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# Gulf of Mexico Shrimp Effort Estimation

**Presentation to: GMFMC Shrimp AP**

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# How Cellular Electronic Logbooks (cELBs) Work

*The goal of the current cELB program is to develop a better system to collect effort data in the Gulf of Mexico shrimp fishery.*

Distance and speed between data points are calculated to determine the amount of time fished by location (effort). Fishing effort data are then matched to the number of pounds of shrimp catch unloaded at the dock (landings) based on date.



NOAA Fisheries Service  
Galveston, TX

Data are received,  
stored, and  
transmitted to  
Galveston.



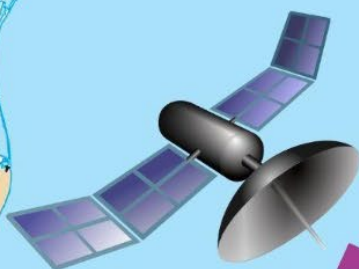
National Coastal Data  
Development Center (NCDDC)  
at Stennis Space Center, MS

When the vessel is within  
**NON-ROAMING** cellular  
range, data stored on the  
cELB are uploaded.



Cellular Tower

The cELB  
records the  
vessel's  
location every  
10 minutes  
using GPS  
technology.



GPS Satellite

Shrimp Boat  
with cELB



In early 2014, 500  
federally-permitted  
vessels were chosen  
to carry a cELB.



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# Goals

- Develop a method to produce robust effort estimates with
  - Simplified assumptions
  - Increased transparency
  - Modernized code
  - More complete use of the data

$$\text{total effort} = \sum \text{ELB effort}_{\text{area/time}} \times (\text{total landings}_{\text{area/time}} / \text{ELB landings}_{\text{area/time}})$$

$$= \sum \text{effort from boxes in a time/area cell} \times$$

$$(\text{total trip ticket landings in time/area cell}) / (\text{landings from vessels with ELB boxes in a time/area cell})$$



# SEFSC Estimation Process

1. Pull and QC raw ELB track data
2. Determine optimal cutpoint to classify fishing activity
3. Keep only fishing activity that fits the profile of a tow
4. Assign ELB effort to GOM stat/depth zones
5. Scale up to total fleet effort according to landings aggregated at the season/area level and matched by vessel ID
6. Allocate total scaled effort to depth zones/stat areas according to observed ELB effort distribution



# Assumptions

1. ELB devices are capturing all fishing activity
2. There is no systematic bias in classification of effort from ELB devices
3. CPUE of vessels with ELBs on board is representative of the total fleet
4. Spatial distribution of ELB vessels is representative of the total fleet within strata
5. Reporting of landings is similar between ELB and non-ELB vessels

