

# Expanded Sampling of the Fleet for Effort Monitoring in the Gulf of Mexico Shrimp Industry

Shrimp AP Meeting  
March 2023

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**LGL Ecological Research Associates**

\*presenting

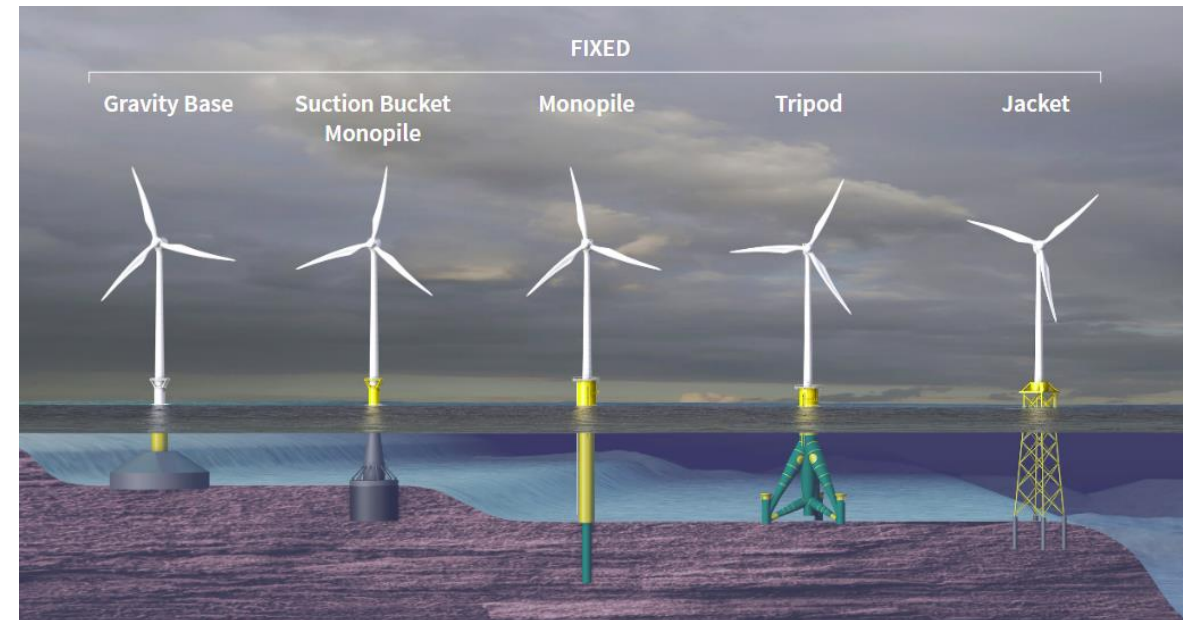
# Outline of Presentation

- Council-funded testing of P-Sea WindPlot software (Nathan Putman)
  - Background & Goals
  - Summary of progress
  - Results of final testing
  - Recommendations
- Additional, no-cost, side-by-side comparisons of P-Sea WindPlot and other position recording devices (Taylor Beyea)
  - Background & Goals
  - Tests: cELB, NEMO, Zen
  - Results: Failures and Promising Avenues

# Background

## Monitoring shrimping effort is important

- Assessing how shrimping impacts others
  - Calculating takes and interactions with sea turtles
  - Red Snapper stock assessments
- Assessing how others impact shrimping
  - Artificial reef placement
  - Infrastructure associated with offshore energy
  - Aquaculture siting



# Background



**NOAA**  
**FISHERIES**



- Previously, monitoring was achieved by NOAA Fisheries with a cELB (cellular electronic logbook)
  - Vessel speed is indicative of fishing behavior, shrimp towing occurs between 2 and 3.8 knots.
    - By recording a boat's (1) latitude/longitude and (2) date/time vessel speed can be estimated.
    - Recording these two standard data elements at 10-minute intervals over the length of a trip allows the amount of towing time (effort) to be calculated.
- Data were transmitted via 3G cellular networks (Verizon) to NOAA Fisheries for estimating effort, but in December 2020 Verizon discontinued 3G service
  - Data is recorded to cELB, but there is no mechanism for automatic retrieval
  - Shrimpers must return/replace SD cards within the cELB units manually

# Background

- Shrimping industry stakeholders suggested that existing navigational software on shrimp boats could be used to obtain the same data as recorded by cELBs
- Southern Shrimp Alliance (SSA) funded LGL Ecological Research Associates to work with the P-Sea WindPlot developer to modify the software to record the same information as the existing cELB program (location data at 10-minute intervals) in a way that would be compatible with existing software routines that use that data to calculate shrimping effort.
- These efforts were successful, but P-Sea WindPlot was not designed to automatically transfer data.
- The automatic transfer of position data (similar to the cELB system) was considered an essential component of any effort monitoring system by NOAA Fisheries.



# Goals

The Gulf of Mexico Fisheries Management Council funded the project, 'Expanded Sampling of the Fleet for Effort Monitoring in the Gulf of Mexico Shrimp Industry' with the following five objectives:

- (1) update P-Sea WindPlot so that it electronically transmits ELB files with the latitude/longitude and date/time in the format used in the cELB program to a specified destination (e.g., server);
- (2) develop a mechanism by which computers using P-Sea WindPlot can connect to a mobile communications services network;
- (3) conduct initial tests on five commercial shrimp boats from across the Gulf of Mexico;
- (4) troubleshoot and revise software/hardware and implementation protocols as necessary;
- (5) conduct secondary tests on 20\* additional commercial shrimp boats.

\*Owing to (a) the need for more extensive troubleshooting and desktop testing of P-Sea WindPlot and (b) a major drop in shrimping activity as a result of Hurricane Ian and high fuel prices, only 10 tests were conducted.

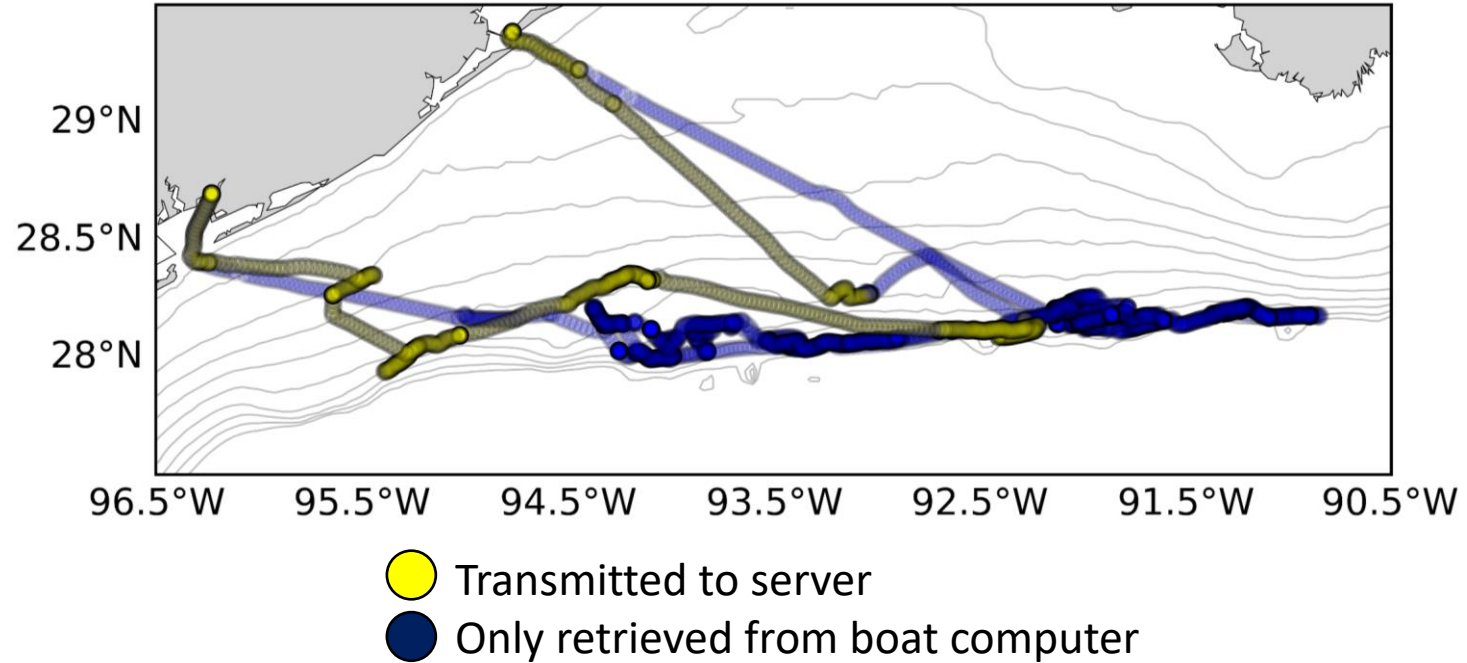


# Goal 1 and 2:

- Software Update
  - An FTP client was successfully added to P-Sea WindPlot
    - Secure Shell (SSH) transfers files to a designated server
  - At the start of a new trip, P-Sea WindPlot automatically writes a file designated by unique ID based on either the MMSI number for the boat (an AIS designation) or the P-Sea WindPlot Key and the date/time the trip began.
  - Every 10 minutes, the date/time (GMT) and lat/lon are appended to this file.
  - If the computer is connected to internet, every 10 minutes this file is transferred to a designated server.
  - If the internet connection is lost, data continues to be recorded and upon re-connection with the internet, files are automatically transmitted to the server.
  - File naming conventions and processing ensure that no duplicate files are transmitted to the server.
- Desktop testing
  - Computer wired with GPS and updated version of P-Sea WindPlot
  - Verizon hotspot used as connection
  - Local LGL server used as repository
  - Success - simulated logged ELB files sent automatically to server from P-Sea WindPlot upon connection to internet signal
  - Success – P-Sea WindPlot continues to log data when hotspot out of range
  - Success – P-Sea WindPlot automatically reconnects to hotspot when in range and transmits unsent data, seamlessly continues transferring data thereafter

# Goal 3:

- Installations of P-Sea WindPlot on 8 vessels
  - 3 vessels out of Bayou La Batre
  - 5 vessels out of Palacios
- 9 trips to Palacios for installing revisions (6/15 – 10/03)
  - Typically, ~2 boats per trip.
  - Lots of software troubleshooting, some hardware issues.





# Goal 3: PSea WindPlot Challenges

- Installation issues:
  - Different problems for different computers
    - Some unrelated to PSea WindPlot (e.g., GPS drivers not connecting)
    - Some related to Windows update incompatibilities (e.g., file transfers don't always function)
- Technical issues
  - The GPS devices on some vessels give the wrong date/time
    - e.g., GPS on Sept. 7, 2022 was reporting January 3, 2022.
  - Some “freezing” issues (e.g., PSea WindPlot needs to be restarted after remaining on for a number of days)
  - Some cosmetic issues (e.g., setting map range, boat heading icon)
  - Unique IDs on ELB files may change if different PSea WindPlot keys are used (makes compiling data difficult)
- People problems:
  - Some captains don't like us messing with their computers
  - There are lots of versions of PSea WindPlot and some folks are comfortable with “their” version (cosmetic issues are problems for them)
  - Some captains haven't turned on hotspots
  - Some captains turn off PSea WindPlot at different points during the trip
- *Biggest hurdle: Each computer is its own, unique set of problems. It's hard to guarantee that what we install won't “mess something up”*

# Goal 4: Revised PSea WindPlot software

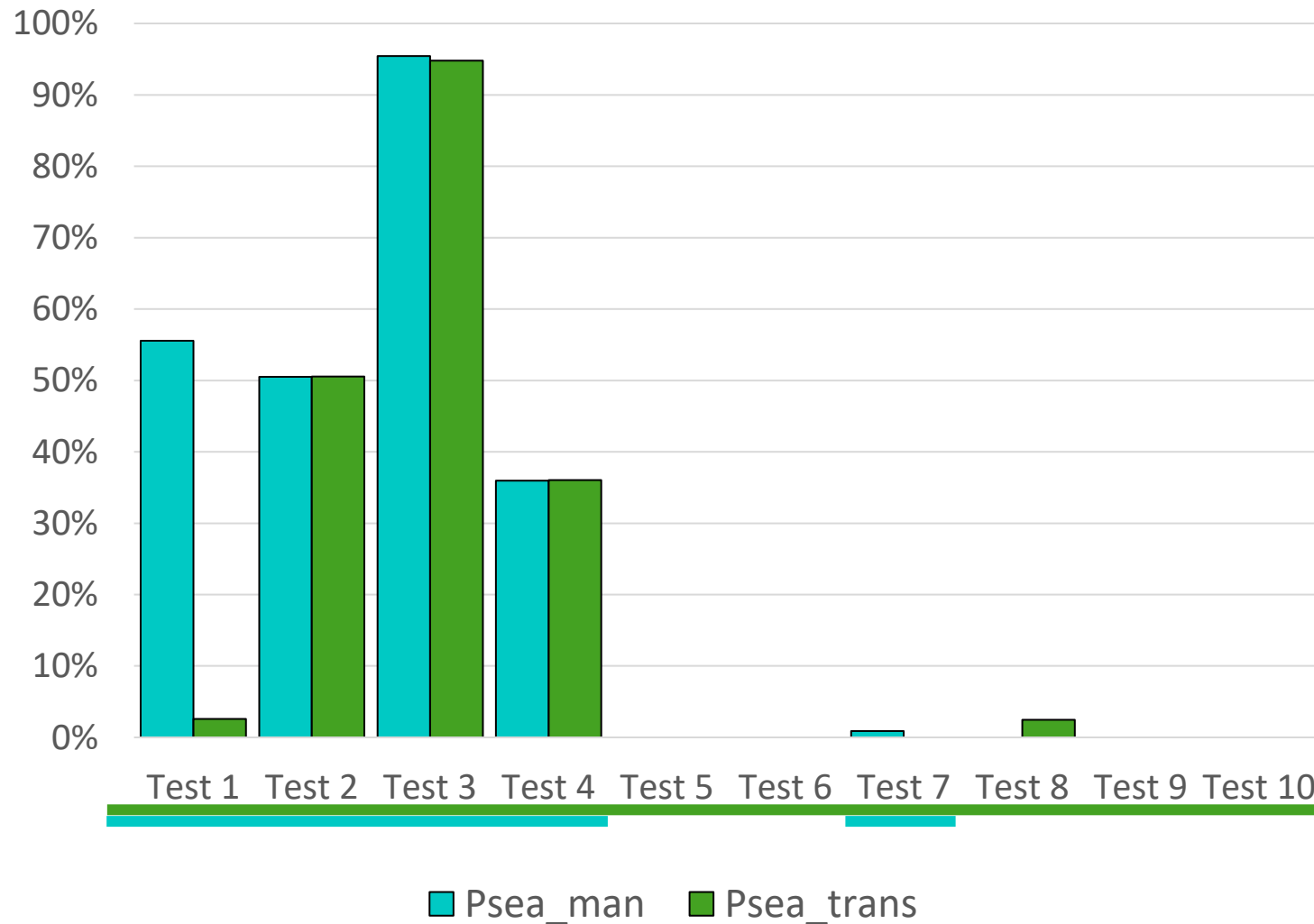
- Installer can select the attempted transmission frequency (e.g., every 10 minutes or every 24 hours) to reduce freezing/plotting issues
- Installer can input the shrimp boat's permit number as the unique ID for ELB files
- Revision of the function that sends all ELB files from a vessel's computer to the server (to help with the "partial" transmission issue)
  - Each position record sent to server as an individual file, rather than appending to a single, large file.
- Installer can select the ELB program to use the GPS time or computer time (based on which one is more accurate)

