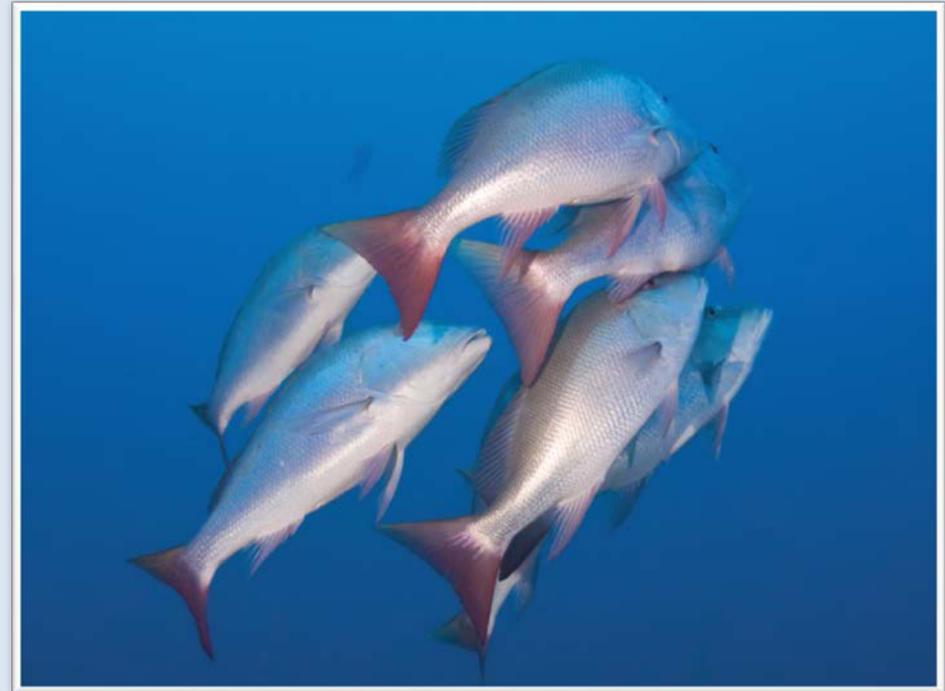


Tortugas Ecological Reserves Characterization

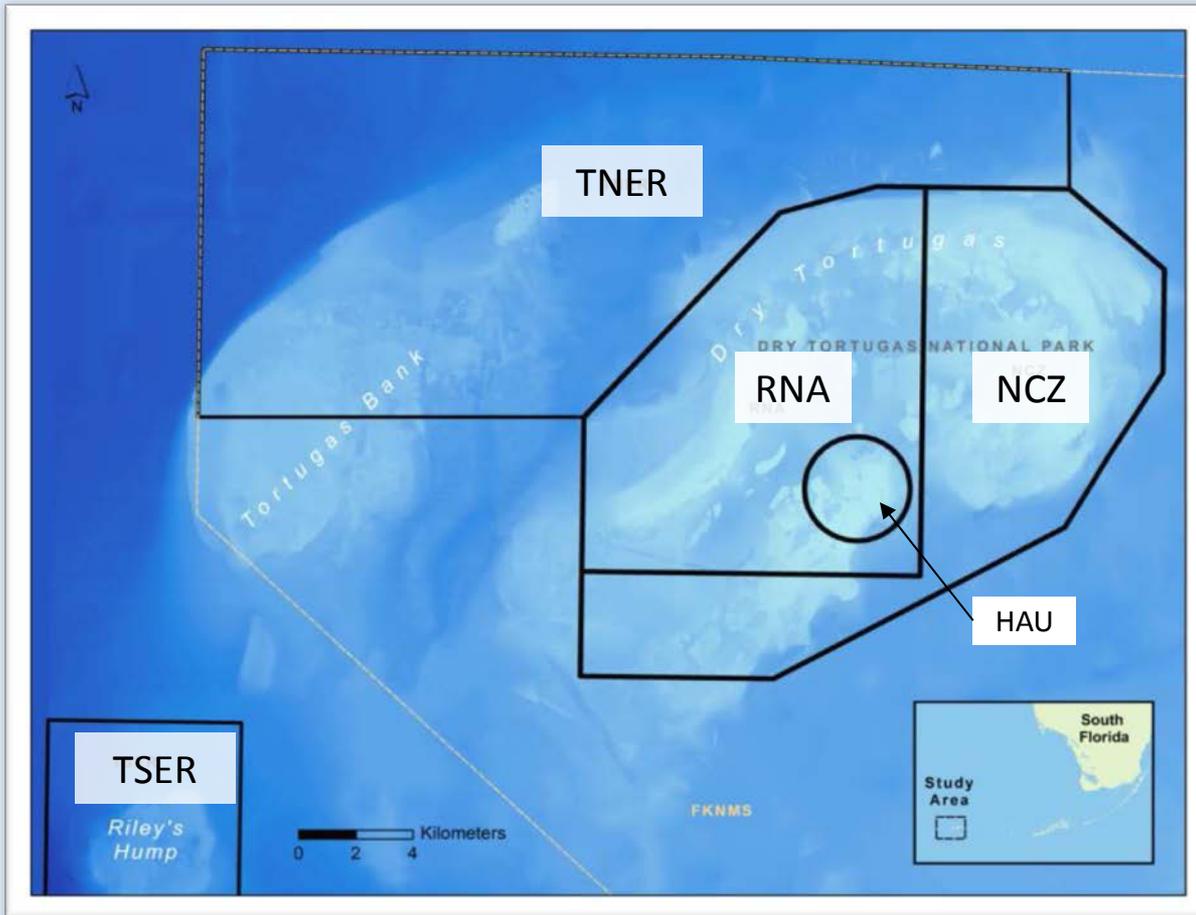
Presented by:

Alejandro Acosta



Alejandro.Acosta@myFWC.com

Zoning in the Dry Tortugas



Implemented 2001:

TSER – Tortugas South Ecological Reserve

TNER – Tortugas North Ecological Reserve

NCZ – Natural Cultural Zone

HAU – Historic adaptive use Zone

Implemented 2007:

RNA – Research Natural Area

A suite of methodological approaches are use to support research at the Tortugas Ecological Reserves

Reef Fish Visual census (RVC)



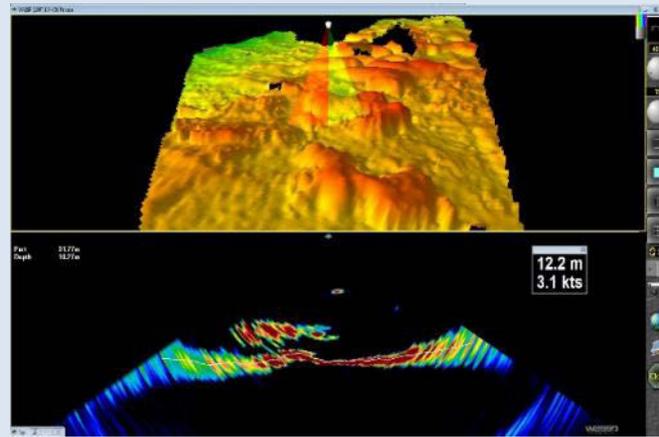
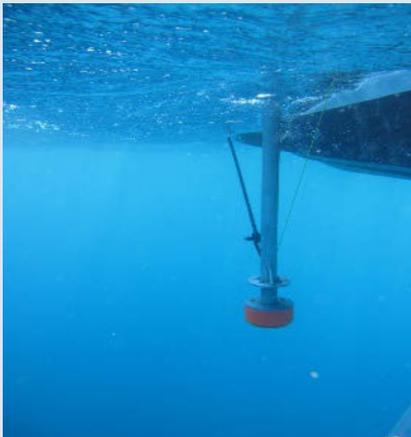
Fish acoustic tagging



Fish Spawning Aggregation



Bathymetry: Sonar and Multi-beam mapping



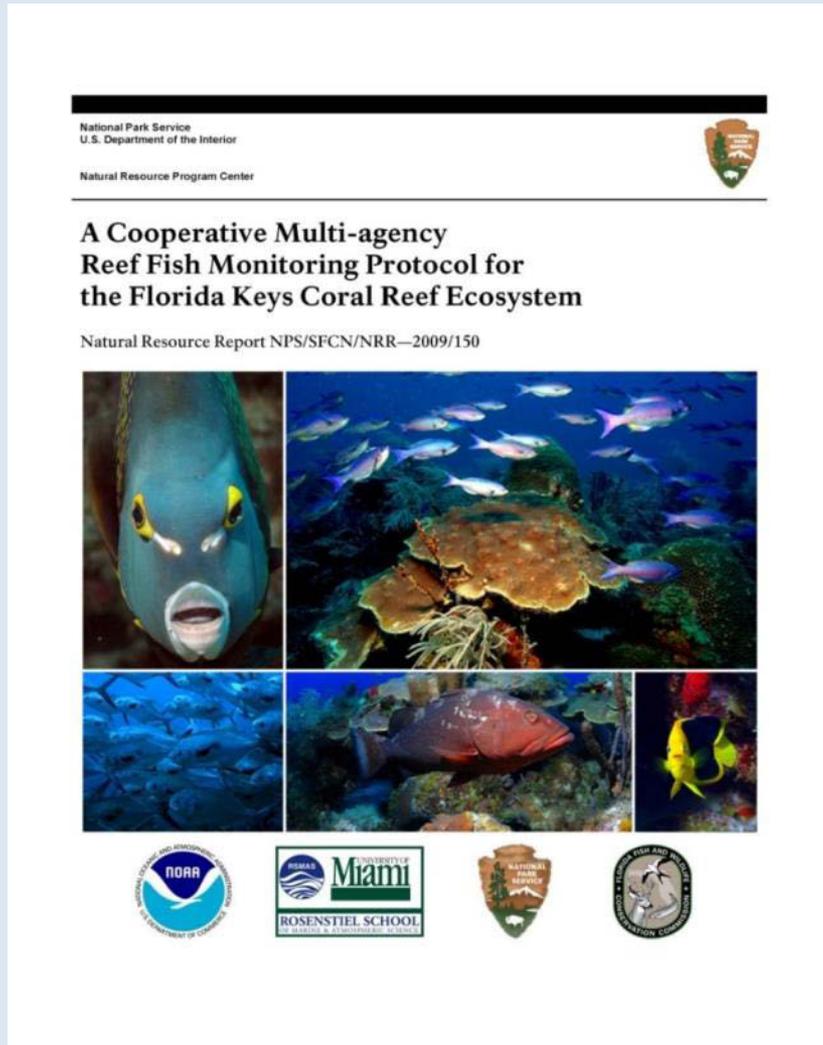
ROV's



Different working platforms



South Florida Reef Fish Visual Census (RVC)



Approach: Conduct biennial scuba-based surveys of the reef fish communities in the Florida Keys, using visual point counts based on a habitat-stratified sampling design. Multi-agency approach conducted by FWC, NOAA/NMFS, University of Miami (RSMAS), and National Park Service.

