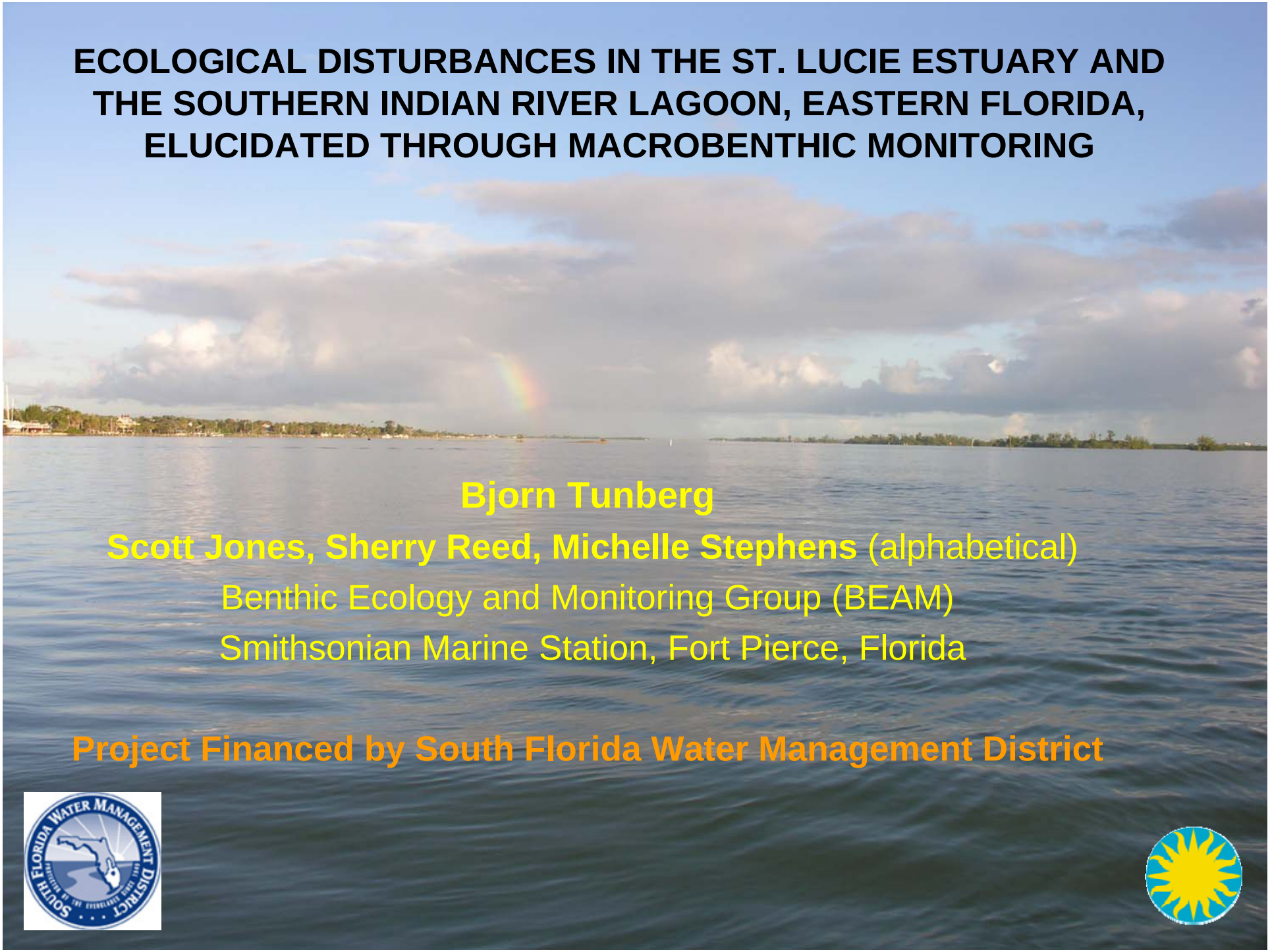
ECOLOGICAL DISTURBANCES IN THE ST. LUCIE ESTUARY AND THE SOUTHERN INDIAN RIVER LAGOON, EASTERN FLORIDA, ELUCIDATED THROUGH MACROBENTHIC MONITORING



Bjorn Tunberg

Scott Jones, Sherry Reed, Michelle Stephens (alphabetical)

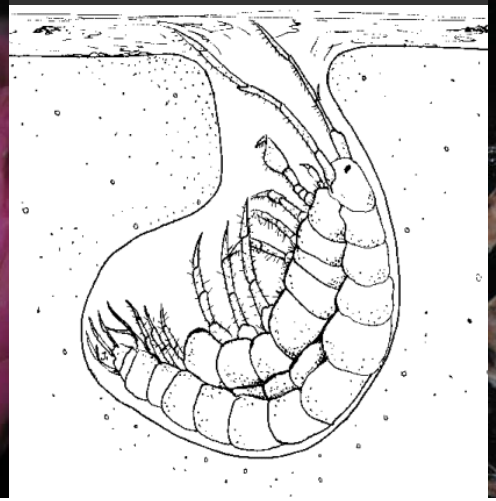
Benthic Ecology and Monitoring Group (BEAM)

Smithsonian Marine Station, Fort Pierce, Florida

Project Financed by South Florida Water Management District

Benthic Monitoring

- reliable indicators of habitat quality in aquatic environments.
- respond to multiple types of environmental stress.
- reflect environmental conditions that vary over time.
- live in bottom sediments where exposure to contaminants and oxygen stress are most frequent.
- indicate local conditions because they have limited mobility and cannot migrate to avoid stressful situations.



