



Smalltooth Sawfish: 15 Years of Research to Promote Recovery of a Critically Endangered Species

R. Dean Grubbs (FSUCML)

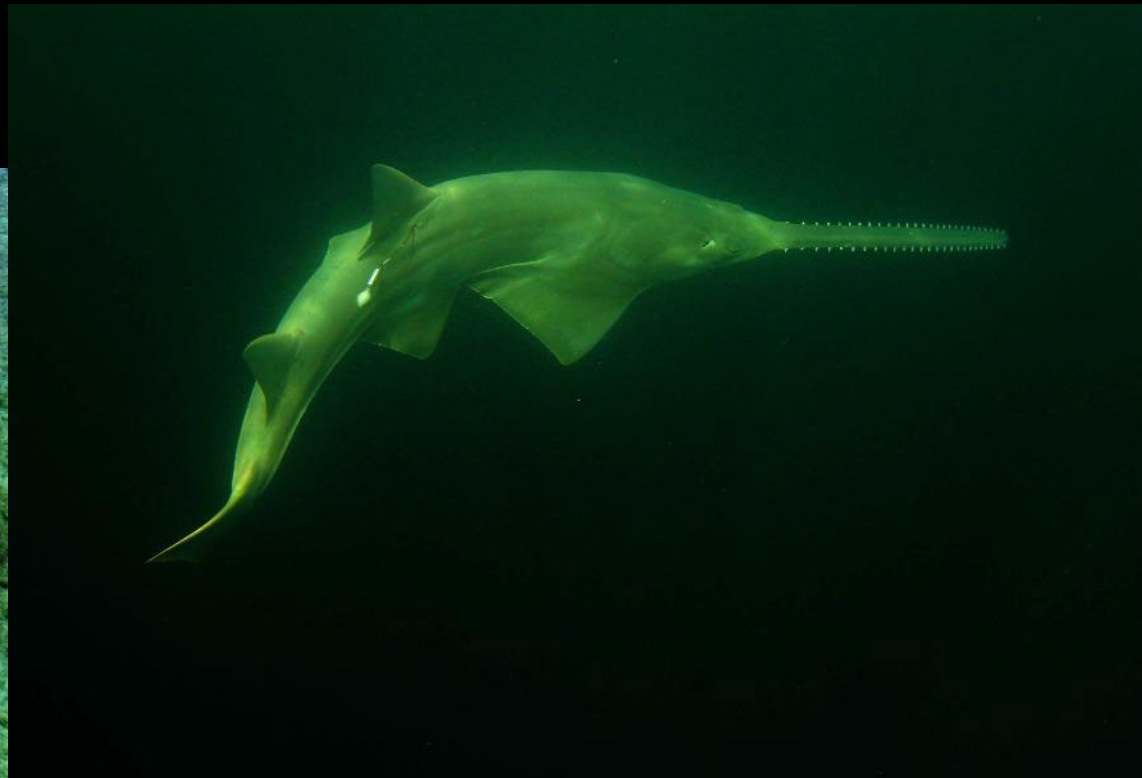


Collaborators:

- J. Carlson, A. Kroetz, A. Hilton, A. Brame – NOAA
- G. Poulakis and colleagues – FWC
- Tonya Wiley – Havenworth Coastal Conservation
- Jim Gelslecither - UNF
- K. Feldheim – Field Museum
- M. Smukall – Bimini Biological Field Station

Current/Former Graduate Students:

- Ashley Dawdy – FSU
- Bianca Prohaska – FSU
- Jasmin Graham – FSU



SAWFISHES

- Small family of very large rays
 - 5 coastal subtropical/tropical species
 - 1 in the U.S./Bahamas – *Pristis pectinata*
 - 4 species get at least 500 cm long!



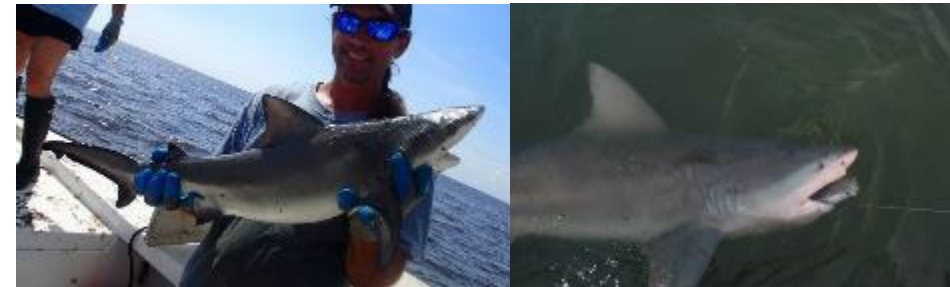
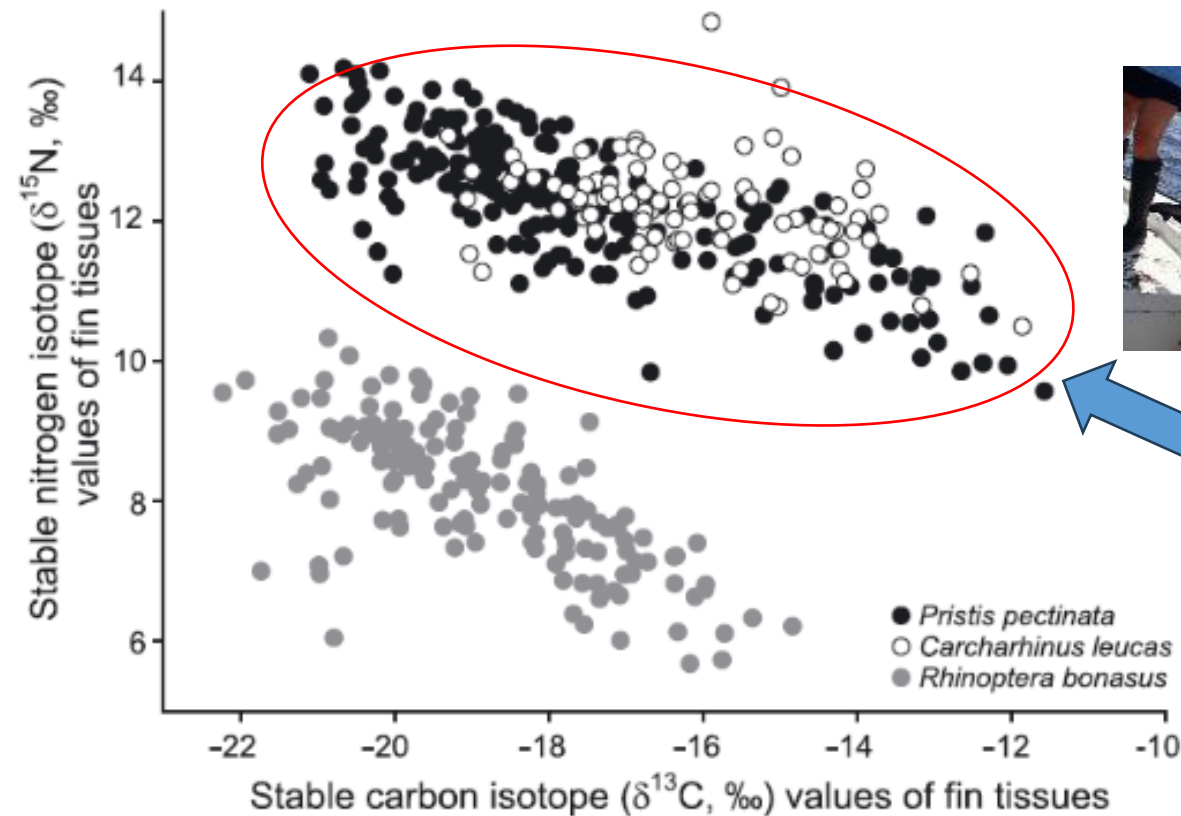
© Blair Witherington, Disney
All research activities were conducted under ESA permit# 17787
and ENP permit EVER-2017-SCF022.





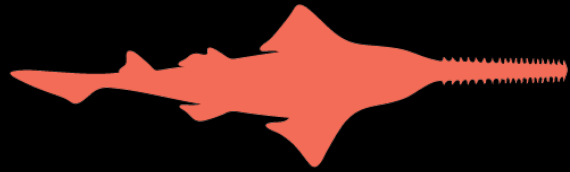
Sympatric elasmobranchs and fecal samples provide insight into the trophic ecology of the smalltooth sawfish

Gregg R. Poulakis^{1,*}, Hidetoshi Urakawa², Phillip W. Stevens³, Jacquelyn A. DeAngelo¹, Amy A. Timmers¹, R. Dean Grubbs⁴, Aaron T. Fisk⁵, Jill A. Olin⁶



Sawfish are upper predators
Overlapping niche space with bull sharks

IUCN: Critically Endangered



Largetooth Sawfish
(*Pristis pristis*)



Smalltooth Sawfish
(*Pristis pectinata*)



Green Sawfish
(*Pristis zijsron*)



Dwarf Sawfish
(*Pristis clavata*)



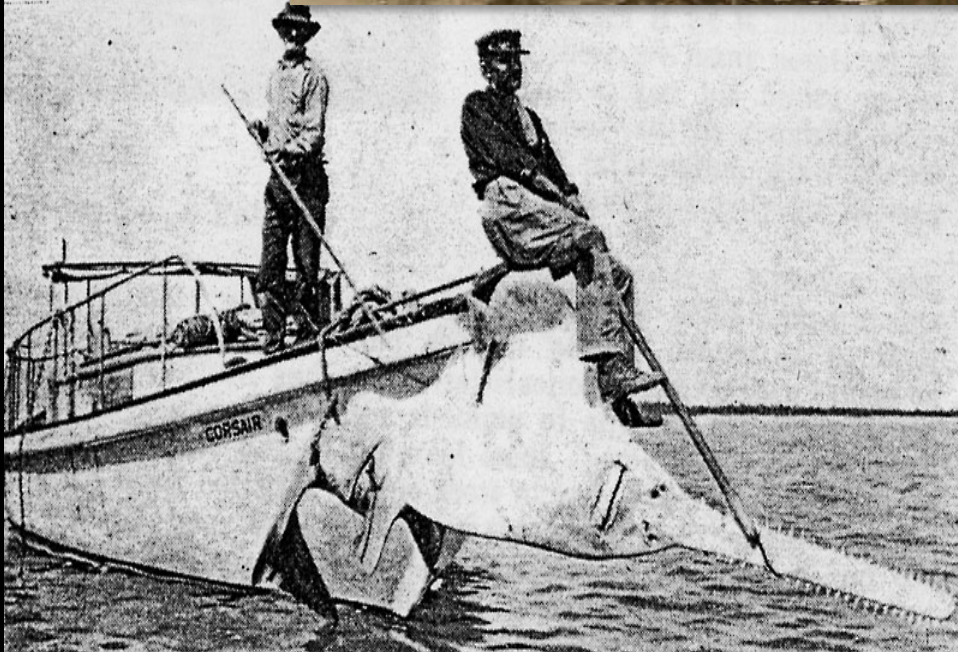
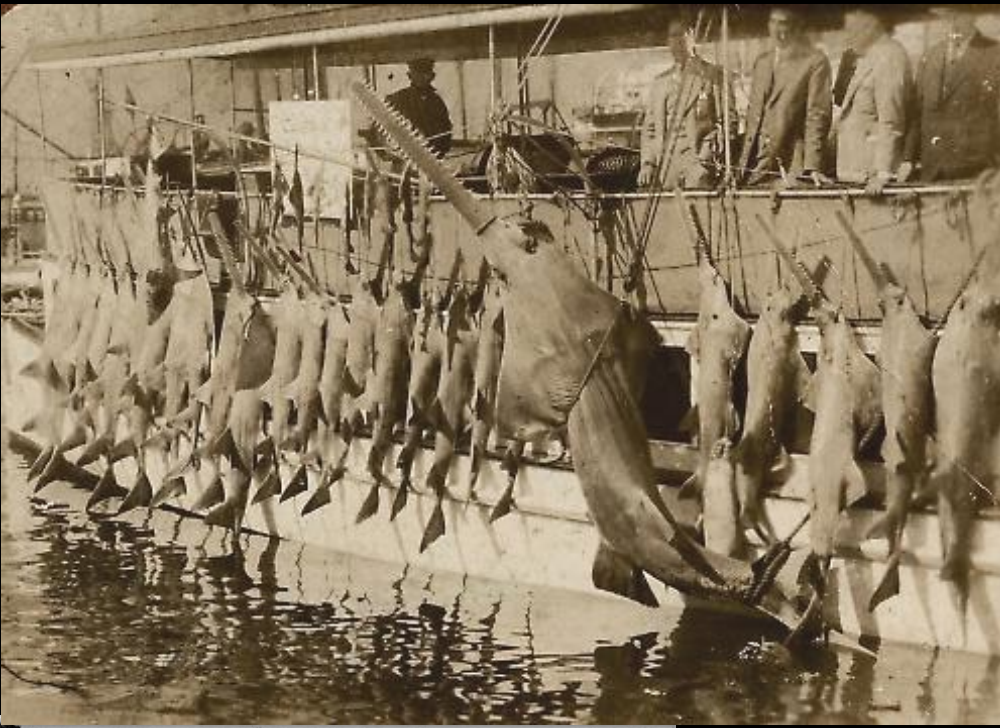
Narrow Sawfish
(*Anoxypristis cuspidata*)



Smalltooth Sawfish distribution:
orange = current, dark gray = historical

Sources of population decline

Targeted commercial fishing



Photos courtesy FMNH Historical Photos

Sources of population decline: Sportfishing



**Sources of population decline:
Bycatch mortality
(gillnets, trawls, longline)**



Sources of population decline: Habitat loss



Conservation Actions



- 1992: Sawfish protected in Florida
- 1995: Gill nets banned in Florida waters
- 2003: First marine fish listed as *Endangered* under the U.S. Endangered Species Act
- **IUCN Red List:** Critically Endangered 1996
- **CITES:** Appendix I listing in 2007
(Bans all international trade)
- **CMS:** Annexes I and II - 2014
(Convention on the Conservation of Migratory Species of Wild Animals)



Endangered Smalltooth Sawfish Research

Distinction between U.S. and adjacent “populations”

Reproductive biology

Abundance trends to monitor recovery

Movements and Critical Habitat mapping

Bycatch reduction in commercial fisheries



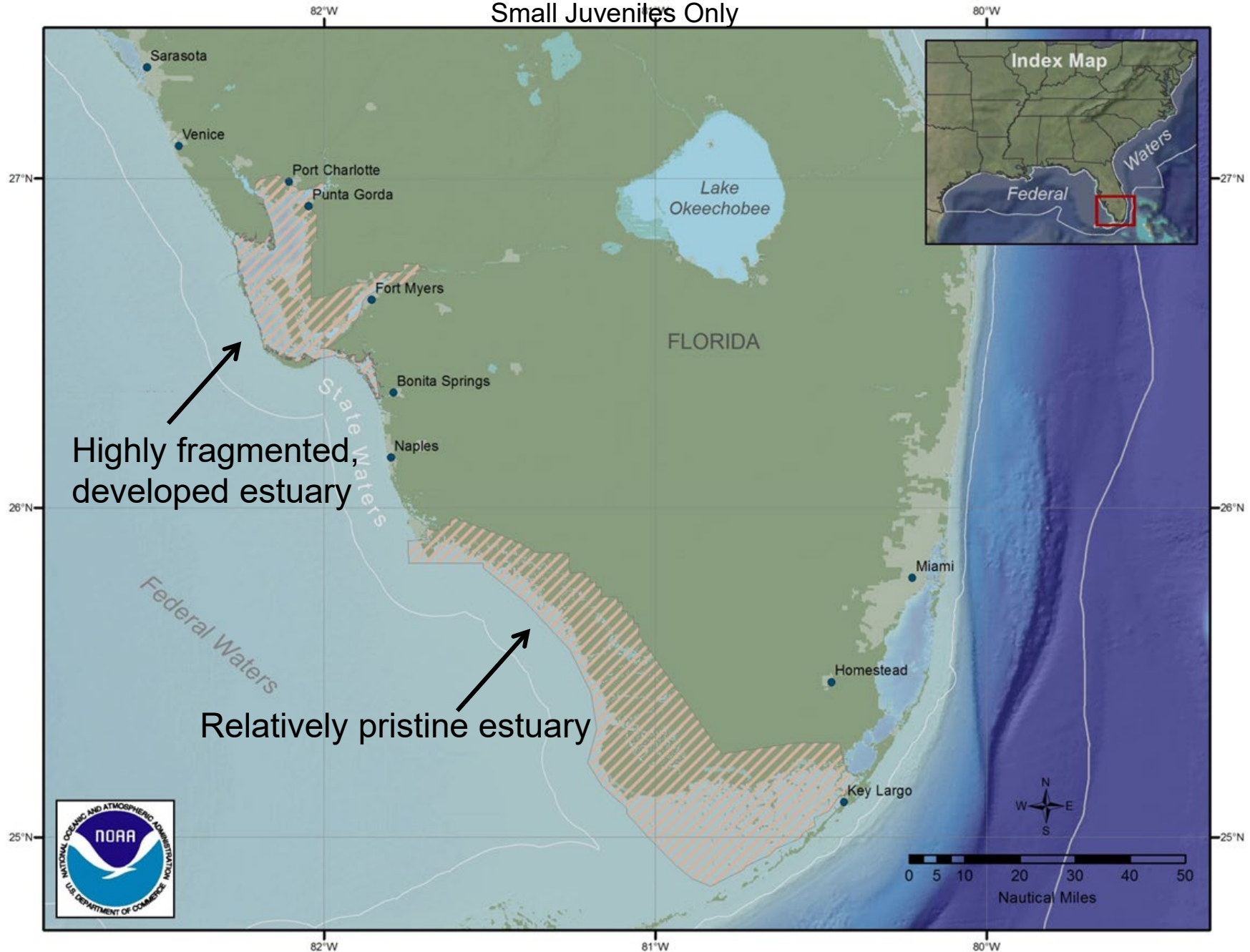
Sawfish Research:

Questions related to recovery

- **Critical Habitat:**
 - What characterizes Critical Habitat spatially and seasonally over ontogeny?
 - Where are the highest risks of fisheries interactions?
 - When and where does mating take place?
- Population status:
 - Is the U.S. population segment of smalltooth sawfish “distinct”?
 - Is there movement of adults between Florida and adjacent regions (e.g. Bahamas, Cuba)?
 - Are there pupping areas/nurseries outside of Florida?

