



NOAA
FISHERIES
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Gulf of Mexico Shrimp Effort Estimation

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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.



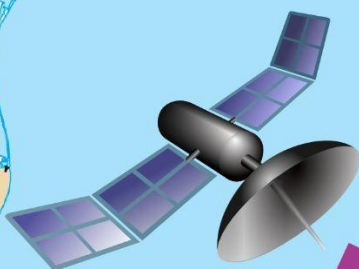
National Coastal Data
Development Center (NCDDC)
at Stennis Space Center, MS

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

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

$$= \sum ((\text{effort from boxes in an area and time period}) \times (\text{total landings in an area from trip ticket data}) / (\text{landings from trips with ELB boxes in an area}))$$

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 (add equation)
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. CPUE of vessels with ELBs on board is representative of the total fleet
3. Spatial distribution of ELB vessels is representative of the total fleet
4. 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%)



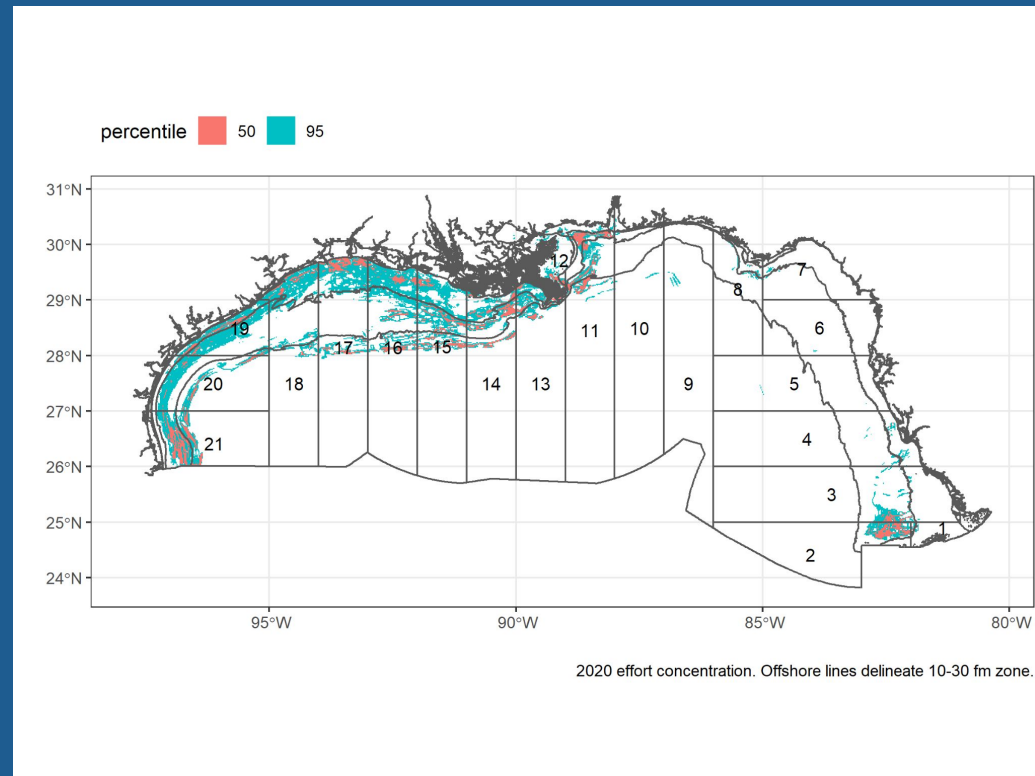
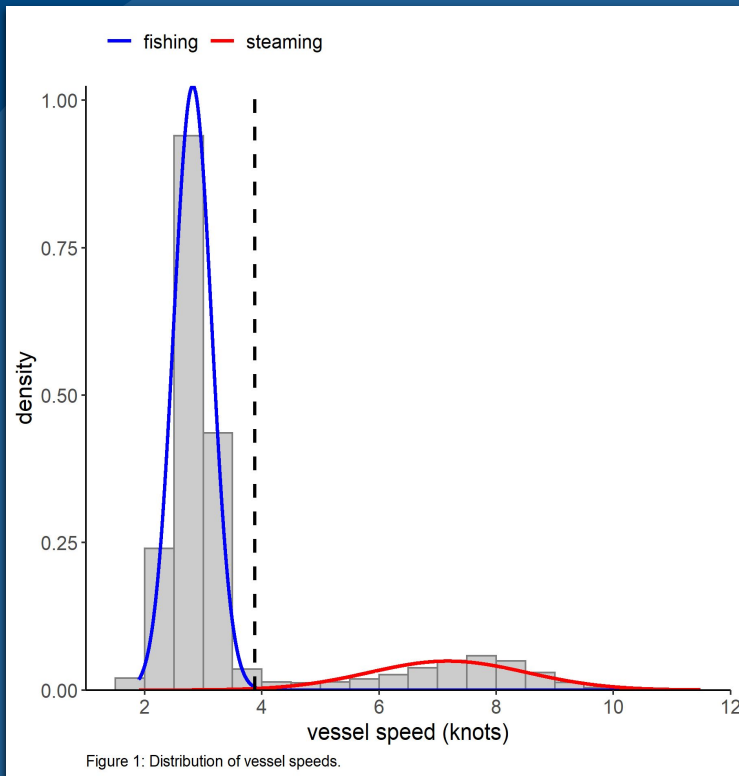
Summary of Changes (part 2)

