ENVIRONMENTAL TRENDS AND ECOLOGICAL RESPONSES TO WATER MANAGEMENT, RESTORATION, AND EXTREME EVENTS IN FLORIDA BAY

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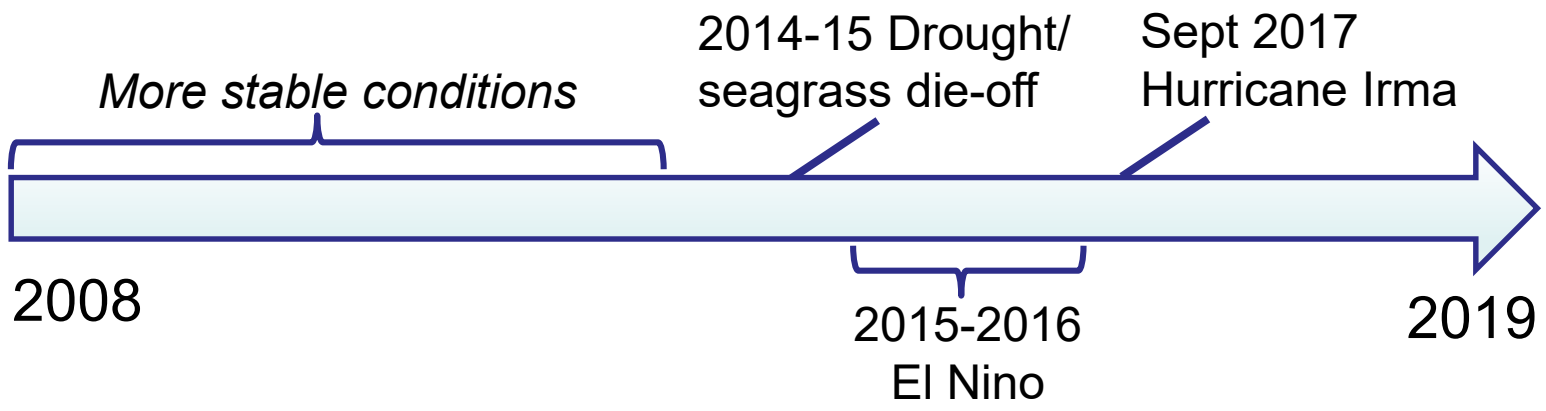
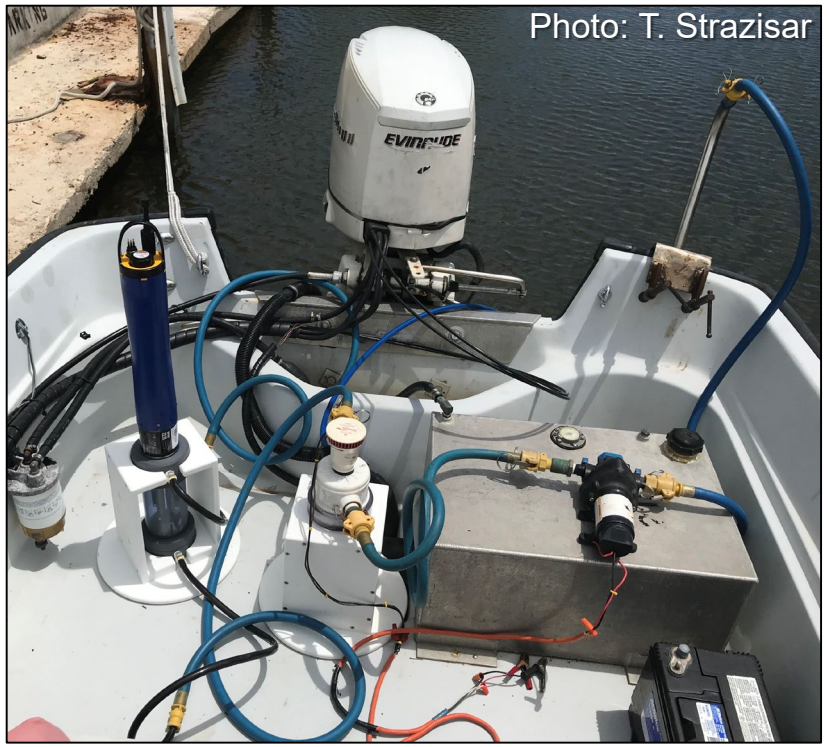
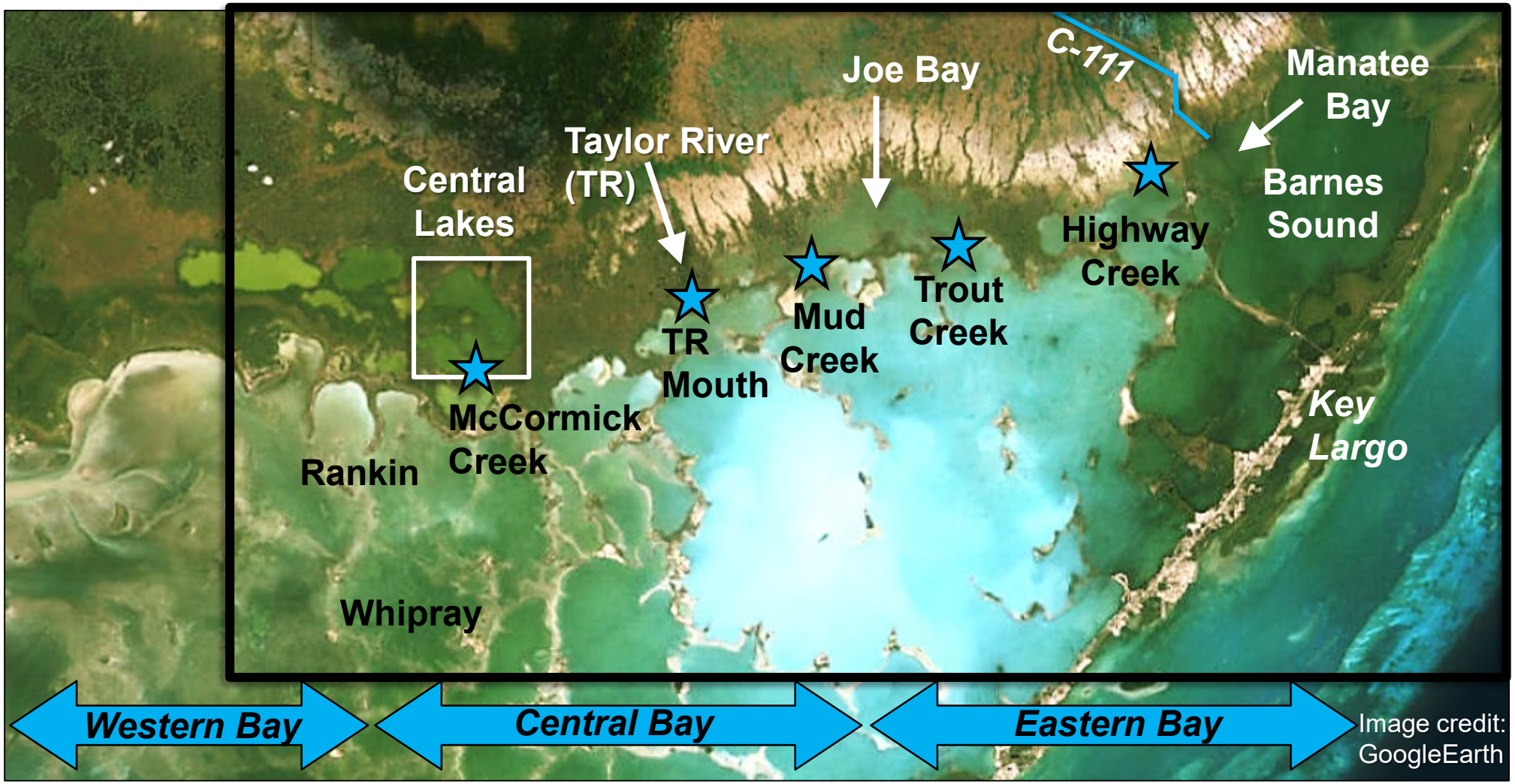
Dataflow Program: Examines Spatial and Temporal Patterns in Florida Bay Conditions

- Examine spatial and temporal patterns
  - Hydrology (management, restoration, natural events)
    - salinity, temperature, photosynthetic pigments, CDOM, turbidity, O_2, nutrients
  - High-resolution spatial context
  - Identifies/tracks gradients and changes
- Link hydrology to ecology

