Eye on the Gulf - Electronic Monitoring:
An Effective Tool for Improving Fishery Sustainability

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**Data Collection AP Meeting**
13 February 2023

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MISSION

The Center for Fisheries Electronic Monitoring at Mote is dedicated to developing and implementing electronic monitoring video technology as a tool in the Gulf of Mexico commercial reef fish fishery to provide industry and management the accurate, independent data required to ensure long-term fishery health.
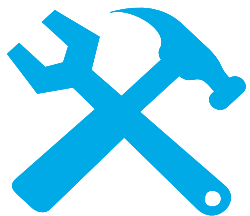
CFEMM
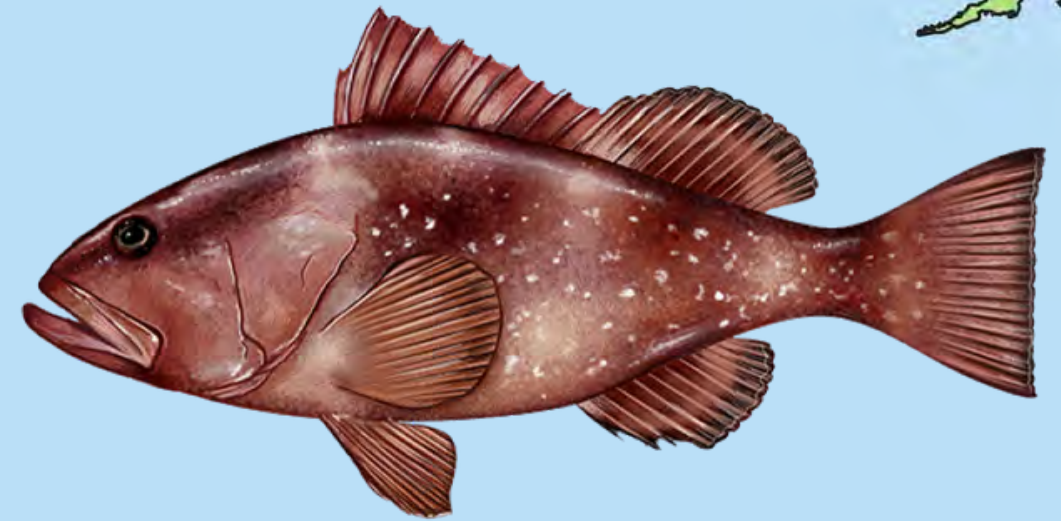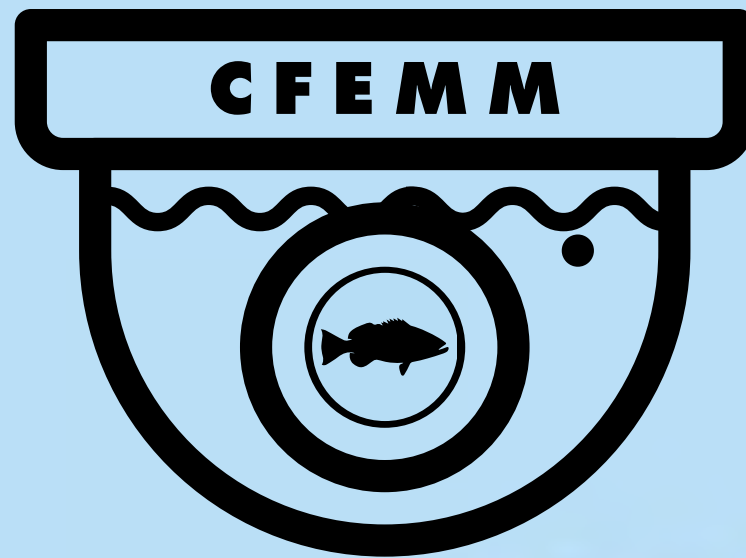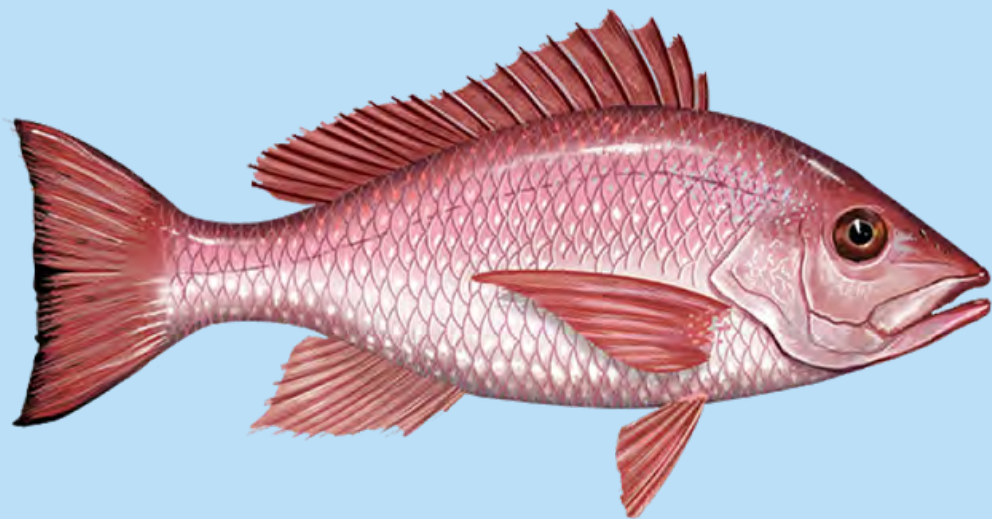
Why is EM Needed in the Gulf of Mexico Reef Fish Fishery?

*Growing need for more timely and accurate data*

1. **Limited resources ($$$$) for observer coverage** - **~2%** of the vessels covered by observers /yr
2. **Limited bycatch & discard information** - NOAA - voluntary reporting program, often "0" discards reported

NMFS Management Goal - "Implement Electronic Methods to Improve Data Collection, Accuracy & Timeliness"

Apply EM as an Effective "Tool" 🔧 **to Fill Important Data Gaps**

Fishery-Dependent Monitoring Complement
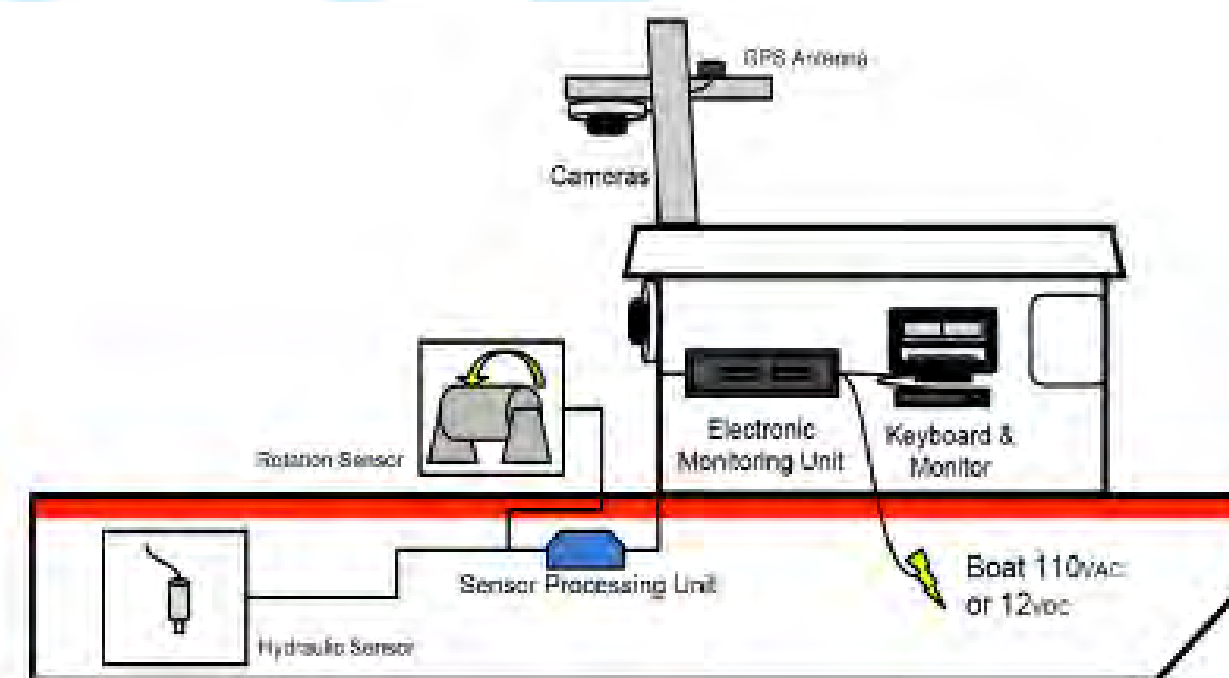
What is an EM System?

Integrated – onboard video cameras, GPS, and sensors

Cameras

Processor w/2 Hard Drive Slots

Cabin Ceiling Mounted Monitor & Pocessor

2021 SWI SWIM+ System

EM Unit (EMU) Components

- Processor (Linux™ software)
- 2 encrypted 1-2 tb hard drives
- GPS
- IP cameras (3.6mm) w/LED's (up to 8)
- hydraulic sensor
- rotation sensor(s)
- monitor
- waterproof keyboard w/mouse

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Monitor View - Cameras & Sensors

