

A Sedimentological and Granulometric Atlas of the Beach Sediments of Florida's Southwest Coast and Keys

Daniel C. Phelps, Michelle M. L. Ladle, and Adel A. Dabous

The Florida Geological Survey
Coastal Research Program
under a cooperative agreement with

The National Oceanic and
Atmospheric Administration



Florida's Beaches & Dunes

- Provide a buffer between the sea and urban coastal regions
- Important wildlife habitats
- Provide valuable recreation areas
- Integral part of Florida's economy



Sampling Summary

- 390 samples were collected and described from 214 sites on the southwest coast of Florida
- 33 samples were collected and described from 28 sites in the Florida Keys archipelago
- Of those samples, 214 from the southwest coast and 28 from the Keys were also granulometrically analyzed.
- Samples, where possible, were collected at an approximate one mile interval.



Catalogue of Beach Sediments

- Sample Descriptions
- Munsell Color Values
- Grain Size Statistics
- Carbonate Percentages
- Site and Sample Photographs
- Photomicrographs of Select Samples



The atlas provides a snap shot in time of the sediments of the beaches of the southwest coast and Keys of Florida.



A few beaches on the southwest coast are quite wide



More of the beaches on the southwest coast are narrower



Some beaches on the southwest coast are quite narrow



Most of the beaches in the Keys are quite narrow as well



In some areas on the southwest coast erosion and coastline retreat is quite evident



Beach Sediment Sample Collection



In 2009 and 2010,
samples were collected
from
Pinellas, Hillsborough,
Manatee, Sarasota
Charlotte, Lee,
Collier, and
Monroe Counties



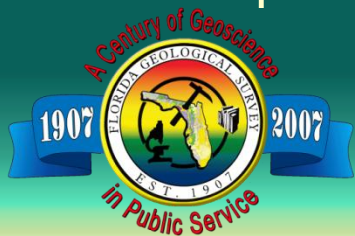
Sample Collection

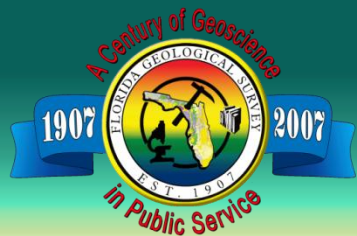
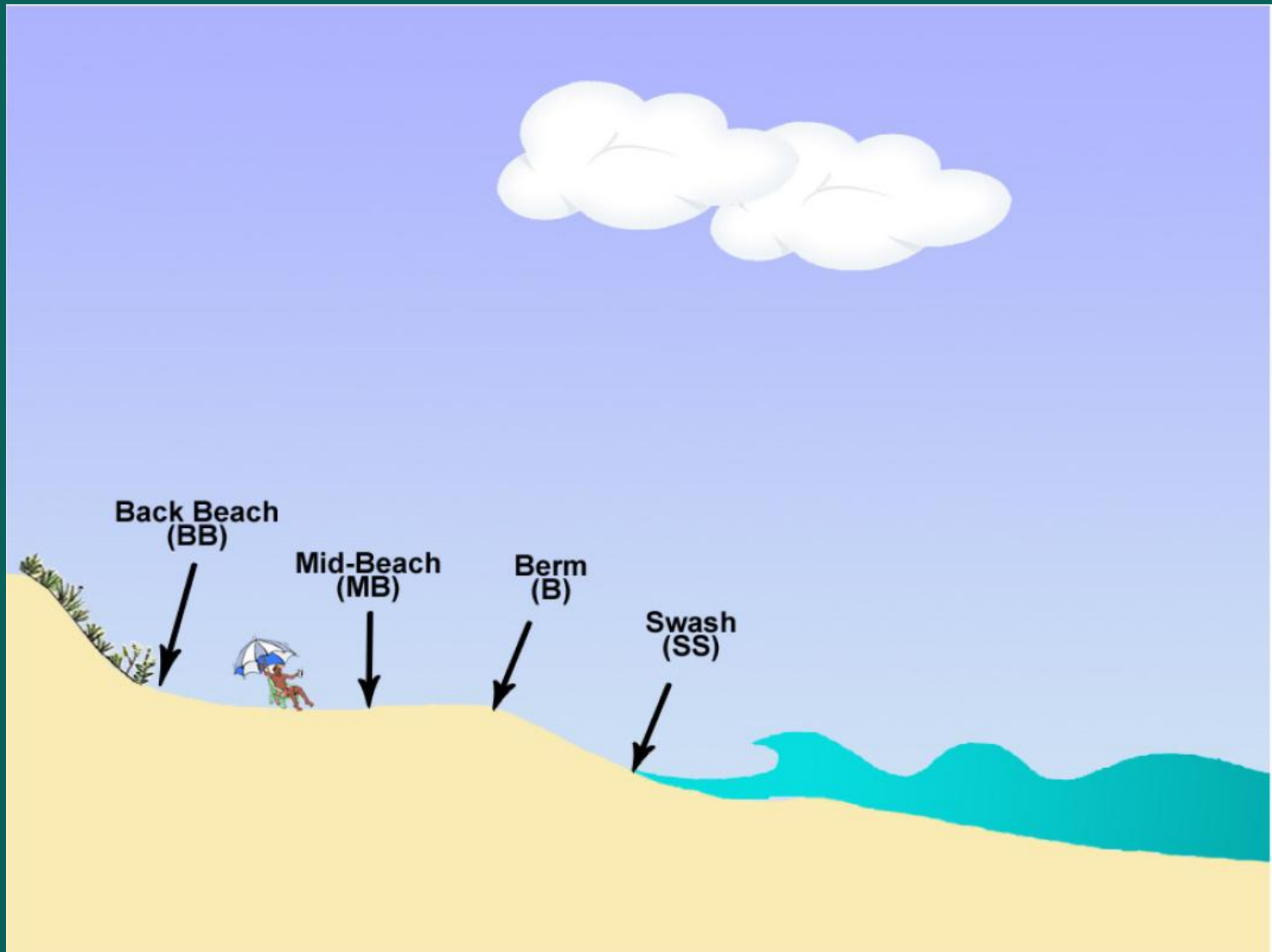
- Sample points were typically marked using survey flags, caution triangles and/or “traffic cones”.
- Photographs were taken illustrating the sample points as marked.
- GPS coordinates of all sampling points were recorded.
- Sampling holes were dug at each sample point and four individual bags of two oz (56.7 gm) sample were collected at a depth of 6 to 12 inches (15.2 cm to 30.4 cm) below land surface.
- Sampling holes were then back filled.



Sample Collection

- Optimally, samples would be collected from the swash zone, the beach berm, mid-beach and back beach. Few locations were optimal.
- At some locations, where there was no beach berm, samples were collected from the swash zone, the mid-beach and back beach.
- At other locations, where the beach was narrow, only swash zone and back beach samples were collected.
- At a few locations, where the beach was extremely narrow only a single sample point was utilized.
- At several locations, typically where no beach was present, no samples were taken.