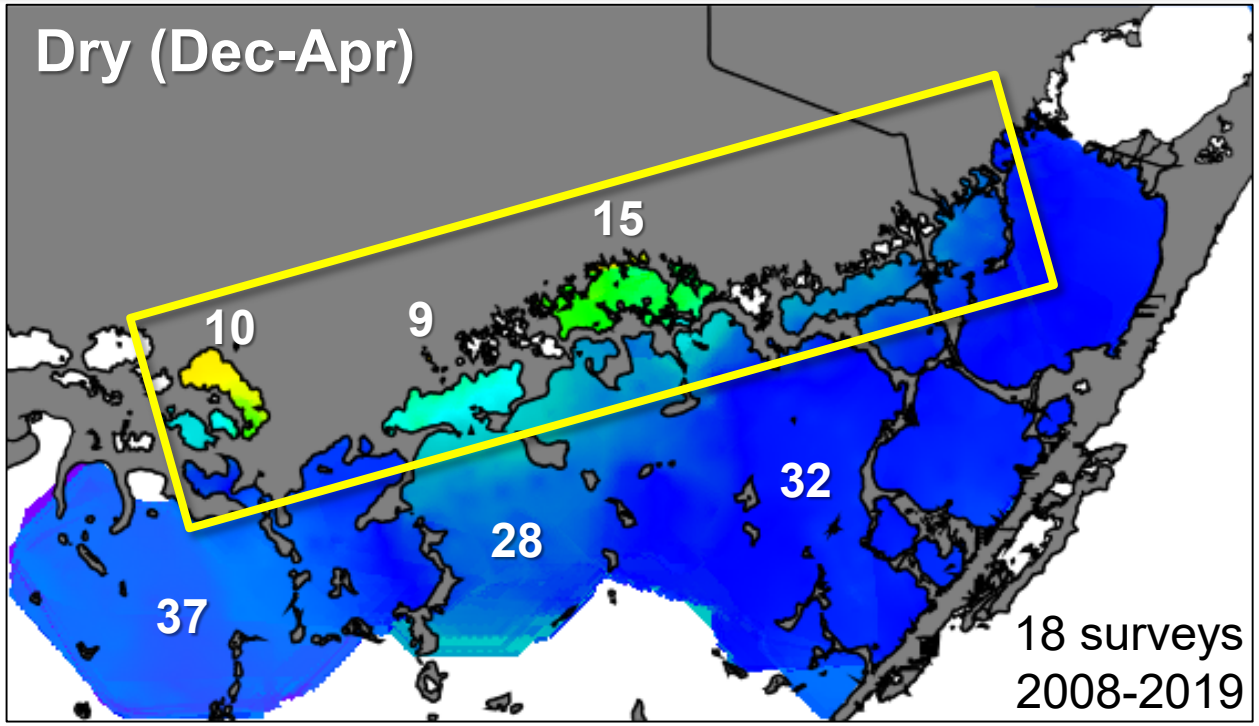


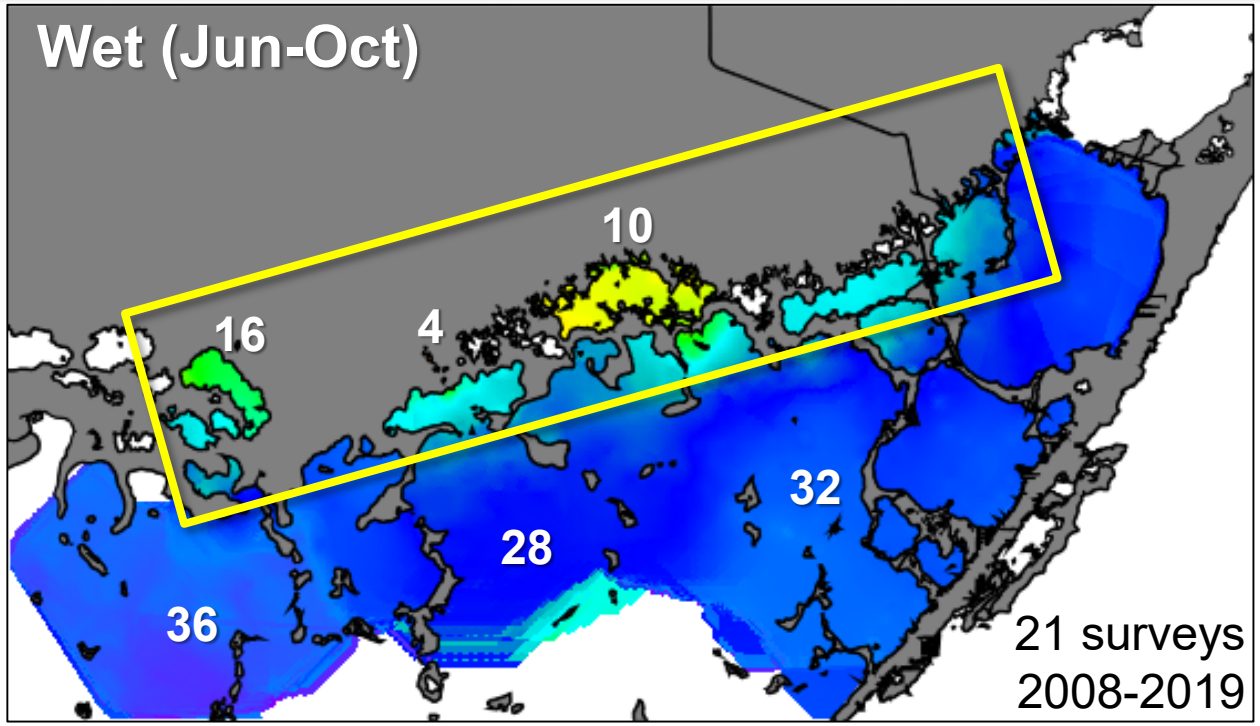


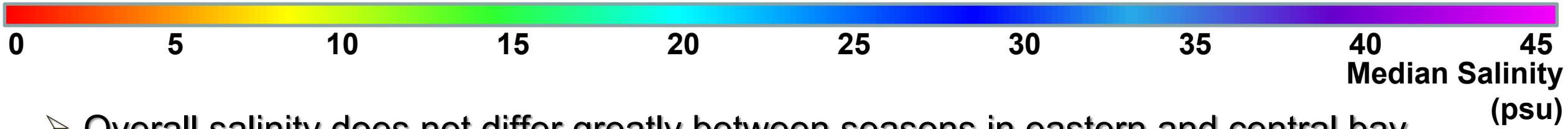
Study Area – Eastern and Central Bay



Wet and Dry "Seasonality"

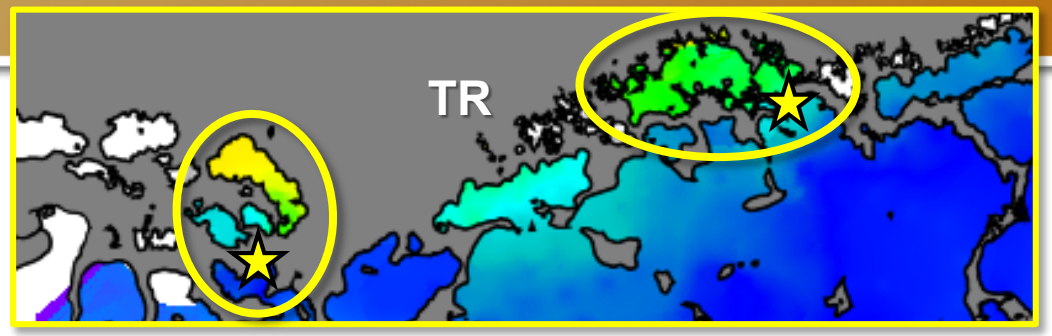




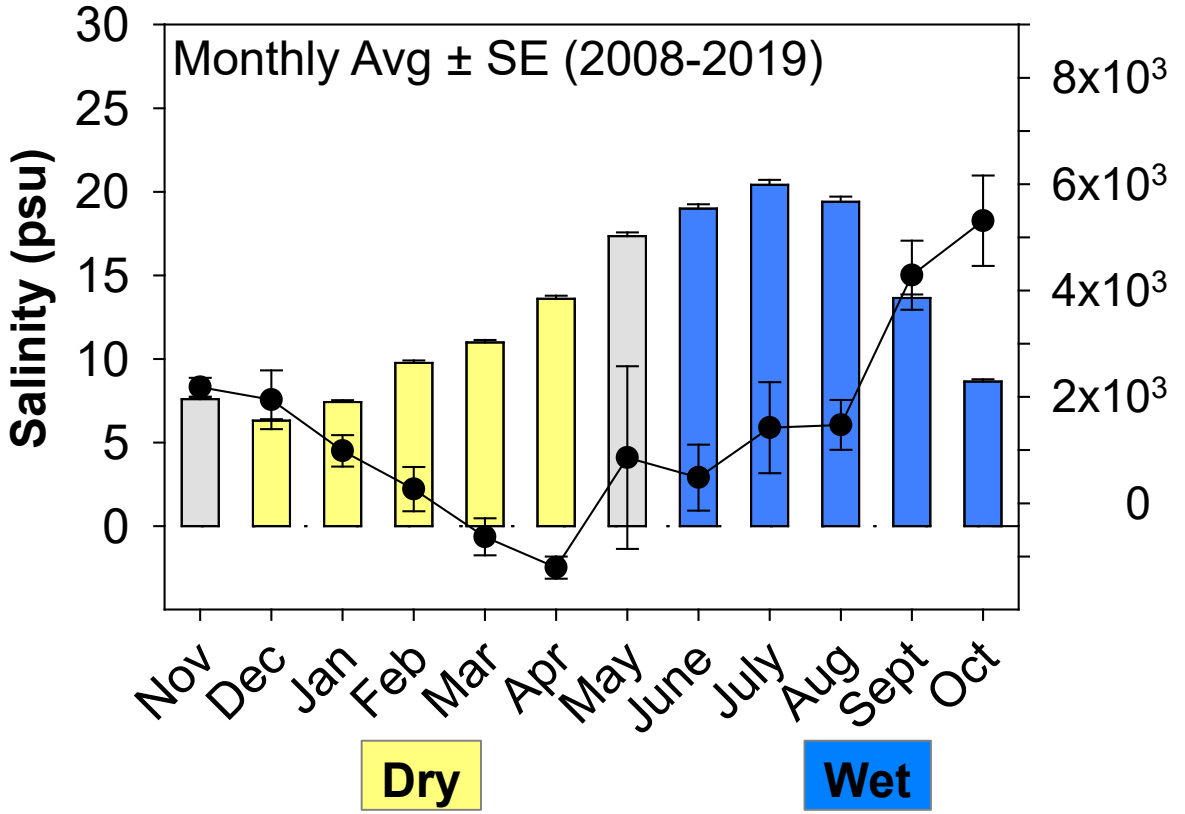


- Overall salinity does not differ greatly between seasons in eastern and central bay
- Lowest salinities along nearshore areas are influenced by hydrology

