

# Monitoring our waters with innovative technology



Dr. Edie Widder, Co-Founder, CEO & Senior Scientist  
Ocean Research & Conservation Association

[www.teamorca.org](http://www.teamorca.org)



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# Ocean Research & Conservation Association

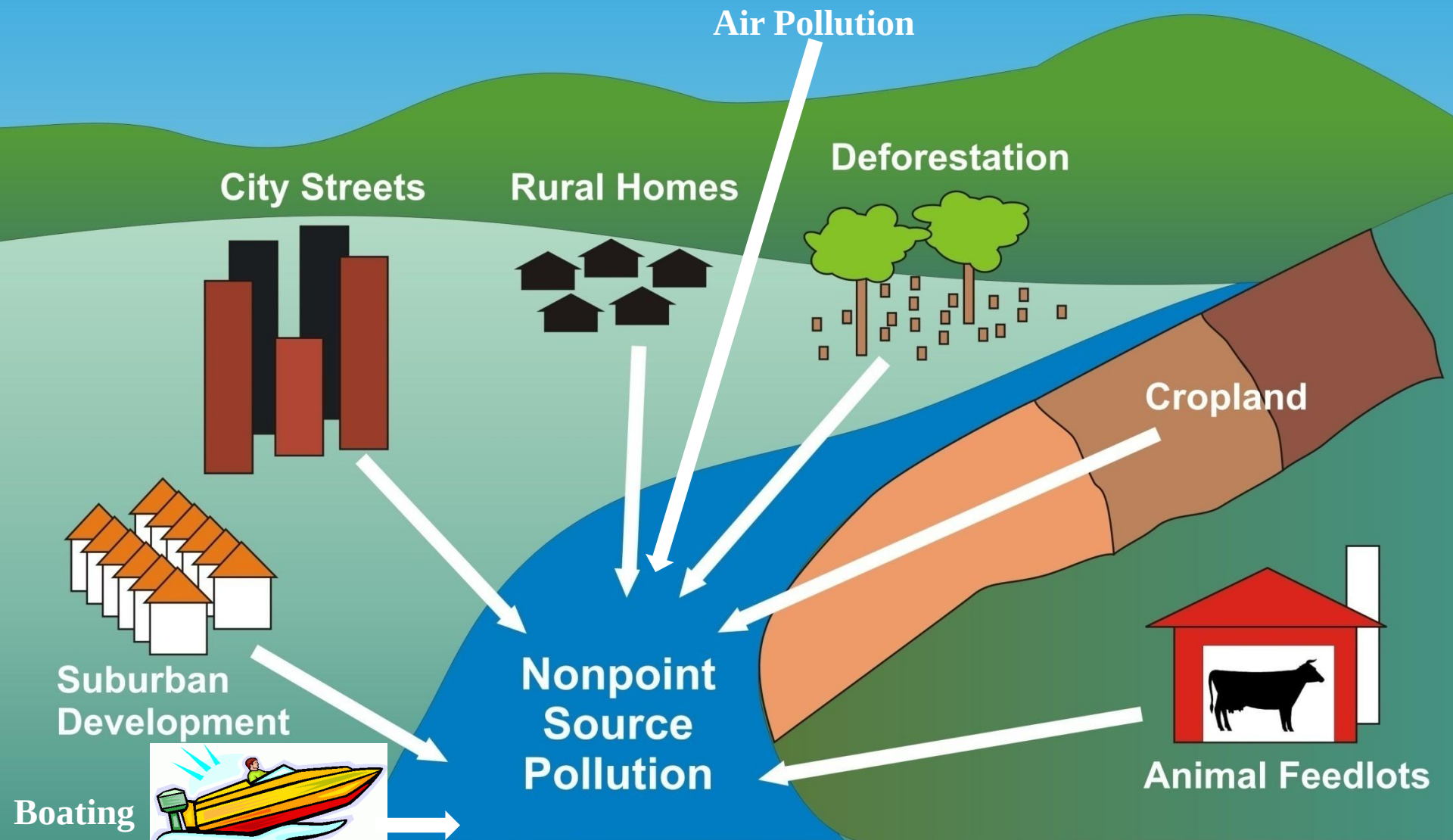
Dedicated to protecting aquatic ecosystems and the species they sustain through the development of innovative technologies and science-based conservation action.



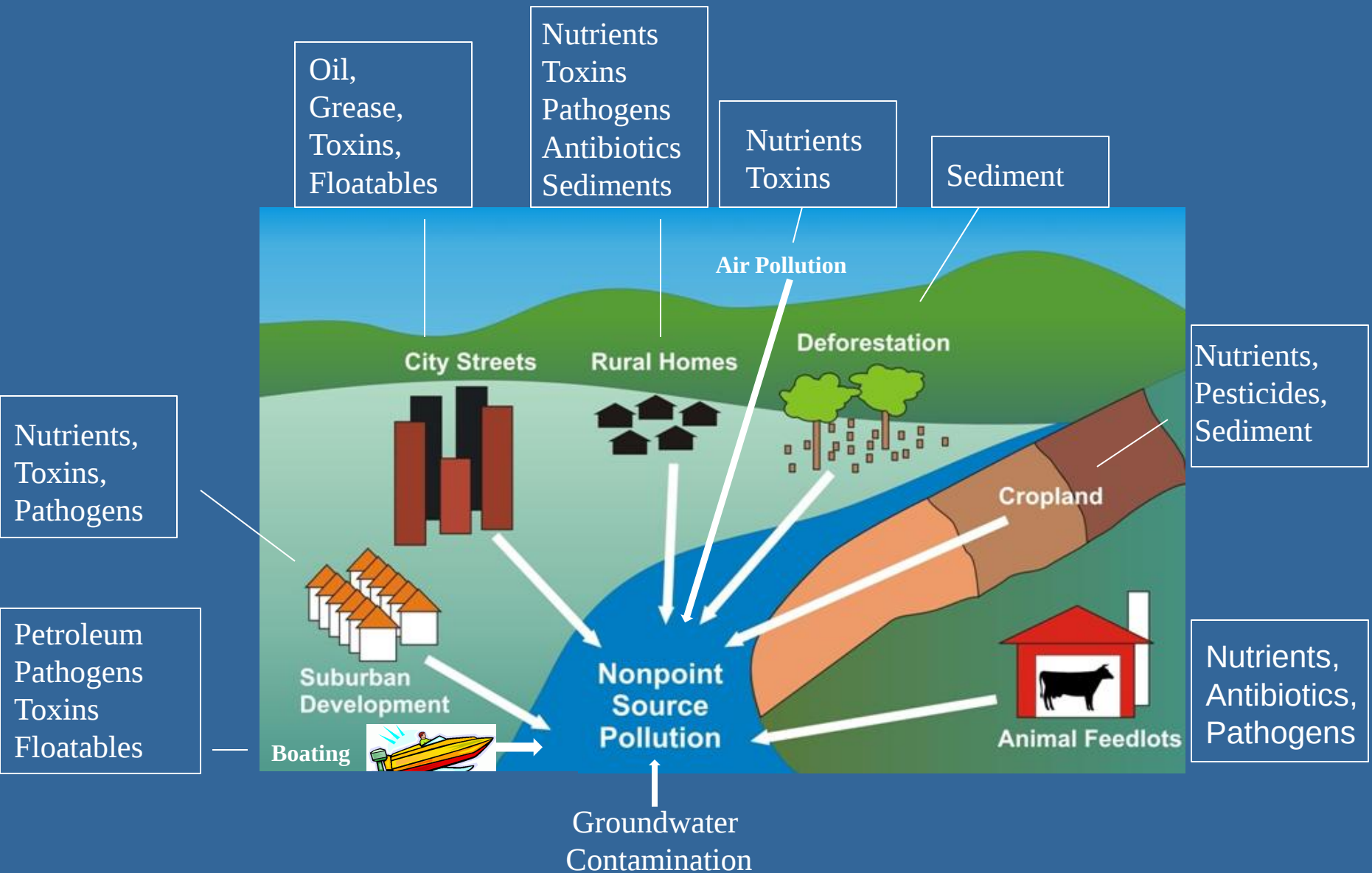
IRS 501(c)(3) Nonprofit Corporation

**ORCA**

# Nonpoint Source Pollution



# Nonpoint Source Pollution







# Finding Pollution Sinks



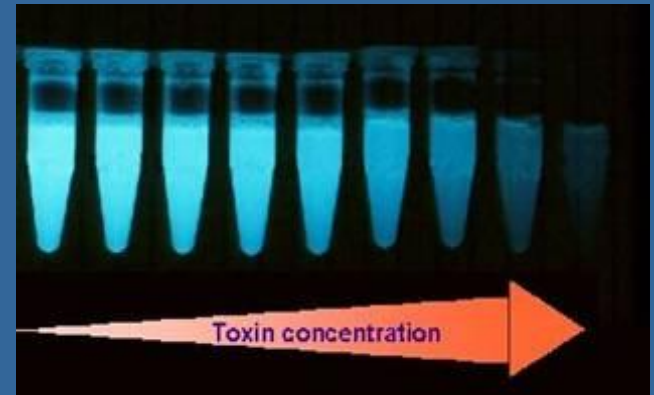
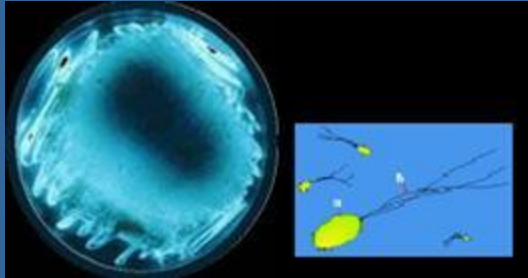




