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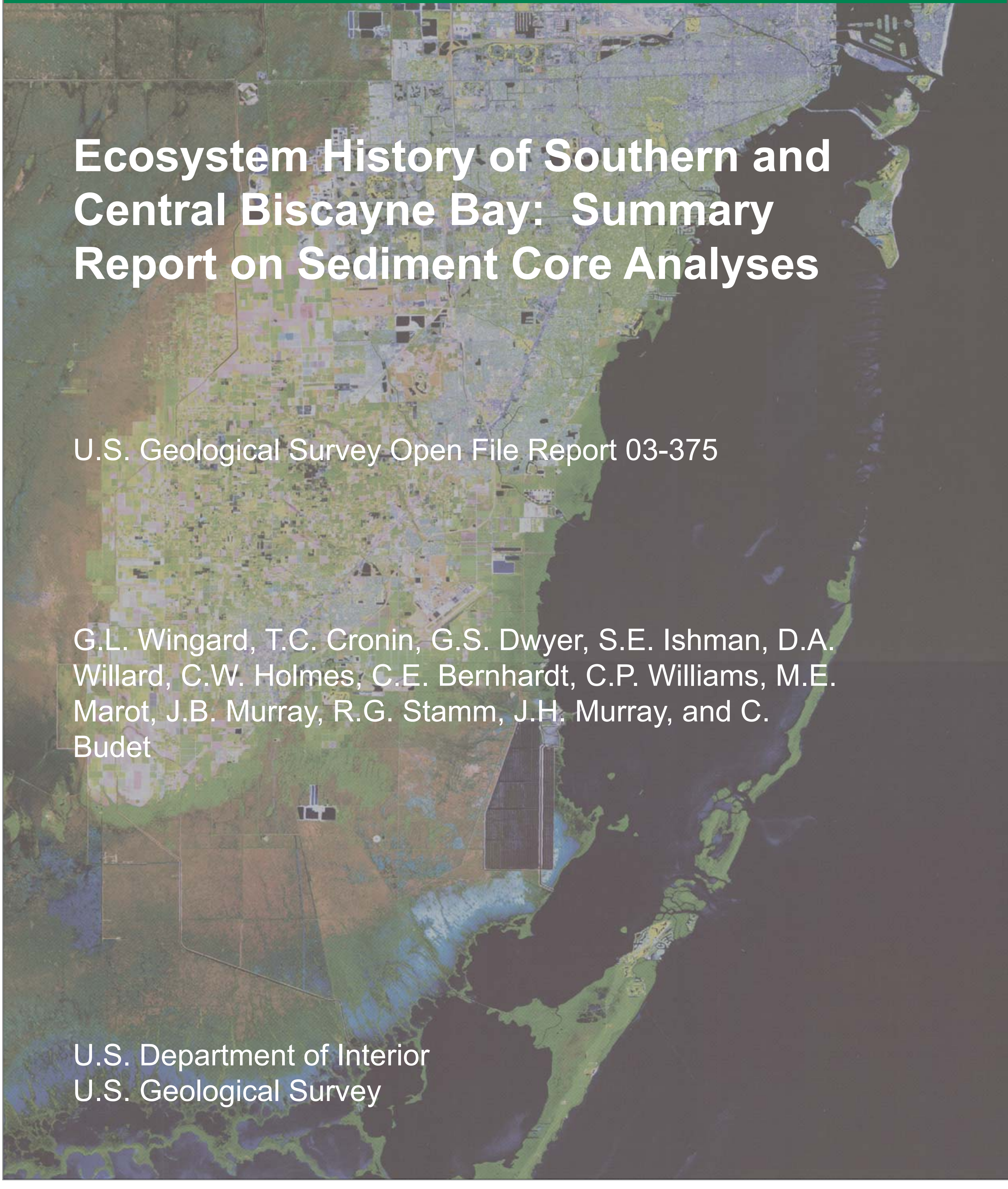

# Ecosystem History of Southern and Central Biscayne Bay: Summary Report on Sediment Core Analyses

U.S. Geological Survey Open File Report 03-375

G.L. Wingard, T.C. Cronin, G.S. Dwyer, S.E. Ishman, D.A. Willard, C.W. Holmes, C.E. Bernhardt, C.P. Williams, M.E. Marot, J.B. Murray, R.G. Stamm, J.H. Murray, and C. Budet

U.S. Department of Interior
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U.S. Department of Interior
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# Abstract/Executive Summary

During the last century, the environs of Biscayne Bay have been greatly affected by anthropogenic alteration through urbanization of the Miami/Dade County area. The sources, timing, delivery, and quality of freshwater flow into the Bay have been changed by construction of a complex canal system that controls movement of water throughout south Florida. Changes in shoreline and sub-aquatic vegetation and marine organisms have been observed and changes in water delivery are believed to be the cause.

Current restoration goals are attempting to restore natural flow of fresh water into Biscayne and Florida Bays and to restore the natural fauna and flora, but first we need to determine pre-alteration baseline conditions in order to establish targets and performance measures for restoration. This research is part of an ongoing study designed to address the needs of the Biscayne Bay Coastal Wetlands Project (BBCW) of the Comprehensive Everglades Restoration Plan (CERP).

By establishing the natural patterns of temporal change in salinity, water quality, vegetation, and benthic fauna in Biscayne Bay and the nearby wetlands over the last 100-500 years the USGS, in collaboration with our partners, will provide the data necessary to set realistic targets to achieve the BBCW Project goals.

Six cores from three sites in Biscayne Bay were collected in April 2002 for multidisciplinary multi-proxy analyses. This report details the results of these analyses and compares the 2002 cores to cores collected in 1997. The following are our significant findings to date:

- The salinity of central Biscayne Bay has become increasingly marine and increasingly stable over the last 100 years.
    - At No Name Bank, prior to approximately 1915, the inter-decadal and decadal salinity fluctuations appear to have been greater than after 1915 when salinities stabilized at that site.
    - Continental shelf/open marine influence on the sites has increased during the 20$^{th}$ century.
    - There is no indication of inter-decadal salinity extremes or periods of hypersalinity.
    - Freshwater and mesohaline salinities have had a minor influence on No Name bank throughout the time of deposition. At Featherbed Bank, the influence is reduced to mesohaline salinities.
- Card Bank has experienced relatively large swings in salinity over multi-decadal and centennial timescales, compared to central Biscayne Bay, but marine influence at the site has increased over the last century.
- Indications of regional scale patterns have been found, especially in the shell chemistry data and the pollen assemblages. These regional patterns indicate that the changes are not site specific and may not be limited to Biscayne Bay.

- Sub-aquatic vegetation has undergone bay-wide patterns of change over the last 200-500 years, which includes expansion prior to 1900 and declines during the last century in central Biscayne Bay.
    - *Thalassia* appears to have increased at all three core sites sometime between 1550 and 1750 AD.
    - A decline in *Thalassia* appears to have occurred after 1950 at No Name Bank and slightly earlier in the $20^{th}$ century at Featherbed Bank.
    - Card Bank does not appear to have experienced any declines in vegetation on an inter-decadal scale during the $20^{th}$ century.
- Molluscan faunal abundance and diversity have undergone significant changes in central Biscayne Bay.
- Indicators of increased organic-rich sediments at No Name occur between 1869 to 1888 and between the 1930's to 1975. These changes may correlate to human activities (settlement, population growth).

These findings represent a first step towards the project's goal to reconstruct the history of Biscayne Bay and they provide us with a working model to be tested at other sites. It is clear from our findings that Biscayne Bay has been a dynamic environment over the last 500 years, with natural changes occurring in salinity and benthic habitats. However, several significant changes have occurred in the $20^{th}$ century: 1) increased stabilization of marine salinities; 2) declines in seagrass in central Biscayne Bay; 3) dramatic changes in molluscan abundance and diversity in central Biscayne Bay. The question remains - how do we better differentiate natural cycles of change from anthropogenic change within these observed trends?

The preliminary implications from our research are that changes in salinity and benthic habitats have occurred naturally in Biscayne Bay on inter-decadal to centennial scales, perhaps due to climatic changes, changes in sea level, bank migrations, or a combination of factors. However, further work needs to be done to determine which components of change in the 20th century are human-induced and which are natural. By examining the historical records preserved in the sediments of Biscayne Bay, we can provide restoration trust agencies with the information necessary to set realistic targets and performance measures for Biscayne Bay.

# INTRODUCTION

During the last century, Biscayne Bay has been greatly affected by anthropogenic alteration of the environment through urbanization of the Miami/Dade County area and alteration of natural freshwater flow patterns. The sources, timing, delivery, and quality of freshwater flow into the Bay have been changed by construction of a complex canal system that controls movement of water throughout south Florida (SWIM, 1995). Changes in shoreline and sub-aquatic vegetation and marine organisms observed during the last century have been attributed to changes in water delivery.

Current restoration goals include restoration of the natural flow of fresh water into Biscayne and Florida Bays and of the natural fauna and flora, but first we need to determine pre-alteration baseline conditions in order to establish targets and performance measures for restoration. This research is part of an ongoing study designed to address the needs of the Biscayne Bay Coastal Wetlands Project (BBCW) of the Comprehensive Everglades Restoration Plan (CERP). The purpose of the BBCW Project is "to rehydrate wetlands and reduce point source discharge to Biscayne Bay" (http://www.evergladesplan.org/pm/projects/proj_28.cfm) and the project identifies the need to "define target freshwater flows for Biscayne Bay and the wetlands."

Examination of natural patterns of temporal change in salinity, water quality, vegetation, and benthic fauna in Biscayne Bay and the nearby wetlands during the last 100-500 years provides data necessary to set realistic targets to achieve the BBCW Project goals. Long term data covering decadal to centennial scale change is necessary in order to understand components of change due to natural cycles and to set targets that encompass the natural range of variation present within the ecosystem.

Cores collected in sediment deposits retain information about the history of an ecosystem in the sediments themselves and in the fauna and flora preserved in the sediments. A multiproxy approach utilizes several major groups of animals (forams, ostracodes, and mollusks – over 150 faunal groups in all), pollen, and geochemical data to determine past sequences of change to the environment and derive information on the physical, chemical and biological components of the environment. The interpretations of the faunal and floral assemblages in the cores are based on observations and analyses of modern organisms (Brewster-Wingard and others, 2001; Cronin and others, 2001; Ishman, 2001). By using multiple proxies, we are able to derive more detailed information, examine the covariance of environmental indicators, and increase confidence in the results. This approach, utilized in this study, has been successfully applied to research in Florida Bay and in a previous project in Biscayne Bay (Brewster-Wingard and others, 1998; Brewster-Wingard and Ishman, 1999; Ishman and others, 1998; Nelsen and others, 2002; Wardlaw, 2001).

## Project Goals: Scientific

- **To determine the historical sources, timing and delivery of freshwater input into Biscayne Bay**
- **To determine changes in sub-aquatic and shoreline vegetation and associated fauna**
- **To provide information on natural variability within the system, sequences of changes to the system, and possible causes of change**

## Project Goals: Management Needs

**Address the needs of SFWMD and the ACOE in implementing the CERP Biscayne Bay Coastal Wetlands Project (BBCW) by providing:**

- **Realistic targets and performance measures for freshwater influx, sub-aquatic vegetation, and wetlands vegetation**
- **Insight into natural patterns and scales of change, and possible causes of change that will allow predictive capabilities as restoration proceeds**

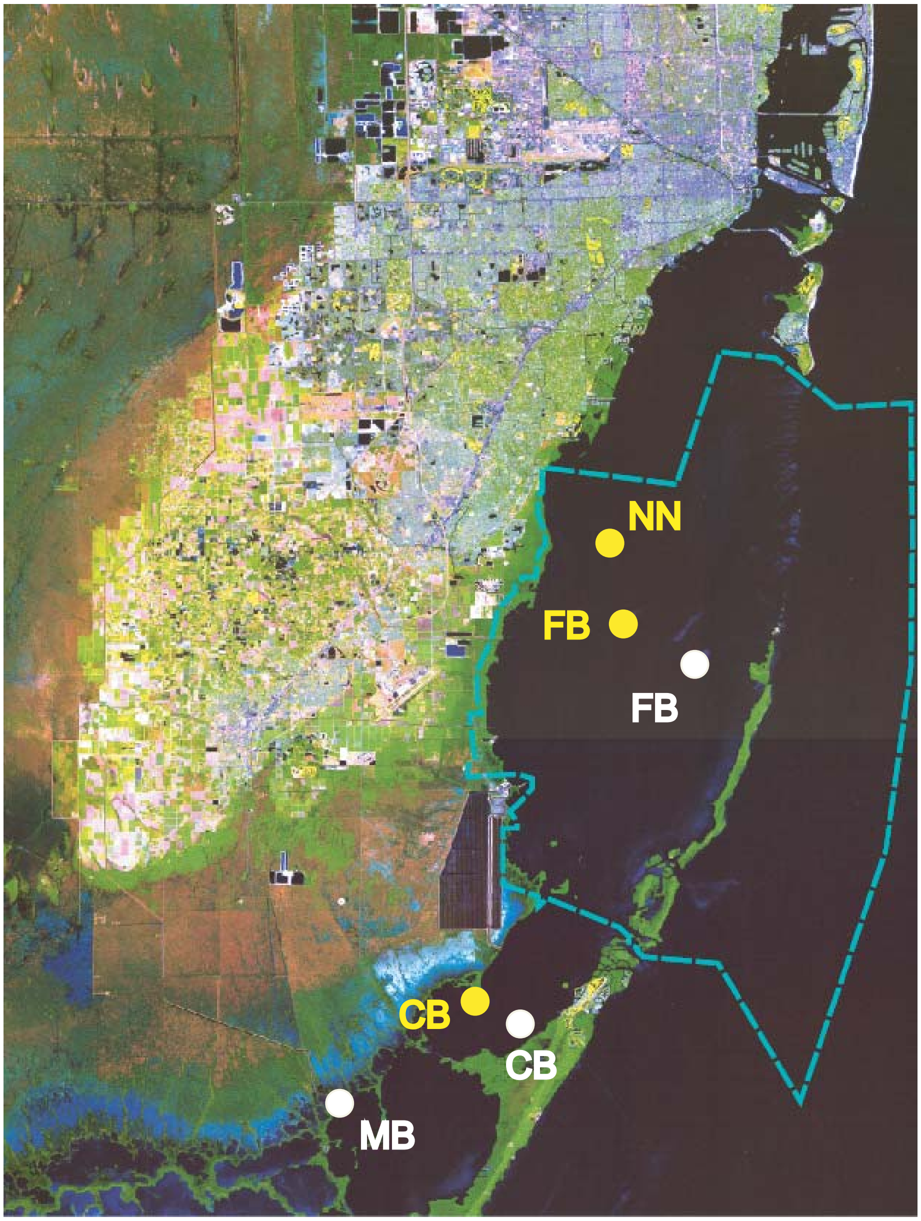
**Address Biscayne National Park needs to protect their natural resources, specifically to reestablish natural freshwater flows and to protect the health of the coastal vegetation, seagrass beds and coral reefs by providing:**

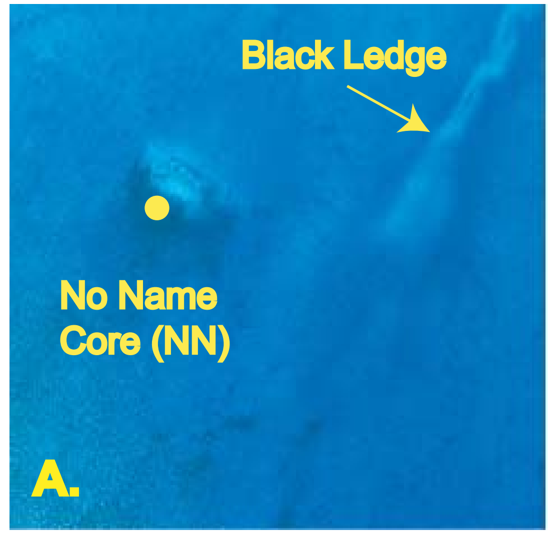
- **Information on historical conditions, natural ranges of variation, and changes the system has undergone during the 20th century.**

### Setting

Biscayne Bay is an elongate, shallow (1-3 m) bay bounded on the west by the south Florida Coast formed by the Atlantic Coastal Ridge made of Miami Limestone, and on the east by the northern Florida Keys formed by the Key Largo Limestone (Figure 1). The bay can be divided informally into northern, central and southern regions. Our investigations were conducted in the central and southern portions of the Bay, including Biscayne National Park. These areas are relatively undisturbed in comparison to the northern Bay near the Miami area.

Sedimentation is controlled mainly by bedrock topography, *Thalassia* (seagrass) distribution, winds, tides, and longshore currents. Modern bottom sediments consist of





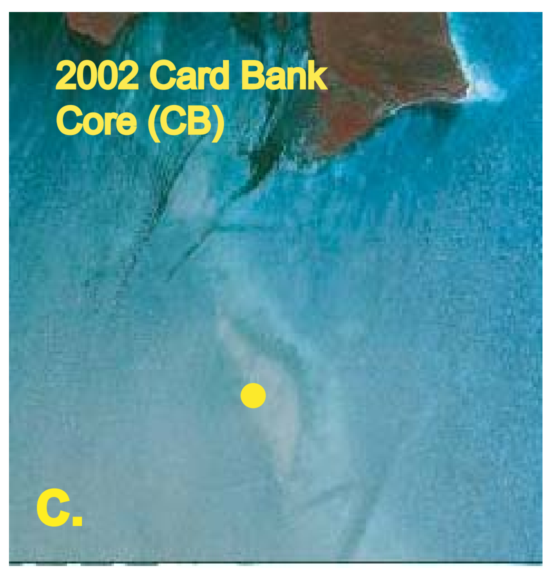



Figure 1. Location of cores collected in 2002 (yellow dots) and 1996-97 (white dots). Blue dash line represents boundary of Biscayne National Park. (Image cropped from Jones, et al. 2001). Detailed digital ortho photo quads (DOQ) of A. No Name Bank; B. Featherbed Bank (western side); and C. Card Bank (northern side). (DOQs cropped from images obtained from http://edcsns17.cr.usgs.gov/EarthExplorer. A = Perrine FL 7.5" quadrangle, NE quadrant, acquired 1/15/1994. B=Perrine FL 7.5" quadrangle, SE quadrant, acquired 1/15/1994. C=Card Sound FL 7.5" quadrangle, NW quadrant, acquired 1/15/1994.)

quartz sand, carbonate sand, and mud (especially in southern Card and Barnes Sounds) with large areas of little or no Holocene sediment accumulation (see Wanless, 1969; Tedesco and Wanless, 1991; and Wanless and others, 1995; for detailed discussion of sediment composition, distribution and genesis).

## ACKNOWLEDGEMENTS

This project is jointly funded by the South Florida Water Management District and the U.S. Geological Survey Place-Based Studies Program, under SFWMD contract no. C-13400, Biscayne Bay Paleoecological Salinity Study. We would especially like to thank our Project Managers Richard Alleman and Trisha Stone at SFWMD, and Ronnie Best, USGS, for their assistance and support. Many individuals at Biscayne National Park have facilitated this research; Richard Curry and Shay Viehman deserve special thanks. We owe our gratitude to the radiology department at Mariners Hospital, Tavernier, FL. Meg Griswald, Radiology Supervisor, accommodated us and made arrangements for us to have our cores x-rayed. Joan Baker and Cathy Ball, radiology technicians at Mariners, did an incredible job producing the x-radiographs of the cores included in this report. Keys Marine Lab, Long Key Florida, provided the facilities for us to cut the cores. Jack McGeehin, USGS, conducted the carbon-14 analyses. Bruce Wardlaw, USGS, improved the quality of this manuscript with his thorough review.

## MATERIAL AND METHODS

### Core Sites and Collection

Six cores were collected from three sites in Biscayne Bay on April 30, 2002 from the following locations (Table 1; Figure 1): 1) Card Bank; 2) Featherbed Bank; and 3) No Name Bank. Duplicate cores, A and B, were taken side by side at each site (10-20 cm apart). The sites were selected based on SFWMD research priorities to 1) characterize pre-drainage conditions (prior to 1900) and 2) to identify trends beginning in the 1960's and 1970's as diversion of water caused changes in the freshwater distribution and influx into the Bay. The three sites collected had greater than one meter of sediment cover, little human disturbance, and relatively low incidence of bioturbation.

Table 1: List of cores collected in April 2002.

| | No Name Bank | | Featherbed Bank | | Card Bank | |
|---|---|---|---|---|---|---|
| Latitude | N 25°34.484 | | N 25°31.850 | | N 25°19.295 | |
| Longitude | W 80°16.320 | | W 80°15.575 | | W 80°21.362 | |
| | GLW402 -NNA | GLW402 -NNB | GLW402 -FBA | GLW402 -FBB | GLW402 -CBA | GLW402 -CBB |
| Date collected | 4/30/2002 | 4/30/2002 | 4/30/2002 | 4/30/2002 | 4/30/2002 | 4/30/2002 |
| Salinity at surface (ppt) | 37.72 | 37.72 | 38.17 | 38.17 | 38.57 | 38.57 |
| Salinity at sediment interface (ppt) | 37.79 | 37.79 | 38.23 | 38.23 | 38.60 | 38.60 |
| Temp. at surface (deg C) | 28.44 | 28.44 | 29.44 | 29.44 | 28.35 | 28.35 |
| Temp. at sediment interface (deg C) | 28.49 | 28.49 | 29.46 | 29.46 | 28.25 | 28.25 |
| Water depth at core (cm) | 50.0 | 50.0 | 60.0 | 60.0 | 76.0 | 76.0 |
| Initial core length (cm) | 150.0 | 163.0 | 195.5 | 209.0 | 157.5 | 154.5 |
| Core length when cut (cm) | 144.0 | 153.0 | 188.0 | 197.0 | 149.0 | 148.0 |
| Loss due to compaction (cm) | 6.0 | 10.0 | 7.5 | 12.0 | 8.5 | 6.5 |

Subset A cores were analyzed for pollen and $^{210}$Pb, with samples extracted for nutrient and diatom analyses to be performed at a later date. The remainder of each sample from the A cores has been archived. Subset B cores were analyzed for all faunal and macro-plant remains. Careful examination of the stratigraphy and x-radiographs (Figures 2-4) of the A and B cores provided assurance that data from the two cores can be confidently compared. Core descriptions are in Appendix A.

This report also reviews results from 3 cores collected between 1996 and 1997 at Featherbed Bank (SEI297-FB1), Card Bank (SEI297-CB1), and Manatee Bay (SEI1196-MB1) (Figure 1). Information on core sites is given in Table 2 and descriptions of the 1996-97 cores can be found in Ishman (1997). Ishman and others, (1998) described the faunal and floral patterns obtained from the SEI1196-MB1 core and Stone and others (2000) describes the faunal assemblages at SEI297-FB1. New Mg/Ca data is presented in this report for SEI297-FB1, and ostracode data from SEI297-CB1 is included in the appendices. Interpretations and patterns in the 1996 and 1997 cores are discussed in light of the new findings from the April 2002 cores.

Table 2: List of cores collected in 1996-1997 (adapted from Ishman, 1997, Table 1)

| Core Location | Core Number | Latitude | Longitude | Core Length (cm) |
|---|---|---|---|---|
| Featherbed Bank | SEI2997-FB1 | 25 31.31 N | 80 15.39W | 225 |
| Card Bank | SEI297-CB1 | 25 18.37 N | 80 20.63 W | 146 |
| Manatee Bay | SEI1196-MB1 | 25 15.69 N | 80 24.06 W | 120 |

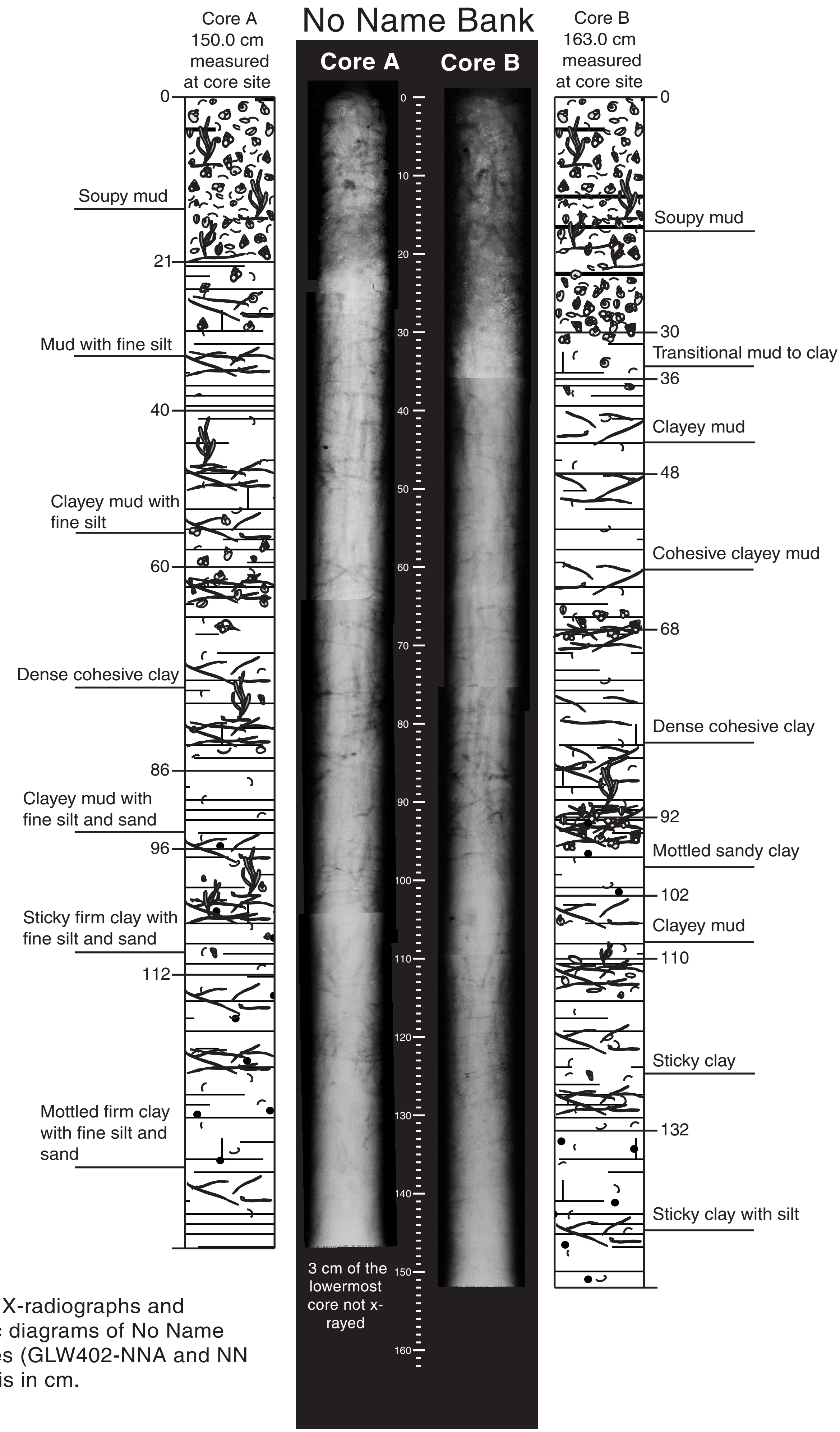



Figure 2 . X-radiographs and schematic diagrams of No Name Bank cores (GLW402-NNA and NN B). Scale is in cm.

# Featherbed Bank

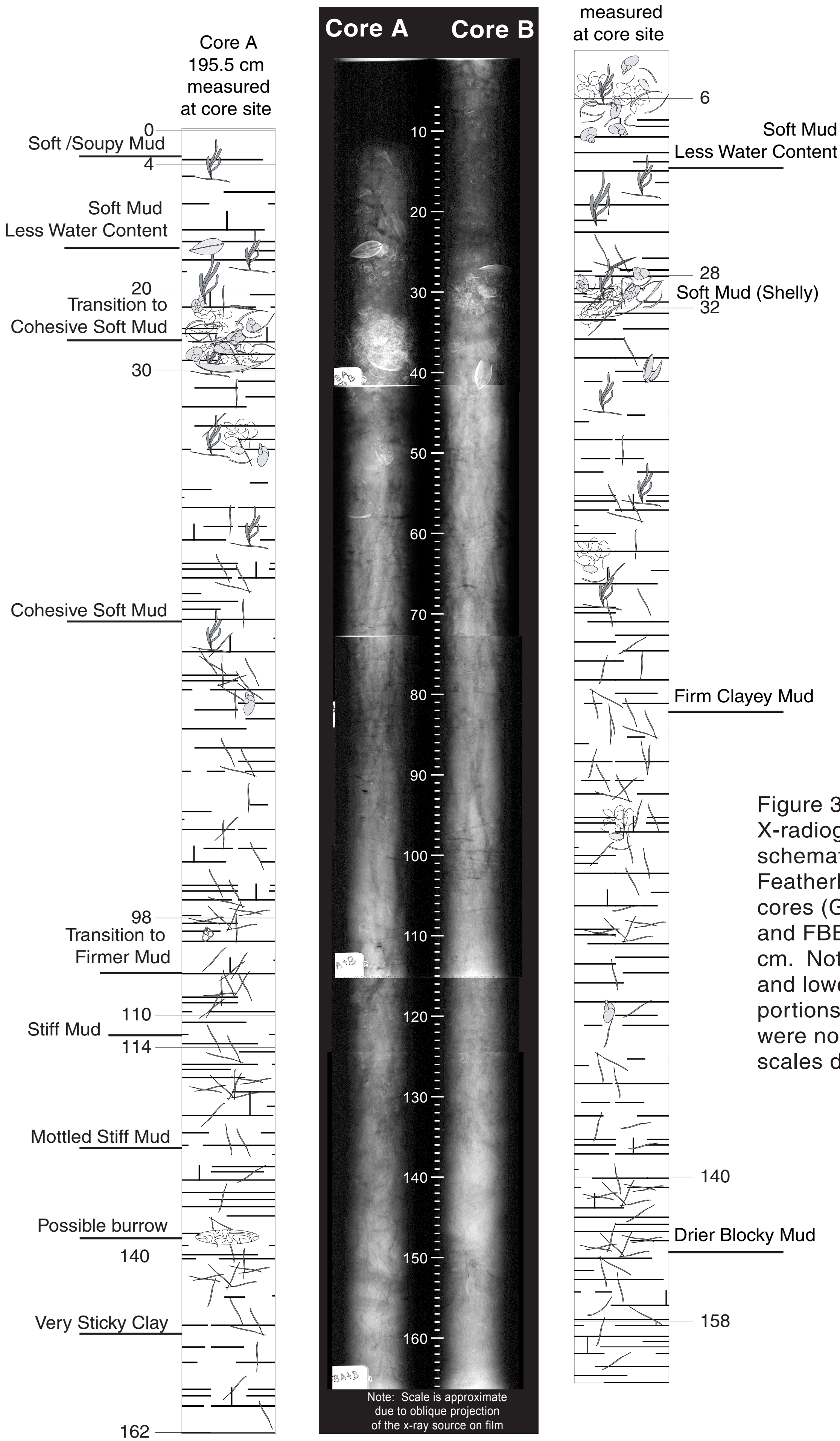



Figure 3.
X-radiographs and schematic diagrams of Featherbed Bank cores (GLW402-FBA and FBB). Scale is in cm. Note: uppermost and lowermost portions of B core were not x-rayed, so scales do not line up.

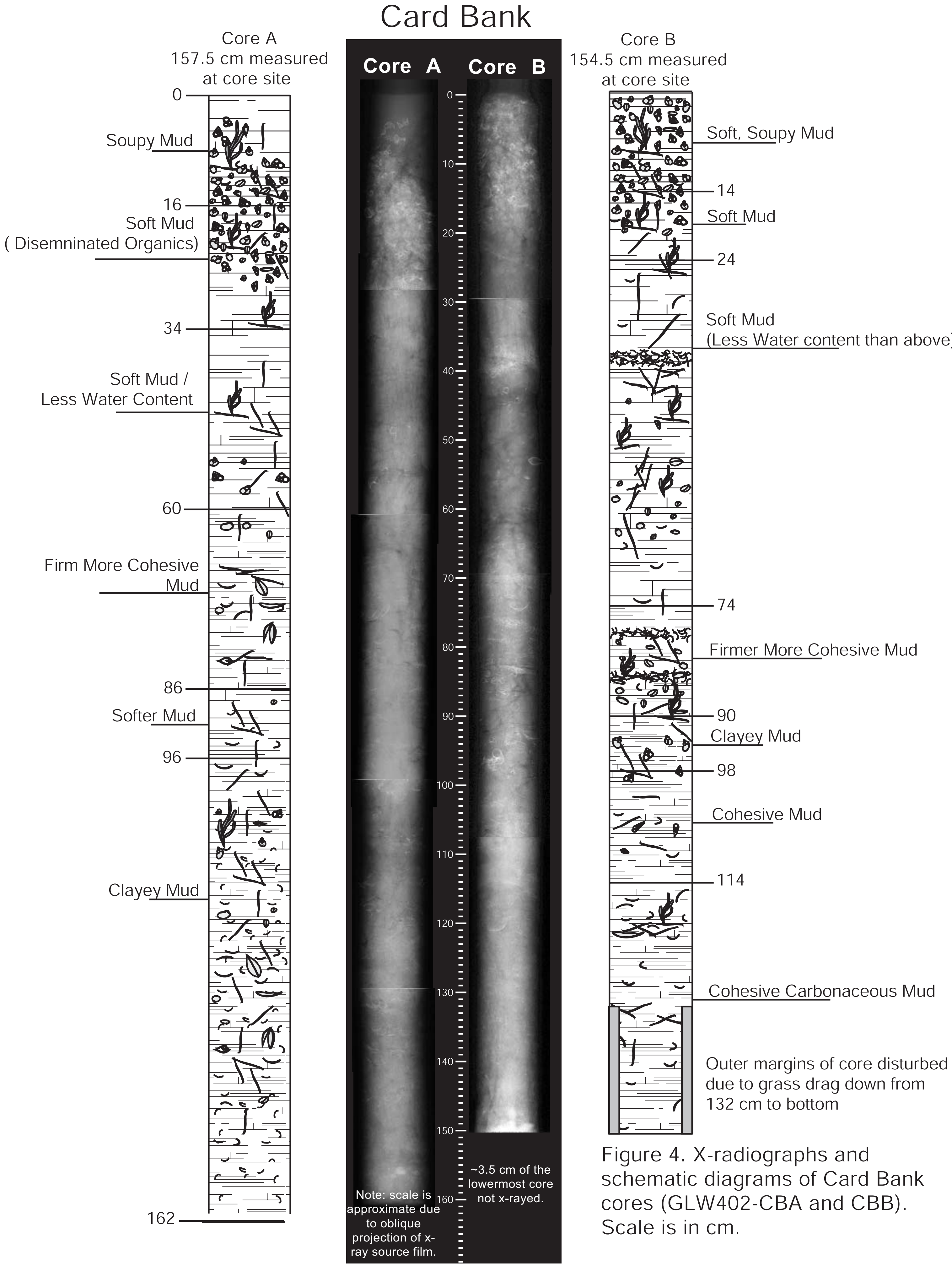



Figure 4. X-radiographs and schematic diagrams of Card Bank cores (GLW402-CBA and CBB). Scale is in cm.

## Faunal and Floral Analyses

Pollen, foraminifers, ostracodes, and mollusks were analyzed using the processing procedures described in Ishman and others (1998), Cronin and others, (2001), Brewster-Wingard and others, (2001), and Willard and others (2001), respectively. Sampling intervals varied from 2-cm to 10-cm spaced samples depending on chronology, stratigraphy, and time constraints (Table 3). Faunal data were converted to percent abundance for comparisons.

Table 3: Distribution of faunal and floral sampling for 2002 cores.

| | **No Name Core (GLW402 NN)** | | **Featherbed Core (GLW402 FB)** | | **Card Bank (GLW402 CB)** | |
|---|---|---|---|---|---|---|
| | Sampling Interval | Number of Taxonomic Groups | Sampling Interval | Number of Taxonomic Groups | Sampling Interval | Number of Taxonomic Groups |
| Pollen | 10 cm | 37 | 10 cm | 29 | 10 cm | 36 |
| Foraminifera | 2 cm | 91 | | | | |
| Ostracoda | 2 cm | 11 | | | | |
| Mollusca | 8 cm | 79 | 8 cm | 95 | | |

_Pollen:_ Pollen assemblages from No Name Bank (GLW402-NN-A), Featherbed Bank (GLW402-FB-A), and Card Bank (GLW402-CB-A), cores were analyzed at 10-cm intervals, identified into 37 taxonomic categories, to reconstruct past vegetation changes on land adjacent to the bay.

_Foraminifera:_ A total of 71 samples at 2 cm intervals were picked for foraminifera from the ≥ 63 μ fraction of the No Name Bank Core (GLW402 NNB). Preliminary analyses were conducted on 20 samples selected at approximately 8 cm intervals. A total of 300 foraminifera were picked from each sample when possible, otherwise all the foraminifera present in the sample were picked. The results from the preliminary report (20 samples) presented the data showing absolute counts and relative abundances of 55 taxonomic groups (species and species groups [spp.]). From the preliminary analyses it was determined that 100 specimens would result in the same conclusions as those achieved using total counts of 300 and increase the efficiency of the analyses by allowing 3 times as many samples to be analyzed, increasing the temporal resolution of the results. The subsequent counts of the additional 51 samples produced 91 taxonomic groups within the core. In order to compare the data from the preliminary analyses, using 300 counts, and the subsequent analyses, using 100 counts when possible, the data was standardized using the log normal transform. This method is used because of the different scales used for the counts. For final comparison to ostracode and mollusk data, benthic foraminifer data were converted to percent abundance. No significant differences were noted between log-normal and percent abundance plots.

_Ostracoda_: Sixty-eight samples from No Name (GLW402 NNB) were analyzed at 2-cm intervals. One hundred specimens were picked from ≥ 150 μ fraction and sorted into eleven taxonomic categories representing either indicator species, genera or groups having similar ecological preferences.

<u>Mollusca</u>: Samples from No Name (GLW402 NNB) and Featherbed Bank (GLW402 FB) Cores were analyzed at 8-cm intervals for molluscan faunal assemblages. All mollusks ≥ 850 μ were picked, sorted, and classified into one of nine preservation categories and 79 taxonomic categories. The data presented here represent all specimens counted, excluding worn specimens and fragments, which may be more indicative of transport rather than in situ conditions.

## Ostracode Shell Chemistry Analyses

In addition to faunal analyses, geochemical studies of metal/calcium ratios also were carried out on ostracode shells from the cores at Featherbed Bank (SEI297 FB-1) and No Name Bank (GLW402 NNB) to reconstruct patterns of salinity variability. Metal/Ca ratios (especially magnesium/calcium (Mg/Ca)) are useful proxies for estimating past salinity changes in Florida and Biscayne Bays (Dwyer and Cronin, 2001). For efficiency and to allow for direct comparison between ostracode shell chemistry data and faunal assemblage data, ostracodes selected for analyses were picked directly from slides or sample residues used in the faunal assemblage analyses.

Four to five adult valves of ostracode *Loxoconcha matagordensis* were selected from each sample interval. These valves were processed and analyzed individually for Mg/Ca, Sr/Ca, and Na/Ca ratios by direct current plasma atomic emission spectrophotometry (DCP-AES) following procedures in Dwyer and Cronin (2001, and references therein). Precision on Mg/Ca, Sr/Ca, and Na/Ca measurements is around 2%, 4%, and 10%. Some of the disparity in precision results is because the instrument is optimized for Mg/Ca ratio analysis since Mg/Ca has proven to be the most useful paleoenvironmental indicator. While their usefulness is unclear, Sr/Ca and Na/Ca ratios are collected because it requires no extra effort and with further study these data may provide additional paleoenvironmental information.

Prior to DCP-AES analysis, each valve was examined and assigned a preservation index (optical clarity-based dissolution index). In core SEI297-FB1, valve lengths were measured using a binocular microscope at 50X magnification in order to evaluate the possible use of this measure as a proxy indicator of water temperature. Preliminary studies by Japanese and US ostracode workers suggest that valve length in *Loxoconcha* is temperature dependent. Gender and valve (left, right) were also recorded. An effort was made to limit the possibility of analyzing valves from the same carapace, by selecting female left valves from each sample interval. Two sample intervals from the SEI297-FB1 core were replicated to evaluate intra-sample variability.

## Preliminary Age Model for Cores

The preliminary age model for each core site (A cores; Figures 5-7) was established using three methods of dating: 1) lead-210 analyses of the sediments (Figures 8-10); 2) carbon-

14 analysis of a shell from the lower portion of the cores; and 3) first occurrence of *Casuarina* pollen (Australian Pine). The lead-210 analysis was used to establish the chronology of the upper portions of the core since lead-210 provides reliable age models for samples up to approximately 100 years old (see Holmes and others, 2001, for detailed explanation of the methodology). Future analyses will investigate the causes of different background lead-210 and radon-226 from one bank to another within Biscayne Bay and the potential effects these differences have on age models.

Carbon-14 analyses on individual shells from the lower portion of the cores established a tie-point to the oldest lead-210 date (Table 4). Because we have only dated the basal portion of each core, these are preliminary age models only. Conventional radiocarbon ages on marine shells must be corrected to account for reservoir effect of ocean circulation of carbon. In this report, ages were calibrated using the standard marine reservoir correction of 400 years using the Calib 43 program (Stuiver and others, 1998). We refer to calibrated ages in terms of calendar years (AD); the conventional calibrated radiocarbon dates (in years before 1950 (yr BP)) and the two sigma errors are also provided in Table 4. Because local atmospheric and oceanic processes also may affect the radiocarbon ages of marine shells, future research will include dating of mollusks collected live in the early 20th century before atomic testing elevated carbon-14 values above 1950 AD levels. This will establish the appropriate reservoir correction for Biscayne Bay mollusks and facilitate correlation with other regions.

Table 4: Data on carbon-14 analyses performed at USGS radiocarbon laboratory. Years before present (yrBP) = years before 1950.

| Core ID | Depth (cm) | Sample | Conventional $C^{14}$ Age (yrBP) | ± 1σ | Calibrated yrBP | 2σ calibrated age range | Years before collection (2002) * | Corrected age range * |
|---|---|---|---|---|---|---|---|---|
| GLW402-CBA | 122-124 | mollusk *Chione* | 830 | 40 | 470 | 515-413 | 522 | 567-465 |
| GLW402-FBB | 186-188 | mollusk *Turbo* | 540 | 35 | 167 | 268-0 | 219 | 320-52 ^ |
| GLW402-NNB | 138-140 | mollusk *Chione* | 670 | 35 | 297 | 405-263 | 349 | 457-315 |

* Data plotted on Figures 5-7.

^ Reported result indicates a calibrated age of 0 BP (corrected age of 52 years before 2002) and is beyond the limit of radiocarbon dating.

The first occurrence of *Casuarina* pollen (Australian Pine), an exotic introduced into south Florida in the late 1800s (Langeland, 1990), provides a good stratigraphic marker for the beginning of the 20th century in the cores. Consistency between *Casuarina* pollen records and lead-210 age models provides confidence in the position of this important horizon in the cores. A lack of correspondence between *Casuarina* and lead-210 age models provides a warning that the sediments may be disturbed.

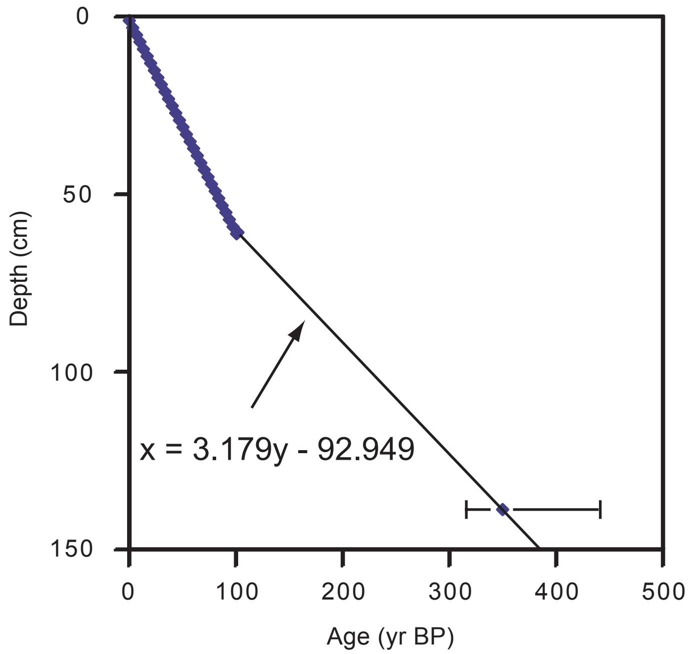



Figure 5. Age vs. depth, No Name Bank cores. yrBP indicates years before 2002 AD. The age model for 1900-2002 is based on lead-210 from GLW402-NNA; the age model from 1900 AD to the base of the core is a linear interpolation between the lowest lead-210 date and a radiocarbon date at 139 cm in GLW402-NNB.

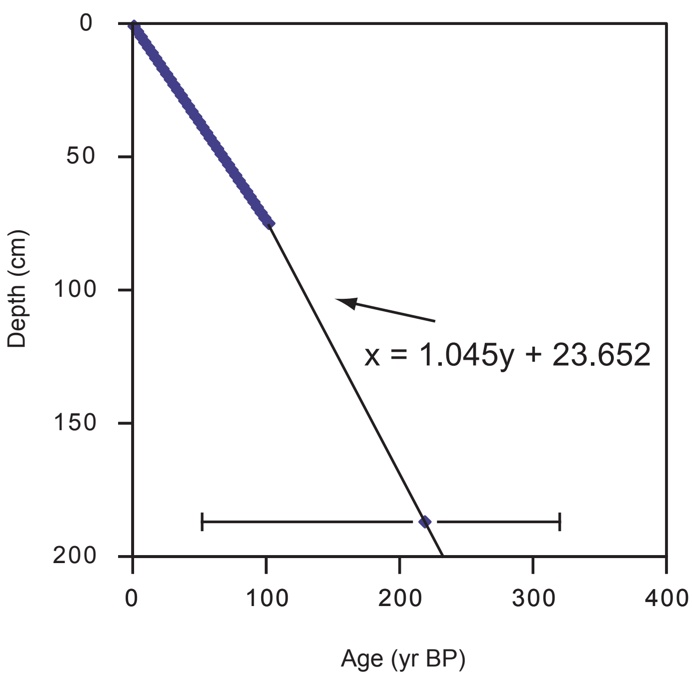



Figure 6. Age vs. depth, Featherbed Bank cores. yrBP indicates years before 2002 AD. The age model for 1900-2002 is based on lead-210 from GLW402-FBA; the age model from 1900 AD to the base of the core is a linear interpolation between the lowest lead-210 date and a radiocarbon date at 187 cm in GLW402-FBB.

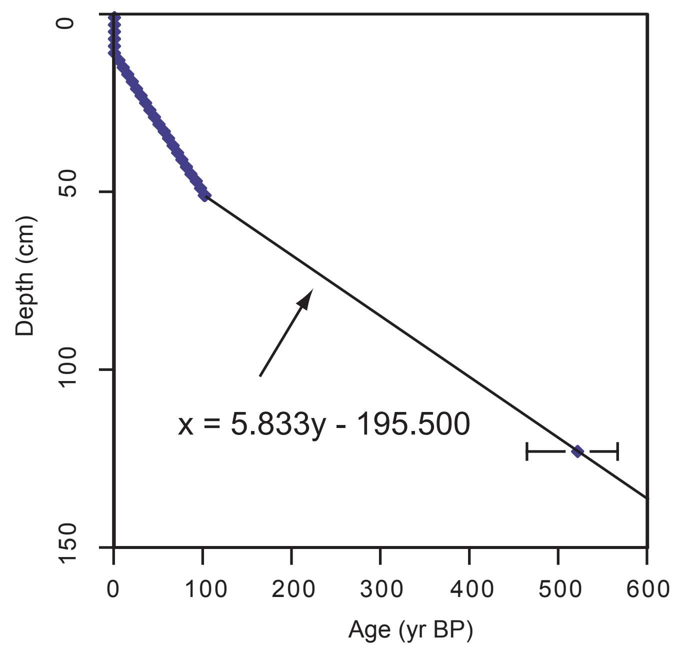



Figure 7. Age vs. depth, Card Bank core (GLW402-CBA). yrBP indicates years before 2002 AD. The age model for 1900-2002 is based on lead-210; the age model from 1900 AD to the base of the core is a linear interpolation between the lowest lead-210 date and a radiocarbon date at 123 cm.