Sample points along the beach profile

Sample Processing

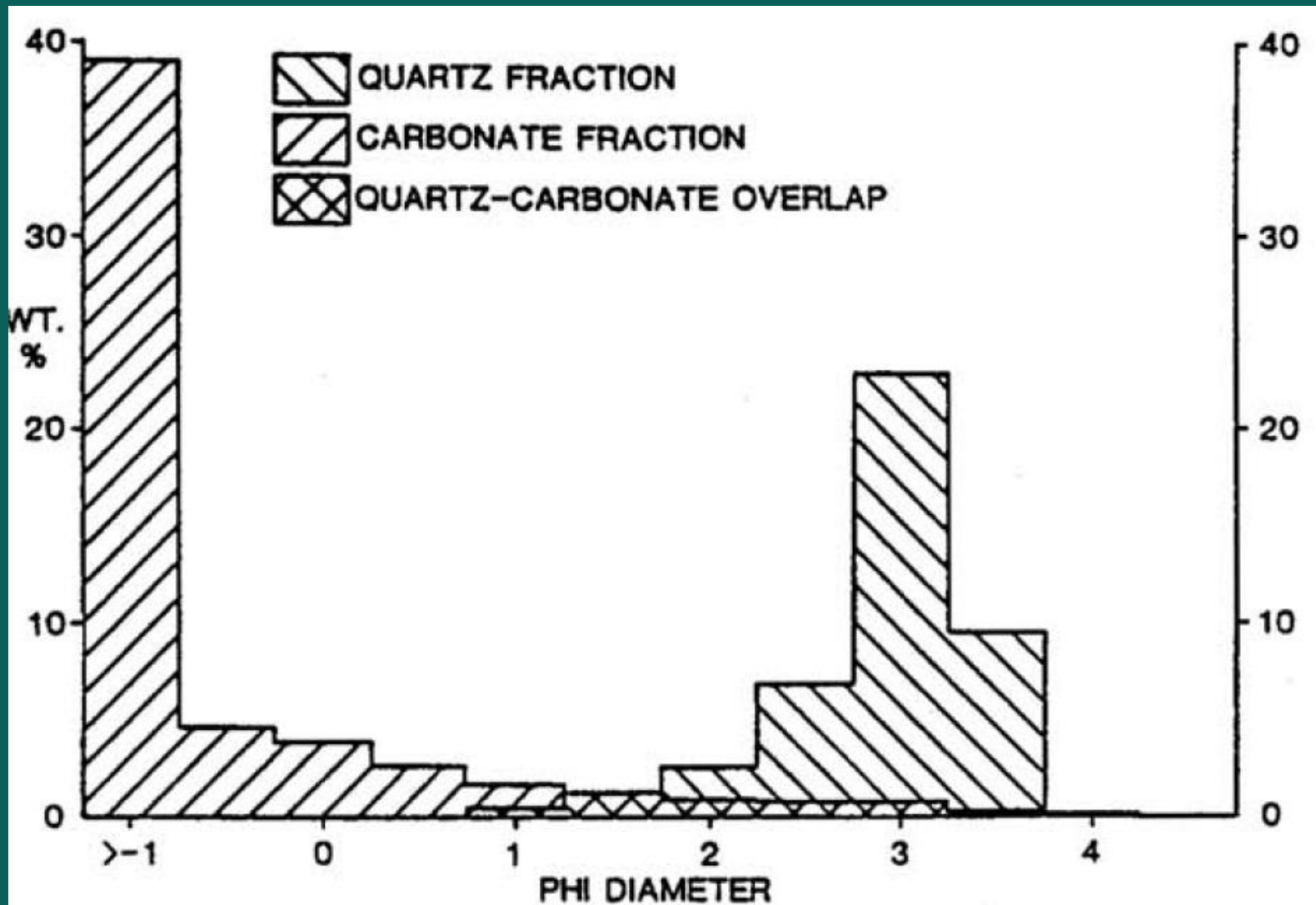
- Initially weighed after oven drying
- Wet sieved through a #230 (0.63 mm or 4 phi) sieve, oven dried and reweighed
- Dry sieved
- Digested with a 4 Molar hydrochloric acid solution, rinsed with deionized water, oven dried, reweighted and resieved.
- The weight of the fine fraction was assigned to the less than 4 phi fraction.





Granulometric Analysis

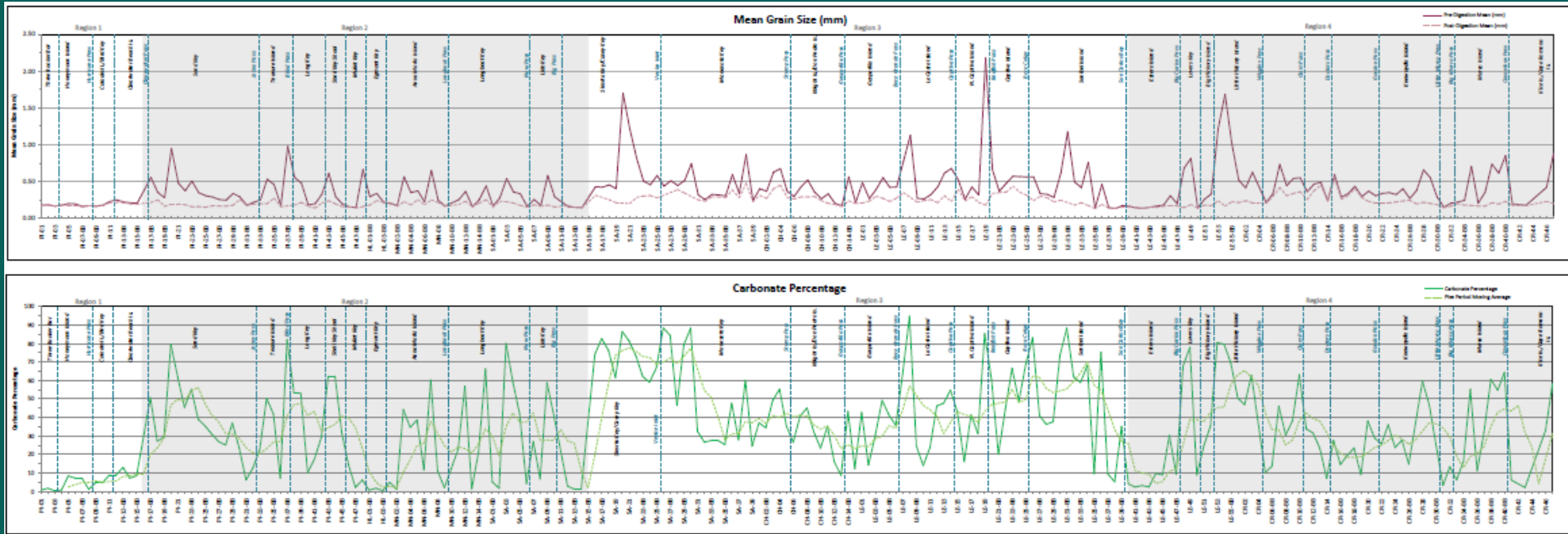




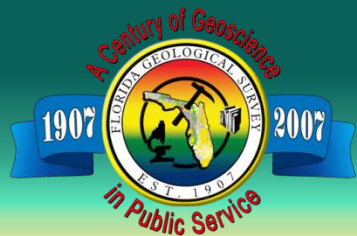
Histogram of typical southwest Florida beach sediments showing bimodality of coarse shell and fine quartz sand. (from Davis, 1994)



