Electronic Monitoring Documentation of Red Grouper (*Epinephelus morio*) in the Eastern Gulf of Mexico Bottom Longline Fishery

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SEDAR88-WP-14

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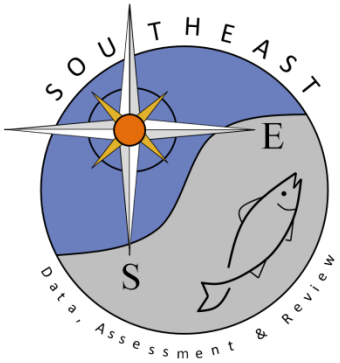

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SEDAR 88 - Red Grouper

March 21, 2024

Overview of Electronic Monitoring Efforts in the Gulf of Mexico Commercial Bottom Longline Reef Fish Fishery

The Center for Fisheries Electronic Monitoring at Mote (CFEMM) has been pioneering electronic monitoring (EM) in the Gulf of Mexico (GoM) commercial reef fish fishery since 2016, utilizing Saltwater Inc. (SWI) hardware and software. Industry volunteer participation has included collaborations with 22 commercial bottom longline (BLL) and vertical line vessels. Data reported for red grouper (*Epinephelus morio*) was generated by 15 Eastern Gulf of Mexico (EGoM) BLL vessels fishing out of ports along Florida's west coast from Cortez, FL to Inglis, FL from July 2016 through December 2022.

- Red Grouper Catch Events = 70,929
- All Catch Events = 107,030
- Trips = 392
- Hauls Reviewed = 2,136 (Represents 25% of all potentially analyzable set-haul events)
- Sea Days = 3,450

Video Review Protocol

Hard drives containing data are collected from participating vessels during dockside visits or mailed by the respective captains or vessel owners. These drives are loaded to workstations, where SWI review software is used to annotate the collected video footage. Sets and hauls are marked along a timeline by reading associated sensor data (hydraulic pressure and rotation). Subsamples of 25% of complete set/haul events from each trip are reviewed. Each recorded catch event is assigned characteristics based on a series of custom dropdown menus for the reviewer to select from. These variables include:

- **Species**
- **Handling**
    - Brought onboard,
    - Not handled (dropped off),
    - Cutoff at rail (no entanglement),
    - Cutoff at rail (entanglement), or
    - Unknown handling
- **Condition**
    - Live healthy,
    - Live stomach and/or eyes protruding,
    - Live damaged,
    - Dead on arrival damaged,
    - Dead on arrival undamaged, or
    - Unknown condition

- **Fate**

    - Retained,
    - Retained as bait,
    - Discarded live healthy (vented),
    - Discarded live healthy (not vented),
    - Discarded live damaged (not vented),
    - Discarded live damaged (vented,
    - Discarded dead,
    - Discarded unknown, or
    - Unknown fate
- **Shark Specific Attributes**
    - Sex - male/female,
    - Maturity - juvenile/known adult, or
    - Size estimate - small (>1m), medium (1.1 to 2.9m), and large (>3m).
- **Post-Release Status**
    - Floated off,
    - Swam down,
    - Eaten by marine mammal,
    - Eaten by unknown predator, or
    - Unknown release fate

Post-Review Processing

Resulting data navigates a CFEMM established QA/QC process where all annotated events and sensor data anomalies are reviewed by experienced staff to screen for identification errors or missing catch. Aggregated groupings of trips are further screened using "R", applying a series of over 75 error checks to flag any abnormalities. Once approved, final data is appended to the master database in Microsoft (MS) Access™. For reporting purposes, additional automatic calculations and environmental metadata are linked to the MS Access™ database through an export routine in "R", allowing for key variables to be associated to catch events such as depth, average temperature, and bottom type, with over 200 variables recorded.

