

Cooperative Monitoring Program for Spawning Aggregations in the Gulf of Mexico:

An assessment of existing information, data gaps, and research priorities



NOAA RESTORE Act Science Program

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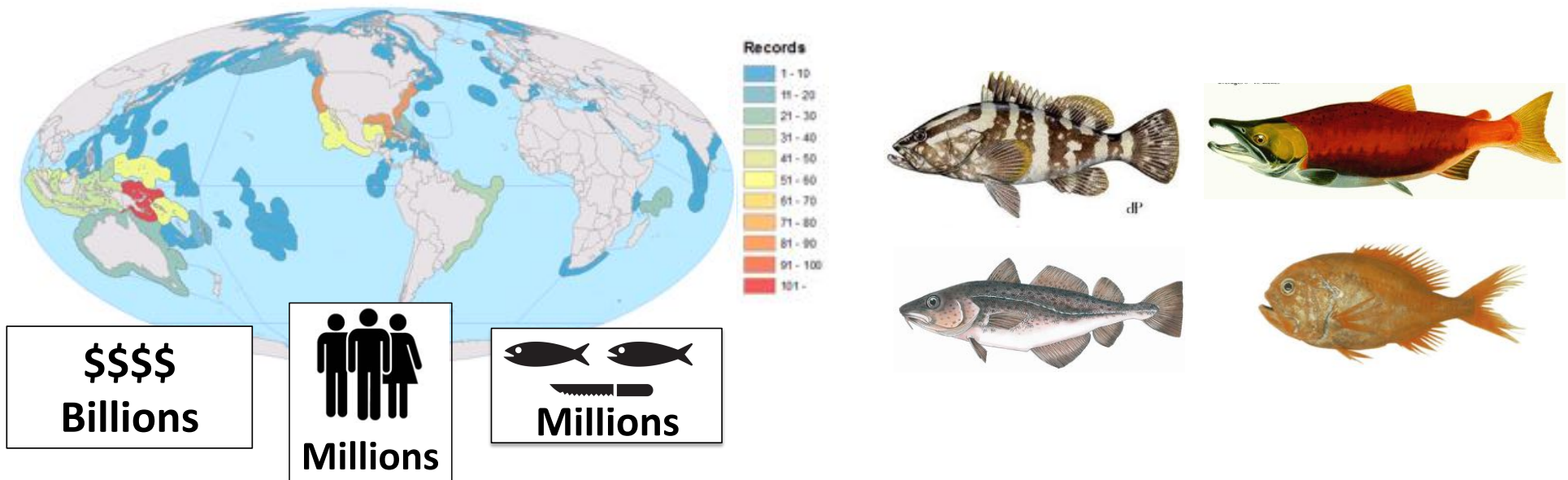
Fish Spawning Aggregations (FSAs)



Temporary, large gatherings of fish that form for the purpose of reproduction, are predictable in time and space, and involve densities higher than non-reproductive periods

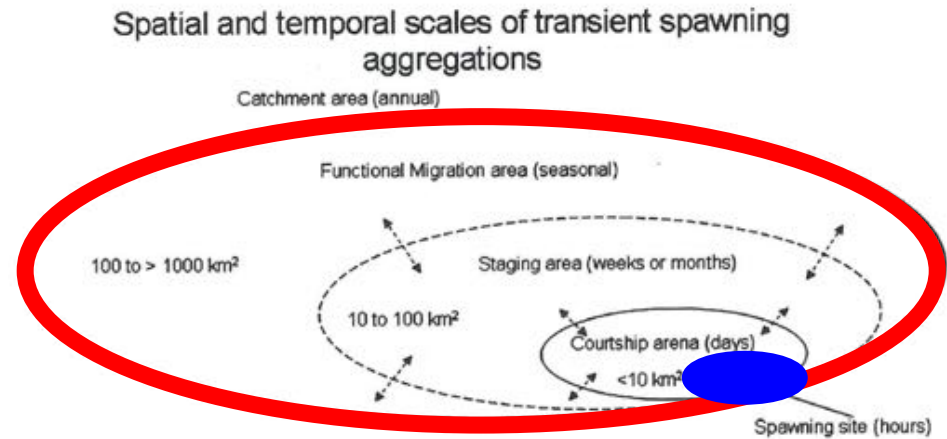
- Critical events for reproductive success
- Represent Essential Fish Habitat (EFH)
- Important for Ecosystem structure/function

Fish Spawning Aggregations (FSAs) are important to global fisheries...