Southwest Coast Statistics



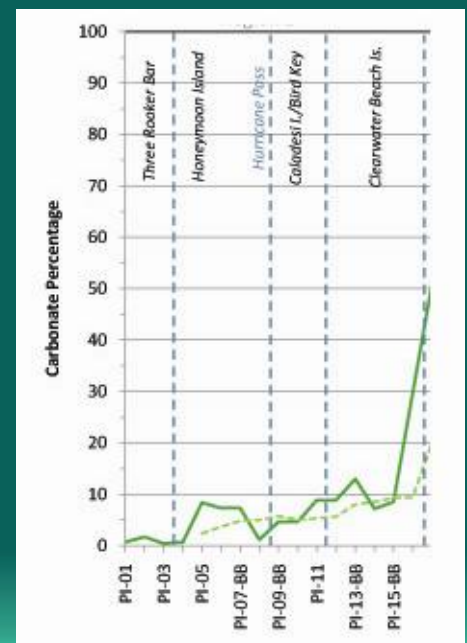
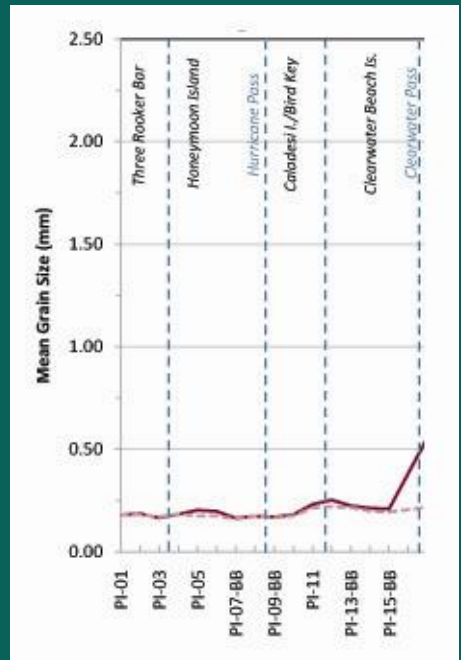
By graphing mean grain size and carbonate percentage along the length of the Southwest Coast, four distinct regions were observed.



Region 1

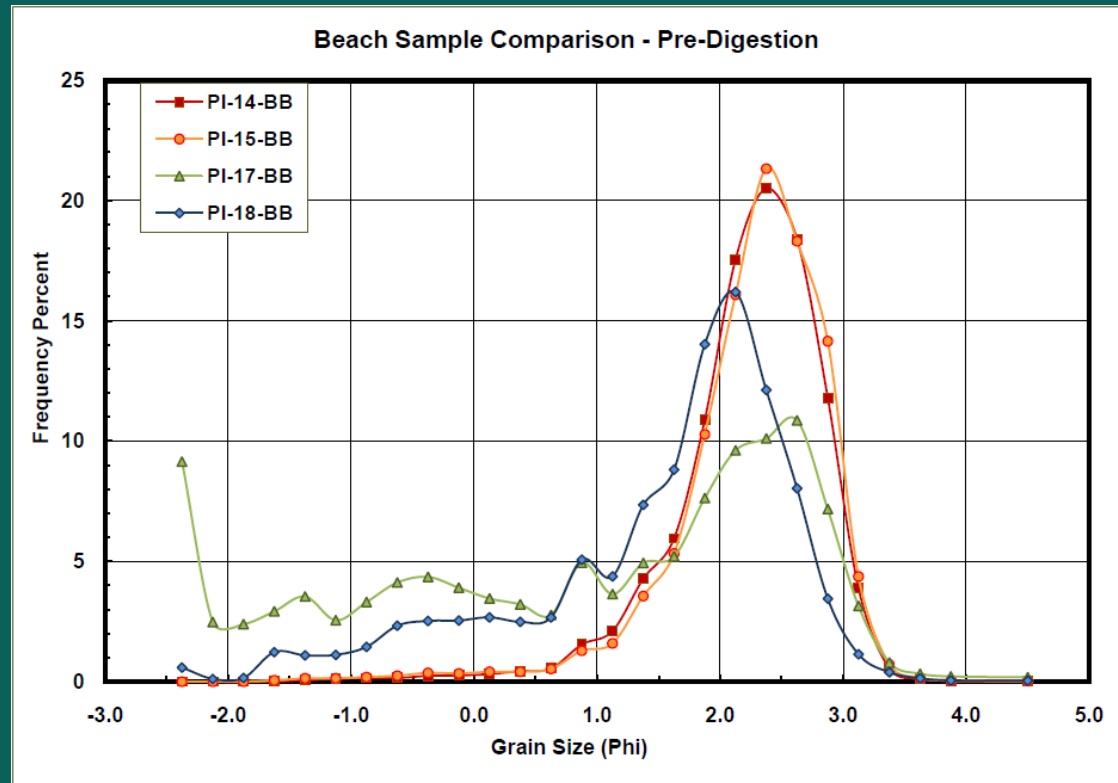
Three Rooker Bar to Clearwater Pass

- In this region, the carbonate fraction is low and the mean grain size is relatively fine.
- Three Rooker Bar displays the minimum carbonate percentages for the region.
- Both the percent carbonate and, to a very minor degree, the mean grain size curves trend upward across the region from north to south.



Clearwater Pass

Of the inlets that define the reaches in this region only Dunedin Pass and Clearwater Pass show lateral changes in grain size across them. These lateral changes are most pronounced across Clearwater Pass. PI-14 and 15 are to the north and PI-17 and 18 are to the south of the Pass.



