

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

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

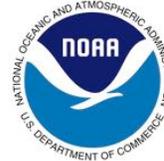


## NOAA RESTORE Act Science Program

Brad Erisman, Will Heyman, Shinichi Kobara, Christopher Biggs, Nick Farmer,  
Susan Lowerre-Barbieri, Mandy Karnauskas, Jorge Brenner



Ecological Research Associates, Inc.



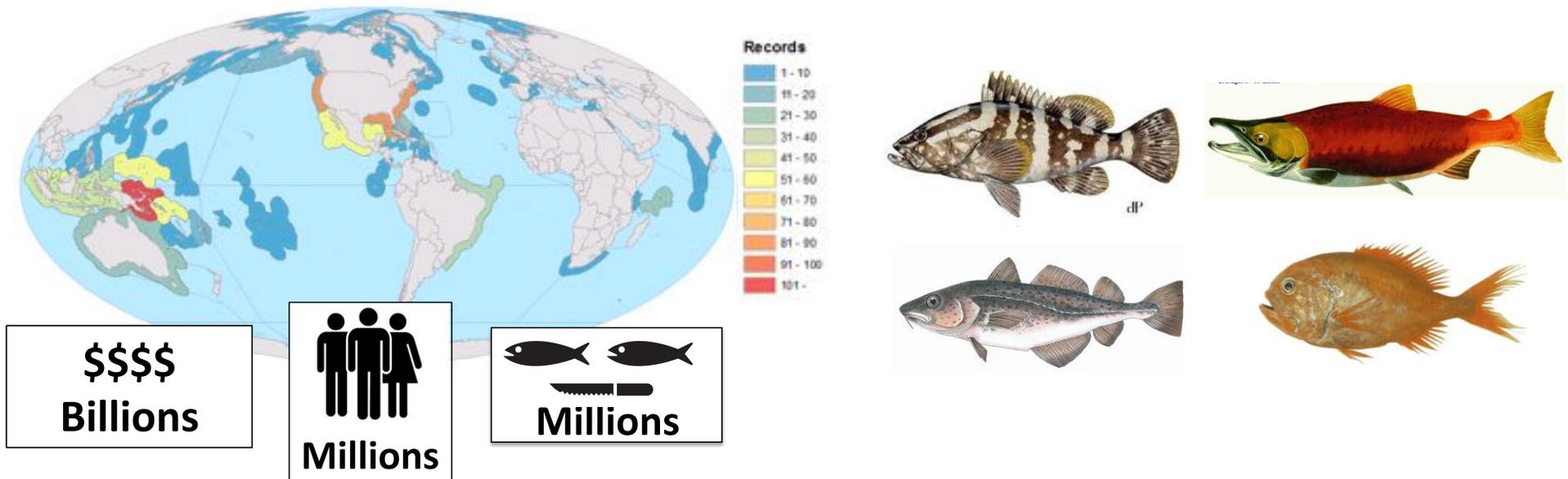
# Fish Spawning Aggregations (FSAs)



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

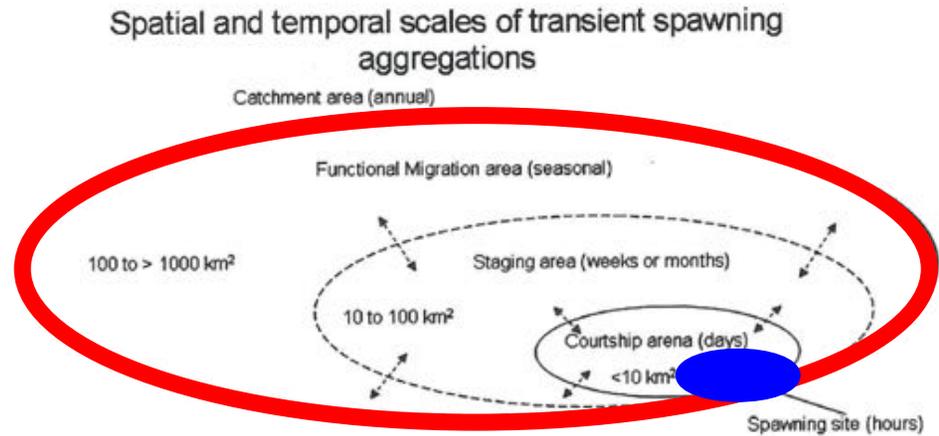
- Critical events for reproductive success
- Represent Essential Fish Habitat (EFH)
- Productivity Hotspots
- Important for Ecosystem structure/function

