



Estuarine and Coastal Wildlife Research at Cape Canaveral  
Kennedy Space Center Ecological Program (December 2015)



## Kennedy Space Center

- Primary US Space Launch Site
- Merritt Island NWR
- Canaveral National Seashore
- 140,000 Acres
- 30 Federal or State-Listed Species
- NASA Culture of Stewardship

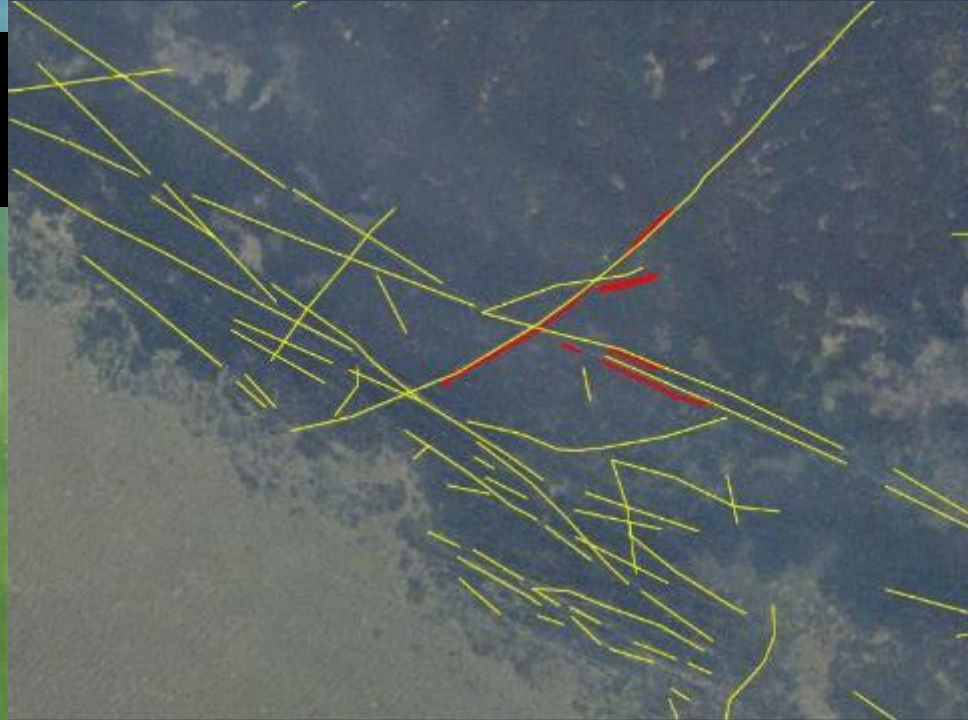


# Kennedy Space Center Ecological Program

- ~15 Staff Including:
  - Ornithologists
  - Herpetologists
  - Marine Biologists
  - Botanists
  - Statisticians
  - GIS
- Focus on Conservation of  
Habitat & Managed Species
- Work with MINWR, CANA &  
CCAFS



# Habitat Assessments





# Marine Mammals



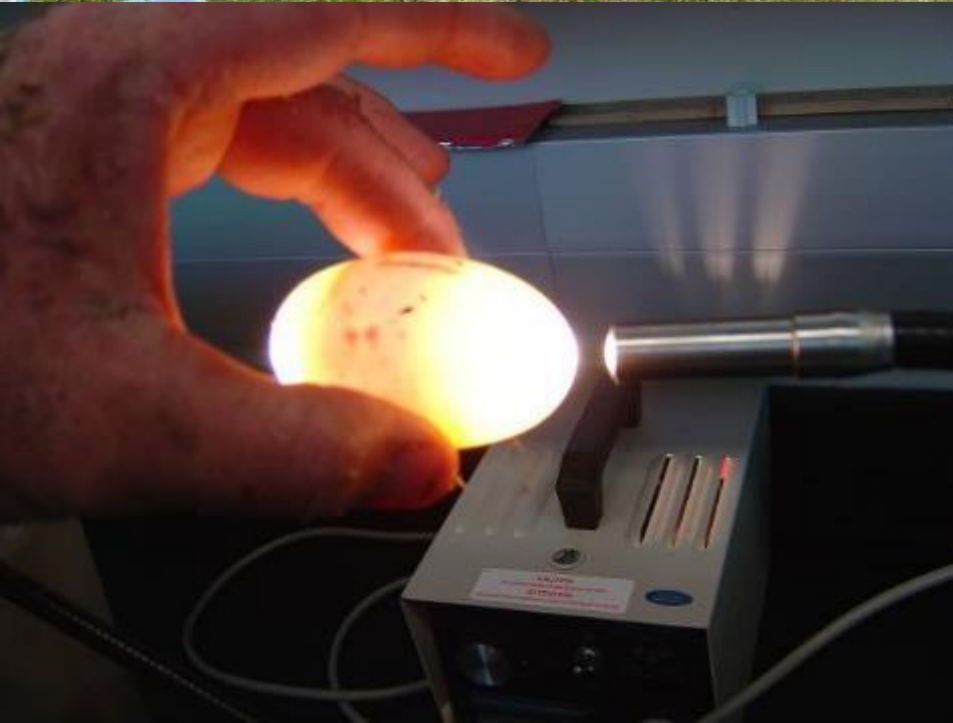


# Sea Turtles





# Alligator Studies





# Coastal Fisheries





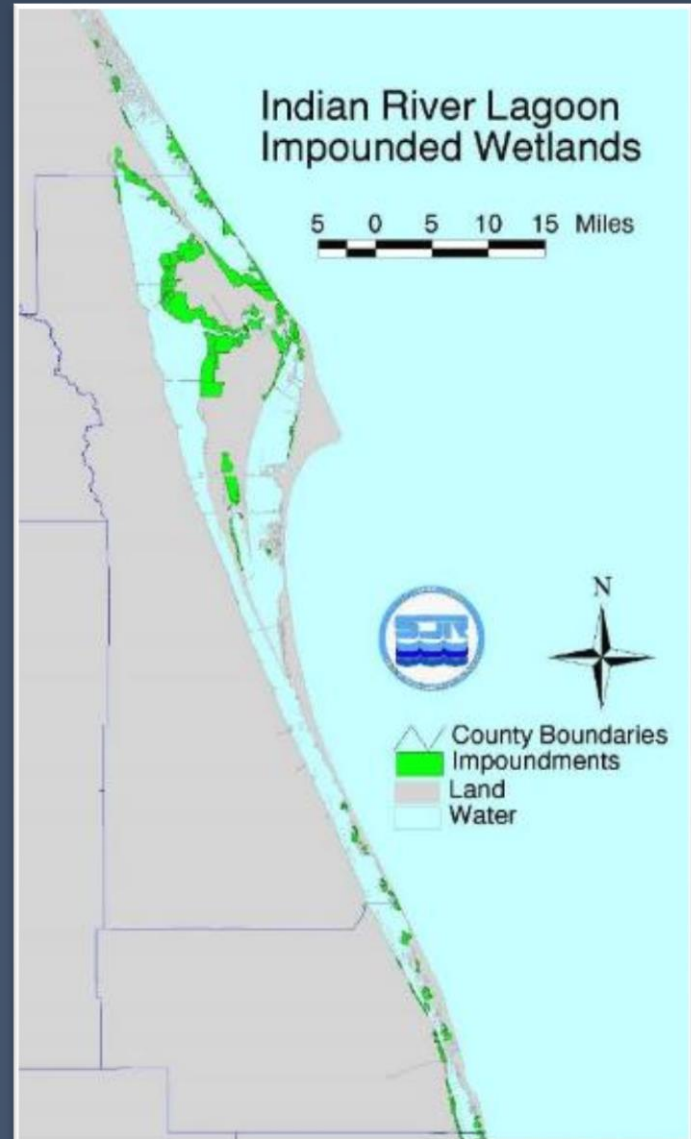
# Kennedy Space Center Ecological Program

