Salinity Patterns in Western Biscayne Bay

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Biscayne Bay Regional Restoration Coordination Team

South Florida Fisheries Science Center
National Marine Fisheries Service
National Oceanographic and Atmospheric Administration
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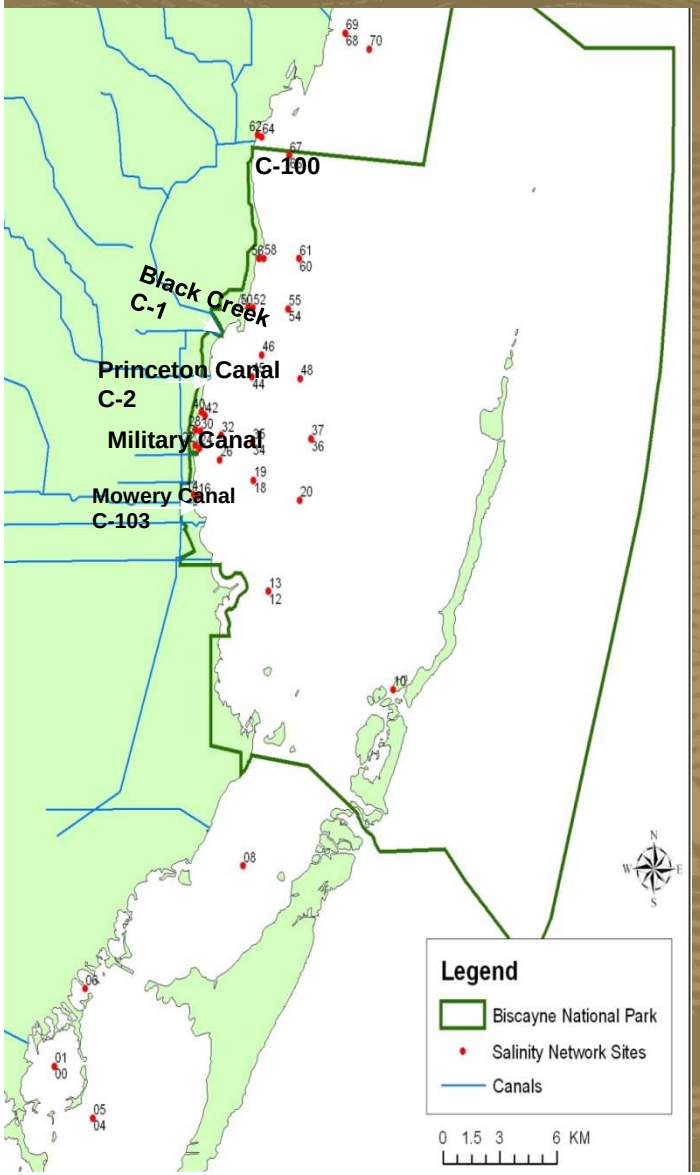
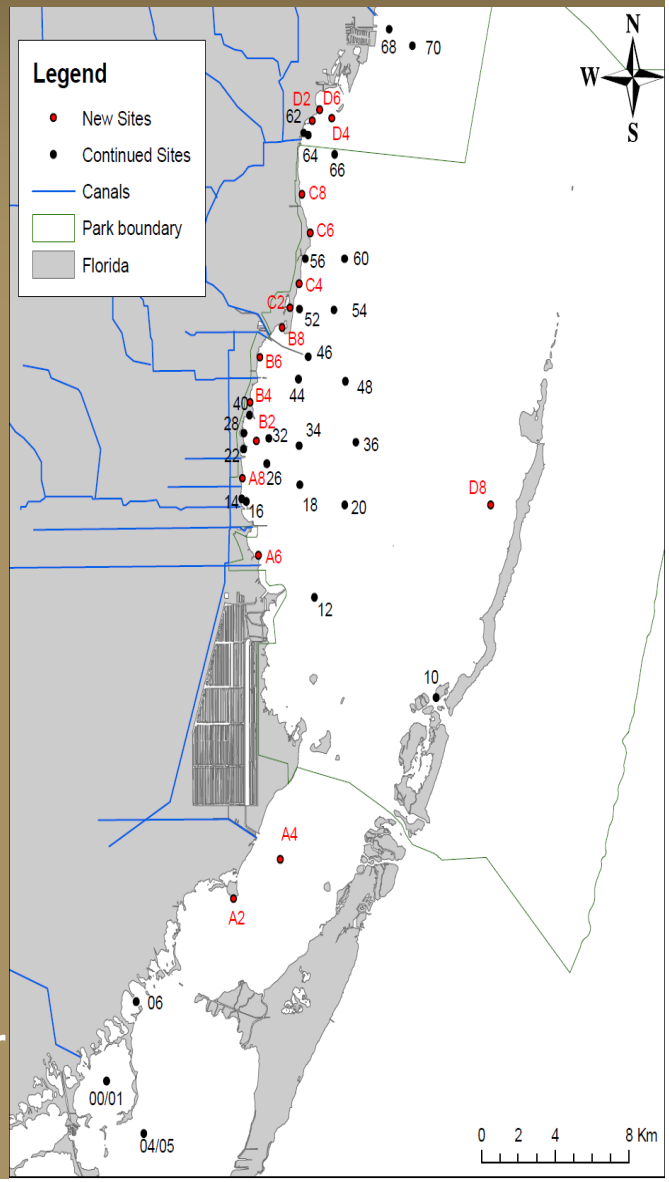
Original Network

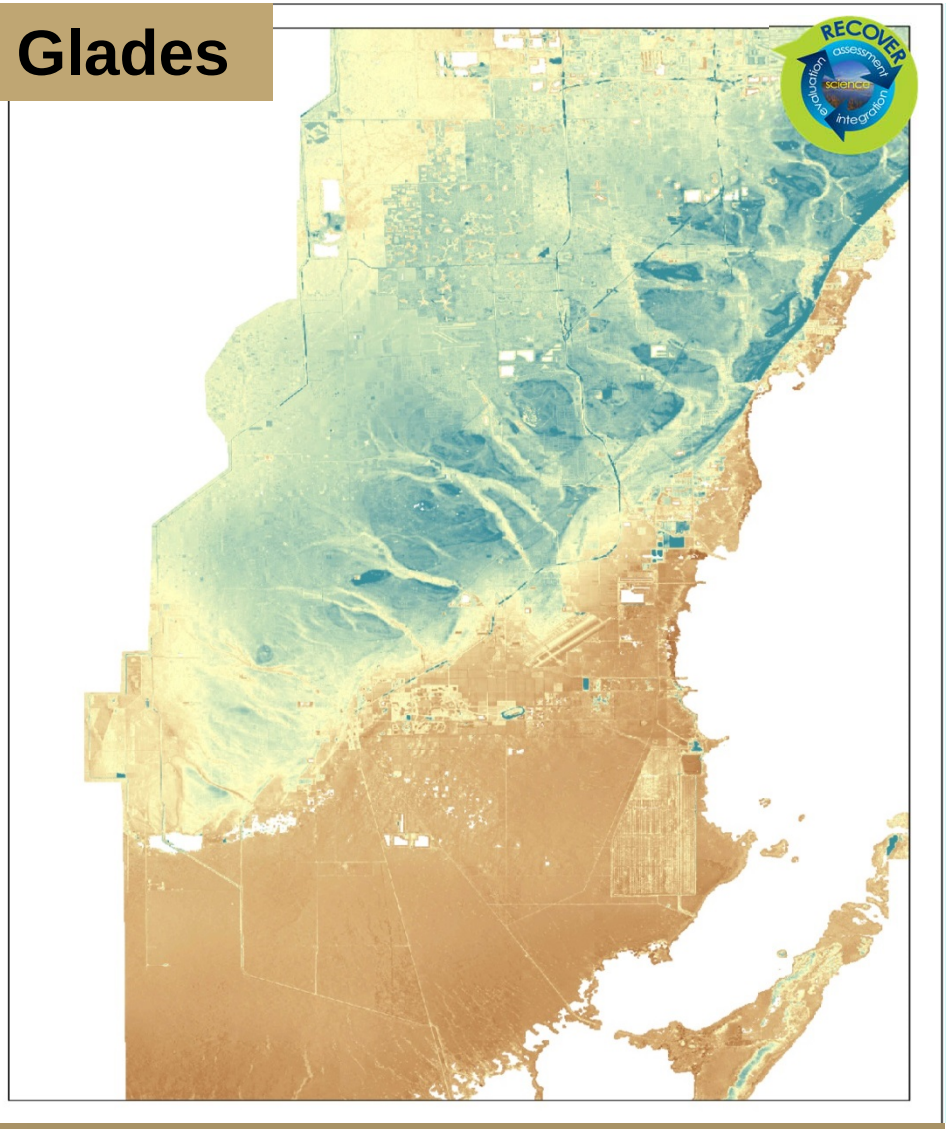


- Designed in 2003-2004 by a multi-agency science team
- Compiled with embedded W-E transects and N-S transects
- Shoreline instruments within 100 meters
- Revised to better characterize shoreline changes from CERP and water operations

Revised Network



Transverse Glades



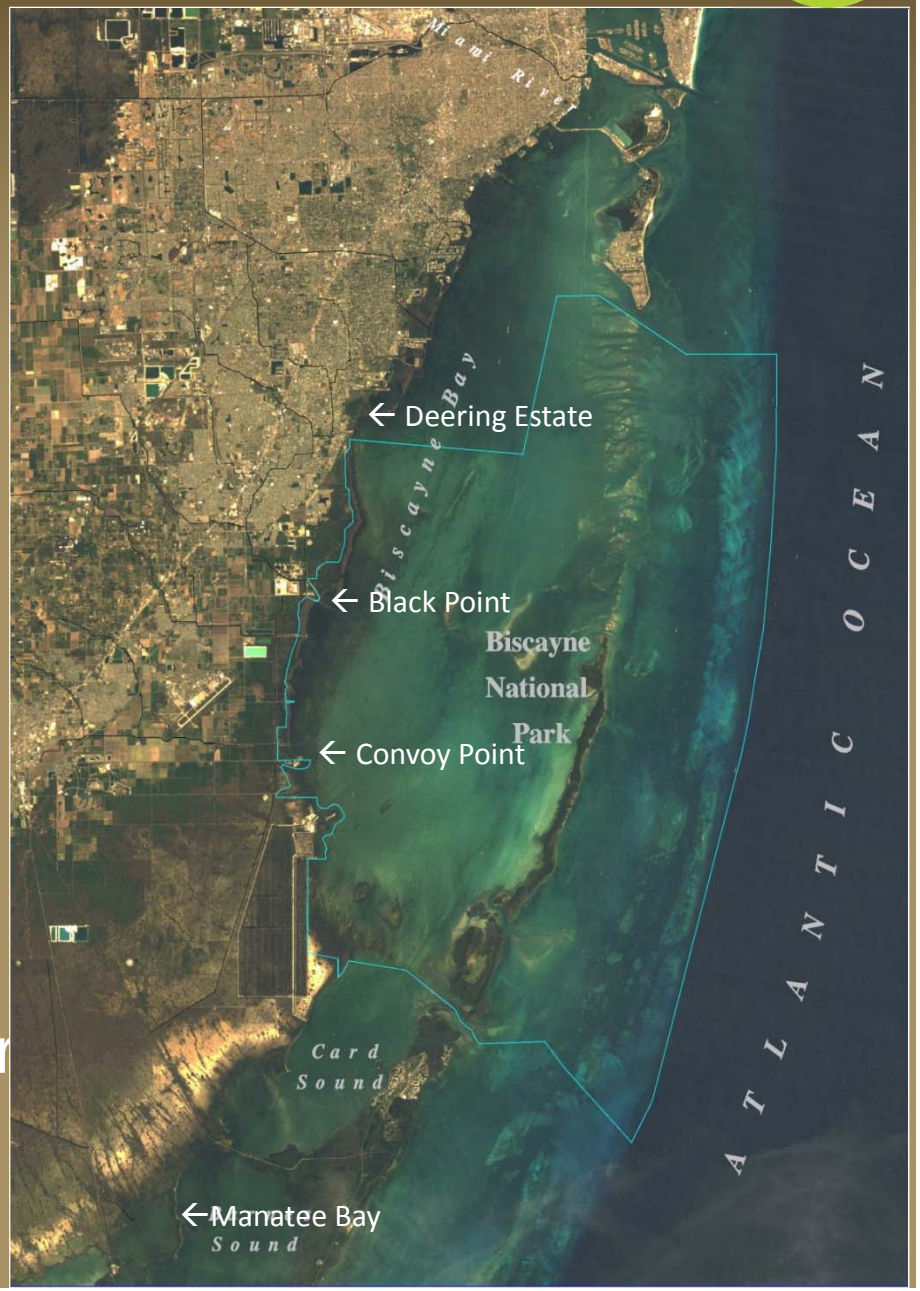
Typically 1-2 km wide.
Typically 2-3 m deep.
Increased gradient compared to Everglades.
Provide "path of least resistance" to water flows.
Now channelized by canals.