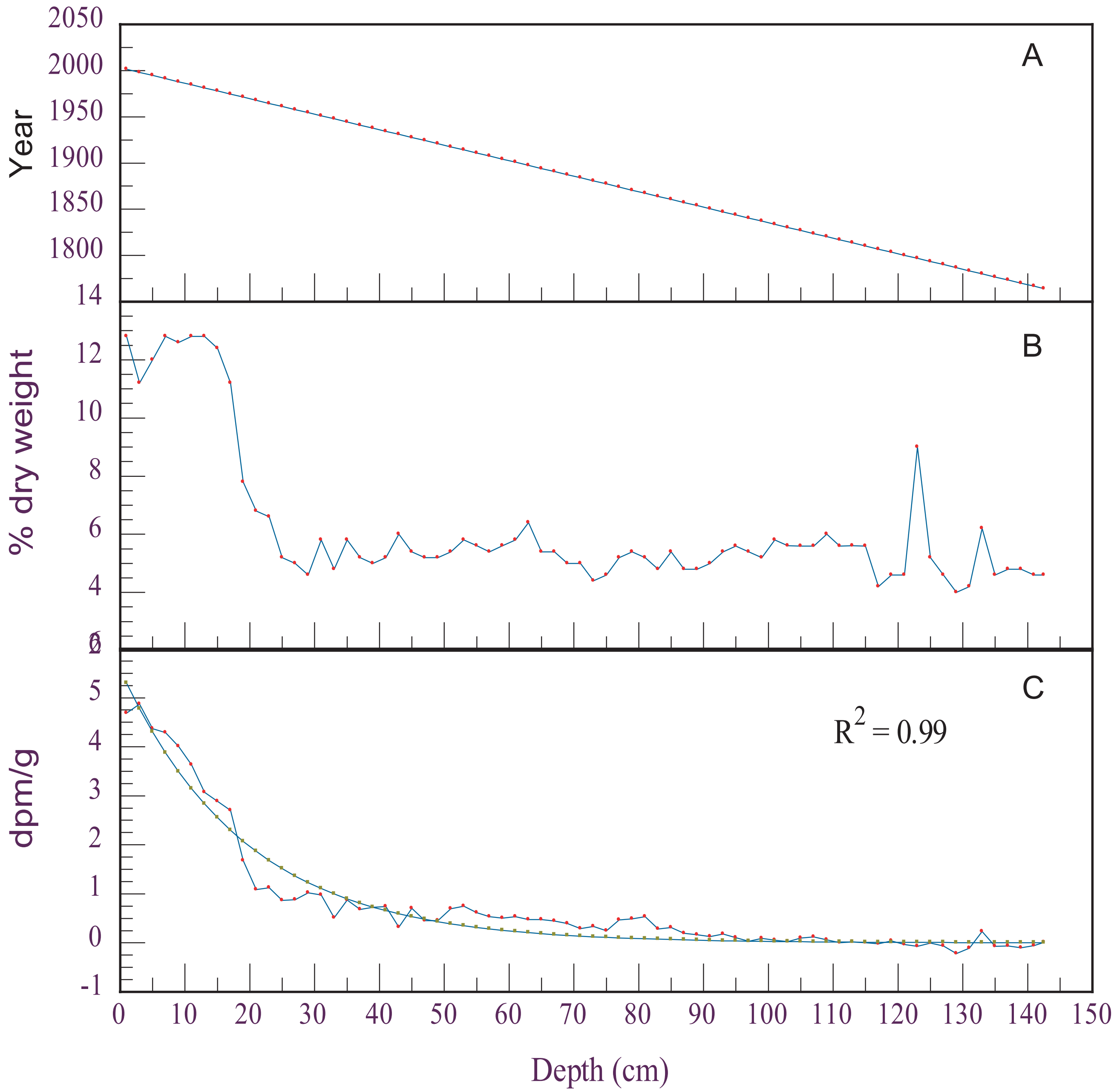



Figure 8. Lead-210 data for No Name Bank core (GLW402-NNA). A. Projected year at depth. B. Loss on ignition (% dry weight). C. Excess lead-210 activity (dpm/g).

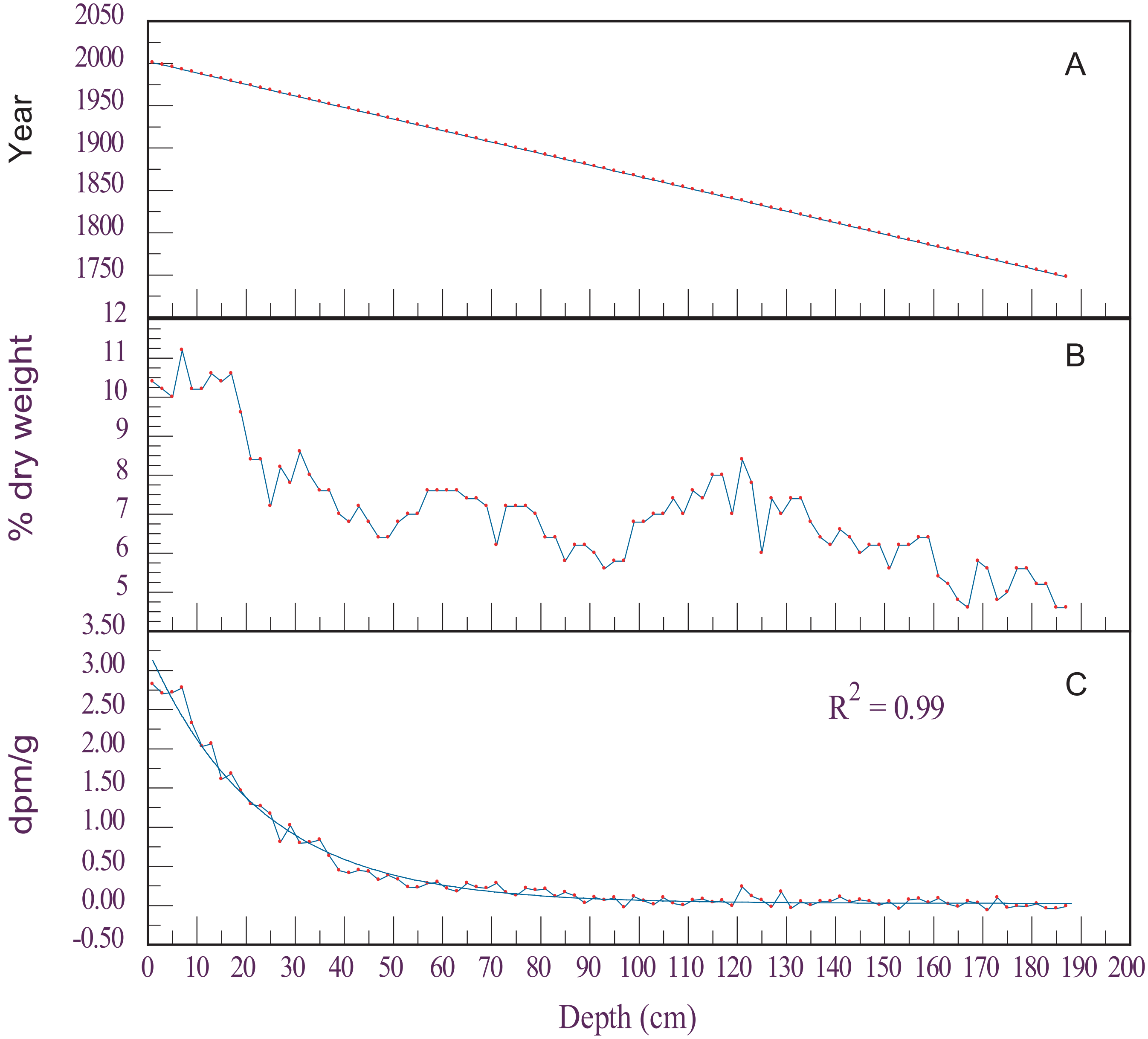



Figure 9. Lead-210 data for Featherbed Bank core (GLW402-FBA). A. Projected year at depth. B. Loss on ignition (% dry weight). C. Excess lead-210 activity (dpm/g).

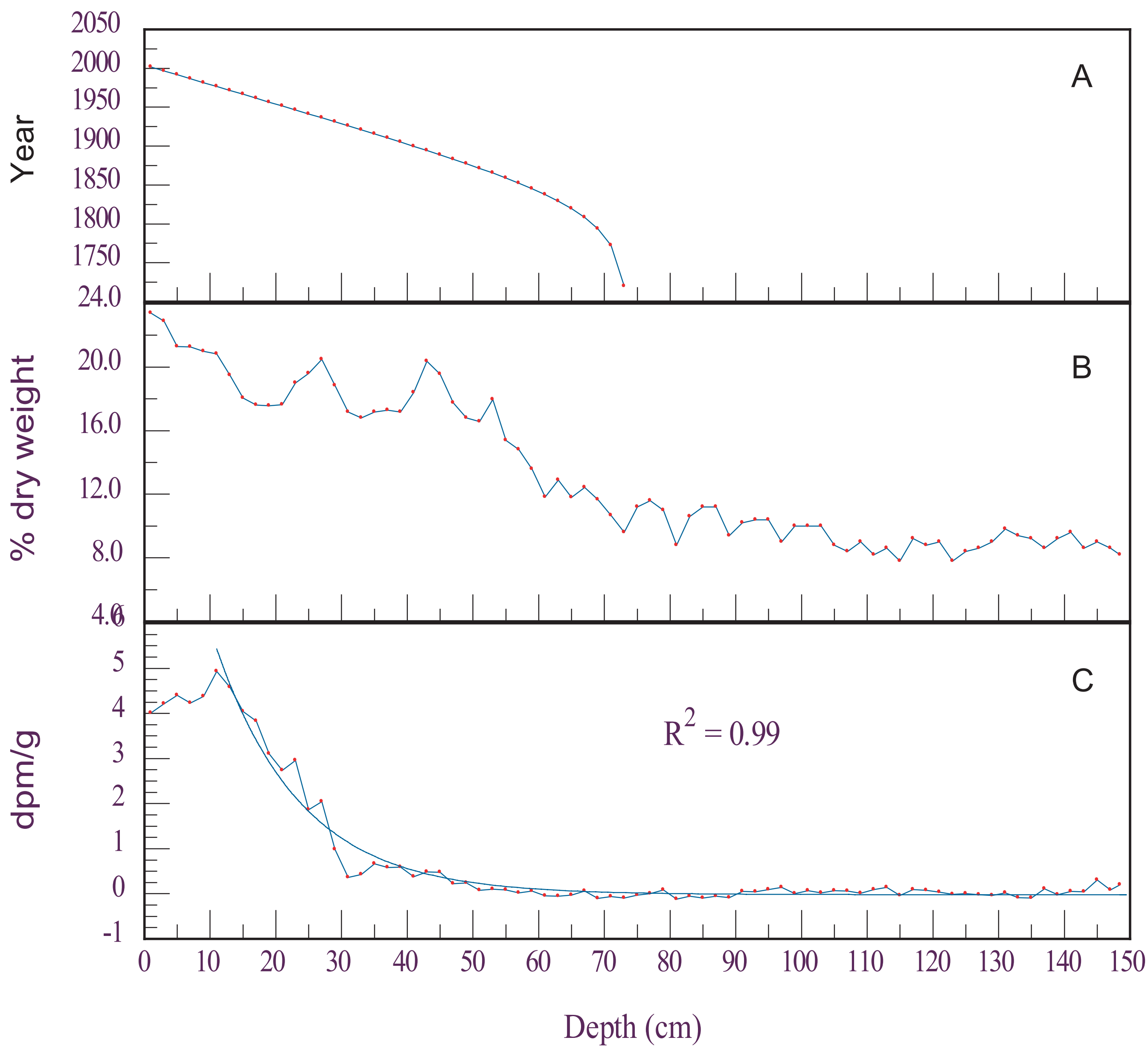



Figure 10. Lead-210 data for Card Bank core (GLW402-CBA). A. Projected year at depth. B. Loss on ignition (% dry weight). C. Excess lead-210 activity (dpm/g).

# RESULTS

## Pollen Assemblages and Trends

Pollen assemblages from No Name Bank (GLW402-NNA), Featherbed Bank (GLW402-FBA), and Card Bank (GLW402-CBA) are all strongly dominated (50- 99%) by *Pinus* (pine) pollen, with values decreasing during the 20$^{th}$ century (Figures 11-13, Appendices B, C, and D). Three assemblage zones are distinguishable in the three cores. The basal unit, zone 1, is characterized by an absence of *Casuarina* (Australian pine) pollen and extremely high abundance (>90%) of *Pinus* pollen. The base of zone 2 is marked by the appearance of *Casuarina* pollen; pollen of marsh taxa (grasses, sedges, asters) and fern spores are more abundant in this zone. The uppermost unit, zone 3, is distinguished by 15-20% *Quercus* (oak) pollen and sharp decreases in abundance of *Pinus* pollen to ~50%. In this unit, *Casuarina* and *Myrica* (wax myrtle) pollen also increase in abundance.

## Faunal Assemblages and Trends

### No Name Bank

The results discussed below all pertain to the core collected at No Name bank in April 2002 (GLW402-NNB).

**<u>Faunal Assemblages</u>**

Approximately 91 foraminiferal taxonomic groups were identified that include species and species groups (spp.) (Appendix E). The foraminiferal assemblages include rotaliid, textulariid, and miliolid forms. All foraminifera identified were benthic with miliolid and rotaliid forms dominant. The arenaceous textulariids constituted a minor component. No planktonic forms were present. The rotaliids are dominated by the genera *Rosalina* and *Cribroelphidium/ Elphidium*. The miliolids are dominated by the genera *Quinqueloculina, Triloculina* and *Miliolinella*. Other important genera occurring in the core are *Ammonia, Archaias, Articulina*, and *Bolivina*. The textulariids are a minor component of the assemblages represented by the genera *Clavulina* and *Valvulina*.

The ostracode assemblages are dominated by *Loxoconcha matagordensis*, *Xestoleberis* spp. and bairdiids (a family of marine ostracodes) with lesser amounts of *Malzella floridana* and other marine species (Appendix F).

The No Name Bank Core has a diverse, generally open-bay to marine molluscan assemblage containing 79 faunal groups (species, genera, and a few family groups) (Appendix G). The dominant species in the core are *Bittiolum varium*, *Laevicardium mortoni*, *Schwartizella catesbyana*, *Parvilucina multilineata*, and *Turbo castaneus*.

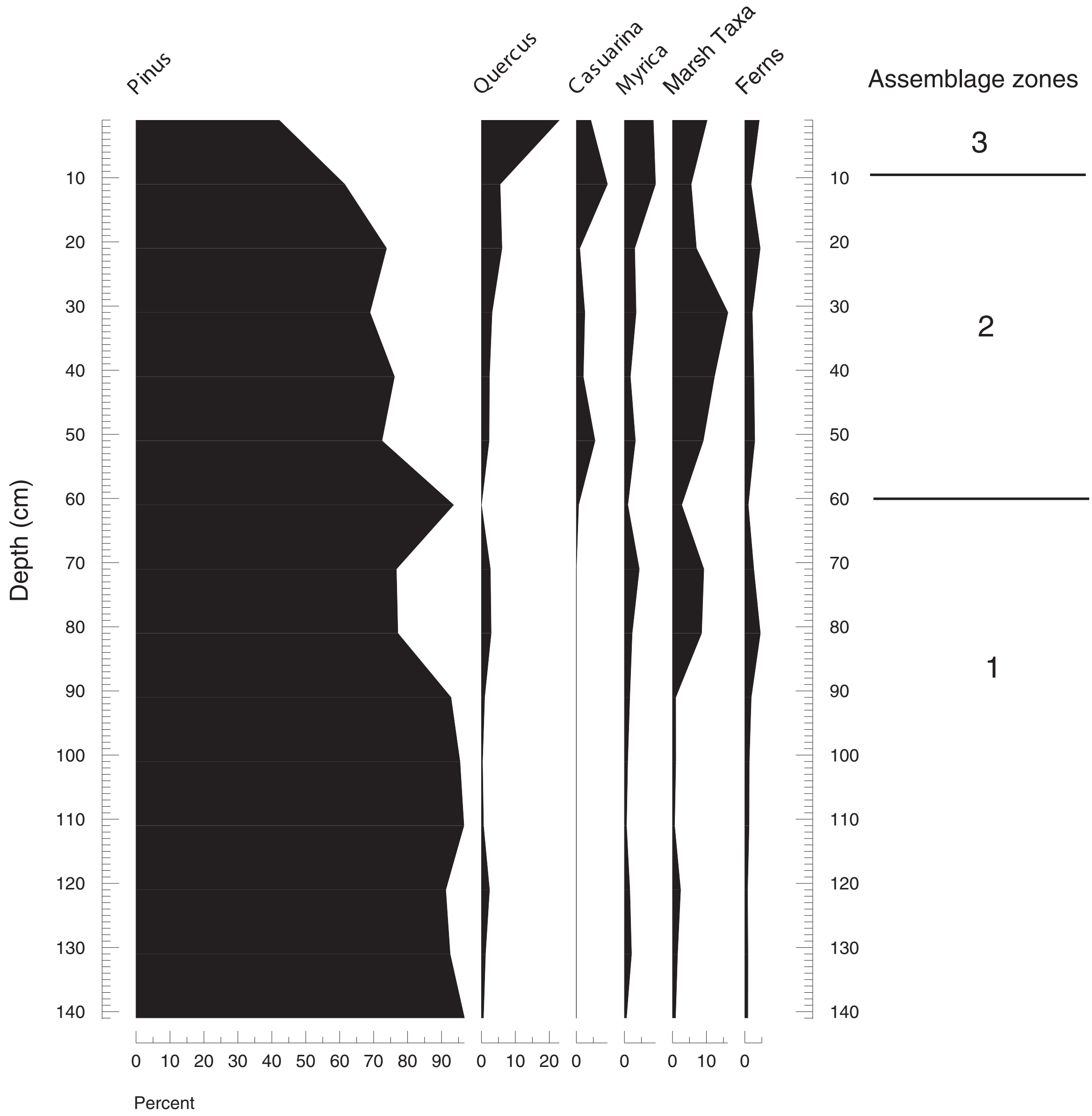



Figure 11. Percent abundance of pollen of major plant types, at No Name Bank (GLW402-NNA). "Marsh taxa" includes the Asteraceae, Cyperaceae, Nympheaceae, and Poaceae. (See Appendix B for data.)

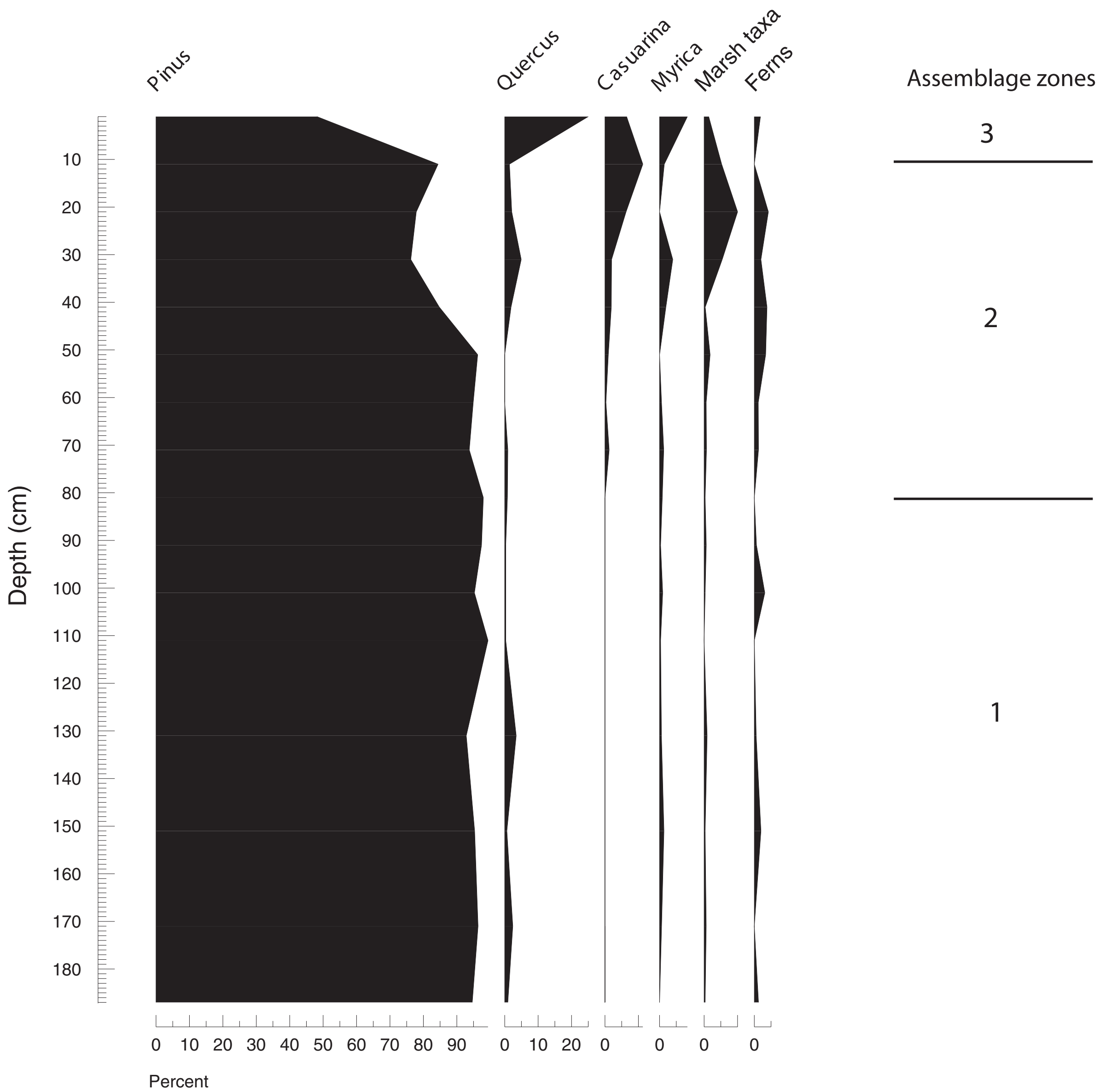



Figure 12. Percent abundance of pollen of major plant types, Featherbed Bank core (GLW402-FBA). "Marsh taxa" includes the Asteraceae, Cyperaceae, Nympheaceae, and Poaceae. (See Appendix C for data.)

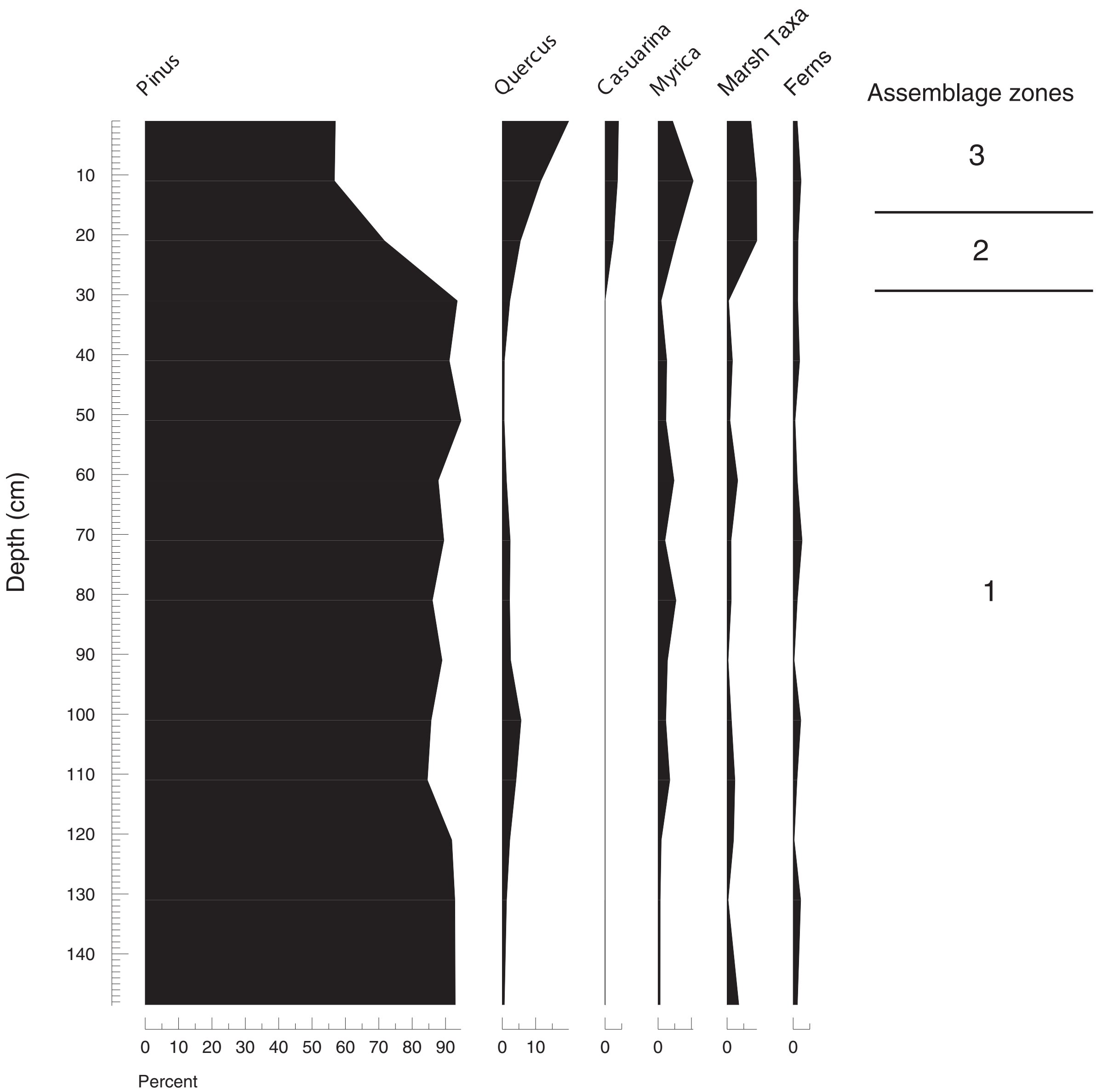



Figure 13. Percent bundance of pollen of major plant types, Card Bank core (GLW402-CBA). "Marsh taxa" includes the Asteraceae, Cyperaceae, Nympheaceae, and Poaceae. (See Appendix D for data.)

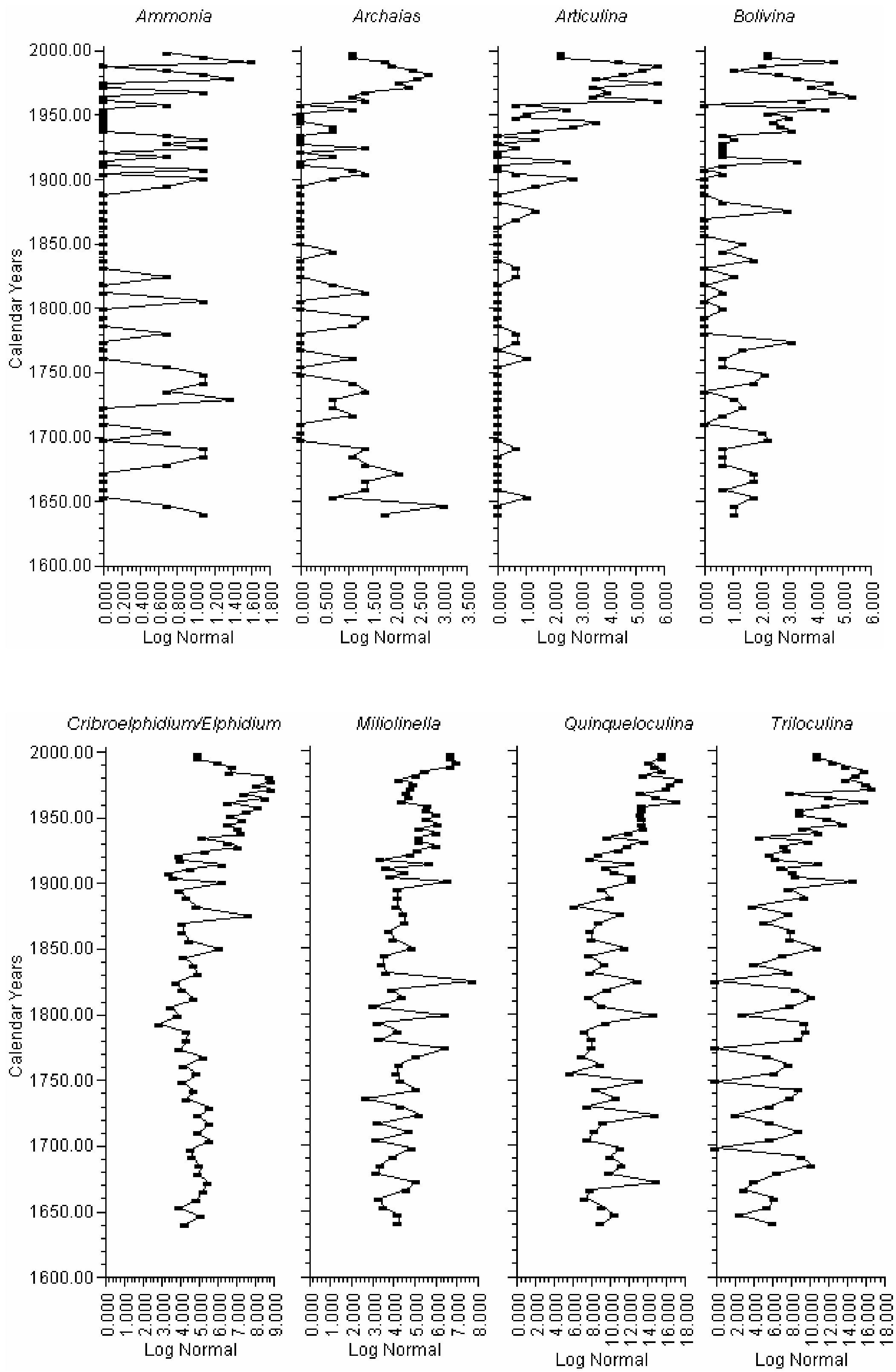



Figure 14. Downcore log normal plots of the major benthic foraminiferal taxonomic groups present in the No Name Bank Core (GLW402-NNB).

**Faunal Trends**

The distribution of faunal elements is presented in the interpreted time interval of deposition.

*Foraminifera:* *Ammonia* is present in very low abundance throughout the core but is absent from about 1830-1890 (Figure 14; Appendix E). *Archaias* also is found in low abundances throughout the core; however there are several significant intervals. From 1640-~1700, *Archaias* is abundant. *Archaias* is absent from 1850-1895 and then significantly increases between 1958-1981 before declining to moderate abundances between 1981-1998. *Articulina* was rarely present in the core until the 1860s. Between 1958 and 1961 *Articulina* abundance increases from low to high and remains high until about 1991. From 1991 to 1998 there is a decline in this species' abundance.

*Bolivina* is typically an infaunal taxa associated with organic-rich sediments. It was absent to rare throughout the core (Figure 14); however, *Bolivina* abundance relative to the rest of the core increases from the 1930s to the 1970s.

The *Cribroelphidium-Elphidium* and *Miliolinella* have been significant components of foraminiferal assemblages throughout the core (Figure 14). *Cribroelphidium-Elphidium* were most common between ~1930 and 1980 (especially post-1960), similar to the *Bolivina*. The *Cribroelphidium-Elphidium* abundance decreased from 1980-2000. The *Miliolinella* abundances were particularly high between 1920-1960 and ~1978-2000. Five of the six highest abundances of *Miliolinella* occurred in samples from 1988-2000.

*Quinqueloculina* and *Triloculina* also are common in the core (Figure 14). *Quinqueloculina* abundances were relatively stable until 1955, when they became more abundant. *Triloculina*, however, gradually increased in abundance throughout the core, with a significant increase post-1955. Since ~1980, however, *Triloculina* abundance decreased.

*Ostracoda:* The relative proportions of the ostracode taxa fluctuate downcore indicating important environmental changes in the vicinity of No Name Bank during the past four centuries (Figure 15, Appendix F). The more significant ostracode faunal changes include the following. Beginning around 1750, a gradual increase occurs in the bairdiids, a group of marine ostracodes, from < 10 % to 30- 40 %. Bairdiid relative abundance fluctuated between ~1918 and 1924, shifting from 16 to 60 %. *Loxoconcha matagordensis*, an epiphytal ostracode, increased in abundance from the early 1600s to the late 1700s, then declined sharply; and increased again beginning around 1800 until ~1900. The general trend in abundance of *Loxoconcha* during the 20$^{th}$ century is a decline. A progressive decline occurred in the abundance of *Xestoleberis* spp., an epiphytal species typically found on macro-benthic algae, beginning in the early to mid 1800s and continuing to the 1940s. *Malzella floridana*, a species tolerant of hypersalinity and often dominant in cores from central Florida Bay (Cronin and others, 2001) was present in persistently low abundances (<10%) throughout the core. However, prior to ~1910 *M. floridana* was consistently present and fluctuated between 1-13% abundance;

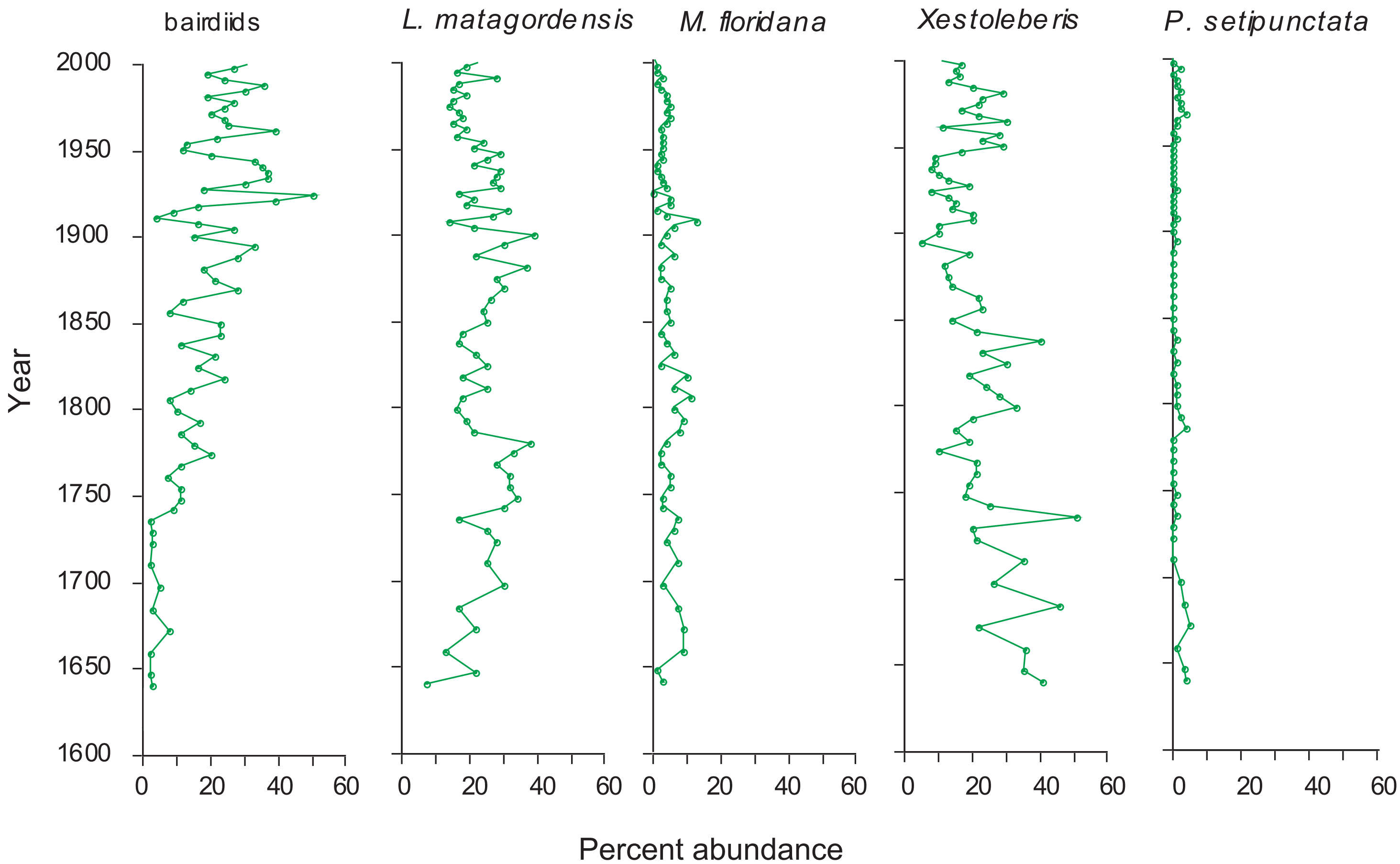



Figure 15. Downcore plots of key ostracode species from No Name Bank core (GLW402-NNB. Percent abundance of species plotted against year. (See Appendix F for data.)

after ~1910, it comprised 5% or less of the assemblage, and was completely absent in some intervals.

<u>Mollusca:</u> The lowest portion of the No Name core, from 153 to approximately 140 cm (early 1600s) has relatively high absolute abundance and diversity. However, based on the preservation of some of the mollusks, and observations while cutting the core, the samples from 153-146 cm contain some modern contamination, as well as mixing of fossil debris from the underlying limestone. This mixing contributes to the high molluscan diversity seen in these lowermost samples. Based on these findings, the samples from 153-146 cm were removed from consideration for all analyses.

The lowermost section is dominated by infaunal pelecypod species (Figure 16; Appendix G). The section from the late 1600s to the mid-1800s does not show any signs of contamination, and was dominated by epiphytal species (primarily *Bittiolum varium*) that dwell on either seagrass or other types of sub-aquatic vegetation. From approximately 1840-1950 mollusks were rare. The species present show a mix of infaunal and epiphytal species in the interval from 1840 to approximately 1920, indicating that vegetation was probably present, but sparse. Around 1940, the number of epiphytal species increased significantly (primarily *Turbo castaneus* and *Bittiolum varium*) while the number of infaunal species decreased. Abundance and diversity increased briefly between 1950 and 1970. The uppermost segment of the core has relatively abundant epiphytal species, low numbers of infaunal species, and low abundance and diversity.

## Ostracode Magnesium/Calcium Ratios

Results of the Mg/Ca analyses of ostracodes from No Name Bank core (GLW402 NNB) show interannual to multi-decadal Mg/Ca oscillations (Figure 17, Appendix H). The Mg/Ca is not expressed as absolute salinity in this report. That conversion awaits additional analyses on modern ostracodes and local environmental constraints. However, the shifts from high to low Mg/Ca typically indicate shifts from higher to lower salinities. Prior to the early 1900s, fluctuations in the Mg/Ca had a relatively high amplitude; this shifted to lower amplitude fluctuations during the remainder of the $20^{th}$ century. A large sustained shift towards higher ratios occurs from approximately 1850 to 1895.

### Featherbed Bank

The results discussed below refer to two cores: 1) GLW402-FBB, collected in April, 2002 from the western margin of the bank; and 2) SEI297-FB1, collected in February, 1997 from the southern margin of the bank. For a complete discussion of the faunal assemblages and chronology for SEI297-FB1 see Stone and others, (2000). Only a brief summary of the faunal data from the 1997 core is presented below for comparison. The 225 cm recovered from SEI297- FB1 yielded excellent lead-210 and radiocarbon chronology indicating deposition during the past 500-600 years. Four radiocarbon dates on shells indicate a mean sedimentation rate of about 0.5 cm $yr^{-1}$ at this core site. The lead-210 chronology suggests the uppermost 88 cm were deposited at a rate of about 0.74

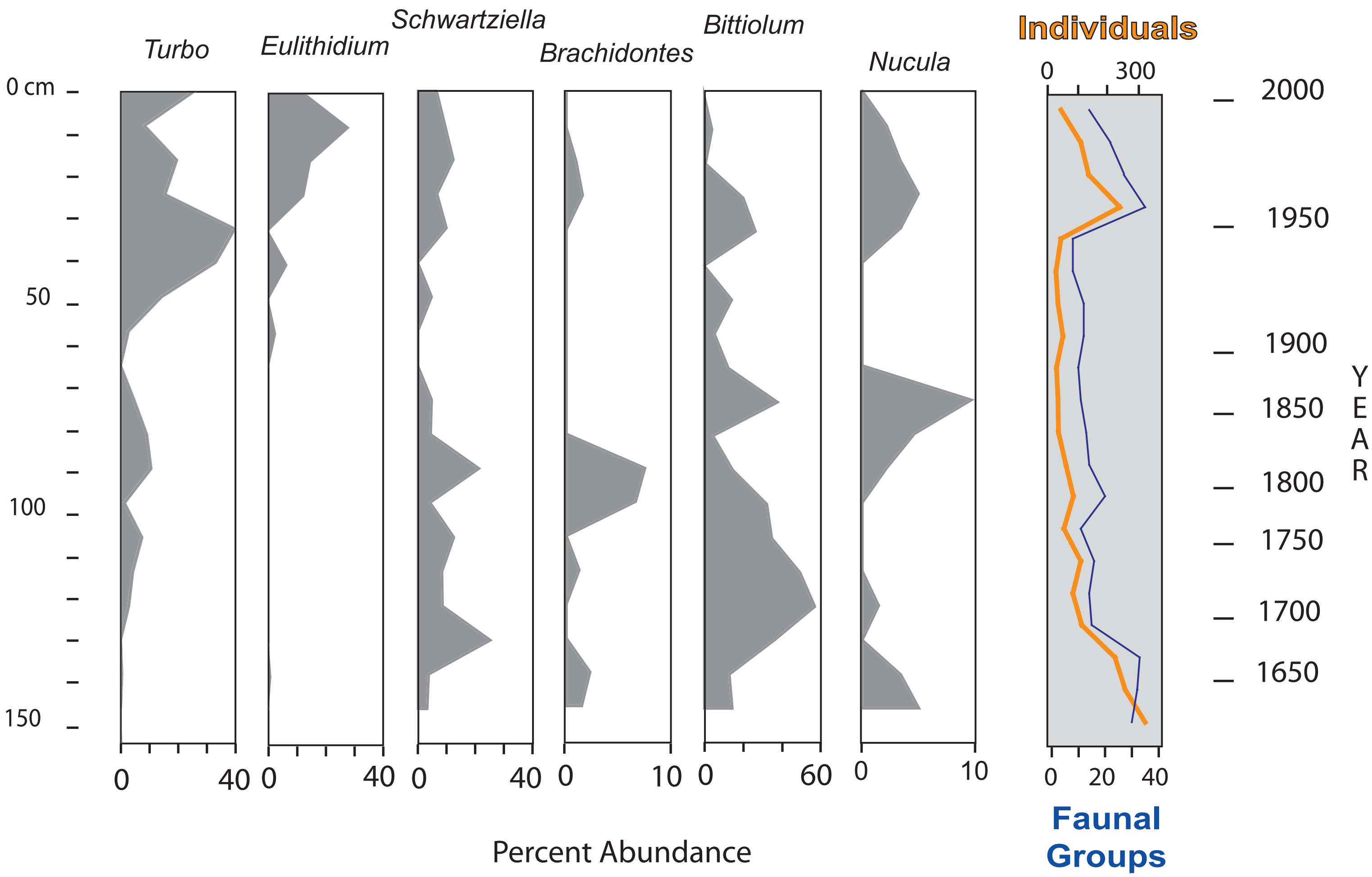
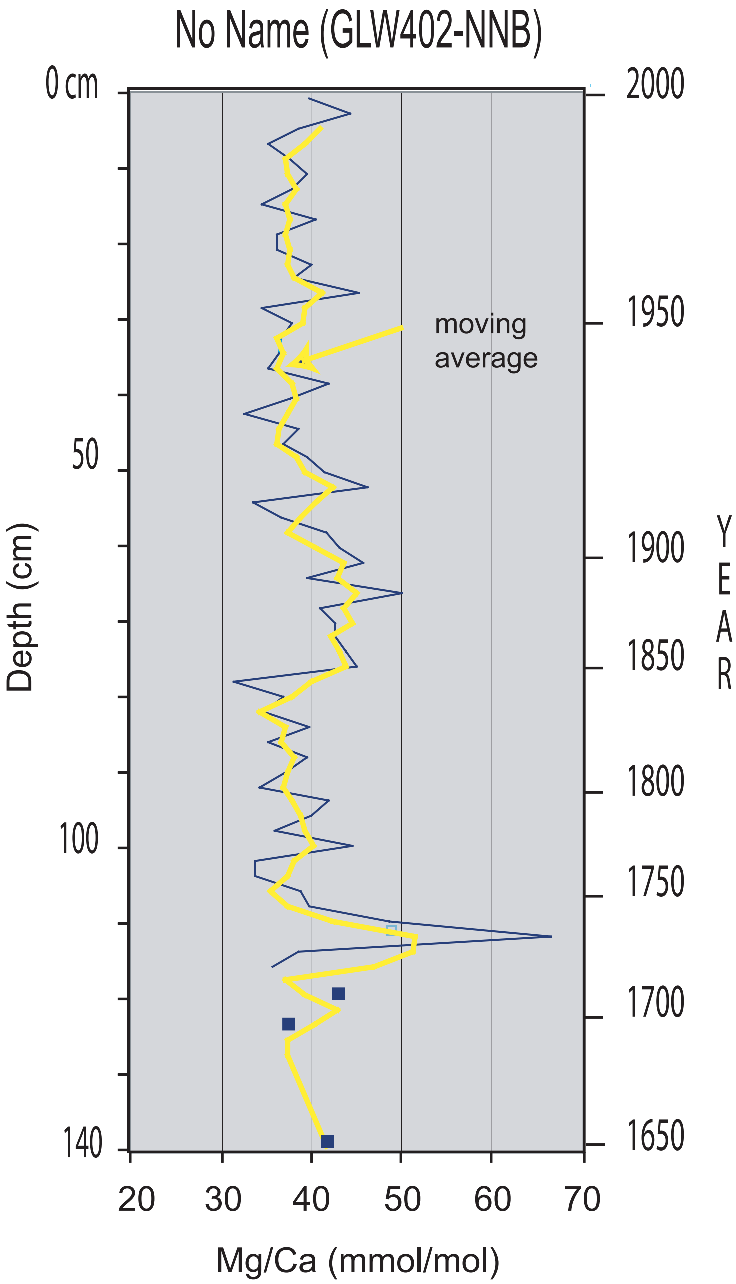



Figure 16. Percent abundance of key molluscan taxa in No Name Core (GLW402-NNB). Number of molluscan individuals (absolute abundance) and faunal groups (a rough measure of diversity) are plotted on the right. (See Appendix G for data.)



