

Science, Service, Stewardship



Facilitating ecosystem approaches to management: research examples from NMFS-Beaufort, NC

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**NOAA
FISHERIES
SERVICE**

NOAA

Science, Service, Stewardship



NOAA Beaufort Facility:

1. National Ocean Service (CCFHR)
2. NMFS / NOAA Fisheries

**NOAA
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How is NMFS Beaufort implementing NOAA mandates for ecosystem-based fishery management?

How is NMFS Beaufort implementing NOAA mandates for ~~ecosystem-based~~ fishery management?

- Stock assessments (overfishing / overfished?)
- Performing applied fisheries research

How is NMFS Beaufort implementing NOAA mandates for ecosystem-based fishery management?

What are NOAA's mandates for ecosystem-based management?

What are NMFS's mandates for ecosystem-based management?

- Magnuson-Stevens Act
- Endangered Species Act
- Marine Mammal Protection Act

Magnuson Stevens Act (1976, 1996, 2006)

- For overfished species, specify a time period for ending overfishing and rebuilding the fishery that shall be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem
- Create an advisory panel to develop recommendations to expand the application of ecosystem principles in fishery conservation and management activities
- Create a report to include an (1) analysis of the extent to which ecosystem principles are being applied in fishery conservation and management activities... and (2) proposed actions that should be undertaken to expand the application of ecosystem principles in fishery conservation and management

NMFS's mandates for EBM

- MSA provisions related to ecosystem considerations :
 - FMPs shall identify Essential Fish Habitat and minimize to the extent practicable adverse effects on such habitat (MSA 303(a)(7))
 - FMPs may “include management measures to conserve target and non-target species and habitats, considering the variety of ecological factors affecting fishery populations” (MSA 303(b)(12))

NMFS's mandates

- Strong and clear for (single-species) fisheries management
- Less clear for ecosystem approaches, aside from guidance to consider them
- Currently, ecosystem approaches, or research to assess or apply such approaches, are underway in multiple regions
- Examples:
 - Ecosystem modeling (Ecosim/path/space, Atlantis)
 - Multi-species and spatially explicit models
 - Integrated Ecosystem Assessments
 - Marine Spatial Planning / Marine Protected Areas

In the South Atlantic...

- Caveat: my opinions
- Focus remains heavily on single species management
- Focus remains heavily on stock assessments / ending overfishing
 - Core mandates of Magnuson Stevens
- Funding for stock assessments increasing
- Stock assessment staff increasing
- Research personnel decreasing
 - Exception: FI survey personnel
- Limited “ecosystem” funding sources
 - MARFIN, CRP
 - CAMEO, FATE
- “Ecosystem” research and approaches lower priority

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NMFS South

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Fisheries Ecosystems Branch

- Spatiotemporal trends in abundance
- Habitat mapping
- Fish-habitat relationships
- Reef fish life-history patterns
- Habitat restoration ecology
- Use of otolith microchemistry to assess spatiotemporal distribution patterns
- Genetic connectivity of reef fish populations
- Reef fish spawning aggregations
- Reef fish reproductive ecology
- Temperate hardbottom community ecology
- Predator-prey relationships
- Invasive species impacts



Fisheries Ecosystems Branch

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Southeast Fishery-Independent Survey (SEFIS)

Created in 2010 in response to:

- Declines of important reef fish species (e.g., red snapper)
- Reductions in fishery-dependent data
- Limitations of existing survey (MARMAP)
- Gear selectivity issues