Courtesy Dr. John Meeder and Peter Harlem
and the South Florida Natural Resources Center

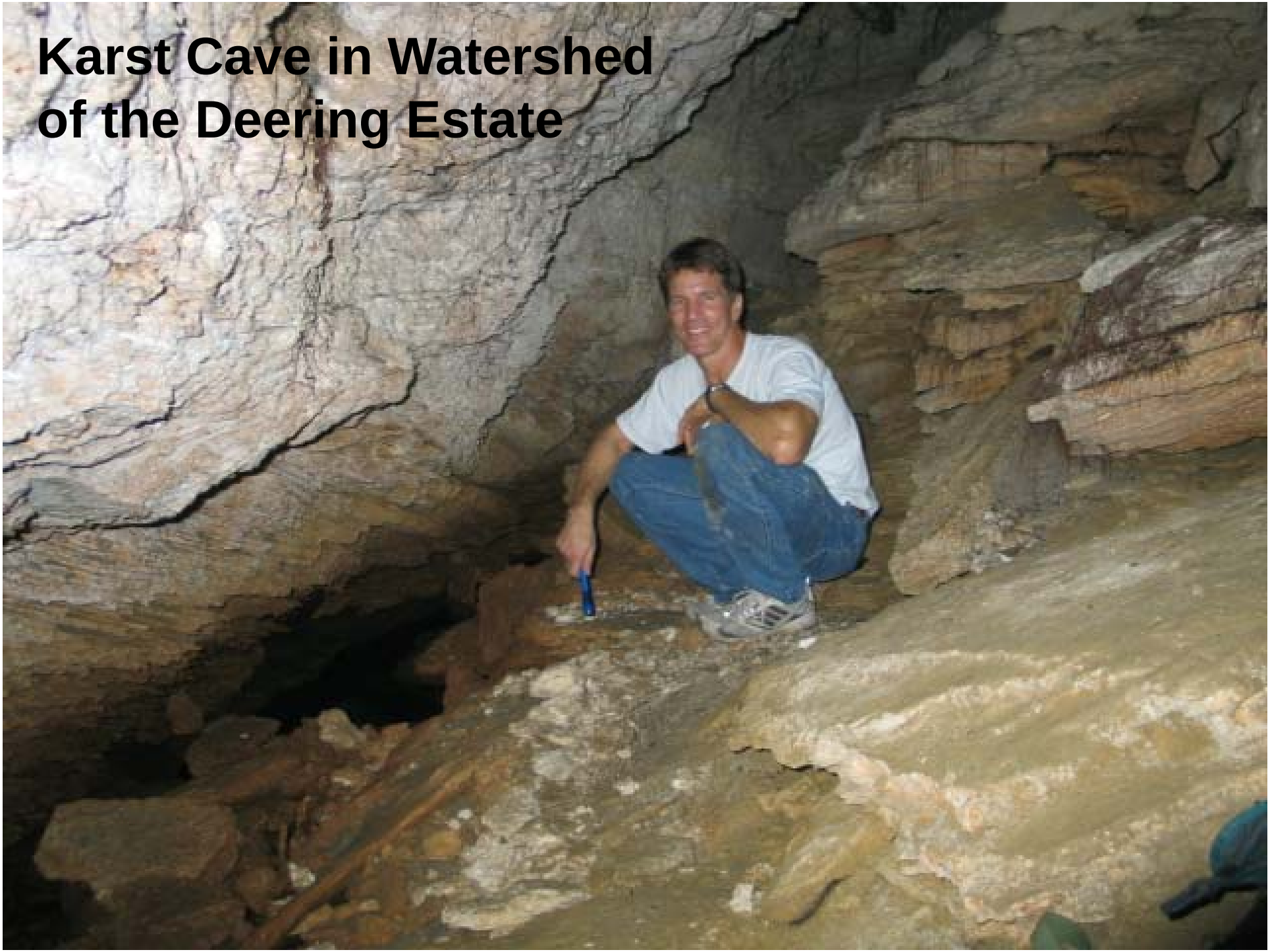
Salinity Patterns in Southern Biscayne Bay

More persistent high salinity north of Black Point

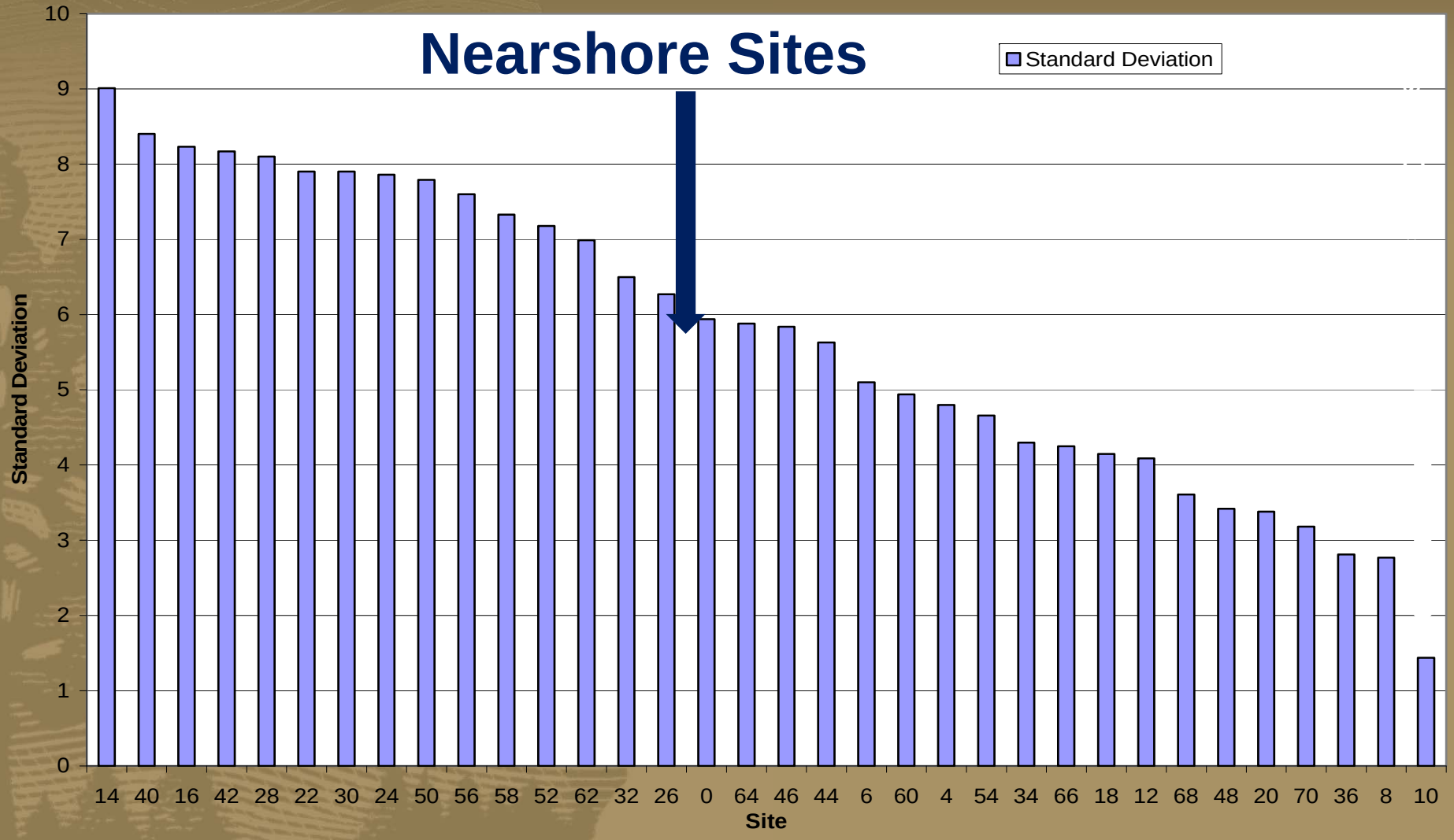
- Stratification is a normal occurrence even in shallow water
- Hypersalinity along the western shoreline
- Three distinct areas of the Bay:
  1) Deering Estate to Black Point
  2) Black Point to Convoy Point
  3) Convoy Point to Manatee Bay
- Rapid Changes in salinity which return to pre-event levels over short periods of time
- Estuarine zone develops every year that is more or less persistent depending on operations