# Goal 5: Vessel Testing Summary

Test #	Dates	Port	Psea Details	Data Recorded / Transmitted	Problems Encountered
Test 1	11/30 – 12/19 2022	Palacios, TX	New Laptop/GPS	55.6% / 2.6%	Failed to transmit after leaving port, erratic recording. Likely Windows 11 incompatibility.
Test 2	11/29 – 12/18 2022	Palacios, TX	New Laptop/GPS	50.5% / 50.5%	Erratic (on/off) recording and transmission. Likely Windows 11 incompatibility.
Test 3	11/28 – 12/3 2022	Palacios, TX	Captain Desktop/GPS	95.4% / 94.8%	Performed well.
Test 4	12/8 – 12/17 2022	Palacios, TX	Captain Desktop/GPS	36.0% / 36.0%	Psea WindPlot “froze” during trip resulting in captain turning off computer for parts of the trip
Test 5	11/27 – 12/12 2022	Palacios, TX	Captain Laptop/GPS	-- / 0%	Failed to transmit after leaving port Laptop was old/unreliable
Test 6	11/27 – 12/15 2022	Palacios, TX	Captain Laptop/GPS	-- / 0%	Failed to transmit after leaving port Laptop was old/unreliable
Test 7	11/27 – 12/16 2022	Palacios, TX	Captain Laptop/GPS	0.8% / 0%	Failed to transmit after leaving port. Capt. may have primarily used another Psea WindPlot version
Test 8	10/27 – 12/8 2022	Palacios, TX	Captain Desktop/GPS	-- / 2.5%	Scattered transmissions of location. Capt. proficient with Psea WindPlot troubleshooting
Test 9	11/27 – 12/17 2022	Palacios, TX	Captain Laptop/GPS	-- / 0%	Failed to transmit after leaving port. Unsure why.
Test 10	12/3 – 12/19 2022	Tampa, FL	New Laptop/GPS	-- / 0%	Failed to transmit after leaving port. Unsure why.

# Goal 5: Vessel Testing

**Percentage of Data Points Collected at  
10 Minute (+/- 30 Sec) Expected Interval**

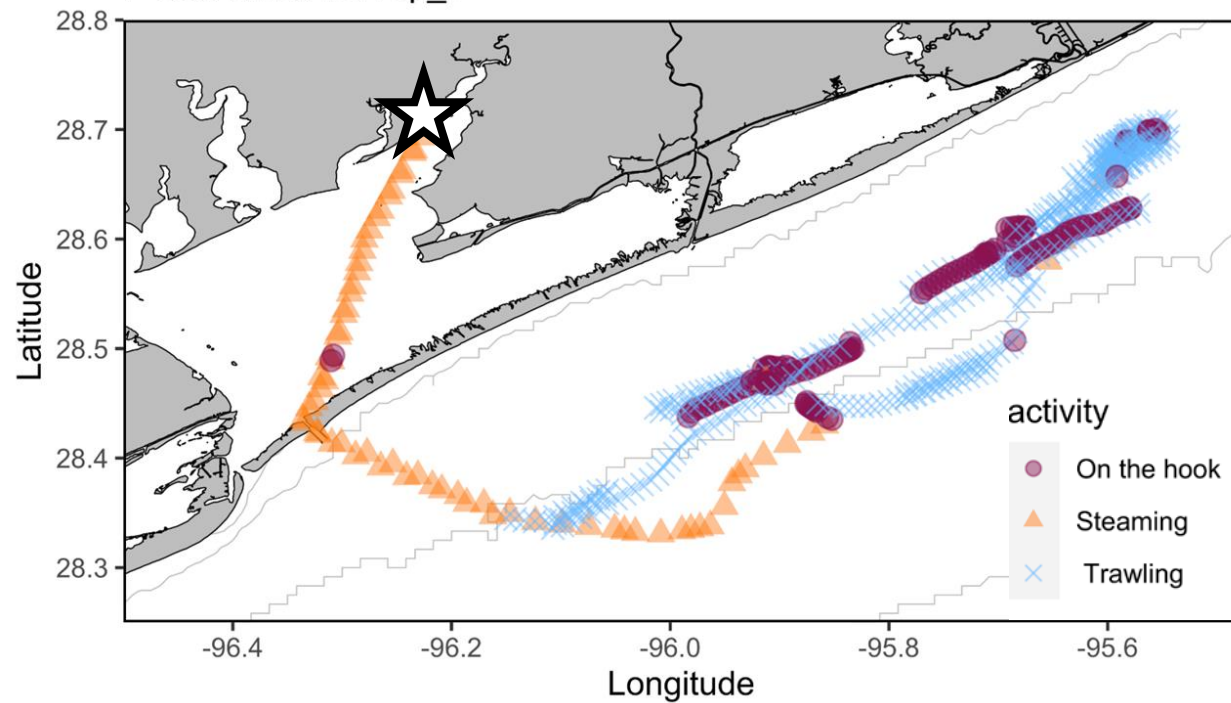


# Position data run through the “LGL Effort Algorithm”

Box#:18637

P-Sea WindPlot Trip\_1

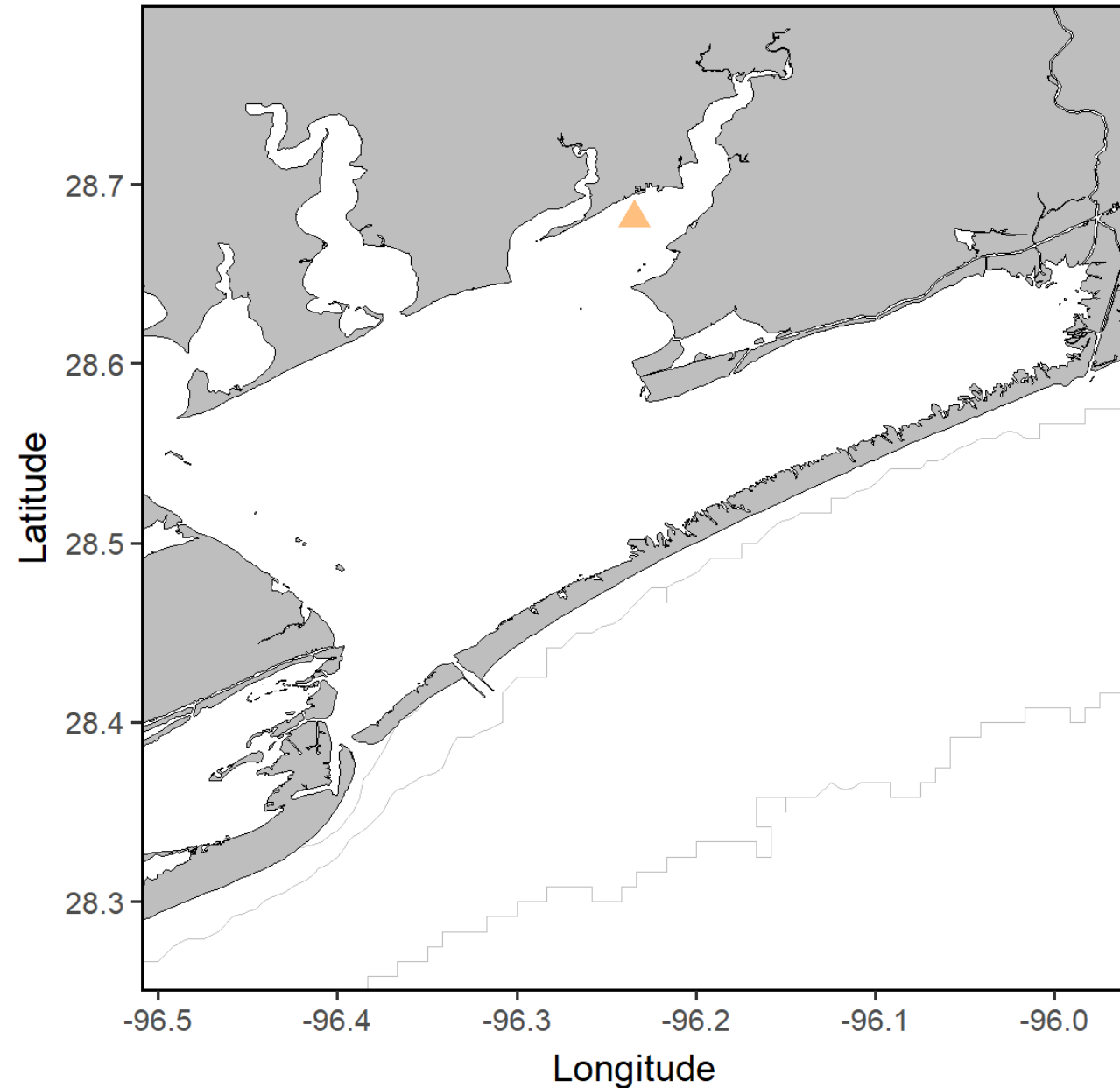
**Test 3**



Date\_time: 4022-11-28 09:46:00

P-Sea WindPlot Trip\_1

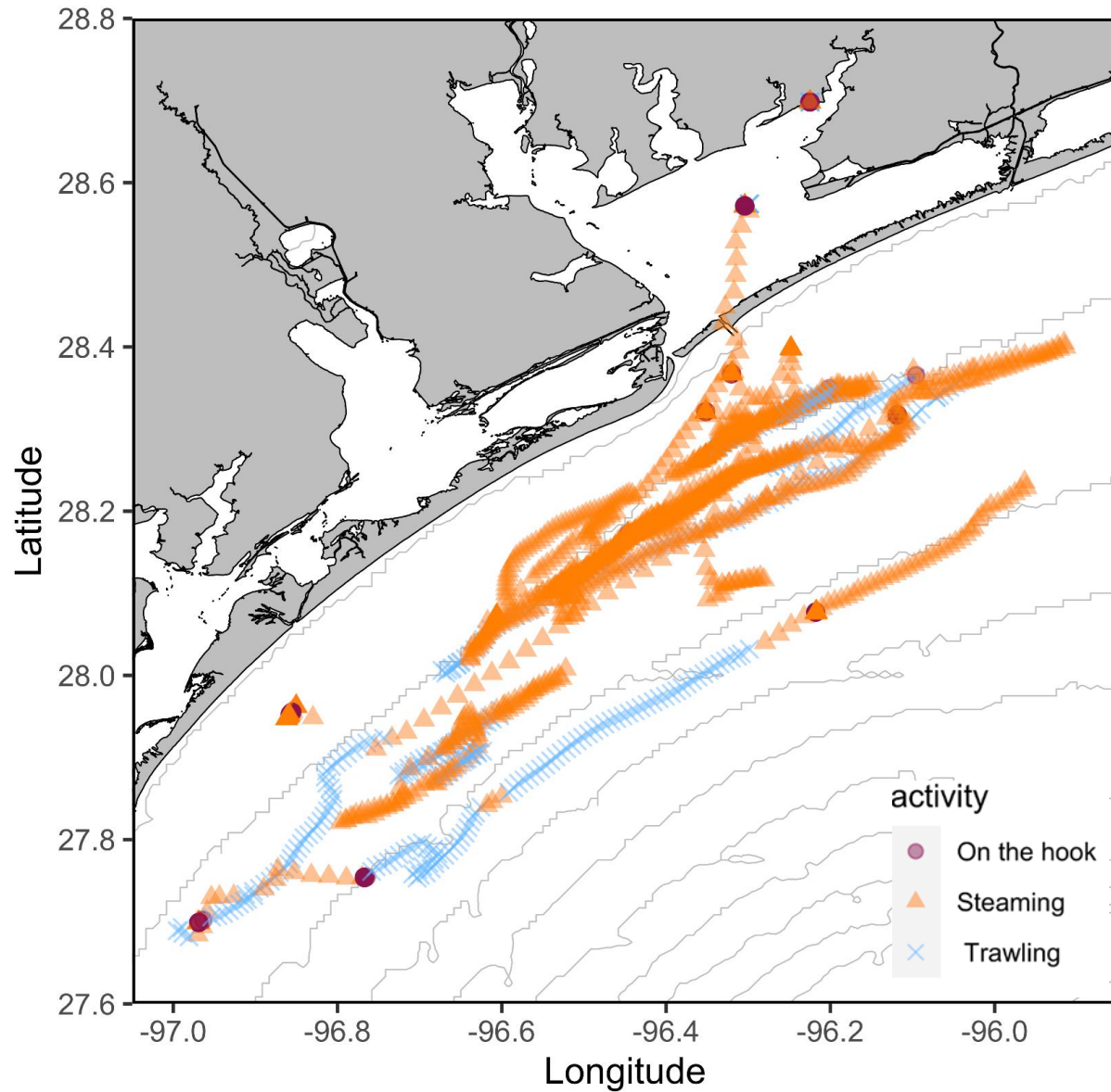
**Test 3**



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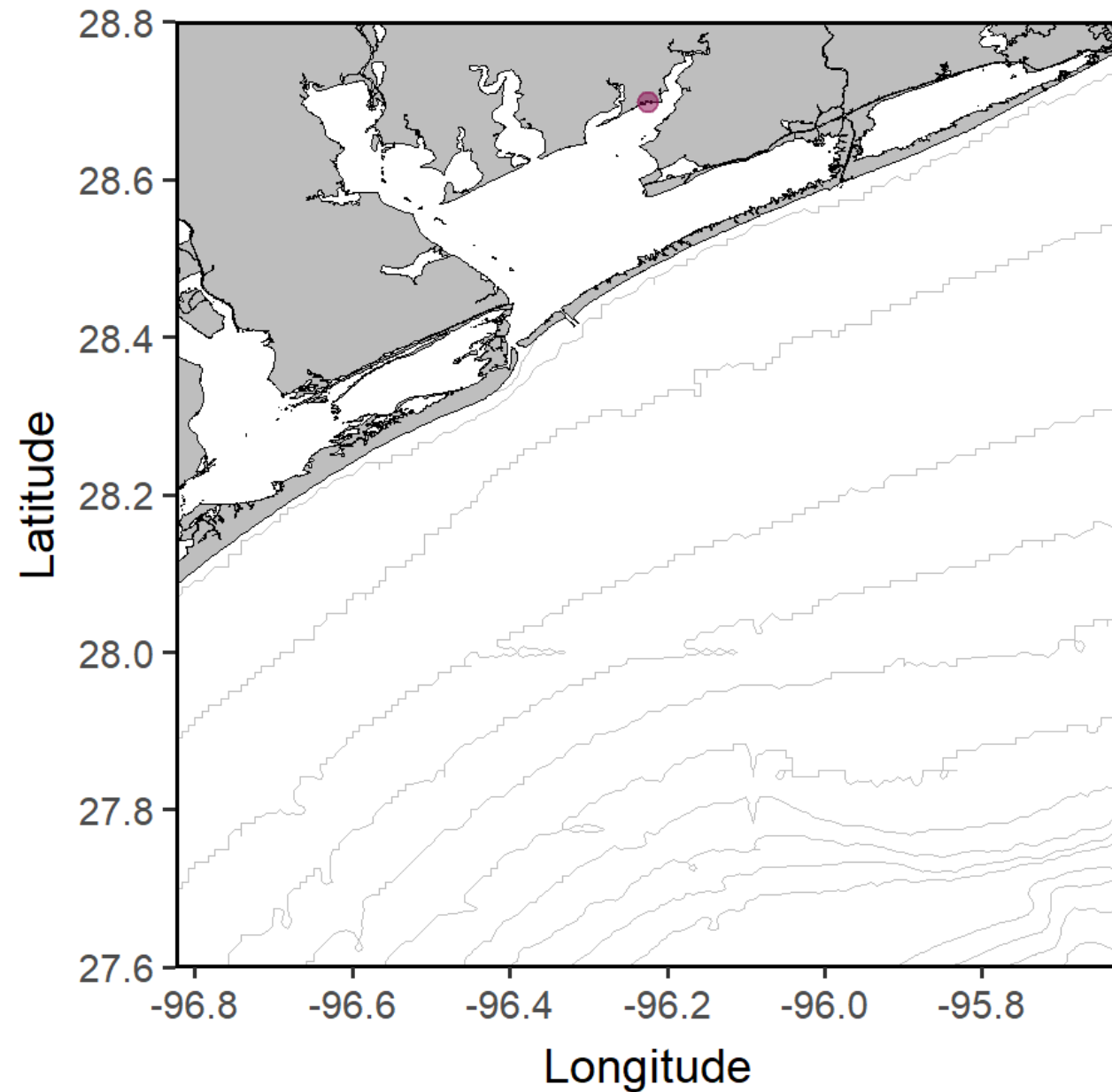
## Test 1