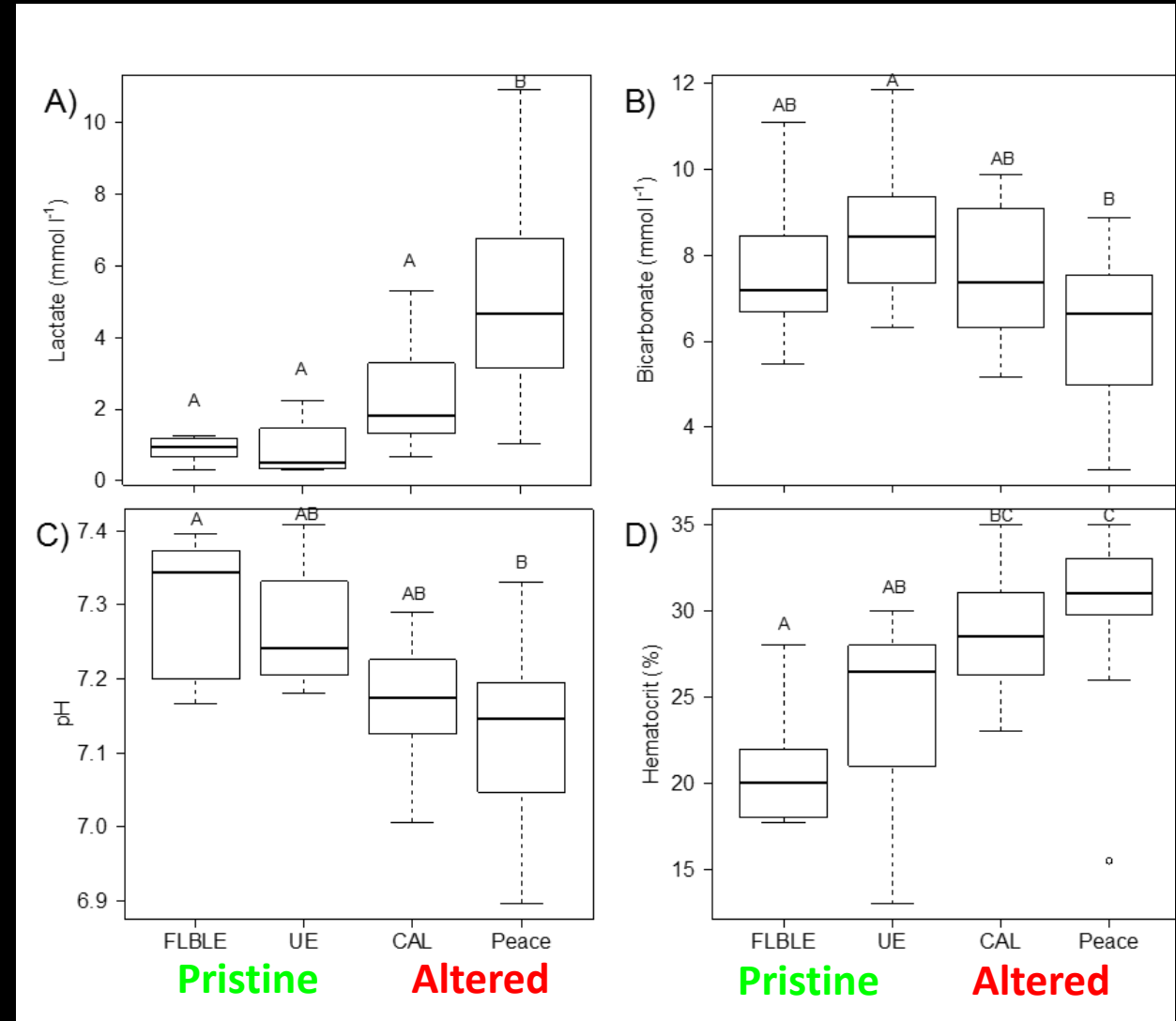


Smalltooth Sawfish Critical Habitat Small Juveniles Only



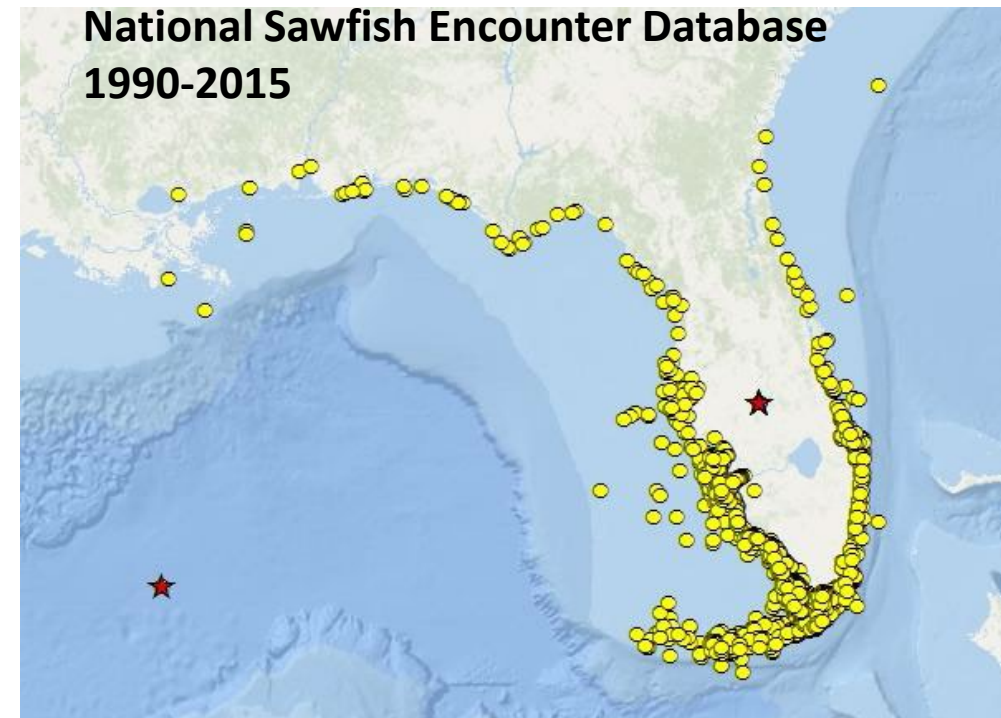
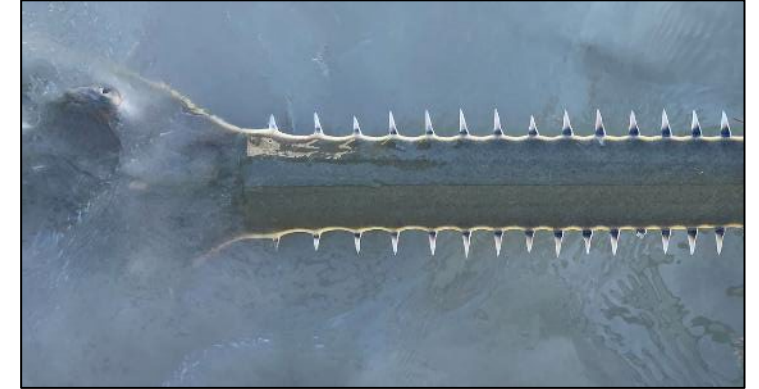
Importance of habitat quality:

Compared baseline physiological stress in fragmented vs “pristine” juvenile critical habitats. There is physiological cost to habitat fragmentation.



Sampling Methods: Adults

- Bottom longline- ~750m long, 50 16/0 hooks, 1 hr soak
- Station depth: 0.9m- 75.1m
- Environmental data collected at each station
 - Temperature, salinity, dissolved oxygen (YSI Pro)
 - Water clarity (Secchi disk)
 - Depth and bottom type (sonar)
- Data uses:
 - Community Structure analyses
 - Adult sawfish habitat associations
 - Animals for Tagging
 - Index of Relative Abundance
 - Samples
 - Reproduction
 - Genetics
 - Trophic Ecology
 - Toxicology/Heavy Metals
 - Stress Physiology



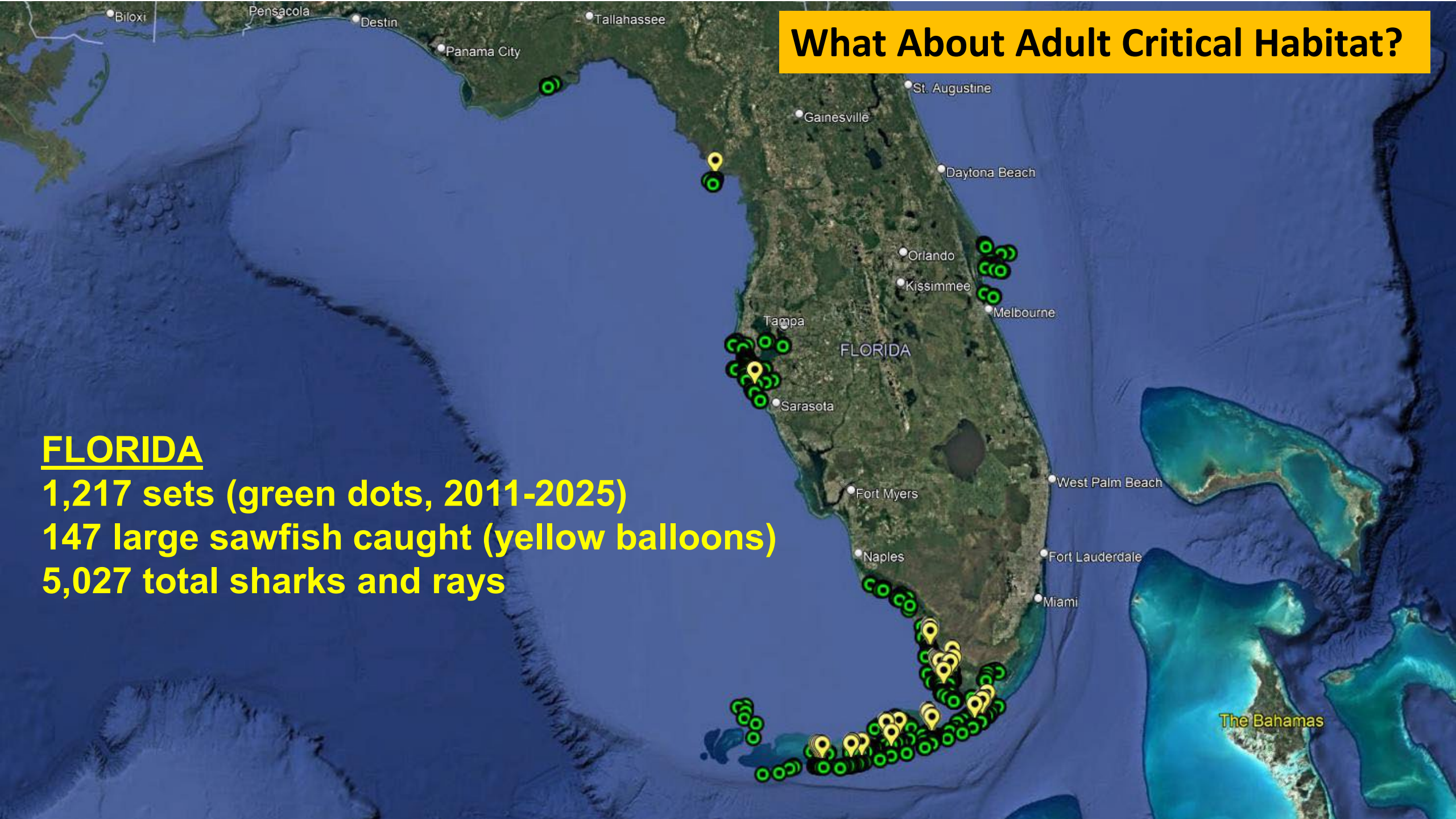
What About Adult Critical Habitat?

FLORIDA

1,217 sets (green dots, 2011-2025)

147 large sawfish caught (yellow balloons)

5,027 total sharks and rays



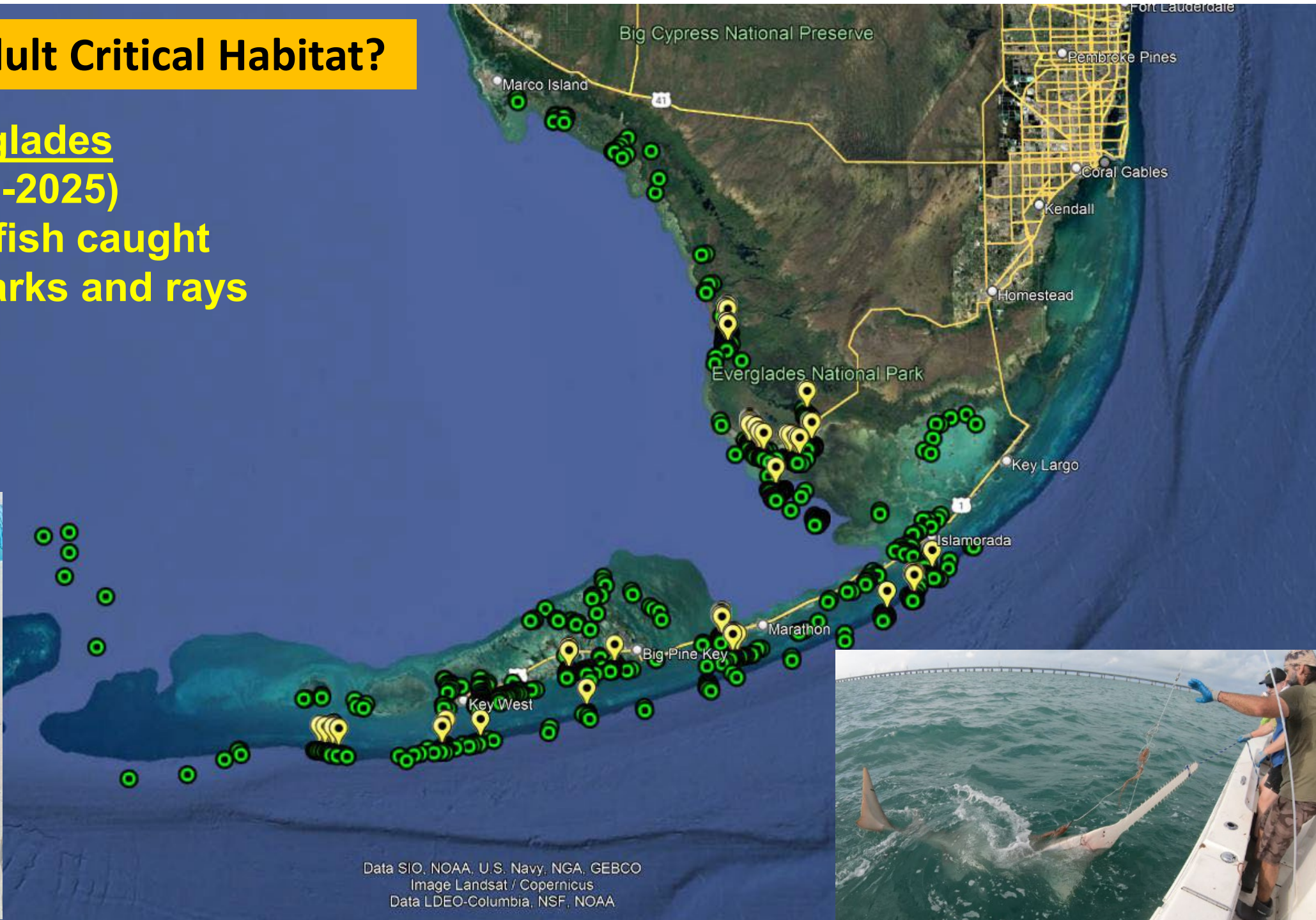
What About Adult Critical Habitat?