Karst Cave in Watershed of the Deering Estate

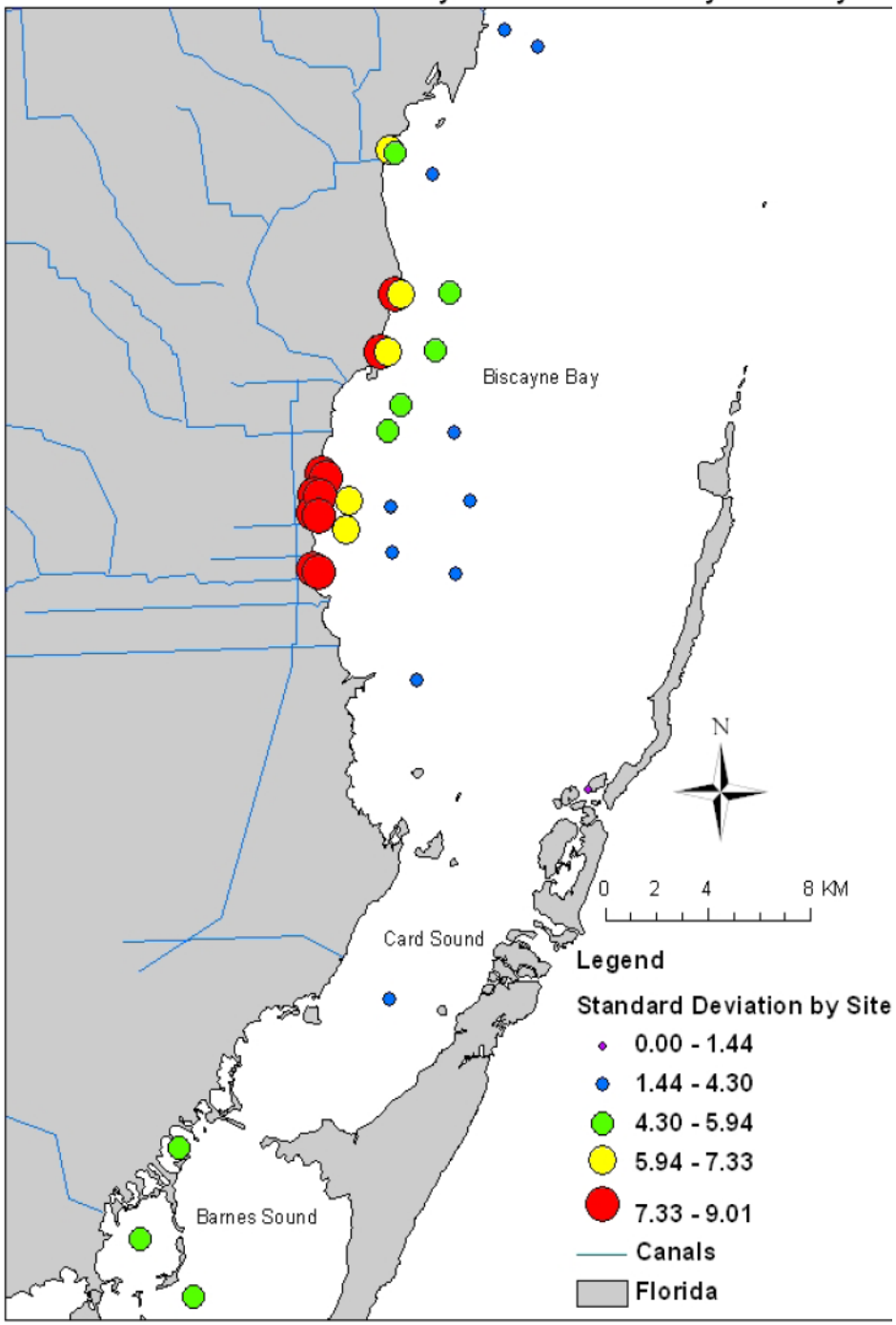


Site Deviation with Respect to Location

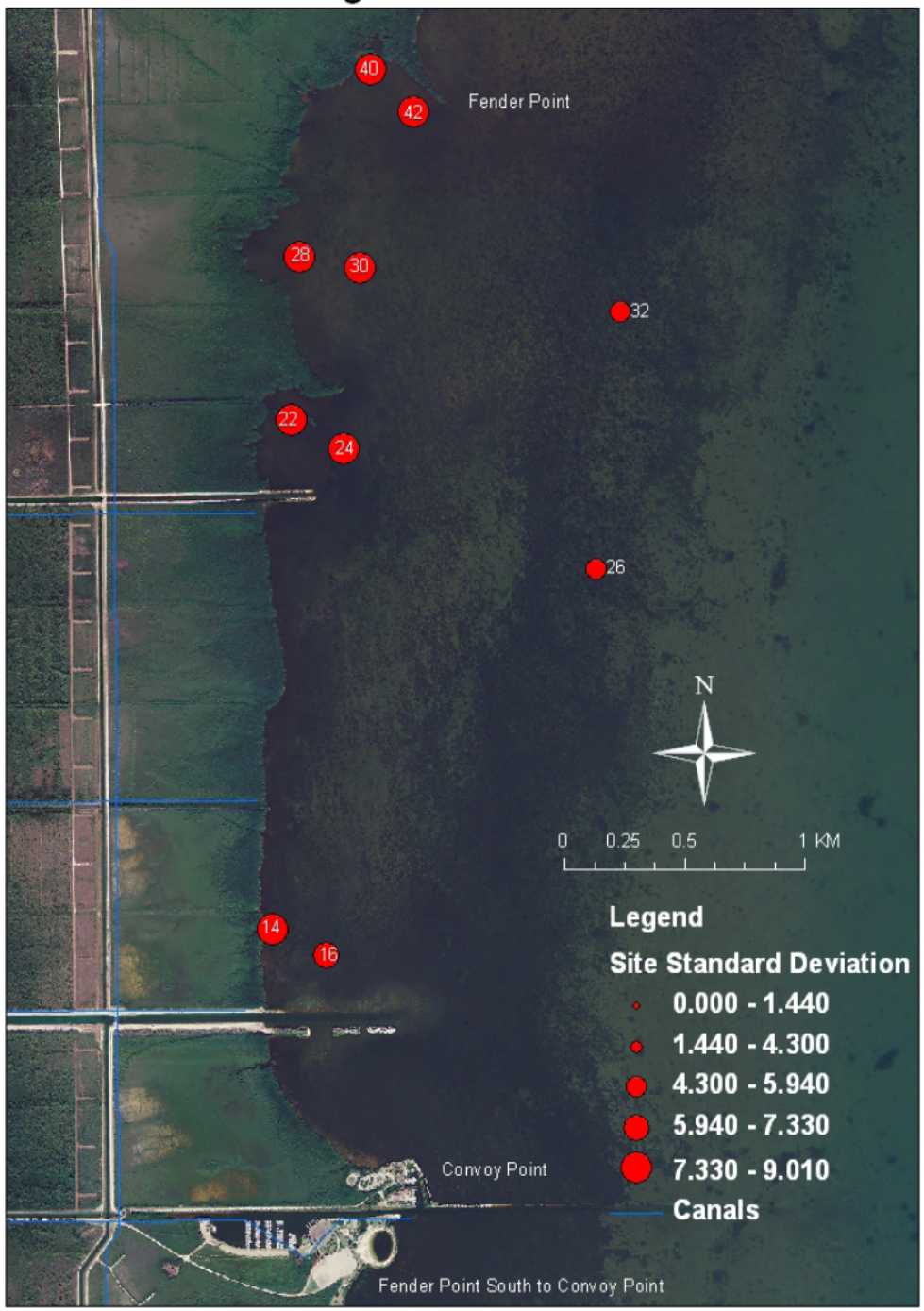


Fresh Groundwater
moving up through
the bottom of
Biscayne Bay

Standard Deviation by Site in Biscayne Bay



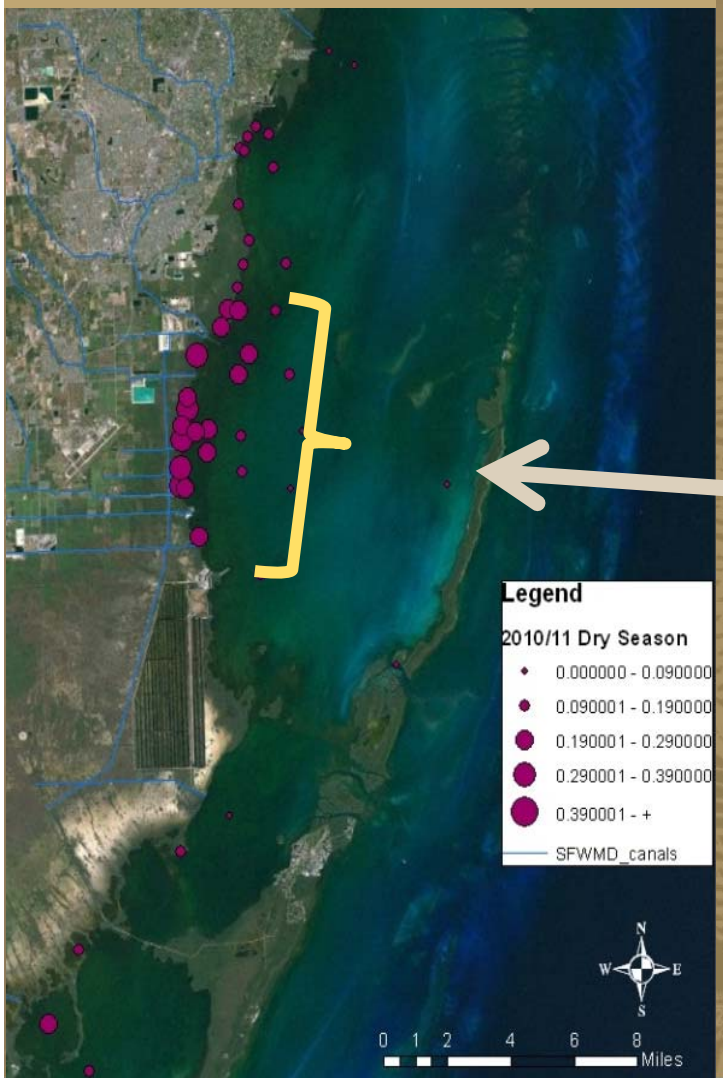
Western Mangrove Standard Deviation



Variation

1) Largest between Mowery Canal (C-103) & Black Point (C-1), 2) Larger variability along the western shoreline, 3) Larger in the wet season north of Black Point

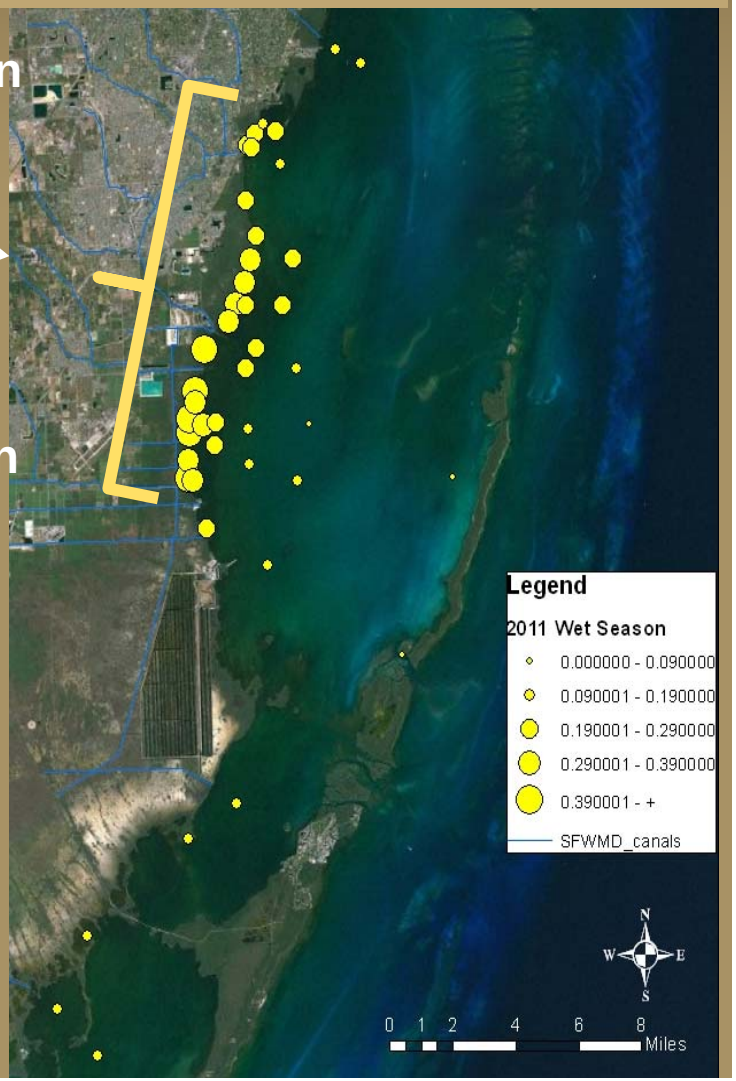
Dry Season



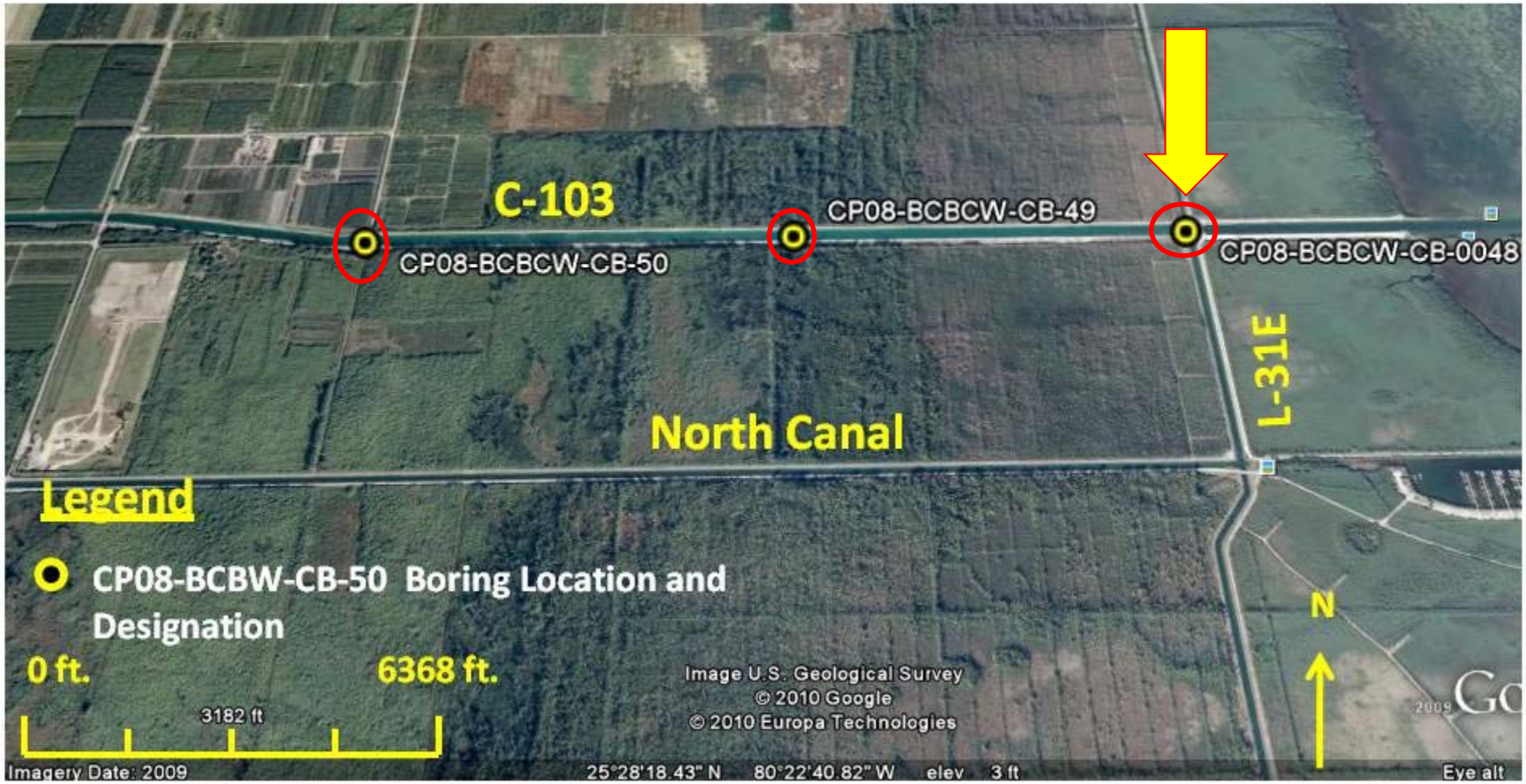
Occurs Wet Season along the western shoreline