- Emphasis on Question-Driven Research
- Focus on Publishing and Internal Reports
- Recognized Need For More Public Outreach

## Objectives

- Describe Our IRL & Coastal Research Efforts
  - Identify Products (if any) Useful to Aquarium Project
  - Identify Areas of Future Collaboration
- Provide a Tour of KSC Reserve

# Seagrass and Wetlands Research





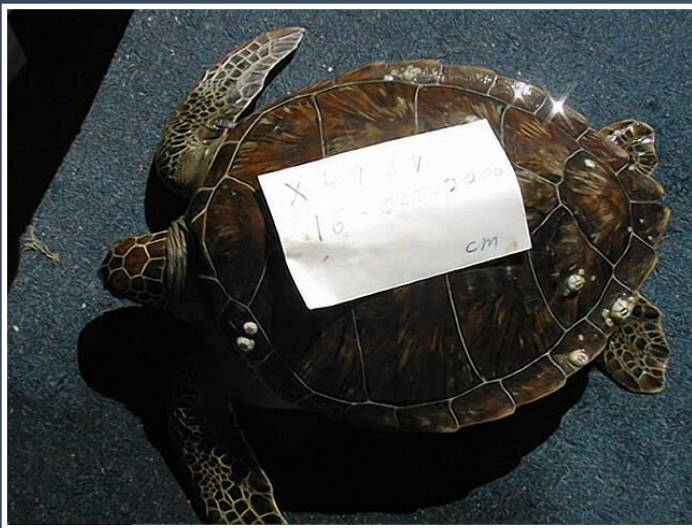
# Aerial Manatee Surveys



# Estuarine Sea Turtle Monitoring



Loggerhead (*Caretta caretta*)



Green turtle (*Chelonia mydas*)







Photo Credit: Blair Witherington

# Impacts of Rocket Launches and Facility Lighting on Sea Turtle Nesting Success

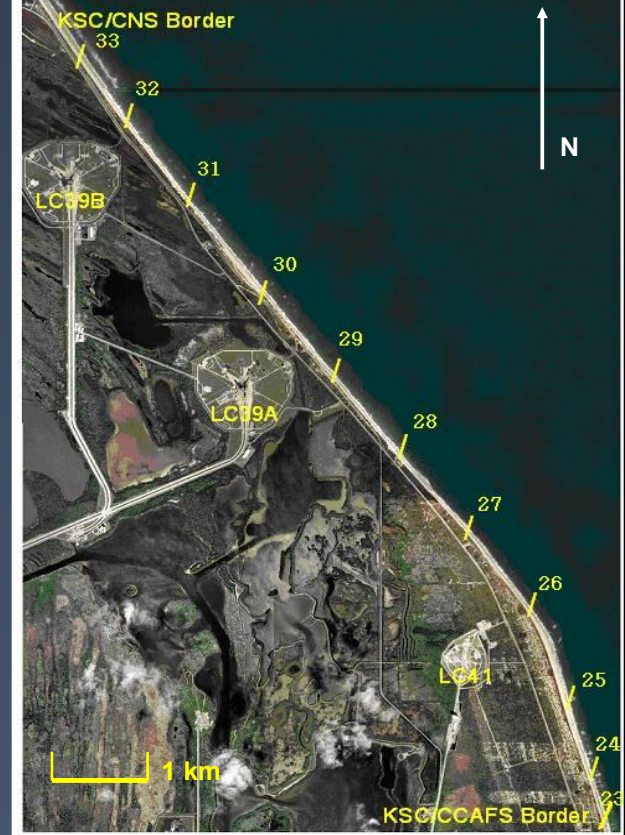
- Goal: Identify and eliminate lighting that impacts sea turtle nesting and hatchling emergence behavior
- Collaboration with MINWR, USFWS, and FWC
- Provide NASA with lighting assessments for best ROI modifications and managing future construction





# Methods

- Ongoing monitoring during turtle nesting & hatching seasons
- Night lighting surveys (helicopter, beach, road)
- Sky quality logger
- Emergence surveys (disorientations)
- Mitigation (shields, dune restoration)



# Findings

- 20+ year database of sea turtle nesting & disorientation
- Tracking effect of launches as well as dune and vegetation loss with sea turtle orientation behavior
- Future: Dark Sky Initiative - opportunity to quantitatively analyze light. Impact of climate change on habitat and resource availability





# Impact of Green Turtles and Herbivorous Fishes on the Macroalgal Community in Port Canaveral

- Goal: Describe macroalgal resources for herbivorous fishes and juvenile green turtles
- Collaboration with CCAFS, Florida Atlantic University
- Provide data for environmental assessments of Port ecological resources and guidance for construction mitigation



# Methods

- Two-Year Study (2008-2010)
- Quarterly sampling of macroalgae from rock rubble
- Foraging analyses of green turtles (lavage) and herbivorous fishes (stomach content)
- UW video and boat transects for fish and turtle distribution





# Findings

- Identified 9 fish species foraging as herbivores (> 50% of diet = algae). Most abundant = 4 species
- Green turtles predominantly consumed red algae (*Gelidium crinale*, *Grateloupia filicina*, *Hypnea spinella*)
- Green turtle and sheepshead foraged as generalist. Other 3 fishes, predominantly specialist on green algae