# FAST

## FAST ASSESSMENT OF SEDIMENT TOXICITY

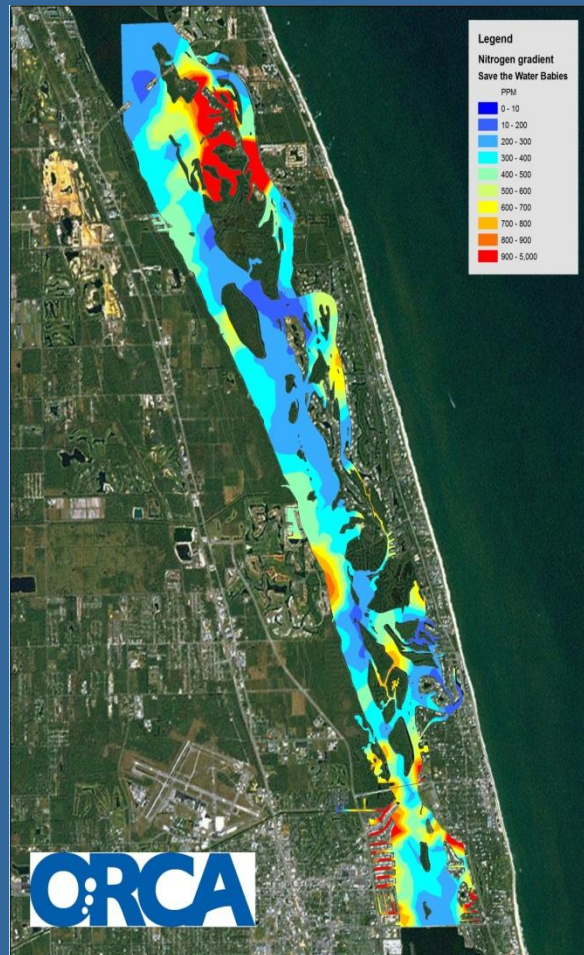
### MICROTOX BIOASSAY



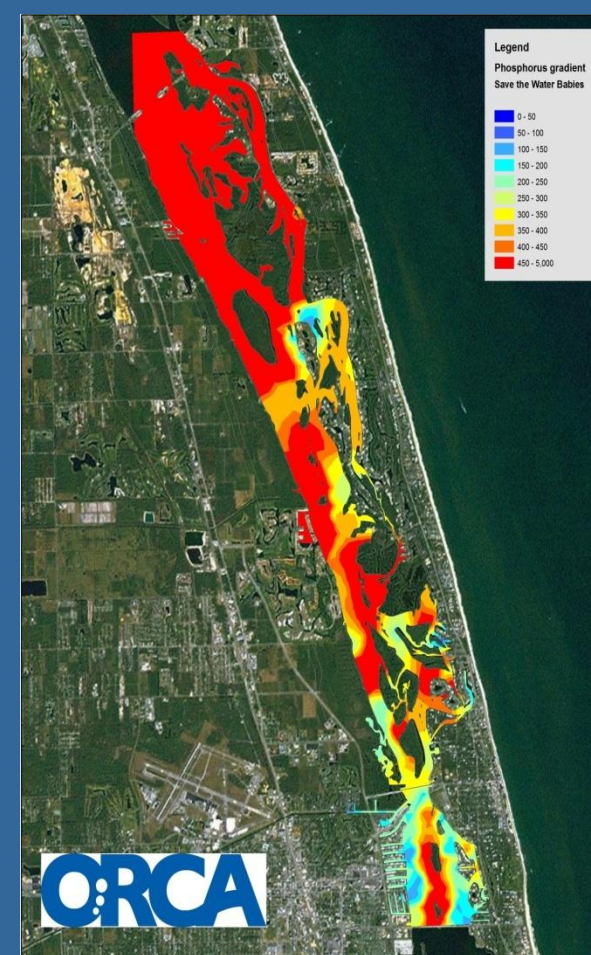
# Mapping



Relative Toxicity



Total Kjeldahl  
Nitrogen



Total Phosphorus

# Vero Beach Map a Mile





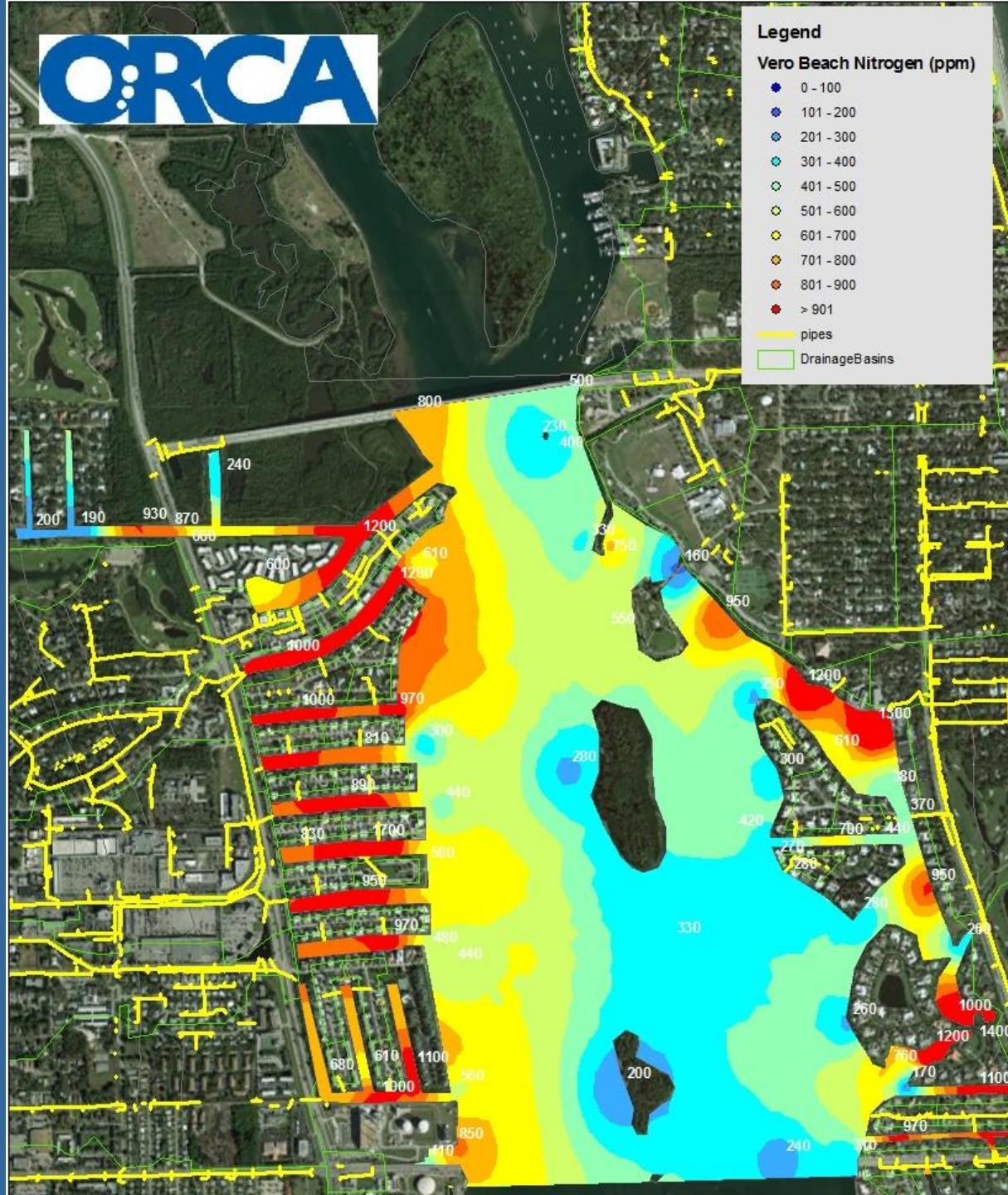
# Legend

## Vero Beach Nitrogen (ppm)

- 0 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- > 901

pipes

DrainageBasins



KILROY  
IS  
HERE



**ORCA**



## Kilroy ecosystem monitoring

- Real time
- Wireless
- Low cost
- Easy to install

Kilroy  
Sensor  
Suite



10 W  
Solar  
Panel

Kilroy's Voice  
(Telemetry Unit)

Kilroy's Hatrack



## Kilroy Measurements

Rainfall  
Solar insolation  
Wind speed  
Wind direction

Salinity  
Temperature  
Water level  
Wave height  
Wave period  
Flow magnitude  
Flow direction  
GPS (position, UTC)  
Turbidity  
Speed of sound  
Bioluminescence