FL Keys/Everglades

944 sets (2011-2025)

145 large sawfish caught

4,284 total sharks and rays



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Data LDEO-Columbia, NSF, NOAA





Smalltooth Sawfish (PPEC)

FKNMS/ENP

145

Blacknose Shark (CACR)

550

Atlantic Sharpnose Shark (RTER)

545

Blacktip Shark (CLIM)

1116

Bull Shark (CLEU)

387

Nurse Shark (GCIR)

510

Lemon Shark (NBRE)

494

Scalloped Hammerhead (SLEW)

120

Great Hammerhead (SMOK)

195

Bonnethead Shark (STIB)

35

Tiger Shark (GCUV)

45

Silky Shark (CFAL)

7

Caribbean Reef Shark (CPER)

2

Sandbar Shark (CPLU)

91

Finetooth Shark (CISO)

3

Southern Stingray (DAME)

39

Total Elasmobranchs

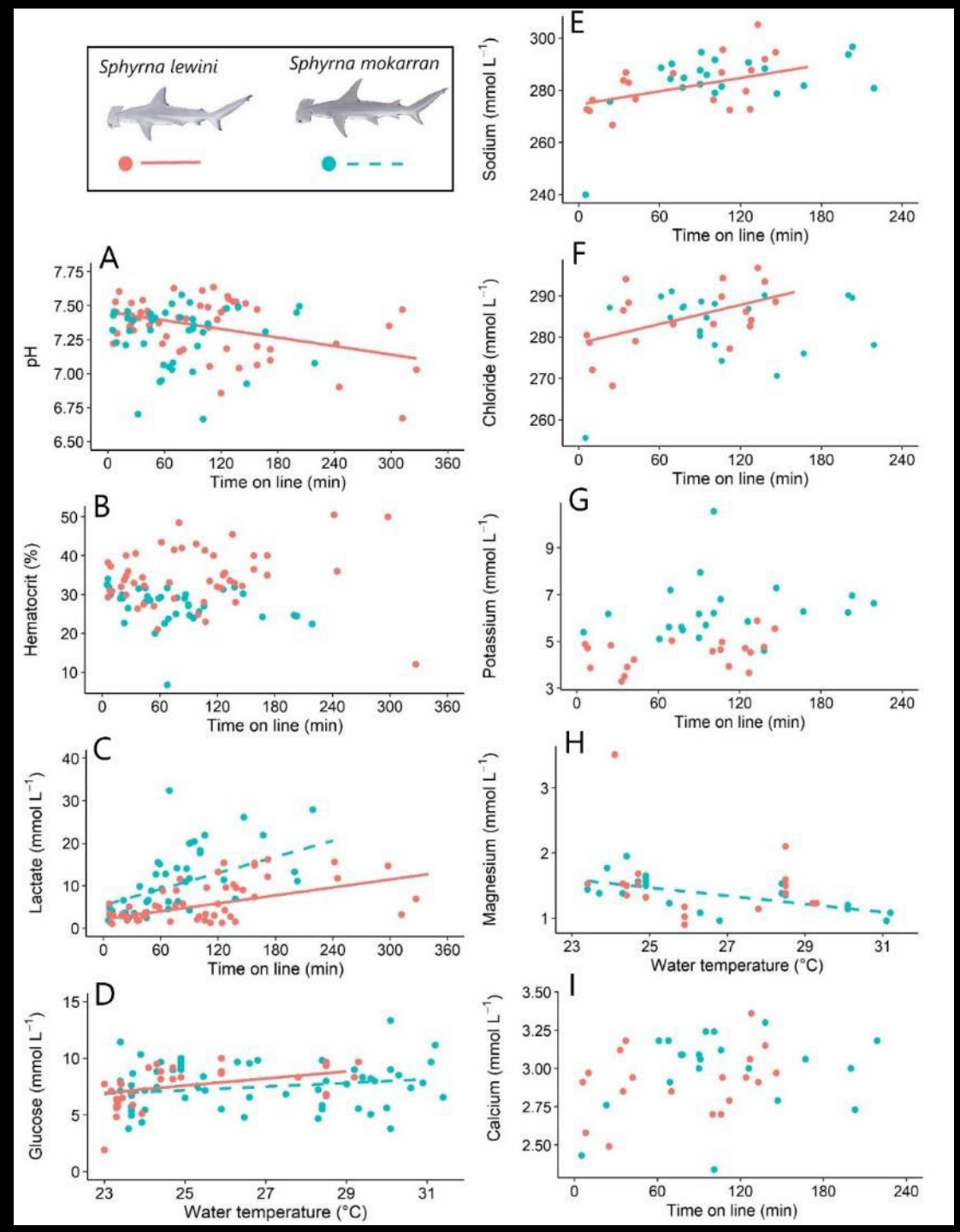
4284





Stress physiology of scalloped and great hammerhead sharks from a bottom longline fishery

Blanca K. Prohaska^{1,2,*}, Heather Marshall^{3,4}, R. Dean Grubbs², Karlssa Lear⁵, Bryan S. Frazier⁶, John J. Morris⁴, Alyssa Andres^{2,4}, Robert E. Hueter^{4,7}, Bryan A. Keller^{2,8} and Nicholas M. Whitney⁹



nMDS: Clustering by Region



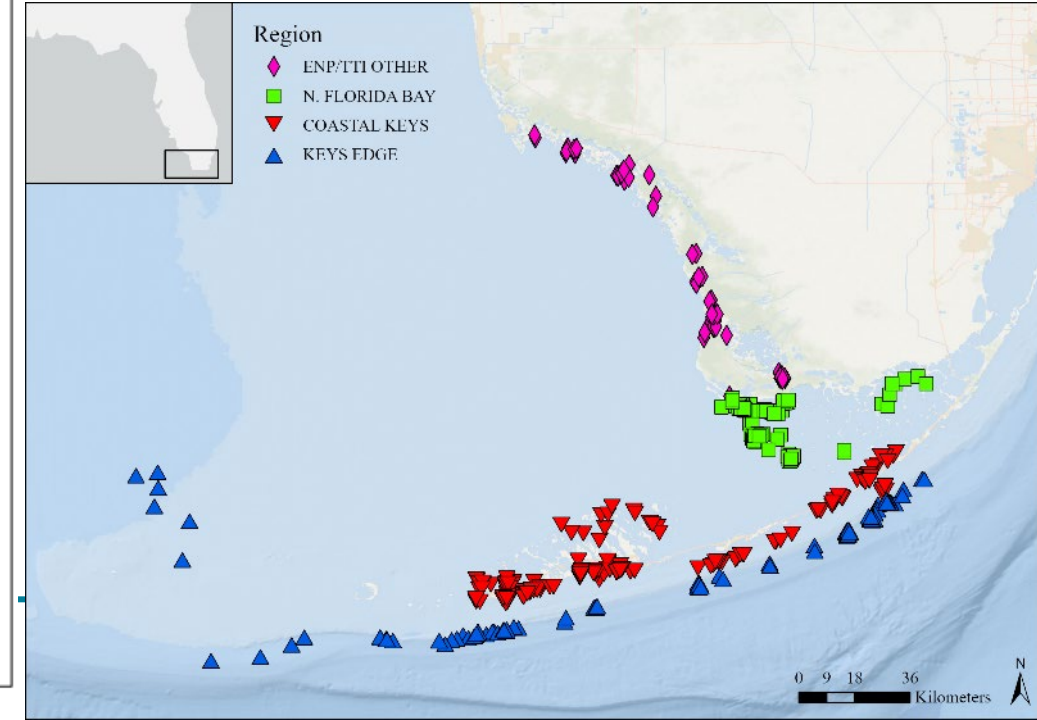
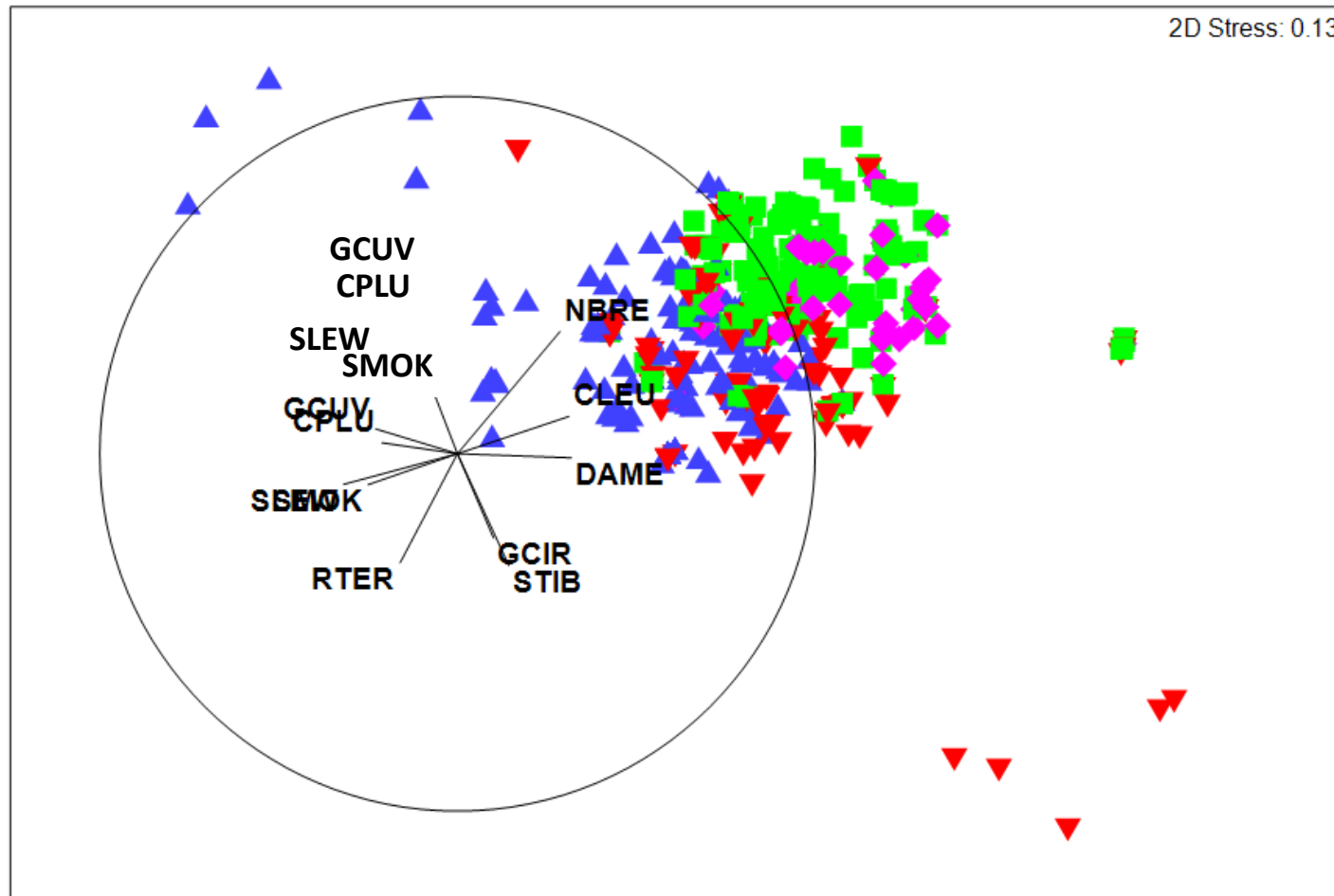
Drivers of Community Structure of Elasmobranchs in Everglades National Park and the Florida Keys

Ashley Dawdy, Cheston Peterson, Dean Grubbs
Florida State University Coastal & Marine Laboratory

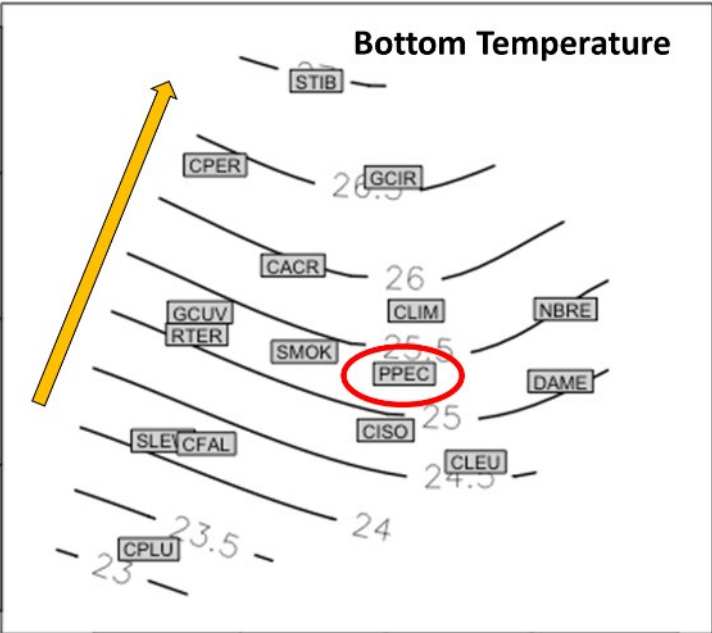
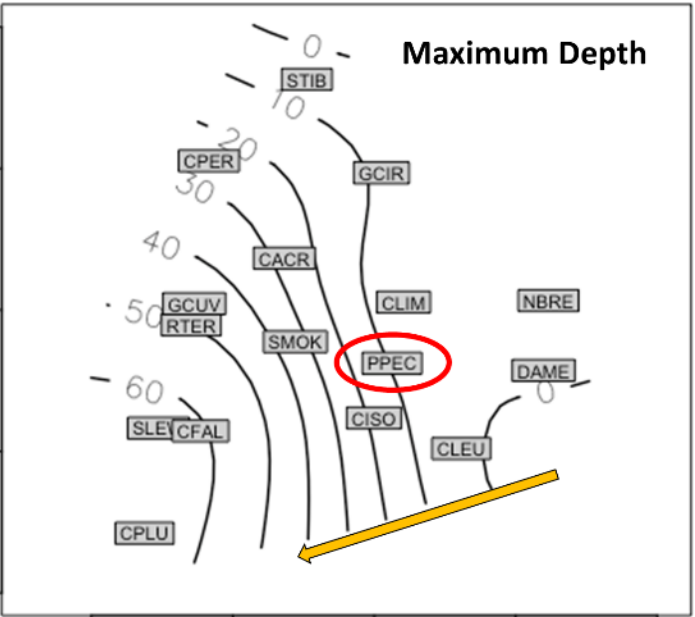
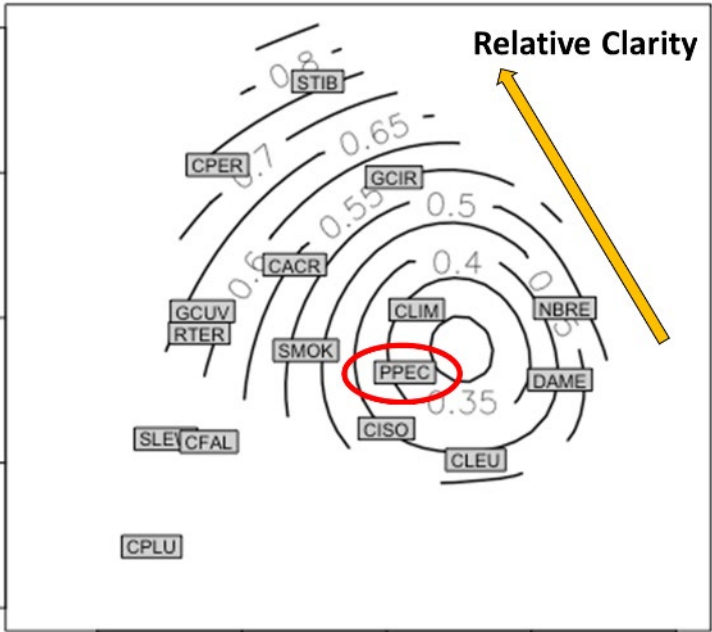
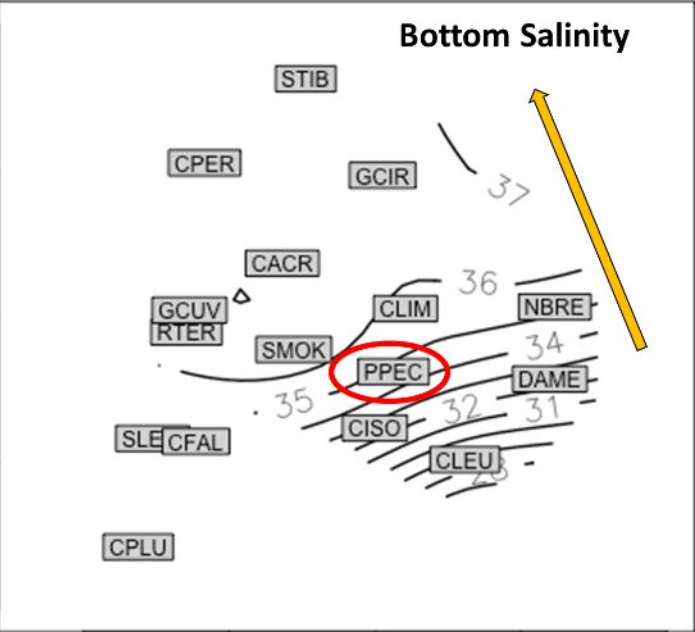