# East Coast Diamondback Terrapin Surveys

**Goal: Develop Sampling  
Procedure to Estimate  
Population Size & Status**

**Model-based sampling  
strategy accounting for  
detection probability &  
availability**





# Methods

**Focus on open-water & known populations, Mar-Nov**

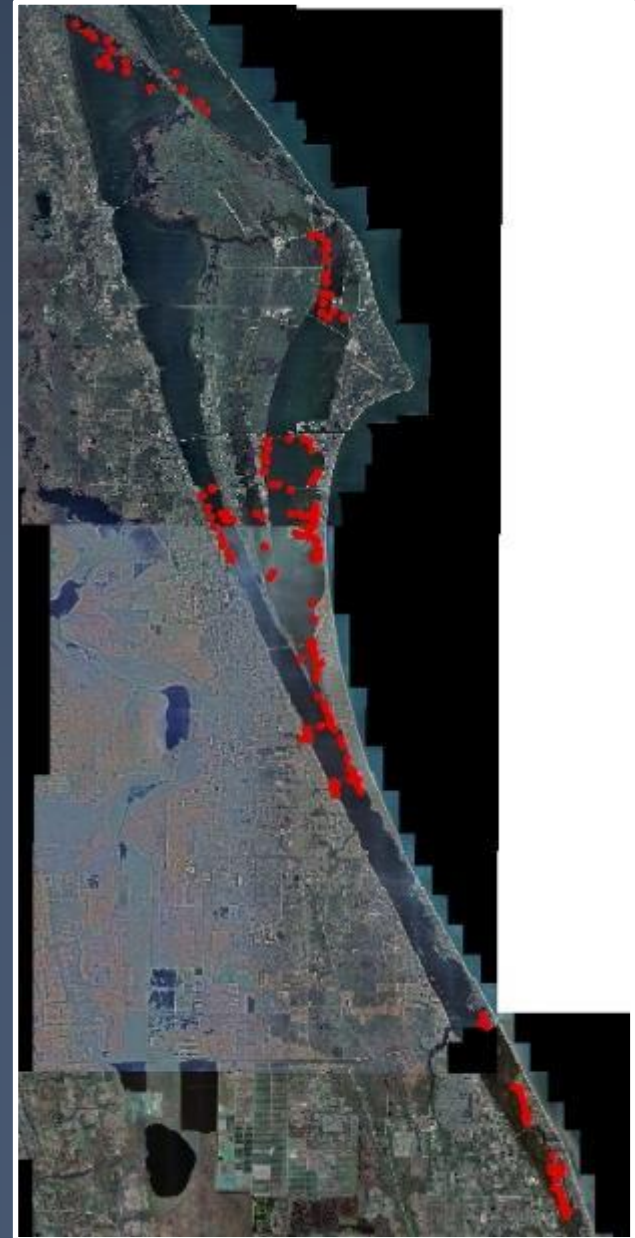
- **Occupancy Sampling**
- **Density Sampling**

**Distance Sampling**

**Time to Detection**

- **R or Winbugs programming**
- **Population Viability Analyses**

Sampling Areas 2014-2015



# Findings

- More widely distributed than previously thought
- Low numbers, probably critically endangered subspecies
- Prefer deeper water?

## Next Steps

- Complete analyses
- Prepare manuscript(s) rare-species sampling focus
- Sample one more year using a similar but different approach
- Define extent for estimating population size



# Health Assessment of the American Alligator at Kennedy Space Center

## Goal 1: Establish Local Life History Baseline

- Reproductive Success
- Comparisons with other FL Populations
- Movement Patterns
- Population Structure
- Nest Temperature Dynamics

## Goal 2: Determine Population Health

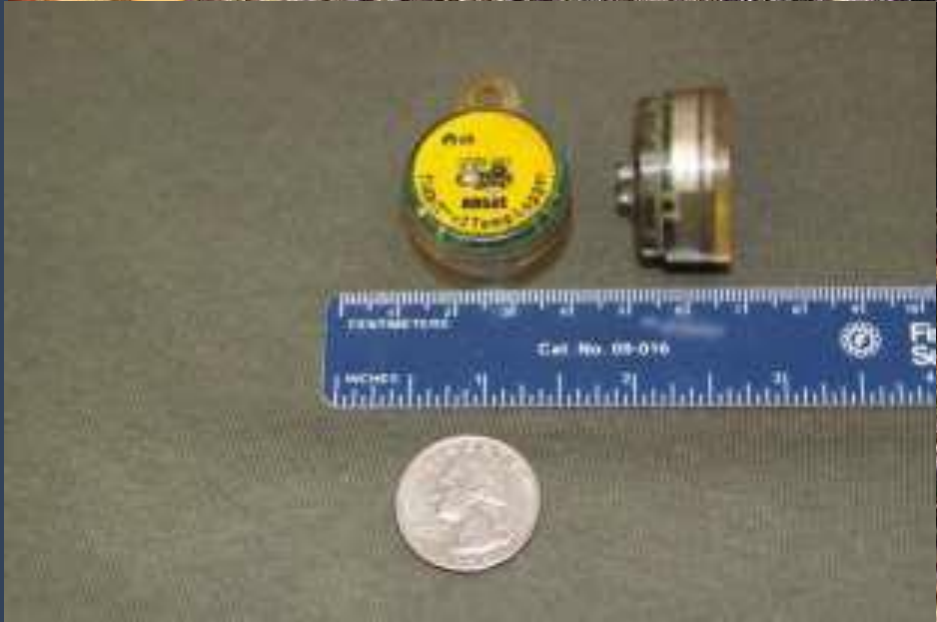
- Blood and Tissue Chemistry
- Hormones, Gene Expression
- Toxicology and Heavy metals



*Alligator mississippiensis*



# Nesting



17 11:30 AM







# Health Assessments





# Findings

- 62 Nests incubated since 2006. 38 additional nests with thermisters.
- Nest success ~75% (generally higher than other Florida populations)
- Mean nest temperature = 31.6°C resulting in 50/50 sex ratio
- 1453 alligators collected, processed, released. Largest 3.8 m (12.4 ft)
- Adult KSC population generally healthy



