Disruptive Events & Salinity Responses in Western Biscayne Bay

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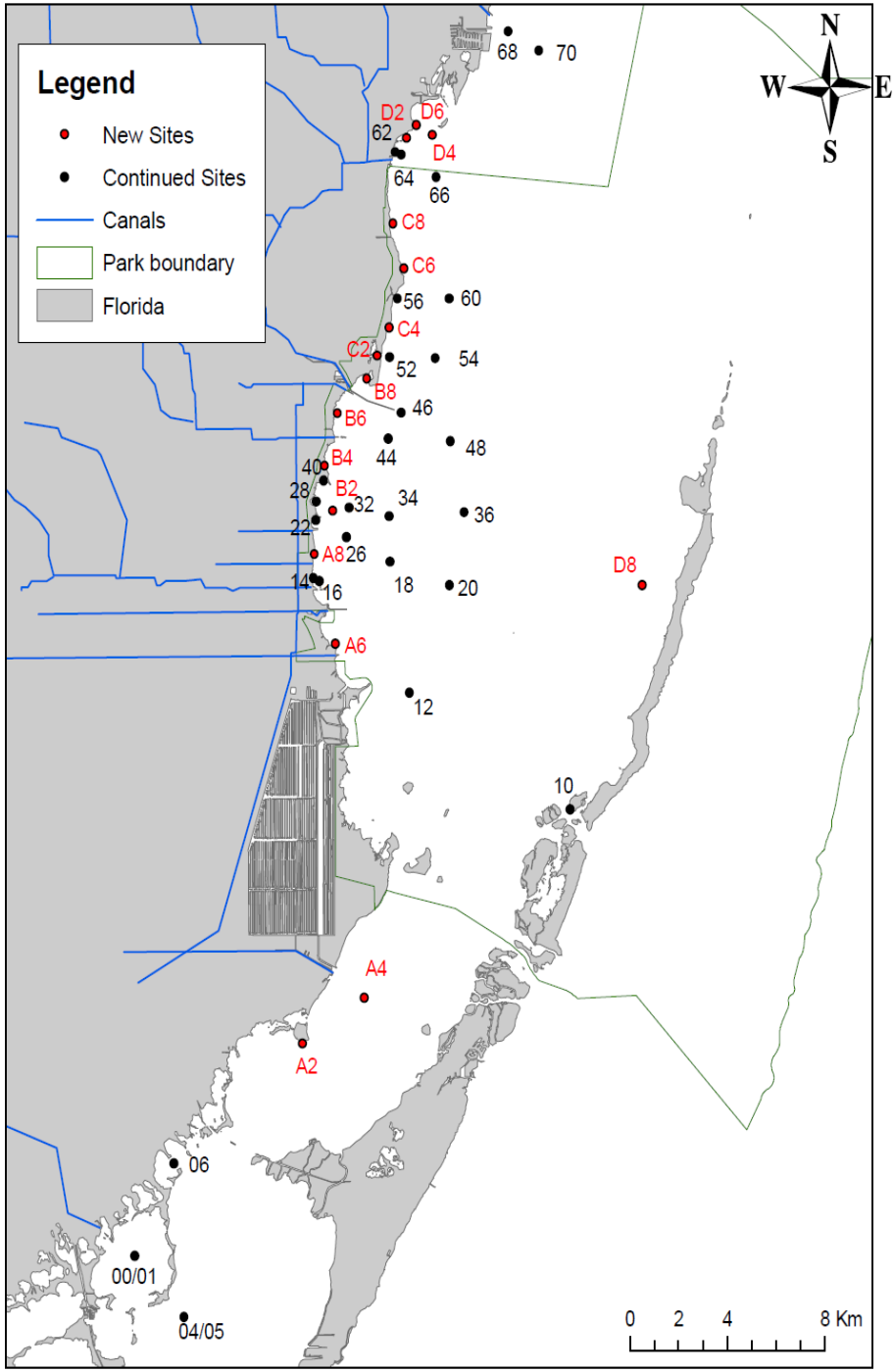
Original Network & Integrated Biscayne Bay Ecological Assessment Monitoring (IBBEAM)

- Salinity sampling designed in 2003-2004 by a multi-agency science team
- Created with embedded W-E transects and N-S transects
- Shoreline instruments within 100 meters
- Included paired surface and bottom instruments
- Designed to meet needs of modeling and collecting data as close as possible to the shoreline at specific features
- Re-designed in 2010 to better assess coastal effects due to implementation of CERP-BBCW
- Surface instruments re-dedicated to shoreline sites
- 2012 funding reduced, number of sites reduced under IBBEAM to only shoreline sites. Remainder sampled by NPS-BISC



