



Ecological Function and Recovery of Canaveral Shoals

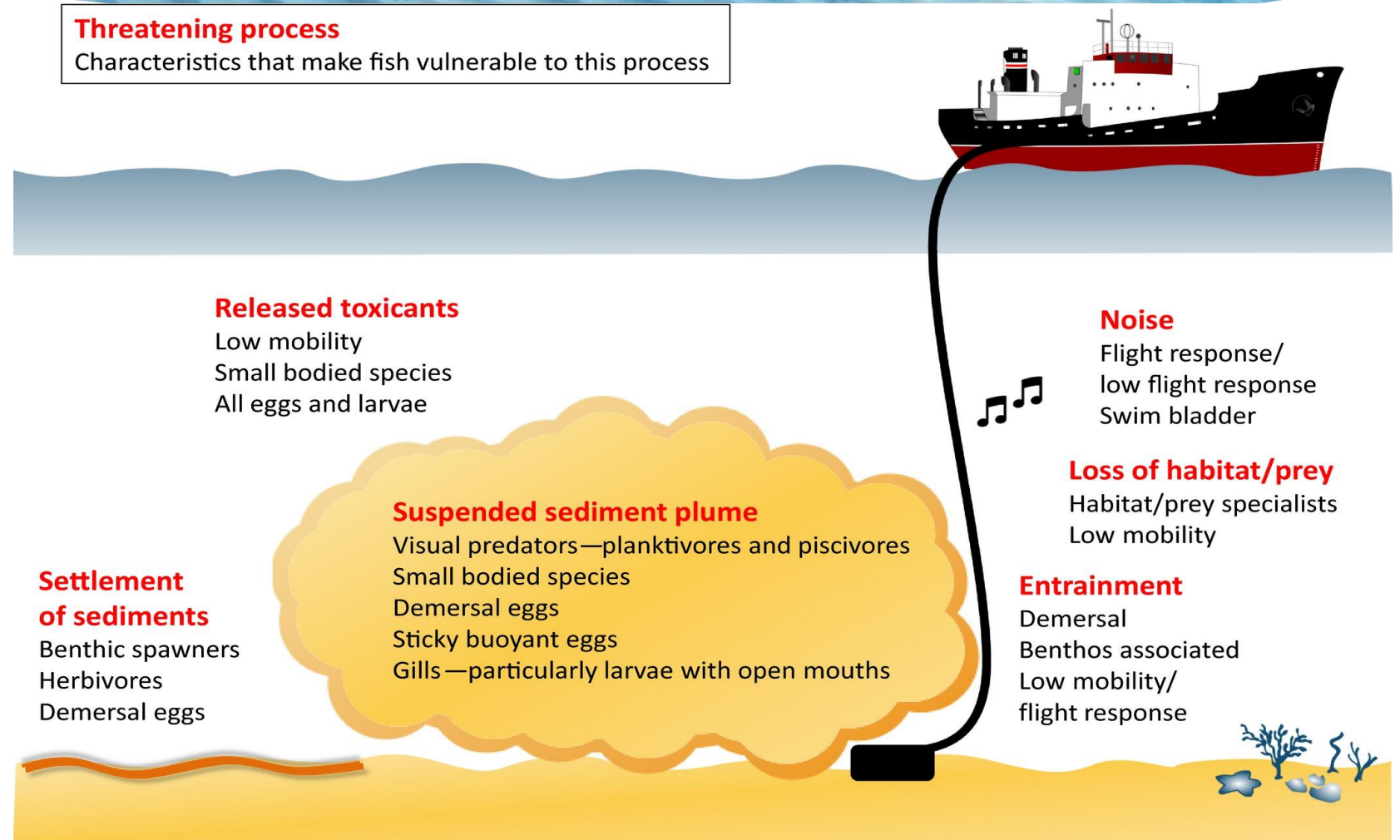
FSBPA 35th National Conference on Beach Preservation Technology
February 3, 2022

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Dredging Impacts

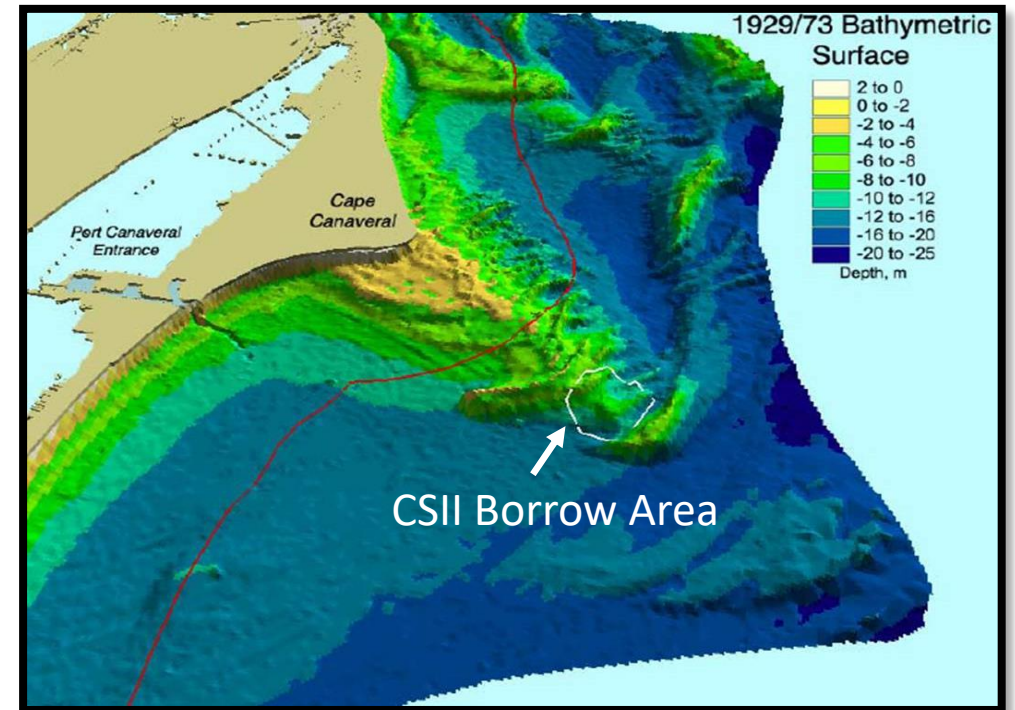
- Entrainment
- Loss of benthic habitat/prey
- Habitat alteration
- Turbidity
- Noise
- Displacement
- Sediment deposition
- Vessel Interactions



Wenger et al. 2017. Fish and Fisheries, Volume: 18, Issue: 5, Pages: 967-985, First published: 27 March 2017, DOI: (10.1111/faf.12218)

