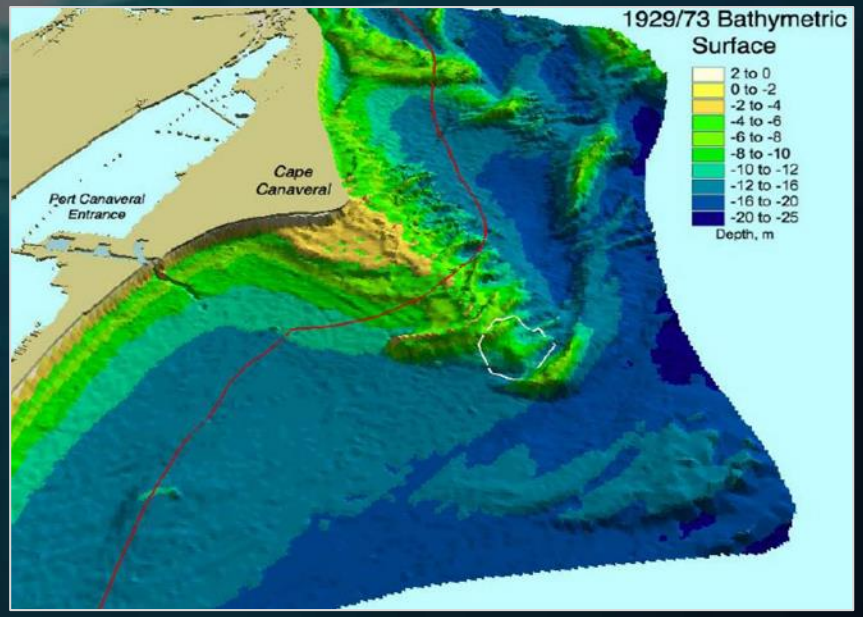
Multi-Year Movements of Blacknose, Finetooth, & Sharpnose Sharks in the US South Atlantic Based on Monitoring within a Regional-Scale Acoustic Telemetry Network

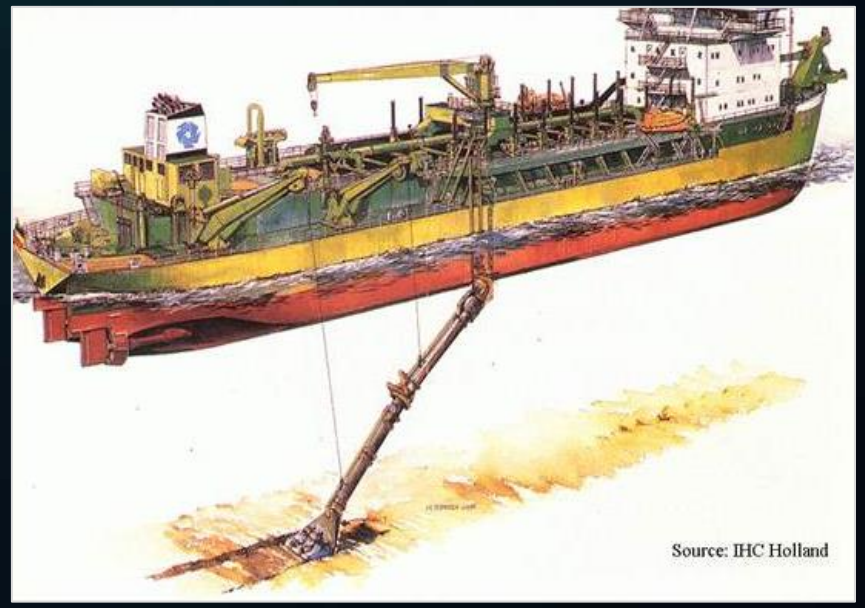
Eric Reyier, Bonnie Ahr & Doug Scheidt Kennedy Space Center Ecological Program
Joe Iafrate & Stephanie Watwood United States Navy

Ensuring Access to Sand

- Canaveral Has Largest Shoals in East Florida
- Source For Beach Nourishments
- Use by Large Fish and Turtles Unknown
- Bureau of Ocean Energy Mgmt. Funds Research To Understand
  - Natural Habitat Function
  - Dredging Effects
- NASA May Eventually Need Offshore Sand

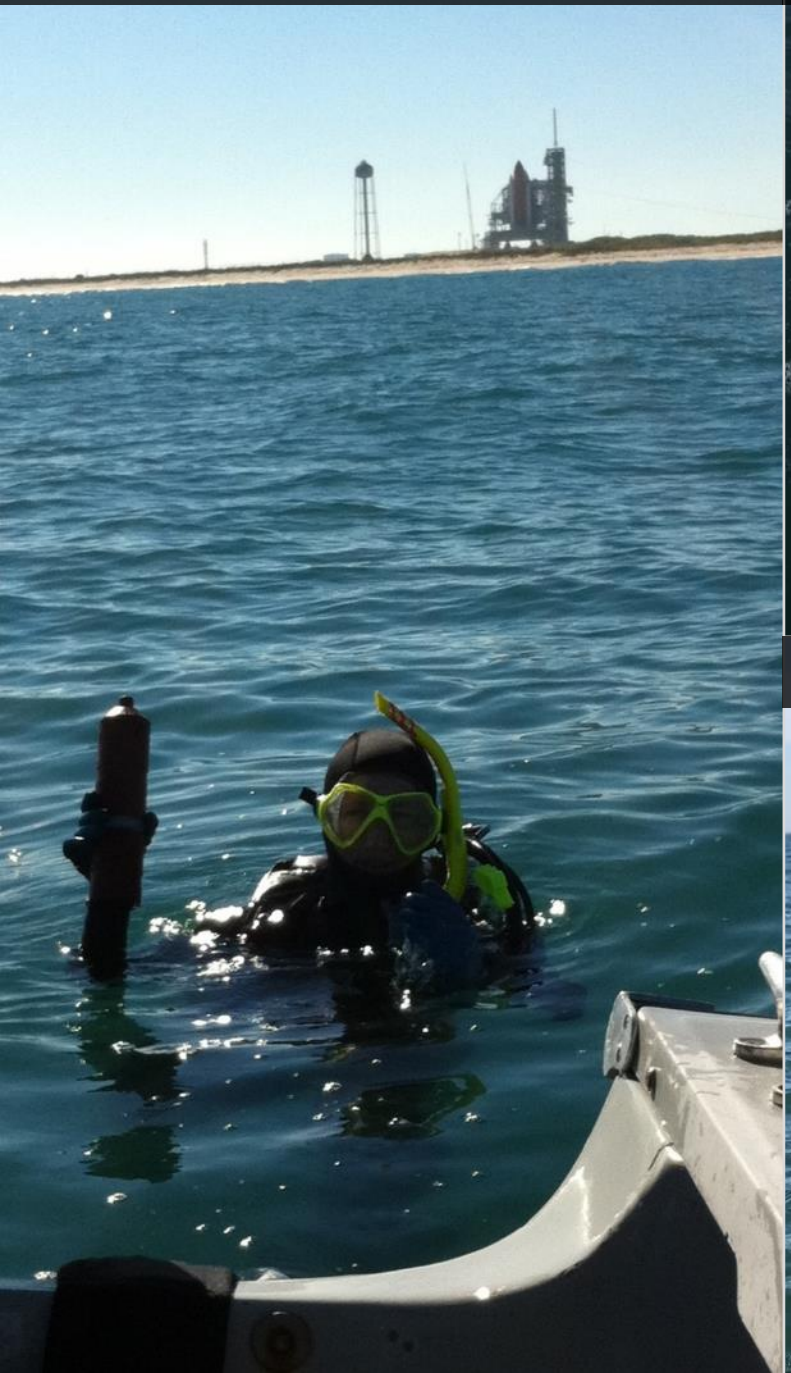


Canaveral Shoals bathymetry. Photo Credit: BOEM



Suction Hopper Dredge. Photo Credit: BOEM

Acoustic Telemetry



Longline Survey

Wave Glider Autonomous Surface Vessel

Sea Turtle Satellite Telemetry

Canaveral Shoals Longline Sets

Species Collected	Total
Sharpnose Shark	1436
Blacknose Shark	488
Blacktip Shark	277
Red Drum	170
Finetooth Shark	157
Nurse Shark	52
Southern Stingray	51
Bonnethead Shark	40
Spinner Shark	34
Scalloped Hammerhead	30
Lemon Shark	24
Sandbar Shark	22
Roughtail Stingray	21


Blacknose Shark


Finetooth Shark


Sharpnose Shark*

Our Target Species

- Co-Occur Throughout SE US
- Small Coastal Complex
- Support Commercial & Rec Fisheries
- Have Local Essential Fish Habitat (EFH)
- Migrations & Habitat Needs Coarsely Defined
- GOAL…..