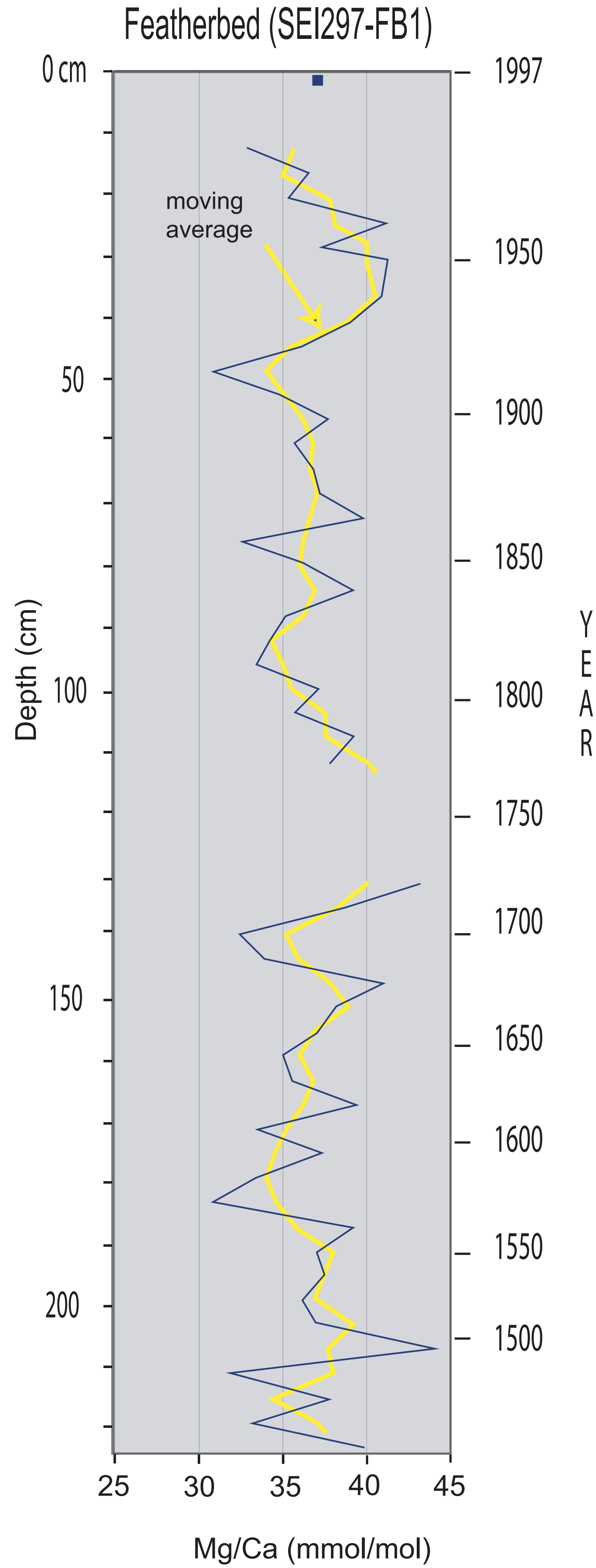




Figure 17. Average Mg/Ca in mmol/mol (blue line and points), for five valves of *Loxoconcha matagordensis* from No Name Bank core (GLW402-NNB) and four valves from 1997 Featherbed Bank core (SEI297-FB1). Yellow line is three point moving average. (See appendices H and J for data).

cm yr$^{-1}$. Additional radiocarbon dates need to be collected from GLW402-FBB to refine the chronology for that core (see discussion under Preliminary Age Model above) and the correlation between the cores improved as discussed below.

## Molluscan Faunal Assemblages

Both Featherbed Bank cores (SEI297-FB1 and GLW402-FBB) contain a diverse, generally open-bay to marine molluscan assemblage. Ninety-five faunal groups (species, genera, and a few family groups) (Figure 18; Appendix I) are present in GLW402-FBB and ninety-six in SEI297-FB1. The 1997 core data illustrated here exclude fragments and worn specimens to be consistent with the 2002 core data; these data differ from the total molluscan faunal data published in Stone and others (2000). The dominant species in both cores are *Bittiolum varium*, *Turbo castaneus,* and *Eulithidium affine [=Tricolia]*. In the 2002 core, *Nucula proxima,* and *Amaea mitchelli?* also are abundant throughout the core. *Tegula fasciata* and *Vermicula spirata* are abundant in the 1997 core.

## Faunal Trends

Three faunal zones based on the foraminfers, ostracodes, and mollusks were recognized in core SEI297-FB1 (Figure 19). Zone 1 (226-175 cm), representing 1440 to 1550 AD in the current age model, is characterized by open-marine biota with relatively limited numbers of epiphytal biota. Molluscan faunal indicators suggest the sediment was capable of supporting infaunal organisms and that faunal richness was relatively limited during this time period. A change in the biotic community occurred between 190-175 cm with an estimated age of 1550 AD. Zone 2 (175-65 cm) indicators show a strong dominance of epiphytal species of foraminifers, ostracodes, and mollusks. Zone 2 assemblages are replaced around 1900 AD by Zone 3 (65-0 cm) assemblages that consist of increased numbers of species that inhabit open-marine environments and substrates lacking in subaquatic vegetation. Zone 3 assemblages differ from those in zone 1 in having fewer infaunal mollusks, greater abundance of the ostracode *Malzella floridana*, and a significant increase in molluscan faunal richness.

The general molluscan trends are similar between the two Featherbed Bank cores (Figure 18). Total molluscan abundance and diversity are high in the upper portions of both cores, but in GLW402-FBB diversity and abundance also are high at the bottom of the core and decrease in the middle. Epiphytal species are dominant in both cores, with highest amounts in the middle section of the cores. Infaunal species are consistently present at Featherbed, but only dominate in the lower portions of the cores.

## Ostracode Magnesium/Calcium Ratios

Preliminary analysis of the ostracode Mg/Ca ratios from Featherbed Bank Core SEI297-FB-1 indicates considerable short-term (approximately interannual-to-decadal) variability as well as apparent multi-decadal oscillations (Figure 17; Appendix J). Three segments of the core were identified where average Mg/Ca ratios exceeded 38 mmol/mol: 1) 210-190 cm; 2) 130-110 cm, which is bounded above and below by high values with a

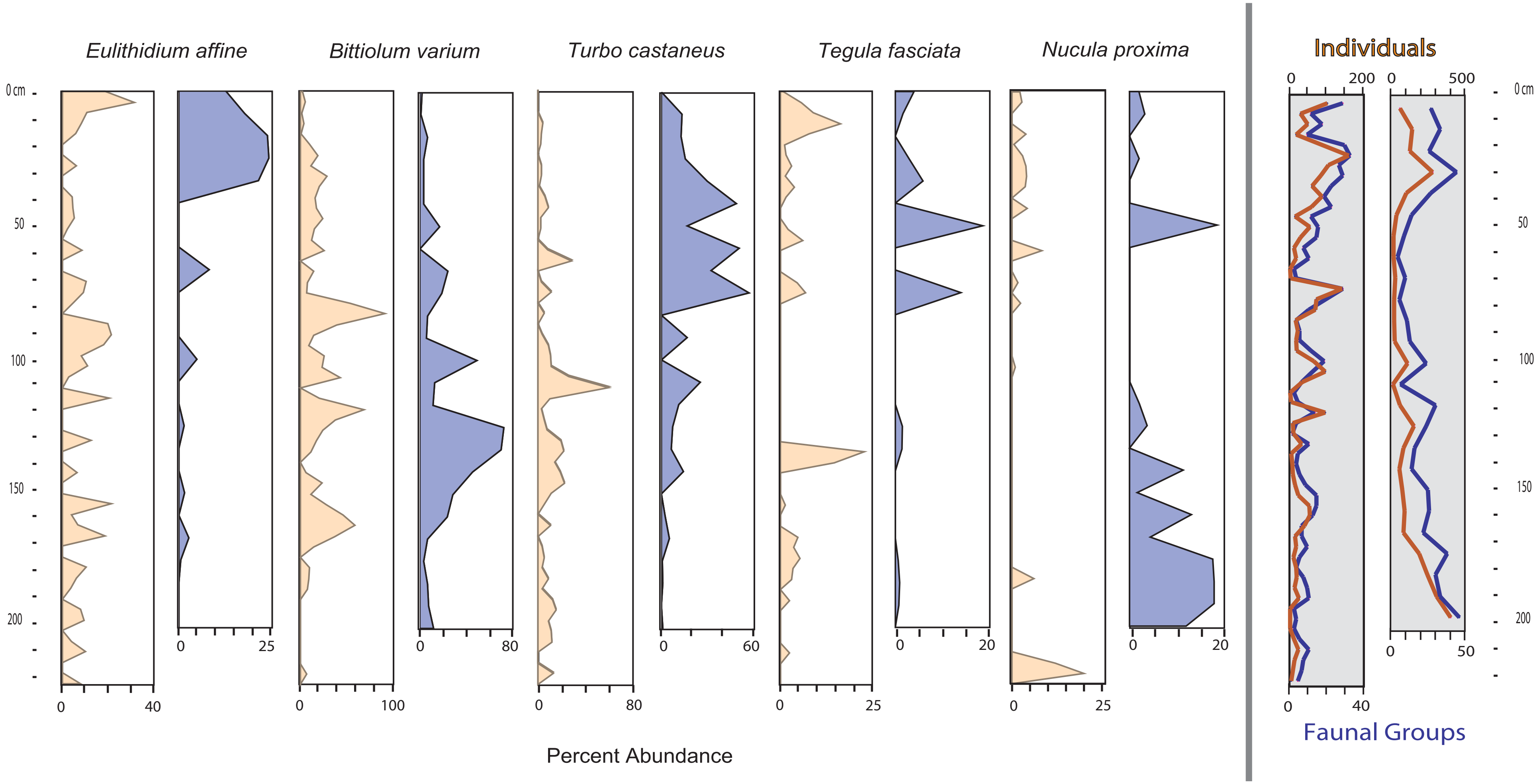



Figure 18. Percent abundance of selected molluscan fauna (excluding worn and fragmented specimens) in 2002 Featherbed Bank core shown in blue (GLW402-FBB) and 1997 Featherbed Bank core shown in tan (SEI297-FB1). Columns on right show number of molluscan individual specimens (absolute abundance)(excluding worn and fragmented) and number of faunal groups (a rough measure of diversity). (See appendix I for data from 2002 core. See Stone, et al. (2000) for total molluscan data from 1997 core. Note: data shown here is a subset of data published in Stone, et al.)

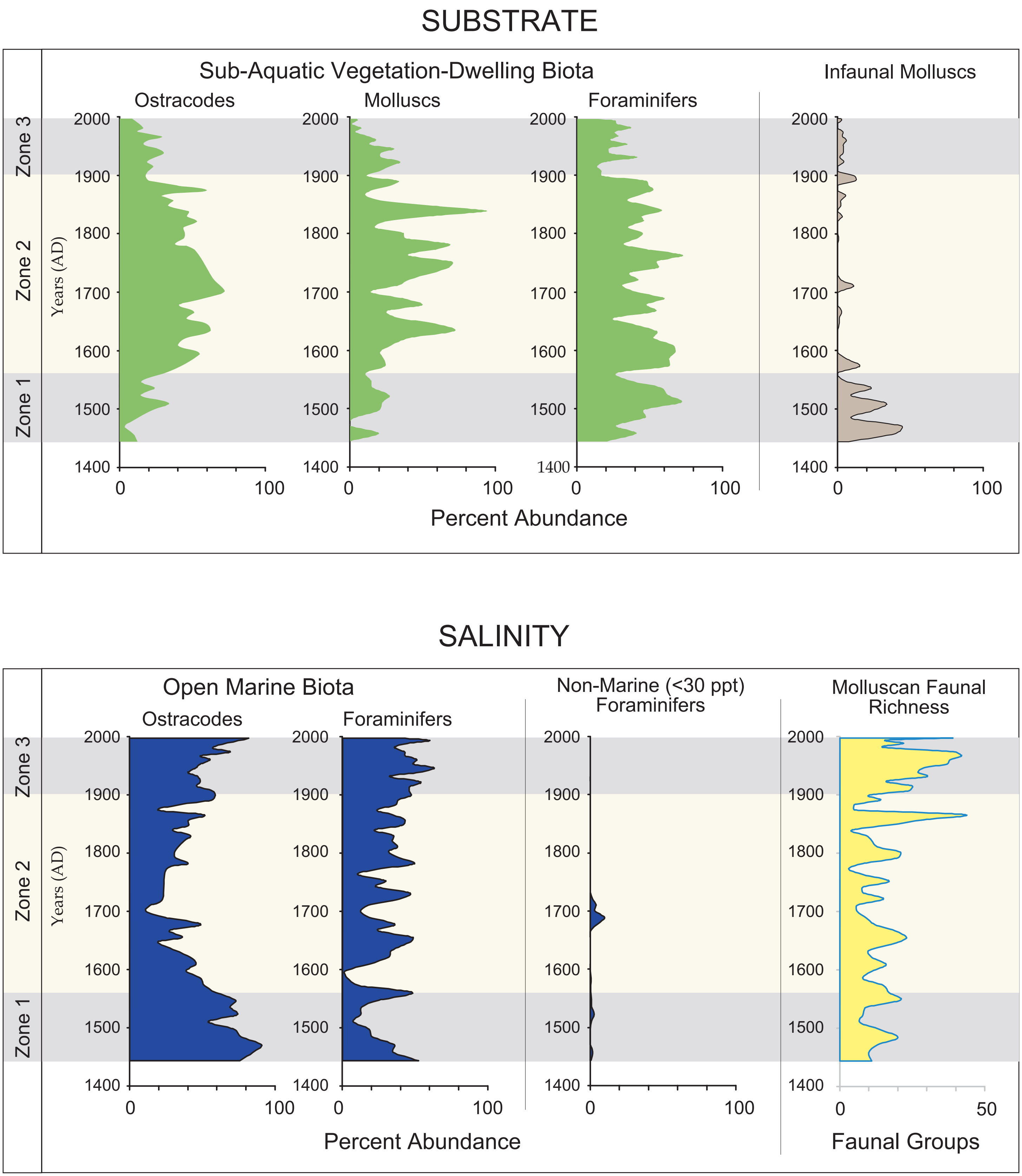



Figure 19. Summary of findings from 1997 Featherbed Bank core (SEI297-FB1). Figure modified from Stone and others, 2000.

sampling gap in between; and 3) 40-25 cm. These periods alternate with times when Mg/Ca ratios are below 32-34 mmol/mol. No core-long trend in Mg/Ca is indicated.

### Card Bank

Two sets of cores have been collected from Card Bank: 1) GLW402-CBA and CBB, collected in April, 2002; and 2) SEI297-CB1, collected in February, 1997. The stratigraphy of Card Bank, in the southern part of Card Sound, consists of about 1-2 m of marine carbonate muds that have accumulated during late Holocene. Core SEI297-CB1 was taken on the southeastern flank of Card Bank and core GLW402-CBA and CBB on the northwestern flank. Two calibrated radiocarbon dates on shells from SEI297-CB1 from core depths of 81 cm and 131 cm yield ages of 1253 and 1440 AD, respectively, indicating a mean late Holocene sedimentation rate of about 0.2 cm $yr^{-1}$ at this site and a potential for decadal temporal resolution.

The ostracode assemblages (Figure 20; Appendix K) at Card Bank (SEI297-CB1) indicate changing bottom habitats and salinity conditions over the past 800-900 years with a notable change around 1700 AD when larger proportions of *Thalassia*-dwelling species occur. Due to the uncertainty in the age model in the uppermost 40-50 cm of the SEI297-CB1 core, the 20$^{th}$ century history of Card Bank cannot be determined without additional dating and analysis of the new cores, which is still underway.

# DISCUSSION

## Changes in Salinity

The changes in benthic faunal and floral assemblages and shell geochemistry illustrate important changes in the environment of Biscayne Bay over the last 350-550 years. Determining changing patterns of salinity over decadal to centennial time scales is particularly important to restoration of natural freshwater flow in Biscayne Bay. The results of our analyses indicate that the salinity of central Biscayne Bay has become increasingly marine.

Figure 21 illustrates some of the significant salinity indicators for No Name Bank. These data highlight several points. Prior to approximately 1915, the inter-decadal and decadal salinity fluctuations appear to have been greater than after 1915 when salinities stabilized at No Name Bank. Although present in minor amounts (<10% relative abundance) throughout the core, the ostracode *Malzella floridana* and the mollusk *Brachidontes exustus* are more abundant in the lower portion of the core and fluctuate with greater frequency and higher amplitude. Both of these species are tolerant of fluctuating salinities, and can tolerate hypersaline conditions. The fluctuations in the Mg/Ca ratios, although not yet calibrated to actual salinity values for Biscayne Bay, can be interpreted as relative increases or decreases in salinity. The pattern of fluctuation in Mg/Ca ratios show increased frequency and amplitude of fluctuations prior to approximately 1915, than compared to post-1915. The large sustained shift in Mg/Ca between ~1844-1850

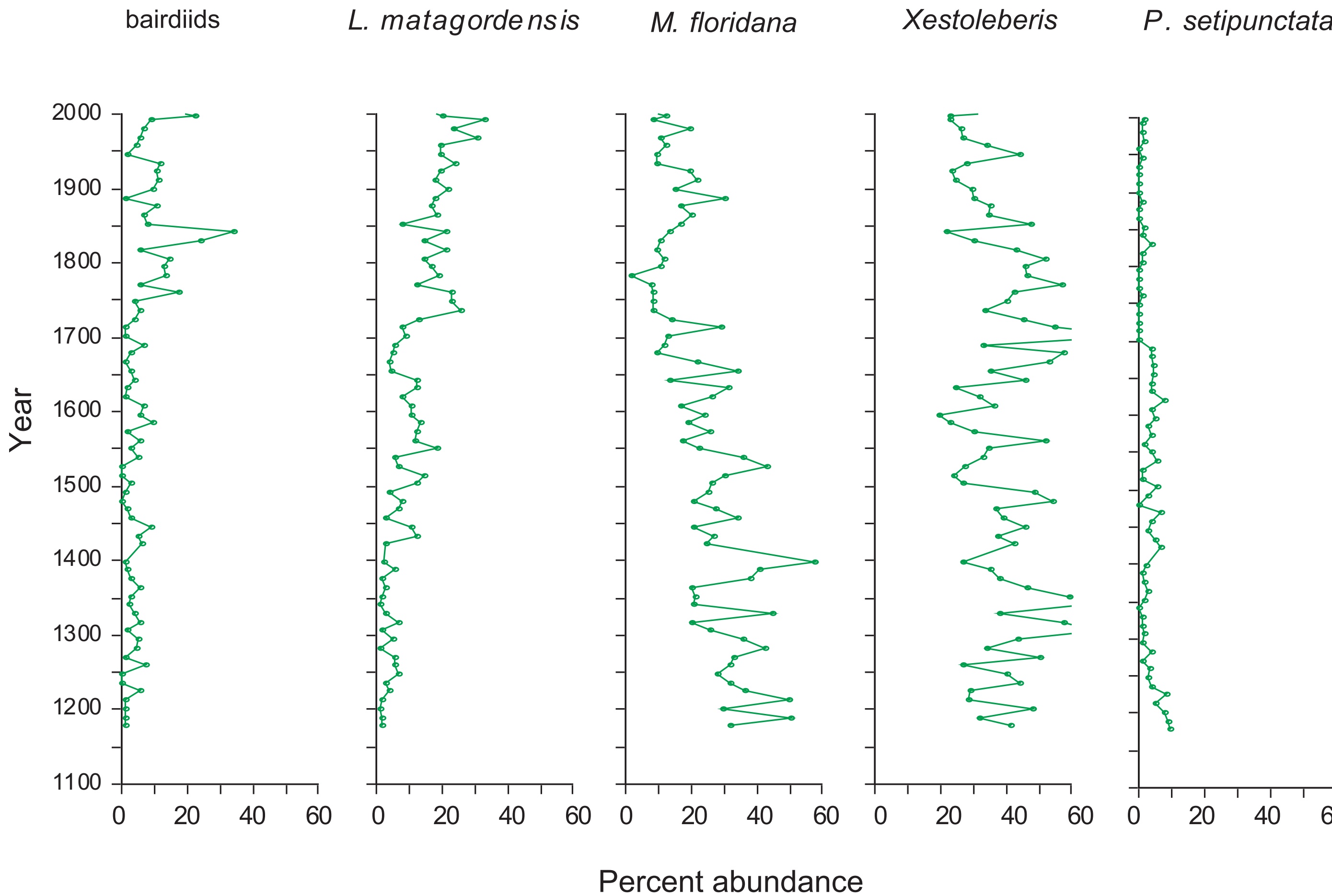



Figure 20. Downcore plots of important ostracode species from Card Bank core (SEI297-CB1). Percent abundance of species plotted against year. (See Appendix K for data.)

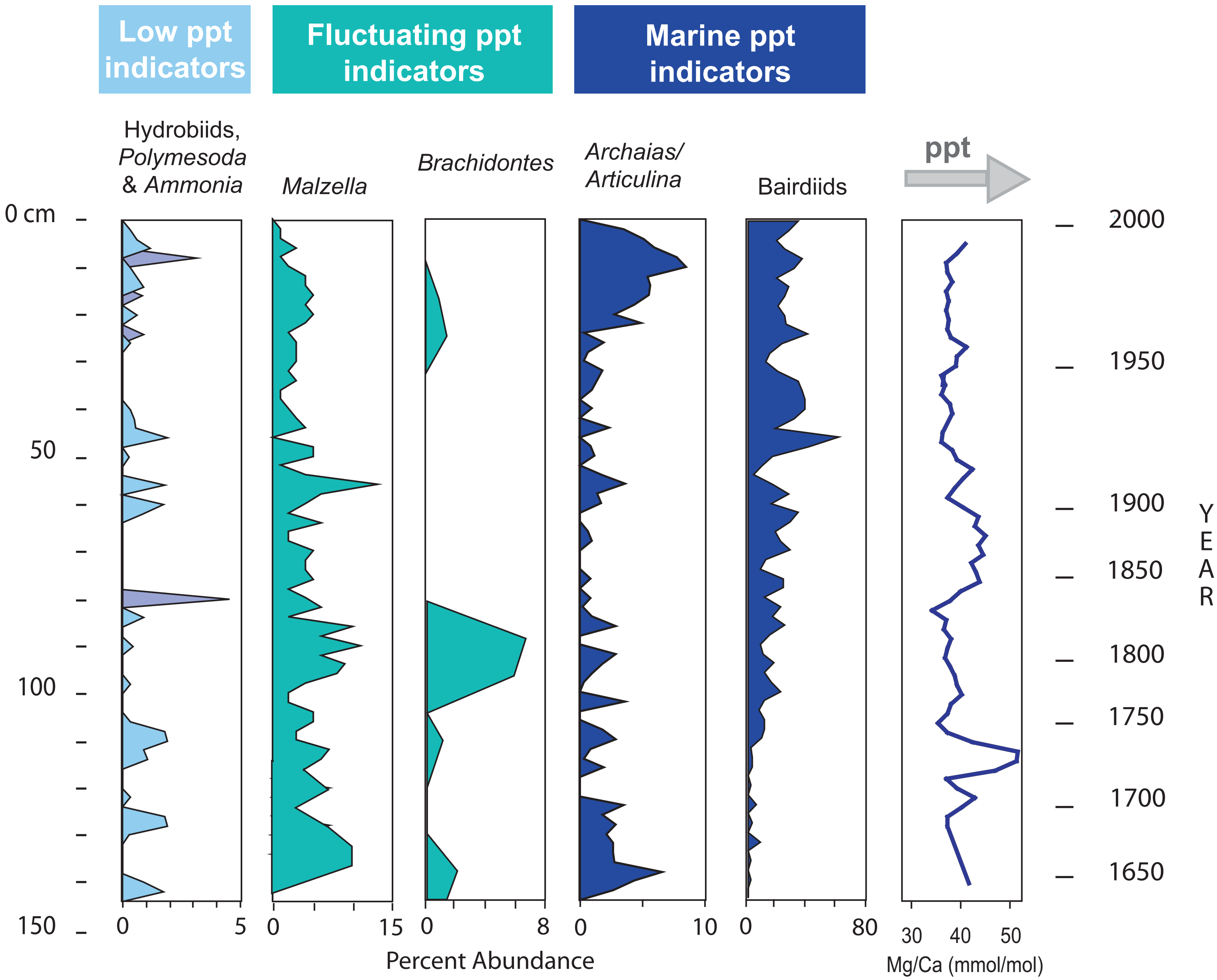



Figure 21. Key salinity indicators in No Name Bank core (GLW402-NNB). Percent abundance of indicator species and 3-point moving average Mg/Ca in mmol/mol plotted against depth on the left and calendar year on the right. See text for explanation.

corresponds to a significant shift in relative abundance of many of the faunal groups and in diversity and absolute abundance of the mollusks.

There are several indications of increasingly stable marine salinities during the 20$^{th}$ century at No Name Bank: 1) less variation in the Mg/Ca ratio; 2) a progressive increase in the marine ostracode group, the bairdiids; 3) increases in the benthic foraminifers *Archaias* and *Articulina*, both indicative of continental shelf influence; and 4) increases in mollusks (for example, *Turbo castaneus*) typically found in marine salinities (30-40 ppt). The progressive increase in bairdiids, is supported by the presence of several other normal marine ostracode taxa (i.e. *Neocaudites*, *Cytherella*, *Radimella*). In contrast, there is some evidence of minor freshwater influence on No Name Bank, presumably from discharge, throughout the time of deposition of the core as demonstrated by the minor (< 4%) amounts of the freshwater hydrobiid gastropods and the presence of the mesohaline mollusk *Polymesoda maritima* and foram *Ammonia beccarii var. parkinsoniana*.

At Featherbed Bank *Malzella floridana* is present in minor amounts (<16% relative abundance in SEI297-FB1) (Figure 22) and *Brachidontes exustus* is nearly absent (SEI297-FB1 and GLW402-FBB). The marine ostracode bairdiids are present in relatively high abundances in the lower and upper portions of the core (SEI297-FB1). *Archaias* and *Articulina* increase in the upper half of the core (SEI297-FB1), similar to their pattern at No Name. Featherbed Bank also shows some minor indications of influx of mesohaline waters at the 1997 core site (SEI297-FB1), with the presence of *Polymesoda*, *Cyrenoida* and *Ammonia*. No freshwater gastropods are found at either Featherbed Bank site. The ostracode Mg/Ca ratio (SEI297-FB1) shows less variation than at No Name (Figures 17 and 22), but follows a similar trend with increased frequency and amplitude of fluctuations in the lower portion of the core. At Card Bank (SEI297-CB1) *Malzella floridana* is present in higher abundances and experiences greater fluctuations in abundance, and the bairdiids increase sometime between 1720 and 1840.

Examining *Malzella* trends at the three sites indicates that over multi-decadal and centennial timescales, Card Bank has experienced large swings in salinity, whereas central Biscayne Bay has been comparatively stable. There is no indication of inter-decadal salinity extremes at Featherbed and No Name banks and periods of hypersalinity are not in evidence. The increases in bairdiids at the three sites indicate increasing marine influence throughout the Bay, and the increase in *Ammonia* and *Archaias* at the two central Biscayne Bay sites indicate increasing continental shelf influence. It is too early in our study to determine the causes of these changes, however, the increases in *Archaias* and *Articulina* appear to have come shortly after the 1947 reduction of freshwater flow into Biscayne Bay as a result of changing water management practices. These findings are consistent with the record from Manatee Bay (Ishman and others, 1998). The fauna in the Manatee Bay core record an increasingly marine influence throughout the 1900's, with an increase in the amplitude of salinity fluctuations occurring around 1940.

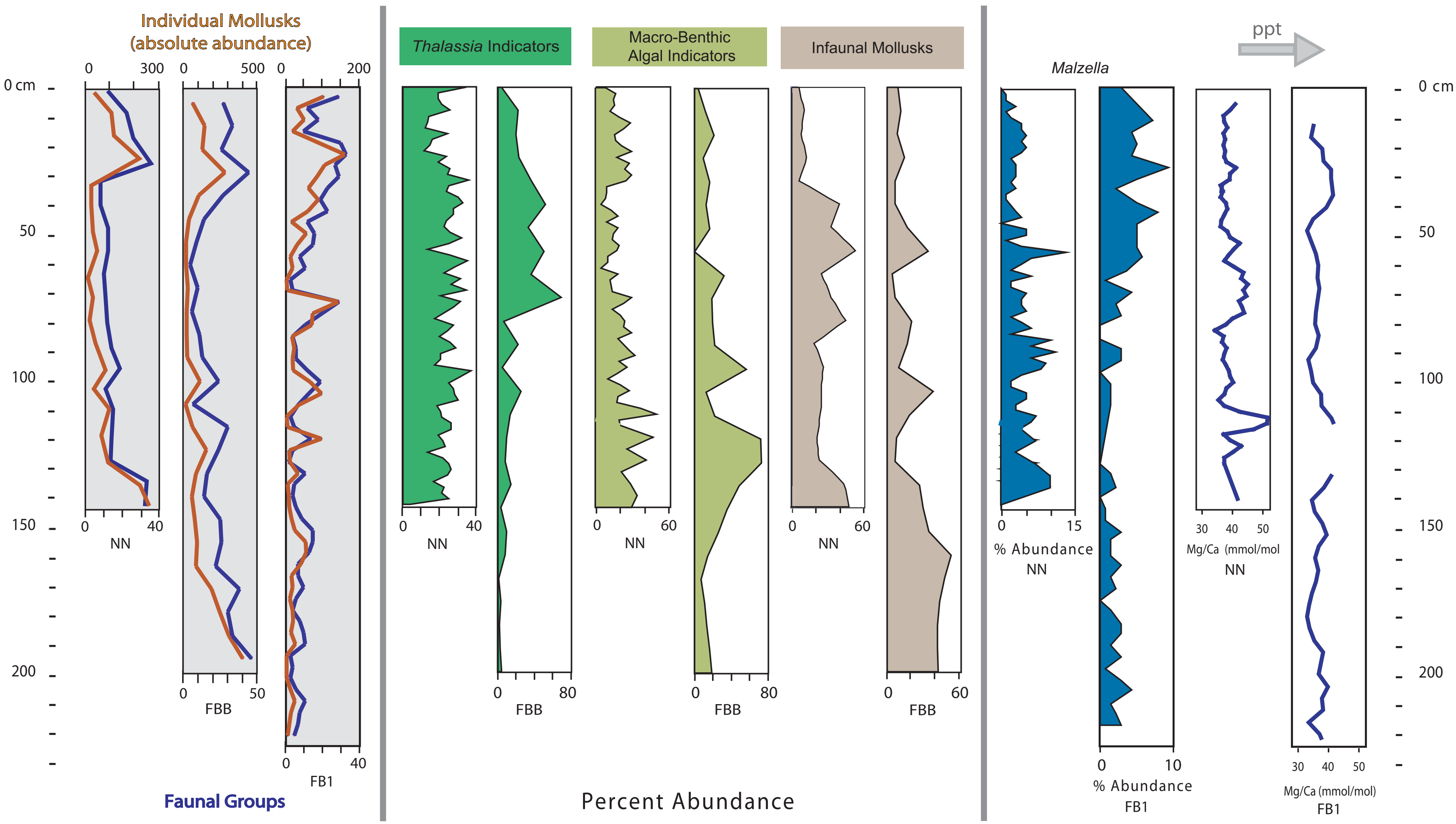



Figure 22. Comparison of No Name Bank (GLW402-NNB) and Featherbed Bank (GLW402-FBB and SEI297-FB1). Left section shows changes in molluscan absolute abundance (total number of individual specimens excluding worn and fragments) and number of faunal groups (a rough measure of diversity). Middle section shows changes in percent abundance of benthic faunal habitat indicators; the No Name sub-aquatic vegetation data include mollusks, forams and ostracodes (a sum of all data shown on Figure 23, plus additional molluscan species) but the Feather Bed Bank data are mollusks only. Right section shows changes in salinity indicators - the ostracode *Malzella floridana* and three point moving average for Mg/Ca data (see figure 17 for full data plot). NN: No Name core GLW402-NNB. FBB: Featherbed Bank core GLW402-FBB. FB1: SEI297-FB1.

Correlation of the Mg/Ca records to other published data indicates that regional trends may be emerging. The inter-annual to multi-decadal Mg/Ca (salinity) oscillations at No Name Bank have a strong correspondence with wet/dry oscillations interpreted from the coral $\delta^{18}O$ record off Elliot Key published by Swart and others, (1996). The upper portion (66-0 cm) of the Featherbed Bank Core (SEI297-FB-1) Mg/Ca record shows a pattern that is similar to the Mg/Ca record from Russell Bank in eastern Florida Bay (Dwyer and Cronin, 2001). The Mg/Ca changes at the Russell site are thought to primarily reflect changes in salinity, which in turn are largely driven by changes in freshwater runoff/discharge into Florida Bay. Temperature variations likely amplify the Russell Mg/Ca changes. The similarity between the Mg/Ca records at Russell and Featherbed, suggests that comparable, synchronous ecosystem changes occurred in Florida and Biscayne Bays and that the changes are driven by a regional (or larger) scale forcing mechanism.

Additional faunal and geochemical analyses and refinement of the age model are needed to more thoroughly understand the salinity history of Biscayne Bay and the minor differences seen between No Name and Featherbed Banks. Completion of the analyses at Card Bank will provide confirmation of the patterns noted here.

## Changes in Sub-Aquatic Vegetation and Benthic Habitat

Sub-aquatic vegetation (SAV) and benthic habitats change naturally over time. It is important to restoration of the estuarine environments to determine what recent changes may be due to anthropogenic influences and what may be due to natural cycles of change. The distribution of epiphytal species within the cores provides an indication of the presence of sub-aquatic vegetation and in some cases, the type of vegetation. While many factors can control the distribution of an individual species (salinity, food supply, substrate, water quality), by looking at multiple proxies, we can get a fairly accurate picture of long term trends in SAV and benthic habitats (Cronin and others, 2001; Brewster-Wingard and Ishman, 1999; Ishman, 2001).

Figures 23 and 24 illustrate changes in SAV, based on the abundance of epiphytal indicator species of foraminifers, ostracodes, and mollusks at No-Name Bank (GLW402-NNB) over the last 350-400 years. On an inter-decadal scale SAV appears to have been present throughout the time of deposition of the core, but the relative abundance of the indicators has fluctuated over time, indicating that the SAV itself has fluctuated. In general, *Thalassia* was most abundant between approximately 1700 and 1950 as indicated by *Loxoconcha matatgordensis* and *Miliolinella* spp. The dominant molluscan *Thalassia* indicator *Turbo castaneus* reaches a peak between 1900 and 1950 probably responding to a combination of stabilized salinity and *Thalassia* availability. A decline occurs in almost all of the indicator species for *Thalassia* after 1950, indicating a decline in seagrass abundance. Macro-benthic algae, as indicated by *Brachidontes, Bittiolum* and *Xestoleberis* was most abundant at No Name Bank prior to ~ 1700, but increased slightly

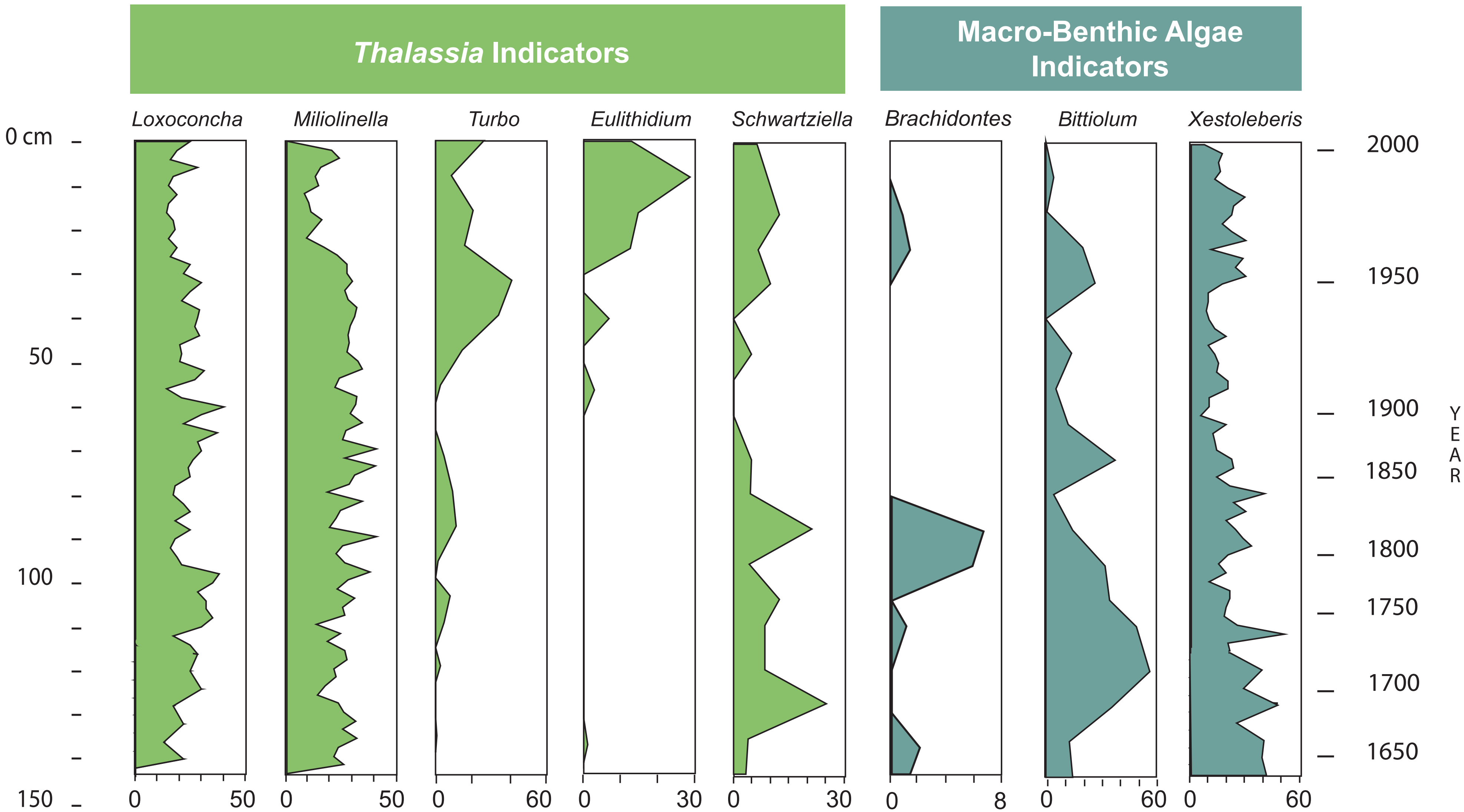



Figure 23. Sub-aquatic vegetation indicators in No Name Bank core (GLW402-NNB). Percent abundance of key indicator species, plotted against depth on the left and calendar year on the right. Increases in epiphytal species are indicative of increases in the vegetation they live on. Use of multiproxies increases the reliability of this method. See text for full explanation.

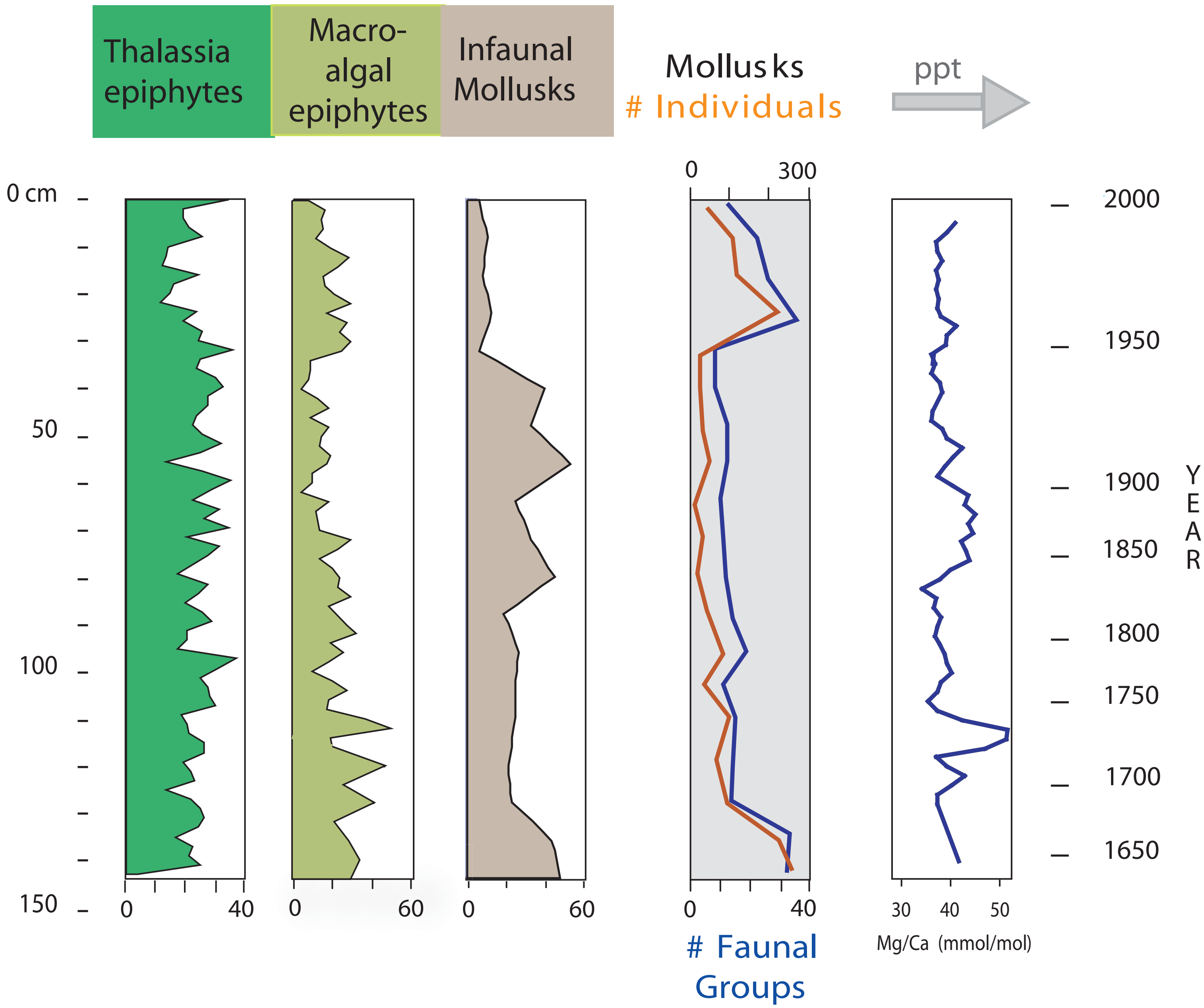



Figure 24. Indicators of environmental change at No Name Bank (GLW402-FBB) as shown in Figure 22, plotted against age and depth. Three left plots show percent abundance of key indicator species. Data for *Thalassia* and macro-algal epiphytes are a sum of all indicator species shown in Figure 23, plus additional molluscan species. Data for number of molluscan individuals (absolute abundance) and number of faunal groups (a rough measure of diversity) is given in Appendix G. Mg/Ca data is shown as three point moving average (see figure 17 for full data plot).

after 1950 when *Thalassia* declined.

Examining epiphytal species in the other cores reveals some bay-wide patterns of change. All three cores reveal a significant increase in *Loxoconcha matatgordensis* in the lower portion of the cores between 1550 and 1750 AD. A decrease in *L. matagordensis* and *Turbo castaneus* occurs at Featherbed Bank beginning in the late 19th century continuing into the 20th century. This decline at Featherbed begins earlier (based on the current age model) and is more pronounced than the decline at No Name. At Card Bank (SEI297-CB1), however, *L. matagordensis* did not decrease in abundance during the 20th century. Based on the ecology of these indicator species, these patterns indicate that there was a substantial increase in seagrass habitats throughout central and southern Biscayne Bay 450-250 years ago, but a decline occurred in central Biscayne Bay during the last century. Southern Biscayne Bay-Card Sound seems to have retained healthy seagrass communities during the last century, but additional existing core data and new cores need to be examined to confirm this trend.

All three cores also record a decrease in abundance in the ostracode genus *Xestoleberis* since the 18th century, although a slight rise in abundance during the last 50 years is observed at No Name Bank as discussed above. *Bittiolum varium* matches the trends for *Xestoleberis* at both Featherbed Bank cores. *Xestoleberis* abundance is extremely variable over inter-decadal time scales at Card Bank over the last 800 years, however, the environmental significance is not clear.

The patterns of change in the infaunal molluscan assemblages are nearly identical (all though offset on the timing based on current age models) in the No Name core and the 2002 Featherbed Bank core (GLW402-FBB) (Figure 22) and similar to the 1997 Featherbed Bank core. The abundance of infaunal species is highest at the bottom of all three cores (>30%), then declines between 1550 and 1820 (based on the current age models). In No Name and the 2002 Featherbed cores the infaunal species increase somewhat again in the middle of the core and then decline in the later half of the 20th century, corresponding to the decrease in *Thalassia*. This pattern is the opposite of what has been observed in Florida Bay cores (Brewster-Wingard and others, 1998, 1999, 2001). Typically when epiphytal molluscan species decline, infaunal species increase in relative abundance. The environmental significance of the decline in infaunal mollusks is not currently understood.

Stone and others, (2000) concluded that the sequence of changes in faunal zones at Featherbed Bank (SEI297-FB1) was consistent with a model for bank migration and gradual shallowing of the bank. The flank of the migrating bank was characterized by the abundant sub-aquatic vegetation in zone 2 in the core. The conclusion of Stone and others, (2000) was that it would be difficult to determine if the changes at Featherbed represented regional scale change, or local bank migration. While bank migration can still not be completely ruled out, the commonality of trends seen at No Name and both Featherbed cores (Figure 22) implies there are regional-scale factors at work.

## Other Indicators of Change

The benthic foraminifer *Bolivina* is an infaunal taxa typically associated with organic-rich sediments. The distribution of this group in the No Name core seems to correlate with human activities in south Florida. It is absent from 1856 to1901 except for the period 1869-1888, which corresponds to the first major increase of European settlement in south Florida. The increase in *Bolivina* abundance, suggesting higher organic conditions, initially increased just after the population growth of the 1920s when Dade County's population increased six-fold from 30,000 to 177,000. The decline in *Bolivina* since 1975 may be related to decreases in freshwater pollution loads as a result of passage of the Federal Clean Water Act in 1972.

Patterns of molluscan faunal diversity and abundance are nearly identical in the No Name and 2002 Featherbed Bank (GLW402-FBB) cores (Figure 22). The highest abundance and diversity are found at the bottom of the cores and at approximately 25 cm depth. These differences are not due to taxonomic effects, because the data plotted have excluded worn and broken specimens. The 1997 Featherbed Bank core (SEI297-FB1) shows high diversity and abundance in the upper portion, similar to the other two, but not at the bottom. The differences in the lower portion of the core, however, are probably due to the age of deposition. Based on the current age models, the bottom of the 1997 core is several hundred years older that the bottom of the 2002 core. The increases in the upper portion of the three cores are particularly interesting because diversity and abundance increase at a time when epiphytal habitats were declining, and infaunal species were declining. Currently these patterns cannot be explained, but they raise a critical issue for restoration. The highest diversity and abundance occurs in an already altered system, therefore high diversity is not necessarily a good performance measure for restoration.

## Correlation Between Sites

A number of similar faunal and floral trends occur at the three sites - No Name, Featherbed and Card Banks. These trends allow us to determine regional or bay-wide changes, but variations in timing of events from bank to bank also point out areas of concern in the age models. For example, we would reasonably expect the pollen zones to be synchronous because these assemblages are indicative of regional changes. The same three pollen assemblage zones can be found in the three Biscayne cores and similar trends have been seen in the region. The decrease in *Pinus* pollen during the 20$^{th}$ century also has been noted in cores from Florida Bay (Brewster-Wingard and others, 1997; Wingard and others, 1995) and Manatee Bay (Ishman and others, 1998) and reflects urbanization in the Miami/Dade county area. The shift from Zone 1 to Zone 2 is marked by the first occurrence of *Casuarina* pollen. Since *Casuarina* was introduced into south Florida around 1900 (Langeland, 1990), this provides another means to check age models. Using this criteria, the No Name and Featherbed Bank (GLW402-FBA) cores appear to have good age models for the upper portion of the cores; the first occurrence of *Casuarina* is dated at ~1900 in No Name and at ~1905 in Featherbed based on the $^{210}$Pb ages. Given the error in $^{210}Pb$ models, the uncertainty of the specific year *Casuarina* was introduced, and the spacing of the pollen samples, these cores appear to have accurate age models. Our age model for Card Bank (GLW402-CBA), however, is much more suspect because the first occurrence of *Casuarina* does not occur until 1976 based on the $^{210}Pb$ ages.

Pollen data were not obtained for the 1997 Card Bank core, however, a comparison of ostracode assemblages between Card Bank (SEI297-CB1) and the central Biscayne sites illustrates some faunal events that may be synchronous. The local extinction of the rare (in these cores) but distinctive species *Peratocytheridea setipunctata* and the associated increase in bairdiids at ~1700 in both the No Name and Card Bank (SEI297-CB1) cores is strong evidence that the age models for these two cores are reliable and these region-wide faunal events are nearly synchronous within the resolution of the age models. The increase in *Loxoconcha* also occurs around 1700 in both No Name and Card Bank (SEI297-CB1) cores.

Further evidence of the correlation between No Name and Featherbed Bank (GLW402-FBB) can be seen by comparing molluscan and foraminifer distributions between the two sites. These comparisons between sites raise two important points: 1) there are bay wide patterns of change in the fauna and flora, indicating change is occurring on a regional scale (not at isolated banks) and 2) the majority of the age models appear to be sound, but further refinement is necessary.

