



Restoration Blueprint

Environmental Consequences: Biological and Physical

Andy Bruckner
Research Coordinator





Outline

- What are we trying to achieve
- How do we achieve our goals
- Has existing management worked
- What are biological benefits of proposed measures
 - Marine zones
 - Regulations
 - Management

Focus on Alternative 3



- Protect biodiversity
- Enhance reef fish abundance and biomass
- Protect vulnerable life stages
- Reduce physical impacts and injury to sanctuary resources and habitats
- Protect and recover threatened and endangered species
- Restore high-relief habitat
- Reestablish ecosystem function
- Enhance resilience to global stressors

Sanctuary Conservation Approaches



Boundary modification

Include high-value habitats within Sanctuary boundaries

Marine zoning

Modify size & boundaries of existing protected areas and establish new MPAs

- Protect large contiguous habitats through networks of connected MPAs
- Include different habitat types and sites that support key species and different life stages
- Protect resilient sites

Regulations

Minimize physical impacts to corals, seagrass and hardbottom from vessels

Eliminate harmful practices

Balance use with carrying capacity

Management

Research and monitoring to understand trends and changes

Research to adapt management

Restore degraded habitats

How do we identify places that benefit from protection?



- Analysis of long term monitoring and research datasets
- Evaluation of habitat maps and other data products
- Examination of the efficacy of existing management strategy
- SAC Working groups and SAC goals and priorities
- Local knowledge
- Consultations with user groups
- Expert input

Marxan

Identifying Ecologically Important Areas

Planning units:

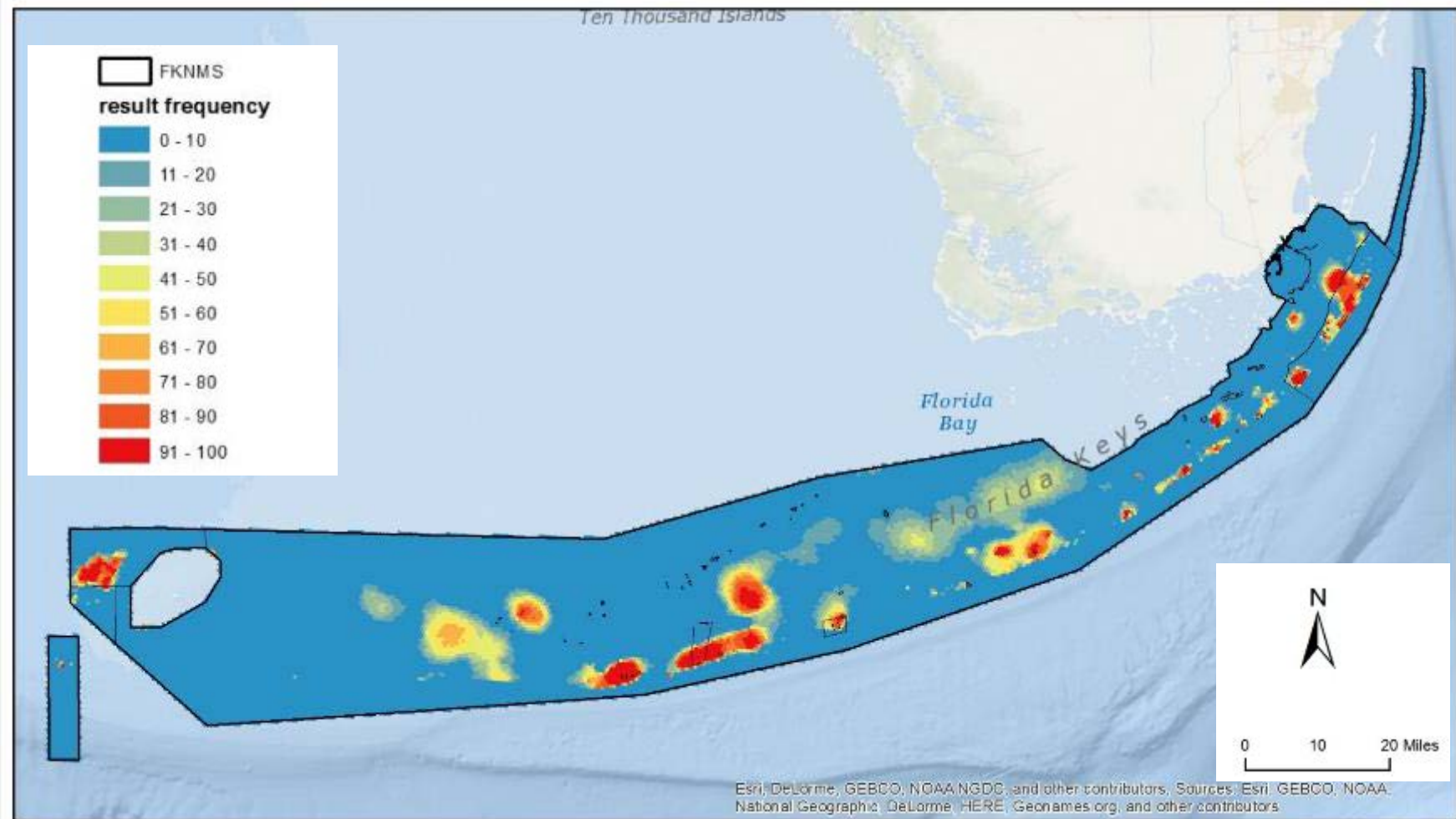
21,000 50 ha polygons

Datasets:

CREMP, NCRMP, FRRP; Seagrass, RVC fish

Ecological representation:

Benthic habitat types, seagrass density, high relief reefs, resilient reefs, spawning aggregation sites, fish abundance/richness, groupers, parrotfish, ornamentals, coral cover, density, richness, soft corals, ESA listed species



NOAA/NCCOS

Performance of marine zones

Fisheries targets and non-target reef-associated fishes

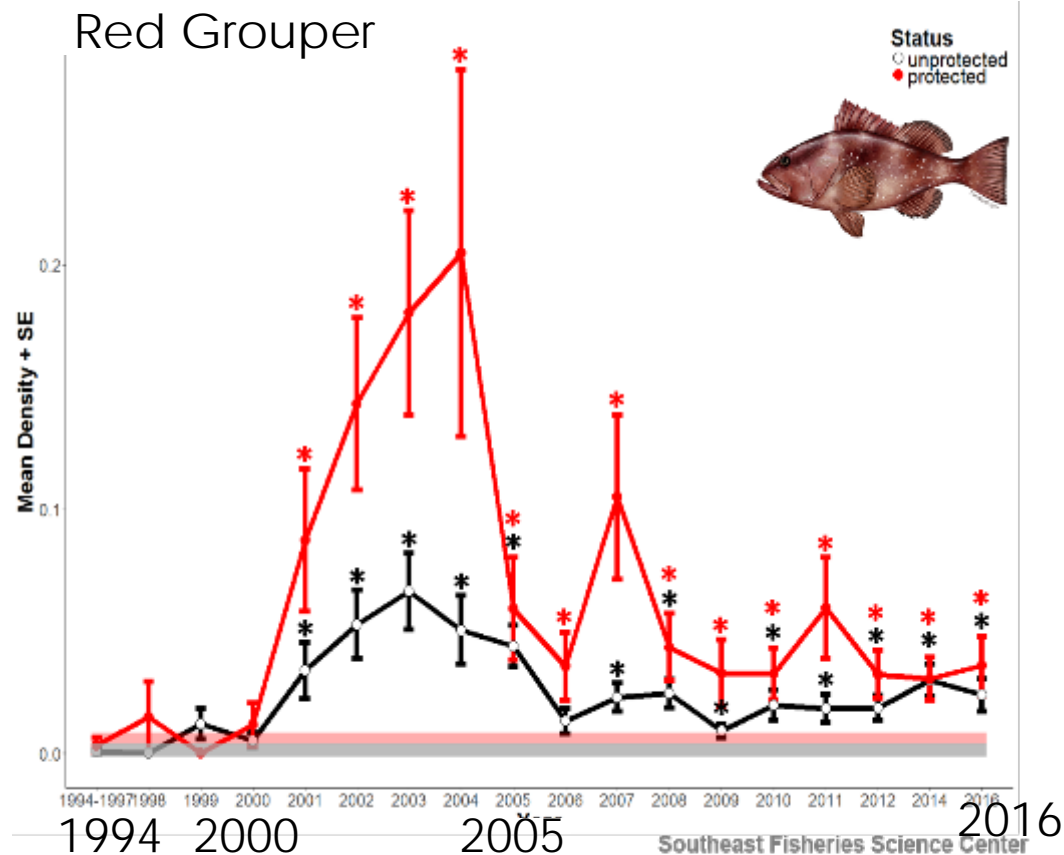


Have the SPAs worked?

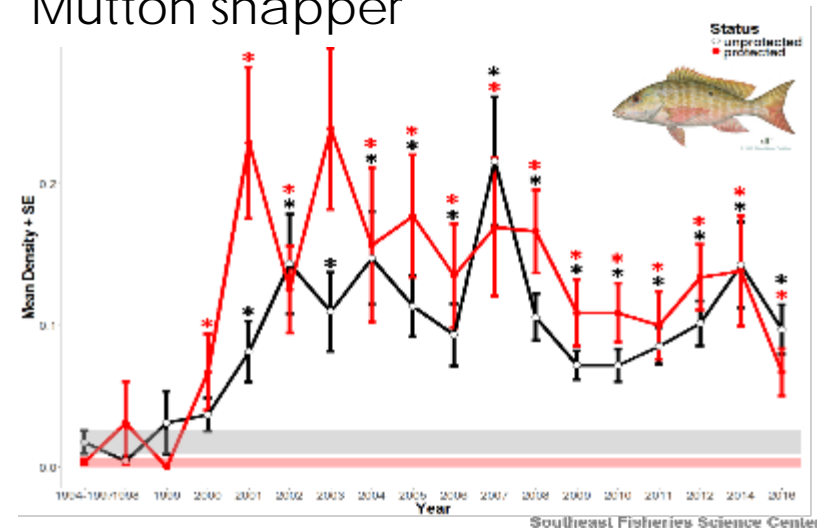
Yes, with caveats

Target Species

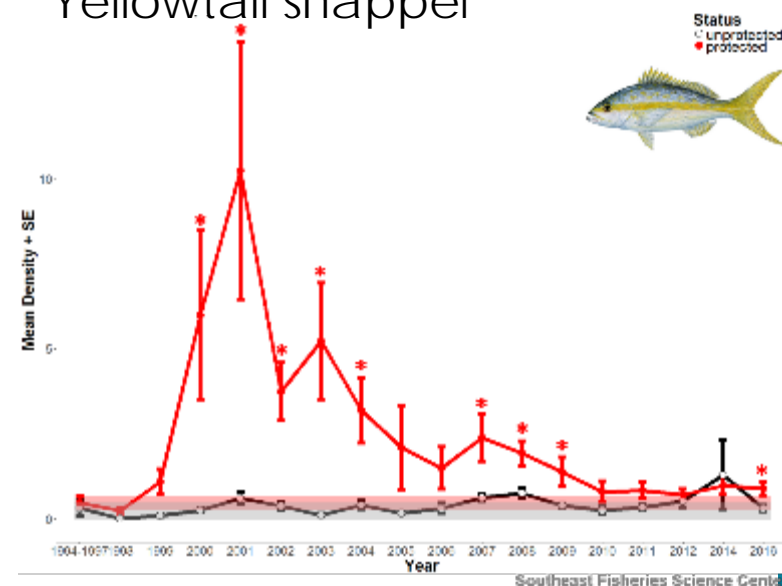
- Larger response in protected areas (grouper; pelagic snapper)
- Increases both inside and outside (benthic snapper)
- Declines following hurricanes