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

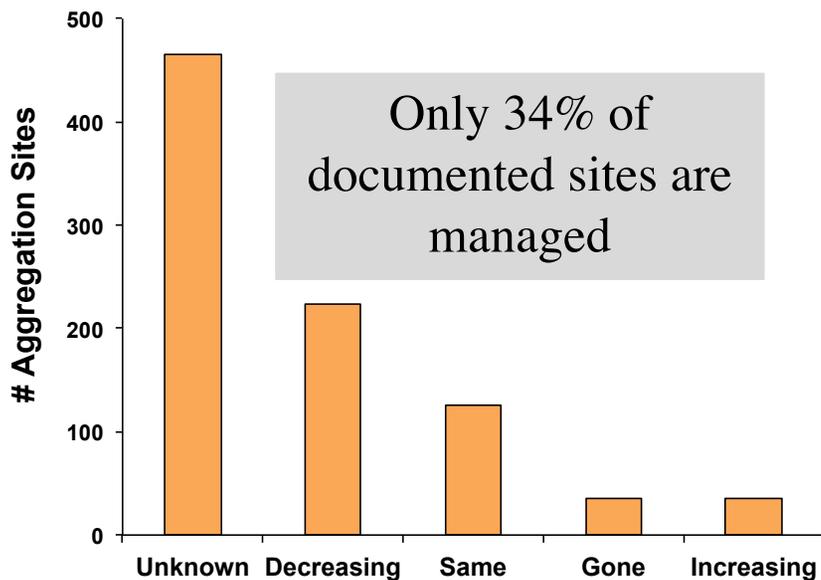


# Global Challenge

**FSA**s can be vulnerable to overfishing...fishing effects “scale up”



**FSA**s are declining globally...few are monitored, assessed or managed



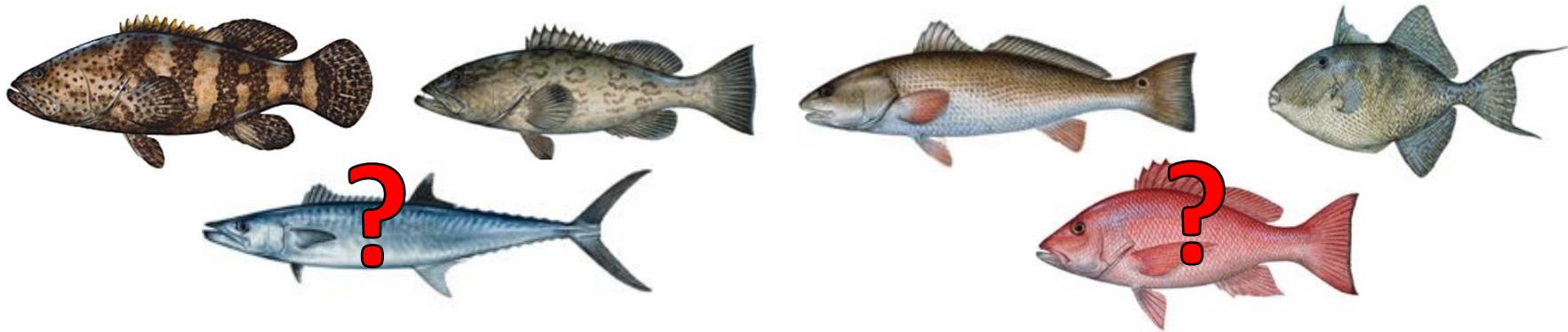
## Inclusion within management works

- 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**

Felicia C. Coleman<sup>1</sup>, Christopher C. Koenig<sup>1,2</sup> & L. Alan Collins<sup>2</sup>  
<sup>1</sup> FSU/NMFS Institute for Fishery Resource Ecology, Department of Biological Science, Florida State University, Tallahassee, FL 32306-2043, U.S.A.  
<sup>2</sup> National Marine Fisheries Service, 3500 Delwood Beach Road, Panama City, FL 32408-7499, U.S.A.



