Survey Design and Estimated Costs for Position-recording Devices in the Gulf of Mexico Shrimp Fleet

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History of vessel selection

- Original sample frame: shrimp vessels permitted to fish in GOM federal waters as of December 31, 2004 that reported landings in either 2003 or 2004 (2,104 vessels). Ultimately 577 vessels submitted data through the cELB program at some point between 2005 and 2013.
- Vessels assigned to one of 9 geographic zones across the Gulf Coast based on port with majority of landings in most recent year with fishing activity
- 5 of the 9 zones with significant numbers of both ice and freezer boats were split into two strata, for a total of 14 strata (5x2 + 4 = 14)
- Number of samples within each stratum based on proportion of total offshore landings
- Individual vessel selection probability within strata based on weighted average of 2003 and 2004 landings, with twice as much weight assigned to 2004 landings
- Vessels that would not participate were replaced with an alternate randomly selected vessel
- If a problem arose with installation on a randomly selected vessel, researchers would seek volunteer vessels to complete the installations

SEFSC selection followed similar logic with 500 SPGM vessels in initial 2014 selection and an additional 100 vessels selected in 2018 (~40% of permitted fleet)

Current ELB vessel coverage

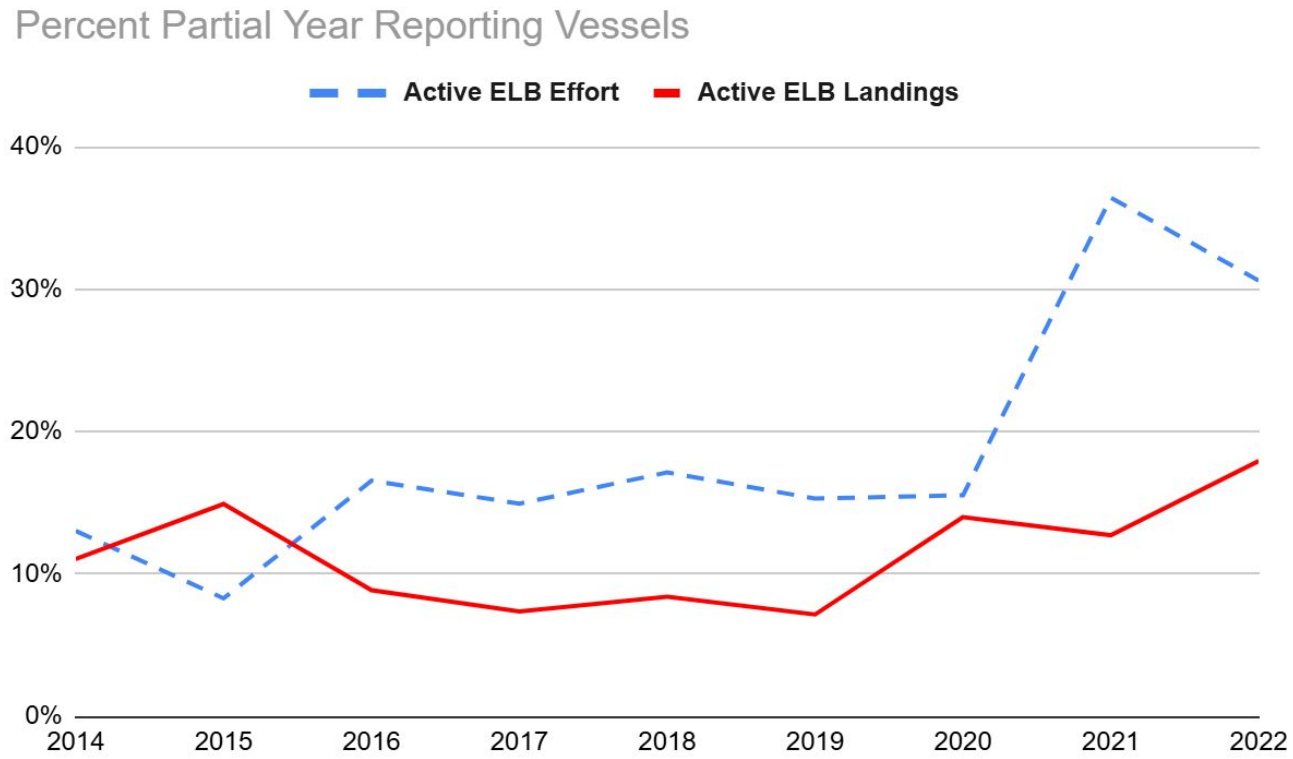
- Current (as of October 2024) Gulfwide coverage is ~32%, or 397 out of 1,257 vessels with valid and renewable permits
- In 2023 we received effort data from ~27%, or 176 out of 651 active offshore vessels based on trip ticket landings
- Receipt of effort data is down from closer to ~60% of active offshore vessels pre-2020 loss of 3G

Current Assumptions

1. ELB devices are capturing all fishing activity for a vessel
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*

*Assumptions 3-5 can be eliminated with a census

Are we capturing all ELB effort?