Region 2

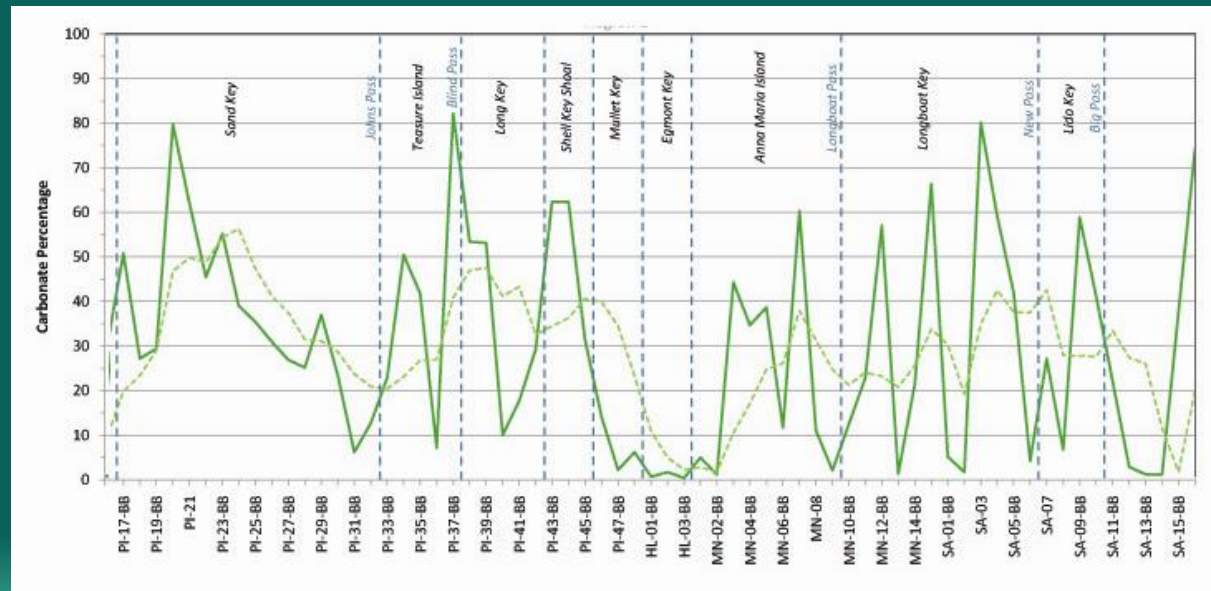
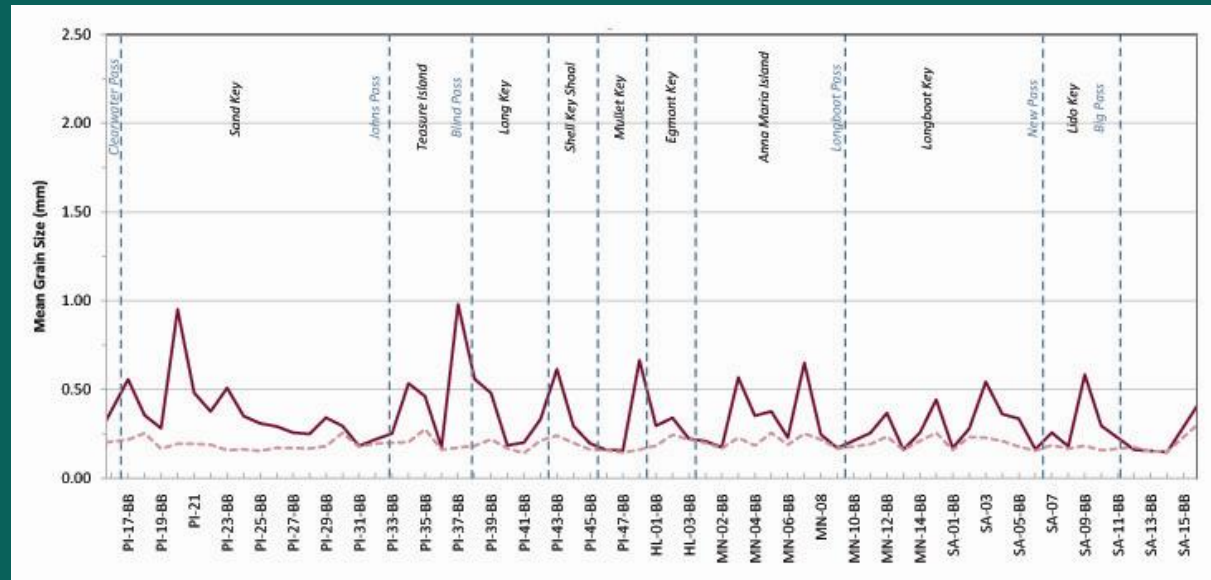
Clearwater Pass to Midnight Pass

This region is characterized by peaking values that gradually decline southward.

Sand Key to Mullet Key: Peaks and declines more uniform in character than those to the south..

Egmont Key: Finer grained and lower in carbonate material compared to the reaches north and south.

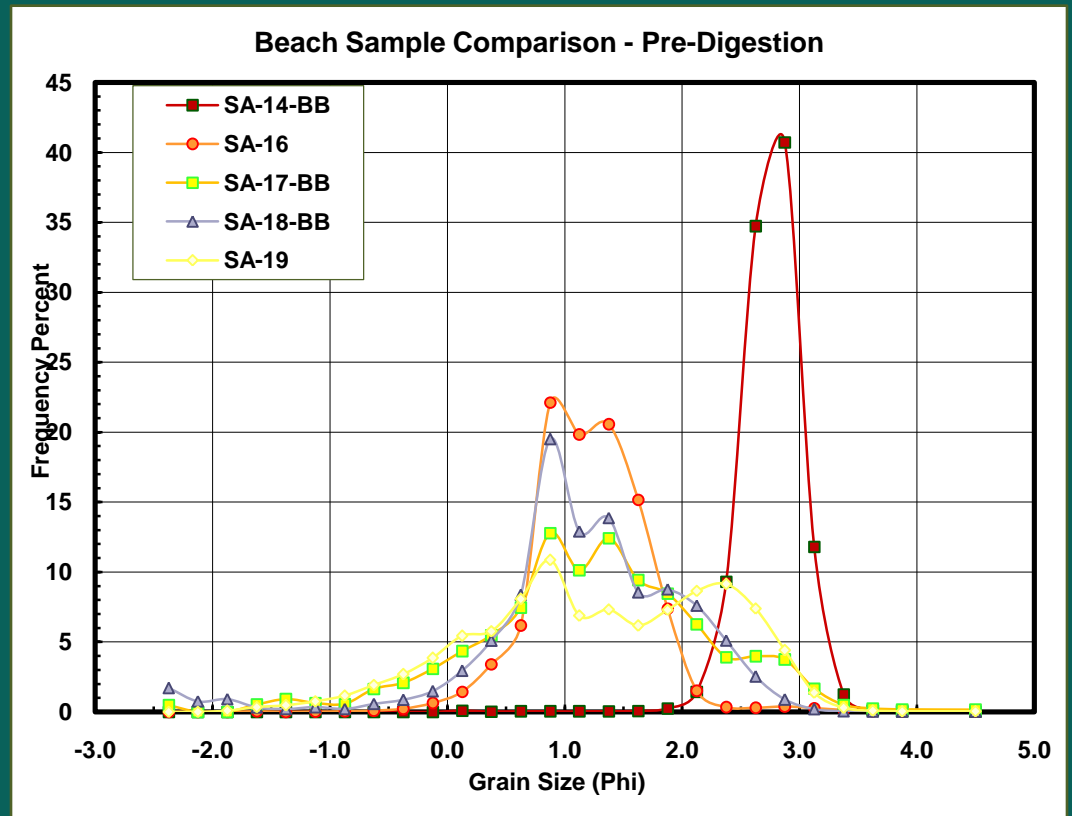
Anna Maria Island to Lido Key: Less uniform in character and more spiky than those in the north



Region 2

Rapid lateral changes in carbonate percentage are strongly associated with Clearwater Pass, Johns Pass, Blind Pass, Pass-a-Grille, Bunces Pass, Longboat, New Pass, Big Pass and the former location of Midnight Pass. Sample location numbers increase from north to south.

