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

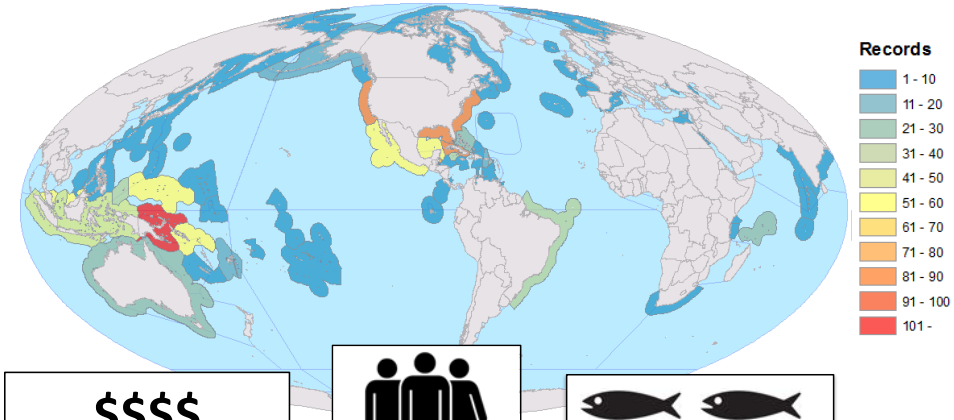
Brad Erisman, Will Heyman, Shinichi Kobara, Christopher Biggs, Nick Farmer, Susan Lowerre-Barbieri, Mandy Karnauskas, Jorge Brenner

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

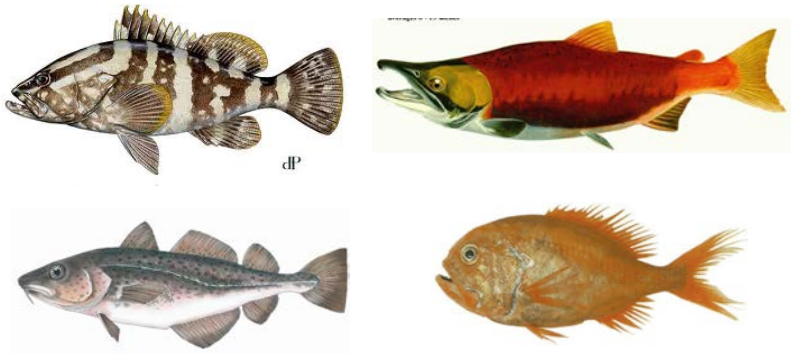
Fish Spawning Aggregations (FSAs) are important to global fisheries...