## SIGNIFICANT FINDINGS, IMPLICATIONS AND FUTURE WORK

Comparison of the results from the three cores collected in 2002 with cores collected in 1997 has established some patterns and hypotheses that need to be tested in additional cores to be collected in 2003 and in further analyses on the cores already collected.

- The salinity of central Biscayne Bay has become increasingly marine and increasingly stable over the last 100 years.
    - At No Name Bank, prior to approximately 1915, the inter-annual and decadal salinity fluctuations appear to have been greater than after 1915 when salinities stabilized at that site.
    - Continental shelf/open marine influence on the sites has increased during the 20$^{th}$ century.
    - There is no indication of inter-decadal salinity extremes or periods of hypersalinity.
    - Freshwater and mesohaline salinities have had a minor influence on No Name bank throughout the time of deposition. At Featherbed Bank, the influence is reduced to mesohaline salinities.
- Card Bank has experienced relatively large swings in salinity over multi-decadal and centennial timescales, compared to central Biscayne Bay, but marine influence at the site has increased over the last century. This is consistent with findings from Manatee Bay (Ishman and others, 1998).

- Indications of regional scale patterns have been found, especially in the shell chemistry data and the pollen assemblages. These regional patterns indicate that the changes are not site specific and may not be limited to Biscayne Bay.
    - Changes in Mg/Ca ratios in central Biscayne Bay appear to correlate to coral $\delta^{18}O$ records at Elliot Key and to records from eastern Florida Bay.
    - Pollen assemblages correlate between the three cores, and agree with data from eastern Florida Bay.
    - Similar patterns of change can be seen from bank to bank within Biscayne Bay, indicating that the changes seen are not site specific.
- Sub-aquatic vegetation has undergone bay-wide patterns of change over the last 200-500 years, which includes expansion prior to 1900 and declines during the last century.
    - *Thalassia* has been present on an inter-decadal time-scale in central Florida Bay over the last 200-500 years, but it has undergone natural patterns of fluctuation in abundance.
    - *Thalassia* appears to have increased at all three core sites sometime between 1550 and 1750 AD.
    - A decline in *Thalassia* appears to have occurred after 1950 at No Name Bank and slightly earlier in the $20^{th}$ century at Featherbed Bank.
    - Card Bank does not appear to have experienced any declines in vegetation on an inter-decadal scale during the $20^{th}$ century.
    - Macro-benthic algae appear to have declined at all three sites since the $18^{th}$ century, although a slight increase occurred at No Name Bank after 1950 when *Thalassia* declined.
- Molluscan faunal abundance and diversity have undergone significant changes in central Biscayne Bay.
    - Patterns of change in diversity and abundance are nearly identical at No Name Bank and western Featherbed Bank.
    - No Name and both Featherbed Bank cores show high abundance and diversity in the mid-$20^{th}$ century, an already altered system, suggesting high diversity is not necessarily a good performance measure for restoration.
    - Molluscan infaunal species abundance is highest at the bottom of all three cores (>30%), then declines between 1550 and 1820.
- Indicators of increased organic-rich sediments at No Name occur between 1869 to 1888 and between the 1930's to 1975. These changes may correlate to human activities (settlement, population growth).

These findings represent a first step towards the project's goal to reconstruct the history of Biscayne Bay and they provide us with a working model to be tested at other sites. It is clear from our findings that Biscayne Bay has been a dynamic environment over the last 500 years, with natural changes occurring in salinity and benthic habitats. However, several significant changes have occurred in the $20^{th}$ century: 1) increased stabilization of marine salinities; 2) declines in seagrass in central Biscayne Bay; and 3) dramatic changes in molluscan abundance and diversity in central Biscayne Bay. The question remains - how do we better differentiate natural cycles of change from anthropogenic change within these observed trends?

In order to best answer this question, the next step will be to collect cores from nearshore locations where changes in freshwater delivery can be clearly detected. Earlier work at Manatee Bay (Ishman and others, 1998) indicates distinctive changes have occurred during the 20$^{th}$ century and additional cores will be able to determine the spatial and temporal extent of these changes. Additionally, we need to refine our age models by developing a better understanding of the reservoir effects of $^{14}C$ in the bay and the variations in background $^{226}Ra$ from site to site. Our on going modern site studies will allow refinement of faunal analyses and calibration of Mg/Ca to absolute salinity values.

The preliminary implications from our research are that changes in salinity and benthic habitats have occurred naturally in Biscayne Bay on inter-decadal to centennial scales, perhaps due to climatic changes, changes in sea level, bank migrations, or a combination of factors. However, further work needs to be done to determine which components of change in the 20th century are human-induced and which are natural. By examining the historical records preserved in the sediments of Biscayne Bay, we can provide restoration trust agencies with the information necessary to set realistic targets and performance measures for Biscayne Bay.

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# Appendices

# APPENDIX A

## Description of Cores

X-radiographs and schematic illustrations of the lithology are show in Figures 2-4. Information on core locations and depths is given below and in Table 1.

<u>No Name Bank Cores</u> – were collected in very dense (nearly 100%) *Thalassia* beds with a small, dispersed amount of *Syringodium.*

| Depth in cm | Core A |
|---|---|
| 0-21 | Soft, soupy mud with abundant shells and *Thalassia*. |
| 21-40 | Mud with fine silt; scattered shells and plant material (*Thalassia* and *Halodule*). |
| 40-60 | Clayey mud with fine silt; plant material and scattered shell. |
| 60-86 | Dense, cohesive clay; plant material and scattered shell. |
| 86-96 | Clayey mud with silt and fine sand; plant material and scattered shell. |
| 96-112 | Sticky firm clay with silt and fine sand; plant material and scattered shell. |
| 112-bottom | Mottled firm clay with silt and fine sand; scattered shells and Halimeda grains, possible burrow near 114-116, some contamination from modern on outside edge of core that was removed and discarded. |

| Depth in cm | Core B |
|---|---|
| 0-30 | Soft, soupy mud with abundant shells, *Thalassia*, and *Halodule*. |
| 30-36 | Transitional from soupy mud to clayey mud; decreasing water content. |
| 36-48 | Clayey mud; rare shells and scattered plant material visible. |
| 48-68 | Cohesive clayey mud; scattered shells with lense near 68; plant material (*Thalassia*). |
| 68-92 | Dense, cohesive clay; abundant *Thalassia*; scattered shell material with lense around 92. |
| 92-102 | Mottled sandy clay; with *Thalassia* and a lense of shell material; possible burrows. |
| 102-110 | Clayey mud, with *Thalassia* and scattered shells. |
| 110-132 | Sticky clay with scattered shells and plant material (*Thalassia*). |
| 132-bottom | Sticky clay with silt; scattered large shells; possible burrow around 140-144. |

<u>Featherbed Bank Cores</u> – were collected in an area of nearly 100% subaquatic vegetation coverage (*Thalassia, Syringodium, Halodule*, and *Chondria/Laurencia*).

| Depth in cm | Core A |
|---|---|
| 0-4 | Soft, soupy mud with live mollusks, *Thalassia* and *Syringodium*. |
| 4-20 | Soft mud; scattered large whole shells and plant material (*Syringodium*). |
| 20-30 | Tranisition to more cohesive mud; very dense shell layer. |
| 30-98 | Cohesive soft mud; with plant material (*Thalassia* and *Halodule*) and scattered shells. |
| 98-110 | Transition to firmer mud; scattered shells and plant material (*Thalassia* and *Halodule*). |

| | |
|---|---|
| 110-114 | Stiff mud with scattered root casts. |
| 114-140 | Mottled stiff mud with dispersed organics, scattered *Halimeda* grains, shells, and plant material (*Thalassia* and *Halodule*). |
| 140-182 | Sticky clay; scatterred shells and plant material. Possible burrow around 152. Some contamination on side of barrel from modern plant material (164-170). |
| 182-bottom | Sticky clay with coarse sand to pebble size grains of limestone. |

| Depth in cm | Core B |
|---|---|
| 0-6 | Soft, soupy mud with abundant mollusks and plant material (*Thalassia*, *Halodule*) and scattered *Halimeda* grains. |
| 6-28 | Soft mud with less water content; scattered shells and plant material (*Thalassia* and *Halodule*). |
| 28-32 | Transition; very dense shell layer with abundant plant material. |
| 32-140 | Firm, clayey mud; with plant material (*Thalassia* and *Halodule*) and scattered shells. Several zones of concentrated shell debris. |
| 140-158 | Drier, blocky clay; possible burrow around 142. |
| 158-bottom | Firm, sticky clay with coarse sand to pebble size grains of limestone at 182-194; scattered shells, coral, and plant material (*Thalassia* and *Halodule*). |

<u>*Card Bank Cores*</u> –were collected in an area of patchy *Thalassia* cover. The specific core sites were on the edge of a relatively open area (<15% coverage).

| Depth in cm | Core A |
|---|---|
| 0-16 | Soft soupy mud, with abundant shells (many whole), and plant material (*Thalassia*). |
| 16-34 | Soft mud with abundant disseminated organic material; scattered *Halimeda* grains. |
| 34-60 | Soft mud, but decreasing water content; scattered shells and root casts present. |
| 60-86 | Mud firmer, continuing decrease in water content. |
| 86-96 | Increased water content, mud less cohesive; root casts and shells present. |
| 96-bottom | Clayey mud, with numerous large whole shells, and zones of abundant debris. Potential contamination from modern surface starting at 132 cm. |

| Depth in cm | Core B |
|---|---|
| 0-14 | Soft, soupy mud, with abundant shells and plant material (*Thalassia*). |
| 14-24 | Soft Mud with abundant shells and plant material. |
| 24-74 | Soft mud, but decreasing water content; scattered areas of concentrated shell debris; plant material (*Halodule* and *Thalassia*). |
| 74-90 | Firmer more cohesive mud, continuing decrease in water content. Concentrated shell lenses. Scattered plant material. |
| 90-98 | Clayey mud with scattered shells and plant material. |
| 98-114 | Cohesive mud with sparse shells and plant material. |
| 114-bottom | Cohesive carbonaceous mud, with scattered shells, and plant material. Contamination begins at 128 from modern material. |

**Appendix B: Percent abundance major pollen types, No Name Core (GLW402 NNA)**

| Depth (cm) | *Pinus* | *Quercus* | *Casuarina* | *Myrica* | Cheno-Ams | Poaceae | Asteraceae | Cyperaceae | *Cladium* | Fern spores |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 42.13 | 22.98 | 4.26 | 8.51 | 3.40 | 0.85 | 5.11 | 0.00 | 0.00 | 4.26 |
| **11** | 61.47 | 5.50 | 9.17 | 9.17 | 0.00 | 3.67 | 1.83 | 0.00 | 0.00 | 1.83 |
| **21** | 73.80 | 6.05 | 1.01 | 3.02 | 2.02 | 0.00 | 5.04 | 0.00 | 0.00 | 4.53 |
| **31** | 68.92 | 3.14 | 2.51 | 3.45 | 3.77 | 0.63 | 11.62 | 0.31 | 0.00 | 2.20 |
| **41** | 76.14 | 2.36 | 2.06 | 1.77 | 3.83 | 1.77 | 6.19 | 0.00 | 0.29 | 2.65 |
| **51** | 72.45 | 2.27 | 5.51 | 3.24 | 1.30 | 0.32 | 6.16 | 0.00 | 0.00 | 2.92 |
| **61** | 93.56 | 0.00 | 0.68 | 1.02 | 0.34 | 0.68 | 1.02 | 0.00 | 0.34 | 1.02 |
| **71** | 76.70 | 2.64 | 0.00 | 4.40 | 3.08 | 2.64 | 3.52 | 0.00 | 0.00 | 2.64 |
| **81** | 77.14 | 2.86 | 0.00 | 2.29 | 3.43 | 2.29 | 2.86 | 0.00 | 0.00 | 4.57 |
| **91** | 92.78 | 0.94 | 0.00 | 1.57 | 0.31 | 0.31 | 0.00 | 0.00 | 0.00 | 1.88 |
| **101** | 95.43 | 0.33 | 0.00 | 0.98 | 0.33 | 0.33 | 0.33 | 0.00 | 0.00 | 1.31 |
| **111** | 96.58 | 0.62 | 0.00 | 0.62 | 0.00 | 0.00 | 0.00 | 0.31 | 0.31 | 1.24 |
| **121** | 91.24 | 2.39 | 0.00 | 1.59 | 0.80 | 0.00 | 1.59 | 0.00 | 0.00 | 0.80 |
| **131** | 92.53 | 1.20 | 0.00 | 2.09 | 0.60 | 0.00 | 0.90 | 0.00 | 0.00 | 0.90 |
| **141** | 96.76 | 0.59 | 0.00 | 0.59 | 0.00 | 0.00 | 0.00 | 0.29 | 0.29 | 0.88 |

**Appendix C: Percent abundance major pollen types, Featherbed Bank Core (GLW402 FBA)**

| Depth (cm) | *Pinus* | *Quercus* | *Casuarina* | *Myrica* | Cheno-Ams | Poaceae | Asteraceae | Cyperaceae | *Cladium* | Fern spores |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 48.15 | 25.00 | 6.48 | 8.33 | 1.85 | 0.00 | 1.85 | 0.93 | 0.00 | 1.85 |
| **11** | 84.40 | 1.42 | 11.35 | 1.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **21** | 77.89 | 2.11 | 6.32 | 0.00 | 2.11 | 3.16 | 0.00 | 1.05 | 0.00 | 4.21 |
| **31** | 76.24 | 4.95 | 1.98 | 3.96 | 2.97 | 2.97 | 1.98 | 0.00 | 0.00 | 1.98 |
| **41** | 84.76 | 1.90 | 1.90 | 1.90 | 3.81 | 0.63 | 0.00 | 0.00 | 0.00 | 1.90 |
| **51** | 96.26 | 0.00 | 1.02 | 0.00 | 0.00 | 0.34 | 0.00 | 0.00 | 0.00 | 2.04 |
| **61** | 94.92 | 0.00 | 0.30 | 0.60 | 1.49 | 0.30 | 0.00 | 0.00 | 0.00 | 0.90 |
| **71** | 93.73 | 0.94 | 1.25 | 1.25 | 0.31 | 0.00 | 0.31 | 0.00 | 0.00 | 0.63 |
| **81** | 97.94 | 0.82 | 0.00 | 0.82 | 0.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **91** | 97.42 | 0.32 | 0.00 | 0.32 | 0.00 | 0.32 | 0.00 | 0.00 | 0.65 | 0.32 |
| **101** | 95.28 | 0.31 | 0.00 | 0.94 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 1.89 |
| **111** | 99.35 | 0.32 | 0.00 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **131** | 92.84 | 3.44 | 0.00 | 0.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 0.57 |
| **151** | 95.35 | 0.66 | 0.00 | 1.33 | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 | 1.00 |
| **171** | 96.36 | 2.42 | 0.00 | 0.61 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.61 |
| **187** | 94.64 | 0.95 | 0.00 | 0.00 | 0.32 | 0.32 | 0.00 | 0.00 | 0.00 | 1.58 |

**Appendix D: Percent abundance major pollen types, Card Bank Core (GLW402 CBA)**

| Depth (cm) | *Pinus* | *Quercus* | *Casuarina* | *Myrica* | Cheno-Ams | Poaceae | Asteraceae | Cyperaceae | *Cladium* | *Nymphaea* | *Typha* | *Sagittaria* | Fern spores |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 57.01 | 19.94 | 4.05 | 4.36 | 1.56 | 0.93 | 1.87 | 0.00 | 0.93 | 0.62 | 0.93 | 0.00 | 1.87 |
| **11** | 56.73 | 11.58 | 3.75 | 10.56 | 1.70 | 1.70 | 2.04 | 1.02 | 1.02 | 0.00 | 1.02 | 0.34 | 2.04 |
| **21** | 71.71 | 5.46 | 2.48 | 5.46 | 2.98 | 2.98 | 1.49 | 0.50 | 0.00 | 0.50 | 0.50 | 0.00 | 1.49 |
| **31** | 93.53 | 2.31 | 0.00 | 0.92 | 0.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **41** | 91.13 | 0.66 | 0.00 | 2.63 | 0.33 | 0.00 | 0.66 | 0.00 | 0.33 | 0.33 | 0.00 | 0.00 | 0.66 |
| **51** | 94.66 | 0.59 | 0.00 | 2.37 | 0.30 | 0.00 | 0.59 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.59 |
| **61** | 87.82 | 1.28 | 0.00 | 4.81 | 0.96 | 0.32 | 0.96 | 0.00 | 0.64 | 0.00 | 0.32 | 0.00 | 0.96 |
| **71** | 89.51 | 2.40 | 0.00 | 2.10 | 0.30 | 0.00 | 0.60 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 |
| **81** | 86.08 | 2.22 | 0.00 | 5.38 | 0.63 | 0.00 | 0.32 | 0.00 | 0.00 | 0.00 | 0.32 | 0.00 | 0.32 |
| **91** | 88.96 | 2.52 | 0.00 | 2.84 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **101** | 85.69 | 5.66 | 0.00 | 2.33 | 0.33 | 0.00 | 0.33 | 0.00 | 0.33 | 0.00 | 0.00 | 0.33 | 0.33 |
| **111** | 84.57 | 4.15 | 0.00 | 3.56 | 0.89 | 0.30 | 0.89 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 0.89 |
| **121** | 91.88 | 2.27 | 0.00 | 0.97 | 0.65 | 0.00 | 0.97 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.97 |
| **131** | 92.81 | 1.31 | 0.00 | 0.65 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 |
| **148.5** | 92.93 | 0.64 | 0.00 | 0.64 | 0.32 | 0.00 | 0.32 | 0.32 | 1.93 | 0.32 | 0.00 | 0.32 | 0.32 |

Appendix E: Log Normal data for benthic foraminifers in No Name core (GLW402-NNB)

| Sample Interval (cm) | Calendar Years | *Ammonia beccarii var. parkinsoniana* | *Anomalina globulosa* | *Archaias angulatus* | *Articulina antillarum* | *Articulina lineata* | *Articulina mexicana* | *Articulina mucronata* | *Articulina pacifica* | *Articulina sagra* | *Articulina sp.* | *Asterigerina carinata* | *Bigeneria irregularis* | *Bolivina lanceolata* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 0.693 | 0.693 | 1.099 | 0.000 | 0.000 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 4-6 | 1995 | 1.099 | 0.000 | 1.792 | 0.000 | 0.000 | 1.099 | 2.197 | 1.099 | 0.000 | 0.000 | 0.693 | 0.000 | 1.386 |
| 6-8 | 1991 | 1.609 | 0.000 | 1.946 | 0.000 | 0.000 | 1.386 | 1.946 | 1.386 | 0.000 | 1.099 | 0.693 | 0.000 | 1.386 |
| 8-10 | 1988 | 0.000 | 0.000 | 2.398 | 0.000 | 0.000 | 1.099 | 2.398 | 1.099 | 0.000 | 0.693 | 0.000 | 1.099 | 1.099 |
| 10-12 | 1985 | 0.693 | 0.000 | 2.708 | 0.000 | 0.000 | 0.693 | 2.079 | 0.000 | 0.000 | 1.792 | 0.000 | 0.000 | 1.099 |
| 12-14 | 1981 | 1.099 | 0.000 | 2.485 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 1.099 | 1.386 | 0.000 | 0.000 | 1.792 |
| 14-16 | 1978 | 1.386 | 0.000 | 2.079 | 0.000 | 0.693 | 0.693 | 1.099 | 0.693 | 0.693 | 1.946 | 0.000 | 0.000 | 2.079 |
| 16-18 | 1975 | 0.000 | 0.000 | 2.303 | 0.000 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 1.946 |
| 18-20 | 1971 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.693 | 1.099 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 2.565 |
| 20-22 | 1968 | 1.099 | 0.000 | 1.099 | 0.000 | 0.000 | 1.386 | 0.693 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 1.946 |
| 22-24 | 1965 | 0.000 | 0.000 | 1.386 | 0.000 | 0.693 | 0.693 | 1.386 | 1.099 | 0.000 | 1.946 | 0.000 | 0.000 | 1.946 |
| 24-26 | 1961 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 26-28 | 1958 | 0.693 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 1.099 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 2.197 |
| 28-30 | 1954 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 |
| 30-32 | 1951 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.398 |
| 32-34 | 1948 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.099 | 0.000 | 0.693 | 1.099 | 0.000 | 0.000 | 1.386 |
| 34-36 | 1944 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 0.693 | 0.000 | 0.693 | 0.693 | 0.000 | 0.693 | 1.386 |
| 36-38 | 1941 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.792 |
| 38-40 | 1938 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 40-42 | 1934 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 1.099 |
| 42-44 | 1931 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 |
| 44-46 | 1928 | 0.693 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 46-48 | 1924 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 48-50 | 1921 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 50-52 | 1918 | 0.693 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.099 | 0.000 | 0.000 | 1.099 |
| 52-54 | 1914 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 54-56 | 1911 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 56-58 | 1908 | 1.099 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 |
| 58-60 | 1904 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.693 | 0.693 | 0.000 | 0.000 | 0.000 |
| 60-62 | 1901 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 |
| 62-64 | 1895 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 64-66 | 1888 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 66-68 | 1882 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.609 |
| 68-70 | 1876 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Sample Interval (cm) | Calendar Years | *Ammonia beccarii var. parkinsoniana* | *Anomalina globulosa* | *Archaias angulatus* | *Articulina antillarum* | *Articulina lineata* | *Articulina mexicana* | *Articulina mucronata* | *Articulina pacifica* | *Articulina sagra* | *Articulina sp.* | *Asterigerina carinata* | *Bigeneria irregularis* | *Bolivina lanceolata* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 72-74 | 1863 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 74-76 | 1857 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 |
| 76-78 | 1850 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 78-80 | 1844 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 80-82 | 1837 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 82-84 | 1831 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 84-86 | 1825 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 86-88 | 1818 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 88-90 | 1812 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 90-92 | 1806 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 92-94 | 1799 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 94-96 | 1793 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 96-98 | 1787 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 98-100 | 1780 | 0.693 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 100-102 | 1774 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 |
| 102-104 | 1768 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 104-106 | 1761 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 106-108 | 1755 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.197 |
| 108-110 | 1748 | 1.099 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 110-112 | 1742 | 1.099 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 112-114 | 1736 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 |
| 114-116 | 1729 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 |
| 116-118 | 1723 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 118-120 | 1717 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 120-122 | 1710 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 |
| 122-124 | 1704 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 124-126 | 1698 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 |
| 126-128 | 1691 | 1.099 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 128-130 | 1685 | 1.099 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 130-132 | 1679 | 0.693 | 0.000 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 |
| 132-134 | 1672 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 |
| 134-136 | 1666 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 136-138 | 1659 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 1.099 |
| 138-140 | 1653 | 0.000 | 0.000 | 3.045 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 |
| 140-142 | 1647 | 0.693 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 |
| 142-144 | 1640 | 1.099 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 |

Appendix E:

| Sample Interval (cm) | Calendar Years | *B. lowmani* | *B. paula* | *B. pulchella var. primitiva* | *B. striatula* | *B. subspinescens* | *Broeckina orbitolitoides* | *Buliminella elegantissima* | *Cassidulina subglobosa* | *Cassidulinoides bradyi* | *Clavulina difformis* | *C. mexicana* | *C. tricarinata* | *Cribroelphidium poeyanum* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 2.773 |
| 4-6 | 1995 | 1.946 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 | 1.099 | 0.000 | 0.000 | 0.000 | 2.890 |
| 6-8 | 1991 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.833 |
| 8-10 | 1988 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.398 |
| 10-12 | 1985 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.497 |
| 12-14 | 1981 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 2.944 |
| 14-16 | 1978 | 0.693 | 0.000 | 0.000 | 0.693 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.497 |
| 16-18 | 1975 | 1.946 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.219 |
| 18-20 | 1971 | 1.386 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 3.714 |
| 20-22 | 1968 | 1.609 | 0.000 | 0.000 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.555 |
| 22-24 | 1965 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.833 |
| 24-26 | 1961 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 3.714 |
| 26-28 | 1958 | 1.099 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.664 |
| 28-30 | 1954 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.689 |
| 30-32 | 1951 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.296 |
| 32-34 | 1948 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 3.135 |
| 34-36 | 1944 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.693 | 0.000 | 3.807 |
| 36-38 | 1941 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 3.807 |
| 38-40 | 1938 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.890 |
| 40-42 | 1934 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.738 |
| 42-44 | 1931 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 3.555 |
| 44-46 | 1928 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.944 |
| 46-48 | 1924 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.565 |
| 48-50 | 1921 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 1.946 |
| 50-52 | 1918 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 3.135 |
| 52-54 | 1914 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 54-56 | 1911 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 56-58 | 1908 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 58-60 | 1904 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.091 |
| 60-62 | 1901 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 |
| 62-64 | 1895 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.197 |
| 64-66 | 1888 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.833 |
| 66-68 | 1882 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.871 |
| 68-70 | 1876 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.079 |

| Sample Interval (cm) | Calendar Years | *B. lowmani* | *B. paula* | *B. pulchella var. primitiva* | *B. striatula* | *B. subspinescens* | *Broeckina orbitolitoides* | *Buliminella elegantissima* | *Cassidulina subglobosa* | *Cassidulinoides bradyi* | *Clavulina difformis* | *C. mexicana* | *C. tricarinata* | *Cribroelphidium poeyanum* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 72-74 | 1863 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 74-76 | 1857 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 3.091 |
| 76-78 | 1850 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.609 |
| 78-80 | 1844 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 80-82 | 1837 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.485 |
| 82-84 | 1831 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.807 |
| 84-86 | 1825 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 86-88 | 1818 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 |
| 88-90 | 1812 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 |
| 90-92 | 1806 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 3.912 |
| 92-94 | 1799 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 |
| 94-96 | 1793 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 96-98 | 1787 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.565 |
| 98-100 | 1780 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.989 |
| 100-102 | 1774 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.773 |
| 102-104 | 1768 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.639 |
| 104-106 | 1761 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 2.639 |
| 106-108 | 1755 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.159 |
| 108-110 | 1748 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.565 |
| 110-112 | 1742 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.792 |
| 112-114 | 1736 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.398 |
| 114-116 | 1729 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 3.912 |
| 116-118 | 1723 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.398 |
| 118-120 | 1717 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.773 |
| 120-122 | 1710 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.708 |
| 122-124 | 1704 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.585 |
| 124-126 | 1698 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.398 |
| 126-128 | 1691 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |
| 128-130 | 1685 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.708 |
| 130-132 | 1679 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 3.892 |
| 132-134 | 1672 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.890 |
| 134-136 | 1666 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 2.485 |
| 136-138 | 1659 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.398 |
| 138-140 | 1653 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.738 |
| 140-142 | 1647 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 2.079 |
| 142-144 | 1640 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 |

Appendix E:

| Sample Interval (cm) | Calendar Years | *Cyclogyra sp.* | *Discorbis mira* | *D. rosea* | *Elphidium advenum* | *E. discoidale* | *E. galvestonense* | *E. sagrum* | *Eponides antillarum* | *Frondicularia sagittula* | *Fursenkoina compressa* | *F. mexicana* | *F. pontoni* | *Hauerina bradyi* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 0.693 | 1.386 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 |
| 4-6 | 1995 | 0.693 | 1.386 | 1.386 | 1.099 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6-8 | 1991 | 0.000 | 1.609 | 1.609 | 0.693 | 2.565 | 0.000 | 0.693 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 8-10 | 1988 | 0.000 | 2.079 | 1.609 | 1.099 | 3.135 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 10-12 | 1985 | 0.000 | 1.946 | 1.386 | 1.099 | 2.833 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 12-14 | 1981 | 0.000 | 2.303 | 0.693 | 1.099 | 3.714 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 14-16 | 1978 | 0.000 | 2.303 | 1.609 | 0.693 | 3.258 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 16-18 | 1975 | 0.000 | 2.398 | 0.693 | 0.693 | 3.611 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 18-20 | 1971 | 0.000 | 1.792 | 0.693 | 0.000 | 3.714 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 20-22 | 1968 | 0.000 | 1.946 | 0.693 | 1.099 | 3.912 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 22-24 | 1965 | 0.000 | 2.079 | 0.693 | 0.000 | 3.761 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 24-26 | 1961 | 0.693 | 2.833 | 0.000 | 0.000 | 3.829 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 |
| 26-28 | 1958 | 0.000 | 1.386 | 0.693 | 0.000 | 3.912 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 28-30 | 1954 | 0.000 | 1.609 | 0.000 | 0.000 | 3.091 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 30-32 | 1951 | 0.000 | 2.303 | 1.099 | 0.000 | 4.043 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 32-34 | 1948 | 0.000 | 2.485 | 0.693 | 0.000 | 3.466 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 34-36 | 1944 | 0.000 | 1.609 | 0.000 | 0.000 | 3.332 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 36-38 | 1941 | 0.000 | 1.386 | 0.000 | 0.000 | 3.497 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 38-40 | 1938 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 40-42 | 1934 | 0.000 | 0.000 | 0.000 | 0.000 | 2.890 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 42-44 | 1931 | 0.693 | 1.609 | 0.000 | 0.000 | 3.555 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 44-46 | 1928 | 0.000 | 0.000 | 0.000 | 0.000 | 2.398 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 46-48 | 1924 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 48-50 | 1921 | 0.000 | 1.099 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 50-52 | 1918 | 0.000 | 1.792 | 0.000 | 0.000 | 3.178 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 52-54 | 1914 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 54-56 | 1911 | 0.000 | 1.609 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 56-58 | 1908 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 58-60 | 1904 | 0.000 | 1.792 | 0.000 | 0.000 | 3.219 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 60-62 | 1901 | 0.693 | 0.000 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 62-64 | 1895 | 0.000 | 0.000 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 64-66 | 1888 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 66-68 | 1882 | 0.000 | 0.000 | 0.000 | 0.000 | 3.829 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 68-70 | 1876 | 0.000 | 0.693 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Sample Interval (cm) | Calendar Years | *Cyclogyra sp.* | *Discorbis mira* | *D. rosea* | *Elphidium advenum* | *E. discoidale* | *E. galvestonense* | *E. sagrum* | *Eponides antillarum* | *Frondicularia sagittula* | *Fursenkoina compressa* | *F. mexicana* | *F. pontoni* | *Hauerina bradyi* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 72-74 | 1863 | 0.000 | 0.693 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 74-76 | 1857 | 0.000 | 0.000 | 0.000 | 0.000 | 3.045 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 76-78 | 1850 | 0.000 | 0.693 | 0.000 | 0.000 | 2.639 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 78-80 | 1844 | 0.000 | 0.693 | 0.000 | 0.000 | 2.639 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 80-82 | 1837 | 0.000 | 0.693 | 0.000 | 0.000 | 2.485 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 82-84 | 1831 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 84-86 | 1825 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 86-88 | 1818 | 0.000 | 1.099 | 0.000 | 0.000 | 2.485 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 88-90 | 1812 | 0.000 | 1.099 | 0.000 | 0.000 | 1.946 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 90-92 | 1806 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 92-94 | 1799 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 94-96 | 1793 | 0.000 | 0.693 | 0.000 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 96-98 | 1787 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 98-100 | 1780 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 100-102 | 1774 | 0.000 | 0.000 | 0.000 | 0.000 | 2.485 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 102-104 | 1768 | 0.000 | 1.099 | 0.000 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 104-106 | 1761 | 0.000 | 0.693 | 0.693 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 106-108 | 1755 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 108-110 | 1748 | 0.000 | 0.693 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 110-112 | 1742 | 0.000 | 1.099 | 0.000 | 0.000 | 2.565 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 112-114 | 1736 | 0.000 | 0.000 | 1.099 | 0.000 | 3.219 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 114-116 | 1729 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 116-118 | 1723 | 0.000 | 0.693 | 0.000 | 0.693 | 2.485 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 118-120 | 1717 | 0.000 | 1.386 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 120-122 | 1710 | 0.000 | 0.693 | 0.000 | 0.000 | 2.890 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 122-124 | 1704 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 124-126 | 1698 | 0.000 | 1.099 | 1.099 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 126-128 | 1691 | 0.000 | 0.693 | 0.000 | 0.693 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 128-130 | 1685 | 0.000 | 0.693 | 0.000 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 130-132 | 1679 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 132-134 | 1672 | 0.000 | 0.000 | 0.693 | 0.000 | 2.398 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 134-136 | 1666 | 0.000 | 0.693 | 0.000 | 0.000 | 2.398 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 136-138 | 1659 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 138-140 | 1653 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 140-142 | 1647 | 0.000 | 1.386 | 0.693 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 142-144 | 1640 | 0.000 | 0.693 | 0.000 | 0.000 | 2.398 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Appendix E:

| Sample Interval (cm) | Calendar Years | *Hoeglundina elegans* | *Jaculella acuta* | *Laticarenina halophora* | *Massilina protea* | *M. secans* | *Miliolinella circularis* | *M. fichteliana* | *M. labiosa* | *Nodobaculariella cassis* | *Nonion grateloupi* | *Nonionella depressulum var. matagordanum* | *Peneroplis bradyi* | *P. carinatus* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 3.829 | 0.000 | 2.944 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4-6 | 1995 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 4.111 | 0.000 | 2.890 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 |
| 6-8 | 1991 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.738 | 0.693 | 2.303 | 1.099 | 1.099 | 0.693 | 0.000 | 0.000 |
| 8-10 | 1988 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 3.584 | 0.000 | 1.946 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 10-12 | 1985 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.738 | 0.000 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 12-14 | 1981 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 3.219 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 14-16 | 1978 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.367 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 |
| 16-18 | 1975 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.466 | 0.000 | 1.386 | 0.000 | 0.693 | 0.000 | 1.099 | 0.693 |
| 18-20 | 1971 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 3.932 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 20-22 | 1968 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.638 | 0.000 | 1.099 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 |
| 22-24 | 1965 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.332 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 24-26 | 1961 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 3.892 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 26-28 | 1958 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 4.205 | 0.000 | 1.386 | 0.000 | 0.693 | 0.000 | 0.693 | 0.693 |
| 28-30 | 1954 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.443 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 30-32 | 1951 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.477 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 |
| 32-34 | 1948 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.533 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 34-36 | 1944 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.554 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 36-38 | 1941 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.443 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 38-40 | 1938 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.638 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 40-42 | 1934 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.522 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 42-44 | 1931 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.654 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 44-46 | 1928 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 3.807 | 0.000 | 1.386 | 0.000 | 1.099 | 0.000 | 0.000 | 1.099 |
| 46-48 | 1924 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.258 | 0.000 | 1.609 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 |
| 48-50 | 1921 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.434 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 50-52 | 1918 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.625 | 0.000 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 52-54 | 1914 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.664 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 54-56 | 1911 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.178 | 0.000 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 56-58 | 1908 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.178 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 58-60 | 1904 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.644 | 0.000 | 1.946 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 60-62 | 1901 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.555 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 62-64 | 1895 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.526 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 64-66 | 1888 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.497 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 66-68 | 1882 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.500 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 68-70 | 1876 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.178 | 0.000 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |

| Sample Interval (cm) | Calendar Years | *Hoeglundina elegans* | *Jaculella acuta* | *Laticarenina halophora* | *Massilina protea* | *M. secans* | *Miliolinella circularis* | *M. fichteliana* | *M. labiosa* | *Nodobaculariella cassis* | *Nonion grateloupi* | *Nonionella depressulum var. matagordanum* | *Peneroplis bradyi* | *P. carinatus* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.807 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 72-74 | 1863 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.332 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 74-76 | 1857 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.890 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 76-78 | 1850 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.584 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 78-80 | 1844 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.466 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 80-82 | 1837 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.996 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 82-84 | 1831 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.700 | 0.000 | 3.045 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 |
| 84-86 | 1825 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.258 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 86-88 | 1818 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.045 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 88-90 | 1812 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.045 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 90-92 | 1806 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 5.112 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 92-94 | 1799 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.296 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 94-96 | 1793 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.135 | 0.000 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 96-98 | 1787 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.367 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 98-100 | 1780 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.682 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 100-102 | 1774 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.296 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 102-104 | 1768 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.178 | 0.000 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 104-106 | 1761 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.497 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 106-108 | 1755 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.357 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 108-110 | 1748 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.178 | 0.000 | 1.946 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 110-112 | 1742 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.708 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 112-114 | 1736 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.258 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 114-116 | 1729 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.871 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 116-118 | 1723 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.296 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 118-120 | 1717 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.367 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 120-122 | 1710 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.178 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 122-124 | 1704 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.190 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 124-126 | 1698 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.890 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 126-128 | 1691 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.708 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 128-130 | 1685 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.219 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 |
| 130-132 | 1679 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.407 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 132-134 | 1672 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.526 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 134-136 | 1666 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.367 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 136-138 | 1659 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.526 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 138-140 | 1653 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 4.234 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 140-142 | 1647 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.135 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 142-144 | 1640 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.401 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 |

Appendix E:

| Sample Interval (cm) | Calendar Years | *P. pertusus* | *P. proteus* | *Pyrgo denticulata* | *Pyrgo fornasinii* | *Pyrgo murrhina* | *Pyrgo subsphaerica* | *Quinqueloculina agglutinans* | *Q. bicarinata* | *Q. bicostata* | *Q. bosciana* | *Q. crassa* | *Q. lamarckiana* | *Q. polygona* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.386 | 1.792 | 2.079 | 3.784 | 0.000 | 2.485 | 0.000 |
| 4-6 | 1995 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 1.386 | 0.000 | 3.664 | 0.000 | 2.197 | 0.000 |
| 6-8 | 1991 | 1.609 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 1.946 | 1.099 | 0.000 | 3.664 | 0.693 | 1.099 | 0.000 |
| 8-10 | 1988 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 1.099 | 1.386 | 1.946 | 0.693 | 3.258 | 0.000 | 2.565 | 0.000 |
| 10-12 | 1985 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 2.773 | 0.693 | 2.708 | 0.000 |
| 12-14 | 1981 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.000 | 2.398 | 1.099 | 1.099 | 3.091 | 0.000 | 2.708 | 0.693 |
| 14-16 | 1978 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.609 | 1.386 | 1.099 | 2.565 | 0.693 | 2.890 | 0.000 |
| 16-18 | 1975 | 0.000 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 2.197 | 1.792 | 0.693 | 2.890 | 0.000 | 2.944 | 0.000 |
| 18-20 | 1971 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 2.890 | 0.000 | 2.773 | 0.000 |
| 20-22 | 1968 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.946 | 1.386 | 0.693 | 2.996 | 0.000 | 2.890 | 0.000 |
| 22-24 | 1965 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.609 | 1.946 | 0.693 | 1.609 | 2.773 | 0.000 | 3.466 | 0.000 |
| 24-26 | 1961 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.000 | 3.296 | 0.000 | 2.565 | 0.000 |
| 26-28 | 1958 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 3.091 | 0.000 | 2.565 | 0.000 |
| 28-30 | 1954 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 3.689 | 0.000 | 2.197 | 0.000 |
| 30-32 | 1951 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 1.386 | 3.367 | 0.000 | 2.639 | 0.000 |
| 32-34 | 1948 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.693 | 0.693 | 3.367 | 0.000 | 2.303 | 0.000 |
| 34-36 | 1944 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.693 | 3.989 | 0.000 | 1.386 | 0.000 |
| 36-38 | 1941 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.693 | 3.555 | 0.000 | 0.693 | 0.000 |
| 38-40 | 1938 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.386 | 0.693 | 2.565 | 0.000 | 1.386 | 0.000 |
| 40-42 | 1934 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.693 | 3.689 | 0.000 | 1.946 | 0.000 |
| 42-44 | 1931 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.761 | 0.000 | 1.609 | 0.000 |
| 44-46 | 1928 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.693 | 0.693 | 2.944 | 0.000 | 1.386 | 0.000 |
| 46-48 | 1924 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.386 | 2.079 | 0.000 | 1.792 | 0.000 |
| 48-50 | 1921 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.946 | 0.000 | 1.609 | 0.000 |
| 50-52 | 1918 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.000 | 3.091 | 0.000 | 2.079 | 0.000 |
| 52-54 | 1914 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 1.386 | 2.398 | 0.000 | 0.693 | 0.000 |
| 54-56 | 1911 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.693 | 3.091 | 0.000 | 1.609 | 0.000 |
| 56-58 | 1908 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 1.792 | 2.565 | 0.000 | 2.398 | 0.000 |
| 58-60 | 1904 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 3.178 | 0.000 | 2.197 | 0.000 |
| 60-62 | 1901 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 2.303 | 0.000 | 1.386 | 0.000 |
| 62-64 | 1895 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 1.609 | 2.398 | 0.000 | 0.693 | 0.000 |
| 64-66 | 1888 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 2.485 | 0.000 | 0.693 | 0.000 |
| 66-68 | 1882 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.784 | 0.000 | 1.946 | 0.000 |
| 68-70 | 1876 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 2.708 | 0.000 | 1.792 | 0.000 |

| Sample Interval (cm) | Calendar Years | *P. pertusus* | *P. proteus* | *Pyrgo denticulata* | *Pyrgo fornasinii* | *Pyrgo murrhina* | *Pyrgo subsphaerica* | *Quinqueloculina agglutinans* | *Q. bicarinata* | *Q. bicostata* | *Q. bosciana* | *Q. crassa* | *Q. lamarckiana* | *Q. polygona* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 0.000 | 1.946 | 0.000 |
| 72-74 | 1863 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.303 | 0.000 | 1.099 | 0.000 |
| 74-76 | 1857 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.555 | 0.000 | 2.197 | 0.693 |
| 76-78 | 1850 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.565 | 0.000 | 2.079 | 0.000 |
| 78-80 | 1844 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 2.565 | 0.000 | 1.386 | 0.000 |
| 80-82 | 1837 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 1.792 | 0.000 | 1.099 | 0.000 |
| 82-84 | 1831 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 3.638 | 0.000 | 3.912 | 0.000 |
| 84-86 | 1825 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 2.485 | 0.000 | 2.079 | 0.000 |
| 86-88 | 1818 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.792 | 0.000 | 1.386 | 0.000 |
| 88-90 | 1812 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 2.303 | 0.000 | 1.792 | 0.000 |
| 90-92 | 1806 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 0.000 | 2.773 | 2.197 | 0.000 | 3.555 | 0.000 |
| 92-94 | 1799 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.693 | 1.946 | 0.000 | 2.303 | 0.000 |
| 94-96 | 1793 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.565 | 0.000 | 1.946 | 0.000 |
| 96-98 | 1787 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 2.708 | 0.000 | 1.792 | 0.000 |
| 98-100 | 1780 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 3.932 | 0.000 |
| 100-102 | 1774 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 2.708 | 0.000 | 0.693 | 0.000 |
| 102-104 | 1768 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.944 | 0.000 | 1.946 | 0.000 |
| 104-106 | 1761 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.773 | 0.000 | 0.000 | 0.000 |
| 106-108 | 1755 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 | 3.178 | 0.000 | 4.220 | 0.000 |
| 108-110 | 1748 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.386 | 0.000 | 2.485 | 0.000 | 0.000 | 0.000 |
| 110-112 | 1742 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 0.693 | 0.000 | 2.565 | 0.000 | 1.099 | 0.000 |
| 112-114 | 1736 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.693 | 2.398 | 0.000 | 0.693 | 0.000 |
| 114-116 | 1729 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 2.890 | 3.332 | 0.000 | 3.466 | 0.000 |
| 116-118 | 1723 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.099 | 0.693 | 2.398 | 0.000 | 1.946 | 0.000 |
| 118-120 | 1717 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.693 | 2.398 | 0.000 | 1.386 | 0.000 |
| 120-122 | 1710 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 2.079 | 0.000 | 1.099 | 0.000 |
| 122-124 | 1704 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 3.091 | 0.000 | 4.043 | 0.000 |
| 124-126 | 1698 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.693 | 0.000 | 2.197 | 0.000 | 2.079 | 0.000 |
| 126-128 | 1691 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 0.693 | 0.000 | 2.398 | 0.000 | 2.303 | 0.000 |
| 128-130 | 1685 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 1.099 | 0.693 | 2.303 | 0.000 | 1.946 | 0.000 |
| 130-132 | 1679 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 | 0.000 | 1.609 | 3.738 | 0.000 | 3.738 | 0.000 |
| 132-134 | 1672 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 2.639 | 0.000 | 1.099 | 0.000 |
| 134-136 | 1666 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.398 | 0.000 | 0.693 | 0.000 |
| 136-138 | 1659 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 2.079 | 0.000 | 1.792 | 0.000 |
| 138-140 | 1653 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.639 | 0.000 | 0.000 | 4.094 | 0.000 |
| 140-142 | 1647 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 0.693 | 0.000 | 2.773 | 0.000 | 1.099 | 0.000 |
| 142-144 | 1640 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 2.197 | 0.000 | 1.792 | 0.000 |

Appendix E:

| Sample Interval (cm) | Calendar Years | *Q. subpoeyana* | *Q. wiesneri* | *Rectobolivina advena* | *Rosalina floridana* | *R. floridensis* | *Spiroloculina antillarum* | *S. arenata* | *S. caduca* | *Textularia candeiana* | *Tretomphalus atlanticus* | *Trifarina bella* | *Triloculina bassensis* | *T. bermudezi* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 4.078 | 0.000 | 0.000 | 2.708 | 1.099 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.946 | 2.708 |
| 4-6 | 1995 | 4.159 | 1.792 | 0.693 | 2.303 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.946 | 2.890 |
| 6-8 | 1991 | 4.190 | 2.197 | 0.000 | 2.398 | 0.000 | 1.099 | 0.000 | 1.099 | 1.386 | 0.000 | 0.000 | 2.079 | 1.946 |
| 8-10 | 1988 | 3.989 | 1.792 | 0.000 | 1.946 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.639 | 2.485 |
| 10-12 | 1985 | 4.043 | 2.079 | 0.000 | 1.386 | 1.099 | 0.693 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 1.792 | 2.398 |
| 12-14 | 1981 | 3.932 | 2.485 | 0.000 | 2.303 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 2.197 | 1.792 |
| 14-16 | 1978 | 4.043 | 2.197 | 0.000 | 2.079 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 1.099 | 0.000 | 1.946 | 2.398 |
| 16-18 | 1975 | 3.434 | 2.079 | 0.693 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 2.398 | 2.485 |
| 18-20 | 1971 | 3.912 | 2.398 | 0.000 | 2.565 | 1.792 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.946 |
| 20-22 | 1968 | 4.007 | 1.099 | 0.000 | 2.398 | 0.000 | 1.099 | 0.000 | 1.099 | 0.000 | 0.693 | 0.000 | 1.099 | 2.197 |
| 22-24 | 1965 | 4.078 | 2.565 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 1.792 | 2.197 |
| 24-26 | 1961 | 3.555 | 2.708 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 2.485 |
| 26-28 | 1958 | 3.526 | 2.890 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 1.792 |
| 28-30 | 1954 | 4.025 | 2.773 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 0.693 | 1.946 |
| 30-32 | 1951 | 3.367 | 2.079 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.639 |
| 32-34 | 1948 | 3.611 | 2.197 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 3.135 |
| 34-36 | 1944 | 3.714 | 2.398 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 3.178 |
| 36-38 | 1941 | 3.850 | 1.946 | 0.000 | 1.609 | 0.000 | 0.693 | 0.693 | 0.693 | 0.000 | 0.000 | 0.000 | 1.386 | 2.944 |
| 38-40 | 1938 | 3.045 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 40-42 | 1934 | 3.466 | 2.565 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 2.890 |
| 42-44 | 1931 | 3.664 | 2.890 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.219 |
| 44-46 | 1928 | 2.890 | 1.386 | 0.000 | 1.946 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.099 | 2.944 |
| 46-48 | 1924 | 2.197 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 2.890 |
| 48-50 | 1921 | 2.398 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.386 | 2.708 |
| 50-52 | 1918 | 3.296 | 2.485 | 0.000 | 1.946 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 3.555 |
| 52-54 | 1914 | 2.398 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 1.946 |
| 54-56 | 1911 | 2.485 | 1.609 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 2.398 |
| 56-58 | 1908 | 2.303 | 1.946 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 2.079 |
| 58-60 | 1904 | 3.738 | 2.639 | 0.000 | 1.609 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 3.434 |
| 60-62 | 1901 | 2.639 | 1.792 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.197 |
| 62-64 | 1895 | 2.485 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.099 | 2.303 |
| 64-66 | 1888 | 1.792 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 66-68 | 1882 | 3.219 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.303 |
| 68-70 | 1876 | 2.944 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.485 |

| Sample Interval (cm) | Calendar Years | *Q. subpoeyana* | *Q. wiesneri* | *Rectobolivina advena* | *Rosalina floridana* | *R. floridensis* | *Spiroloculina antillarum* | *S. arenata* | *S. caduca* | *Textularia candeiana* | *Tretomphalus atlanticus* | *Trifarina bella* | *Triloculina bassensis* | *T. bermudezi* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 2.565 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 1.792 |
| 72-74 | 1863 | 2.890 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.079 |
| 74-76 | 1857 | 3.367 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 2.944 |
| 76-78 | 1850 | 2.485 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 2.708 |
| 78-80 | 1844 | 2.773 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.398 |
| 80-82 | 1837 | 3.045 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 2.398 |
| 82-84 | 1831 | 4.331 | 0.000 | 0.000 | 0.000 | 3.807 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 84-86 | 1825 | 2.708 | 1.792 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 1.792 |
| 86-88 | 1818 | 2.485 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 1.946 |
| 88-90 | 1812 | 2.565 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 2.833 |
| 90-92 | 1806 | 4.078 | 0.000 | 0.000 | 0.000 | 4.043 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 92-94 | 1799 | 2.485 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.398 | 1.792 |
| 94-96 | 1793 | 2.079 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 2.565 |
| 96-98 | 1787 | 2.890 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 1.946 |
| 98-100 | 1780 | 3.466 | 0.000 | 0.000 | 0.000 | 3.807 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 100-102 | 1774 | 2.565 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 102-104 | 1768 | 2.303 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.079 |
| 104-106 | 1761 | 2.303 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 2.485 |
| 106-108 | 1755 | 3.434 | 0.000 | 0.000 | 0.000 | 3.526 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 108-110 | 1748 | 2.565 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.197 |
| 110-112 | 1742 | 2.996 | 1.609 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 1.609 |
| 112-114 | 1736 | 1.386 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 2.197 |
| 114-116 | 1729 | 4.007 | 0.000 | 0.000 | 0.000 | 3.367 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 116-118 | 1723 | 2.485 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.079 |
| 118-120 | 1717 | 2.565 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.609 | 1.946 |
| 120-122 | 1710 | 3.091 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.792 |
| 122-124 | 1704 | 3.367 | 0.000 | 0.000 | 0.000 | 3.178 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 124-126 | 1698 | 2.944 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 1.792 |
| 126-128 | 1691 | 2.773 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.946 |
| 128-130 | 1685 | 2.197 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 1.099 |
| 130-132 | 1679 | 3.689 | 0.000 | 0.000 | 0.000 | 3.367 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 132-134 | 1672 | 2.197 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.303 |
| 134-136 | 1666 | 2.485 | 1.792 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 1.792 |
| 136-138 | 1659 | 2.890 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.099 | 1.946 |
| 138-140 | 1653 | 3.784 | 0.000 | 0.000 | 0.000 | 3.638 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 140-142 | 1647 | 2.890 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 2.398 |
| 142-144 | 1640 | 2.773 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 |