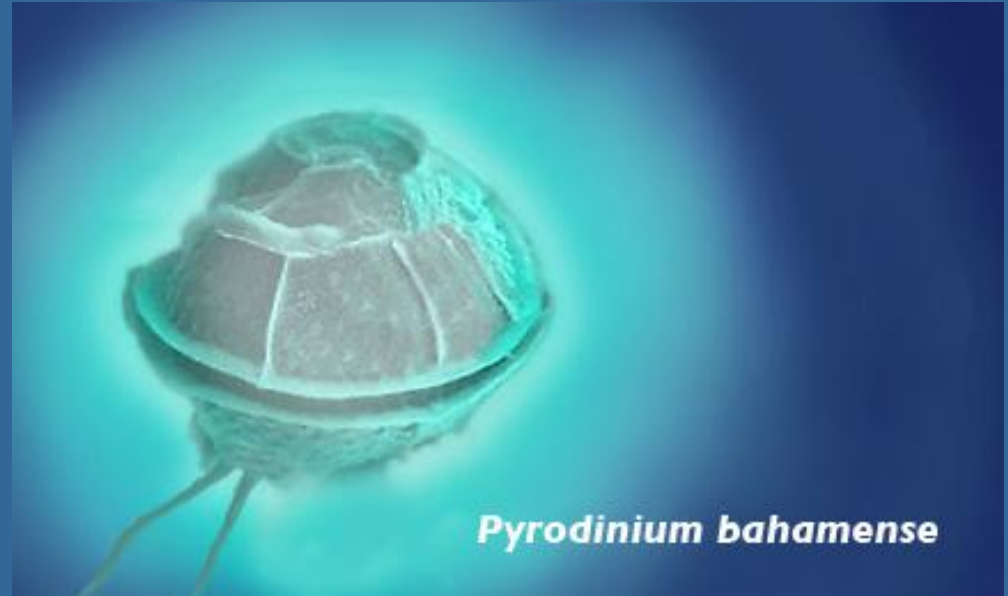
### Kilroy ecosystem monitoring

- Real time
- Wireless
- Low cost
- Easy to install

# Bioluminescence monitoring of two important species in the Indian River Lagoon, Florida

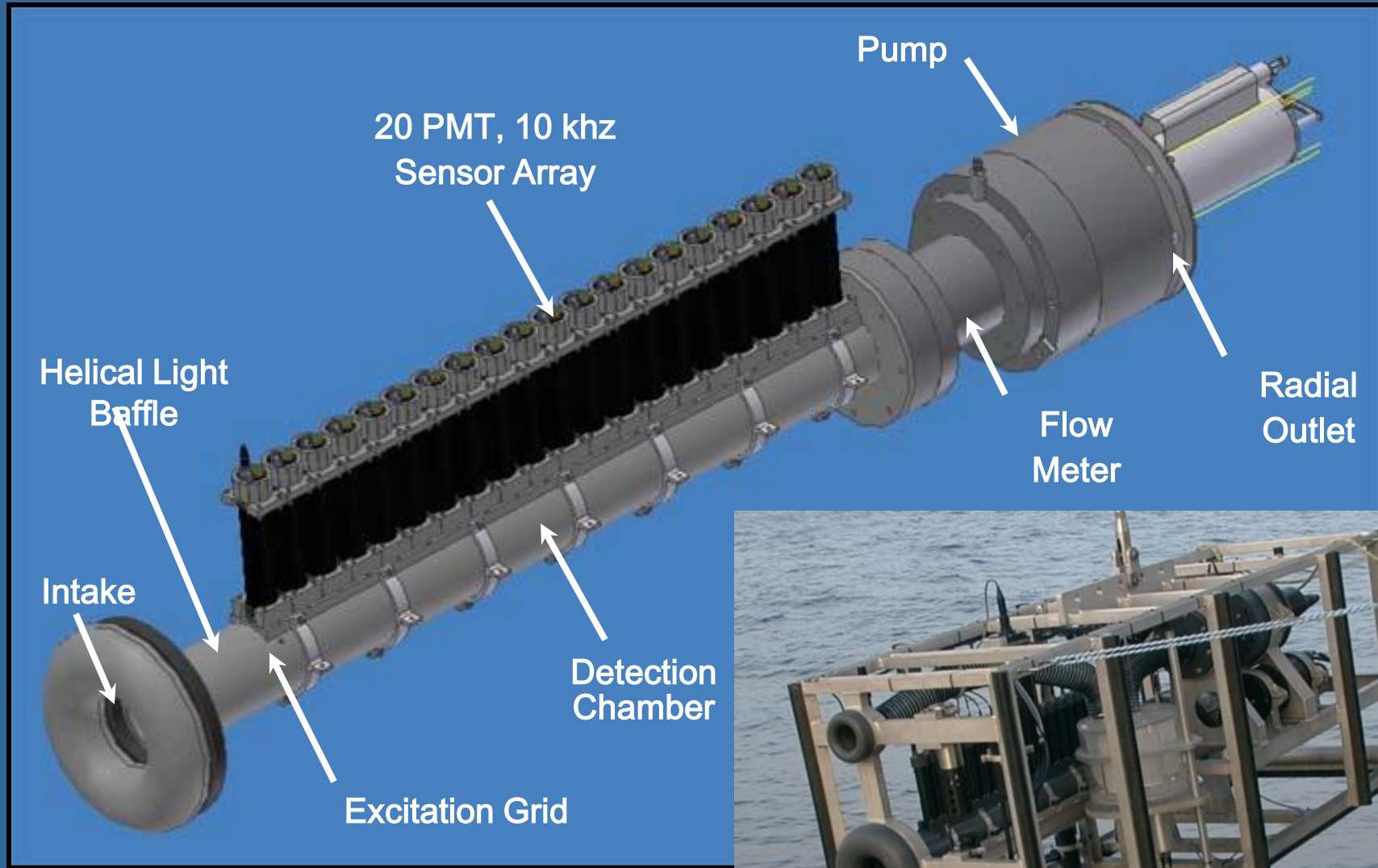


The comb jelly *Mnemiopsis*

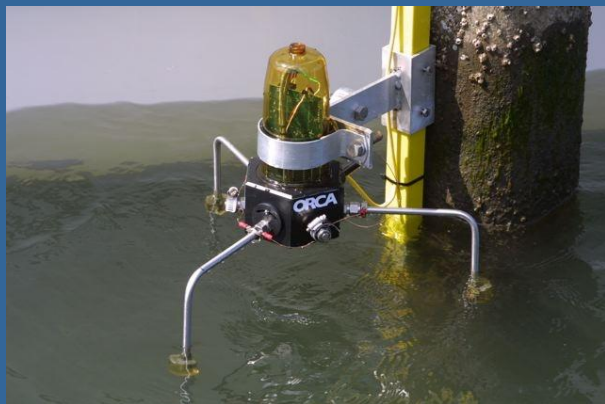


The toxic dinoflagellate *Pyrodinium bahamense* var. *bahamense*

# HIDEX-Bathyphotometer



# ORCA Kilroy Integration with 3<sup>rd</sup> Party Sensors



pH  
sensors

Nutrient  
sensors

Dissolved  
Oxygen Probes

Crude Oil  
Probes

Hydrocarbon  
Probes

Weather  
Stations



Sondes



PetroSense



OCEAN RESEARCH & CONSERVATION ASSOCIATION

CHANGING THE NATURE  
OF AQUATIC CONSERVATION

ABOUT ORCA

COASTAL PROGRAMS

DEEP SEA PROGRAMS

HOW YOU CAN HELP

MEDIA & EVENTS

ORCA STORE



ORCA IS DEDICATED TO THE PROTECTION & RESTORATION OF AQUATIC ECOSYSTEMS & THE SPECIES THEY SUSTAIN THROUGH THE DEVELOPMENT OF INNOVATIVE TECHNOLOGIES & SCIENCE BASED CONSERVATION ACTION. PLEASE HELP SUPPORT OUR MISSION.

[MAKE A DONATION](#)



## Live Kilroy Data

View live, realtime Kilroy data and meteorological data from the Ft. Pierce Inlet, FL.  
[View Feed](#)



Ocean Research & Conservation Association

✓ Like You like this.

## LATEST HEADLINES



### The Campaign for a Clean Indian River Lagoon

ORCA has created a Campaign for a Clean Indian River Lagoon. The plan includes simple steps; first we will create a pollution gradient map of the entire 156 miles of the Indian River Lagoon. Then we will install 50 ORCA Kilroy™ water monitoring devices in the lagoon. With these two steps, sources of pollution can be identified and then be corrected or eliminated and nature can be restored. To learn more about ORCA's Campaign for a Clean Indian River Lagoon. [Click Here](#)



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## Kilroy IRL Observation System

[Terms and Conditions](#)

[User Home](#)

### Kilroy-FPI #4

GPS Location N 27° 28' 38"  
W -80° 19' 04"

Battery 14.1 V

Depth 0.55 m (1.80 ft)

Gain Setting 1

RRMS 1301.5

RSSI -69.0 dB

Flow Dir. E ( 91°)

Flow Speed 0.539 m/s (1.206 mph)

Salinity 31.41 PSU

Turbidity 14.5 NTU

Water Temp. 21.4°C (70.5°F)

[Data Table](#)

[Detailed Graphs](#)

*This mooring is sponsored by*

**Team ORCA**



Fort Pierce Inlet Project - location 'West Inlet'



[Map Data](#) - [Terms of Use](#)

### Mooring List

 Kilroy-FPI #1

 Weather Station #1

 Kilroy-FPI #5

 Kilroy-FPI #2

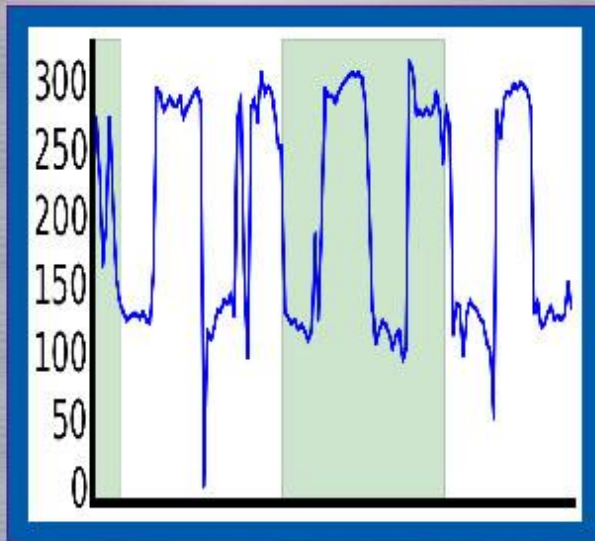
 Kilroy-FPI #3

 Kilroy-FPI #4

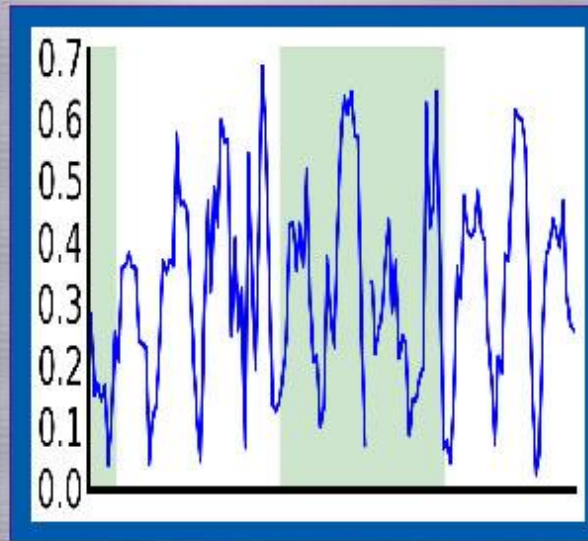
### Data for Kilroy-FPI #3 over past 3 days

*(shaded regions are alternating days, click on plot for detailed view)*

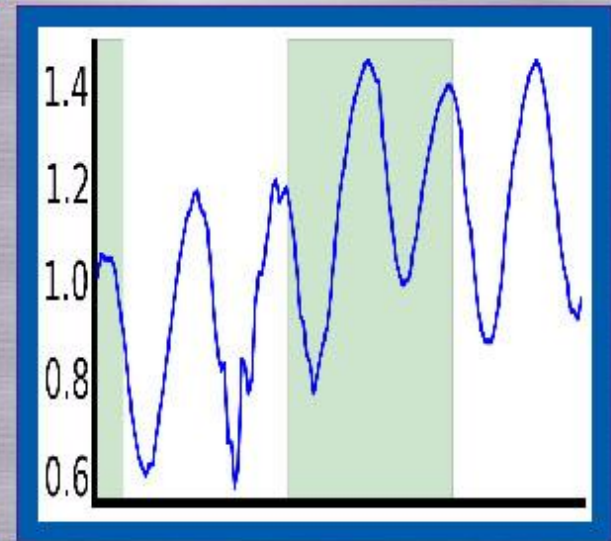
Flow Direction (0-360)



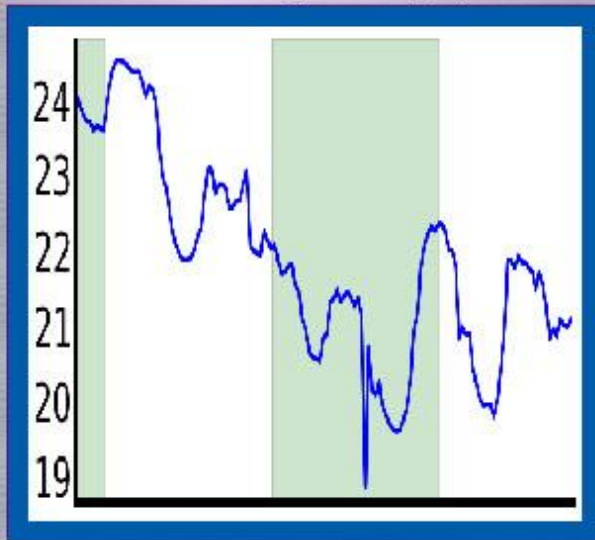
Flow Speed (m/s)



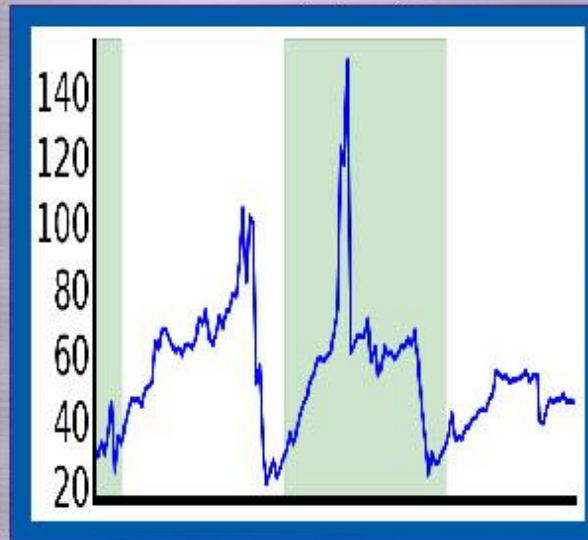
Depth (m)