Transform: Square root
Resemblance: S17 Bray-Curtis similarity

2D Stress: 0.13



Abiotic drivers of community structure: nMDS



Vector	R ²	p
Bottom Salinity	0.24	< 0.001
Depth	0.12	< 0.001
Relative Clarity	0.06	< 0.001
Bottom Temperature	0.05	< 0.001
Bottom D.O.	0.02	0.06



Florida Bay/Ponce de Leon Bay (ENP)

Dominated by adult males: March-September

Few adult females: January (near-term pregnant), March/April (post-partum or mated)

September (mid-term pregnant)





High encounter rates with commercial trawl, longline and trap fisheries

Florida Keys (FKNMS): Edge of shelf, Hawk Channel

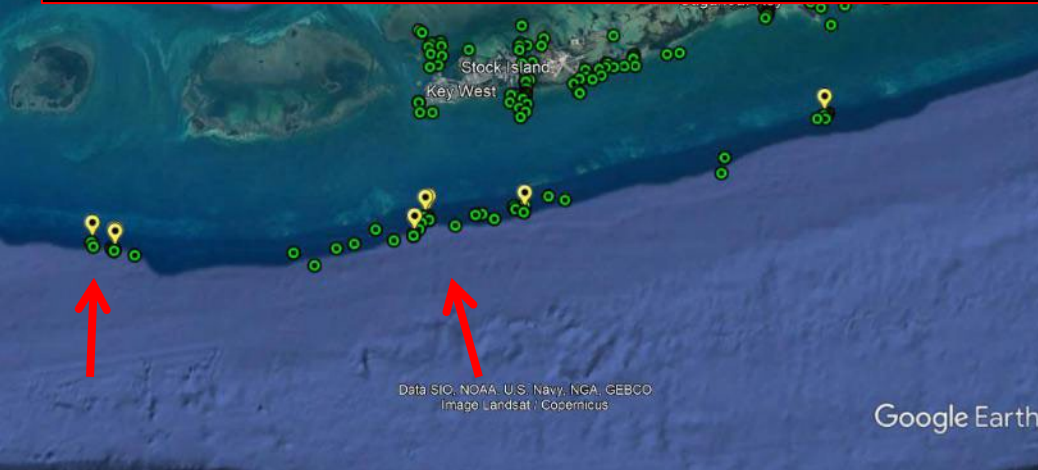
Adults of both sexes: January, April, July

Pregnant females: September, April





High encounter rates with commercial trawl, longline and trap fisheries



Florida Keys (FKNMS): Edge of continental shelf

Adults of both sexes: January, April, July

Pregnant females: September, April



REPRODUCTIVE STATUS:
Where and when does mating take place?
Aggregated or dispersed?

★ Locations where adult males and females were caught together





E.I. Medical Imaging®

EVD

PATIENT:

ID:

Fri Sep 24 2021 11:43

B CLI3E

4.4MHz

D 20.0cm

Repro

G 55dB

N 10dB

F 43dB

12Hz



User1



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Researchers Discover Critical Clue in the Mystery of Sawfish Mating

BY: FSUCML | PUBLISHED: FRIDAY, APRIL 14, 2017 | 12:00 AM | SHARE: [f](#) [t](#) [e](#) [r](#)

Scientific First Marks Key Step in Efforts to Recover Endangered Species

Tallahassee, Florida. April 13, 2017. For the first time in 17 years of Florida-based research, scientists have discovered a mating ground for the Endangered smalltooth sawfish. During an expedition early April to the shallow-water back-country of Everglades National Park, a research team captured, tagged, and released three adult sawfish (one male and two females) in an area previously known almost exclusively as juvenile sawfish habitat. All three had distinctive lacerations, apparently sustained during mating, that match the pattern of teeth on the



Dr. Grubbs and team secure a sawfish for analysis, tagging and release

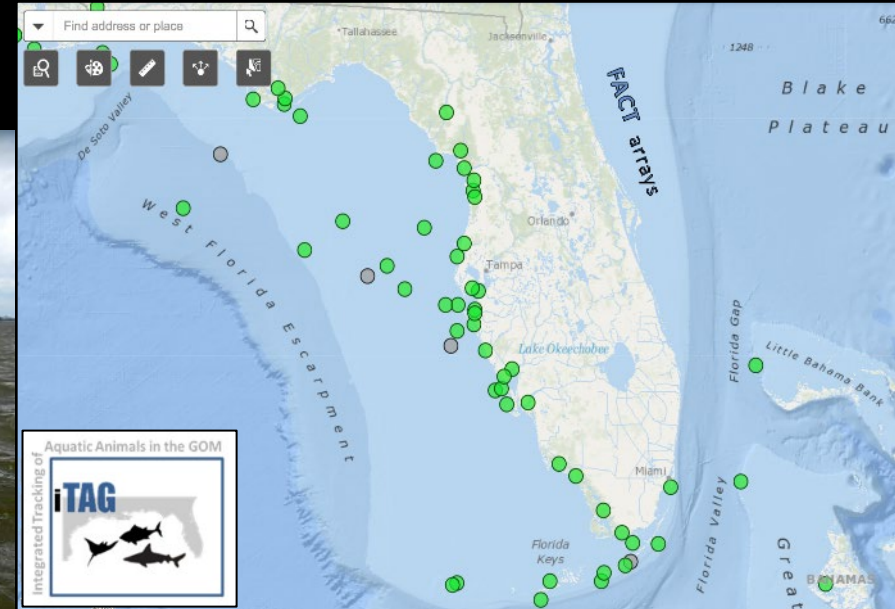
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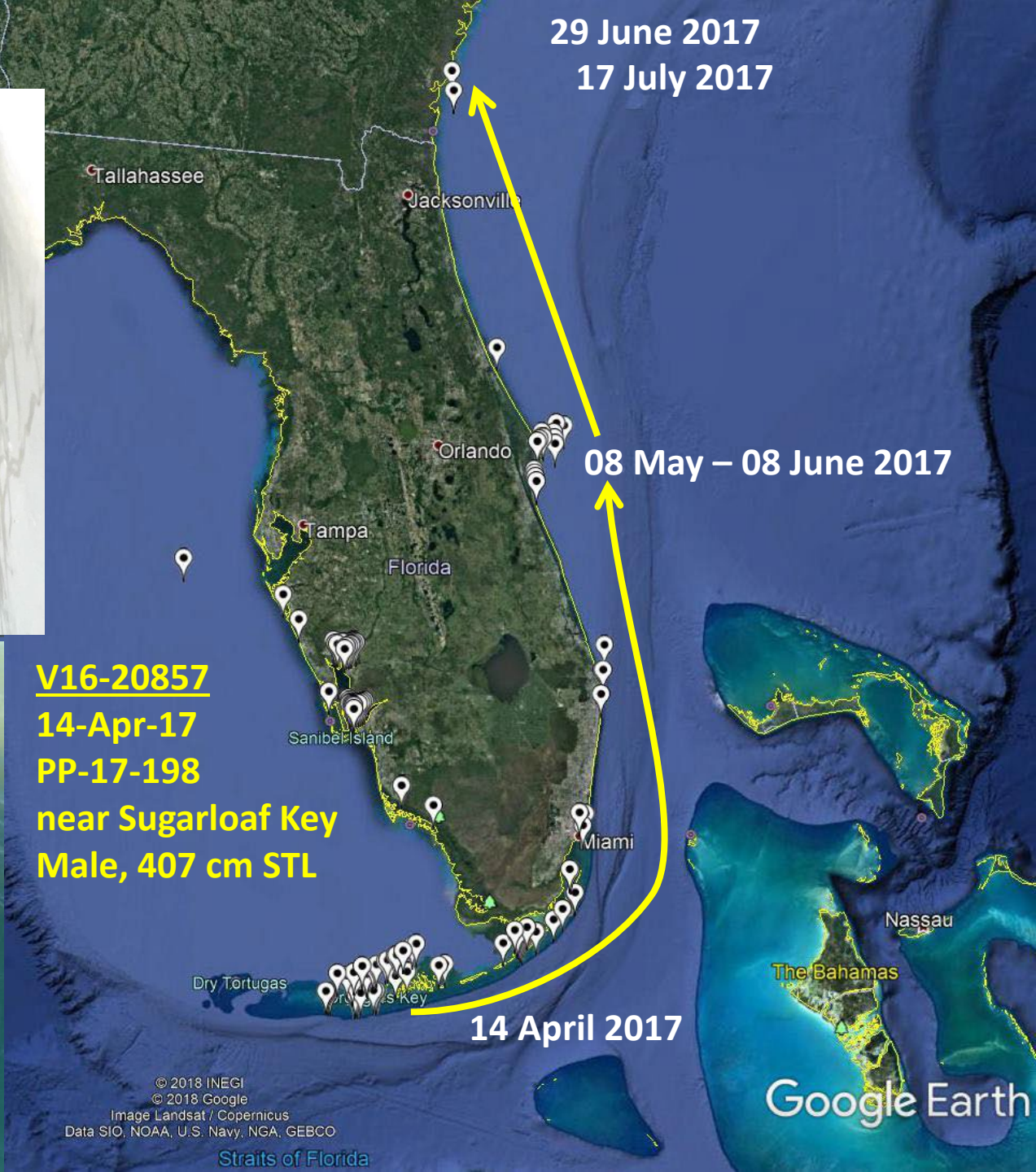
Acoustic telemetry: 2016-present

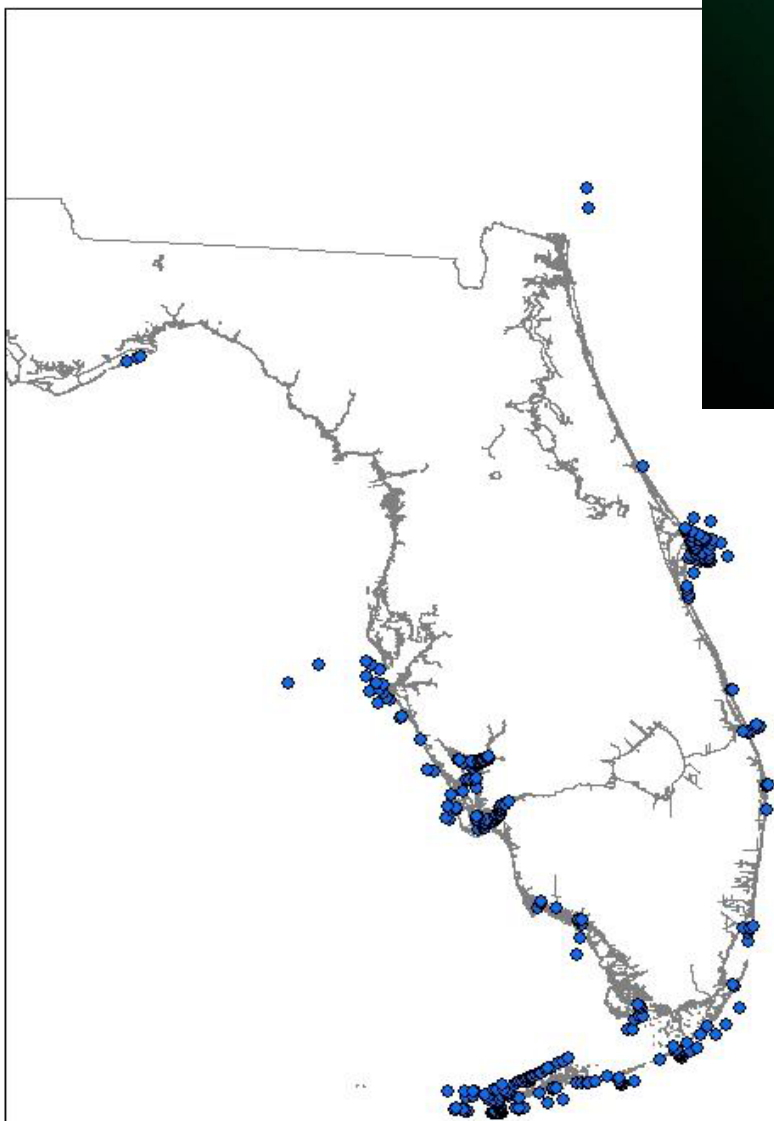
5-10 year implanted acoustic tags





V16-20857
14-Apr-17
PP-17-198
near Sugarloaf Key
Male, 407 cm STL

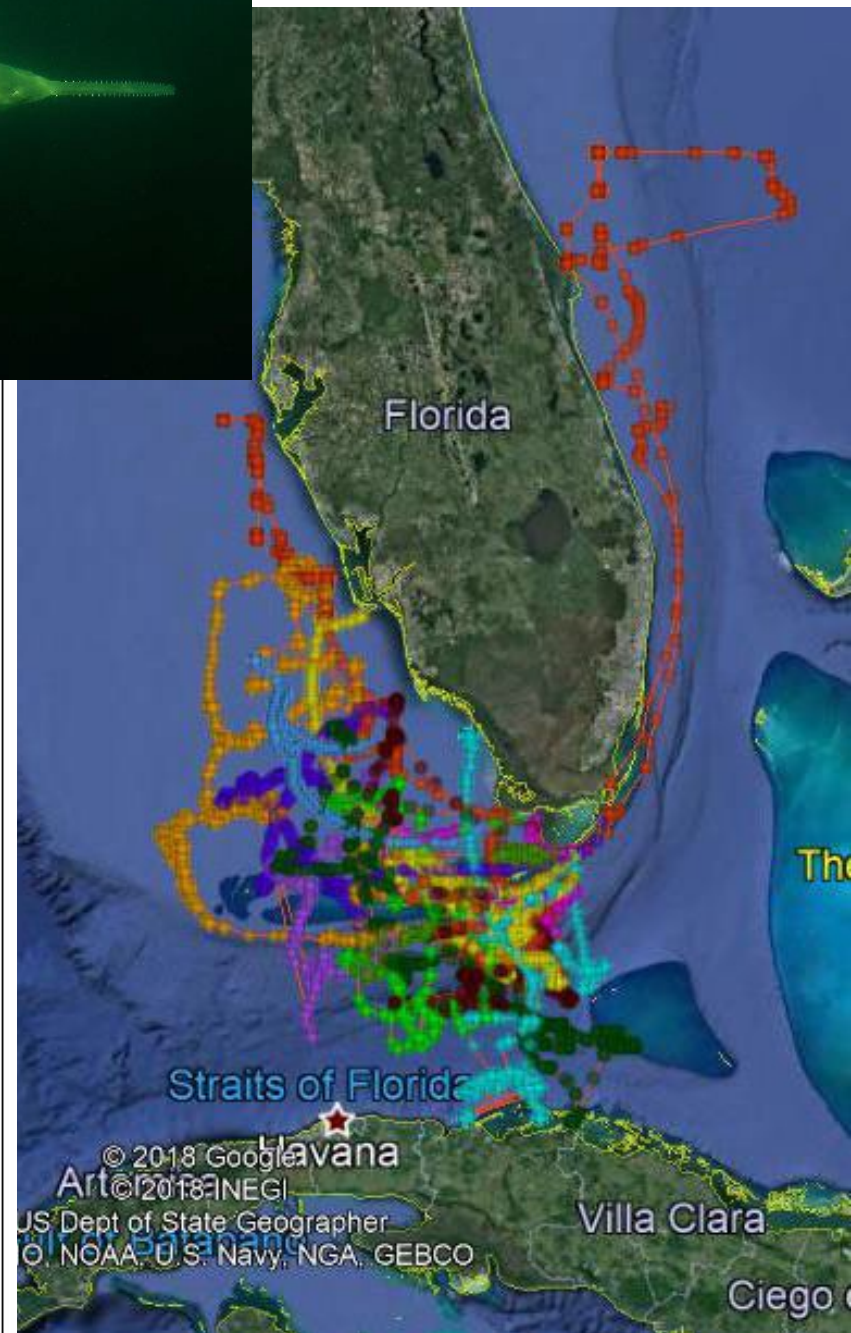
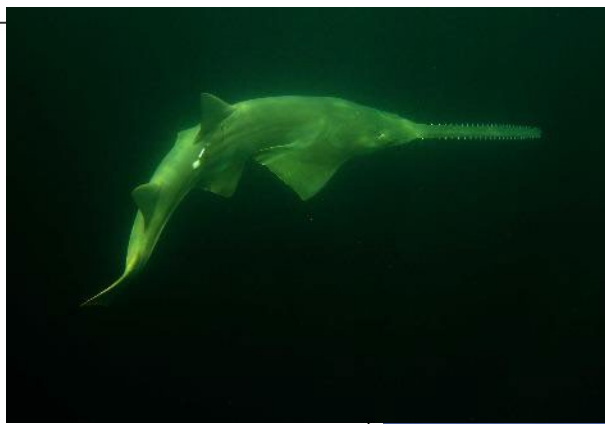