Overview of Red Grouper (*Epinephelus morio*) Occurrence in the EGoM BLL Fishery

The EGoM BLL fishery primarily targets red grouper (*Epinephelus morio*), red snapper (*Lutjanus campechanus*), and yellowedge grouper (*Epinephelus flavolimbatus*) across the West Florida Shelf from The Edges to the Dry Tortugas. The CFEMM documented 70,929 captures of red grouper on EGoM BLL gear targeting reef fish from 2,136 reviewed hauls. Red grouper in the region were the most frequently caught species on this gear type and were recorded on 81% of all BLL hauls reviewed.

Catch and Fleet Effort Distribution

Red grouper were recorded on BLL gear from 24.72° latitude to 28.94° latitude, and as far west as 85.14° longitude. Catches were documented in depths from 36m to 122m, with an average capture depth of 51m. Catch density was highest from approximately Tarpon Springs to Fort Myers shoreward of the 35 fathom boundary line (Figure 1). Catch per unit effort (CPUE) was calculated based on hook-hours, using the EGoM regulatory limit of 750 hooks. The average species-specific CPUE within 10 x 10 minute grid cells is depicted in Figure 2. Results showed high CPUE areas adjacent to the bottom longline prohibited zone boundary. A hotspot analysis conducted for red grouper also indicated hotspots primarily along the inshore boundary and cold spots in depths greater than 35 fathoms (Figure 3). A generalized additive model (GAM) was generated based on hook-hours to show CPUE at the haul level (Figure 4), depicting annual and seasonal effort changes. Clusters of low CPUE within the GAM are typically reflective of the bottom longline closure, which occurs inside 35 fathoms annually from June to September in an effort to reduce interactions with sea turtles, causing vessels to fish further offshore where overall catch rates are lower.

Condition on Arrival, Discards, and Depredation

At vessel mortality for this species was 1.83%, with 1.05% of overall catch showing signs of depredation (Table 1). Discard rates are high (47.67%) compared to other target species, with discards primarily occurring due to undersized catch (Table 2). The use of stern mounted cameras on a subset of vessels assessed “post-release status” - the ability of individuals to return to depth. Results based on 5,099 individuals showed 27% of discards were assumed moralities (Table 3). Scavenging by marine mammals was primarily documented between 40-50m (95%), with 57 individuals being consumed by marine mammals representing 1% of total discards assessed.

Management Factors Influencing Catch in the BLL Fishery

Red grouper are the primary target within this fishery for the majority of the year. Effort does vary seasonally due to a shift to deepwater grouper and/or mutton snapper during the seasonal closure. Over 88% of red grouper catches occur within this seasonally closed area, as depicted in Figure 1. In addition, the substantial reduction in gag grouper quota for the commercial sector in 2023 is likely to impact traditional fishing effort. Though those changes are outside of the terminal year for this assessment, Figure 5 shows the most recent patterns in catch rates; because this data may be influenced by both size and distribution of red grouper populations as well as changes in the fleet's spatial effort, further examination is warranted.

An unpublished study on the impacts of hook size was conducted by CFEMM through NOAA BREP support in 2023 and revealed a 40% reduction on average in red grouper discards with the use of 15/0 hooks when compared to the most commonly used 13/0 hook. The study also showed that an average loss of 7 retainable red grouper per haul was

projected while using 15/0 hooks and indicated substantial reductions to retainable non-IFQ species such as porgies and small snappers. In a fishery with both high discard rates and discard mortality, the reduction in bycatch through gear modifications has the potential to allow for more sustainable fishing and increase the quota available for harvest by reducing reef fish discards. Further collaborative efforts with the commercial sector could explore ways in which management could incentivize those actions without additional regulation, considering the variable catch rates among targeted species.

Table 1. Condition of red grouper on arrival on BLL gear in the EGoM.

Condition On Arrival	% of Red Grouper
Dead on Arrival - Damaged	0.79
Dead on Arrival - Undamaged	1.04
Live - Damaged	0.26
Live - Healthy	55.99
Live - Stomach and/or Eyes Protruding	41.62
Unknown Condition	0.31

Table 2. Fate of red grouper on BLL gear in the EGoM.