Mutton snapper

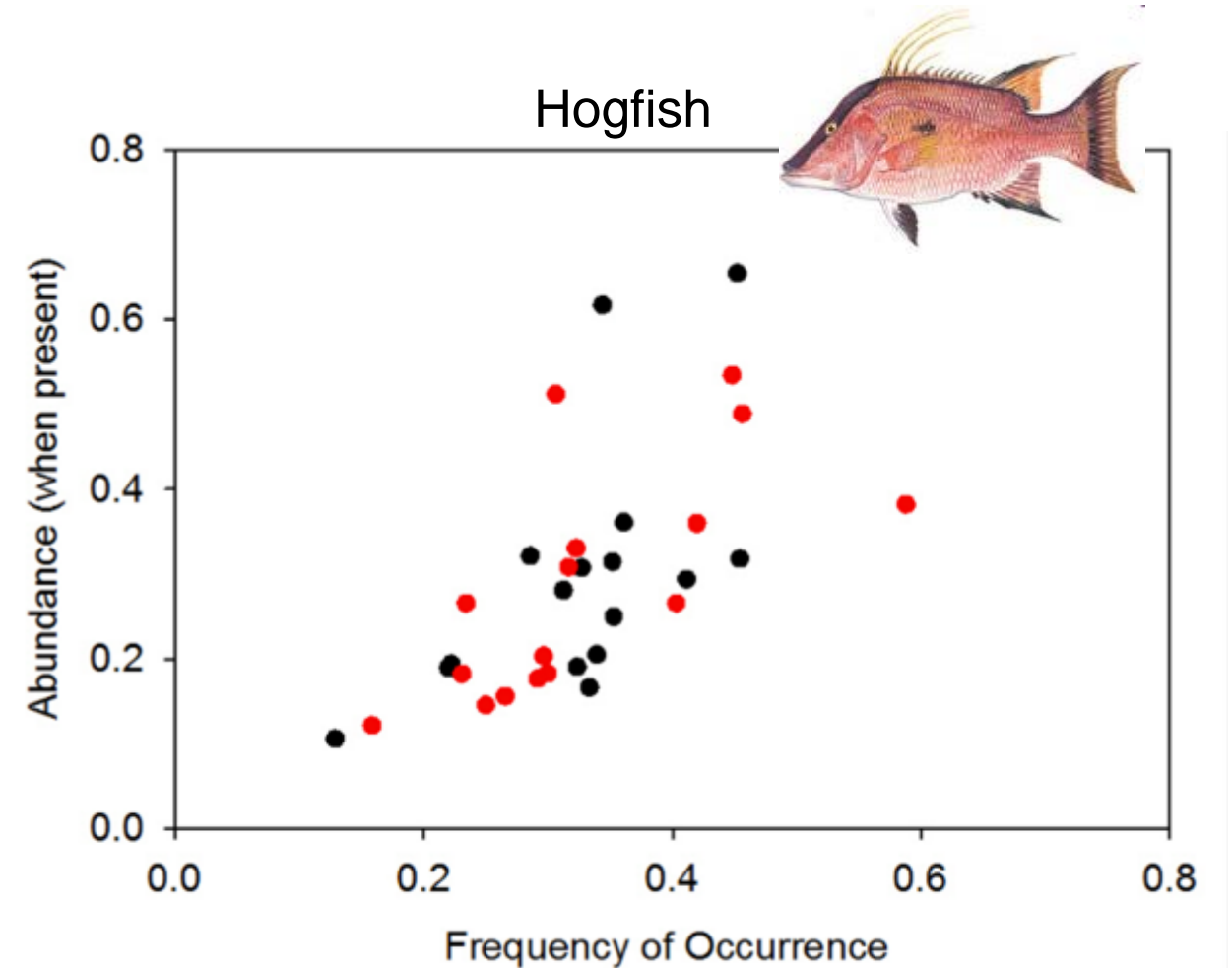
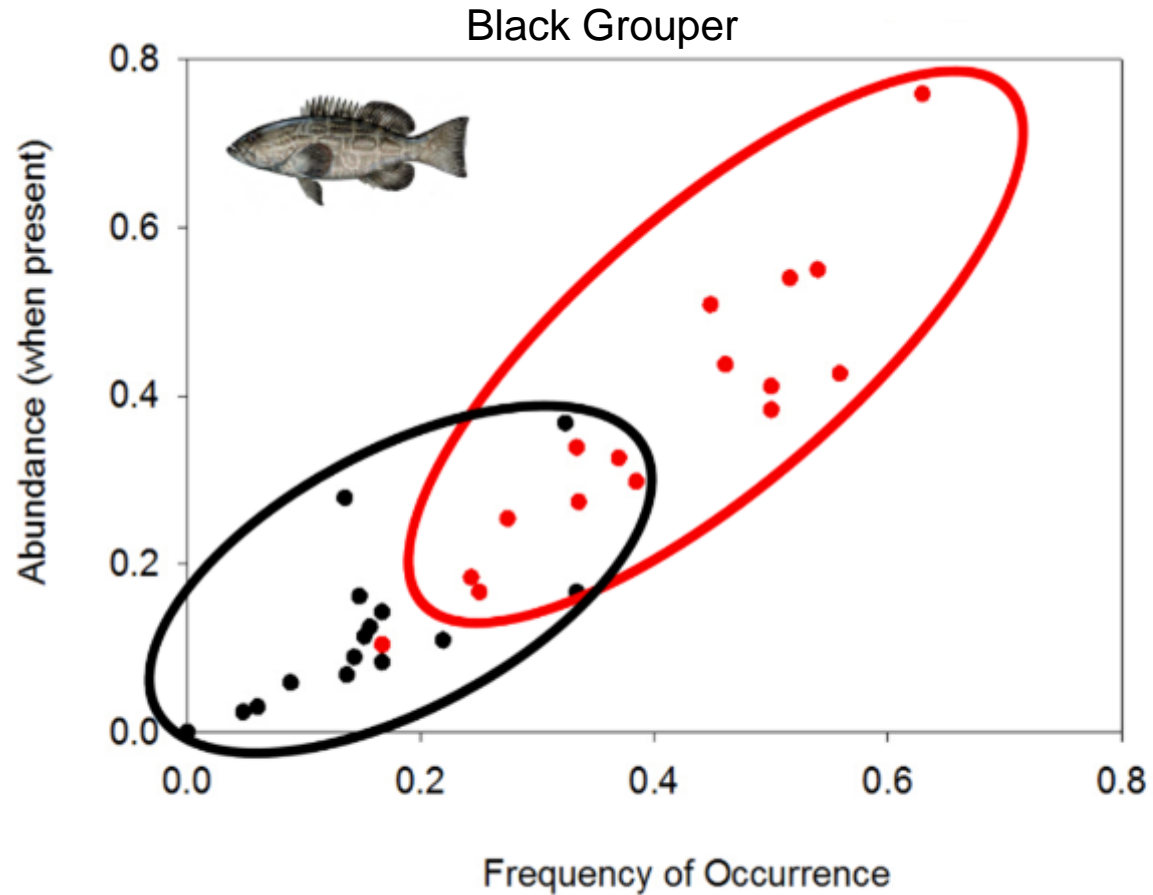


Yellowtail snapper



Have the SPAs worked?

Yes, for some species

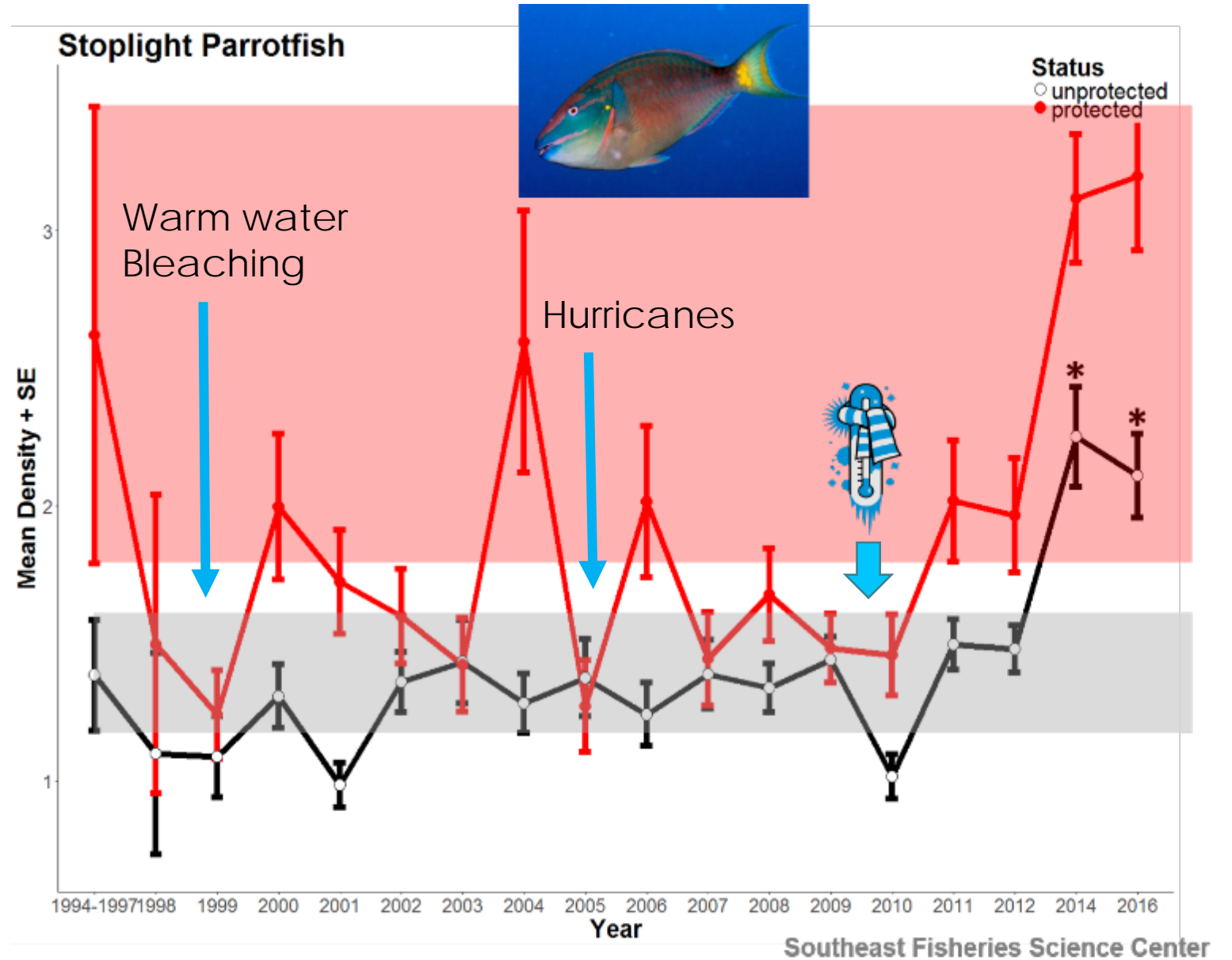


Mean Annual Data: **unprotected** versus **protected**

Have the SPAs worked?