Objectives of SEFIS

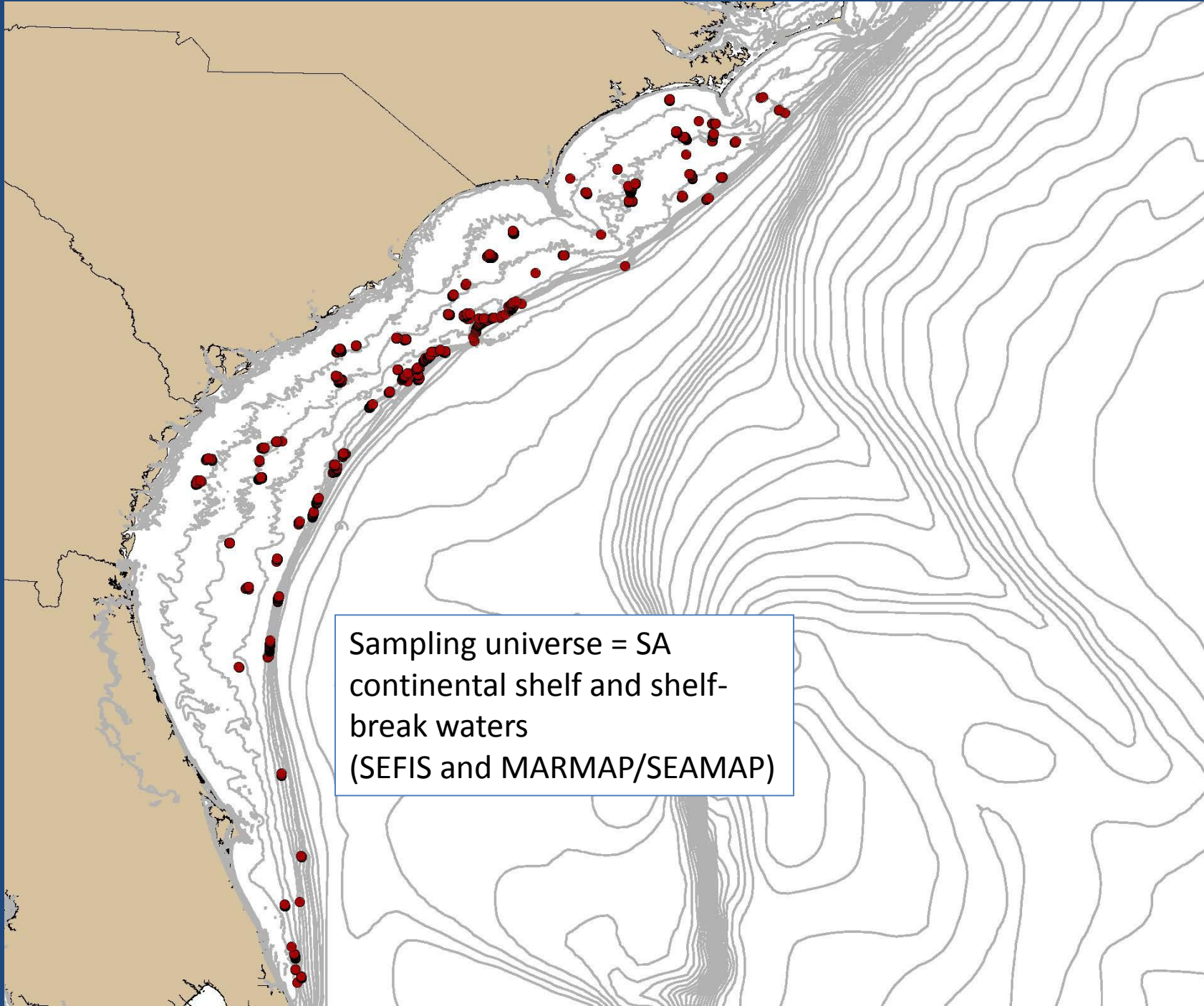
1. Increase spatial footprint and sample sizes of fishery-independent surveys in US South Atlantic
2. Implement video cameras as a survey gear to address trap selectivity and develop indices of abundance
3. Map hardbottom habitats to improve survey design
4. Applied research to inform survey methods and address management issues



SEFIS sampling approach

1. Chevron traps
2. Video cameras affixed to traps
 - Read for 107 “priority” species
3. Multibeam mapping (expands sampling universe)
4. Directed ROV, longline and fisheries sonar efforts





Sampling universe = SA
continental shelf and shelf-
break waters
(SEFIS and MARMAP/SEAMAP)

2012 Plans

- 30 days at sea on NOAA ship *Pisces*
 - Trap/video samples
 - Multibeam mapping
 - Fisheries acoustics
- 50 days at sea planned on *R/V Savannah*
- Video surveys now system-wide (SEFIS and MARMAP/SEAMAP)
- ~ 1,000 trap/[video](#) samples likely each year between NC and FL



Realized and anticipated results

- **> 100% increase in annual survey sample sizes over historical (solely MARMAP) levels**
 - Improved trap-based abundance indices due to increased survey sample size and spatial footprint
 - Improved size-at-age and sex ratio information due to increase trap-based biological collections (otoliths and gonads)
- **Establishment of video-based abundance indices (more precise than trap-based) for use in future assessments**
- **Improved stock assessments**