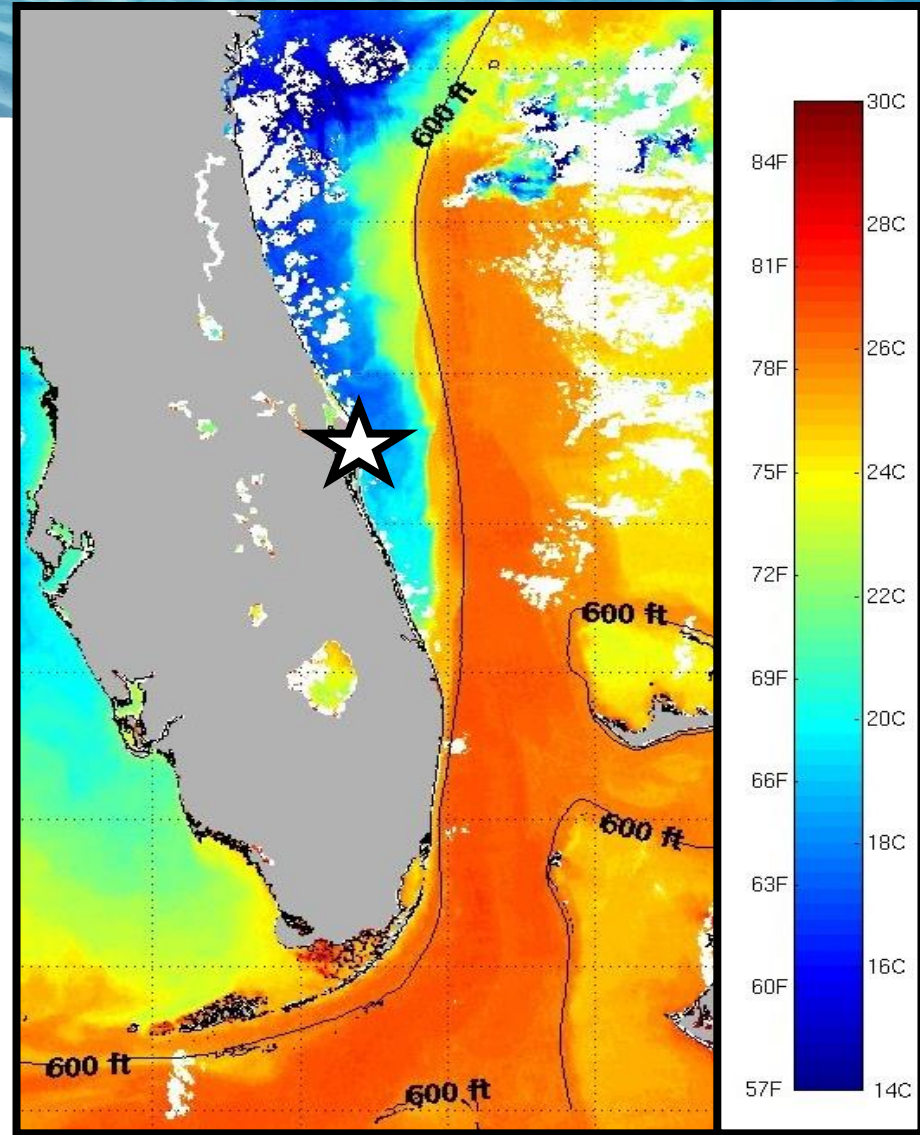
Study Importance

- Sand shoals are important source of beach-quality sand along Atlantic and Gulf of Mexico.
- Demand for this resource is predicted to grow.
- Sand shoals are also an important habitat.
- National Marine Fisheries Service (NMFS) defines Essential Fish Habitat (EFH) for federally managed species.
- NMFS has identified ridge swale and cape-associated shoal complexes as EFH.
- Also utilized by protected species (sturgeon, sea turtles, manta ray, sawfish).



Study Importance

- Florida fisheries support
 - 2020 - \$57 million in commercial landings (east FL)
 - High recreational usage
- Canaveral has high marine diversity
- 100+ fish species are Federally managed
- Important sea turtle nesting region



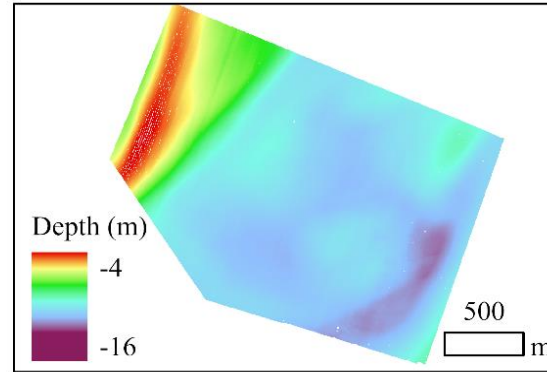
NOAA-19 Sea Surface Temperature (February 17, 2019)

Study Importance

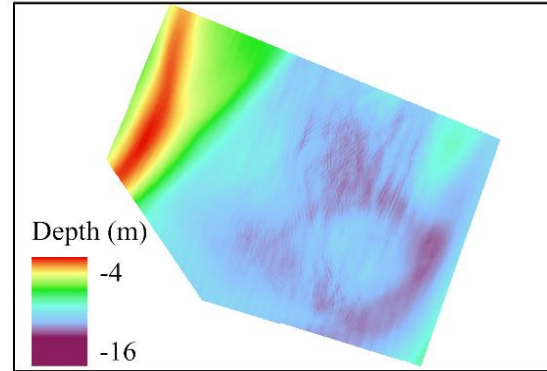
Canaveral Shoals (CSII) has been dredged multiple times

- 2000 – 7.3 mcy Brevard
- 2001 – 600,000 cy PAFB
- 2005 – 2.35 mcy Brevard and PAFB
- 2009 – 1.3 mcy Brevard
- 2013 – 2.75 mcy Brevard and PAFB
- 2018 – 1.7 mcy – Brevard
- 2019 – 2.62 mcy Brevard and PAFB

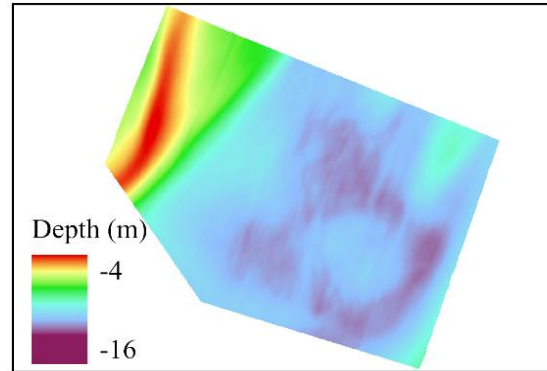
CSII 2013



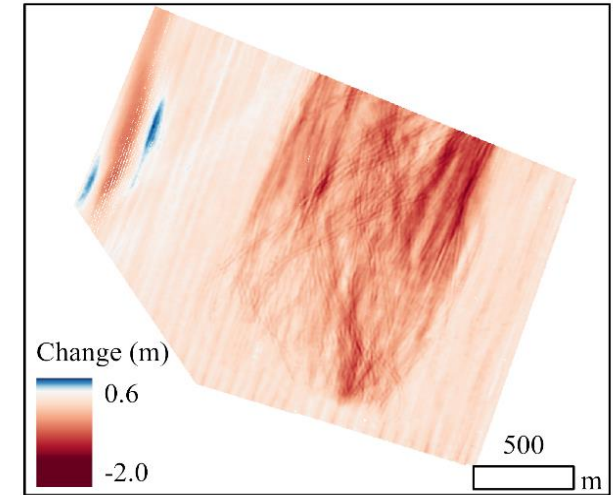
CSII 2014



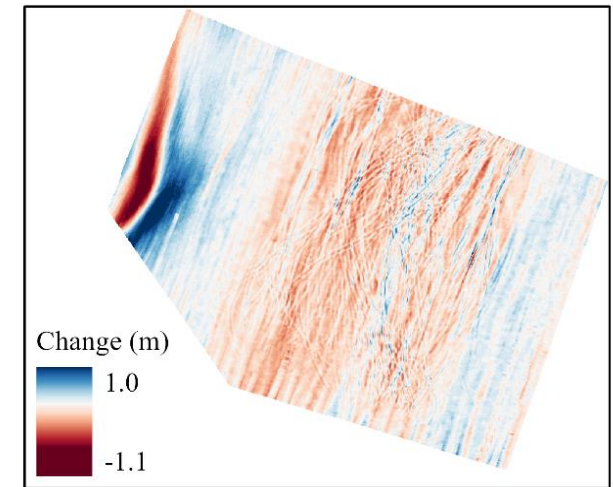
CSII 2015



CSII Difference 2013-2014



CSII Difference 2014-2015




Study Introduction

- Projects began in 2013 with Hurricane Sandy funding.
- First final report on study examining the impact and recovery of dredging on Canaveral Shoals was completed in 2020 (<https://www.boem.gov/BOEM-2019-043/>) – **Navy**.
- Ecological Function and Recovery of Biological Communities within Dredged Ridge-Swale Habitats in the South-Atlantic Bight – **University of Florida (UF)**.
- Additional final reports will be available this year:
 - UF – July 2022
 - Navy – March 2022