Non-target Species

- Many: no difference
- Some: higher densities in protected areas.
- Herbivore densities increased following warm water bleaching, cold water events and hurricanes



Why do some protected areas perform poorly?

FKNMS SPA	Total Area (km ²)
Conch Reef (Research)	0.2
Newfound Harbor Key	0.2
Cheeca Rocks	0.29
Key Largo Dry Rocks	0.32
Rock Key	0.39
Hen and Chickens	0.41
Davis Reef	0.5
Eastern Dry Rocks	0.51
Grecian Rocks	0.52
Looe Key (Research)	0.52
Tennessee Reef (Research)	0.55
French Reef	0.67
Eastern Sambo (Research)	0.7
Sombrero Key	0.83
Coffins Patch	0.84
Conch Reef	0.85
Alligator Reef	0.94
Sand Key	1.17
The Elbow	1.24
Molasses Reef	1.31
Looe Key	1.41
Carysfort	6.27
Western Sambo Ecological Reserve	9.24
Tortugas Ecological Reserve	355
DTNP RNA	119

Species	Home Range (km ²)	Study
Red grouper	2.09 ± 0.39	Farmer and Ault 2011
Black grouper	1.44 ± 1.04	Farmer and Ault 2011
Mutton snapper	2.5 ± 1.31	Feeley et al. 2018
Yellowtail snapper	4.17 ± 1.75	Farmer and Ault 2011
Yellowtail snapper	5.45 ± 1.79	Herbig et al. 2018

- Enough enforcement?
- Angler compliance?
- Increased fishing pressure?
- Total protected area is too small?
- Key habitats missing
- Key life stages not protected?
- Habitat loss?



Proposed marine zoning modifications

Tortugas to the Upper Keys



Protect spawning stock of exploited species

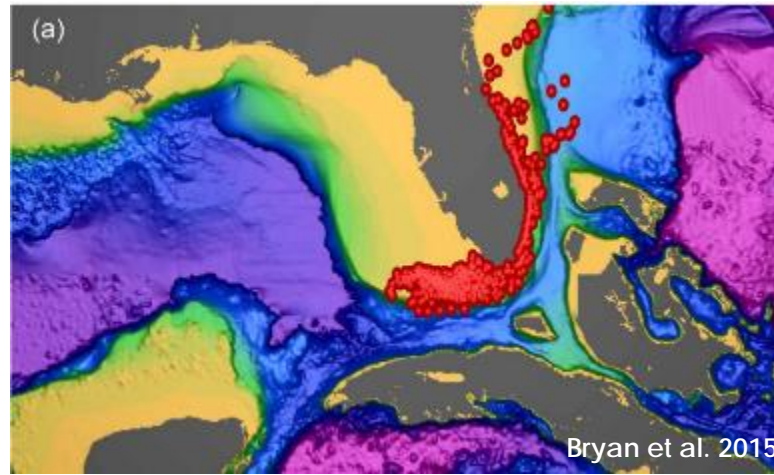
Zoning strategy in Tortugas has had far reaching benefits

- MPA size exceeds the home range of most species
- MPAs increased density and abundance of fish above minimum legal size of capture
- Reef fish spillover to adjacent fished areas
- No take MPAs allowed recovery of spawning aggregations
- Large proportion of Florida's fisheries targets occur in Tortugas
- High degree of connectivity between GOM, Fl. Keys, SE Florida
- Tortugas supply larvae and recruits to the rest of Florida



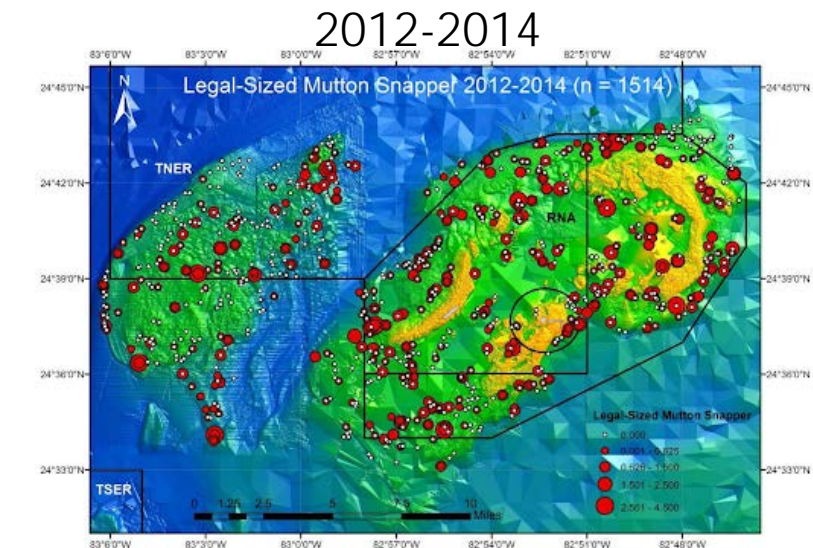
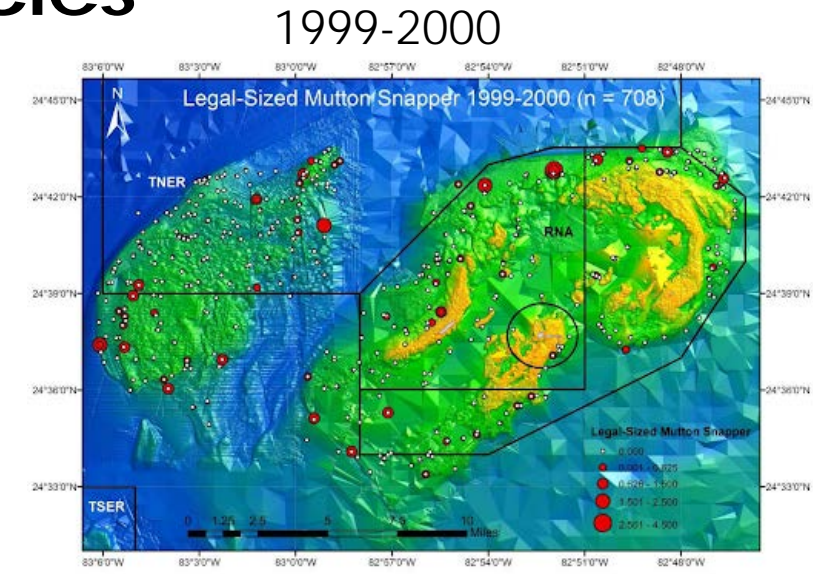
C. Parsons

Mutton snapper spawning



Bryan et al. 2015

Movement of larval drift particles



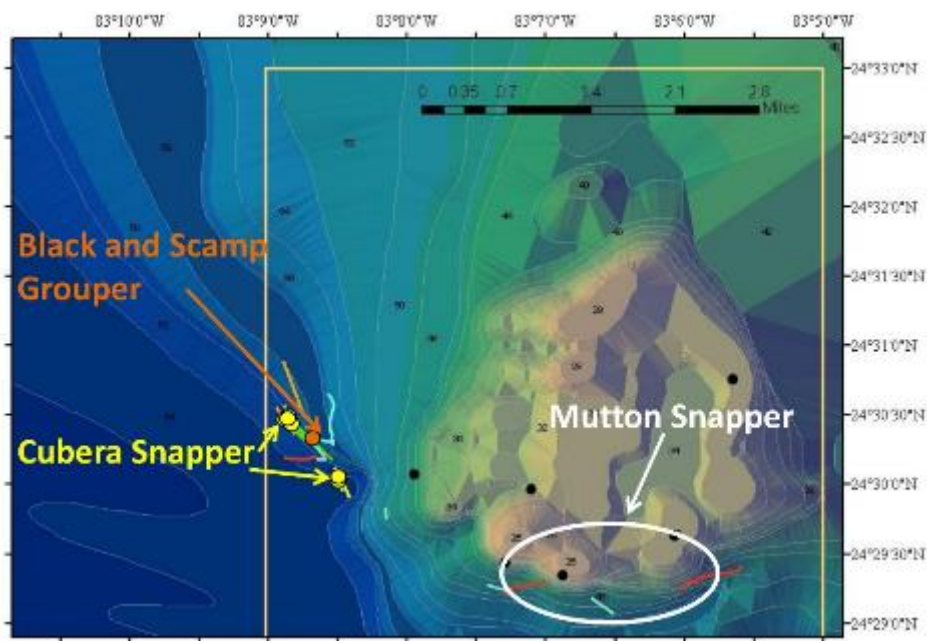
Ault et al. 2013

Mutton Snapper Density

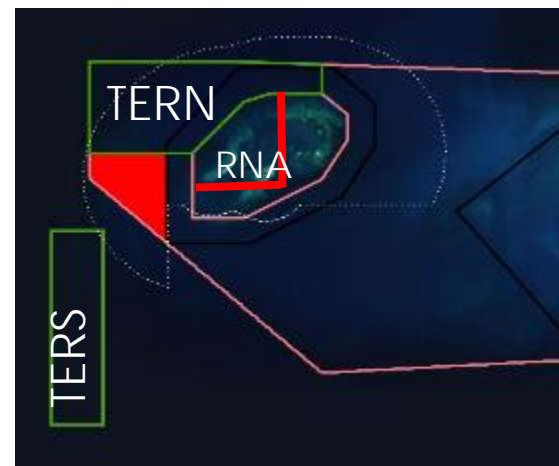
Boundary & marine zoning modifications

Can enhance benefits in the Tortugas

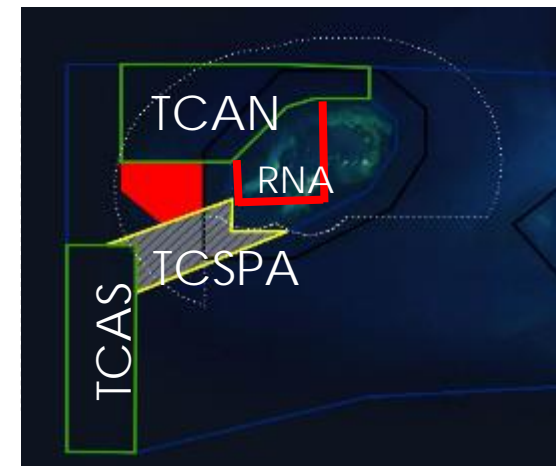
- Expand Sanctuary boundary
- Expand TERS 1 mile west
- Establish new Tortugas Corridor SPA