Catch Fate	% of Red Grouper
Discarded - Dead	1.87
Discarded - Live and Damaged (Not Vented)	0.15
Discarded - Live and Damaged (Vented)	0.21
Discarded - Live and Healthy (Not Vented)	12.52
Discarded - Live and Healthy (Vented)	32.45
Discarded - Unknown	0.24
Retained	52.33
Retained as Bait	0.01
Unknown Fate	0.22

Table 3. Post-release status of red grouper in the EGoM.

Depth Bin	Eaten by Marine Mammal	Eaten by Unknown Predator	Floated Off	Swam Down	Unknown Release Fate	Total
30-40m	0	0	174	545	137	856
40-50m	54	1	690	2,381	659	3,785
50-60m	3	2	347	658	291	1,301
60-70m	0	0	36	50	3	89
70-80m	0	0	51	69	9	129
80-90m	0	0	16	20	3	39
90-100m	0	0	0	1	0	1
>100m	0	0	0	1	0	1
Total	57	3	1,314	3,725	1,102	6,201

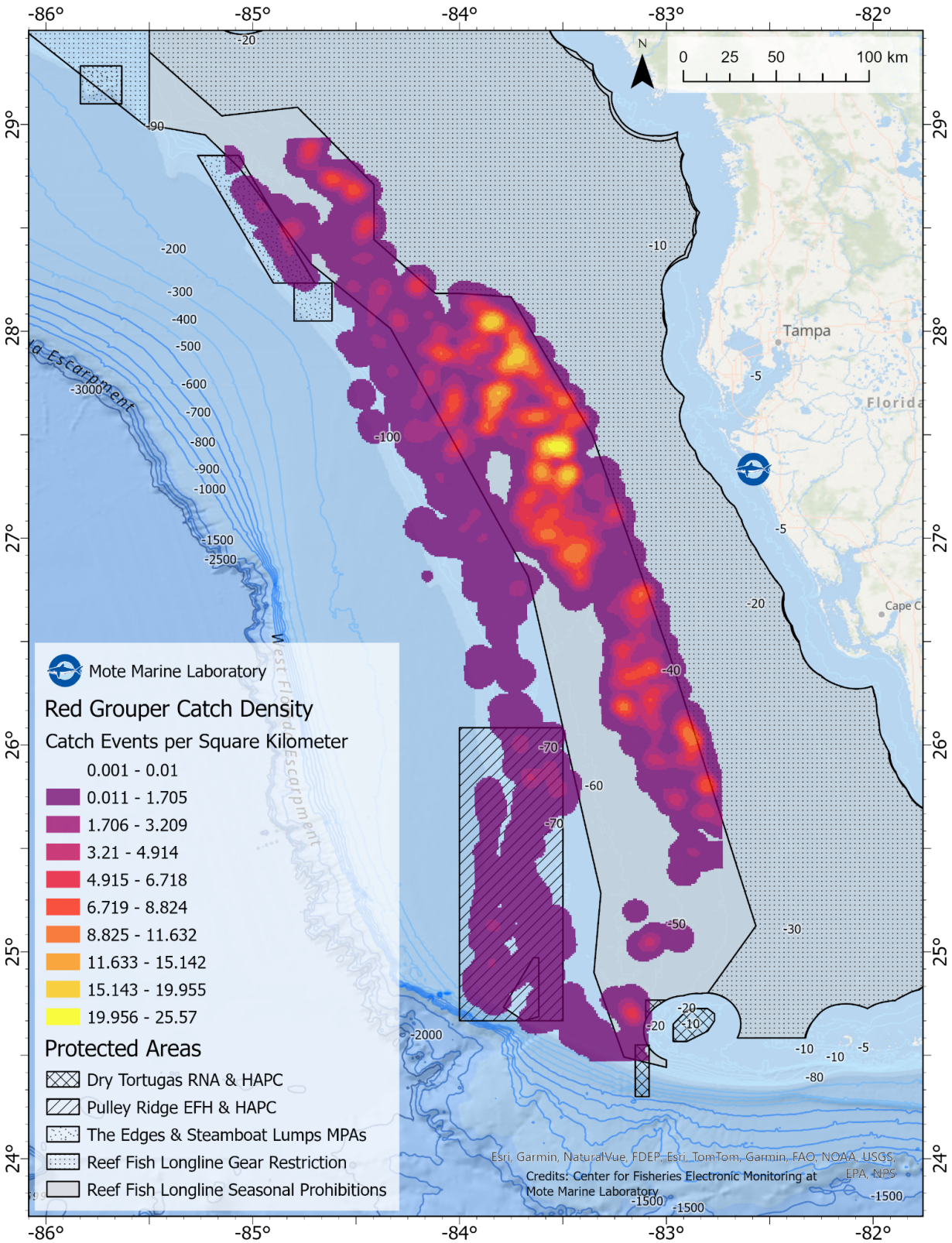

Figure 1. Density analysis of catch events for red grouper recorded in the EGoM BLL fishery (n=70,929).