$$$$
Billions

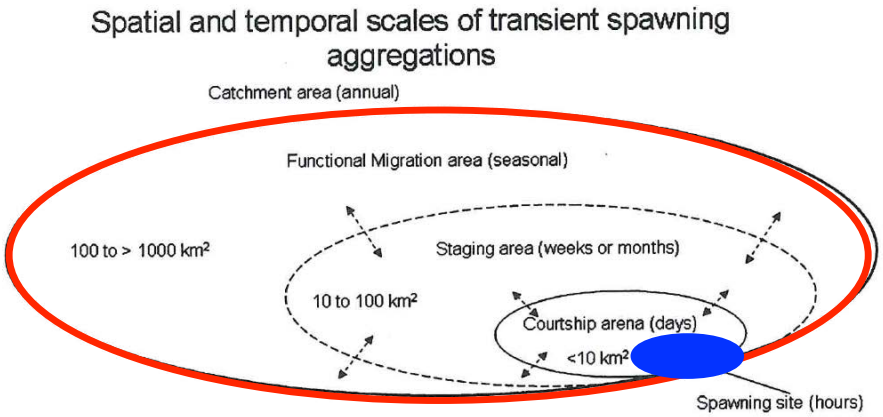
Millions

Millions

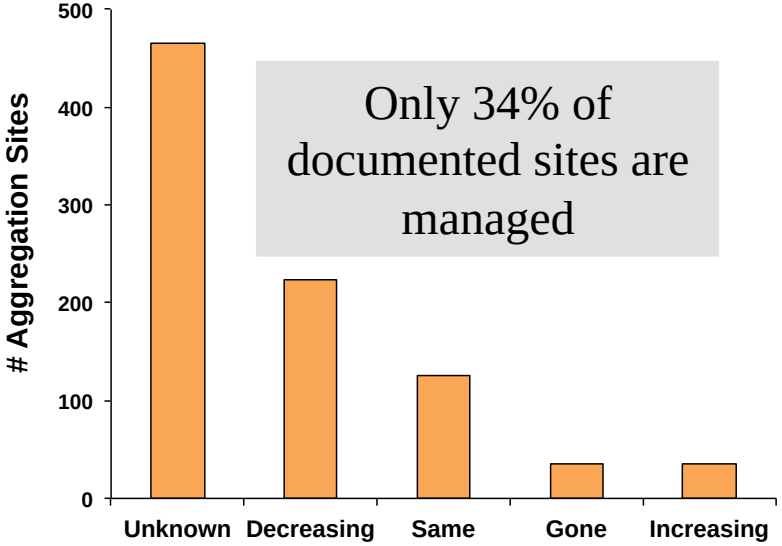


Global Challenge

FSAs can be vulnerable to overfishing...fishing effects "scale up"



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



Only 34% of documented sites are managed

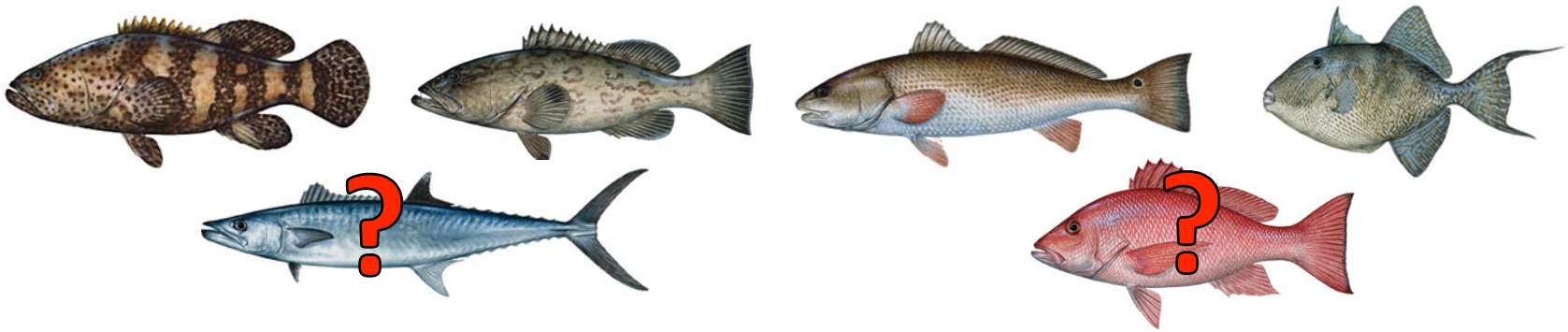
Inclusion within management works

- 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[1], Christopher C. Koenig[1,2] & L. Alan Collins[2]
[1] *FSU/NMFS Institute for Fishery Resource Ecology, Department of Biological Science, Florida State University, Tallahassee, FL 32306-2043, U.S.A.*
[2] *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

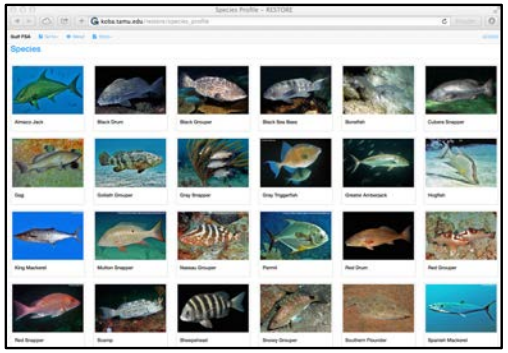
Compile and evaluate existing information on fish spawning aggregations in the Gulf of Mexico as the basis to design a cooperative, regional monitoring program.