Acoustic Tagging

- Tagging 2014-2017
- Caught on Longlines
- Measured, Sexed, Dart Tags
- All Implanted with Vemco 16-4H Transmitters

Species	No.	Mean FL (Range)	Sex Ratio (F:M)
Blacknose	60	96 (89–115)	33:27
Finetooth	61	104 (64–130)	39:22
Sharpnose	44	74 (67–83)	24:19

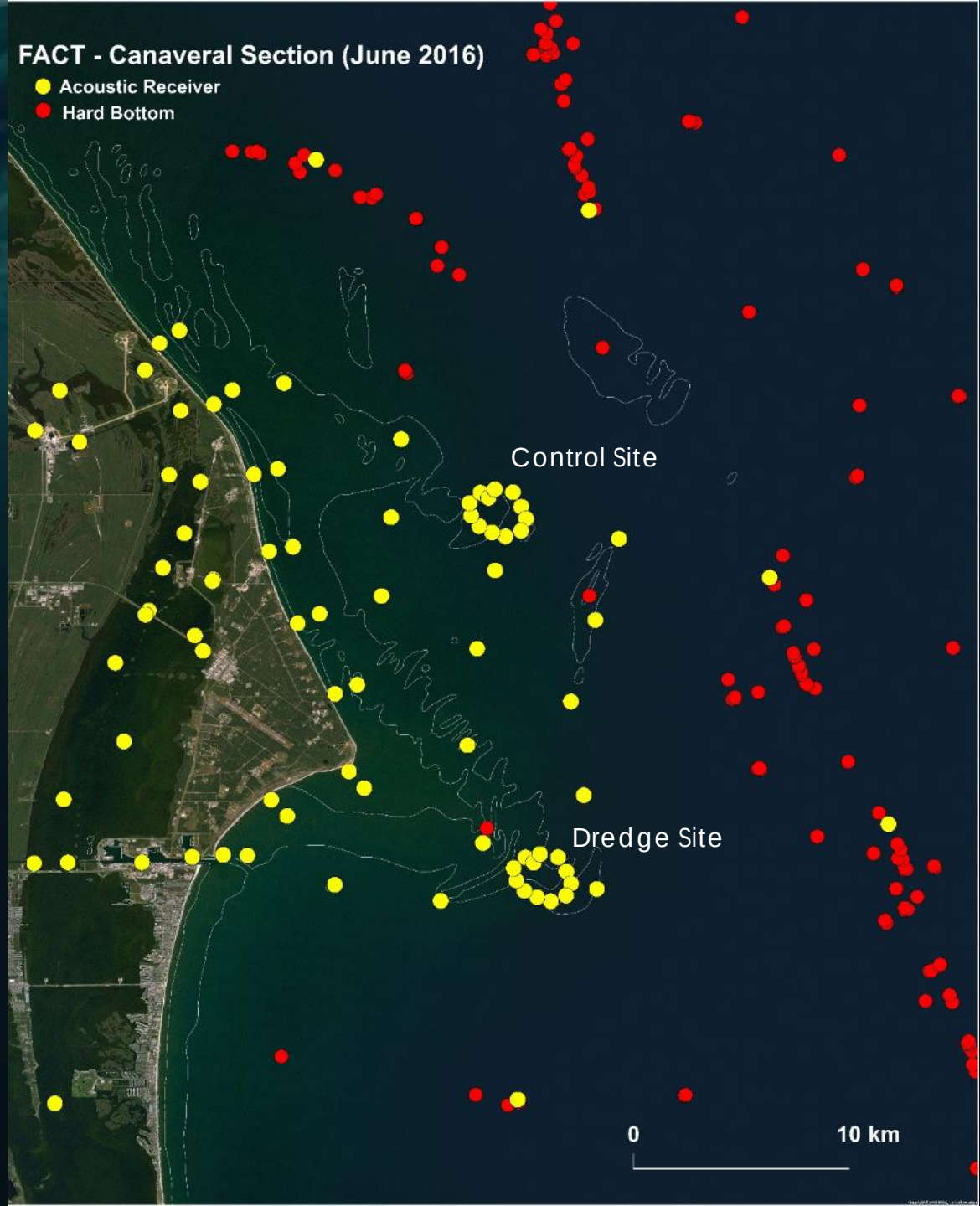
FACT Network Evolution (2007-2017)

The FACT Network

- 93 Research Groups
- 1500 Acoustic Receivers
- 5,700 Animals Tagged
- 94 Fish & Turtle Species
- Share Data
- Meet Twice Yearly
- www.secoora.org/fact