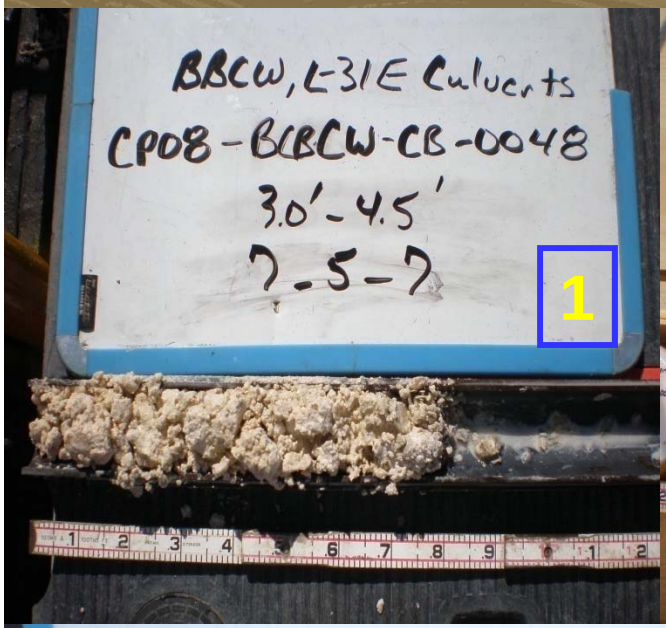
Occurs Dry Season where highly managed

Wet Season



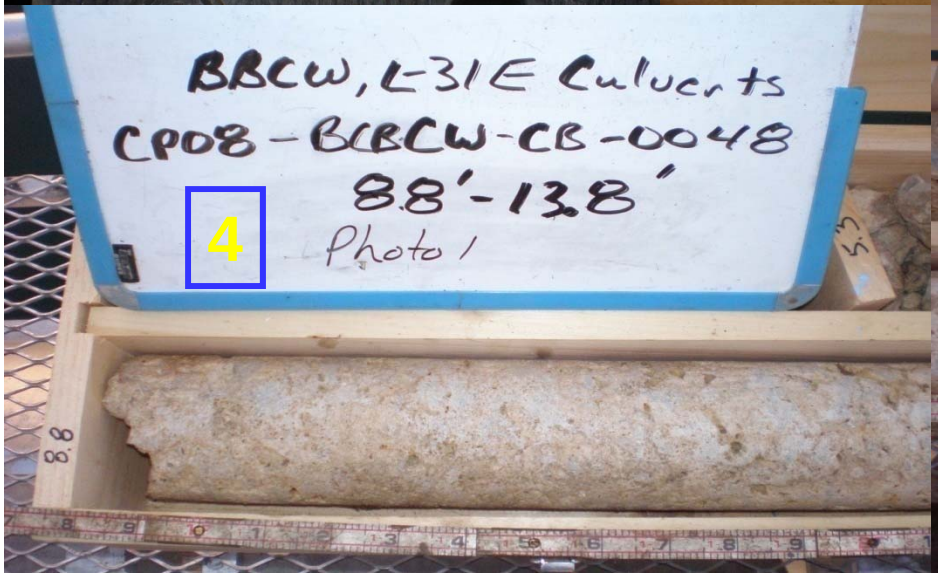
Aquifer Coring In C-103 Mowry Canal




BBCW, L-31E Culverts
CP08-BCBCW-CB-0048
3.0'-4.5'
7-5-7
1

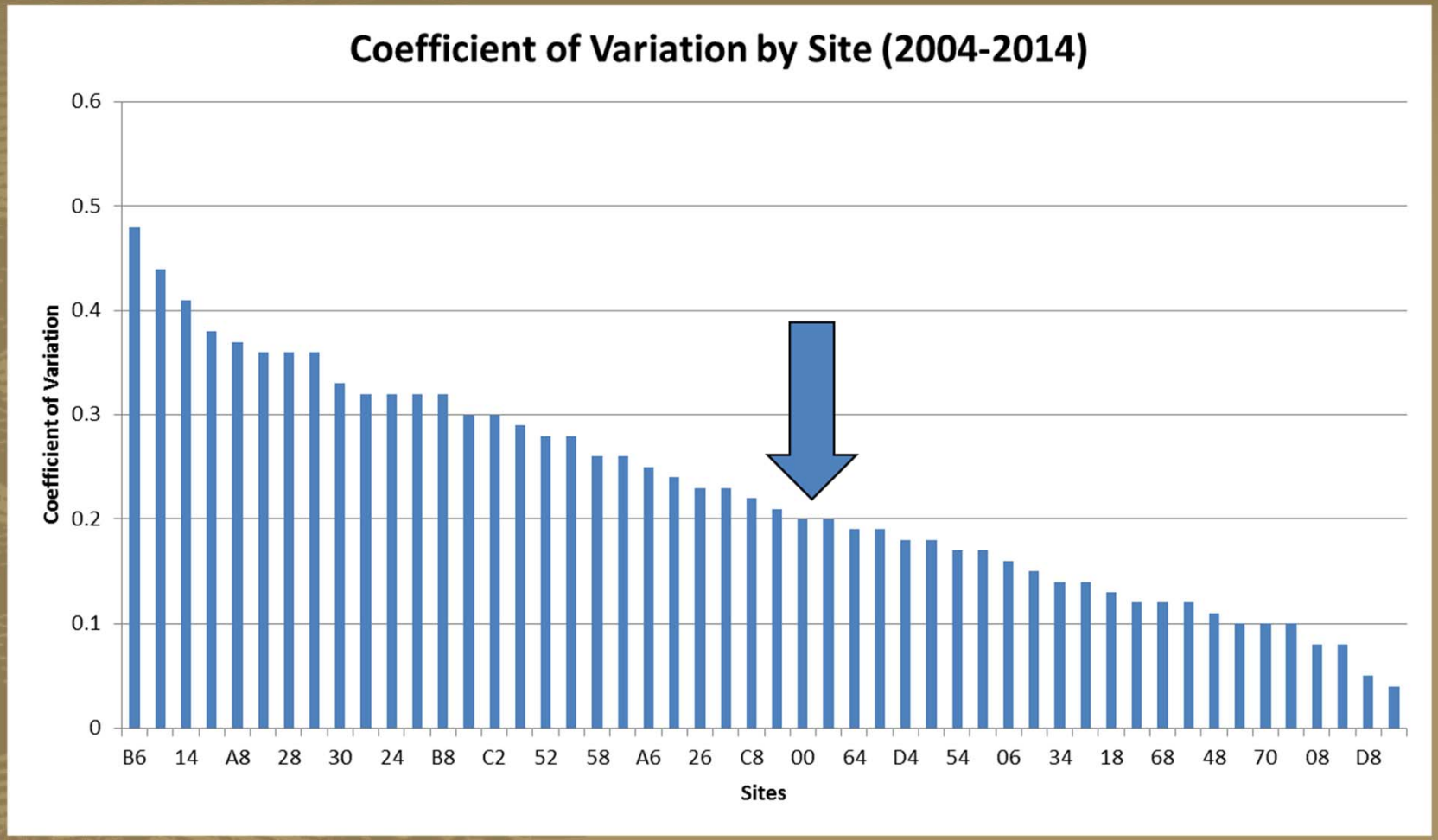
BBCW, L-31E Culverts
CP08-BCBCW-CB-0048
5.3'-7.6'
2

BBCW, L-31E Culverts
CP08-BCBCW-CB-0048
7.6'-8.8'
3

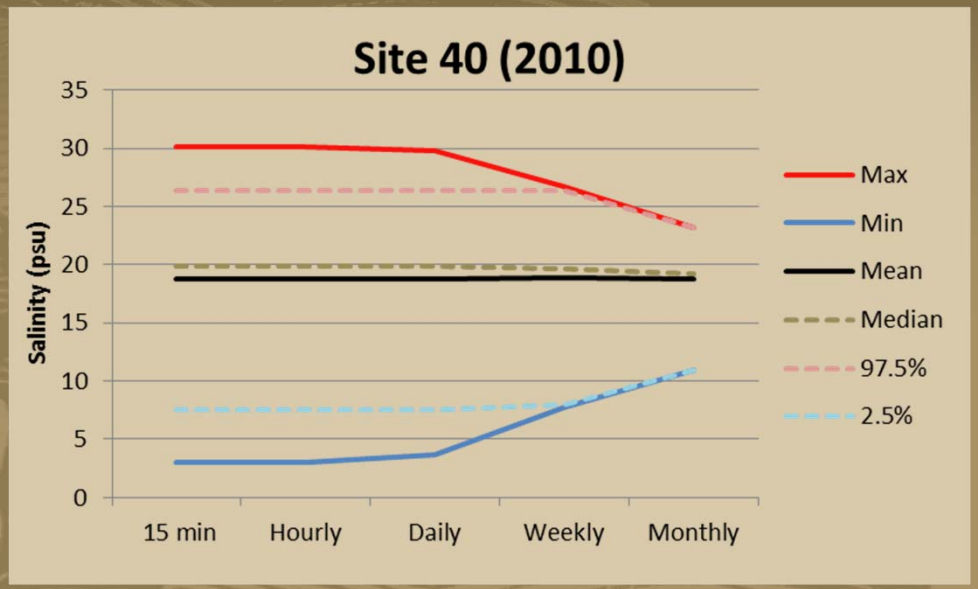

BBCW, L-31E Culverts
CP08-BCBCW-CB-0048
8.8'-13.8'
Photo 1
4

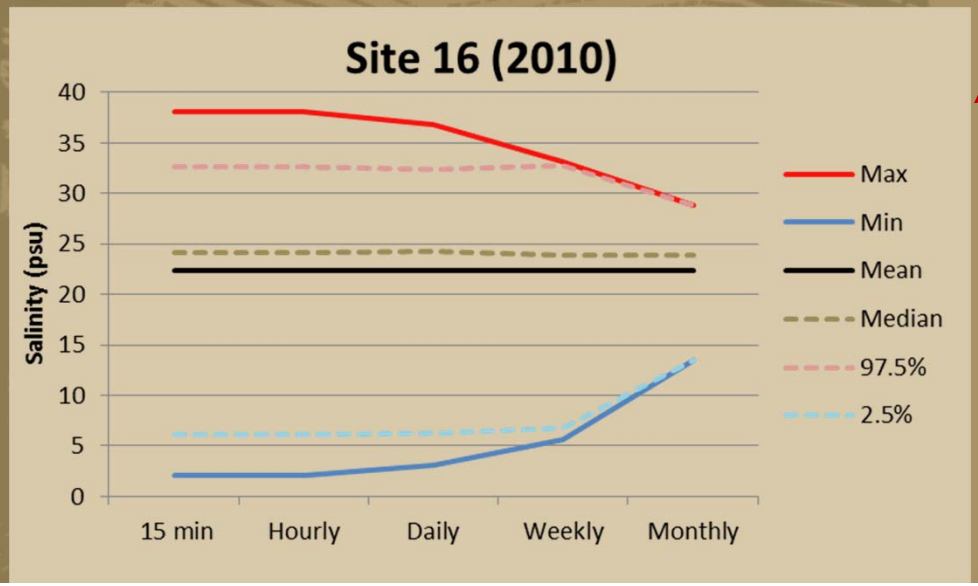
BBCW, L-31E Culverts
CP08-BCBCW-CB-0048
8.8'-13.8'
Photo 3
5