Objectives

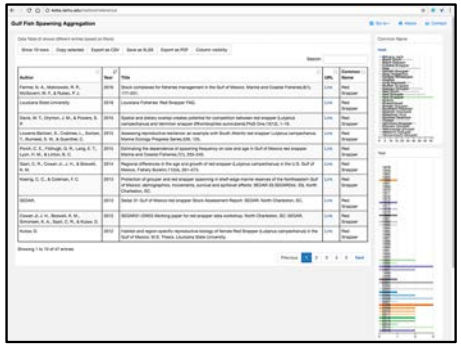
1. Identify existing literature, datasets, and monitoring programs in the GOM that could inform regional monitoring of fish spawning aggregations.
2. Compile existing biological and fisheries information on GOM species known or likely to form spawning aggregations in the region.
3. Synthesize information 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

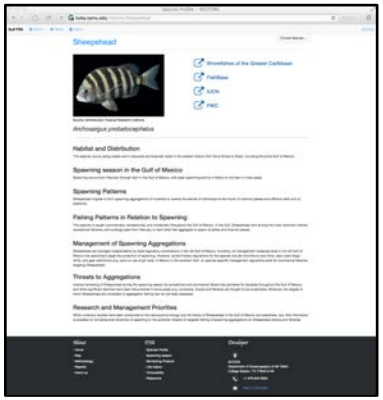
28 species



Database of 800 refs.



Species Profiles



Life history and spawning behavior

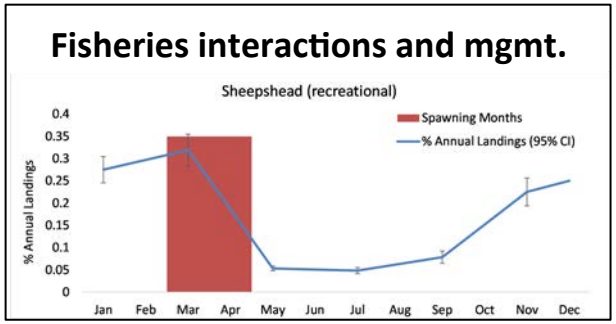
General Information					Intrinsic Indicators					
Common Name	Genus	Species	Aggregation Type (1-4)	Spawning Season Months	Spawning Season Duration (1-4)	Max Age (years)	K ($\pm\beta$ Growth Coeff.	L_∞ Asymptotic Length (cm)	Age at Maturity (mo)	M Nat. mort.	Density Change (1-6)
Gag Grouper	Mycteroperca	Mycteroperca microlepis	4	JFMA	3	31	0.1342	127.795	42	0.1342	3
Red Grouper	Epinephelus	Epinephelus morio	3	MAMJJJ	3	29	0.1253	82.9	33.6	0.14	2
Red Drum	Sciaenops	Sciaenops ocellatus	3	AJSON	3	67	0.17	98.7	60	0.18	4
Red Snapper	Lutjanus	Lutjanus campechanus	3	MJJJASO	3	48	0.191857	85.6317	24	0.17	2
Vermilion Snapper	Rhomboplites	Rhomboplites aurorubens	3	AMJJJASO	3	26	0.3254	34.4	24	0.25	2
Greater Amberjack	Seriola	Seriola dumerili	3	MAMJJJ	3	15	0.144798	141.6	27	0.25	3
Black Grouper	Mycteroperca	Mycteroperca bonaci	3	JJFMA	3	33	0.1433	133.4	78	0.138	4
Gray Triggerfish	Balistes	Balistes capriscus	3	MJJJASO	3	15	0.14	58.97	18	0.3	2
Hogfish	Lachnolaimus	Lachnolaimus maximus	2	JJSJFMAMJJJ	2	23	0.1057	84.87	10.8	0.178	2
Nassau Grouper	Epinephelus	Epinephelus striatus	4	JJF	3	29	0.13	76	60	0.18	6
Yellowedge Grouper	Hyporthodus	Hyporthodus flavolimbatus	1	85	0.058	106.45			Qbma:		
Snowy Grouper	Hyporthodus	Hyporthodus niveatus	2	AMJJJASO	2	30	0.094	106.46	L14=0.1057		
Almaco Jack	Seriola	Seriola rivoliana	3	JJASOJF	3				L59=0.0611		
Cubera Snapper	Lutjanus	Lutjanus cyanopterus	3	JJJFMA	3	20	0.18	120	M0=0.679		
Scamp	Mycteroperca	Mycteroperca phenax	3	JFMAMJJ	3	31	0.09	77.2	M1=0.0968 (cuba)		
Speckled Hind	Epinephelus	Epinephelus drummondhayi	3	AMJJJASO	3	45	0.12	88.8	M2=0.1896 (fl keys)		
Tilefish	Lopholatilus	Lopholatilus chamaeleonticeps	3	JFMAMJJJ	3	40	0.13	87	M3=0.079, (s. fl=0.259, key large		
Yellowfin Grouper	Mycteroperca	Mycteroperca venenosa	4	JFM	4				Marquesas keys=0.168, dry tortuga		
Yellowmouth Grouper	Mycteroperca	Mycteroperca interstitialis	1	28	0.08	82.8			M4=0.094 (offshore, 0.36;fl keys		
Goliath Grouper	Epinephelus	Epinephelus itajara	3	37	0.2937	222.7			L13=0.128		
Mutton Snapper	Lutjanus	Lutjanus analis	3	40	0.169	86.7			M5=0.0798		
Warsaw Grouper	Hyporthodus	Hyporthodus nigritus	4	41	0.05	239.4			M6=0.19 (Mexic		
Spanish Mackerel	Scomberomorus	Scomberomorus maculatus	3	15	0.63	50			M7=0.98		
King Mackerel	Scomberomorus	Scomberomorus cavalla	3	26	0.1879	115.4			2	0.17	2
Spotted Seatrout	Cynoscion	Cynoscion nebulosus	3	18	0.32	68.7			48	0.178	2
Sheepshead	Archosargus	Archosargus probatocephalus	3	18	0.34	46.7			12	0.3	3
Southern Flounder	Paralichthys	Paralichthys lethostigma	4	MAMJJJ	4	10	0.36	46.7	24	0.15	1
Black Drum	Pogonias	Pogonias cromis	3	ONDJ	3	8	0.28	65.2	24	0.36	5
			3	JFMA AJJJO	3	34	0.167	111.8	60	0.06	4