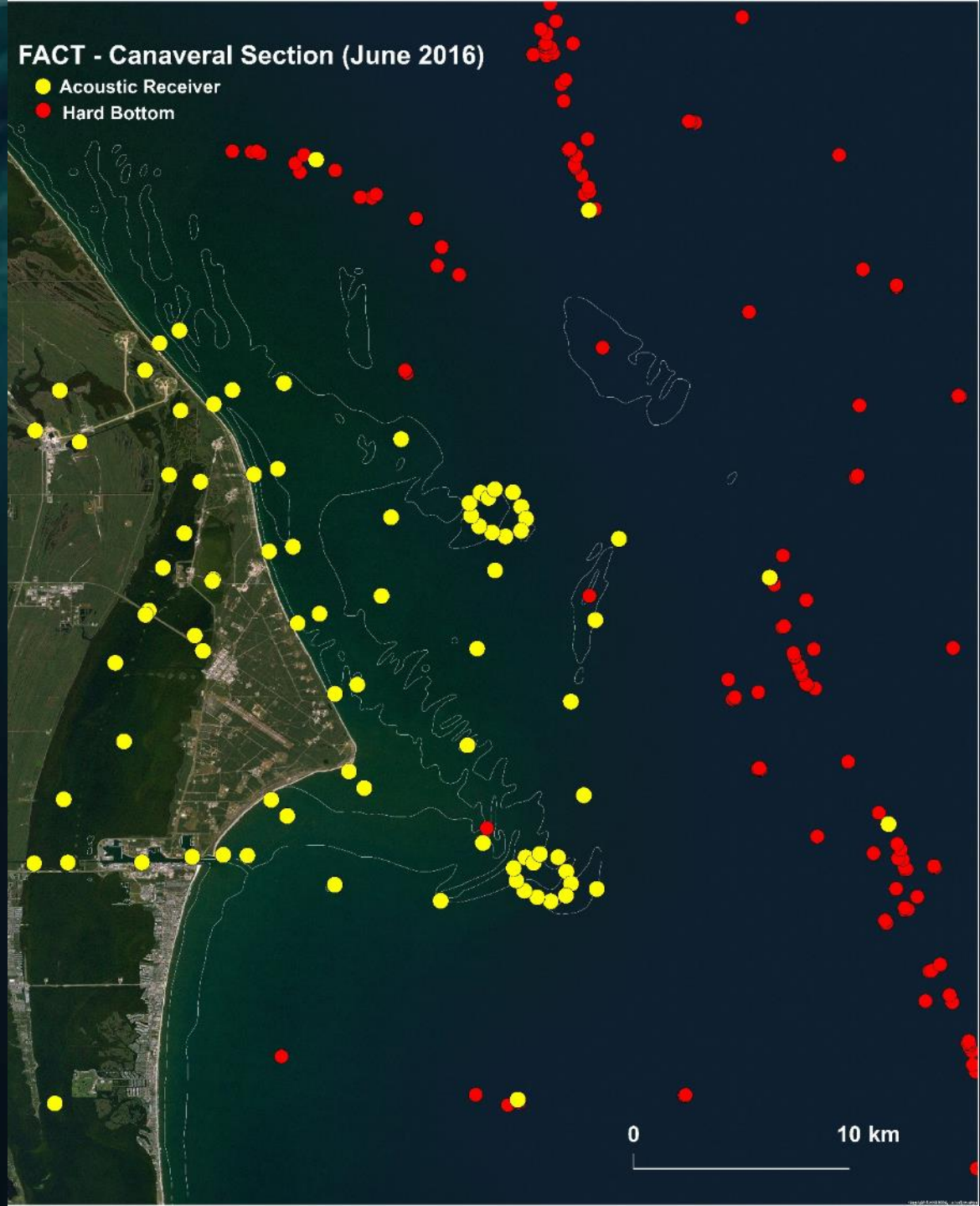
FACT Network at Cape Canaveral

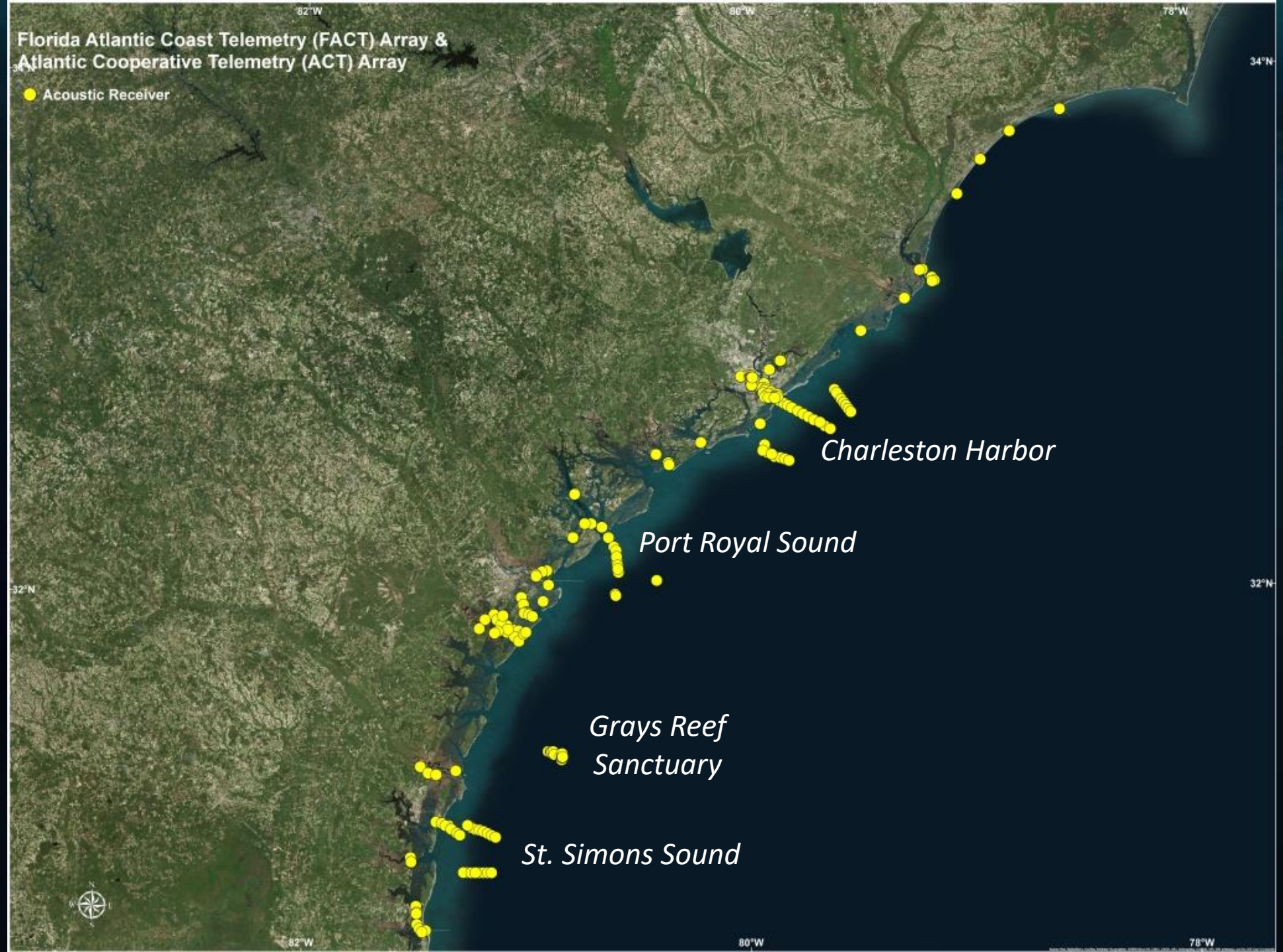
- 119 Acoustic Receivers
  - 65 Shoals Complex
  - 5 Reef Tract
  - 49 Estuary
- Dredge & Control Site Monitoring
- Deployed 2013-Present
- Serviced Every 6 Months



Telemetry Analyses

- Rate of Movement
- Visit Duration Modeling
  - Season, Water Temp, Depth, Slope, Solar Irradiance, Distance From Shore, Sediment % Fines, Sediment Organics
- Seasonal KDE Maps
- Coastal Migration Plots

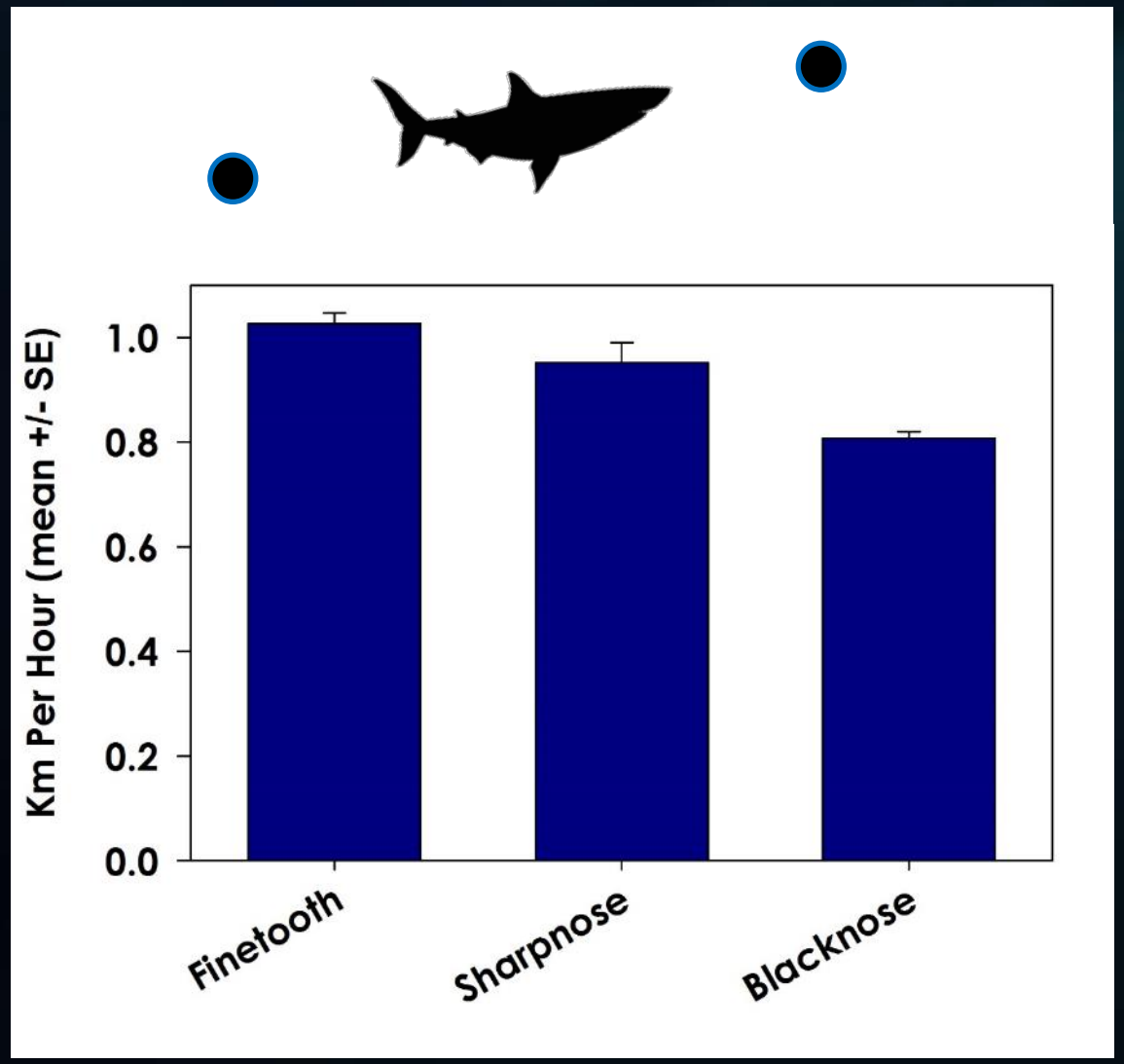



Florida Atlantic Coast Telemetry (FACT) Array &
Atlantic Cooperative Telemetry (ACT) Array
Acoustic Receiver
82°W
80°W
78°W
34°N
32°N
Charleston Harbor
Port Royal Sound
Grays Reef
Sanctuary
St. Simons Sound