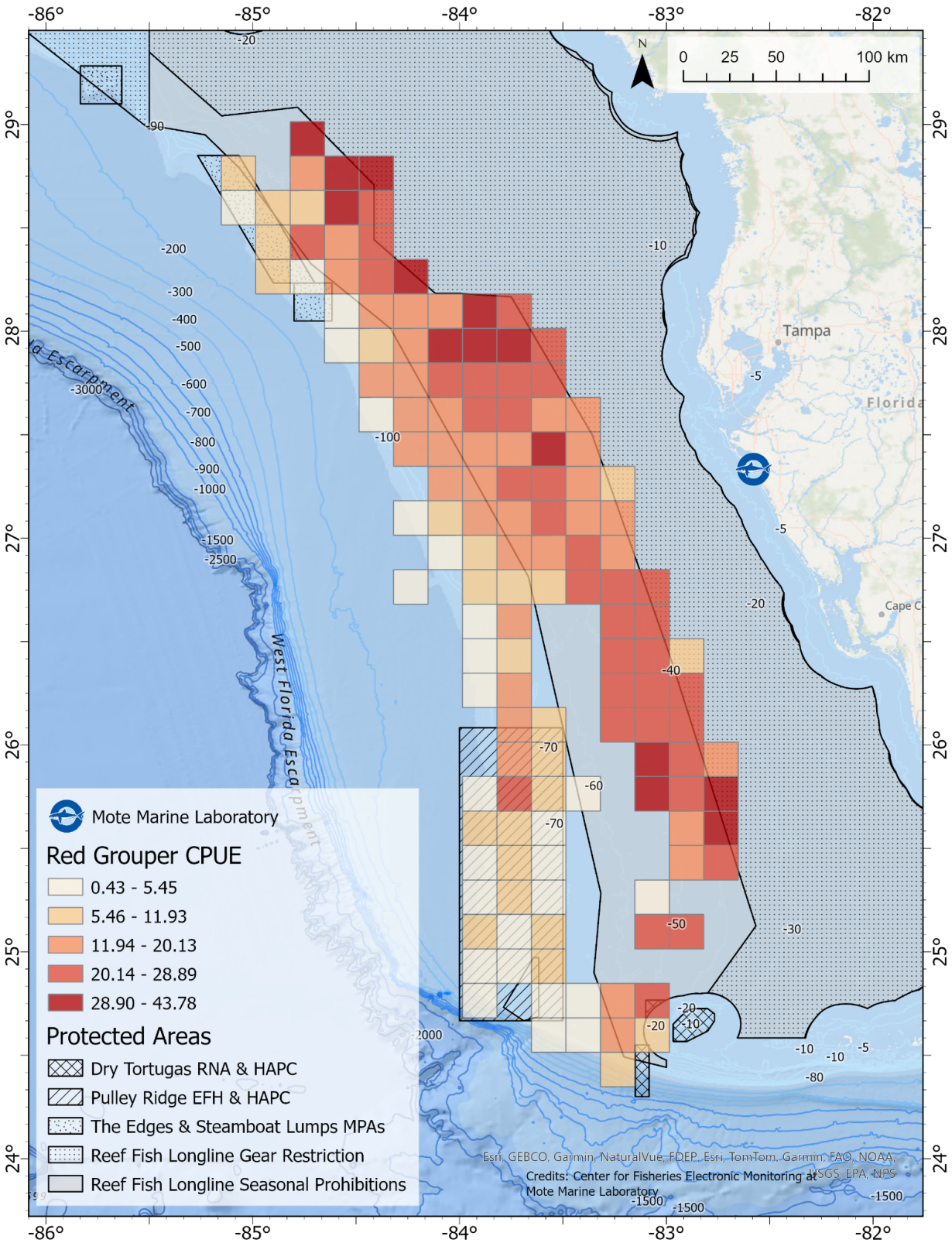

Figure 2. Catch per 1000 hook hours of red grouper in the EGoM BLL fishery with a grid cell size of 10 x 10min.