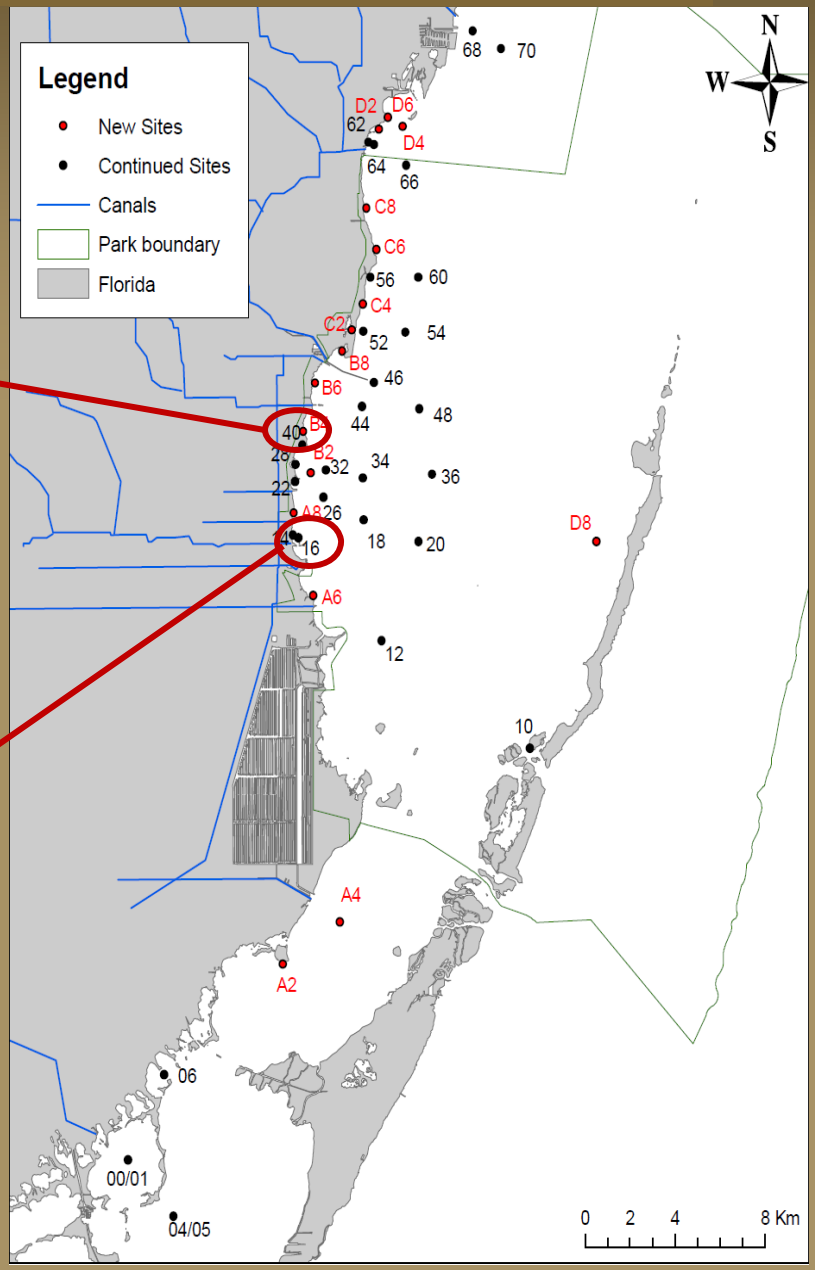
Variation in all Site Locations



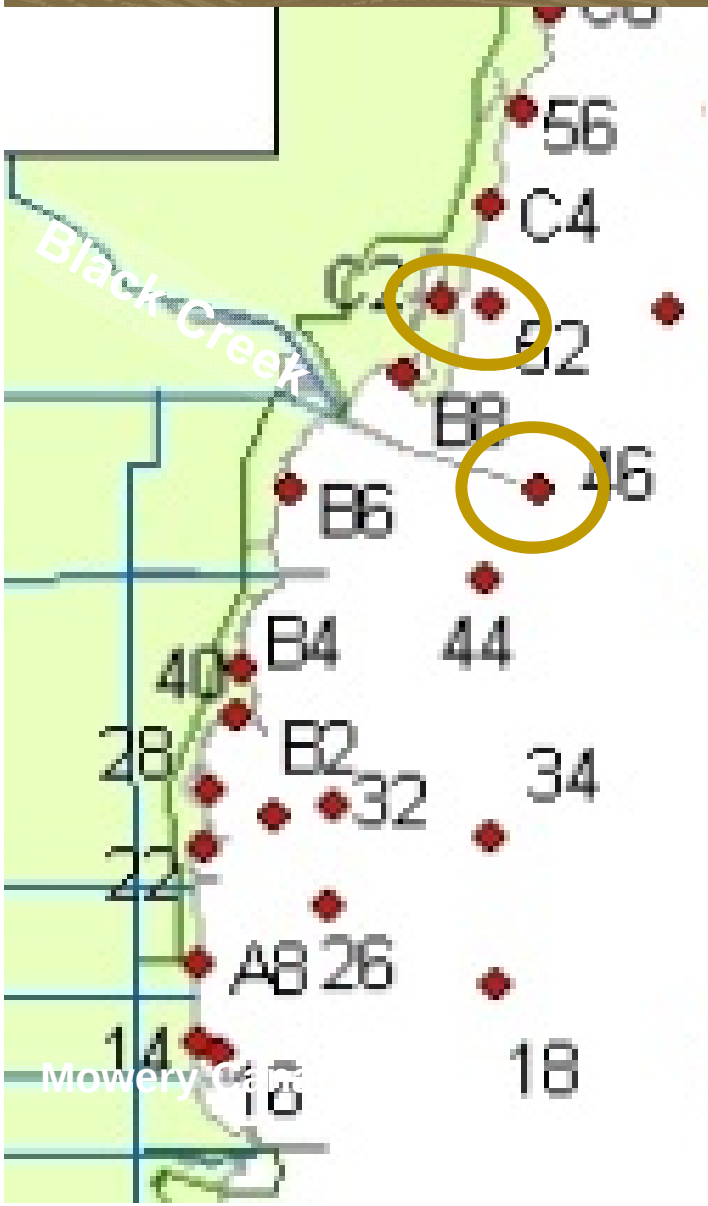
Effect of Averaging Data

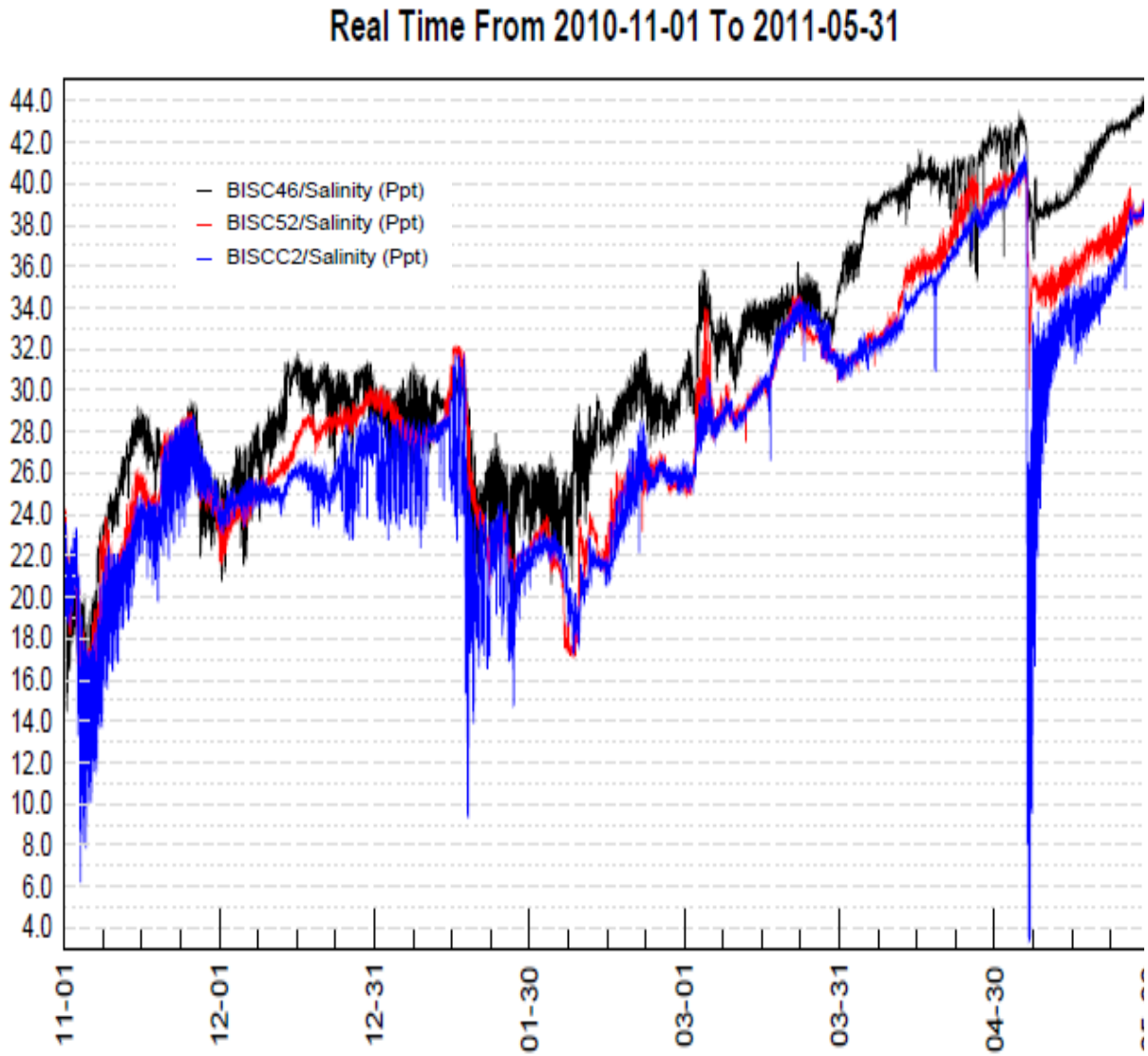




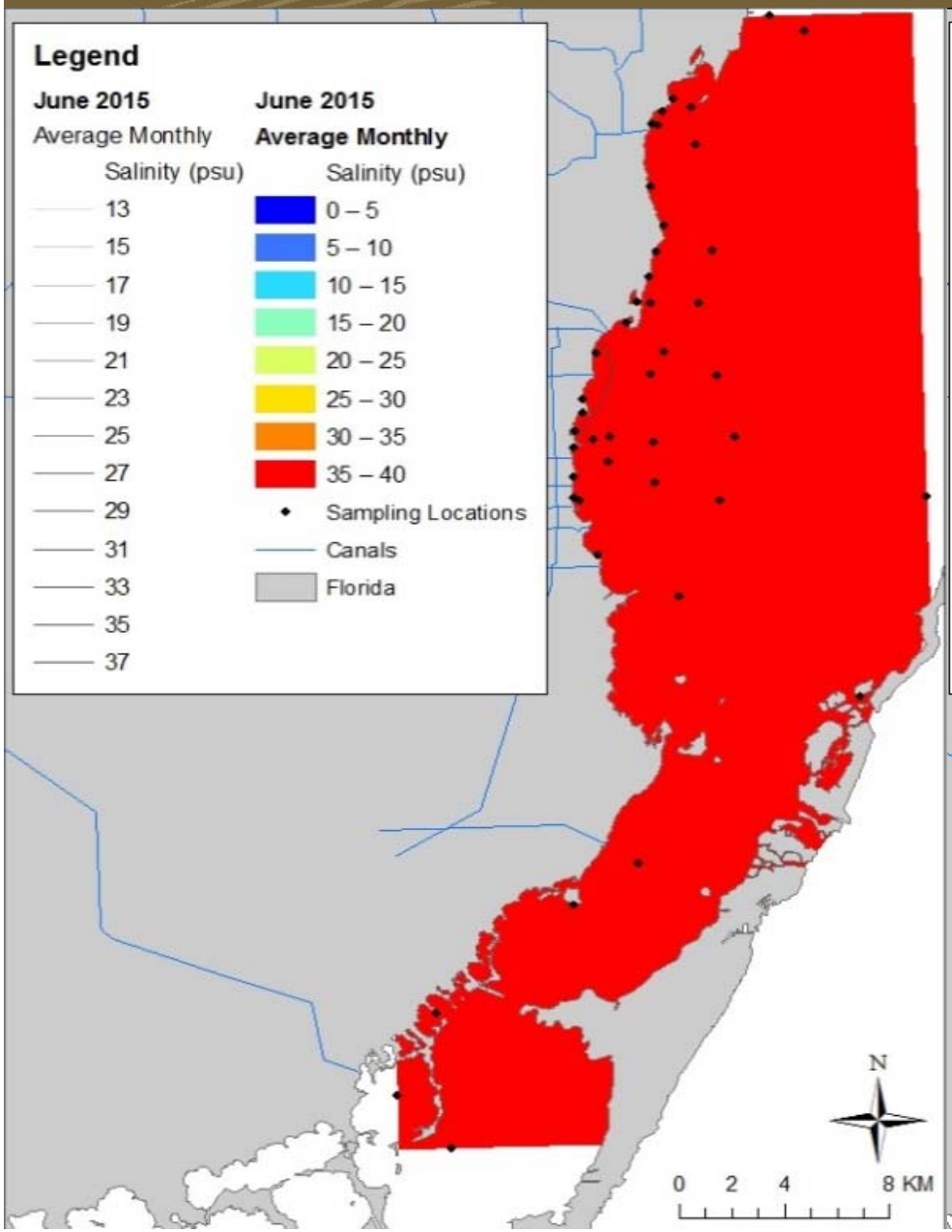


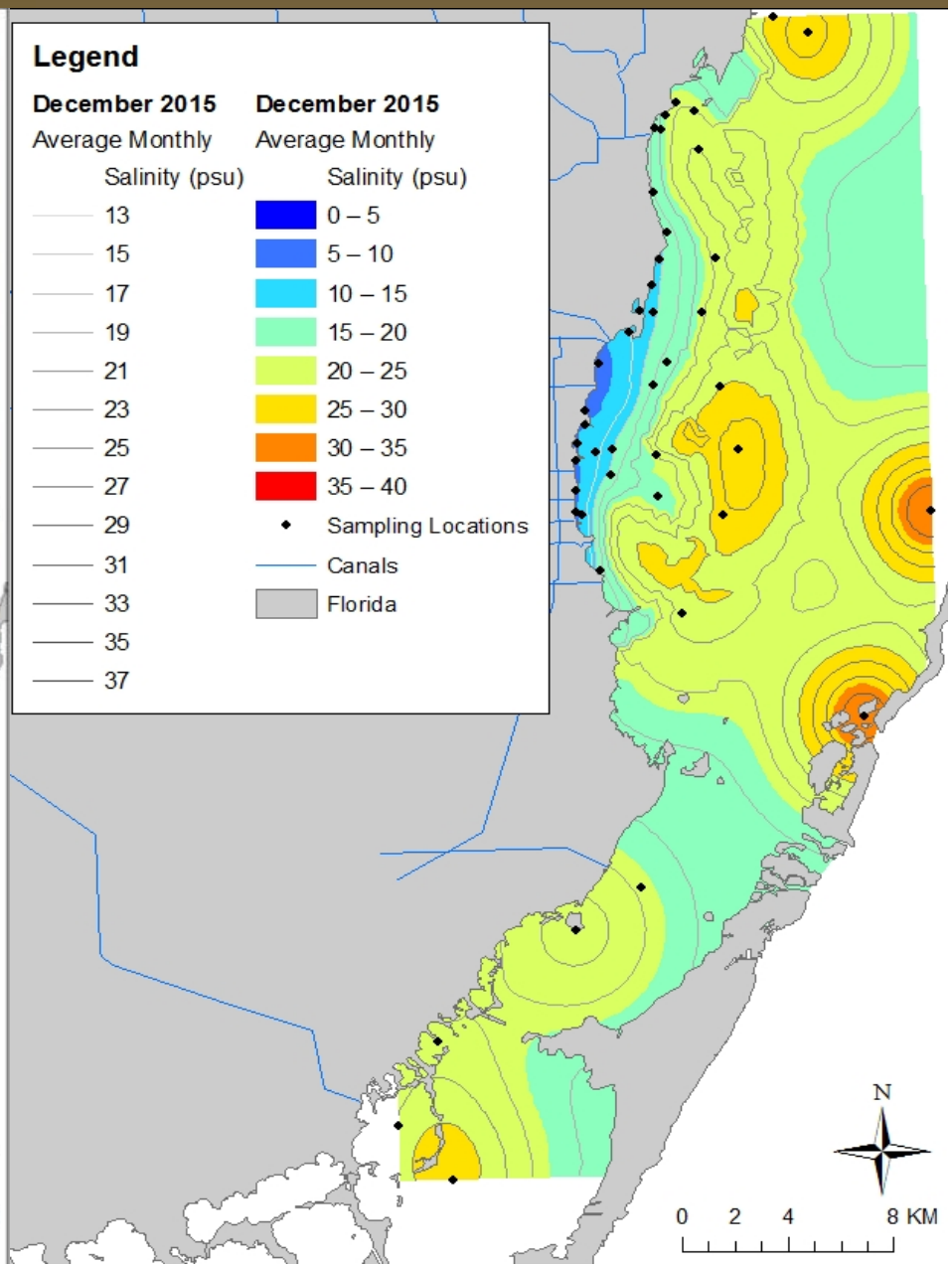
Large Event Scale Salinity Changes

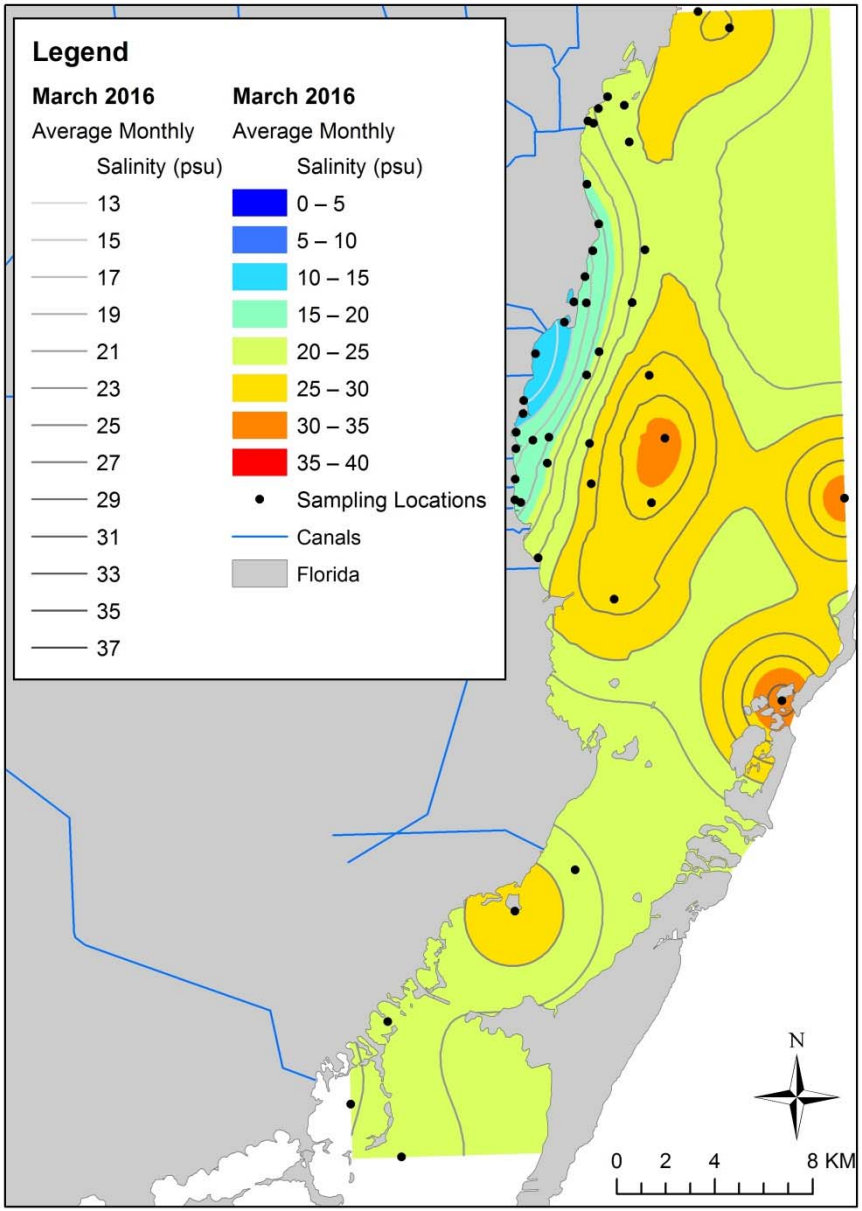




Inverted Salinity Extremes in 2015