# Managed Fish Survey of Canaveral Nearshore Waters

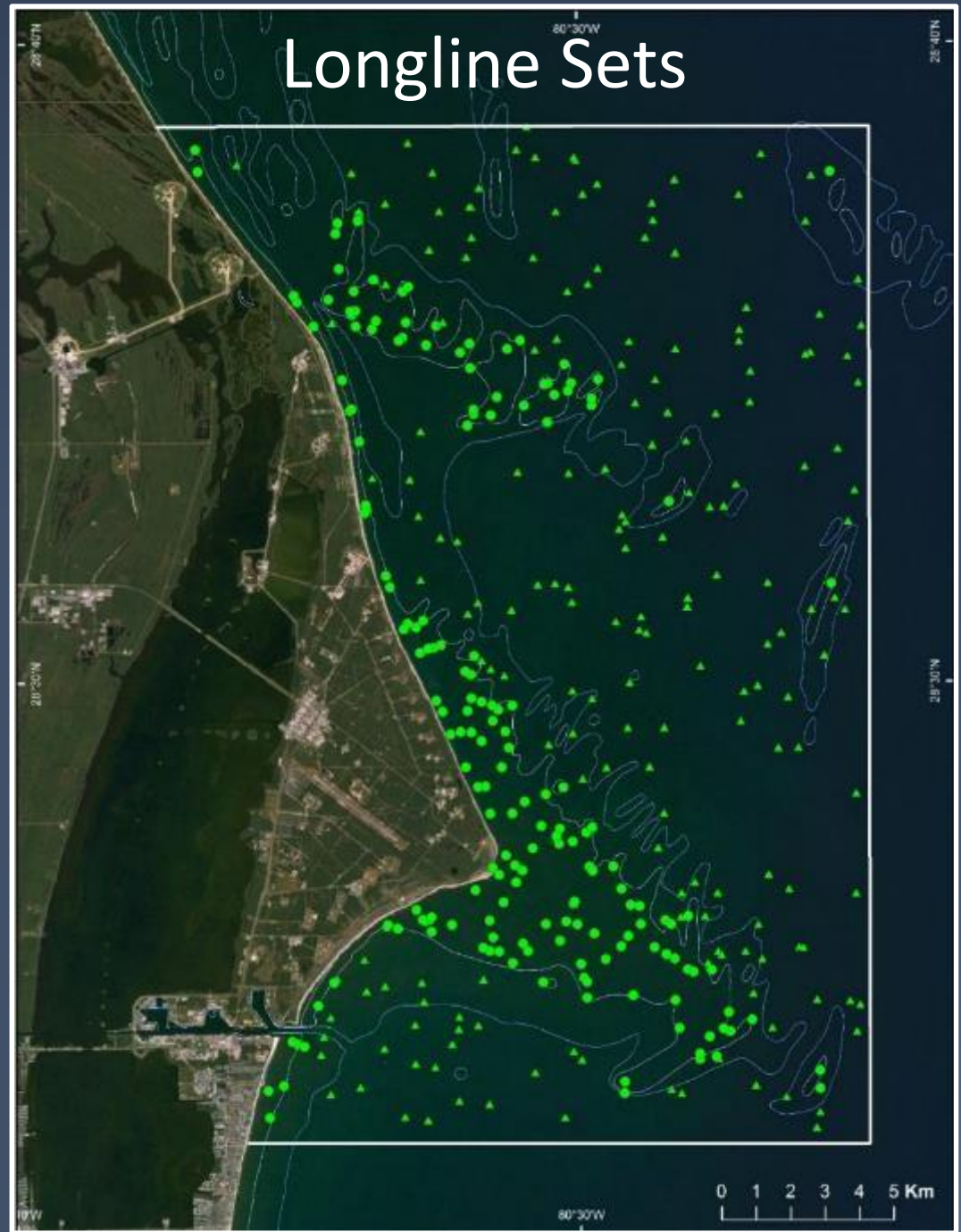
- Goal: Resolve Seasonal Abundance and Habitat Preferences of Coastal Fishes
- Collaboration with BOEM and US Navy
- Helps Guide Dredge and Renourishment Projects





# Methods

- Five Year Study (2012-2017)
- 16 Monthly Longline Sets
- Sites Randomly Selected
- Most Fish Tagged