# Our Team



**Brad Erisman**  
(University of Texas at Austin)  
Principal Investigator  
[Send Mail](#)



**William Heyman**  
(LGL Ecological Research Associates, Inc.)  
Co-Principal Investigator  
[Send Mail](#)



**Shin Kobara**  
(GCOOS)  
Co-Principal Investigator  
[Send Mail](#)



**Christopher Biggs**  
(University of Texas at Austin)  
Graduate Research Assistant



**Nick Farmer**  
(NOAA SERO)  
Collaborator and NOAA Technical Point of Contact



**Mandy Karnauskas**  
(NOAA)  
Collaborator



**Susan Lowerre-Barbieri**  
(University of Florida)  
Collaborator



**Jorge Brenner**  
(The Nature Conservancy)  
Collaborator

## Support provided by:

Scott Hickman (CFA) & Roy Williams  
Todd Kellison (NOAA SEFSC – Beaufort)  
Martin Russell (SCRFA)  
Chris Koenig (FSU)

Chris Taylor (NOS/NCCOS/CCFHR)  
John Froeschke (GMFMC)  
NOAA Southeast Regional Office  
Many, many fishermen

# Project Goal

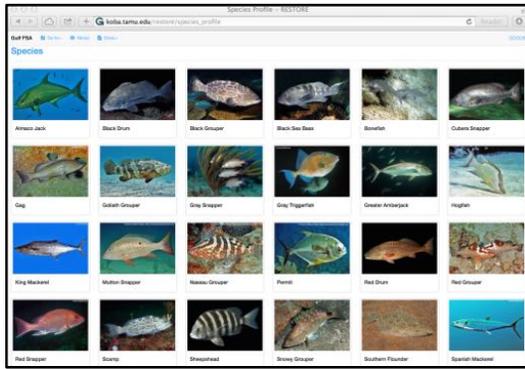
Compile and evaluate existing information on fish spawning aggregations in the Gulf of Mexico as the basis to design a cooperative, regional monitoring program.

## Objectives

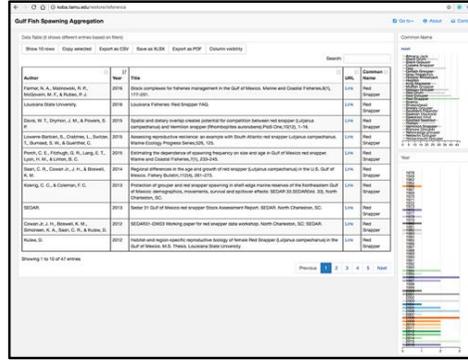
1. Identify existing literature, datasets, and monitoring programs in the GOM that could inform regional monitoring of fish spawning aggregations.
2. Compile existing biological and fisheries information on GOM species known or likely to form spawning aggregations in the region.
3. Synthesize information and convene a workshop to prioritize species, habitats, monitoring methods, and research areas.
4. Engage in a comprehensive outreach and data-sharing program to ensure all data and project outputs are available to inform management.

# Outputs

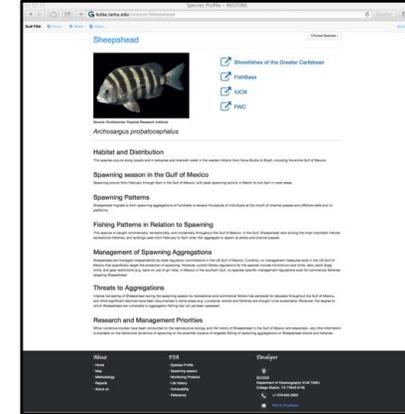
28 species



Database of 800 refs.