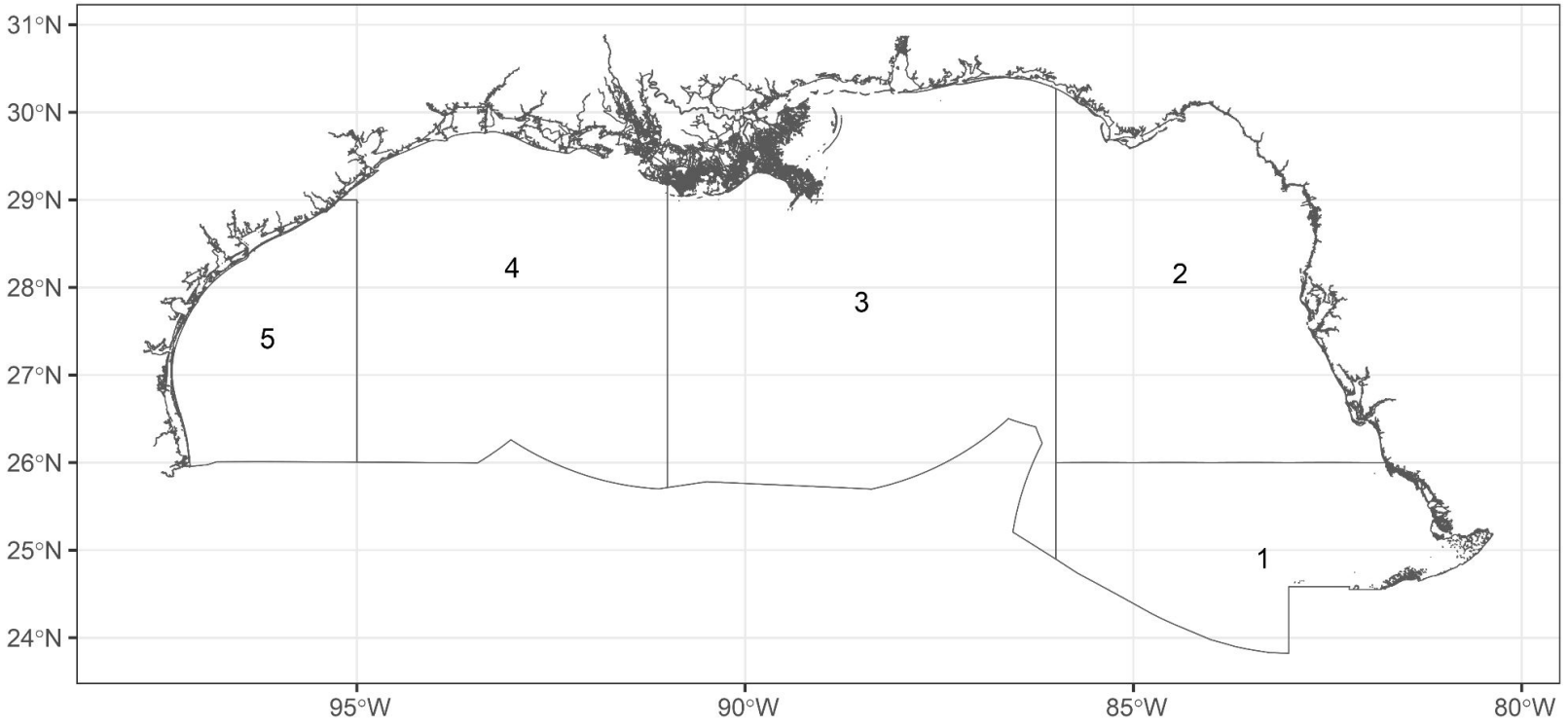


Uptick in vessels with partial year (6 month) ELB effort relative to partial year reported landings beginning in 2021 suggests we are not receiving complete effort data with chips

Spatial/Temporal Representation

- Percentage landings by area, quadrimester, and species have generally remained constant through time (2014-2022)
- ELB proportional coverage by strata has remained relatively steady through time
- Consistently representative coverage of ELB landings by quadrimester
- Area 3 (sz 9-14) is generally somewhat underrepresented by ELBs in relation to areas 4 (sz 15-18) and 5 (sz 19-21)
- White shrimp generally underrepresented in relation to brown shrimp
- Pink shrimp generally well represented
- Scaling process accounts for potentially unequal representation among strata, but we assume equal representation within strata

Map of aggregate areas used for effort scaling



Stat zones:

1: 1-3, 2: 4-8, 3: 9-14, 4: 15-18, 5: 19-21

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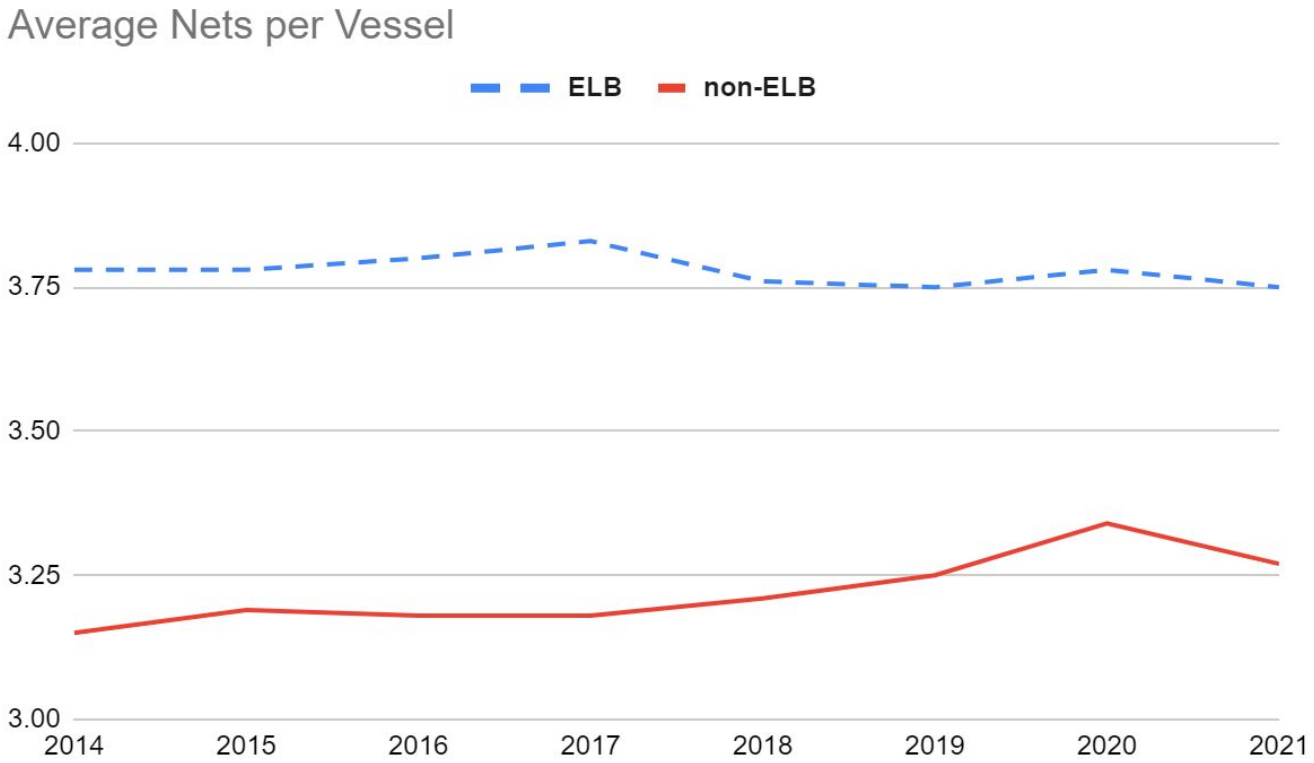
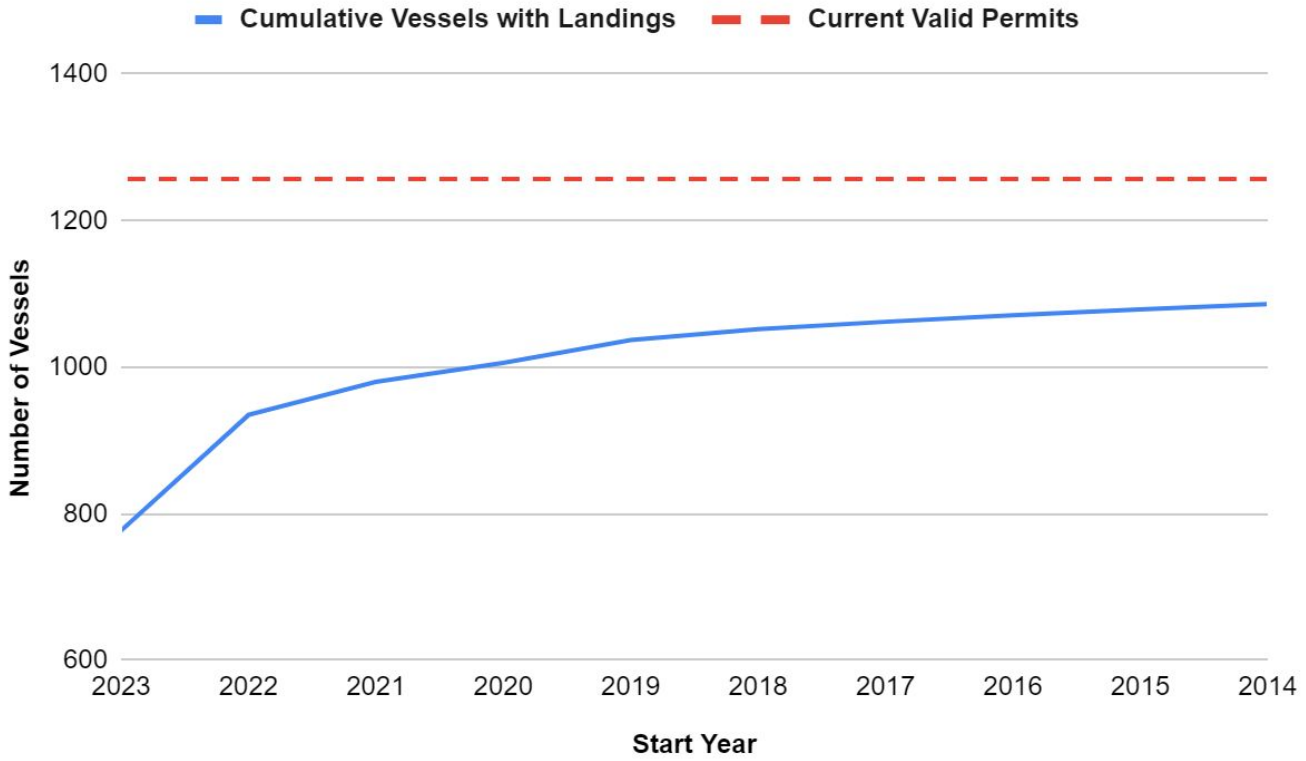
CPUE: ELB vs. non-ELB number of nets