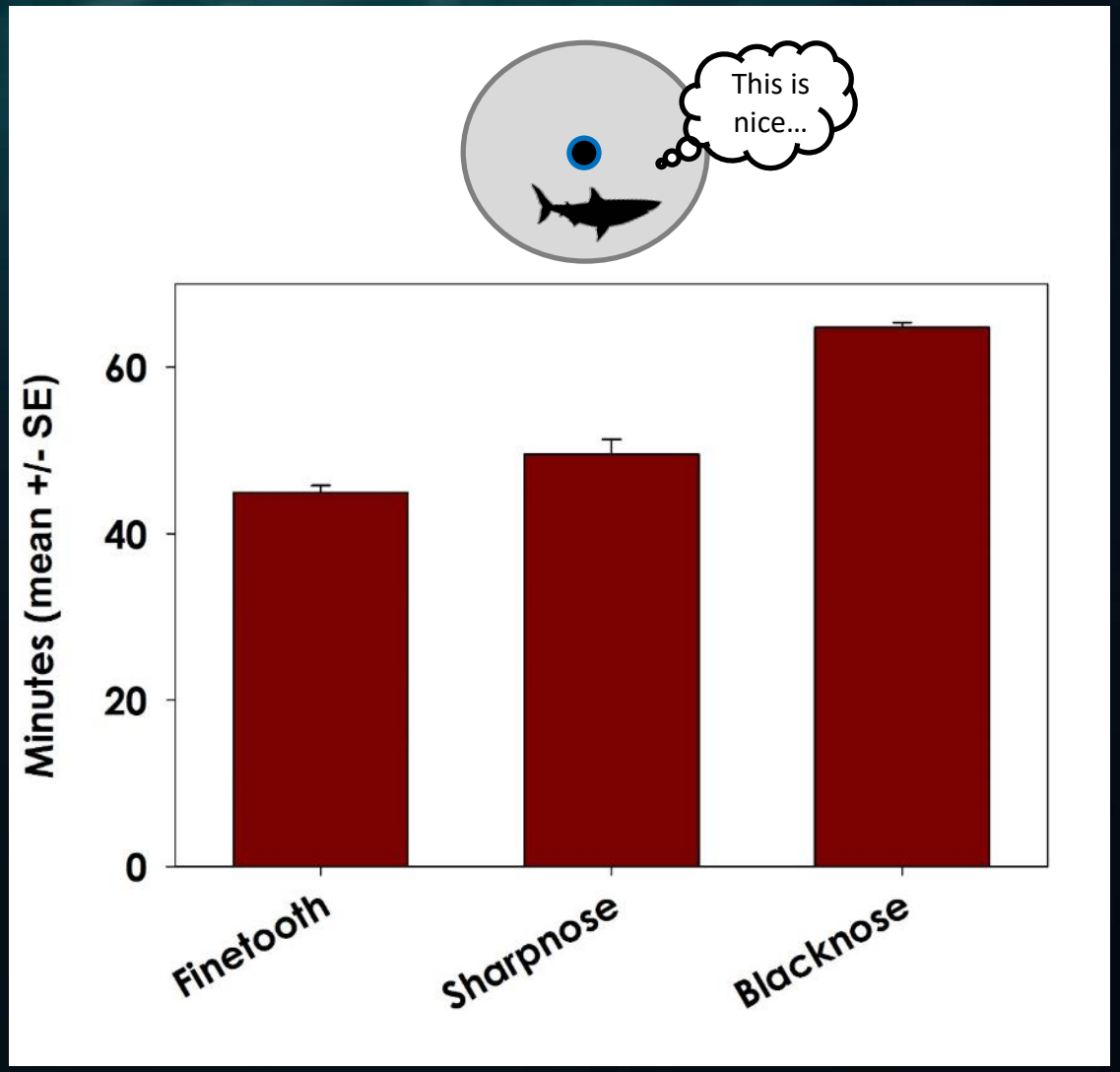
Results: Data Overview

Species	Detects	Receiver Visits	Days Tracked
Blacknose	535k	30k	798
Finetooth	183k	13k	841
Sharpnose	38k	3k	159
Total	758k	46k	