- **Fish:** Size-Structured Abundance of Fish Species
- **Benthic:** Size-Structured Abundance of Coral Species (Demographics)



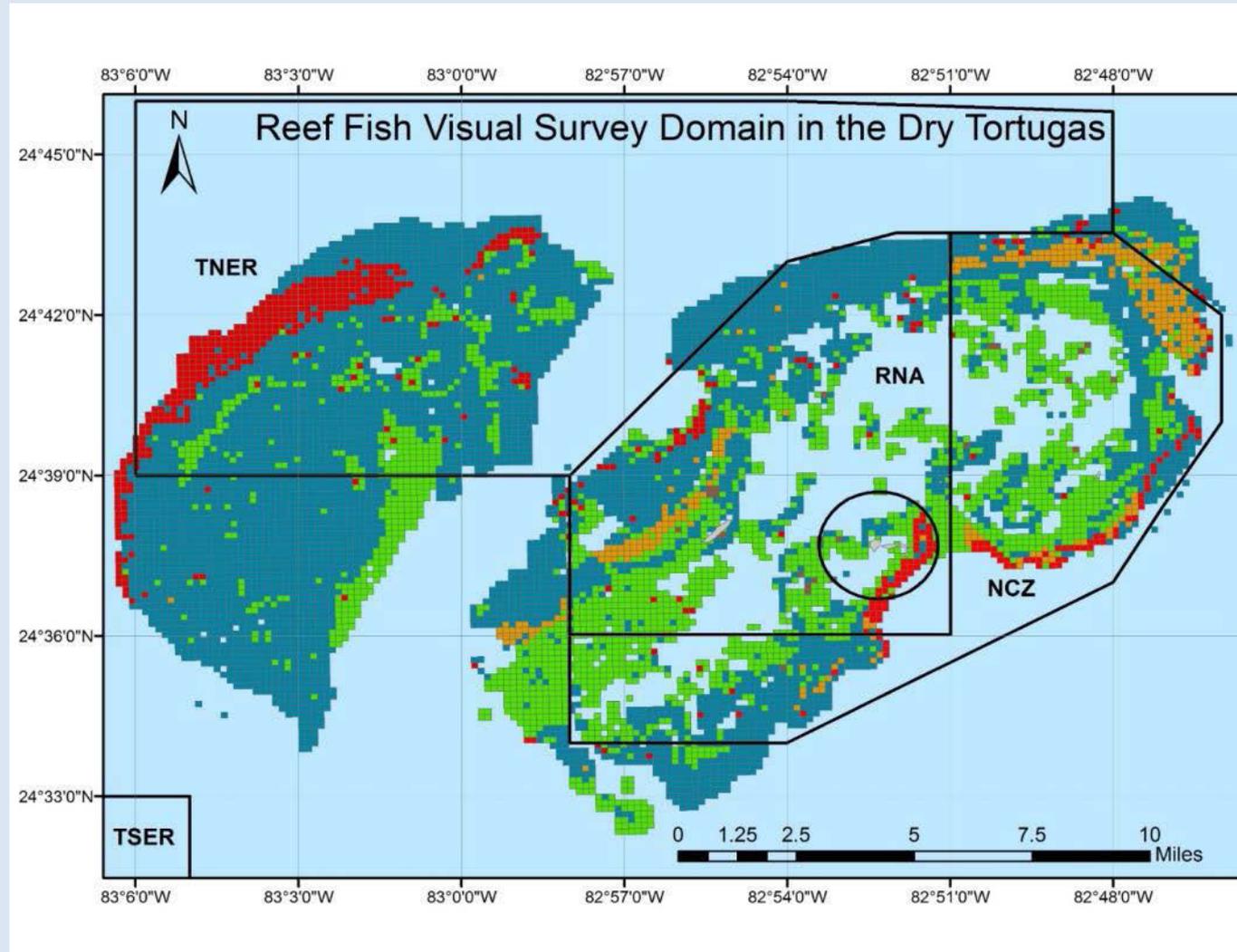
South Florida Reef Fish Visual Census (RVC)

- Long time series (> 20 years) and methodology is essentially unchanged
- Describe status and trends of fish populations in the FL Keys
- Allows synoptic analysis of large temporal and spatial scale changes in ecosystems
- Evaluate management actions related to zoning

Habitat Maps

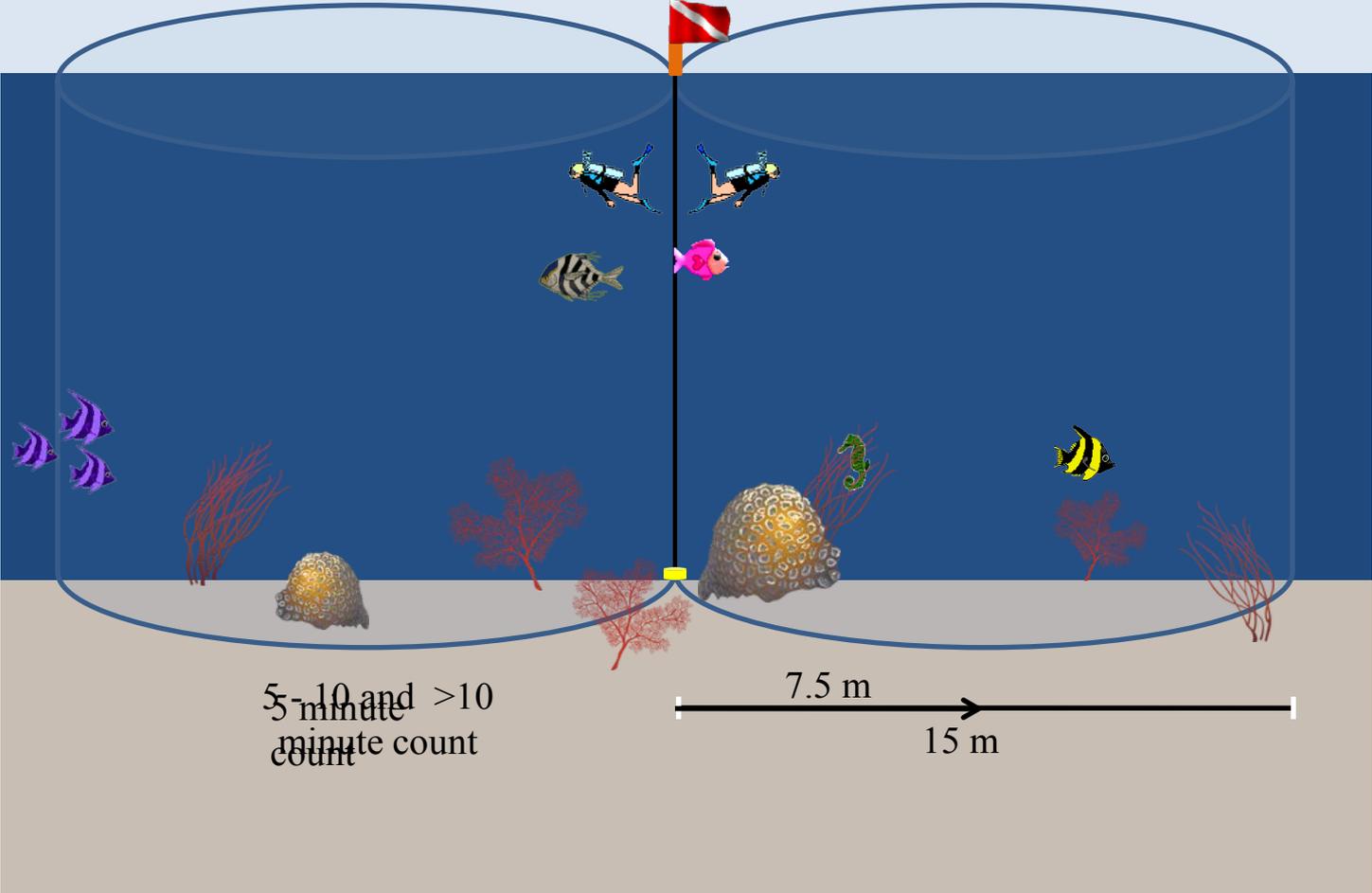
DRTO Habitat Classification

- High-Relief Reef 
 - Continuous Reef 
 - Isolated Patch 
 - Spur and Groove 
 - Reef Rubble 
- Each of these reef types are further subdivided into relief categories (High, Medium, or Low)
 - The combination of reef and relief type is called a “strata”, and each strata is classified as protected or unprotected based on its location