Track -
- vessels (status), collect hard drives

Inhouse Processes

Pre-process -
- hard drives for review – Linux™ to Windows™

Review - 25% complete events *(set, soak, haul)/trip*, (75% *archived* - available for data extraction, auditing)
- events - random number generated
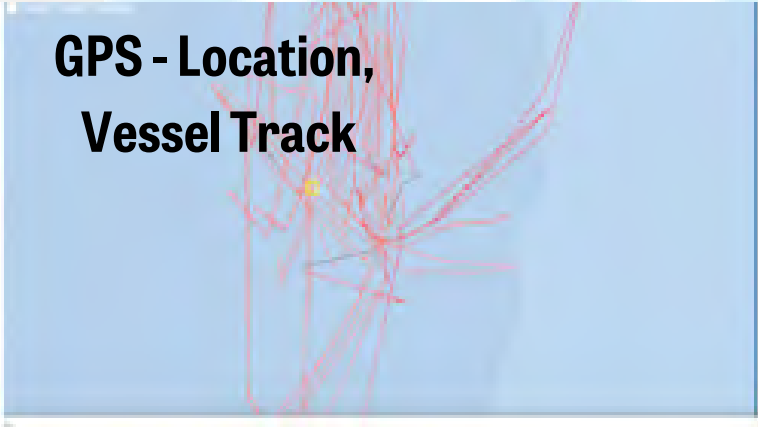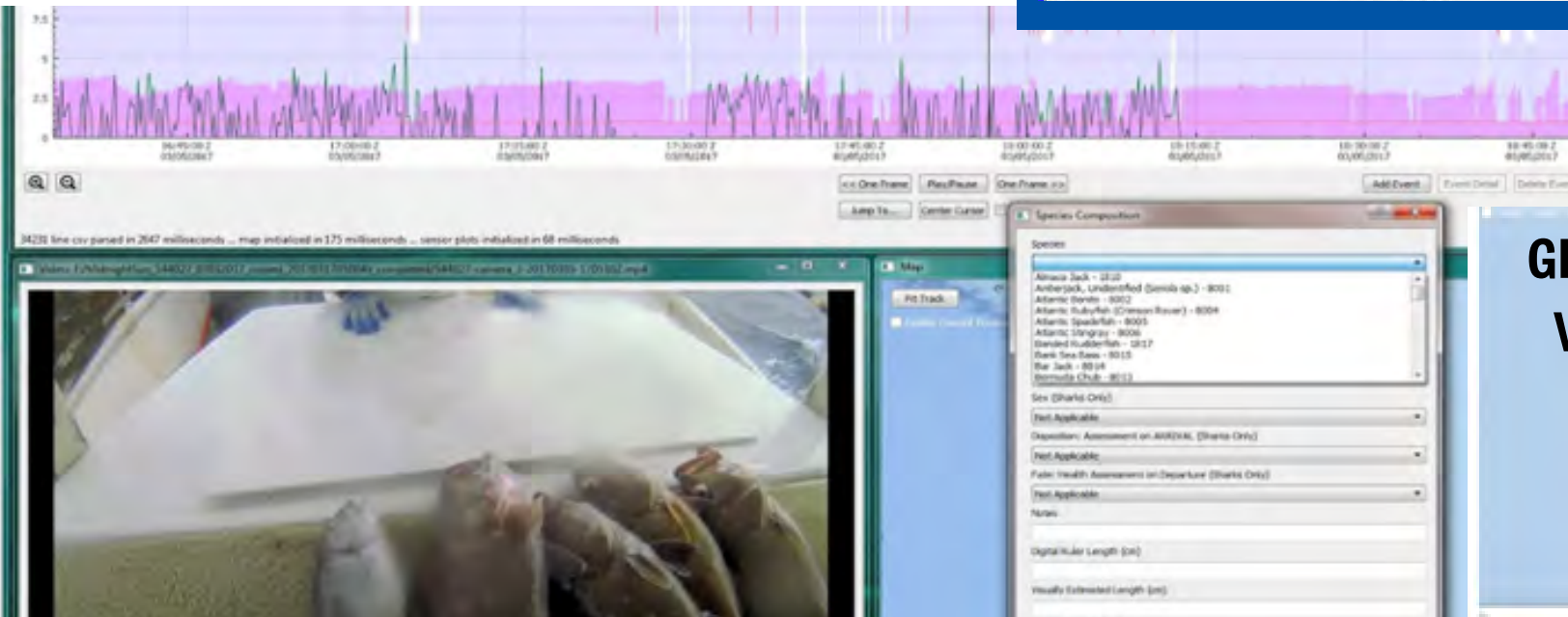- species annotated (CFEMM Staff + trained long-term volunteers)

Storage – dedicated EM server, Network Attached Storage (NAS) systems

QA/QC – >50 manual & automated data checks

Data - process & aggregate **–** "R" statistical software
- link to metadata (environmental, bathymetric, oceanographic, geological)
  - shapefiles - closure areas, bottom type; rasters - temp., chlorophyll

Complete Event

RED LINES = Fish Annotations

SET   SOAK   HAUL

Trip Timeline - Series of Events
Sensors - Speed, Gear Activation

GPS - Location,
Vessel Track

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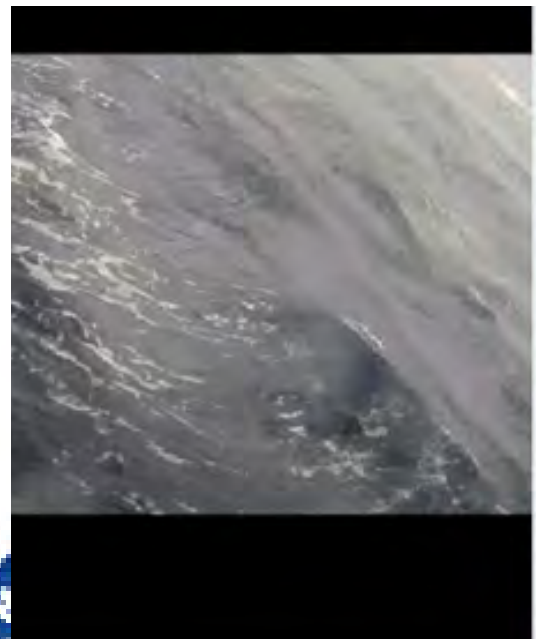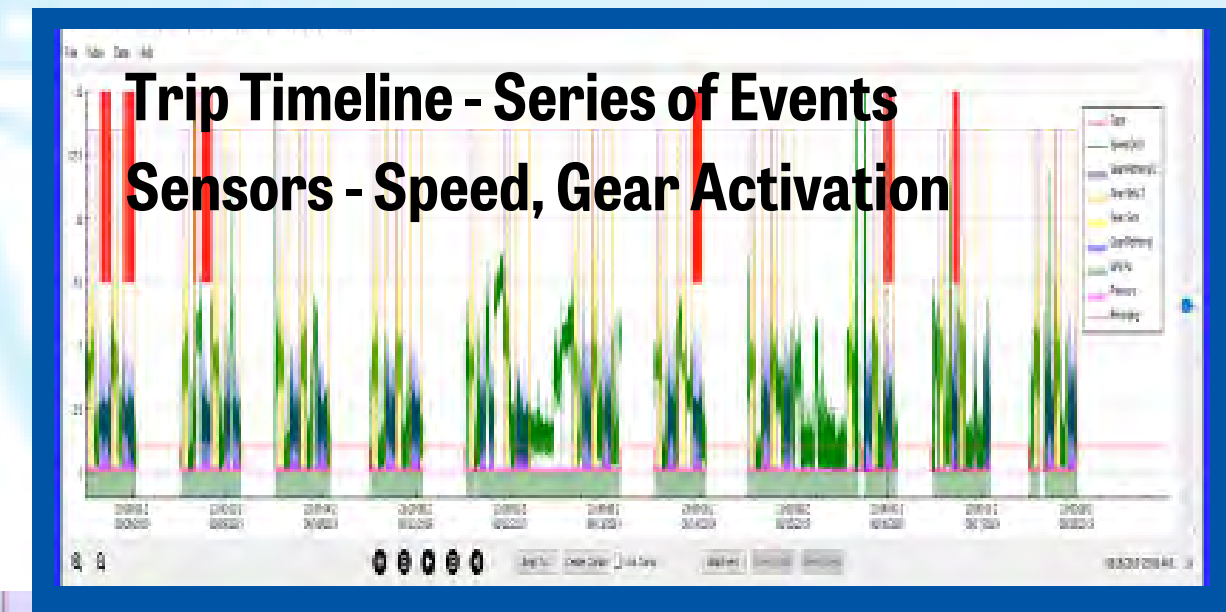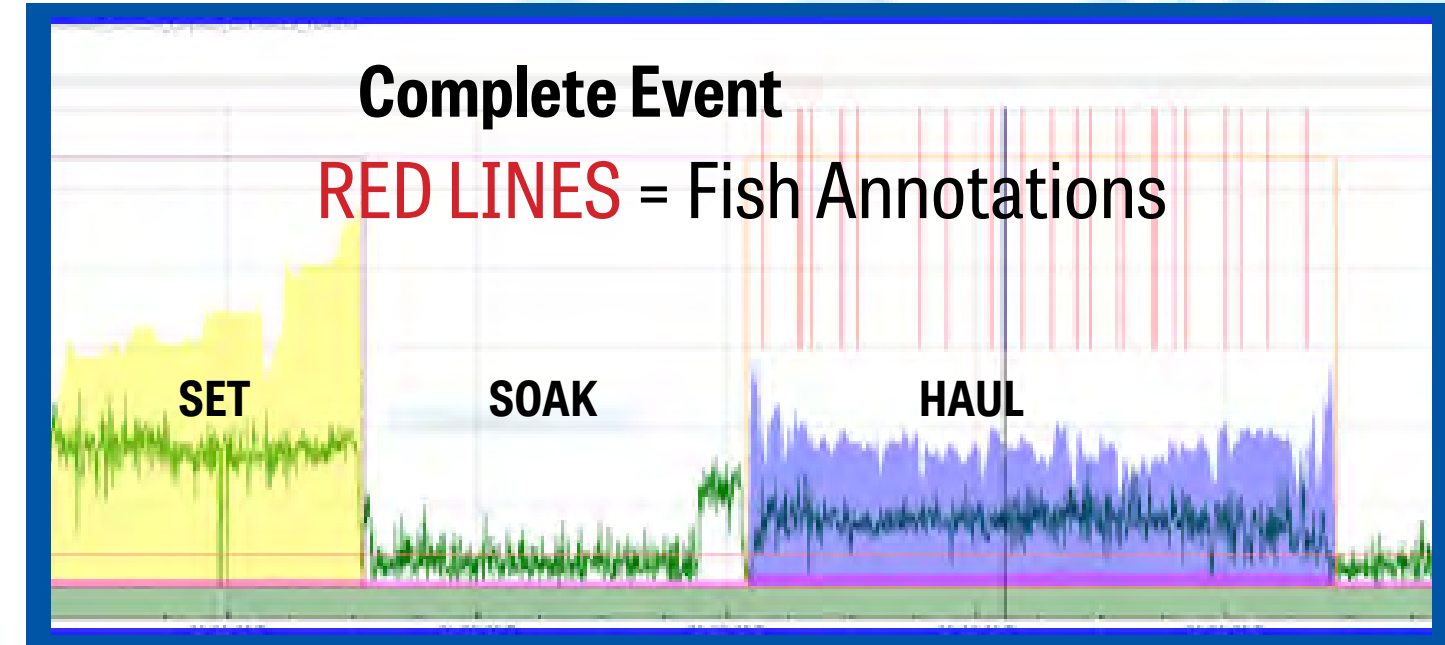
Vessel Trip Review Template - Annotations (drop down menus)

Identification: species, or grouping

Handling:
- brought onboard
- not handled (dropped off)
- cutoff at rail (entanglement)
- unknown