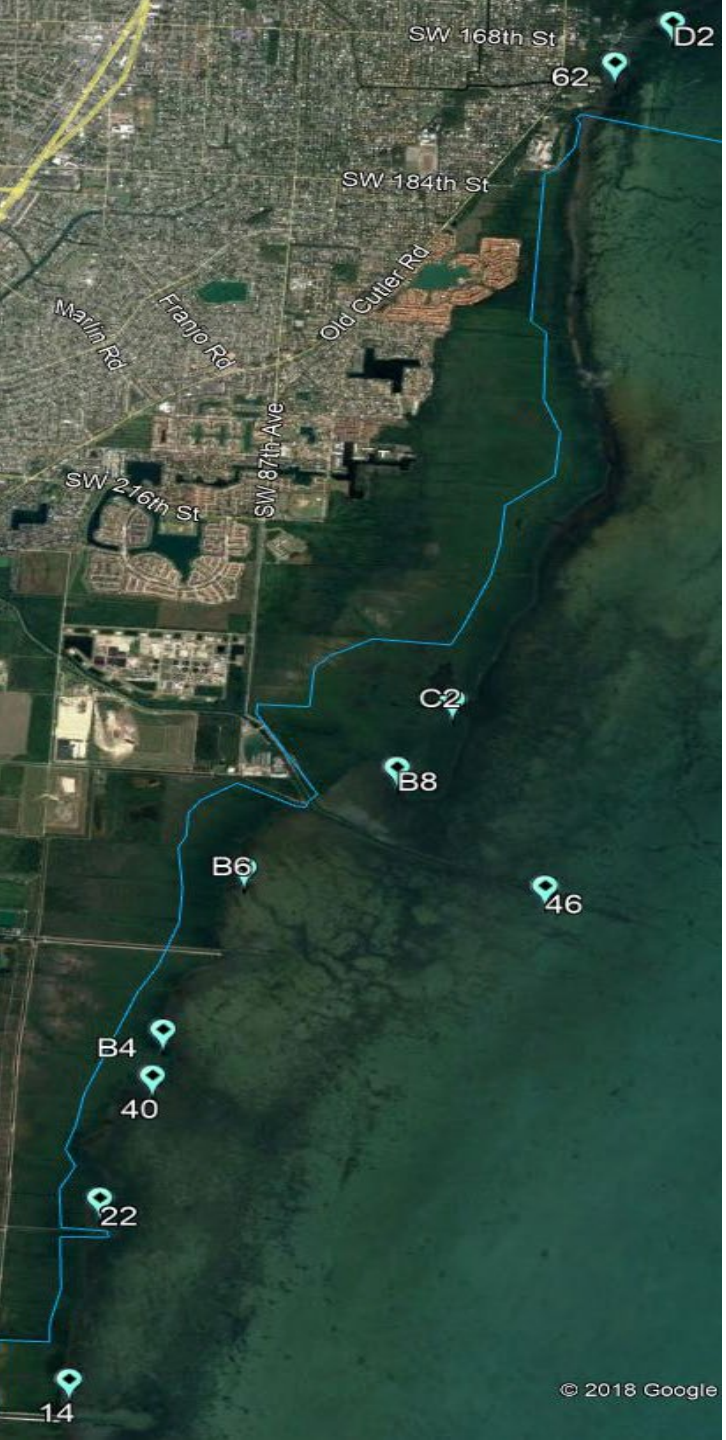
General

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
- Develops an estuarine zone every year which may be more or less persistent depending on operations
- **Rapid changes in salinity, which return to pre-event levels over short periods of time**

Disruptive Salinity Patterns

- High Variability
- Rapid Rate of Salinity Change
- Large Salinity Oscillations in a Short Time Period
- Salinity Changes Greater than 15 psu occurring multiple times over a 24-48hr period
- Patterns of Occurrence Over time



Legend

- New Sites
- Continued Sites
- Canals
- Park boundary
- Florida

N
W
E
S

68 70
D2 D6
62
D4
64 66
C8
C6
56 60
C4
C2 54
52
B8
46
B6
48
44
40 B4
28 B2
32 34 36
22
A8 26
14 16 18 20
D8
A6
12
10
A4
A2
06
00/01
04/05

0 2 4 8 Km

Salinity Effects on Organisms

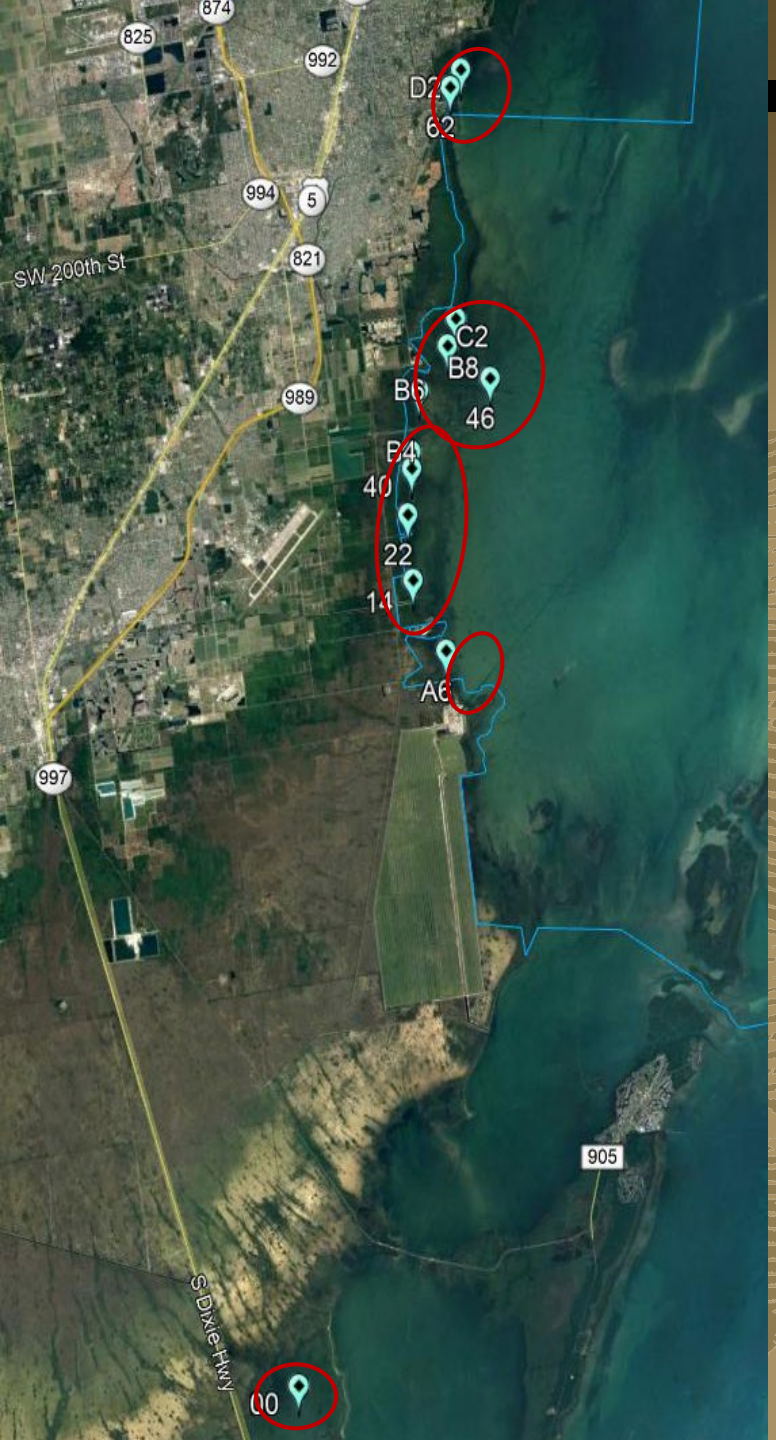
- Animal Biota have Variable Tolerance for Salinity Changes
  - Highly mobile species such as crabs and shrimp move with water masses
  - Sessile or immobile invertebrate species such as oysters and welks generally have a ‘wait it out’ strategy
  - Fish, as highly mobile organisms have in the past been assumed to move when salinity or temperature changes to a less favorable range.