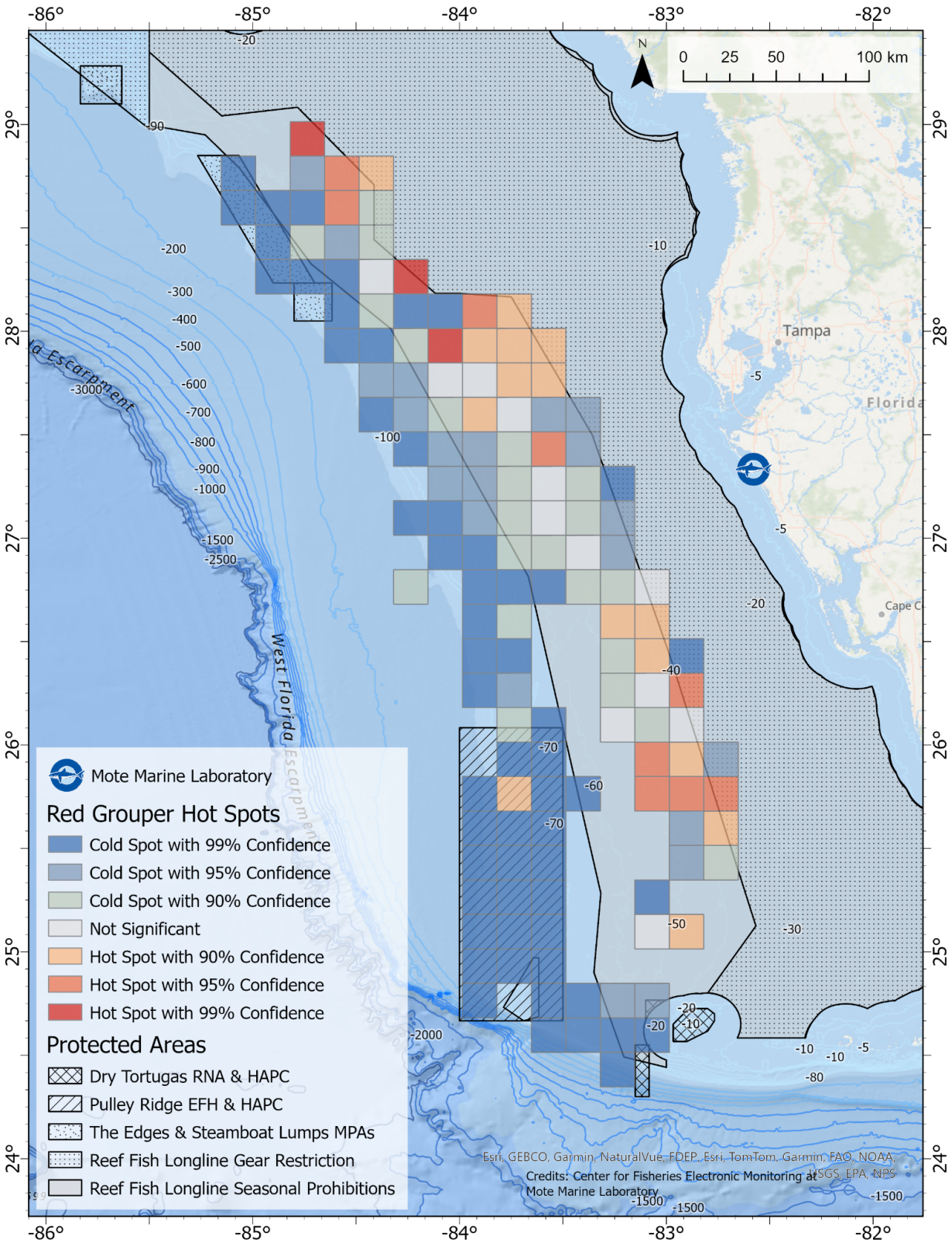

Figure 3. Hotspot analysis for red grouper in the EGoM BLL fishery.