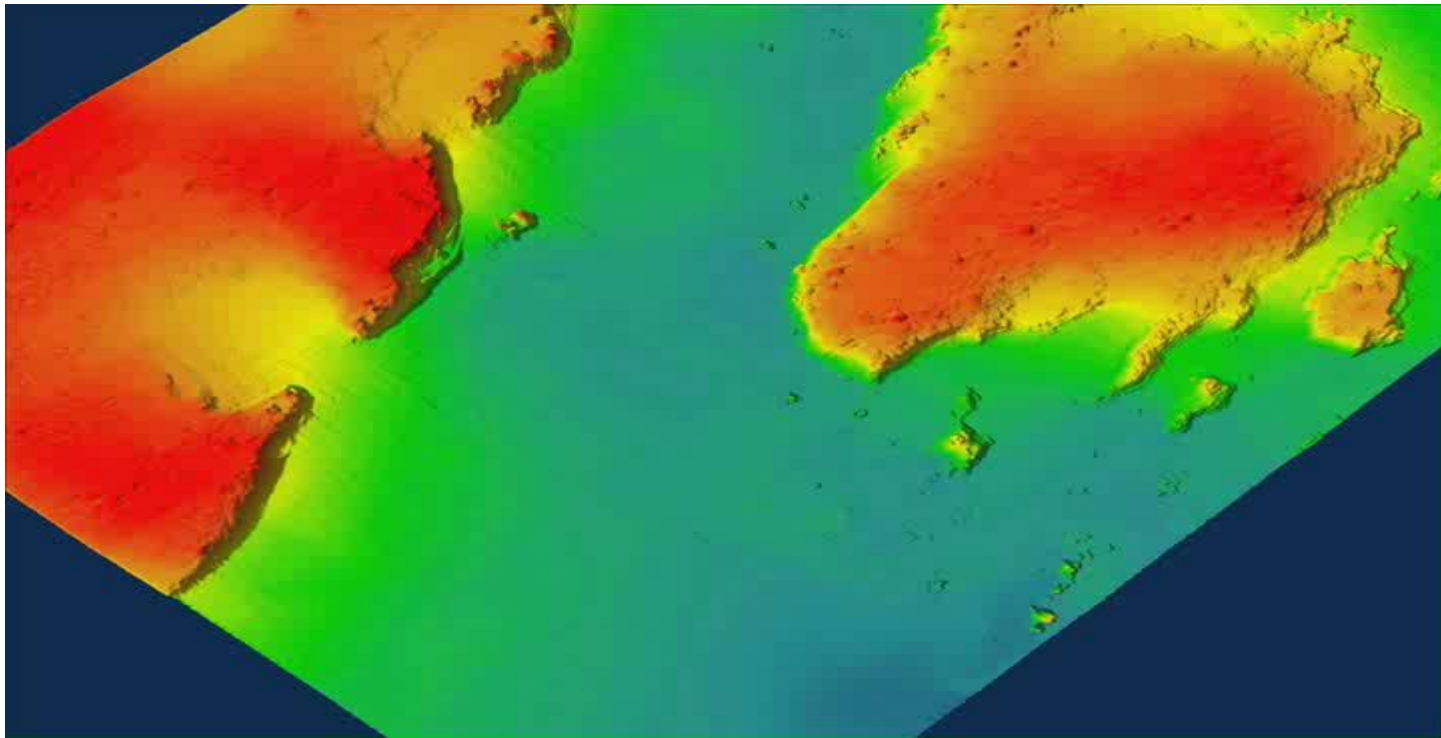
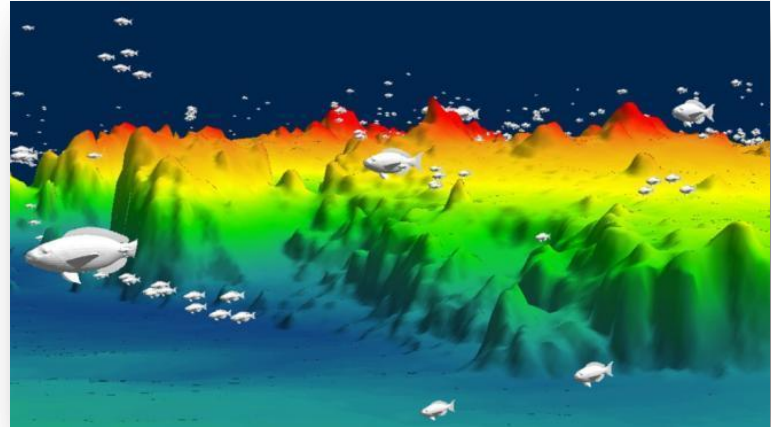


Realized and anticipated results

- Improved capability to assess multi-species trends & species interactions
- Improved knowledge of hardbottom distribution (via mapping) = improved survey design
- Capability to assess relationships between fish distribution and habitat characteristics

