NOAA FISHERIES

SEFSC

Gulf of Mexico Shrimp Effort Estimation

Presentation to: GMFMC SSC

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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.

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

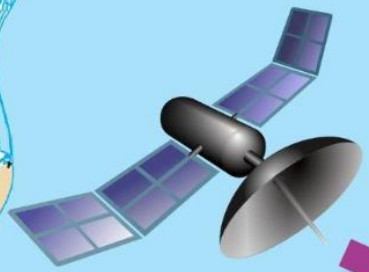
Data are received, stored, and transmitted to Galveston.

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

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

Cellular Tower



GPS Satellite

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

Shrimp Boat with cELB

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

Goals

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

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

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

(total trip ticket landings in time/area cell) / (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
5. Reporting of landings is similar between ELB and non-ELB vessels

Summary of Changes (part 1)

- Effort classification
  - Distances are calculated using the Vincenty ellipsoid method rather than a Euclidean metric with rough fixed parameters
  - GOM bathymetry is used to filter out data at depths too deep for shrimping activity (>1000 m)
  - 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%)

Summary of Changes (part 2)

- Code
  - Code is substantially simplified and modernized
  - All processing and report generation is done in a single R script with one input parameter (year)
  - All decisions are transparent as function arguments informed by observer data and examination of resulting distributions
  - No randomized components