Spawning Seasons

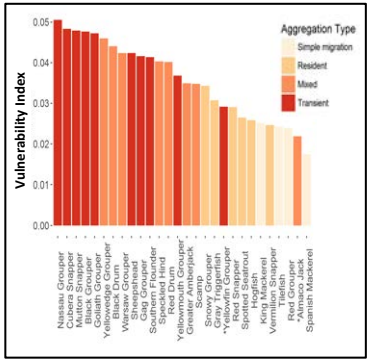
Species	Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mycteroperca microlepis	Gag												
Epinephelus morio	Red Grouper												
Sciaenops ocellatus	Red Drum												
Lutjanus campechanus	Red Snapper												
Rhomboplites aurorubens	Vermilion Snapper												
Seriola dumerili	Greater Amberjack												
Mycteroperca bonaci	Black Grouper												
Balistes capriscus	Gray Triggerfish												
Lachnolaimus maximus	Hogfish												
Epinephelus striatus	Nassau Grouper												
Hyporthodus flavolimbatus	Yellowedge Grouper												
Hyporthodus niveatus	Snowy Grouper												
Seriola rivoliana	Almaco Jack												
Lutjanus cyanopterus	Cubera Snapper												
Mycteroperca phenax	Scamp												
Epinephelus drummondhayi	Speckled Hind												
Lopholatilus chamaeleonticeps	Tilefish												
Mycteroperca venenosa	Yellowfin Grouper												
Mycteroperca interstitialis	Yellowmouth Grouper												
Epinephelus itajara	Goliath Grouper												
Lutjanus analis	Mutton Snapper												
Hyporthodus nigritus	Warsaw Grouper												
Scomberomorus maculatus	Spanish Mackerel												
Scomberomorus cavalla	King Mackerel												
Cynoscion nebulosus	Spotted Seatrout												
Archosargus probatocephalus	Sheepshead												
Paralichthys lethostigma	Southern Flounder												
Pogonias cromis	Black Drum												

Bathymetric and FSA maps

Fisheries interactions and mgmt.