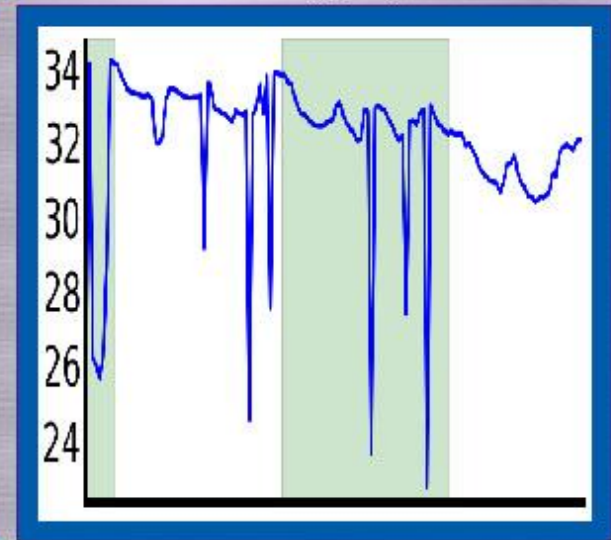
Water Temperature (°C)



Turbidity (NTU)



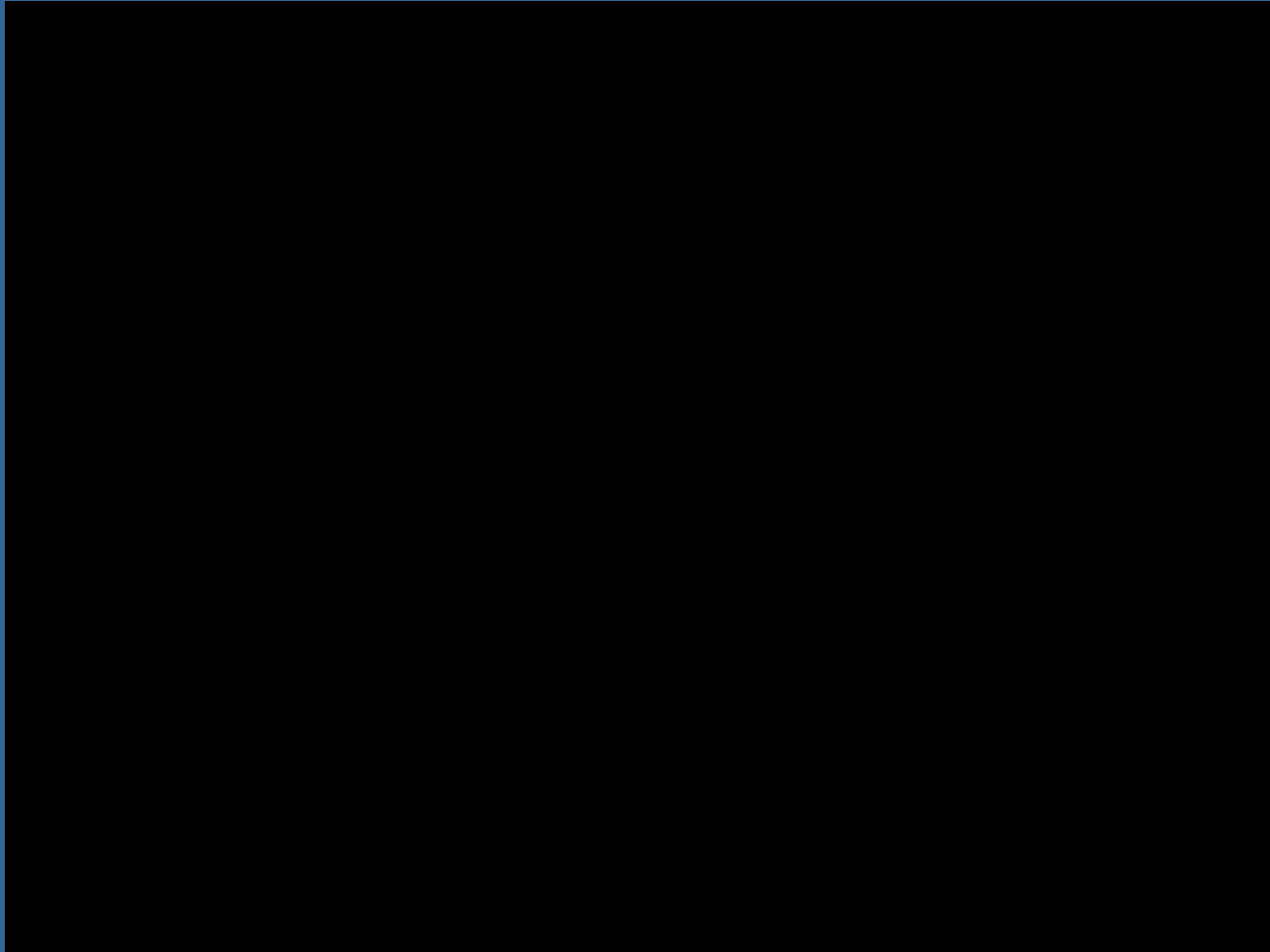
Salinity (PSU)