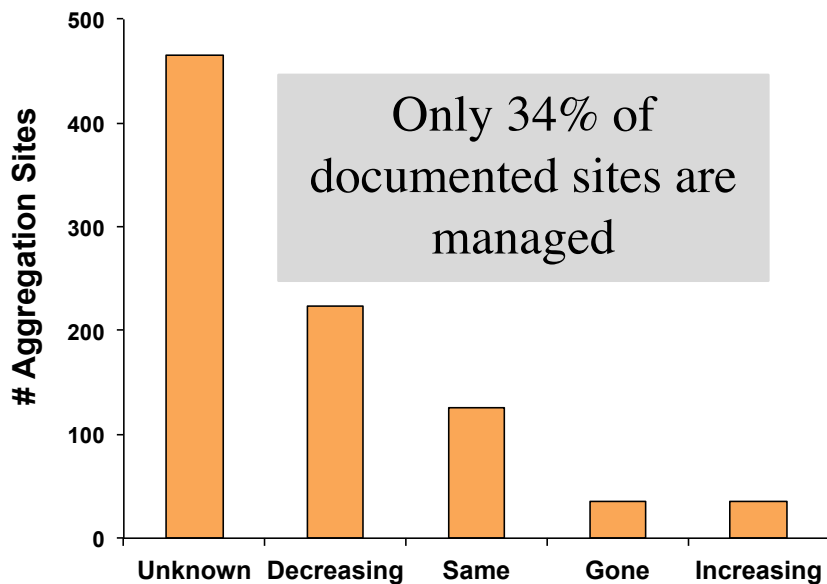


Global Challenge

FSAs can be vulnerable to overfishing...fishing effects “scale up”



FSAs are declining globally...few are monitored, assessed or managed



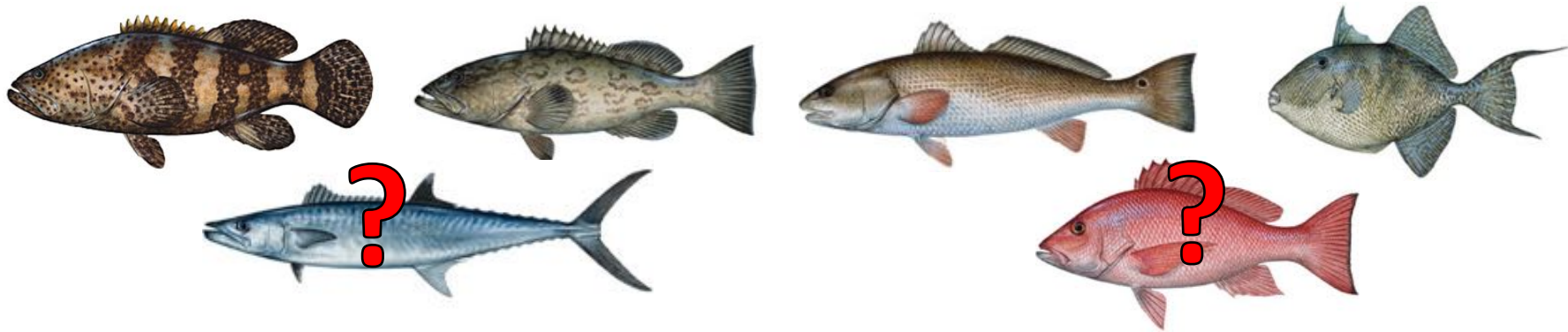
Inclusion within management works

- Increased reproductive output
- Stabilized population structure
- Practical for monitoring
- Improved stock assessments
- Increased catches and CPUE
- Supports ecosystem-based management