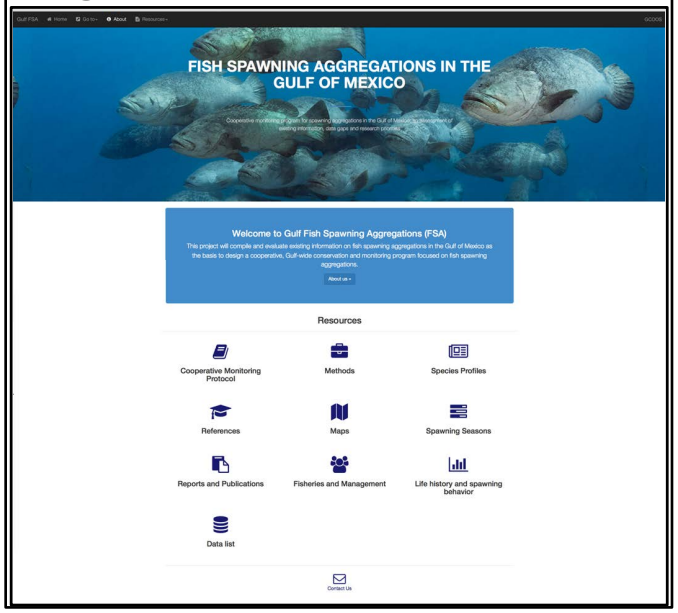
Vulnerability Assessments



Monitoring Protocol

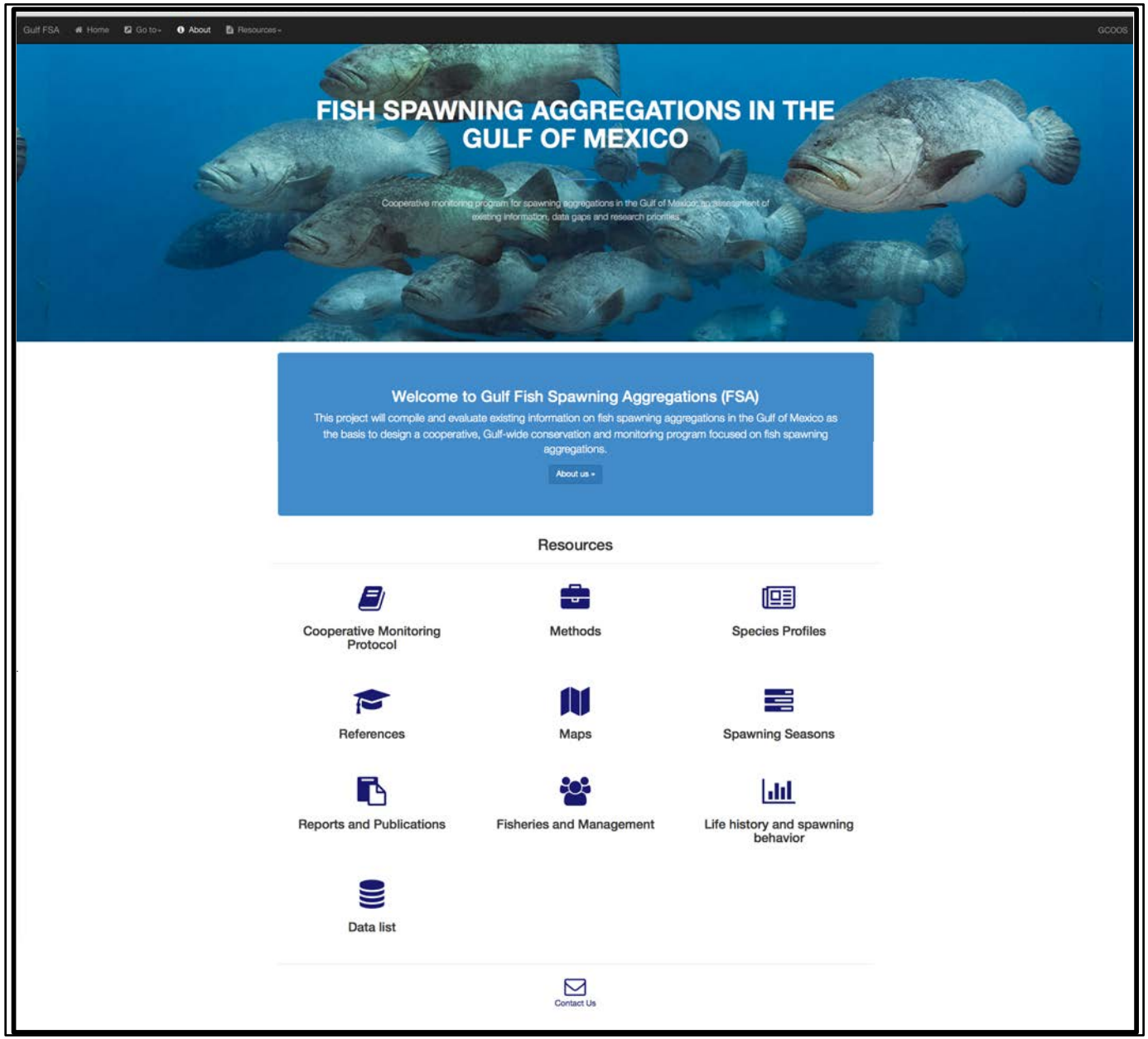
Outputs

gcoos3.tamu.edu/restore



FSA Workshop
October 4-5 2016, NOAA SERO

http://gcoos3.tamu.edu/restore



Take-Home Messages

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

Research Priorities

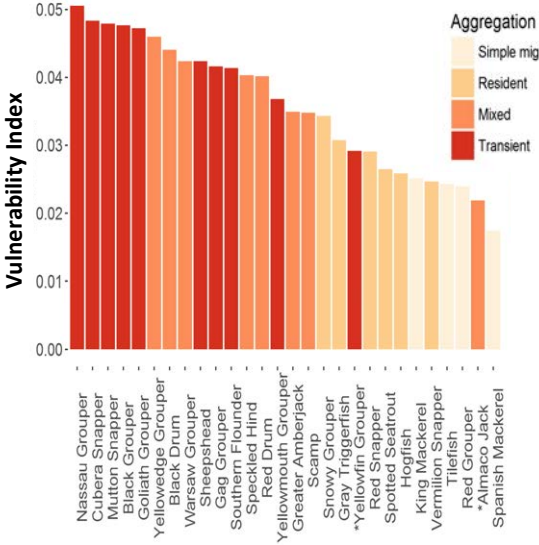
1) Mine existing data to assess interaction strengths between fishing and spawning to **identify species of highest vulnerability**