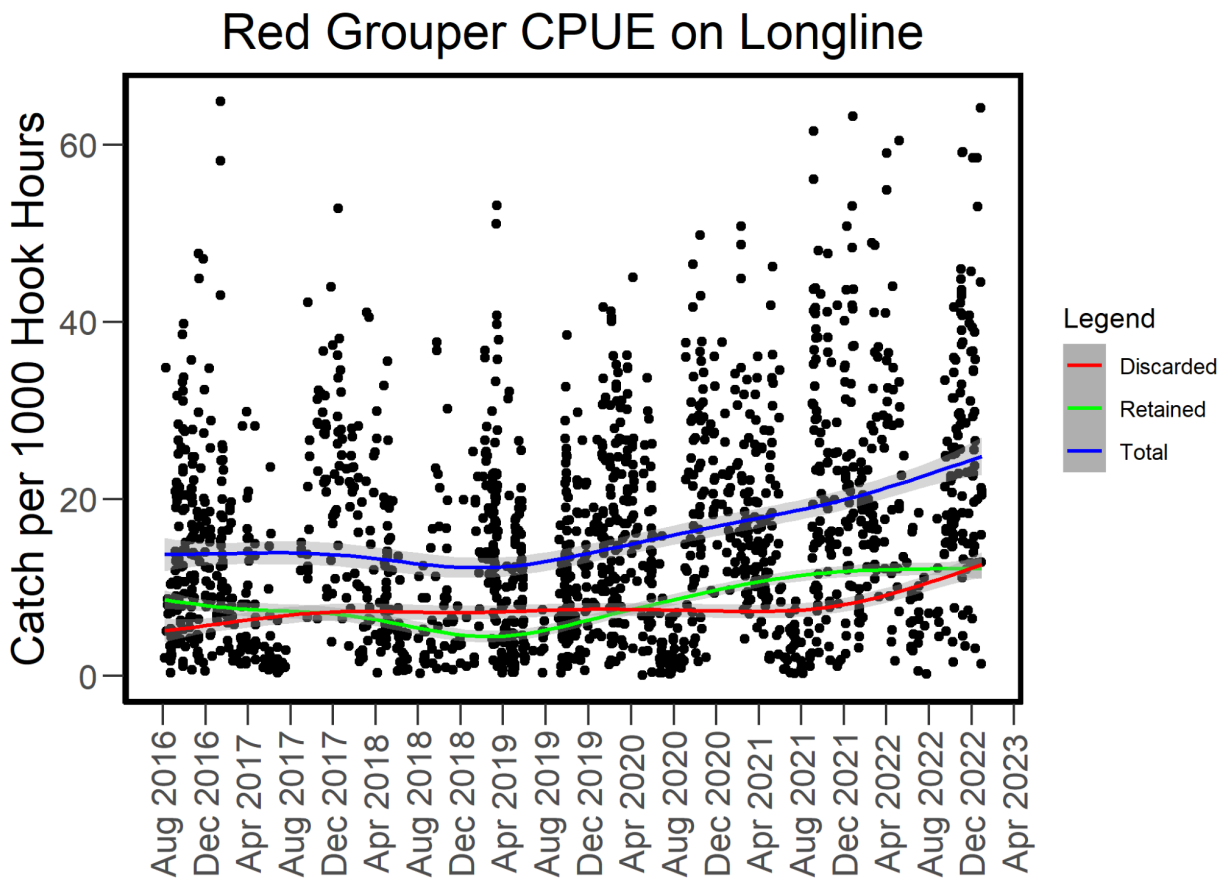

Figure 4. Red grouper catch per unit effort GAM for the EGoM BLL fishery, 7/2016 - 12/2022.