Average nets used per vessel (based on annual landings and gear survey) among federally permitted active vessels is consistently higher for ELB vessels (~3.75) than non-ELB vessels (~3.25)

Landings reporting of ELB vs. non-ELB vessels



- Out of 1,257 current SPGM permitted vessels, 1,086 (86%) have reported trip ticket landings at some point since 2014

- Among the 171 vessels that have not reported landings, 158 (92%) have never held an ELB

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Conclusions

- Recent increase in partial year effort relative to partial year landings indicates we are likely not receiving complete chip data.
  - This will bias effort estimates downward
- ELB coverage has remained relatively constant through time across strata, but some strata are not proportionally represented.
  - Representativeness could be addressed with a new sample, but is only valid at the time of selection and may not remain valid into the future
  - Would only be based on 86% of vessels with valid permits that have reported landings in the past 10 years
- Evidence indicates assumptions 4 (equal CPUE) and 5 (equal likelihood of reporting landings) are likely not being met.
  - These will both bias effort estimates downward
  - A new sample could alleviate the issue of unequal CPUE, but not the fact that vessels with ELBs may be more likely to report landings

Statistical Aspects

A census* would be the most scientifically defensible data collection approach

- All vessels are selected
- Provides much more rapid effort data (current reliance on trip tickets creates a >1 year delay on effort)
- Provides complete spatial coverage
- Eliminates assumptions associated with scaling to the fleet
- Eliminates dependence on trip ticket landings to estimate effort and helps determine number of latent permits

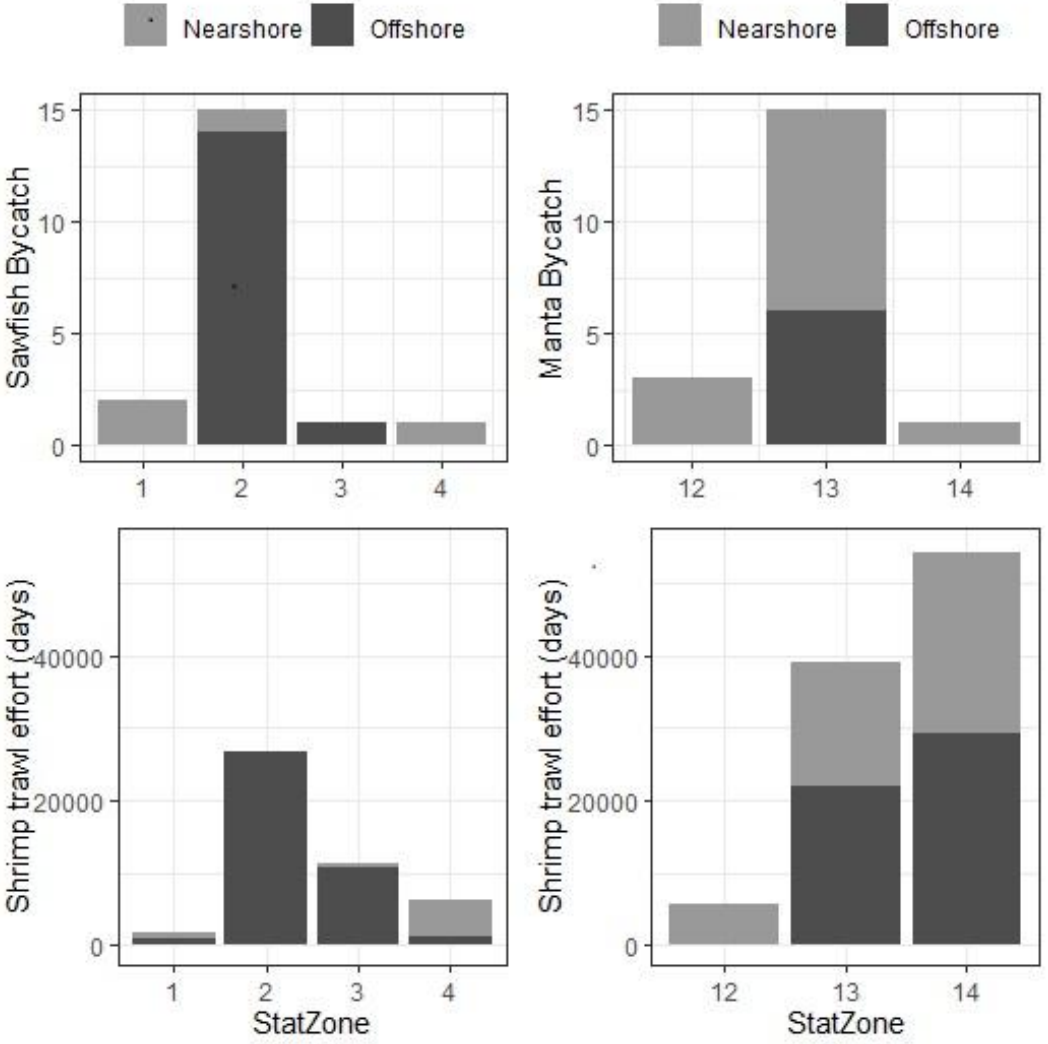
*Primary recommendation of Center of Independent Experts (CIE) review of effort estimation methodology