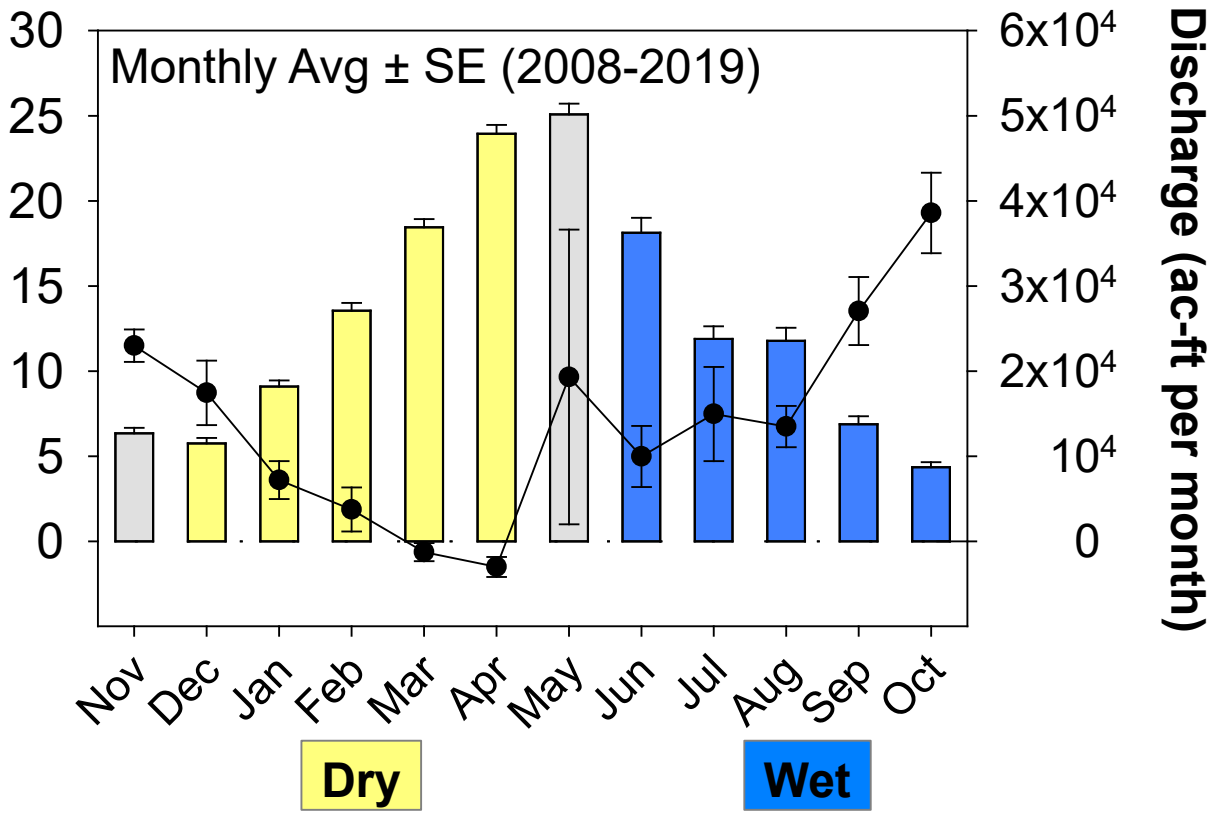
Salinity seasonality is regional and linked to hydrology



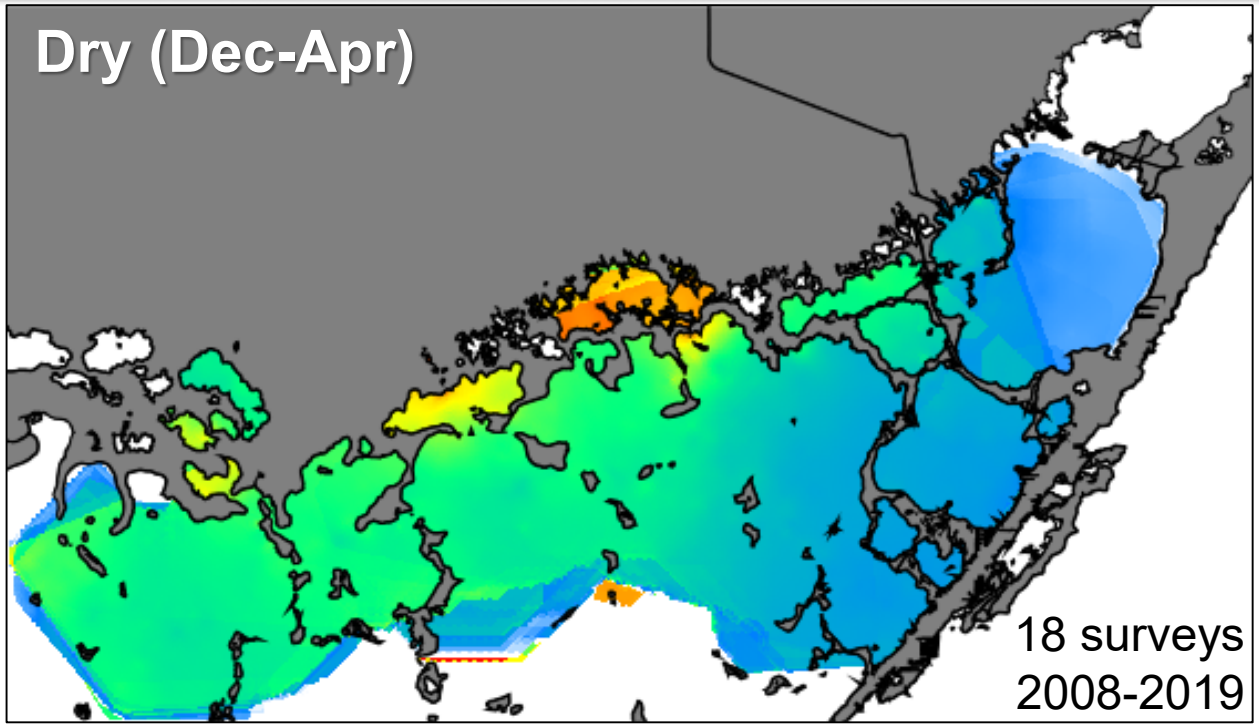
7 Palm Lake salinity & McCormick Creek flow

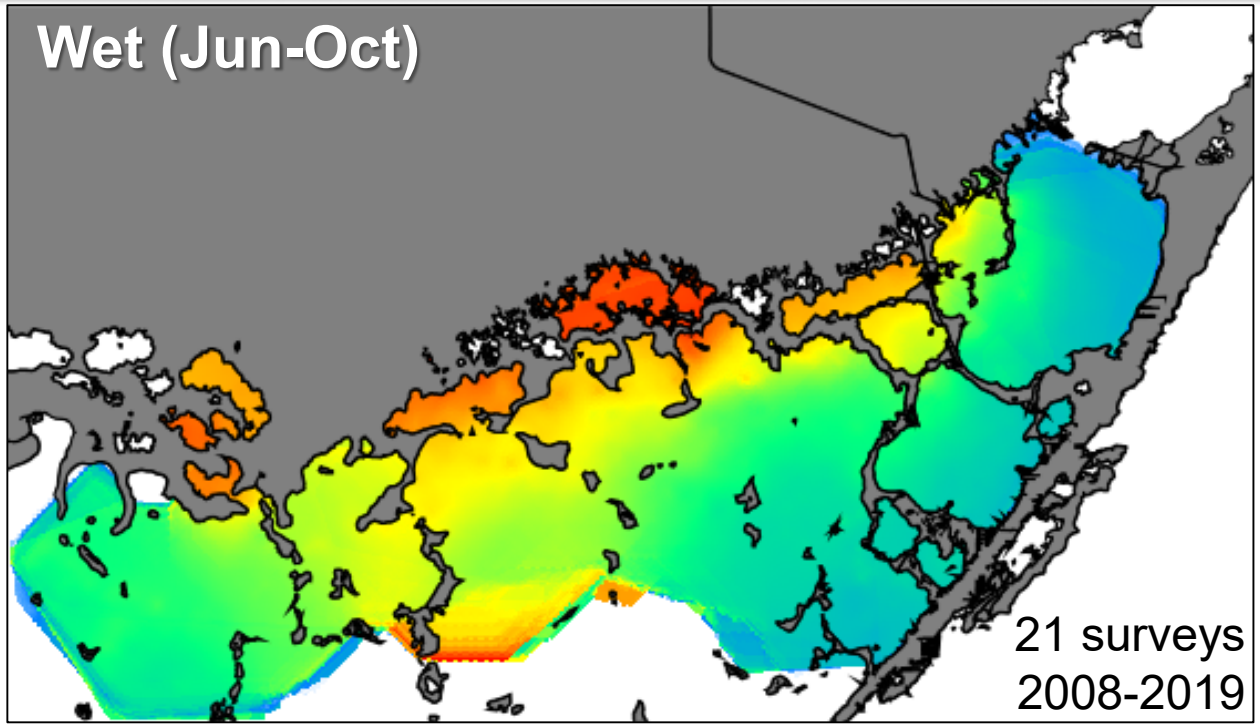


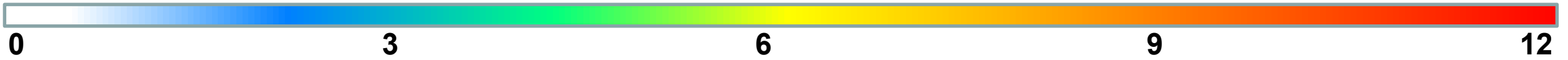
Joe Bay salinity & Trout Creek flow



Role of Salinity Variability in "Seasonality"