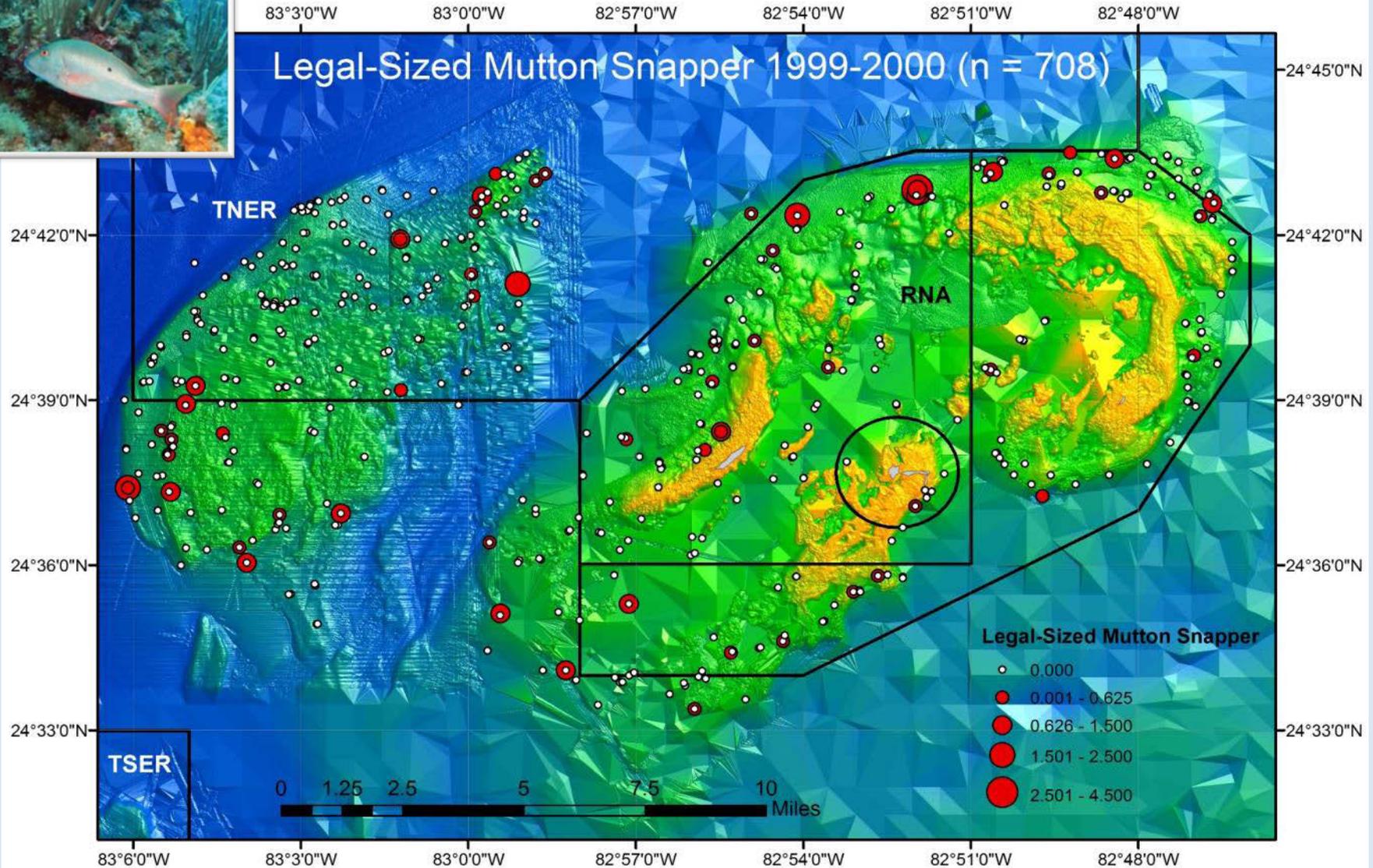


Reef Visual Census (RVC) Program

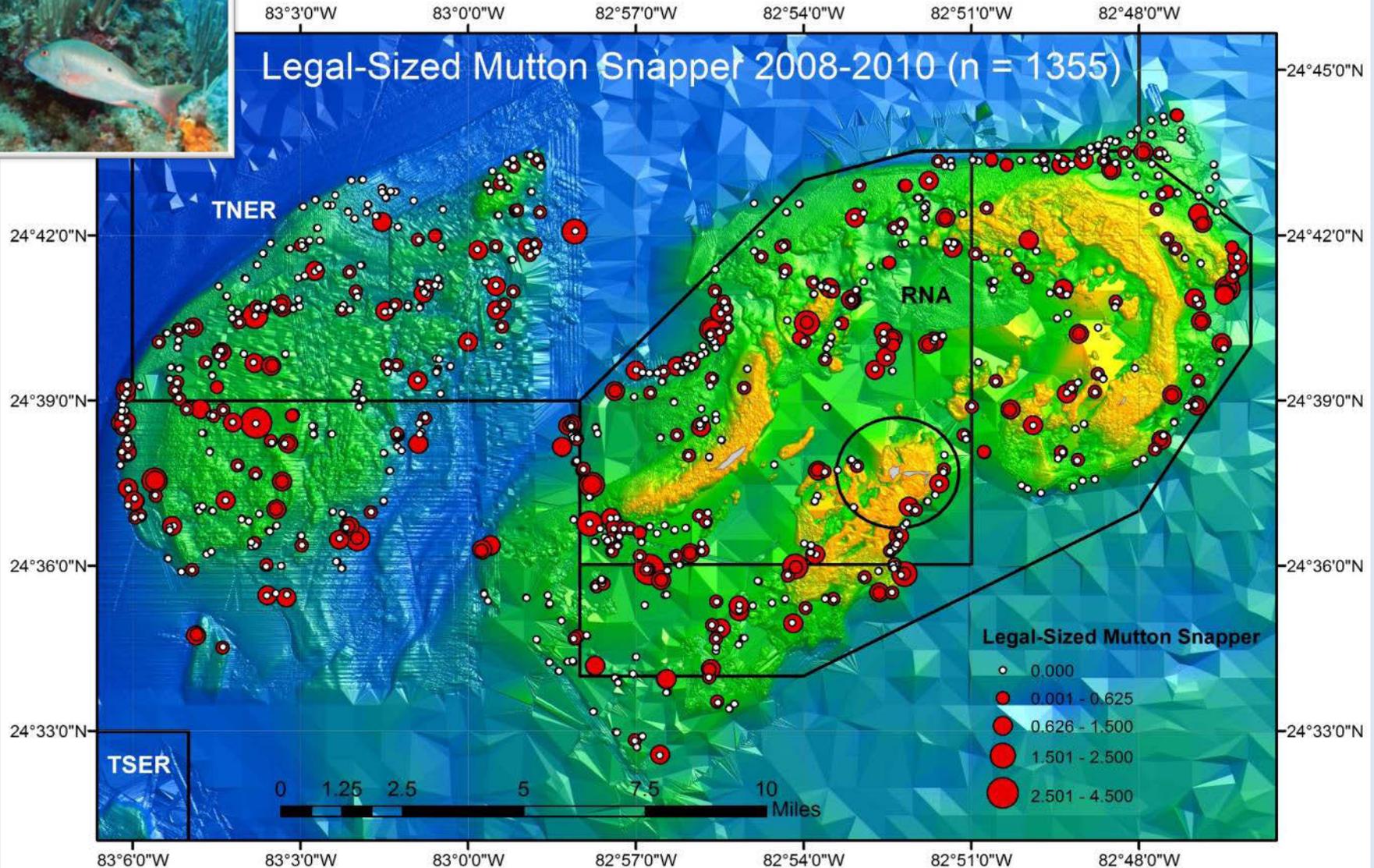
Stationary Point Counts



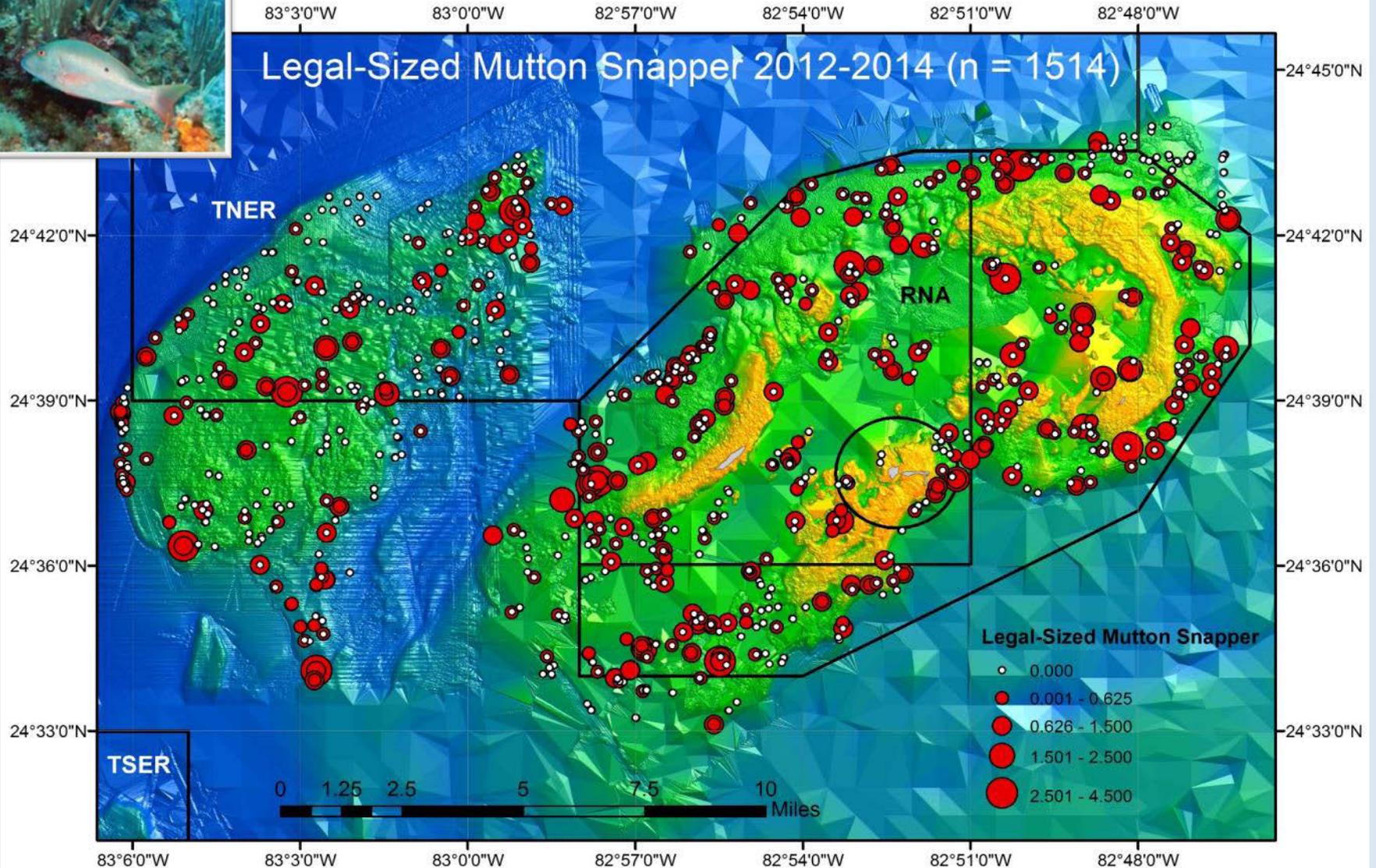
Changes in Abundance and Size-structure of Mutton Snapper 1999-2014



Changes in Abundance and Size-structure of Mutton Snapper 1999- 2014

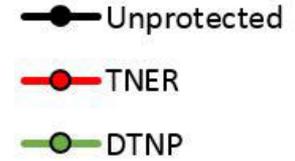
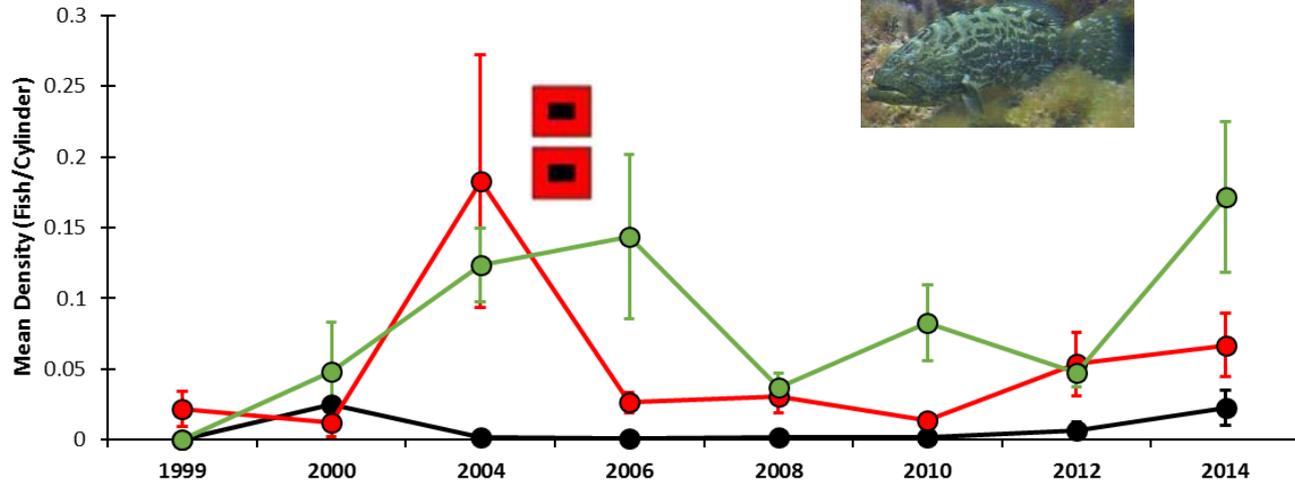


Changes in Abundance and Size-structure of Mutton Snapper 1999- 2014

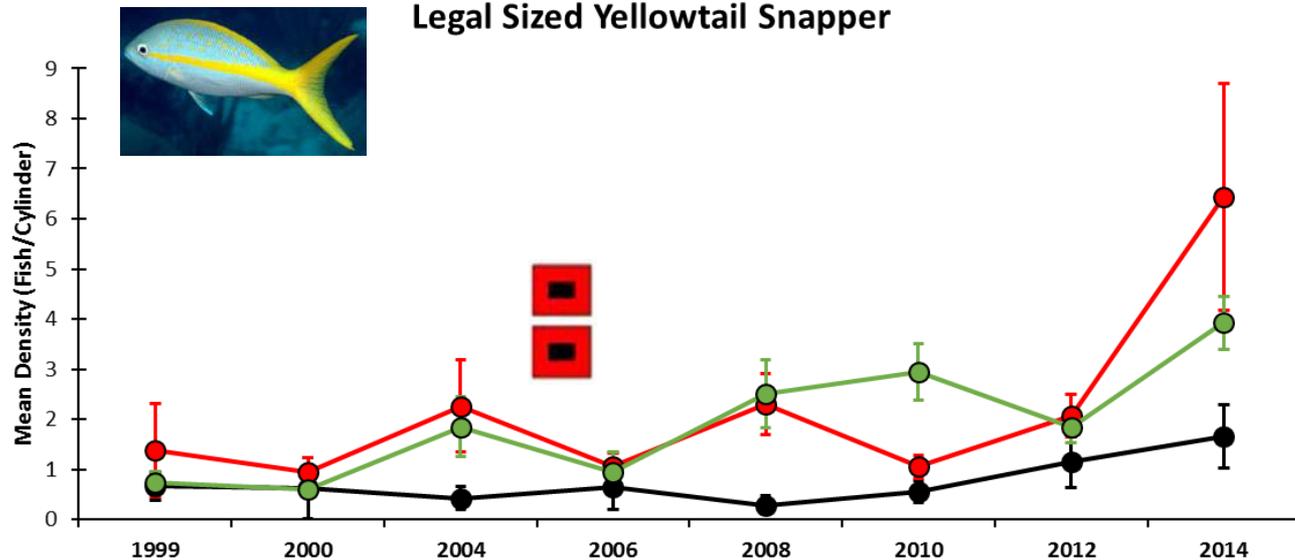


Mean Density of Commercially Important Species within Tortugas Management Zones

Legal Sized Black Grouper



Legal Sized Yellowtail Snapper

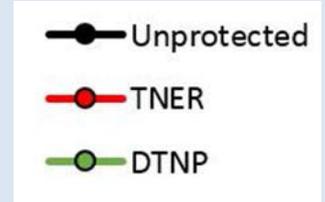
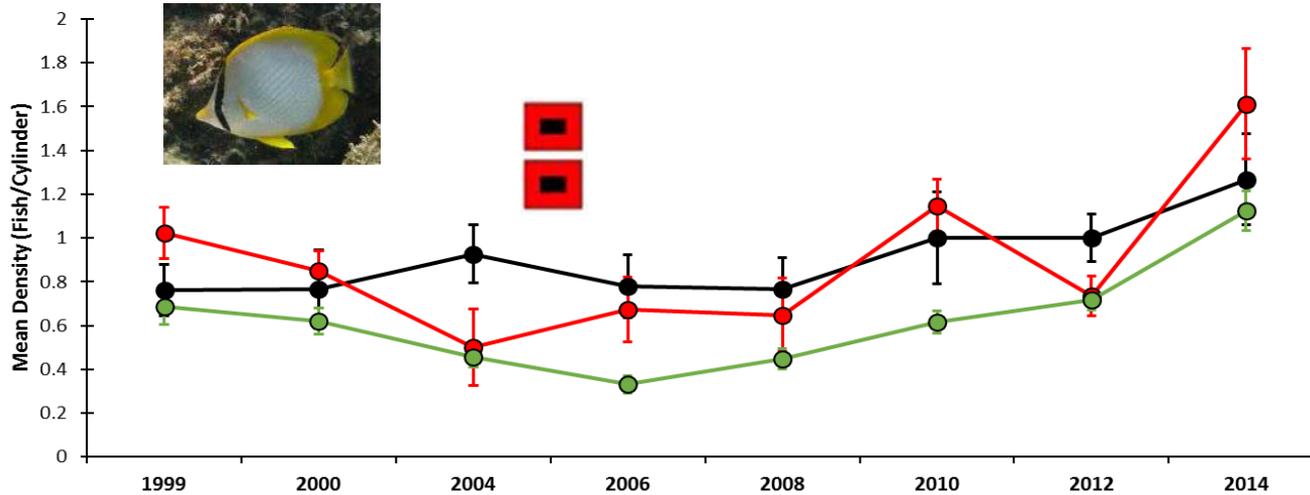