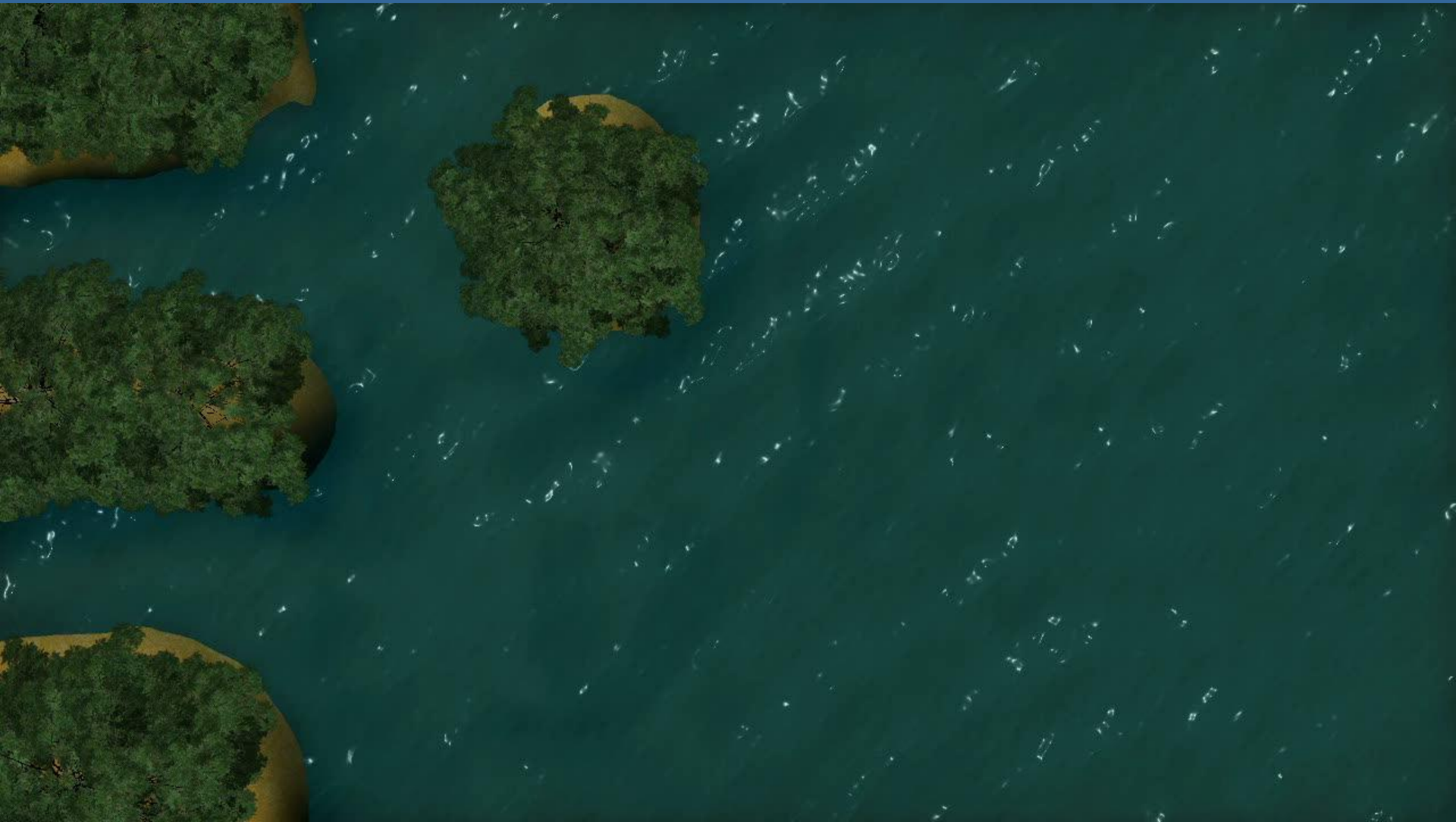
# Finding Pollution Sources



# Finding Pollution Sources



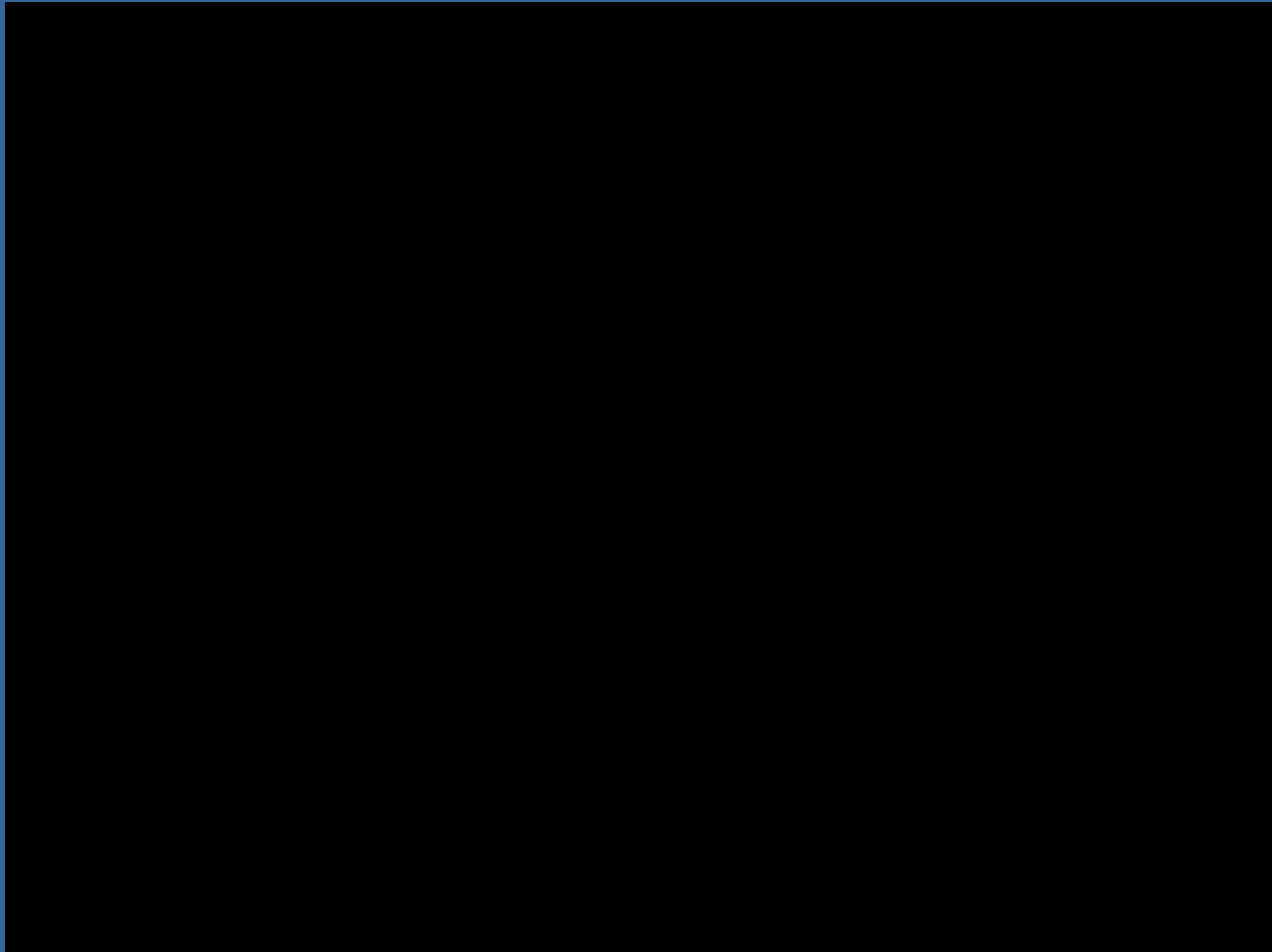
# Using Kilroy to create a more accurate pollution gradient map



# Automatic collection of a water sample triggered by detection of a turbidity event



# Enforcing the Clean Water Act

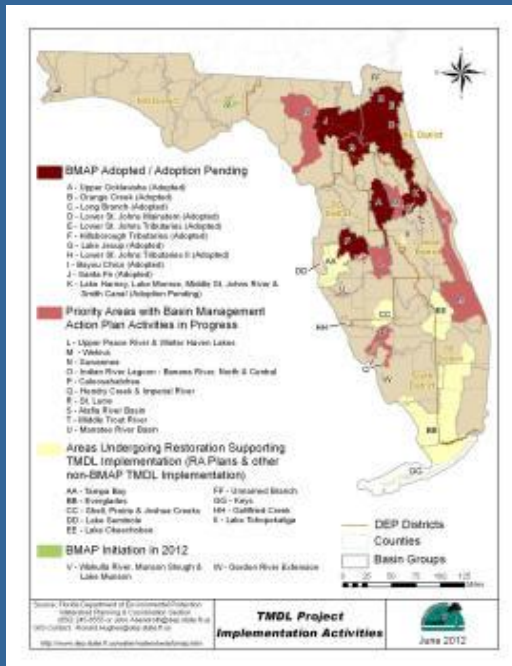


# Basin Management Action Plan

“To restore and protect Florida’s water quality”

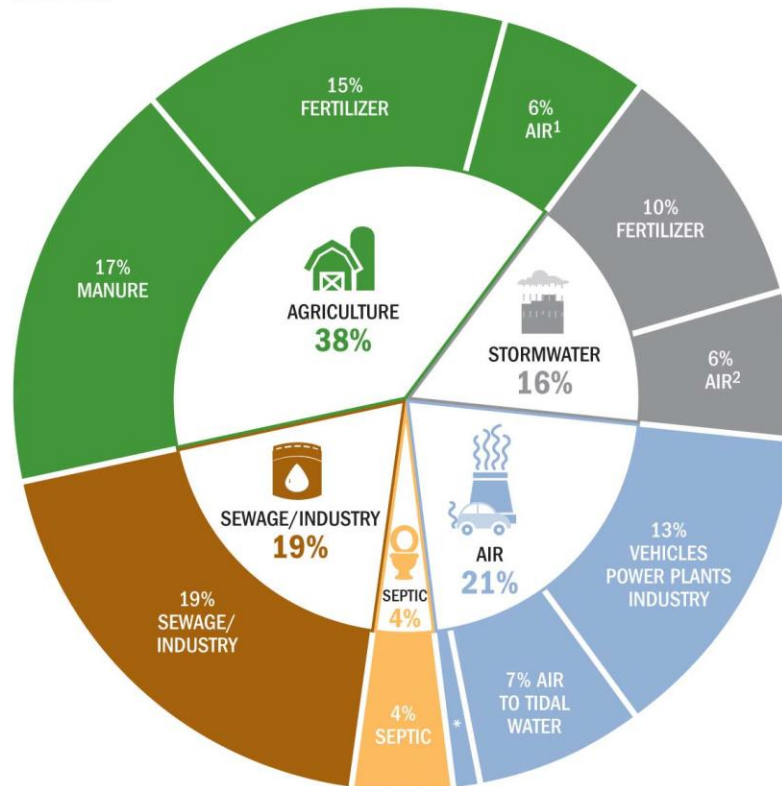
## Monitoring Objectives:

- Track trends in TN and TP loads in the major canals and tributaries as well as the St. Lucie River and Estuary
- Monitor key parameters including DO, Chl a, pH, temperature, specific conductance and turbidity.



# Nitrogen Pollution to the Chesapeake Bay

## By Sector



SOURCE: CHESAPEAKE BAY PROGRAM

\* 1% NATURAL AIR POLLUTION

<sup>1</sup> AGRICULTURAL EMISSIONS OF AIR POLLUTION

<sup>2</sup> ASSUMING THAT ROUGHLY 40% OF TOTAL STORMWATER NITROGEN COMES FROM THE AIR

December 2012



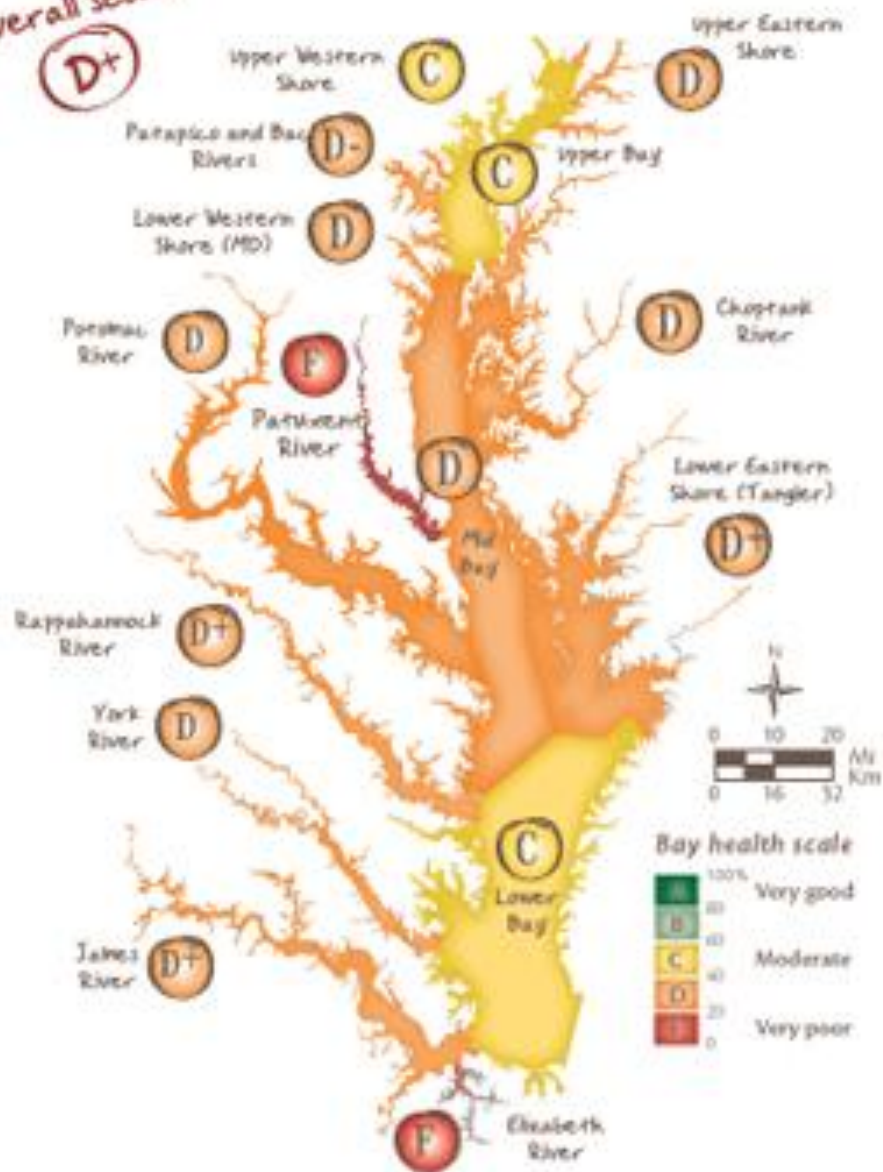
CHESAPEAKE BAY FOUNDATION  
*Saving a National Treasure*

cbf.org

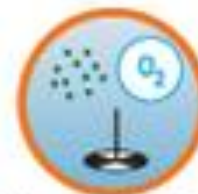
# Chesapeake Bay Report Card

Overall score:

**D+**



Water clarity



Water Quality Index



Chlorophyll *a*



Dissolved oxygen



Bay Health Index



Benthic community



Biotic Index



Aquatic grasses



Phytoplankton community

# STATE OF THE BAY IN 2012

**32**

**A** EXCELLENT  
**B** GOOD  
**C** FAIR  
**D** POOR  
**F** CRITICAL

| POLLUTION | <br><b>NITROGEN/PHOSPHORUS</b><br><b>F/D</b><br>N Score=16<br>P Score=27<br><br> | <br><b>DISSOLVED OXYGEN</b><br><b>D</b><br>Score=25<br>    |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | <br><b>WATER CLARITY</b><br><b>F</b><br>Score=16<br>                                                                                                               | <br><b>TOXICS</b><br><b>D</b><br>Score=28<br>              |
| HABITAT   | <br><b>FORESTED BUFFERS</b><br><b>B+</b><br>Score=58<br>                                                                                                           | <br><b>UNDERWATER GRASSES</b><br><b>D-</b><br>Score=20<br> |
|           | <br><b>WETLANDS</b><br><b>C+</b><br>Score=42<br>                                                                                                                   | <br><b>RESOURCE LANDS</b><br><b>D+</b><br>Score=32<br>     |
| FISHERIES | <br><b>ROCKFISH</b><br><b>A</b><br>Score=69<br>                                                                                                                | <br><b>OYSTER</b><br><b>F</b><br>Score=6<br>           |
|           | <br><b>CRABS</b><br><b>B+</b><br>Score=55<br>                                                                                                                  | <br><b>SHAD</b><br><b>F</b><br>Score=9<br>             |