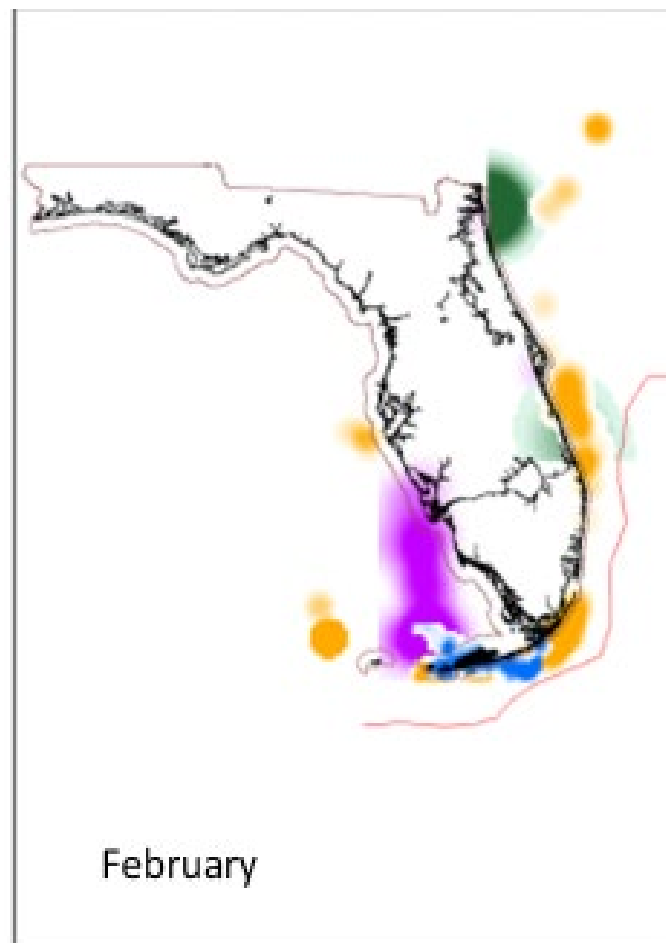


FLORIDA

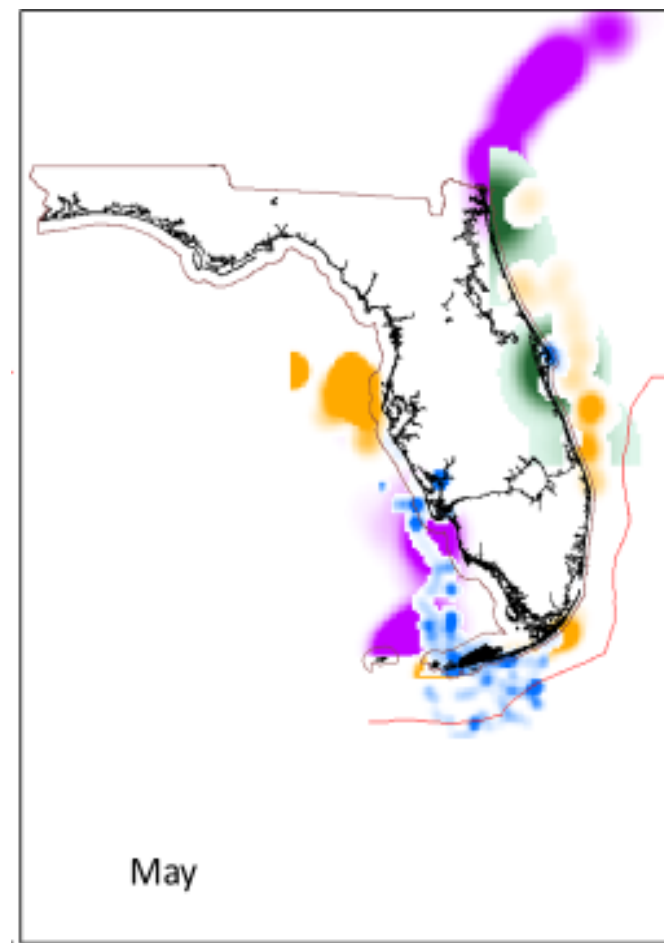
**>50 large sawfish implanted with V16 acoustic tags
(May 2016 – April 2021)**

Detected on 500+ receivers!





February



May

Received: 1 April 2021 | Revised: 22 November 2021 | Accepted: 8 December 2021
 DOI: 10.1002/aqc.3777

RESEARCH ARTICLE

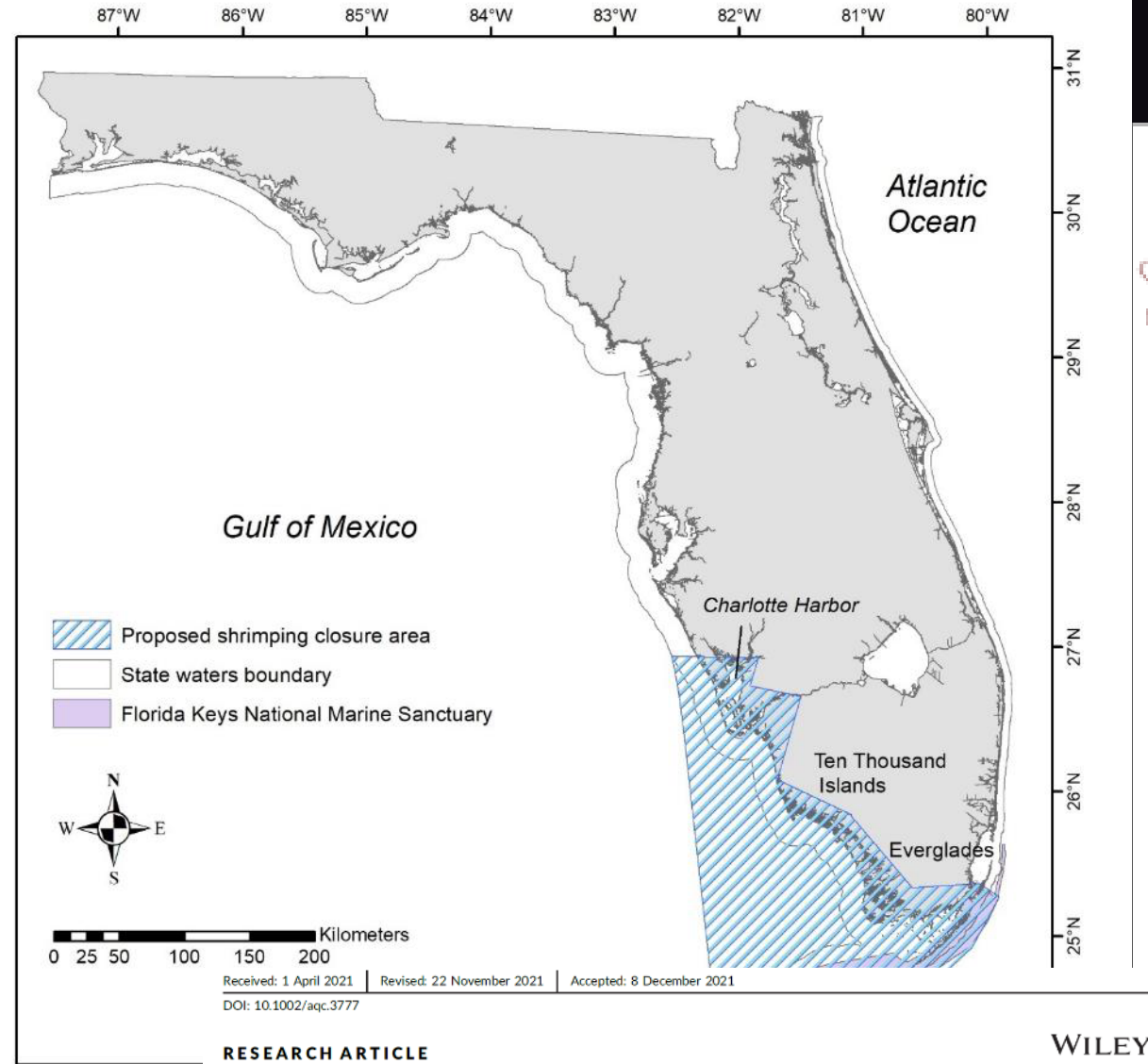
WILEY

Commercial fishery bycatch risk for large juvenile and adult smalltooth sawfish (*Pristis pectinata*) in Florida waters

Jasmin Graham¹ | Andrea M. Kroetz^{2,3} | Gregg R. Poulakis⁴ |
 Rachel M. Scharer⁴ | John K. Carlson³ | Susan K. Lowerre-Barbieri^{5,6} |
 Danielle Morley⁷ | Eric A. Reyier⁸ | R. Dean Grubbs¹

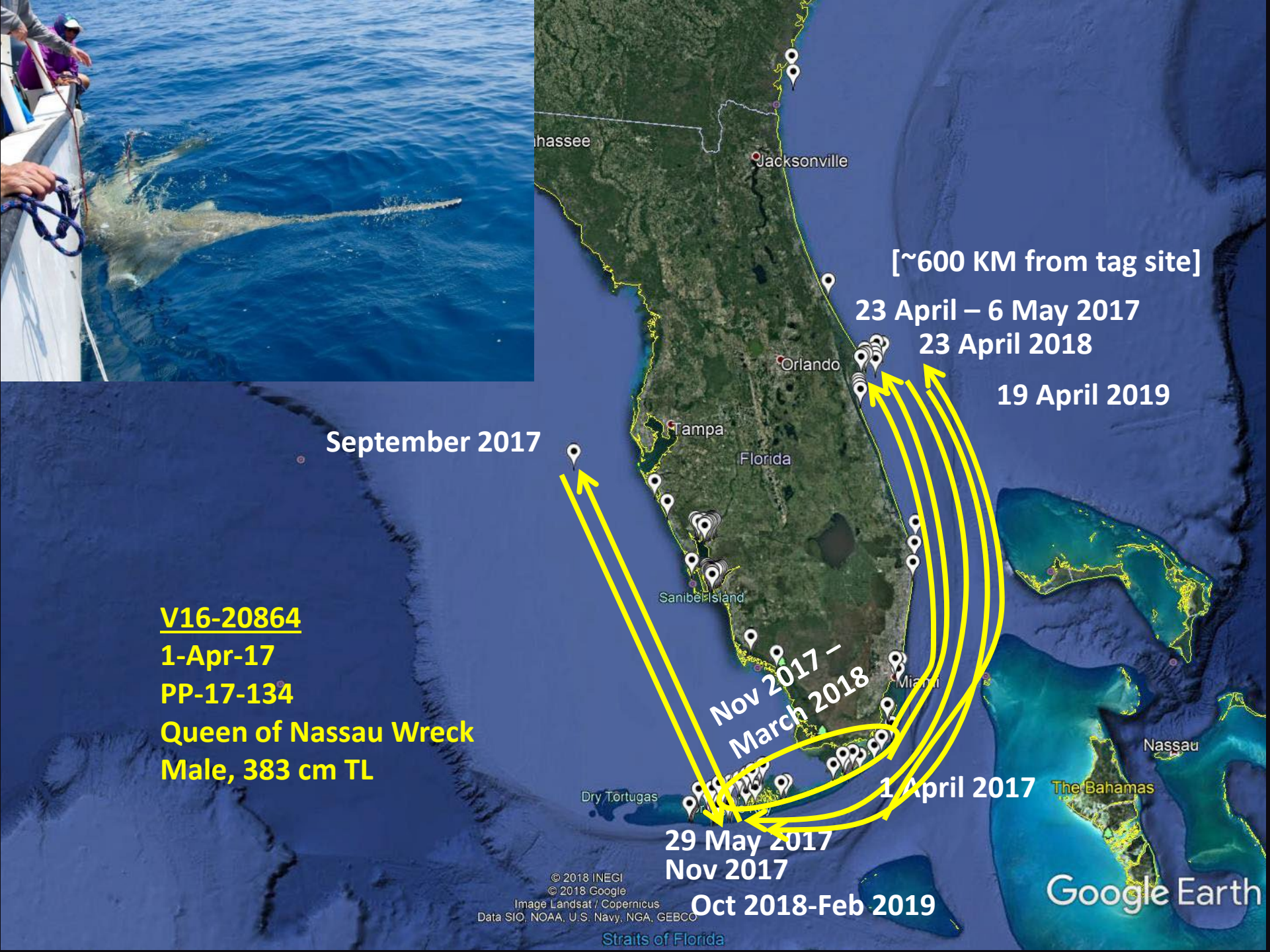


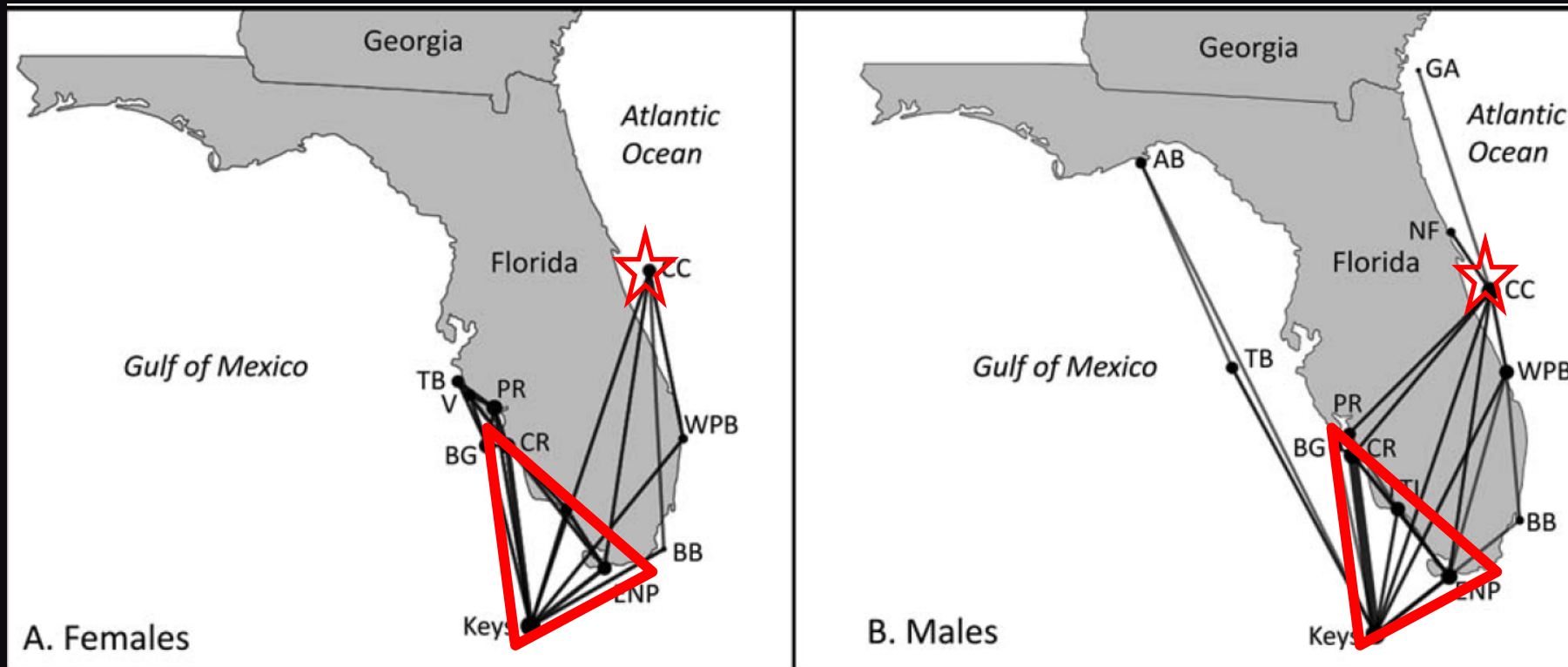
Wi



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**Regions containing possible
Critical Habitat for adult sawfish**