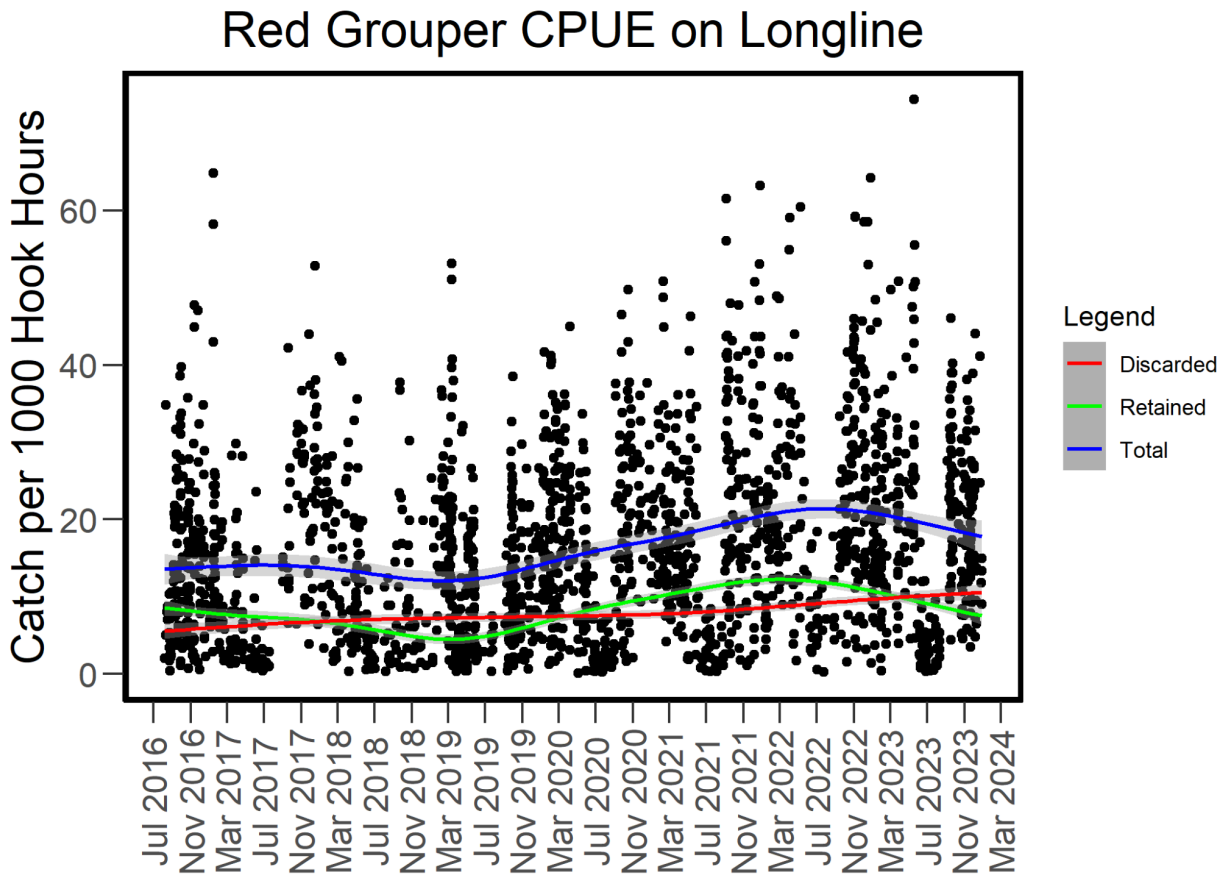

Figure 5. Red grouper catch per unit effort GAM for the EGoM BLL fishery, 7/2016 - 12/2023.