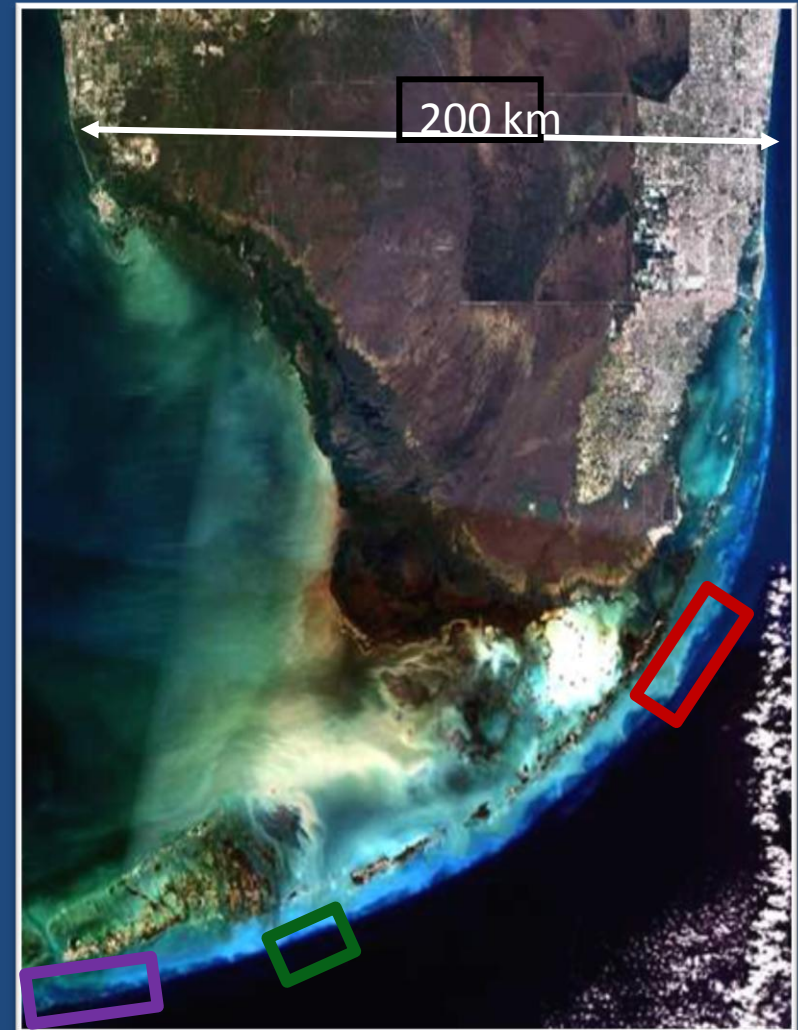


Future work: linking fisheries acoustics and multibeam data to assess relationships between fish distribution and habitat characteristics



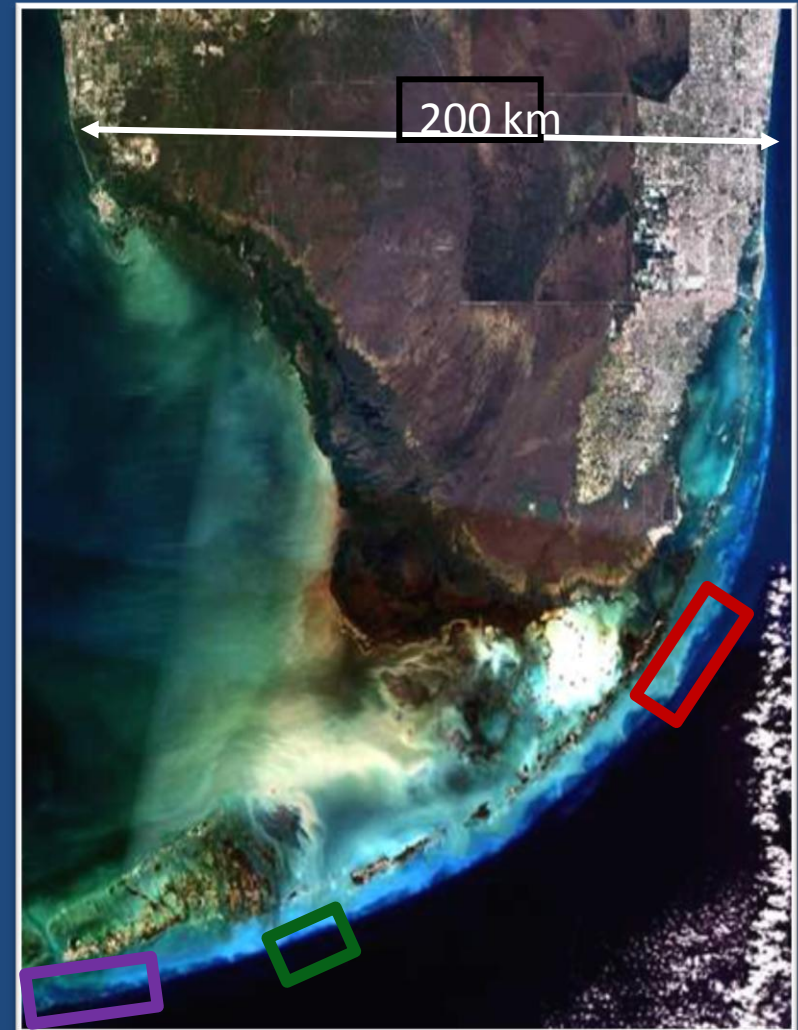
Reef Fish Spawning Aggregations (FSAs)