Vol. 44: 45–59, 2021
<https://doi.org/10.3354/esr01088>

ENDANGERED SPECIES RESEARCH
 Endang Species Res

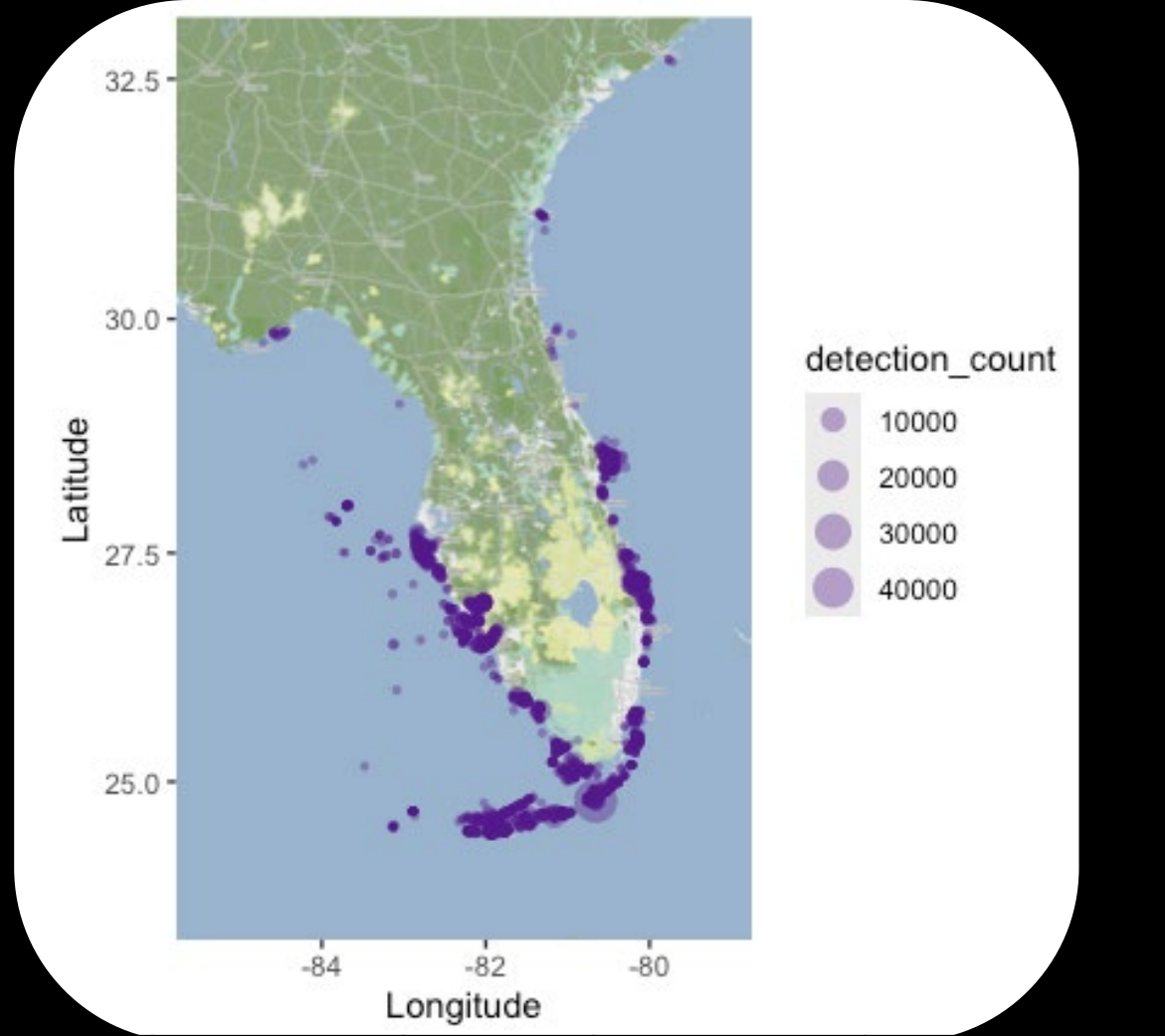
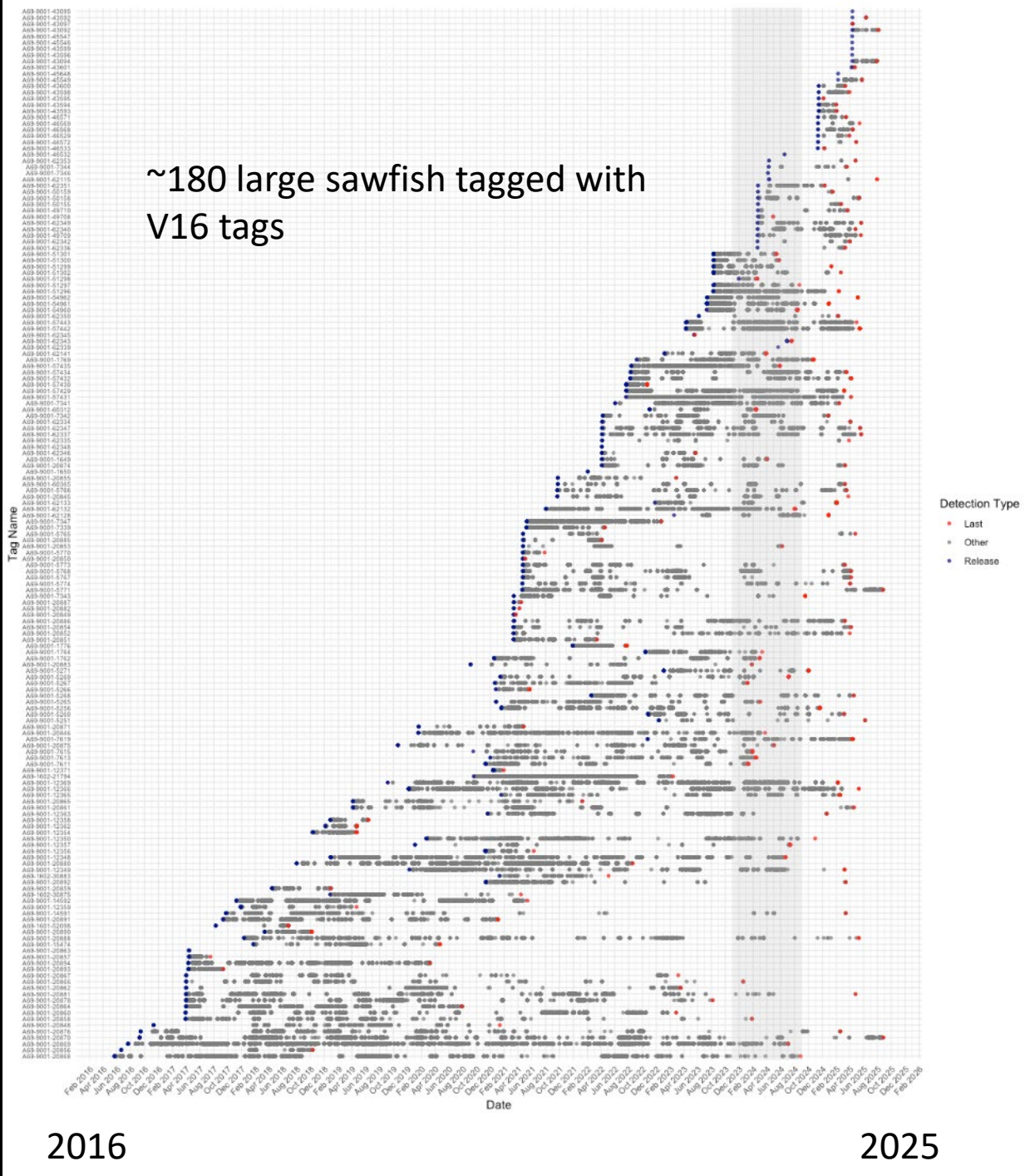
Published January 28



Large-scale space use of large juvenile and adult smalltooth sawfish *Pristis pectinata*: implications for management

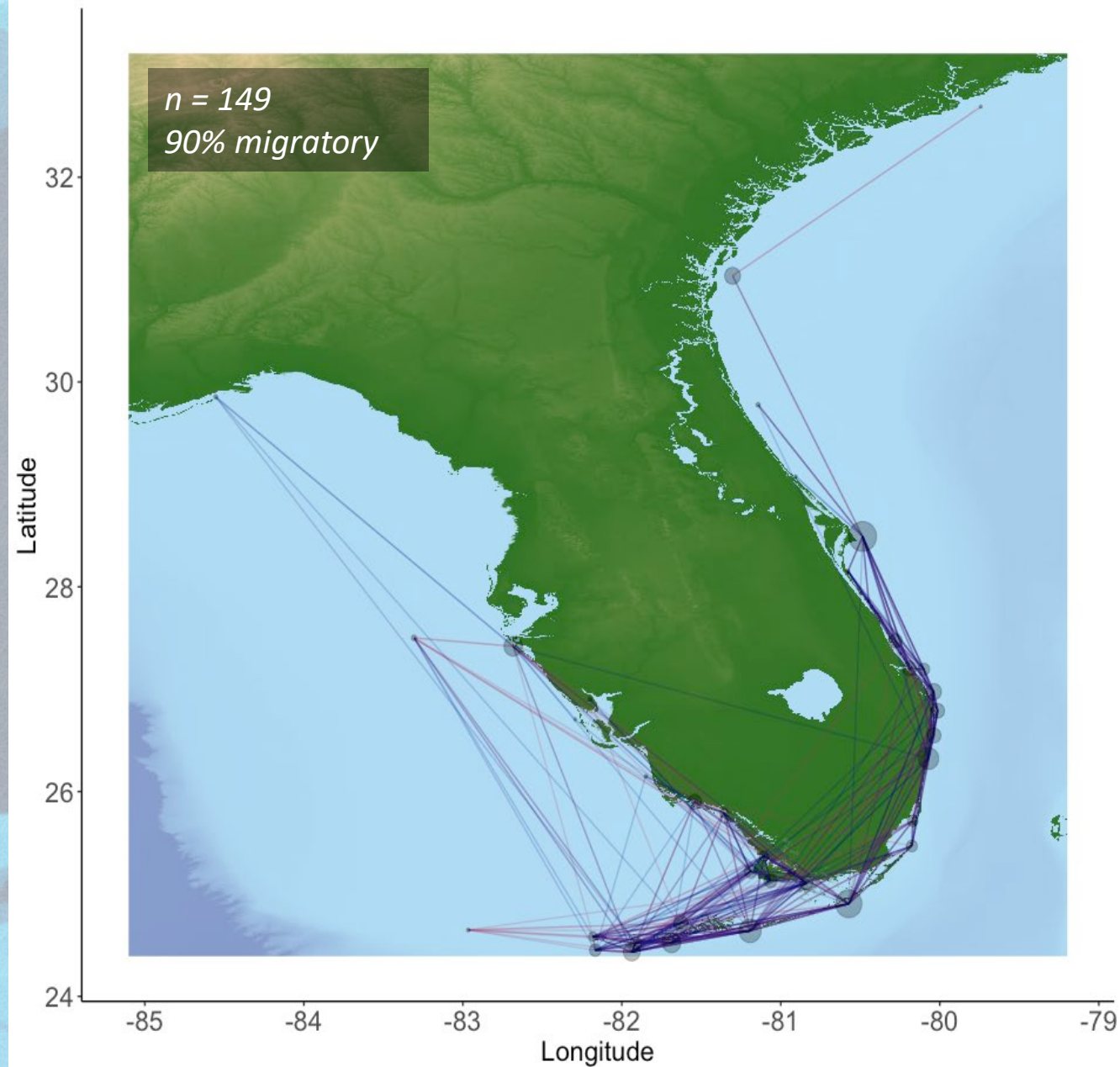
Jasmin Graham^{1,*}, Andrea M. Kroetz², Gregg R. Poulakis³, Rachel M. Scharer³, John K. Carlson⁴, Susan Lowerre-Barbieri^{5,6}, Danielle Morley⁷, Eric A. Reyier⁸, R. Dean Grubbs¹

Abacus Plot of Acoustic Detections



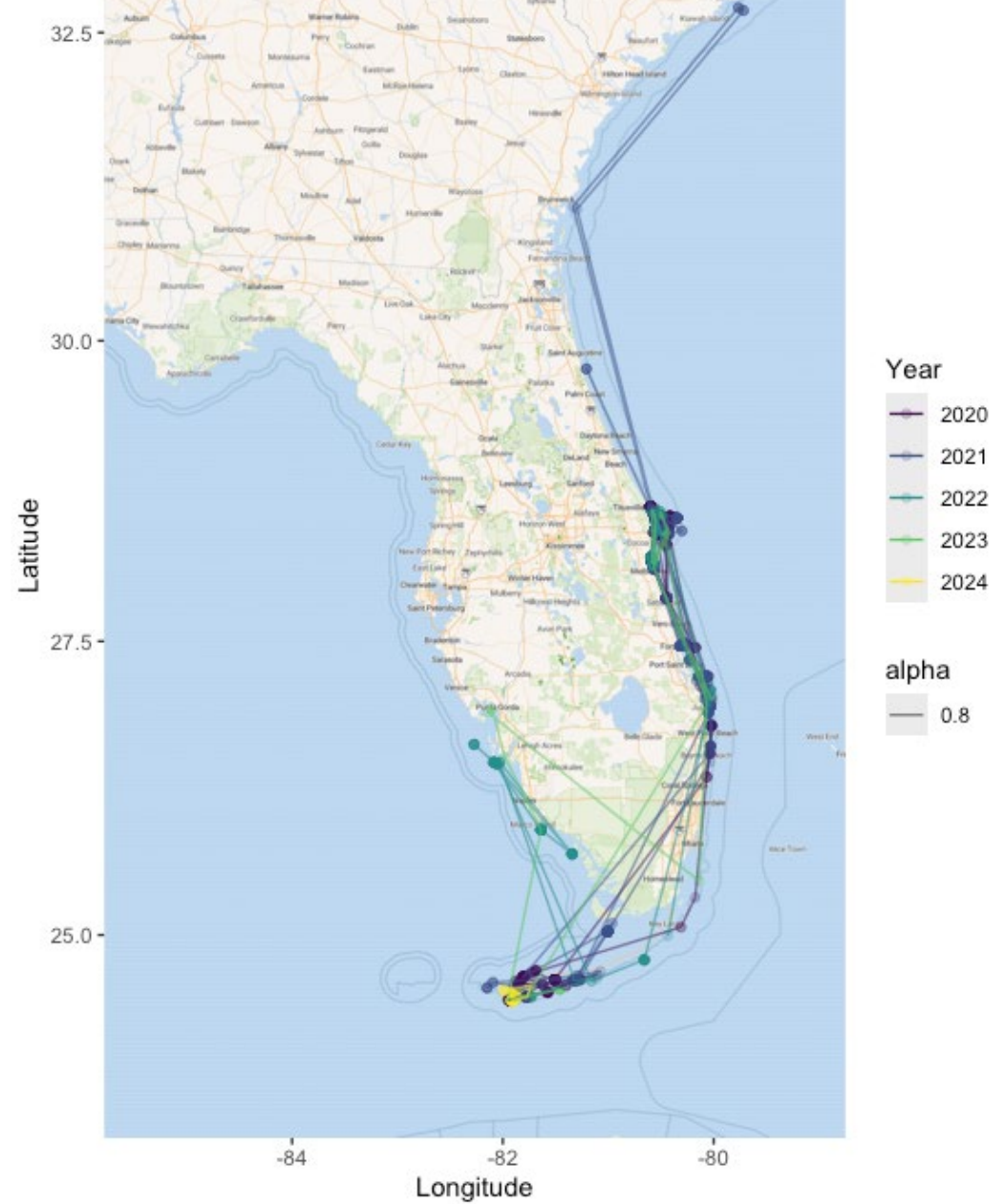
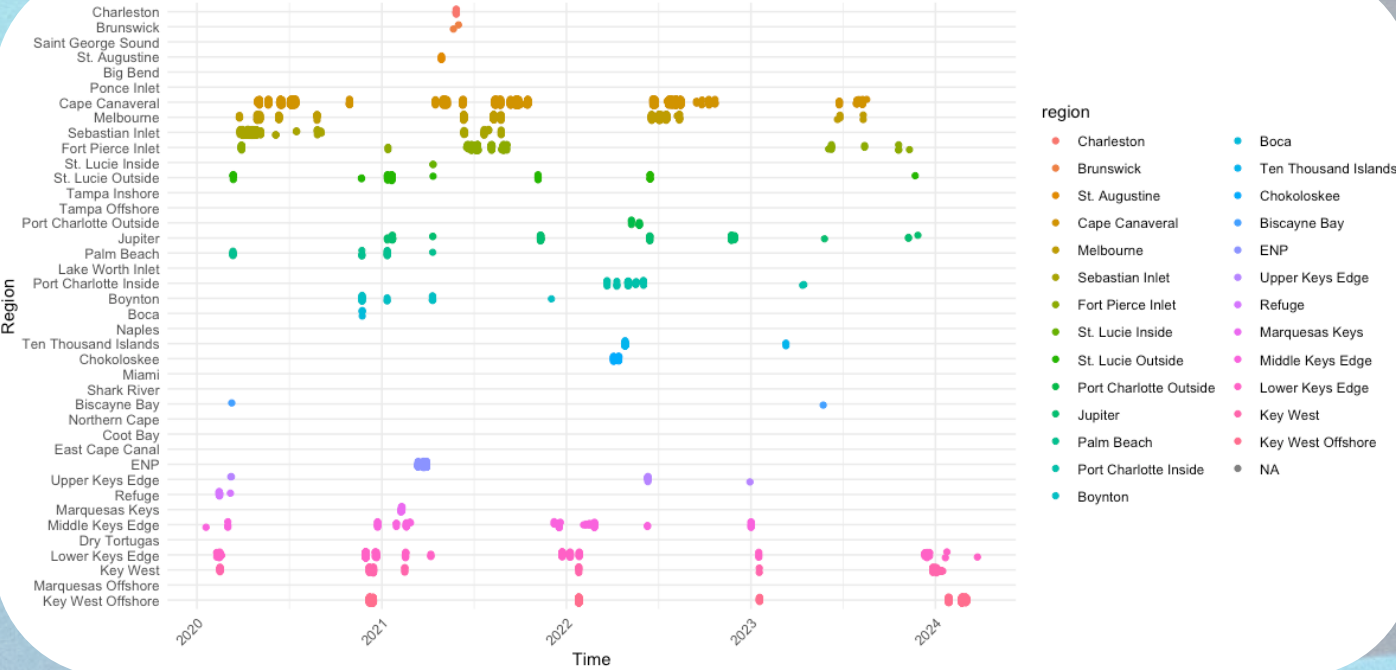
Maturity	Sex	n	# Stations	# Detections
JUV	FEMALE	37	680	151,096
JUV	MALE	29	507	55,340
MAT	FEMALE	40	1022	137,525
MAT	MALE	43	1125	87,518
		149		431,479