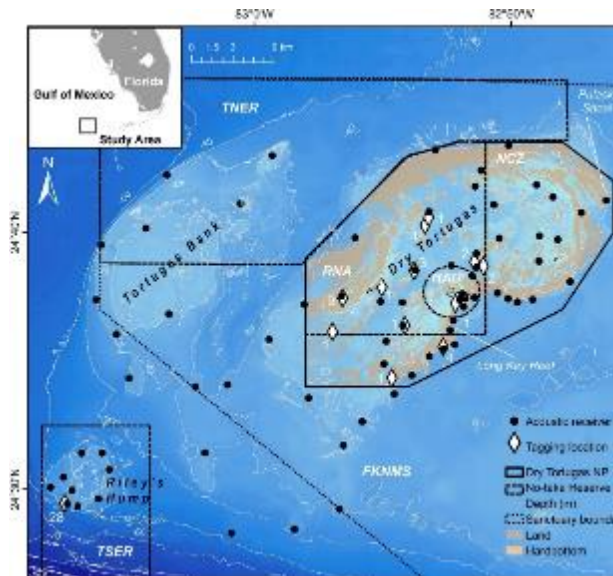
- Reduce damage to corals, prevent "take"
- Protect additional spawning aggregations
- Protect migratory route of mutton snapper



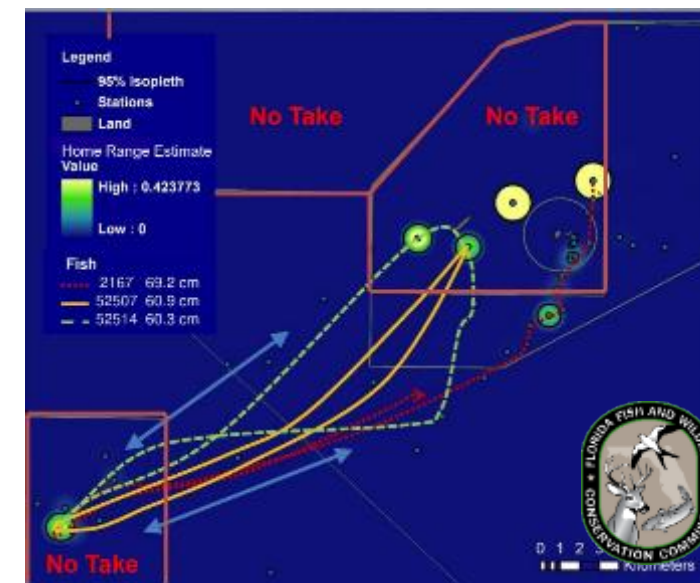
Current (Alt 1)



Proposed (Alt 3)



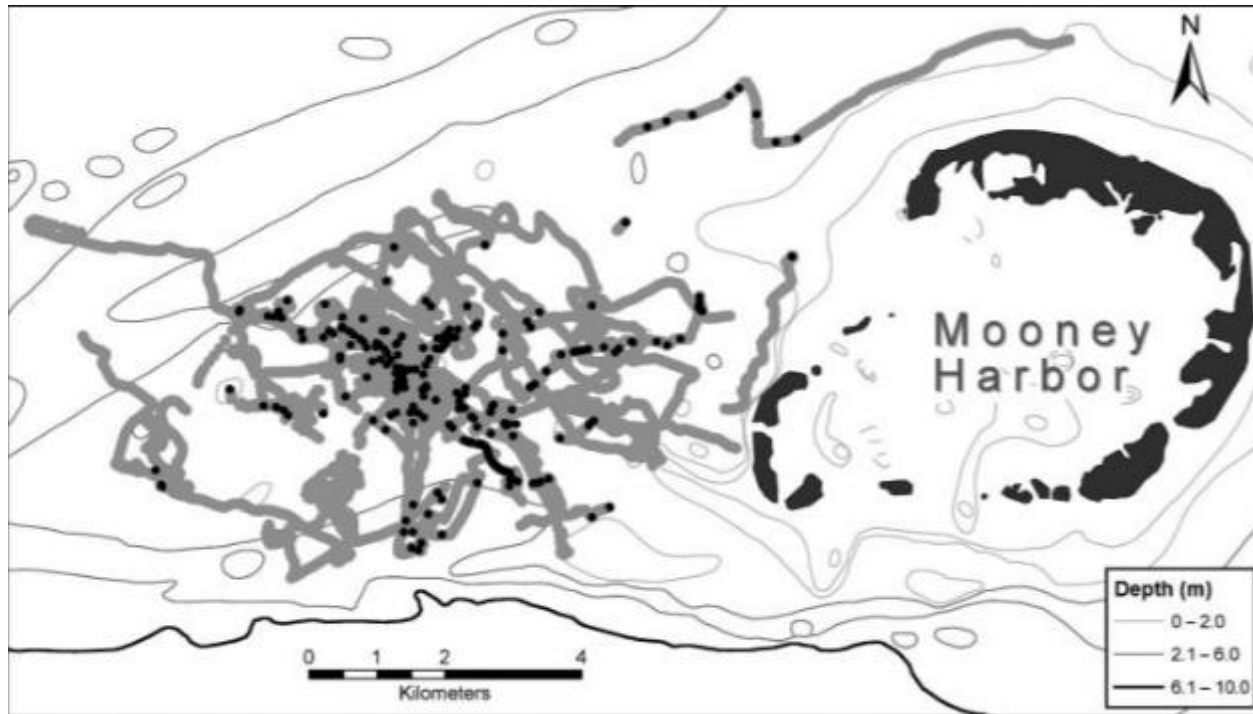
Acoustic receiver locations



Protect sea turtle feeding areas

Marquesas Turtle Zone (WMA)

- Unique aggregation of subadult/adult green sea turtles- only known population in southeast US and only known example of foraging herds in turtles
- Sensitive to impacts from boat wake/prop injuries and fishing gear
- Mitigate disturbance through idle speed & no anchoring



Turtle herding and movement patterns

Bresette et al. 2010



TURTLE TRAUMA



Photos by Bette Zirkelbach

Turtle Hospital Rehabilitation Specialists Gen Schave, left, and Marika Weber work to flush boat propeller wounds on a loggerhead sea turtle this week at the Marathon Turtle Hospital.

Deaths prompt warning for boaters

BY TIMOTHY O'HARA
Key West Citizen



'Geronimo,' a sub-adult loggerhead sea turtle, is treated last week for boat propeller wounds sustained off Marathon at the Marathon Turtle Hospital.

More than a dozen docile sea turtles have died in the past two weeks after being struck by boat propellers. The deaths have prompted the Marathon Turtle Hospital to issue a reminder for boaters to be vigilant and on the lookout for sea turtles at the surface.

The Turtle Hospital took in two turtles on Tuesday, Turtle Hospital Manager Bette Zirkelbach said, adding that one of the turtles is still being treated, but the other died.

Zirkelbach spoke with one of the boaters who had hit a turtle and said the incident was "obviously" an accident.

"They were in tears," she said.

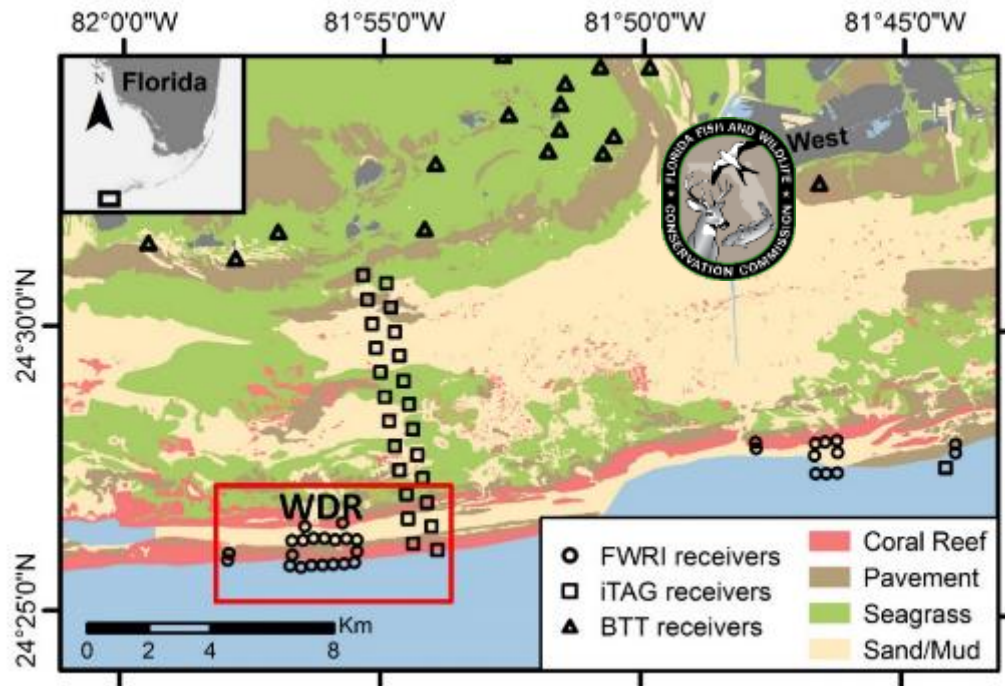
Another turtle, Geronimo, was admitted to the hospital