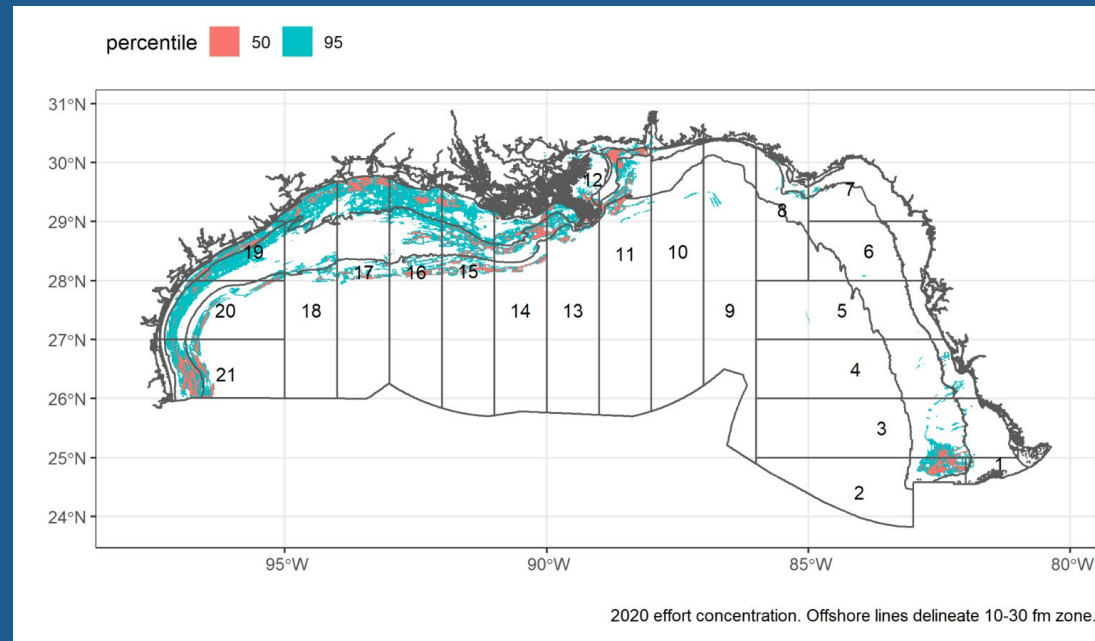
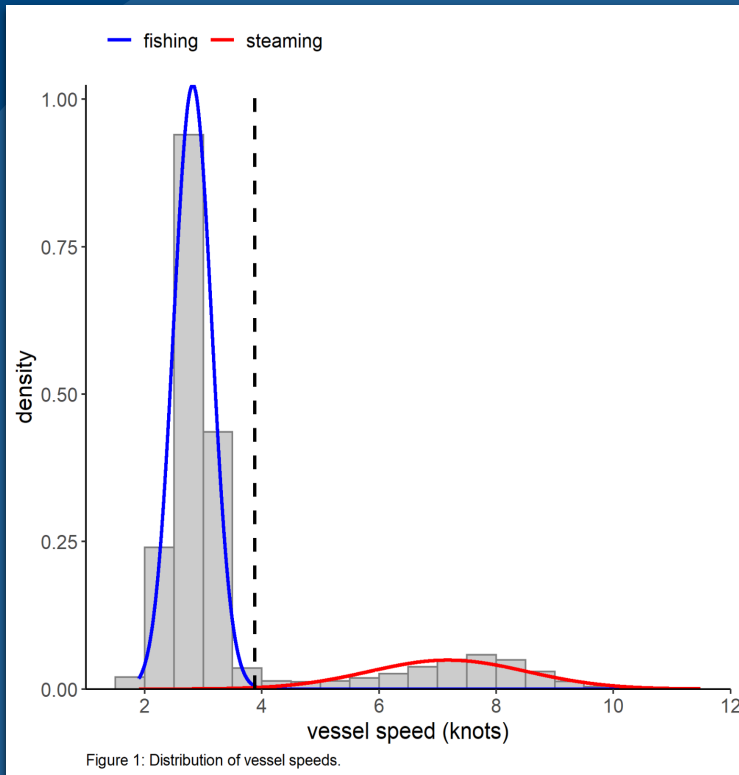


# Summary of Changes

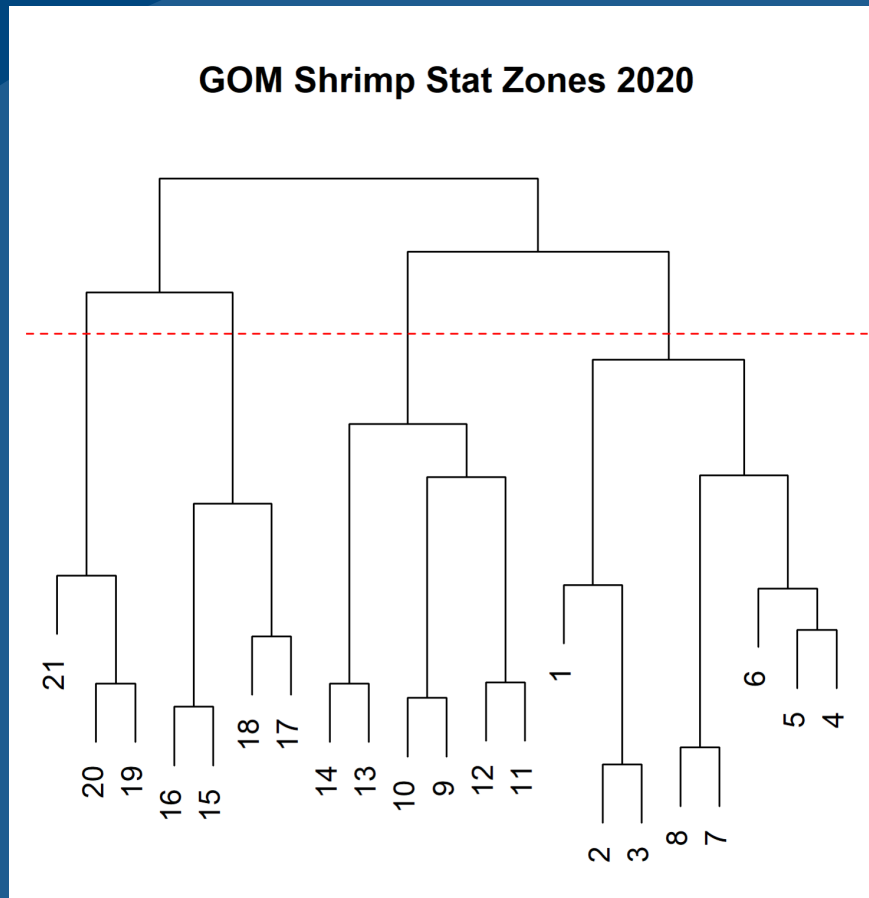
- Effort classification
  - Distances are calculated using the Vincenty ellipsoid method
  - GOM bathymetry used to filter out data at depths too deep for shrimping activity ( $>2,500$  ft)
  - Higher resolution, updated shapefile that encompasses entire Gulf EEZ
  - Upper fishing speed threshold is calculated using a Gaussian mixture distribution rather than using fixed numbers
- Scaling of effort to total fleet
  - Done using landings at aggregate level of time/area rather than attempting to match trips. This ensures 100% of ELB recorded effort is used in the calculation rather than only those trips that are matched (50-60%)
- Code
  - Code is substantially simplified and modernized
  - All processing and report generation is done in a single R script with one input parameter (year)