P-Sea WindPlot Manual



Date\_time: 4022-12-01 04:17:00

Box#:55597 P-Sea WindPlot Manual

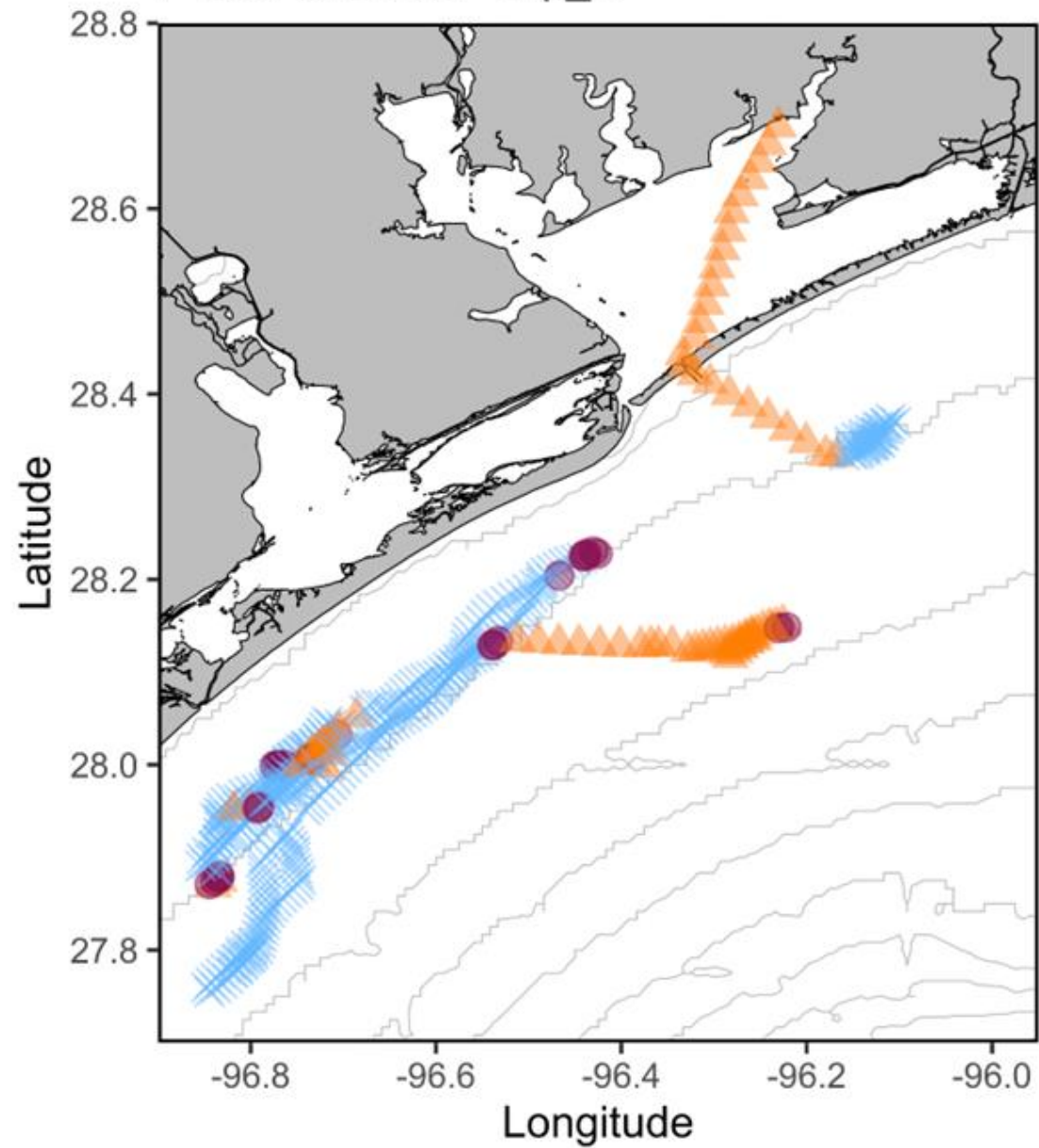




Box#:18637

## Test 4

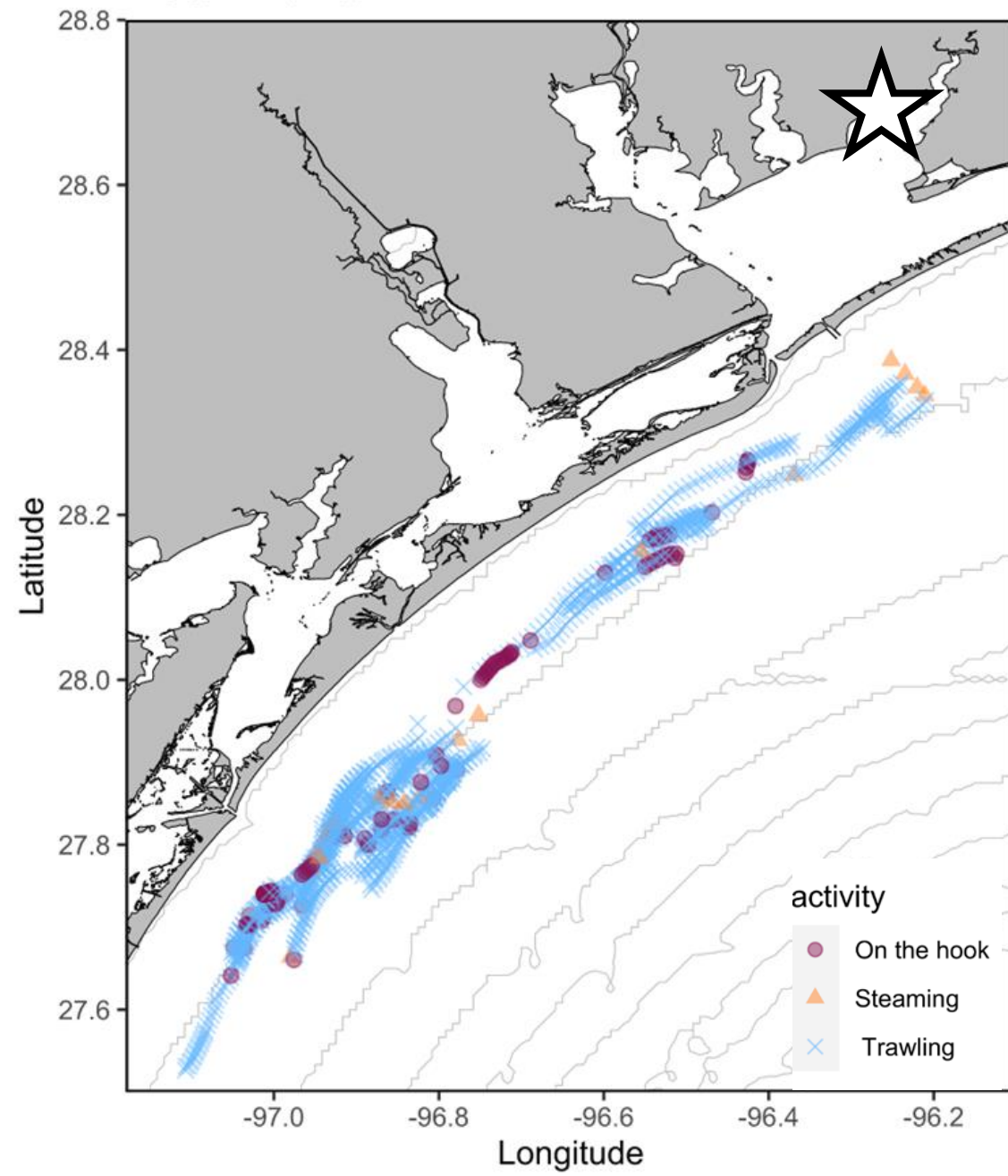
P-Sea WindPlot Trip\_2



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## Test 2

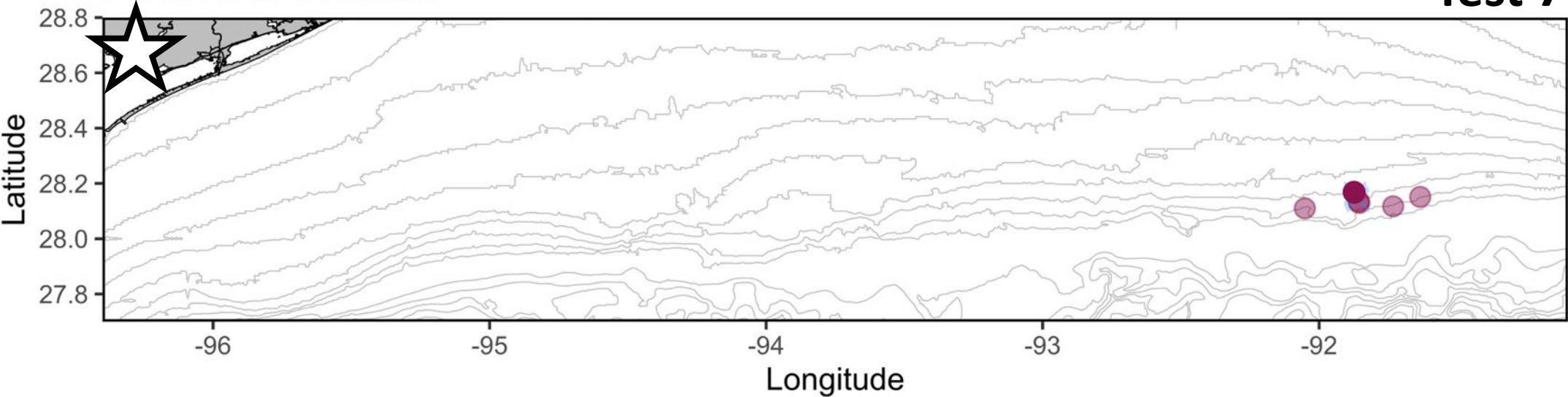
P-Sea WindPlot



Box#:59441

P-Sea WindPlot Manual

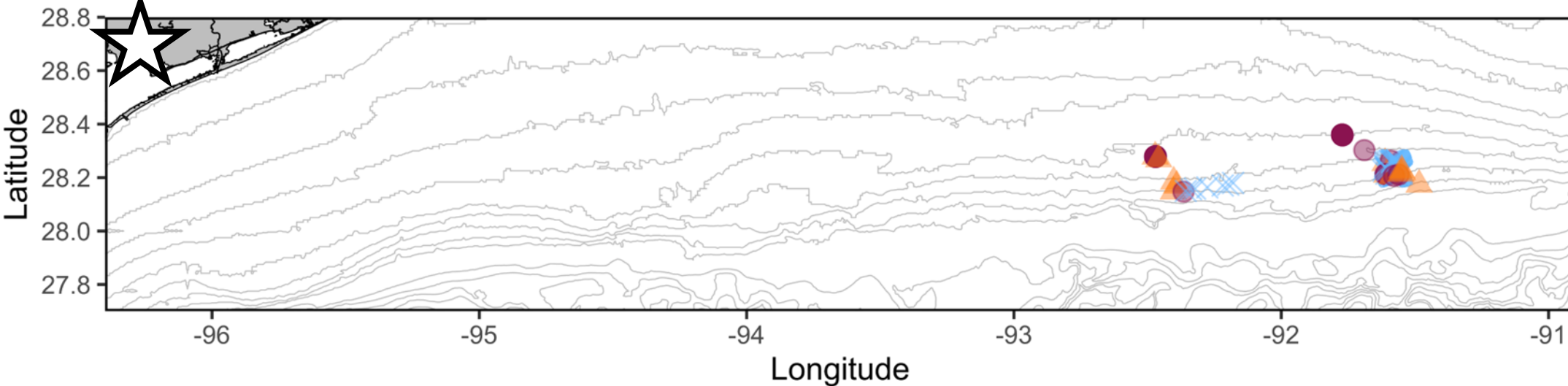
Test 7



Box#:17039

P-Sea WindPlot

Test 8





# Conclusions and Recommendations

- Psea Windplot continues to display a variety of malfunctions despite extensive troubleshooting and revision.
  - Erratic performance depending on specific vessel hardware/software configurations.
  - Potential for captain introduced error
  - Installation process on onboard computers received pushback from some captains (don't mess with their navigation software).
- Psea Windplot cannot perform according to requirements of the shrimp industry, Council, or NOAA Fisheries and is not able to reliably record and transmit vessel position data as necessary.
- We do not recommend further investment in Psea Windplot as a method to record shrimp vessel positions for calculating effort. It's a great piece of software for navigational purposes.

And now  
for something  
completely different...



# Background

- Additional, no-cost, side-by-side comparisons of multiple position recording devices
  - SSA was concerned about weak performance of Psea WindPlot and requested LGL's help testing Zen units (Atlantic Radio & Telephone)
  - NOAA Fisheries was struggling to get volunteers to for their VMS testing and requested LGL's help testing Nemo units (Woods Hole Group) in comparison to cELB units.
- No funding was provided to LGL for these tests, nor were Council funds used to conduct these tests.
  - Cost for units, transmission, etc. were covered by the respective companies.

