, with an increase in *Pinus*, and changes in other components as well.

Benthic faunal diversity in the lower portion of the core (138-158 cm; ~1868-1850) is higher than in the middle portion, but does not reach the level of diversity seen in the upper portion of the core. The salinity and substrate patterns (Figures 7) show a trend toward the oscillations seen in the upper portion of the core, but because only 3 samples were examined for benthic fauna it is impossible to determine the significance of these trends. Between 122 and 132 cm, the dinocyst assemblage reverts to one dominated by *Spiniferites*, the assemblage present in the upper portion of the core.

## SUMMARY

The preliminary paleoenvironmental interpretation of the faunal and floral data from Bob Allen Core #6A documents several episodes of significant changes in environmental conditions for this site. Faunal data from benthic foraminifera, mollusks, and ostracodes record fluctuations in environmental conditions at approximately the same positions in the core. This similarity indicates the patterns are real, not artifacts of taphonomic or sedimentologic processes. Similar patterns were seen in the dinocyst record, indicating the environmental changes affected the entire water column. The pollen data suggest a terrestrial vegetational change also occurred. The preliminary results from the analysis of the faunal and floral data have demonstrated the feasibility of using environmentally sensitive species to document the history of Florida Bay. These initial results can be refined by the further analysis of more closely spaced samples from this core, and by the comparison of this core to other cores as they are analyzed. Future analyses will increase our understanding of the temporal and spatial resolution of environmental variability in Florida Bay over the last 150 years.

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