Species Profiles



## Spawning Seasons

Life history and spawning behavior

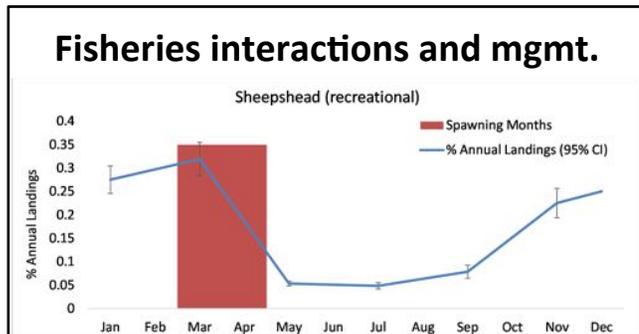
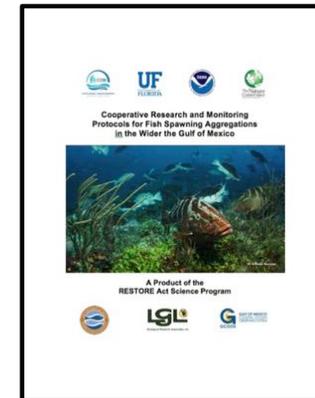
Species	Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Mycteroperca microlepis</i>	Cog												
<i>Epinephelus morio</i>	Red Grouper												
<i>Sciaenops ocellatus</i>	Red Drum												
<i>Lutjanus campechanus</i>	Red Snapper												
<i>Rhomboplites auratus</i>	Vermilion Snapper												
<i>Seriola lalandi</i>	Greater Amberjack												
<i>Mycteroperca bonaci</i>	Black Grouper												
<i>Seriola capricornis</i>	Gray Triggerfish												
<i>Loachilobus xanthurus</i>	Hogfish												
<i>Epinephelus striatus</i>	Nassau Grouper												
<i>Hypanthias flavilimbatus</i>	Yelloweye Grouper												
<i>Hypanthias viverratus</i>	Shrew Grouper												
<i>Seriola melanops</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>Centroscopus nebulosus</i>	Spotlet Seatrout												
<i>Archosargus probatocephalus</i>	Sheepshead												
<i>Paralichthys lethostigma</i>	Southern Flounder												
<i>Agonias cromis</i>	Black Drum												