SAMPLING & LABORATORY PROCEDURES FOLLOW EPA AND ICES GUIDELINES

- 13 fixed sites sampled quarterly starting in February 2005 (15 sites from 2007),

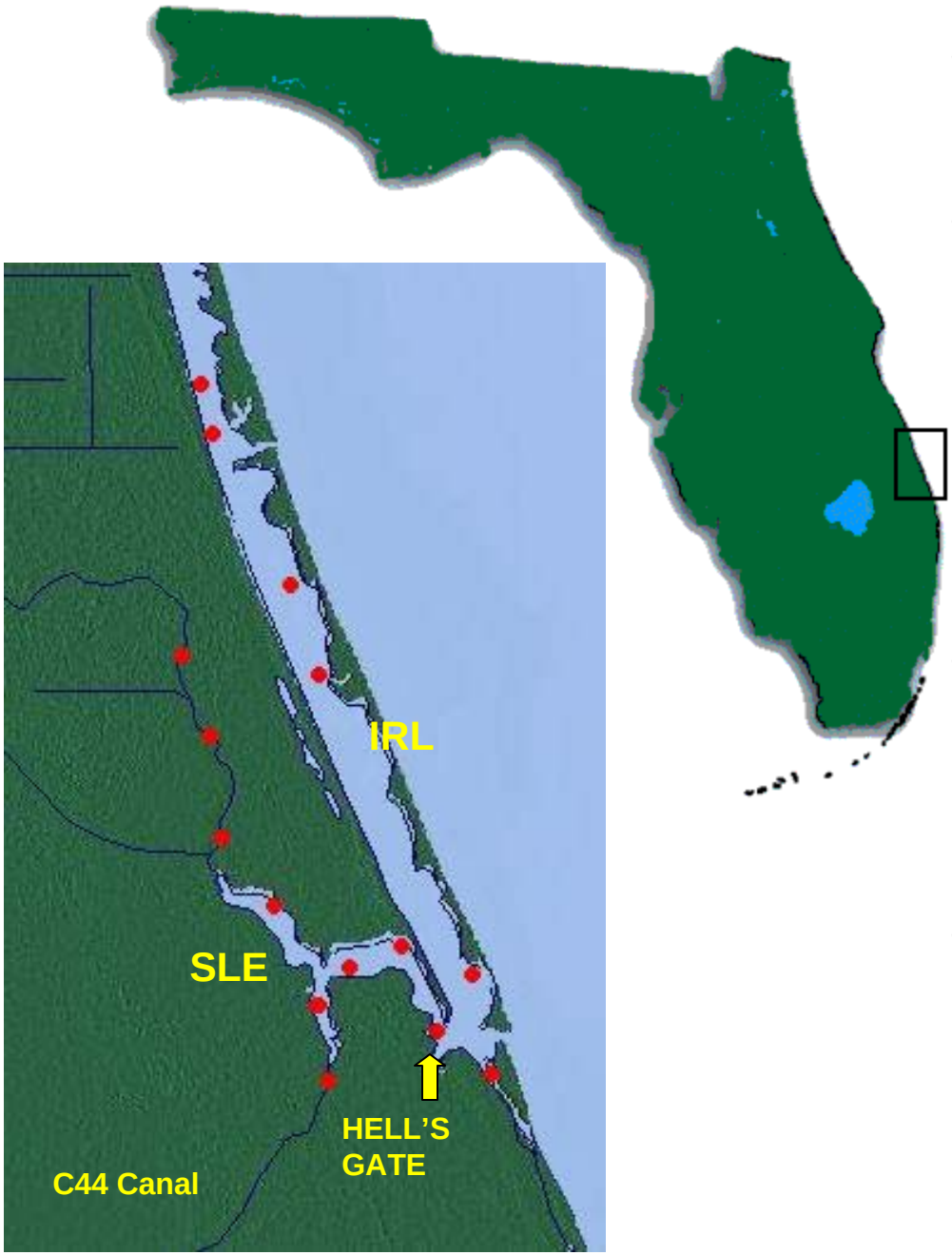
- 0.02 m^2 Petite Ponar grab (three replicates per site)
  - sieved through 0.5 mm, fixed in formalin & stained with Rose Bengal
  - transferred to ethanol in lab

- Sediment cores 0-2 cm & 2-5 cm
  - analyzed for percentage water and organic content (LOI)

- Environmental parameters (temp profile, salinity profile, pH, DO, turbidity, secchi depth, weather)