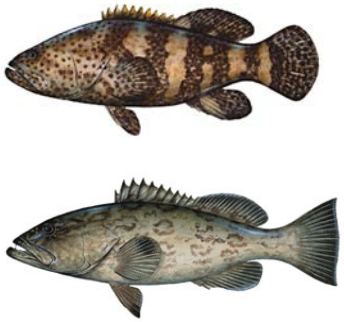
2) Work collaboratively with commercial and recreational fishers to identify, **characterize, assess, and monitor key spawning areas** (i.e. multi-species FSAs)

3) Contribute to regional **stock assessments of aggregating species** by incorporating spawning dynamics into existing assessment models

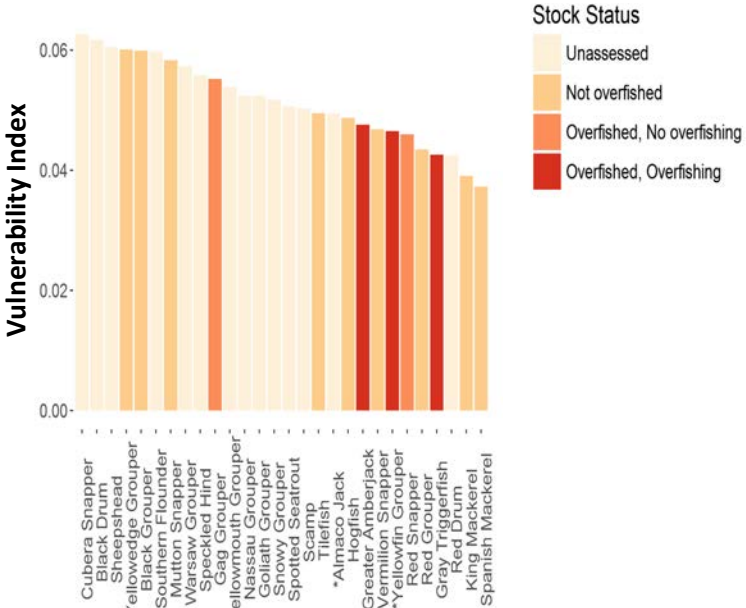
Research Priority #1: Mine existing data to assess interaction strengths between fishing and spawning to identify species of highest vulnerability