# Vessel Testing

Test #	Dates	Psea	Zen	Nemo	cELB
Test 1	11/30 – 12/19 2022	X	X	X	X
Test 2	11/29 – 12/18 2022	X	X	X	X
Test 3	11/28 – 12/3 2022	X	X	X	X
Test 4	12/8 – 12/17 2022	X	X	X	X
Test 5	11/27 – 12/12 2022	X	X	X	X*
Test 6	11/27 – 12/15 2022	X	X	X	X
Test 7	11/27 – 12/16 2022	X	X	--	X
Test 8	10/27 – 12/8 2022	X	X	--	--
Test 9	11/27 – 12/17 2022	X	X	--	--
Test 10	12/3 – 12/19 2022	X	X	--	--

Psea = computer-based

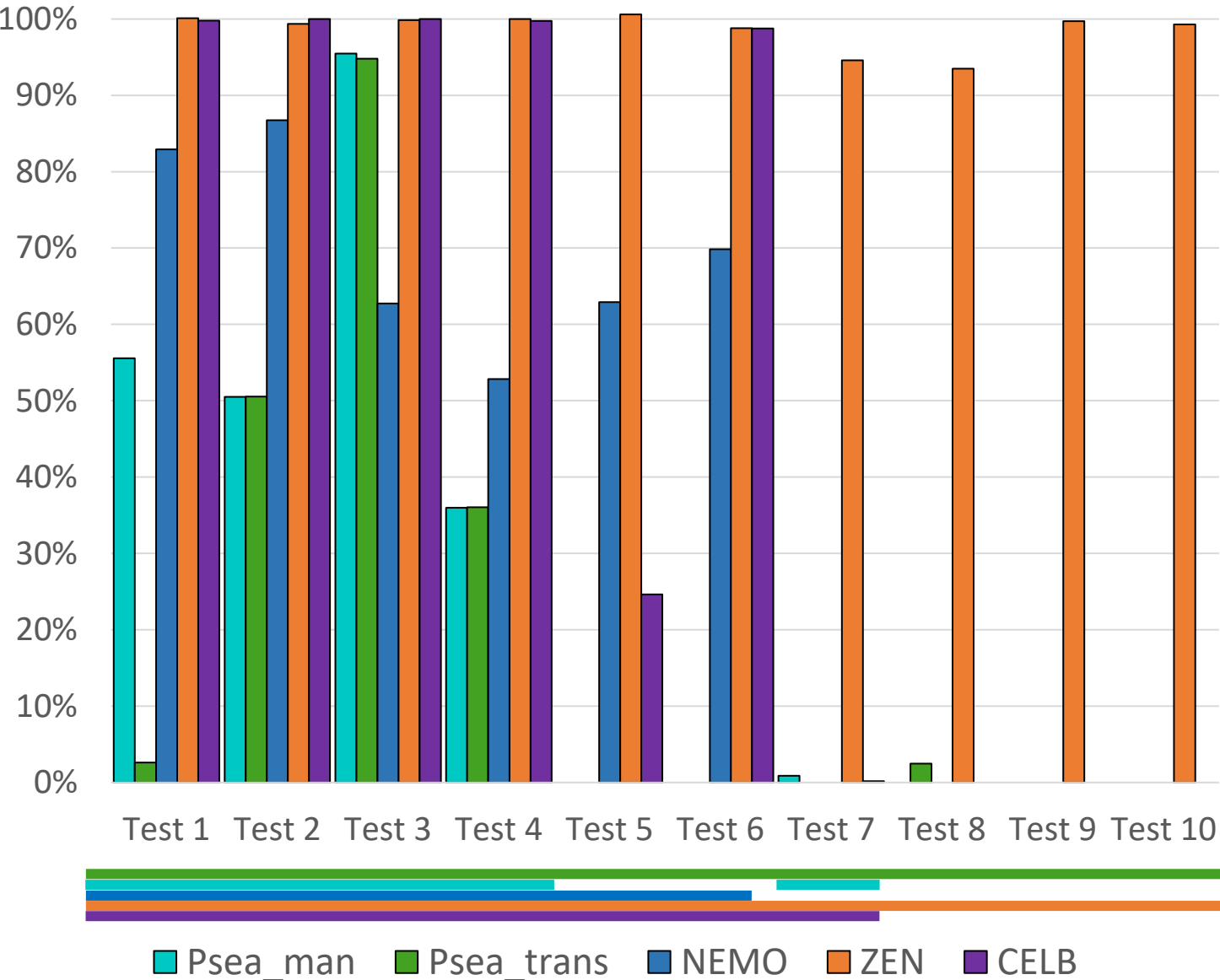
Zen = pluggable, standalone

Nemo = solar-powered, standalone

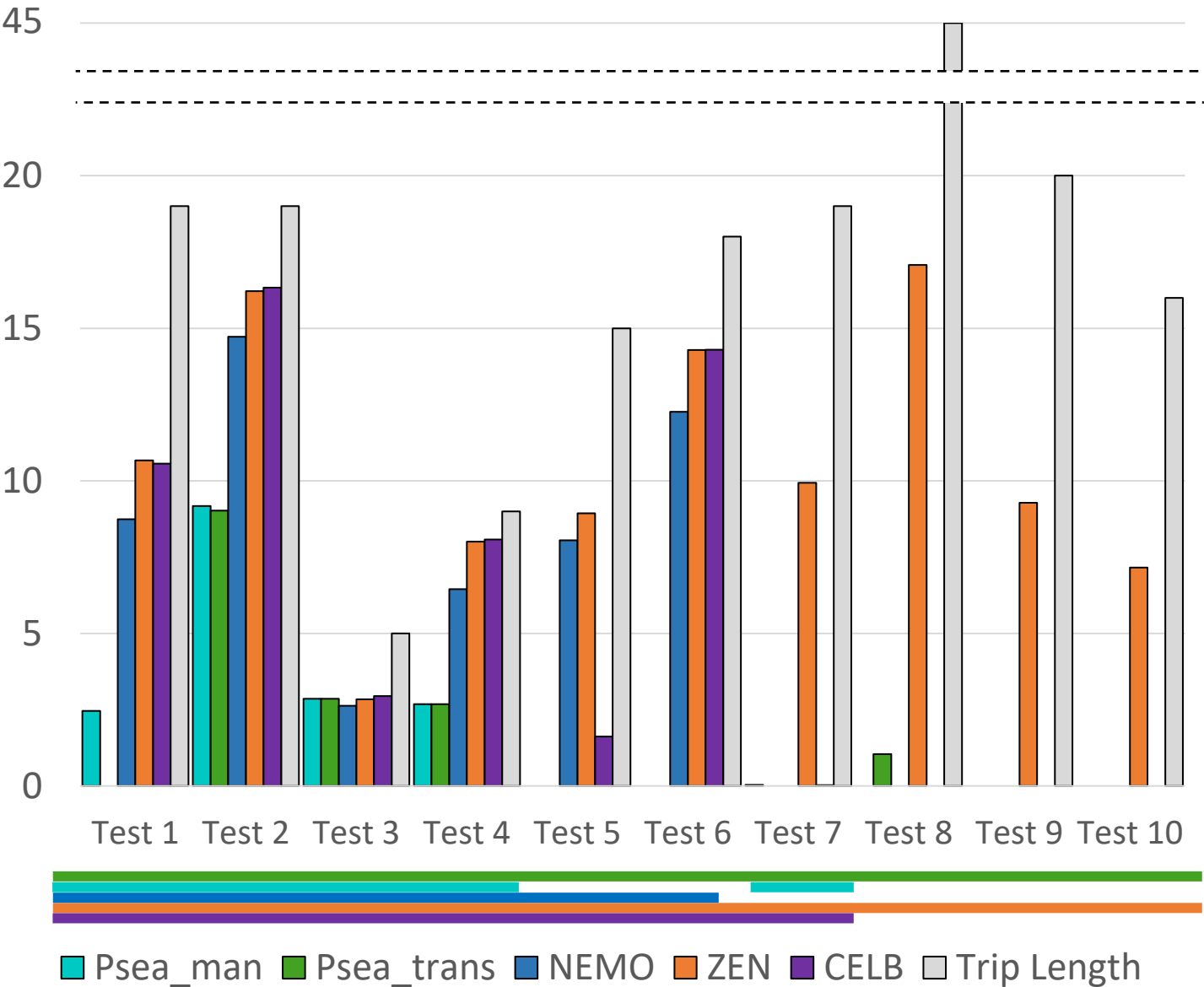
cELB = pluggable, standalone

\*Two cELB units monitored – one original unit and one newly installed

Percentage of Data Points Collected at  
10 Minute (+/- 30 Sec) Expected Interval



Tow Day and Trip Length



# Vessel Testing – Estimated Tow Days

Test #	Dates	Psea transmitted	Psea manual	Zen	Nemo	cELB
Test 1	11/30 – 12/19 2022	0	2.46	10.67	8.74	10.57
Test 2	11/29 – 12/18 2022	9.03	9.18	16.22	14.72	16.33
Test 3	11/28 – 12/3 2022	2.86	2.86	2.84	2.62	2.95
Test 4	12/8 – 12/17 2022	2.68	2.68	8.01	6.45	8.08
Test 5	11/27 – 12/12 2022	0	--	8.93	8.05	1.62 (8.92* new unit)
Test 6	11/27 – 12/15 2022	0	--	14.29	12.26	14.30
Test 7	11/27 – 12/16 2022	0	0.03	9.93	--	0.03
Test 8	10/27 – 12/8 2022	1.04	--	17.08	--	--
Test 9	11/27 – 12/17 2022	0	--	9.28	--	--
Test 10	12/3 – 12/19 2022	0	--	7.15	--	--
Mean % Difference from Zen		-79.7%	-54.8%	--	-13.1%	-25.3% (-13.6% with new unit)

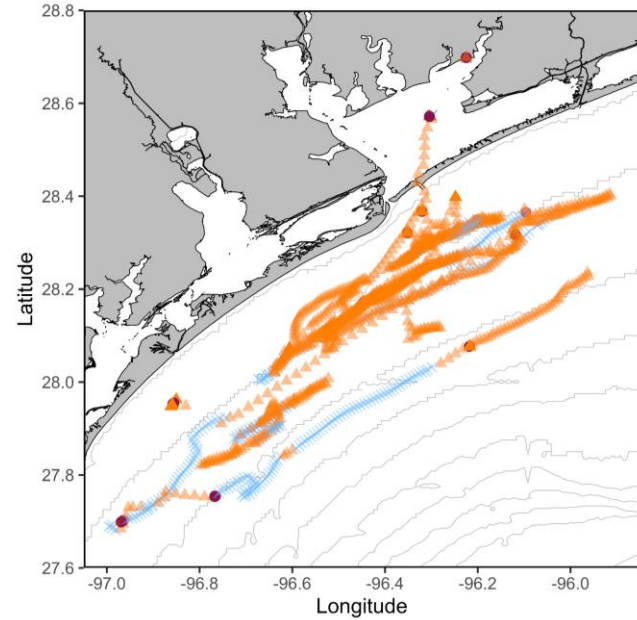




# Shrimping Activity

Psea Manual

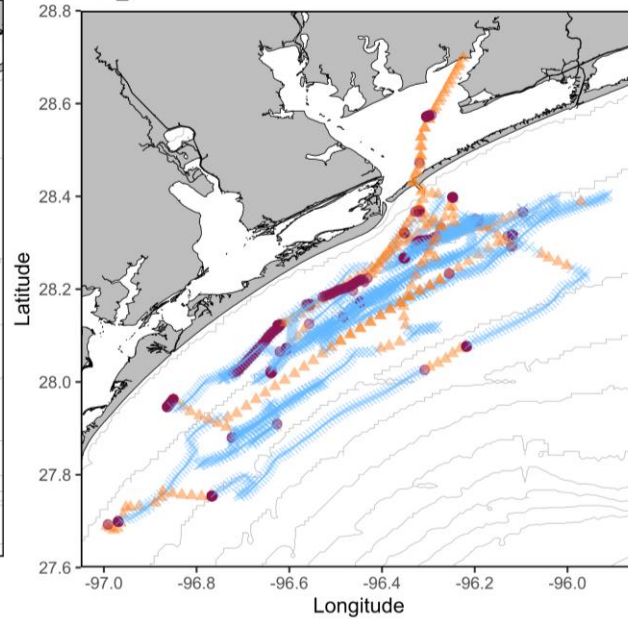
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P-Sea WindPlot Manual



2.46 tow days

Zen

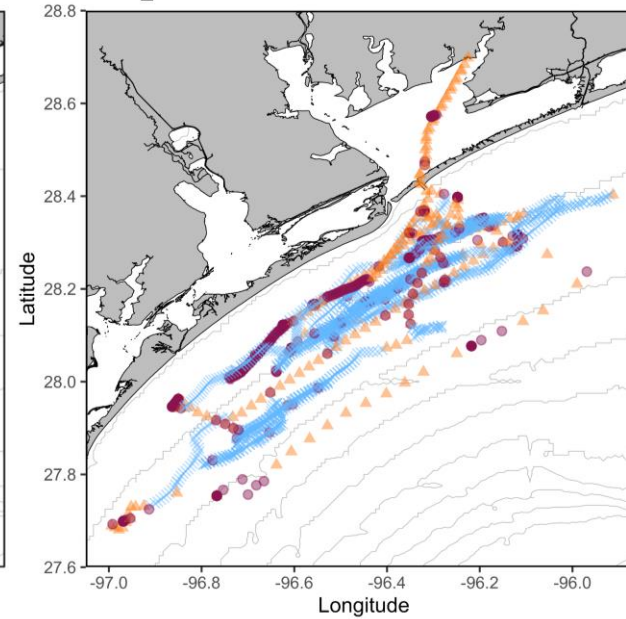
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Zen\_cELB



10.67 tow days

Nemo

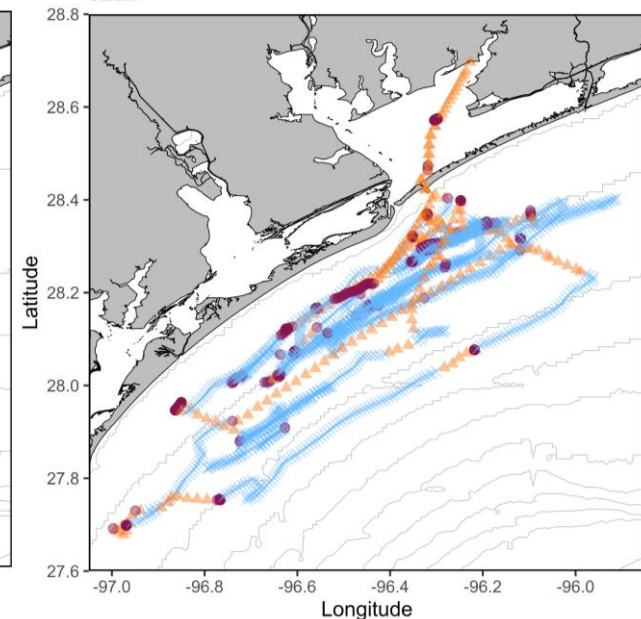
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Nemo\_VMS