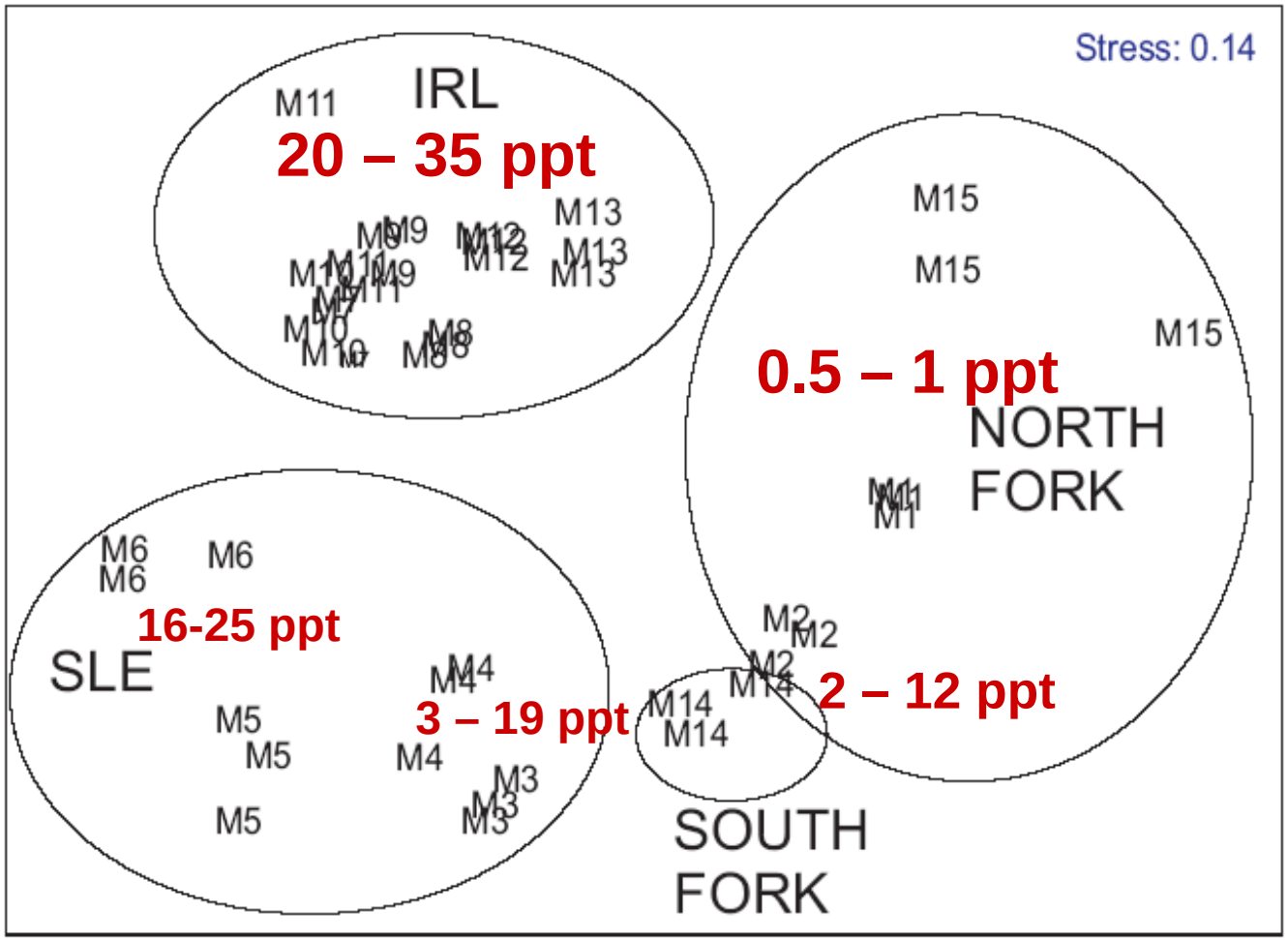
- Samples sorted in lab, identified to lowest possible taxonomic level