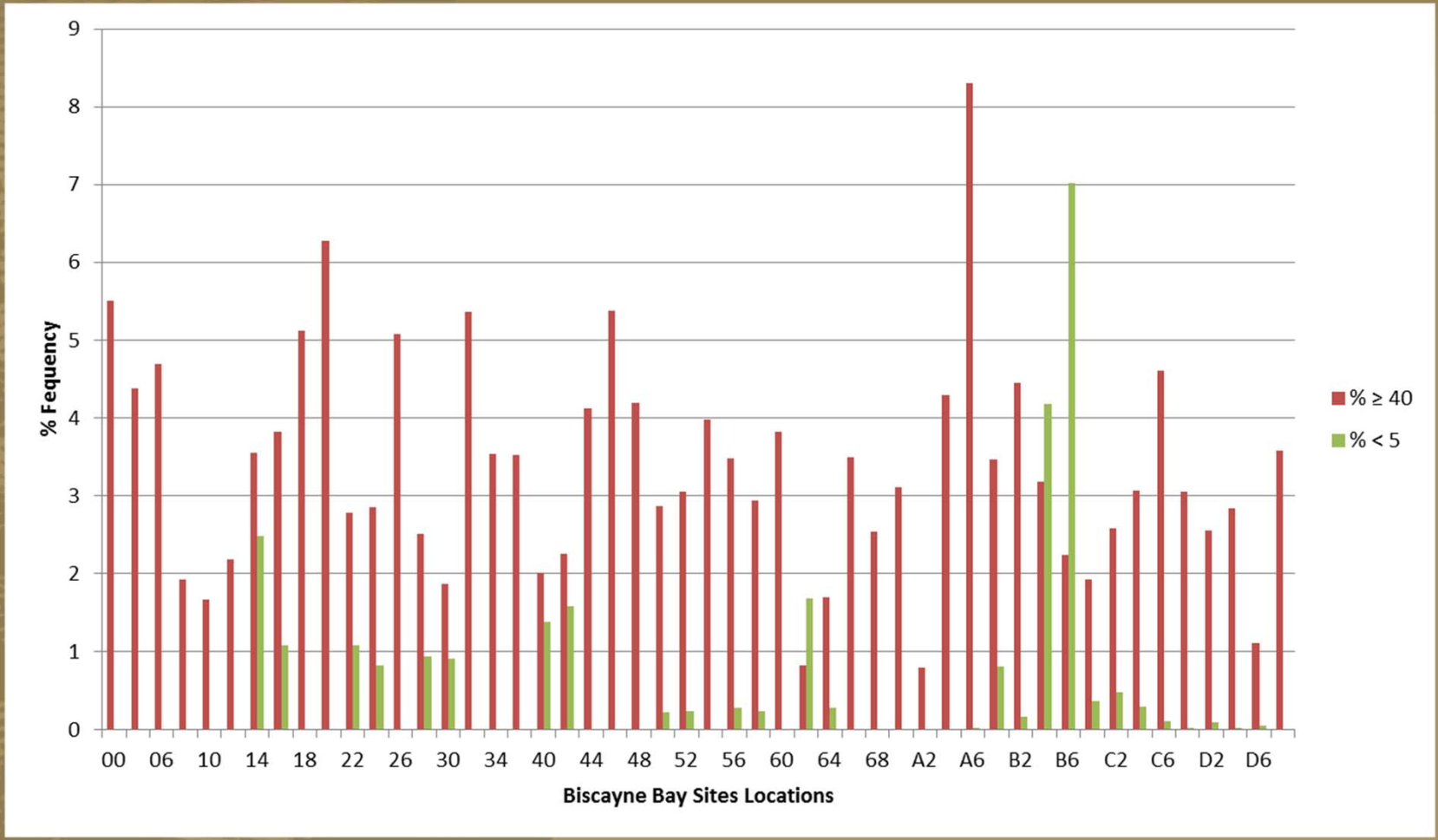


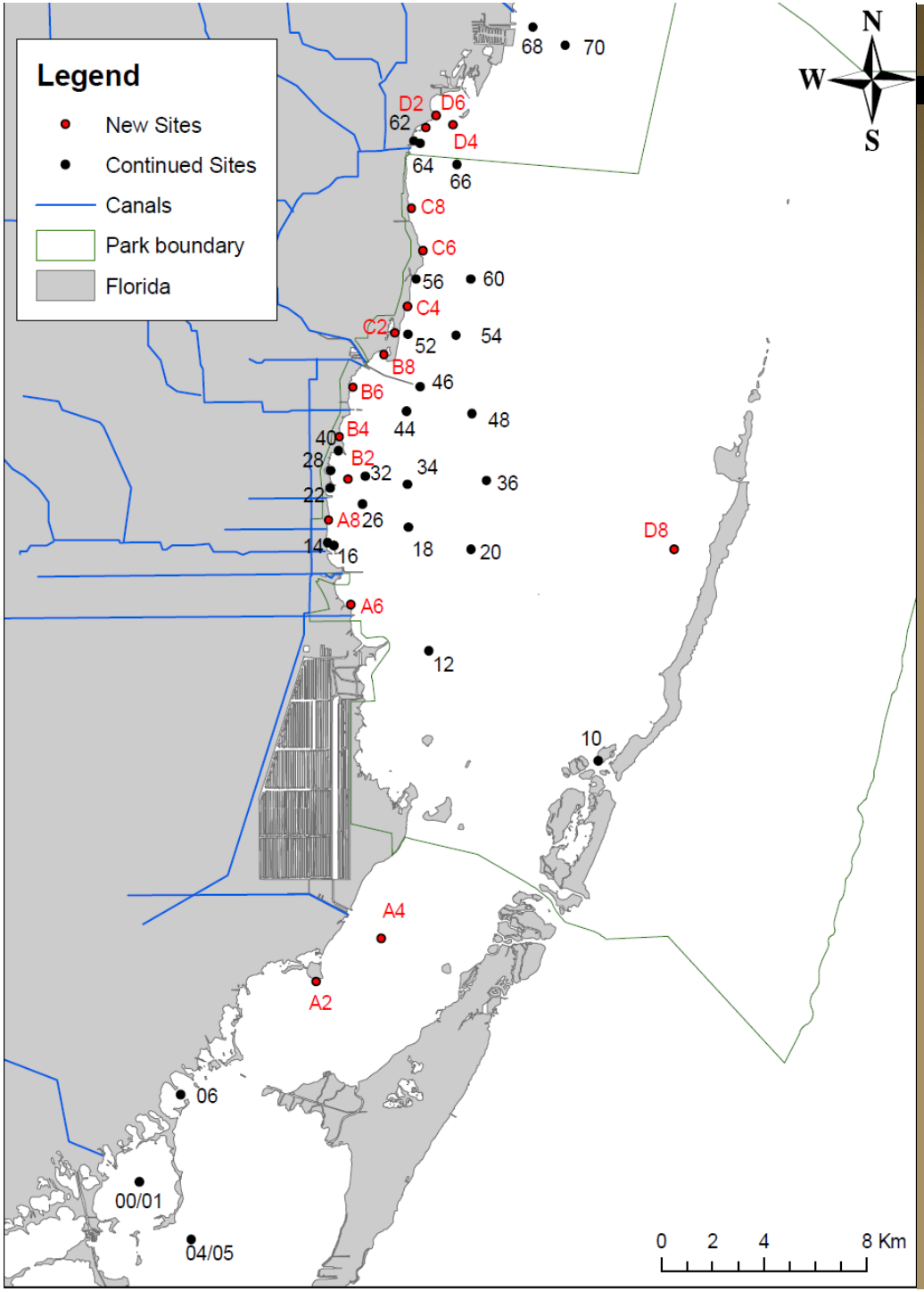



Legend
March 2016
Average Monthly
Salinity (psu)
13
15
17
19
21
23
25
27
29
31
33
35
37
March 2016
Average Monthly
Salinity (psu)
0 – 5
5 – 10
10 – 15
15 – 20
20 – 25
25 – 30
30 – 35
35 – 40
Sampling Locations
Canals
Florida
N
0 2 4 8 KM

R AMERICA

Benthic Salinity
Percent Frequency
Hypersalinity and Low Salinity in Biscayne Bay
2004-2015