See TRAUMA, Page 6A

Protect large multi-species fish aggregations

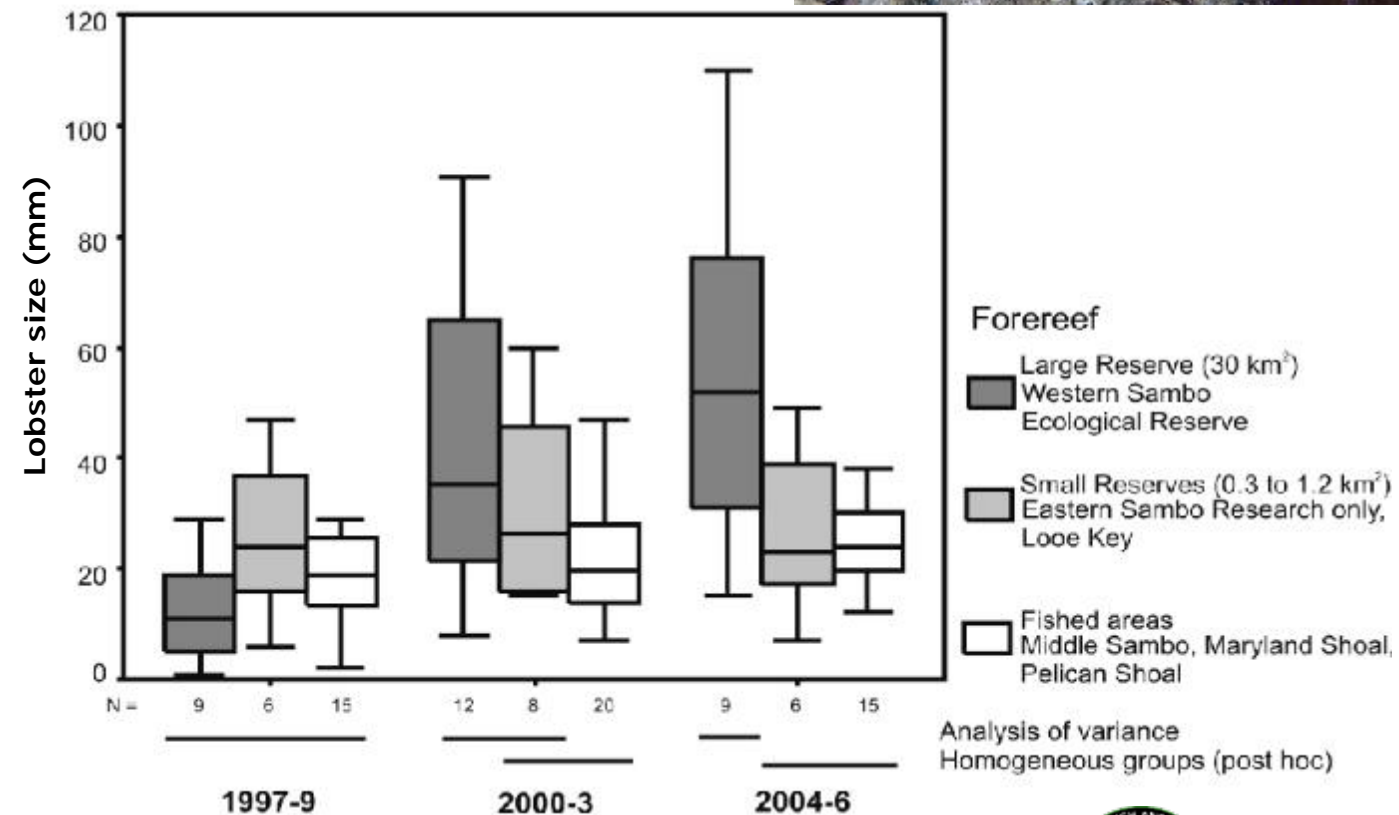
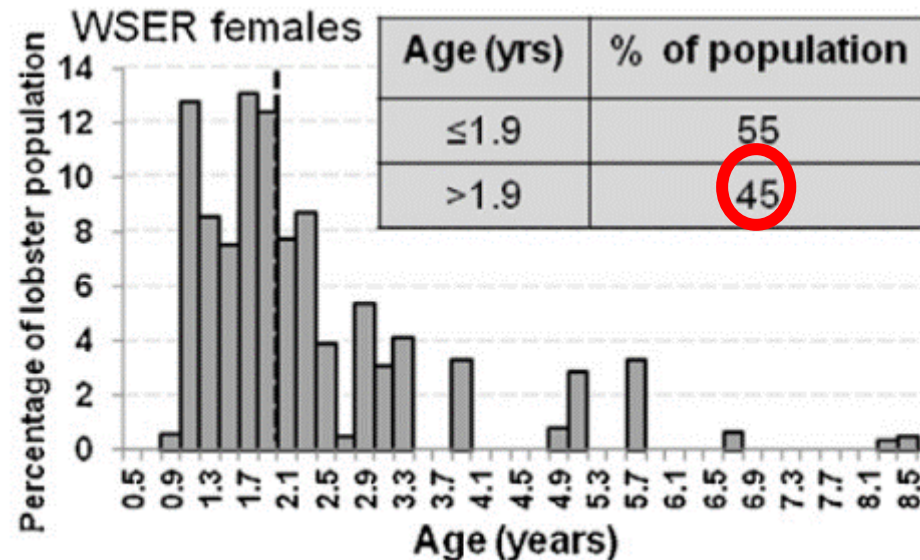
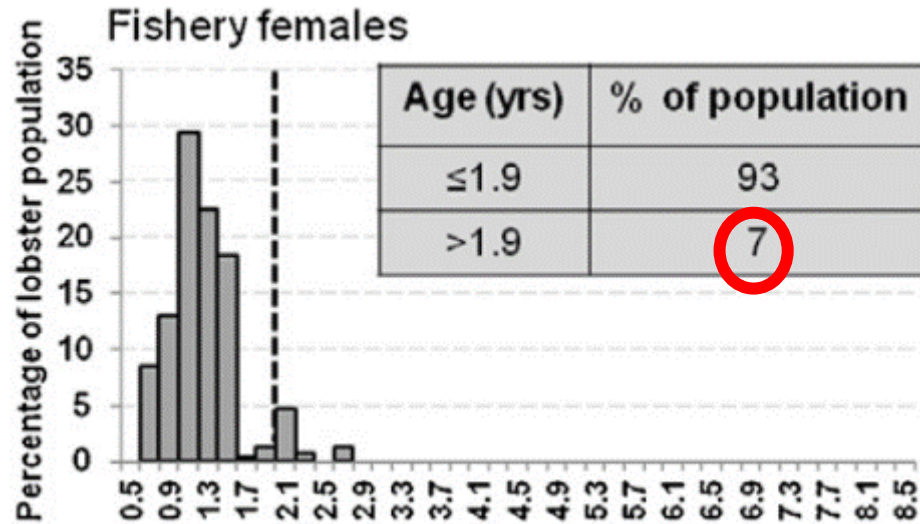
Fisheries species aggregate seasonally to spawn at Western Dry Rocks

- Grey snapper, mahogany snapper, goatfish, permit and spadefish aggregate in summer
- Grouper aggregate in winter
- Important fishing area
- Establish new WMA
 - Trolling only; no anchoring
 - Reduce bottom fishing; protect aggregations



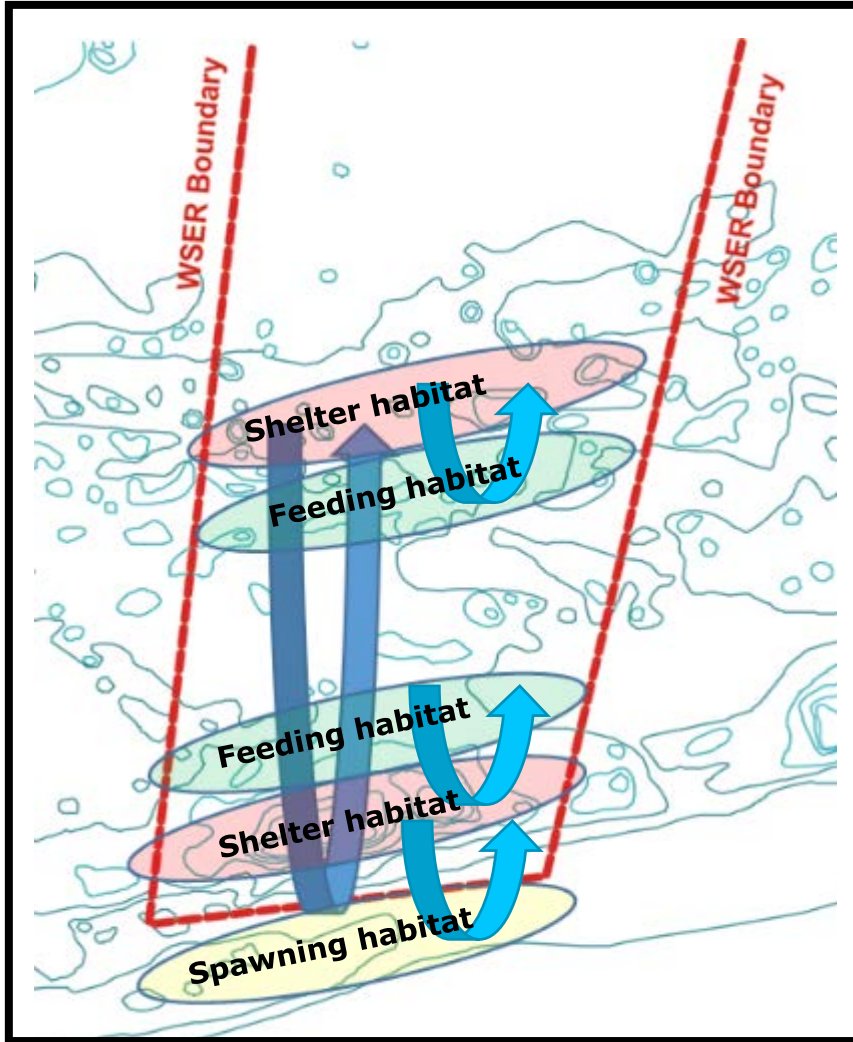
Enhance lobster populations

By protecting large contiguous habitats at Western Sambo



Enhance reproductive success

Include deep habitats within Western Sambo ER



Female lobster movement and habitat use

- Lobsters utilized multiple habitats for shelter and foraging.
- Midshelf path reefs are connected to offshore reef systems
- Female lobsters migrate to deep water outlier reefs to spawn
- Lobster spawning sites are outside the current deep water WSER boundary
- Grey snapper spawning aggregations also found here