(Erisman et al. 2015, Fish & Fisheries)

Regional Challenge

Many species of exploited and protected fishes are known to or likely form FSAs In the Gulf of Mexico



...BUT it is one of the world's least studied areas for the biology and fisheries of FSAs

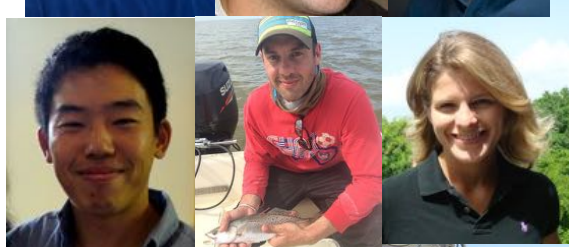
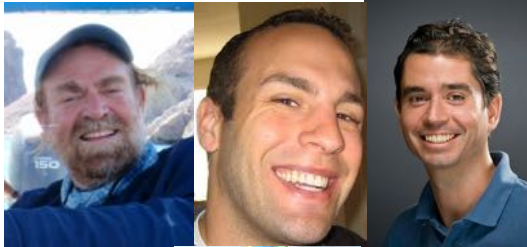
Despite a wealth of scientific information and regional knowledge on the biology and fisheries on aggregating species

Reproductive styles of shallow-water groupers (Pisces: Serranidae) in the eastern Gulf of Mexico and the consequences of fishing spawning aggregations

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Our Team



Support provided by:

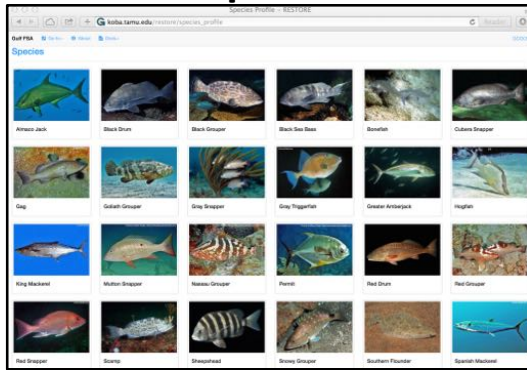
Scott Hickman (CFA) & Roy Williams
Chris Taylor (NOS/NCCOS/CCFHR)
Todd Kellison (NOAA SEFSC – Beaufort)
John Froeschke (GMFMC)
Martin Russell (SCRFA)
NOAA Southeast Regional Office
Chris Koenig (FSU)
Many, many fishermen

Objectives

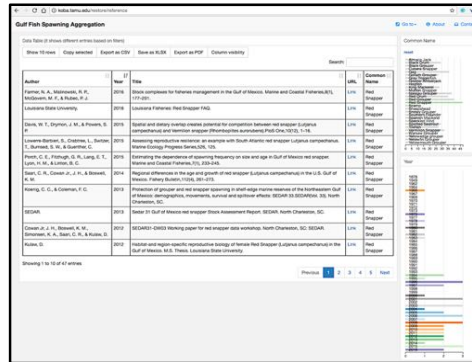
1. Compile and evaluate existing information on fish spawning aggregations in the GOM as the basis to design a cooperative monitoring program for FSAs.
2. Engage in a comprehensive outreach and data-sharing program to ensure all data and project outputs are available to inform management.

Objective #1: Outputs

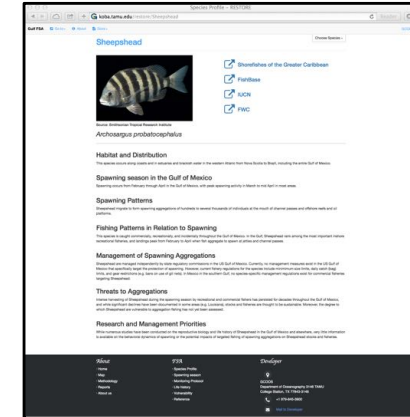
30 species



Database of 800 refs.