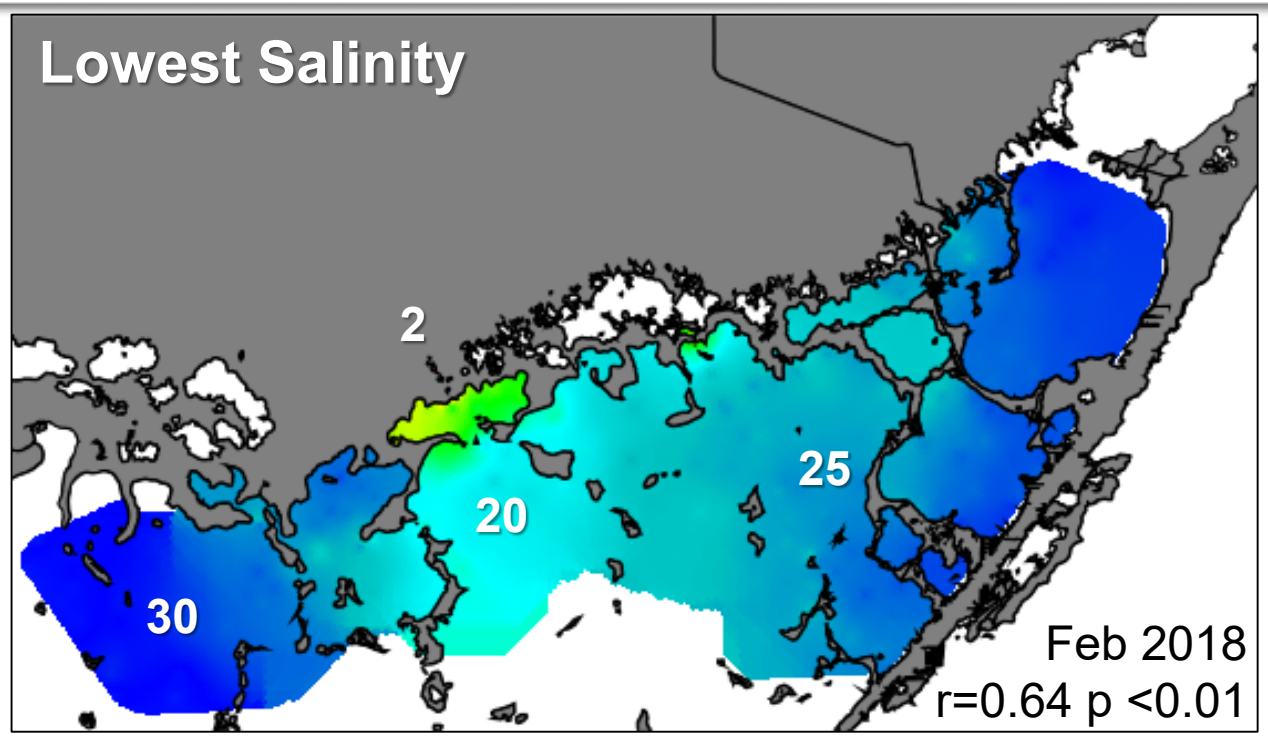


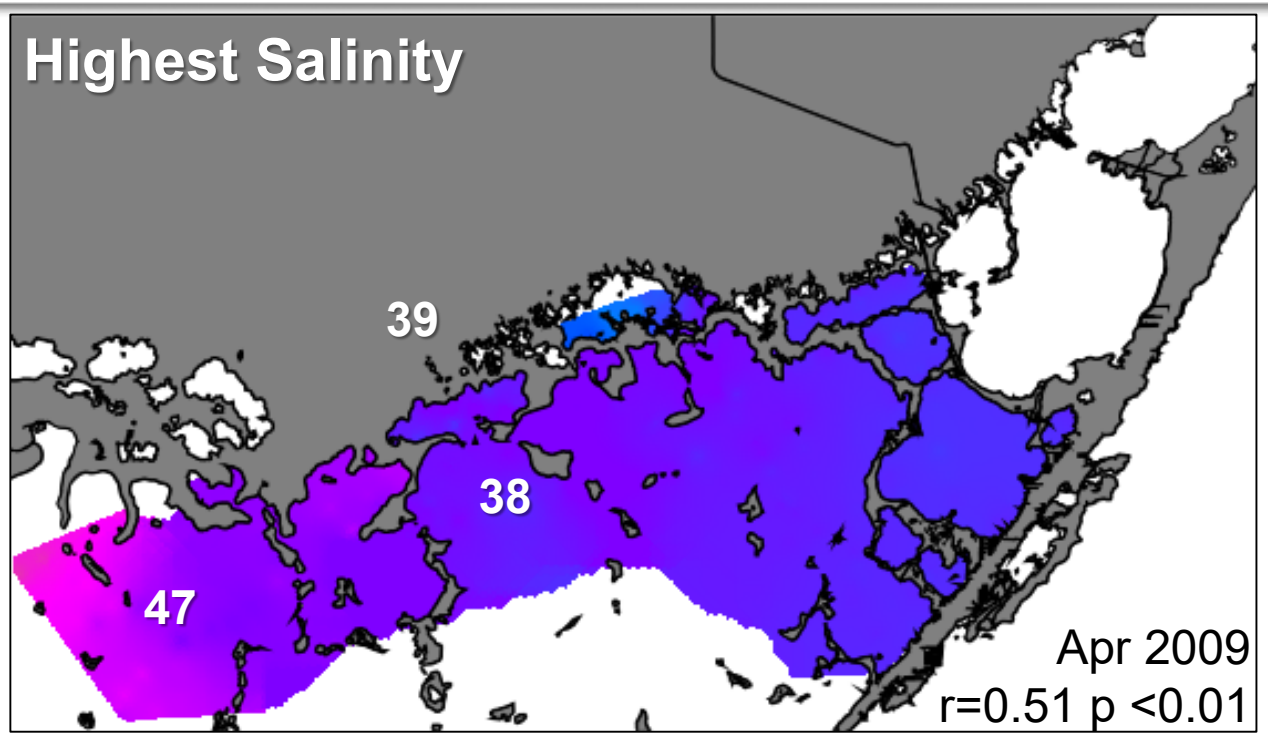


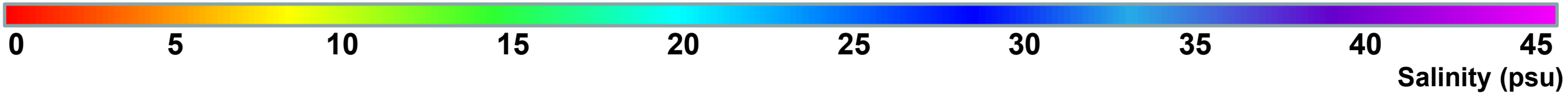


- High spatial variability distinguishes ecotone from rest of bay (>7 psu)
- Higher temporal variability in wet season bay wide

Conditions can vary extremely in dry season (Dec-Apr)

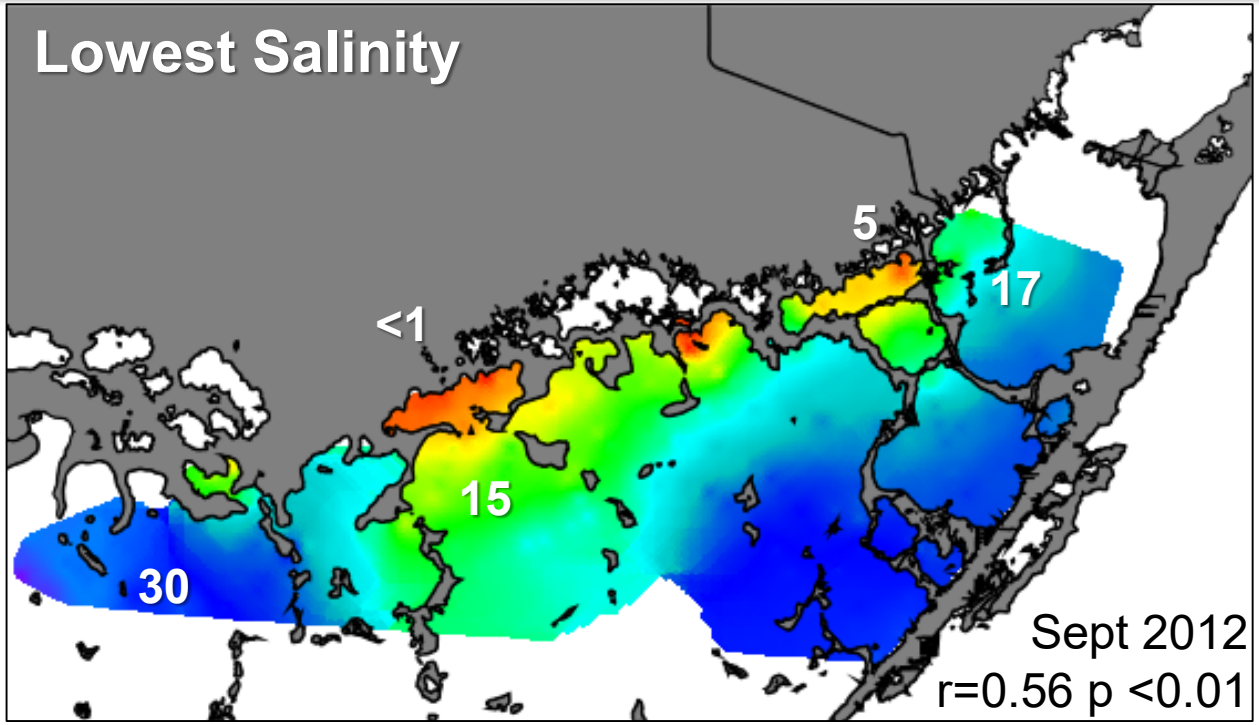


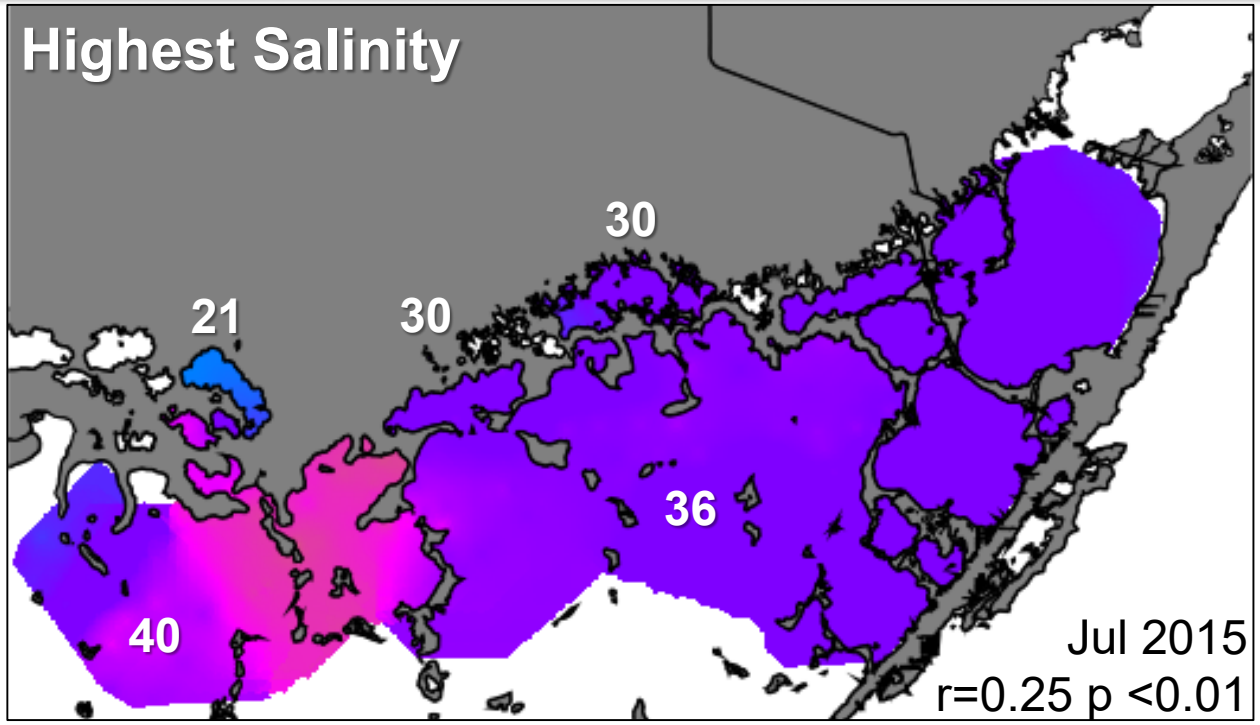




- High spatial variability in bay (range = 2-30 psu in Feb 2018)
- Entire bay can become hypersaline in dry season