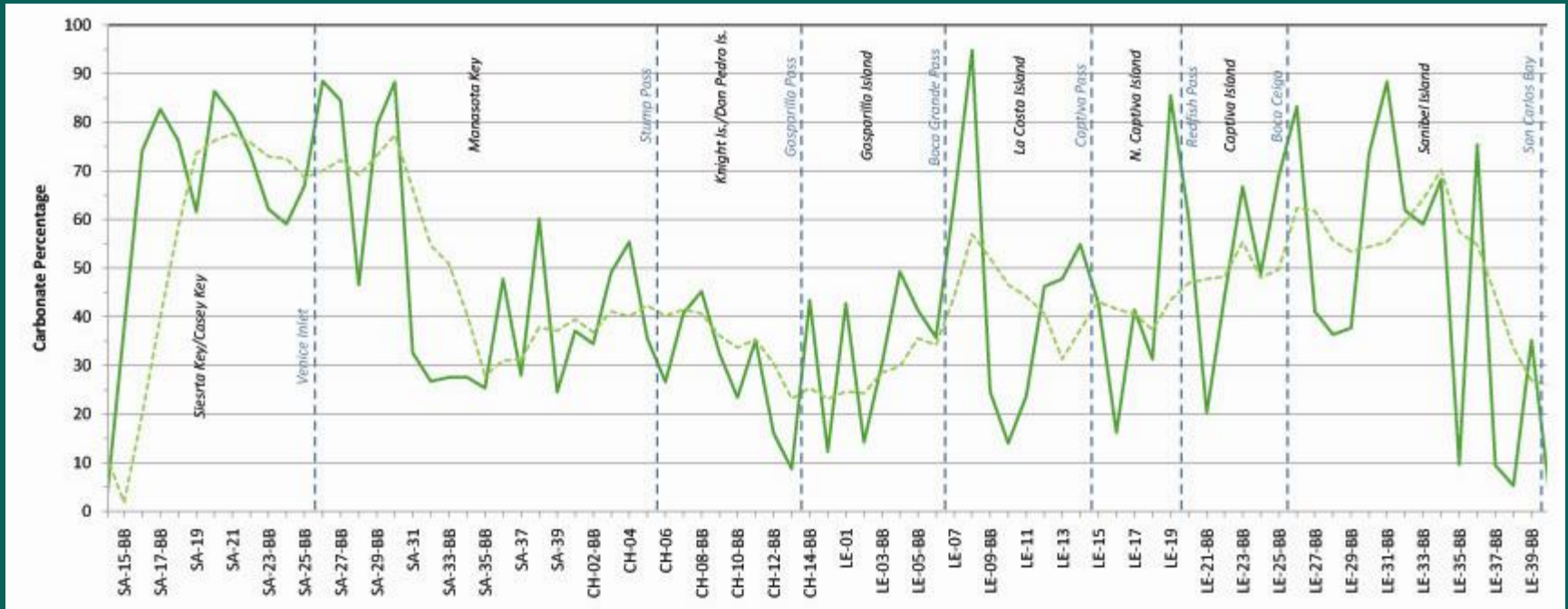
- Midnight Pass



Region 3

Midnight Pass to Big Carlos Pass

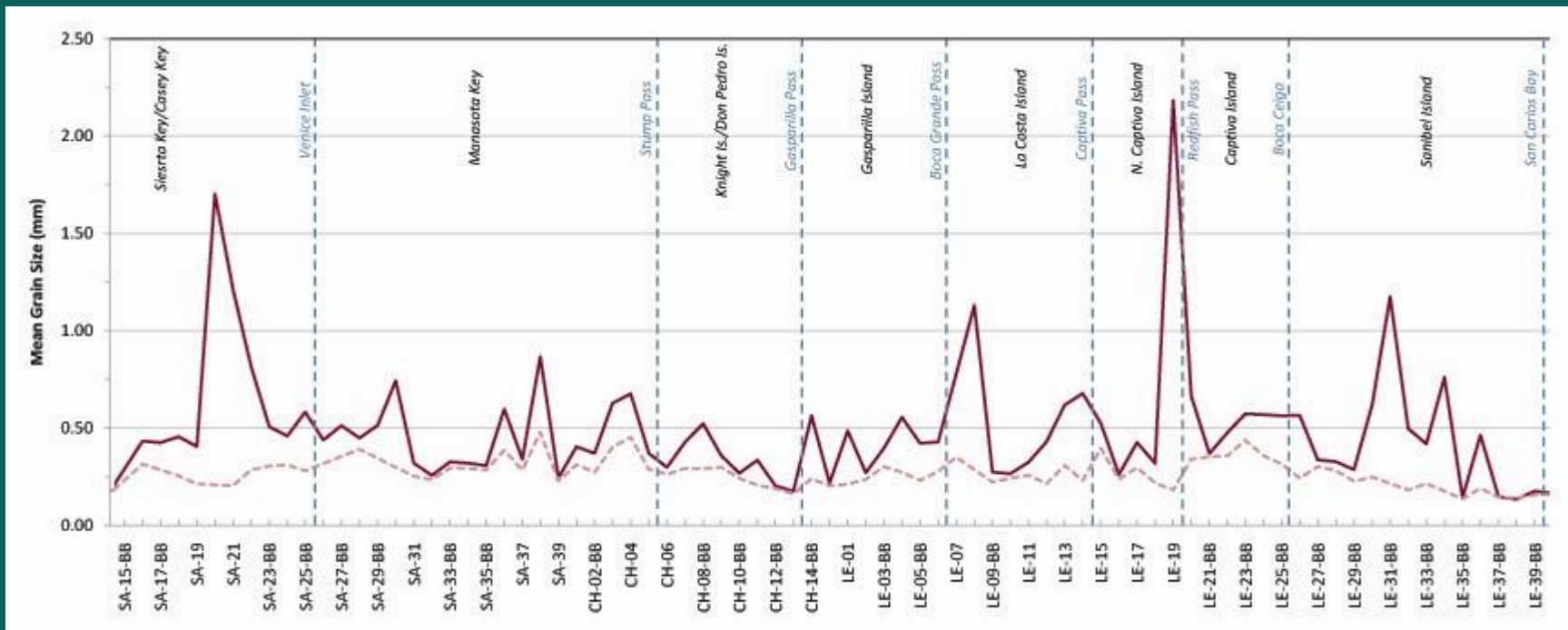
- Carbonate Percentage is significantly higher.
- Both curves periodically peak together with a broad minimum centered on Gasparilla Pass.