Species Profiles



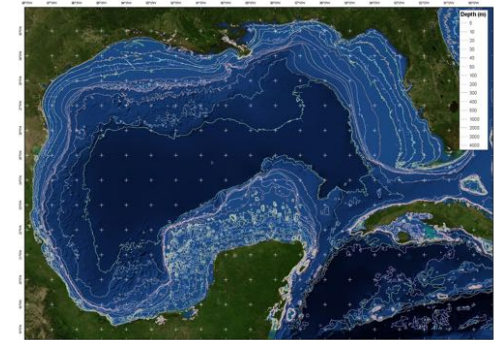
Spawning Seasons

Life history and spawning behavior

Species	Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Mycteroperca microlepis</i>	Cog												
<i>Epinephelus morio</i>	Red Grouper												
<i>Sciaenops ocellatus</i>	Red Drum												
<i>Lutjanus campechanus</i>	Red Snapper												
<i>Rhomboplites auratus</i>	Vermilion Snapper												
<i>Seriola lalandi</i>	Greater Amberjack												
<i>Mycteroperca bonaci</i>	Black Grouper												
<i>Seriola capricornis</i>	Grey Triggerfish												
<i>Loachilobus roxanus</i>	Hogfish												
<i>Epinephelus striatus</i>	Nassau Grouper												
<i>Hypanthias flavilimbatus</i>	Yelloweye Grouper												
<i>Hypanthias viverratus</i>	Shrew Grouper												
<i>Seriola rivoliana</i>	Almaco Jack												
<i>Lutjanus cyanopterus</i>	Cubera Snapper												
<i>Mycteroperca phenax</i>	Scamp												
<i>Epinephelus drummondhayi</i>	Speckled Hind												
<i>Loachilobus chrysomelas</i>	Tierfish												
<i>Mycteroperca venenosa</i>	Yellowfin Grouper												
<i>Mycteroperca interstitialis</i>	Yellowmouth Grouper												
<i>Epinephelus itajara</i>	Goliath Grouper												
<i>Lutjanus analis</i>	Mutton Snapper												
<i>Hypanthias nigritus</i>	Wanpan Grouper												
<i>Scorpaenurus maculatus</i>	Spanish Mackerel												
<i>Scorpaenurus cavallii</i>	King Mackerel												
<i>Cynoscion nebulosus</i>	Spot Seatrout												
<i>Archosargus probatocephalus</i>	Sheepshead												
<i>Paralichthys lethostigma</i>	Southern Flounder												
<i>Agonias cromis</i>	Black Drum												