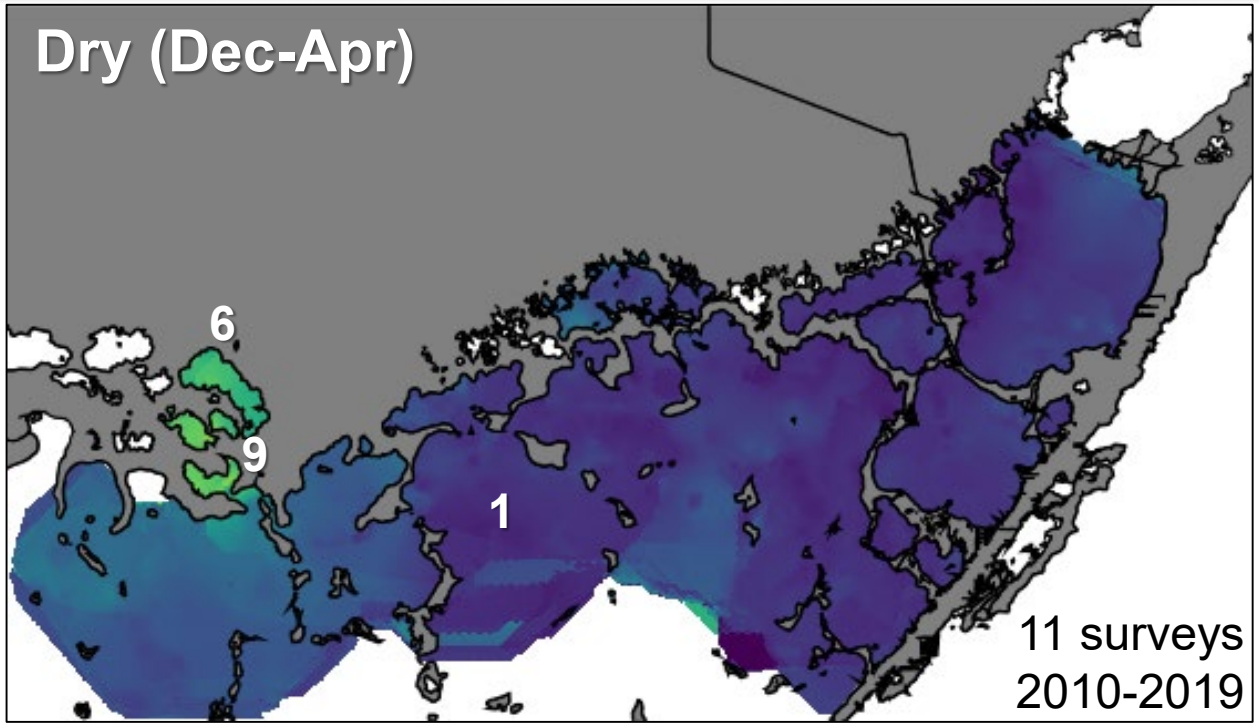
…and also vary extremely in the wet season (Jun-Oct)

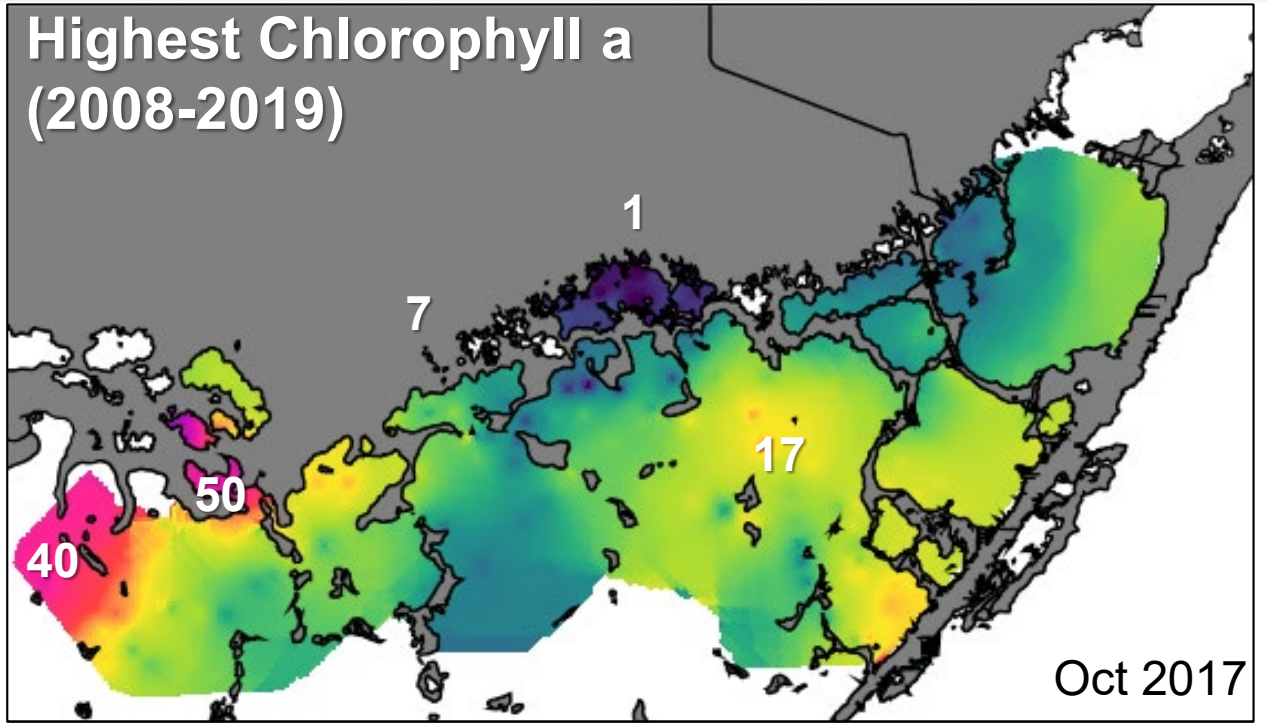




- High spatial variability in bay (range = <1-30 psu in Sept 2012)
- Almost entire bay can become hypersaline in wet season

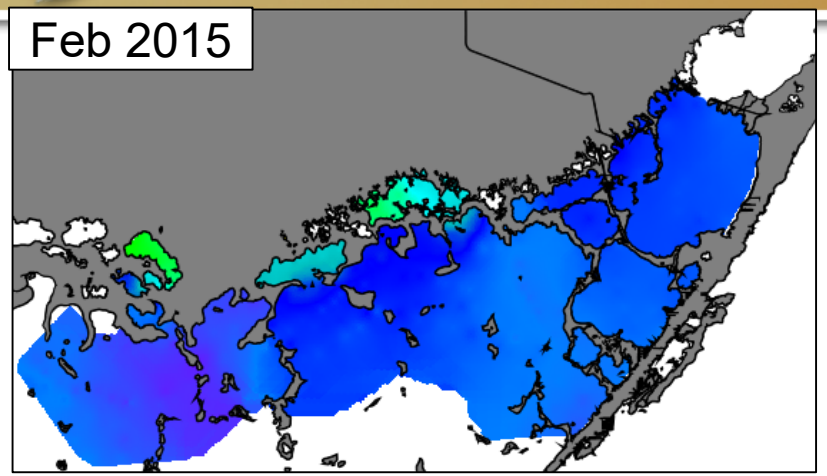
Phytoplankton in Florida Bay is generally low