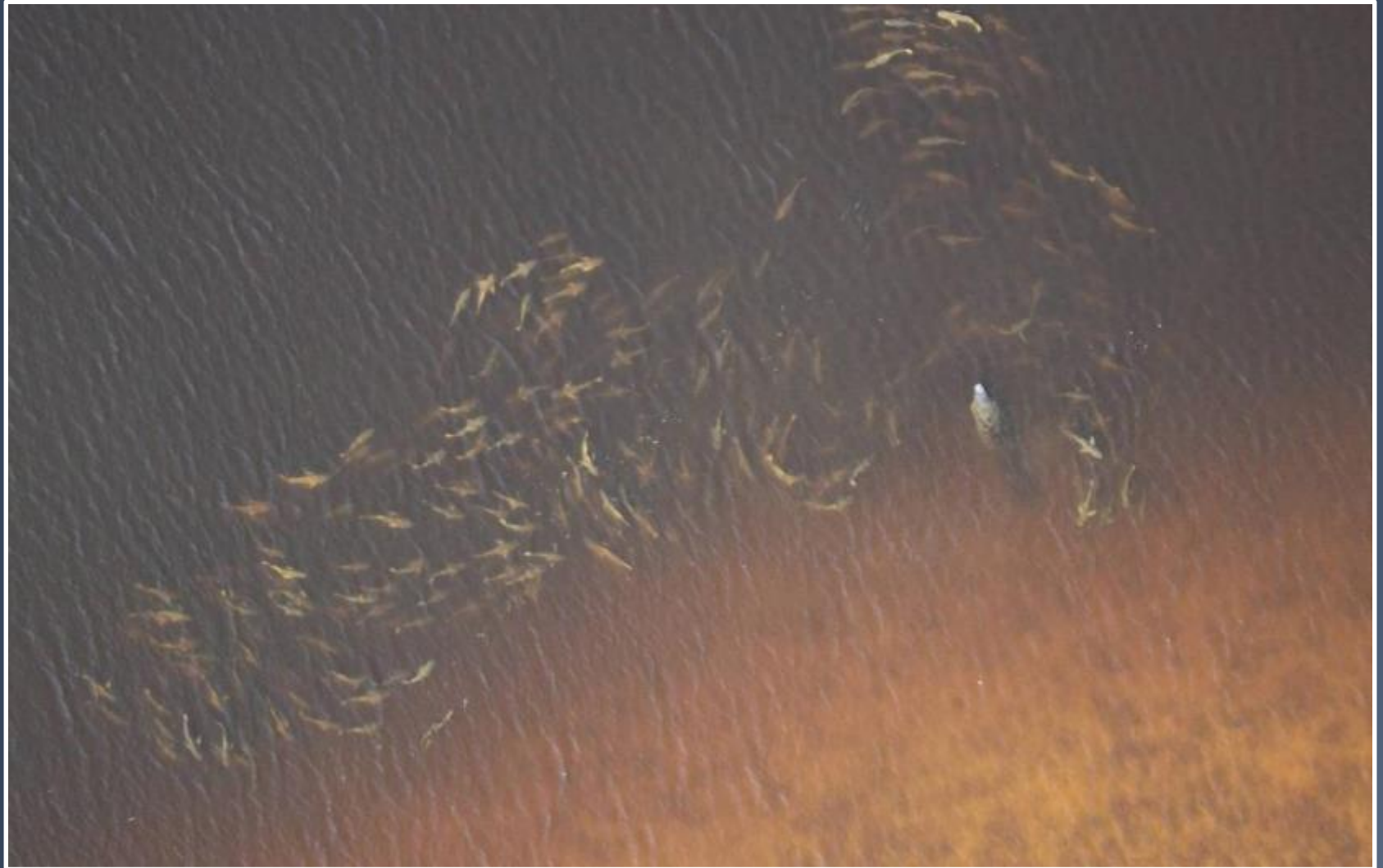
# Findings

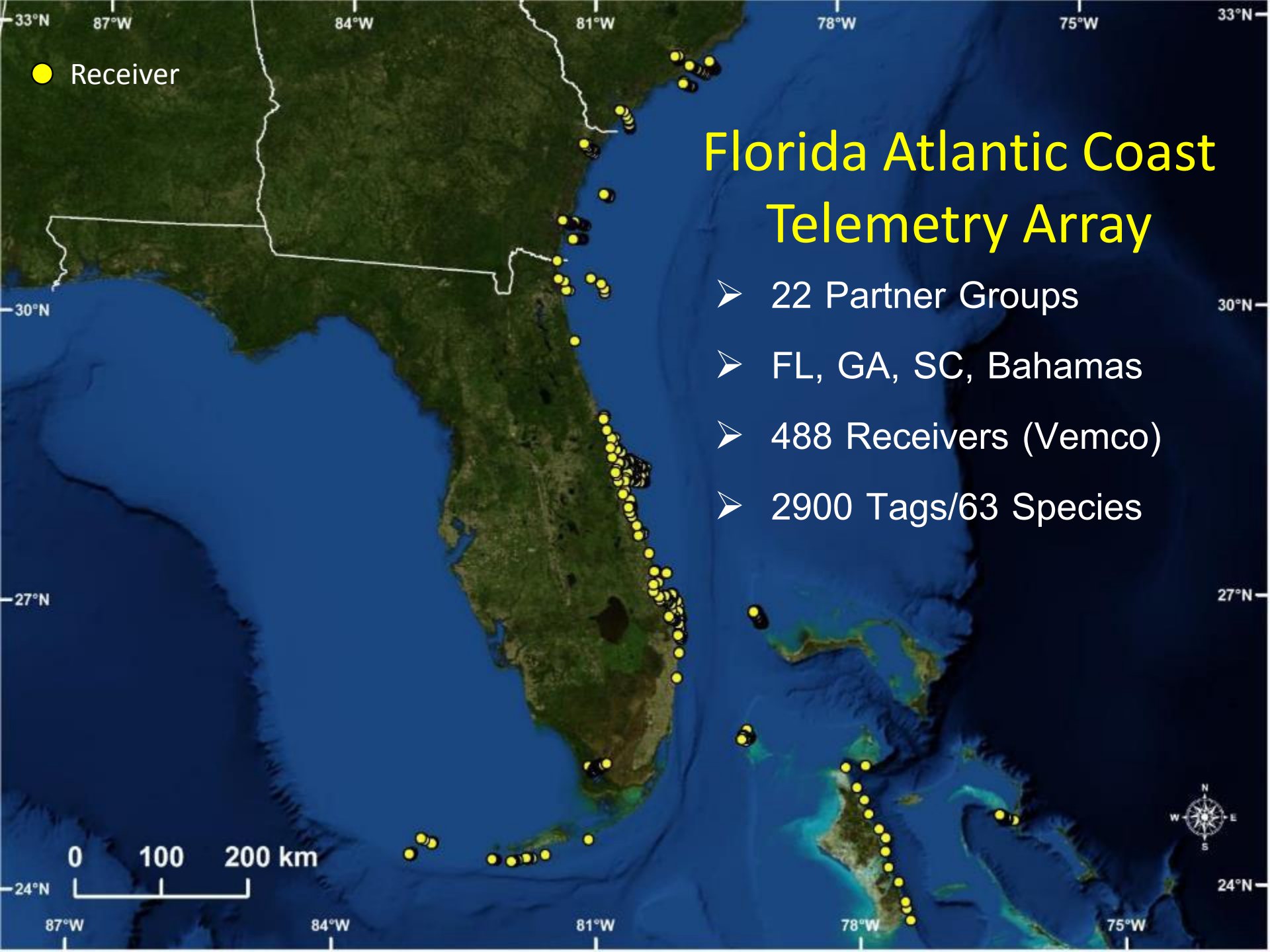
- 2010 Fishes Sampled
- 34 Species
- Catch >90% Coastal Sharks  
(Sharpnose, Blacknose, Blacktip,  
Finetooth) and Rays





# Passive Acoustic Telemetry to Resolve Fish Migration and Behavior



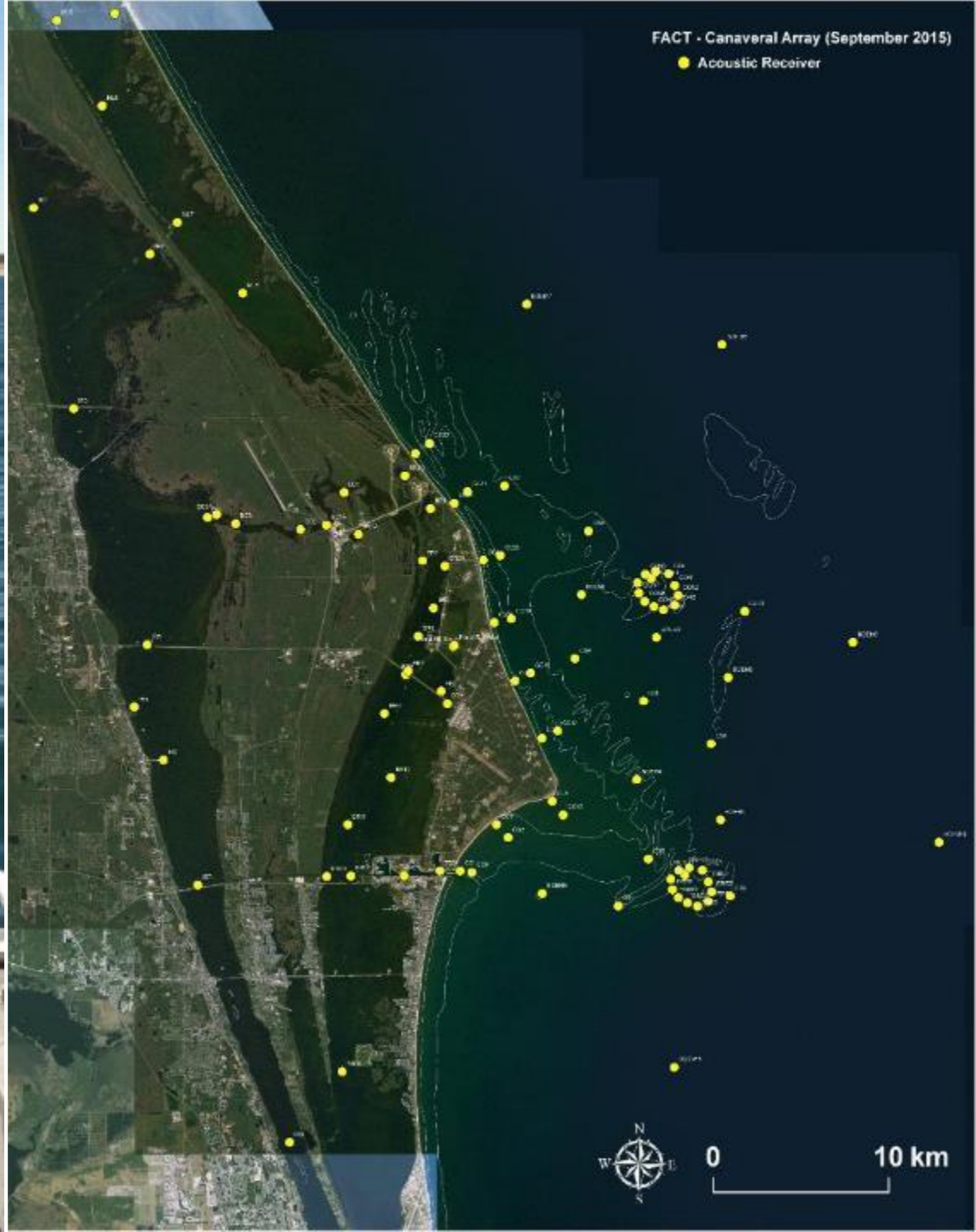


● Receiver

## Florida Atlantic Coast Telemetry Array

- 22 Partner Groups
- FL, GA, SC, Bahamas
- 488 Receivers (Vemco)
- 2900 Tags/63 Species