8.74 tow days

cELB

Box#:46858  
cELB

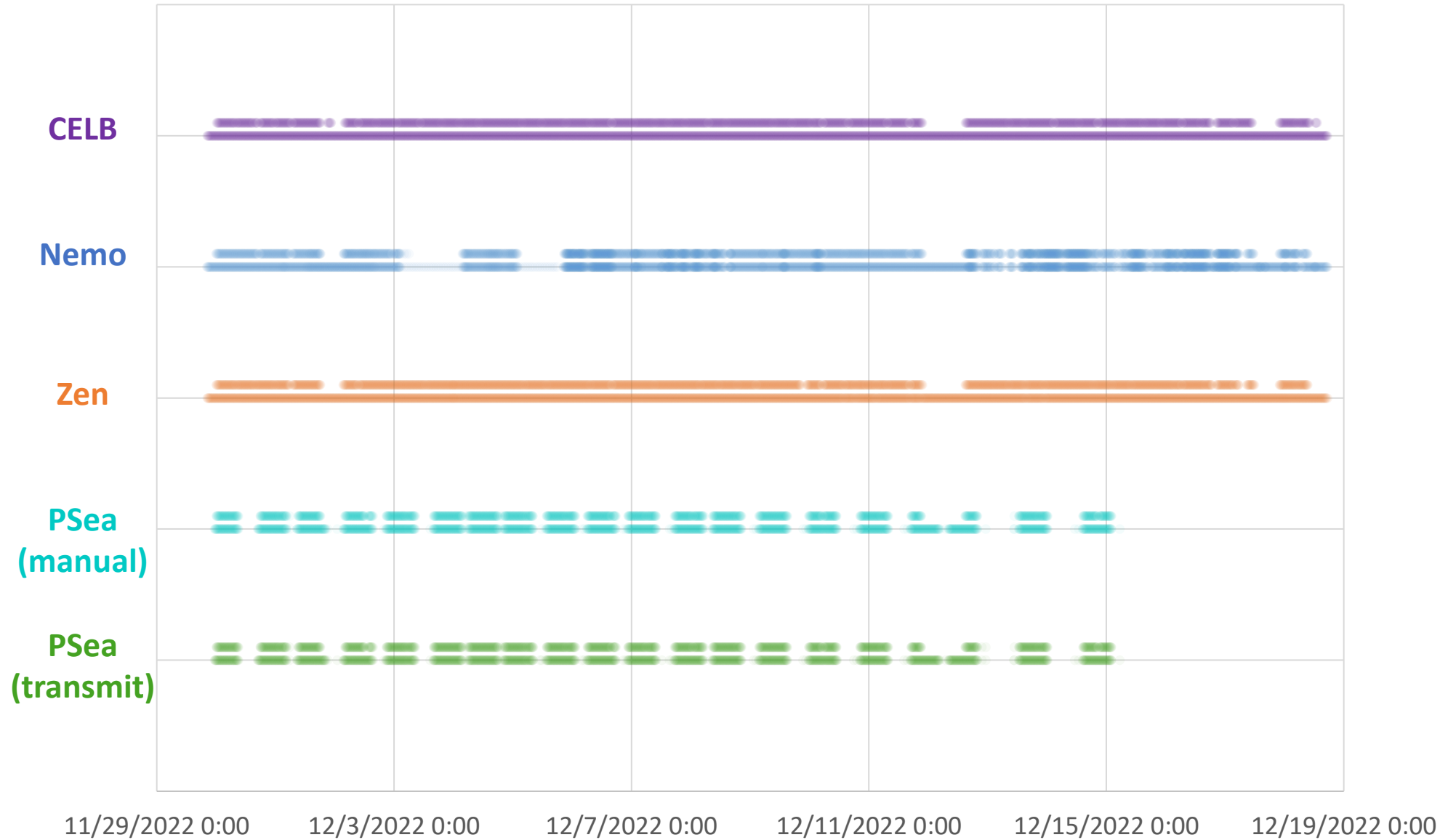


10.57 tow days

activity

- On the hook
- Steaming
- Trawling

Estimated Tows (upper), Collected Data (lower)



# Shrimping Activity

Psea Transmitted

Zen

Nemo

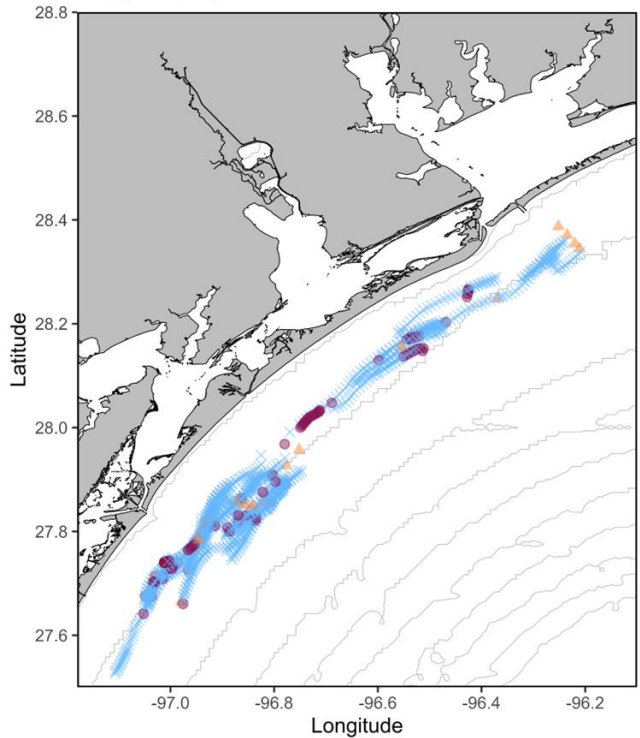
cELB

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P-Sea WindPlot

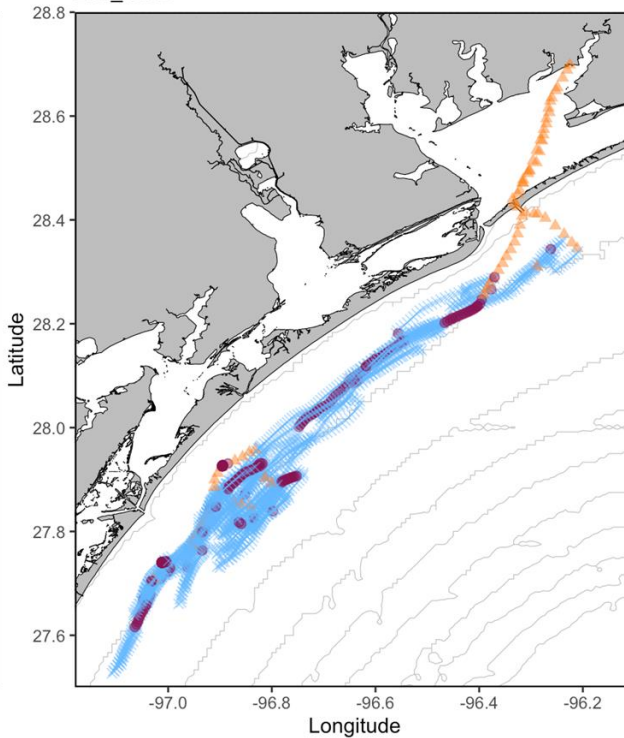
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Zen\_cELB

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Nemo\_VMS

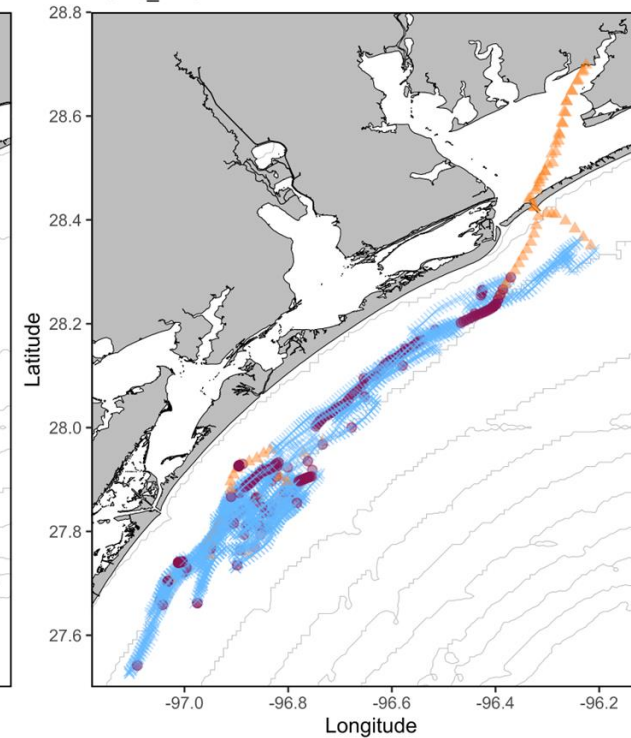
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cELB



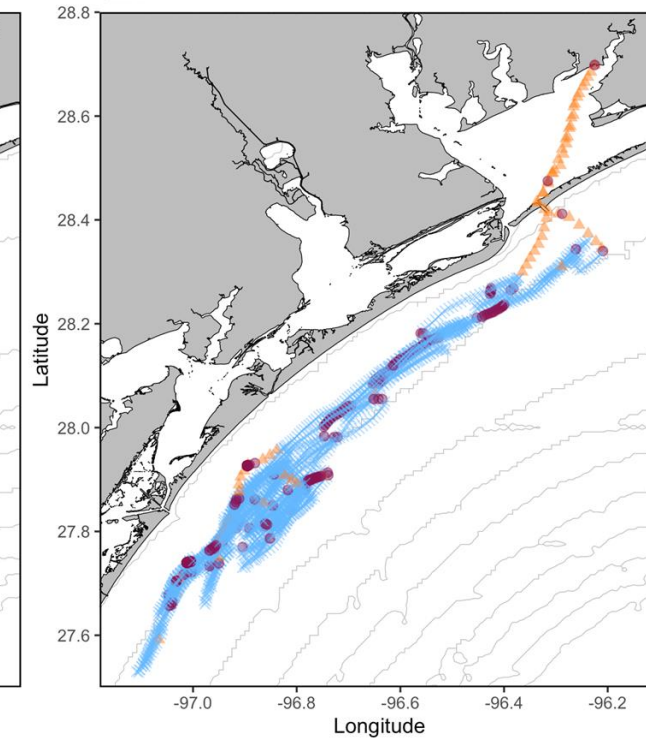
9.18 tow days



16.22 tow days



14.72 tow days

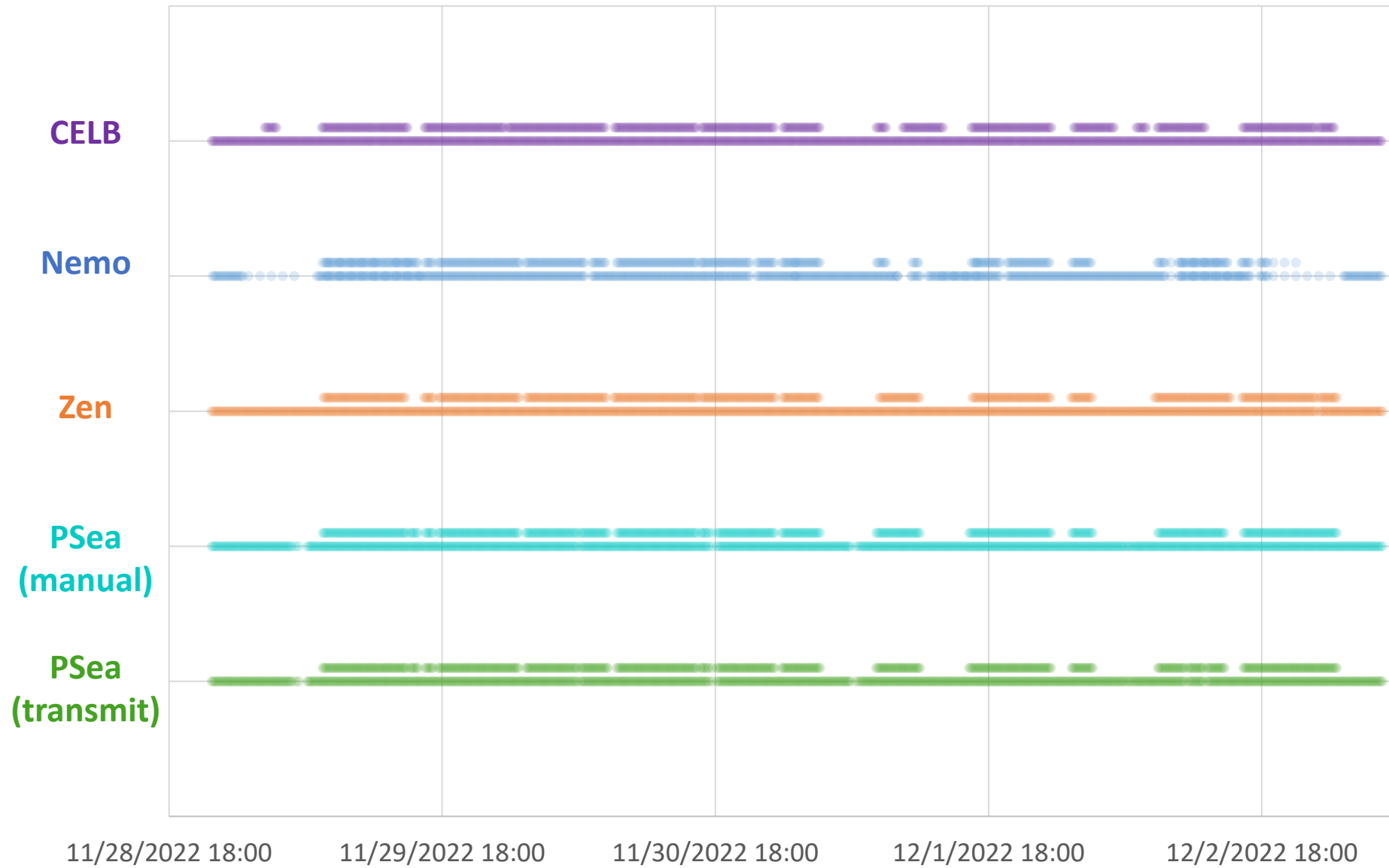


16.33 tow days

activity

- On the hook
- Steaming
- Trawling

Estimated Tows (upper), Collected Data (lower)