Rate of Movement

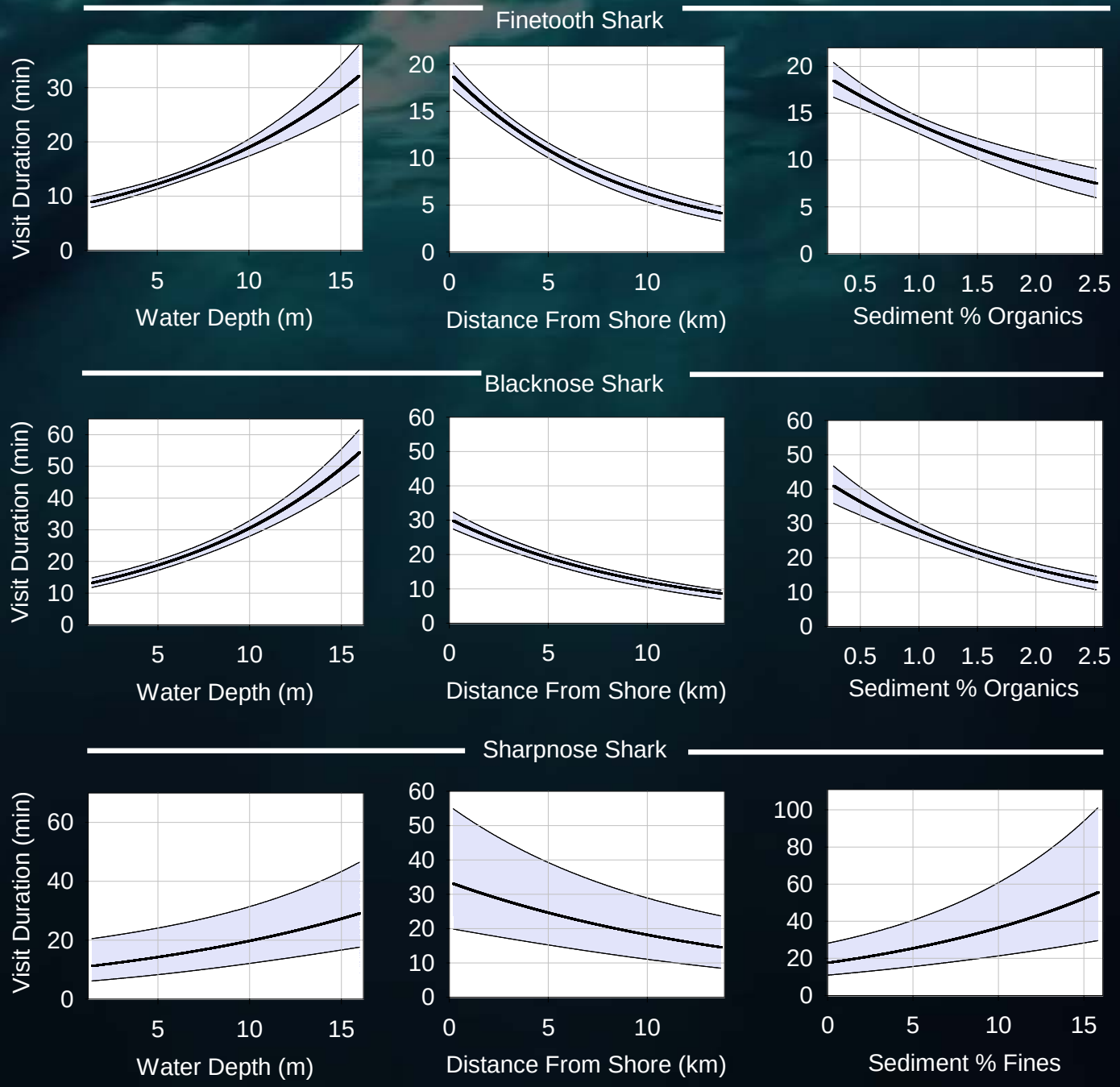


Visit Duration



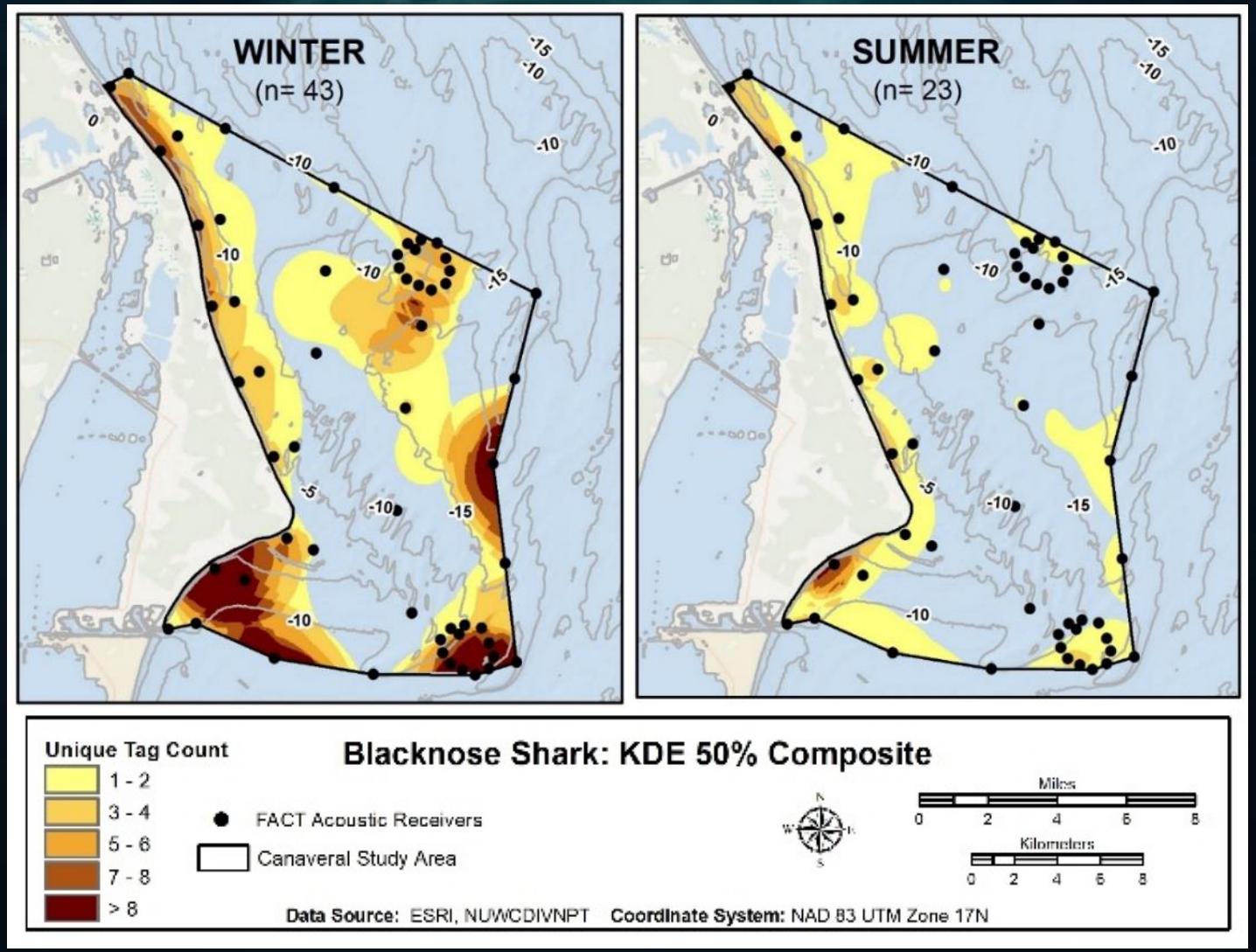
Visit Duration Model Results

- Season Important but Species-Specific
- Temperature Not Always Important
- Longer Visits in Deeper Water
- Longer Visits Near Shore
- Longer Visits in Areas of Finer Sediments and/or Lower Organics



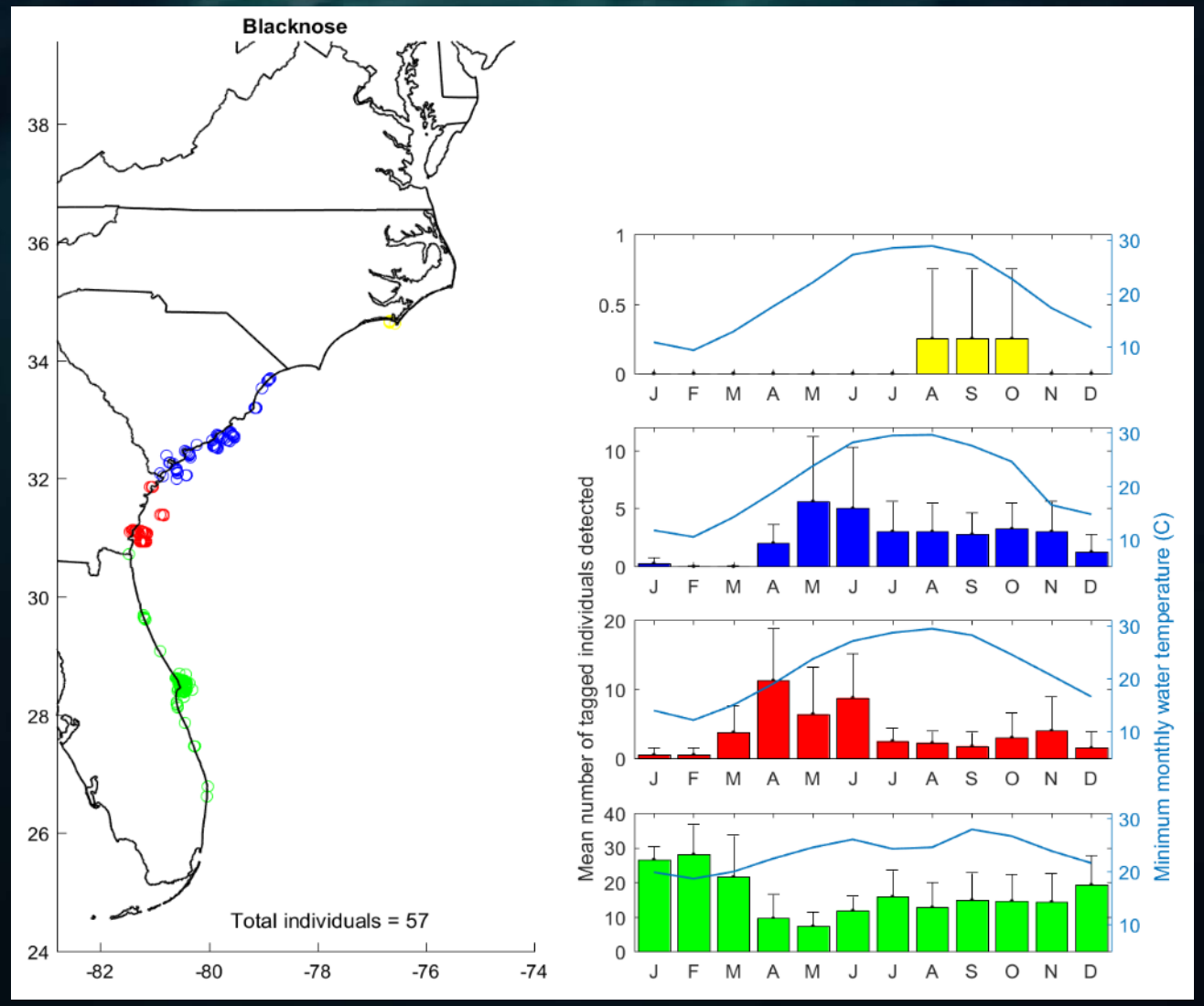
Blacknose Shark: Local Habitat Use

- Present Year-Round
- Wider Distribution in Winter
- Common out to Reef Tract
- Shoreward Shift in Summer
- Canaveral Bight Consistently Valuable
- No Avoidance of Dredge Site