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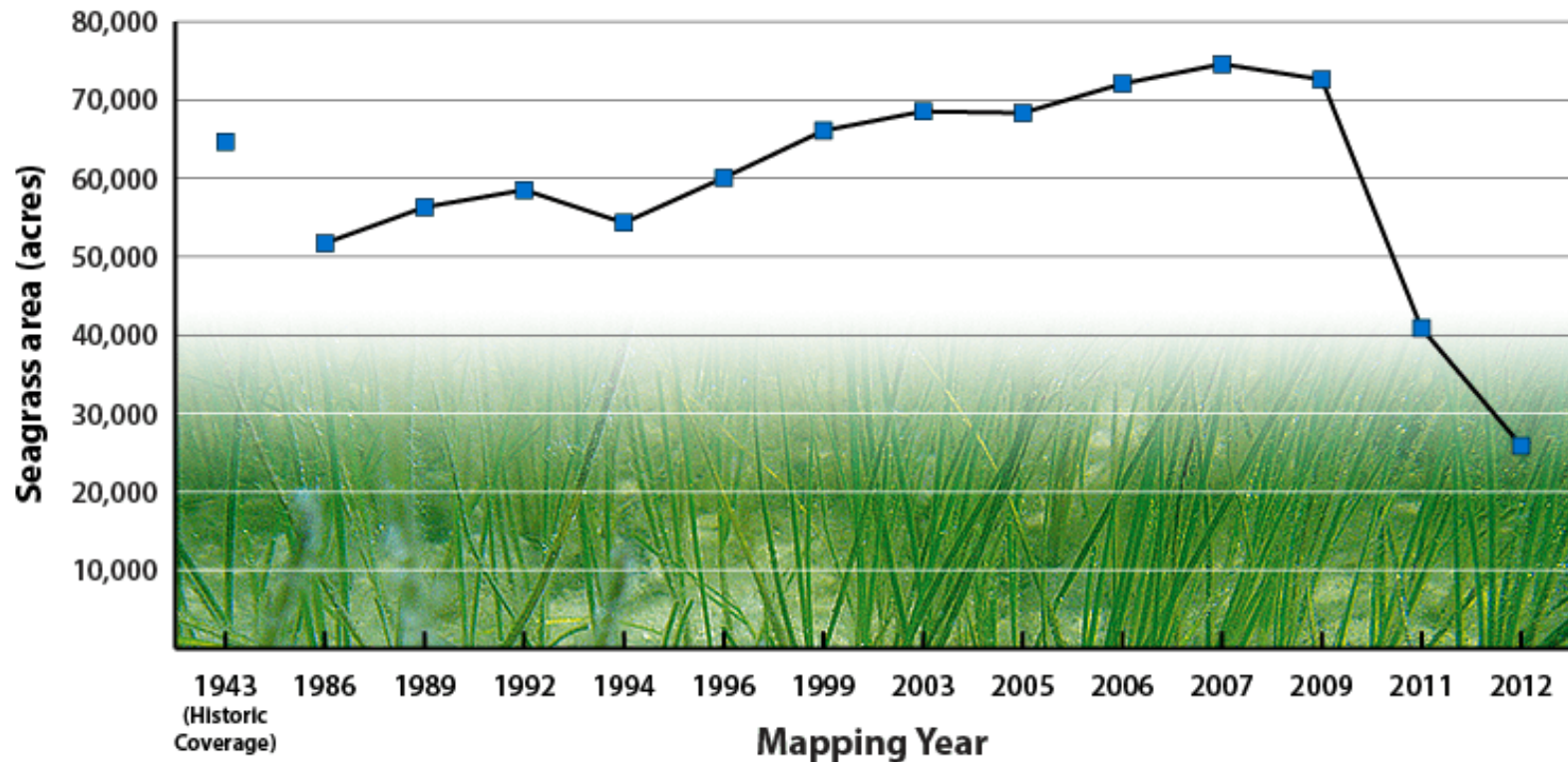


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# Indian River Lagoon Seagrass Coverage

(within SJRWMD to Fort Pierce Inlet)

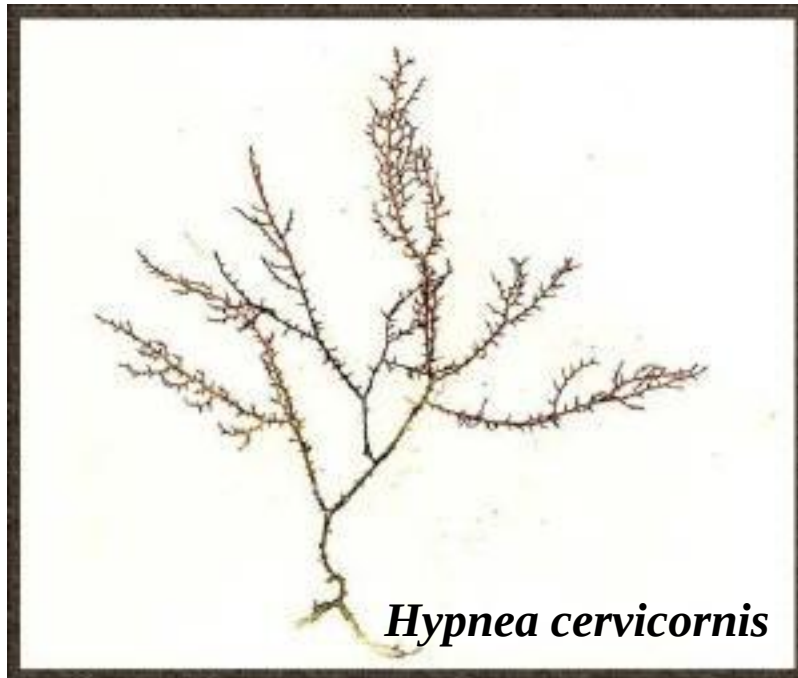


- Aerial photographs of lagoon seagrass are taken every two years and new seagrass maps are produced from this photography. Scientists monitor seagrass transects and collect water quality samples monthly.
- Scientists recorded a 60 percent loss of seagrass in the lagoon between 2009 and 2012.

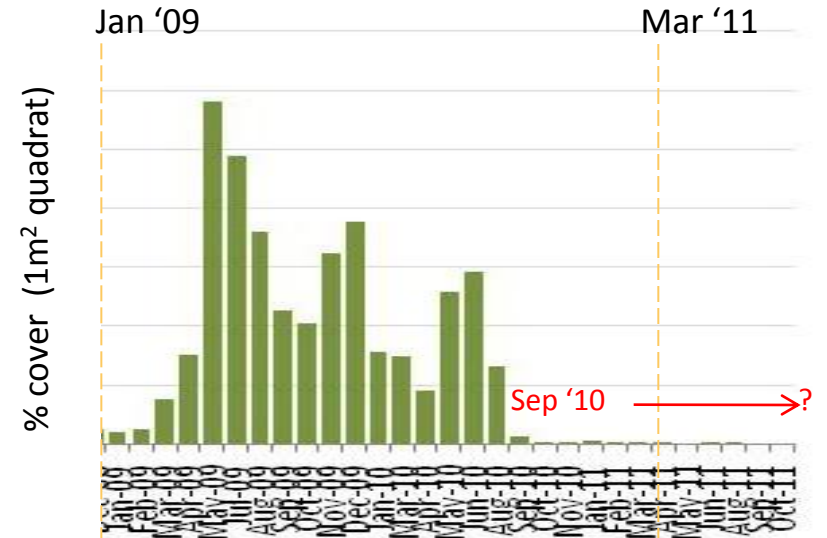
© 2013 St. Johns River Water Management District