Extend protection into deep water

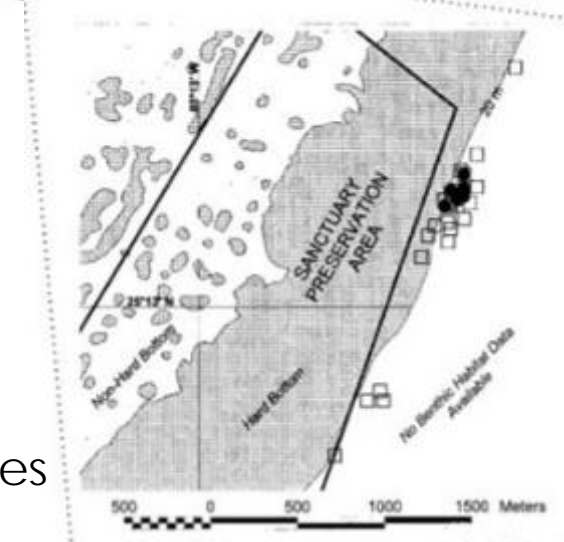
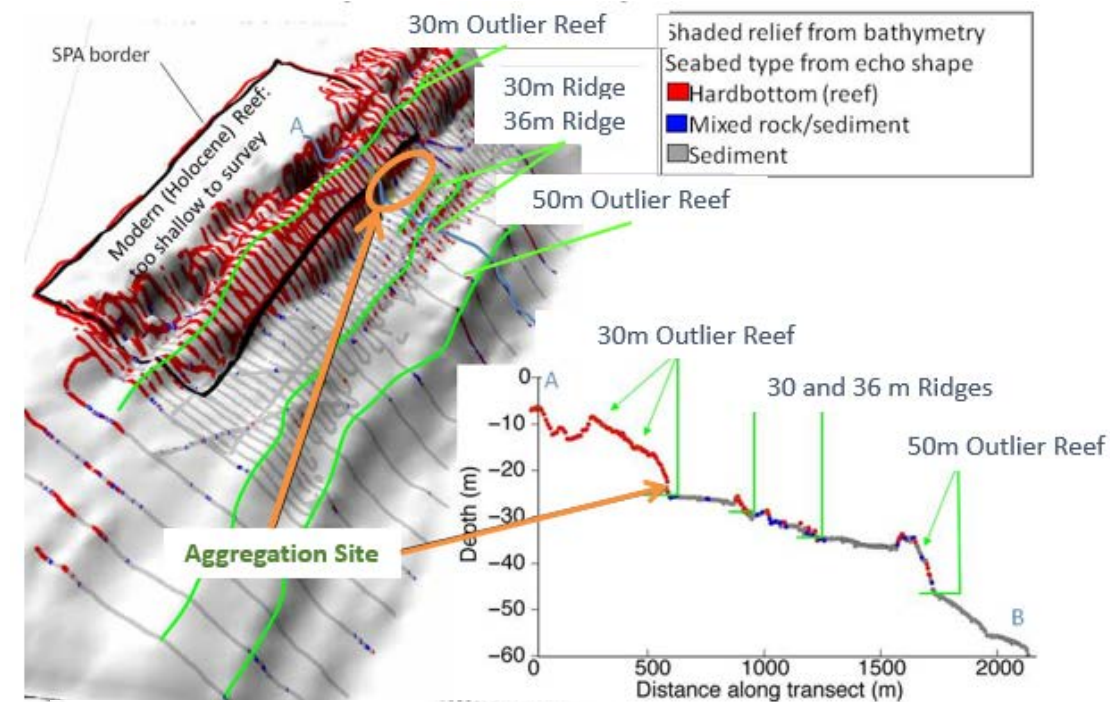
Looe Key, Alligator Reef, Carysfort

- Extend from 60 ft contour to 90 ft depth



Species	D	J	F	M	A	M	J	J	A	S	O	N
Black grouper												
Nassau grouper												
Scamp												
Nassau grouper												
Gag grouper												
Red hind												
Goliath grouper												
Yellowtail snapper												
Dog snapper												
Mutton snapper												
Gray snapper												
Schoolmaster												
Lane snapper												
Cubera snapper												
Permit												

- Protect unique coral assemblages
- Encompass spawning aggregation sites



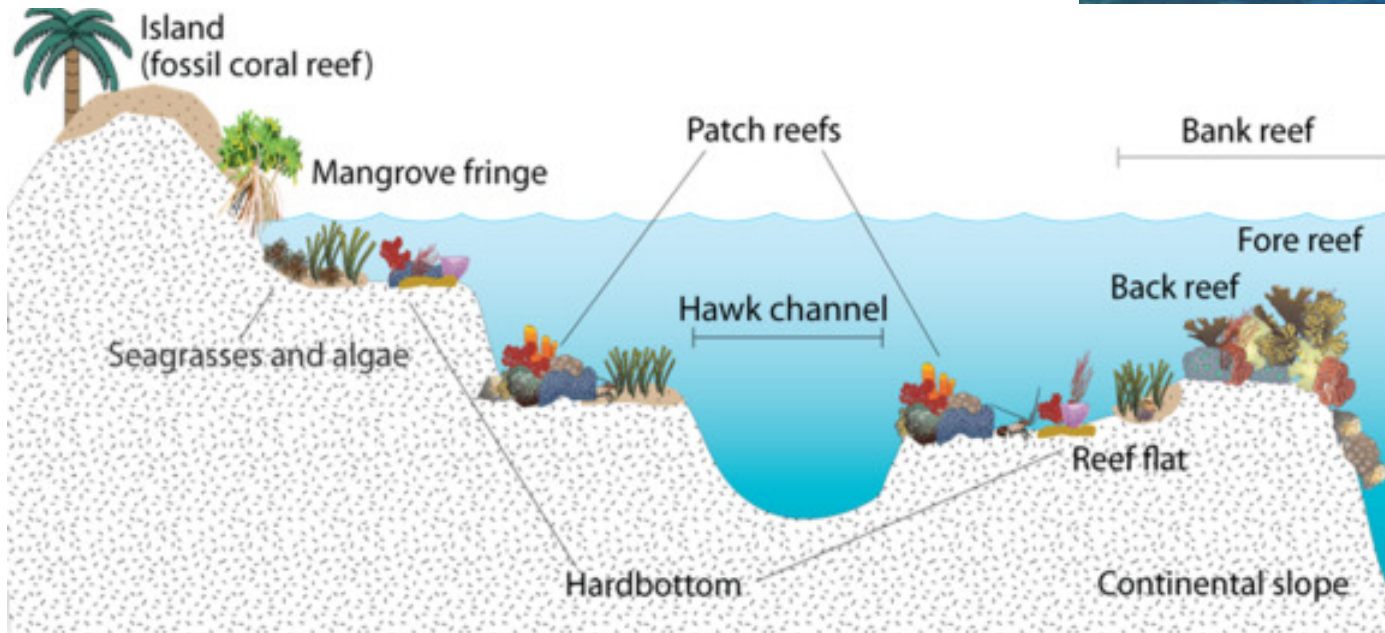
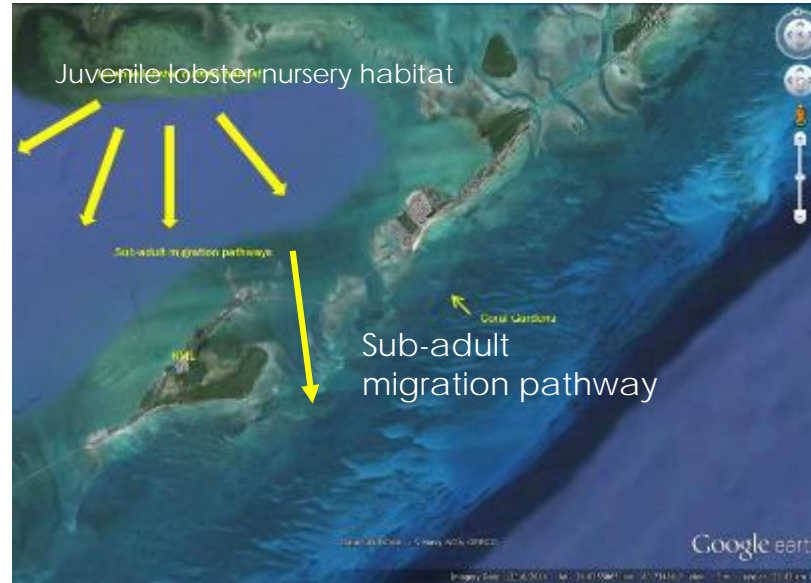
Carysfort
Black Grouper
Aggregation Site

Eklund et al. 2000

Protect large contiguous, interconnected habitats

Long Key/Tennessee Reef Spa

- Extends from shore to deep reef
- Multiple habitat types
- Connects Florida Bay habitats
- Protects multiple life stages
- Encompasses resilient reefs