- Many reef fish species aggregate to reproduce at predictable times and locations, making them susceptible to overexploitation
- In the FL Keys, we are assessing reef fish utilization patterns and geomorphological signatures of reported reef fish aggregation sites
- Developed conceptual model linking “drowned”, outlier reefs with reef fish aggregation sites
- Objective: enable prediction of location of additional aggregation sites

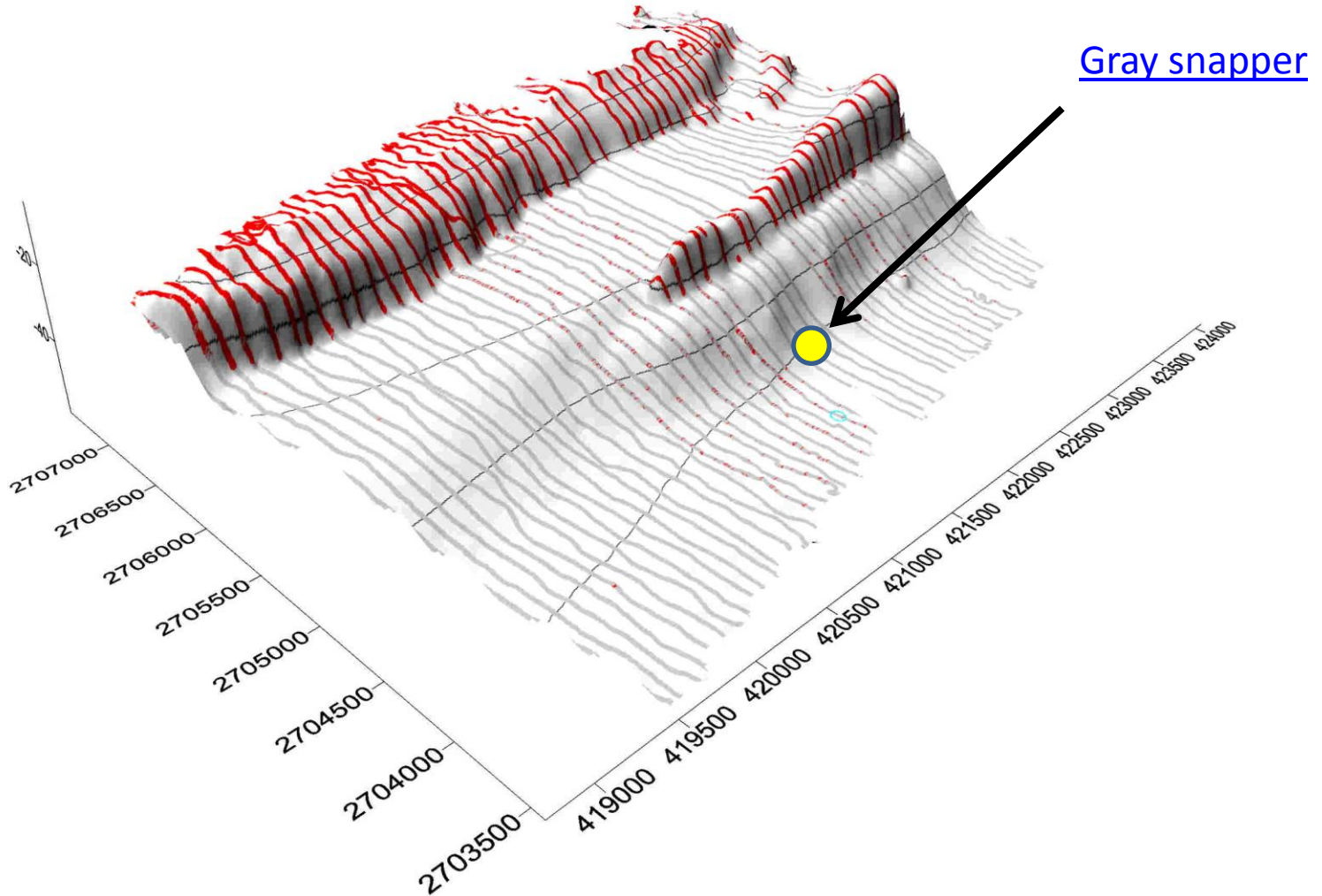


Reef Fish Spawning Aggregations (FSAs)