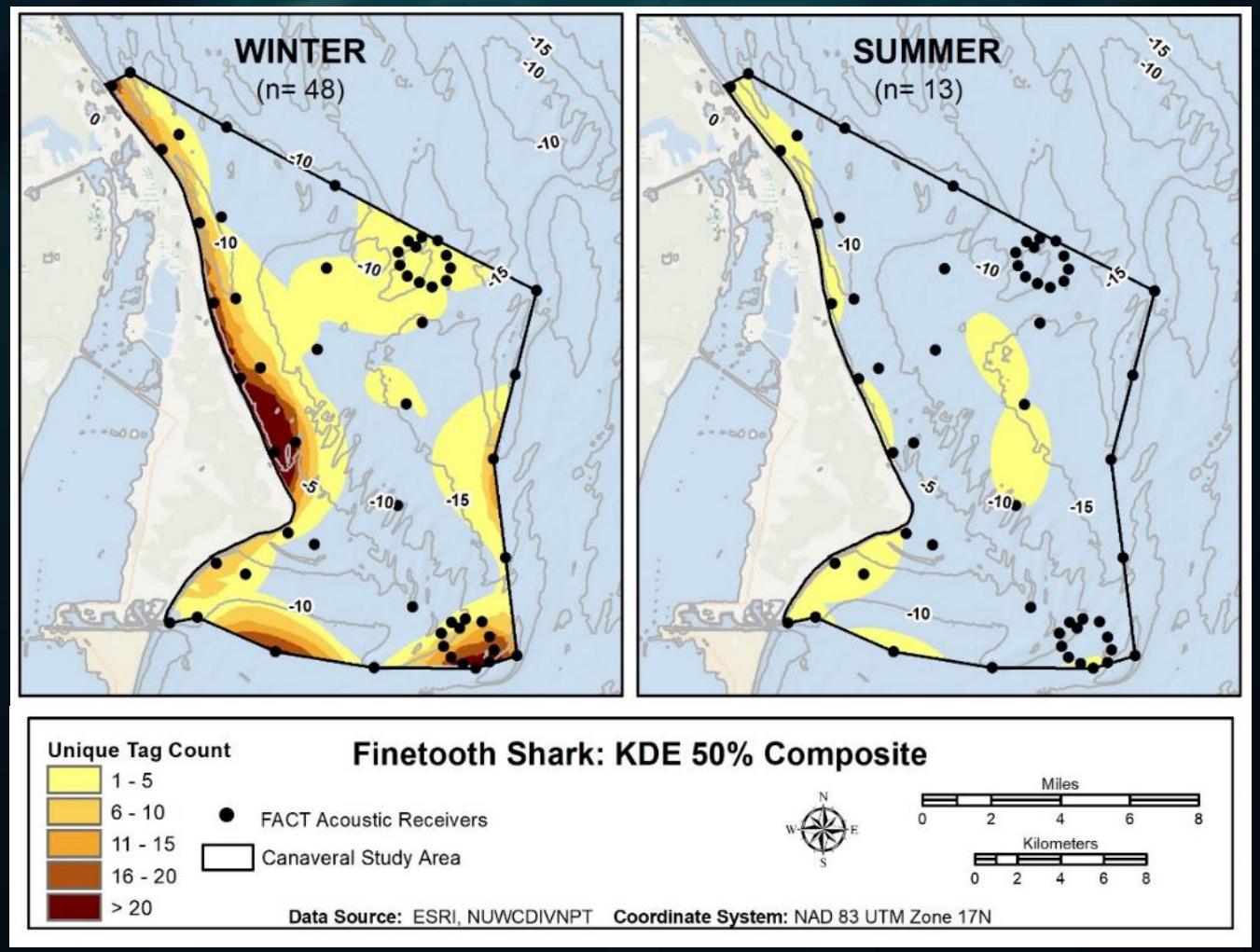
Blacknose Shark: Migrations

- Non-Obligate Migrations
- X (X%) Sharks Migrated
- Moving North by March
- Reach NC by August
- Some Females Return June-August
- Small Number Overwintered in GA
- Estuarine Use in GA and SC but not Central FL



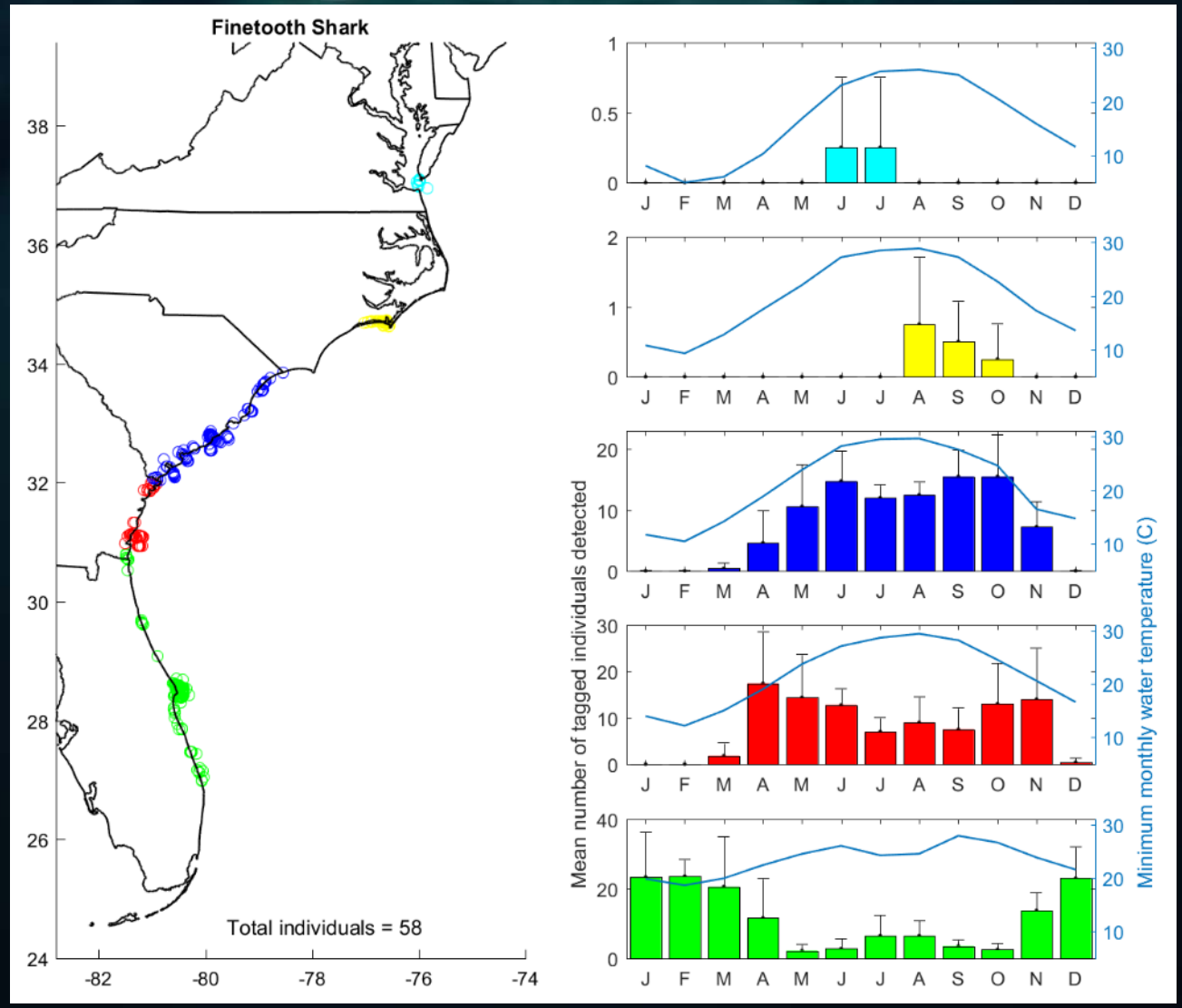
Finetooth Shark: Local Habitat Use

- Most Abundant in Winter
- Common out to Reef Tract
- Dramatic Shoreward Shift Each Spring
- Intermittent Visits in Summer
- No Avoidance of Dredge Site