OCS Study
BOEM 2019-043

Behavior, Seasonality, and Habitat Preferences of Mobile Fishes and Sea Turtles Within a Large Sand Shoal Complex: Insights From Traditional Sampling and Emerging Technologies

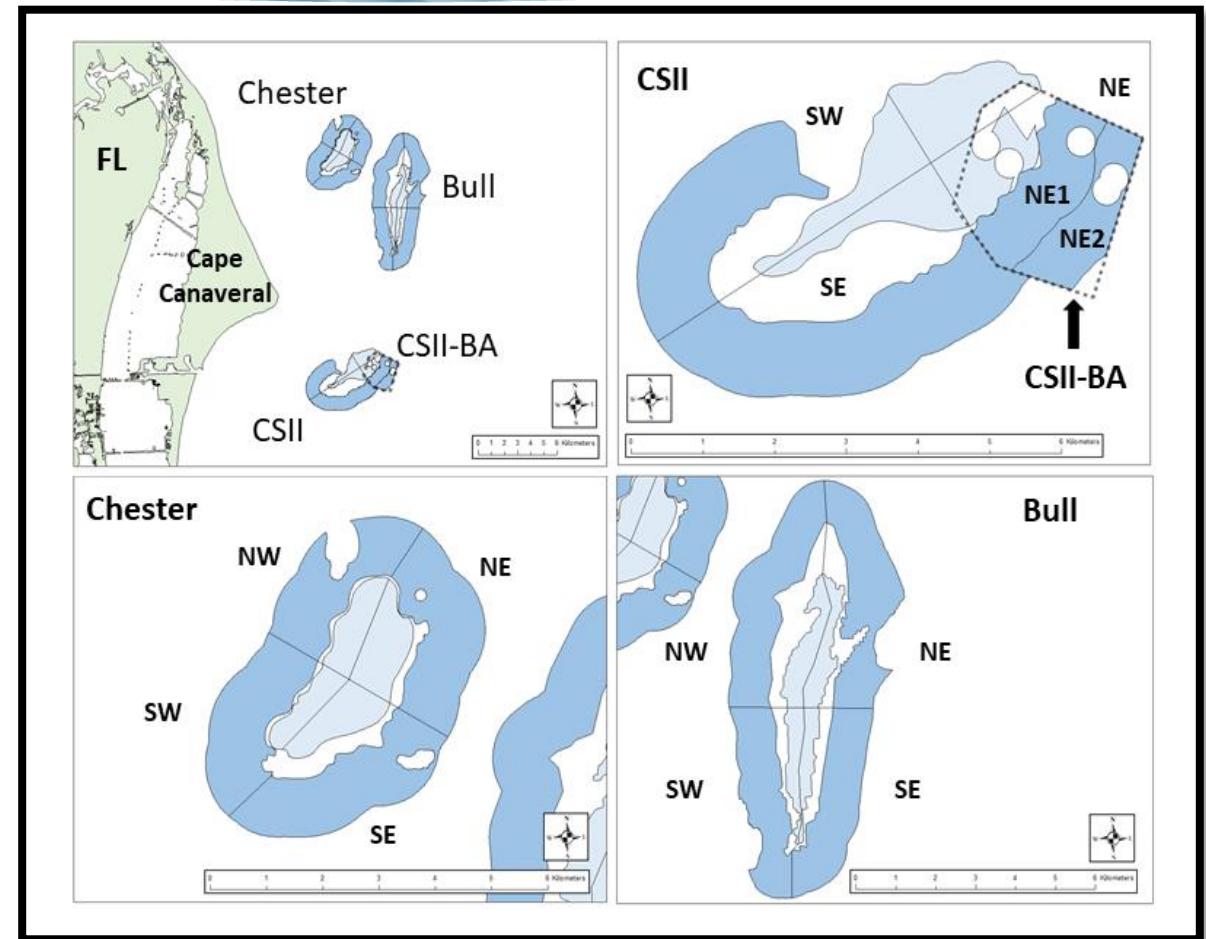


US Department of the Interior
Bureau of Ocean Energy Management
Headquarters

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Study Goals

- 1) Characterize the coastal oceanography and environment;
- 2) Quantify habitat preferences and seasonality of fish and sea turtles;
- 3) Compare species abundance, biomass, and assemblages;
- 4) Determine the biological recovery;
- 5) Discern functional, ecosystem-level services potentially compromised by dredging.



Resource Areas Studied

	UF	Navy
Physical Oceanographic Surveys	X	X
Bathymetry	X	
Habitat Classification	X	X
Water Quality	X	
Plankton	X	
Benthic Infauna and Epifauna	X	
Demersal Invertebrates	X	
Fish Abundance	X (Partial)	X
Fish Habitat Use	X	X
Sea Turtles		X
Ecological Modeling	X	
Soundscape		X