Region 3 cont.

Midnight Pass to Big Carlos Pass

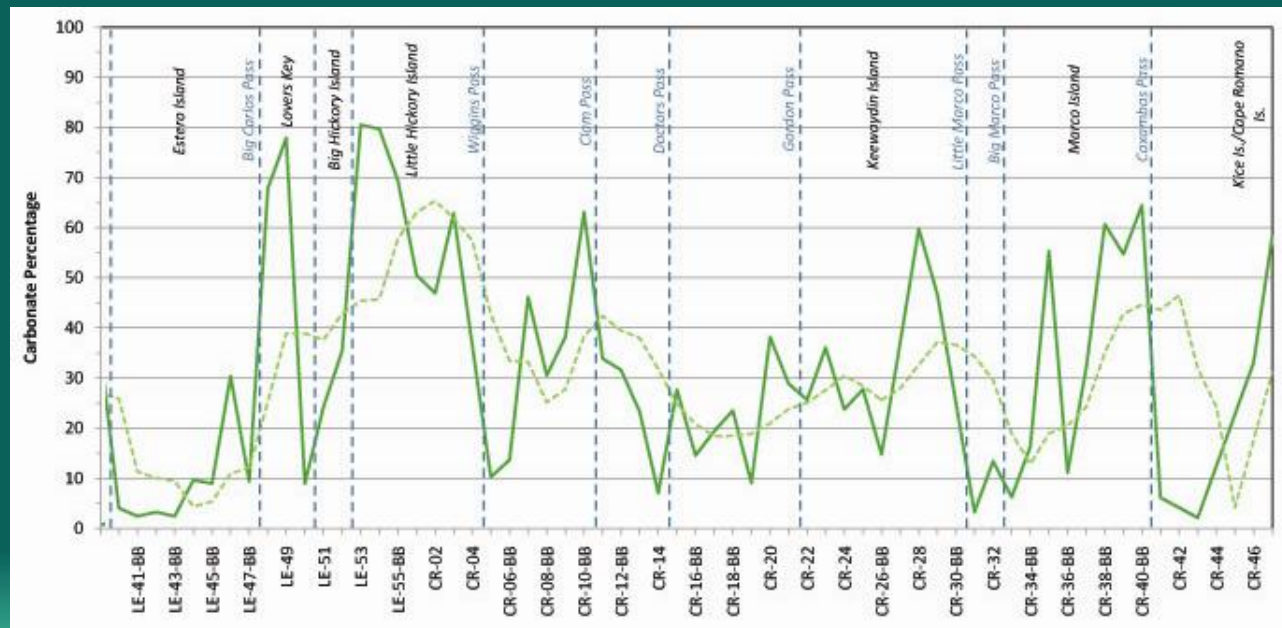
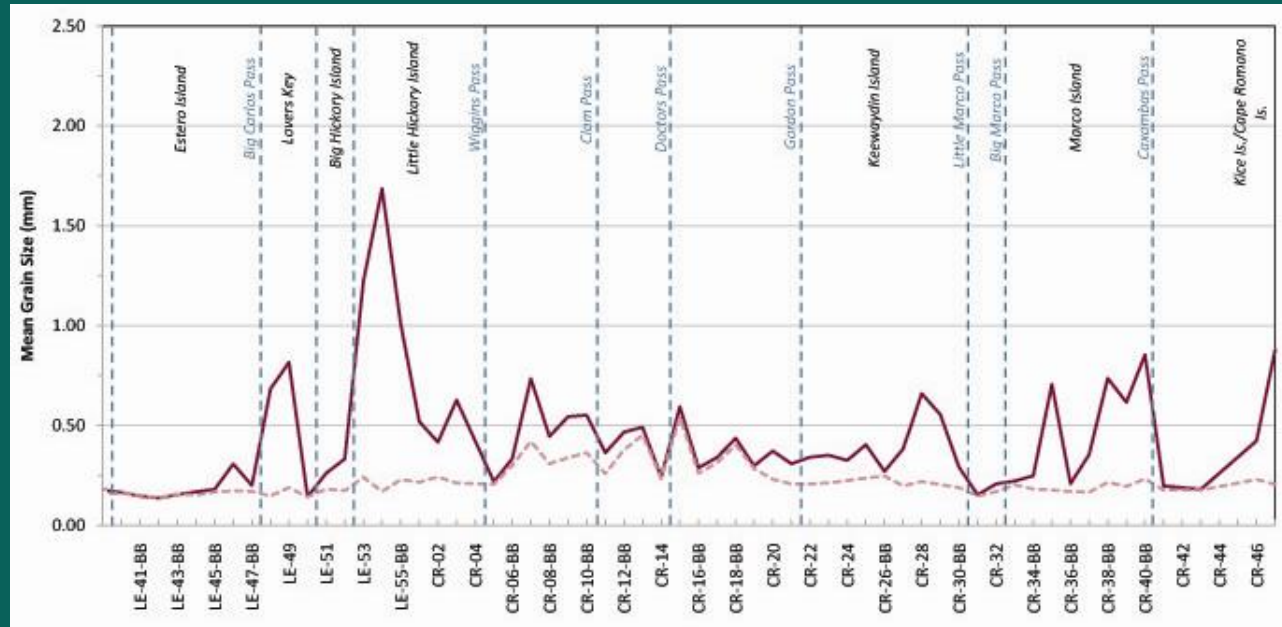
- Both the northern most and southern most reaches are more uniform in character than the middle reaches.



Region 4

Big Carlos Pass to Cape Romano

- Carbonate Percentage is lower in this Region
- Both curves broadly peak periodically with less variability.