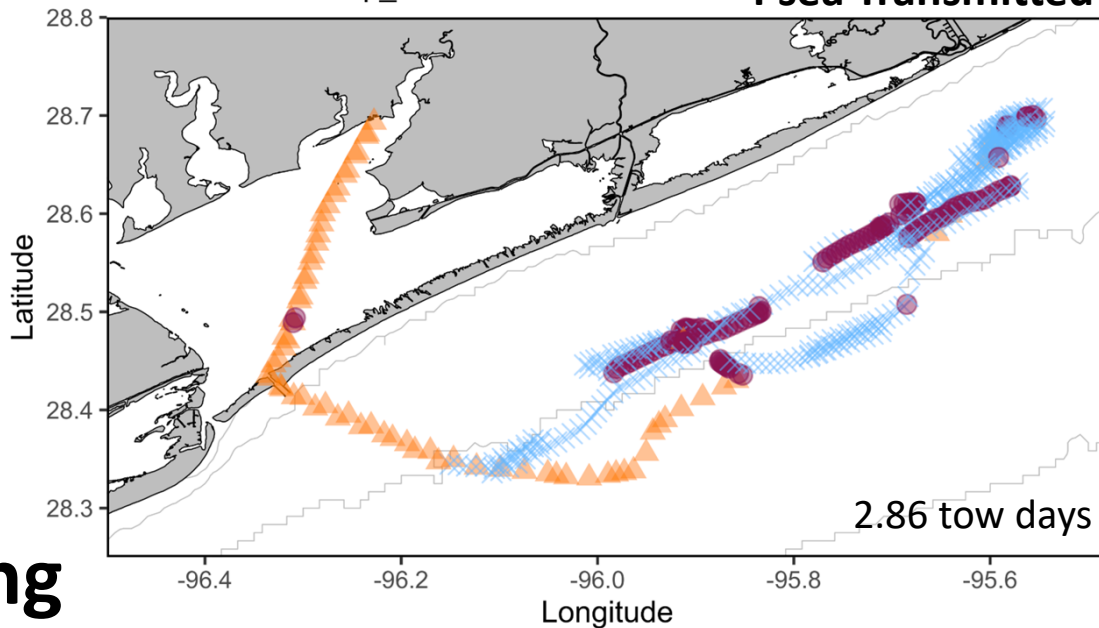


# Shrimping Activity

Box#:18637

P-Sea WindPlot Trip\_1

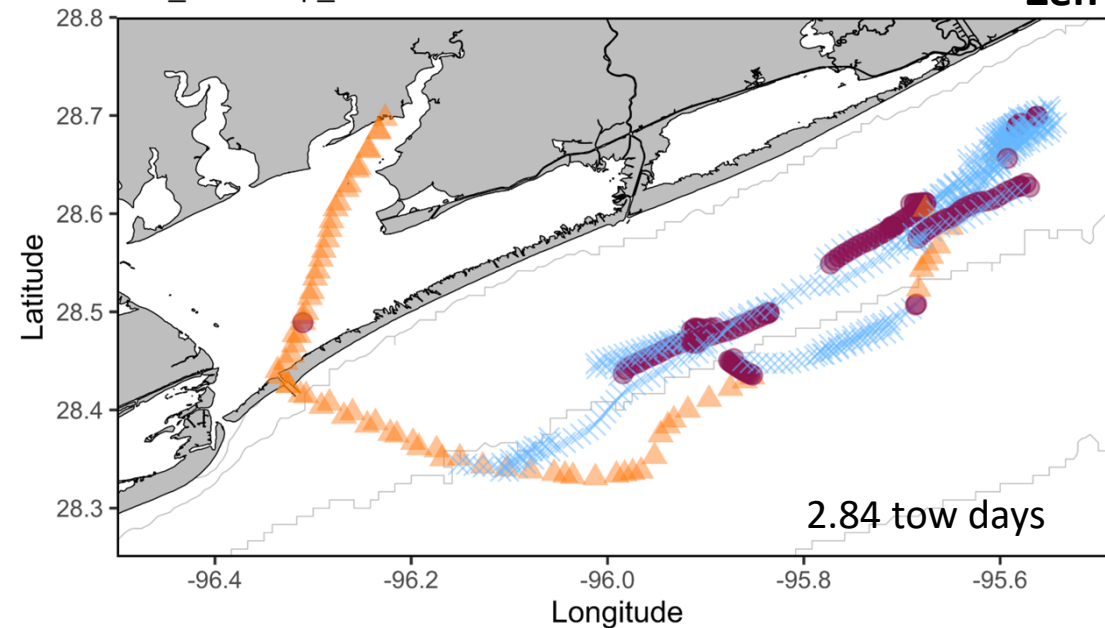
Psea Transmitted



Box#:24598

Zen\_cELB Trip\_1

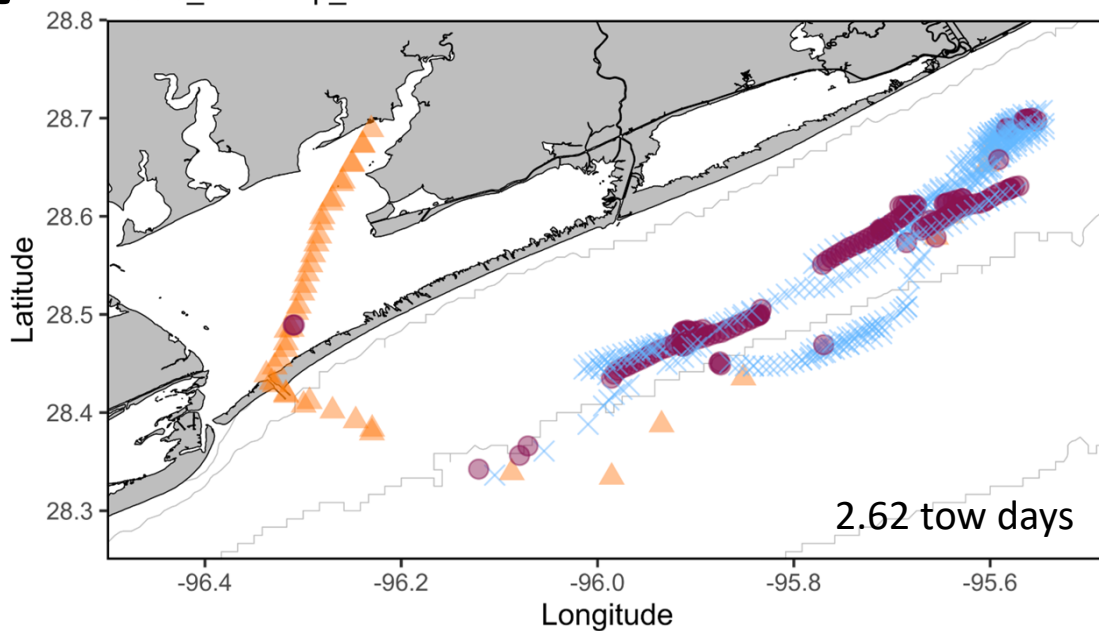
Zen



Box#:32599

Nemo\_VMS Trip\_1

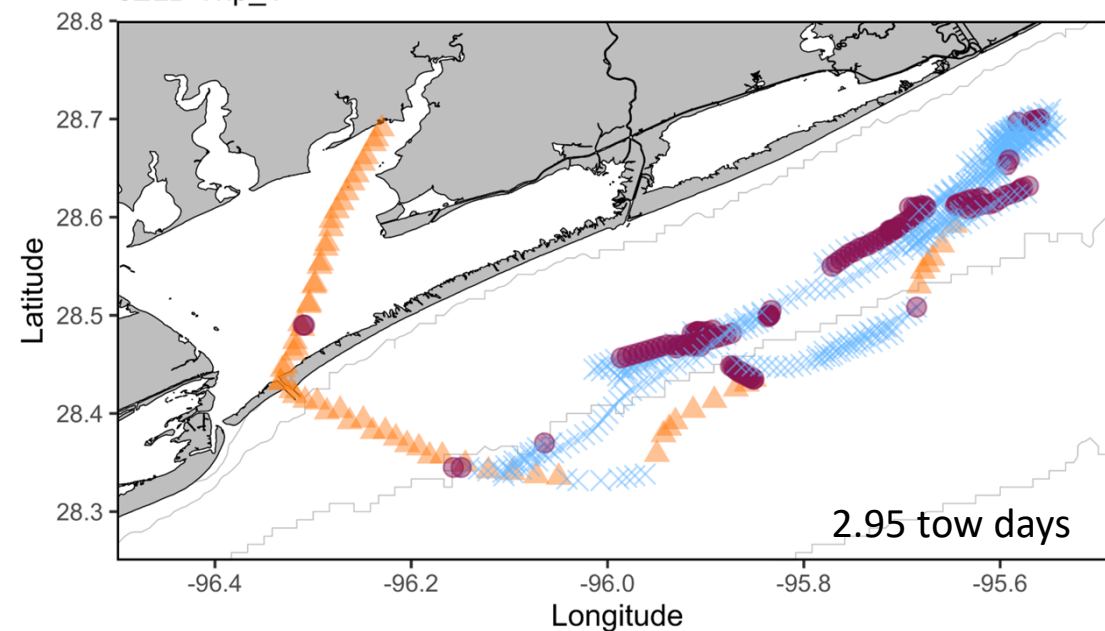
Nemo



Box#:47163

cELB Trip\_1

cELB

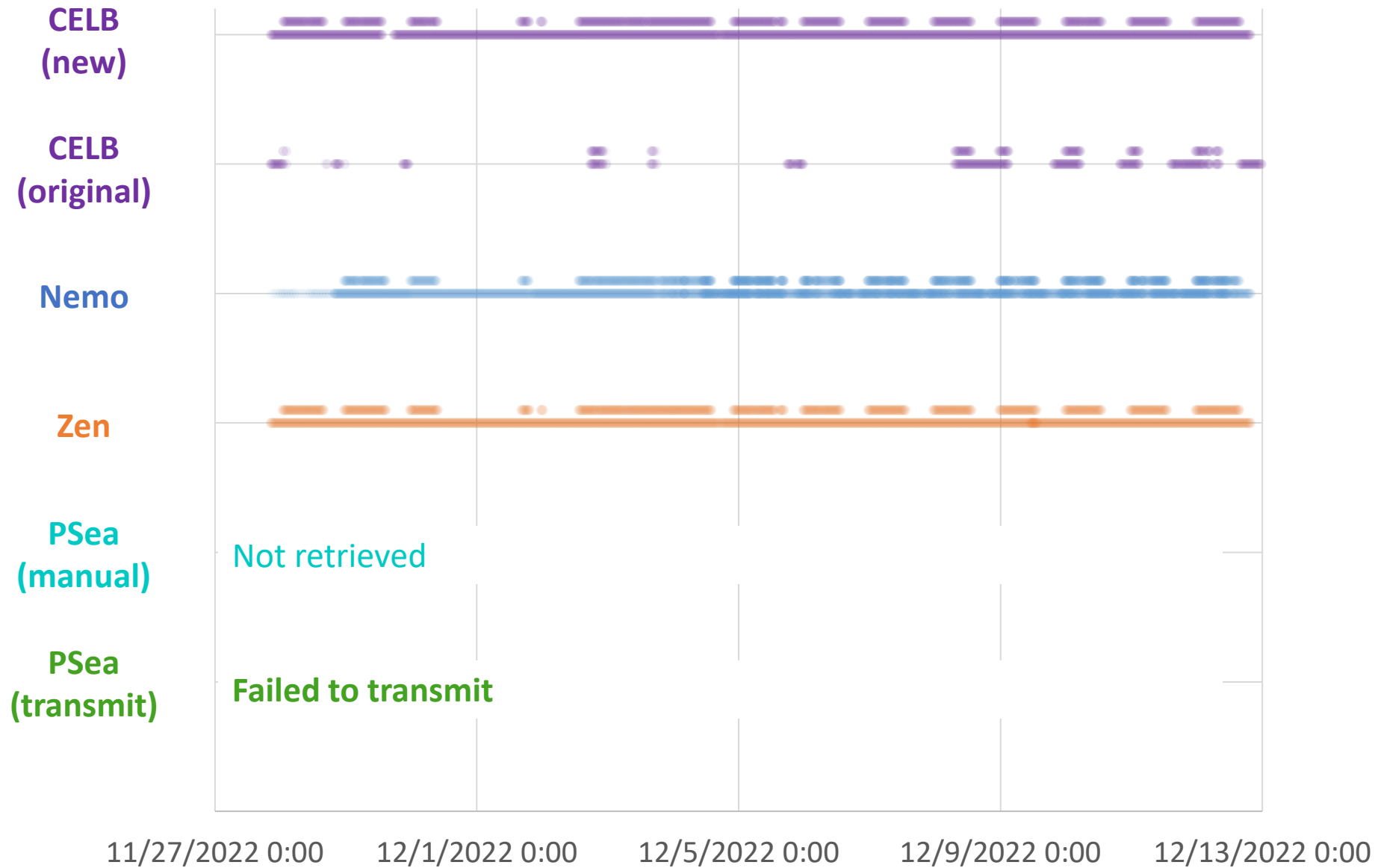


activity

- On the hook
- Steaming
- Trawling

Test 3

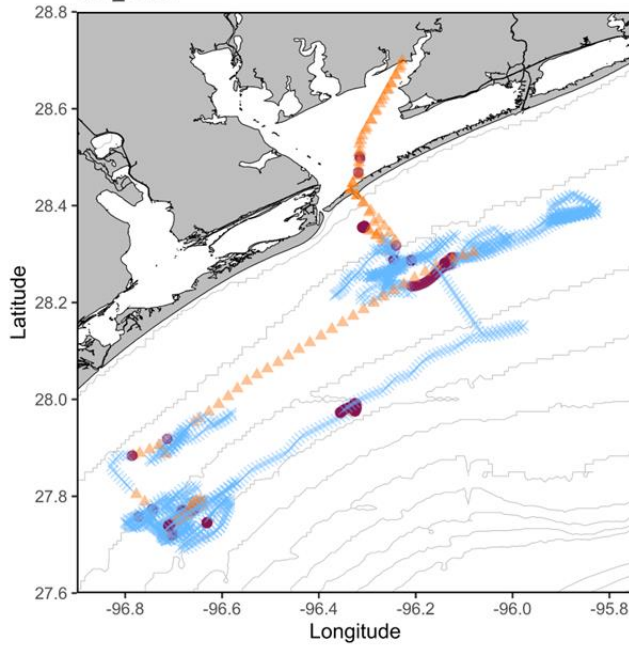
Estimated Tows (upper), Collected Data (lower)



# Shrimping Activity

**Zen**

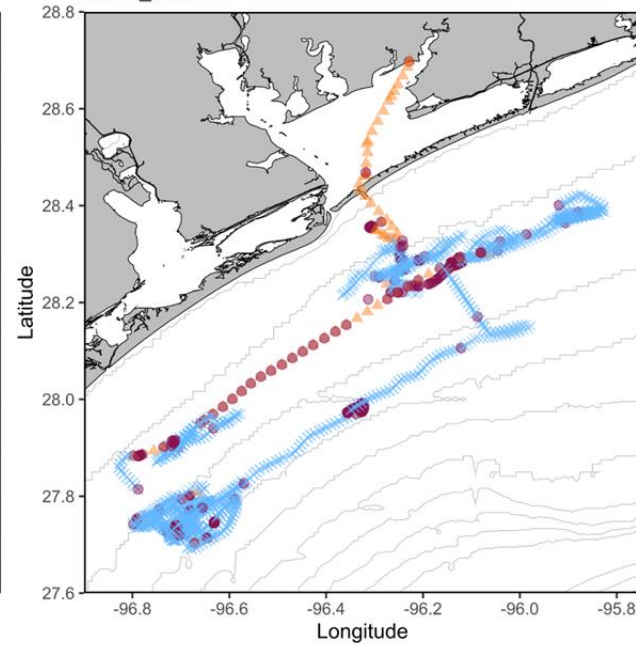
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Zen\_cELB