## Legend

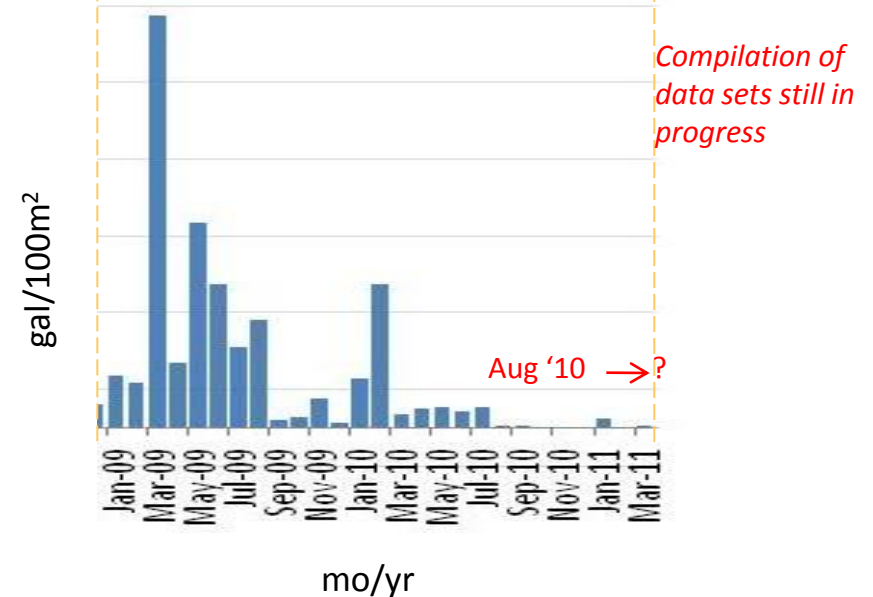
seagrass\_2009\_habitat\_centralB



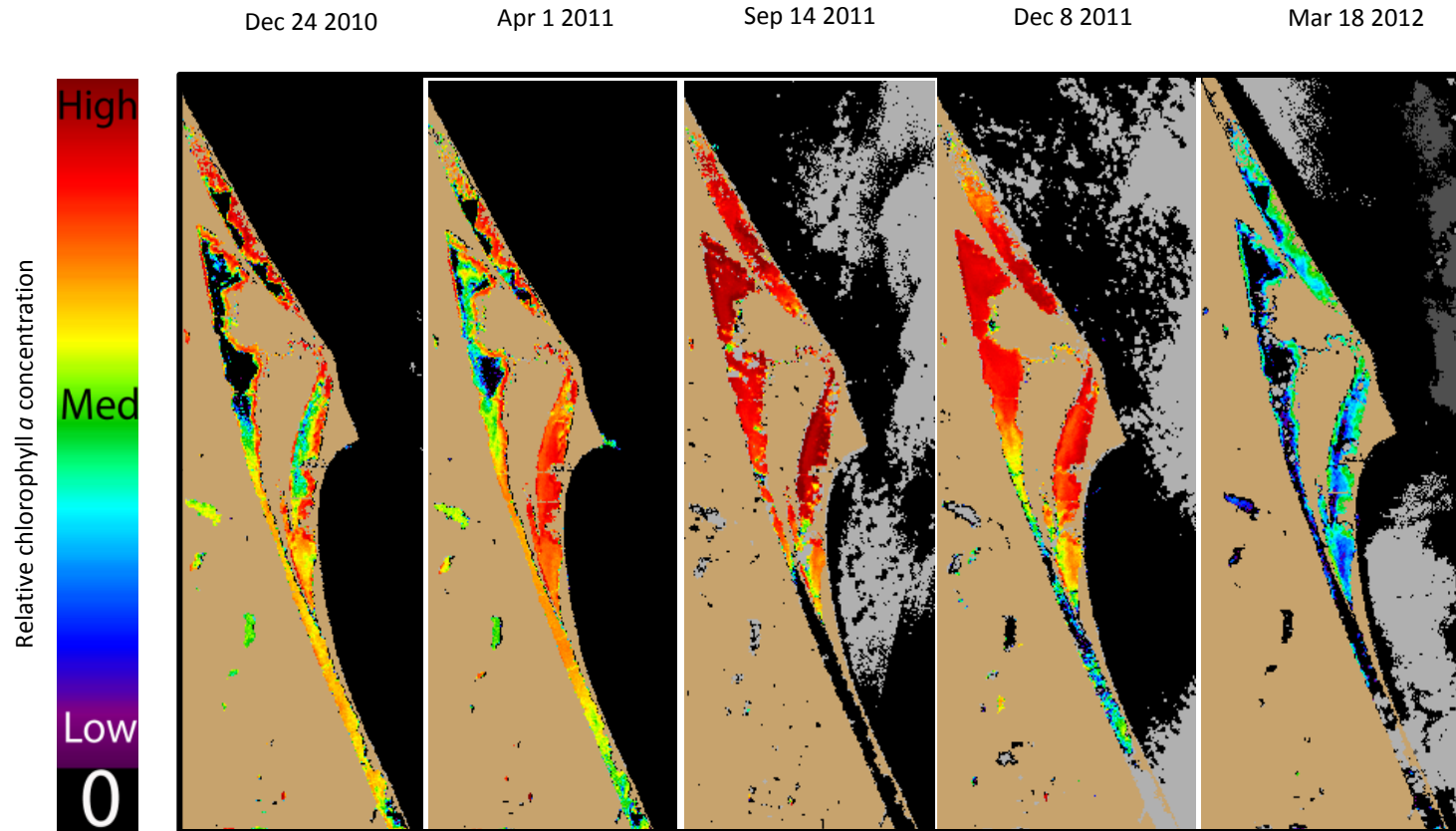
# Drift Algae (SJRWMD) Port St. John



# Drift Algae (FWRI, FFWCC) Cocoa-Melbourne

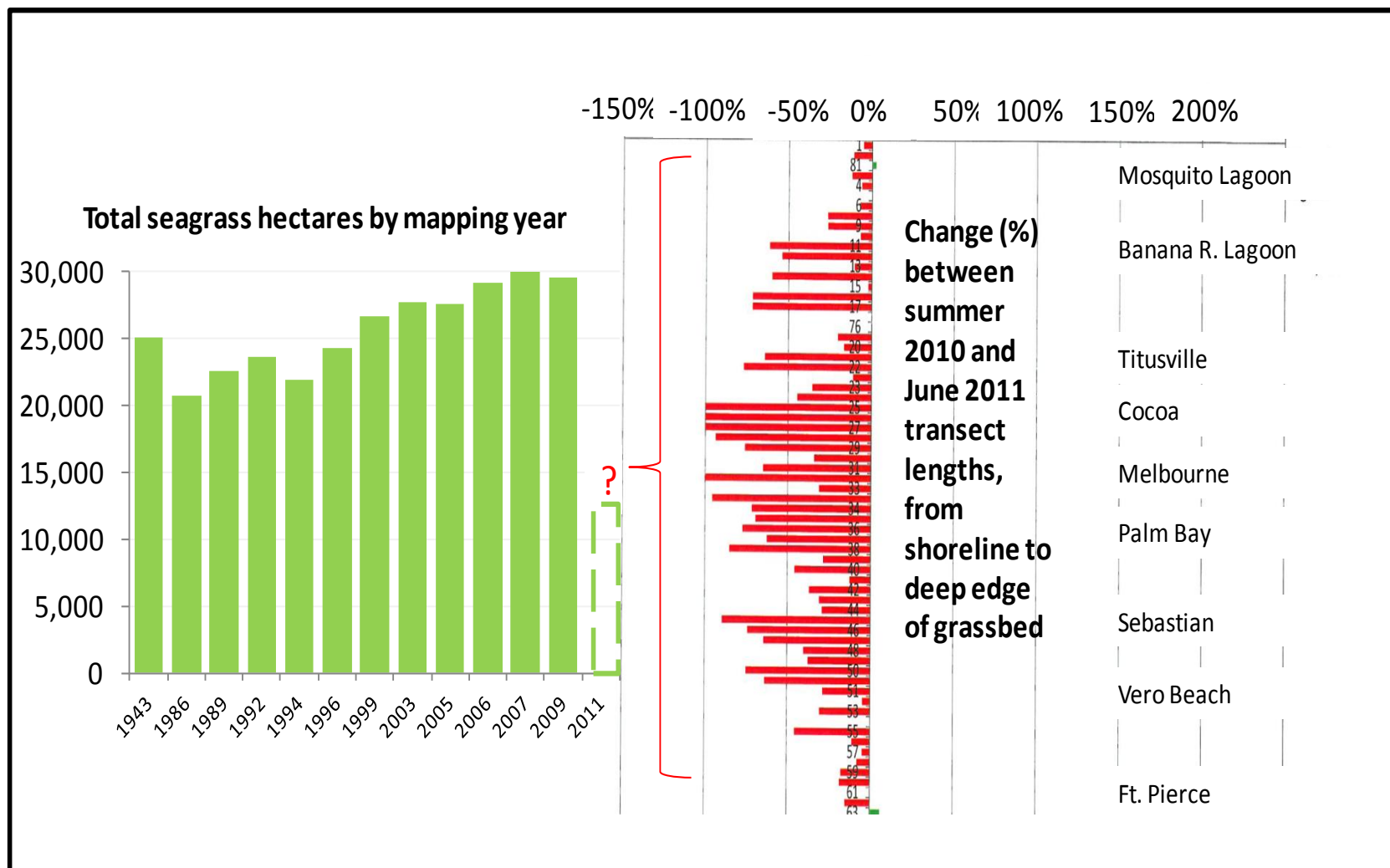


# Superbloom



*MERIS Satellite images of the Indian River Lagoon system depicting the relative intensity (concentration of chlorophyll) of the 2011 phytoplankton superbloom .*

Grassbed lengths measured in June 2011 indicated a significant loss compared to summer 2010. (Need to compare transect lengths for 2009 to 2010.)



Mapping the Distribution and Abundance of  
Macroalgae in the Indian River Lagoon

CONTRACT #26265

April 1, 2011

Bernhard Riegl, PhD

J. Greg Foster, PhD

Nova Southeastern University

Oceanographic Center,

Dania Beach, FL

**According to a large-scale acoustic survey conducted between May 4 and July 1, 2010, the lagoon-wide percent cover of short SAV (short submerged aquatic vegetation) (typically *Caluerpa prolifera* and *Halophila spp*) had dropped to 6.5% compared to 24.1% in 2008.**