COMPLETE SPATIAL NETWORK (ALL INDIVIDUALS)

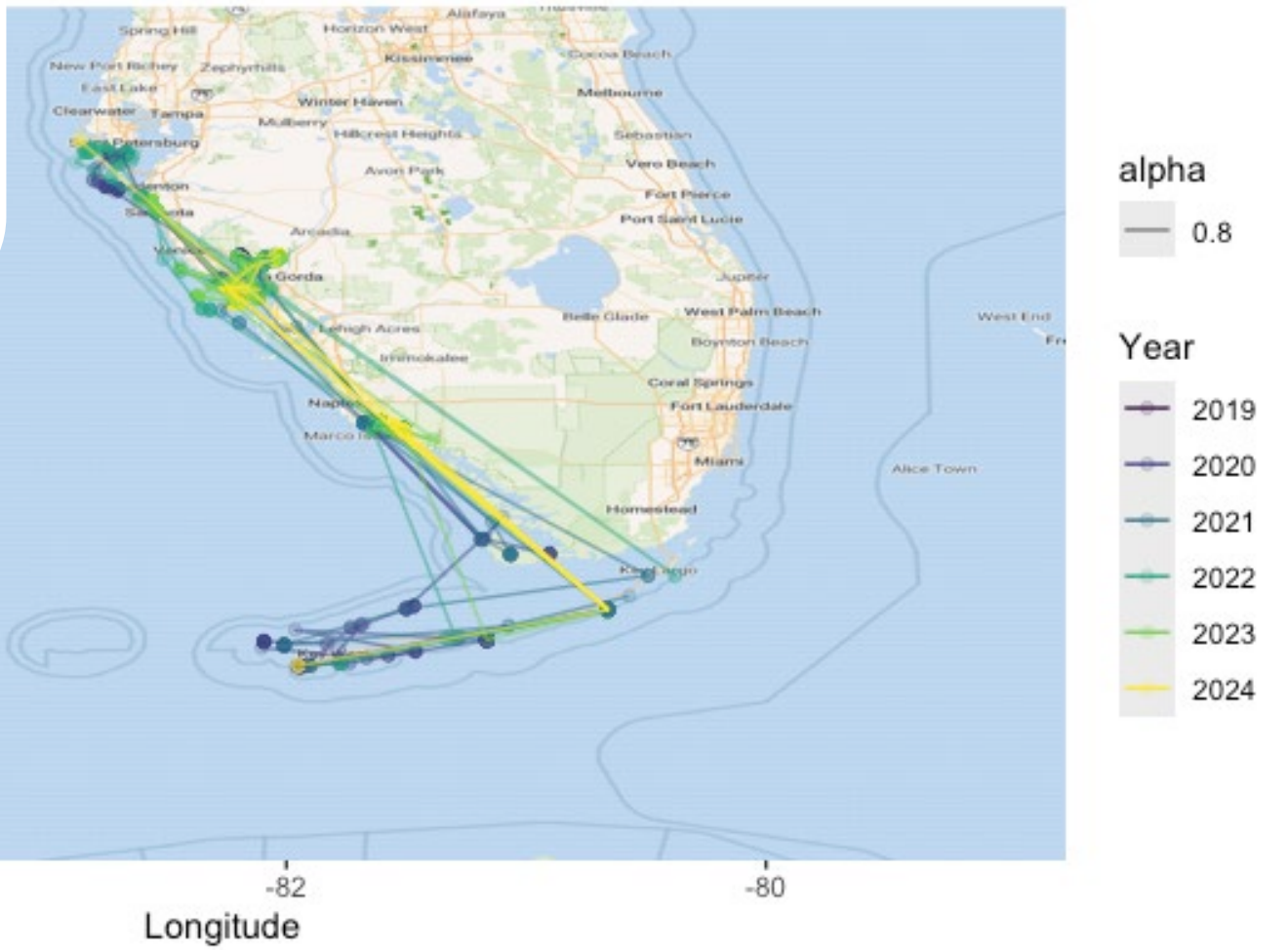
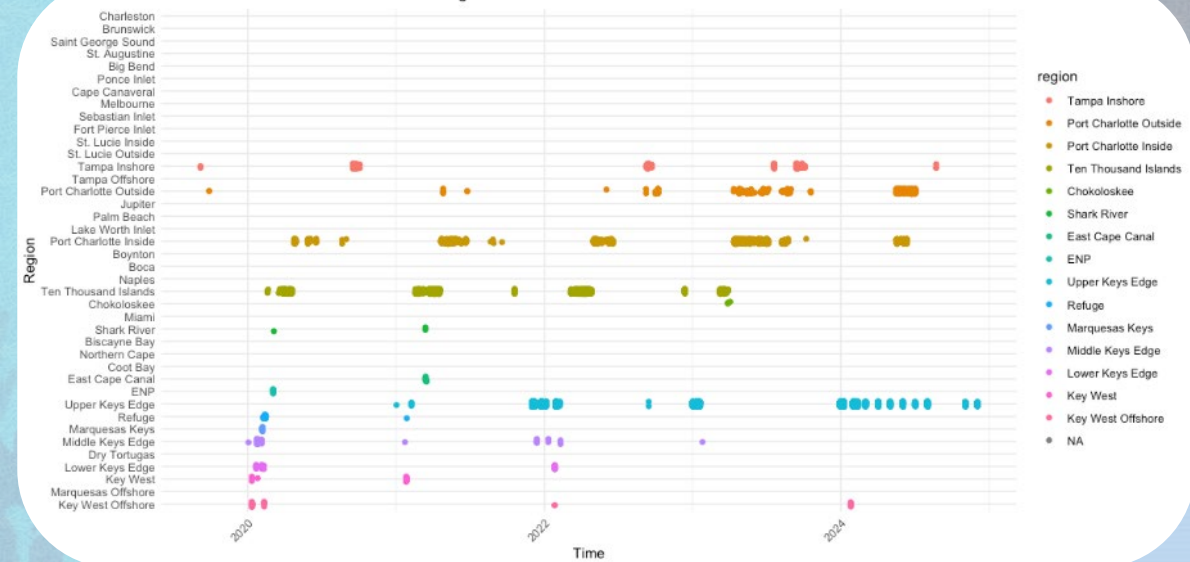


MOVEMENT GROUP: EAST COAST MIGRANT

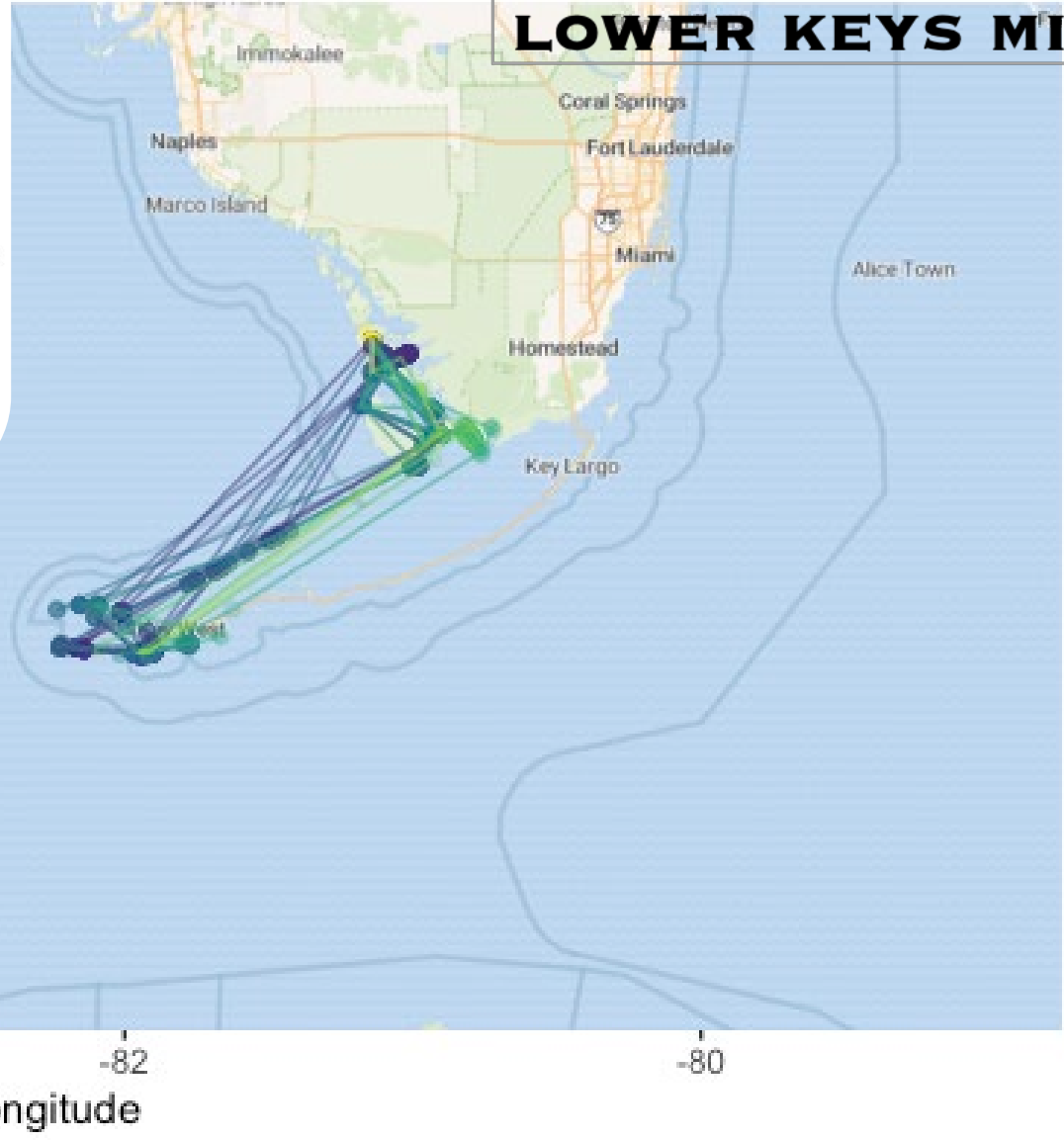
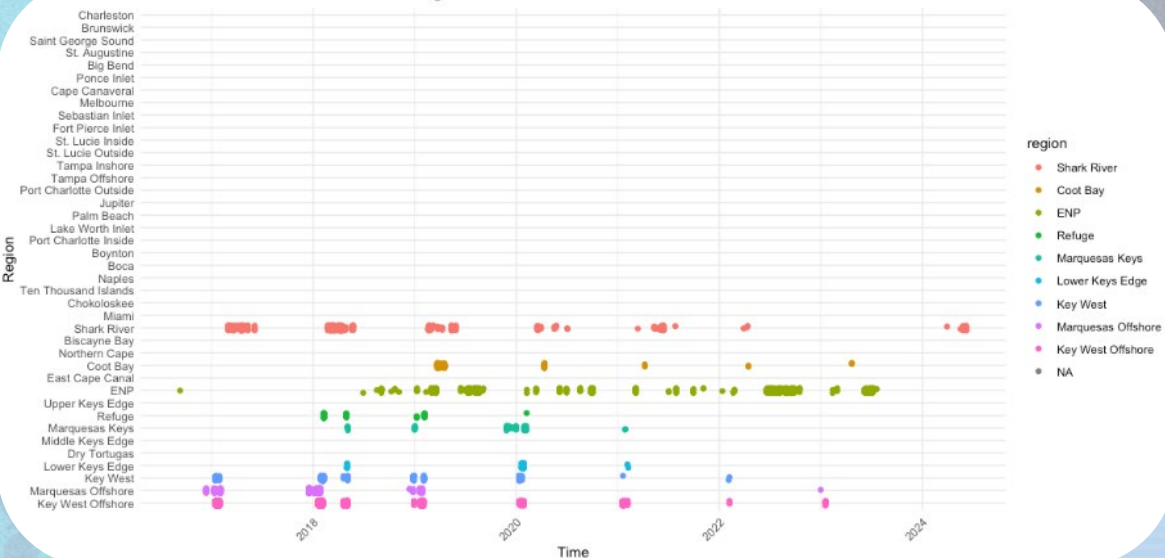
FSU Sawfish Acoustic Detections - Tag: A69-9001-20846



MOVEMENT GROUP: GULF COAST MIGRANT

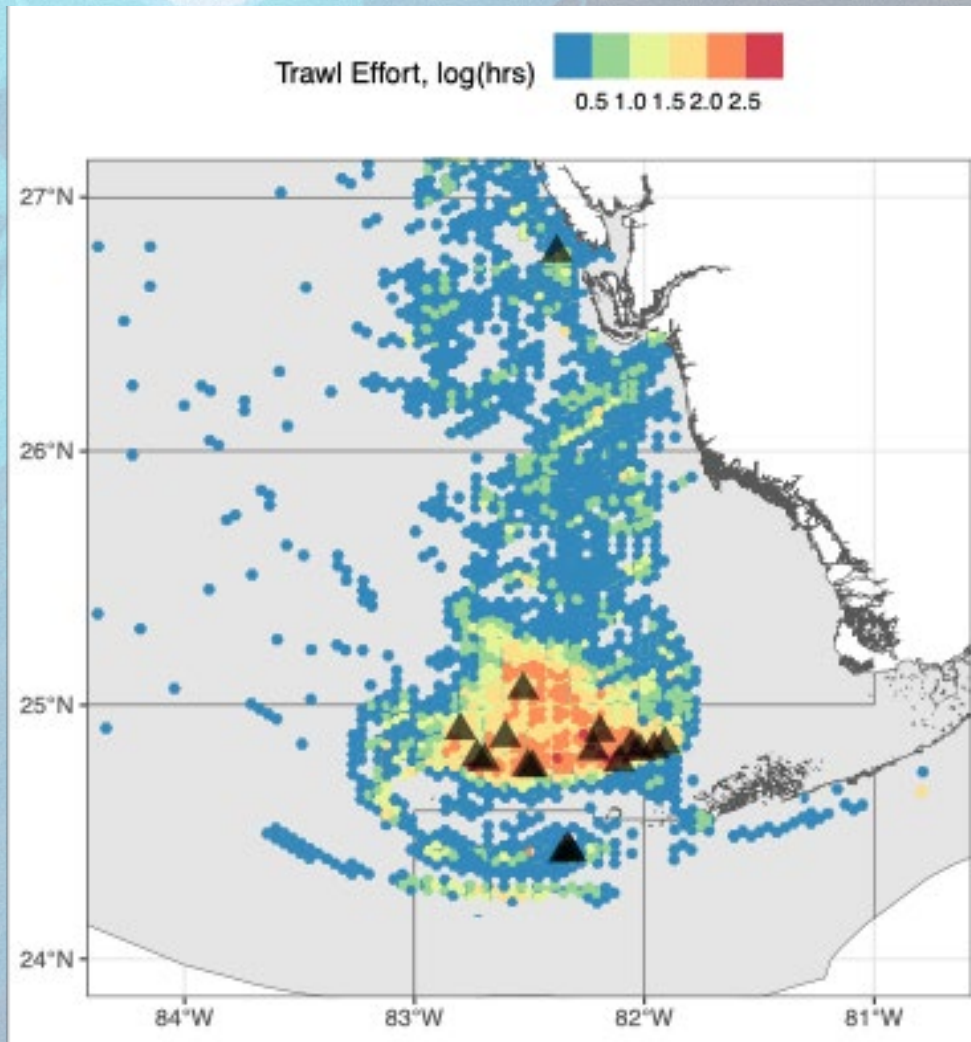


MOVEMENT GROUP: LOWER KEYS MIGRANT



IMPLICATIONS

All migratory contingents are susceptible to shrimp trawling



US Federal shrimp trawl fishery (<1% observer coverage):