Bathymetric and FSA maps

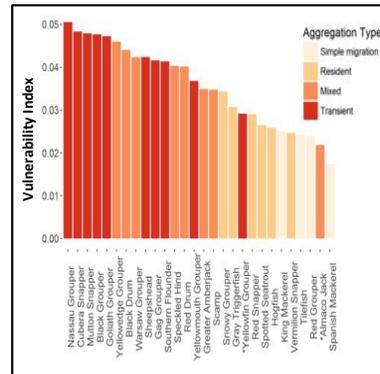


General Information				Metabolic Indicators																	
Common Name	Genus	Species	Aggregation Type (1-4)	Spawning Season Months	Spawning Season Duration (1-5)	Max Age (years)	K VR Growth Coeff.	L <sub>∞</sub> Asympt. Length (cm)	Age at Maturity (mo)	M Nat. mort.	Density Change (±SE)										
Red Grouper	Mycteroperca	Microlepis	3	3	3	13	0.1442	127.09	43	0.1442	3										
Red Snapper	Epinephelus	Morio	3	3	3	29	0.1371	82.39	33.8	0.147	3										
Black Drum	Agonias	Ocellatus	3	3	3	42	0.137	86.3	48	0.167	4										
Yellowfin Grouper	Lutjanus	Cyanopterus	3	3	3	48	0.13426	85.612	24	0.1	3										
Greater Amberjack	Rhomboplites	Auratus	3	3	3	25	0.1324	81.24	24	0.12	3										
Black Grouper	Mycteroperca	Bonaci	3	3	3	15	0.14426	141.6	24	0.12	3										
Gray Triggerfish	Seriola	Capricornis	3	3	3	15	0.1427	113.4	28	0.134	4										
Hogfish	Lachnolaima	Schroederi	3	3	3	15	0.1427	113.4	28	0.134	4										
Yelloweye Grouper	Hypanthias	Flavilimbatus	3	3	3	15	0.1427	113.4	28	0.134	4										
Shrew Grouper	Hypanthias	Viverratus	3	3	3	15	0.1427	113.4	28	0.134	4										
Almaco Jack	Seriola	Melanops	3	3	3	15	0.1427	113.4	28	0.134	4										
Cubera Snapper	Lutjanus	Cyanopterus	3	3	3	15	0.1427	113.4	28	0.134	4										
Scamp	Mycteroperca	Phenax	3	3	3	15	0.1427	113.4	28	0.134	4										
Speckled Hind	Epinephelus	Drummondhayi	3	3	3	15	0.1427	113.4	28	0.134	4										
Tierfish	Loachilobus	Chrysomelas	3	3	3	15	0.1427	113.4	28	0.134	4										
Yellowmouth Grouper	Mycteroperca	Interstitialis	3	3	3	15	0.1427	113.4	28	0.134	4										
Goliath Grouper	Epinephelus	Itajara	3	3	3	15	0.1427	113.4	28	0.134	4										
Mutton Snapper	Lutjanus	Analis	3	3	3	15	0.1427	113.4	28	0.134	4										
Wanpan Grouper	Hypanthias	Nigritus	3	3	3	15	0.1427	113.4	28	0.134	4										
Spanish Mackerel	Scorpaenurus	Maculatus	3	3	3	15	0.1427	113.4	28	0.134	4										
King Mackerel	Scorpaenurus	Cavallii	3	3	3	15	0.1427	113.4	28	0.134	4										
Spotlet Seatrout	Centroscopus	Nebulosus	3	3	3	15	0.1427	113.4	28	0.134	4										
Sheepshead	Archosargus	Probatocephalus	3	3	3	15	0.1427	113.4	28	0.134	4										
Southern Flounder	Paralichthys	Lethostigma	3	3	3	15	0.1427	113.4	28	0.134	4										
Black Drum	Agonias	Cromis	3	3	3	15	0.1427	113.4	28	0.134	4										

Monitoring Protocol

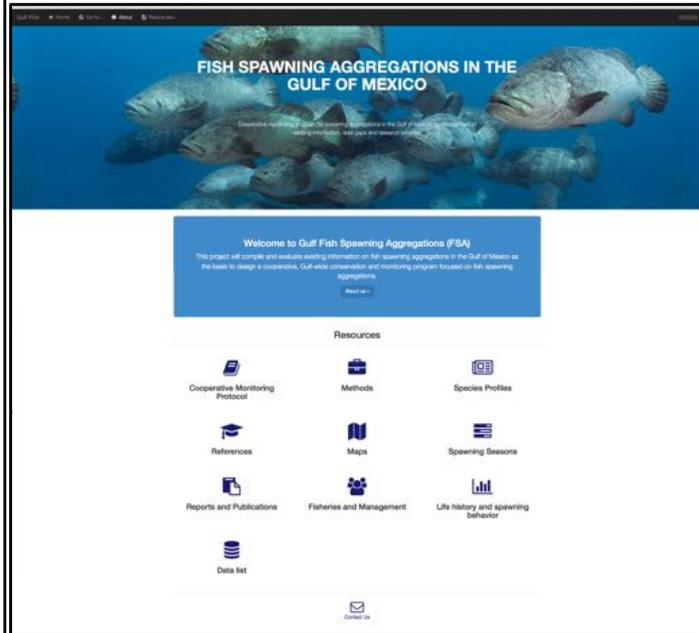


Vulnerability Assessments



# Outputs

[gcoos3.tamu.edu/restore](http://gcoos3.tamu.edu/restore)



FSA Workshop  
October 4-5 2016, NOAA SERO



# gcoos3.tamu.edu/restore

gcoos3.tamu.edu/restore

Home Get Involved About Resources

## FISH SPAWNING AGGREGATIONS IN THE GULF OF MEXICO

Cooperative monitoring of fish spawning aggregations in the Gulf of Mexico: development of a monitoring protocol, data gaps and research priorities

Welcome to Gulf Fish Spawning Aggregations (FSA)

This project will compile and evaluate existing information on fish spawning aggregations in the Gulf of Mexico as the basis to design a cooperative, Gulf-wide conservation and monitoring program focused on fish spawning aggregations.