General Information			Metabolic Indicators									
Common Name	Genus	Species	Aggregation Type (1-4)	Spawning Season Months	Spawning Season Duration (1-5)	Max Age (years)	K VR Growth Coeff.	L _∞ Asympt. Length (cm)	Age at Maturity (mo)	M Nat. mort.	Density Change (±SE)	
Red Grouper	Mycteroperca	<i>Mycteroperca microlepis</i>	3	3	3	13	0.1462	127.09	43	0.1840	3	
Red Snapper	Epinephelus	<i>Epinephelus morio</i>	3	3	3	20	0.1371	127.09	43	0.1840	3	
Black Drum	Agonias	<i>Agonias cromis</i>	3	3	3	21	0.1371	127.09	43	0.1840	3	
Red Snapper	Sciaenops	<i>Sciaenops ocellatus</i>	3	3	3	21	0.1371	127.09	43	0.1840	3	
Greater Amberjack	Lutjanus	<i>Lutjanus campechanus</i>	3	3	3	24	0.1371	127.09	43	0.1840	3	
Vermilion Snapper	Rhomboplites	<i>Rhomboplites auratus</i>	3	3	3	25	0.1371	127.09	43	0.1840	3	
Black Grouper	Mycteroperca	<i>Mycteroperca bonaci</i>	3	3	3	19	0.1429	133.4	38	0.1394	4	
Grey Triggerfish	Seriola	<i>Seriola capricornis</i>	3	3	3	15	0.1429	133.4	38	0.1394	4	
Hogfish	Lachnolabes	<i>Lachnolabes morrisii</i>	3	3	3	23	0.1027	84.89	32.8	0.1728	2	
Nassau Grouper	Epinephelus	<i>Epinephelus striatus</i>	4	3	3	25	0.118	95	34	0.1728	2	
Yelloweye Grouper	Hypanthias	<i>Hypanthias flavilimbatus</i>	3	3	3	30	0.0567	100.05	40	0.1728	2	
Shrew Grouper	Hypanthias	<i>Hypanthias viverratus</i>	3	3	3	30	0.0567	100.05	40	0.1728	2	
Almaco Jack	Seriola	<i>Seriola rivoliana</i>	3	3	3	25	0.094	106.40	35	0.1728	2	
Cubera Snapper	Lutjanus	<i>Lutjanus cyanopterus</i>	3	3	3	20	0.119	103	34	0.1728	2	
Scamp	Mycteroperca	<i>Mycteroperca phenax</i>	3	3	3	13	0.109	73.7	24	0.1728	2	
Speckled Hind	Epinephelus	<i>Epinephelus drummondhayi</i>	3	3	3	20	0.119	88.2	34	0.1728	2	
Tierfish	Loachilobus	<i>Loachilobus chrysomelas</i>	3	3	3	46	0.119	88.2	34	0.1728	2	
Yellowmouth Grouper	Mycteroperca	<i>Mycteroperca interstitialis</i>	3	3	3	18	0.119	88.2	34	0.1728	2	
Goliath Grouper	Epinephelus	<i>Epinephelus itajara</i>	3	3	3	17	0.0937	222.3	31	0.1728	2	
Mutton Snapper	Lutjanus	<i>Lutjanus analis</i>	3	3	3	16	0.105	86.3	30	0.1728	2	
Wanpan Grouper	Hypanthias	<i>Hypanthias nigritus</i>	4	3	3	41	0.05	238.4	89	0.1728	1	
Spanish Mackerel	Scorpaenurus	<i>Scorpaenurus maculatus</i>	3	3	3	13	0.167	106	34	0.1728	2	
King Mackerel	Scorpaenurus	<i>Scorpaenurus cavallii</i>	3	3	3	14	0.167	106	34	0.1728	2	
Spot Seatrout	Cynoscion	<i>Cynoscion nebulosus</i>	3	3	3	12	0.237	113.43	40	0.1728	1	
Sheepshead	Archosargus	<i>Archosargus probatocephalus</i>	3	3	3	12	0.237	113.43	40	0.1728	1	
Southern Flounder	Paralichthys	<i>Paralichthys lethostigma</i>	3	3	3	8	0.237	61.2	24	0.1728	1	
Black Drum	Agonias	<i>Agonias cromis</i>	3	3	3	8	0.119	113.8	40	0.1728	1	

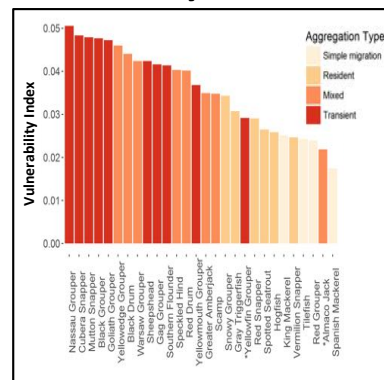
Bathymetric and FSA maps



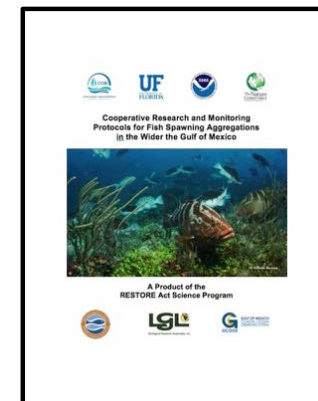
Fisheries interactions and mgmt.