Five hurricanes impacted the DRTO region between the 2004 and 2006 data collection

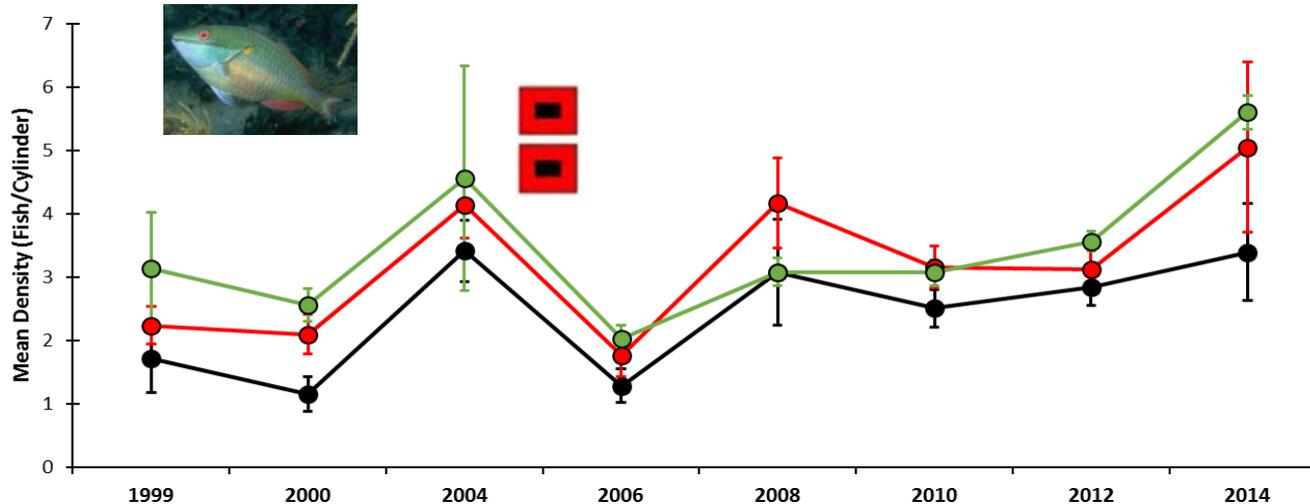
- Including Cat. 3 Hurricane Charley that traveled directly over the Dry Tortugas

Mean Density of Non-Commercially Important Species within Tortugas Management Zones

Spotfin Butterflyfish



Redband Parrotfish

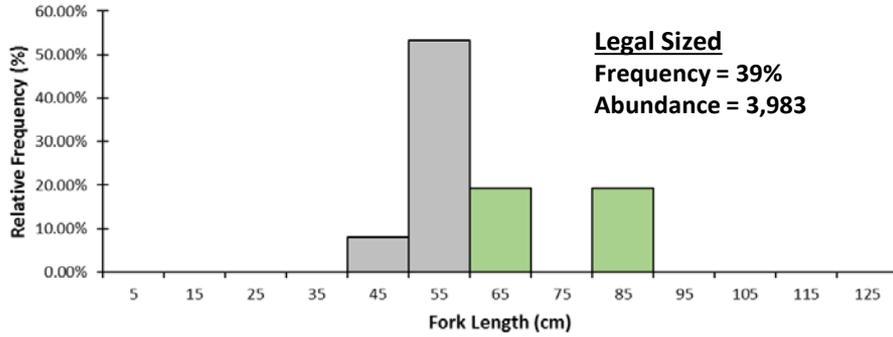


- Non-commercial species are expected to have similar densities between management zones
- Corroborating density trends for each management zone can be used to confirm that the overall density for the DRTO region is accurate

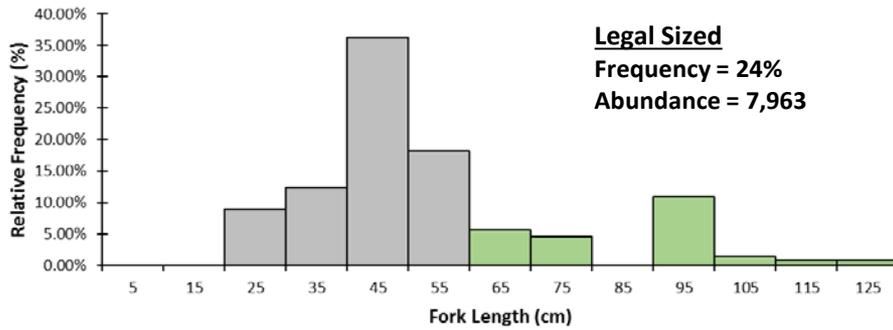
Black Grouper Length Frequency for Dry Tortugas Management Zones

1999-2000

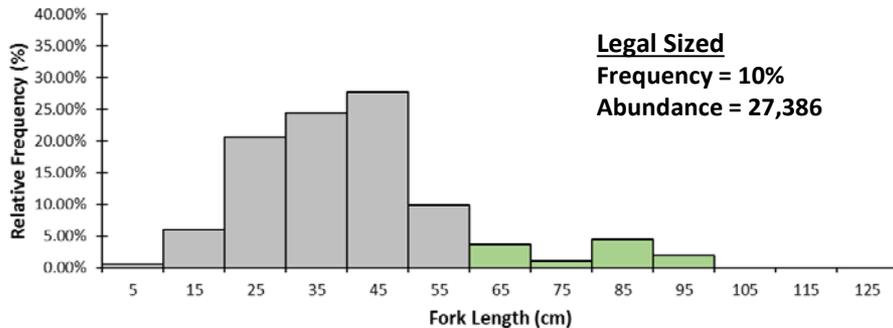
Tortugas Bank (Open)



Tortugas North Ecological Reserve (TNER)

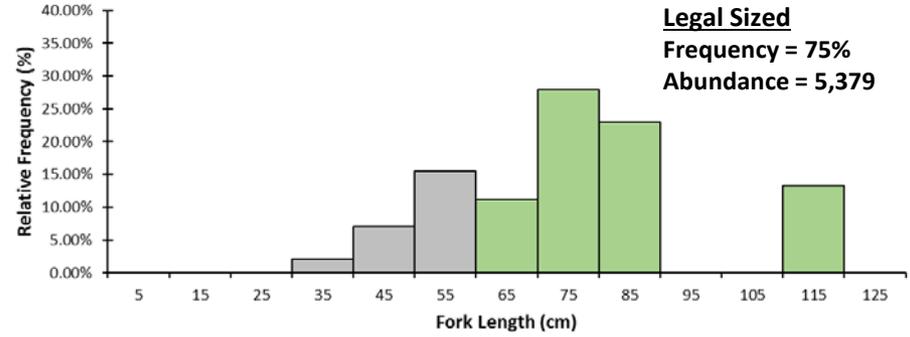


Dry Tortugas National Park (DTNP)

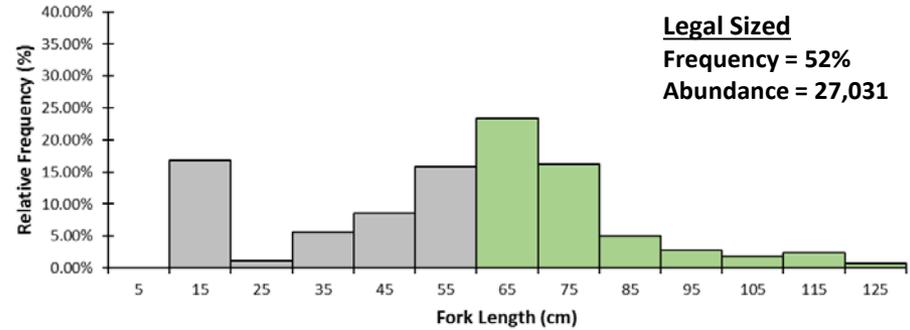


2012-2014

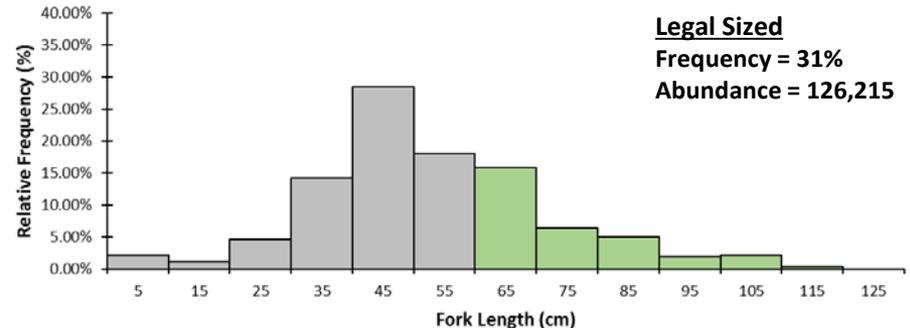
Tortugas Bank (Open)



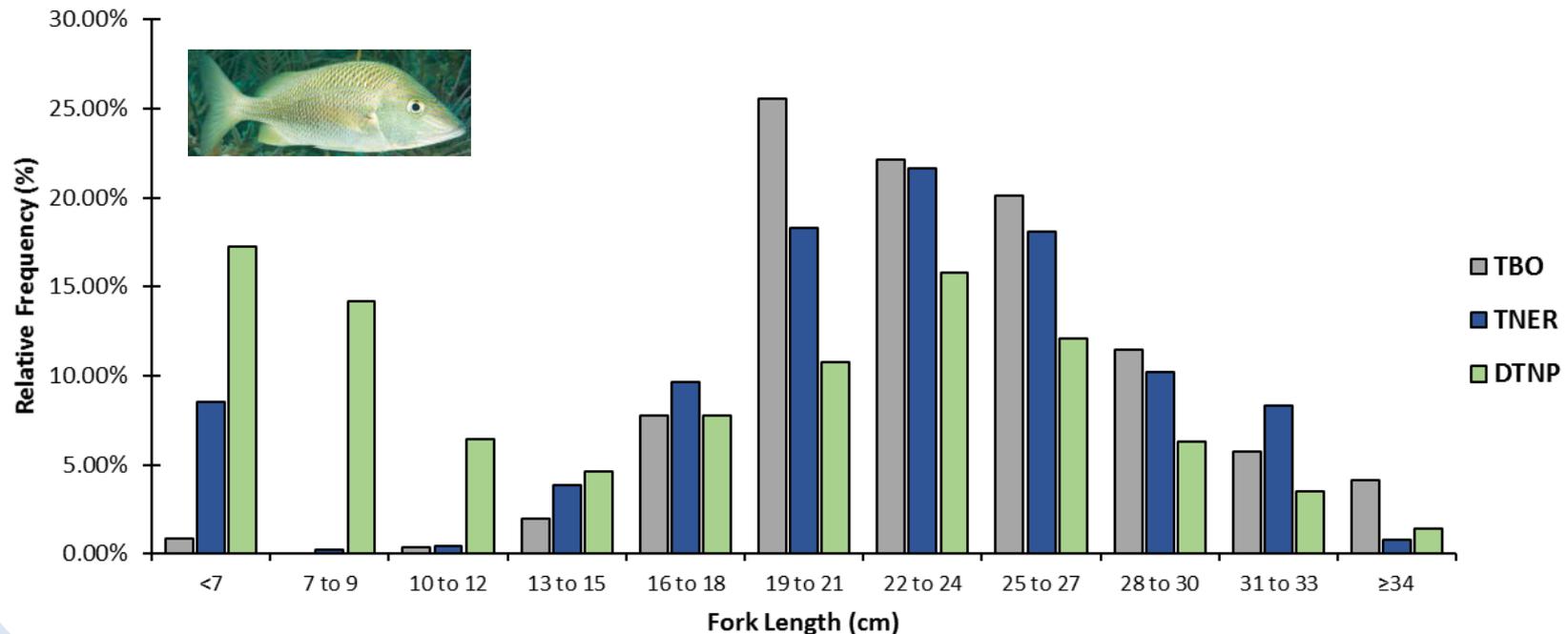
Tortugas North Ecological Reserve (TNER)