8.93 tow days

**Nemo**

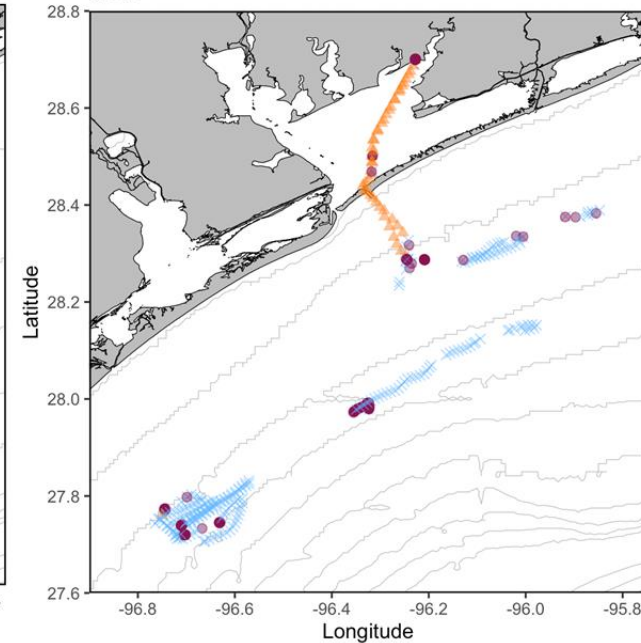
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Nemo\_VMS



8.05 tow days

**cELB (original)**

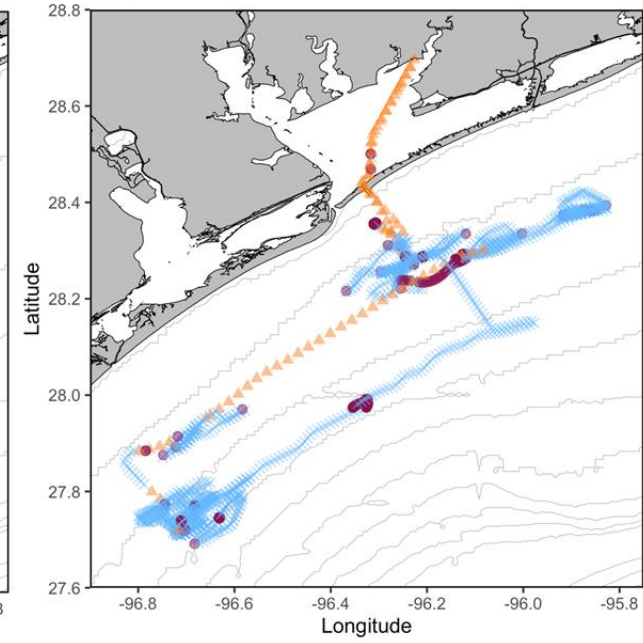
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cELB



1.62 tow days

**cELB (new)**

Box#:42886  
cELB

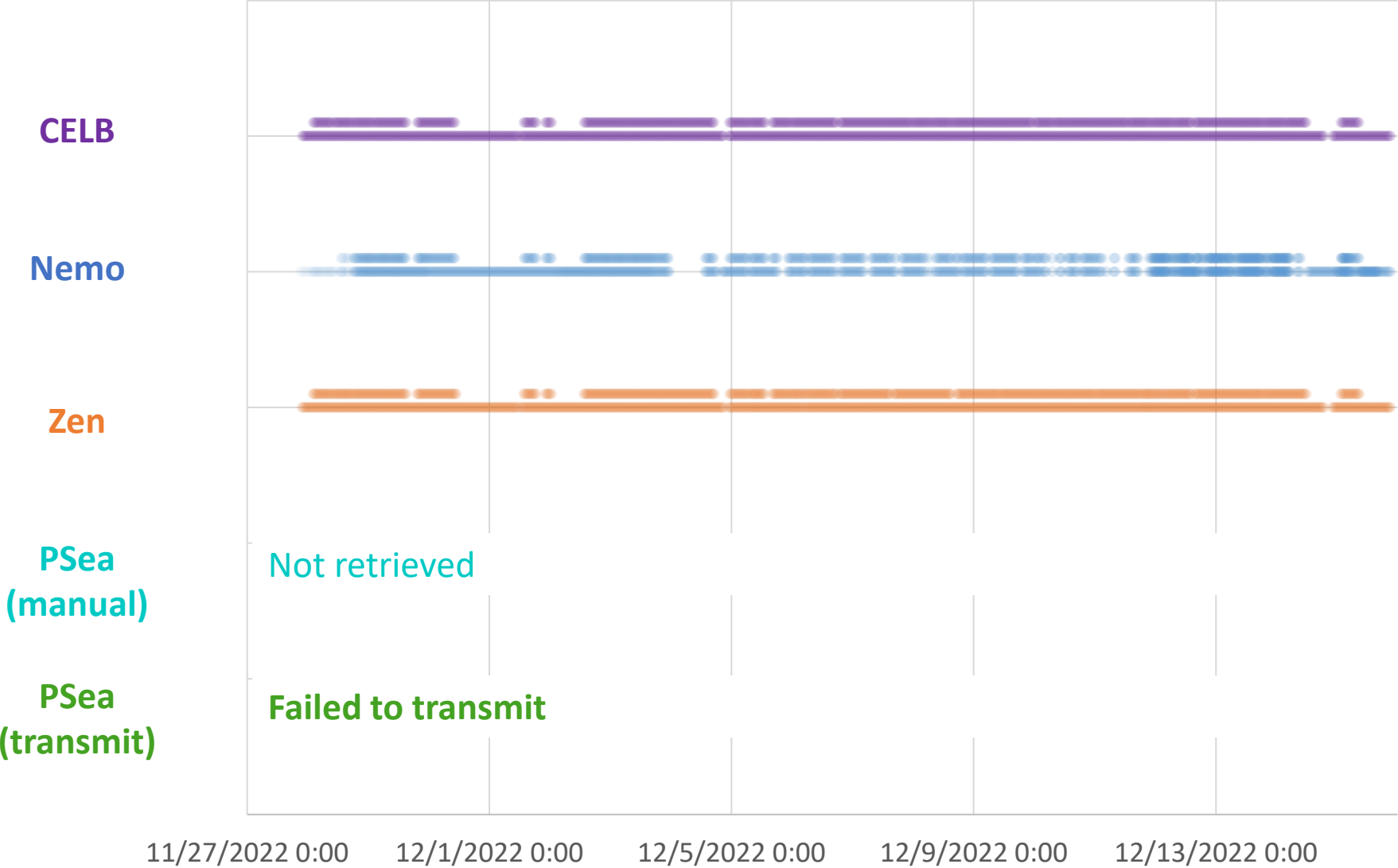


8.92 tow days

activity

- On the hook
- Steaming
- Trawling

Estimated Tows (upper), Collected Data (lower)

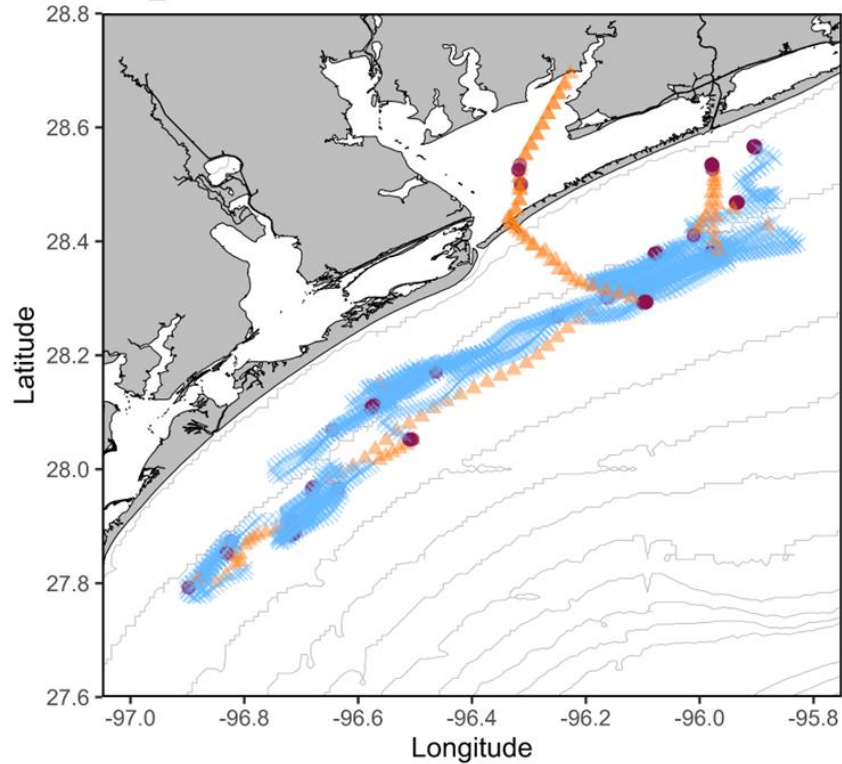




# Shrimping Activity

Zen

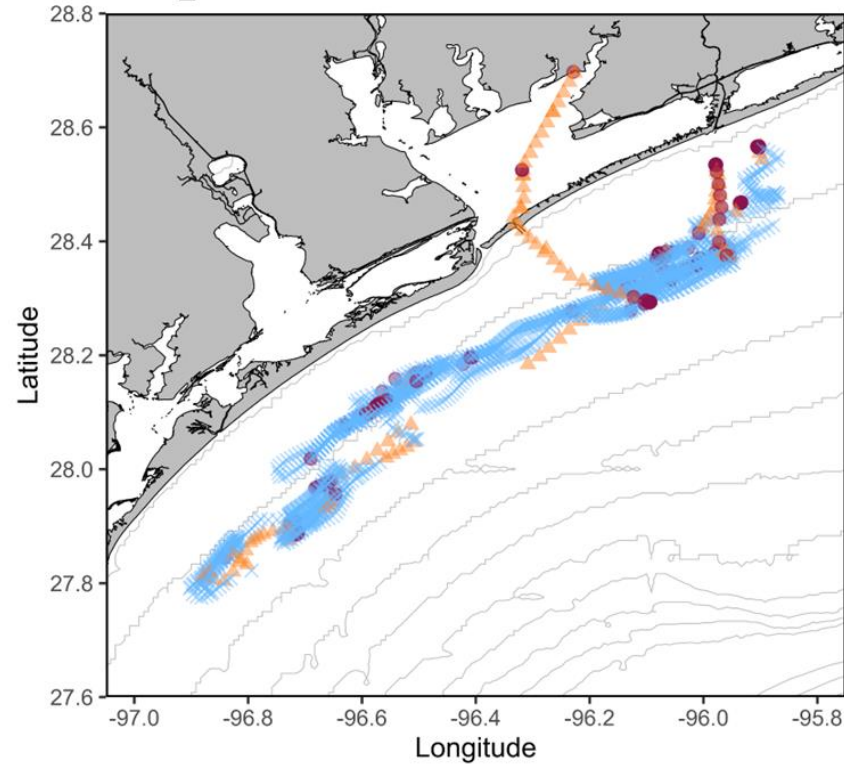
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Zen\_cELB



14.29 tow days

Nemo

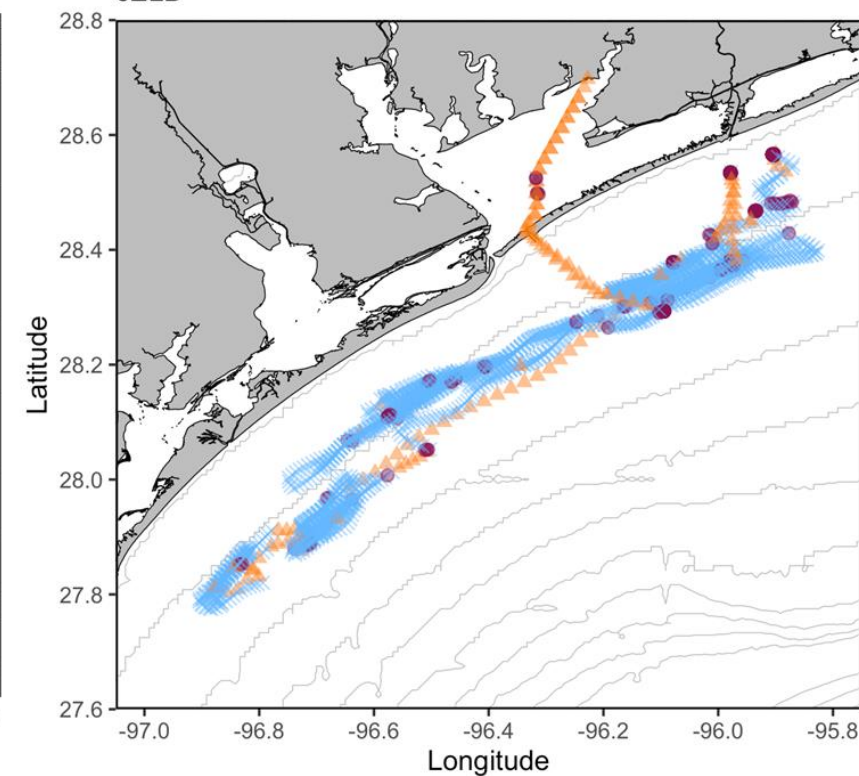
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Nemo\_VMS