Benthic Grab Sampling



Plankton Tows

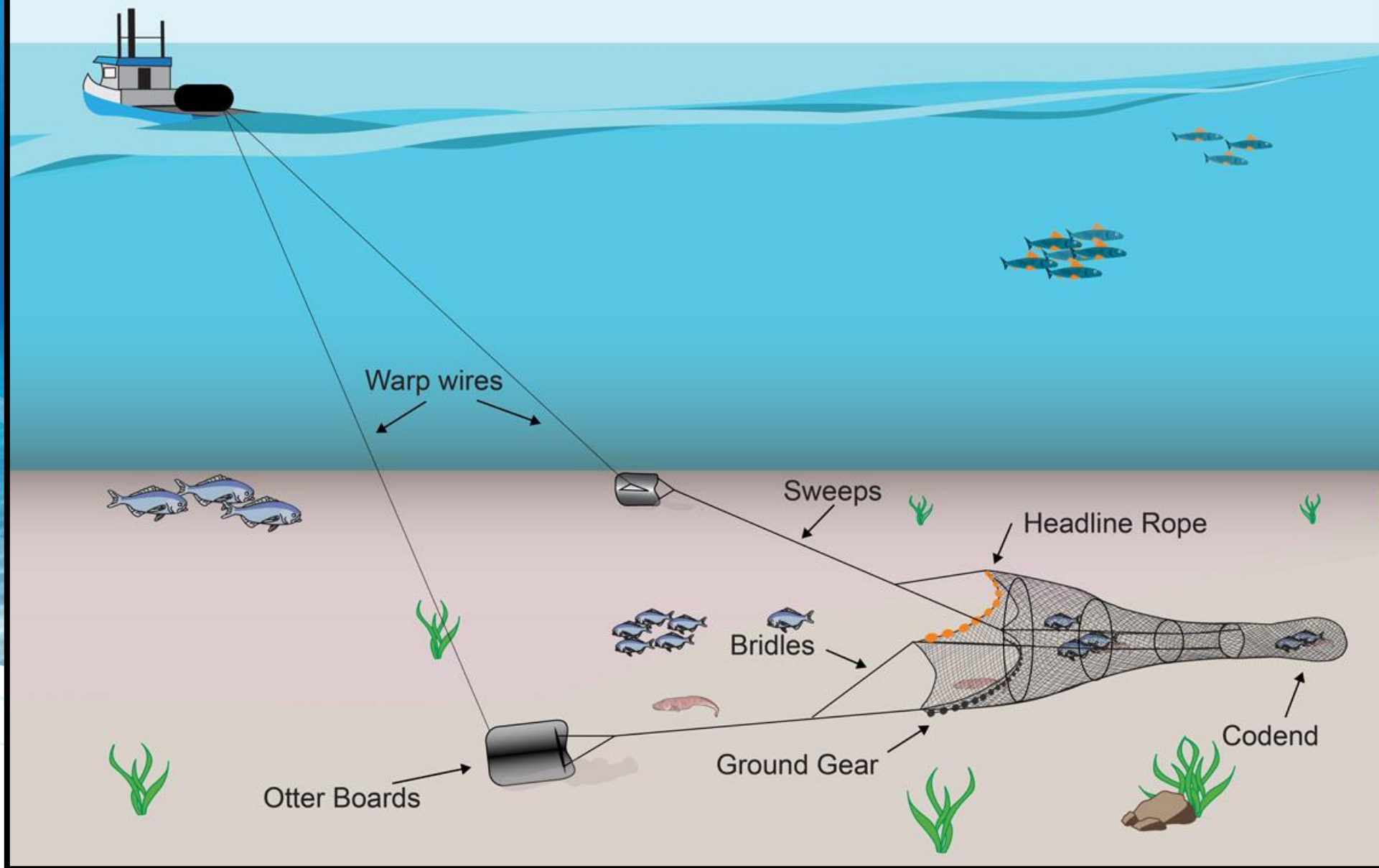


Benthic Grab Sampling





Demersal (Bottom) Trawl



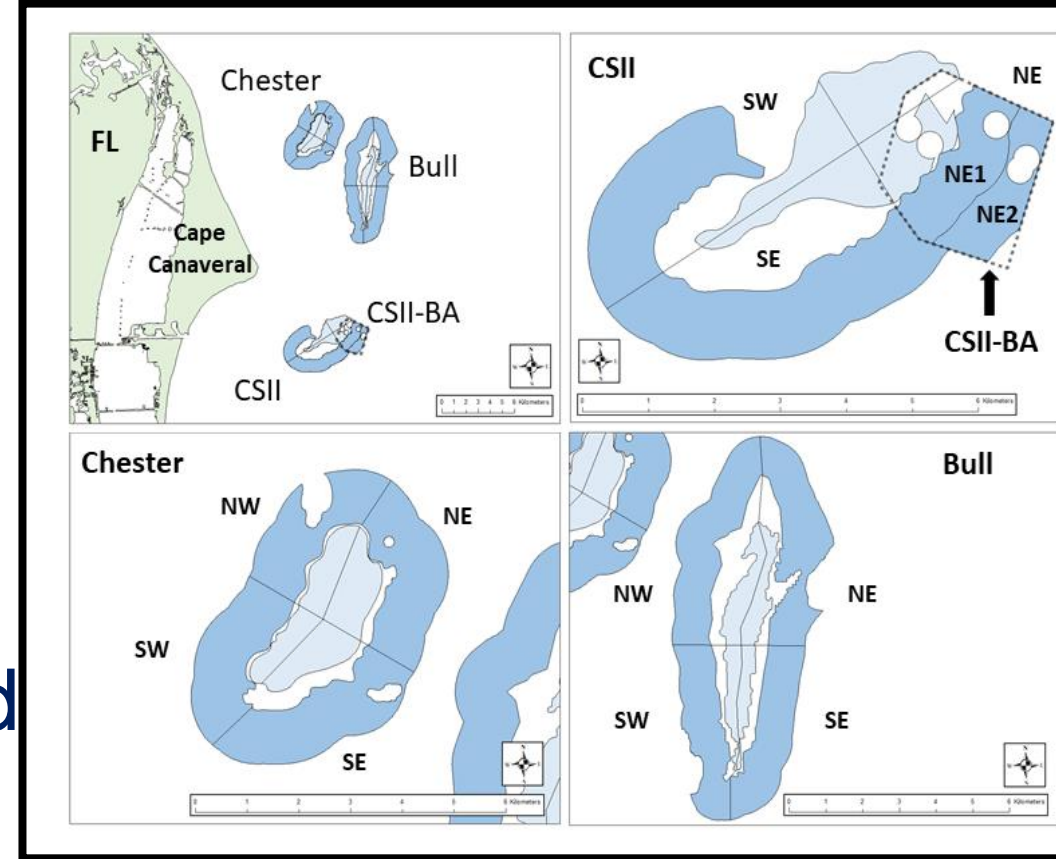
Biological Sampling

Temporal Framework:

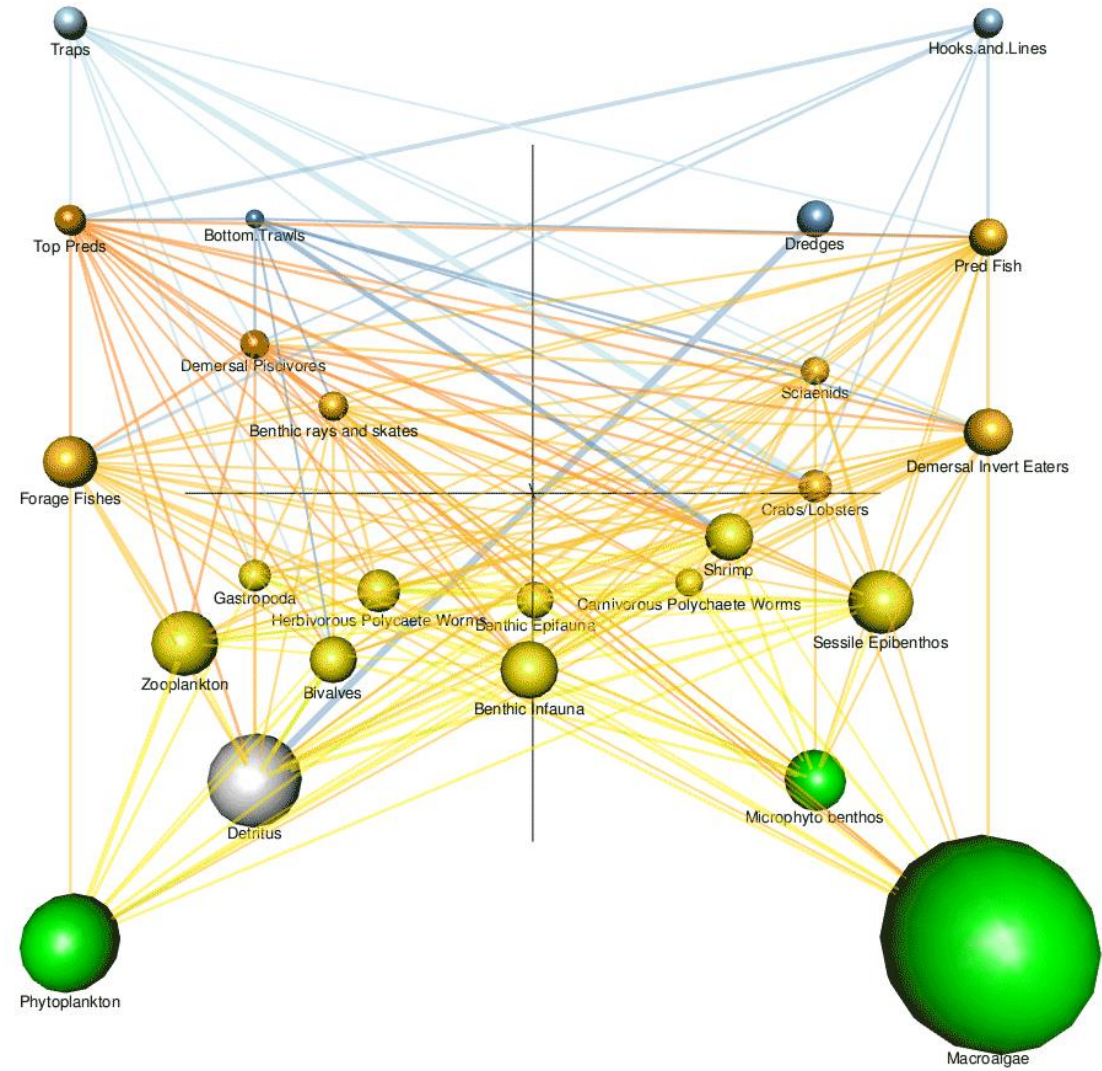
- Annual
- Seasonal (Spring, Summer, Fall, Winter)
- Diel (Day/Night differences)