2020 ELB Effort Distribution

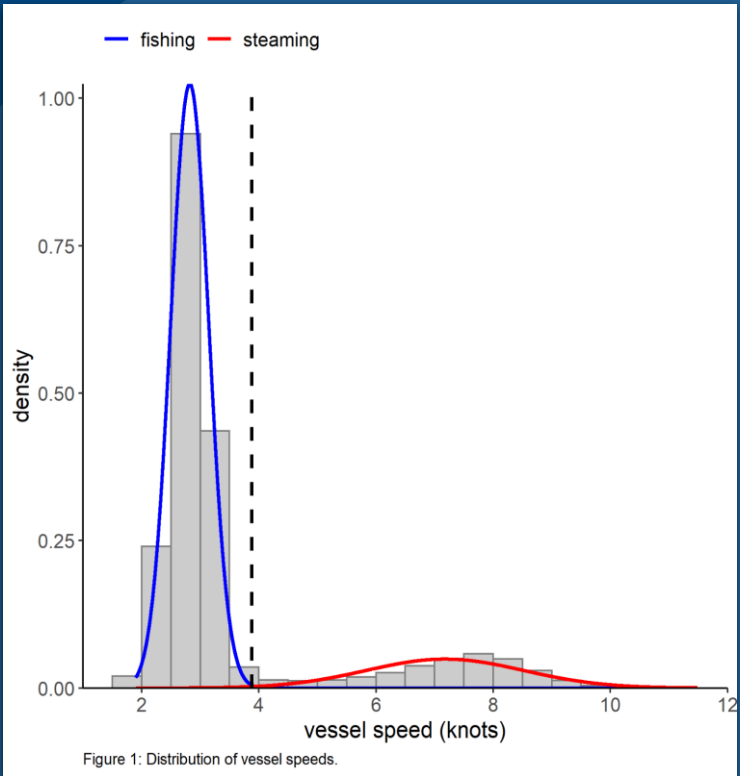
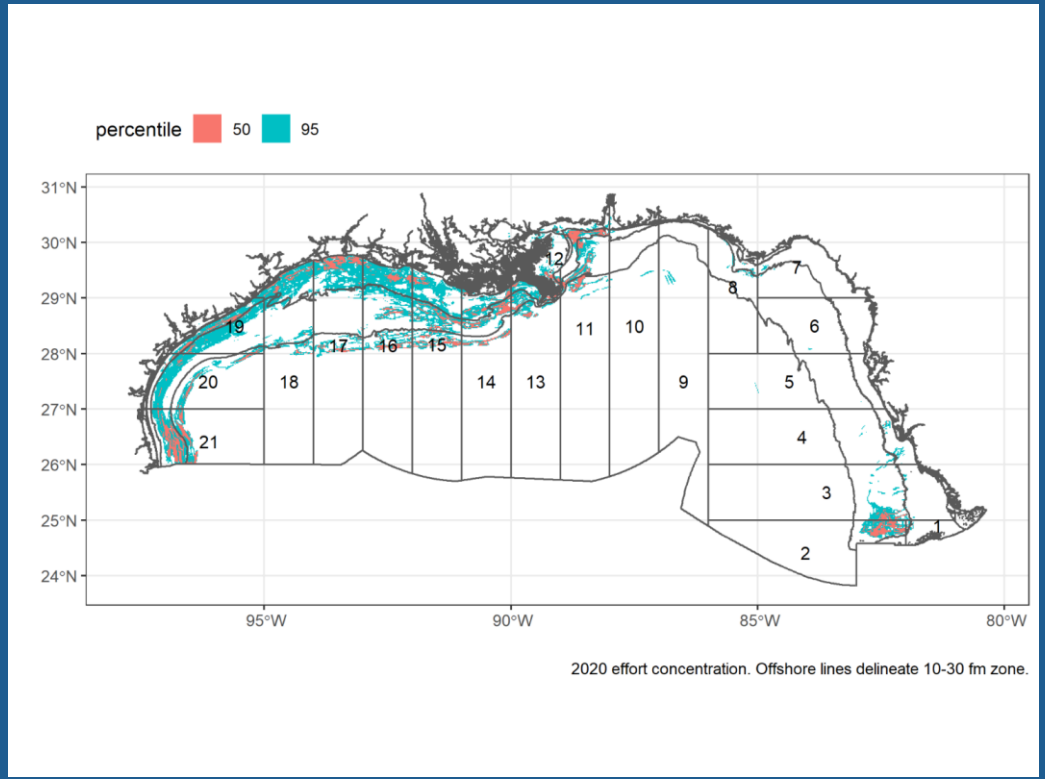
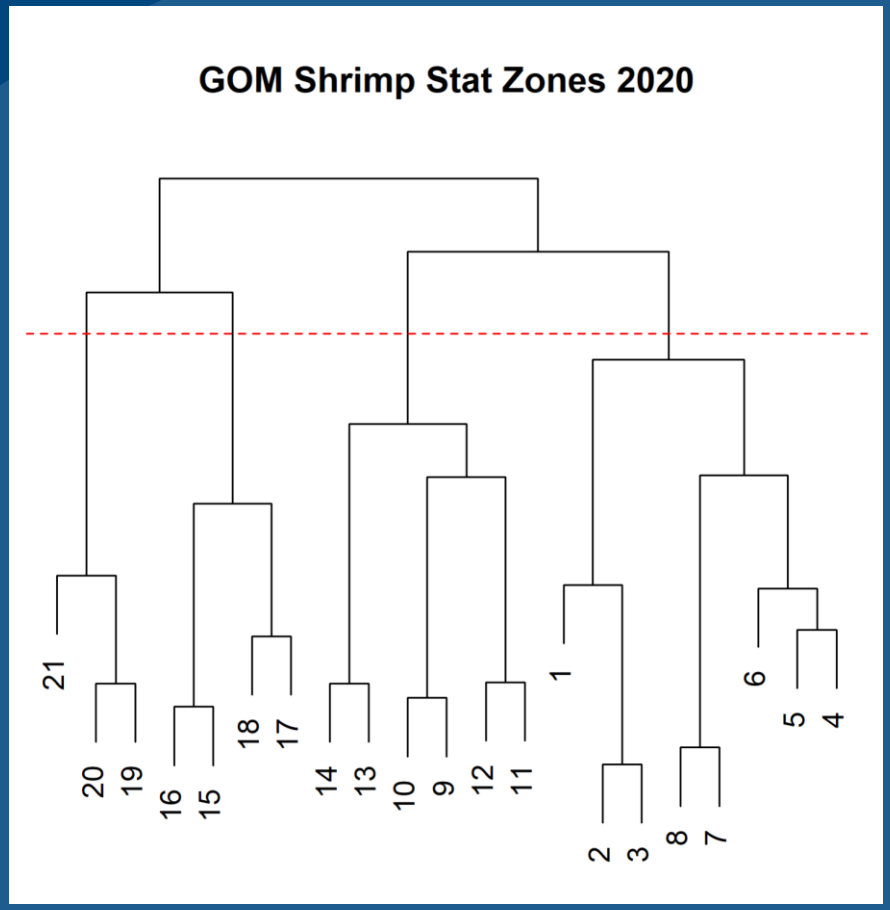


Figure 1: Distribution of vessel speeds.



2020 effort concentration. Offshore lines delineate 10-30 fm zone.