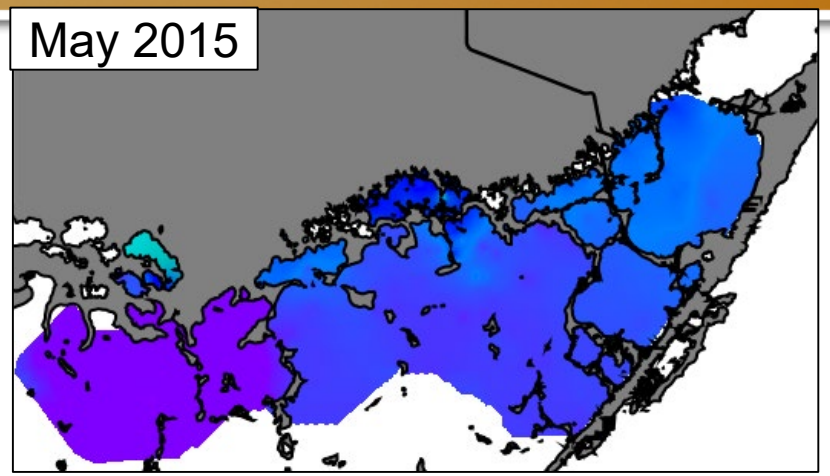


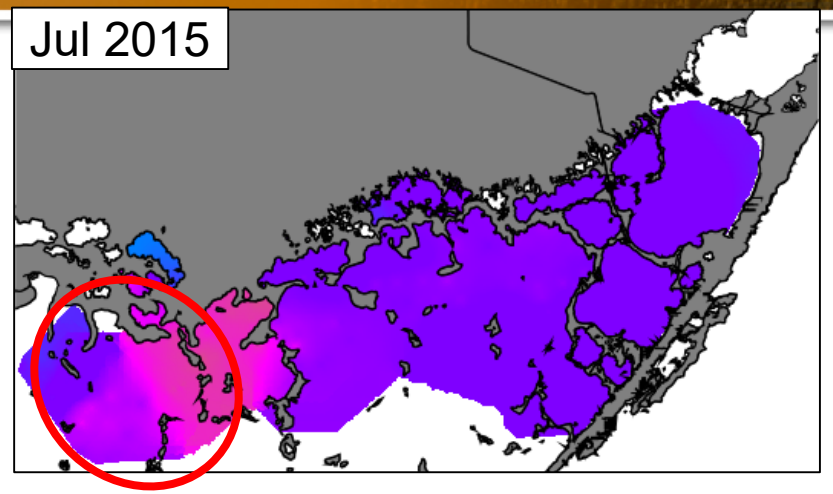


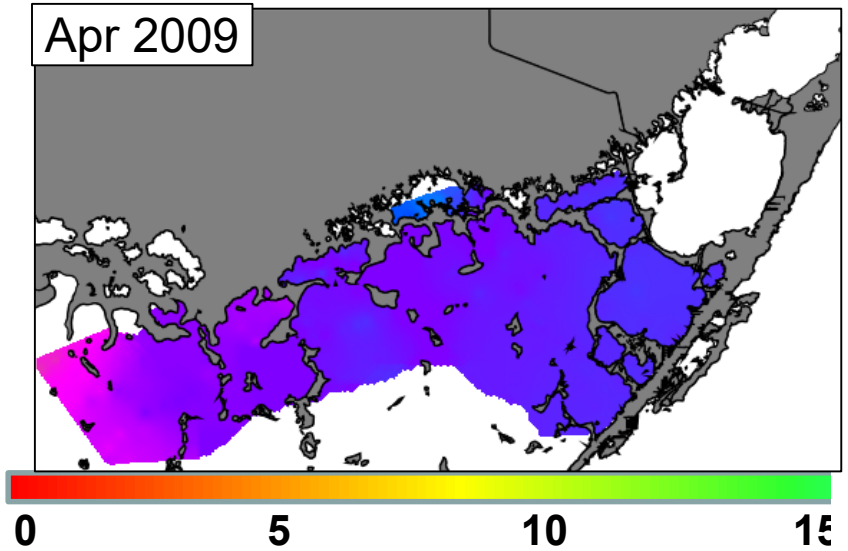
- Low baywide (<5 µg/l) indicating bloom conditions not persistent
- Higher in central lakes close to sources of CDOM and nutrients
- Event-driven extremes (e.g., high and low rainfall)