- Code

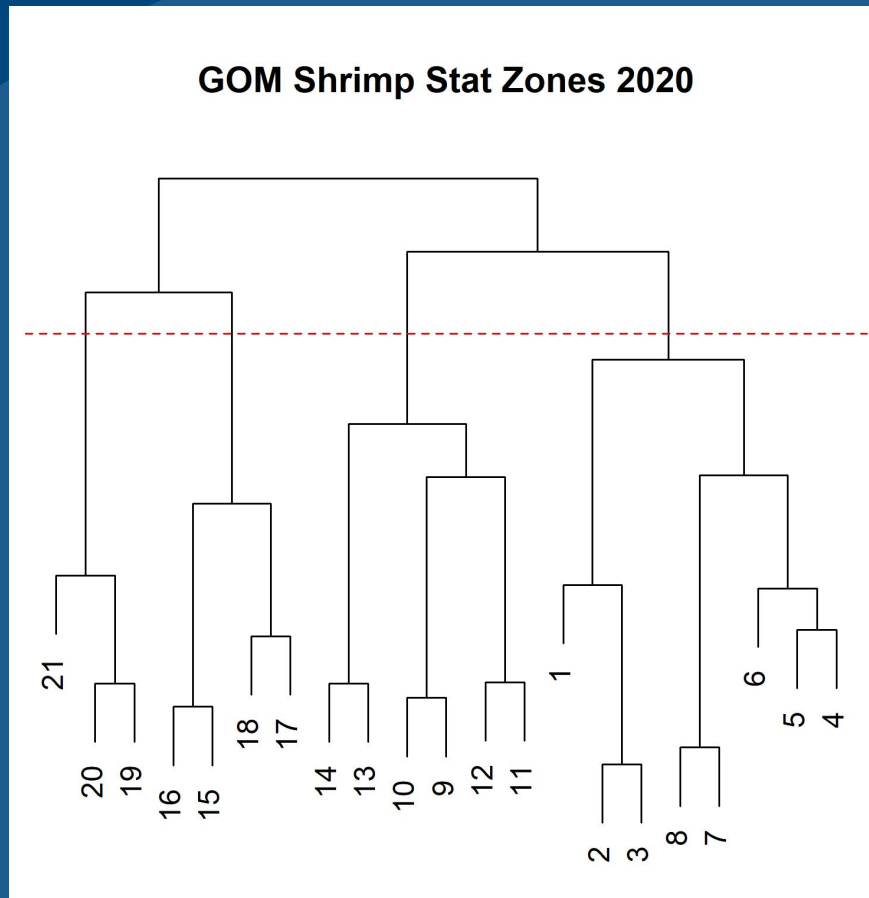
- Code is substantially simplified and modernized
- All processing and report generation is done in a single R script with one input parameter (year)
- All decisions are transparent as function arguments informed by observer data and examination of resulting distributions
- No randomized components



2020 ELB Effort Distribution



Effort Scaling



Area Definitions:

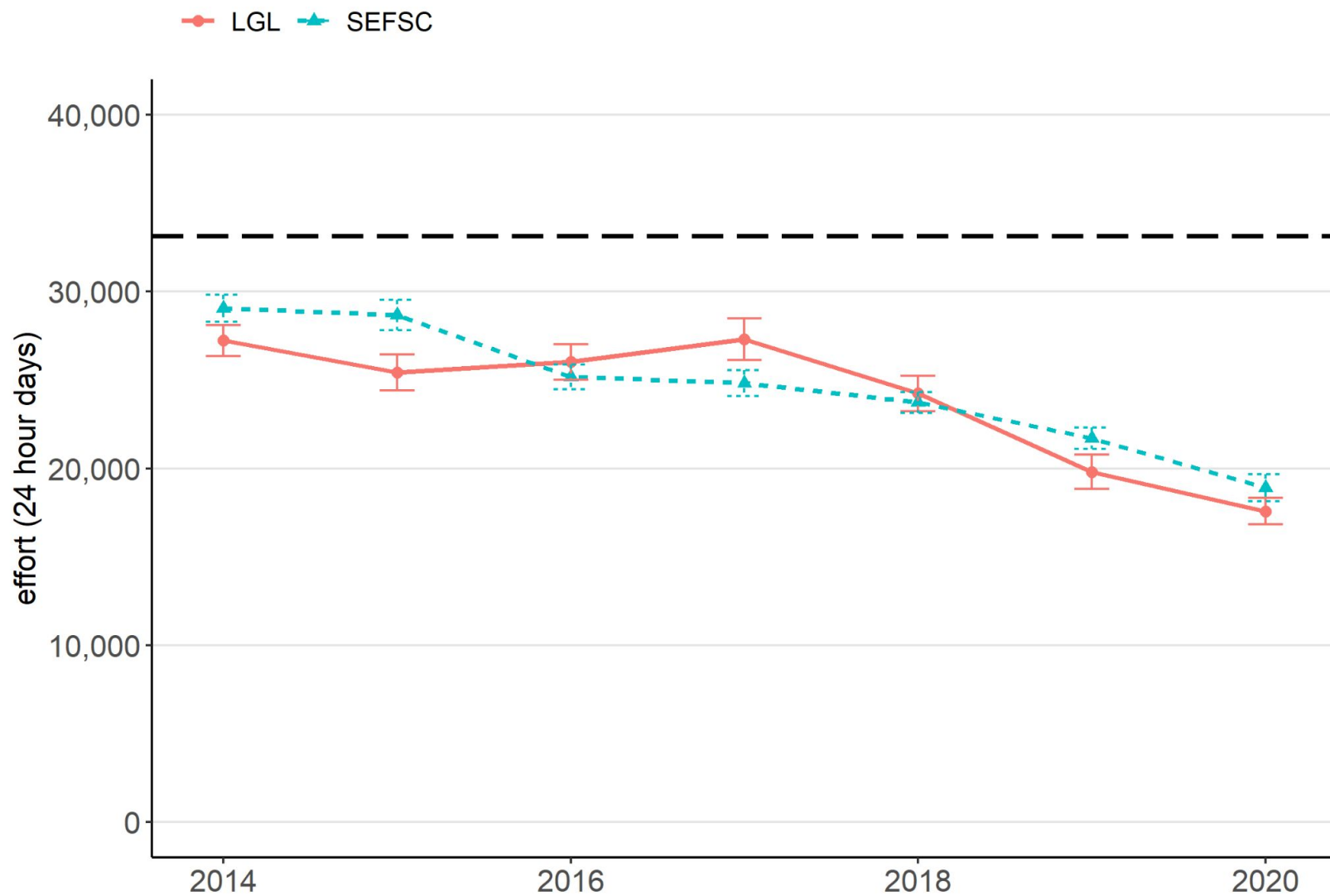
1. Zones 1-8
2. Zones 9-14
3. Zones 15-18
4. Zones 19-21

Quadrimesters:

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

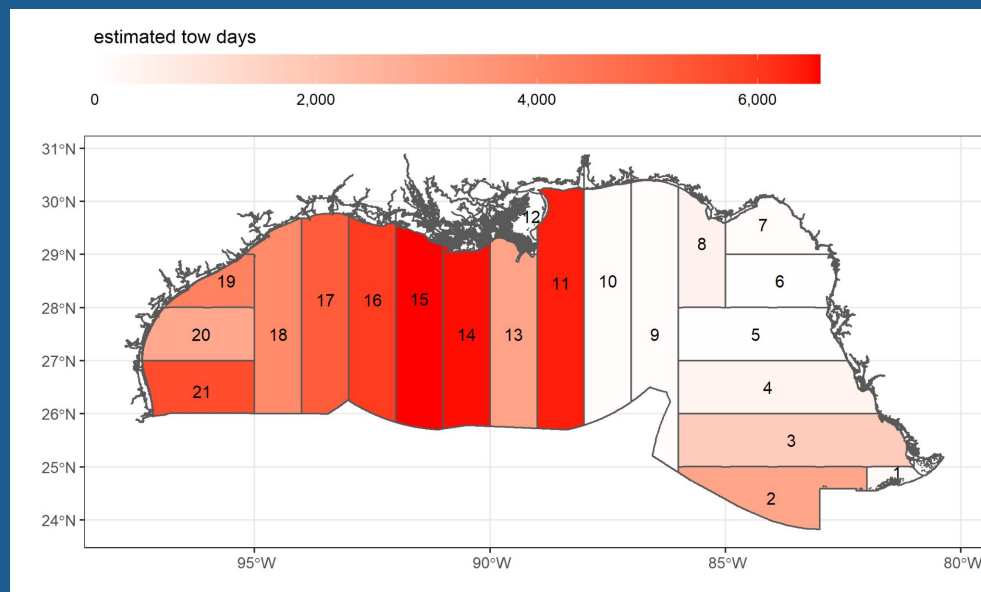
$$\text{total effort} = \sum \text{ELB effort}_{\text{area/quad}} \times \left(\text{total landings}_{\text{area/quad}} / \text{ELB landings}_{\text{area/quad}} \right)$$