Transient FSAs are most vulnerable





The most vulnerable spp. have not been assessed

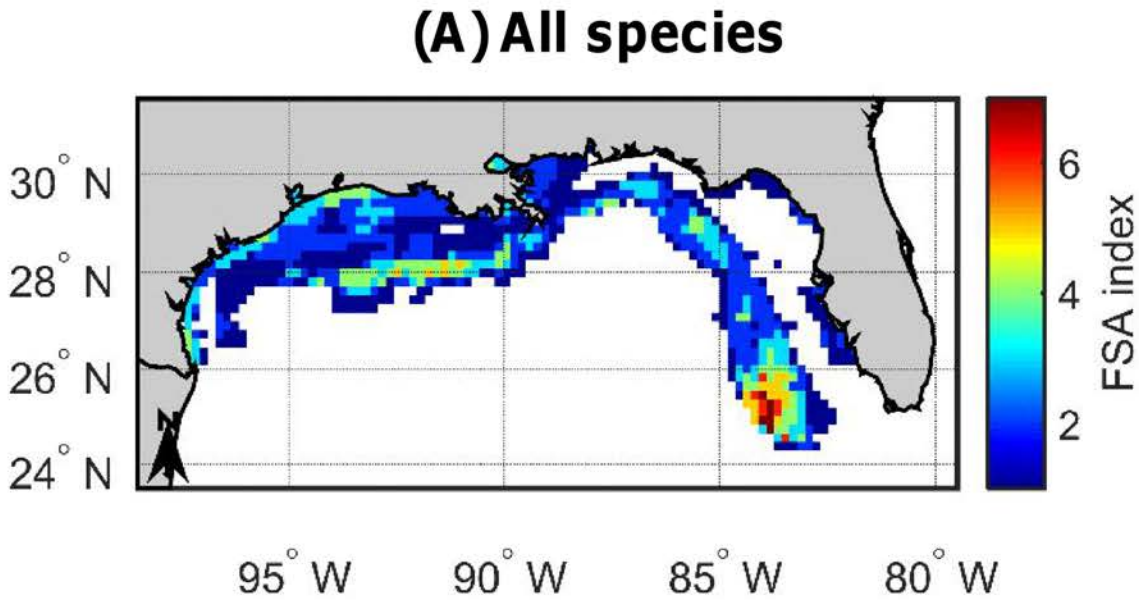


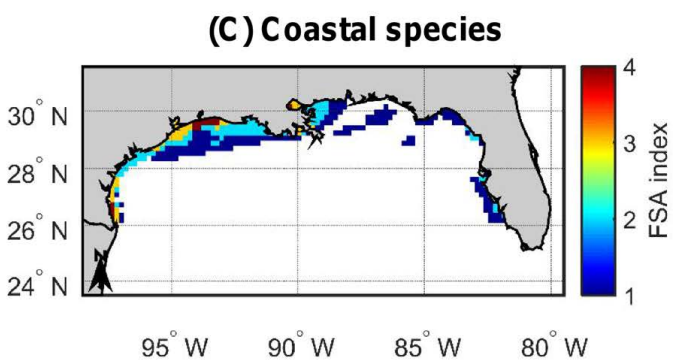
Research Priority #2: Work collaboratively with commercial and recreational fishers to identify, characterize, assess, and monitor key spawning areas (i.e. multi-species FSAs)

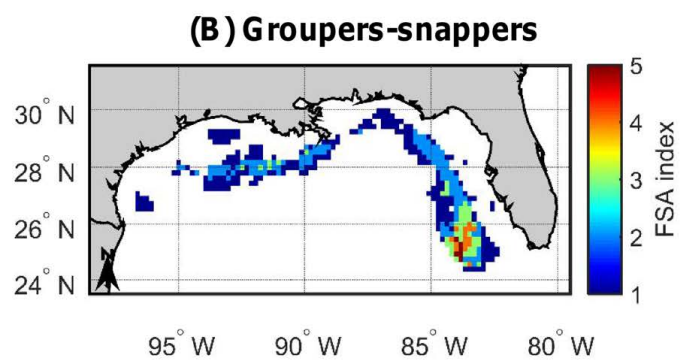
Name of the monitoring program	Alias
Alabama Marine Resources Division (AMRD) Fisheries Assessment and Monitoring Program (FAMP) Gillnet Survey (fisheries-independent)	ALGILL
National Marine Fisheries Service (NMFS) Bottom Longline Survey (fisheries-independent)	BLL
Deep Pelagic Nekton Dynamics of the 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)	OBSSHRIMP
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

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







Next Steps

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

- Enhance visibility, access, and capability of website, profiles, databases
- Identify a long-term home for the database
- 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

1. Is this information useful to the SSC for stock assessments?

2. What other uses do you see for these data?

3. How can we improve the database to its usage by the SSC?

4. What do you see as the main priorities for research moving forward?