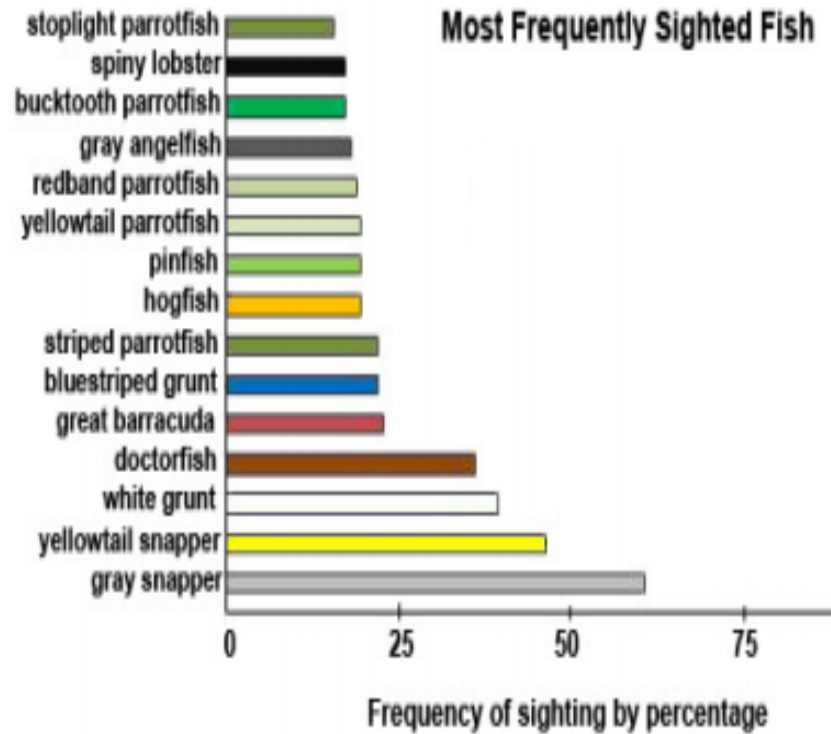
Cynthia Lewis

Protect new habitat types sensitive to prop scarring

Channel Key and Red Bay Bank Conservation Areas

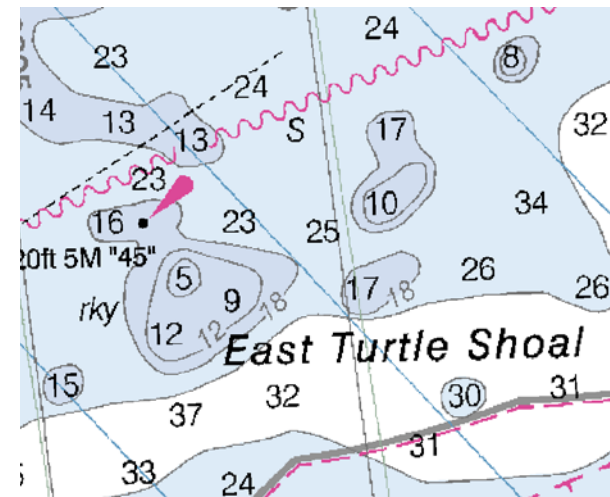
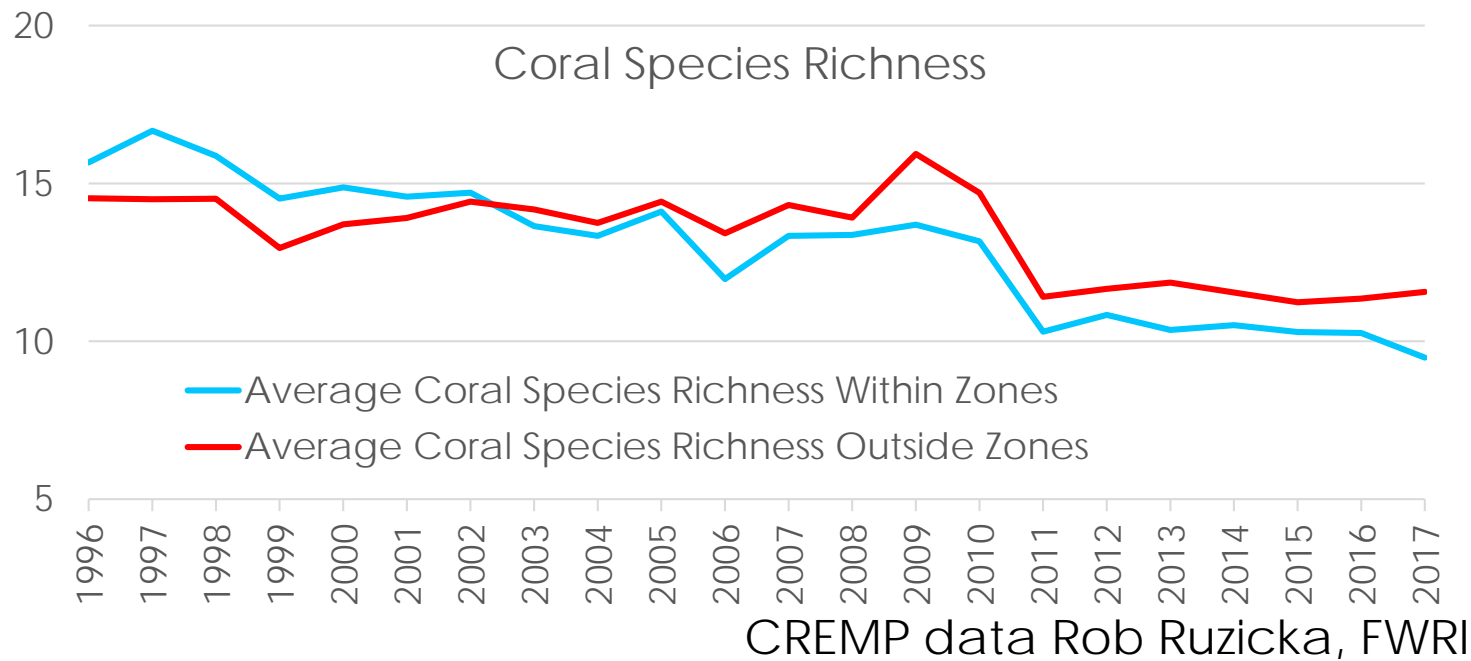


Burke et al. 2012



Include resilient mid channel sites in MPAs East Turtle Shoal (Middle Keys)

- Protected from Florida Bay waters
- Habitat type not well represented in SPAs
- Resilient site that supported ESA listed corals
- High survival from coral disease/bleaching



Ken Nedimeyer

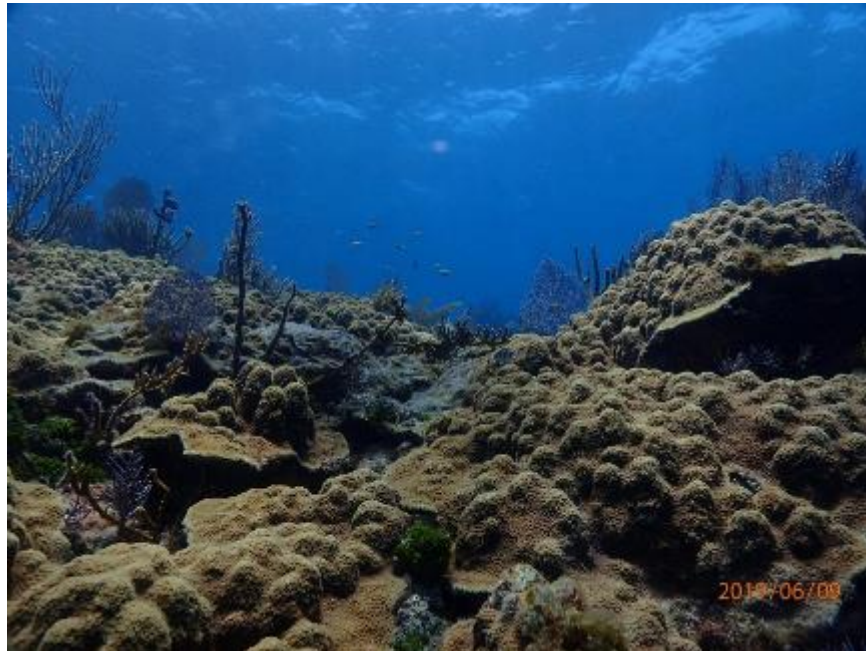
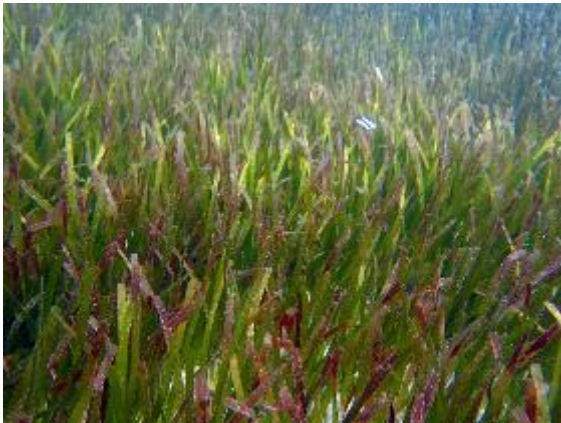
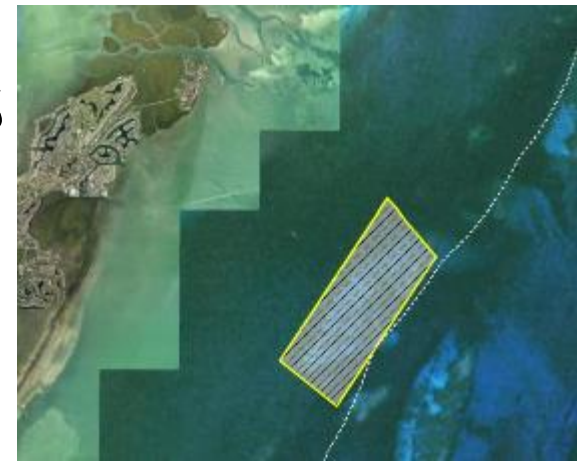
Include resilient mid channel sites in MPAs

Turtle Rocks (Upper Keys)

- Multiple habitat types
- Existing lobster no-trap area
- Inshore stepping stone to Carysfort
- Resilient coral communities