Western Gulf 10-30 fm

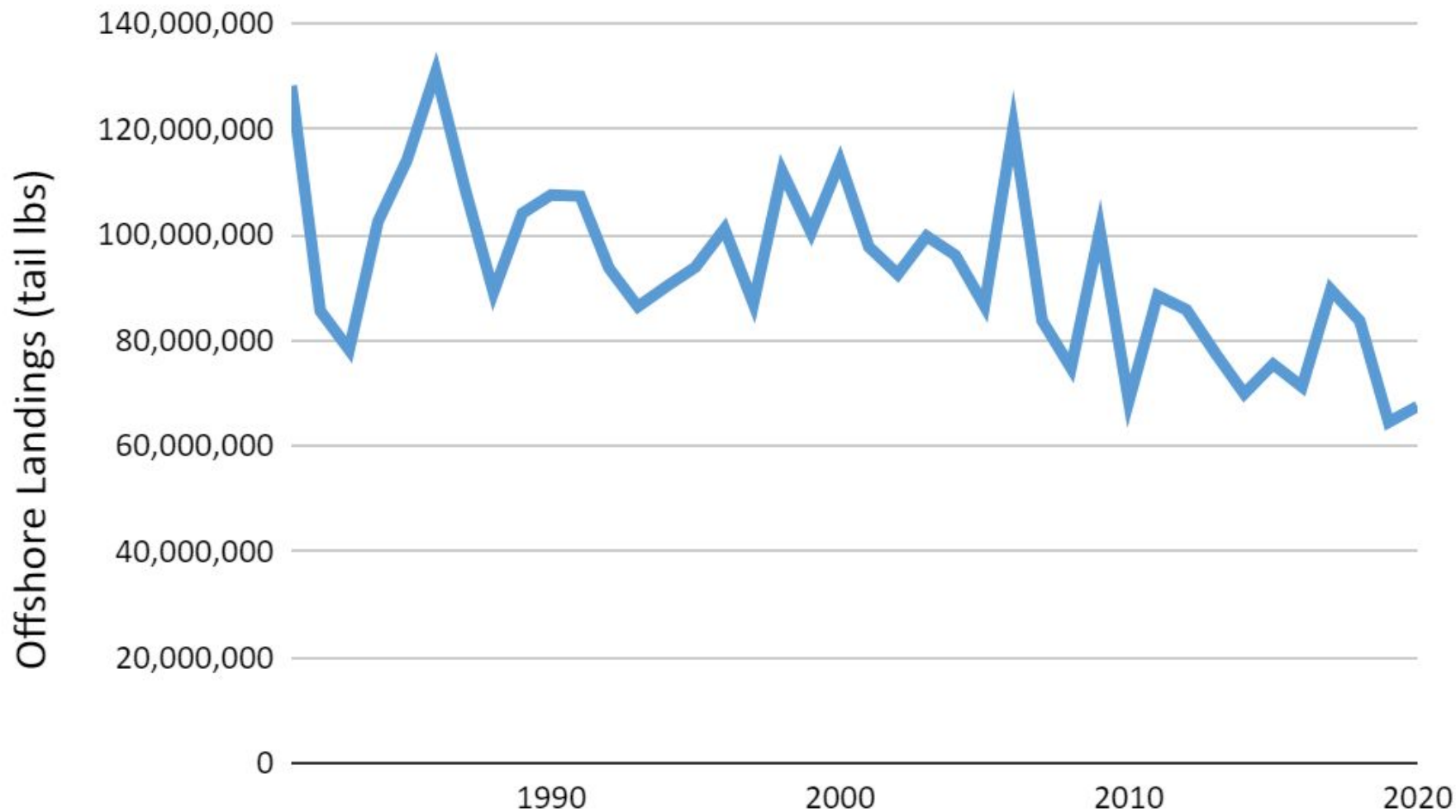


2020 SEFSC Offshore Estimates

| 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



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