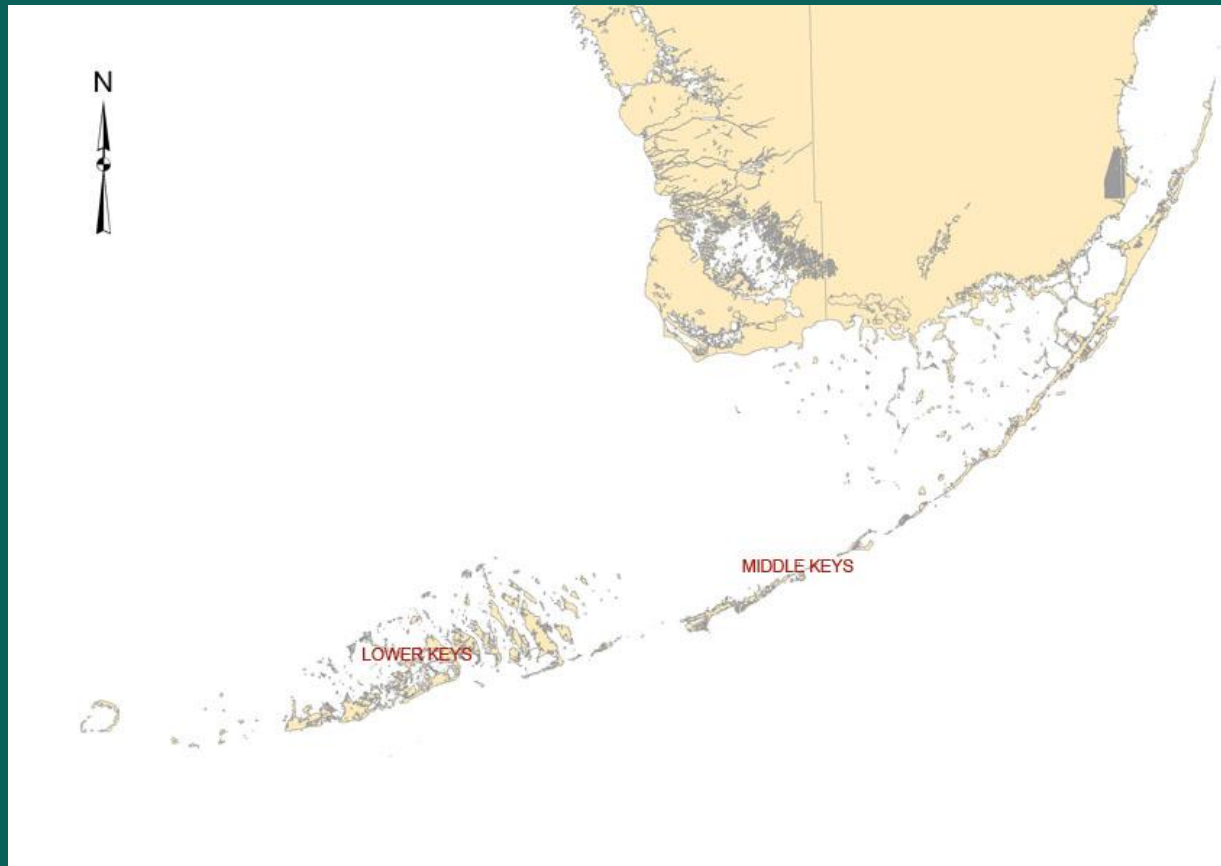


Conclusions

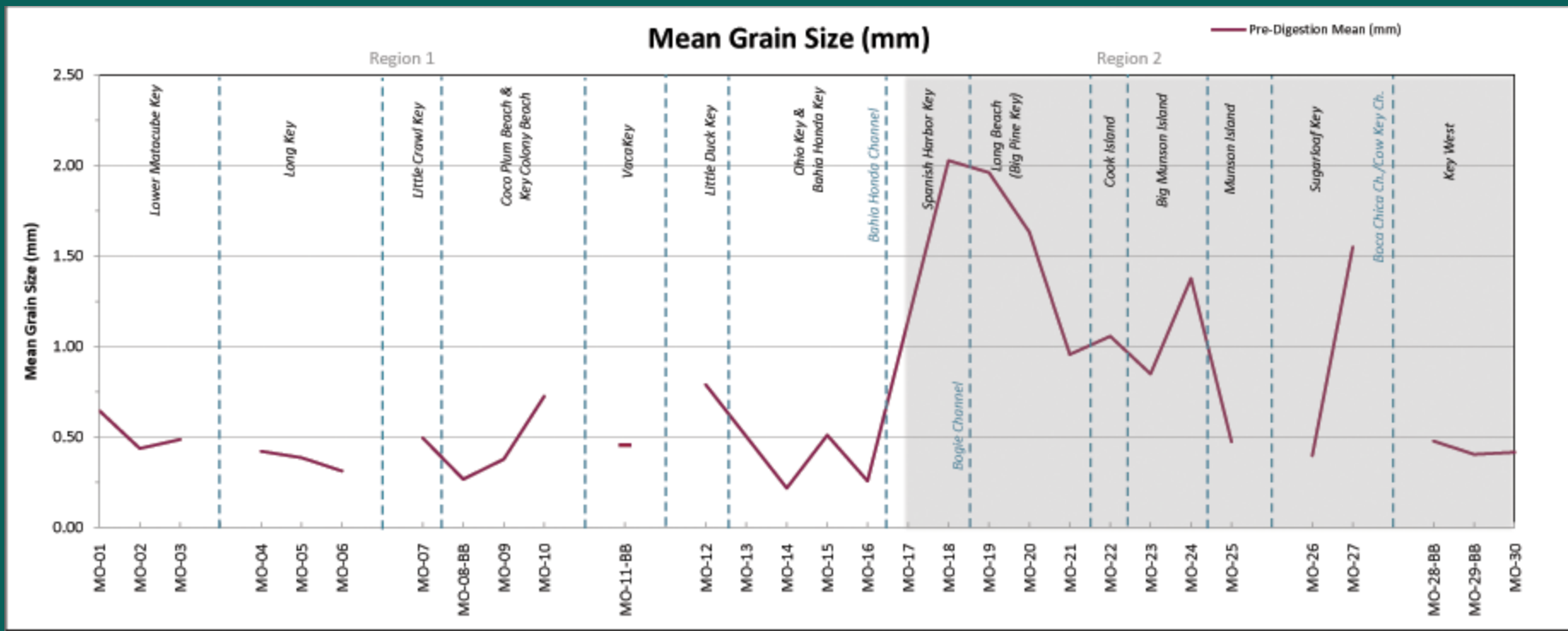
- Changes in Mean Grain Size and Carbonate Percentage define four regions.
- A moderate positive correlation exists between Mean Grain Size and Carbonate Percentage.
- The carbonate sediments present in the samples appear to be coarser than the non-carbonate fraction. This difference appears to be most significant where the carbonate percentage rises above 25 percent.
- Where carbonate percentages increase so does mean grain size.
- While the ratio of carbonate material to non-carbonate material varies substantially, the general trend from north to south along the southwest coast of Florida shows an increase in the percentage of carbonate material within the samples which broadly peaks in central Sarasota County, central Lee County and at the Lee County/Collier County line and then slightly declines southward to Cape Romano.



The Middle and Lower Florida Keys



Beaches of the Florida Keys Statistics



By graphing mean grain size along the length of the lower portion of the middle Keys and the lower Keys, two distinct regions were observed.