Likely Causes:

- Canal Operations
  - Hurricane & Storm Operations
  - Dry Season Drawdown
- Local Water Table/ Local Operations
- Groundwater (generally moderated by the slow movement in the aquifer)

Biscayne Bay Salinity Affects on Fish (Serafy et al., 1997)

Species and Mortality	Presence at Black Point
Pinfish (12.5% mortality)	Abundant
Rainwater killifish (50% mortality)	Present
White grunt (100% mortality)	Present
Spotted sea trout (100% mortality)	Absent
Sheepshead (100%)	Absent



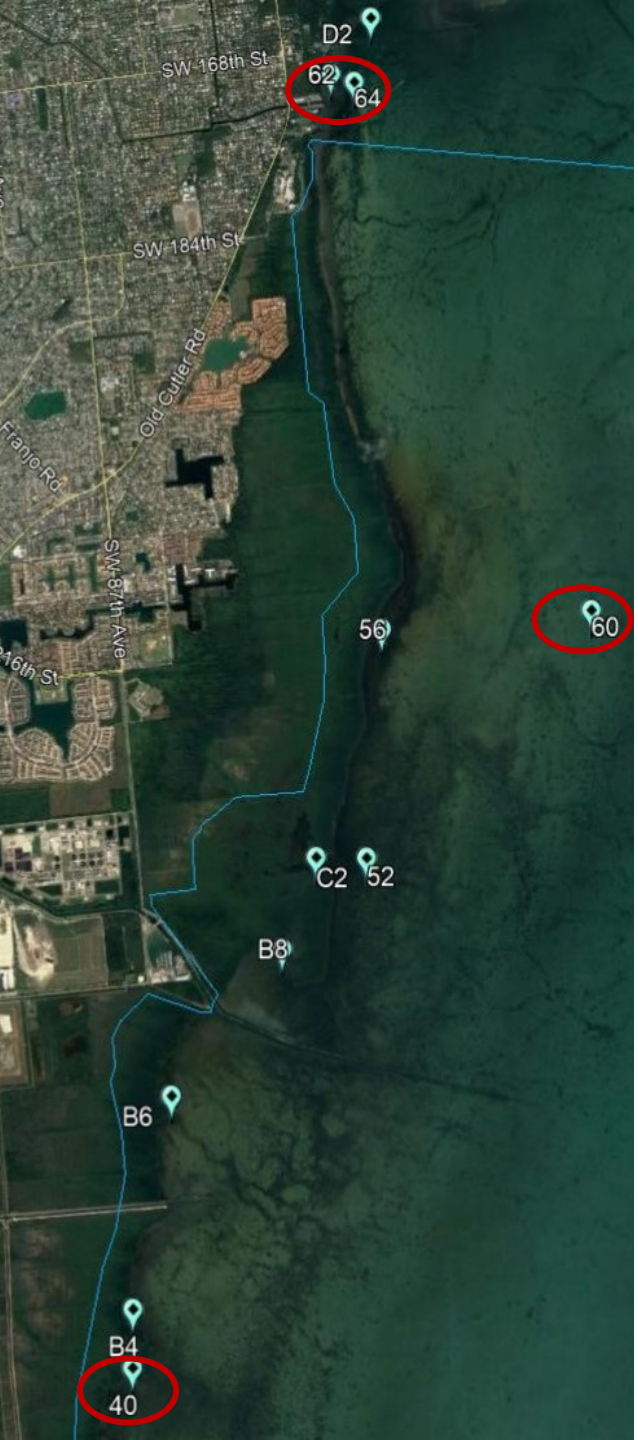
Areas Experiencing Large Salinity Change Events