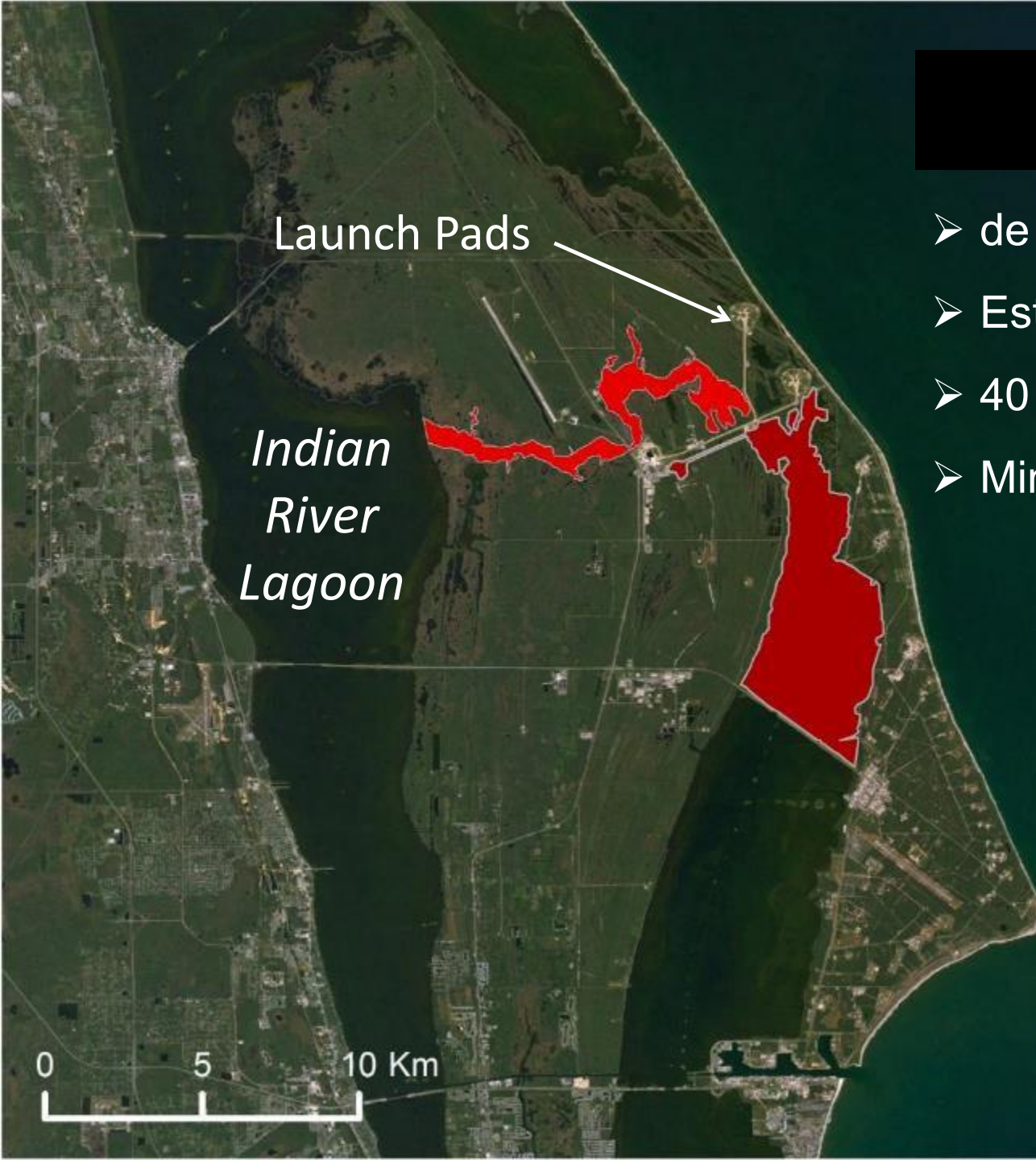
## KSC Reserve

- de facto Marine Reserve
- Est. 1962
- 40 km<sup>2</sup>
- Minimal Disturbance

Launch Pads

*Indian  
River  
Lagoon*

0 5 10 Km





Red drum  
(*Sciaenops ocellatus*)





Black drum  
(*Pogonias cromis*)