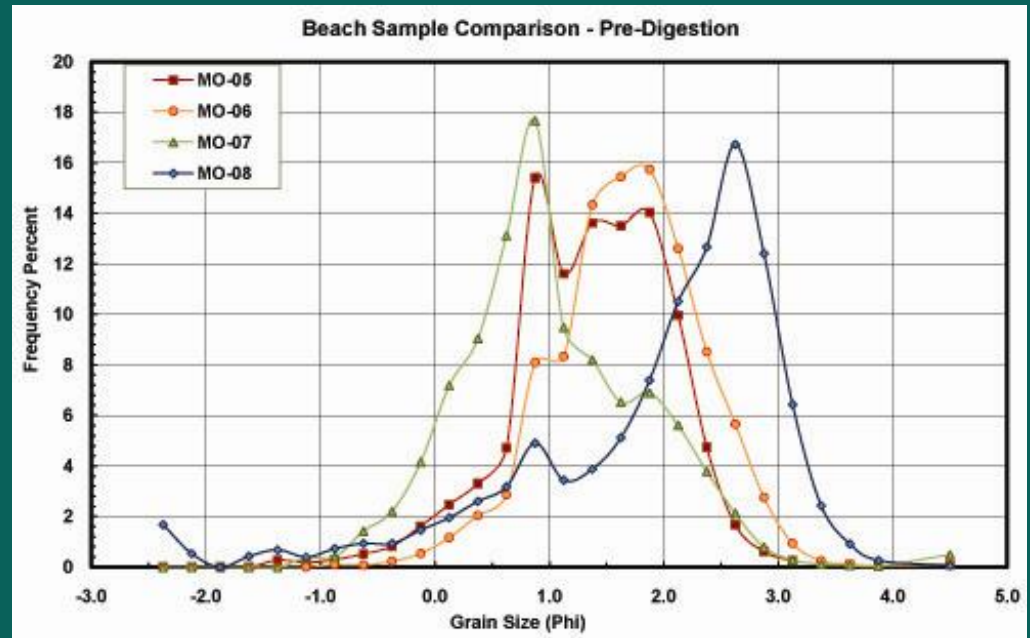
Middle Keys sampling locations



Region 1

- Extends from Matacumbe Key to Bahia Honda Key
- Characterized by a mean grain size which generally fines southwestward
- Compared to the sediments of the Spanish Harbor Keys and those to the west of them, there is an abrupt shift in grain size.

Long Key (MO-05 & 06), Little Crawl Key (MO-07) and Coco Plum Beach (MO-08)



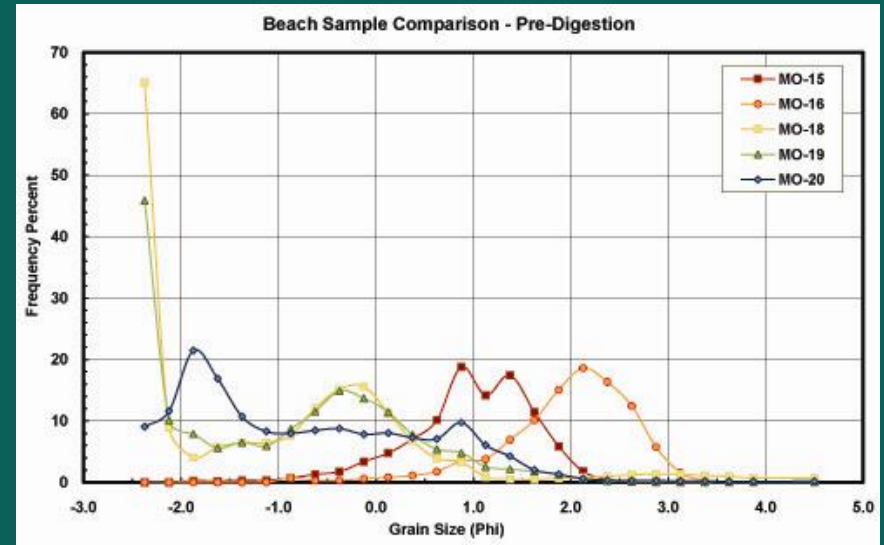
Lower Keys sampling locations



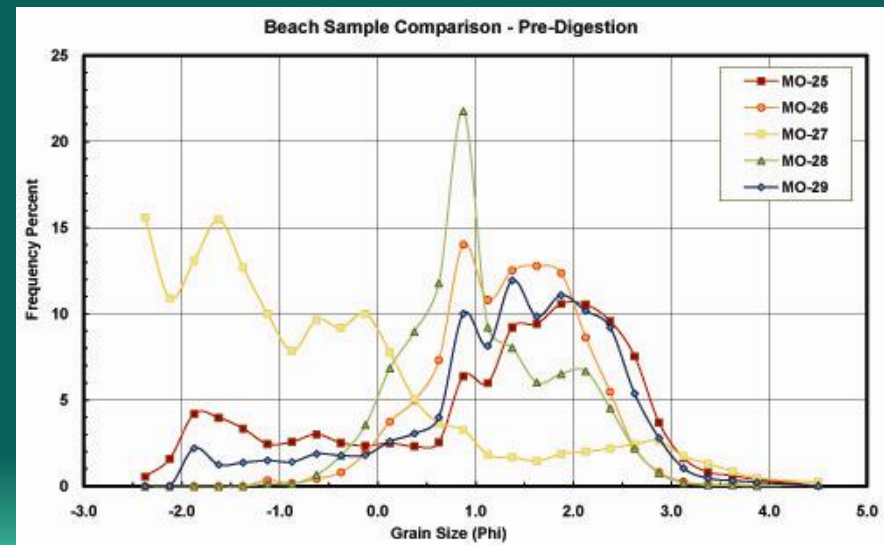
Region 2

- Extends from Spanish Harbor Keys to Key West
- Characterized by a larger mean grain size than those beaches to the Northeast.
- Includes a significant change in fossil constituents within the samples. Samples from MO-18 through MO-24 contain coral fragments and gastropods
- The mean grain size in this region also fines southwestward.

Bahia Honda (MO-15 & 16) Spanish Harbor (MO-18) and Big Pine Key (MO-19 and 20)



Munson Island (MO-25) Sugar Loaf Key (MO-26 & 27) and Key West (MO-28 & 29)



Conclusions

- Correlation exists between Bahia Honda Channel and changes in mean grain size.
- The two regions in the Florida Keys archipelago identified within the study area were defined both by the generally recognized geographic boundary separating the middle and lower Keys and a nearly coinciding distinct change in sediment grain size, with the sediments of the beaches of the lower Keys being the coarser of the two.
- Sediments collected from the Florida Keys archipelago were almost exclusively carbonate. The only exceptions to this, on Little Crawl Key, Munson Island and Key West, are probably the result of beach replenishment activities.
- The grain size curve peaks broadly from the Spanish Harbor Keys sample to the east end of Long Beach on Big Pine Key and then, when the effects of beach replenishment are considered and discounted, declines westward.