Spatial Framework:

- Reference Shoals versus Dredged Shoal
- Ridge versus Swale

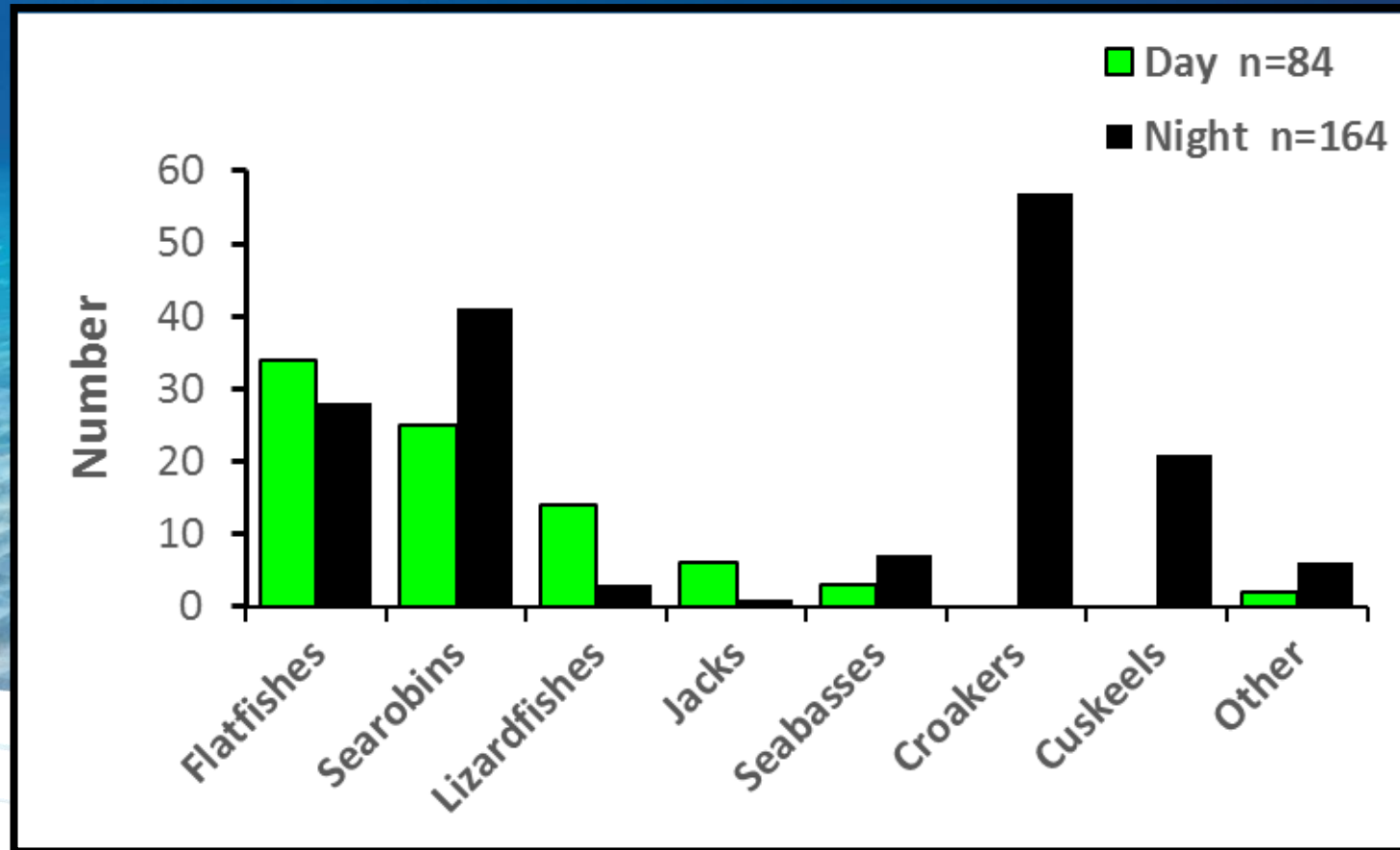


Ecological Modeling



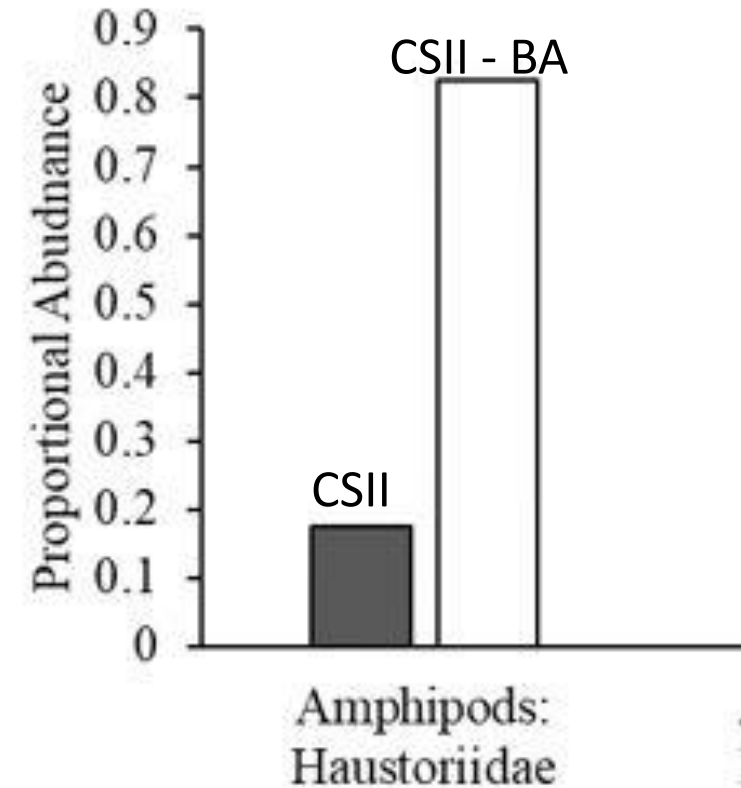
UF Study – Fish Trawl

Winter Trawling: Bull Shoal
(Abundance: 31 species total)



UF Study Results – Plankton and Invertebrates

- Plankton data detected significant differences between shoals, seasons, and topography.
 - Not attributed to dredge impacts.
- Invertebrates such as amphipods, lancelets, and sand dollars were all more abundant in dredged than non-dredged portions of CSII but this could not be statistically linked to dredging events.
- The only taxon with a significant response to dredging was the amphipod family Haustoriidae with an increase in the dredged area.



UF Study Results – Invertebrates

- Higher diversity of benthic infauna and epifauna invertebrates in swales (a mean of 8.8 species versus 6.3 on ridge)
 - Highest diversity in summer.
 - Not significantly different before and after dredge events.
- For demersal invertebrates, a weak biomass response to dredging
 - Significant variability between years suggesting environmental factors were more important
- No difference in general biological factors – invertebrate abundance, biomass, species richness, or Simpson's Diversity of Index.