Condition (Arrival):
- live healthy
- live stomach and/or eyes
- live damaged,
- dead on
- arrival (damaged),
- dead on arrival (undamaged)
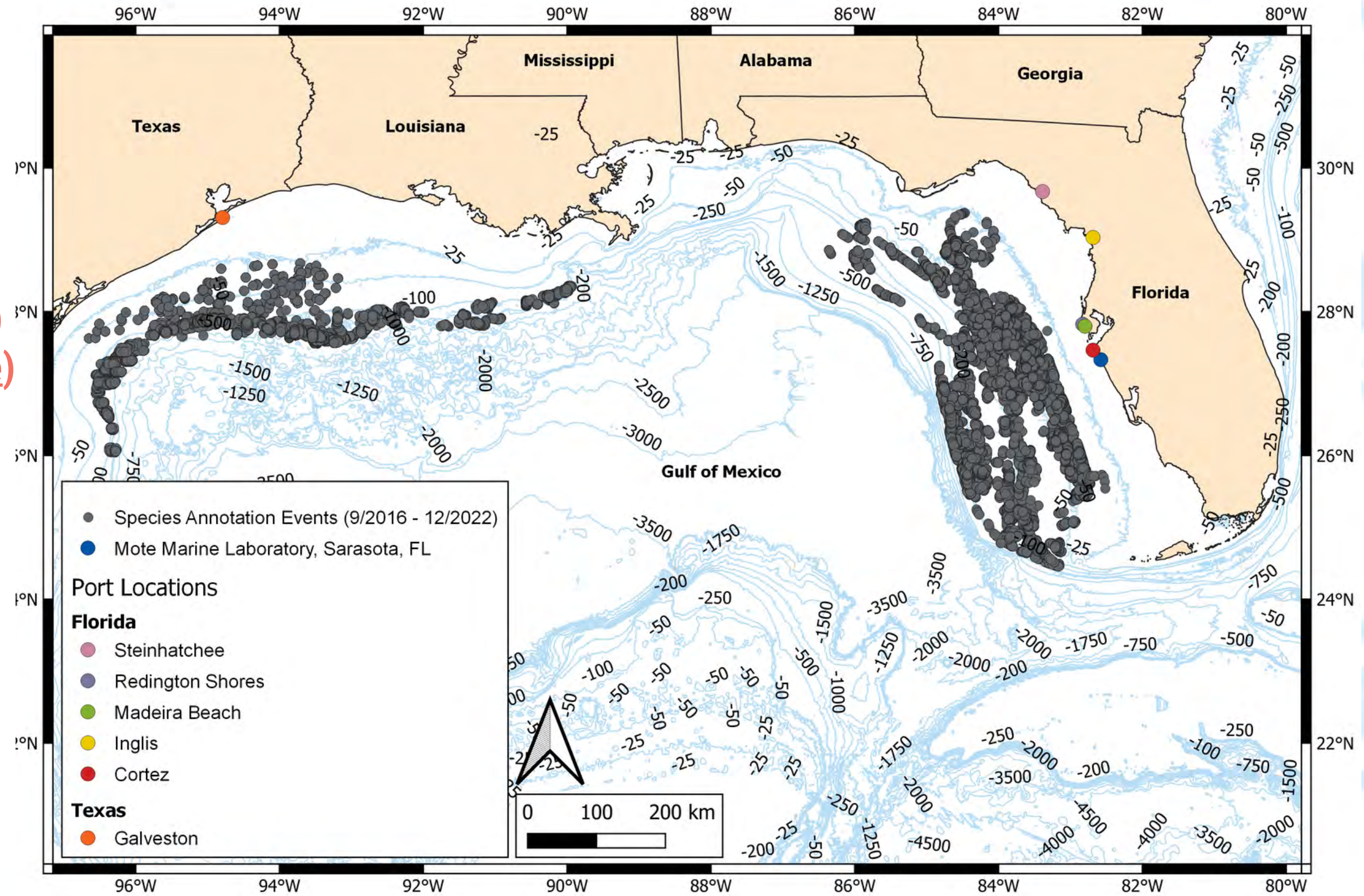- unknown condition

Fate:
- retained
- retained as bait
- discarded live healthy (vented),
- discarded live healthy (not vented)
- discarded
- live damaged (vented)
- discarded live damaged (not vented)
- discarded dead
- discarded
- unknown

Specific to shark bycatch:
- juvenile or adult
- sex
- estimated length category

small (< 1m), medium (1 to 2m), or large (> 2m)

Saltwater Inc. non-proprietary review software developed w/CFEMM

Species Composition ?

Species
Yellowedge Grouper

Handling
Brought on Board (Retained/Discarded)

Condition on Arrival
Live - Stomach and/or Eyes Protruding

Fate
Retained

Sex (Sharks Only)
Not Applicable

Notes

Digital Ruler Length (cm)

Shark Length Estimate (Shark Mandatory!)

Shark Q/A Required?
No

Save   Cancel

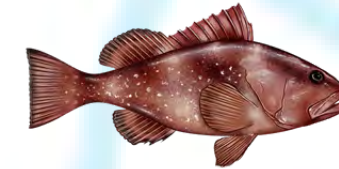| #	Time	Latitude	Longitude	Species	Handling	Condition on Arrival	Fate	Sex (Sharks Only)	Notes	Digital Ruler Length (cm)	Shark Length Estimate (Shark Mandatory!)	Shark Q/A Required?
197	2019-08-16T22:52:55Z	25 36.985 N	84 11.353 W	Yellowedge Grouper	Brought on Board (Retai...	Dead on Arrival - Damag...	Discarded - Dead	Not Applicable				No
198	2019-08-16T23:03:32Z	25 37.307 N	84 11.203 W	Yellowedge Grouper	Brought on Board (Retai...	Live - Stomach and/or E...	Retained	Not Applicable				No
199	2019-08-16T23:06:43Z	25 37.406 N	84 11.161 W	Speckled Hind	Brought on Board (Retai...	Live - Healthy	Retained	Not Applicable				No
200	2019-08-16T23:11:02Z	25 37.545 N	84 11.094 W	Blueline Tilefish	Brought on Board (Retai...	Live - Healthy	Retained	Not Applicable				No
201	2019-08-16T23:18:10Z	25 37.781 N	84 10.993 W	Yellowedge Grouper	Brought on Board (Retai...	Live - Stomach and/or E...	Retained	Not Applicable				No
202	2019-08-16T23:24:05Z	25 37.976 N	84 10.916 W	Yellowedge Grouper	Brought on Board (Retai...	Live - Stomach and/or E...	Retained	Not Applicable				No
203	2019-08-16T23:27:20Z	25 38.007 N	84 10.883 W	Yellowedge Grouper	Brought on Board (Retai...	Live - Stomach and/or E...	Retained	Not Applicable				No
204	2019-08-16T23:34:04Z	25 38.310 N	84 10.784 W	Moray Eel, Unidentified	Brought on Board (Retai...	Live - Healthy	Retained as Bait	Not Applicable				No
205	2019-08-16T23:35:20Z	25 38.353 N	84 10.768 W	Speckled Hind	Brought on Board (Retai...	Live - Healthy	Retained	Not Applicable				No

EM Data - Examples

Top 20 species - all vessels (TX & FL BLL & VL)

Common Name	Number Caught	% of All Catch
Red Grouper	64784	39.38
Red Snapper	52011	31.62
Yellowedge Grouper	7689	4.67
Tilefish, Golden	7124	4.33
Blueline Tilefish	3672	2.23
Vermilion Snapper	3110	1.89
King Snake Eel	2661	1.62
Dogfish, Smooth (Florida)	2373	1.44
Hake, Unidentified	1581	0.96
Dogfish, Spiny (Cuban)	1426	0.87
Atlantic Sharpnose Shark	1291	0.78
Scamp	1281	0.78
Gag Grouper	1253	0.76
Sandbar Shark	833	0.51
Mutton Snapper	799	0.49
Snowy Grouper	793	0.48
Jolthead Porgy	726	0.44
Blacknose Shark	613	0.37
Moray Eel, Unidentified	603	0.37
Lane Snapper	566	0.34

shark bycatch = 🦈

46.93% Discard Rate

12.60% Discard Rate

10.90% Discard Rate

Fate - red grouper, red snapper, other bony fishes

Catch Fate	Red Grouper		Red Snapper		Other Bony Fishes	
	Number	%	Number	%	Number	%
Discarded - Dead	1164	1.80	785	1.51	1060	2.73
Discarded - Live and Damaged (Not Vented)	103	0.16	20	0.04	47	0.12
Discarded - Live and Damaged (Vented)	143	0.22	15	0.03	4	0.01
Discarded - Live and Healthy (Not Vented)	8321	12.84	3180	6.11	2302	5.94
Discarded - Live and Healthy (Vented)	20528	31.69	2395	4.60	483	1.25
Discarded - Unknown	144	0.22	161	0.31	331	0.85
Retained	34260	52.88	45422	87.33	28632	73.82
Retained as Bait	10	0.02	8	0.02	5599	14.44
Unknown Fate	111	0.17	25	0.05	326	0.84

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Shark Bycatch

n = 8,544 caught (5.20% of total catch)