Industry Benefits

- Value of data per unit is maximized under a census
- Ensures better representation of effort by depth (e.g., it is possible that effort in the red snapper restricted 10-30 ftm zone is being overrepresented by ELBs compared to nearshore effort based on brown vs. white species composition)
- If closures were deemed necessary to reduce interactions with protected species, complete spatial coverage of effort would allow for decisions that minimize negative impacts to the shrimp fishery and improve recovery outcomes for the protected species (e.g., smalltooth sawfish interactions on the West Florida Shelf)
- All shrimping effort would be available for deconflicting the placement of offshore wind turbines with important fishing grounds for the shrimp industry.
- Complete effort data could be used to better estimate underreported landings, and thus a more accurate total economic value of the fishery

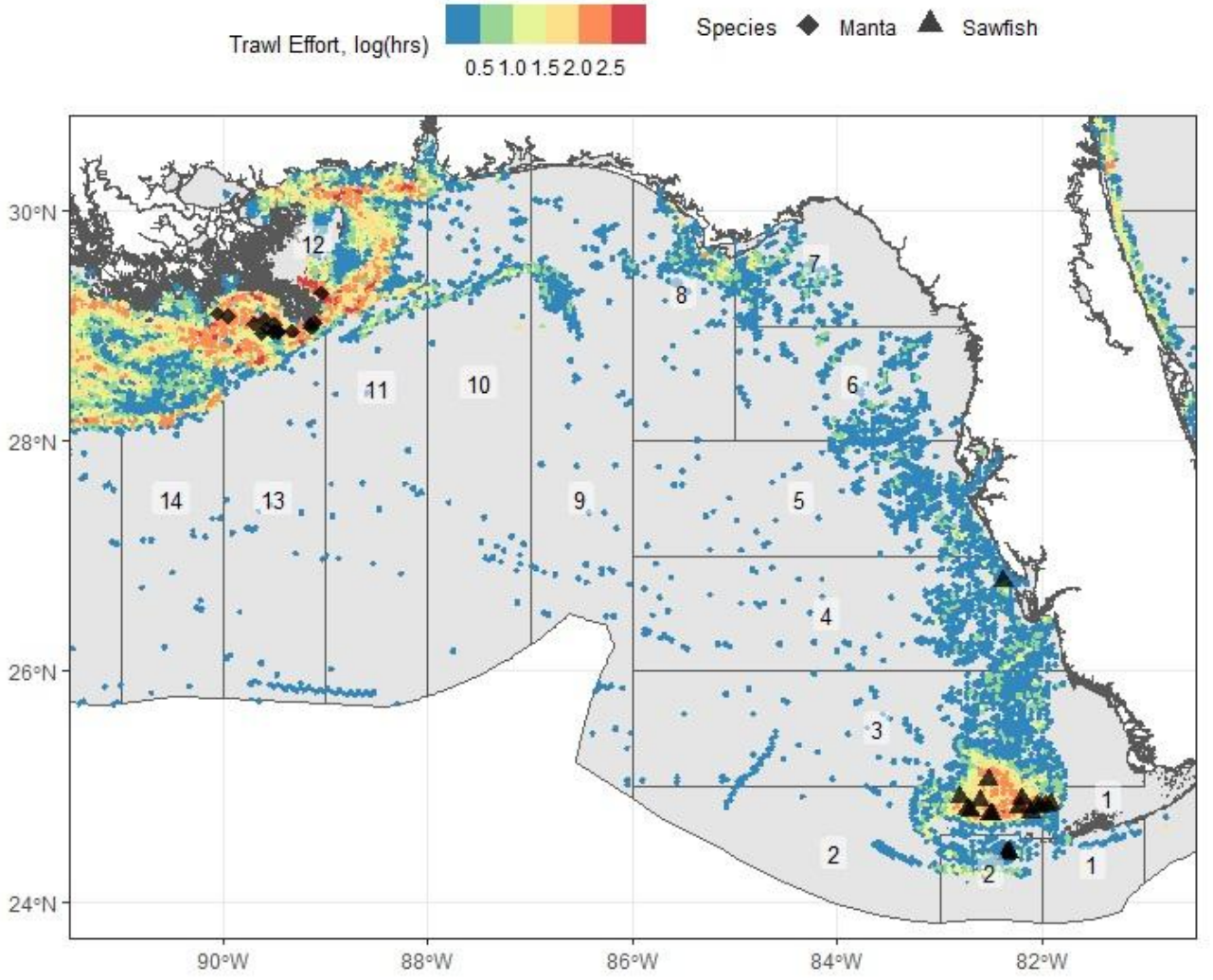
PR interactions

Sawfish and manta bycatch with shrimp trawl effort



PR interactions

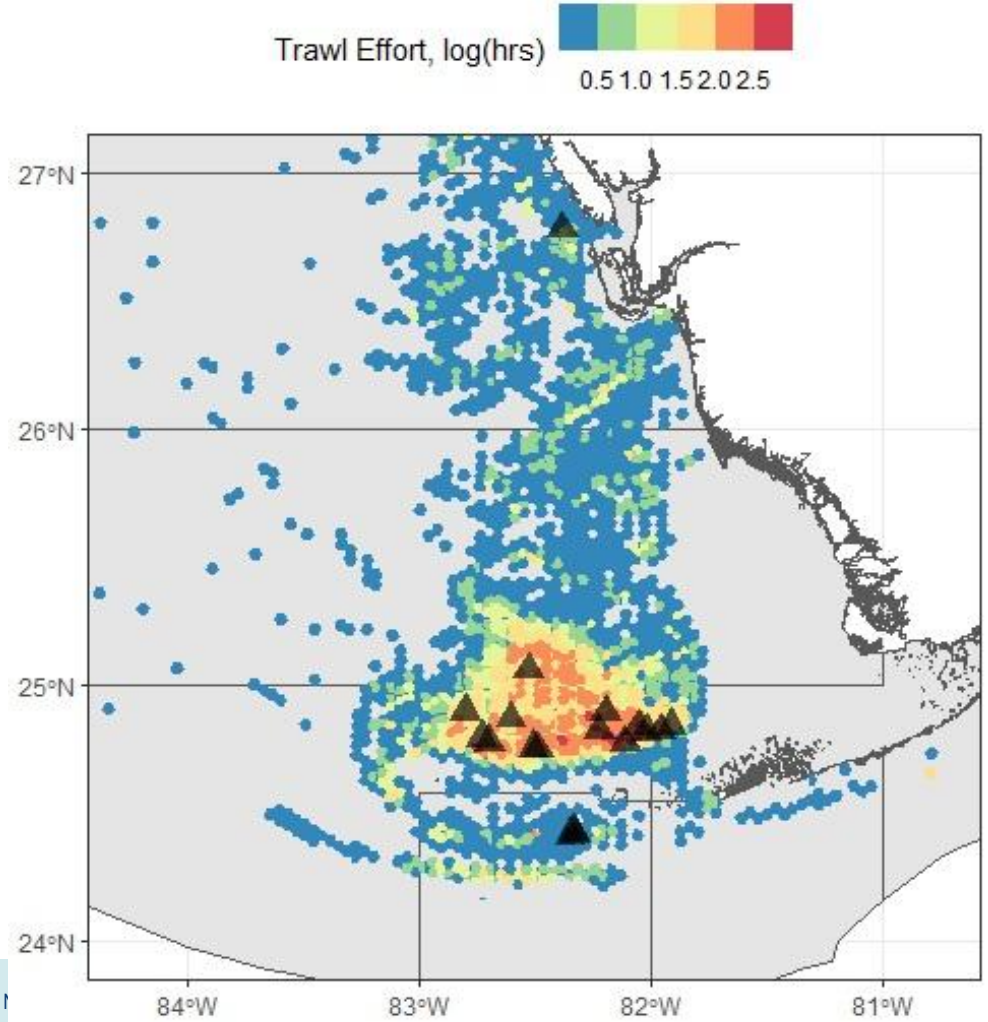
Shrimp observer program observations of manta and sawfish