The Indian River Lagoon and The St. Lucie Estuary



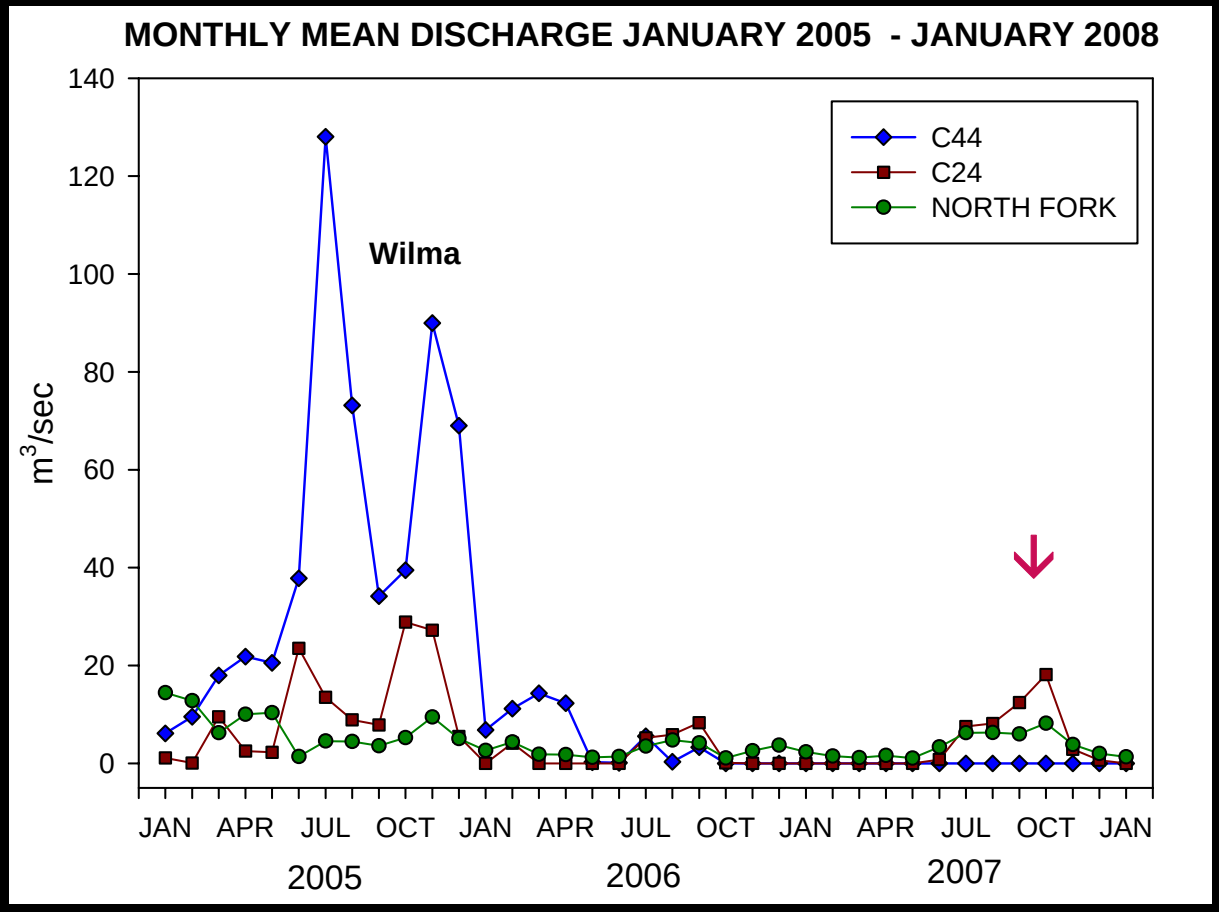
- One of the largest estuarine water systems on the east coast of Florida
- The St Lucie Estuary includes:
  - the North Fork and the South Fork (surface area of about 17 km^2 (6.4 square miles)
  - a single Middle Estuary (surface area of 12 km^2 (4.7 square miles)
- The middle estuary extends east for 8 km (5 miles) until it meets the Indian River Lagoon, opening to the Atlantic Ocean at the St. Lucie Inlet
- Diversity and function threatened by a host of ecological stressors:
  1. Irregular, extreme salinity shifts
  2. Accumulation of soft, reducing sediments
  3. Elevated nutrient & DOM input