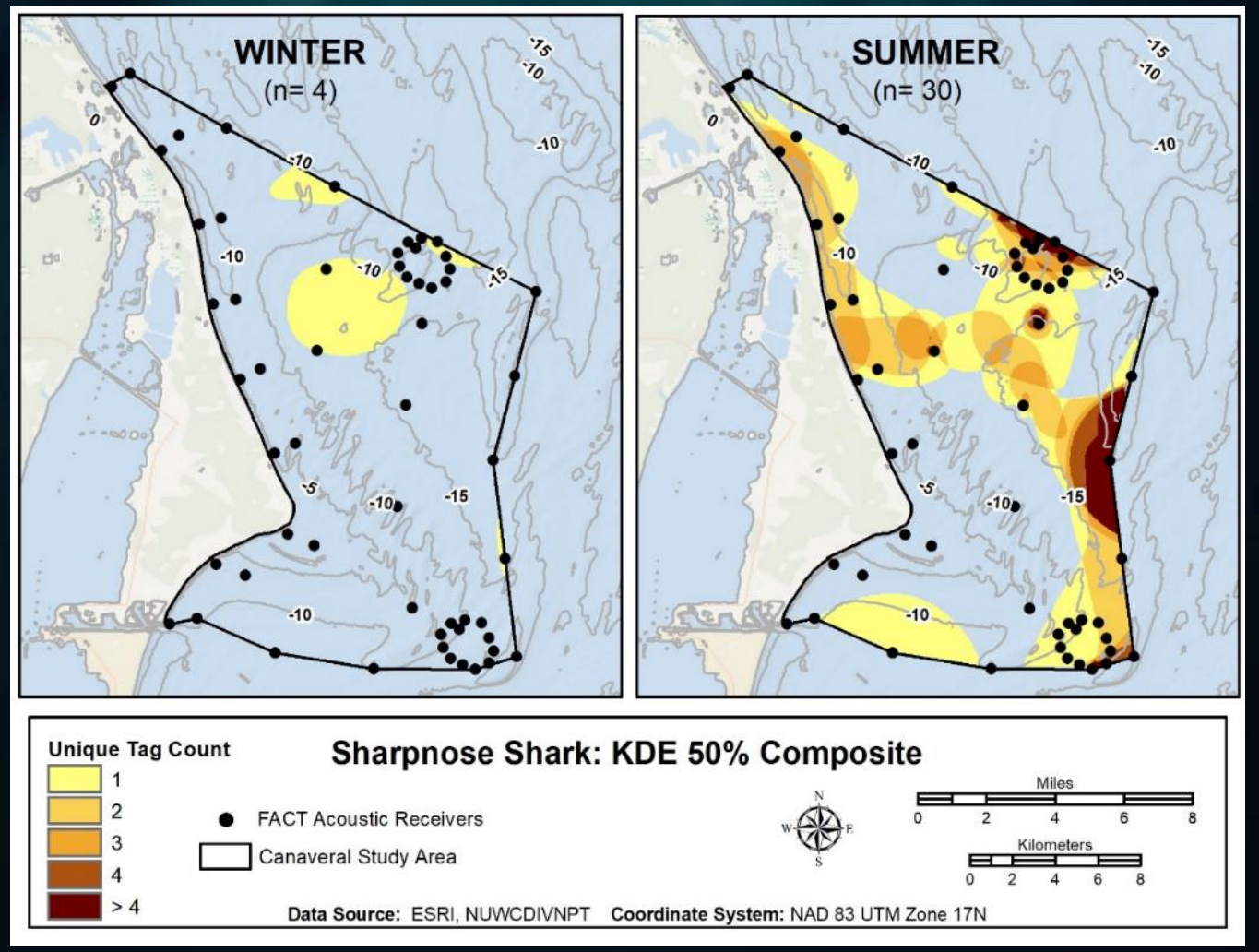
Finetooth Shark: Migrations

- Obligate Migrations
- X Sharks Migrated
- Moving North by March
- Reached VA by June
- Females Left Earlier and Some Returned Jun-Aug
- Estuarine Use Common in GA and SC, Limited in Central FL



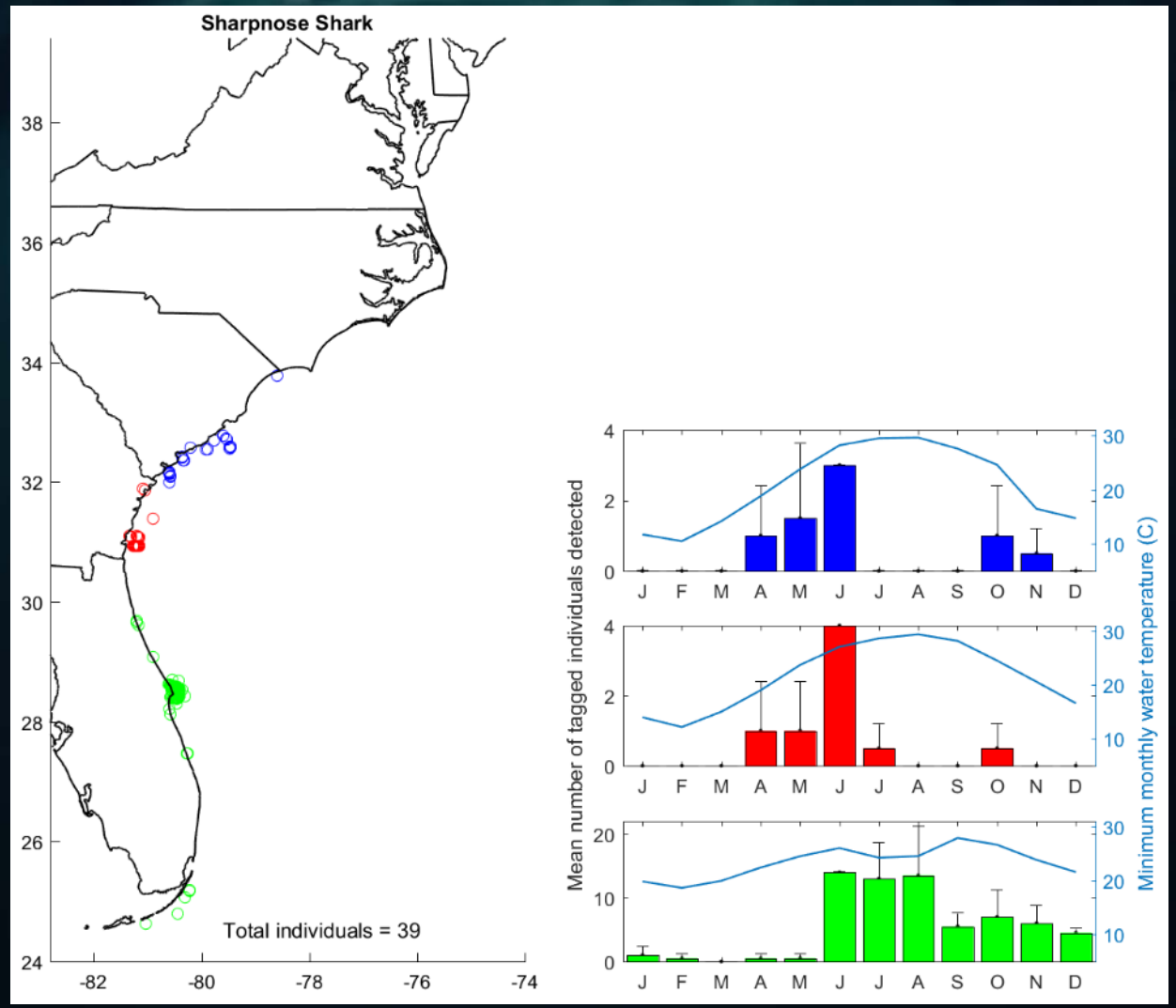
Sharpnose Shark Core Use Areas

- Most Abundant in Summer
- Intermittent Visits in Winter
- Preference for Deeper Water
- Uncommon on Shoals
- More Common on Control vs. Dredge Site



Sharpnose Shark: Migrations

- Complex Migrations
- Observed
  - North Migrations in Fall
  - South Migrations in Summer
- Migration Routes Seaward of Acoustic Arrays
- Only Species to Move to FL Keys