Dry Tortugas National Park (DTNP)



White Grunt Length Frequency in the Dry Tortugas (2014)



- Densities of White grunt are higher in the DTNP due to a large number of juveniles
- There is a mosaic of habitat within the DTNP, which is suitable for multiple white grunt life history stages

White Grunt

Tortugas Bank Open

Occurrence = 87.3%

Mean Density = 3.33 fish/cylinder

Tortugas North Ecological Reserve

Occurrence = 91.4%

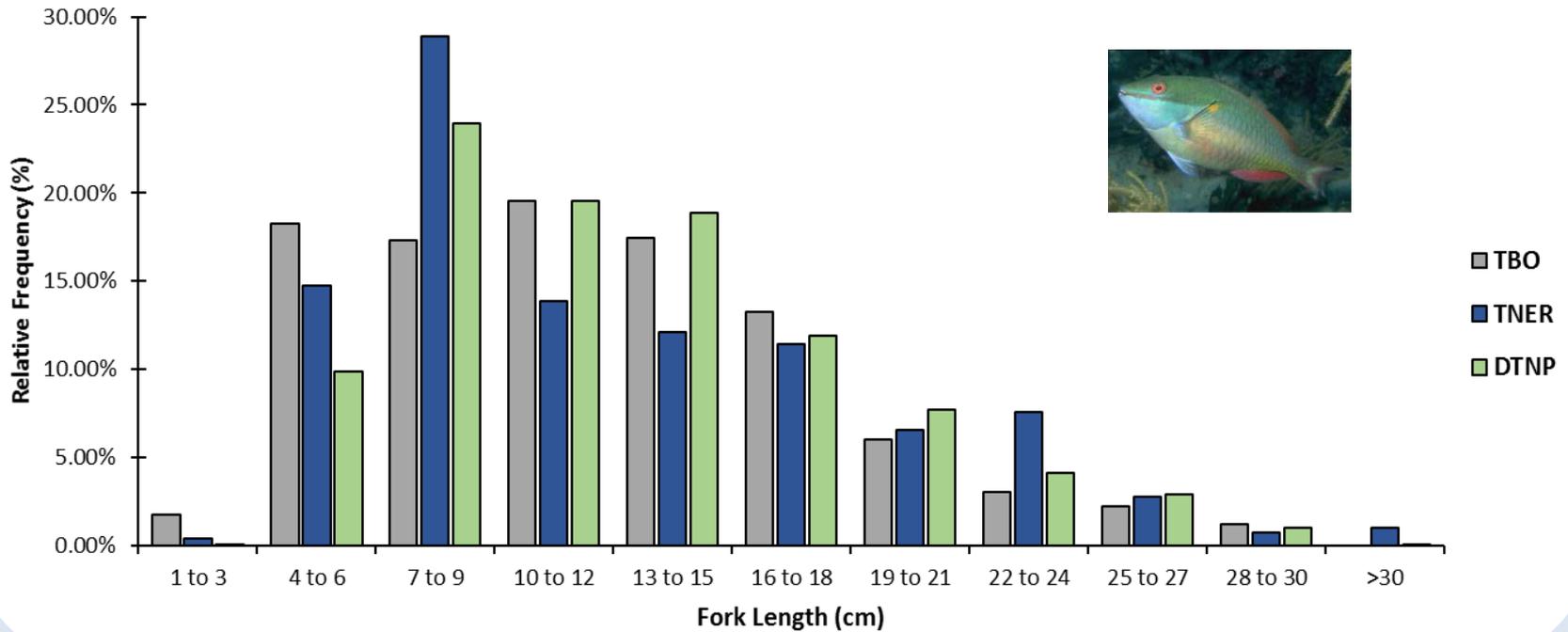
Mean Density = 4.39 fish/cylinder

Dry Tortugas National Park

Occurrence = 91.8%

Mean Density = 8.96 fish/cylinder

Redband Parrotfish Length Frequency in the Dry Tortugas (2014)



- Not surprising that the densities and length distribution are similar between the management zones

Redband Parrotfish

Tortugas Bank Open

Occurrence = 69.0%

Mean Density = 3.39 fish/cylinder

Tortugas North Ecological Reserve

Occurrence = 87.1%

Mean Density = 5.05 fish/cylinder

Dry Tortugas National Park

Occurrence = 92.6%

Mean Density = 5.60 fish/cylinder

Fish Spawning Aggregations and Fish Acoustic Tagging Studies in the marine reserves of Dry Tortugas, Florida

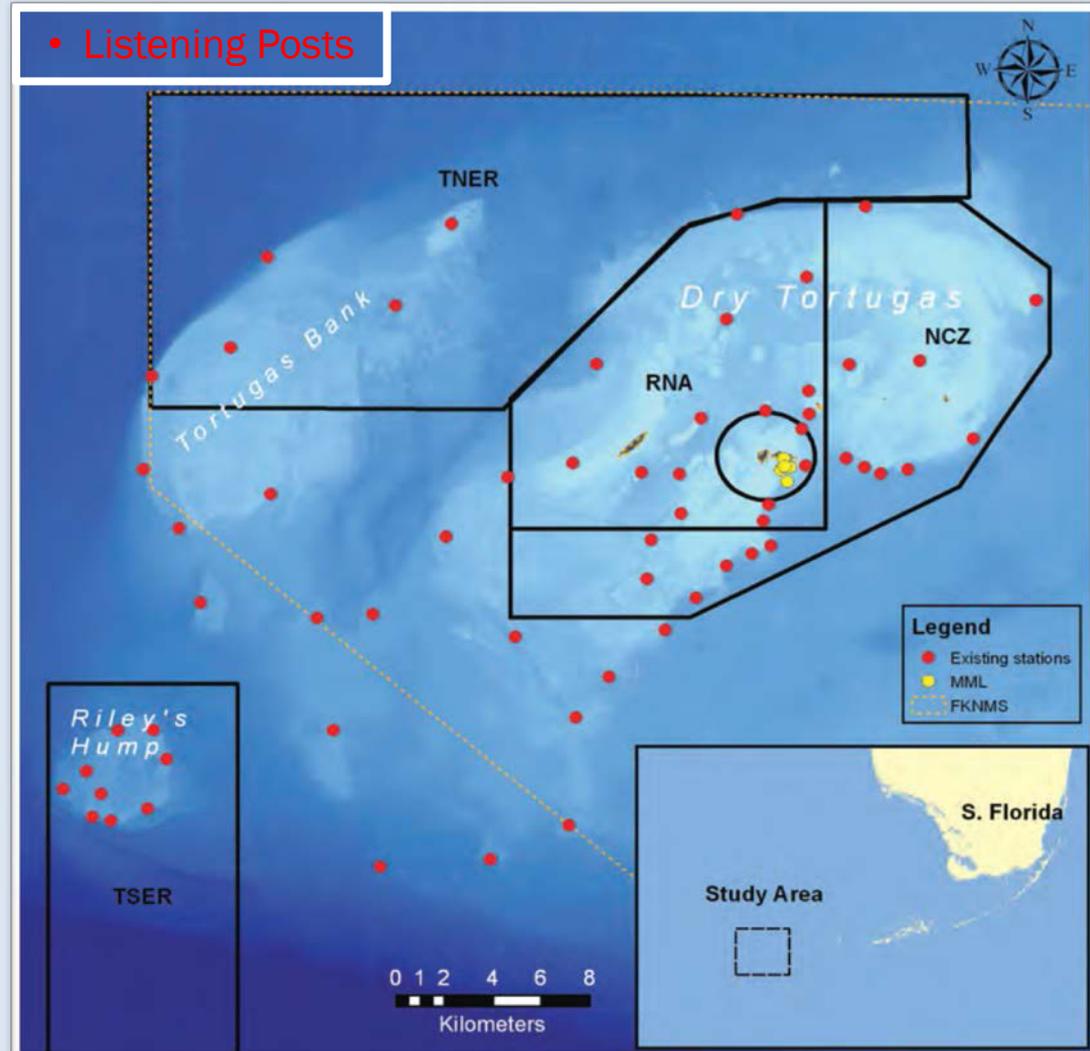
Two components:

- **Identification and monitoring of Fish Spawning Aggregation sites.**
(e.g. location, size, timing of aggregation, for snappers and groupers)
- **Acoustic seabed mapping and quantification of reef fish habitat and FSA sites.**
(e.g. multi-beam sonar acoustic mapping, ROV, drop camera and visual censuses)



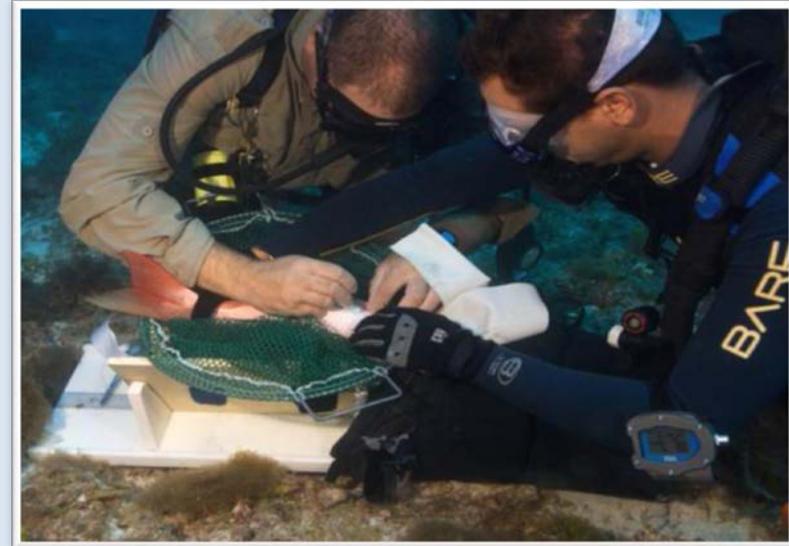
Tagging of Mutton Snapper

- Regional connectivity of fishes within the Tortugas region of Florida.
 - Riley's Hump is a well known mutton snapper spawning aggregation site.
 - Mutton snapper were acoustically tagged within the RNA & Riley's Hump and tracked with a network of underwater 'listening outposts'.