- **Distinct , consistent zonation patterns**
- **Structured by salinity**



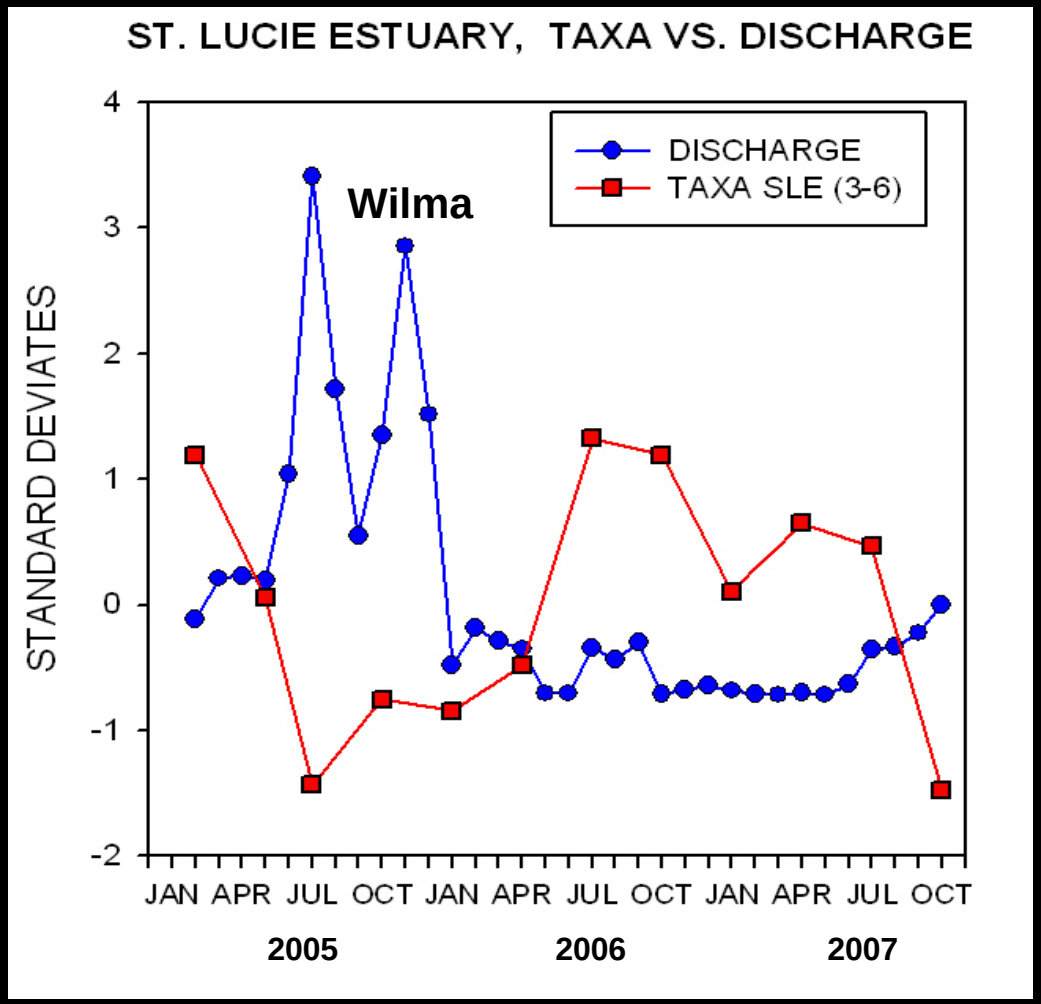
FRESHWATER INPUT

- **Unstable estuarine salinity has the most significant effect**
- **Study period (2005-2008) has witnessed extreme high flows (storm events and discharges) and extreme low flows (drought)**
- **Primary source of freshwater release is Lake Okeechobee via the C-44 canal**



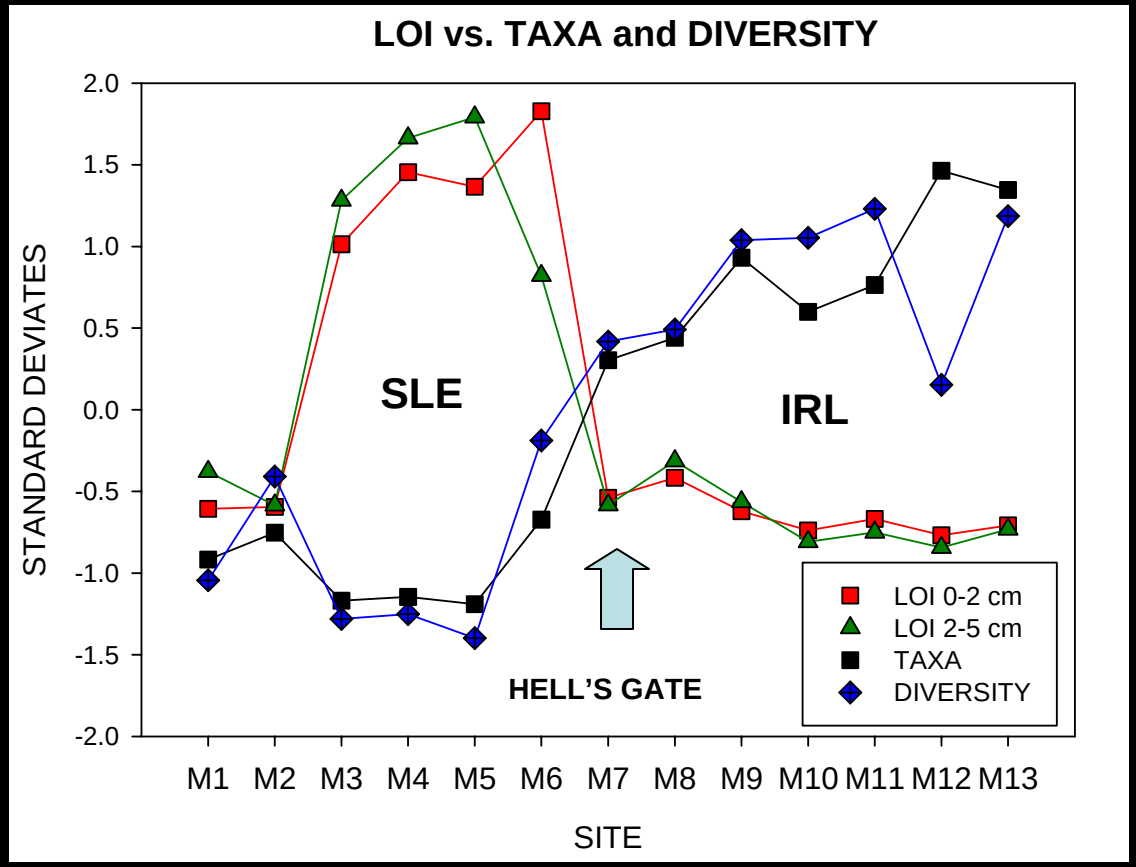
Source:
DBHYDRO

- **Periods of high and low discharge causes alternating shifts between estuarine and freshwater species**
- **Deteriorating water quality has led to an overall decrease in benthic diversity, coupled with an increase in pollution-tolerant species.**