# ELB Effort Distribution



# Effort Scaling



## Area Definitions:

1. Zones 1-8
2. Zones 9-14
3. Zones 15-18
4. Zones 19-21

## Quadrimesters:

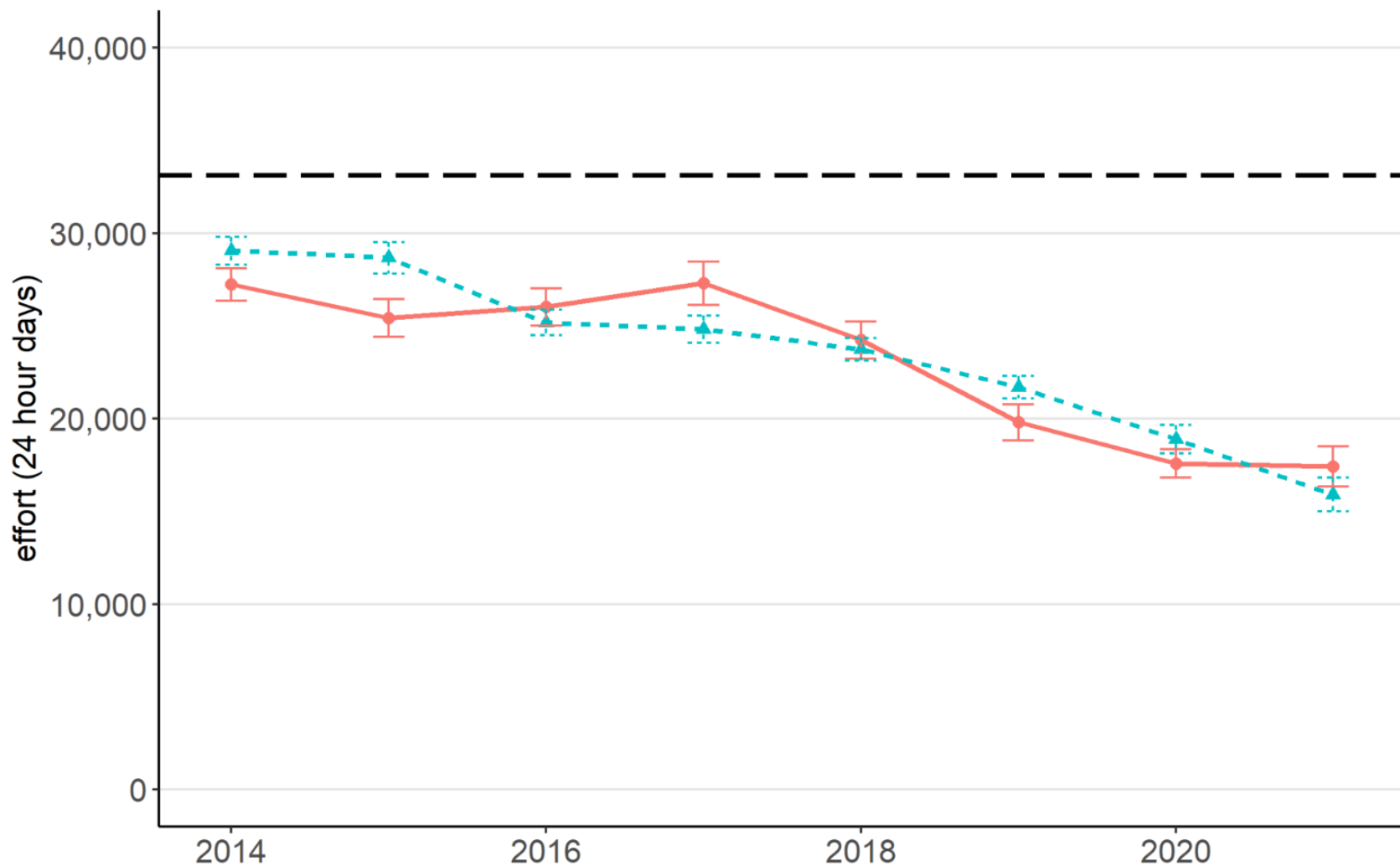
1. Jan-Apr
2. May-Aug
3. Sep-Dec

$$\text{total effort} = \sum \text{ELB effort}_{\text{area/time}} \times (\text{total landings}_{\text{area/time}} / \text{ELB landings}_{\text{area/time}})$$