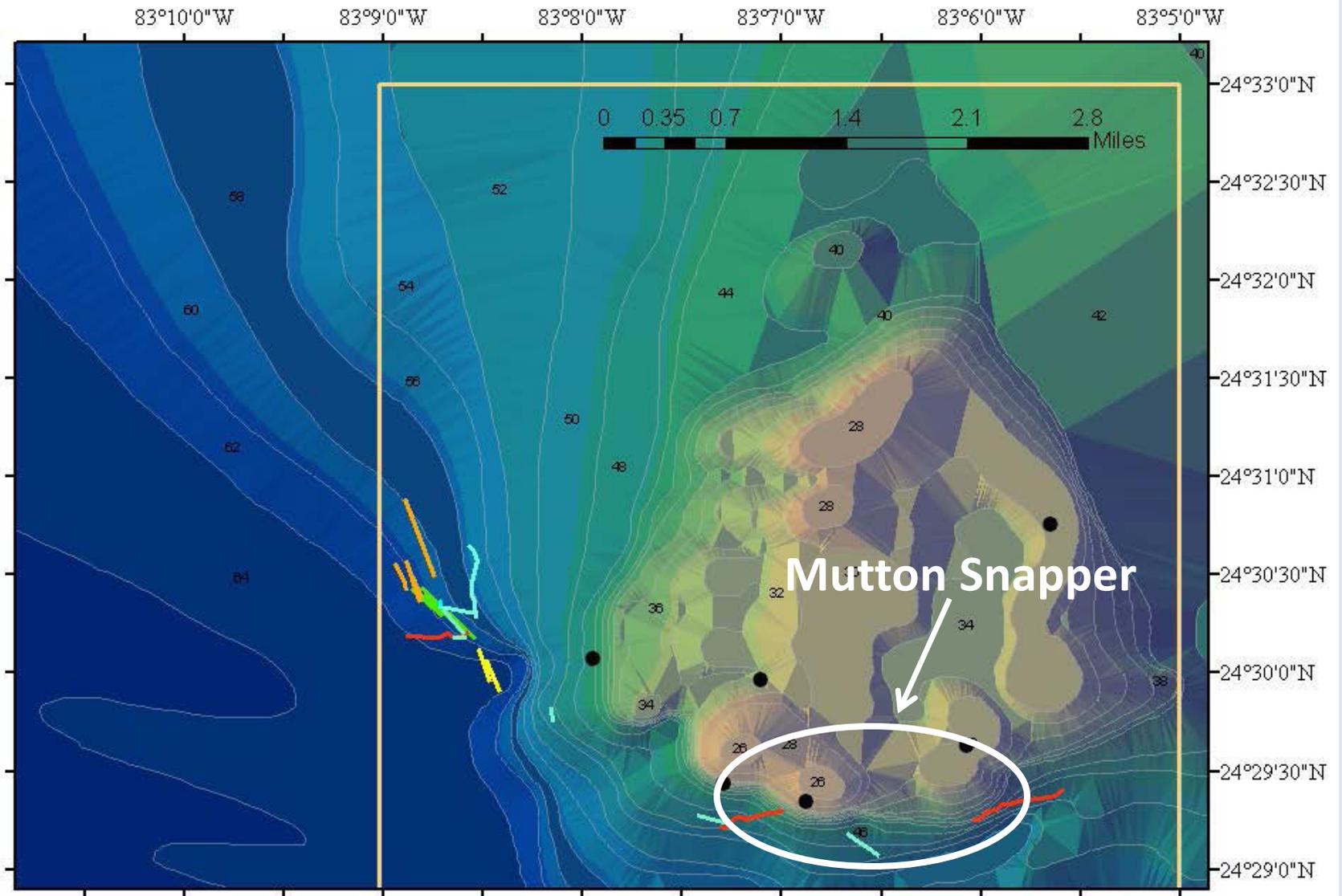


Tagging of Mutton Snapper

- 55 Mutton snapper were tagged
- 21 fish made multiple migratory trips to Riley's Hump
- 12 fish were residents of the RNA



Utilization of Riley's Hump

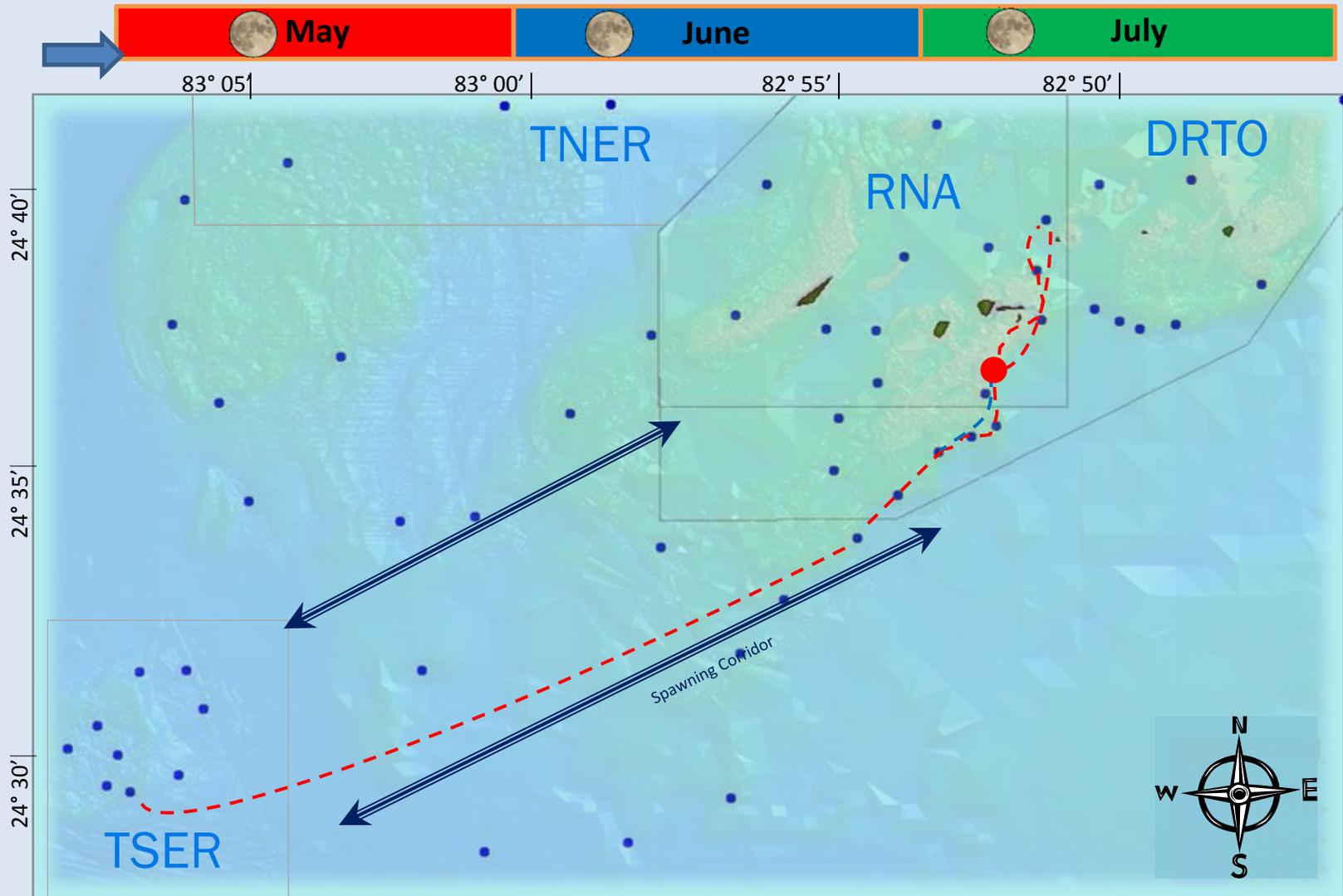


Observations of Mutton Snapper on Riley's Hump

Date and Station	Numbers observed	Moon phase
28 May–1 June 1999	1 fish in 3 of the 11 dives	Full moon May 30*
31 July–3 Aug 2000	1 fish in 5 of the 6 dives	New moon July 30*
17 July 2001 Station 2	10	3 days before new moon*
27 May 2002 Station 2	75 -100	1 day after full moon*
15 June 2003 Station 2	75 -100	1 day after full moon*
15 June 2003 Station 12	200 +	1 day after full moon*
4 July 2004 Station 12	300	2 days after full moon*
3 July 2007 Station 12	100 +	3 days after full moon**
12 June 2009 (1415-1715 hrs)	~4000	5 days after full moon***
20 March 2011	~ 100	1 days after full moon***
3 August 2012	~ 300	1 days after full moon***
4 July 2015 (afternoon)	~700	2 days after full moon**

From: Burton ML, Brennan KJ, Muñoz RC, Parker RO Jr (2005) Preliminary evidence of increased spawning aggregations of mutton snapper (*Lutjanus analis*) at Riley's Hump two years after establishment of the Tortugas South Ecological Reserve. Fish Bull 103:404–410.

** Mike Burton's Trip report; *** FWC current study

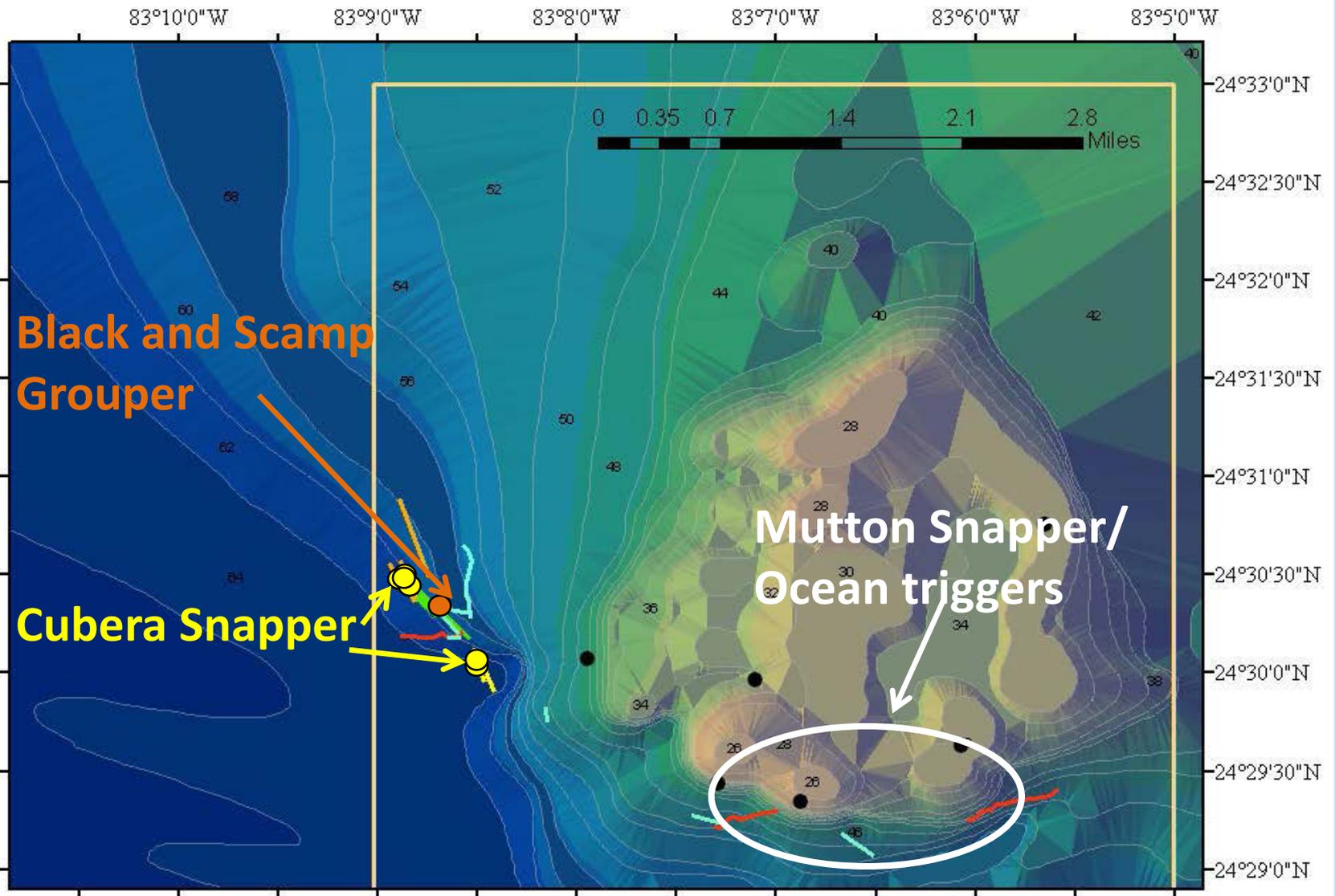


Mutton Snapper Spawning at Riley's Hump



From C. Parsons (2009)