24 species

9.53% dead on arrival

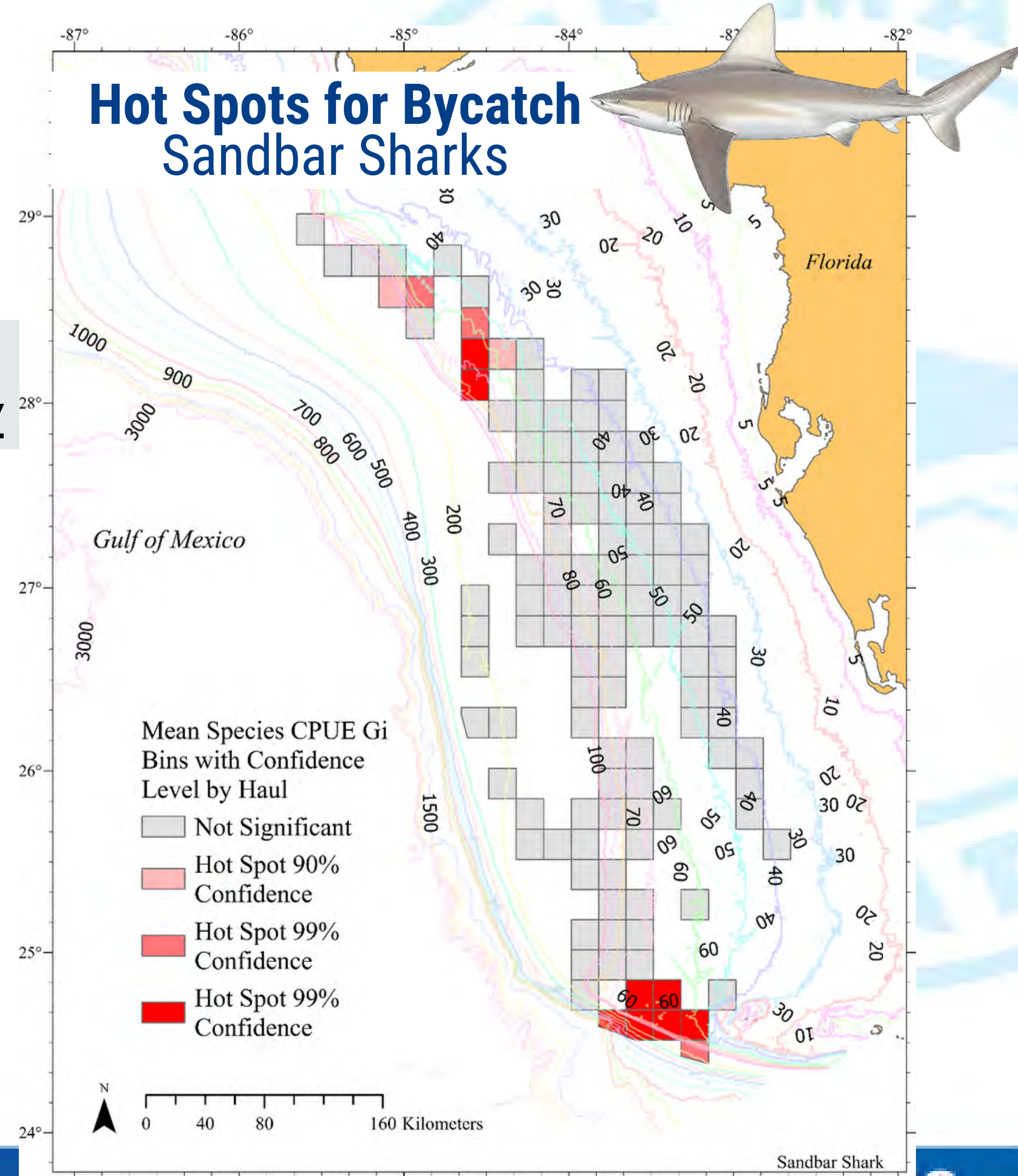| Common Name	Number Caught	% of All Catch	% of All Sharks
Dogfish, Smooth (Florida)	2373	1.44	27.77
Dogfish, Spiny (Cuban)	1426	0.87	16.69
Atlantic Sharpnose Shark	1291	0.78	15.11
Sandbar Shark	833	0.51	9.75
Blacknose Shark	613	0.37	7.17
Tiger Shark	425	0.26	4.97
Shark, Unidentified (most cut-off)	366	0.22	4.28
Nurse Shark	287	0.17	3.36
Silky Shark	258	0.16	3.02
Scalloped Hammerhead	181	0.11	2.12
Carcharhinid, Unidentified	126	0.08	1.47
Night Shark	123	0.07	1.44
Sharpnose Sevengill Shark	57	0.03	0.67
Sixgill Shark (all)	51	0.03	0.60
Spinner Shark	23	0.01	0.27
Great Hammerhead	15	0.01	0.18
Blacktip Shark	13	0.01	0.15
Chain Catshark	13	0.01	0.15
Lemon Shark	13	0.01	0.15
Dusky Shark	12	0.01	0.14
Shortfin Mako	12	0.01	0.14
Hammerhead, Unidentified	11	0.01	0.13
Angel Shark	10	0.01	0.12
Bull Shark	10	0.01	0.12
Common Thresher Shark	2	<0.01	0.02
Total	8544	5.20	100.00

Species Hotspot Maps

ArcGIS Optimized Hot Spot Analysis

- Set haul event data aggregated over time

*catch rate x 1,000 hook hrs averaged across set haul events - results generalized to 10 min. grid cells for vessel _confidentiality_

Hot Spots for Bycatch
Sandbar Sharks

Mean Species CPUE Gi Bins with Confidence Level by Haul

- Not Significant
- Hot Spot 90% Confidence
- Hot Spot 99% Confidence
- Hot Spot 99% Confidence

Gulf of Mexico

Florida

Sandbar Shark

Data Products -Distribution

A. Industry -
Vessel Reports
- vessel owners
- captains
- organizations
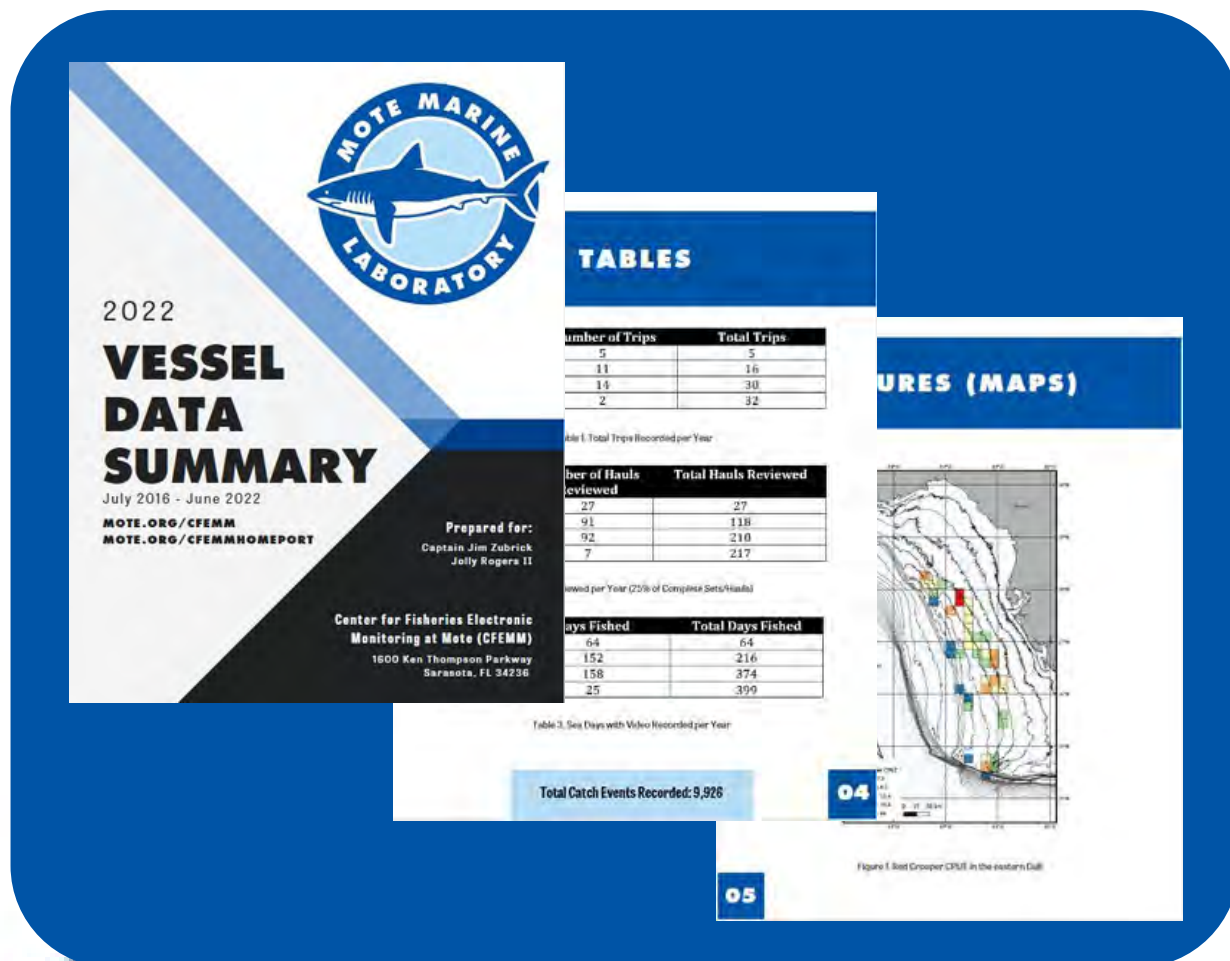
B. Working Groups -

- **SouthEast Data Assessment and Review (SEDAR) - presentations & 5 working papers (*stock assessment consideration*)**
    - Mutton Snapper, S79-DW-05.
    - Red Snapper, S74-DW-08.
    - Gray Snapper, S75-WP-04.
    - Hammerhead Sharks, S77-DW-05.
    - *Scamp (*Mycteroperca phenax*) S68-DW-22.
    - *S68 Commercial WG Final Report* - *recommendations support CFEMM GoM EM research*
        - *Use EM to provide contributions future stock assessments, particularly discard data*
        - *Provide sustained investment for EM GoM infrastructure*
        - *Support EM application for priority species biological sample collection*
        - *Provide regional support for machine learning activities*

- **Atlantic Coastal Cooperative Program (ACCSP) Commercial Technical (ComTech) EM Group - EM Data Standards**

- **International Council for the Exploration of the Seas (ICES) Technology Integration for Fisheries Dependent Data (WGTIFD)**

CFEMM Home Port

CFEMM Home Port is a password-protected website that allows commercial fishermen, fisheries managers, and researchers to exchange knowledge produced through electronic monitoring (EM) of fisheries in the Gulf of Mexico.
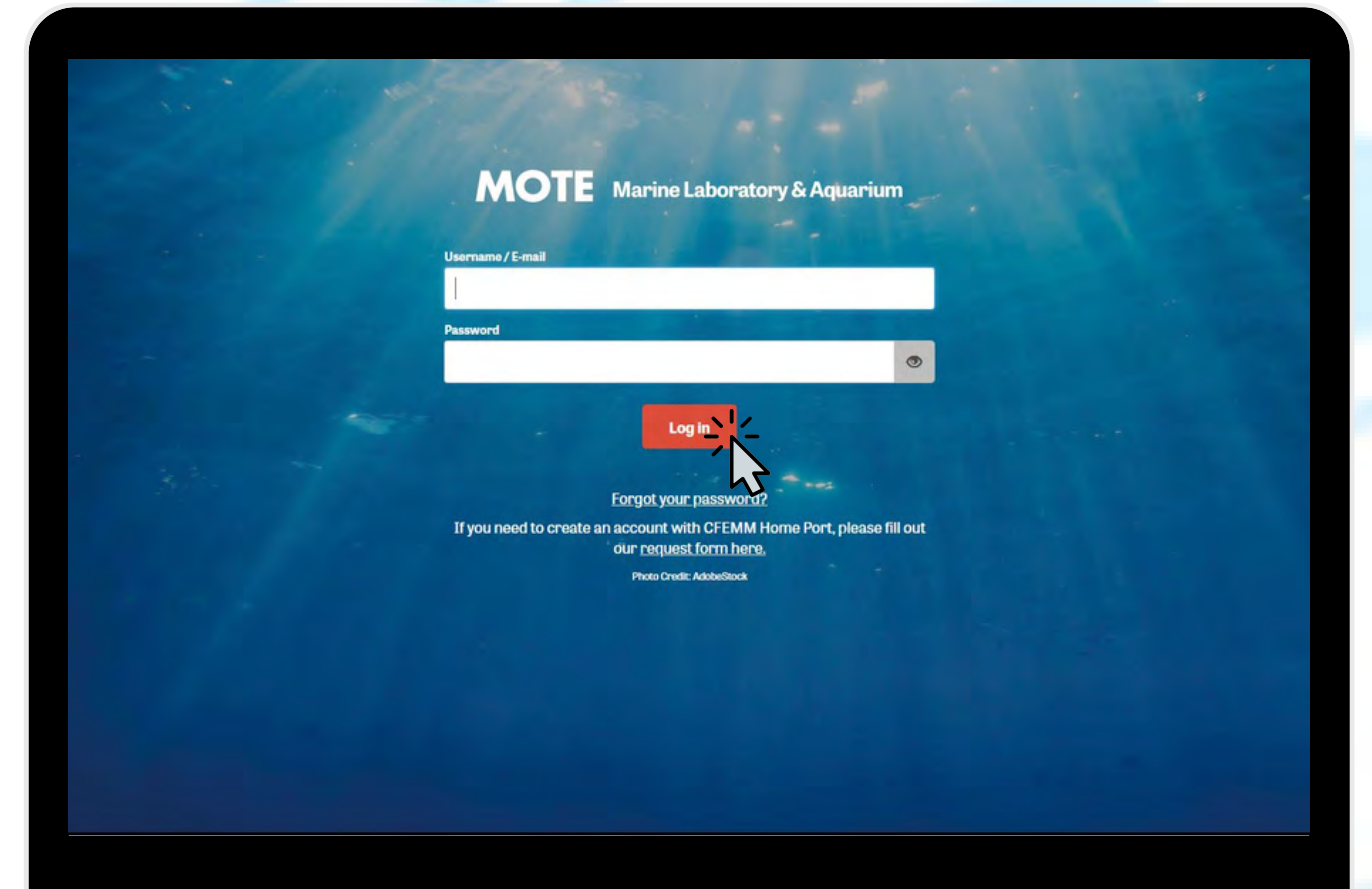
Commercial fishermen can:

✓ Download short highlight videos recorded from your trips

✓ Access data products* designed to help you optimize your fishing practices

✓ Fill out surveys

✓ Communicate with the CFEMM team and find contact information

Fishery managers can:

✓ Request data and data products* from CFEMM's participating commercial fishing vessels

✓ Facilitate discussions on how electronic monitoring can help answer fisheries questions

✓ Access forms, surveys, and non-disclosure agreements

✓ Request feedback direct from our participating fishermen

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*Note: Confidentiality of individual vessel data is of the utmost importance to the CFEMM and is protected through national policy guidance and/or at a CFEMM participants' request.

MOTE Marine Laboratory & Aquarium

Username / E-mail

Password

Log in

Forgot your password?

If you need to create an account with CFEMM Home Port, please fill out our request form here.

Photo Credit: AdobeStock

Support -
Net Gains Alliance
NOAA Cooperative Research Program

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CFEMM *Shift* in Data Collection - 2021

Southeast Region Electronic Technologies Implementation Plan

AUGUST 2021

Prior 2021 - (move towards compliance)
- increase vessel participation, data collection
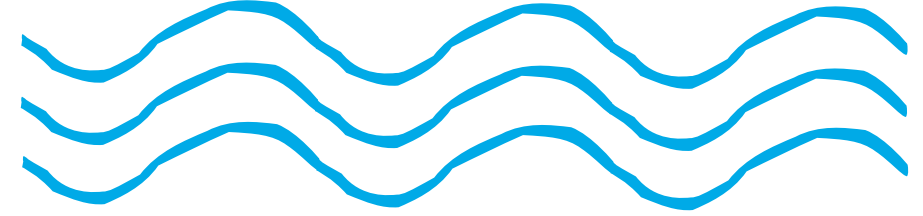
Mid 2021 - adaptive approach & proactive measures
- address industry and management data gaps with innovative methods - *example projects shown next* »»

Maintaining Industry Engagement, Continuing to Build Database & Staying Poised for

NOAA ByCatch Reduction and Engineering Program -

A. Underwater Camera (UCAM) & Deployment Device

Onboard Hauling Camera View prior to cut-off

Same Event UCAM - Sandbar shark, adult female

New EM Tool - *developed **1st** underwater camera & deployment device integrated w/EM system on BLL vessel*

Improved:
- video imagery to document large shark cut-offs (*important - threatened & endangered species*)
- species identification, maturity, sex, and size range accuracy
- fate designation
- views of potential predators (marine mammals)

NOAA Bycatch Reduction and Engineering Program -
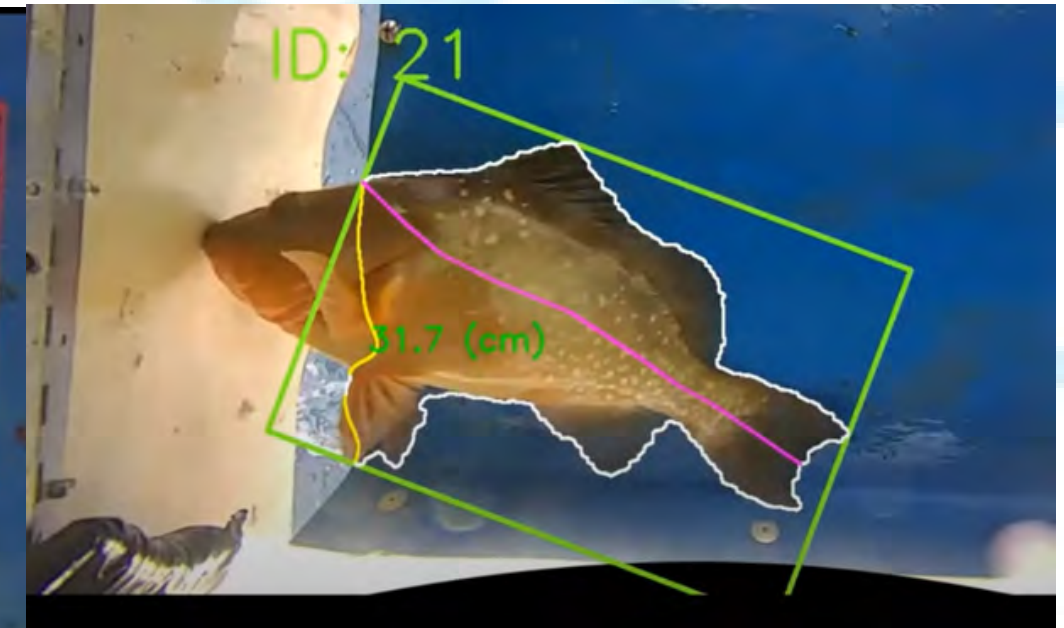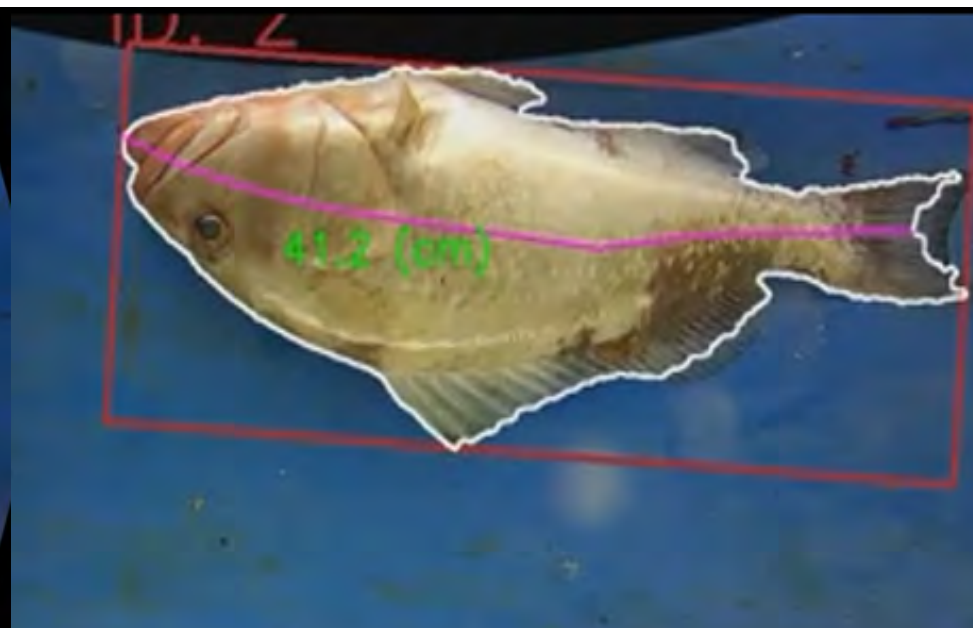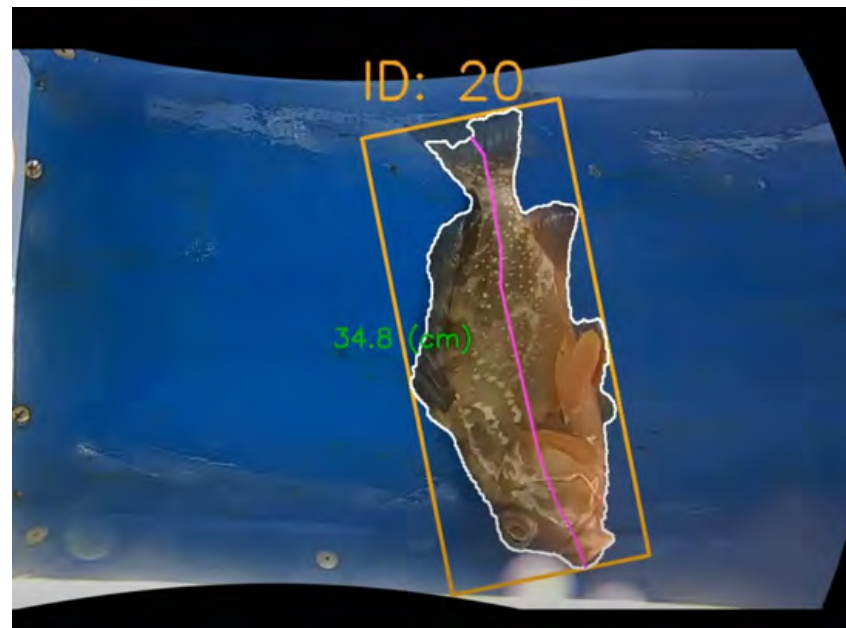## B. Discard Chute

New EM Tool - *1st discard chute modified for BLL vessel*

- *partnership* w/industry, NOAA SEFSC, Galveston & NOAA Alaska Fishery Science Center (device), NOAA affiliate Univ. of Washington (software)

Improved:
- discard species imagery (test species red grouper)
- acquiring automated length measurements