- Direct fisheries implications
 - Monitoring spawning stock biomass at aggregation sites over time
- Ecosystem implications
 - Identifying essential fish habitat
 - Facilitating marine spatial planning



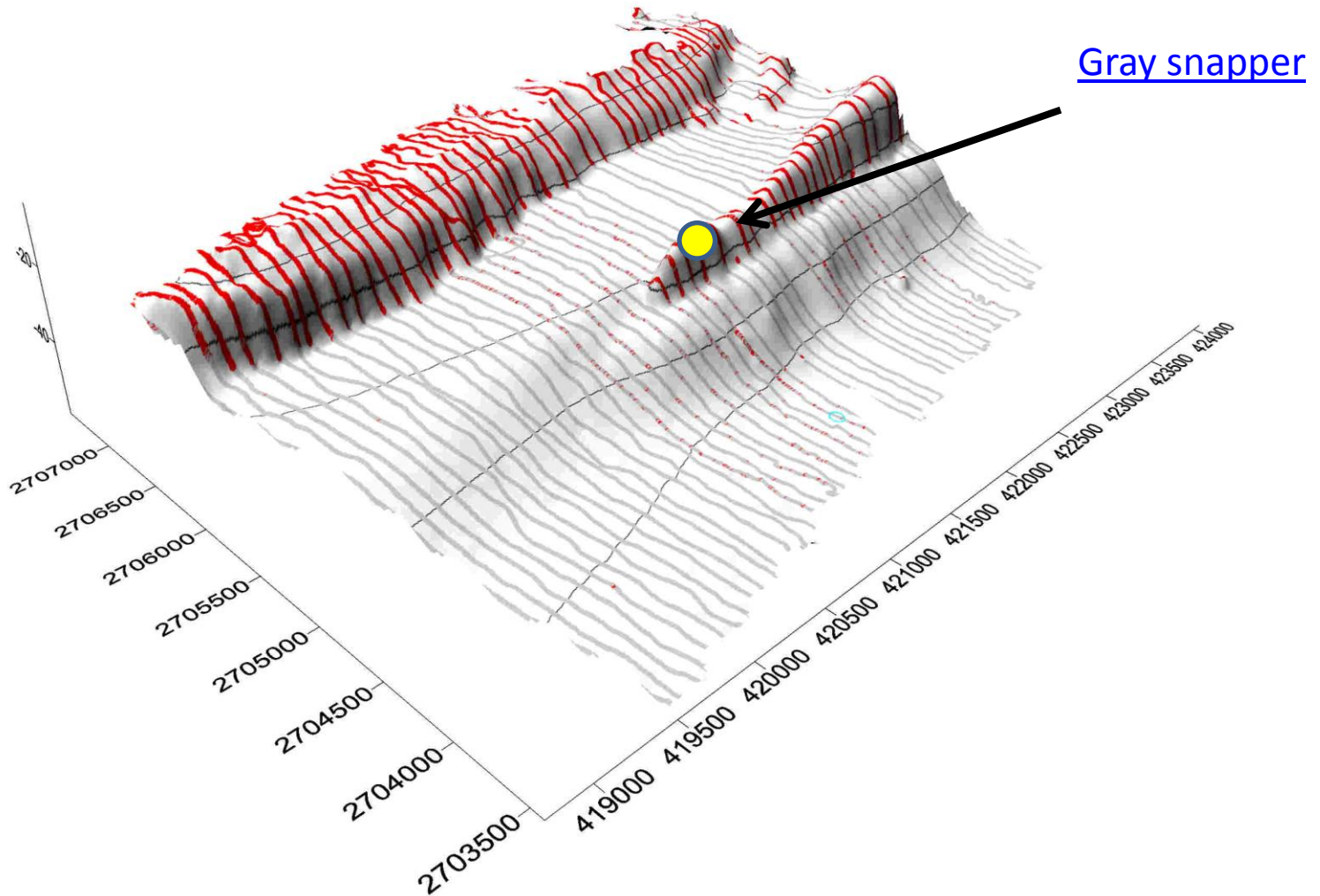
Lower FL Keys



Gleason, ACR, PR Reid and GT Kellison. 2009. Single-beam acoustic remote sensing for coral reef mapping. Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, USA, 7-11 July 2008: 611-615.

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A large school of fish, likely snappers, is swimming in clear blue water above a coral reef. The fish are densely packed in the upper half of the frame, moving towards the right. The reef below is covered in various coral species, including branching and table corals. The overall scene is a vibrant underwater ecosystem.