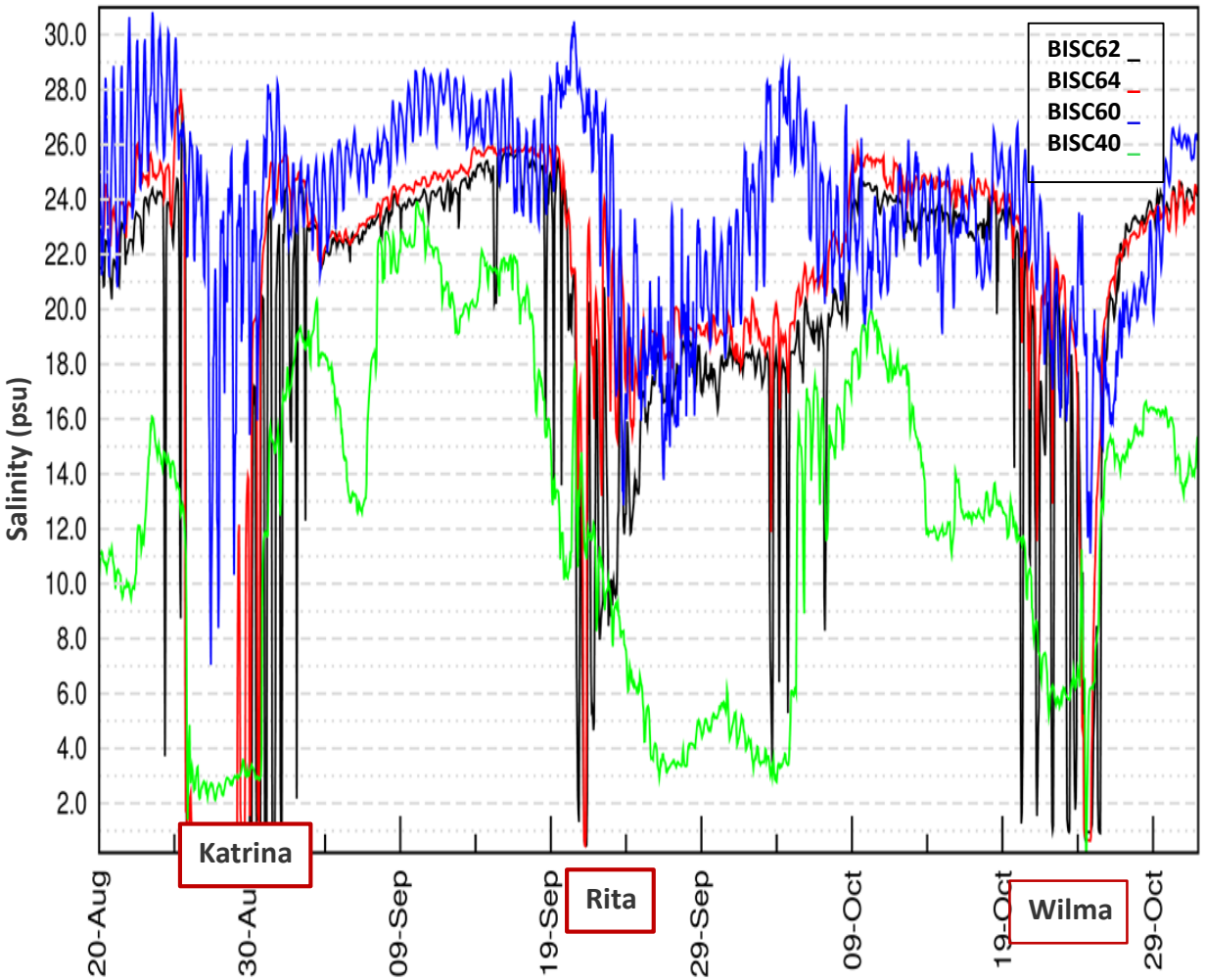
Hurricane Operations

- Katrina
- Rita
- Wilma

Hurricane Effects

Hourly Salinity from Aug 20 to Oct 31 2005

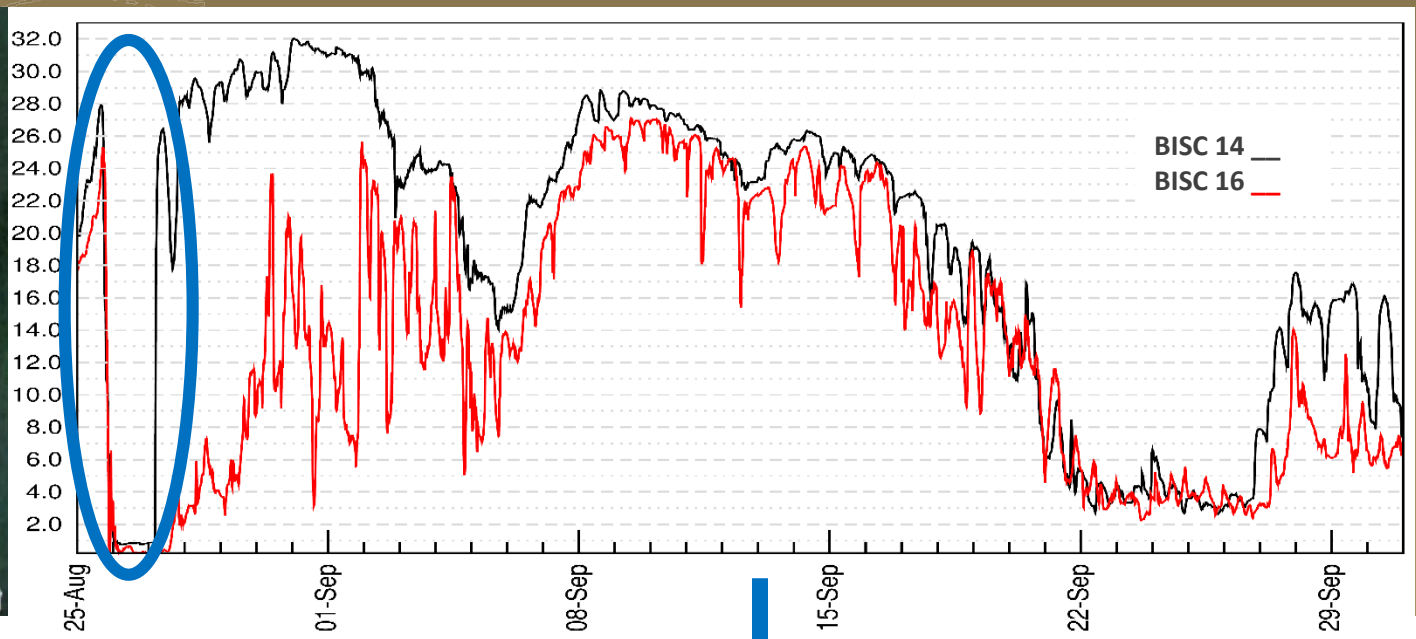