C. Stern Cameras - *in progress*

Red Grouper Mean Post-Release Status

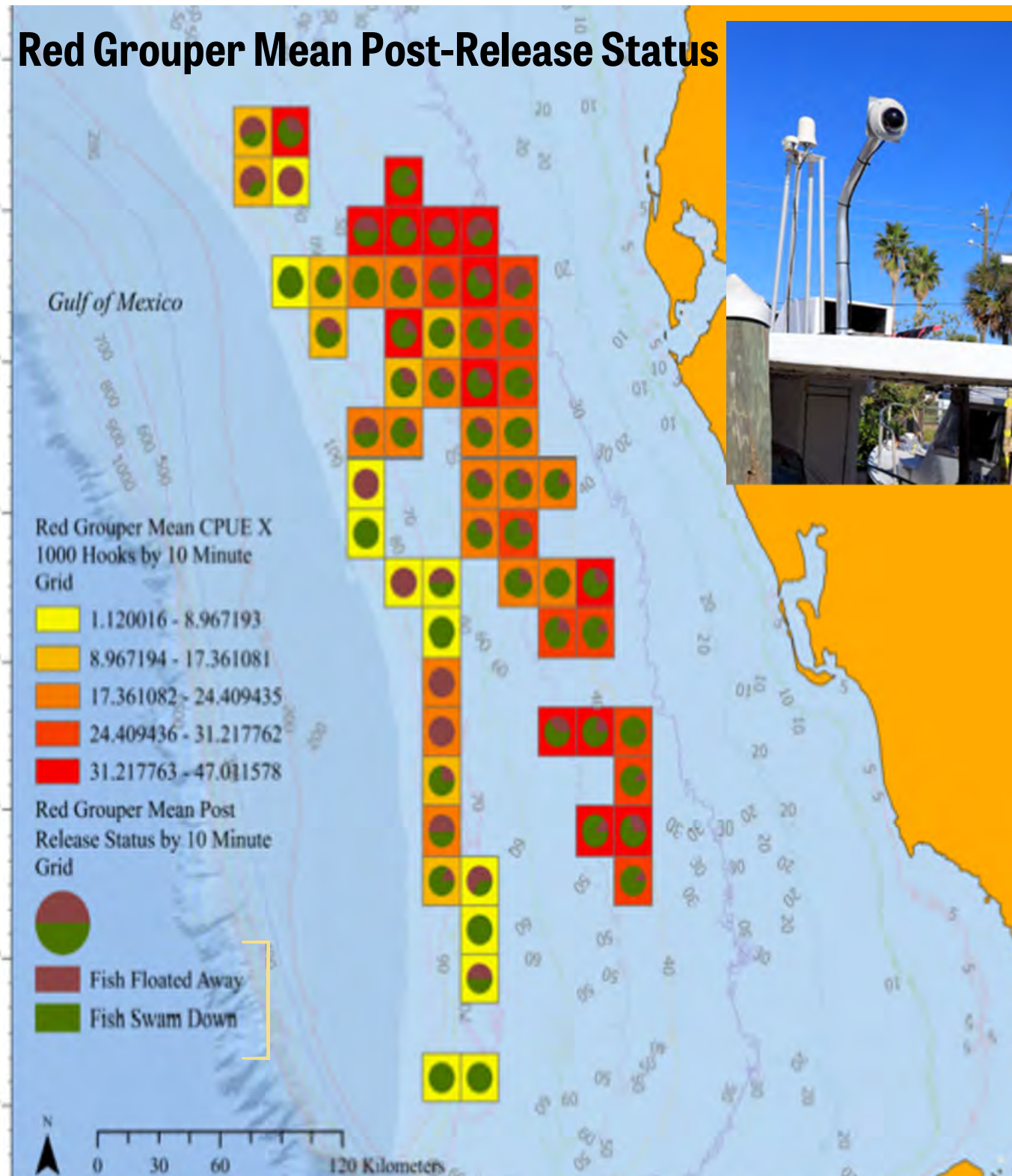**New EM Tool** - *Applied on BLL vessels*

Improved:
- discard short-term discard survival documentation
- predator interactions (depredation) documentation

Example of Data: Stern camera depth specific post-release status of red grouper - 4 Gulf BLL vessels (2/2021 - 6/2022)

Depth Bin	Eaten by Marine Mammal	Eaten by Unknown Predator	Floated Off	Swam Down	Unknown Release Fate	Total
30-40m	0	0	118	276	31	425
40-50m	40	1	438	1311	206	1996
50-60m	0	1	131	294	7	433
60-70m	0	0	17	28	1	46
70-80m	0	0	45	57	2	104
80-90m	0	0	5	10	2	17
90-100m	0	0	0	1	0	1
>100m	0	0	0	1	0	1
Total	40	2	754	1978	249	3023

NOTE: Short-term post-release mortality was lowest (40-50m [26.8%]) & highest (70-80m [44.1%])

NOAA Bycatch Reduction and Engineering Program (BREP)-
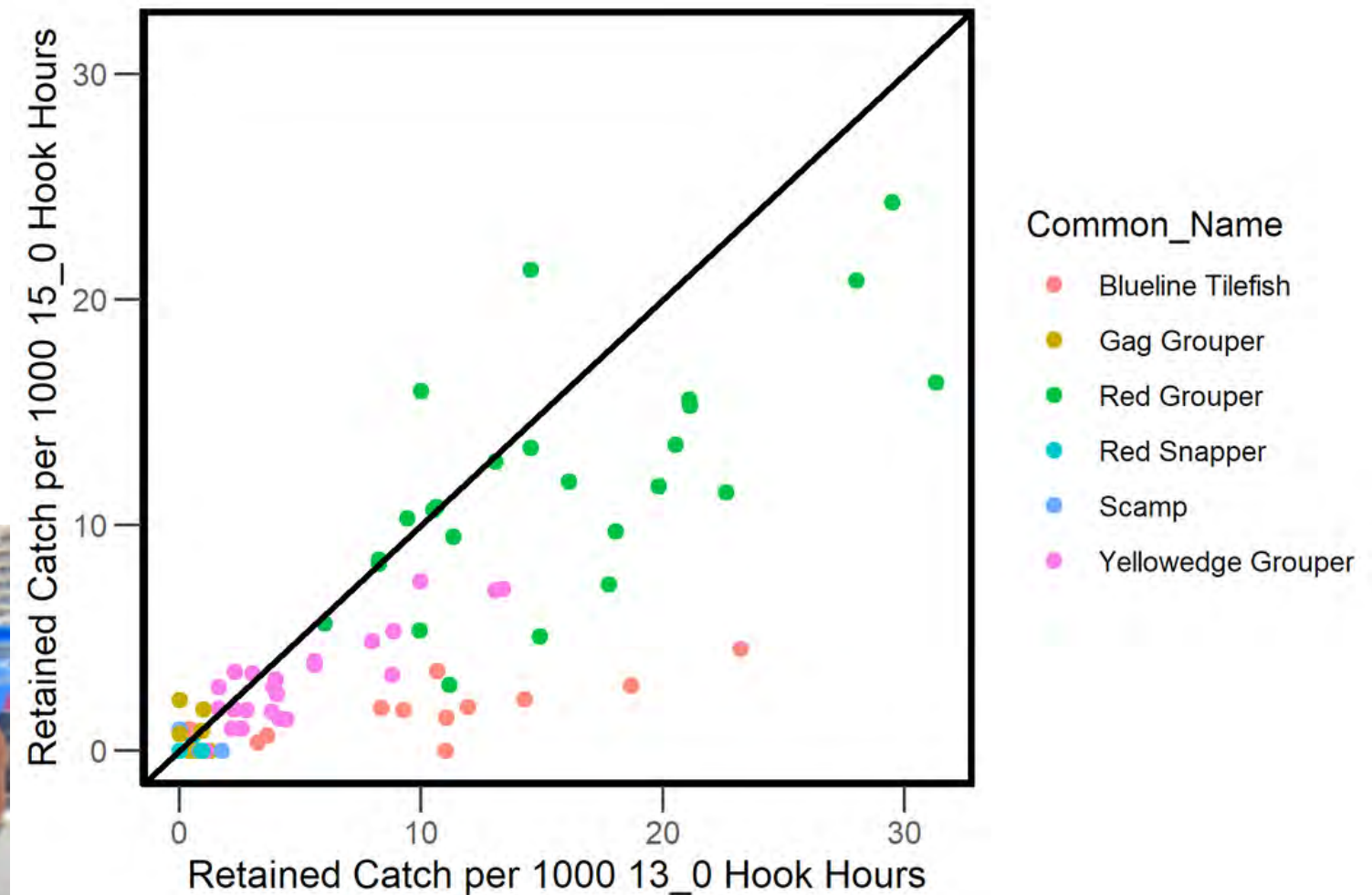# Hook Size - *in progress*

Industry Request - Apply EM as _tool_ to document Gear specific question -
hook size (13/0 & 15/0) possible to decrease bycatch?

- red grouper - higher proportion caught w/13/0 than discarded (lower impact on number retained)
- most of other species high retention rates. No big impact except Blueline tilefish 15/0 hooks selected against.
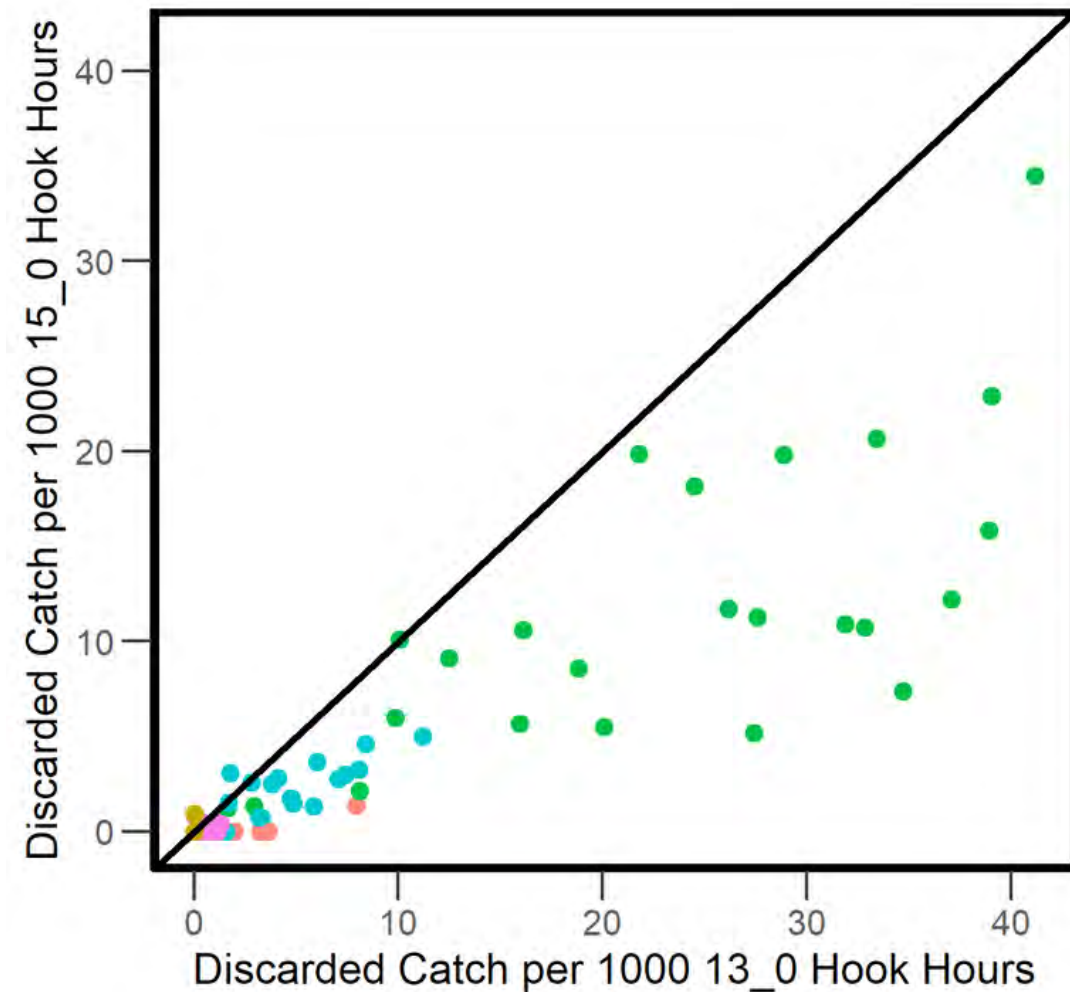
NOAA Cooperative Research Project (CRP) - Biological Samples - *in progress*