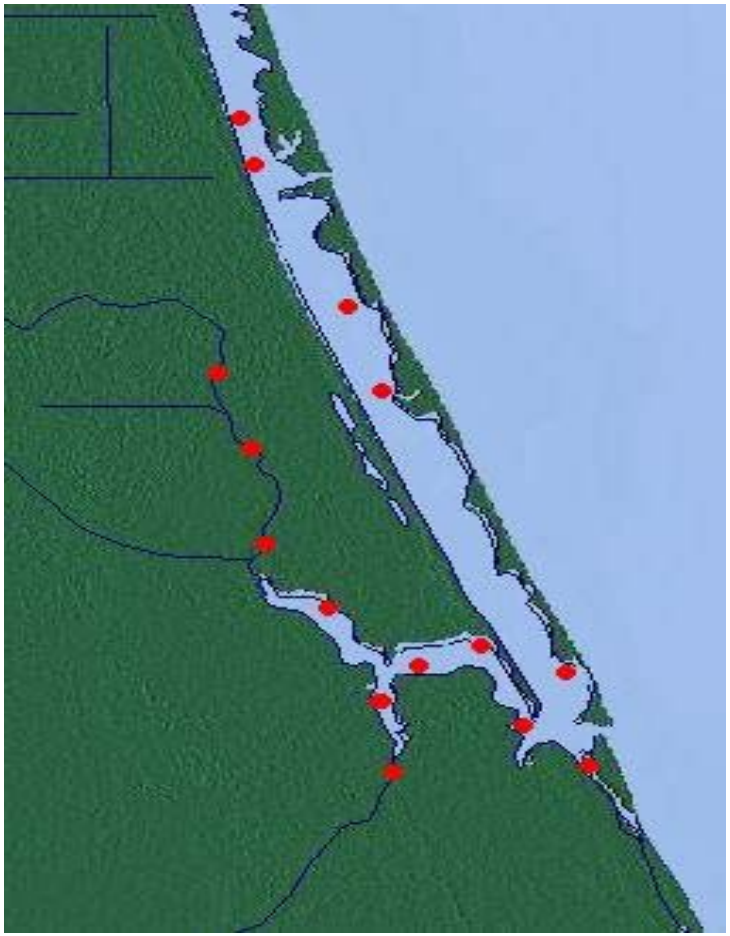
CONTAMINATED SOFT SEDIMENTS (CSS)

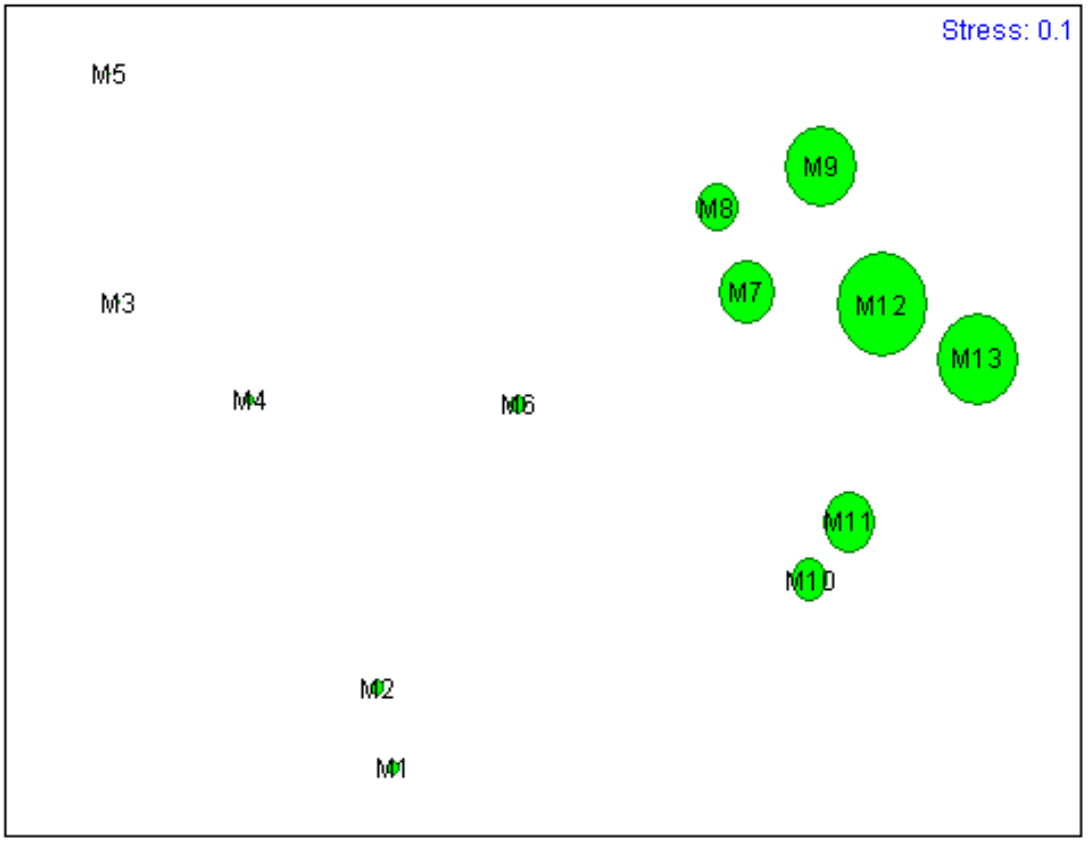
- Accompanies regulatory freshwater releases
- Large deposits of CSS affect the inner estuary
- Accumulation causes: oxygen depletion, build-up of ammonia and sulfide; settlement inhibition; filter-feeder exclusion
- Significant improvement past Hell's Gate and in
- the IRL (increased current velocity, increased tidal flushing)



Hell's Gate a tipping point?