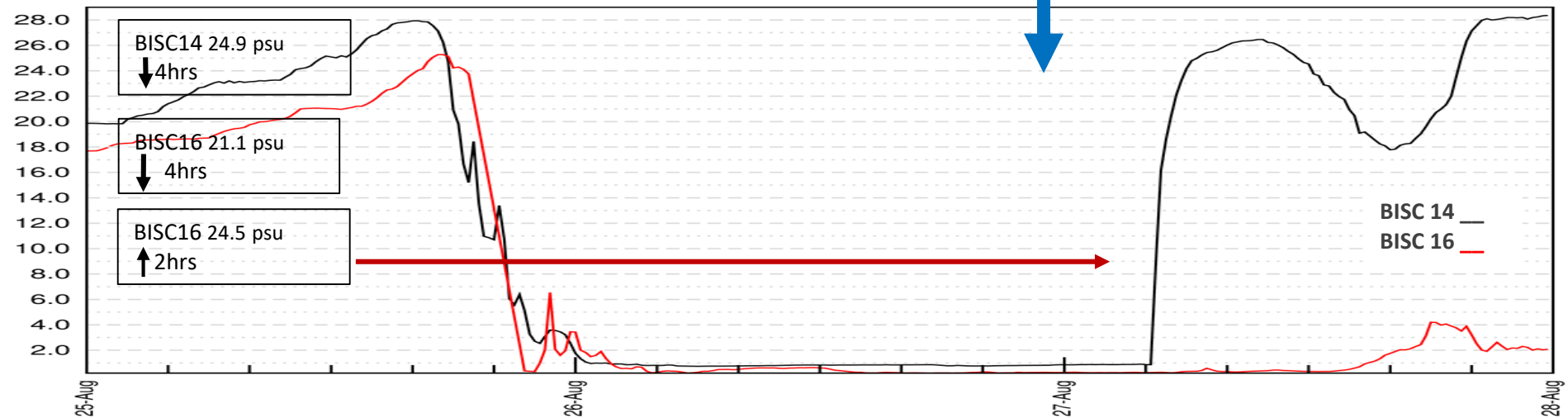


Hurricanes 2005

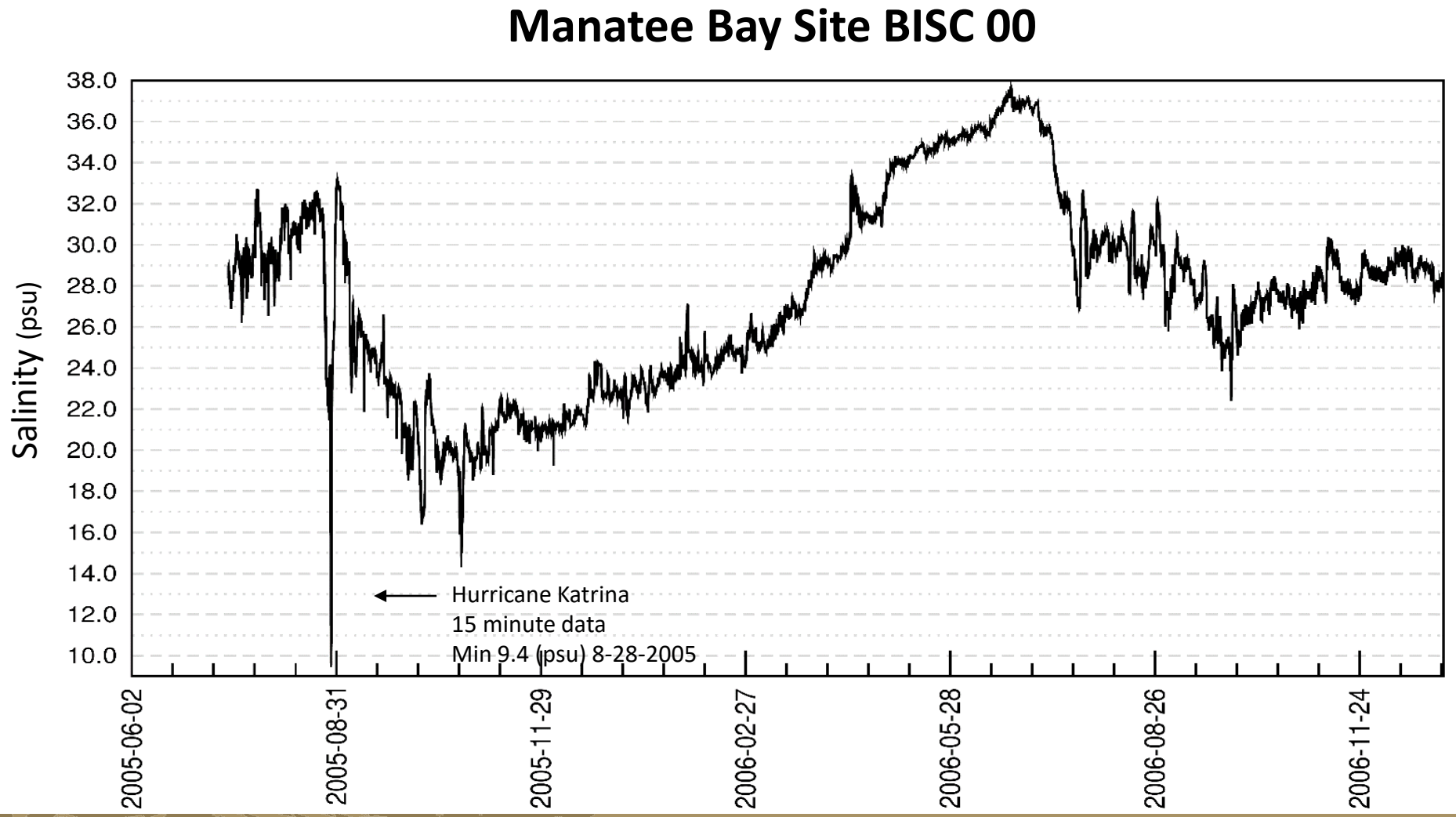
Hurricane Katrina

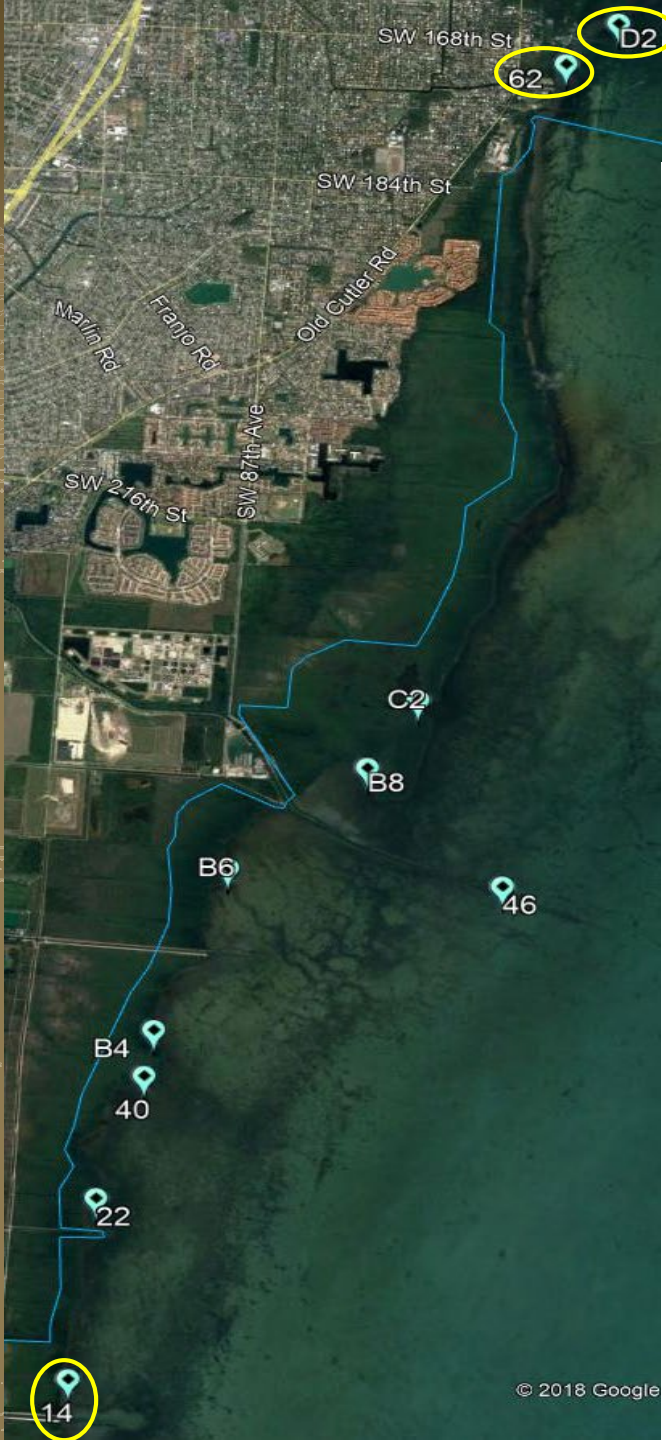
C-103