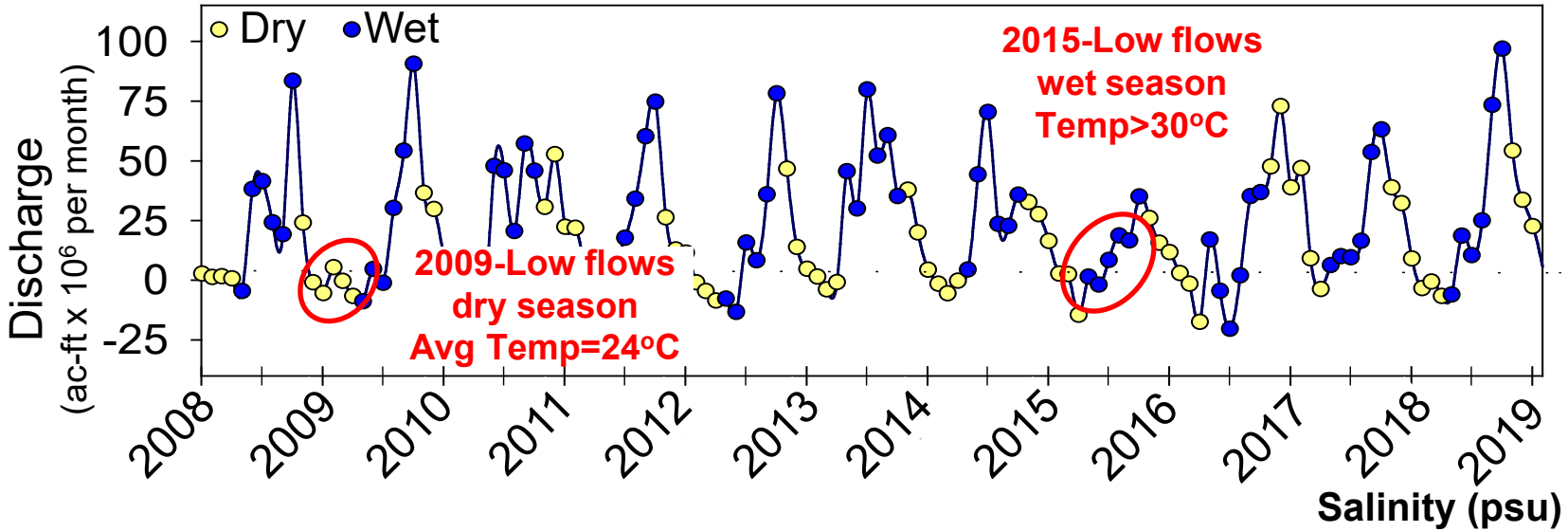
Salinity Response to Hydrology



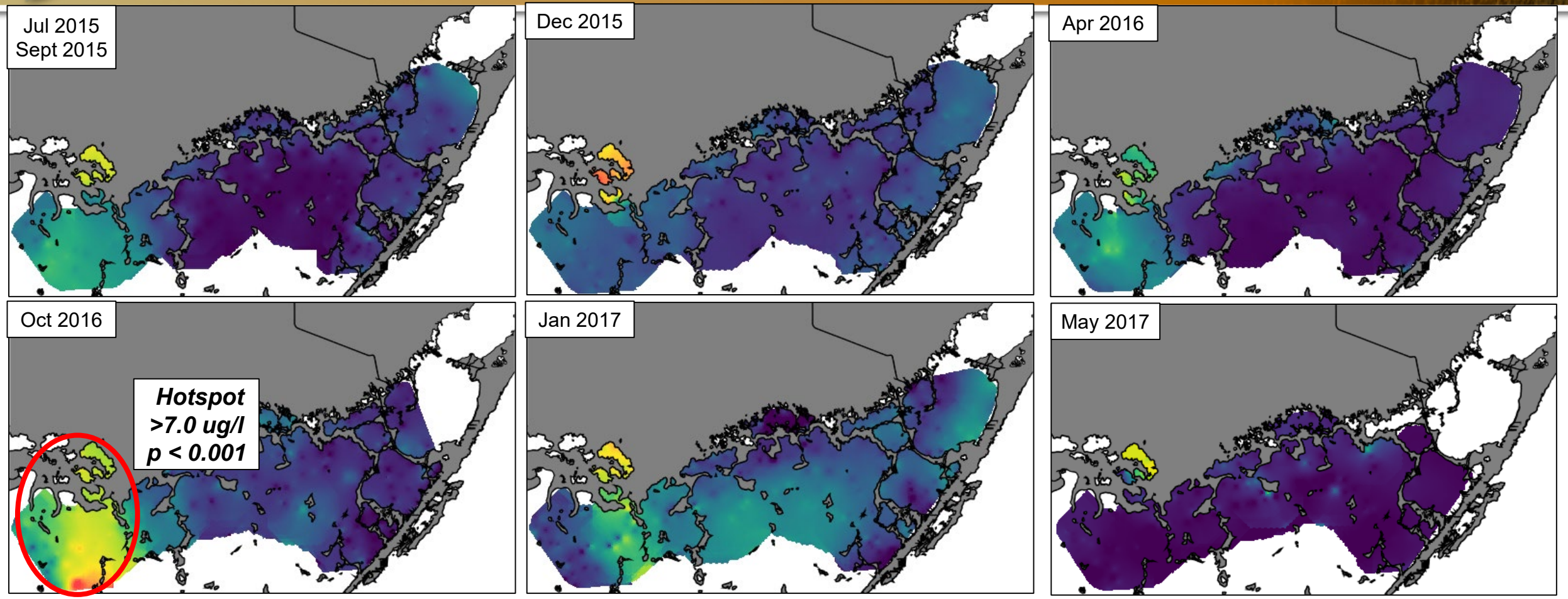








Localized Ecological Response to Seagrass Die-off



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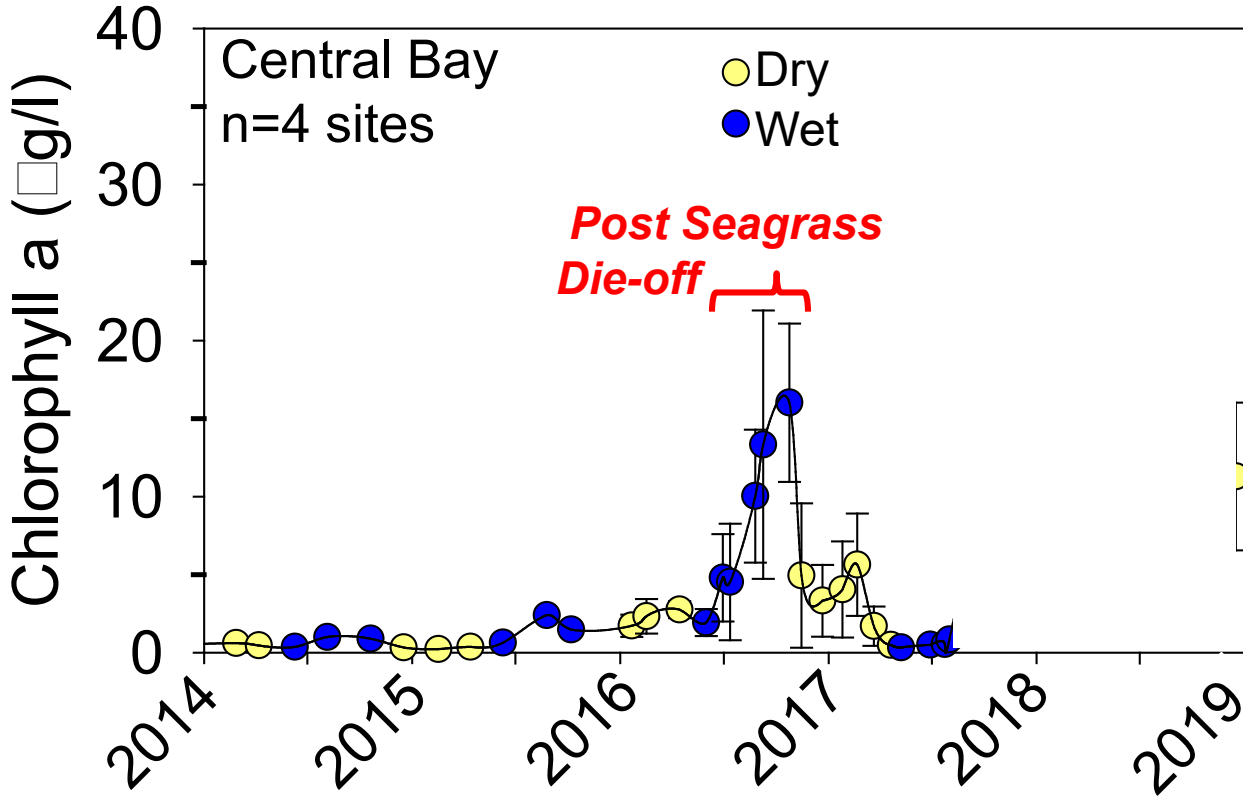
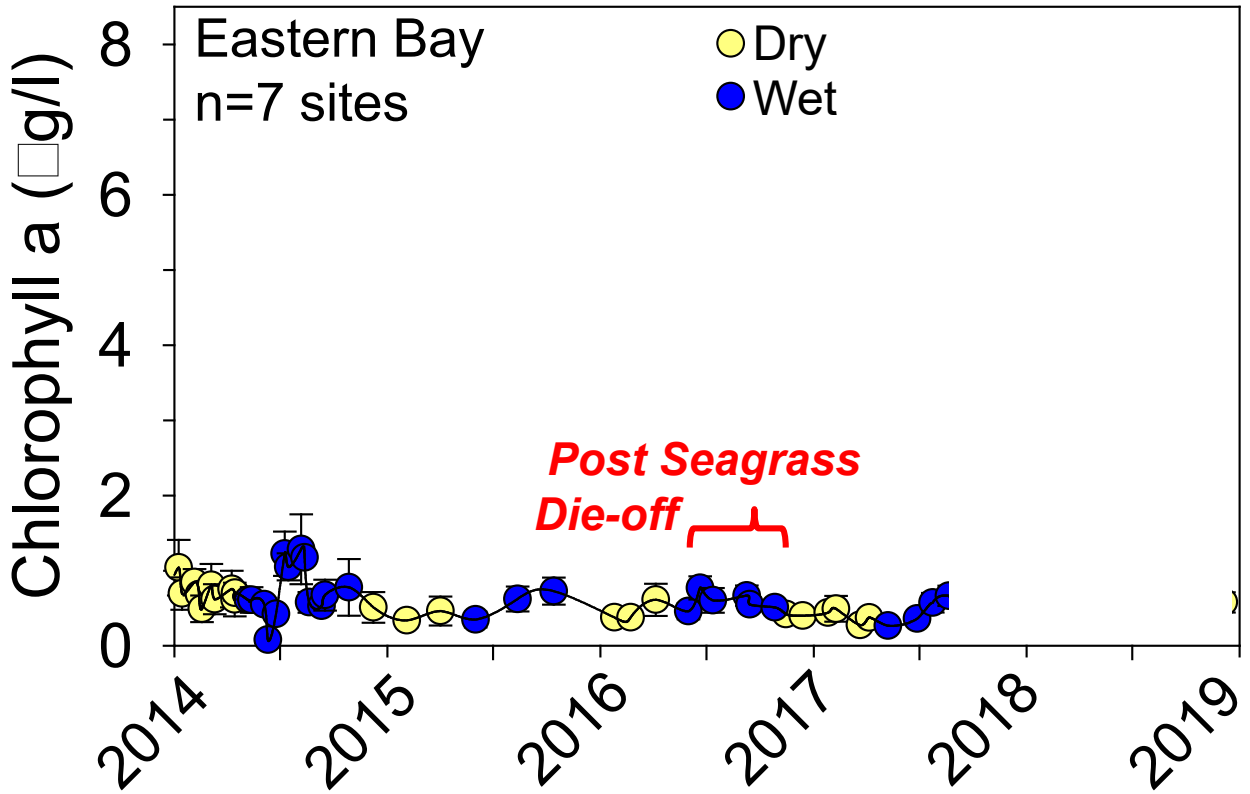
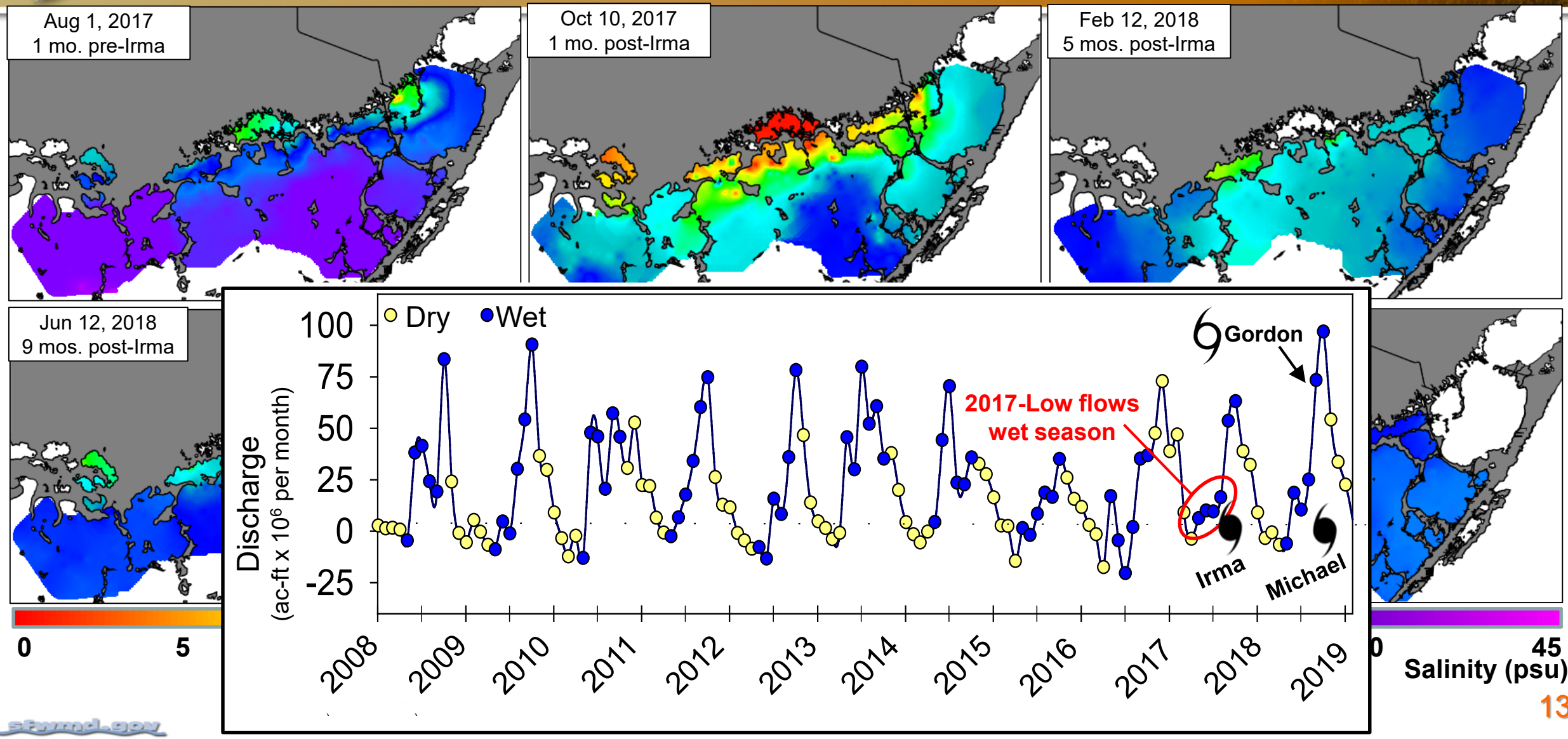