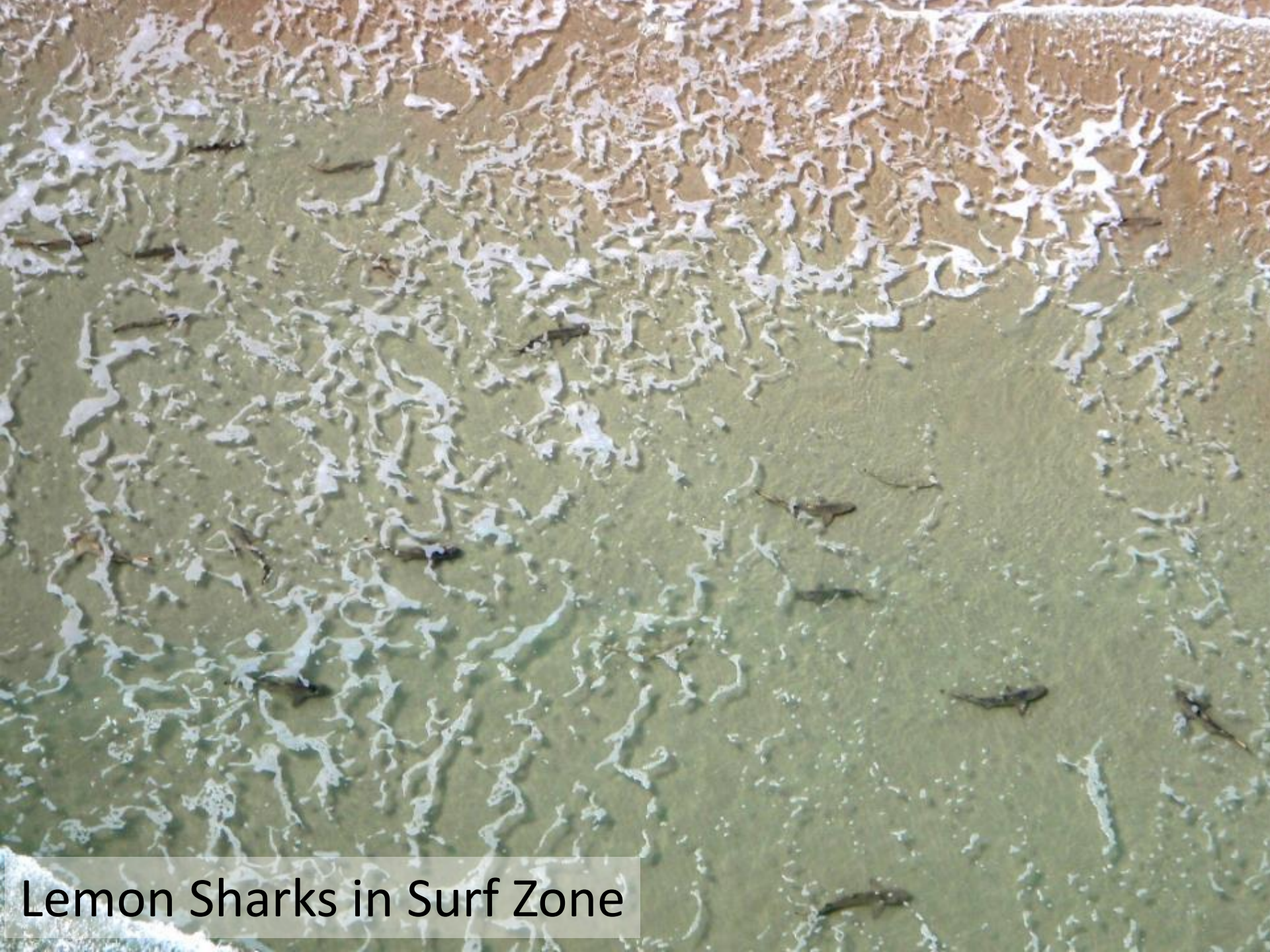


Spotted Seatrout  
(*Cynoscion nebulosus*)









Lemon Sharks in Surf Zone















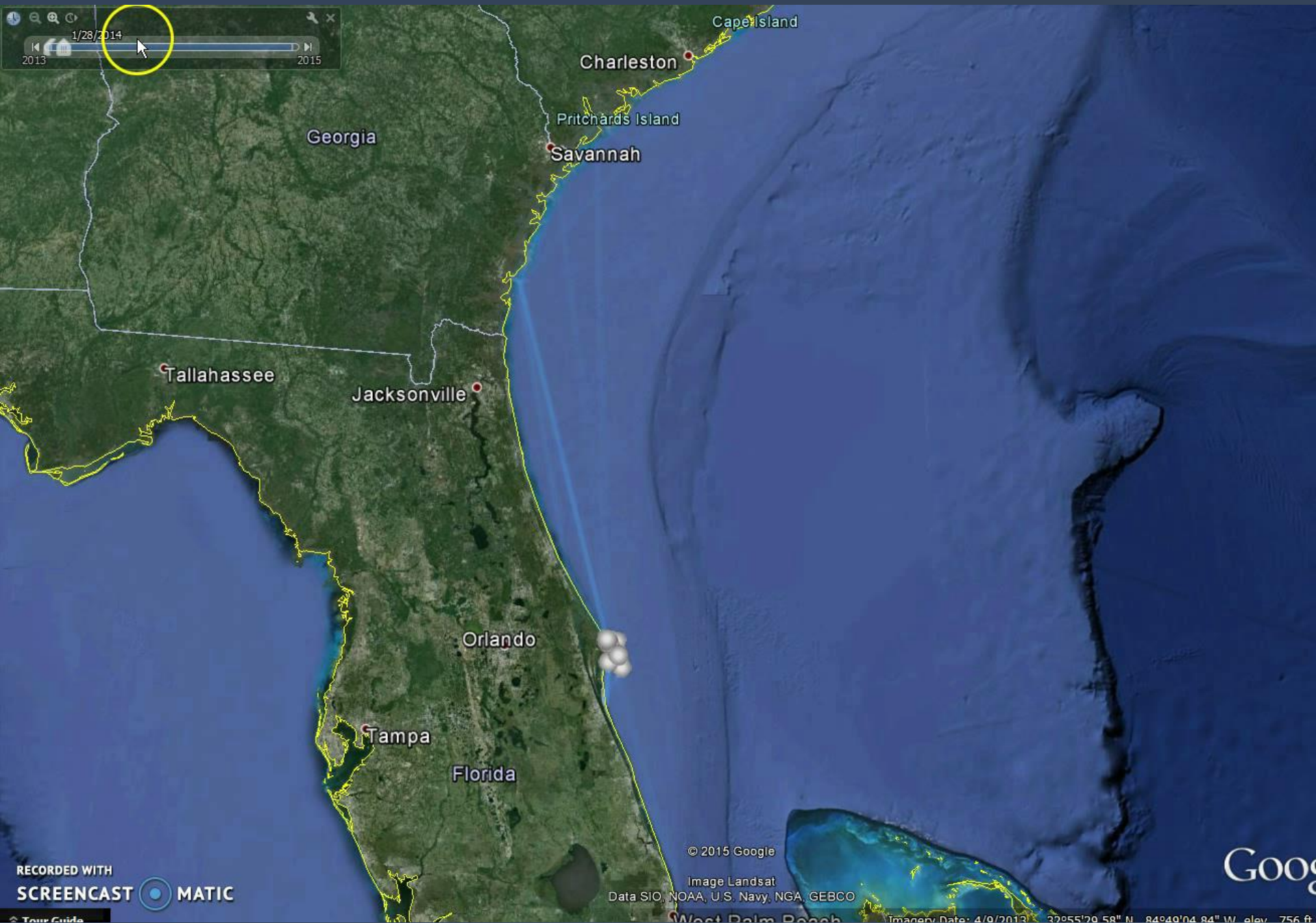
# Natural Habitat Associations and Effects of Dredging on Fish of the Canaveral Shoals