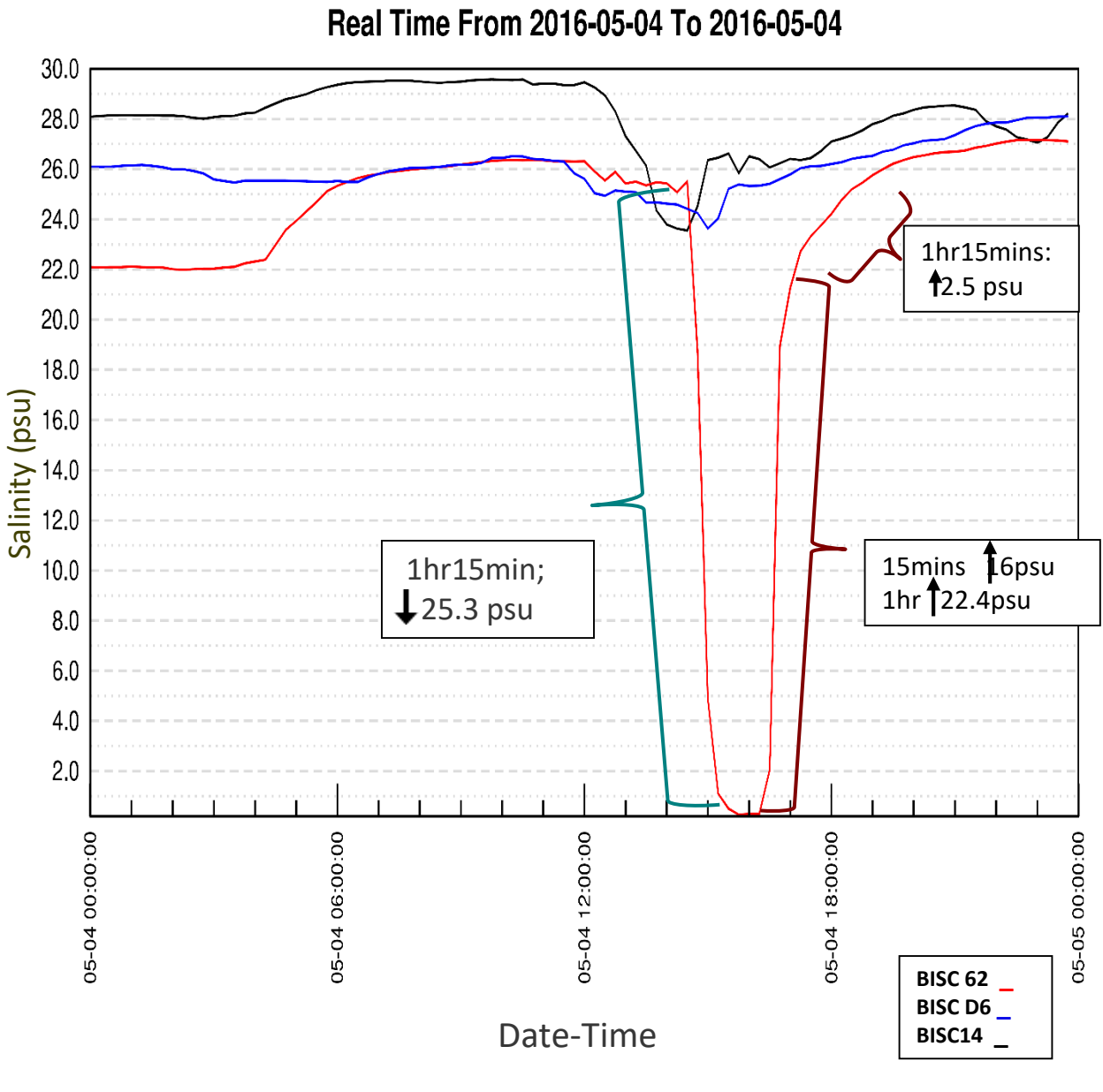


Hurricane Katrina



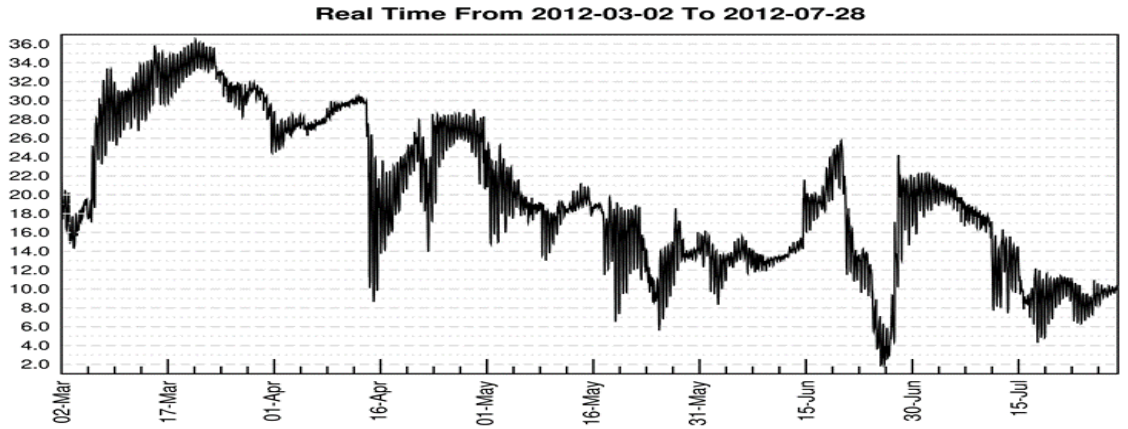


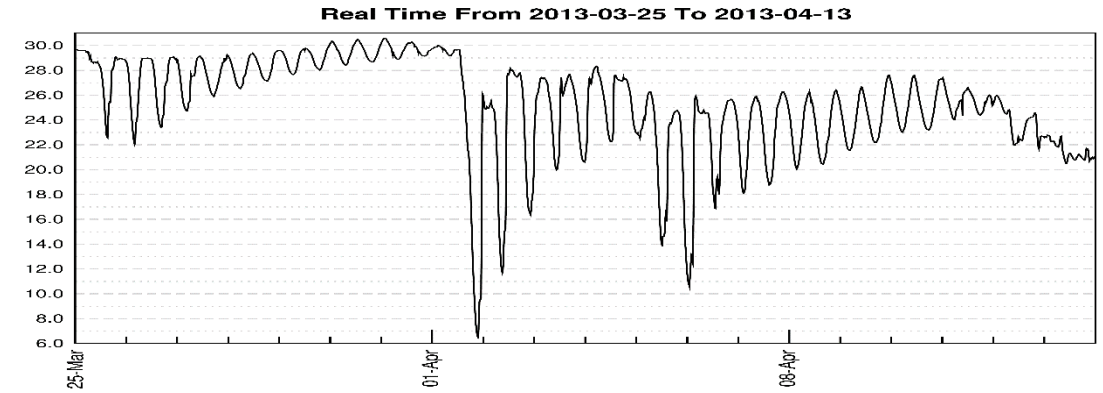
Rainfall & Flow Driven Event