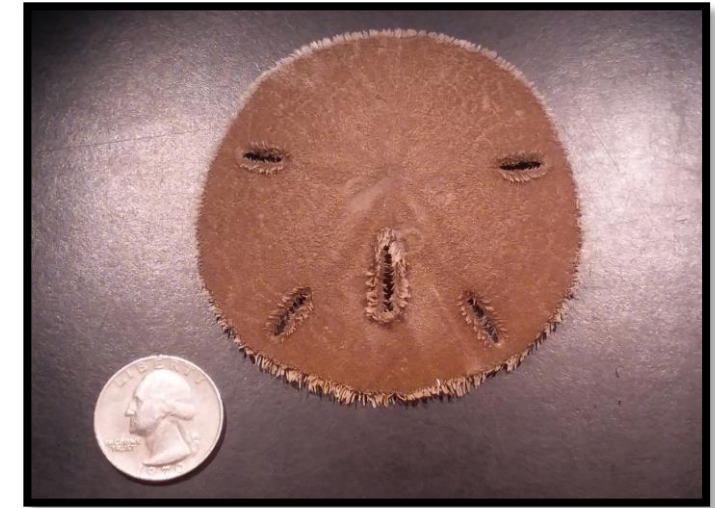


Photo: P. Baker

UF Study Results – Invertebrates and Ecosystem

- It is highly likely there were dredging impacts on benthic invertebrates, however the effects were transient, and recovery was rapid.
- According to the modeled ecological indicators, there were no clear effects of dredging on the CSII-BA ecosystem.
- Impacts fell within the variability seen across the Cape Canaveral ecosystem or recover too rapidly to be detected by most sampling schemes.
- Most ecological indicators showed higher similarities between borrow area and Chester, the reference shoal, than between borrow area and CSII.



Navy Study

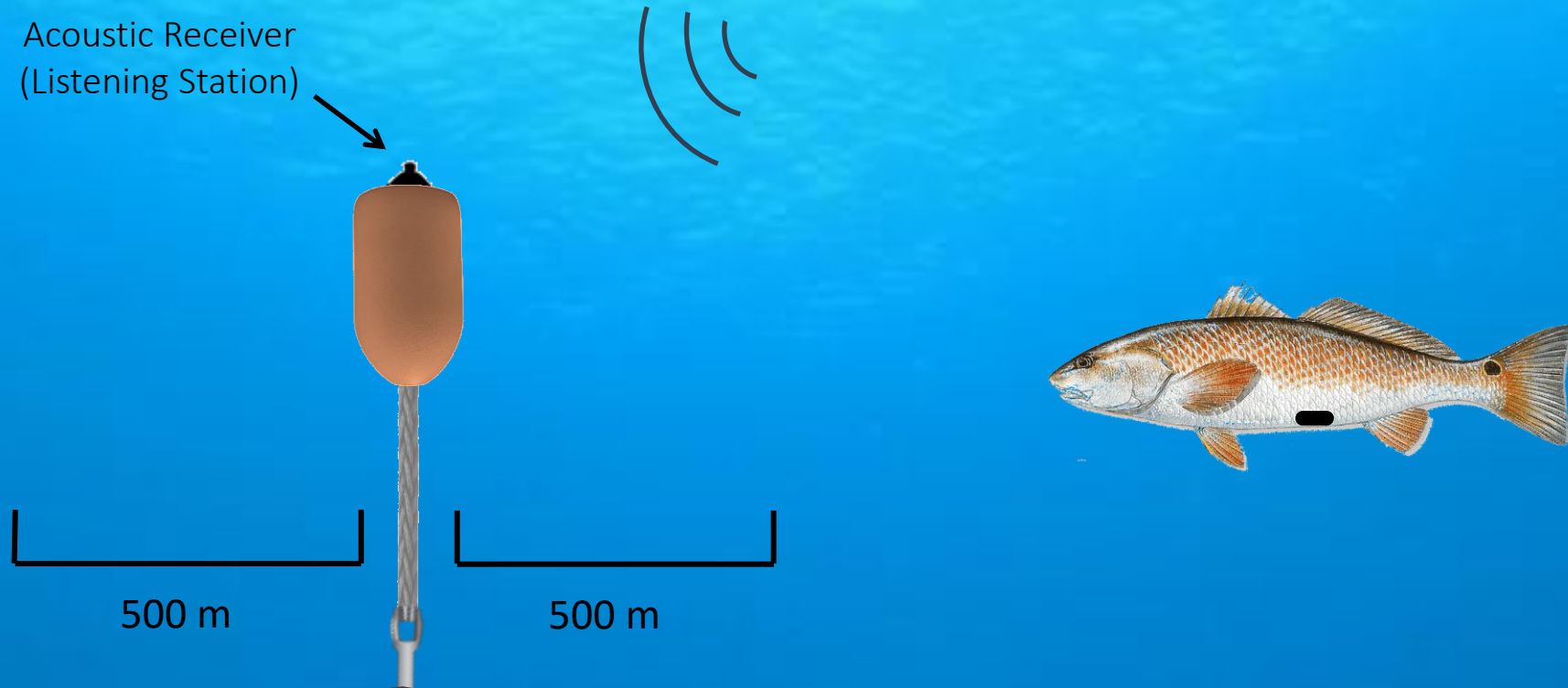
- Traditional longline sampling.
- Tag-recapture techniques with passive acoustic telemetry.
- Tagging of female green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles with satellite transmitters.
- Use of Wave Glider unmanned surface vehicle (USV).



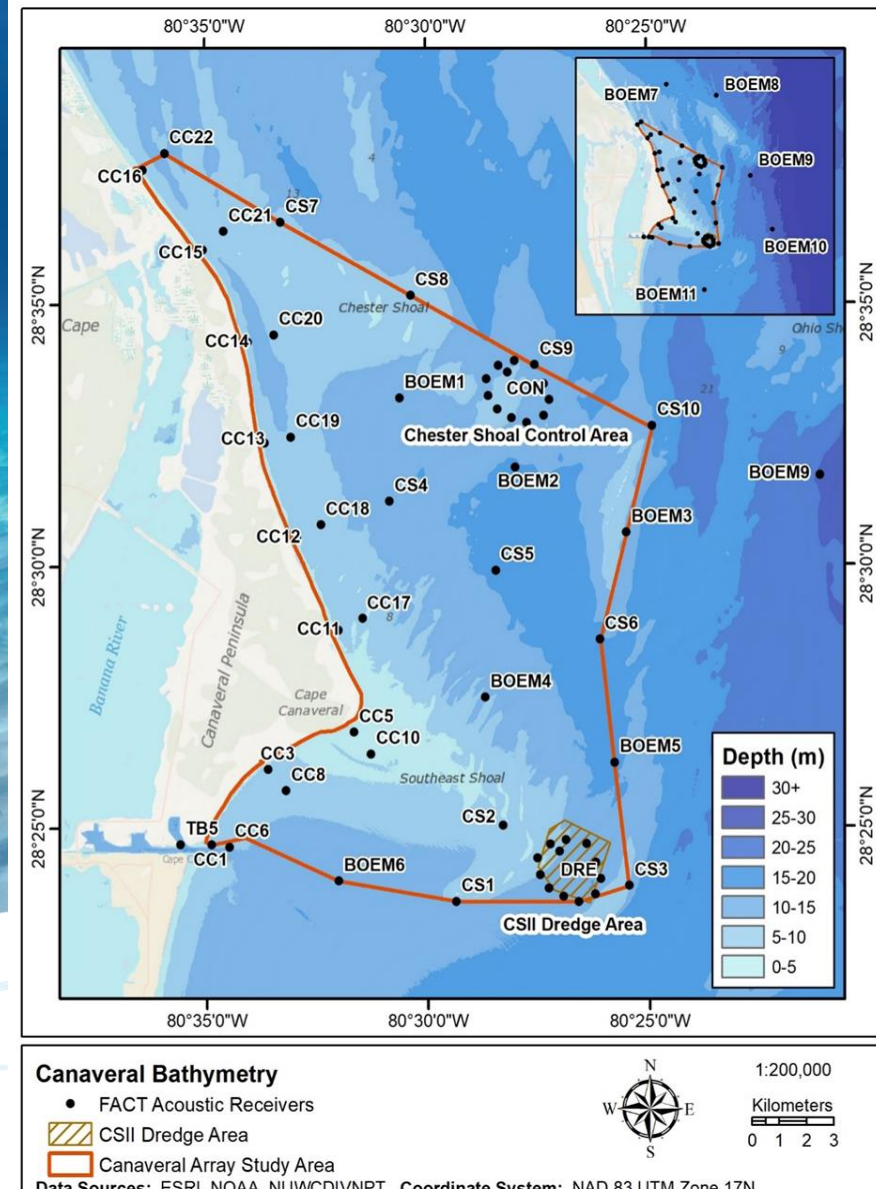
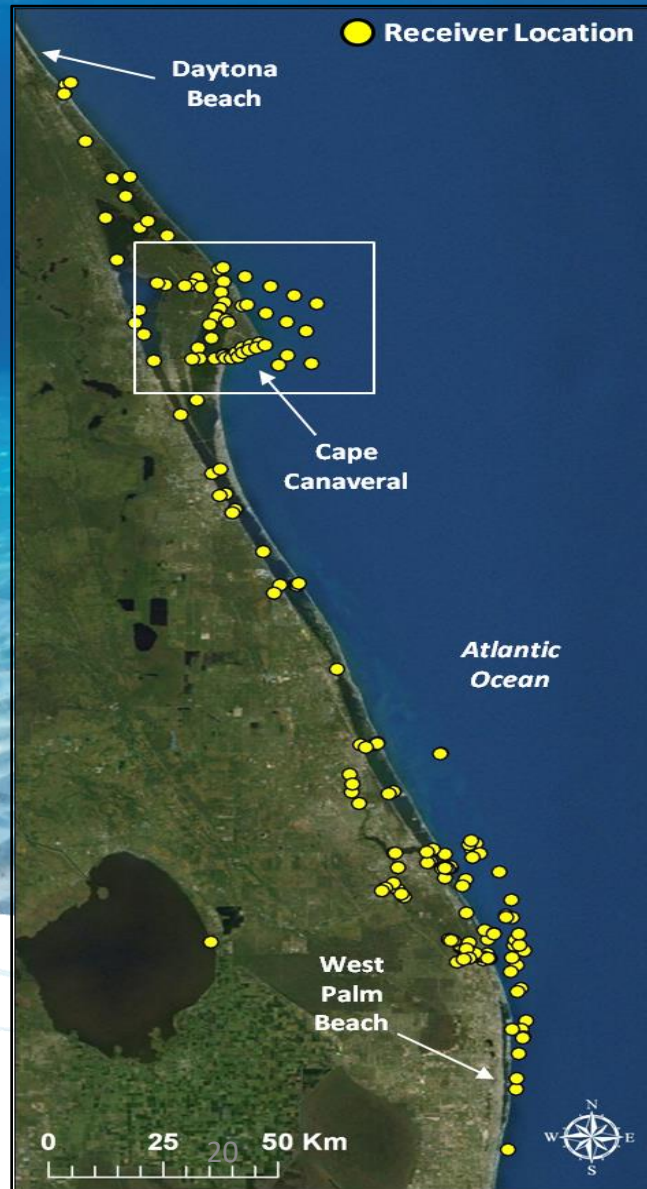
Passive Acoustic Telemetry – Stationary Receiver