Observed 21 individuals (19 in Gulf, 2 in S. Atlantic) from 2009 to 2023 (Babcock et al. 2025)

**No observer program in state fishery*

Extrapolated take estimates: 17–163
smalltooth sawfish captured per year
(Carlson & Scott-Denton 2011)

Population indices

Catch rates increasing

Encounter rates increasing

Range expansion

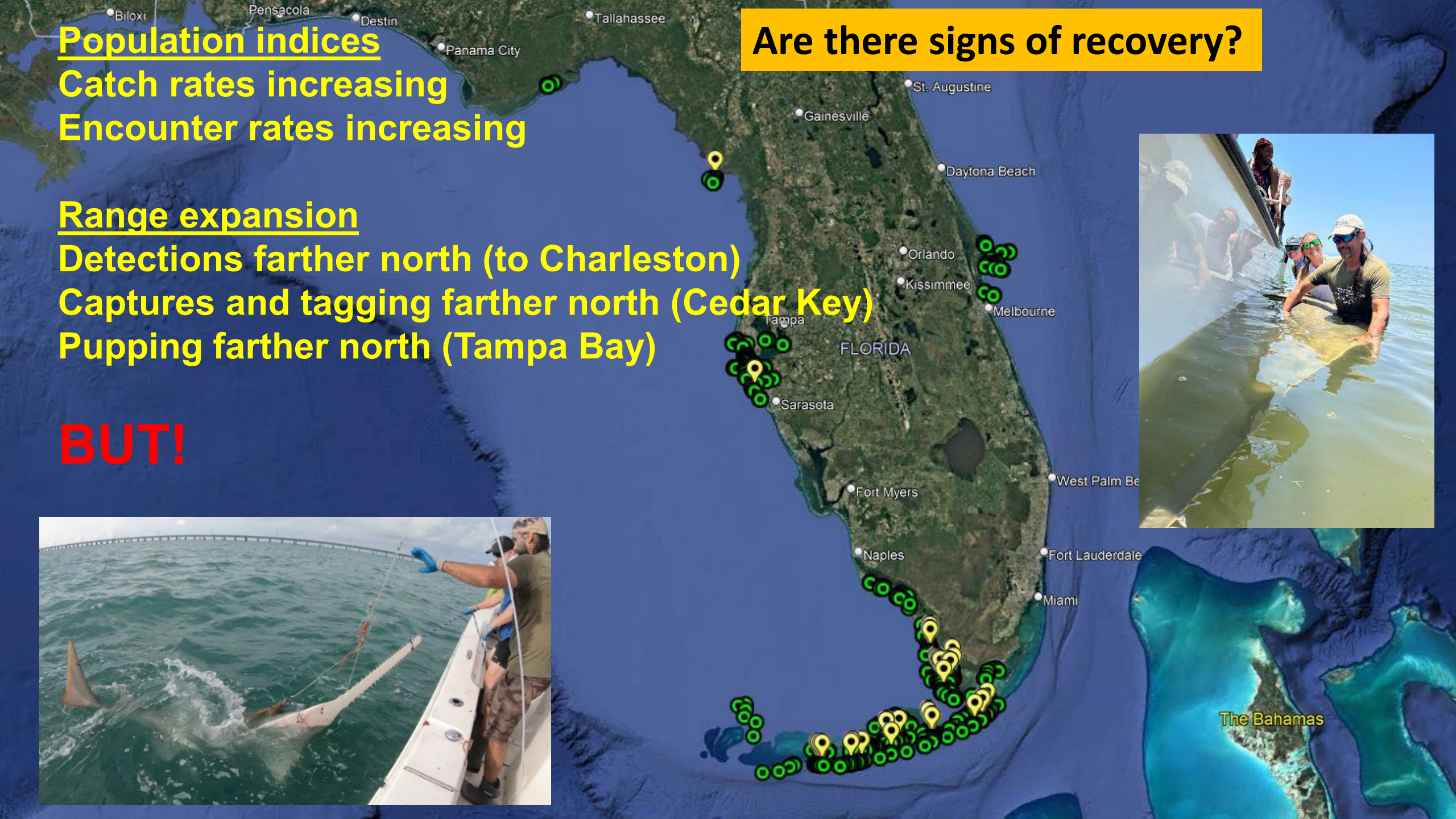
Detections farther north (to Charleston)

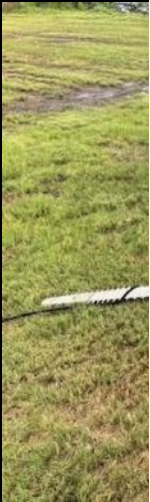
Captures and tagging farther north (Cedar Key)

Pupping farther north (Tampa Bay)

BUT!

Are there signs of recovery?





3:50 PM	Benthic Dinoflagellates, Spinning Fish, and Sawfish Mortalities: Is There a Connection? Dr. Michael Parsons Florida Gulf Coast University, Fort Myers, Florida
4:05 PM	Pioneering a First-in-Kind, Fishing Guide-Led Model for Rapid Scientific and Ecological Response Allison Delashmit Key West and Lower Keys Fishing Guides Association, Summerland Key, Florida
4:20 PM	Spinning Sawfish in the Florida Keys: Weather Conditions, Movements, and Mortality Dr. Gregg Poulakis Florida Fish and Wildlife Conservation Commission, Port Charlotte, Florida

Forbes

M

W

M

C

Deaths Baffle Florida Keys

on sharks

Follow

Mar 20, 2024, 09:22pm EDT

F

R

R

D

A

g': Tourists watch sawfish die on

Oh as death toll rises

D

F

W

Sawfish Research:

Questions related to recovery

- Critical Habitat:

- What characterizes potential Critical Habitat spatially over ontogeny?
- Where are the highest risks of fisheries interactions?
- When and where does mating take place?



- **Population status:**

- Is the U.S. population segment of smalltooth sawfish “distinct”?
- Is there movement of adults between Florida and adjacent regions (e.g. Bahamas, Cuba)?
- Are there pupping areas/nurseries outside of Florida?

Florida
(largest population)

Sawfish protected
Recovering?
Mangrove protections

Little Bahama Bank

West Palm Beach

50 KM
600 m deep

Bahamas
(2 smaller populations?)

Miami

80 KM
800 m deep

Genie Popped

No specific sawfish protections
Small remnant populations
Still harvested
No mangrove protection

**Recovery of smalltooth sawfish
as a species may depend on
recovering the US population**

Cuba
(population size?)

Great Bahama E

20 KM
1000 m deep

Sawfish protected, enforcement lacking
Population viability unknown
Mangrove protections

Artemisa

Pinar del

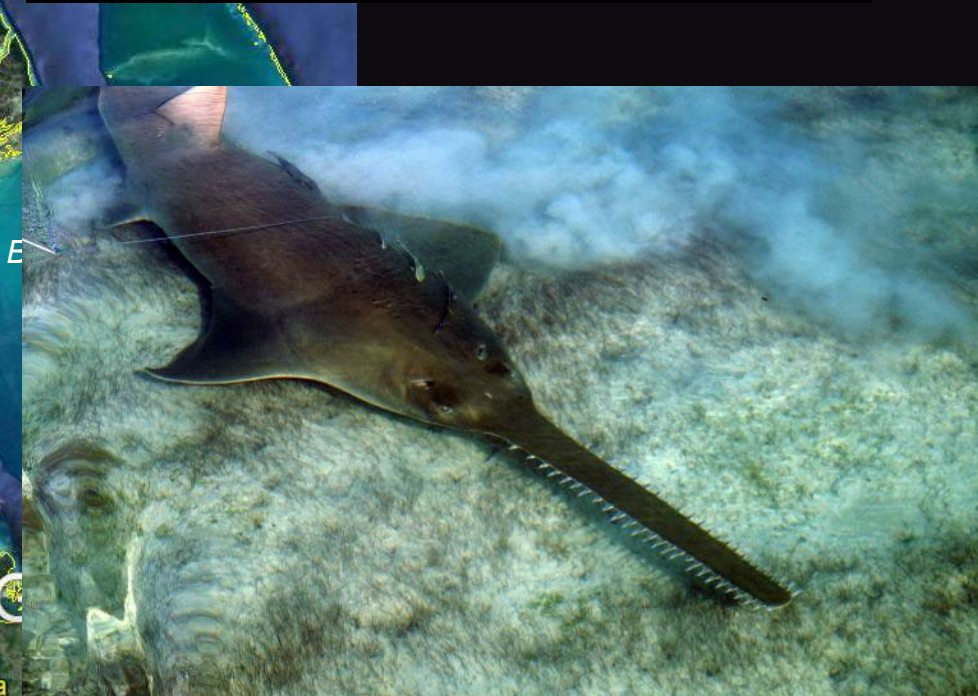
Virritus

Ciego de Avila

Isla de la Juventud

Image courtesy Copernicus
US Dept of State Geographer

Cuba





Funding:

US Research

- NOAA Office of Protected Resources
- NOAA/FWC Section 6
- Department of Defense/US Navy
- Disney Conservation Fund

Bahamas Research

- Save Our Seas Foundation
- Rackley Family Foundation
- National Geographic
- Shark Conservation Fund

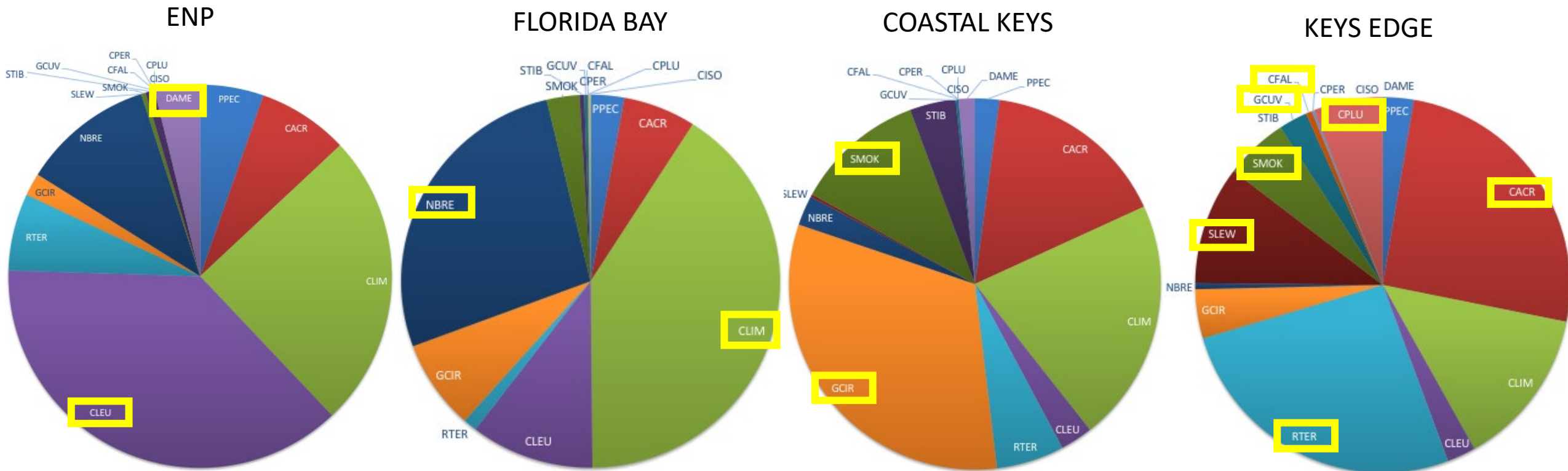


Thanks for listening!



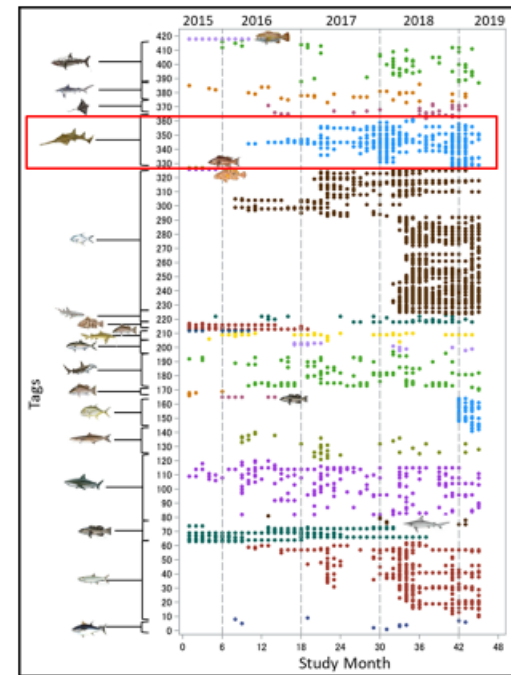
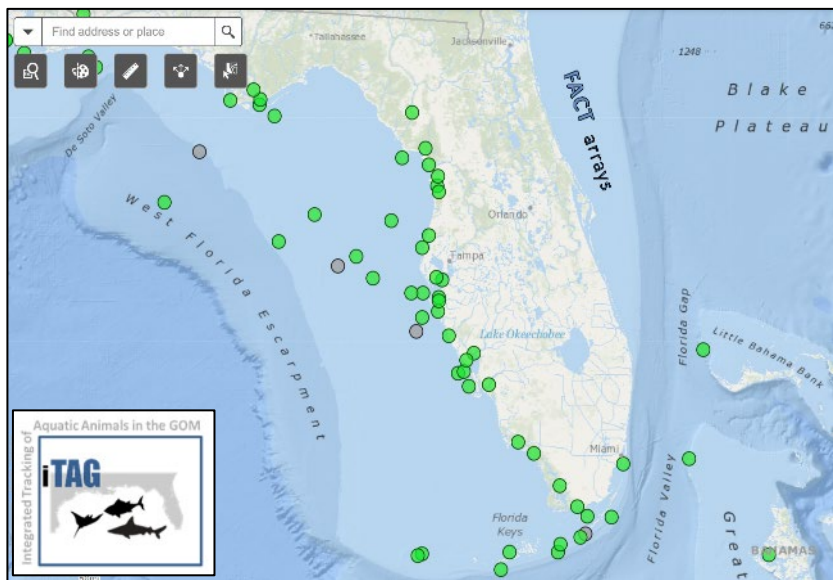
Dufrene-Legendre* Indicator Species Analysis

- Classes assigned by maximum significant ($P < 0.05$) indicator value

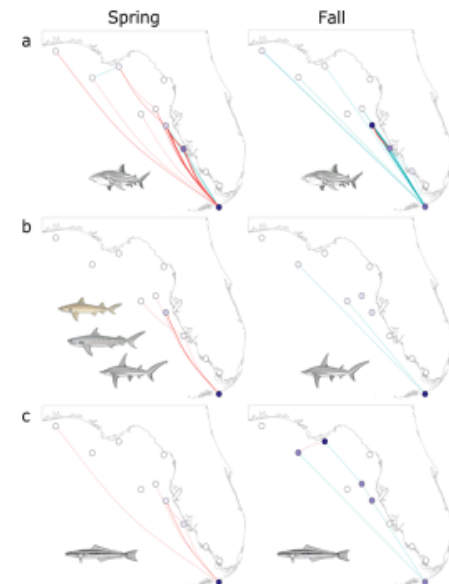
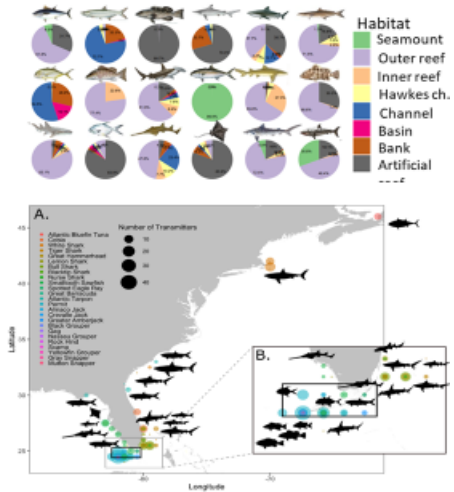


■ PPEC ■ CACR ■ CLIM ■ CLEU ■ RTEU ■ GCIR ■ NBRE ■ SLEW ■ SMOK ■ STIB ■ GCUV ■ CFAL ■ CPER ■ CPLU ■ CISO ■ DAME





Lowerre-Barbieri, S. +29 co-authors. 2021. Movescapes and eco-evolutionary movement strategies in marine fish: Assessing a connectivity hotspot. *Fish and Fisheries*: doi.org/10.1111/faf.12589



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