Spawning aggregation
research supports marine
zoning evaluation efforts
conducted by FKNMS

Invasive lionfish impacts

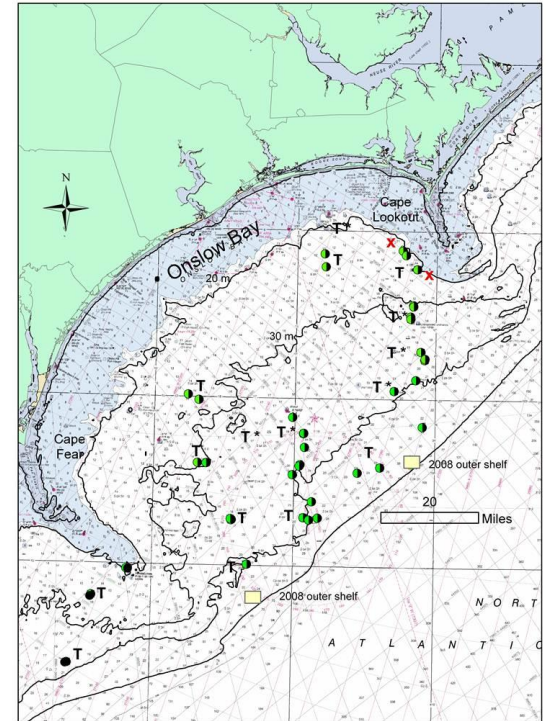
- Lionfish now widely distributed throughout SE US continental shelf waters
- Potential predatory impact on ecologically and economically important species?
- Stomach content analysis shows that lionfish have a generalist diet, eating mostly benthic fishes by weight and volume
- Diet includes groupers and snappers, as well as prey of those species
- Experimental removals underway to assess community impacts



Invasive lionfish impacts

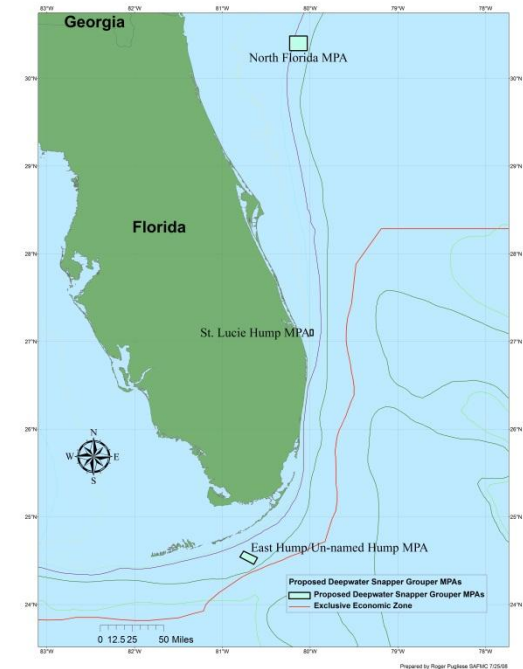
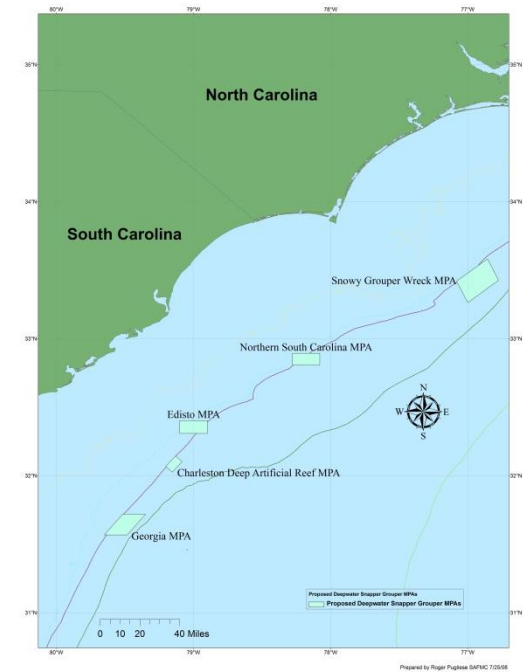
“Given current theory pertaining to invasive species impacts, the expanding lionfish distribution, and observations that lionfish appear capable of settling to many different habitat types, the overall pattern of generalist piscivory emerging from these data indicates the potential for significant impacts to the invaded community.”