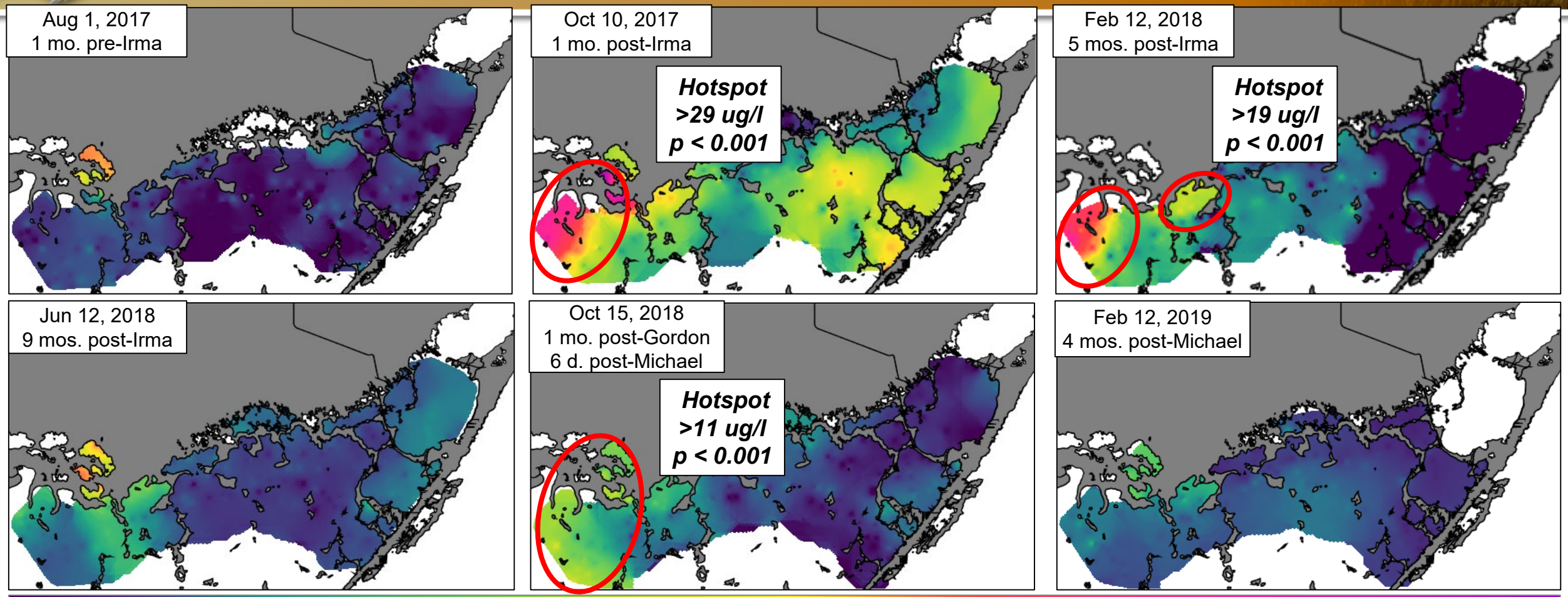


- 2016 phytoplankton bloom localized to 2015 seagrass die-off area in central bay

System-wide Response to Hurricane Irma in Florida Bay



Florida Bay Resilience to Disturbance Events



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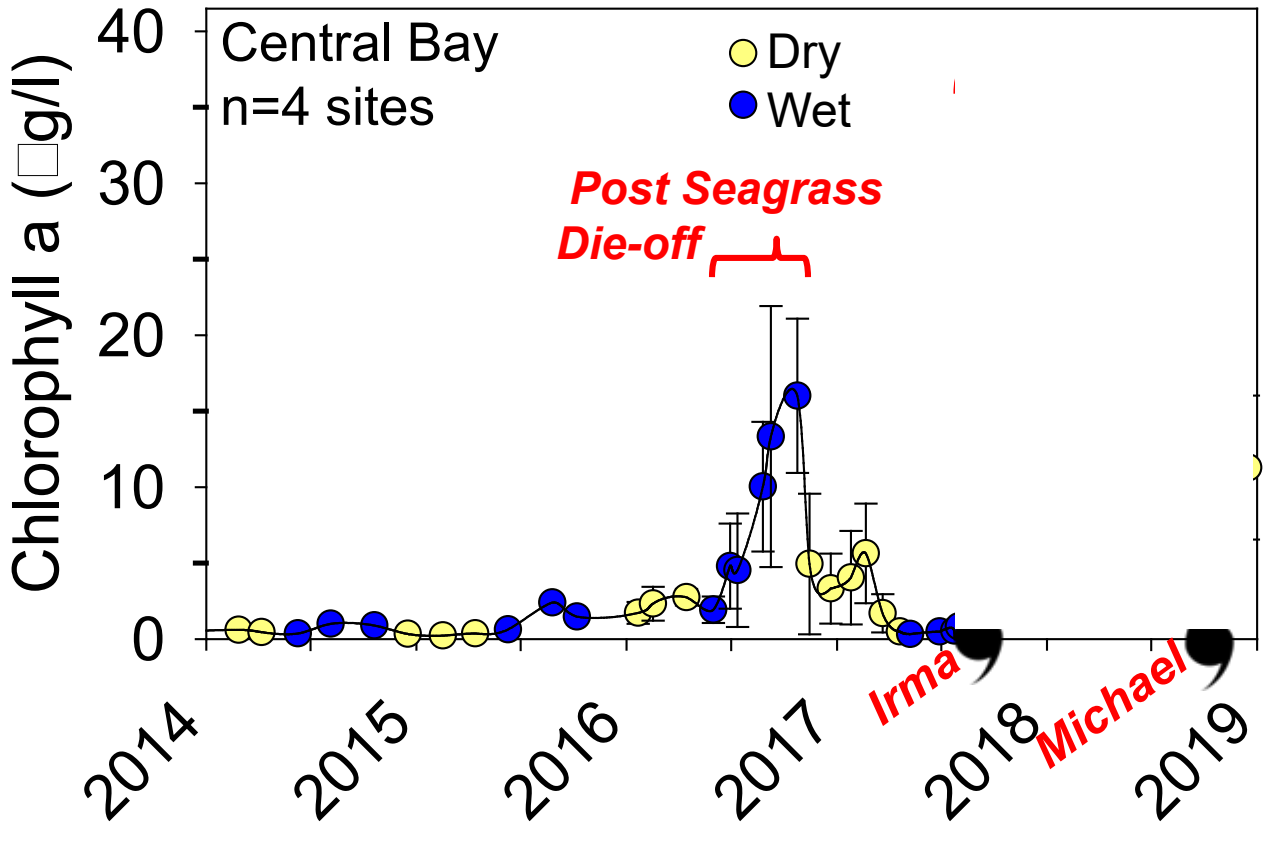

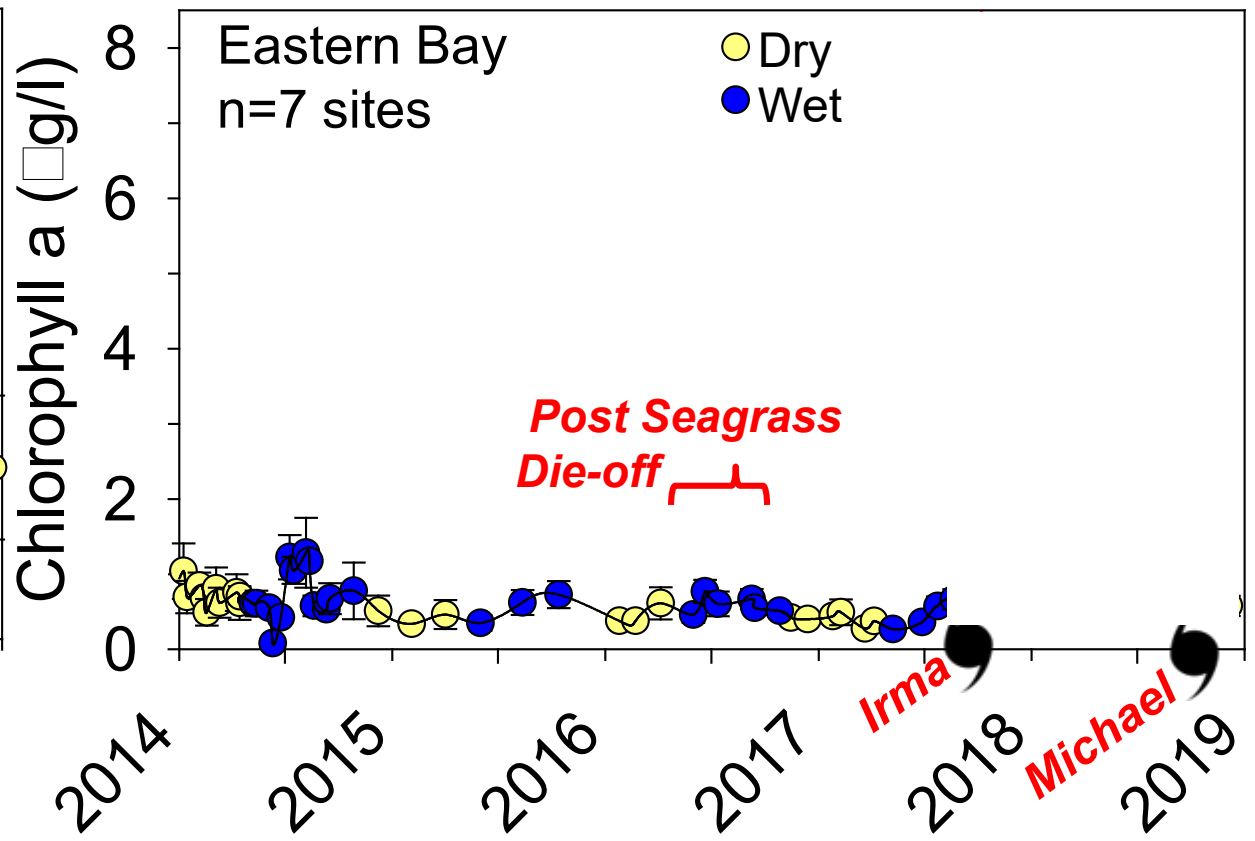

- Phytoplankton bloom bay-wide after Hurricane Irma (Sep 2017)
- Eastern bay resilient to single disturbance event
- Effects of hurricanes/tropical storm exacerbated by die-off (Central vs. Eastern Bay chlorophyll)

Fine-scale Understanding of Florida Bay Environmental Trends and Ecological Responses

- Ecological responses to hydrology: variability, timing, and extremes important

- Events cannot be viewed singularly:
  - El Niño (2015-2016) and Hurricane Irma (2017) precipitation/increased flows compensated for low flows
  - H. Irma exacerbated by die-off in Central Bay (existing detritus)
  - Long-term effects of die-off likely lessened by Irma (removal/flushing of system)

- Chlorophyll patterns highlight Florida Bay resiliency
  - Oct 2016 bloom did not persist
  - Post-Irma dissipated in East within 5 months
  - Continues decrease in Central

Questions?

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- Fabiola Santamaria
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FCE LTER

Resources:

Madden, C. and J.W. Day. 1992. An instrument system for high-speed mapping of chlorophyll a and physico-chemical variables in surface waters. *Estuaries*, 15(3), pp.421-427. DOI:10.2307/1352789.

Stachelek, J. and C. Madden. 2015. Application of Inverse Path Distance Weighting for high-density spatial mapping of coastal water quality patterns. *Int. J. Geographical Information Science.* DOI:10.1080/13658816.2015.1018833.

Dataflow interpolation documentation available at https://github.com/jstachelek/onboard-dataflow-processing

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