[Read on >](#)

### Resources

- [Cooperative Monitoring Protocol](#)
- [Methods](#)
- [Species Profiles](#)
- [References](#)
- [Maps](#)
- [Spawning Seasons](#)
- [Reports and Publications](#)
- [Fisheries and Management](#)
- [Life history and spawning behavior](#)
- [Data list](#)

[Contact Us](#)

# Take-Home Messages

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

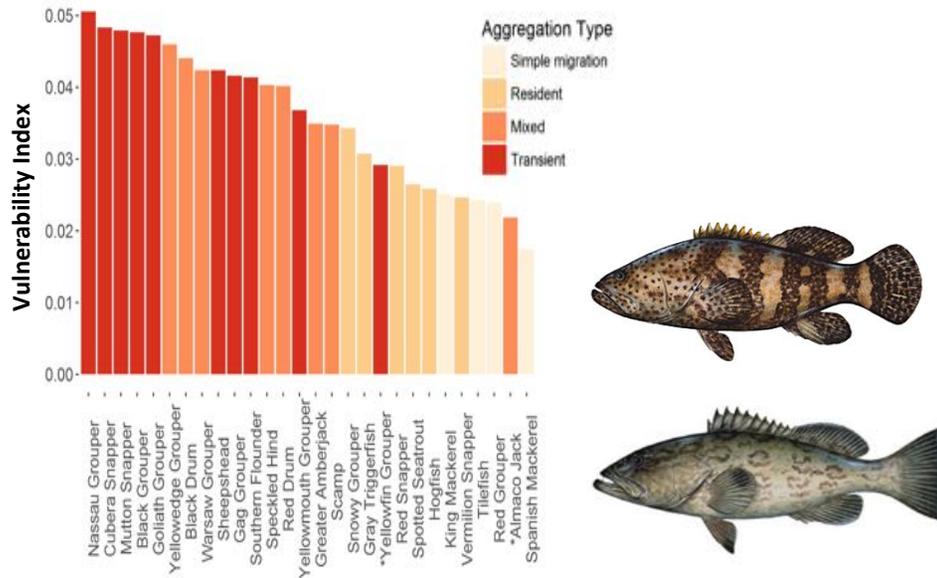
# Research Priorities

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

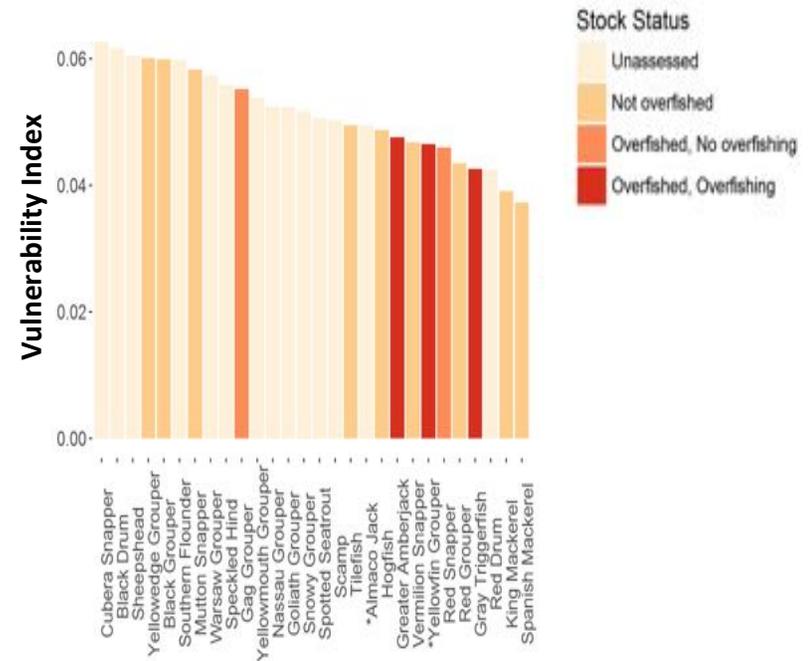
# Research Priorities

- 1) Mine existing data to assess interaction strengths between fishing and spawning to **identify species of highest vulnerability**