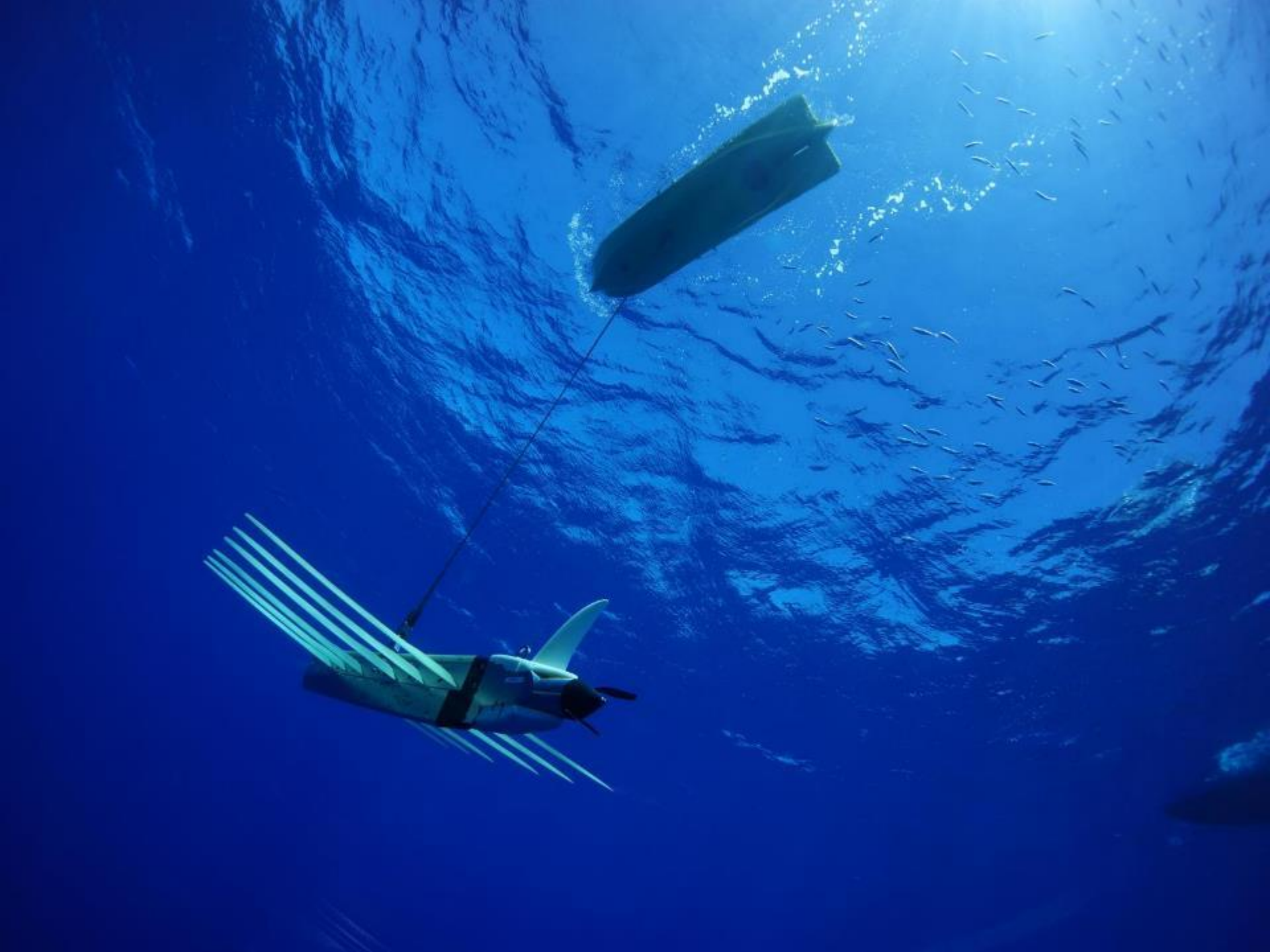




# BOEM Wave Glider Project

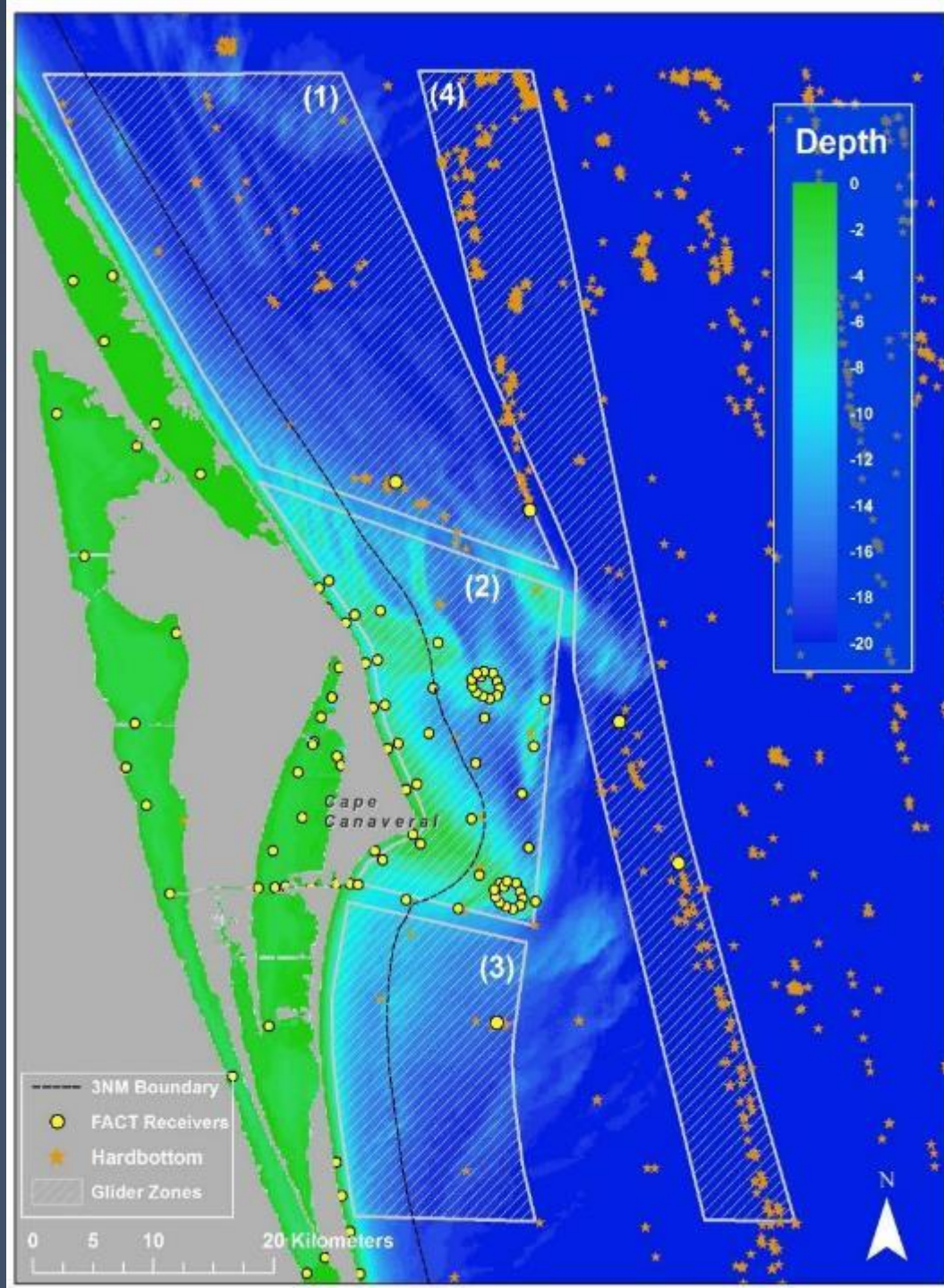






# Wave Glider Project

- Powered by Wave Energy and Solar
- Support Varied Scientific Payloads
- Can Stay at Sea for Months
- Operates in High Sea States
- Runs Pre-Defined Transects
- Controlled Via Web Browser
- Real-Time Data Streaming





Questions?