Appendix E:

| Sample Interval (cm) | Calendar Years | *T. bicarinata* | *T. carinata* | *T. linneiana* | *T. oblonga* | *T. planciana* | *T. rotunda* | *T. sidebottomi* | *T. tricarinata* | *T. trigonula* | *T. sp.* | *Trochammina japonica* | *Uvigerina peregrina* | *Valvulina oviedoiana* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 0.000 | 0.000 | 1.609 | 0.000 | 1.099 | 2.890 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4-6 | 1995 | 0.000 | 0.000 | 1.946 | 0.000 | 1.792 | 2.639 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6-8 | 1991 | 0.000 | 0.000 | 2.197 | 0.693 | 1.609 | 3.135 | 1.609 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 8-10 | 1988 | 0.000 | 0.000 | 2.398 | 0.000 | 2.398 | 2.890 | 0.693 | 1.099 | 1.386 | 0.000 | 0.000 | 0.693 | 2.303 |
| 10-12 | 1985 | 0.000 | 0.000 | 2.565 | 0.000 | 2.303 | 2.565 | 0.000 | 2.079 | 1.386 | 0.000 | 0.693 | 0.000 | 1.099 |
| 12-14 | 1981 | 0.000 | 0.000 | 2.565 | 0.000 | 2.773 | 2.565 | 0.000 | 0.693 | 1.386 | 0.000 | 0.000 | 0.000 | 1.946 |
| 14-16 | 1978 | 0.000 | 0.000 | 2.197 | 0.693 | 2.708 | 2.944 | 0.000 | 1.099 | 2.079 | 0.000 | 0.000 | 0.000 | 2.079 |
| 16-18 | 1975 | 0.000 | 0.693 | 2.565 | 1.099 | 1.946 | 2.708 | 1.099 | 0.693 | 1.099 | 0.000 | 0.000 | 0.000 | 2.079 |
| 18-20 | 1971 | 0.000 | 0.000 | 1.386 | 0.000 | 1.386 | 2.565 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 20-22 | 1968 | 0.000 | 0.000 | 2.197 | 0.000 | 1.792 | 2.398 | 0.000 | 1.386 | 1.099 | 0.000 | 0.000 | 0.693 | 1.609 |
| 22-24 | 1965 | 0.000 | 0.000 | 2.303 | 0.000 | 1.792 | 3.135 | 1.099 | 1.099 | 1.386 | 1.099 | 0.000 | 0.000 | 1.099 |
| 24-26 | 1961 | 0.693 | 0.000 | 1.792 | 0.000 | 1.099 | 2.773 | 0.000 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 2.079 |
| 26-28 | 1958 | 0.000 | 0.000 | 1.609 | 0.000 | 1.609 | 1.609 | 0.000 | 1.099 | 0.693 | 0.000 | 0.000 | 0.693 | 0.693 |
| 28-30 | 1954 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 2.197 | 0.000 | 1.792 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 30-32 | 1951 | 0.000 | 0.000 | 2.303 | 0.693 | 1.099 | 1.609 | 0.000 | 1.099 | 0.693 | 1.099 | 0.000 | 0.000 | 0.000 |
| 32-34 | 1948 | 1.099 | 0.000 | 2.485 | 0.000 | 1.946 | 2.079 | 0.000 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 34-36 | 1944 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 0.693 | 0.000 | 0.693 | 2.079 | 0.000 | 0.000 | 0.000 | 1.099 |
| 36-38 | 1941 | 0.000 | 0.000 | 1.609 | 0.000 | 1.099 | 0.693 | 0.000 | 0.693 | 0.693 | 1.946 | 0.000 | 0.000 | 0.000 |
| 38-40 | 1938 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.693 |
| 40-42 | 1934 | 0.000 | 0.000 | 1.099 | 0.000 | 1.099 | 1.609 | 0.000 | 1.099 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 42-44 | 1931 | 0.000 | 0.000 | 2.079 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 1.099 |
| 44-46 | 1928 | 0.000 | 0.000 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 | 1.792 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 46-48 | 1924 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 48-50 | 1921 | 0.000 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 50-52 | 1918 | 0.000 | 0.000 | 1.386 | 0.693 | 0.000 | 1.386 | 0.000 | 0.000 | 2.639 | 0.000 | 0.000 | 0.693 | 0.000 |
| 52-54 | 1914 | 0.000 | 0.000 | 1.792 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 54-56 | 1911 | 0.000 | 0.000 | 1.386 | 0.000 | 1.099 | 0.693 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 56-58 | 1908 | 0.000 | 0.000 | 1.792 | 0.000 | 1.609 | 0.000 | 0.000 | 0.693 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 |
| 58-60 | 1904 | 0.000 | 0.000 | 2.398 | 0.000 | 1.099 | 1.099 | 0.000 | 0.693 | 1.946 | 1.946 | 0.000 | 0.000 | 0.000 |
| 60-62 | 1901 | 0.000 | 0.000 | 1.946 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 |
| 62-64 | 1895 | 0.000 | 0.000 | 1.792 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 1.609 | 1.386 | 0.000 | 0.000 | 0.000 |
| 64-66 | 1888 | 0.000 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 66-68 | 1882 | 0.000 | 0.693 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.079 | 0.000 | 0.000 | 0.000 | 0.000 |
| 68-70 | 1876 | 0.000 | 0.000 | 1.386 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Sample Interval (cm) | Calendar Years | *T. bicarinata* | *T. carinata* | *T. linneiana* | *T. oblonga* | *T. planciana* | *T. rotunda* | *T. sidebottomi* | *T. tricarinata* | *T. trigonula* | *T. sp.* | *Trochammina japonica* | *Uvigerina peregrina* | *Valvulina oviedoiana* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 0.000 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 1.099 | 1.099 | 0.000 | 0.000 | 0.000 |
| 72-74 | 1863 | 0.000 | 0.000 | 1.609 | 0.000 | 1.099 | 1.386 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 74-76 | 1857 | 0.000 | 0.000 | 2.398 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 1.946 | 0.000 | 0.693 | 0.693 |
| 76-78 | 1850 | 0.000 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 78-80 | 1844 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 80-82 | 1837 | 0.000 | 0.000 | 1.386 | 0.000 | 1.609 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 82-84 | 1831 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 84-86 | 1825 | 0.000 | 0.000 | 1.386 | 0.000 | 1.609 | 1.099 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 |
| 86-88 | 1818 | 0.000 | 0.000 | 1.609 | 0.693 | 1.792 | 1.099 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 |
| 88-90 | 1812 | 0.000 | 0.000 | 1.386 | 0.000 | 1.099 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 90-92 | 1806 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 2.639 |
| 92-94 | 1799 | 0.000 | 0.693 | 1.946 | 0.000 | 1.609 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 94-96 | 1793 | 0.000 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.099 | 1.609 | 0.000 | 0.000 | 0.693 |
| 96-98 | 1787 | 0.000 | 0.000 | 1.386 | 0.000 | 1.099 | 0.693 | 0.000 | 0.000 | 1.099 | 1.099 | 0.000 | 0.000 | 0.000 |
| 98-100 | 1780 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 100-102 | 1774 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.693 |
| 102-104 | 1768 | 0.000 | 0.000 | 1.792 | 0.000 | 0.693 | 0.693 | 0.000 | 0.693 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 |
| 104-106 | 1761 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 0.000 |
| 106-108 | 1755 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 108-110 | 1748 | 0.000 | 0.000 | 1.386 | 0.000 | 1.099 | 1.099 | 0.000 | 0.693 | 0.693 | 1.099 | 0.000 | 0.000 | 0.000 |
| 110-112 | 1742 | 0.000 | 0.000 | 0.693 | 0.000 | 1.099 | 1.099 | 0.000 | 0.693 | 0.000 | 1.609 | 0.000 | 0.000 | 0.693 |
| 112-114 | 1736 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 |
| 114-116 | 1729 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 |
| 116-118 | 1723 | 0.000 | 0.000 | 1.609 | 0.000 | 0.693 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 118-120 | 1717 | 0.000 | 0.000 | 1.946 | 0.000 | 1.609 | 0.000 | 0.000 | 0.693 | 0.000 | 1.099 | 0.000 | 0.000 | 0.693 |
| 120-122 | 1710 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 1.609 | 0.000 | 0.000 | 0.000 |
| 122-124 | 1704 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 124-126 | 1698 | 0.000 | 0.000 | 1.609 | 0.000 | 0.693 | 1.609 | 0.000 | 0.693 | 0.693 | 0.693 | 0.000 | 0.000 | 0.693 |
| 126-128 | 1691 | 0.000 | 0.000 | 1.099 | 0.000 | 1.099 | 1.792 | 0.693 | 1.099 | 1.099 | 0.693 | 0.000 | 0.000 | 0.000 |
| 128-130 | 1685 | 0.000 | 0.000 | 1.609 | 0.000 | 0.000 | 1.386 | 0.000 | 0.693 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 |
| 130-132 | 1679 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.197 | 0.000 | 0.000 | 0.000 | 1.946 | 0.000 | 0.000 | 0.693 |
| 132-134 | 1672 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 134-136 | 1666 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.386 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 | 1.099 |
| 136-138 | 1659 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.099 | 0.000 | 0.000 | 0.000 |
| 138-140 | 1653 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.639 | 0.000 | 0.000 | 0.693 |
| 140-142 | 1647 | 0.000 | 0.000 | 0.693 | 0.000 | 0.000 | 1.609 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 0.000 | 0.693 |
| 142-144 | 1640 | 0.000 | 0.000 | 1.099 | 0.000 | 0.693 | 1.099 | 1.099 | 0.000 | 0.693 | 0.000 | 0.000 | 0.000 | 1.099 |

Appendix E:

| Sample Interval (cm) | Calendar Years | Planktonic | Rotaliids | *Articulina* | *Bolivina* | *Crib-Elph* | *Miliolinella* | *Quinqueloculina* | *Rosalina* | *Triloculina* |
|---|---|---|---|---|---|---|---|---|---|---|
| 2-4 | 1998 | 0.000 | 1.609 | 2.303 | 2.303 | 4.970 | 6.773 | 15.604 | 3.807 | 10.946 |
| 4-6 | 1995 | 0.000 | 1.386 | 4.394 | 4.718 | 6.068 | 7.001 | 14.296 | 2.303 | 12.599 |
| 6-8 | 1991 | 0.693 | 2.398 | 5.817 | 2.079 | 6.784 | 6.733 | 14.887 | 2.398 | 13.963 |
| 8-10 | 1988 | 0.000 | 2.485 | 5.288 | 1.099 | 6.632 | 5.529 | 15.629 | 1.946 | 15.988 |
| 10-12 | 1985 | 0.000 | 2.197 | 4.564 | 2.708 | 8.815 | 5.124 | 13.683 | 2.485 | 15.088 |
| 12-14 | 1981 | 0.000 | 2.833 | 3.584 | 3.401 | 8.855 | 4.317 | 17.504 | 2.303 | 13.971 |
| 14-16 | 1978 | 0.000 | 2.398 | 5.817 | 4.564 | 8.141 | 4.977 | 16.483 | 2.079 | 16.065 |
| 16-18 | 1975 | 0.000 | 2.708 | 3.466 | 3.892 | 8.909 | 4.852 | 16.030 | 2.079 | 16.784 |
| 18-20 | 1971 | 0.000 | 2.708 | 3.989 | 4.644 | 7.427 | 4.625 | 13.359 | 4.357 | 7.977 |
| 20-22 | 1968 | 0.000 | 2.079 | 3.466 | 5.347 | 8.566 | 4.736 | 15.017 | 2.398 | 12.168 |
| 22-24 | 1965 | 0.000 | 1.792 | 5.817 | 3.555 | 6.594 | 4.431 | 17.129 | 1.609 | 15.901 |
| 24-26 | 1961 | 0.000 | 2.944 | 0.693 | 0.000 | 8.235 | 5.684 | 13.510 | 0.693 | 11.837 |
| 26-28 | 1958 | 0.000 | 2.197 | 2.485 | 4.394 | 7.576 | 5.591 | 13.459 | 1.609 | 9.105 |
| 28-30 | 1954 | 0.000 | 2.996 | 1.099 | 2.303 | 6.780 | 6.052 | 13.377 | 1.386 | 9.113 |
| 30-32 | 1951 | 0.000 | 2.833 | 0.693 | 3.091 | 7.339 | 5.576 | 13.533 | 2.197 | 11.926 |
| 32-34 | 1948 | 0.000 | 2.565 | 3.584 | 2.485 | 6.601 | 6.142 | 13.557 | 1.386 | 13.635 |
| 34-36 | 1944 | 0.000 | 3.401 | 2.773 | 2.773 | 7.139 | 5.247 | 13.566 | 1.792 | 9.416 |
| 36-38 | 1941 | 0.000 | 2.398 | 1.386 | 3.178 | 7.303 | 6.052 | 12.124 | 1.609 | 11.064 |
| 38-40 | 1938 | 0.000 | 1.946 | 0.000 | 0.693 | 5.193 | 5.247 | 9.768 | 0.693 | 4.787 |
| 40-42 | 1934 | 0.000 | 3.091 | 1.386 | 1.099 | 6.628 | 5.215 | 13.745 | 1.609 | 9.993 |
| 42-44 | 1931 | 0.000 | 3.951 | 0.000 | 0.693 | 7.111 | 6.040 | 11.925 | 1.386 | 7.378 |
| 44-46 | 1928 | 0.000 | 1.946 | 0.693 | 0.693 | 5.342 | 5.193 | 11.092 | 1.946 | 7.627 |
| 46-48 | 1924 | 0.000 | 1.792 | 0.000 | 0.693 | 3.951 | 4.868 | 8.841 | 0.000 | 5.886 |
| 48-50 | 1921 | 0.000 | 2.773 | 0.000 | 0.693 | 4.025 | 3.434 | 8.033 | 0.693 | 6.397 |
| 50-52 | 1918 | 0.000 | 3.367 | 2.485 | 3.401 | 6.314 | 5.724 | 12.338 | 1.946 | 11.046 |
| 52-54 | 1914 | 0.000 | 2.303 | 0.000 | 0.693 | 4.605 | 3.664 | 9.583 | 0.000 | 7.034 |
| 54-56 | 1911 | 0.000 | 0.693 | 0.000 | 0.000 | 3.466 | 4.564 | 10.587 | 1.386 | 8.284 |
| 56-58 | 1908 | 0.000 | 1.386 | 0.693 | 0.693 | 3.689 | 3.871 | 12.389 | 0.000 | 8.659 |
| 58-60 | 1904 | 0.000 | 3.466 | 2.773 | 0.000 | 6.310 | 6.590 | 12.445 | 1.609 | 14.694 |
| 60-62 | 1901 | 0.000 | 2.079 | 1.386 | 0.000 | 3.989 | 4.248 | 9.218 | 1.099 | 7.832 |
| 62-64 | 1895 | 0.000 | 2.303 | 0.000 | 0.000 | 4.394 | 4.220 | 10.076 | 0.000 | 9.575 |
| 64-66 | 1888 | 0.000 | 2.303 | 0.000 | 0.693 | 4.913 | 4.190 | 6.356 | 0.000 | 3.912 |
| 66-68 | 1882 | 0.000 | 3.714 | 1.386 | 2.996 | 7.700 | 4.500 | 11.146 | 0.000 | 7.848 |
| 68-70 | 1876 | 0.000 | 1.946 | 0.693 | 0.000 | 4.159 | 4.564 | 8.831 | 0.000 | 5.257 |

| Sample Interval (cm) | Calendar Years | Planktonic | Rotaliids | *Articulina* | *Bolivina* | *Crib-Elph* | *Miliolinella* | *Quinqueloculina* | *Rosalina* | *Triloculina* |
|---|---|---|---|---|---|---|---|---|---|---|
| 70-72 | 1869 | 0.000 | 2.079 | 0.000 | 0.000 | 4.159 | 3.807 | 7.977 | 0.000 | 8.083 |
| 72-74 | 1863 | 0.000 | 2.565 | 0.000 | 0.000 | 4.500 | 4.025 | 8.083 | 0.693 | 7.966 |
| 74-76 | 1857 | 0.000 | 3.638 | 0.000 | 1.386 | 6.136 | 4.890 | 11.605 | 0.000 | 10.872 |
| 76-78 | 1850 | 0.000 | 2.079 | 0.000 | 0.693 | 4.248 | 3.584 | 7.822 | 0.000 | 7.208 |
| 78-80 | 1844 | 0.000 | 2.303 | 0.000 | 1.792 | 4.718 | 3.466 | 9.496 | 0.000 | 4.190 |
| 80-82 | 1837 | 0.000 | 2.773 | 0.693 | 0.000 | 4.970 | 3.689 | 8.014 | 0.000 | 7.879 |
| 82-84 | 1831 | 0.000 | 0.000 | 0.693 | 1.099 | 3.807 | 7.745 | 12.979 | 3.807 | 0.000 |
| 84-86 | 1825 | 0.000 | 2.398 | 0.000 | 0.000 | 4.159 | 3.951 | 9.757 | 0.693 | 8.659 |
| 86-88 | 1818 | 0.000 | 2.398 | 0.000 | 0.693 | 4.787 | 4.431 | 7.742 | 0.000 | 10.317 |
| 88-90 | 1812 | 0.000 | 2.833 | 0.000 | 0.000 | 3.555 | 3.045 | 9.144 | 0.000 | 8.026 |
| 90-92 | 1806 | 0.000 | 0.000 | 0.000 | 0.693 | 3.912 | 6.498 | 14.682 | 4.043 | 2.890 |
| 92-94 | 1799 | 0.000 | 2.398 | 0.000 | 0.000 | 2.890 | 3.296 | 9.624 | 0.000 | 9.537 |
| 94-96 | 1793 | 0.000 | 2.197 | 0.000 | 0.000 | 4.382 | 4.234 | 7.283 | 0.000 | 9.655 |
| 96-98 | 1787 | 0.000 | 1.792 | 0.693 | 0.000 | 4.357 | 3.367 | 8.083 | 0.000 | 8.931 |
| 98-100 | 1780 | 0.000 | 0.000 | 0.693 | 3.178 | 3.989 | 6.474 | 8.091 | 3.807 | 0.000 |
| 100-102 | 1774 | 0.000 | 2.303 | 0.000 | 1.386 | 5.257 | 5.088 | 7.065 | 0.000 | 5.481 |
| 102-104 | 1768 | 0.000 | 1.946 | 1.099 | 0.693 | 4.248 | 4.277 | 8.985 | 0.000 | 7.742 |
| 104-106 | 1761 | 0.000 | 1.792 | 0.000 | 0.693 | 4.942 | 4.190 | 5.768 | 0.000 | 6.356 |
| 106-108 | 1755 | 0.000 | 0.000 | 0.000 | 2.197 | 4.159 | 4.357 | 13.134 | 3.526 | 0.000 |
| 108-110 | 1748 | 0.000 | 1.946 | 0.000 | 1.792 | 4.762 | 5.124 | 8.516 | 0.000 | 8.959 |
| 110-112 | 1742 | 0.000 | 1.946 | 0.000 | 0.000 | 4.357 | 2.708 | 10.754 | 0.000 | 7.901 |
| 112-114 | 1736 | 0.000 | 2.485 | 0.000 | 1.099 | 5.617 | 4.357 | 7.655 | 0.000 | 5.781 |
| 114-116 | 1729 | 0.000 | 0.000 | 0.000 | 1.386 | 5.011 | 5.257 | 14.794 | 3.367 | 2.197 |
| 116-118 | 1723 | 0.000 | 1.609 | 0.000 | 0.693 | 5.576 | 3.296 | 9.314 | 0.000 | 5.768 |
| 118-120 | 1717 | 0.000 | 2.079 | 0.000 | 0.000 | 4.970 | 4.754 | 8.429 | 0.000 | 8.902 |
| 120-122 | 1710 | 0.000 | 2.079 | 0.000 | 2.079 | 5.598 | 3.178 | 7.655 | 0.000 | 5.886 |
| 122-124 | 1704 | 0.000 | 0.000 | 0.000 | 2.303 | 4.585 | 4.883 | 11.195 | 3.178 | 0.000 |
| 124-126 | 1698 | 0.000 | 1.946 | 0.693 | 0.693 | 4.700 | 3.989 | 10.111 | 0.000 | 9.170 |
| 126-128 | 1691 | 0.000 | 2.197 | 0.000 | 0.693 | 5.075 | 3.401 | 11.344 | 0.000 | 10.212 |
| 128-130 | 1685 | 0.000 | 1.946 | 0.000 | 0.693 | 5.011 | 3.219 | 10.029 | 0.000 | 6.579 |
| 130-132 | 1679 | 0.000 | 0.000 | 0.000 | 1.792 | 5.501 | 5.100 | 15.076 | 3.367 | 4.143 |
| 132-134 | 1672 | 0.000 | 2.197 | 0.000 | 1.792 | 5.288 | 4.625 | 8.014 | 0.693 | 2.996 |
| 134-136 | 1666 | 0.000 | 2.708 | 0.000 | 0.693 | 4.883 | 3.367 | 7.368 | 0.693 | 6.356 |
| 136-138 | 1659 | 0.000 | 2.197 | 1.099 | 1.792 | 4.007 | 3.526 | 9.246 | 0.000 | 5.529 |
| 138-140 | 1653 | 0.000 | 0.000 | 0.000 | 1.099 | 5.124 | 4.234 | 10.518 | 3.638 | 2.639 |
| 140-142 | 1647 | 0.000 | 1.386 | 0.000 | 1.099 | 4.277 | 4.234 | 9.064 | 0.693 | 6.087 |
| 142-144 | 1640 | 0.000 | 2.197 | 0.693 | 0.693 | 4.190 | 3.401 | 10.227 | 0.000 | 6.762 |

Appendix F: Percent abundance data for ostracodes from No Name Bank core (GLW402-NNB).

| Depth (cm) | Calendar | *Actino* | *Bairdiids* | *Loxoconcha* | *Malzella* | *P. setipunctata* | *Puriana* | *Xestoleberis* | *Other* | *Neocaud/Caudites* | *Radimella/Jugs* | *Cytherella* | Total % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2001 | 0 | 33 | 25 | 0 | 0 | 0 | 7 | 23 | 2 | 3 | 7 | 100 |
| 3 | 1998 | 0 | 27 | 19 | 1 | 0 | 0 | 17 | 29 | 0 | 1 | 8 | 102 |
| 5 | 1995 | 0 | 19 | 16 | 1 | 2 | 0 | 15 | 30 | 2 | 3 | 12 | 100 |
| 7 | 1991 | 0 | 24 | 28 | 3 | 0 | 0 | 16 | 18 | 0 | 4 | 8 | 101 |
| 9 | 1988 | 0 | 36 | 17 | 1 | 1 | 1 | 13 | 17 | 1 | 5 | 8 | 100 |
| 11 | 1985 | 1 | 30 | 15 | 2 | 1 | 0 | 20 | 16 | 2 | 5 | 8 | 100 |
| 13 | 1981 | 0 | 19 | 19 | 4 | 2 | 0 | 29 | 13 | 2 | 6 | 6 | 100 |
| 15 | 1978 | 1 | 27 | 15 | 4 | 1 | 1 | 23 | 22 | 0 | 3 | 3 | 100 |
| 17 | 1975 | 6 | 24 | 14 | 5 | 2 | 0 | 22 | 15 | 1 | 4 | 7 | 100 |
| 19 | 1971 | 1 | 20 | 17 | 4 | 2 | 1 | 17 | 19 | 3 | 7 | 8 | 99 |
| 21 | 1968 | 1 | 24 | 18 | 5 | 4 | 1 | 22 | 13 | 2 | 3 | 7 | 100 |
| 23 | 1965 | 0 | 25 | 15 | 4 | 1 | 0 | 30 | 11 | 1 | 4 | 9 | 100 |
| 25 | 1961 | 0 | 39 | 19 | 2 | 1 | 3 | 11 | 10 | 3 | 4 | 9 | 101 |
| 27 | 1958 | 1 | 22 | 16 | 3 | 0 | 1 | 28 | 18 | 3 | 4 | 6 | 102 |
| 29 | 1954 | 1 | 14 | 25 | 3 | 1 | 0 | 24 | 23 | 5 | 5 | 4 | 105 |
| 31 | 1951 | 0 | 12 | 22 | 3 | 0 | 1 | 30 | 16 | 7 | 3 | 9 | 103 |
| 33 | 1948 | 1 | 20 | 30 | 2 | 0 | 0 | 17 | 11 | 4 | 5 | 12 | 102 |
| 35 | 1944 | 0 | 33 | 25 | 3 | 0 | 1 | 9 | 10 | 4 | 3 | 12 | 100 |
| 37 | 1941 | 1 | 36 | 21 | 1 | 0 | 0 | 9 | 16 | 2 | 3 | 13 | 102 |
| 39 | 1938 | 1 | 37 | 29 | 1 | 0 | 1 | 8 | 14 | 1 | 2 | 6 | 100 |
| 41 | 1934 | 0 | 37 | 28 | 2 | 0 | 0 | 10 | 18 | 2 | 1 | 2 | 100 |
| 43 | 1931 | 1 | 30 | 27 | 3 | 0 | 1 | 13 | 15 | 0 | 3 | 7 | 100 |
| 45 | 1928 | 3 | 18 | 29 | 4 | 0 | 1 | 19 | 19 | 0 | 0 | 7 | 100 |
| 47 | 1924 | 0 | 60 | 20 | 0 | 1 | 0 | 9 | 21 | 2 | 0 | 7 | 120 |
| 49 | 1921 | 1 | 40 | 21 | 5 | 0 | 0 | 13 | 21 | 0 | 0 | 1 | 102 |
| 51 | 1918 | 1 | 16 | 20 | 5 | 0 | 1 | 15 | 27 | 3 | 5 | 10 | 103 |
| 53 | 1914 | 1 | 9 | 31 | 1 | 0 | 0 | 14 | 36 | 2 | 1 | 5 | 100 |
| 55 | 1911 | 2 | 4 | 27 | 4 | 0 | 6 | 20 | 30 | 3 | 2 | 3 | 101 |
| 57 | 1908 | 1 | 16 | 14 | 13 | 1 | 6 | 20 | 20 | 1 | 7 | 1 | 100 |
| 59 | 1904 | 0 | 27 | 21 | 6 | 0 | 1 | 10 | 25 | 1 | 6 | 3 | 100 |
| 61 | 1901 | 0 | 15 | 40 | 4 | 0 | 2 | 10 | 25 | 0 | 2 | 4 | 102 |
| 63 | 1895 | 0 | 33 | 30 | 2 | 1 | 1 | 5 | 22 | 0 | 3 | 3 | 100 |
| 65 | 1888 | 0 | 28 | 22 | 6 | 0 | 2 | 19 | 18 | 1 | 0 | 4 | 100 |
| 67 | 1882 | 0 | 18 | 37 | 2 | 0 | 0 | 12 | 18 | 2 | 3 | 7 | 99 |
| 69 | 1876 | 0 | 21 | 28 | 2 | 0 | 2 | 13 | 21 | 1 | 3 | 9 | 100 |
| 71 | 1869 | 1 | 28 | 30 | 5 | 0 | 0 | 14 | 11 | 1 | 3 | 7 | 100 |
| 73 | 1863 | 1 | 12 | 26 | 4 | 0 | 1 | 22 | 23 | 1 | 1 | 9 | 100 |
| 75 | 1857 | 0 | 8 | 24 | 4 | 0 | 0 | 23 | 28 | 4 | 2 | 7 | 100 |
| 77 | 1850 | 1 | 23 | 25 | 5 | 0 | 0 | 14 | 23 | 2 | 2 | 6 | 101 |
| 79 | 1844 | 2 | 23 | 18 | 2 | 0 | 3 | 21 | 22 | 1 | 5 | 3 | 100 |
| 81 | 1837 | 1 | 11 | 17 | 4 | 1 | 0 | 40 | 17 | 2 | 2 | 5 | 100 |
| 83 | 1831 | 2 | 21 | 22 | 6 | 0 | 1 | 23 | 21 | 0 | 0 | 4 | 100 |
| 85 | 1825 | 0 | 16 | 25 | 2 | 1 | 1 | 30 | 16 | 1 | 2 | 6 | 100 |
| 87 | 1818 | 0 | 24 | 18 | 10 | 0 | 0 | 19 | 19 | 1 | 0 | 9 | 100 |

| Depth (cm) | Calendar | *Actino* | *Bairdiids* | *Loxoconcha* | *Malzella* | *P. setipunctata* | *Puriana* | *Xestoleberis* | *Other* | *Neocaud/Caudites* | *Radimella/Jugs* | *Cytherella* | Total % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 89 | 1812 | 1 | 14 | 25 | 6 | 1 | 0 | 24 | 20 | 0 | 1 | 8 | 100 |
| 91 | 1806 | 1 | 8 | 18 | 11 | 1 | 1 | 28 | 25 | 2 | 3 | 2 | 100 |
| 93 | 1799 | 0 | 10 | 16 | 6 | 1 | 0 | 33 | 25 | 1 | 3 | 5 | 100 |
| 95 | 1793 | 1 | 17 | 19 | 9 | 2 | 3 | 20 | 22 | 1 | 1 | 3 | 98 |
| 97 | 1787 | 2 | 11 | 21 | 8 | 4 | 1 | 15 | 29 | 3 | 2 | 4 | 100 |
| 99 | 1780 | 1 | 15 | 38 | 4 | 0 | 0 | 19 | 15 | 1 | 1 | 6 | 100 |
| 101 | 1774 | 1 | 21 | 35 | 2 | 0 | 0 | 10 | 34 | 0 | 0 | 2 | 105 |
| 103 | 1768 | 0 | 11 | 28 | 2 | 0 | 1 | 21 | 28 | 3 | 0 | 6 | 100 |
| 105 | 1761 | 0 | 7 | 32 | 5 | 0 | 0 | 21 | 27 | 1 | 0 | 7 | 100 |
| 107 | 1755 | 1 | 11 | 32 | 5 | 0 | 0 | 19 | 23 | 0 | 1 | 8 | 100 |
| 109 | 1748 | 0 | 11 | 35 | 3 | 1 | 0 | 18 | 27 | 0 | 1 | 7 | 103 |
| 111 | 1742 | 0 | 9 | 30 | 3 | 0 | 1 | 25 | 22 | 0 | 1 | 9 | 100 |
| 113 | 1736 | 0 | 2 | 17 | 7 | 1 | 1 | 51 | 15 | 0 | 0 | 6 | 100 |
| 115 | 1729 | 2 | 3 | 25 | 6 | 0 | 0 | 20 | 32 | 0 | 2 | 9 | 99 |
| 117 | 1723 | 2 | 3 | 28 | 4 | 0 | 2 | 21 | 34 | 0 | 1 | 5 | 100 |
| 121 | 1710 | 0 | 2 | 25 | 7 | 0 | 0 | 35 | 23 | 0 | 1 | 8 | 101 |
| 125 | 1698 | 2 | 5 | 30 | 3 | 2 | 3 | 26 | 23 | 0 | 1 | 5 | 100 |
| 129 | 1685 | 0 | 3 | 17 | 7 | 3 | 0 | 47 | 20 | 2 | 1 | 2 | 102 |
| 133 | 1672 | 1 | 8 | 22 | 9 | 5 | 0 | 22 | 29 | 0 | 0 | 4 | 100 |
| 137 | 1659 | 3 | 2 | 13 | 9 | 1 | 0 | 36 | 29 | 1 | 0 | 6 | 100 |
| 141 | 1647 | 1 | 2 | 22 | 1 | 3 | 1 | 35 | 28 | 1 | 0 | 6 | 100 |
| 145 | 1640 | 0 | 3 | 7 | 3 | 4 | 3 | 41 | 28 | 3 | 1 | 7 | 100 |
| 149* | | 2 | 2 | 9 | 10 | 2 | 1 | 34 | 38 | 0 | 1 | 2 | 101 |
| 151.5* | | 0 | 0 | 4 | 9 | 6 | 3 | 47 | 20 | 4 | 0 | 7 | 100 |

* The lowest portion of No Name core, from 146-153 cm shows evidence of modern contamination, so these samples were not included in any of the analyses.

Appendix G: Molluscan Percent Abundance (excluding worn specimens and fragments) in No Name Bank Core (GLW402-NNB)

| **Depth in core (cm)** | **1** | **9** | **17** | **25** | **33** | **41** | **49** | **57** |
|---|---|---|---|---|---|---|---|---|
| **Calendar Year** | 2001 | 1988 | 1975 | 1961 | 1948 | 1934 | 1921 | 1908 |
| **Species** | | | | | | | | |
| *Acteocina canaliculata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Acteon punctastriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Acteon* sp. ? | 3.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Amaea mitchelli ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Americardia guppyi* | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Anomalocardia auberiana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Anomia simplex* | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 9.52 | 0.00 |
| *Arcopsis adamsi* | 0.00 | 0.00 | 4.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Argopecten* sp ? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bittiolum varium* | 0.00 | 4.21 | 0.82 | 20.09 | 26.67 | 0.00 | 14.29 | 5.41 |
| *Boonea bisuturalis* | 3.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Brachidontes exustus* | 0.00 | 0.00 | 0.82 | 1.34 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bratechlamys antillarum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bulla striata* | 3.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum cornucopiae* | 0.00 | 0.00 | 3.28 | 2.23 | 0.00 | 13.33 | 0.00 | 0.00 |
| *Caecum pulchellum* | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis greeni* | 0.00 | 0.00 | 4.92 | 5.80 | 6.67 | 0.00 | 4.76 | 0.00 |
| *Cerithiopsis* spp | 0.00 | 8.42 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium eburneum ?* | 3.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium muscarum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Chione cancellata* | 3.23 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Codakia* spp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.70 |
| *Columbella* spp. | 0.00 | 4.21 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Conus* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Costanachis* sp | 0.00 | 0.00 | 4.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crenella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crepidula* spp | 3.23 | 2.11 | 1.64 | 2.23 | 6.67 | 0.00 | 9.52 | 10.81 |
| *Cumingia tellinoides* | 0.00 | 1.05 | 0.00 | 0.45 | 0.00 | 13.33 | 9.52 | 24.32 |
| *Cyclostremiscus suppressus* | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Dentimargo* sp | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Diodora* sp | 0.00 | 1.05 | 0.00 | 0.00 | 0.00 | 0.00 | 4.76 | 0.00 |
| *Epitomium echinocostum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.70 |
| *Eulithidium affine* | 12.90 | 28.42 | 14.75 | 12.50 | 0.00 | 6.67 | 0.00 | 2.70 |
| *Gouldia cerina* | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 4.76 | 0.00 |
| *Granulina hadria* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrobiids | 0.00 | 3.16 | 0.82 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 |
| Laesidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Laevicardium mortoni* | 0.00 | 1.05 | 0.82 | 1.34 | 0.00 | 0.00 | 4.76 | 18.92 |
| *Limaria* sp cf *L pellucida* | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 6.67 | 0.00 | 2.70 |
| *Lithopoma caelatum* | 0.00 | 1.05 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lucina pectinata* | 0.00 | 1.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lucinisca nassula* | 0.00 | 3.16 | 2.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella ocellata* | 3.23 | 0.00 | 5.74 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Modiolus* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Modulus modulus* | 0.00 | 1.05 | 2.46 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mysella* sp ? | 0.00 | 3.16 | 1.64 | 0.00 | 0.00 | 13.33 | 0.00 | 0.00 |
| *Nassarius albus* | 0.00 | 2.11 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |

| **Depth in core (cm)** | **1** | **9** | **17** | **25** | **33** | **41** | **49** | **57** |
|---|---|---|---|---|---|---|---|---|
| **Calendar Year** | 2001 | 1988 | 1975 | 1961 | 1948 | 1934 | 1921 | 1908 |
| *Nassarius* sp ? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Naticarius canrena* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Nucula proxima* | 0.00 | 2.11 | 3.28 | 4.91 | 3.33 | 0.00 | 0.00 | 0.00 |
| *Odostomia laevigata* | 0.00 | 1.05 | 3.28 | 1.34 | 3.33 | 0.00 | 0.00 | 0.00 |
| *Olivella sp* | 6.45 | 1.05 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Parvilucina multilineata* | 0.00 | 0.00 | 0.00 | 2.68 | 0.00 | 6.67 | 14.29 | 5.41 |
| *Patelloida pustulata* | 0.00 | 0.00 | 0.82 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pecten* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pilsbryspira leucocyma* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pitar* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pleuromeris tridenta* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Polymesoda maritima ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Prunum apicinum* | 19.35 | 3.16 | 4.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Prunum* sp (aff *apicinum*) | 0.00 | 0.00 | 0.00 | 4.46 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pteria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rictaxis punctostriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rissoina cancellata* | 3.23 | 0.00 | 0.00 | 2.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Schwartziella catesbyana* | 6.45 | 9.47 | 12.30 | 6.70 | 10.00 | 0.00 | 4.76 | 0.00 |
| *Stellatoma stellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tegula fasciata* | 0.00 | 0.00 | 0.82 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Teinostoma biscaynense* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina mera* | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina* spp | 3.23 | 0.00 | 0.82 | 2.23 | 3.33 | 0.00 | 4.76 | 0.00 |
| *Tellina texana* | 0.00 | 0.00 | 0.00 | 1.34 | 0.00 | 6.67 | 0.00 | 16.22 |
| *Trachycardium muricatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Transennella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.41 |
| *Triptychus niveus* | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Turbo castaneus* | 25.81 | 8.42 | 19.67 | 15.63 | 40.00 | 33.33 | 14.29 | 2.70 |
| *Turbonilla* sp. | 0.00 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vermicularia* sp. | 0.00 | 0.00 | 1.64 | 3.57 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vexillum hanleyi ?* | 0.00 | 0.00 | 1.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Gastropods | 0.00 | 9.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Pelecypods | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | |
| Percent Total/Sample | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Absolute Abundance each sample | 31 | 95 | 122 | 224 | 30 | 15 | 21 | 37 |
| Number of Faunal Categories each sample | 14 | 22 | 27 | 35 | 8 | 8 | 12 | 12 |

Appendix G:

| **Depth in core (cm)** | **65** | **73** | **81** | **89** | **97** | **105** |
|---|---|---|---|---|---|---|
| **Calendar Year** | 1888 | 1863 | 1837 | 1812 | 1787 | 1761 |
| **Species** | | | | | | |
| *Acteocina canaliculata* | 0.00 | 0.00 | 0.00 | 2.13 | 1.41 | 0.00 |
| *Acteon punctastriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 0.00 |
| *Acteon* sp. ? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Amaea mitchelli ?* | 6.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Americardia guppyi* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Anomalocardia auberiana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Anomia simplex* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Arcopsis adamsi* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Argopecten* sp ? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bittiolum varium* | 12.50 | 38.10 | 4.55 | 14.89 | 32.39 | 35.00 |
| *Boonea bisuturalis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Brachidontes exustus* | 0.00 | 0.00 | 0.00 | 6.38 | 5.63 | 0.00 |
| *Bratechlamys antillarum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bulla striata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum cornucopiae* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum pulchellum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis greeni* | 6.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis* spp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium eburneum ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium muscarum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Chione cancellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Codakia* spp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Columbella* spp. | 6.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Conus* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Costanachis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crenella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 2.82 | 0.00 |
| *Crepidula* spp | 0.00 | 0.00 | 4.55 | 2.13 | 0.00 | 0.00 |
| *Cumingia tellinoides* | 0.00 | 0.00 | 4.55 | 0.00 | 2.82 | 2.50 |
| *Cyclostremiscus suppressus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Dentimargo* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Diodora* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Epitomium echinocostum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.50 |
| *Eulithidium affine* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Gouldia cerina* | 0.00 | 9.52 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Granulina hadria* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrobiids | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Laesidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Laevicardium mortoni* | 12.50 | 0.00 | 4.55 | 14.89 | 12.68 | 10.00 |
| *Limaria* sp cf *L pellucida* | 0.00 | 4.76 | 9.09 | 0.00 | 0.00 | 2.50 |
| *Lithopoma caelatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lucina pectinata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lucinisca nassula* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella ocellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Modiolus* sp | 0.00 | 4.76 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Modulus modulus* | 0.00 | 0.00 | 0.00 | 2.13 | 0.00 | 0.00 |
| *Mysella* sp ? | 0.00 | 0.00 | 4.55 | 10.64 | 7.04 | 2.50 |
| *Nassarius albus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| **Depth in core (cm)** | **65** | **73** | **81** | **89** | **97** | **105** |
|---|---|---|---|---|---|---|
| **Calendar Year** | 1888 | 1863 | 1837 | 1812 | 1787 | 1761 |
| *Nassarius* sp ? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Naticarius canrena* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Nucula proxima* | 0.00 | 9.52 | 4.55 | 2.13 | 0.00 | 0.00 |
| *Odostomia laevigata* | 0.00 | 0.00 | 0.00 | 2.13 | 1.41 | 5.00 |
| *Olivella sp* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Parvilucina multilineata* | 12.50 | 0.00 | 0.00 | 6.38 | 2.82 | 0.00 |
| *Patelloida pustulata* | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 0.00 |
| *Pecten* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pilsbryspira leucocyma* | 0.00 | 0.00 | 0.00 | 2.13 | 0.00 | 0.00 |
| *Pitar* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 0.00 |
| *Pleuromeris tridenta* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Polymesoda maritima ?* | 0.00 | 0.00 | 4.55 | 0.00 | 0.00 | 0.00 |
| *Prunum apicinum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Prunum* sp (aff *apicinum*) | 0.00 | 0.00 | 0.00 | 0.00 | 2.82 | 0.00 |
| *Pteria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rictaxis punctostriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rissoina cancellata* | 6.25 | 4.76 | 9.09 | 2.13 | 1.41 | 0.00 |
| *Schwartziella catesbyana* | 0.00 | 4.76 | 4.55 | 21.28 | 4.23 | 12.50 |
| *Stellatoma stellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tegula fasciata* | 12.50 | 0.00 | 4.55 | 0.00 | 0.00 | 0.00 |
| *Teinostoma biscaynense* | 0.00 | 0.00 | 0.00 | 0.00 | 5.63 | 0.00 |
| *Tellina mera* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina* spp | 0.00 | 9.52 | 0.00 | 0.00 | 5.63 | 12.50 |
| *Tellina texana* | 12.50 | 4.76 | 31.82 | 0.00 | 4.23 | 7.50 |
| *Trachycardium muricatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Transennella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Triptychus niveus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Turbo castaneus* | 0.00 | 4.76 | 9.09 | 10.64 | 1.41 | 7.50 |
| *Turbonilla* sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vermicularia* sp. | 12.50 | 4.76 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vexillum hanleyi ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Gastropods | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 0.00 |
| Unidentified Pelecypods | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | |
| Percent Total/Sample | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Absolute Abundance each sample | 16 | 21 | 22 | 47 | 71 | 40 |
| Number of Faunal Categories each sample | 10 | 11 | 13 | 14 | 20 | 11 |

Appendix G:

| Depth in core (cm) | 111 | 121 | 129 | 137 | 145 | 151* | Absolute Abundance/ species |
|---|---|---|---|---|---|---|---|
| Calendar Year | 1742 | 1710 | 1685 | 1659 | | | |
| **Species** | | | | | | | |
| *Acteocina canaliculata* | 0.00 | 0.00 | 0.00 | 0.00 | 1.24 | 0.98 | 8 |
| *Acteon punctastriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Acteon* sp. ? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Amaea mitchelli ?* | 0.00 | 0.00 | 1.01 | 4.81 | 4.55 | 3.26 | 33 |
| *Americardia guppyi* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Anomalocardia auberiana* | 0.00 | 0.00 | 1.01 | 0.00 | 0.00 | 0.00 | 1 |
| *Anomia simplex* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3 |
| *Arcopsis adamsi* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6 |
| *Argopecten* sp ? | 0.00 | 0.00 | 0.00 | 0.48 | 0.00 | 0.33 | 2 |
| *Bittiolum varium* | 49.47 | 57.14 | 36.36 | 12.98 | 14.46 | 11.40 | 338 |
| *Boonea bisuturalis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Brachidontes exustus* | 1.05 | 0.00 | 0.00 | 1.92 | 1.24 | 0.33 | 20 |
| *Bratechlamys antillarum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 | 1 |
| *Bulla striata* | 0.00 | 1.43 | 0.00 | 1.92 | 1.24 | 0.65 | 11 |
| *Caecum cornucopiae* | 0.00 | 0.00 | 0.00 | 0.48 | 0.00 | 0.00 | 12 |
| *Caecum pulchellum* | 0.00 | 0.00 | 0.00 | 0.48 | 0.41 | 0.65 | 5 |
| *Cerithiopsis greeni* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 23 |
| *Cerithiopsis* spp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10 |
| *Cerithium eburneum ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Cerithium muscarum* | 0.00 | 0.00 | 0.00 | 2.40 | 0.00 | 0.00 | 5 |
| *Cerithium* sp | 0.00 | 0.00 | 1.01 | 0.96 | 1.65 | 4.23 | 20 |
| *Chione cancellata* | 0.00 | 0.00 | 1.01 | 2.40 | 4.55 | 1.63 | 24 |
| *Codakia* spp | 0.00 | 0.00 | 0.00 | 0.96 | 0.00 | 0.65 | 5 |
| *Columbella* spp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6 |
| *Conus* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.33 | 2 |
| *Costanachis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5 |
| *Crenella* sp | 0.00 | 0.00 | 0.00 | 1.92 | 0.83 | 1.63 | 13 |
| *Crepidula* spp | 0.00 | 1.43 | 0.00 | 1.44 | 0.00 | 1.63 | 29 |
| *Cumingia tellinoides* | 2.11 | 1.43 | 5.05 | 5.77 | 1.24 | 1.30 | 46 |
| *Cyclostremiscus suppressus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Dentimargo* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 2 |
| *Diodora* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Epitomium echinocostum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Eulithidium affine* | 0.00 | 0.00 | 0.00 | 0.96 | 0.00 | 0.00 | 81 |
| *Gouldia cerina* | 0.00 | 0.00 | 0.00 | 0.48 | 1.24 | 0.98 | 11 |
| *Granulina hadria* | 0.00 | 0.00 | 0.00 | 1.44 | 1.24 | 1.30 | 10 |
| Hydrobiids | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6 |
| Laesidae | 1.05 | 0.00 | 0.00 | 0.48 | 0.00 | 0.00 | 2 |
| *Laevicardium mortoni* | 8.42 | 4.29 | 11.11 | 16.83 | 14.88 | 16.94 | 181 |
| *Limaria* sp cf *L pellucida* | 0.00 | 0.00 | 0.00 | 0.48 | 0.00 | 0.00 | 8 |
| *Lithopoma caelatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Lucina pectinata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Lucinisca nassula* | 0.00 | 0.00 | 0.00 | 0.00 | 0.83 | 0.00 | 8 |
| *Mitrella ocellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8 |
| *Modiolus* sp | 0.00 | 1.43 | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Modulus modulus* | 0.00 | 1.43 | 0.00 | 0.48 | 0.83 | 0.00 | 10 |
| *Mysella* sp ? | 1.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 20 |
| *Nassarius albus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 4 |

| Depth in core (cm) | 111 | 121 | 129 | 137 | 145 | 151* | Absolute Abundance/ species |
|---|---|---|---|---|---|---|---|
| Calendar Year | 1742 | 1710 | 1685 | 1659 | | | |
| *Nassarius* sp ? | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 | 1 |
| *Naticarius canrena* | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 | 1 |
| *Nucula proxima* | 0.00 | 1.43 | 0.00 | 3.37 | 4.96 | 2.61 | 50 |
| *Odostomia laevigata* | 1.05 | 0.00 | 1.01 | 0.00 | 0.00 | 0.00 | 15 |
| *Olivella sp* | 0.00 | 0.00 | 0.00 | 0.96 | 0.83 | 0.00 | 8 |
| *Parvilucina multilineata* | 4.21 | 0.00 | 4.04 | 12.98 | 11.98 | 13.36 | 124 |
| *Patelloida pustulata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4 |
| *Pecten* | 1.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Pilsbryspira leucocyma* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Pitar* sp | 3.16 | 1.43 | 2.02 | 3.85 | 10.74 | 10.10 | 72 |
| *Pleuromeris tridenta* | 0.00 | 0.00 | 1.01 | 0.48 | 0.83 | 0.98 | 7 |
| *Polymesoda maritima ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Prunum apicinum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14 |
| *Prunum* sp (aff *apicinum*) | 0.00 | 0.00 | 0.00 | 1.92 | 0.00 | 0.65 | 18 |
| *Pteria* sp | 1.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Rictaxis punctostriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 | 1 |
| *Rissoina cancellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12 |
| *Schwartziella catesbyana* | 8.42 | 8.57 | 25.25 | 3.85 | 3.31 | 2.93 | 129 |
| *Stellatoma stellata* | 0.00 | 0.00 | 0.00 | 0.00 | 1.24 | 0.00 | 3 |
| *Tegula fasciata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5 |
| *Teinostoma biscaynense* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4 |
| *Tellina mera* | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 | 2 |
| *Tellina* spp | 7.37 | 7.14 | 8.08 | 4.81 | 4.55 | 0.98 | 64 |
| *Tellina texana* | 3.16 | 8.57 | 1.01 | 2.40 | 6.61 | 11.73 | 93 |
| *Trachycardium muricatum* | 0.00 | 0.00 | 0.00 | 0.00 | 1.65 | 0.65 | 6 |
| *Transennella* sp | 3.16 | 1.43 | 0.00 | 4.33 | 0.00 | 6.84 | 36 |
| *Triptychus niveus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Turbo castaneus* | 4.21 | 2.86 | 0.00 | 0.48 | 0.00 | 0.33 | 116 |
| *Turbonilla* sp. | 0.00 | 0.00 | 1.01 | 0.00 | 0.41 | 0.00 | 3 |
| *Vermicularia* sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13 |
| *Vexillum hanleyi ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| Unidentified Gastropods | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10 |
| Unidentified Pelecypods | 0.00 | 0.00 | 0.00 | 0.48 | 0.00 | 0.00 | 1 |
| Percent Total/Sample | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | |
| Absolute Abundance each sample | 95 | 70 | 99 | 208 | 242 | 307 | 1813 |
| Number of Faunal Categories each sample | 16 | 14 | 15 | 33 | 32 | 30 | |

* The lowest portion of No Name core, from 146-153 cm shows evidence of modern contamination, so these samples were not included in any of the analyses.