Vulnerability Assessments



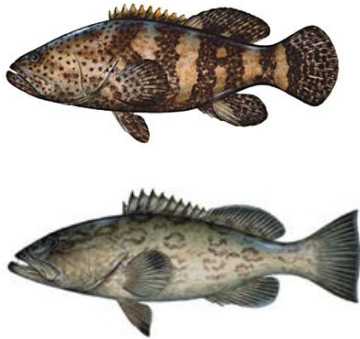
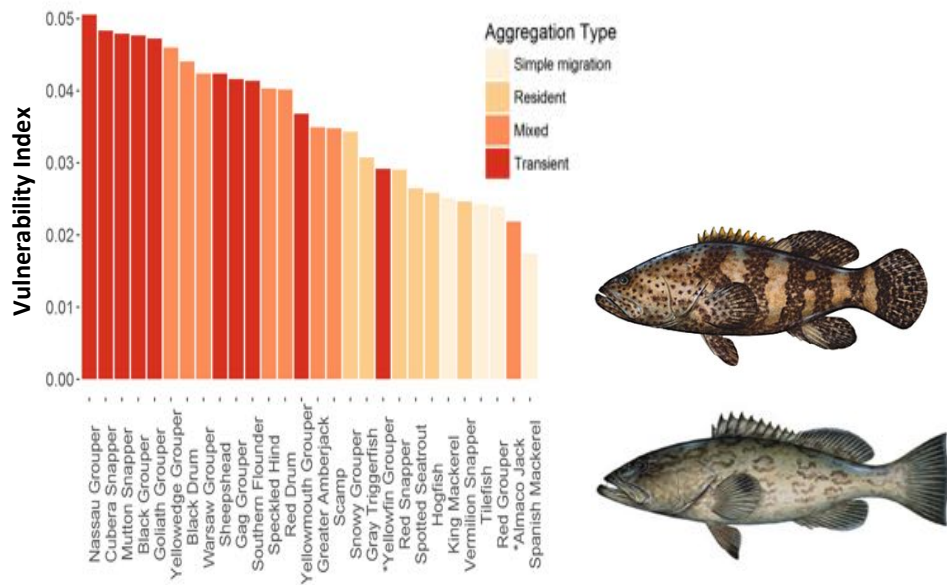
Monitoring Protocol