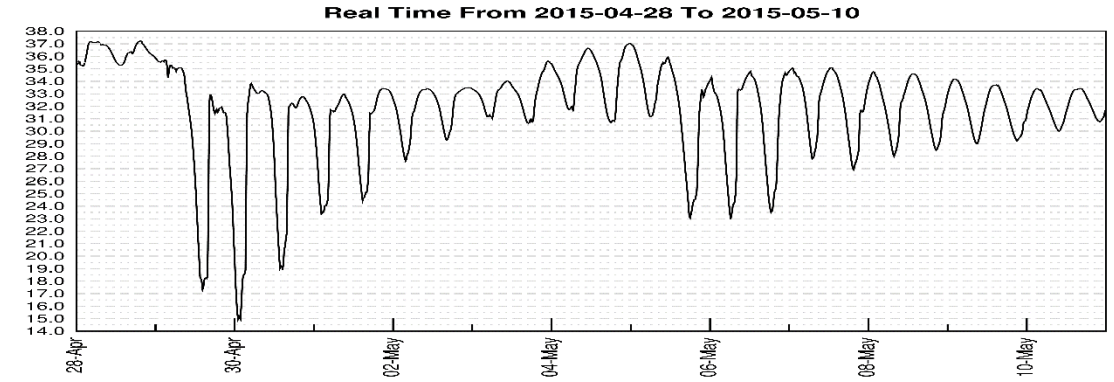


Biscayne Bay Coastal Wetlands
Black Point - Cutler Wetlands

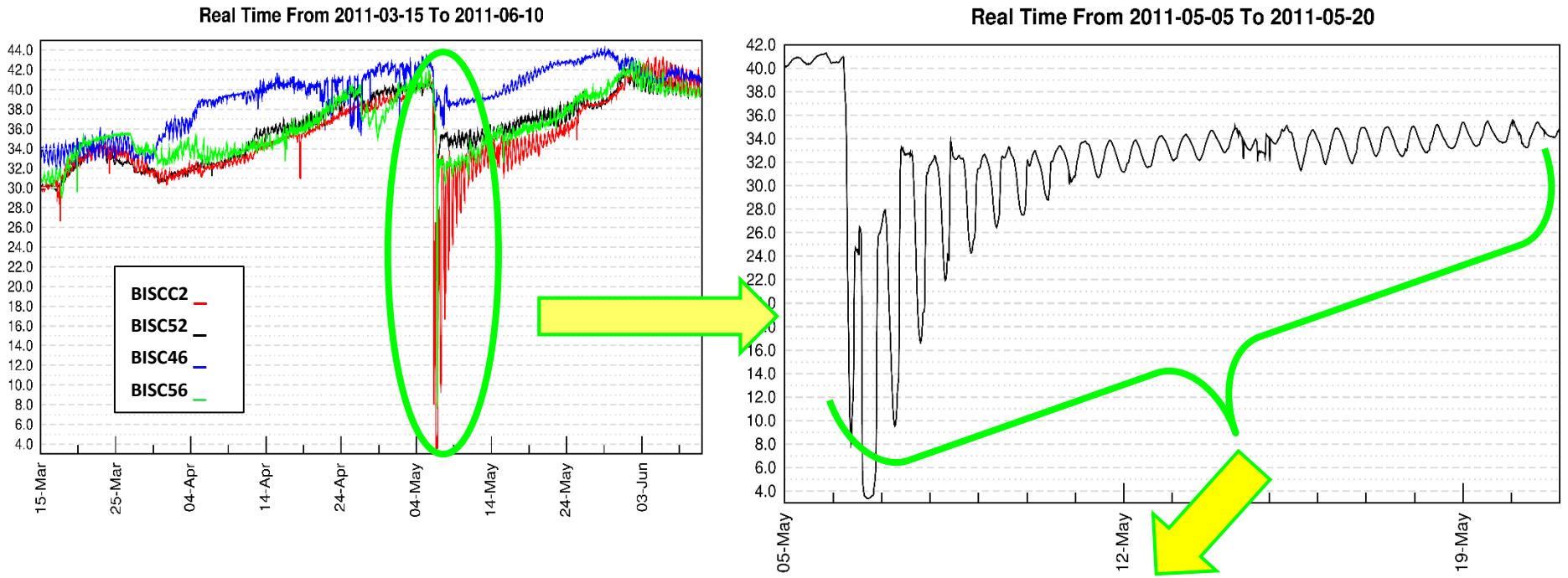
Episodes of Wide Salinity Fluctuations at BISCC2