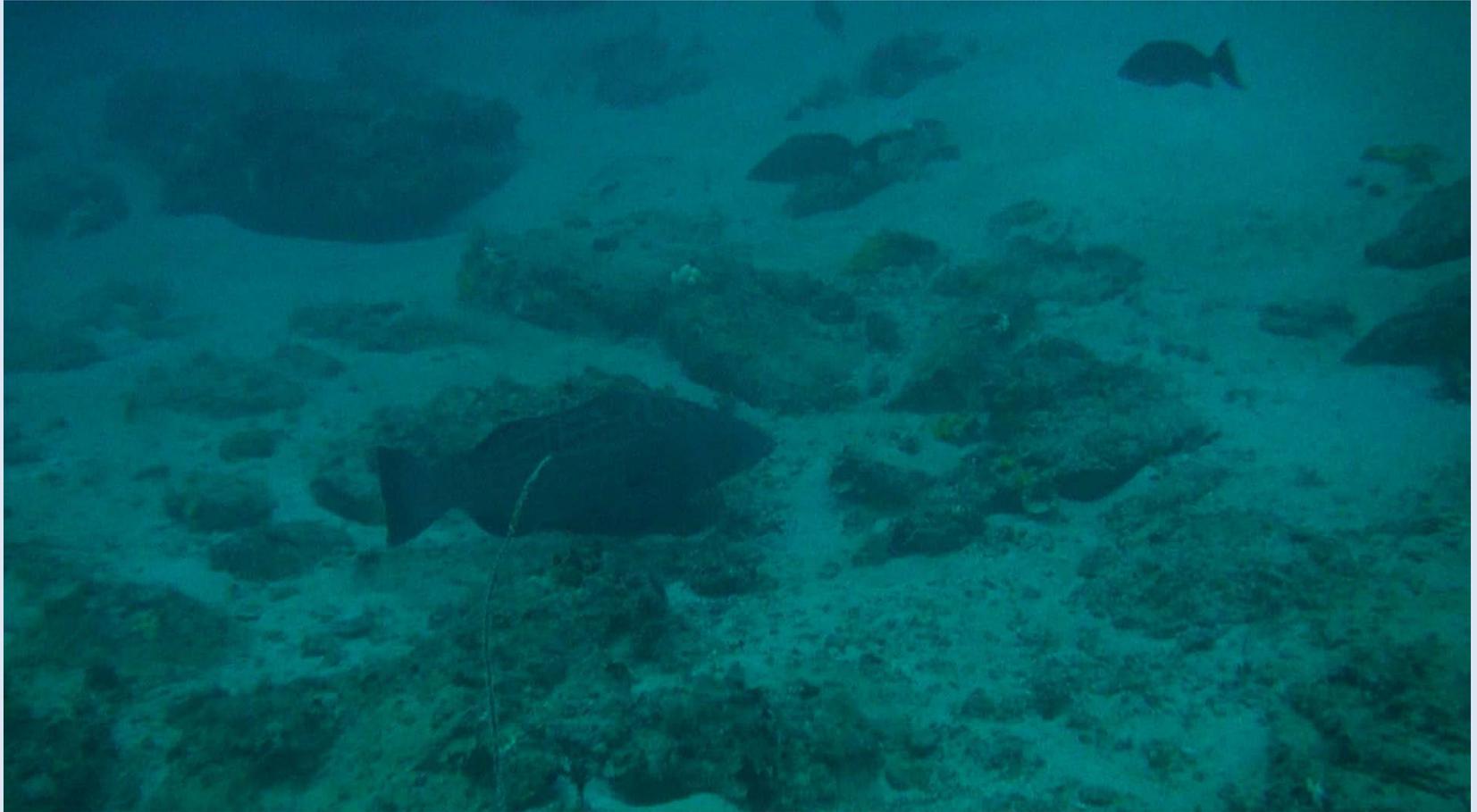
Utilization of Riley's Hump



Multispecies Aggregation Site: Muttons and Triggers



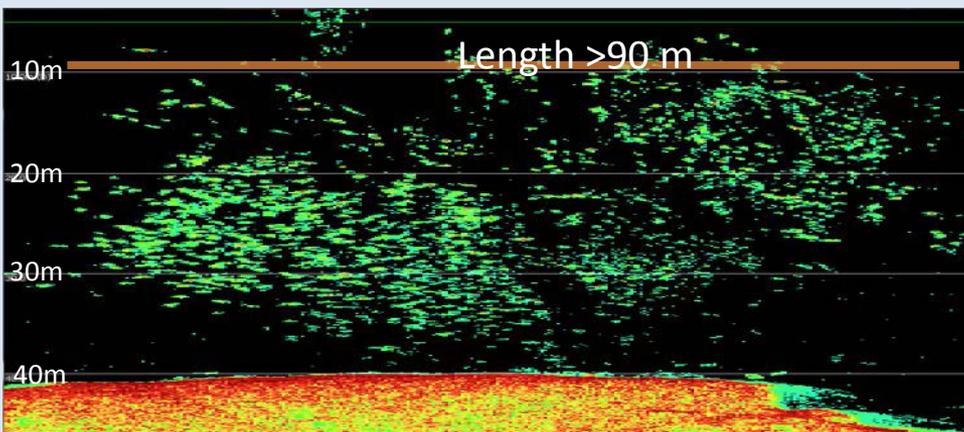
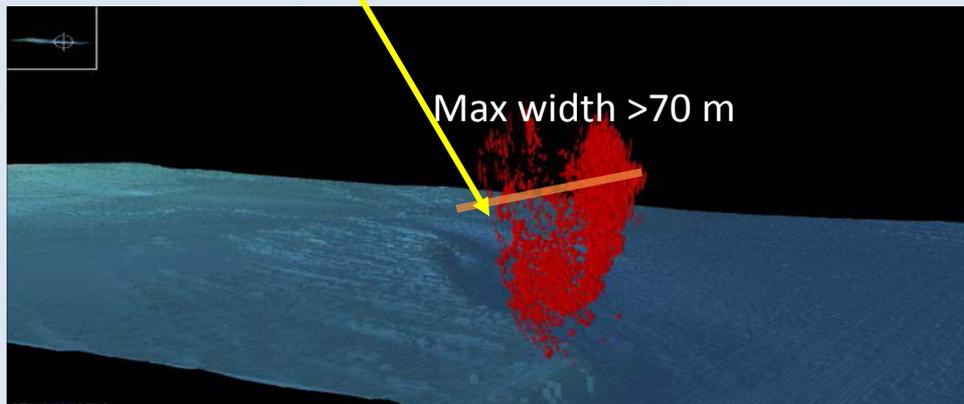
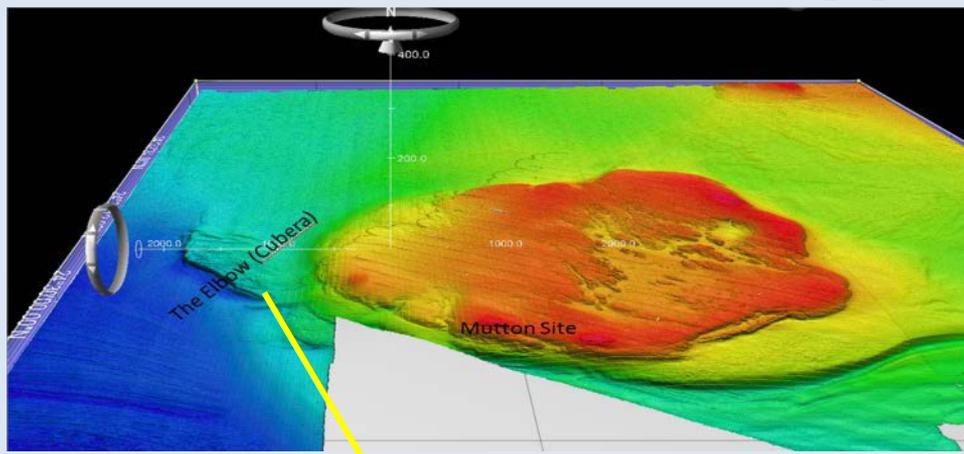
Multispecies Aggregation Site: Grouper



Multispecies Aggregation Site: Cubera Snapper

Riley's Hump aggregation viewed by multibeam sonar

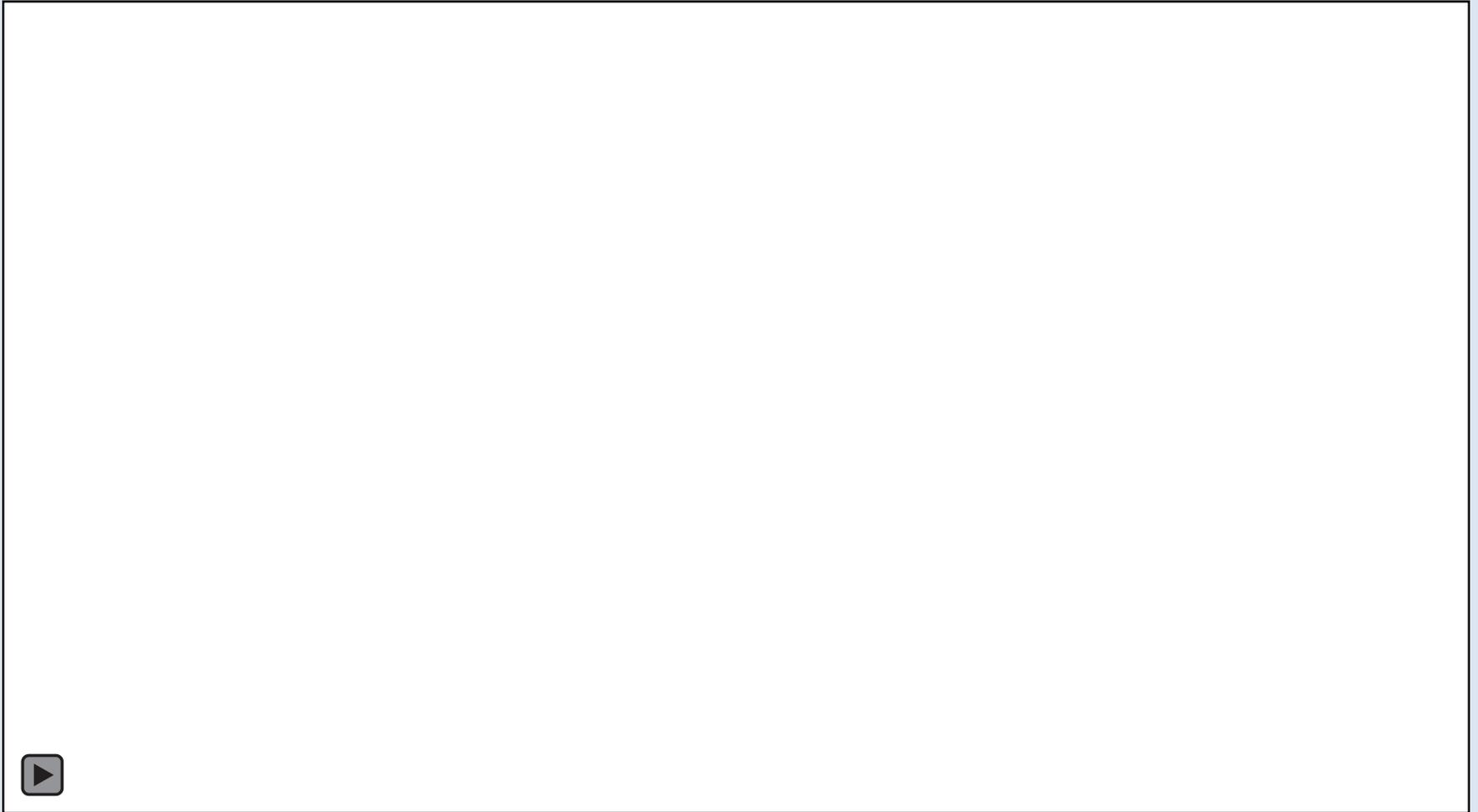
- Past acoustic surveys (2011, 2012 and 2014) have shown order of magnitude fish densities at The Elbow compared to other regions of Riley's Hump
- Large, complex shape school of very large fish, same as documented by divers and ROV
- Shape and volume of school, and estimated abundance/biomass can be calculated (nearly impossible using divers due to depth and size of aggregation).