Appendix H. Mg/Ca analyses on Loxoconcha matagordensis for No Name core (GLW402-NNB)

| Sample | Lab # | Depth Top (cm) | Depth Base (cm) | molt | VPI | Ca (ppm) | CaCO3 (µg) | Mg/Ca (mmol/mol) | Sr/Ca (mmol/mol) | Na/Ca (mmol/mol) | avg Mg/Ca | avg Sr/Ca | avg Na/Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5101 | 0 | 2 | A | 2 to 3 | 0.8 | 6.3 | 44.05 | 3.53 | 14.04 | 39.70 | 3.81 | 16.14 |
| 2 | 5102 | 0 | 2 | A | 2 to 3 | 0.6 | 4.5 | 39.77 | 4.15 | 17.78 | | | |
| 3 | 5103 | 0 | 2 | A | 2 to 3 | 0.7 | 5.4 | 38.01 | 4.04 | 16.38 | | | |
| 4 | 5104 | 0 | 2 | A | 2 to 3 | 0.5 | 4.0 | 32.18 | 3.53 | 18.07 | | | |
| 5 | 5105 | 0 | 2 | A | 2 to 3 | 0.7 | 5.4 | 44.49 | 3.78 | 14.44 | | | |
| 6 | 5106 | 2 | 4 | A | 2 to 3 | 0.8 | 6.0 | 52.60 | 3.54 | 13.78 | 44.24 | 3.92 | 15.83 |
| 7 | 5107 | 2 | 4 | A | 2 to 3 | 0.7 | 4.9 | 43.14 | 3.86 | 19.37 | | | |
| 8 | 5108 | 2 | 4 | A | 2 to 3 | 0.8 | 6.3 | 36.95 | 4.16 | 13.96 | | | |
| 9 | 5109 | 2 | 4 | A | 2 to 3 | 0.9 | 6.4 | 48.20 | 3.61 | 15.27 | | | |
| 10 | 5110 | 2 | 4 | A | 2 to 3 | 0.7 | 5.0 | 40.34 | 4.44 | 16.78 | | | |
| 11 | 5111 | 4 | 6 | A | 2 to 3 | 0.8 | 6.1 | 43.73 | 3.84 | 15.47 | 38.59 | 3.68 | 15.05 |
| 12 | 5112 | 4 | 6 | A | 2 to 3 | 0.5 | 3.7 | 47.74 | 3.51 | 16.55 | | | |
| 13 | 5113 | 4 | 6 | A | 2 to 3 | 0.7 | 5.3 | 33.22 | 3.85 | 14.99 | | | |
| 14 | 5114 | 4 | 6 | A | 2 to 3 | 0.8 | 6.2 | 29.76 | 3.49 | 14.44 | | | |
| 15 | 5115 | 4 | 6 | A | 2 to 3 | 0.8 | 5.6 | 38.50 | 3.74 | 13.82 | | | |
| 16 | 5116 | 6 | 8 | A | 2 to 3 | 0.7 | 5.6 | 39.94 | 3.70 | 13.37 | 35.15 | 3.55 | 15.83 |
| 17 | 5117 | 6 | 8 | A | 2 to 3 | 0.7 | 5.2 | 36.79 | 3.51 | 14.82 | | | |
| 18 | 5118 | 6 | 8 | A | 2 to 3 | 0.6 | 4.8 | 30.58 | 3.65 | 14.19 | | | |
| 19 | 5119 | 6 | 8 | A | 2 to 3 | 0.8 | 6.1 | 36.40 | 3.42 | 20.95 | | | |
| 20 | 5120 | 6 | 8 | A | 2 to 3 | 0.8 | 5.8 | 32.04 | 3.46 | 15.80 | | | |
| 21 | 5121 | 8 | 10 | A | 2 to 3 | 0.9 | 6.4 | 40.44 | 3.45 | 15.94 | 37.73 | 3.62 | 15.12 |
| 22 | 5122 | 8 | 10 | A | 2 to 3 | 0.6 | 4.5 | 35.67 | 3.99 | 15.57 | | | |
| 23 | 5123 | 8 | 10 | A | 2 to 3 | 0.7 | 5.1 | 36.15 | 3.61 | 11.93 | | | |
| 24 | 5124 | 8 | 10 | A | 2 to 3 | 0.7 | 5.3 | 40.18 | 3.57 | 16.41 | | | |
| 25 | 5125 | 8 | 10 | A | 2 to 3 | 0.7 | 5.5 | 36.21 | 3.46 | 15.76 | | | |
| 26 | 5126 | 10 | 12 | A | 2 to 3 | 0.7 | 5.0 | 39.78 | 3.70 | 13.14 | 39.50 | 3.61 | 14.94 |
| 27 | 5127 | 10 | 12 | A | 2 to 3 | 0.7 | 5.1 | 44.52 | 3.81 | 14.72 | | | |
| 28 | 5128 | 10 | 12 | A | 2 to 3 | 0.7 | 5.1 | 38.19 | 3.65 | 15.18 | | | |
| 29 | 5129 | 10 | 12 | A | 2 to 3 | 0.7 | 5.4 | 30.28 | 3.35 | 18.48 | | | |
| 30 | 5130 | 10 | 12 | A | 2 to 3 | 0.4 | 3.2 | 44.72 | 3.54 | 13.19 | | | |
| 31 | 5131 | 12 | 14 | A | 2 to 3 | 0.5 | 3.8 | 43.33 | 3.67 | 15.68 | 37.75 | 3.53 | 16.06 |
| 32 | 5132 | 12 | 14 | A | 2 to 3 | 0.7 | 5.4 | 34.49 | 3.39 | 13.56 | | | |
| 33 | 5133 | 12 | 14 | A | 2 to 3 | 0.8 | 6.3 | 35.24 | 3.76 | 17.58 | | | |
| 34 | 5134 | 12 | 14 | A | 2 to 3 | 0.5 | 4.1 | 45.36 | 3.41 | 16.78 | | | |
| 35 | 5135 | 12 | 14 | A | 2 to 3 | 0.7 | 5.6 | 30.32 | 3.43 | 16.71 | | | |
| 36 | 5136 | 14 | 16 | A | 2 to 3 | 1.0 | 7.2 | 30.47 | 3.57 | 13.43 | 34.53 | 3.51 | 13.79 |
| 37 | 5137 | 14 | 16 | A | 2 to 3 | 0.5 | 3.8 | 37.50 | 3.46 | 14.12 | | | |
| 38 | 5138 | 14 | 16 | A | 2 to 3 | 0.5 | 3.6 | 39.87 | 3.61 | 12.37 | | | |
| 39 | 5139 | 14 | 16 | A | 2 to 3 | 0.5 | 3.7 | 29.05 | 3.15 | 12.80 | | | |
| 40 | 5140 | 14 | 16 | A | 2 to 3 | 0.6 | 4.1 | 35.76 | 3.75 | 16.24 | | | |
| 41 | 5141 | 16 | 18 | A | 2 to 3 | 0.5 | 3.5 | 36.99 | 3.30 | 14.75 | 40.41 | 3.44 | 15.30 |
| 42 | 5142 | 16 | 18 | A | 2 to 3 | 0.8 | 5.8 | 32.95 | 3.33 | 15.49 | | | |
| 43 | 5143 | 16 | 18 | A | 2 to 3 | 0.6 | 4.3 | 37.27 | 3.53 | 12.44 | | | |
| 44 | 5144 | 16 | 18 | A | 2 to 3 | 0.5 | 3.6 | 47.60 | 3.61 | 19.91 | | | |
| 45 | 5145 | 16 | 18 | A | 2 to 3 | 0.8 | 5.9 | 47.23 | 3.44 | 13.91 | | | |

| Sample | Lab # | Depth Top (cm) | Depth Base (cm) | molt | VPI | Ca (ppm) | CaCO3 (µg) | Mg/Ca (mmol/ mol) | Sr/Ca (mmol/ mol) | Na/Ca (mmol/ mol) | avg Mg/Ca | avg Sr/Ca | avg Na/Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46 | 5146 | 18 | 20 | A | 2 to 3 | 0.5 | 4.0 | 39.51 | 3.97 | 14.67 | 36.15 | 3.74 | 15.63 |
| 47 | 5147 | 18 | 20 | A | 2 to 3 | 0.8 | 6.2 | 32.91 | 3.67 | 19.60 | | | |
| 48 | 5148 | 18 | 20 | A | 2 to 3 | 0.8 | 5.8 | 38.43 | 4.15 | 14.26 | | | |
| 49 | 5149 | 18 | 20 | A | 2 to 3 | 0.7 | 5.6 | 41.79 | 3.57 | 14.95 | | | |
| 50 | 5150 | 18 | 20 | A | 2 to 3 | 0.6 | 4.9 | 28.10 | 3.35 | 14.68 | | | |
| 51 | 5151 | 20 | 22 | A | 2 to 3 | 0.7 | 5.6 | 28.65 | 3.20 | 18.13 | 36.19 | 3.39 | 17.78 |
| 52 | 5152 | 20 | 22 | A | 2 to 3 | 0.8 | 6.1 | 37.12 | 3.48 | 16.16 | | | |
| 53 | 5153 | 20 | 22 | A | 2 to 3 | 0.7 | 4.9 | 37.07 | 3.24 | 19.18 | | | |
| 54 | 5154 | 20 | 22 | A | 2 to 3 | 0.7 | 5.2 | 35.73 | 3.59 | 17.24 | | | |
| 55 | 5155 | 20 | 22 | A | 2 to 3 | 0.5 | 3.9 | 42.38 | 3.44 | 18.17 | | | |
| 56 | 5156 | 22 | 24 | A | 2 to 3 | 0.6 | 4.4 | 39.19 | 3.44 | 47.89 | 40.10 | 3.34 | 23.66 |
| 57 | 5157 | 22 | 24 | A | 2 to 3 | 0.4 | 3.3 | 43.43 | 3.41 | 18.57 | | | |
| 58 | 5158 | 22 | 24 | A | 2 to 3 | 0.7 | 5.2 | 36.27 | 3.37 | 16.69 | | | |
| 59 | 5159 | 22 | 24 | A | 2 to 3 | 0.7 | 5.2 | 41.07 | 3.32 | 16.65 | | | |
| 60 | 5160 | 22 | 24 | A | 2 to 3 | 0.7 | 5.3 | 40.52 | 3.17 | 18.53 | | | |
| 61 | 5161 | 24 | 26 | A | 2 to 3 | 0.8 | 6.2 | 26.45 | 3.32 | 13.79 | 38.17 | 3.50 | 14.97 |
| 62 | 5162 | 24 | 26 | A | 2 to 3 | 0.6 | 4.7 | 50.60 | 3.61 | 17.35 | | | |
| 63 | 5163 | 24 | 26 | A | 2 to 3 | 0.8 | 5.8 | 37.72 | 3.90 | 14.94 | | | |
| 64 | 5164 | 24 | 26 | A | 2 to 3 | 0.7 | 5.6 | 41.37 | 3.56 | 14.92 | | | |
| 65 | 5165 | 24 | 26 | A | 2 to 3 | 0.7 | 5.6 | 34.74 | 3.09 | 13.87 | | | |
| 66 | 5166 | 26 | 28 | A | 2 to 3 | 0.7 | 5.4 | 47.09 | 3.63 | 19.43 | 45.14 | 3.45 | 16.95 |
| 67 | 5167 | 26 | 28 | A | 2 to 3 | 0.7 | 5.2 | 53.66 | 3.36 | 16.50 | | | |
| 68 | 5168 | 26 | 28 | A | 2 to 3 | 0.6 | 4.5 | 49.16 | 3.38 | 14.67 | | | |
| 69 | 5169 | 26 | 28 | A | 2 to 3 | 0.8 | 5.8 | 40.78 | 3.57 | 18.00 | | | |
| 70 | 5170 | 26 | 28 | A | 2 to 3 | 0.8 | 6.2 | 35.00 | 3.31 | 16.19 | | | |
| 71 | 5171 | 28 | 30 | A | 2 to 3 | 0.7 | 5.1 | 45.22 | 2.96 | 15.72 | 34.47 | 3.41 | 15.15 |
| 72 | 5172 | 28 | 30 | A | 2 to 3 | 0.8 | 5.9 | 39.59 | 3.85 | 14.94 | | | |
| 73 | 5173 | 28 | 30 | A | 2 to 3 | 0.9 | 6.7 | 32.13 | 3.58 | 14.97 | | | |
| 74 | 5174 | 28 | 30 | A | 2 to 3 | 0.7 | 5.4 | 25.05 | 3.23 | 16.21 | | | |
| 75 | 5175 | 28 | 30 | A | 2 to 3 | 0.7 | 5.2 | 30.37 | 3.44 | 13.89 | | | |
| 76 | 5176 | 30 | 32 | A | 2 to 3 | 0.7 | 5.5 | 32.33 | 3.60 | 17.40 | 37.77 | 3.64 | 15.82 |
| 77 | 5177 | 30 | 32 | A | 2 to 3 | 0.6 | 4.6 | 44.63 | 3.55 | 15.20 | | | |
| 78 | 5178 | 30 | 32 | A | 2 to 3 | 0.7 | 5.3 | 35.52 | 3.62 | 17.71 | | | |
| 79 | 5179 | 30 | 32 | A | 2 to 3 | 0.4 | 3.2 | 43.02 | 3.68 | 13.69 | | | |
| 80 | 5180 | 30 | 32 | A | 2 to 3 | 0.7 | 5.0 | 33.33 | 3.74 | 15.07 | | | |
| 81 | 5181 | 32 | 34 | A | 2 to 3 | 0.7 | 5.4 | 37.30 | 3.63 | 17.33 | 36.62 | 3.27 | 15.01 |
| 82 | 5182 | 32 | 34 | A | 2 to 3 | 0.5 | 3.9 | 36.28 | 3.32 | 14.62 | | | |
| 83 | 5183 | 32 | 34 | A | 2 to 3 | 0.6 | 4.6 | 29.31 | 3.12 | 17.72 | | | |
| 84 | 5184 | 32 | 34 | A | 2 to 3 | 0.7 | 5.6 | 46.68 | 3.17 | 16.89 | | | |
| 85 | 5185 | 32 | 34 | A | 2 to 3 | 0.6 | 4.6 | 33.54 | 3.12 | 8.50 | | | |
| 86 | 5186 | 34 | 36 | A | 2 to 3 | 0.4 | 3.4 | 40.66 | 3.28 | 13.01 | 36.49 | 3.31 | 14.61 |
| 87 | 5187 | 34 | 36 | A | 2 to 3 | 0.5 | 3.5 | 38.80 | 3.28 | 21.90 | | | |
| 88 | 5188 | 34 | 36 | A | 2 to 3 | 0.6 | 4.1 | 28.95 | 3.23 | 8.36 | | | |
| 89 | 5189 | 34 | 36 | A | 2 to 3 | 0.5 | 3.9 | 32.85 | 3.14 | 14.75 | | | |
| 90 | 5190 | 34 | 36 | A | 2 to 3 | 0.8 | 6.1 | 41.17 | 3.62 | 15.01 | | | |
| 91 | 5191 | 36 | 38 | A | 2 to 3 | 0.6 | 4.4 | 32.69 | 3.33 | 17.51 | 35.14 | 3.38 | 15.21 |
| 92 | 5192 | 36 | 38 | A | 2 to 3 | 0.5 | 3.9 | 44.89 | 3.30 | 11.81 | | | |

| Sample | Lab # | Depth Top (cm) | Depth Base (cm) | molt | VPI | Ca (ppm) | CaCO3 (µg) | Mg/Ca (mmol/ mol) | Sr/Ca (mmol/ mol) | Na/Ca (mmol/ mol) | avg Mg/Ca | avg Sr/Ca | avg Na/Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 93 | 5193 | 36 | 38 | A | 2 to 3 | 0.7 | 5.0 | 34.27 | 3.56 | 13.83 | | | |
| 94 | 5194 | 36 | 38 | A | 2 to 3 | 0.8 | 5.7 | 27.38 | 3.14 | 16.32 | | | |
| 95 | 5195 | 36 | 38 | A | 2 to 3 | 0.6 | 4.8 | 36.46 | 3.59 | 16.60 | | | |
| 96 | 5196 | 38 | 40 | A | 2 to 3 | 0.7 | 5.1 | 40.01 | 3.37 | 13.74 | 41.94 | 3.57 | 20.63 |
| 97 | 5197 | 38 | 40 | A | 2 to 3 | 0.8 | 5.9 | 45.66 | 3.62 | 22.08 | | | |
| 98 | 5198 | 38 | 40 | A | 2 to 3 | 0.8 | 6.3 | 36.66 | 3.88 | 25.25 | | | |
| 99 | 5199 | 38 | 40 | A | 2 to 3 | 0.6 | 4.3 | 53.59 | 3.43 | 16.07 | | | |
| 100 | 51100 | 38 | 40 | A | 2 to 3 | 0.8 | 6.3 | 33.77 | 3.55 | 26.03 | | | |
| 101 | 51101 | 40 | 42 | A | 2 to 3 | 0.7 | 5.4 | 37.14 | 3.84 | 18.51 | 37.66 | 3.52 | 20.95 |
| 102 | 51102 | 40 | 42 | A | 2 to 3 | 0.6 | 4.6 | 33.72 | 3.49 | 20.96 | | | |
| 103 | 51103 | 40 | 42 | A | 2 to 3 | 0.6 | 4.8 | 52.51 | 3.48 | 27.92 | | | |
| 104 | 51104 | 40 | 42 | A | 2 to 3 | 0.9 | 6.4 | 37.67 | 3.60 | 24.31 | | | |
| 105 | 51105 | 40 | 42 | A | 2 to 3 | 0.8 | 5.9 | 27.27 | 3.20 | 13.06 | | | |
| 106 | 51106 | 42 | 44 | A | 2 to 3 | 0.6 | 4.7 | 29.01 | 3.22 | 16.11 | 32.73 | 3.49 | 15.09 |
| 107 | 51107 | 42 | 44 | A | 2 to 3 | 0.7 | 5.6 | 31.89 | 3.75 | 15.96 | | | |
| 108 | 51108 | 42 | 44 | A | 2 to 3 | 1.0 | 7.3 | 32.61 | 3.68 | 15.42 | | | |
| 109 | 51109 | 42 | 44 | A | 2 to 3 | 0.7 | 5.1 | 34.08 | 3.22 | 14.14 | | | |
| 110 | 51110 | 42 | 44 | A | 2 to 3 | 0.8 | 6.1 | 36.07 | 3.59 | 13.85 | | | |
| 111 | 51111 | 44 | 46 | A | 2 to 3 | 0.8 | 5.7 | 35.81 | 3.63 | 12.86 | 38.69 | 3.61 | 14.25 |
| 112 | 51112 | 44 | 46 | A | 2 to 3 | 0.8 | 5.6 | 31.36 | 3.79 | 12.85 | | | |
| 113 | 51113 | 44 | 46 | A | 2 to 3 | 0.7 | 5.3 | 38.26 | 3.71 | 14.77 | | | |
| 114 | 51114 | 44 | 46 | A | 2 to 3 | 0.9 | 6.4 | 48.67 | 3.39 | 17.59 | | | |
| 115 | 51115 | 44 | 46 | A | 2 to 3 | 0.7 | 5.6 | 39.35 | 3.54 | 13.19 | | | |
| 116 | 51116 | 46 | 48 | A | 2 to 3 | 0.6 | 4.7 | 39.67 | 3.30 | 17.10 | 36.90 | 3.47 | 15.93 |
| 117 | 51117 | 46 | 48 | A | 2 to 3 | 0.4 | 2.8 | 39.47 | 3.62 | 17.10 | | | |
| 118 | 51118 | 46 | 48 | A | 2 to 3 | 0.7 | 5.2 | 28.52 | 3.29 | 14.68 | | | |
| 119 | 51119 | 46 | 48 | A | 2 to 3 | 0.5 | 3.8 | 35.15 | 3.52 | 14.47 | | | |
| 120 | 51120 | 46 | 48 | A | 2 to 3 | 0.5 | 3.6 | 41.69 | 3.62 | 16.32 | | | |
| 121 | 51121 | 48 | 50 | A | 2 to 3 | 0.7 | 5.0 | 45.04 | 3.62 | 23.54 | 39.56 | 3.61 | 18.16 |
| 122 | 51122 | 48 | 50 | A | 2 to 3 | 0.7 | 5.3 | 39.74 | 3.65 | 17.01 | | | |
| 123 | 51123 | 48 | 50 | A | 2 to 3 | 0.7 | 5.5 | 39.21 | 3.75 | 18.25 | | | |
| 124 | 51124 | 48 | 50 | A | 2 to 3 | 0.9 | 6.4 | 34.25 | 3.57 | 17.52 | | | |
| 125 | 51125 | 48 | 50 | A | 2 to 3 | 0.6 | 4.4 | 39.54 | 3.47 | 14.50 | | | |
| 126 | 51126 | 50 | 52 | A | 2 to 3 | 0.8 | 5.7 | 47.44 | 3.83 | 20.22 | 41.48 | 3.68 | 18.21 |
| 127 | 51127 | 50 | 52 | A | 2 to 3 | 0.6 | 4.3 | 34.26 | 3.12 | 17.73 | | | |
| 128 | 51128 | 50 | 52 | A | 2 to 3 | 0.6 | 4.6 | 37.03 | 3.63 | 18.48 | | | |
| 129 | 51129 | 50 | 52 | A | 2 to 3 | 0.8 | 5.8 | 41.5 | 3.9 | 17.2 | | | |
| 130 | 51130 | 50 | 52 | A | 2 to 3 | 0.8 | 6.0 | 47.2 | 3.9 | 17.5 | | | |
| 131 | 51131 | 52 | 54 | A | 2 to 3 | 0.7 | 5.2 | 65.1 | 3.6 | 36.0 | 46.13 | 3.49 | 19.76 |
| 132 | 51132 | 52 | 54 | A | 2 to 3 | 0.7 | 5.6 | 42.1 | 3.4 | 15.5 | | | |
| 133 | 51133 | 52 | 54 | A | 2 to 3 | 0.6 | 4.9 | 46.8 | 3.7 | 16.8 | | | |
| 134 | 51134 | 52 | 54 | A | 2 to 3 | 0.8 | 5.7 | 34.1 | 3.5 | 12.9 | | | |
| 135 | 51135 | 52 | 54 | A | 2 to 3 | 0.4 | 2.9 | 42.6 | 3.3 | 17.6 | | | |
| 136 | 51136 | 54 | 56 | A | 2 to 3 | 0.5 | 4.0 | 31.6 | 3.0 | 10.5 | 33.52 | 3.42 | 14.80 |
| 137 | 51137 | 54 | 56 | A | 2 to 3 | 0.6 | 4.5 | 33.9 | 3.1 | 12.8 | | | |
| 138 | 51138 | 54 | 56 | A | 2 to 3 | 0.5 | 3.7 | 30.7 | 3.5 | 17.9 | | | |
| 139 | 51139 | 54 | 56 | A | 2 to 3 | 0.5 | 3.8 | 32.5 | 3.6 | 17.7 | | | |

| Sample | Lab # | Depth Top (cm) | Depth Base (cm) | molt | VPI | Ca (ppm) | CaCO3 (µg) | Mg/Ca (mmol/mol) | Sr/Ca (mmol/mol) | Na/Ca (mmol/mol) | avg Mg/Ca | avg Sr/Ca | avg Na/Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 | 51140 | 54 | 56 | A | 2 to 3 | 0.8 | 5.8 | 38.8 | 3.9 | 15.1 | | | |
| 141 | 51141 | 56 | 58 | A | 2 to 3 | 0.7 | 5.6 | 35.1 | 4.0 | 13.3 | 36.60 | 3.70 | 14.37 |
| 142 | 51142 | 56 | 58 | A | 2 to 3 | 0.7 | 5.3 | 31.0 | 3.7 | 16.9 | | | |
| 143 | 51143 | 56 | 58 | A | 2 to 3 | 0.7 | 5.0 | 43.0 | 3.6 | 15.3 | | | |
| 144 | 51144 | 56 | 58 | A | 2 to 3 | 0.6 | 4.3 | 40.3 | 3.4 | 16.1 | | | |
| 145 | 51145 | 56 | 58 | A | 2 to 3 | 0.4 | 3.2 | 33.5 | 3.8 | 10.1 | | | |
| 146 | 51146 | 58 | 60 | A | 2 to 3 | 0.8 | 6.0 | 34.4 | 3.2 | 14.6 | 41.69 | 3.26 | 14.91 |
| 147 | 51147 | 58 | 60 | A | 2 to 3 | 0.9 | 6.5 | 44.7 | 3.3 | 15.6 | | | |
| 148 | 51148 | 58 | 60 | A | 2 to 3 | 0.7 | 4.9 | 39.8 | 3.5 | 18.2 | | | |
| 149 | 51149 | 58 | 60 | A | 2 to 3 | 0.7 | 5.6 | 37.8 | 3.3 | 15.5 | | | |
| 150 | 51150 | 58 | 60 | A | 2 to 3 | 0.5 | 3.6 | 51.8 | 3.0 | 10.6 | | | |
| 151 | 51151 | 60 | 62 | A | 2 to 3 | 0.8 | 6.0 | 35.1 | 4.0 | 22.0 | 43.19 | 3.65 | 20.98 |
| 152 | 51152 | 60 | 62 | A | 2 to 3 | 0.8 | 5.7 | 47.1 | 3.9 | 26.1 | | | |
| 153 | 51153 | 60 | 62 | A | 2 to 3 | 0.9 | 6.7 | 59.3 | 3.7 | 21.1 | | | |
| 154 | 51154 | 60 | 62 | A | 2 to 3 | 0.8 | 6.0 | 44.6 | 3.3 | 19.1 | | | |
| 155 | 51155 | 60 | 62 | A | 2 to 3 | 0.9 | 6.6 | 29.7 | 3.4 | 16.6 | | | |
| 156 | 51156 | 62 | 64 | A | 2 to 3 | 0.7 | 4.9 | 33.8 | 3.4 | 16.1 | 45.64 | 3.53 | 19.22 |
| 157 | 51157 | 62 | 64 | A | 2 to 3 | 0.9 | 6.6 | 33.6 | 3.7 | 15.8 | | | |
| 158 | 51158 | 62 | 64 | A | 2 to 3 | 0.9 | 6.4 | 37.8 | 3.6 | 15.5 | | | |
| 159 | 51159 | 62 | 64 | A | 2 to 3 | 0.6 | 4.2 | 37.5 | 3.2 | 15.0 | | | |
| 160 | 51160 | 62 | 64 | A | 2 to 3 | 0.7 | 5.5 | 85.6 | 3.8 | 33.6 | | | |
| 161 | 51161 | 64 | 66 | A | 2 to 3 | 0.4 | 3.2 | 38.8 | 3.4 | 17.4 | 39.47 | 3.41 | 18.82 |
| 162 | 51162 | 64 | 66 | A | 2 to 3 | 0.7 | 5.0 | 38.5 | 3.7 | 14.9 | | | |
| 163 | 51163 | 64 | 66 | A | 2 to 3 | 0.7 | 4.9 | 32.6 | 3.5 | 19.3 | | | |
| 164 | 51164 | 64 | 66 | A | 2 to 3 | 0.5 | 4.0 | 41.6 | 3.3 | 17.8 | | | |
| 165 | 51165 | 64 | 66 | A | 2 to 3 | 0.2 | 1.6 | 45.9 | 3.2 | 24.8 | | | |
| 166 | 51166 | 66 | 68 | A | 2 to 3 | 0.5 | 3.6 | 40.4 | 3.2 | 18.9 | 49.99 | 3.39 | 18.24 |
| 167 | 51167 | 66 | 68 | A | 2 to 3 | 0.8 | 5.9 | 44.3 | 3.5 | 14.9 | | | |
| 168 | 51168 | 66 | 68 | A | 2 to 3 | 0.8 | 5.7 | 50.5 | 3.7 | 18.1 | | | |
| 169 | 51169 | 66 | 68 | A | 2 to 3 | 0.8 | 6.2 | 46.8 | 3.7 | 20.2 | | | |
| 170 | 51170 | 66 | 68 | A | 2 to 3 | 0.2 | 1.6 | 68.0 | 2.8 | 19.2 | | | |
| 171 | 51171 | 68 | 70 | A | 2 to 3 | 0.4 | 2.8 | 46.0 | 3.1 | 21.4 | 40.97 | 3.33 | 17.33 |
| 172 | 51172 | 68 | 70 | A | 2 to 3 | 0.6 | 4.3 | 31.1 | 3.2 | 12.9 | | | |
| 173 | 51173 | 68 | 70 | A | 2 to 3 | 0.6 | 4.4 | 36.2 | 3.5 | 15.6 | | | |
| 174 | 51174 | 68 | 70 | A | 2 to 3 | 0.5 | 4.1 | 46.9 | 3.5 | 15.0 | | | |
| 175 | 51175 | 68 | 70 | A | 2 to 3 | 0.6 | 4.8 | 44.6 | 3.3 | 21.7 | | | |
| 176 | 51176 | 70 | 72 | A | 2 to 3 | 0.6 | 4.5 | 48.5 | 3.8 | 17.1 | 42.59 | 3.82 | 18.80 |
| 177 | 51177 | 70 | 72 | A | 2 to 3 | | | | | | | | |
| 178 | 51178 | 70 | 72 | A | 2 to 3 | 0.7 | 4.9 | 33.3 | 4.0 | 19.0 | | | |
| 179 | 51179 | 70 | 72 | A | 2 to 3 | 0.7 | 5.1 | 45.9 | 3.6 | 20.3 | | | |
| 180 | 51180 | 70 | 72 | A | 2 to 3 | | | | | | | | |
| 181 | 51181 | 72 | 74 | A | 2 to 3 | 0.7 | 5.1 | 34.5 | 3.4 | 14.6 | 42.62 | 3.35 | 15.87 |
| 182 | 51182 | 72 | 74 | A | 2 to 3 | 0.6 | 4.2 | 37.6 | 3.5 | 17.2 | | | |
| 183 | 51183 | 72 | 74 | A | 2 to 3 | 0.5 | 3.8 | 39.0 | 3.1 | 11.8 | | | |
| 184 | 51184 | 72 | 74 | A | 2 to 3 | 0.7 | 5.1 | 59.4 | 3.4 | 19.8 | | | |
| 185 | 51185 | 72 | 74 | A | 2 to 3 | | | | | | | | |
| 186 | 51186 | 74 | 76 | A | 2 to 3 | 0.6 | 4.2 | 41.4 | 3.6 | 17.7 | 43.77 | 3.57 | 14.76 |

| Sample | Lab # | Depth Top (cm) | Depth Base (cm) | molt | VPI | Ca (ppm) | CaCO3 (µg) | Mg/Ca (mmol/ mol) | Sr/Ca (mmol/ mol) | Na/Ca (mmol/ mol) | avg Mg/Ca | avg Sr/Ca | avg Na/Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 187 | 51187 | 74 | 76 | A | 2 to 3 | | | | | | | | |
| 188 | 51188 | 74 | 76 | A | 2 to 3 | 0.6 | 4.5 | 46.1 | 3.6 | 11.8 | | | |
| 189 | 51189 | 74 | 76 | A-1 | 2 to 3 | | | | | | | | |
| 190 | 51190 | 74 | 76 | A-1 | 2 to 3 | | | | | | | | |
| 191 | 51191 | 76 | 78 | A | 2 to 3 | 0.7 | 4.9 | 47.9 | 3.5 | 11.4 | 45.07 | 3.47 | 17.07 |
| 192 | 51192 | 76 | 78 | A | 2 to 3 | 0.7 | 5.3 | 60.1 | 3.5 | 22.5 | | | |
| 193 | 51193 | 76 | 78 | A | 2 to 3 | 0.6 | 4.5 | 44.4 | 3.6 | 19.6 | | | |
| 194 | 51194 | 76 | 78 | A | 2 to 3 | 1.0 | 7.1 | 35.6 | 3.4 | 16.4 | | | |
| 195 | 51195 | 76 | 78 | A | 2 to 3 | 0.8 | 6.0 | 37.4 | 3.4 | 15.4 | | | |
| 196 | 51196 | 78 | 80 | A | 2 to 3 | 0.9 | 6.6 | 31.7 | 3.5 | 15.4 | 31.41 | 3.44 | 16.15 |
| 197 | 51197 | 78 | 80 | A | 2 to 3 | 0.8 | 6.3 | 29.3 | 3.4 | 14.4 | | | |
| 198 | 51198 | 78 | 80 | A | 2 to 3 | 0.9 | 6.8 | 27.1 | 3.4 | 16.6 | | | |
| 199 | 51199 | 78 | 80 | A | 2 to 3 | 0.7 | 4.9 | 37.5 | 3.4 | 18.1 | | | |
| 200 | 51200 | 78 | 80 | A | 2 to 3 | | | | | | | | |
| 201 | 51201 | 80 | 82 | A | 2 to 3 | 0.6 | 4.5 | 40.2 | 3.5 | 14.2 | 36.88 | 3.49 | 15.42 |
| 202 | 51202 | 80 | 82 | A | 2 to 3 | 0.7 | 5.4 | 41.7 | 3.8 | 15.6 | | | |
| 203 | 51203 | 80 | 82 | A | 2 to 3 | 0.6 | 4.2 | 36.0 | 4.0 | 18.6 | | | |
| 204 | 51204 | 80 | 82 | A | 2 to 3 | 0.5 | 3.8 | 35.3 | 3.0 | 17.0 | | | |
| 205 | 51205 | 80 | 82 | A | 2 to 3 | 0.7 | 5.4 | 31.2 | 3.2 | 11.7 | | | |
| 206 | 51206 | 82 | 84 | A | 2 to 3 | 0.4 | 3.2 | 28.4 | 3.3 | 16.2 | 34.86 | 3.52 | 17.22 |
| 207 | 51207 | 82 | 84 | A | 2 to 3 | 0.4 | 3.2 | 35.5 | 3.7 | 16.1 | | | |
| 208 | 51208 | 82 | 84 | A | 2 to 3 | 0.5 | 3.5 | 42.5 | 3.5 | 16.2 | | | |
| 209 | 51209 | 82 | 84 | A | 2 to 3 | 0.3 | 2.2 | 35.8 | 3.4 | 19.6 | | | |
| 210 | 51210 | 82 | 84 | A | 2 to 3 | 0.3 | 2.2 | 32.2 | 3.6 | 18.0 | | | |
| 211 | 51211 | 84 | 86 | A | 2 to 3 | 0.8 | 6.0 | 40.0 | 3.7 | 15.0 | 39.81 | 3.51 | 12.57 |
| 212 | 51212 | 84 | 86 | A | 2 to 3 | 0.5 | 3.5 | 39.6 | 3.4 | 10.1 | | | |
| 213 | 51213 | 84 | 86 | A-1 | 2 to 3 | | | | | | | | |
| 214 | 51214 | 84 | 86 | A-1 | 2 to 3 | | | | | | | | |
| 215 | 51215 | 84 | 86 | A | 2 to 3 | | | | | | | | |
| 216 | 51216 | 86 | 88 | A | 2 to 3 | 0.5 | 3.5 | 33.1 | 3.4 | 16.1 | 35.28 | 3.37 | 15.86 |
| 217 | 51217 | 86 | 88 | A | 2 to 3 | 0.7 | 5.3 | 31.0 | 3.5 | 15.4 | | | |
| 218 | 51218 | 86 | 88 | A | 2 to 3 | 0.8 | 5.8 | 35.3 | 3.6 | 17.1 | | | |
| 219 | 51219 | 86 | 88 | A | 2 to 3 | 0.5 | 3.5 | 32.4 | 2.8 | 9.4 | | | |
| 220 | 51220 | 86 | 88 | A | 2 to 3 | 0.6 | 4.5 | 44.6 | 3.6 | 21.4 | | | |
| 221 | 51221 | 88 | 90 | A | 2 to 3 | 0.6 | 4.8 | 37.9 | 4.2 | 18.7 | 39.53 | 3.65 | 13.34 |
| 222 | 51222 | 88 | 90 | A | 2 to 3 | 0.9 | 6.6 | 40.8 | 3.5 | 16.7 | | | |
| 223 | 51223 | 88 | 90 | A | 2 to 3 | 0.7 | 5.5 | 37.7 | 3.6 | 18.7 | | | |
| 224 | 51224 | 88 | 90 | A | 2 to 3 | 0.7 | 5.3 | 35.9 | 3.2 | 15.3 | | | |
| 225 | 51225 | 88 | 90 | A | 2 to 3 | 0.1 | 0.9 | 45.3 | 3.7 | -2.7 | | | |
| 226 | 51226 | 90 | 92 | A | 2 to 3 | 0.9 | 6.4 | 41.3 | 3.6 | 18.2 | 37.19 | 3.68 | 18.46 |
| 227 | 51227 | 90 | 92 | A | 2 to 3 | 0.6 | 4.1 | 34.3 | 3.8 | 16.6 | | | |
| 228 | 51228 | 90 | 92 | A | 2 to 3 | 1.2 | 8.9 | 39.0 | 3.8 | 19.6 | | | |
| 229 | 51229 | 90 | 92 | A | 2 to 3 | 0.9 | 6.5 | 34.2 | 3.5 | 18.6 | | | |
| 230 | 51230 | 90 | 92 | A | 2 to 3 | 0.9 | 6.6 | 37.1 | 3.7 | 19.4 | | | |
| 231 | 51231 | 92 | 94 | A | 2 to 3 | 0.8 | 6.0 | 30.9 | 3.5 | 13.9 | 34.29 | 3.63 | 14.50 |
| 232 | 51232 | 92 | 94 | A | 2 to 3 | 0.7 | 5.3 | 40.1 | 4.0 | 14.5 | | | |
| 233 | 51233 | 92 | 94 | A | 2 to 3 | 0.8 | 6.0 | 30.2 | 3.7 | 13.8 | | | |

| Sample | Lab # | Depth Top (cm) | Depth Base (cm) | molt | VPI | Ca (ppm) | CaCO3 (µg) | Mg/Ca (mmol/mol) | Sr/Ca (mmol/mol) | Na/Ca (mmol/mol) | avg Mg/Ca | avg Sr/Ca | avg Na/Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 234 | 51234 | 92 | 94 | A | 2 to 3 | 0.8 | 5.8 | 37.5 | 3.4 | 14.1 | | | |
| 235 | 51235 | 92 | 94 | A | 2 to 3 | 0.9 | 6.7 | 32.7 | 3.5 | 16.1 | | | |
| 236 | 51236 | 94 | 96 | A | 2 to 3 | 0.4 | 2.8 | 56.6 | 3.2 | 18.1 | 41.87 | 3.53 | 15.42 |
| 237 | 51237 | 94 | 96 | A | 2 to 3 | 0.7 | 5.3 | 31.6 | 3.6 | 11.3 | | | |
| 238 | 51238 | 94 | 96 | A | 2 to 3 | 0.5 | 4.1 | 42.9 | 3.5 | 14.7 | | | |
| 239 | 51239 | 94 | 96 | A | 2 to 3 | 0.6 | 4.3 | 39.1 | 3.8 | 19.0 | | | |
| 240 | 51240 | 94 | 96 | A | 2 to 3 | 0.7 | 4.9 | 39.2 | 3.4 | 14.0 | | | |
| 241 | 51241 | 96 | 98 | A | 2 to 3 | 0.8 | 6.2 | 37.1 | 3.9 | 13.8 | 40.02 | 3.75 | 18.63 |
| 242 | 51242 | 96 | 98 | A | 2 to 3 | 0.8 | 5.7 | 43.9 | 3.7 | 15.2 | | | |
| 243 | 51243 | 96 | 98 | A | 2 to 3 | 0.2 | 1.7 | 34.0 | 3.9 | 23.6 | | | |
| 244 | 51244 | 96 | 98 | A | 2 to 3 | 0.6 | 4.4 | 35.8 | 3.5 | 16.4 | | | |
| 245 | 51245 | 96 | 98 | A | 2 to 3 | 0.3 | 2.1 | 49.2 | 3.7 | 24.1 | | | |
| 246 | 51246 | 98 | 100 | A | 2 to 3 | 0.7 | 5.6 | 35.0 | 3.5 | 17.1 | 35.96 | 3.42 | 15.42 |
| 247 | 51247 | 98 | 100 | A | 2 to 3 | 0.4 | 2.9 | 27.8 | 3.6 | 10.6 | | | |
| 248 | 51248 | 98 | 100 | A | 2 to 3 | 0.6 | 4.7 | 49.6 | 3.1 | 12.5 | | | |
| 249 | 51249 | 98 | 100 | A | 2 to 3 | 0.8 | 6.0 | 32.1 | 3.8 | 19.0 | | | |
| 250 | 51250 | 98 | 100 | A | 2 to 3 | 0.7 | 5.2 | 35.3 | 3.1 | 17.9 | | | |
| 251 | 51251 | 100 | 102 | A | 2 to 3 | 0.6 | 4.3 | 50.2 | 3.1 | 20.8 | 44.47 | 3.48 | 18.65 |
| 252 | 51252 | 100 | 102 | A | 2 to 3 | 0.6 | 4.9 | 45.3 | 3.5 | 12.4 | | | |
| 253 | 51253 | 100 | 102 | A | 2 to 3 | 0.3 | 2.2 | 37.2 | 3.7 | 13.7 | | | |
| 254 | 51254 | 100 | 102 | A | 2 to 3 | 0.8 | 6.1 | 40.5 | 3.9 | 17.5 | | | |
| 255 | 51255 | 100 | 102 | A-1 | 2 to 3 | 0.8 | 6.0 | 49.1 | 3.2 | 28.9 | | | |
| 256 | 51256 | 102 | 104 | A | 2 to 3 | 0.6 | 4.5 | 40.5 | 3.8 | 18.9 | 33.92 | 3.68 | 17.84 |
| 257 | 51257 | 102 | 104 | A | 2 to 3 | 0.7 | 5.1 | 32.1 | 3.7 | 16.2 | | | |
| 258 | 51258 | 102 | 104 | A | 2 to 3 | 0.3 | 2.3 | 30.7 | 4.0 | 19.4 | | | |
| 259 | 51259 | 102 | 104 | A | 2 to 3 | 0.9 | 6.7 | 33.7 | 3.4 | 17.5 | | | |
| 260 | 51260 | 102 | 104 | A | 2 to 3 | 0.9 | 6.7 | 32.6 | 3.6 | 17.1 | | | |
| 261 | 51261 | 104 | 106 | A | 2 to 3 | 0.6 | 4.9 | 38.9 | 3.6 | 18.4 | 33.84 | 3.27 | 17.58 |
| 262 | 51262 | 104 | 106 | A | 2 to 3 | | | | | | | | |
| 263 | 51263 | 104 | 106 | A | 2 to 3 | 0.6 | 4.2 | 39.1 | 3.3 | 25.8 | | | |
| 264 | 51264 | 104 | 106 | A | 2 to 3 | 0.4 | 2.9 | 29.2 | 3.0 | 13.4 | | | |
| 265 | 51265 | 104 | 106 | A | 2 to 3 | 0.6 | 4.6 | 28.1 | 3.2 | 12.7 | | | |
| 266 | 51266 | 106 | 108 | A | 2 to 3 | 0.7 | 5.1 | 40.3 | 3.6 | 18.0 | 38.86 | 3.47 | 18.32 |
| 267 | 51267 | 106 | 108 | A | 2 to 3 | 0.8 | 5.9 | 30.1 | 3.3 | 15.8 | | | |
| 268 | 51268 | 106 | 108 | A | 2 to 3 | 0.4 | 2.8 | 42.8 | 3.2 | 17.1 | | | |
| 269 | 51269 | 106 | 108 | A | 2 to 3 | 0.5 | 3.8 | 42.2 | 3.7 | 22.4 | | | |
| 270 | 51270 | 106 | 108 | A | 2 to 3 | | | | | | | | |
| 271 | 51271 | 108 | 110 | A | 2 to 3 | 0.6 | 4.6 | 31.2 | 3.4 | 16.2 | 39.69 | 3.67 | 16.89 |
| 272 | 51272 | 108 | 110 | A | 2 to 3 | 0.7 | 5.5 | 43.9 | 3.7 | 15.1 | | | |
| 273 | 51273 | 108 | 110 | A | 2 to 3 | 0.7 | 5.6 | 44.5 | 4.0 | 19.5 | | | |
| 274 | 51274 | 108 | 110 | A | 2 to 3 | 0.6 | 4.5 | 39.2 | 3.6 | 16.7 | | | |
| 275 | 51275 | 108 | 110 | A | 2 to 3 | | | | | | | | |
| 276 | 51276 | 110 | 112 | A | 2 to 3 | 0.7 | 5.0 | 70.4 | 3.4 | 16.8 | 48.47 | 3.32 | 14.67 |
| 277 | 51277 | 110 | 112 | A | 2 to 3 | 0.3 | 1.9 | 52.2 | 3.5 | 11.4 | | | |
| 278 | 51278 | 110 | 112 | A | 2 to 3 | 0.6 | 4.2 | 41.0 | 3.1 | 16.0 | | | |
| 279 | 51279 | 110 | 112 | A | 2 to 3 | 0.3 | 2.3 | 33.5 | 3.1 | 16.4 | | | |
| 280 | 51280 | 110 | 112 | A | 2 to 3 | 0.2 | 1.7 | 45.2 | 3.4 | 12.8 | | | |