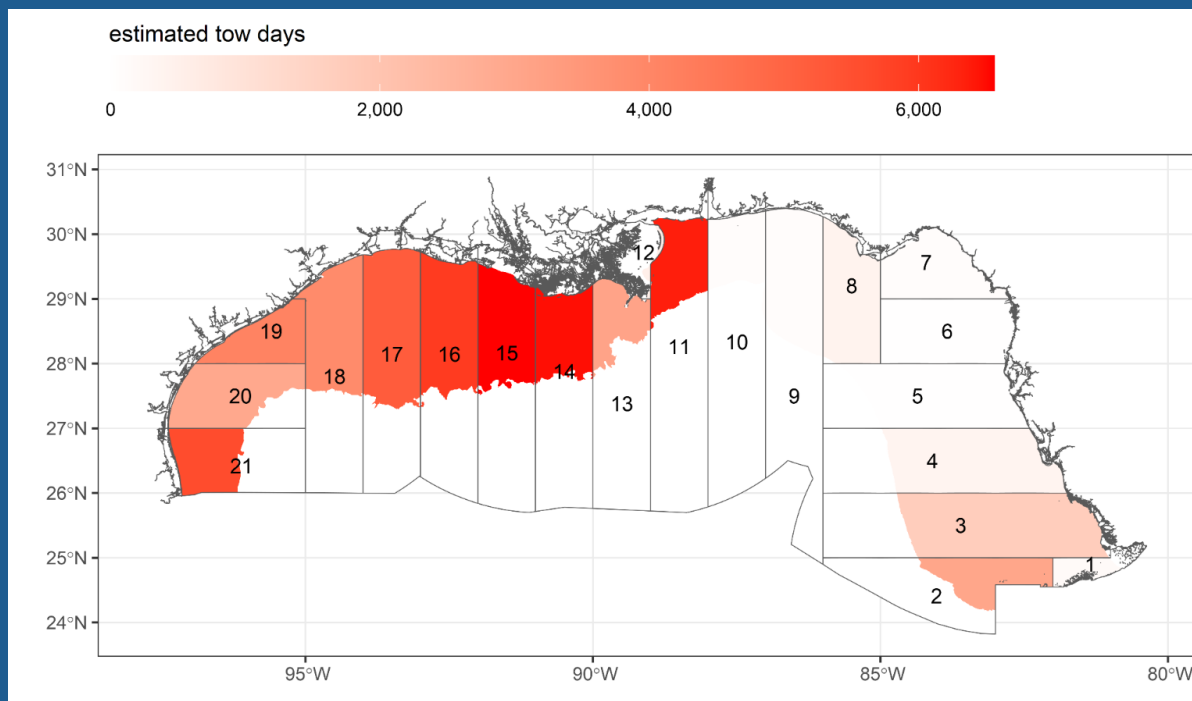
# Western Gulf 10-30 fm

LGL SEFSC



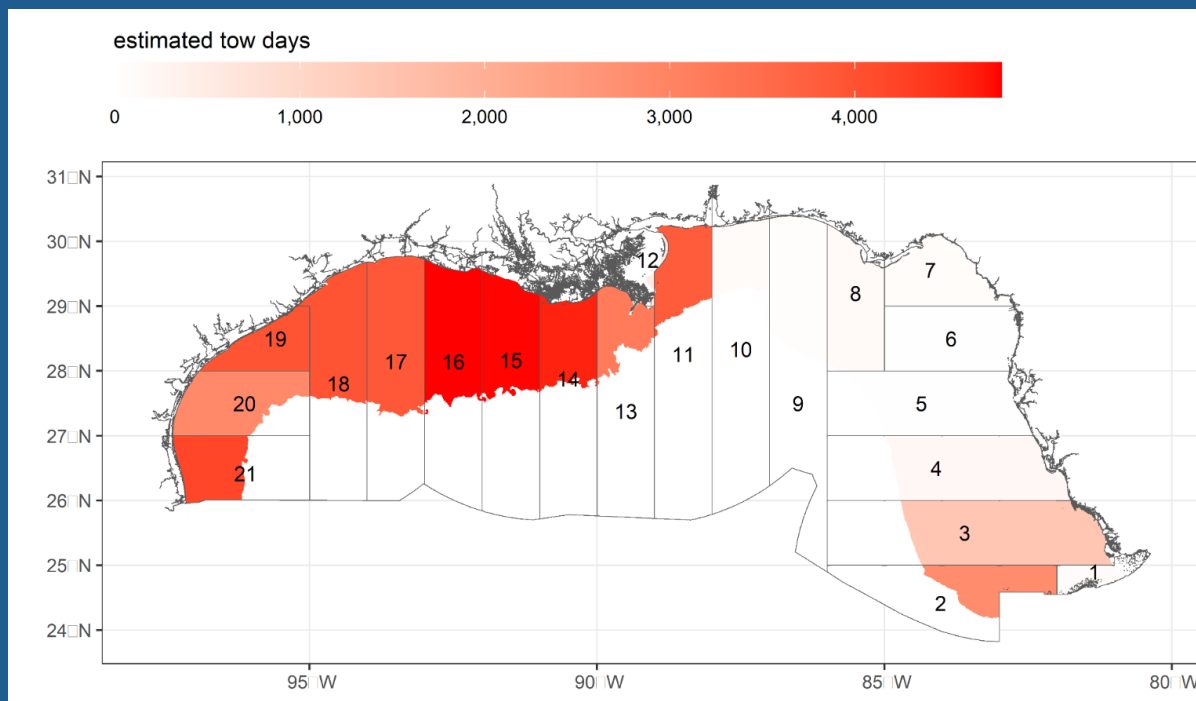
# 2020 SEFSC Offshore Estimates

Region	Depth	Landings (tail lbs.)	Effort (24 hr. days)	Baseline (2001-2003)	Pct. Decrease from Baseline
Western Gulf (Zones 10-21)	10-30 fm	21,715,169	18,898	82,811	77.2%
Total Gulf	All	67,513,636	56,918	—	—