Partnership w/industry, NOAA SEFSC, Panama City & Texas A&M - Apply EM as <u>tool</u> - increase available data

- work w/ industry - collection of data deficient species - obtain otoliths (aging) + DNA (genetics)
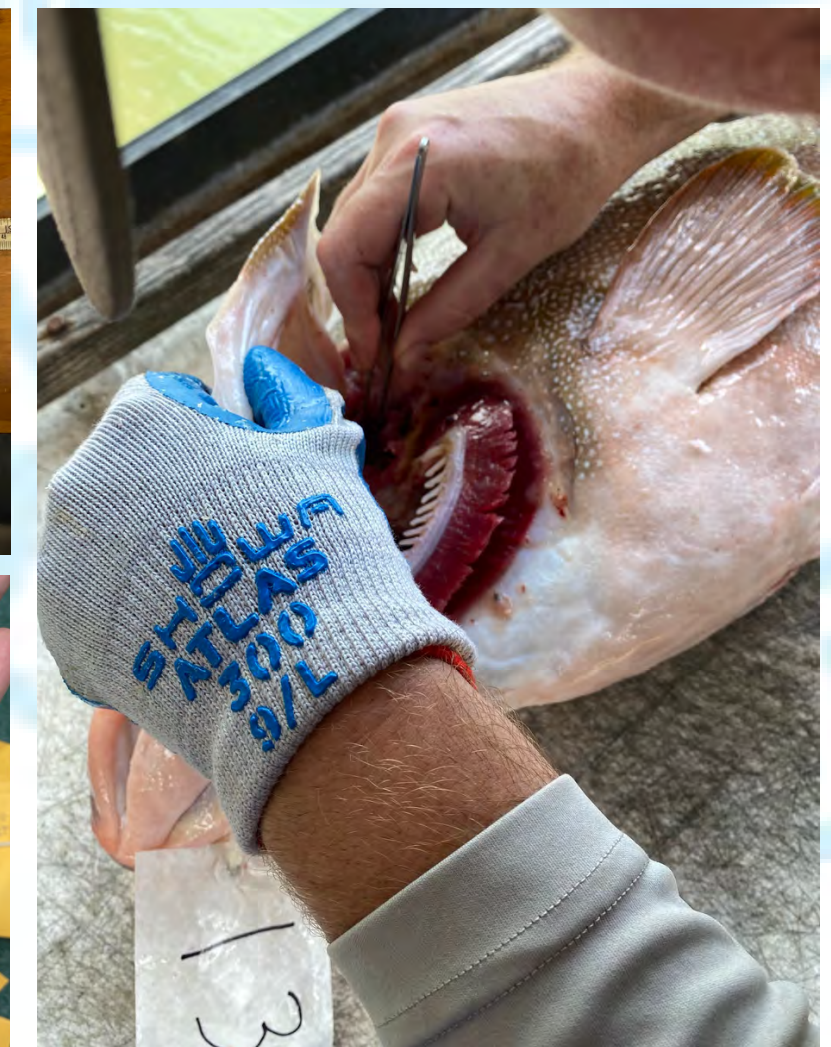- correlate species w/EM data (specific date, time, location)

Species of Interest:
- Yellowedge Grouper
- Golden Tilefish
- Blueline (Gray) Tilefish
- Scamp
- Speckled Hind
- Almaco Jack
- Silk Snapper (Yelloweye)
- Queen Snapper
- Wenchman
- Blackfin Snapper
- Margate
- Blackline Tilefish
- Yellowmouth Grouper

Marked by vessel crew for EM cameras & sample collection

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Sampled Fish Catch Location
- Almaco Jack
- Blueline Tilefish
- Jolthead Porgy
- Longtail Bass
- Misty Grouper
- Scamp
- Scorpionfish, Spiny Cheek
- Snowy Grouper
- Speckled Hind
- Tilefish, Blackline
- Tilefish, Golden
- Wenchman
- Yellowedge Grouper

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CFEMM Next Steps in CFEMM Electronic Monitoring Development

More New Technologies & Approaches commenced & in pursuit

2023 SWI SWIM - Mobile System

- **AI algorithm development & application (NOAA SEFSC Galveston, CVision AI)** *opportunity to use 75% archived EM data*
- **Automated map production development**
- **Mobile SWIM EM system application & evaluation**

- **DNA identification (new method) - predator species causing targeted catch depredation**
- **Document gag grouper retention & discards - near-real time impacts**

DNA Bite Area Swab

AI Algorithm Training
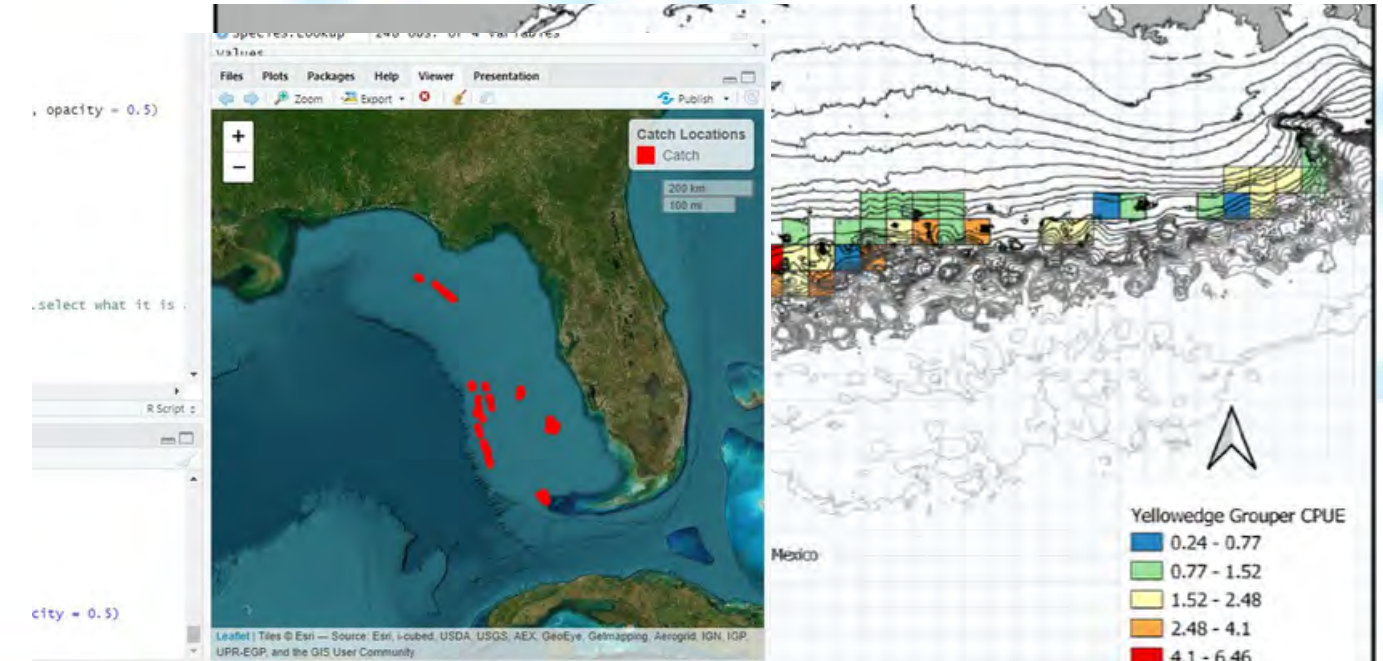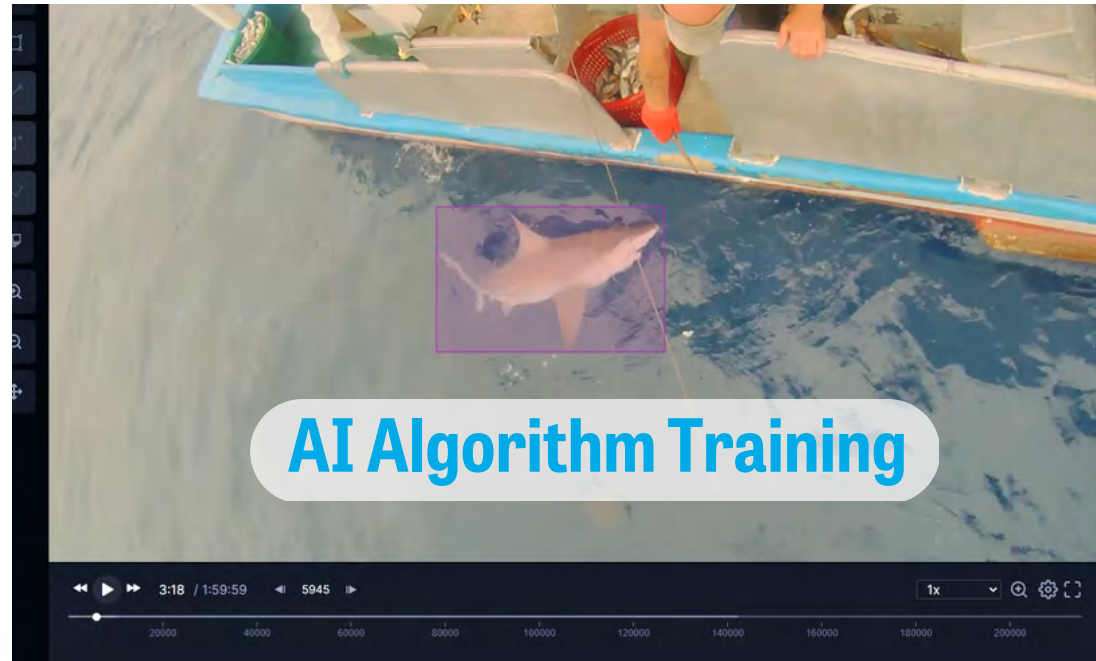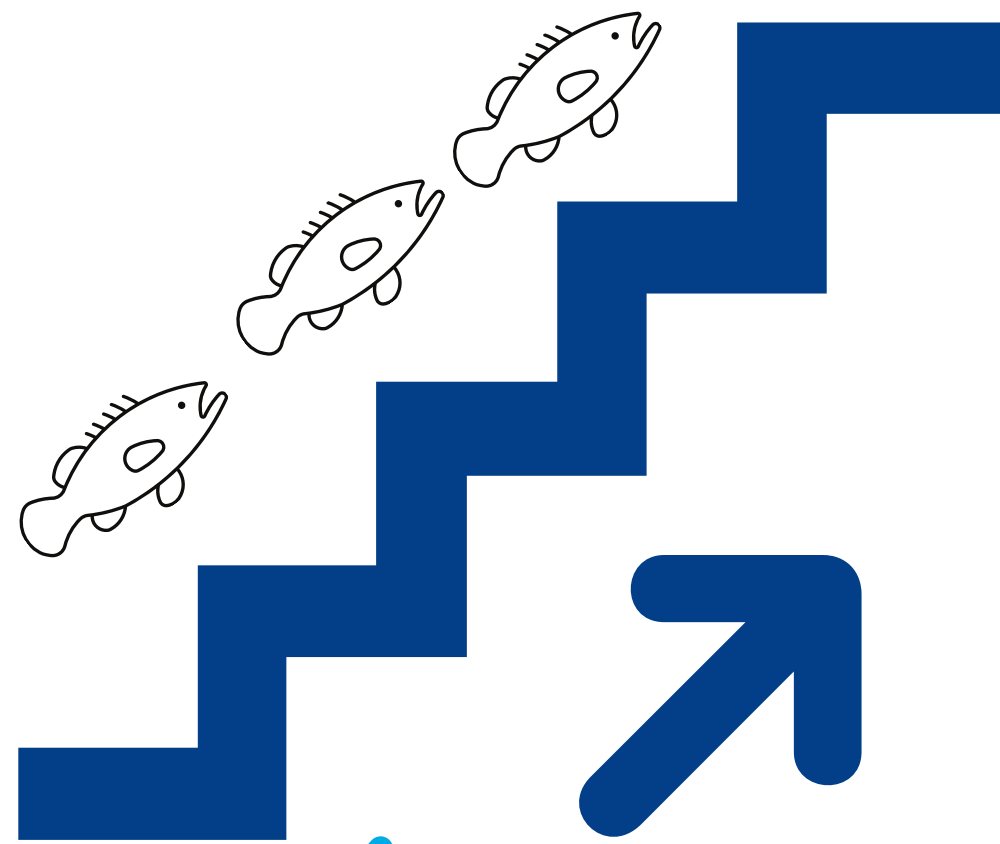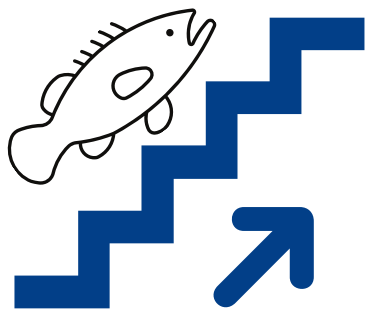
Optimized Retention