| Sample | Lab # | Depth Top (cm) | Depth Base (cm) | molt | VPI | Ca (ppm) | CaCO3 (µg) | Mg/Ca (mmol/mol) | Sr/Ca (mmol/mol) | Na/Ca (mmol/mol) | avg Mg/Ca | avg Sr/Ca | avg Na/Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 281 | 51281 | 112 | 114 | A | 2 to 3 | 0.9 | 7.0 | 78.0 | 3.4 | 23.6 | 66.46 | 3.58 | 22.78 |
| 282 | 51282 | 112 | 114 | A | 2 to 3 | 0.2 | 1.5 | 47.1 | 4.1 | 25.5 | | | |
| 283 | 51283 | 112 | 114 | A | 2 to 3 | 0.5 | 3.9 | 52.5 | 3.4 | 16.3 | | | |
| 284 | 51284 | 112 | 114 | A | 2 to 3 | 0.2 | 1.2 | 88.2 | 3.5 | 25.7 | | | |
| 285 | 51285 | 112 | 114 | A-1 | 2 to 3 | | | | | | | | |
| 286 | 51286 | 114 | 116 | A | 2 to 3 | 0.7 | 5.1 | 46.0 | 3.6 | 14.9 | 38.46 | 3.58 | 16.11 |
| 287 | 51287 | 114 | 116 | A | 2 to 3 | 0.6 | 4.7 | 35.1 | 3.6 | 15.0 | | | |
| 288 | 51288 | 114 | 116 | A | 2 to 3 | 0.9 | 7.0 | 33.4 | 3.6 | 14.8 | | | |
| 289 | 51289 | 114 | 116 | A | 2 to 3 | | | | | | | | |
| 290 | 51290 | 114 | 116 | A | 2 to 3 | 0.7 | 5.3 | 39.4 | 3.6 | 19.6 | | | |
| 291 | 51291 | 116 | 118 | A | 2 to 3 | 0.6 | 4.6 | 41.5 | 3.4 | 15.9 | 35.72 | 3.46 | 15.47 |
| 292 | 51292 | 116 | 118 | A | 2 to 3 | 0.7 | 5.5 | 39.3 | 3.7 | 15.2 | | | |
| 293 | 51293 | 116 | 118 | A | 2 to 3 | 0.8 | 5.9 | 33.4 | 3.3 | 14.8 | | | |
| 294 | 51294 | 116 | 118 | A | 2 to 3 | 0.9 | 6.5 | 35.1 | 3.5 | 14.2 | | | |
| 295 | 51295 | 116 | 118 | A | 2 to 3 | 0.8 | 5.9 | 29.2 | 3.3 | 17.1 | | | |
| 296 | 51296 | 120 | 122 | A | 2 to 3 | 0.9 | 6.9 | 46.8 | 3.5 | 17.3 | 42.83 | 3.53 | 17.25 |
| 297 | 51297 | 120 | 122 | A | 2 to 3 | 0.7 | 5.5 | 43.8 | 3.9 | 18.5 | | | |
| 298 | 51298 | 120 | 122 | A | 2 to 3 | 0.7 | 5.2 | 38.0 | 3.2 | 16.0 | | | |
| 299 | 51299 | 124 | 126 | A | 2 to 3 | 0.9 | 6.6 | 38.7 | 3.3 | 16.2 | 37.47 | 3.50 | 15.09 |
| 300 | 51300 | 124 | 126 | A | 2 to 3 | 0.6 | 4.7 | 32.5 | 3.6 | 15.6 | | | |
| 301 | 51301 | 124 | 126 | A | 2 to 3 | 0.5 | 3.8 | 44.7 | 3.4 | 14.8 | | | |
| 302 | 51302 | 124 | 126 | A | 2 to 3 | 0.7 | 5.2 | 33.9 | 3.7 | 13.7 | | | |
| 303 | 51303 | 140 | 142 | A | 2 to 3 | 0.7 | 5.0 | 47.1 | 3.5 | 16.2 | 41.73 | 3.47 | 17.45 |
| 304 | 51304 | 140 | 142 | A | 2 to 3 | 0.6 | 4.4 | 36.7 | 3.4 | 17.3 | | | |
| 305 | 51305 | 140 | 142 | A | 2 to 3 | 0.6 | 4.4 | 38.9 | 3.5 | 19.3 | | | |
| 306 | 51306 | 140 | 142 | A | 2 to 3 | 0.8 | 6.2 | 44.2 | 3.4 | 16.9 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.0 | | 8.3 | 7.8 | 5.5 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.3 | | 8.4 | 7.7 | 5.4 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.0 | | 8.4 | 7.7 | 5.4 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.0 | | 8.4 | 7.7 | 4.5 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.9 | | 8.1 | 7.9 | 5.5 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.0 | | 8.2 | 7.9 | 6.2 | | | |
| PE3 Standard (Duke EOS) | | | | | | 1.5 | | 8.2 | 8.0 | 7.4 | | | |
| PE3 Standard (Duke EOS) | | | | | | 1.6 | | 8.4 | 7.7 | 5.3 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.3 | | 8.4 | 7.9 | 5.7 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.4 | | 8.2 | 7.9 | 5.6 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.5 | | 8.5 | 7.7 | 7.4 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.5 | | 8.3 | 7.6 | 4.6 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.1 | | 8.4 | 7.8 | 6.2 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.0 | | 8.3 | 7.8 | 5.0 | | | |
| PE3 Standard (Duke EOS) | | | | | | 3.3 | | 8.4 | 7.9 | 5.3 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.2 | | 8.3 | 7.8 | 4.7 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.9 | | 8.3 | 7.9 | 4.9 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.9 | | 8.4 | 7.8 | 4.8 | | | |
| PE3 Standard (Duke EOS) | | | | | | 2.4 | | 8.5 | 7.8 | 4.9 | | | |

Appendix I: Molluscan Percent Abundance (excluding worn specimens and fragments) in Featherbed Bank Core (GLW402-FBB)

| **Calendar Year** | 2001 | 1990 | 1979 | 1968 | 1957 | 1947 | 1936 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 1 | 9 | 17 | 25 | 33 | 41 | 49 |
| **Species** | | | | | | | |
| *Acteocina canaliculata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Amaea mitchelli ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Anachis sp ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Arcopsis adamsi* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bittiolum varium* | 1.79 | 0.73 | 6.72 | 3.30 | 3.16 | 3.23 | 16.67 |
| *Boonea bisuturalis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Brachidontes exustus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bulla striata* | 0.00 | 0.00 | 0.84 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum cornucopiae* | 10.71 | 3.65 | 0.84 | 3.30 | 1.05 | 0.00 | 0.00 |
| *Caecum floridanum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum pulchellum* | 1.79 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Carditamera floridana* | 8.93 | 2.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis greeni* | 0.00 | 0.73 | 0.00 | 0.00 | 1.05 | 0.00 | 0.00 |
| *Cerithiopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis* sp cf. *C. emerson* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium muscarum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium* sp | 0.00 | 2.19 | 4.20 | 3.66 | 7.37 | 0.00 | 0.00 |
| *Chione cancellata* | 0.00 | 1.46 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Codakia orbicularis* | 0.00 | 0.00 | 0.00 | 3.30 | 0.00 | 0.00 | 0.00 |
| *Codakia* spp | 5.36 | 1.46 | 0.84 | 0.00 | 1.05 | 0.00 | 0.00 |
| *Collumbelopsis* sp cf *mycteis* | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Costanachis* sp A | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crenella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crepidula* spp | 0.00 | 2.92 | 5.88 | 1.47 | 1.05 | 9.68 | 0.00 |
| *Cumingia tellinoides* | 0.00 | 0.00 | 1.68 | 1.10 | 1.05 | 0.00 | 0.00 |
| *Cyclostremiscus supressus* | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Dentimargo* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Eulima / Melanella* sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Eulithidium affine* | 12.50 | 17.52 | 23.53 | 23.81 | 21.05 | 0.00 | 0.00 |
| *Fasiolaria* sp | 0.00 | 0.00 | 0.00 | 0.73 | 1.05 | 0.00 | 0.00 |
| *Glycymeris pectinata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Gouldia cerina* | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Granulina hadria* | 3.57 | 2.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Hyalina* sp | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Kurtziella atrostyla* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Laesidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Laevicardium mortoni* | 0.00 | 0.00 | 0.84 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Latirus* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Limaria* sp cf *L pellucida* | 0.00 | 0.00 | 0.00 | 0.00 | 1.05 | 0.00 | 8.33 |
| *Lithophaga* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lithopoma caelatum* | 1.79 | 1.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Longchaeus crenulatus* | 1.79 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| **Calendar Year** | 2001 | 1990 | 1979 | 1968 | 1957 | 1947 | 1936 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 1 | 9 | 17 | 25 | 33 | 41 | 49 |
| *Lucina multilineata* | 0.00 | 0.00 | 1.68 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Marshallora nigrocincta* | 0.00 | 0.00 | 0.00 | 3.66 | 0.00 | 0.00 | 0.00 |
| Eulimidae | 1.79 | 0.73 | 1.68 | 1.10 | 0.00 | 0.00 | 0.00 |
| *Mitra nodulosa* | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Mitrella* sp.? | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Mitrella argus* | 1.79 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella ocellata* | 0.00 | 5.84 | 3.36 | 0.73 | 5.26 | 0.00 | 0.00 |
| *Modulus modulus* | 0.00 | 7.30 | 6.72 | 4.76 | 1.05 | 3.23 | 0.00 |
| *Muricopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mysella* sp ? | 0.00 | 4.38 | 3.36 | 1.47 | 1.05 | 0.00 | 0.00 |
| *Nassarius albus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Nassarius* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Nucula proxima* | 1.79 | 2.92 | 0.00 | 1.83 | 0.00 | 0.00 | 16.67 |
| *Odostomia laevigata* | 3.57 | 0.00 | 6.72 | 2.56 | 3.16 | 6.45 | 0.00 |
| *Olivella nivea* | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Olivella pusilla* | 0.00 | 0.73 | 1.68 | 1.10 | 1.05 | 3.23 | 0.00 |
| *Parvilucina multilineata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Patelloida pustulata* | 5.36 | 1.46 | 3.36 | 0.00 | 2.11 | 3.23 | 8.33 |
| *Periglypta listeri* | 0.00 | 0.73 | 0.84 | 2.56 | 3.16 | 3.23 | 0.00 |
| *Persicula* sp | 0.00 | 1.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pilsbryspira leucocyma* | 1.79 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pitar simpsoni* | 0.00 | 0.00 | 0.00 | 1.47 | 0.00 | 0.00 | 0.00 |
| *Pitar* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pleuromeris tridentata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Prunum apicinum* | 7.14 | 2.92 | 0.84 | 0.00 | 1.05 | 0.00 | 0.00 |
| *Prunum* sp cf *P. apicinum* | 0.00 | 0.00 | 0.00 | 2.20 | 0.00 | 0.00 | 0.00 |
| *Pteria* sp | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Pyramidella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1.05 | 0.00 | 0.00 |
| *Rictaxis punctostriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rissoina cancellata* | 3.57 | 2.92 | 4.20 | 2.20 | 1.05 | 3.23 | 0.00 |
| *Rissoina multicostata* | 1.79 | 1.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Schwartziella catesbyana* | 7.14 | 0.00 | 2.52 | 4.03 | 2.11 | 0.00 | 0.00 |
| *Semele proficua* | 0.00 | 2.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Stellatoma stellata* | 3.57 | 0.00 | 0.00 | 0.73 | 0.00 | 0.00 | 0.00 |
| *Tegula fasciata* | 3.57 | 1.46 | 0.00 | 2.56 | 5.26 | 0.00 | 16.67 |
| *Teinostoma biscaynense* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina mera* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina similis* | 0.00 | 0.00 | 0.00 | 0.73 | 0.00 | 0.00 | 0.00 |
| *Tellina* spp | 1.79 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Tellina texana* | 0.00 | 0.00 | 0.00 | 0.73 | 0.00 | 0.00 | 0.00 |
| *Trachycardium muricatum* | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 |
| *Transennella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.23 | 0.00 |
| *Triphora perversa* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Triptychus niveus* | 0.00 | 0.73 | 0.00 | 0.73 | 2.11 | 0.00 | 0.00 |
| *Turbo castaneus* | 0.00 | 13.14 | 12.61 | 15.38 | 29.47 | 48.39 | 16.67 |
| *Turbonilla* sp | 1.79 | 0.00 | 0.00 | 0.00 | 1.05 | 0.00 | 0.00 |
| Unidentified Gastropods | 1.79 | 2.19 | 1.68 | 0.37 | 0.00 | 3.23 | 8.33 |

| **Calendar Year** | 2001 | 1990 | 1979 | 1968 | 1957 | 1947 | 1936 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 1 | 9 | 17 | 25 | 33 | 41 | 49 |
| Unidentified Pelecypods | 0.00 | 0.00 | 0.00 | 0.73 | 0.00 | 0.00 | 0.00 |
| *Vermicularia* sp | 0.00 | 2.19 | 2.52 | 2.20 | 1.05 | 6.45 | 8.33 |
| *Vexillum hanleyi ?* | 1.79 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vitrinella floridana* | 0.00 | 2.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Zebina browniana* | 1.79 | 5.11 | 0.84 | 1.10 | 0.00 | 3.23 | 0.00 |
| | | | | | | | |
| Percent Total/Sample | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Absolute Abundance each sample | 56 | 137 | 119 | 273 | 95 | 31 | 12 |
| Number of Faunal Categories each sample | 26 | 32 | 25 | 43 | 26 | 13 | 8 |

Appendix I:

| **Calendar Year** | 1925 | 1914 | 1903 | 1894 | 1885 | 1877 | 1869 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 57 | 65 | 73 | 81 | 89 | 97 | 105 |
| **Species** | | | | | | | |
| *Acteocina canaliculata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Amaea mitchelli ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Anachis sp ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Arcopsis adamsi* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bittiolum varium* | 0.00 | 24.00 | 18.75 | 6.67 | 5.56 | 48.57 | 12.50 |
| *Boonea bisuturalis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Brachidontes exustus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bulla striata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum cornucopiae* | 0.00 | 0.00 | 0.00 | 6.67 | 0.00 | 1.90 | 0.00 |
| *Caecum floridanum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum pulchellum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Carditamera floridana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis greeni* | 0.00 | 0.00 | 0.00 | 13.33 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis* sp cf. *C. emerson* | 0.00 | 0.00 | 0.00 | 0.00 | 11.11 | 1.90 | 0.00 |
| *Cerithium muscarum* | 0.00 | 0.00 | 0.00 | 0.00 | 11.11 | 2.86 | 0.00 |
| *Cerithium* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 |
| *Chione cancellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.90 | 0.00 |
| *Codakia orbicularis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 |
| *Codakia* spp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Collumbelopsis* sp cf *mycteis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Costanachis* sp A | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crenella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crepidula* spp | 0.00 | 8.00 | 0.00 | 13.33 | 5.56 | 2.86 | 0.00 |
| *Cumingia tellinoides* | 0.00 | 4.00 | 0.00 | 0.00 | 0.00 | 2.86 | 12.50 |
| *Cyclostremiscus supressus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Dentimargo* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Eulima / Melanella* sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Eulithidium affine* | 0.00 | 8.00 | 0.00 | 0.00 | 0.00 | 4.76 | 0.00 |
| *Fasiolaria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Glycymeris pectinata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Gouldia cerina* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Granulina hadria* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Hyalina* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Kurtziella atrostyla* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Laesidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Laevicardium mortoni* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.76 | 0.00 |
| *Latirus* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Limaria* sp cf *L pellucida* | 0.00 | 0.00 | 0.00 | 6.67 | 5.56 | 0.00 | 0.00 |
| *Lithophaga* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lithopoma caelatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Longchaeus crenulatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| **Calendar Year** | 1925 | 1914 | 1903 | 1894 | 1885 | 1877 | 1869 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 57 | 65 | 73 | 81 | 89 | 97 | 105 |
| *Lucina multilineata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Marshallora nigrocincta* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 |
| Eulimidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitra nodulosa* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella* sp.? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella argus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella ocellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 |
| *Modulus modulus* | 0.00 | 4.00 | 0.00 | 6.67 | 5.56 | 4.76 | 0.00 |
| *Muricopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mysella* sp ? | 33.33 | 0.00 | 0.00 | 6.67 | 0.00 | 0.00 | 0.00 |
| *Nassarius albus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Nassarius* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Nucula proxima* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Odostomia laevigata* | 0.00 | 8.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 |
| *Olivella nivea* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Olivella pusilla* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Parvilucina multilineata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 |
| *Patelloida pustulata* | 0.00 | 0.00 | 0.00 | 6.67 | 5.56 | 0.00 | 0.00 |
| *Periglypta listeri* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 12.50 |
| *Persicula* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pilsbryspira leucocyma* | 8.33 | 0.00 | 0.00 | 0.00 | 5.56 | 0.00 | 0.00 |
| *Pitar simpsoni* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pitar* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pleuromeris tridentata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.50 |
| *Prunum apicinum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Prunum* sp cf *P. apicinum* | 0.00 | 0.00 | 0.00 | 0.00 | 5.56 | 0.00 | 0.00 |
| *Pteria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pyramidella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rictaxis punctostriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rissoina cancellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.76 | 25.00 |
| *Rissoina multicostata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Schwartziella catesbyana* | 0.00 | 0.00 | 6.25 | 0.00 | 5.56 | 4.76 | 0.00 |
| *Semele proficua* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Stellatoma stellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tegula fasciata* | 0.00 | 0.00 | 12.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Teinostoma biscaynense* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina mera* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina similis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina* spp | 0.00 | 0.00 | 6.25 | 13.33 | 0.00 | 0.00 | 0.00 |
| *Tellina texana* | 0.00 | 0.00 | 0.00 | 0.00 | 16.67 | 1.90 | 0.00 |
| *Trachycardium muricatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Transennella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Triphora perversa* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Triptychus niveus* | 0.00 | 0.00 | 0.00 | 20.00 | 0.00 | 0.00 | 0.00 |
| *Turbo castaneus* | 50.00 | 32.00 | 56.25 | 0.00 | 16.67 | 0.00 | 25.00 |
| *Turbonilla* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.90 | 0.00 |
| Unidentified Gastropods | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| **Calendar Year** | 1925 | 1914 | 1903 | 1894 | 1885 | 1877 | 1869 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 57 | 65 | 73 | 81 | 89 | 97 | 105 |
| Unidentified Pelecypods | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vermicularia* sp | 8.33 | 8.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 |
| *Vexillum hanleyi ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vitrinella floridana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Zebina browniana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.90 | 0.00 |
| | | | | | | | |
| Percent Total/Sample | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Absolute Abundance each sample | 12 | 25 | 16 | 15 | 18 | 105 | 8 |
| Number of Faunal Categories each sample | 4 | 9 | 5 | 10 | 12 | 23 | 6 |

Appendix I:

| **Calendar Year** | 1860 | 1852 | 1844 | 1835 | 1827 | 1818 | 1808 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 113 | 121 | 129 | 137 | 145 | 153 | 163 |
| **Species** | | | | | | | |
| *Acteocina canaliculata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Amaea mitchelli ?* | 1.85 | 0.00 | 0.00 | 0.00 | 1.47 | 4.71 | 9.21 |
| *Anachis sp ?* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Arcopsis adamsi* | 0.00 | 0.00 | 1.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Bittiolum varium* | 11.11 | 71.81 | 69.23 | 44.90 | 27.94 | 23.53 | 6.58 |
| *Boonea bisuturalis* | 1.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Brachidontes exustus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.18 | 0.00 |
| *Bulla striata* | 1.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum cornucopiae* | 1.85 | 0.67 | 0.00 | 0.00 | 0.00 | 1.18 | 1.32 |
| *Caecum floridanum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum pulchellum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Caecum* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Carditamera floridana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithiopsis greeni* | 9.26 | 2.01 | 0.00 | 0.00 | 1.47 | 1.18 | 0.00 |
| *Cerithiopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1.47 | 7.06 | 0.00 |
| *Cerithiopsis* sp cf. *C. emerson* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium muscarum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cerithium* sp | 1.85 | 0.00 | 3.85 | 4.08 | 7.35 | 1.18 | 7.89 |
| *Chione cancellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Codakia orbicularis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Codakia* spp | 1.85 | 0.67 | 1.28 | 4.08 | 1.47 | 2.35 | 1.32 |
| *Collumbelopsis* sp cf *mycteis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Costanachis* sp A | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Crenella* sp | 0.00 | 0.67 | 0.00 | 0.00 | 1.47 | 0.00 | 0.00 |
| *Crepidula* spp | 3.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cumingia tellinoides* | 0.00 | 1.34 | 0.00 | 0.00 | 1.47 | 0.00 | 0.00 |
| *Cyclostremiscus supressus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Dentimargo* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Eulima / Melanella* sp. | 3.70 | 0.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Eulithidium affine* | 0.00 | 1.34 | 0.00 | 0.00 | 1.47 | 0.00 | 2.63 |
| *Fasiolaria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Glycymeris pectinata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Gouldia cerina* | 0.00 | 0.67 | 0.00 | 0.00 | 0.00 | 1.18 | 3.95 |
| *Granulina hadria* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Hyalina* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Kurtziella atrostyla* | 0.00 | 0.00 | 0.00 | 0.00 | 1.47 | 0.00 | 0.00 |
| Laesidae | 3.70 | 0.00 | 0.00 | 6.12 | 0.00 | 1.18 | 0.00 |
| *Laevicardium mortoni* | 0.00 | 0.67 | 1.28 | 0.00 | 2.94 | 0.00 | 0.00 |
| *Latirus* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Limaria* sp cf *L pellucida* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lithophaga* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Lithopoma caelatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Longchaeus crenulatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| **Calendar Year** | 1860 | 1852 | 1844 | 1835 | 1827 | 1818 | 1808 |
|---|---|---|---|---|---|---|---|
| **Depth in core (cm)** | 113 | 121 | 129 | 137 | 145 | 153 | 163 |
| *Lucina multilineata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Marshallora nigrocincta* | 1.85 | 0.00 | 1.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eulimidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitra nodulosa* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella* sp.? | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella argus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Mitrella ocellata* | 3.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Modulus modulus* | 1.85 | 0.67 | 0.00 | 0.00 | 2.94 | 7.06 | 2.63 |
| *Muricopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.18 | 0.00 |
| *Mysella* sp ? | 0.00 | 0.67 | 0.00 | 0.00 | 8.82 | 4.71 | 21.05 |
| *Nassarius albus* | 3.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Nassarius* sp | 0.00 | 0.67 | 0.00 | 0.00 | 0.00 | 2.35 | 0.00 |
| *Nucula proxima* | 1.85 | 3.36 | 0.00 | 10.20 | 1.47 | 11.76 | 3.95 |
| *Odostomia laevigata* | 1.85 | 0.67 | 0.00 | 0.00 | 0.00 | 1.18 | 0.00 |
| *Olivella nivea* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Olivella pusilla* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Parvilucina multilineata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.53 | 2.63 |
| *Patelloida pustulata* | 1.85 | 0.00 | 0.00 | 4.08 | 5.88 | 0.00 | 2.63 |
| *Periglypta listeri* | 0.00 | 0.00 | 1.28 | 2.04 | 2.94 | 0.00 | 0.00 |
| *Persicula* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pilsbryspira leucocyma* | 0.00 | 0.67 | 0.00 | 0.00 | 1.47 | 0.00 | 0.00 |
| *Pitar simpsoni* | 0.00 | 0.00 | 0.00 | 2.04 | 0.00 | 0.00 | 0.00 |
| *Pitar* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1.47 | 5.88 | 11.84 |
| *Pleuromeris tridentata* | 0.00 | 0.00 | 2.56 | 0.00 | 5.88 | 3.53 | 6.58 |
| *Prunum apicinum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Prunum* sp cf *P. apicinum* | 1.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pteria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Pyramidella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rictaxis punctostriatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Rissoina cancellata* | 5.56 | 0.00 | 1.28 | 0.00 | 4.41 | 3.53 | 0.00 |
| *Rissoina multicostata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.18 | 0.00 |
| *Schwartziella catesbyana* | 0.00 | 0.67 | 5.13 | 2.04 | 1.47 | 1.18 | 1.32 |
| *Semele proficua* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Stellatoma stellata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tegula fasciata* | 0.00 | 1.34 | 1.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Teinostoma biscaynense* | 0.00 | 0.67 | 0.00 | 0.00 | 0.00 | 2.35 | 1.32 |
| *Tellina mera* | 0.00 | 0.00 | 0.00 | 2.04 | 0.00 | 0.00 | 0.00 |
| *Tellina similis* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Tellina* spp | 3.70 | 0.00 | 1.28 | 0.00 | 5.88 | 0.00 | 1.32 |
| *Tellina texana* | 1.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Trachycardium muricatum* | 0.00 | 0.00 | 1.28 | 2.04 | 1.47 | 0.00 | 1.32 |
| *Transennella* sp | 5.56 | 0.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Triphora perversa* | 1.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Triptychus niveus* | 1.85 | 0.00 | 1.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Turbo castaneus* | 11.11 | 7.38 | 6.41 | 14.29 | 0.00 | 2.35 | 5.26 |
| *Turbonilla* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Gastropods | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Calendar Year** | 1860 | 1852 | 1844 | 1835 | 1827 | 1818 | 1808 |
| **Depth in core (cm)** | 113 | 121 | 129 | 137 | 145 | 153 | 163 |
| Unidentified Pelecypods | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Vermicularia* sp | 1.85 | 1.34 | 0.00 | 2.04 | 5.88 | 3.53 | 3.95 |
| *Vexillum hanleyi ?* | 3.70 | 0.67 | 0.00 | 0.00 | 0.00 | 0.00 | 1.32 |
| *Vitrinella floridana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Zebina browniana* | 1.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | |
| Percent Total/Sample | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Absolute Abundance each sample | 54 | 149 | 78 | 49 | 68 | 85 | 76 |
| Number of Faunal Categories each sample | 29 | 23 | 15 | 13 | 24 | 25 | 21 |

Appendix I:

| | | | | | Absolute Abundance/ species |
|---|---|---|---|---|---|
| **Calendar Year** | 1800 | 1791 | 1783 | | |
| **Depth in core (cm)** | 171 | 179 | 187 | | |
| **Species** | | | | | |
| *Acteocina canaliculata* | 0.55 | 0.00 | 0.67 | 0.00 | 2 |
| *Amaea mitchelli ?* | 14.21 | 11.02 | 12.75 | 12.56 | 120 |
| *Anachis sp ?* | 0.00 | 0.00 | 0.00 | 0.77 | 3 |
| *Arcopsis adamsi* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Bittiolum varium* | 3.28 | 6.78 | 7.38 | 11.79 | 392 |
| *Boonea bisuturalis* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Brachidontes exustus* | 0.00 | 0.00 | 0.00 | 0.51 | 3 |
| *Bulla striata* | 0.55 | 0.00 | 1.34 | 0.51 | 7 |
| *Caecum cornucopiae* | 1.09 | 0.85 | 0.67 | 2.05 | 41 |
| *Caecum floridanum* | 0.00 | 0.00 | 0.00 | 0.77 | 3 |
| *Caecum pulchellum* | 3.28 | 0.00 | 2.01 | 0.00 | 10 |
| *Caecum* sp | 0.00 | 0.00 | 0.00 | 0.26 | 1 |
| *Carditamera floridana* | 0.00 | 0.00 | 0.00 | 0.00 | 8 |
| *Cerithiopsis greeni* | 0.00 | 0.00 | 0.00 | 0.00 | 14 |
| *Cerithiopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 7 |
| *Cerithiopsis* sp cf. *C. emerson* | 0.00 | 0.00 | 0.00 | 0.00 | 4 |
| *Cerithium muscarum* | 0.00 | 0.00 | 0.00 | 0.00 | 5 |
| *Cerithium* sp | 3.28 | 4.24 | 4.03 | 4.62 | 79 |
| *Chione cancellata* | 1.09 | 0.00 | 1.34 | 0.26 | 10 |
| *Codakia orbicularis* | 0.00 | 0.00 | 0.00 | 0.00 | 10 |
| *Codakia* spp | 1.09 | 2.54 | 1.34 | 2.05 | 31 |
| *Collumbelopsis* sp cf *mycteis* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Costanachis* sp A | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Crenella* sp | 3.83 | 2.54 | 4.03 | 1.54 | 24 |
| *Crepidula* spp | 0.00 | 0.00 | 0.67 | 1.28 | 35 |
| *Cumingia tellinoides* | 1.09 | 3.39 | 1.34 | 0.51 | 24 |
| *Cyclostremiscus supressus* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Dentimargo* sp | 0.00 | 0.00 | 0.00 | 0.26 | 1 |
| *Eulima / Melanella* sp. | 0.00 | 0.00 | 0.00 | 0.00 | 3 |
| *Eulithidium affine* | 0.55 | 0.00 | 0.00 | 0.00 | 157 |
| *Fasiolaria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 3 |
| *Glycymeris pectinata* | 0.55 | 0.00 | 0.00 | 0.00 | 1 |
| *Gouldia cerina* | 0.00 | 1.69 | 1.34 | 0.77 | 13 |
| *Granulina hadria* | 1.09 | 0.85 | 0.00 | 0.00 | 9 |
| *Hyalina* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Kurtziella atrostyla* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| Laesidae | 1.64 | 0.85 | 0.00 | 0.00 | 10 |
| *Laevicardium mortoni* | 6.01 | 5.08 | 7.38 | 5.13 | 59 |
| *Latirus* sp | 0.00 | 0.00 | 0.67 | 0.00 | 1 |
| *Limaria* sp cf *L pellucida* | 0.00 | 0.85 | 0.00 | 0.00 | 5 |
| *Lithophaga* sp | 0.00 | 0.00 | 0.00 | 0.51 | 2 |
| *Lithopoma caelatum* | 0.00 | 0.00 | 0.00 | 0.26 | 4 |
| *Longchaeus crenulatus* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |

| Calendar Year | 1800 | 1791 | 1783 | | Absolute Abundance/ species |
|---|---|---|---|---|---|
| **Depth in core (cm)** | 171 | 179 | 187 | | |
| *Lucina multilineata* | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Marshallora nigrocincta* | 0.00 | 0.00 | 0.00 | 0.00 | 13 |
| Eulimidae | 0.00 | 0.00 | 0.00 | 0.00 | 7 |
| *Mitra nodulosa* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Mitrella* sp.? | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Mitrella argus* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Mitrella ocellata* | 0.00 | 0.00 | 0.00 | 0.26 | 23 |
| *Modulus modulus* | 0.00 | 1.69 | 0.67 | 2.56 | 66 |
| *Muricopsis* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Mysella* sp ? | 0.00 | 0.85 | 1.34 | 0.26 | 51 |
| *Nassarius albus* | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Nassarius* sp | 0.55 | 4.24 | 1.34 | 0.26 | 12 |
| *Nucula proxima* | 15.85 | 16.10 | 16.11 | 10.77 | 151 |
| *Odostomia laevigata* | 1.09 | 3.39 | 6.04 | 2.31 | 52 |
| *Olivella nivea* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Olivella pusilla* | 1.64 | 0.00 | 0.00 | 0.00 | 11 |
| *Parvilucina multilineata* | 2.73 | 1.69 | 2.01 | 1.79 | 23 |
| *Patelloida pustulata* | 1.64 | 2.54 | 0.67 | 1.54 | 37 |
| *Periglypta listeri* | 0.55 | 0.00 | 0.67 | 0.26 | 22 |
| *Persicula* sp | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Pilsbryspira leucocyma* | 0.55 | 0.00 | 0.00 | 0.26 | 7 |
| *Pitar simpsoni* | 0.00 | 0.00 | 0.00 | 0.00 | 5 |
| *Pitar* sp | 8.74 | 0.00 | 14.77 | 11.28 | 97 |
| *Pleuromeris tridentata* | 7.10 | 13.56 | 0.00 | 8.46 | 77 |
| *Prunum apicinum* | 0.00 | 0.00 | 0.67 | 0.00 | 11 |
| *Prunum* sp cf *P. apicinum* | 0.00 | 0.00 | 0.00 | 0.00 | 8 |
| *Pteria* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Pyramidella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Rictaxis punctostriatus* | 0.00 | 0.00 | 0.67 | 0.00 | 1 |
| *Rissoina cancellata* | 1.64 | 0.85 | 1.34 | 0.77 | 45 |
| *Rissoina multicostata* | 0.00 | 0.00 | 0.00 | 0.00 | 4 |
| *Schwartziella catesbyana* | 1.09 | 0.85 | 0.00 | 0.77 | 42 |
| *Semele proficua* | 0.00 | 0.00 | 0.00 | 0.00 | 3 |
| *Stellatoma stellata* | 0.55 | 0.85 | 1.34 | 0.26 | 9 |
| *Tegula fasciata* | 0.55 | 0.85 | 0.67 | 0.00 | 26 |
| *Teinostoma biscaynense* | 0.00 | 0.00 | 0.00 | 0.00 | 4 |
| *Tellina mera* | 0.00 | 0.00 | 0.00 | 0.51 | 3 |
| *Tellina similis* | 0.00 | 0.00 | 0.00 | 0.51 | 4 |
| *Tellina* spp | 2.19 | 2.54 | 0.67 | 1.28 | 26 |
| *Tellina texana* | 2.19 | 0.00 | 0.00 | 2.82 | 23 |
| *Trachycardium muricatum* | 2.73 | 3.39 | 0.00 | 2.05 | 22 |
| *Transennella* sp | 2.73 | 0.00 | 0.00 | 0.26 | 11 |
| *Triphora perversa* | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| *Triptychus niveus* | 0.00 | 0.00 | 0.00 | 0.26 | 11 |
| *Turbo castaneus* | 0.55 | 0.85 | 0.00 | 1.03 | 189 |
| *Turbonilla* sp | 0.55 | 0.00 | 0.67 | 0.26 | 7 |
| Unidentified Gastropods | 0.00 | 1.69 | 0.00 | 0.26 | 12 |

| Calendar Year | 1800 | 1791 | 1783 | | Absolute Abundance/ species |
|---|---|---|---|---|---|
| **Depth in core (cm)** | 171 | 179 | 187 | | |
| Unidentified Pelecypods | 0.00 | 0.00 | 0.00 | 0.00 | 2 |
| *Vermicularia* sp | 1.64 | 3.39 | 3.36 | 2.56 | 56 |
| *Vexillum hanleyi ?* | 0.00 | 0.00 | 0.00 | 0.00 | 6 |
| *Vitrinella floridana* | 0.00 | 0.00 | 0.00 | 0.00 | 3 |
| *Zebina browniana* | 0.00 | 0.00 | 0.00 | 0.00 | 16 |
| | | | | | |
| Percent Total/Sample | 100.00 | 100.00 | 100.00 | 100.00 | |
| Absolute Abundance each sample | 183 | 118 | 149 | 390 | 2321 |
| Number of Faunal Categories each sample | 37 | 29 | 32 | 45 | |

Appendix J. Mg/Ca analyses on Loxoconcha matagordensis for Featherbed Bank core (SEI297-FB1)

| Sample | Depth (cm) | midpt (cm) | length | gender | valve | molt | VPI | Ca (ppm) | µg CaCO3 | Mg/Ca (molar) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-2 | 1 | 27 | f | l | A | 2 | 0.8 | 5.7 | 40.71 |
| 2 | 0-2 | 1 | 26 | f | l | A | 3 | 0.9 | 6.8 | 35.67 |
| 3 | 0-2 | 1 | 29 | m | l | A | 3 | 0.7 | 5.5 | 35.78 |
| 4 | 0-2 | 1 | 28 | m | l | A | 3 | 0.7 | 5.1 | 36.71 |
| 5 | 12 to 14 | 13 | 24 | f | l | A | 3 | 0.7 | 5.1 | 23.44 |
| 6 | 12 to 14 | 13 | 22.5 | f | r | A | 3 | | | |
| 7 | 12 to 14 | 13 | | f | l | A | 3 | 0.6 | 4.1 | 37.45 |
| 8 | 12 to 14 | 13 | 27 | m | l | A | 3 | 0.7 | 5.4 | 37.97 |
| 9 | 16-18 | 17 | 27.1 | m | l | A | 3 | 0.6 | 4.8 | 47.78 |
| 10 | 16-18 | 17 | 24.1 | f | l | A | 3 | 1.0 | 7.8 | 32.31 |
| 11 | 16-18 | 17 | 24 | f | l | A | 3 | 0.7 | 5.2 | 28.39 |
| 12 | 16-18 | 17 | | | l | A | 3 | 0.6 | 4.7 | 37.98 |
| 13 | 20-22 | 21 | 28.4 | | r | A | 3 | 0.9 | 6.6 | 44.12 |
| 14 | 20-22 | 21 | 26.5 | f | r | A | 3 | 0.6 | 4.9 | 38.46 |
| 15 | 20-22 | 21 | | f | | A | 3 | 0.5 | 3.9 | 32.09 |
| 16 | 20-22 | 21 | 24 | f | r | A | 3 | 0.8 | 5.7 | 27.59 |
| 17 | 24-26 | 25 | 24 | f | l | A | 3 | 0.9 | 6.7 | 36.64 |
| 18 | 24-26 | 25 | 24 | m | l | A | 3 | 0.8 | 5.9 | 31.53 |
| 19 | 24-26 | 25 | 28 | m | r | A | 3 | 0.8 | 5.9 | 49.71 |
| 20 | 24-26 | 25 | 28 | m | r | A | 3 | 0.9 | 7.0 | 47.36 |
| 21 | 28-30 | 29 | 28 | f | r | A | 3 | 0.7 | 4.9 | 35.07 |
| 22 | 28-30 | 29 | | f | | A | 3 | 0.5 | 3.7 | 39.94 |
| 23 | 28-30 | 29 | | m | | A | 3 | 0.6 | 4.6 | 32.47 |
| 24 | 28-30 | 29 | 27 | m | r | A | 3 | 0.8 | 5.7 | 42.68 |
| 25 | 32-34 | 31 | 27.5 | f | r | A | 3 | 0.8 | 6.2 | 41.11 |
| 26 | 32-34 | 31 | 23.2 | f | r | A | 3 | 0.5 | 4.0 | 42.37 |
| 27 | 32-34 | 31 | 24 | f | l | A | 3 | 0.8 | 5.9 | 34.74 |
| 28 | 32-34 | 31 | 24 | f | r | A | 3 | 0.7 | 5.0 | 47.31 |
| 29 | 36-38 | 37 | 24.5 | f | l | A | 3 | 0.7 | 5.3 | 32.20 |
| 30 | 36-38 | 37 | 25 | m | l | A | 3 | 0.6 | 4.8 | 39.60 |
| 31 | 36-38 | 37 | 28 | m | l | A | 3 | 0.9 | 6.5 | 43.62 |
| 32 | 36-38 | 37 | 28 | m | l | A | 3 | 0.7 | 5.1 | 48.43 |
| 33 | 40-42 | 41 | 26.5 | | l | A | 3 | 0.6 | 4.9 | 44.77 |
| 34 | 40-42 | 41 | 28 | f | l | A | 3 | 0.7 | 5.4 | 32.80 |
| 35 | 40-42 | 41 | 25 | f | l | A | 3 | 0.8 | 6.3 | 35.28 |
| 36 | 40-42 | 41 | 24 | f | l | A | 3 | 0.8 | 5.8 | 43.93 |
| 37 | 44-46 | 45 | 25 | f | l | A | 3 | 0.8 | 6.1 | 35.44 |
| 38 | 44-46 | 45 | 25 | f | l | A | 3 | 0.6 | 4.6 | 38.42 |
| 39 | 44-46 | 45 | 24.2 | m | l | A | 3 | 0.8 | 6.2 | 34.60 |
| 40 | 44-46 | 45 | 28 | f | r | A | 3 | 0.7 | 5.4 | 36.48 |
| 41 | 48-50 | 49 | 23.5 | f | r | A | 3 | | 0.0 | |
| 42 | 48-50 | 49 | 24 | f | r | A | 3 | 0.8 | 5.7 | 28.47 |
| 43 | 48-50 | 49 | 24 | f | r | A | 3 | 0.7 | 5.6 | 33.32 |
| 44 | 48-50 | 49 | 24 | f | r | A | 3 | 0.8 | 6.1 | 31.25 |
| 45 | 52-54 | 53 | 28 | m | r | A | 3 | 0.8 | 6.0 | 39.03 |
| 46 | 52-54 | 53 | 25 | f | l | A | 3 | 0.8 | 5.8 | 33.71 |
| 47 | 52-54 | 53 | 25 | f | l | A | 3 | 0.9 | 6.8 | 32.47 |
| 48 | 52-54 | 53 | 24 | f | l | A | 3 | 0.9 | 6.6 | 34.28 |
| 49 | 56-58 | 57 | 24 | f | l | A | 3 | 0.7 | 5.2 | 33.74 |
| 50 | 56-58 | 57 | 23 | f | r | A | 3 | 0.5 | 3.5 | 42.63 |

| Sample | Depth (cm) | midpt (cm) | length | gender | valve | molt | VPI | Ca (ppm) | µg CaCO3 | Mg/Ca (molar) |
|---|---|---|---|---|---|---|---|---|---|---|
| 51 | 56-58 | 57 | 24 | f | l | A | 3 | 0.6 | 4.9 | 35.59 |
| 52 | 56-58 | 57 | 24 | f | r | A | 3 | 0.6 | 4.8 | 39.30 |
| 53 | 60-62 | 61 | 24 | f | r | A | 3 | 0.9 | 6.9 | 44.14 |
| 54 | 60-62 | 61 | 25 | f | r | A | 3 | 0.8 | 5.7 | 29.20 |
| 55 | 60-62 | 61 | 23.5 | f | r | A | 3 | 0.6 | 4.2 | 37.02 |
| 56 | 60-62 | 61 | 28 | m | r | A | 3 | 0.9 | 6.4 | 32.80 |
| 57 | 64-66 | 65 | 24 | f | l | A | 3 | 0.8 | 5.6 | 39.09 |
| 58 | 64-66 | 65 | 23.5 | f | l | A | 3 | 0.7 | 5.0 | 33.56 |
| 59 | 64-66 | 65 | 23.2 | f | r | A | 3 | 0.7 | 5.6 | 37.95 |
| 60 | 64-66 | 65 | 28 | m | r | A | 3 | 0.9 | 6.6 | 36.91 |
| 61 | 68-70 | 69 |  | f |  | A | 3 | 0.3 | 2.2 | 42.37 |
| 62 | 68-70 | 69 | 24.5 | f | l | A | 3 | 0.7 | 5.6 | 38.08 |
| 63 | 68-70 | 69 | 24.5 | f | r | A | 3 | 0.9 | 6.8 | 27.27 |
| 64 | 68-70 | 69 | 24 | f | r | A | 3 | 0.7 | 5.1 | 41.42 |
| 65 | 68-70 | 69 | 25 | f | r | A | 3 | 0.9 | 7.0 | 35.97 |
| 66 | 68-70 | 69 | 25 | f | l | A | 3 | 0.8 | 6.0 | 35.73 |
| 67 | 68-70 | 69 | 24.2 | f | l | A | 3 | 0.8 | 6.3 | 38.22 |
| 68 | 68-70 | 69 | 25 | f | l | A | 3 | 1.0 | 7.2 | 39.33 |
| 69 | 72-74 | 73 | 24 | f | l | A | 3 | 0.7 | 4.9 | 36.02 |
| 70 | 72-74 | 73 | 24.8 | f | l | A | 3 | 0.7 | 5.5 | 37.69 |
| 71 | 72-74 | 73 | 27.2 | m | r | A | 3 | 0.9 | 6.6 | 39.44 |
| 72 | 72-74 | 73 | 25 | f | r | A | 3 | 0.7 | 4.9 | 46.60 |
| 73 | 76-78 | 77 | 25 | f | r | A | 3 | 0.9 | 7.1 | 35.63 |
| 74 | 76-78 | 77 | 24 | f | r | A | 3 | 1.0 | 7.7 | 32.00 |
| 75 | 76-78 | 77 | 25 | f | r | A | 3 | 0.9 | 6.5 | 33.52 |
| 76 | 76-78 | 77 | 25 | f | r | A | 3 | 1.0 | 7.4 | 29.49 |
| 77 | 80-82 | 81 | 25.5 | f | l | A | 3 | 1.0 | 7.4 | 32.35 |
| 78 | 80-82 | 81 | 24 | f | l | A | 3 | 0.7 | 5.1 | 33.83 |
| 79 | 80-82 | 81 | 24 | f | l | A | 3 | 0.9 | 6.9 | 37.64 |
| 80 | 80-82 | 81 | 28.2 | m | r | A | 3 | 1.3 | 9.5 | 40.79 |
| 81 | 84-86 | 85 | 28.5 | m | l | A | 3 | 1.1 | 7.9 | 48.15 |
| 82 | 84-86 | 85 | 29 | m | l | A | 3 | 0.9 | 7.0 | 35.94 |
| 83 | 84-86 | 85 | 24.2 | m | r | A | 3 | 0.7 | 5.1 | 32.25 |
| 84 | 84-86 | 85 | 23.5 | f | r | A | 3 | 0.8 | 5.9 | 40.92 |
| 85 | 88-90 | 89 | 28 | m | l | A | 3 | 0.8 | 6.4 | 32.45 |
| 86 | 88-90 | 89 | 28.8 | m | l | A | 3 | 0.9 | 7.0 | 35.31 |
| 87 | 88-90 | 89 | 29 | m | l | A | 3 | 1.0 | 7.3 | 39.03 |
| 88 | 88-90 | 89 | 25 | f | l | A | 3 | 0.9 | 6.9 | 33.91 |
| 89 | 92-94 | 93 | 26.5 | f | l | A | 3 | 0.6 | 4.6 | 30.52 |
| 90 | 92-94 | 93 | 25.2 | f | l | A | 3 | 1.1 | 7.9 | 34.37 |
| 91 | 92-94 | 93 | 29 | m | l | A | 3 | 1.0 | 7.2 | 33.24 |
| 92 | 92-94 | 93 | 26 | f | l | A | 3 | 0.8 | 6.3 | 38.51 |
| 93 | 96-98 | 97 | 27 | f | l | A | 3 | 0.9 | 6.9 | 36.41 |
| 94 | 96-98 | 97 | 24 | f | l | A | 3 | 1.1 | 8.2 | 26.98 |
| 95 | 96-98 | 97 | 25.2 | f | l | A | 3 | 0.8 | 5.9 | 39.69 |
| 96 | 96-98 | 97 | 25.2 | f | l | A | 3 | 0.9 | 6.6 | 30.92 |
| 97 | 100-102 | 101 | 25.2 | f | l | A | 3 | 1.1 | 8.6 | 31.49 |
| 98 | 100-102 | 101 | 24.2 | f | r | A | 3 | 0.8 | 5.7 | 40.98 |
| 99 | 100-102 | 101 | 23 | f | r | A | 3 | 0.5 | 3.8 | 43.92 |
| 100 | 100-102 | 101 | 24.8 | f | r | A | 3 | 0.6 | 4.3 | 32.50 |
| 101 | 104-106 | 105 | 25 | f | r | A | 3 |  |  |  |
| 102 | 104-106 | 105 | 25 | f | r | A | 3 |  |  |  |
| 103 | 104-106 | 105 | 25 | f | l | A | 3 | 0.8 | 5.9 | 36.89 |