## 5. Transient FSAs are most vulnerable



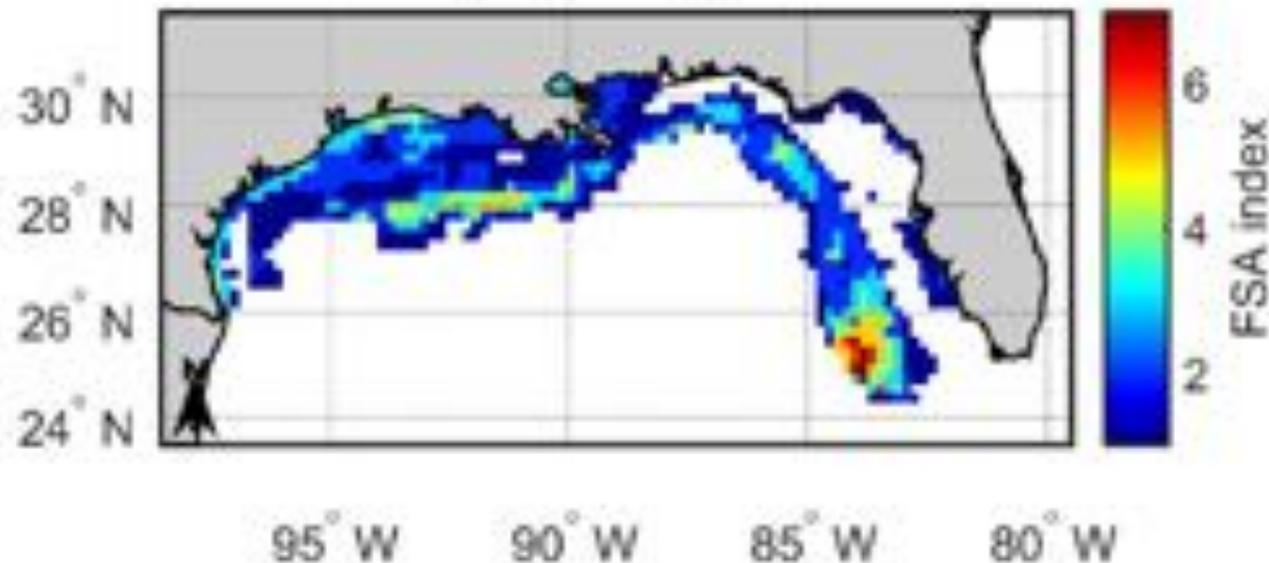
## 6. The most vulnerable spp. have not been assessed



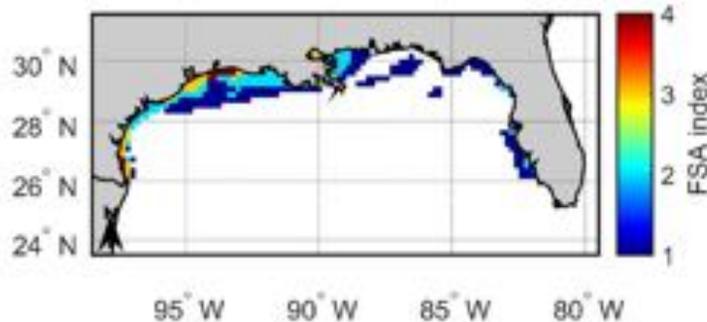
# Prioritizing monitoring and conservation efforts for fish spawning aggregations in the U.S. Gulf of Mexico