PR interactions

Sawfish bycatch

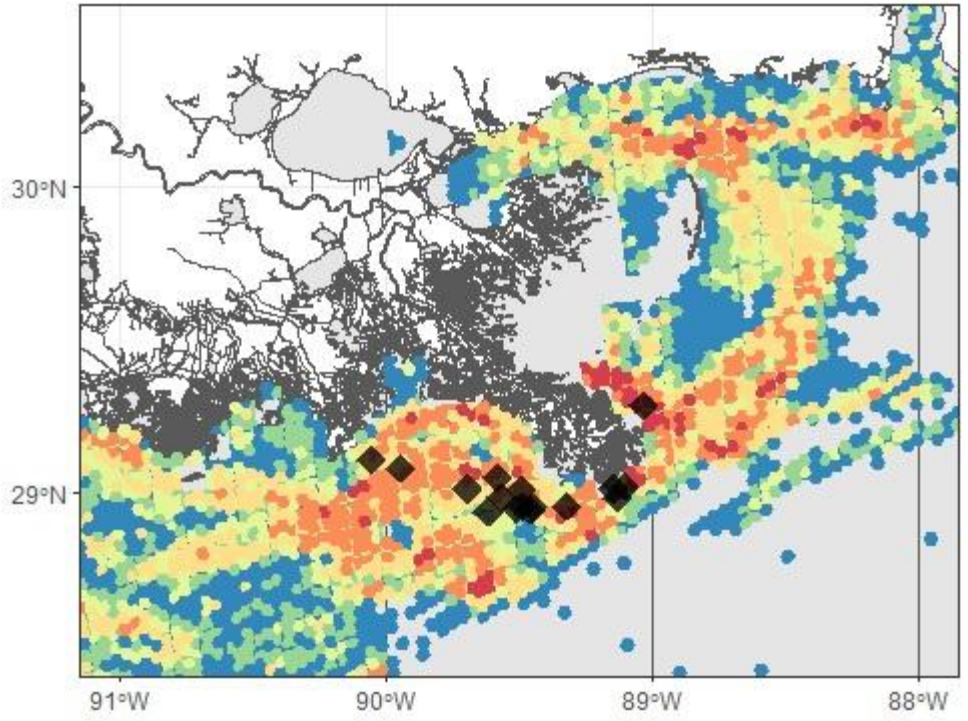
Shrimp observer program observations of sawfish from 2008 to 2022 (triangles) and color-coded effort map



PR interactions

Manta rays

Shrimp observer program observations of mantas from 2019 to 2022 (triangles) and color-coded effort map



Cost Considerations

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Industry Costs

Three units in the early adopter program

- Zen VMS ($1095), with cellular service $99/yr,
- Nemo VMS ($574), with cellular service $175/yr
- BoatCommand VMS ($199) with cellular service $179/yr

Cost Assumptions

- Used the middle value for the unit and cellular service to calculate costs
  - Devices: $199, **$574**, $1095
  - Annual cellular service: $99, **$175**, $179
  - Average installation cost: estimated at $300
- Total costs to the industry will be lower for any "early adopter" units that are type approved, under Alternative 2 (VMS). Discussion with vendors indicates they intend to submit for fishery-specific type approval.
- Assumes all vessels will eventually be selected (will need a unit) either in the initial sample or subsequent resamplings. Calculate costs on all permitted vessels (mimics census approach over time)

Industry Costs

- Total costs based on current active permits
- Costs will be less if owners select lower cost options
- **Alternative 2 (VMS system) would offer device cost reimbursement through the NMFS VMS program.**
  - Cellular VMS devices are reimbursed up to $950 per unit
  - Satellite VMS devices are reimbursed up to $3100
  - If Cellular and Satellite are both allowed, reimbursement would only be available up to the $950 per unit.

Industry Cost by Alternative First Year

This table is based on an indicative "middle" value for first year. Cellular service is an annual cost. Device and installation are one-time costs. 204 volunteers for units, with 90 installed as of August 2024. Funding could handle more than the 204 volunteers.

	Alternative 2 (VMS system)	Alternative 3
Devices	**1257 * $574 = $721,518[1]** [1] VMS reimbursements or early adopter may cover costs of units	**1257 * $574 = $721,518[2]** [2] Early adopter may cover $117,096 costs of units for 204 volunteers
Annual cell service	**1257 * $175 = $219,975[3]** [3] Early adopter program will cover service costs for volunteers for up to 3 years	**1257 * $175 = $219,975[3]** [3] Early adopter program will cover service costs for volunteers for up to 3 years
Installation	**1257 * $300 = $377,100[4]** [4] Early adopter program will cover installation for the 204 volunteers	**1257 * $300 = $377,100[4]** [4] Early adopter program will cover installation for the 204 volunteers
Total first year	**$1,318,593**	**$1,318,593**
Net Total first year **(subtracts early adopter & VMS reimbursement)**	**$500,175** *($0 + $184,275 + $315,900)*	**$1,104,597** *($604,422 + $184,275 + $315,900)*