Coming In 2023

Exempted Fishing Permit (EFP) Application -
w/industry assess feasibility of optimized retention (spatially explict management tool) strategy - (test species = red grouper)
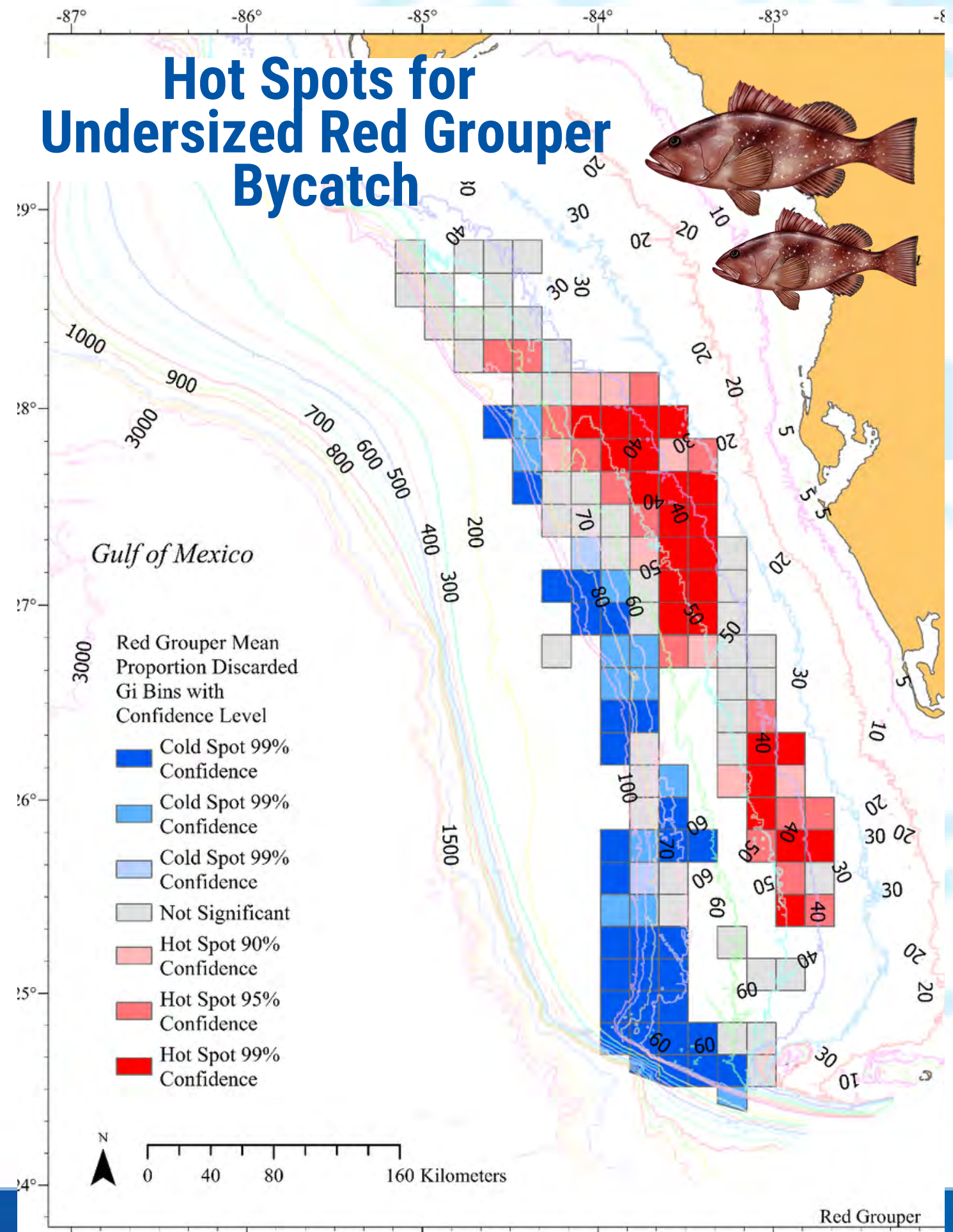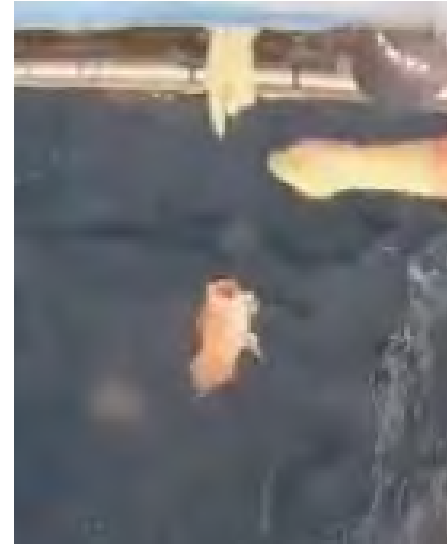
- reduce discards (allow for increased retention) in a high mortality discard area
- incentivize fishermen to target historically low discard areas

Based on results - possible other species w/ high discard rates & mortality

~25% of Blueline Tilefish are discarded

>90% of Blueline Tilefish die after being discarded

Hot Spots for Undersized Red Grouper Bycatch

Gulf of Mexico

Red Grouper Mean Proportion Discarded Gi Bins with Confidence Level

- Cold Spot 99% Confidence
- Cold Spot 99% Confidence
- Cold Spot 99% Confidence
- Not Significant
- Hot Spot 90% Confidence
- Hot Spot 95% Confidence
- Hot Spot 99% Confidence

N

0   40   80   160 Kilometers

Red Grouper

It Takes a Fleet – Partnerships between Science, Industry & Management for a Sustainable Gulf Reef Fish Fishery - *Thank You!*

Funding Agencies

- National Fish and Wildlife Foundation Innovation & Electronic Monitoring & Recording Programs
- NOAA Bycatch Reduction and Engineering Program
- NOAA Cooperative Research Program
- Net Gains Alliance
- Environmental Defense Fund
- Ocean Conservancy
- Sea Pact
- Sustainable Oceans Alliance

NOAA Project(s) Scientific Advisors

Jessica Stephen, Ph.D.
Elizabeth Scott-Denton, Ph.D.
John McGovern, Ph.D.
Skyler Sagarese, Ph.D.

Contributors

- Vessel Owners, Captains, and Crew
- Brooks Dockside Seafood
- Carr Enterprises
- Fishbusterz Seafood
- Florida Fish & Wildlife Research Institute
- Get Reel Fisheries, LLC.
- GoM Reef Fish Shareholders' Alliance
- Katie's Seafood
- MML Center for Shark Research
- MML IT Department
- NOAA NMFS SEFSC, Galveston
- NOAA NMFS AFSC
- Saltwater Inc.
- Save-On Seafood
- SeaSucker LLC.
- Sub-Aqua Imaging
- Waterinterface LLC.
- Wild Seafood

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GAG GROUPER
EASTERN GULF OF
MEXICO
BOTTOM LONGLINE
SUMMARY DATA

September 2016 - December 2022

Prepared for:
Gulf of Mexico Fishery
Management Council
AP Data Collection
Committee Meeting

St. Petersburg, FL

February 13, 2023

Center for Fisheries Electronic
Monitoring at Mote (CFEMM)

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Sarasota, FL 34236

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Thank you for this opportunity!
Questions & Discussion