Arnaud Grüss, Christopher Biggs, William D. Heyman, and Brad Erisman  
(*In Review: Scientific Reports*)

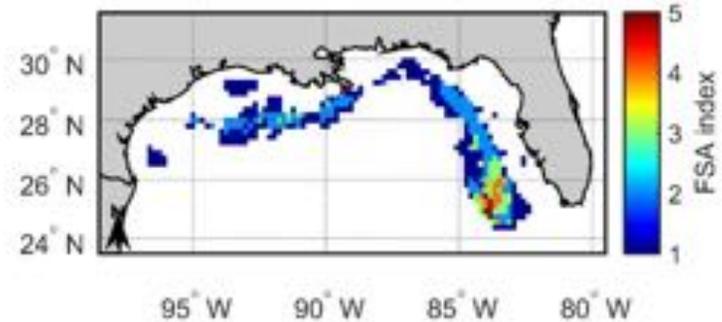
**(A) All species**



**(C) Coastal species**



**(B) Groupers-snappers**



# Results based on 26 fisheries-independent and 8 fisheries-dependent datasets

Name of the monitoring program	Alias
Alabama Marine Resources Division (AMRD) Fisheries Assessment and Monitoring Program (FAMP) Gillnet Survey (fisheries-independent)	ALGILL
National Marine Fisheries Service (NMFS) Bottom Longline Survey (fisheries-independent)	BLL
Deep Pelagic Nekton Dynamics of the Gulf of Mexico (DEEPEND) Survey (fisheries-independent)	DEEPEND
NMFS Expanded Annual Stock Assessment (EASA) Survey – Longline (fisheries-independent)	EASALL
NMFS EASA Survey – Vertical Line (fisheries-independent)	EASAVL
Fish and Wildlife Research Institute (FWRI) Bay Seine Survey (fisheries-independent)	FLBAY
FWRI Haul Seine Survey (fisheries-independent)	FLHAUL
FWRI For-Hire At-Sea Observer Program (fisheries-dependent)	FLOBS
FWRI Purse Seine Survey (fisheries-independent)	FLPURSE
FWRI Reef Fish Trap Survey (fisheries-independent)	FLTRAP
FWRI Trawl Survey (fisheries-independent)	FLTRAWL
Gulf of Mexico Fisheries Information Network (GulfFIN) Head Boat Port Sampling Program (fisheries-dependent)	GULFFINPORT
NMFS Gulf of Mexico Shark Pupping and Nursery (GULFSPAN) Survey (fisheries-independent)	GULFSPAN
Southeast Area Monitoring and Assessment Program (SEAMAP) Gulf of Mexico Inshore Bottom Longline Survey (fisheries-independent)	INBLL
Louisiana Department of Wildlife and Fisheries (LDWF) Vertical Line Survey (fisheries-independent)	LAVL
Mississippi Department of Marine Resources (MDMR) Sport Fish Shark Gillnet Survey (fisheries-independent)	MSGILL
MDMR Sport Fish Shark Handline Survey (fisheries-independent)	MSHAND
MDMR Fisheries Assessment and Monitoring (FAM) Trawl Survey (fisheries-independent)	MSTRAWL
NMFS Southeast Gillnet Observer Program (fisheries-dependent)	OBSGILL
Reef Fish Bottom Longline Observer Program (fisheries-dependent)	OBSLL
Southeastern Shrimp Fisheries Observer Coverage Program (fisheries-dependent)	OBS SHRIMP
Reef Fish Vertical Line Observer Program (fisheries-dependent)	OBSVL
NMFS Panama City Trap Survey (fisheries-independent)	PCTRAP
NMFS Panama City Video Survey (fisheries-independent)	PCVIDEO
NMFS Pelagic Observer Program (fisheries-dependent)	POP
NMFS Shark Bottom Longline Observer Program (fisheries-dependent)	SBLOP
NMFS Small Pelagics Survey (fisheries-independent)	SMALLPEL

# 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.) to database

## **Long-term (3-10 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

# Discussion Questions