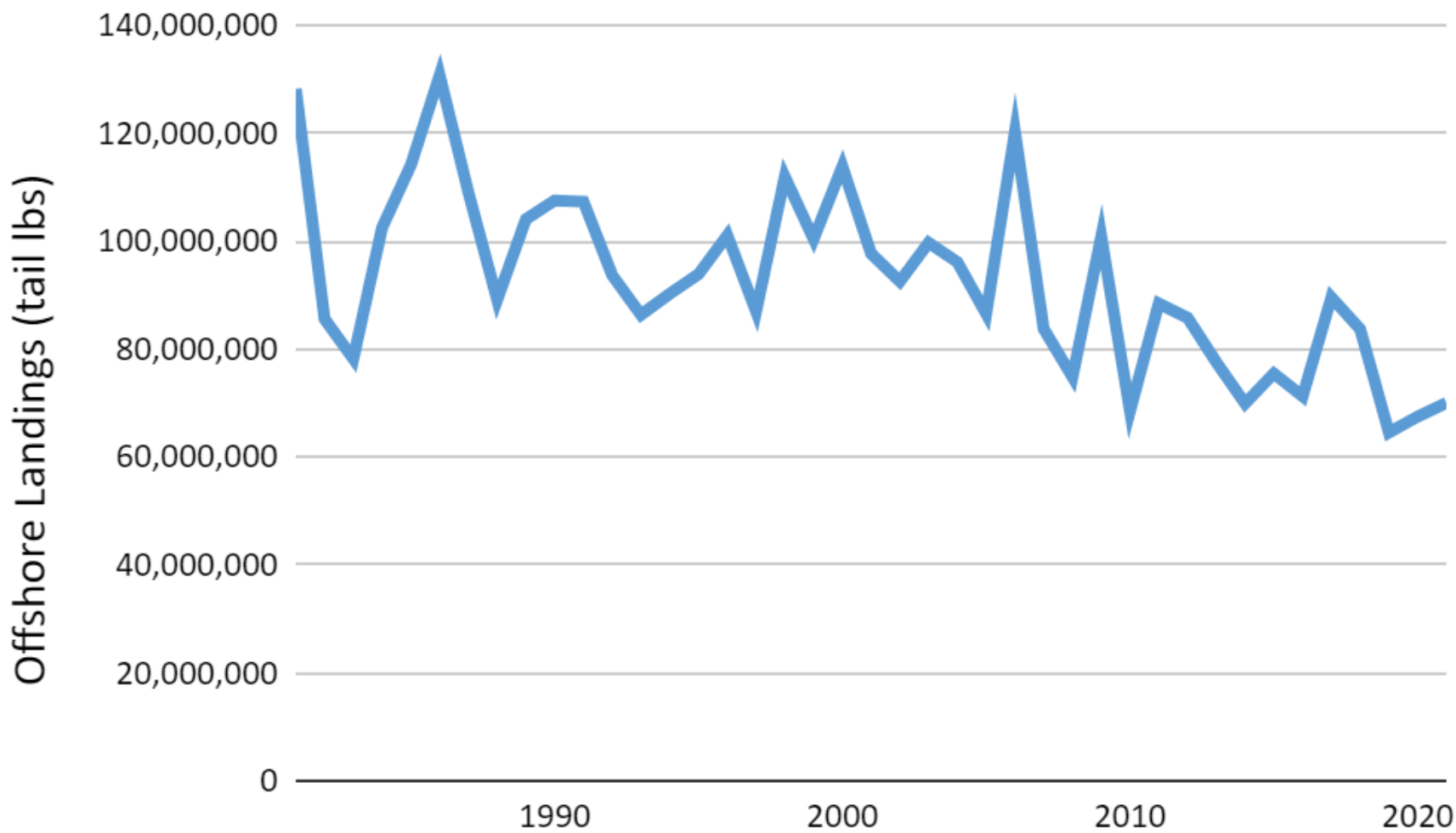


# 2021 SEFSC Offshore Estimates

Region	Depth	Landings (tail lbs.)	Effort (24 hr. days)	Baseline (2001-2003)	Pct. Decrease from Baseline
Western Gulf (Zones 10-21)	10-30 fm	24,614,617	15,904	82,811	80.8%
Total Gulf	All	70,055,984	45,563	—	—



# GOM Total Offshore Landings



# Shrimp Effort Estimation Workshop

- Workshop was recommended by Gulf Shrimp AP in November 2022 and was held February 22-23, 2023.
- Brought together SEFSC, SERO, GMFMC, Shrimp AP reps, and SSC reps
- Review of history of shrimp effort estimation in the Gulf
- Thorough examination of proposed new SEFSC estimation model
- Comparison of results with previous estimation method
- Agreement in the validity of the approach with some suggestions for further examination
- Similar positive reception at the **GMFMC SSC** last week
  - some additional suggestions for further investigation



# SEFSC Next Steps / Recommendations

- SEFSC will explore issues raised at the shrimp effort estimation workshop and the GMFMC SSC
- Suggest adoption of the revised method for effort estimates beginning with 2020



# Acknowledgements

- Gulf of Mexico Shrimp Fishing Industry
- Gulf of Mexico Fishery Management Council, SSC and Shrimp AP
- Gulf of Mexico Commercial Shrimp Fishermen
- Internal SEFSC Shrimp Bycatch and Effort Workgroup