Fish # 21178
14:02:56
06-Jun-2018

Acoustic Receiver
(Listening Station)

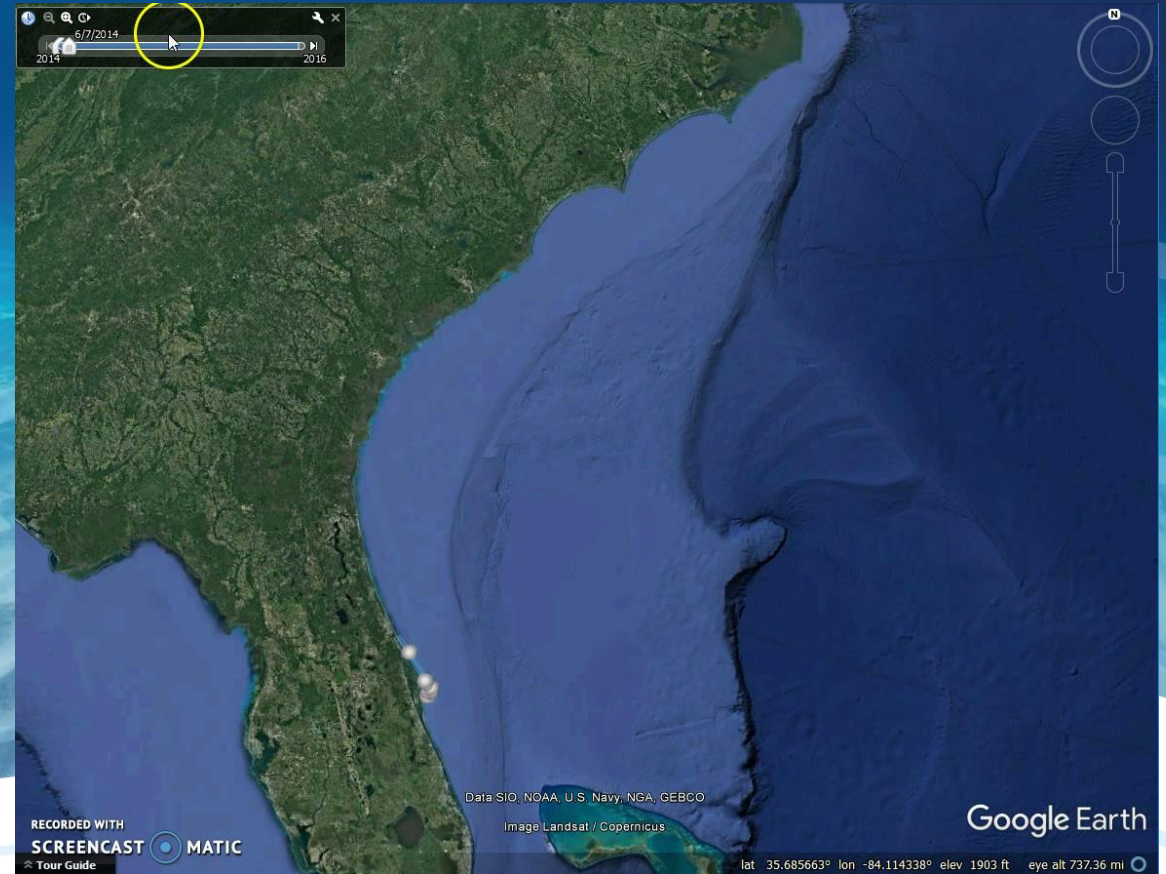
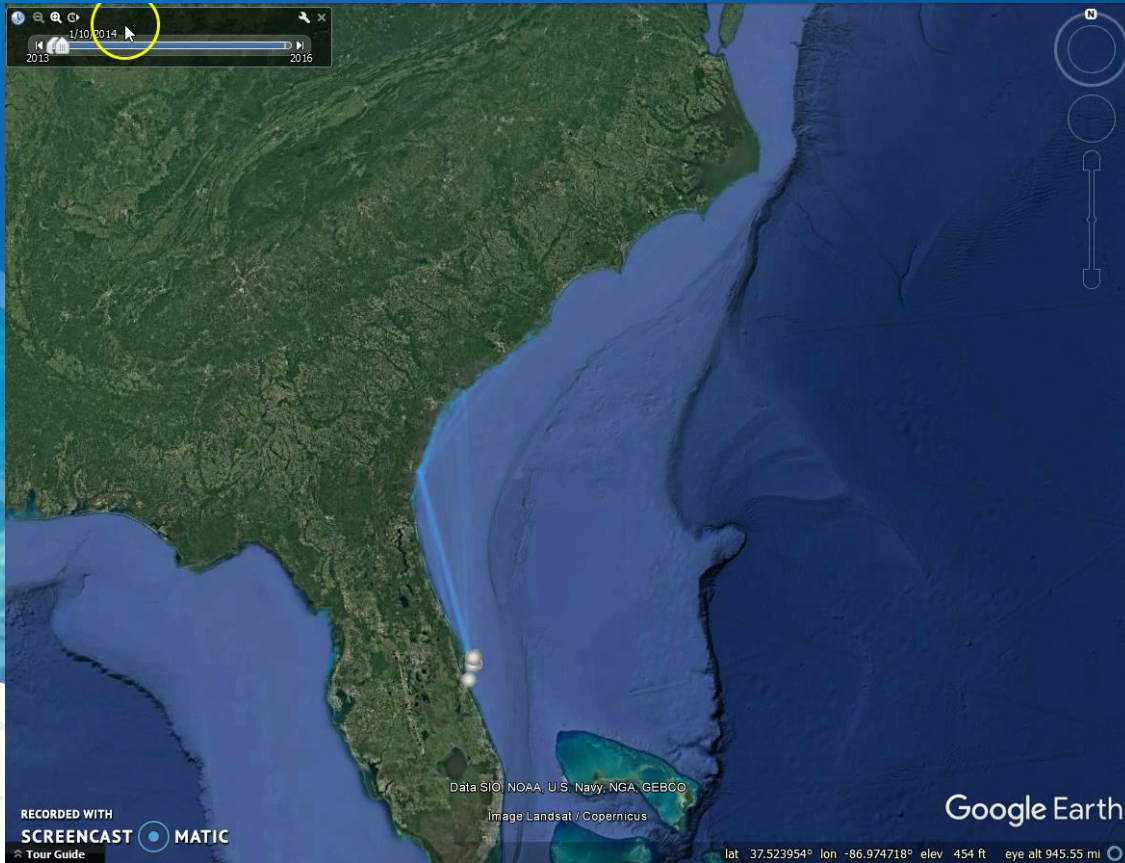