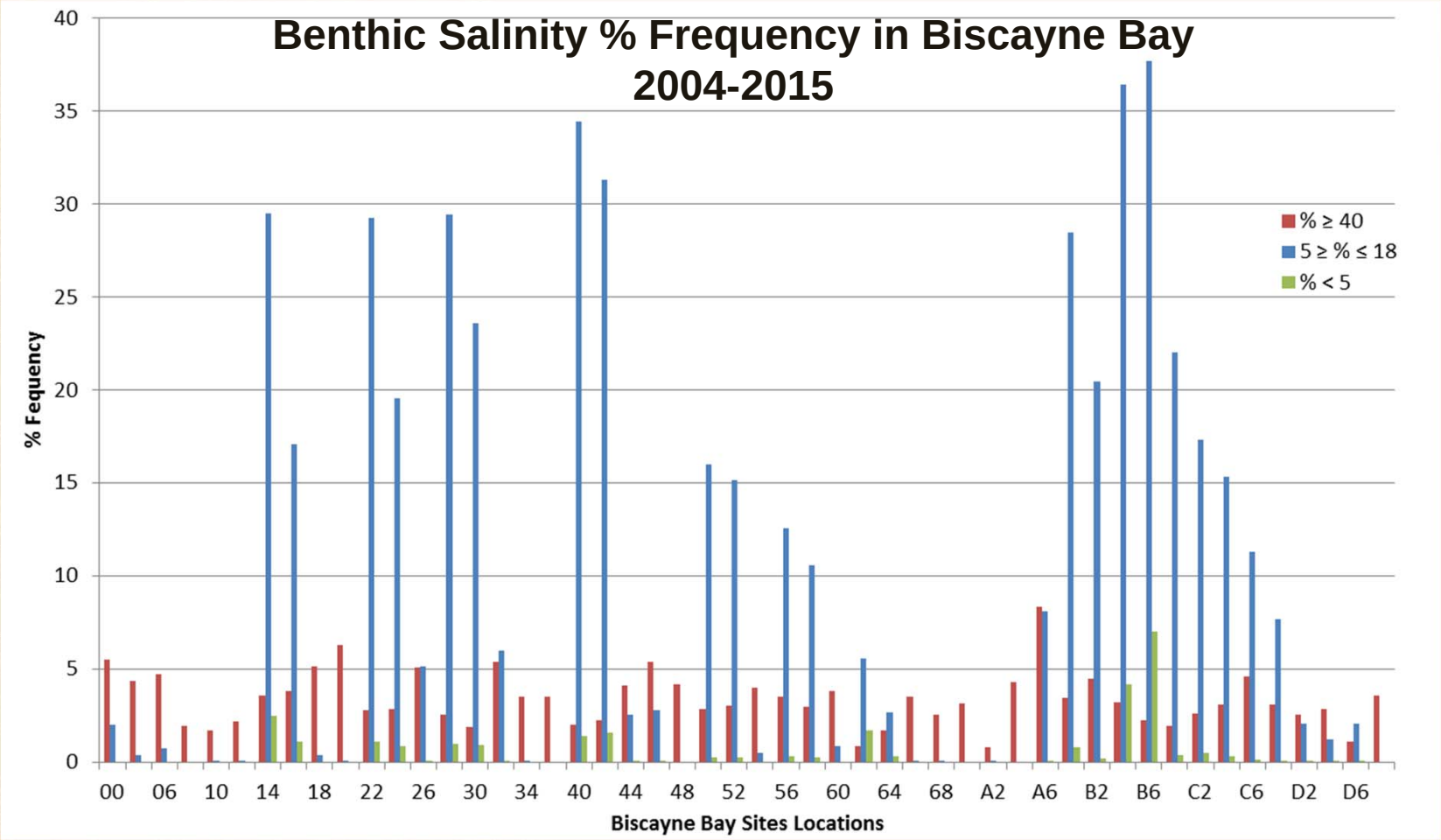


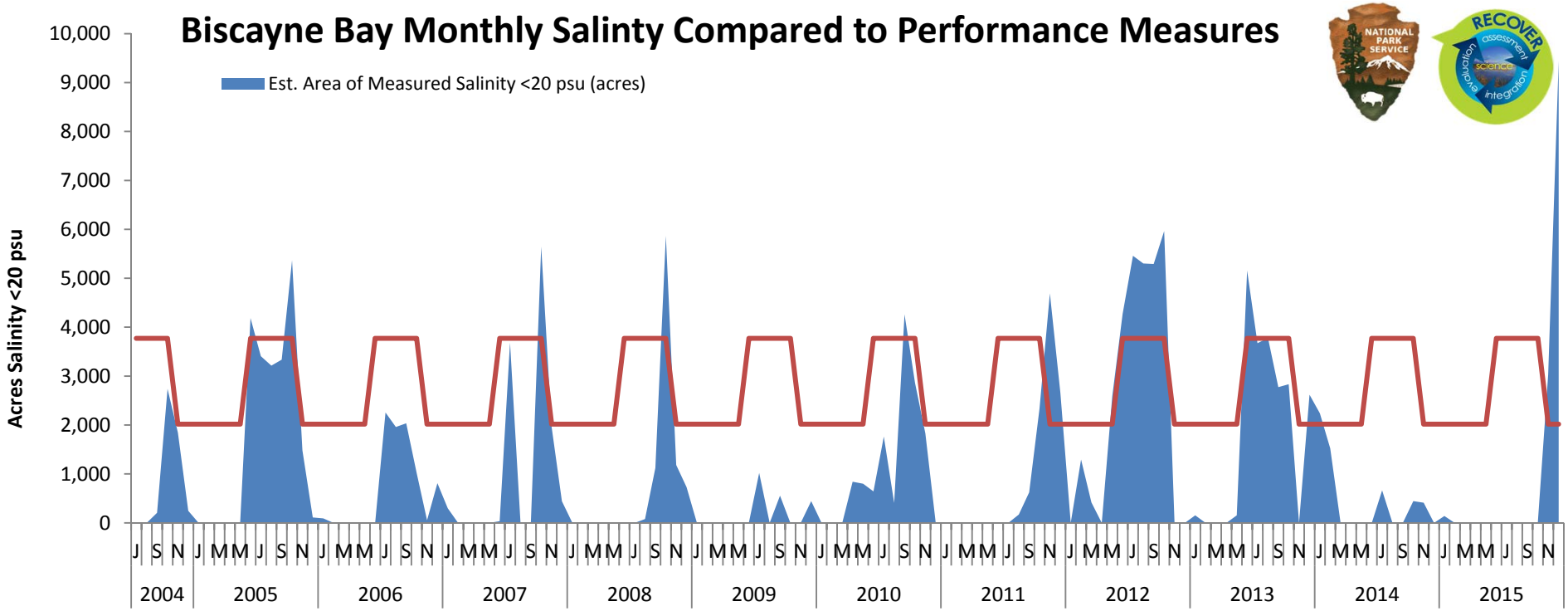


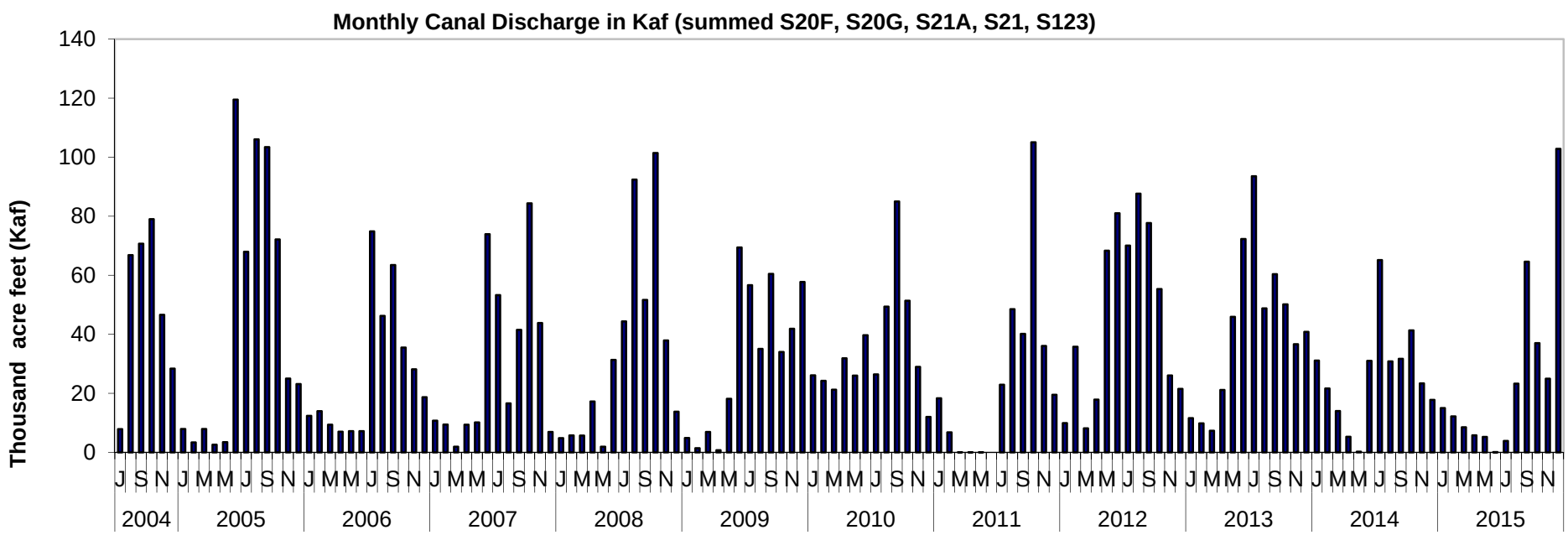
Salinity Station Locations by Site Number

EXPERIENCE YOUR AMERICA

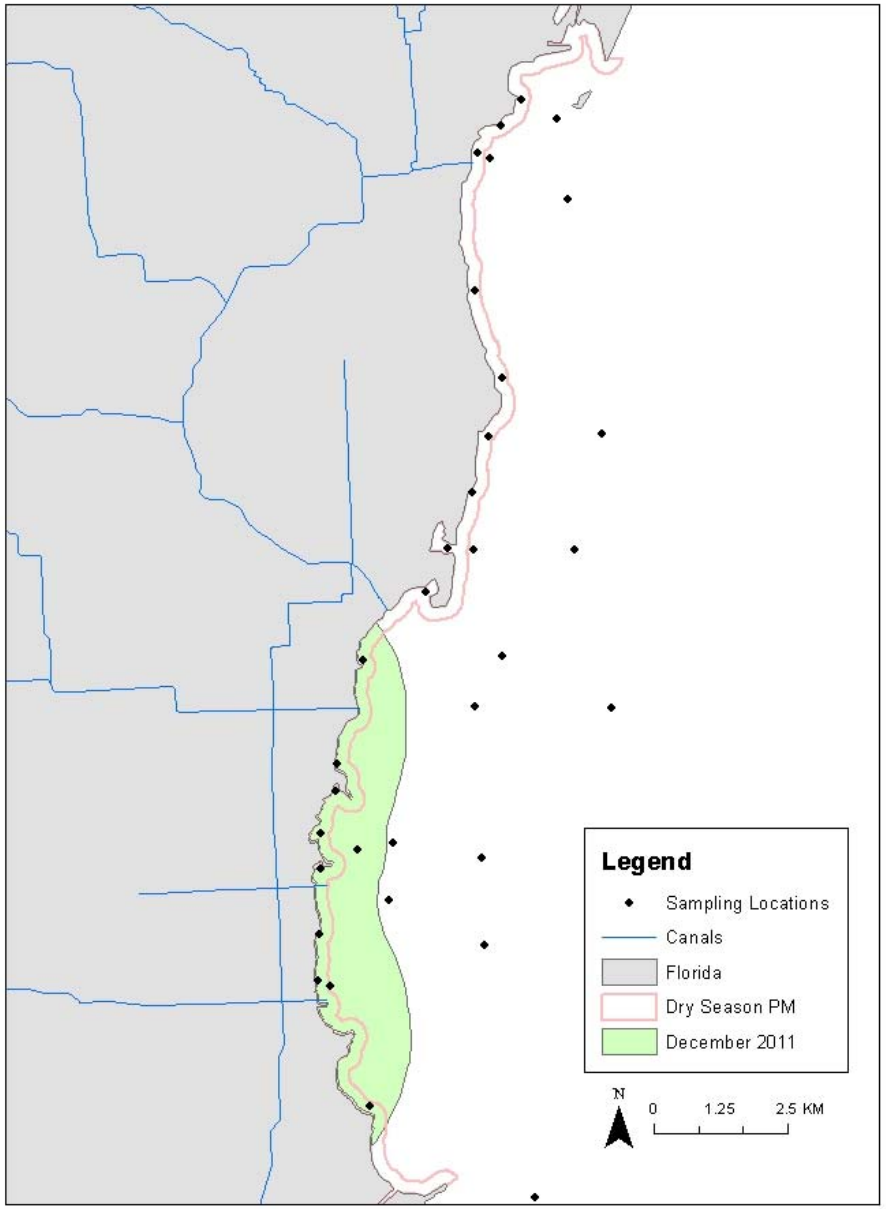
Frequency of Different Salinity Classes



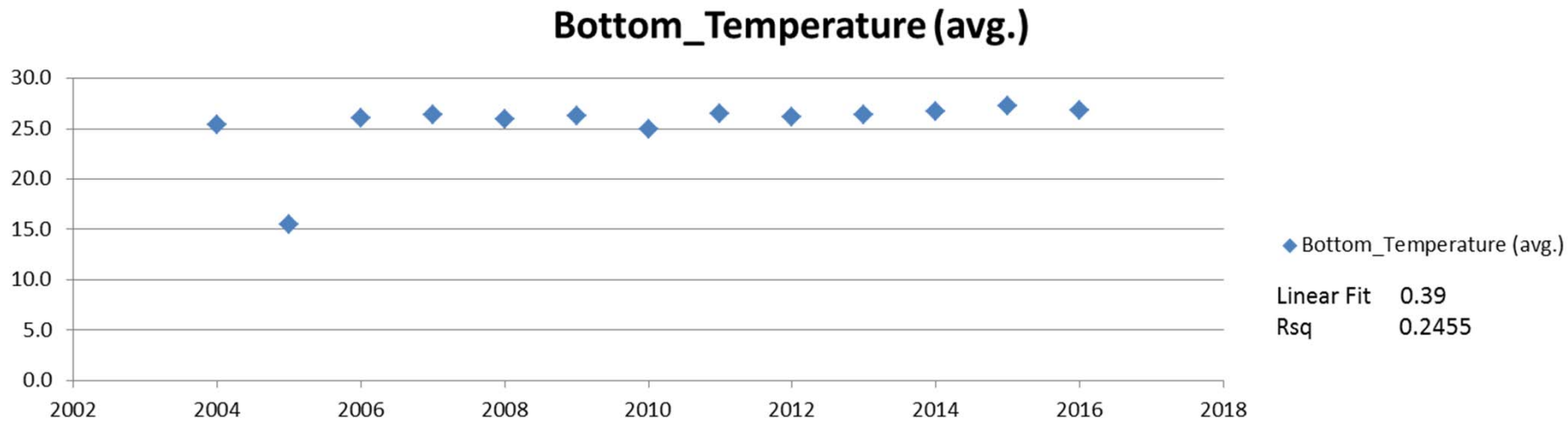

Biscayne Bay Monthly Salinty Compared to Performance Measures
Est. Area of Measured Salinity <20 psu (acres)
Acres Salinity <20 psu
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

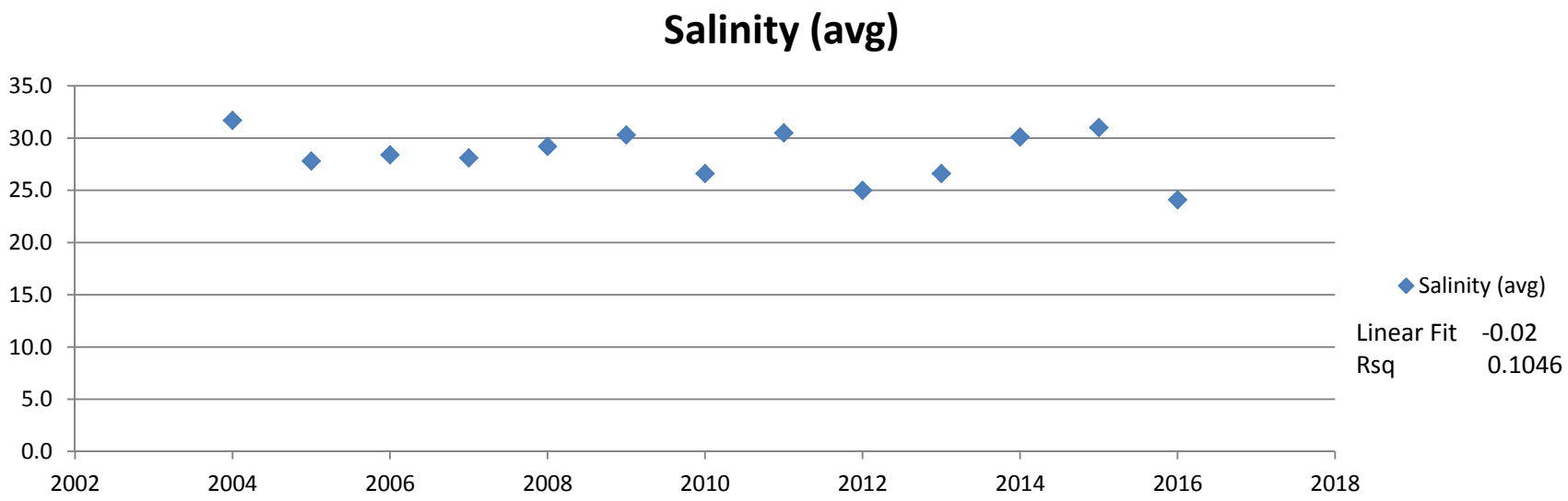

Monthly Canal Discharge in Kaf (summed S20F, S20G, S21A, S21, S123)
Thousand acre feet (Kaf)
140
120
100
80
60
40
20
0
J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N J M M J S N
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

Estuarine Zones 2004-2011



Long Term Trends





Conclusions

- Shoreline sites between Convoy Pt. and Black Pt. are significantly different in salinity than sites between Black Pt. and Deering Estate and have a higher variance
- Highest salinity measurements occur during the early wet season, the period when the aquifer is re-filling as the wet season progresses.
- Estuarine zones develop for wet season and may persist into early dry season or in wet years until January, suggesting the influence of ground water. Dry Season 2015-2016 was a very unusual year
- Groundwater lags surface water flow into the Bay and represents a means of affecting bay salinity well into the dry season
- Extreme Salinity Fluxes happen over short timescales
- Revisit delivery schedules to Biscayne Bay to provide freshwater during the dry season when possible.
- Work with the South Florida Water Management District to Evaluate Different Operations for water delivery to Biscayne Bay and add dry season needs to all plans.

Questions ?

Assistance and Special Thanks :

- Erik Stabenau, NPS
- U. S. Army Corps of Engineers