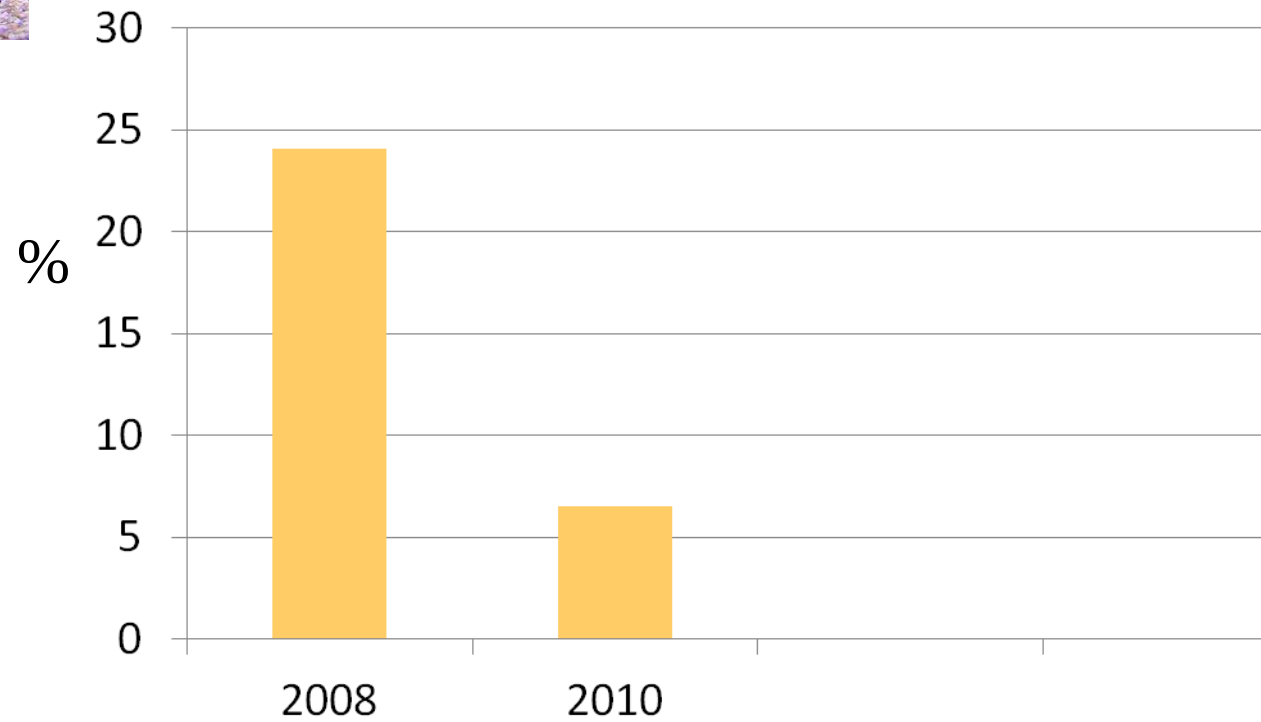


***Calurpa prolifera***

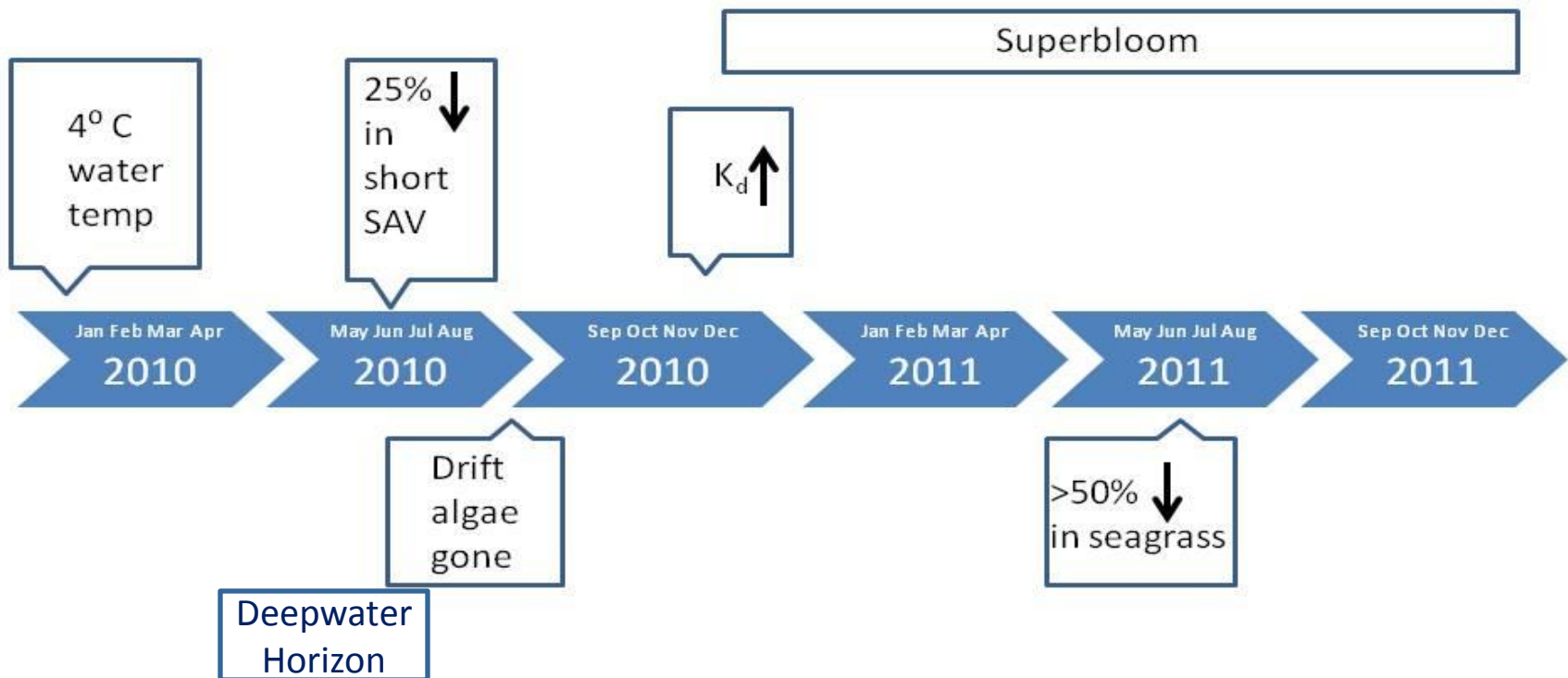


***Halophila spp***

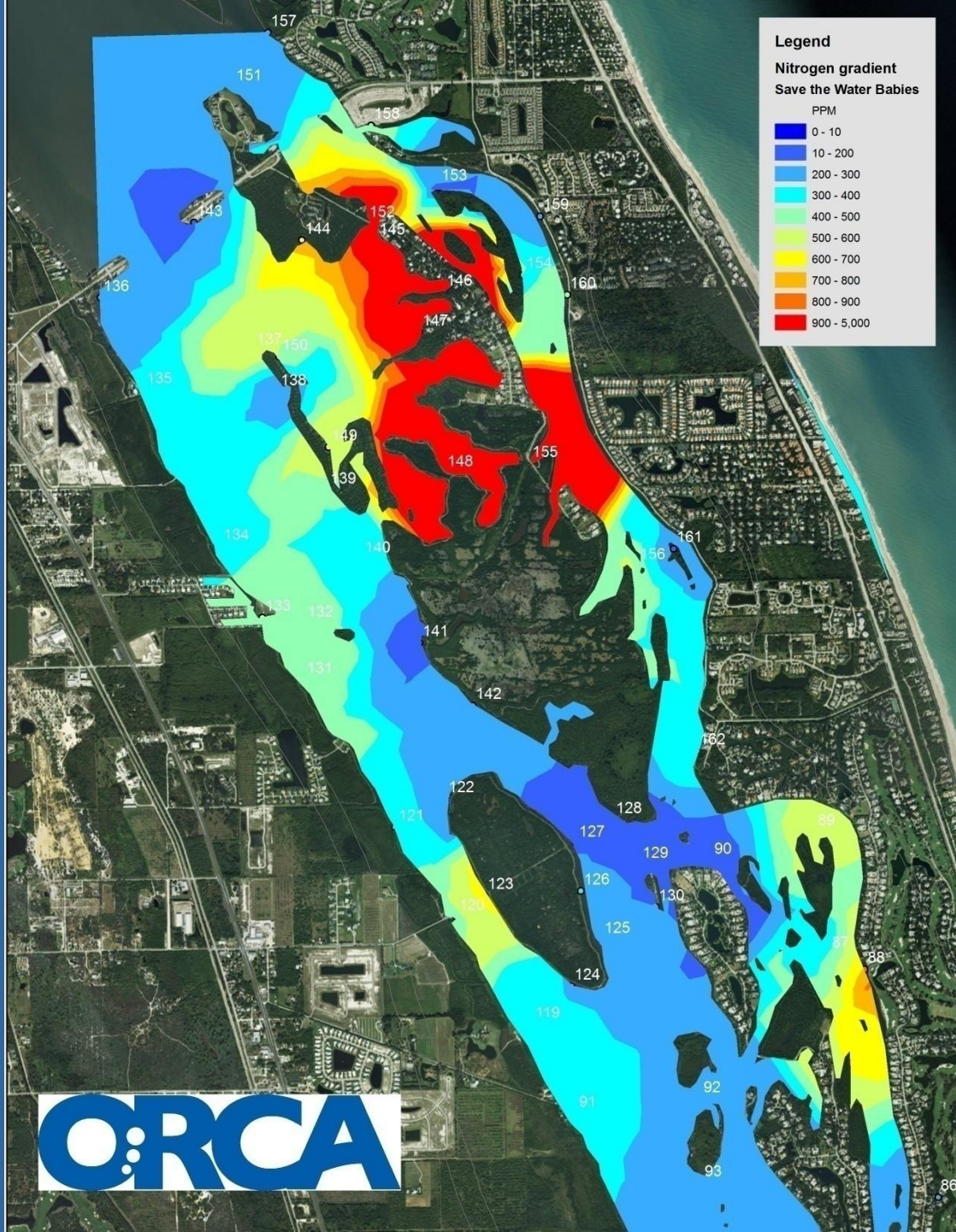
## Short Submerged Aquatic Vegetation



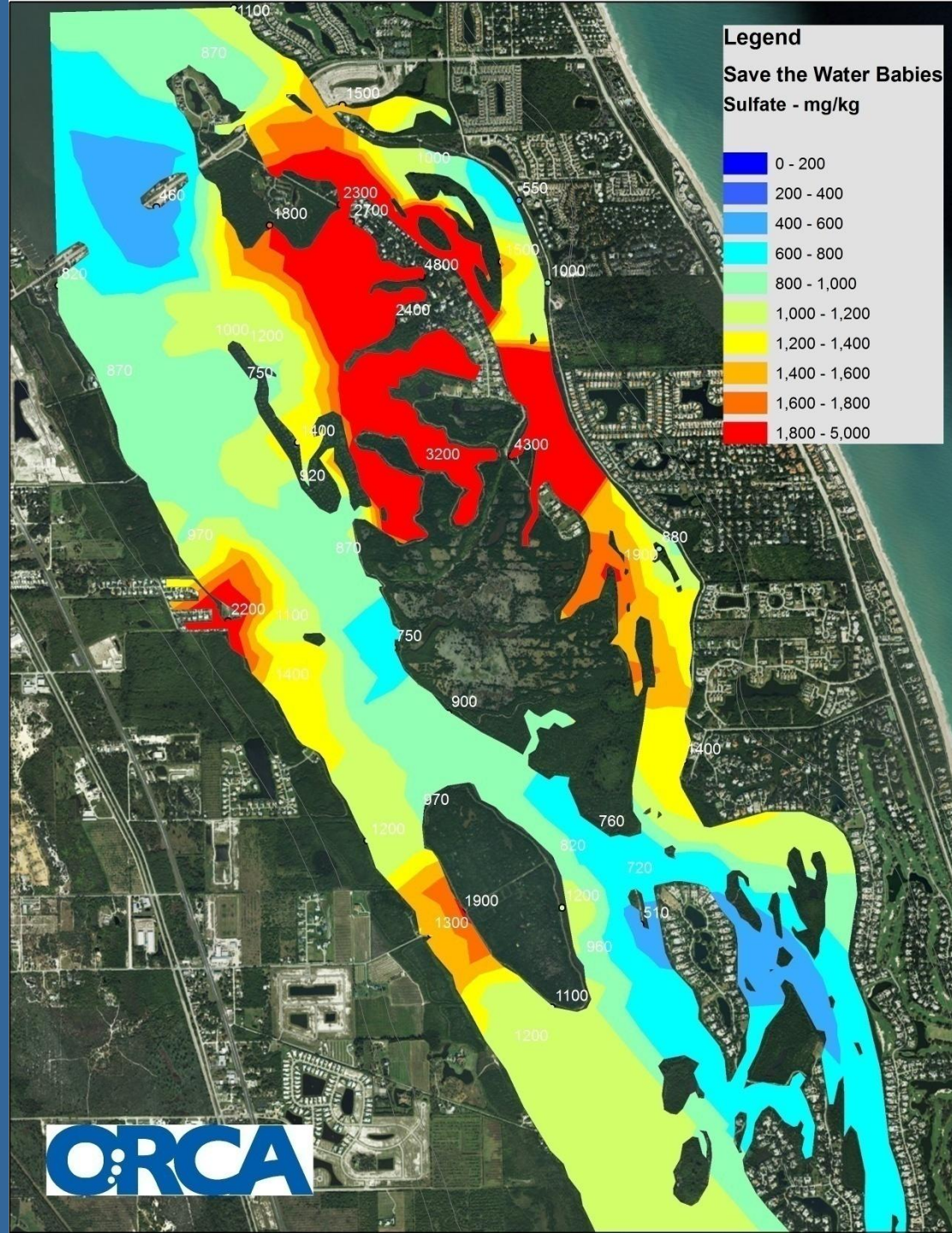
# Time Line



# Nitrogen



# Sulfate





**Davis Reef,  
Florida Keys - FWC**

**NOAA Docks –  
Chesapeake Bay,  
Maryland**





## Manatee Pocket – Port Salerno, Florida

## Titusville, Florida – FWRI Project