- Higher salinity (slightly)
- Dramatically better sediment quality
- Dramatic increases in species richness, diversity

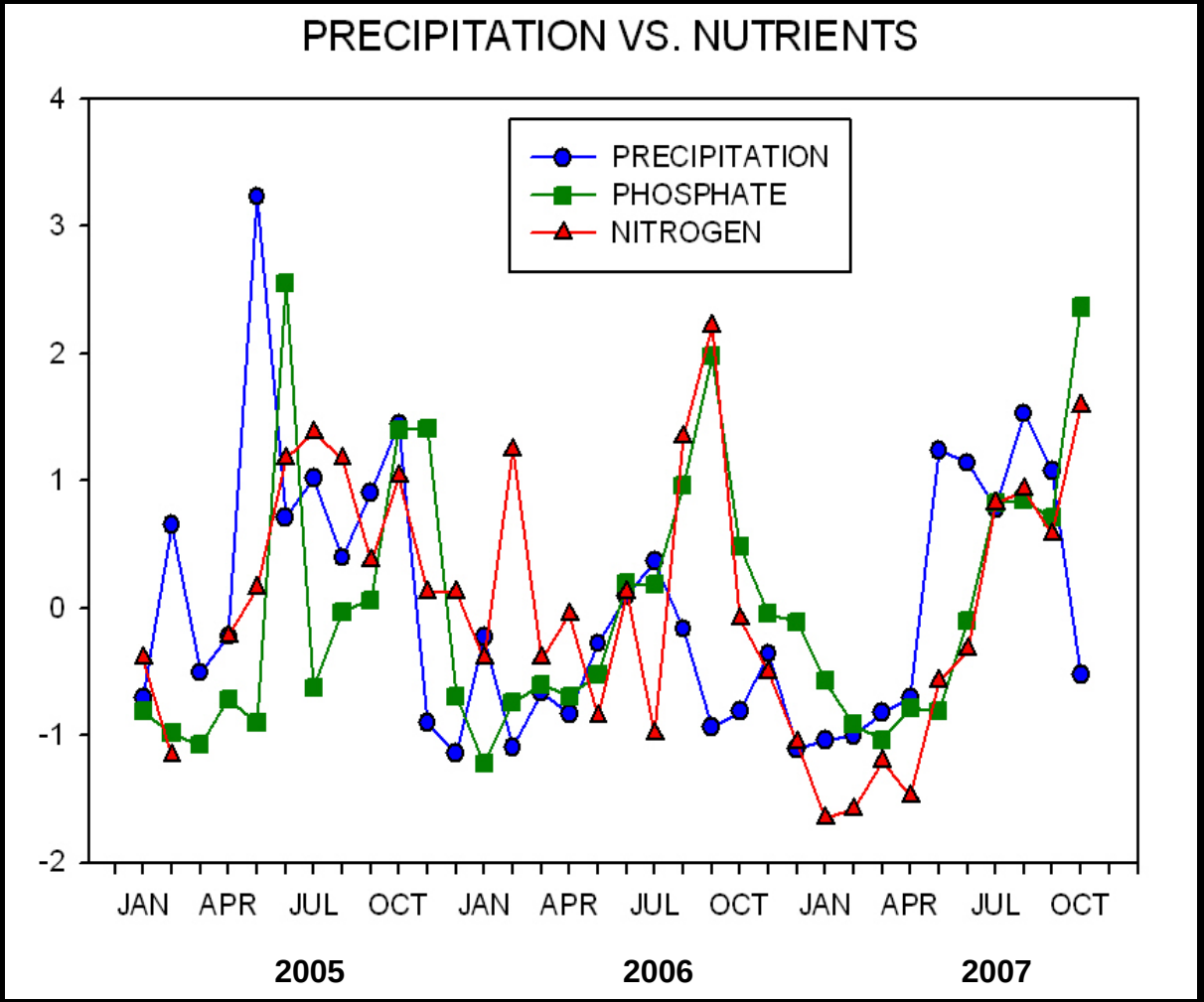




NUMBER OF TAXA

NUTRIENTS

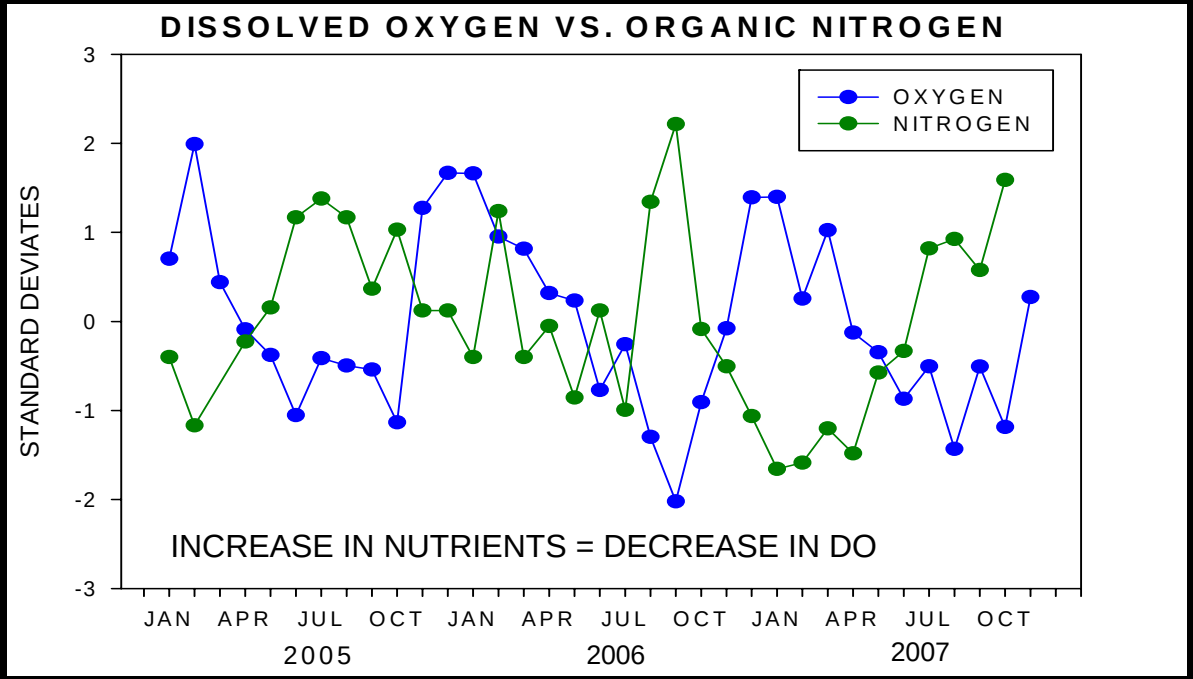
- Throughout the study period, regulatory releases and precipitation (shown here) have delivered dramatic nutrient pulses to the SLE
- Results in classic symptoms of eutrophication, increasing biological oxygen demand, and severely decreasing D.O. in the sediment

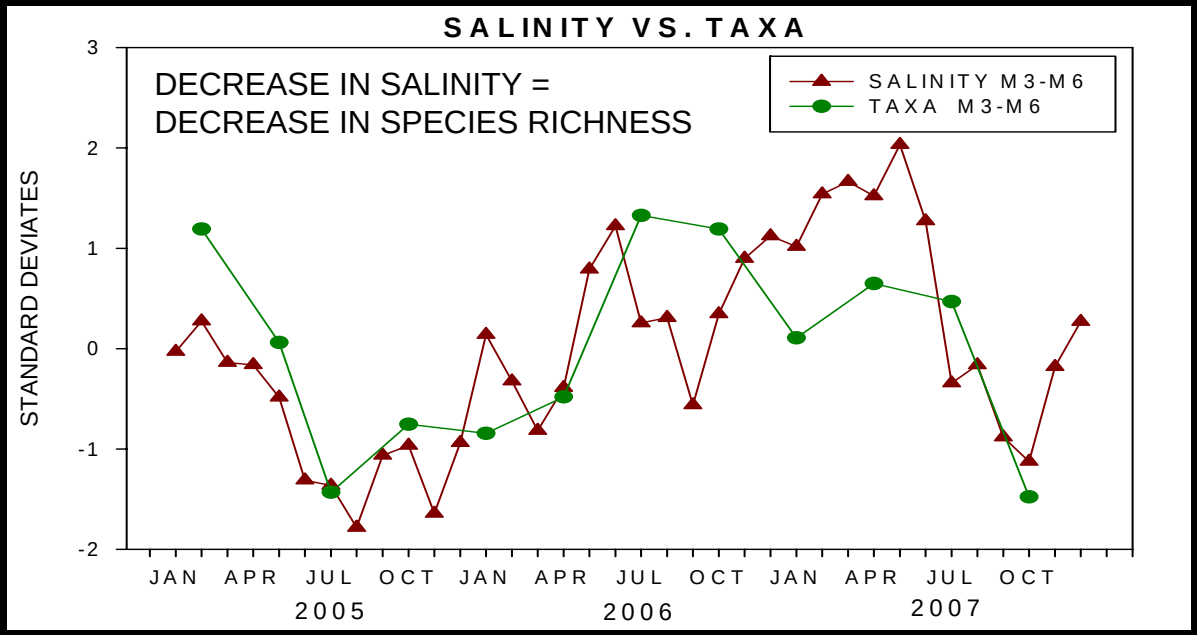


Source: DBHYDRO

FINDINGS

- **Drought of 2006-2007 has allowed assessment of low-flows to the St Lucie Estuary**
- **Initially, richness and abundance returned to the estuary**
- **A brief and relatively rainy period in late summer 2007, delivered a large pulse of nutrients to the estuary….inducing severe hypoxia and one of the worst decreases in species richness in the study period**
- **Established the importance of a whole-watershed approach and stormwater treatment**





Source: DBHYDRO

THANK YOU!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