Effort Scaling



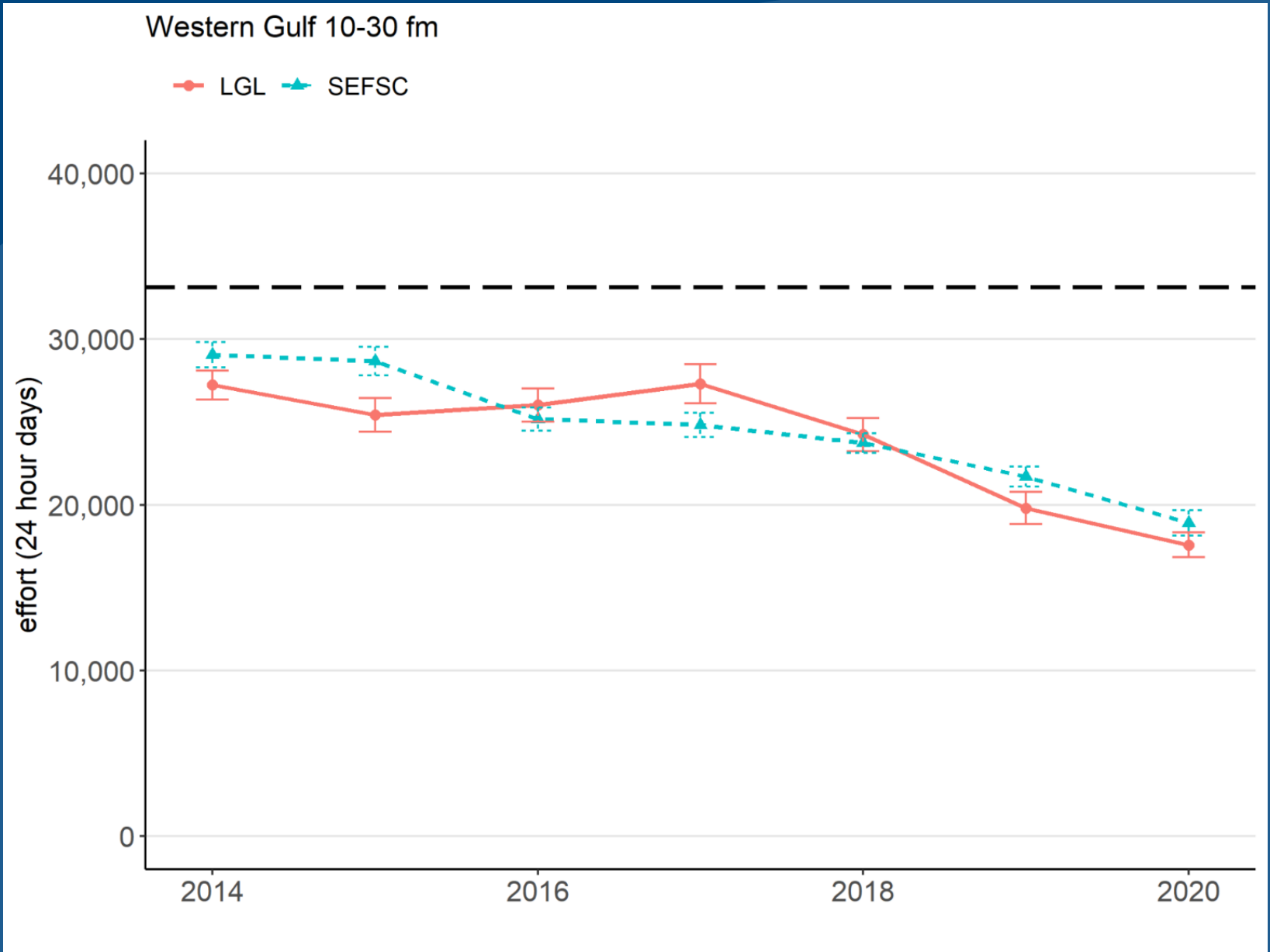
Area Definitions:

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

Quadrimesters:

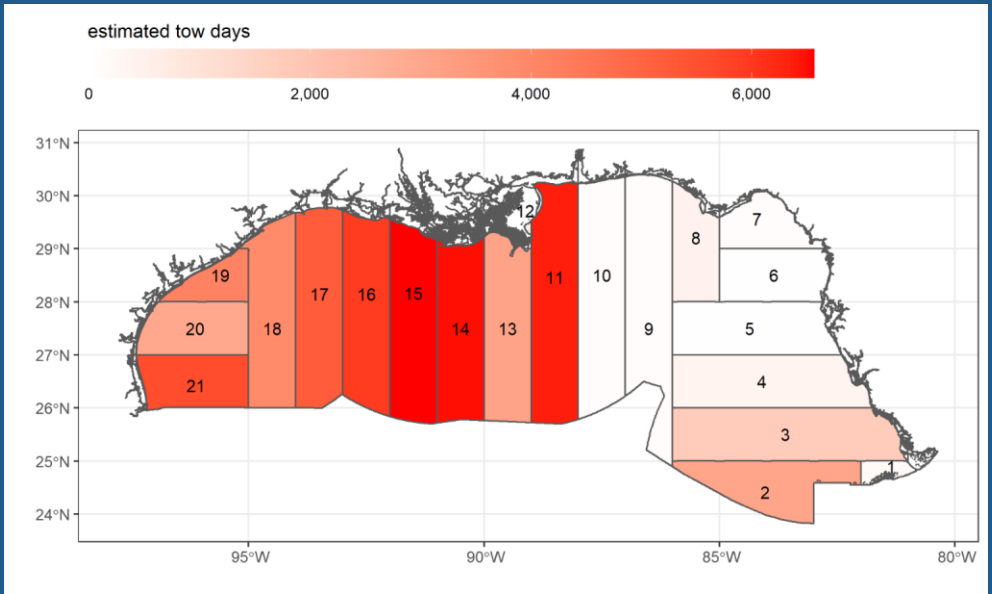
1. Jan-Apr
2. May-Aug
3. Sep-Dec

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

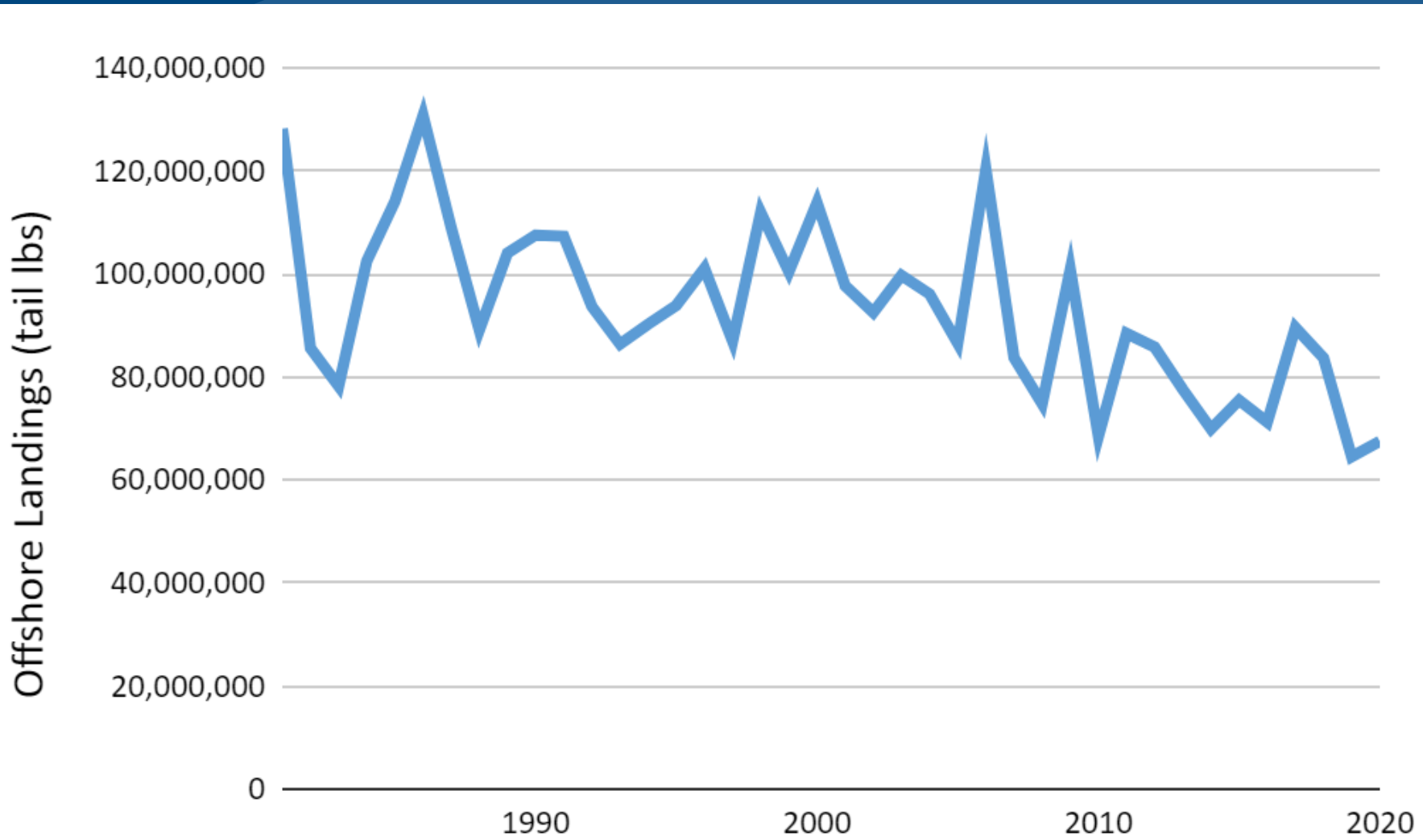

Western Gulf 10-30 fm
LGL
SEFSC
40,000
30,000
20,000
10,000
0
effort (24 hour days)
2014
2016
2018
2020

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	–	–



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

SEFSC Next Steps / Recommendations

- SEFSC will explore issues raised at the shrimp effort estimation workshop
- 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