Dana Williams



Ken Nedimeyer

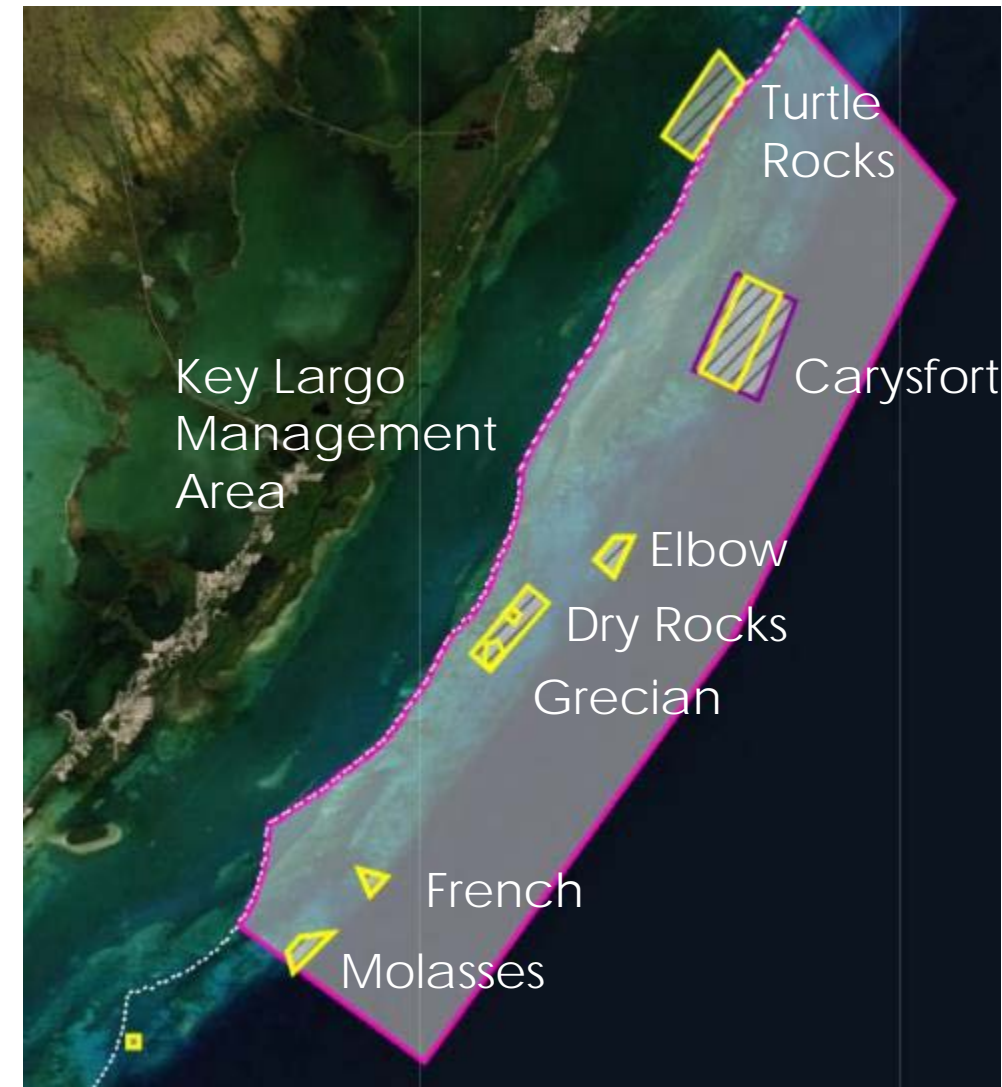


Brenda Altmeier

Create networks of MPAs

Key Largo Management Area

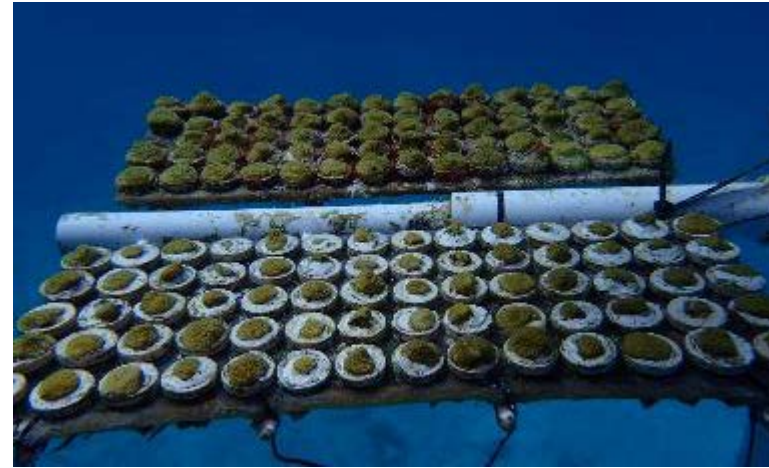
- No-take SPAs embedded in KLMA
- Multiple reef habitats, grassbeds, sand/rubble, hardbottom
- ESA-listed coral species
- Existing spearfishing prohibition
- Existing marine life collection prohibition
- No anchoring for the entire management area



Protect coral nurseries and experimental restoration sites

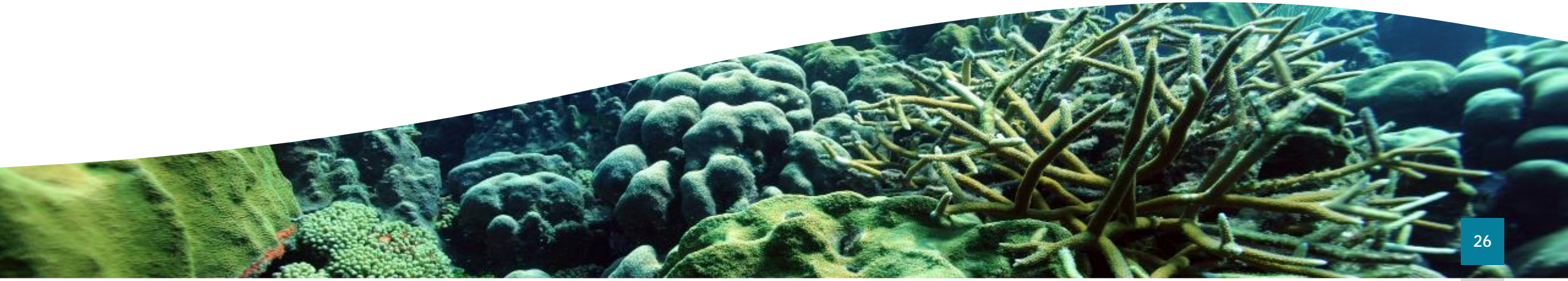
Marathon, Delta Shoal, Key West and Pickles SPAs

- “Regional” propagation nurseries and in situ gene banking sites
- Experimental outplanting, reintroduction and research sites



Regulatory measures

To avoid altering fish behavior and reduce physical impacts



Fish Feeding

Proposed ban on fish feeding with intent to attract wildlife for viewing (from boats and by divers)



Ever go to Looe Key Reef? Ever see sharks, Goliath grouper, spotted rays and thousands of fish? Yea. Me too. Hundreds of times. And I've never used chum to attract those fish to my boat. 3x this week while out there, I witnessed people throwing chum into the water. Sharks start swimming close to the boat. **Then the passengers start screaming, high tail it back into the boat, kids are crying and everyone is freaked out.** Today, 2 **sharks started getting a bit aggressive** and the people on the boat couldn't imagine why they were coming so close. DUH!!!!

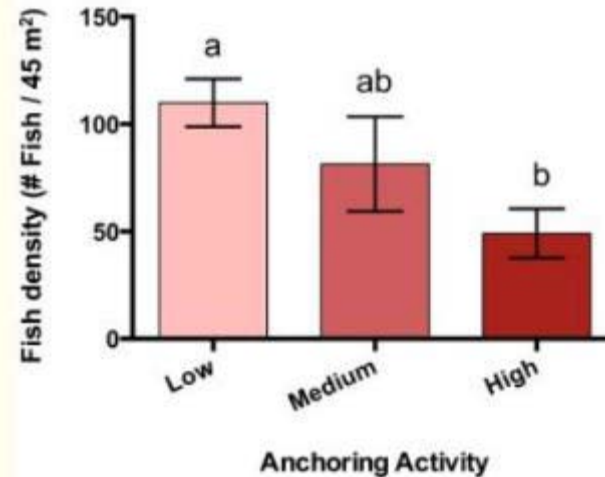
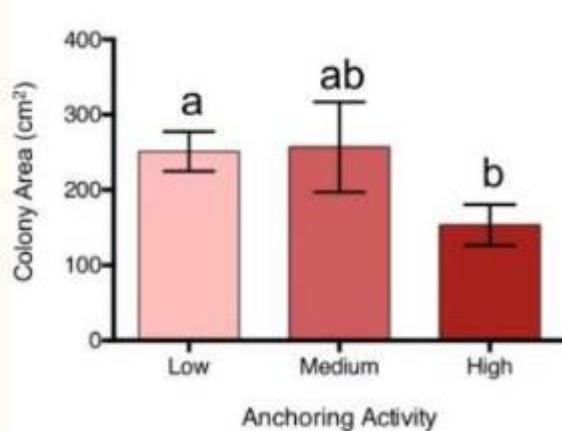
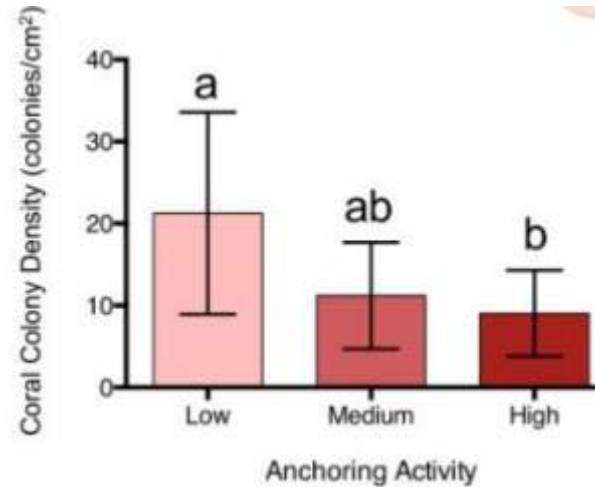
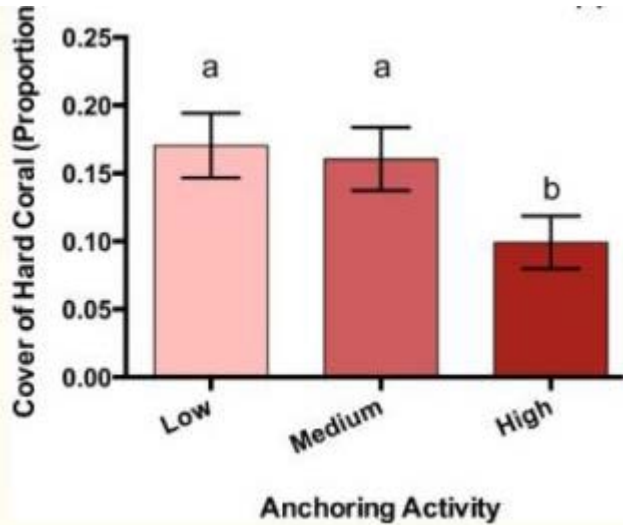
With 1000's of fish all over the reef, one really doesn't need chum to attract the fish. They are there. Trust me. Personally, I love seeing sharks. But not when there is chum in the water and I'm swimming through it.

Folks, please don't chum in the sanctuary areas where people dive and snorkel. One of these days, someone may get bumped or bit and everyone will blame it on the shark. Unless it's me. Then I'm going to blame it on you.

- Name not disclosed, 8/8/19 FACEBOOK Post

Anchoring, prop scarring, groundings & marine debris

Causes significant damage to sensitive habitats and resources



- 20% staghorn in Tortugas destroyed by anchors (Davis, 1977)
- Higher frequency of fragmented corals in UK high use reefs (Dustin and Halas, 1987)
- 60% of sites (n=49) in UK had anchor damage during lobster mini season (Lutz, 2006)
- Dive operators removing debris highlighted anchors as one of most common item recovered from UK (Islamorada)

Anchoring, prop scarring, groundings and marine debris

Causes significant damage to sensitive habitats and resources



Mitigation strategies

- Sanctuary wide: no anchoring on living coral (existing); mooring balls
- Existing no trap zones (sensitive Acropora areas)
- Idle speed/no wake in SPAs, WMAs and Conservation Areas
- **NEW proposed No Anchor** in SPAs, CAs, Looe Key and Key Largo Management Areas



Molasses reef, July 2019



Dana Williams, Turtle Rocks

Are we loving our reefs to death?

Balancing reef use with carrying capacity



Addressing overuse of sensitive habitats

Limit number of boats/divers at Carysfort, Sombrero and Sand Key

Mitigation strategies

- Seasonal closures
- Regulate group size
- Spatial closures
- Restrict activities
- Create alternatives
- Require guides
- Rotation of mooring balls



ACKNOWLEDGEMENTS