Multispecies Aggregation Site: Cubera Snapper



Multispecies Aggregation Site: Cubera Snapper



In Prep

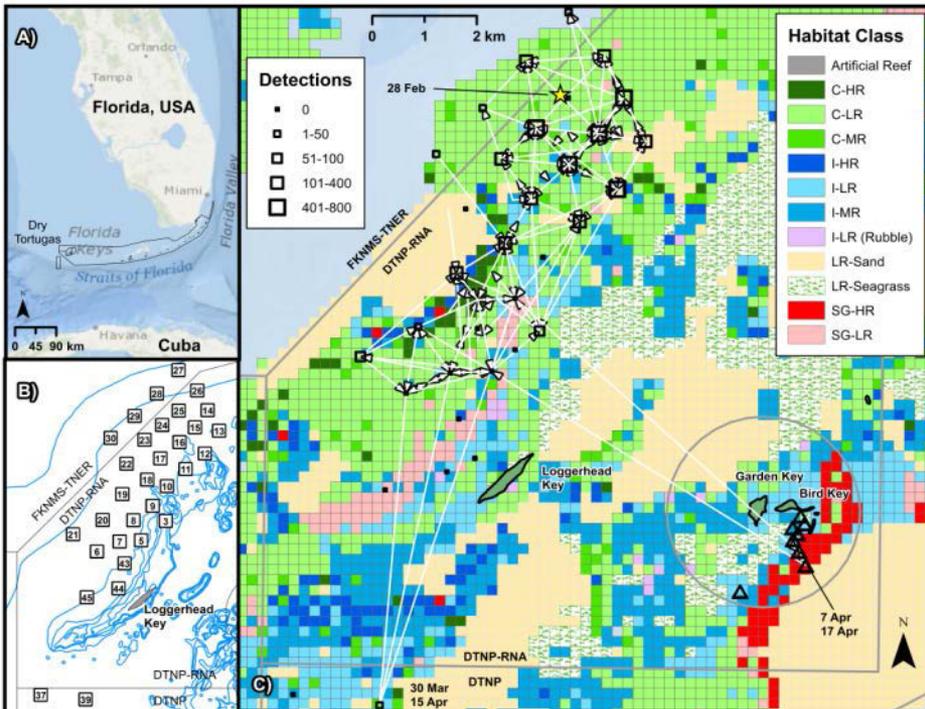
Movements and habitat-space use of a female tiger shark *Galeocerdo cuvier* in the marine reserves of Dry Tortugas, Florida

- Tracked for 47 days
- Detected on average by 9 receivers/day
- Detected once every 10.5 ± 0.99 min
- 68% detection rate per 2-hr interval
- Mean displacement 843 ± 20 m between position fixes



- Detection rates highest dawn/dusk
- Crossed NTMR boundaries >49 times
- Preferentially utilized deep, high-relief habitats
- Simulations accounting for movements out of the acoustic array predicted a 95% KD home range of 25.2 ± 1.0 km².

From N. Farmer (2015)



The Dry Tortugas Nurse Shark Project

Wes Pratt, Adjunct Scientist

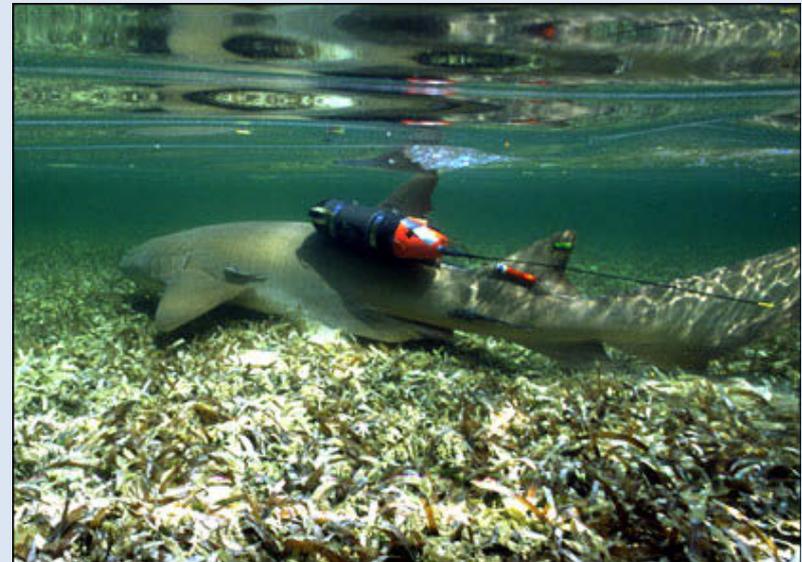
Mote Center for Shark Research, Summerland Key, FL



Wes Pratt, Mote Center for Shark Research

- The Dry Tortugas Nurse Shark Research Project (NSRP) was initiated in 1991. As of July 2015, we have tagged 301 nurse sharks, in the Dry Tortugas study.
- On site observations, telemetry, and videography have revealed the complex nature of adult reproductive interactions and the dependency of this species on the specific habitat where mating and maternity gatherings occur.

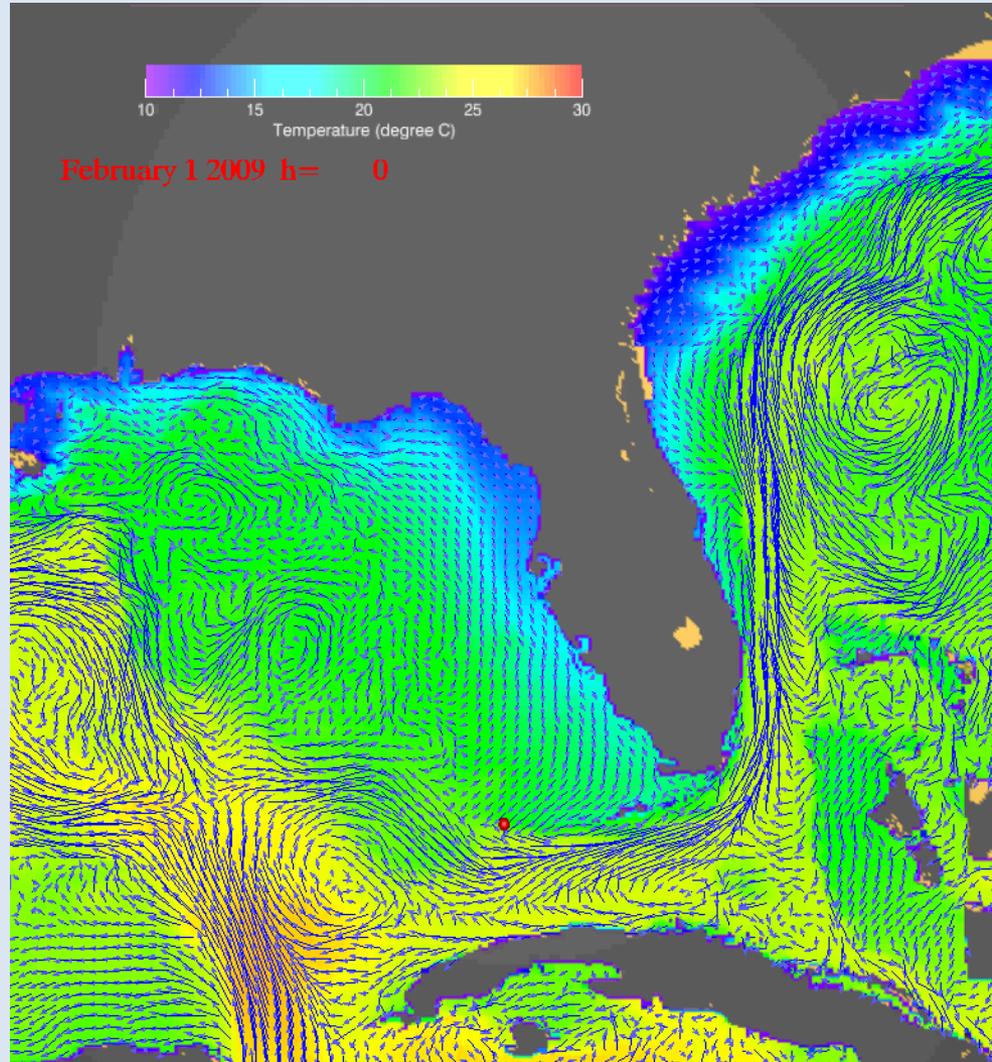
- No similar study of shark reproduction and its conservation exists anywhere else in the world. Our research team has accomplished many inter-related shark life history goals studying, reproductive physiology, genetics, mating behavior, distribution, habitat use, environmental influences, growth and local movements.



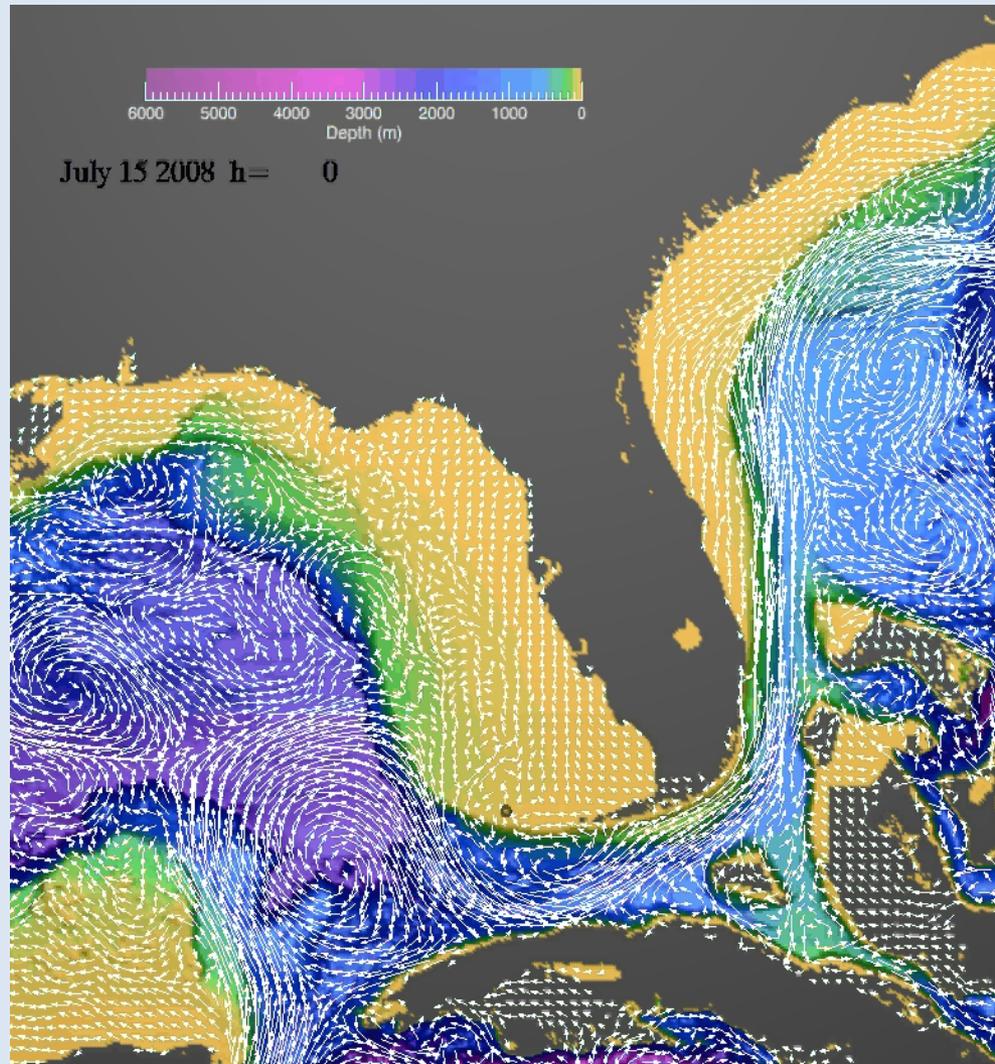
Male nurse shark with National Geographic Crittercam temporarily attached to dorsal fin. A transmitter tag is attached to the second dorsal fin.

Wes Pratt, Mote Center for Shark Research

Larval Transport in February



Larval Transport in July



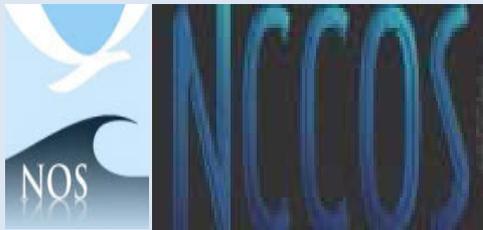
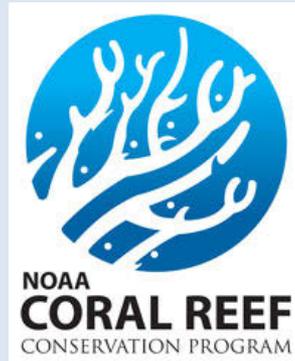
Closing Remarks:

- In the Tortugas region:

The results from fishery-independent surveys, acoustic tagging studies and modeling of larval transport, demonstrated the ecological importance of DRTO and the Tortugas region in sustaining the productivity of coral reef and coastal marine fisheries in southern Florida.

ACKNOWLEDGEMENT

- Thank to the local fishermen and our partners from all these different agencies for their support .



Any Questions?