Take Home

Blacknose

- Slowest Rate of Movement
- Common Year-Round
- Non-Obligate Coastal Migrations

Finetooth

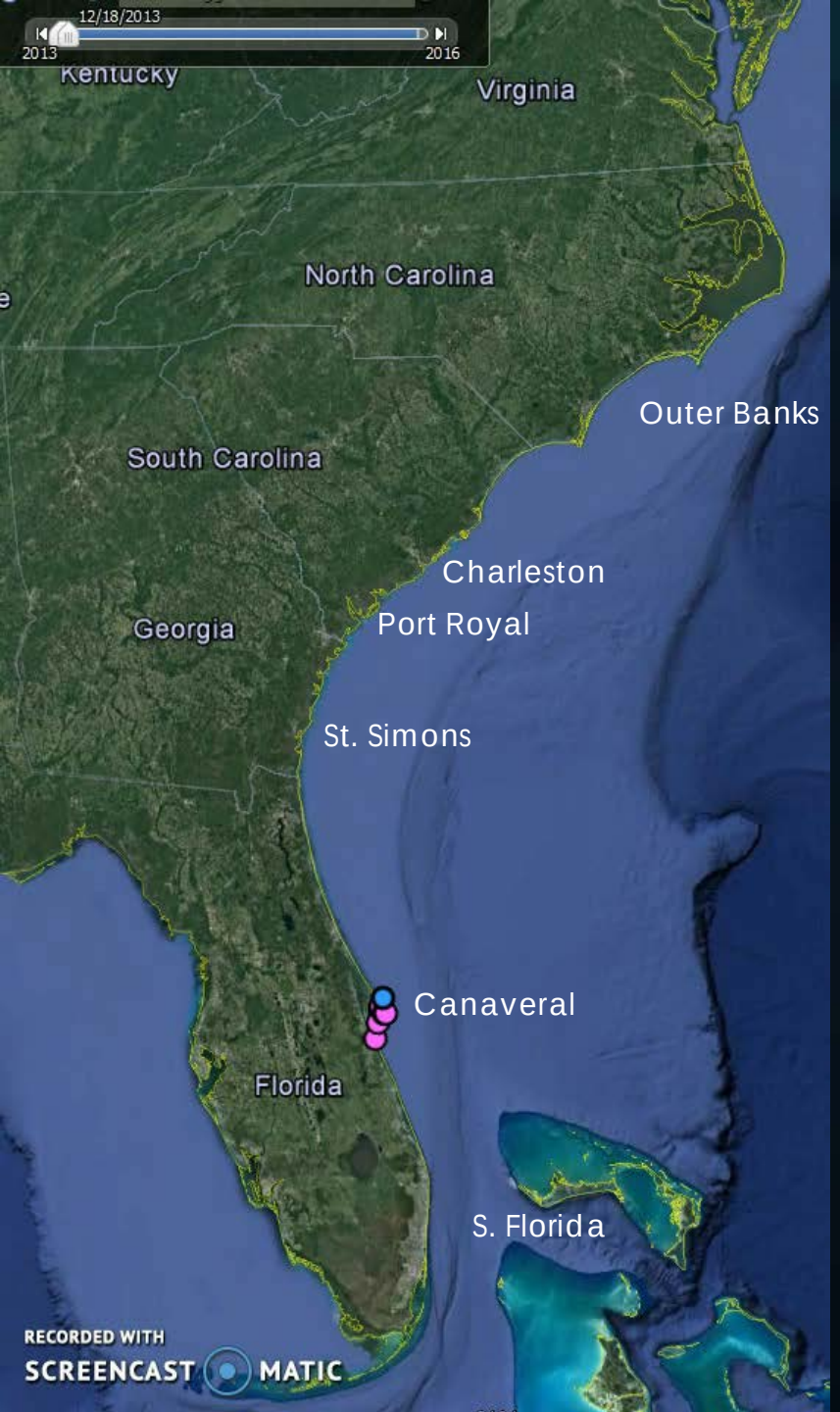
- Fastest Rate of Movement
- Most Common in Winter
- Obligate Coastal Migrations

Sharpnose

- Intermediate Rate of Movement
- More Common in Summer
- Complex Migrations

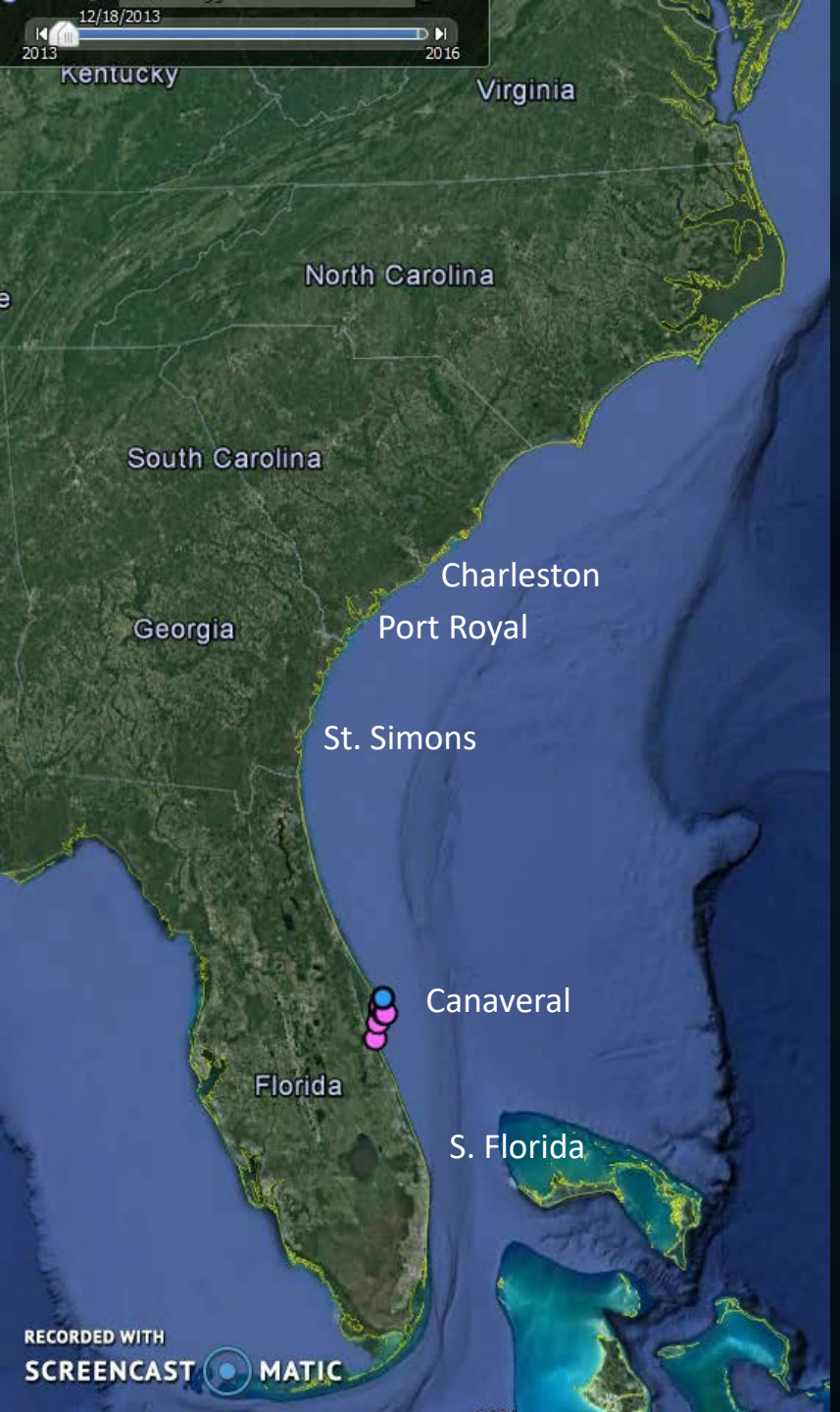
All Three Species

- Shoreward Shift in Warmer Months
- Moved More Slowly When Near Shoreline
- LOWER Site Fidelity on Reef Tract
- Massive Exchange of Animals with GA and SC
- South Migrations Spring/Summer Common
- Returned To/Through Canaveral Annually
- No Use of Estuaries in Central Florida
- Little Movement to S. Florida, None to GOM
- No Aversion To Dredge Site



What Next?

- Acoustic Telemetry Captures Migration Timing with Excellent Detail
- Opportunity to Establish Benchmarks For Migration Timing & Temperatures
- Developing R-Script That is Repeatable & Comparable with Future Data
- Can Subset by Species, Size Class, Sex, Location
- Possibly a Manuscript that Simultaneously Compares Multiple Elasmobranch Species



Finetooth Shark Migration Metrics

(n =764 Events)

		Arrival Dates		Water Temp (°C)		
Travel	Region	First	Median	Lowest	Median	% of Pop
N	St. Simons GA	9 Mar	21 Apr	17.9	20.5	89
N	Charleston SC	4 Apr	13 Jun	18.3	25.6	56
S	St. Simons GA	16 Jul	6 Nov	18.4	22.3	58
S	Canaveral FL	8 Oct	7 Dec	18.6	21.6	84

So Many to Thank……

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  - NASA
  - Naval Undersea Warfare Center


QUESTIONS?