Additional notes on industry costs

- **Satellite device costs** (results of an informal survey)
  - MetOcean (~$1850 for the unit, ~$100/month for transmission)
  - SkyMate - solar powered Satellite unit-type approved for SEFHIER (~$1000-$1500 for the unit, $30-$80 monthly transmission)

- Insufficient responses to calculate costs based on missed fishing opportunities
  - One vendor reported <1% down time for units
  - Will depend on regulations addressing device down-time

SEFSC Costs

- Two main categories of cost:
  - Census vs subsampling
  - VMS system (Alt 2) vs duplicative VMS system at SEFSC (Alt 3)
- Census vs Subsampling
  - Census approach will have lower costs as does not need a Survey Statistician to oversee the survey design and sampling (~ 1 FTE at $250K/yr)
- Building a VMS-like system at SEFSC
  - Increased costs to operate and maintain the system (IT oriented costs)
  - Increased costs to operate a helpdesk, contracting, type approval process, data sharing, data interface, and secure transmission
- Cost slides have the following caveats:
  - Based on FTEs. Hiring IT contractors can be 2 to 2.5 times the cost of an FTE.
  - A portion of costs are required to maintain a system once developed.

VMS-like Monitoring - Additional Costs to SEFSC (Alternative 3)

DOC, NOAA, and NMFS strategic plans emphasis enterprise-level data systems and eliminating duplicative data systems

Additional costs and considerations elaborated by the VMS program

- VMS legal staff authorizes requests for data access and dissemination to VMS data
  - VMS utilizes forms for all request that are reviewed by OLE GC
  - For example, State Law Enforcement under a Joint Enforcement Agreement could obtain access (similar to NOAA OLE) but a state manager access would require review for applicability under MSA
  - A VMS-like system would incur additional costs to SEFSC for legal review ~$30K per year
- SEFSC will need to increase their Federal Information Security Modernization Act (FISMA) and Privacy Impact Assessment (PIA) levels
  - Government mandates that are based on the type of data collected and stored in a data system.
  - One time cost and may take up to a year to implement (~ $200K)

VMS-like Monitoring - Additional Costs to SEFSC (Alternative 3)

- Creation of Graphical User Interface (GUI) for use by OLE, USCG, and state JEA.
  - 16 USC § 1861(b)(1)(A)(vi) and MSA § 311 (b)(1)(A)(vi) allows for access to data, with or without a warrant or other process, from vessel monitoring systems for any officer who is authorized to enforce the regulations
  - Considerable cost to SEFSC, as it requires security measures, data transmission, and summary reports and graphic depictions. ~$300K start-up; $100K maintenance per year
- Hiring help desk staff
  - Assists with unit activation (unit is registered and showing in our system, associated with the permit and vessel)
  - Work with vendors on any software upgrades over time (e.g., security standards)
  - Work with fishermen to troubleshoot a failing unit
  - Assist with data requests
  - Estimated costs at $250K per year, potential increase costs in years that require a software upgrade to keep up with secure transmissions

VMS-like Monitoring - Additional Costs to SEFSC (Alternative 3)

- Device Type Approval
  - Type approvals are by fishery for those fishery requirements. Type approval only can happen after the requirement is final.
  - Vendor must request the type approval for each fishery.
  - Cost is incurred per unit from a vendor (~$30-60K per unit based on VMS program)
  - VMS utilizes a contractor for all type approvals.
    - Under Alternative 3, SEFSC would need to develop their own process and create their own contract that duplicates an existing contract (in essence paying twice for the same type of work). This contract may not meet standards for contracting. Estimated costs ~$300K

Monitoring Costs - VMS-like System Needs

	Alt 2 (start up)	Alt 2 (Maintenance)	Alt 3 (start up)	Alt 3 (Maintenance)
SEFSC analysis and maintenance costs	*$272,500**	*$241,000**	*$487,500*	*$341,700*
Additional SEFSC VMS-like costs	*$0*	*$0*	*$1,080,000*	*$440,000 - $500,000*
SEFSC Total Costs	**$272,500**	**$241,000**	**$1,567,500**	**$781,700 - $841,700**
Industry Costs (reduced: early adopter and/or VMS reimburse)	$500,175	$219,975	$1,104,597	$219,975
Total Program Costs	**$772,675**	**$460,975/yr**	**$2,672,097**	**$1,001,675-$1,061,675/yr**

* Start up costs are currently covered within the budget. Anticipated maintenance costs can also be covered within current budget. Alt 3 costs contain costs currently covered within the budget and new expected costs to maintain the new system.

Conclusion

Estimated costs to the industry and the Agency are lower under Alternative 2 than under Alternative 3.

Estimated cost	Alternative 2	Alternative 3
SEFSC start up	$272,500	$1,567,500
SEFSC maintenance	$241,000	$781,700
Industry start up	$500,175	$1,104,597
Industry maintenance	$219,975	$219,975