Florida Atlantic Coast Telemetry (FACT) Array

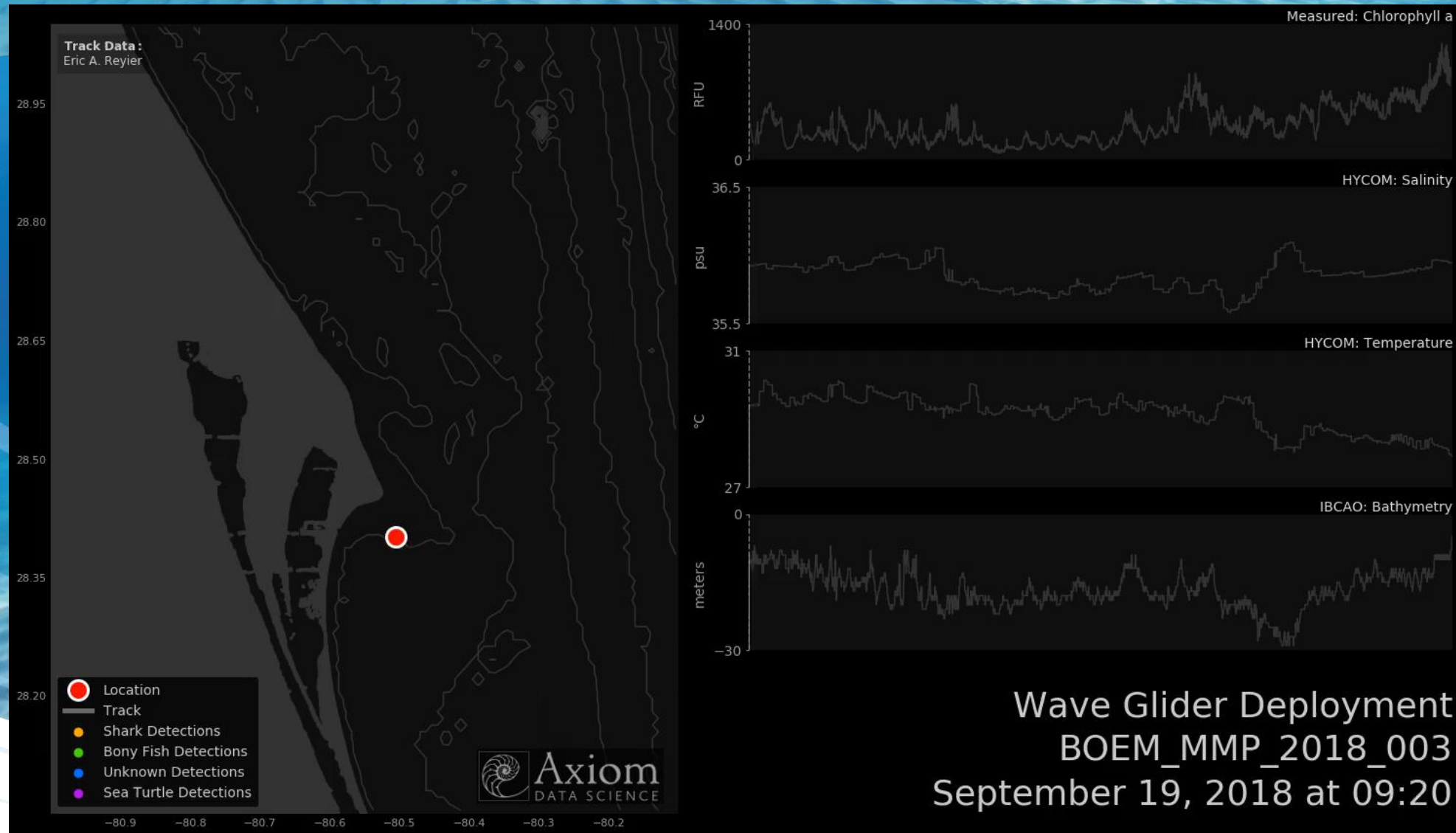


Results – Acoustic Telemetry

- Coastal migrations of many species - general northward migration in spring and returning to east-central Florida in fall



Passive Acoustic Telemetry - Wave Glider



Wave Glider Deployment
BOEM_MMP_2018_003
September 19, 2018 at 09:20

- Expand fixed receiver arrays
- Basic oceanography

Results – Fish and Sea Turtle Habitat

- Greater variation in fish assemblage across seasons than depths.
- No obvious differences in the use of the borrow area and control site.
- Most acoustically-tagged animals exhibited low site fidelity.
- Little evidence that managed fish or sea turtles preferentially associated with the shallowest shoal ridges.
- Shoals appeared to be ephemerally important for some fish species.
 - Spanish mackerel and manta rays

Photo: Jamison Smith



Results – Fish and Sea Turtle Habitat

- Results illustrate the importance of the Canaveral Shoals region to coastal sharks and red drum.
- Sharks dominated catches across all 5 years of sampling.
 - Individuals that undertook northward spring migrations commonly returned each fall.
- For certain shark species, including lemon, scalloped hammerhead, and spinner sharks, the region serves a nursery function.
- Red drum were:
 - the only common teleost fish.
 - present much of the year.
 - returned to Canaveral after leaving in fall.
- The ESA-listed Atlantic sturgeon and smalltooth sawfish were detected in the study area.



Conclusions

- For invertebrates - most impacts fell within variability seen across the Cape Canaveral ecosystem.
 - OR recover too rapidly to be detected by most sampling schemes.
- Benthic invertebrates have higher diversity in swales.
- Shoals appeared to be ephemerally important for some fish species.
- Low site fidelity and large activity spaces suggests dredging may have little impact on large-bodied fishes and sea turtles.
- Presence of ESA listed species at CSII.
- Turbidity may not be detrimental to CSII users.
- On a 2+ year time scale, there were no clear effects of dredging on the CSII-BA ecosystem.



Conclusions

- Stay tuned....
 - Additional final reports will be available this year:
 - UF – July 2022
 - Navy – March 2022
 - Manta Study
 - Additional work under Navy IA – Continuation of array data downloads through fall 2022.

- Thanks to Deb Murie and team (UF), Joe Iafraate and Stephanie Watwood (Navy), Eric Reyier and crew (NASA – Herndon Solutions Group), and Deena Hansen and Jake Levenson (BOEM)



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