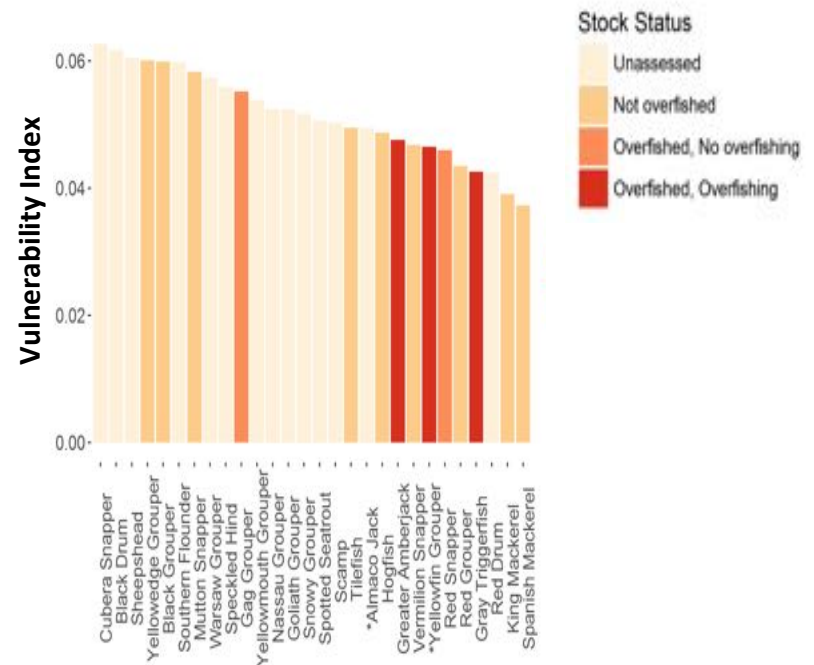
Take-Home Messages

1. Lack of information on locations of spawning aggregations in the Gulf of Mexico.
2. Lack of information on behavioral dynamics of FSAs in space and time (e.g. density change, periodicity, etc.).
3. Commercial fisheries target the spawning season and FSA sites (inferred) of most species.
4. Lack of information on interactions between and impacts of fishing on FSAs.

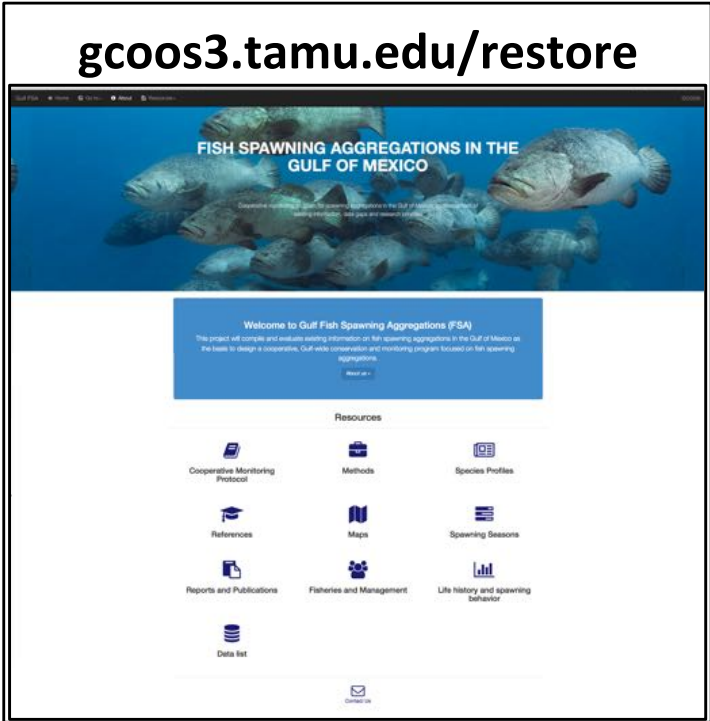
5. Transient FSAs are most vulnerable



6. The most vulnerable spp. have not been assessed



Objective #2: Outputs



Research and Management Priorities

- 1) Mine existing data to assess interaction strengths between fishing and spawning to **identify and prioritize areas and species of highest vulnerability**
- 2) Work collaboratively with commercial and recreational fishers to identify, **characterize, assess, and monitor key spawning areas**
- 3) Inform and **improve stock assessments** by incorporating spawning dynamics into existing assessment models
- 4) Develop **management frameworks** for FSAs and aggregating species through the Fisheries Management Council process

Next Steps

Short-term (1-2 yrs @ \$250k/yr) = continue within scope of current project

- Enhance visibility, access, and capability of website, profiles, databases
- Update GOM bathymetric map (< 200m) and make available on GCOOS/NOAA
- Continue vulnerability assessment and fishing interaction/impact analyses
- Workshops: (1) FSA stock assessments; (2) regional FSA monitoring protocol
- Engage recreational fishing sector
- Increase existing collaborations with commercial sector
- Add more species (bonefish, tarpon, gray snapper, etc.)

Long-term (5-10 yrs @ \$1m/yr)

- Develop a network of fishermen, scientists and managers who cooperatively predict, characterize, and monitor multi-species FSAs throughout the GOM
- Develop methods to integrate FSAs into regional stock assessments
- Establish long-term monitoring sites for FSAs in the wider GOM
- Utilize advanced technologies to improve efficiency & quality of FSA monitoring
- Assess the importance of petroleum platforms as suitable FSA sites
- Model the potential effects of climate change and fishing pressure on the phenology, distribution, and productivity of FSAs