| Sample | Depth (cm) | midpt (cm) | length | gender | valve | molt | VPI | Ca (ppm) | µg CaCO3 | Mg/Ca (molar) |
|---|---|---|---|---|---|---|---|---|---|---|
| 104 | 104-106 | 105 | 29 | m | l | A | 3 | 0.9 | 6.5 | 34.71 |
| 105 | 108-110 | 109 | 24.5 | f | r | A | 3 | 0.8 | 5.9 | 39.40 |
| 106 | 108-110 | 109 | 25 | f | l | A | 3 | 0.8 | 6.1 | 45.57 |
| 107 | 108-110 | 109 | 24.5 | f | l | A | 3 | 0.8 | 6.0 | 32.67 |
| 108 | 108-110 | 109 | 23.5 | f | l | A | 3 | 0.8 | 5.7 | 39.68 |
| 109 | 112-114 | 113 | 24 | f | l | A | 3 | 0.7 | 5.5 | 38.13 |
| 110 | 112-114 | 113 | 25 | f | l | A | 3 | 0.8 | 5.8 | 38.05 |
| 111 | 112-114 | 113 | 24 | f | l | A | 3 | 0.8 | 6.3 | 39.82 |
| 112 | 112-114 | 113 | 29 | m | r | A | 3 | 0.9 | 6.7 | 35.03 |
| 113 | 132-134 | 133 | 27.5 | m | l | A | 3 | 0.6 | 4.7 | 48.80 |
| 114 | 132-134 | 133 | 29 | m | l | A | 3 | 0.9 | 6.4 | 43.81 |
| 115 | 132-134 | 133 | 28 | m | l | A | 3 | 0.7 | 5.5 | 42.98 |
| 116 | 132-134 | 133 | 28.2 | m | l | A | 3 | 0.9 | 6.7 | 37.32 |
| 117 | 136-138 | 137 | 24 | f | r | A | 3 | 0.8 | 5.7 | 38.12 |
| 118 | 136-138 | 137 | 28 | m | r | A | 3 | 0.8 | 5.9 | 42.92 |
| 119 | 136-138 | 137 | 28 | m | r | A | 3 | 0.8 | 6.1 | 42.19 |
| 120 | 136-138 | 137 | 25 | f | r | A | 3 | 0.9 | 7.0 | 32.18 |
| 121 | 140-142 | 141 | 24.5 | f | r | A | 3 | 0.9 | 6.4 | 38.15 |
| 122 | 140-142 | 141 | 25 | f | r | A | 3 | 0.8 | 6.3 | 31.19 |
| 123 | 140-142 | 141 | 25 | f | r | A | 3 | 0.8 | 6.2 | 26.23 |
| 124 | 140-142 | 141 | 25 | f | r | A | 3 | 0.8 | 6.3 | 34.83 |
| 125 | 144-146 | 145 | 26 | f | l | A | 3 | 0.9 | 6.5 | 27.63 |
| 126 | 144-146 | 145 | 25.5 | f | l | A | 3 | 0.9 | 6.9 | 33.18 |
| 127 | 144-146 | 145 | 27.1 | m | r | A | 3 | 0.8 | 5.9 | 42.12 |
| 128 | 144-146 | 145 | 25 | f | l | A | 3 | 0.7 | 5.5 | 33.39 |
| 129 | 148-150 | 149 | 28.5 | m | l | A | 3 | 0.8 | 6.4 | 46.59 |
| 130 | 148-150 | 149 | 26 | f | r | A | 3 | 0.6 | 4.5 | 45.33 |
| 131 | 148-150 | 149 | 25 | f | r | A | 3 | 0.8 | 5.7 | 37.10 |
| 132 | 148-150 | 149 | 29.5 | m | l | A | 3 | 0.8 | 5.8 | 35.28 |
| 133 | 152-154 | 153 | 24.2 | f | l | A | 3 | 0.8 | 6.3 | 37.18 |
| 134 | 152-154 | 153 | 26.5 | f | l | A | 3 | 0.7 | 4.9 | 38.92 |
| 135 | 152-154 | 153 | 28 | m | r | A | 3 | 0.9 | 6.9 | 39.59 |
| 136 | 152-154 | 153 | 28 | m | r | A | 3 | 0.6 | 4.8 | 37.61 |
| 137 | 156-158 | 157 | 25.5 | f | l | A | 3 | 0.9 | 7.0 | 37.52 |
| 138 | 156-158 | 157 | 24 | f | l | A | 3 | 0.9 | 6.8 | 36.56 |
| 139 | 156-158 | 157 | 24.2 | f | l | A | 3 | 0.9 | 6.9 | 36.30 |
| 140 | 156-158 | 157 | 25 | f | l | A | 3 | 1.1 | 8.1 | 38.41 |
| 141 | 160-162 | 161 | 25 | f | l | A | 3 | 1.0 | 7.5 | 30.67 |
| 142 | 160-162 | 161 | 25 | f | l | A | 3 | 1.0 | 7.5 | 36.03 |
| 143 | 160-162 | 161 | 24.2 | f | l | A | 3 | 0.9 | 7.1 | 32.06 |
| 144 | 160-162 | 161 | 24 | f | l | A | 3 | 0.7 | 5.3 | 42.07 |
| 145 | 164-166 | 165 | lost | lost |  | A | 3 |  |  |  |
| 146 | 164-166 | 165 | 24 | f | r | A | 3 | 0.9 | 7.1 | 38.39 |
| 147 | 164-166 | 165 | 23.5 | f | r | A | 3 | 0.8 | 5.6 | 32.67 |
| 148 | 164-166 | 165 | 23.5 | f | r | A | 3 | 0.7 | 4.9 | 35.82 |
| 149 | 168-170 | 169 | 24.5 | f | l | A | 3 | 0.8 | 6.1 | 42.39 |
| 150 | 168-170 | 169 | 25.5 | f | l | A | 3 | 0.9 | 6.7 | 41.68 |
| 151 | 168-170 | 169 | 25 | f | l | A | 3 | 1.0 | 7.8 | 30.55 |
| 152 | 168-170 | 169 | 23.5 | f | l | A | 3 | 0.8 | 6.3 | 43.39 |
| 153 | 172-174 | 173 | 26.2 | f | l | A | 3 | 0.9 | 7.0 | 36.38 |
| 154 | 172-174 | 173 | 24 | f | l | A | 3 | 0.7 | 5.2 | 30.01 |
| 155 | 172-174 | 173 | 24.5 | f | l | A | 3 | 1.0 | 7.4 | 35.05 |
| 156 | 172-174 | 173 | 25 | f | l | A | 3 | 0.8 | 6.3 | 32.94 |

| Sample | Depth (cm) | midpt (cm) | length | gender | valve | molt | VPI | Ca (ppm) | µg CaCO3 | Mg/Ca (molar) |
|---|---|---|---|---|---|---|---|---|---|---|
| 157 | 176-178 | 177 | 25 | f | l | A | 3 | 0.9 | 7.1 | 26.46 |
| 158 | 176-178 | 177 | 24.5 | f | l | A | 3 | 0.8 | 5.8 | 38.53 |
| 159 | 176-178 | 177 | 24.5 | f | l | A | 3 | 0.9 | 6.8 | 29.18 |
| 160 | 176-178 | 177 | 24.5 | f | l | A | 3 | 0.9 | 6.4 | 36.42 |
| 161 | 176-178 | 177 | 25 | f | r | A | 3 | 0.9 | 6.9 | 34.68 |
| 162 | 176-178 | 177 | 24.2 | f | r | A | 3 | 0.7 | 5.4 | 39.61 |
| 163 | 176-178 | 177 | 25 | f | r | A | 3 | 0.9 | 6.9 | 38.02 |
| 164 | 176-178 | 177 | 24 | f | l | A | 3 | 0.7 | 5.4 | 37.65 |
| 165 | 180-182 | 181 | lost | brok | | A | 3 | 0.6 | 4.7 | 31.32 |
| 166 | 180-182 | 181 | 23.5 | f | l | A | 3 | 0.8 | 6.3 | 36.85 |
| 167 | 180-182 | 181 | 24 | f | r | A | 3 | 0.8 | 6.1 | 31.12 |
| 168 | 180-182 | 181 | 25 | f | r | A | 3 | 1.1 | 8.2 | 34.78 |
| 169 | 184-186 | 185 | 24.5 | f | l | A | 3 | 1.0 | 7.7 | 32.25 |
| 170 | 184-186 | 185 | 24.8 | f | l | A | 3 | 0.9 | 6.5 | 29.93 |
| 171 | 184-186 | 185 | 23.5 | f | l | A | 3 | 0.7 | 5.5 | 31.20 |
| 172 | 184-186 | 185 | 23.5 | f | l | A | 3 | 0.6 | 4.6 | 30.64 |
| 173 | 188-190 | 189 | 24.2 | f | r | A | 3 | 0.9 | 6.7 | 30.83 |
| 174 | 188-190 | 189 | 24 | f | r | A | 3 | 0.8 | 5.7 | 34.54 |
| 175 | 188-190 | 189 | 23 | f | r | A | 3 | 0.7 | 5.3 | 43.24 |
| 176 | 188-190 | 189 | lost | brok | | A | 3 | 0.1 | 0.9 | 48.95 |
| 177 | 192-194 | 193 | 24 | f | l | A | 3 | 0.8 | 6.0 | 37.11 |
| 178 | 192-194 | 193 | 24 | f | l | A | 3 | 0.8 | 5.9 | 41.55 |
| 179 | 192-194 | 193 | 24 | f | r | A | 3 | 0.8 | 6.4 | 32.72 |
| 180 | 192-194 | 193 | lost | | | A | 3 | | | |
| 181 | 196-198 | 197 | lost | | | A | 3 | | | |
| 182 | 196-198 | 197 | 24 | f | r | A | 3 | 0.8 | 6.3 | 37.78 |
| 183 | 196-198 | 197 | 25 | f | r | A | 3 | 0.8 | 5.7 | 24.82 |
| 184 | 196-198 | 197 | 28 | m | l | A | 3 | 0.8 | 5.8 | 49.79 |
| 185 | 200-202 | 201 | broke | | | A | 3 | 0.7 | 5.0 | 46.16 |
| 186 | 200-202 | 201 | 24 | f | r | A | 3 | 0.8 | 5.9 | 33.77 |
| 187 | 200-202 | 201 | broke | | | A | 3 | 0.4 | 2.8 | 36.43 |
| 188 | 200-202 | 201 | 24 | f | r | A | 3 | 0.6 | 4.8 | 28.68 |
| 189 | 204-206 | 205 | broke | | | A | 3 | | | |
| 190 | 204-206 | 205 | broke | | | A | 3 | 0.4 | 3.1 | 32.60 |
| 191 | 204-206 | 205 | broke | | | A | 3 | 0.7 | 5.3 | 43.05 |
| 192 | 204-206 | 205 | broke | | | A | 3 | 0.7 | 5.0 | 35.47 |
| 193 | 208-210 | 209 | broke | | | A | 3 | 0.6 | 4.2 | 40.30 |
| 194 | 208-210 | 209 | 24.2 | f | r | A | 3 | 0.8 | 5.7 | 35.43 |
| 195 | 208-210 | 209 | 28 | m | r | A | 3 | 0.7 | 5.5 | 54.51 |
| 196 | 208-210 | 209 | 26 | m | r | A | 3 | 0.7 | 5.5 | 46.56 |
| 197 | 212-214 | 213 | 23.5 | f | r | A | 3 | 0.9 | 6.5 | 30.83 |
| 198 | 212-214 | 213 | lost | | | A | 3 | | | |
| 199 | 212-214 | 213 | lost | | | A | 3 | | | |
| 200 | 212-214 | 213 | broke | | | A | 3 | 0.5 | 4.0 | 33.18 |
| 201 | 216-218 | 217 | 25 | f | l | A | 3 | 0.8 | 5.7 | 36.64 |
| 202 | 216-218 | 217 | 24 | f | l | A | 3 | 0.8 | 6.0 | 30.92 |
| 203 | 216-218 | 217 | 24.5 | f | l | A | 3 | 0.9 | 6.7 | 42.91 |
| 204 | 216-218 | 217 | broke | | | A | 3 | 0.8 | 5.7 | 41.00 |
| 205 | 220-222 | 221 | 24 | f | r | A | 3 | 0.6 | 4.8 | 32.32 |
| 206 | 220-222 | 221 | lost | | | A | 3 | | | |
| 207 | 220-222 | 221 | 24 | f | r | A | 3 | 0.9 | 6.7 | 28.92 |
| 208 | 220-222 | 221 | broke | | | A | 3 | 0.7 | 5.6 | 38.69 |
| 209 | 224-bottom | 225 | broke | | | A | 3 | 1.3 | 9.8 | 43.85 |

| Sample | Depth (cm) | midpt (cm) | length | gender | valve | molt | VPI | Ca (ppm) | µg CaCO3 | Mg/Ca (molar) |
|---|---|---|---|---|---|---|---|---|---|---|
| 210 | 224-bottom | 225 | broke | | | A | 3 | 0.7 | 5.6 | 32.94 |
| 211 | 224-bottom | 225 | 23.7 | f | l | A | 3 | 0.8 | 5.9 | 38.98 |
| 212 | 224-bottom | 225 | 28 | m | | A | 3 | 0.7 | 5.1 | 44.25 |
| CO3 Standard PE-3 | | | | | | | | 2.8 | | 8.32 |
| Standard PE-3 | | | | | | | | 2.5 | | 8.31 |
| Standard PE-3 | | | | | | | | 2.6 | | 8.22 |
| Standard PE-3 | | | | | | | | 2.7 | | 8.27 |
| Standard PE-3 | | | | | | | | 2.6 | | 8.44 |
| Standard PE-3 | | | | | | | | 1.4 | | 8.25 |
| Standard PE-3 | | | | | | | | 6.9 | | 8.18 |
| Standard PE-3 | | | | | | | | 1.8 | | 8.32 |
| Standard PE-3 | | | | | | | | 1.8 | | 8.34 |
| Standard PE-3 | | | | | | | | 1.8 | | 8.32 |
| Standard PE-3 | | | | | | | | 1.8 | | 8.30 |
| Standard PE-3 | | | | | | | | 0.7 | | 7.71 |
| Standard PE-3 | | | | | | | | 0.7 | | 8.40 |
| Standard PE-3 | | | | | | | | 0.7 | | 7.76 |
| Standard PE-3 | | | | | | | | 5.7 | | 8.17 |
| Standard PE-3 | | | | | | | | 2.8 | | 8.33 |
| Standard PE-3 | | | | | | | | 2.9 | | 8.23 |
| Standard PE-3 | | | | | | | | 2.8 | | 8.31 |
| Standard PE-3 | | | | | | | | 2.7 | | 8.25 |
| Standard PE-3 | | | | | | | | 1.7 | | 8.56 |
| Standard PE-3 | | | | | | | | 1.6 | | 8.14 |
| Standard PE-3 | | | | | | | | 1.6 | | 8.44 |
| Standard PE-3 | | | | | | | | 2.1 | | 8.18 |
| Standard PE-3 | | | | | | | | 2.0 | | 8.47 |
| Standard PE-3 | | | | | | | | 2.0 | | 8.50 |
| | | | | | | | | | mean | 8.27 |
| | | | | | | | | | %rstdev | 2.3 |

Appendix J.

| Sample | Depth (cm) | Sr/Ca (molar) | Na/Ca (molar) | Avg Mg/Ca | Avg Sr/Ca | Avg Na/Ca | stdev Mg/Ca | stdev Sr/Ca | stdev Na/Ca |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-2 | 3.98 | 15.51 | 37.22 | 3.73 | 13.50 | 2.4 | 0.3 | 2.1 |
| 2 | 0-2 | 3.86 | 13.42 | | | | | | |
| 3 | 0-2 | 3.80 | 14.52 | | | | | | |
| 4 | 0-2 | 3.29 | 10.56 | | | | | | |
| 5 | 12 to 14 | 3.33 | 14.47 | 32.95 | 3.50 | 14.52 | 8.2 | 0.2 | 1.4 |
| 6 | 12 to 14 | | | | | | | | |
| 7 | 12 to 14 | 3.52 | 15.99 | | | | | | |
| 8 | 12 to 14 | 3.65 | 13.10 | | | | | | |
| 9 | 16-18 | 3.45 | 13.91 | 36.62 | 3.55 | 13.47 | 8.4 | 0.2 | 0.9 |
| 10 | 16-18 | 3.80 | 13.56 | | | | | | |
| 11 | 16-18 | 3.52 | 12.12 | | | | | | |
| 12 | 16-18 | 3.42 | 14.30 | | | | | | |
| 13 | 20-22 | 3.72 | 13.99 | 35.56 | 3.78 | 13.36 | 7.2 | 0.1 | 1.1 |
| 14 | 20-22 | 3.75 | 11.77 | | | | | | |
| 15 | 20-22 | 3.94 | 14.36 | | | | | | |
| 16 | 20-22 | 3.70 | 13.34 | | | | | | |
| 17 | 24-26 | 4.00 | 18.35 | 41.31 | 3.60 | 15.51 | 8.7 | 0.3 | 2.0 |
| 18 | 24-26 | 3.60 | 15.03 | | | | | | |
| 19 | 24-26 | 3.30 | 13.49 | | | | | | |
| 20 | 24-26 | 3.52 | 15.16 | | | | | | |
| 21 | 28-30 | 3.26 | 12.48 | 37.54 | 3.57 | 13.54 | 4.6 | 0.2 | 1.9 |
| 22 | 28-30 | 3.62 | 14.21 | | | | | | |
| 23 | 28-30 | 3.86 | 15.94 | | | | | | |
| 24 | 28-30 | 3.52 | 11.54 | | | | | | |
| 25 | 32-34 | 3.43 | 12.85 | 41.38 | 3.45 | 13.24 | 5.2 | 0.2 | 1.4 |
| 26 | 32-34 | 3.53 | 13.94 | | | | | | |
| 27 | 32-34 | 3.62 | 14.70 | | | | | | |
| 28 | 32-34 | 3.23 | 11.45 | | | | | | |
| 29 | 36-38 | 3.47 | 15.54 | 40.96 | 3.65 | 14.99 | 6.9 | 0.4 | 0.9 |
| 30 | 36-38 | 3.98 | 13.97 | | | | | | |
| 31 | 36-38 | 3.97 | 15.92 | | | | | | |
| 32 | 36-38 | 3.20 | 14.52 | | | | | | |
| 33 | 40-42 | 3.25 | 14.00 | 39.20 | 3.61 | 16.43 | 6.0 | 0.3 | 1.7 |
| 34 | 40-42 | 3.66 | 17.89 | | | | | | |
| 35 | 40-42 | 4.05 | 17.44 | | | | | | |
| 36 | 40-42 | 3.47 | 16.40 | | | | | | |
| 37 | 44-46 | 3.07 | 12.90 | 36.24 | 3.34 | 15.28 | 1.6 | 0.2 | 1.7 |
| 38 | 44-46 | 3.35 | 17.02 | | | | | | |
| 39 | 44-46 | 3.60 | 15.54 | | | | | | |
| 40 | 44-46 | 3.36 | 15.64 | | | | | | |
| 41 | 48-50 | | | 31.01 | 3.55 | 13.89 | 2.4 | 0.1 | 1.9 |
| 42 | 48-50 | 3.65 | 14.01 | | | | | | |
| 43 | 48-50 | 3.51 | 15.71 | | | | | | |
| 44 | 48-50 | 3.48 | 11.95 | | | | | | |
| 45 | 52-54 | 3.60 | 13.71 | 34.87 | 3.67 | 15.80 | 2.9 | 0.2 | 1.7 |
| 46 | 52-54 | 3.58 | 16.71 | | | | | | |
| 47 | 52-54 | 3.58 | 17.62 | | | | | | |
| 48 | 52-54 | 3.92 | 15.16 | | | | | | |
| 49 | 56-58 | 3.76 | 14.25 | 37.81 | 3.39 | 13.86 | 4.0 | 0.5 | 2.3 |
| 50 | 56-58 | 2.78 | 10.51 | | | | | | |

| Sample | Depth (cm) | Sr/Ca (molar) | Na/Ca (molar) | Avg Mg/Ca | Avg Sr/Ca | Avg Na/Ca | stdev Mg/Ca | stdev Sr/Ca | stdev Na/Ca |
|---|---|---|---|---|---|---|---|---|---|
| 51 | 56-58 | 3.71 | 15.21 | | | | | | |
| 52 | 56-58 | 3.28 | 15.47 | | | | | | |
| 53 | 60-62 | 3.64 | 12.00 | 35.79 | 3.69 | 15.42 | 6.4 | 0.3 | 2.5 |
| 54 | 60-62 | 4.12 | 17.37 | | | | | | |
| 55 | 60-62 | 3.47 | 15.18 | | | | | | |
| 56 | 60-62 | 3.54 | 17.12 | | | | | | |
| 57 | 64-66 | 3.64 | 14.88 | 36.88 | 3.54 | 14.84 | 2.4 | 0.2 | 2.5 |
| 58 | 64-66 | 3.65 | 13.74 | | | | | | |
| 59 | 64-66 | 3.59 | 12.47 | | | | | | |
| 60 | 64-66 | 3.28 | 18.26 | | | | | | |
| 61 | 68-70 | 3.92 | 16.12 | 37.28 | 3.57 | 13.98 | 6.9 | 0.2 | 2.7 |
| 62 | 68-70 | 3.53 | 15.99 | | | | | | |
| 63 | 68-70 | 3.40 | 13.49 | | | | | | |
| 64 | 68-70 | 3.45 | 10.33 | | | | | | |
| 65 | 68-70 | 3.99 | 13.30 | 37.31 | 3.65 | 13.34 | 1.7 | 0.3 | 0.9 |
| 66 | 68-70 | 3.43 | 13.66 | | | | | | |
| 67 | 68-70 | 3.28 | 14.28 | | | | | | |
| 68 | 68-70 | 3.88 | 12.11 | | | | | | |
| 69 | 72-74 | 3.50 | 14.19 | 39.94 | 3.30 | 13.77 | 4.7 | 0.2 | 0.8 |
| 70 | 72-74 | 3.32 | 14.29 | | | | | | |
| 71 | 72-74 | 3.38 | 14.01 | | | | | | |
| 72 | 72-74 | 3.01 | 12.59 | | | | | | |
| 73 | 76-78 | 3.43 | 16.01 | 32.66 | 3.63 | 15.09 | 2.6 | 0.3 | 1.3 |
| 74 | 76-78 | 3.48 | 15.13 | | | | | | |
| 75 | 76-78 | 4.04 | 16.00 | | | | | | |
| 76 | 76-78 | 3.56 | 13.21 | | | | | | |
| 77 | 80-82 | 3.65 | 16.65 | 36.15 | 3.70 | 14.84 | 3.8 | 0.3 | 1.2 |
| 78 | 80-82 | 3.87 | 14.22 | | | | | | |
| 79 | 80-82 | 3.93 | 14.03 | | | | | | |
| 80 | 80-82 | 3.37 | 14.47 | | | | | | |
| 81 | 84-86 | 3.49 | 12.52 | 39.32 | 3.61 | 13.36 | 6.9 | 0.1 | 0.8 |
| 82 | 84-86 | 3.65 | 13.89 | | | | | | |
| 83 | 84-86 | 3.62 | 14.19 | | | | | | |
| 84 | 84-86 | 3.70 | 12.85 | | | | | | |
| 85 | 88-90 | 3.19 | 17.54 | 35.18 | 3.42 | 15.15 | 2.8 | 0.2 | 1.9 |
| 86 | 88-90 | 3.42 | 12.93 | | | | | | |
| 87 | 88-90 | 3.70 | 15.21 | | | | | | |
| 88 | 88-90 | 3.37 | 14.92 | | | | | | |
| 89 | 92-94 | 3.74 | 14.09 | 34.16 | 3.63 | 15.66 | 3.3 | 0.2 | 1.8 |
| 90 | 92-94 | 3.82 | 14.29 | | | | | | |
| 91 | 92-94 | 3.56 | 17.94 | | | | | | |
| 92 | 92-94 | 3.41 | 16.30 | | | | | | |
| 93 | 96-98 | 3.95 | 14.54 | 33.50 | 3.65 | 15.56 | 5.7 | 0.2 | 2.5 |
| 94 | 96-98 | 3.64 | 13.93 | | | | | | |
| 95 | 96-98 | 3.47 | 14.50 | | | | | | |
| 96 | 96-98 | 3.55 | 19.26 | | | | | | |
| 97 | 100-102 | 3.75 | 14.29 | 37.22 | 3.81 | 14.70 | 6.2 | 0.1 | 3.5 |
| 98 | 100-102 | 3.79 | 12.38 | | | | | | |
| 99 | 100-102 | 3.84 | 12.35 | | | | | | |
| 100 | 100-102 | 3.87 | 19.77 | | | | | | |
| 101 | 104-106 | | | 35.80 | 3.41 | 15.78 | 1.5 | 0.1 | 1.5 |
| 102 | 104-106 | | | | | | | | |
| 103 | 104-106 | 3.34 | 16.81 | | | | | | |

| Sample | Depth (cm) | Sr/Ca (molar) | Na/Ca (molar) | Avg Mg/Ca | Avg Sr/Ca | Avg Na/Ca | stdev Mg/Ca | stdev Sr/Ca | stdev Na/Ca |
|---|---|---|---|---|---|---|---|---|---|
| 104 | 104-106 | 3.49 | 14.75 | | | | | | |
| 105 | 108-110 | 3.41 | 10.79 | 39.33 | 3.56 | 14.09 | 5.3 | 0.3 | 2.8 |
| 106 | 108-110 | 3.47 | 16.34 | | | | | | |
| 107 | 108-110 | 3.41 | 12.65 | | | | | | |
| 108 | 108-110 | 3.95 | 16.59 | | | | | | |
| 109 | 112-114 | 3.60 | 13.78 | 37.76 | 3.57 | 14.45 | 2.0 | 0.1 | 0.9 |
| 110 | 112-114 | 3.54 | 14.01 | | | | | | |
| 111 | 112-114 | 3.67 | 15.78 | | | | | | |
| 112 | 112-114 | 3.47 | 14.25 | | | | | | |
| 113 | 132-134 | 3.11 | 13.75 | 43.23 | 3.30 | 12.09 | 4.7 | 0.2 | 2.0 |
| 114 | 132-134 | 3.43 | 13.37 | | | | | | |
| 115 | 132-134 | 3.14 | 9.23 | | | | | | |
| 116 | 132-134 | 3.53 | 12.00 | | | | | | |
| 117 | 136-138 | 3.68 | 13.06 | 38.85 | 3.60 | 13.64 | 4.9 | 0.1 | 1.0 |
| 118 | 136-138 | 3.54 | 12.67 | | | | | | |
| 119 | 136-138 | 3.62 | 13.85 | | | | | | |
| 120 | 136-138 | 3.56 | 14.99 | | | | | | |
| 121 | 140-142 | 3.81 | 19.21 | 32.60 | 3.66 | 16.40 | 5.1 | 0.2 | 2.5 |
| 122 | 140-142 | 3.72 | 13.21 | | | | | | |
| 123 | 140-142 | 3.42 | 16.20 | | | | | | |
| 124 | 140-142 | 3.68 | 17.00 | | | | | | |
| 125 | 144-146 | 3.44 | 13.15 | 34.08 | 3.57 | 14.16 | 6.0 | 0.1 | 1.5 |
| 126 | 144-146 | 3.45 | 14.75 | | | | | | |
| 127 | 144-146 | 3.70 | 15.97 | | | | | | |
| 128 | 144-146 | 3.67 | 12.76 | | | | | | |
| 129 | 148-150 | 3.33 | 16.53 | 41.07 | 3.48 | 16.12 | 5.7 | 0.3 | 1.8 |
| 130 | 148-150 | 3.41 | 18.10 | | | | | | |
| 131 | 148-150 | 3.92 | 16.07 | | | | | | |
| 132 | 148-150 | 3.27 | 13.76 | | | | | | |
| 133 | 152-154 | 3.52 | 16.67 | 38.32 | 3.50 | 15.18 | 1.1 | 0.1 | 2.3 |
| 134 | 152-154 | 3.40 | 11.94 | | | | | | |
| 135 | 152-154 | 3.58 | 15.16 | | | | | | |
| 136 | 152-154 | 3.49 | 16.95 | | | | | | |
| 137 | 156-158 | 3.51 | 17.72 | 37.20 | 3.80 | 15.56 | 1.0 | 0.3 | 4.0 |
| 138 | 156-158 | 3.79 | 20.14 | | | | | | |
| 139 | 156-158 | 3.71 | 11.68 | | | | | | |
| 140 | 156-158 | 4.19 | 12.70 | | | | | | |
| 141 | 160-162 | 3.29 | 14.66 | 35.21 | 3.43 | 15.79 | 5.1 | 0.1 | 1.6 |
| 142 | 160-162 | 3.59 | 14.43 | | | | | | |
| 143 | 160-162 | 3.52 | 17.87 | | | | | | |
| 144 | 160-162 | 3.32 | 16.19 | | | | | | |
| 145 | 164-166 | | | 35.63 | 3.45 | 13.34 | 2.9 | 0.5 | 1.9 |
| 146 | 164-166 | 3.78 | 15.26 | | | | | | |
| 147 | 164-166 | 3.65 | 13.19 | | | | | | |
| 148 | 164-166 | 2.93 | 11.55 | | | | | | |
| 149 | 168-170 | 3.60 | 16.87 | 39.50 | 3.68 | 15.80 | 6.0 | 0.1 | 2.0 |
| 150 | 168-170 | 3.68 | 12.89 | | | | | | |
| 151 | 168-170 | 3.82 | 15.96 | | | | | | |
| 152 | 168-170 | 3.61 | 17.48 | | | | | | |
| 153 | 172-174 | 3.60 | 17.55 | 33.59 | 3.52 | 15.07 | 2.8 | 0.2 | 2.2 |
| 154 | 172-174 | 3.29 | 12.76 | | | | | | |
| 155 | 172-174 | 3.78 | 13.65 | | | | | | |
| 156 | 172-174 | 3.40 | 16.33 | | | | | | |

| Sample | Depth (cm) | Sr/Ca (molar) | Na/Ca (molar) | Avg Mg/Ca | Avg Sr/Ca | Avg Na/Ca | stdev Mg/Ca | stdev Sr/Ca | stdev Na/Ca |
|---|---|---|---|---|---|---|---|---|---|
| 157 | 176-178 | 3.36 | 10.32 | 32.65 | 3.61 | 13.09 | 5.7 | 0.2 | 2.4 |
| 158 | 176-178 | 3.62 | 14.46 | | | | | | |
| 159 | 176-178 | 3.57 | 11.85 | | | | | | |
| 160 | 176-178 | 3.87 | 15.72 | | | | | | |
| 161 | 176-178 | 3.36 | 15.38 | 37.49 | 3.48 | 15.99 | 2.1 | 0.2 | 1.8 |
| 162 | 176-178 | 3.49 | 15.01 | | | | | | |
| 163 | 176-178 | 3.79 | 18.68 | | | | | | |
| 164 | 176-178 | 3.28 | 14.88 | | | | | | |
| 165 | 180-182 | 3.59 | 11.61 | 33.52 | 3.56 | 14.66 | 2.8 | 0.2 | 2.8 |
| 166 | 180-182 | 3.44 | 14.68 | | | | | | |
| 167 | 180-182 | 3.41 | 18.37 | | | | | | |
| 168 | 180-182 | 3.78 | 13.99 | | | | | | |
| 169 | 184-186 | 3.78 | 13.63 | 31.00 | 3.52 | 15.14 | 1.0 | 0.2 | 1.6 |
| 170 | 184-186 | 3.44 | 15.08 | | | | | | |
| 171 | 184-186 | 3.30 | 17.30 | | | | | | |
| 172 | 184-186 | 3.58 | 14.54 | | | | | | |
| 173 | 188-190 | 3.76 | 17.15 | 39.39 | 3.67 | 20.24 | 8.2 | 0.2 | 7.3 |
| 174 | 188-190 | 3.44 | 15.37 | | | | | | |
| 175 | 188-190 | 3.58 | 17.26 | | | | | | |
| 176 | 188-190 | 3.88 | 31.17 | | | | | | |
| 177 | 192-194 | 3.80 | 17.83 | 37.13 | 3.79 | 15.05 | 4.4 | 0.1 | 2.4 |
| 178 | 192-194 | 3.85 | 13.34 | | | | | | |
| 179 | 192-194 | 3.73 | 13.97 | | | | | | |
| 180 | 192-194 | | | | | | | | |
| 181 | 196-198 | | | 37.46 | 3.32 | 14.94 | 12.5 | 0.2 | 1.8 |
| 182 | 196-198 | 3.53 | 16.82 | | | | | | |
| 183 | 196-198 | 3.07 | 13.33 | | | | | | |
| 184 | 196-198 | 3.35 | 14.66 | | | | | | |
| 185 | 200-202 | 3.59 | 18.99 | 36.26 | 3.45 | 17.27 | 7.3 | 0.1 | 2.3 |
| 186 | 200-202 | 3.33 | 18.47 | | | | | | |
| 187 | 200-202 | 3.44 | 17.64 | | | | | | |
| 188 | 200-202 | 3.45 | 13.97 | | | | | | |
| 189 | 204-206 | | | 37.04 | 3.74 | 17.67 | 5.4 | 0.2 | 0.6 |
| 190 | 204-206 | 3.56 | 17.12 | | | | | | |
| 191 | 204-206 | 3.96 | 17.58 | | | | | | |
| 192 | 204-206 | 3.70 | 18.33 | | | | | | |
| 193 | 208-210 | 3.39 | 16.20 | 44.20 | 3.51 | 12.94 | 8.2 | 0.3 | 3.9 |
| 194 | 208-210 | 3.93 | 15.14 | | | | | | |
| 195 | 208-210 | 3.41 | 13.00 | | | | | | |
| 196 | 208-210 | 3.33 | 7.41 | | | | | | |
| 197 | 212-214 | 3.53 | 15.11 | 32.01 | 3.45 | 16.90 | 1.7 | 0.1 | 2.5 |
| 198 | 212-214 | | | | | | | | |
| 199 | 212-214 | | | | | | | | |
| 200 | 212-214 | 3.38 | 18.68 | | | | | | |
| 201 | 216-218 | 3.41 | 13.77 | 37.87 | 3.55 | 14.83 | 5.3 | 0.2 | 1.8 |
| 202 | 216-218 | 3.44 | 15.76 | | | | | | |
| 203 | 216-218 | 3.74 | 16.87 | | | | | | |
| 204 | 216-218 | 3.59 | 12.92 | | | | | | |
| 205 | 220-222 | 3.42 | 14.90 | 33.31 | 3.64 | 14.75 | 5.0 | 0.3 | 2.2 |
| 206 | 220-222 | | | | | | | | |
| 207 | 220-222 | 3.57 | 12.48 | | | | | | |
| 208 | 220-222 | 3.94 | 16.88 | | | | | | |
| 209 | 224-bottom | 3.69 | 14.14 | 40.01 | 3.43 | 15.45 | 5.3 | 0.3 | 1.9 |

| Sample | Depth (cm) | Sr/Ca (molar) | Na/Ca (molar) | Avg Mg/Ca | Avg Sr/Ca | Avg Na/Ca | stdev Mg/Ca | stdev Sr/Ca | stdev Na/Ca |
|---|---|---|---|---|---|---|---|---|---|
| 210 | 224-bottom | 3.54 | 18.18 | | | | | | |
| 211 | 224-bottom | 3.43 | 14.27 | | | | | | |
| 212 | 224-bottom | 3.09 | 15.19 | | | | | | |
| CO3 Standard PE-3 | | 7.69 | 4.83 | | | | | | |
| Standard PE-3 | | 7.55 | 5.46 | | | | | | |
| Standard PE-3 | | 7.84 | 4.60 | | | | | | |
| Standard PE-3 | | 7.62 | 5.18 | | | | | | |
| Standard PE-3 | | 7.55 | 5.88 | | | | | | |
| Standard PE-3 | | 7.78 | 5.23 | | | | | | |
| Standard PE-3 | | 7.70 | 4.75 | | | | | | |
| Standard PE-3 | | 7.73 | 5.33 | | | | | | |
| Standard PE-3 | | 7.65 | 5.07 | | | | | | |
| Standard PE-3 | | 7.61 | 5.50 | | | | | | |
| Standard PE-3 | | 7.77 | 4.38 | | | | | | |
| Standard PE-3 | | 7.79 | 3.17 | | | | | | |
| Standard PE-3 | | 7.98 | 5.50 | | | | | | |
| Standard PE-3 | | 7.79 | 1.90 | | | | | | |
| Standard PE-3 | | 7.83 | 4.56 | | | | | | |
| Standard PE-3 | | 7.67 | 4.92 | | | | | | |
| Standard PE-3 | | 7.65 | 5.02 | | | | | | |
| Standard PE-3 | | 7.63 | 5.24 | | | | | | |
| Standard PE-3 | | 7.75 | 4.24 | | | | | | |
| Standard PE-3 | | 7.73 | 5.19 | | | | | | |
| Standard PE-3 | | 7.83 | 4.06 | | | | | | |
| Standard PE-3 | | 7.56 | 4.41 | | | | | | |
| Standard PE-3 | | 7.68 | 4.67 | | | | | | |
| Standard PE-3 | | 7.56 | 7.35 | | | | | | |
| Standard PE-3 | | 7.64 | 7.28 | | | | | | |
| | | 7.70 | 4.95 | | | | | | |
| | | 1.4 | 21.9 | | | | | | |

Appendix K: Percent abundance data for ostracodes from Card Bank core (SEI297-CB1)

| Depth (cm) | Calendar Year | *P. setipunctata* | *Loxoconcha matagordensis* | *Malzella floridana* | *Xestoleberis spp.* | *Bairdiids* | *Puriana* | *Jug-Herm-Rad** | *Neocaudites & Caudites* | *Actinocythereis* | *Other* | Total % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **2002** | 3 | 19 | 9 | 40 | 19 | 2 | 0 | 1 | 1 | 14 | 108 |
| **3** | **1997** | 2 | 21 | 13 | 24 | 23 | 1 | 0 | 0 | 2 | 18 | 104 |
| **5** | **1992** | 1 | 34 | 9 | 24 | 9 | 3 | 0 | 0 | 3 | 21 | 104 |
| **7** | **1981** | 1 | 24 | 20 | 27 | 7 | 7 | 0 | 0 | 0 | 16 | 102 |
| **9** | **1969** | 2 | 32 | 11 | 28 | 6 | 5 | 0 | 0 | 3 | 17 | 104 |
| **11** | **1958** | 0 | 21 | 13 | 36 | 5 | 5 | 1 | 0 | 2 | 23 | 106 |
| **13** | **1946** | 1 | 21 | 10 | 47 | 2 | 4 | 0 | 0 | 3 | 18 | 106 |
| **15** | **1934** | 0 | 25 | 10 | 29 | 12 | 3 | 0 | 0 | 2 | 23 | 104 |
| **17** | **1923** | 0 | 20 | 20 | 24 | 11 | 4 | 0 | 0 | 2 | 21 | 102 |
| **19** | **1911** | 0 | 19 | 23 | 26 | 12 | 4 | 1 | 0 | 2 | 18 | 105 |
| **21** | **1899** | 0 | 23 | 16 | 31 | 10 | 5 | 1 | 0 | 2 | 17 | 105 |
| **23** | **1888** | 1 | 18 | 30 | 30 | 1 | 5 | 0 | 0 | 3 | 12 | 100 |
| **25** | **1876** | 0 | 17 | 17 | 36 | 11 | 4 | 0 | 0 | 1 | 17 | 103 |
| **27** | **1864** | 0 | 19 | 21 | 36 | 7 | 3 | 0 | 0 | 2 | 16 | 104 |
| **29** | **1853** | 2 | 8 | 17 | 49 | 8 | 2 | 0 | 0 | 1 | 16 | 103 |
| **31** | **1841** | 1 | 22 | 14 | 23 | 36 | 0 | 0 | 0 | 2 | 7 | 105 |
| **33** | **1830** | 4 | 15 | 11 | 31 | 25 | 1 | 0 | 0 | 1 | 15 | 103 |
| **35** | **1818** | 1 | 22 | 10 | 44 | 6 | 5 | 0 | 0 | 1 | 14 | 103 |
| **37** | **1806** | 1 | 15 | 12 | 54 | 15 | 0 | 0 | 0 | 0 | 7 | 104 |
| **39** | **1795** | 0 | 17 | 11 | 47 | 13 | 1 | 0 | 0 | 2 | 12 | 103 |
| **41** | **1783** | 0 | 20 | 2 | 48 | 14 | 2 | 0 | 0 | 1 | 17 | 104 |
| **43** | **1771** | 0 | 13 | 8 | 59 | 6 | 1 | 0 | 0 | 0 | 17 | 104 |
| **45** | **1760** | 1 | 24 | 9 | 44 | 18 | 1 | 0 | 0 | 1 | 6 | 104 |
| **47** | **1748** | 0 | 24 | 9 | 42 | 4 | 0 | 0 | 0 | 2 | 23 | 104 |
| **49** | **1736** | 0 | 27 | 9 | 35 | 6 | 1 | 0 | 0 | 1 | 26 | 105 |
| **51** | **1725** | 0 | 14 | 15 | 49 | 4 | 1 | 1 | 1 | 4 | 20 | 109 |
| **53** | **1713** | 0 | 8 | 30 | 57 | 1 | 0 | 0 | 0 | 0 | 8 | 104 |
| **55** | **1702** | 0 | 9 | 13 | 79 | 1 | 0 | 0 | 0 | 0 | 1 | 103 |
| **57** | **1690** | 4 | 6 | 12 | 34 | 7 | 4 | 0 | 1 | 6 | 29 | 103 |
| **59** | **1678** | 4 | 5 | 10 | 60 | 3 | 3 | 0 | 0 | 0 | 19 | 104 |
| **61** | **1667** | 5 | 4 | 23 | 56 | 1 | 3 | 0 | 0 | 0 | 14 | 106 |
| **63** | **1655** | 5 | 5 | 36 | 37 | 3 | 3 | 0 | 0 | 0 | 17 | 106 |
| **65** | **1643** | 4 | 13 | 14 | 48 | 4 | 7 | 0 | 0 | 1 | 14 | 105 |
| **67** | **1632** | 4 | 13 | 33 | 26 | 2 | 5 | 0 | 0 | 2 | 20 | 105 |
| **69** | **1620** | 8 | 8 | 27 | 33 | 1 | 7 | 0 | 0 | 0 | 19 | 103 |
| **71** | **1608** | 4 | 11 | 17 | 37 | 7 | 3 | 1 | 0 | 1 | 21 | 102 |
| **73** | **1597** | 5 | 11 | 25 | 20 | 6 | 4 | 0 | 0 | 0 | 32 | 103 |
| **75** | **1585** | 3 | 14 | 20 | 24 | 10 | 11 | 0 | 0 | 3 | 21 | 106 |

| Depth (cm) | Calendar Year | *P. setipunctata* | *Loxoconcha matagordensis* | *Malzella floridana* | *Xestoleberis* spp. | Bairdiids | *Puriana* | Jug-Herm-Rad* | *Neocaudites* & *Caudites* | *Actinocythereis* | Other | Total % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **85** | **1527** | 1 | 7 | 44 | 28 | 0 | 4 | 0 | 0 | 6 | 13 | 103 |
| **87** | **1515** | 1 | 15 | 31 | 25 | 0 | 4 | 0 | 0 | 4 | 23 | 103 |
| **89** | **1504** | 6 | 13 | 27 | 28 | 3 | 2 | 0 | 0 | 5 | 20 | 104 |
| **91** | **1492** | 3 | 4 | 26 | 50 | 1 | 2 | 0 | 0 | 1 | 16 | 103 |
| **93** | **1480** | 0 | 8 | 21 | 56 | 0 | 2 | 0 | 0 | 2 | 14 | 103 |
| **95** | **1469** | 7 | 7 | 28 | 38 | 2 | 3 | 0 | 0 | 1 | 17 | 103 |
| **97** | **1457** | 4 | 3 | 36 | 41 | 3 | 1 | 0 | 0 | 1 | 16 | 105 |
| **99** | **1446** | 3 | 11 | 21 | 47 | 9 | 0 | 0 | 0 | 1 | 11 | 103 |
| **101** | **1434** | 5 | 13 | 28 | 39 | 5 | 1 | 0 | 0 | 2 | 11 | 104 |
| **103** | **1422** | 7 | 3 | 25 | 43 | 6 | 1 | 0 | 0 | 4 | 13 | 102 |
| **105** | **1411** | 1 | 0 | 16 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 20 |
| **107** | **1399** | 2 | 2 | 58 | 27 | 1 | 6 | 0 | 1 | 0 | 4 | 101 |
| **109** | **1387** | 1 | 6 | 43 | 37 | 2 | 2 | 0 | 0 | 0 | 14 | 105 |
| **111** | **1376** | 2 | 2 | 40 | 40 | 3 | 2 | 0 | 0 | 1 | 15 | 105 |
| **113** | **1364** | 3 | 3 | 21 | 48 | 6 | 0 | 0 | 0 | 2 | 21 | 104 |
| **115** | **1352** | 2 | 2 | 22 | 61 | 3 | 0 | 0 | 0 | 0 | 13 | 103 |
| **117** | **1341** | 0 | 1 | 21 | 66 | 2 | 1 | 0 | 0 | 0 | 11 | 102 |
| **119** | **1329** | 1 | 3 | 46 | 39 | 4 | 0 | 0 | 0 | 0 | 10 | 103 |
| **121** | **1318** | 1 | 7 | 21 | 60 | 6 | 1 | 0 | 0 | 1 | 7 | 104 |
| **123** | **1306** | 2 | 2 | 27 | 68 | 2 | 0 | 0 | 0 | 0 | 4 | 105 |
| **125** | **1294** | 1 | 5 | 37 | 45 | 5 | 0 | 0 | 0 | 2 | 9 | 104 |
| **127** | **1283** | 4 | 1 | 45 | 36 | 5 | 1 | 0 | 0 | 3 | 11 | 106 |
| **129** | **1271** | 1 | 6 | 34 | 52 | 1 | 2 | 1 | 0 | 2 | 5 | 104 |
| **131** | **1259** | 4 | 7 | 41 | 34 | 9 | 7 | 1 | 0 | 3 | 22 | 128 |
| **133** | **1248** | 3 | 7 | 30 | 43 | 0 | 7 | 3 | 0 | 1 | 13 | 107 |
| **135** | **1236** | 4 | 3 | 34 | 47 | 0 | 2 | 0 | 0 | 2 | 14 | 106 |
| **137** | **1224** | 9 | 4 | 38 | 30 | 6 | 1 | 0 | 0 | 5 | 11 | 104 |
| **139** | **1213** | 5 | 2 | 52 | 30 | 1 | 2 | 0 | 0 | 3 | 10 | 105 |
| **141** | **1201** | 8 | 1 | 31 | 50 | 1 | 1 | 0 | 0 | 1 | 11 | 104 |
| **143** | **1190** | 9 | 2 | 52 | 33 | 1 | 3 | 0 | 0 | 2 | 1 | 103 |
| **145** | **1178** | 10 | 2 | 33 | 43 | 1 | 2 | 0 | 0 | 2 | 11 | 104 |

* *Jugosocythereis*, *Hermanites*, and *Radimella* (thick shelled carbonate platform taxa)