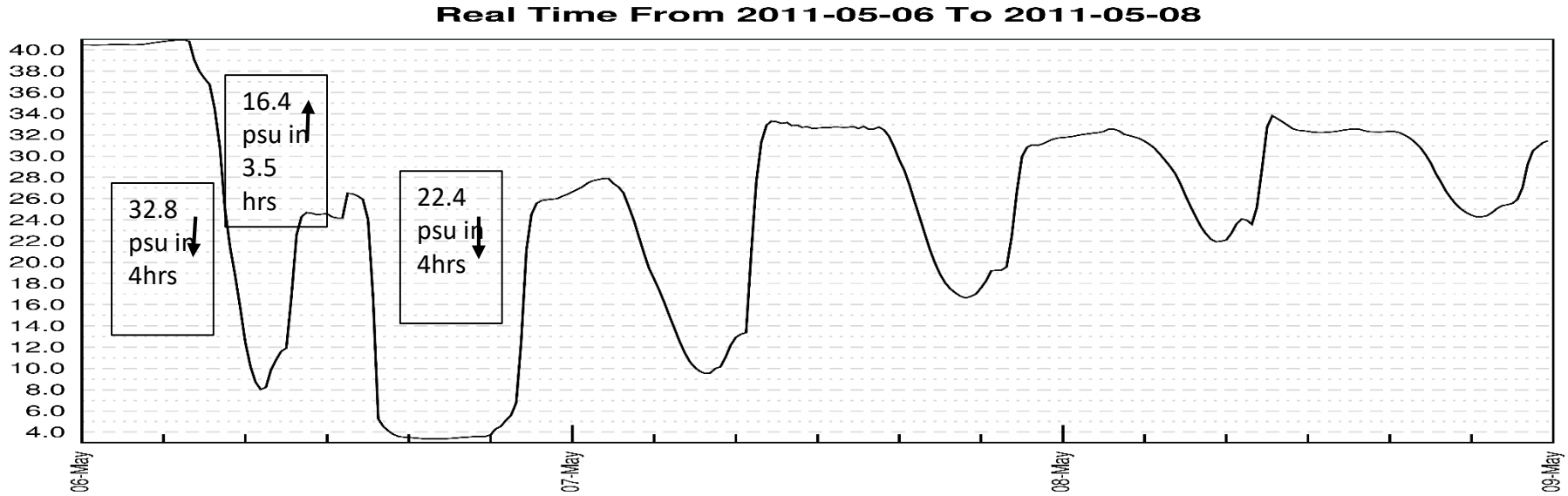






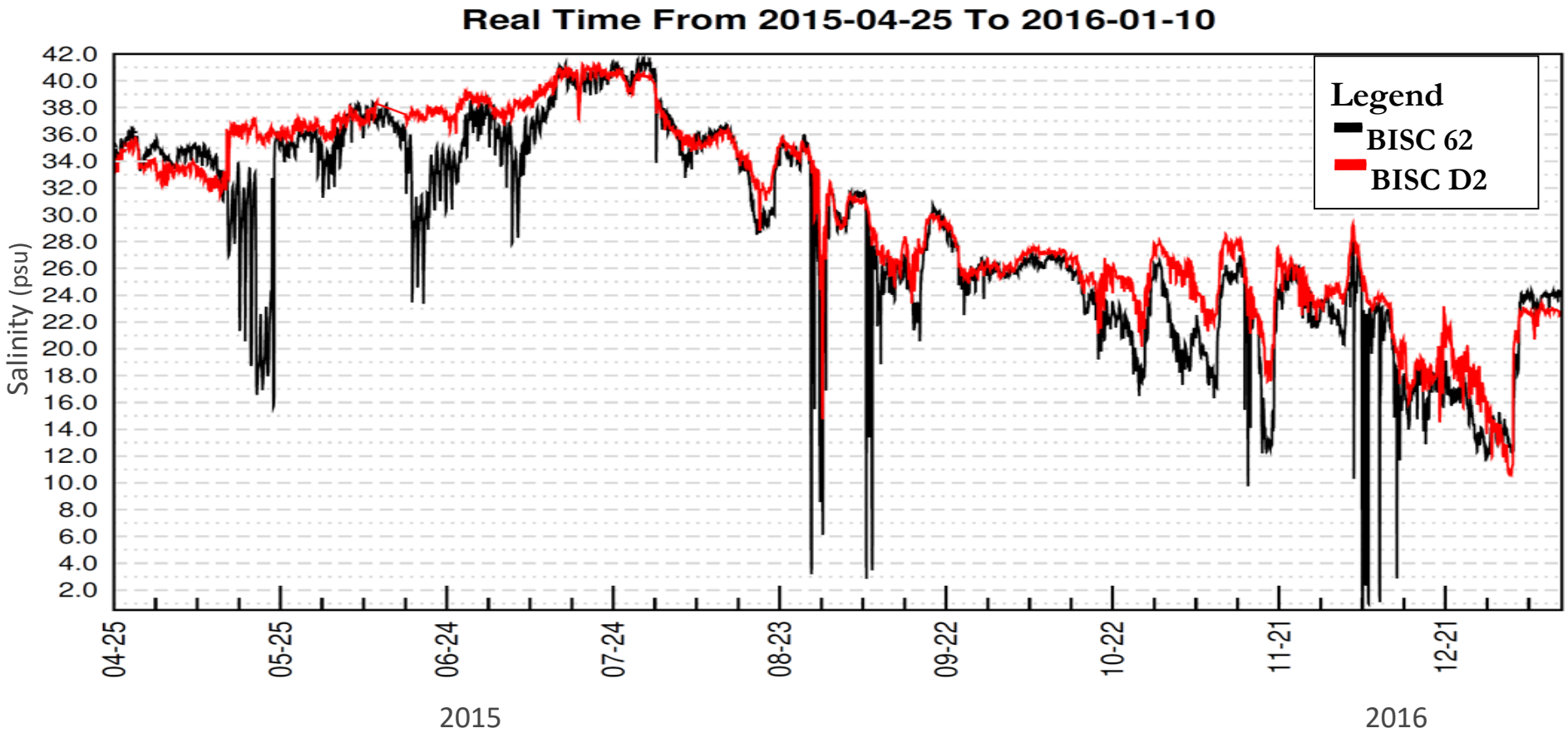
Physical Processes





Areas Experiencing Large Salinity Change Events

Deering Estate



Why is this important ?

"…potential exists for direct mortalities of certain fishes to result from a single, albeit dramatic , canal discharge event."

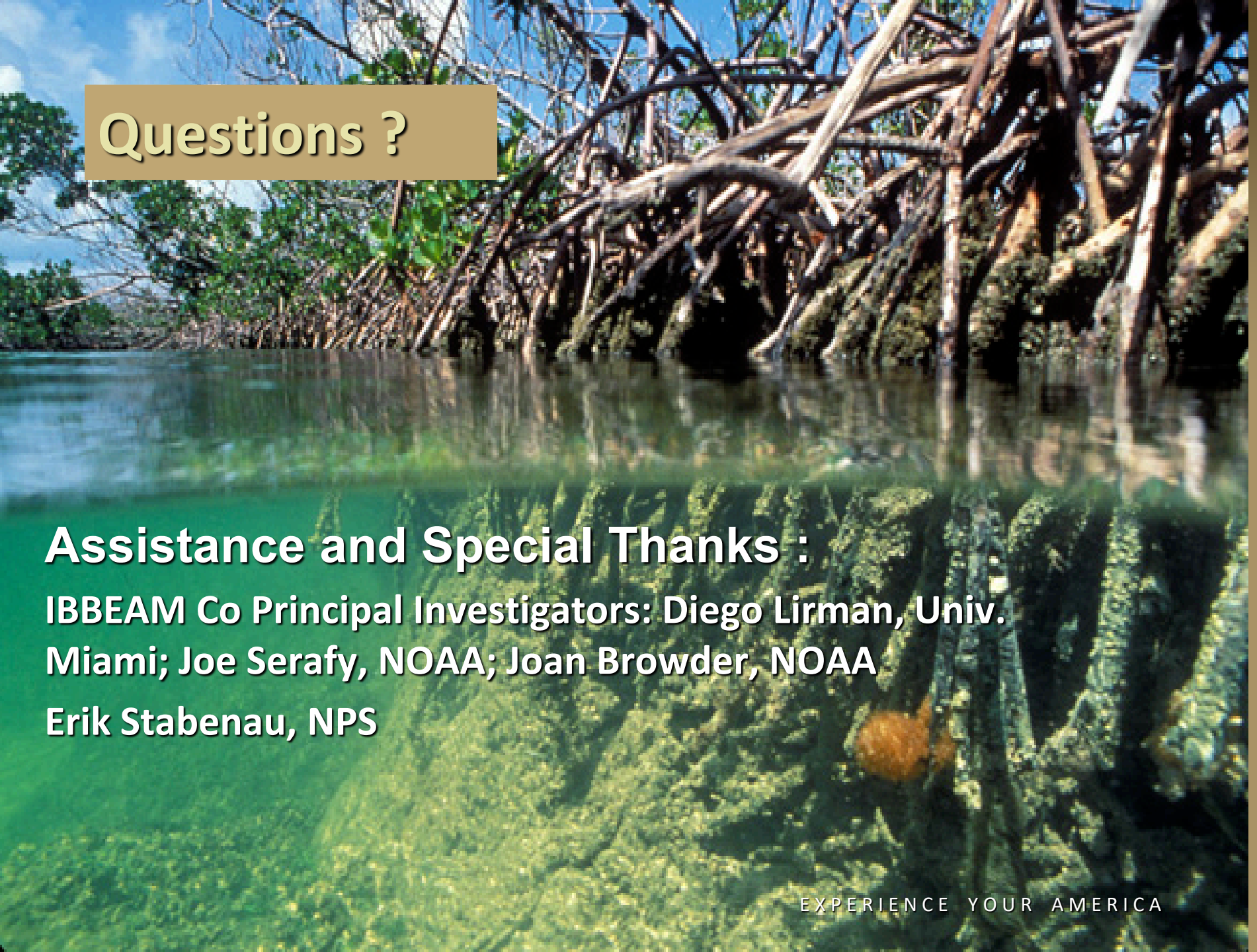
"Whether a fish actively avoids a freshwater pulse or 'waits it out' will depend on size, species, and the perceived risk of predation associated with relocation"

"….canal discharges apparently represent levels of disturbance sufficient to reduce the abundance of freshwater-sensitive species and, therefore, fish species diversity."

What can we do about it ?

Resiliency and Adaptive Management allow us to modify operations to:

- **Put more water in the Biscayne Bay Coastal Wetlands Project as a component of discharge events**
- **Maximize use of the Biscayne Bay Coastal Wetlands Project**
- **Discharge over longer periods of time when known events are approaching**



Questions ?

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Erik Stabenau, NPS

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