Muñoz et al. 2011. Diet of invasive lionfish on hard bottom reefs of the Southeast USA: insights from stomach contents and stable isotopes. *Mar. Ecol. Prog. Ser.* 43: 181-193

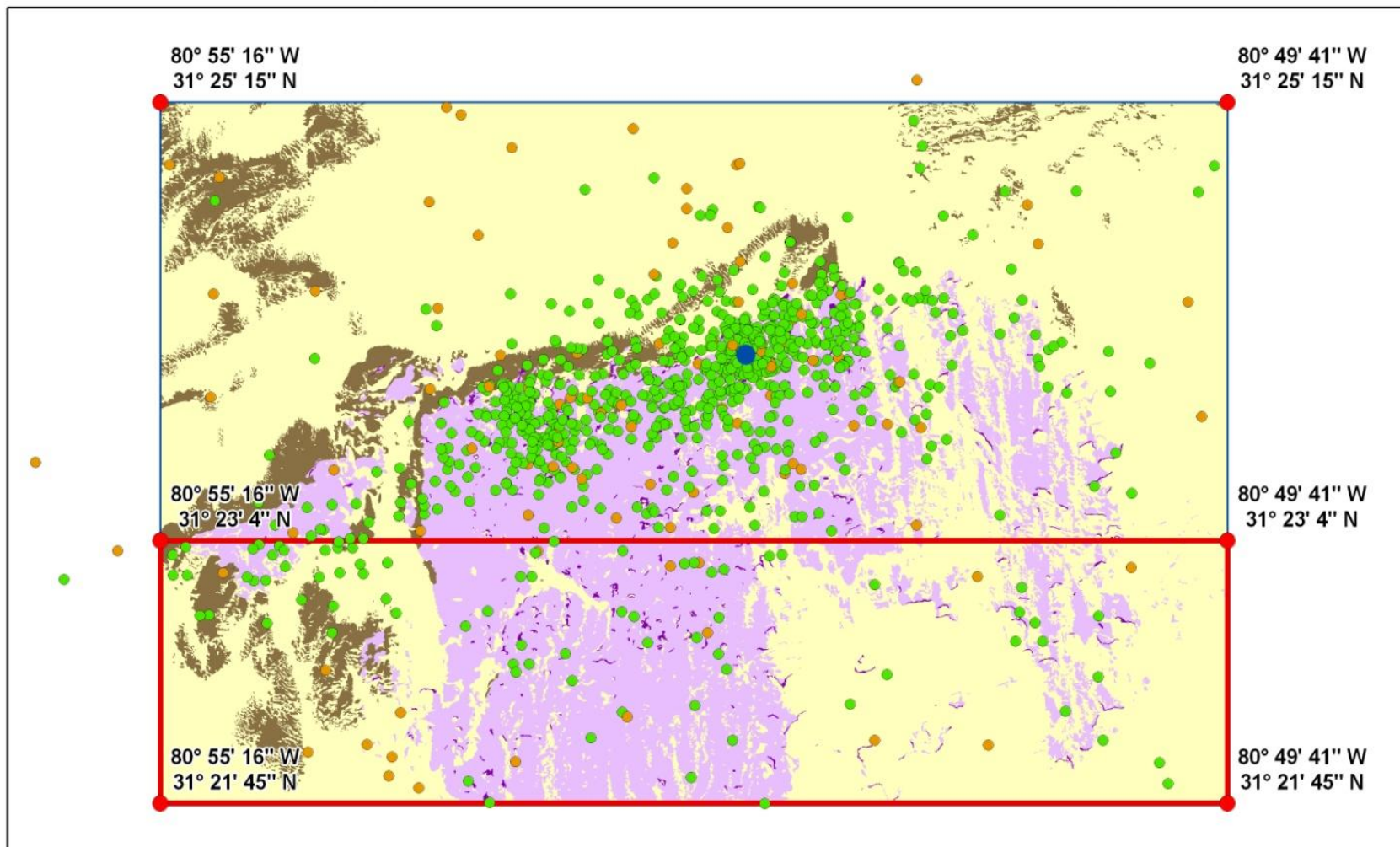


MPA Assessment

- Six “deepwater” MPAs established by the SAFMC on or near the continental shelf break (~ 50-400m depth)
- Multibeam mapping
- [ROV surveys](#)
- Working with colleagues to assess changes over time in reef fish community structure in versus outside of MPAS



Gray's Reef National Marine Sanctuary



- Data Buoy
 - Boats: Moving
 - Boats: Stationary
 - Southern Option
 - GRNMS Boundary
- Habitat Types**
- Densely colonized live bottom
 - Sparsely colonized live bottom
 - Flat sand
 - Rippled sand

Southern Option

21.43 sq km

6.25 sq nm

8.27 sq mi

Habitat Restoration Research

- Research focuses on the largest island habitat restoration project on the Atlantic coast, the 1,200 acre Poplar Island (Maryland) Environmental Restoration Project (PIERP)
- Assesses habitat utilization patterns and production rates of ecologically and economically important species
- Compares responses between restored and reference areas



Conclusion

- Multiple research efforts underway to inform and facilitate ecosystem-based approaches to management
- Challenges:
 - Mandates favor single-species approaches
 - Funding availability
- Efforts will increase



The End





Thank you!