12.26 tow days

cELB

Box#:45781  
cELB



14.30 tow days

activity

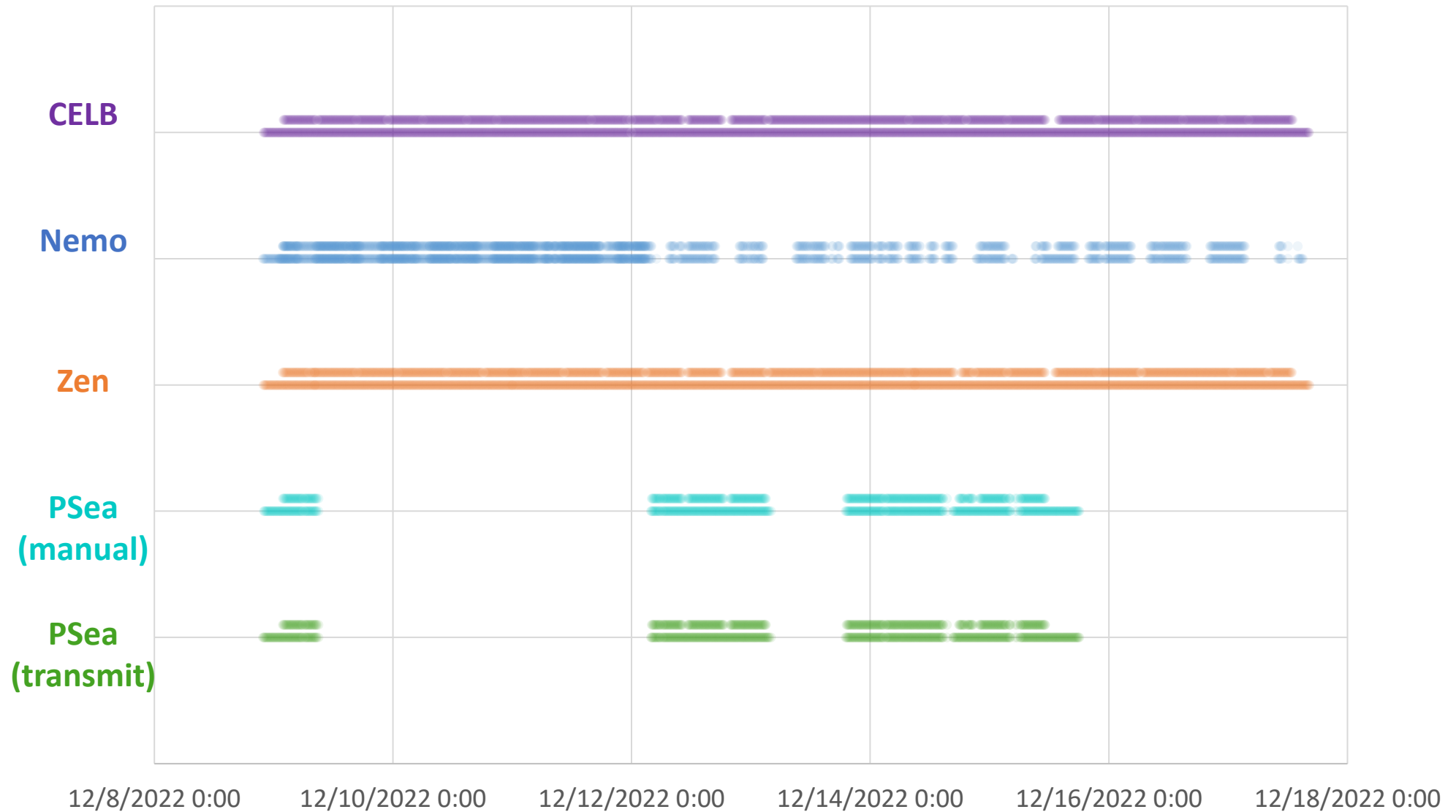
- On the hook
- Steaming
- Trawling

# Conclusions

- Computer-based has serious deficiencies (Psea Windplot)
  - See previous presentation
- Solar-powered has weaknesses (Nemo)
  - Raw data are gappier than ideal for existing shrimp effort algorithm
- cELBs work well, but equipment is aging and no longer reliable
  - 2/7 tested failed
- Pluggable standalone performed well (Zen)
  - Consistently recording at 10 min intervals, transmitting daily

# Extra Tests

Estimated Tows (upper), Collected Data (lower)



# Shrimping Activity

Psea Transmitted

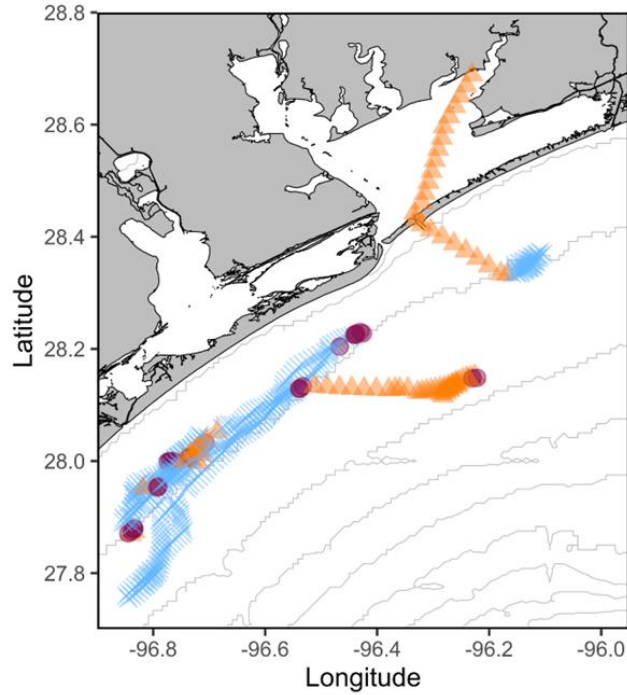
Zen

Nemo

cELB

Box#:18637

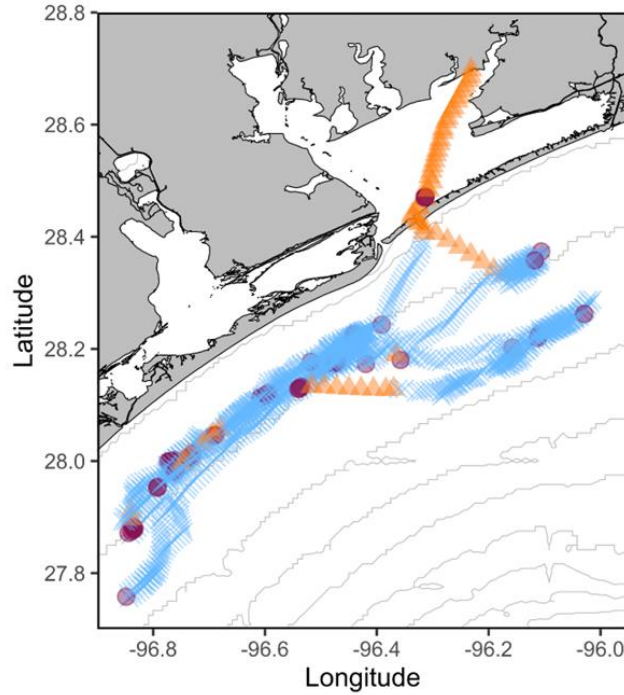
P-Sea WindPlot Trip\_2



2.68 tow days

Box#:24598

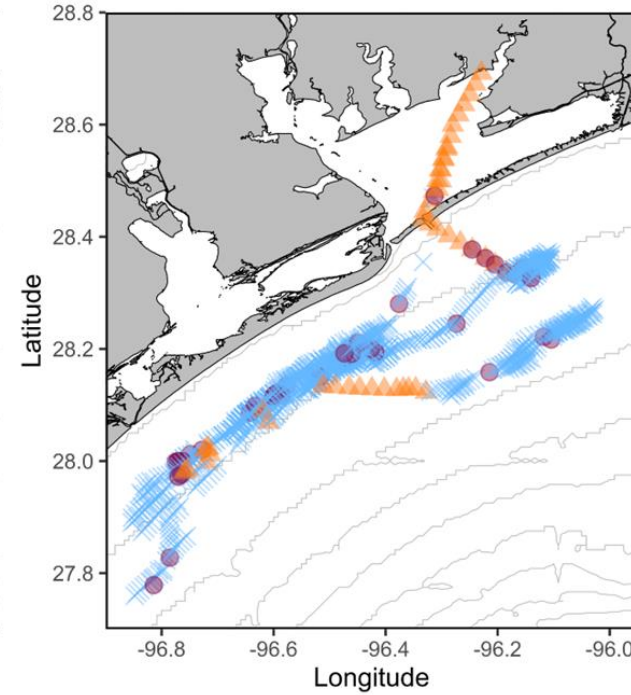
Zen\_cELB Trip\_2



8.01 tow days

Box#:32599

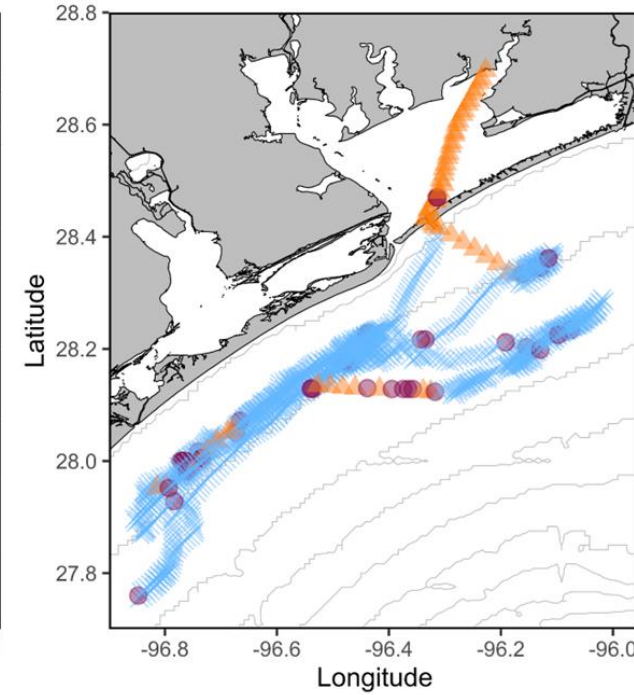
Nemo\_VMS Trip\_2



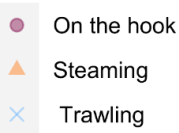
6.45 tow days

Box#:47163

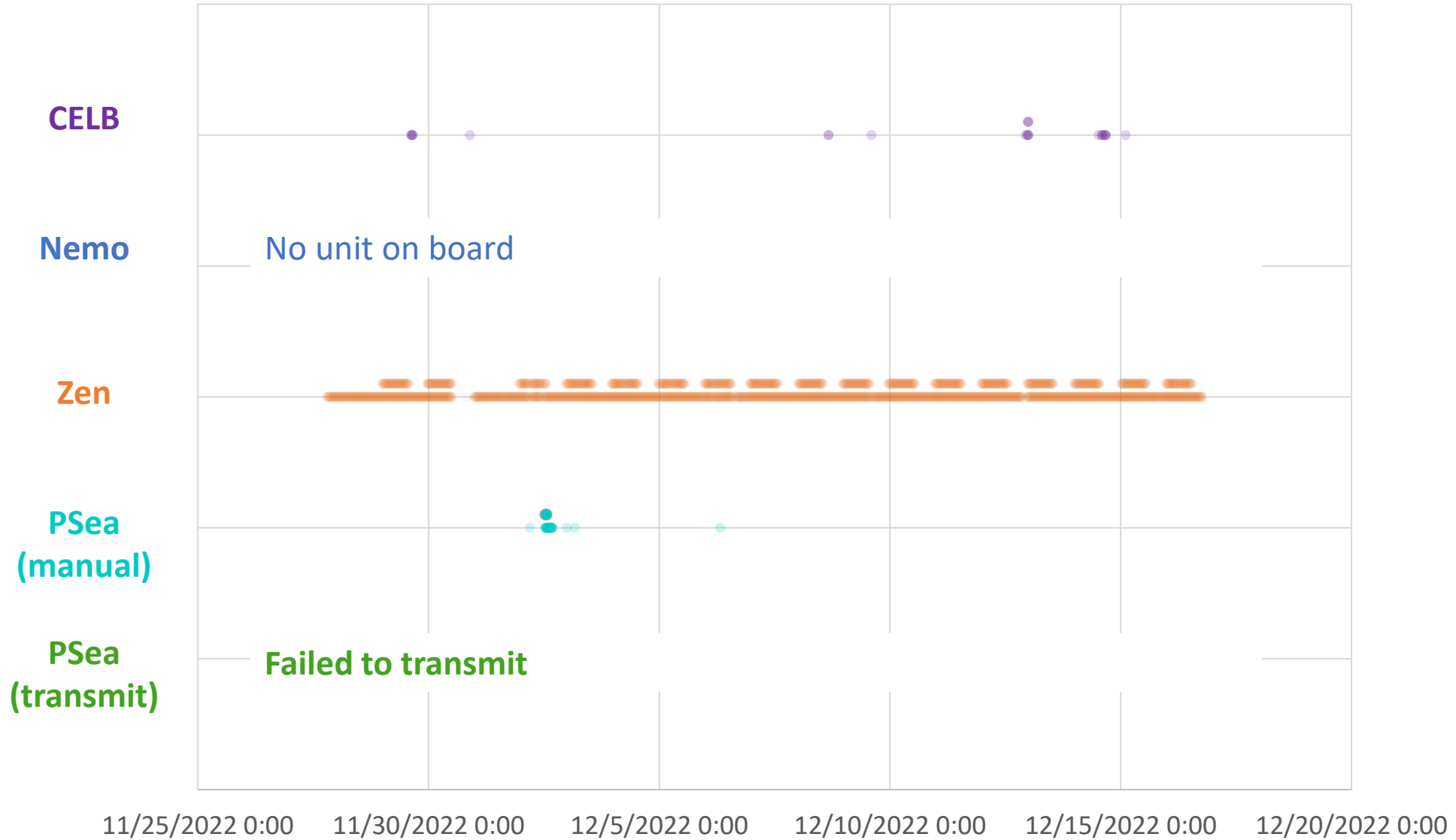
cELB Trip\_2



8.08 tow days  
activity



Estimated Tows (upper), Collected Data (lower)



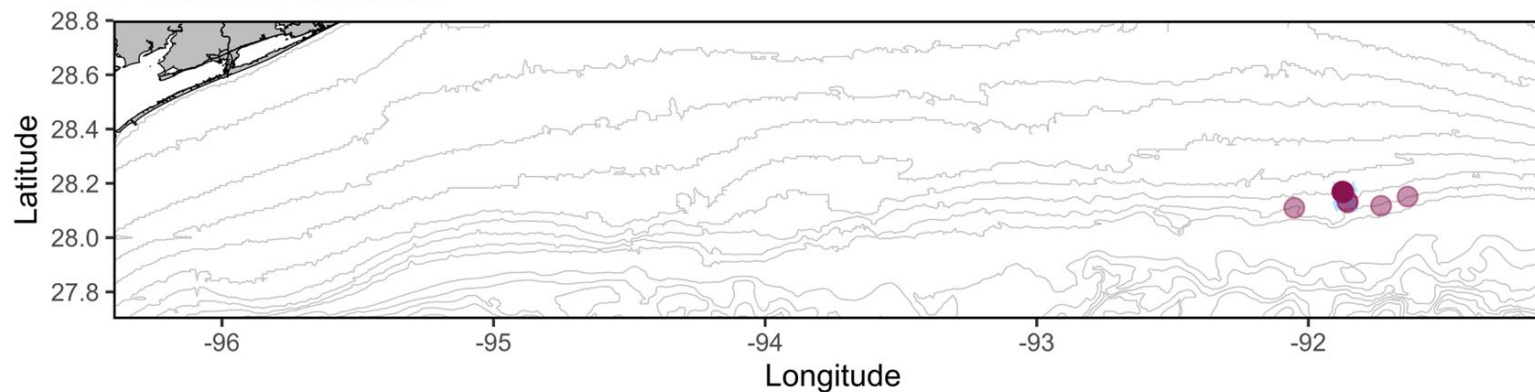


# Shrimping Activity

Box#:59441

P-Sea WindPlot Manual

Psea Manual

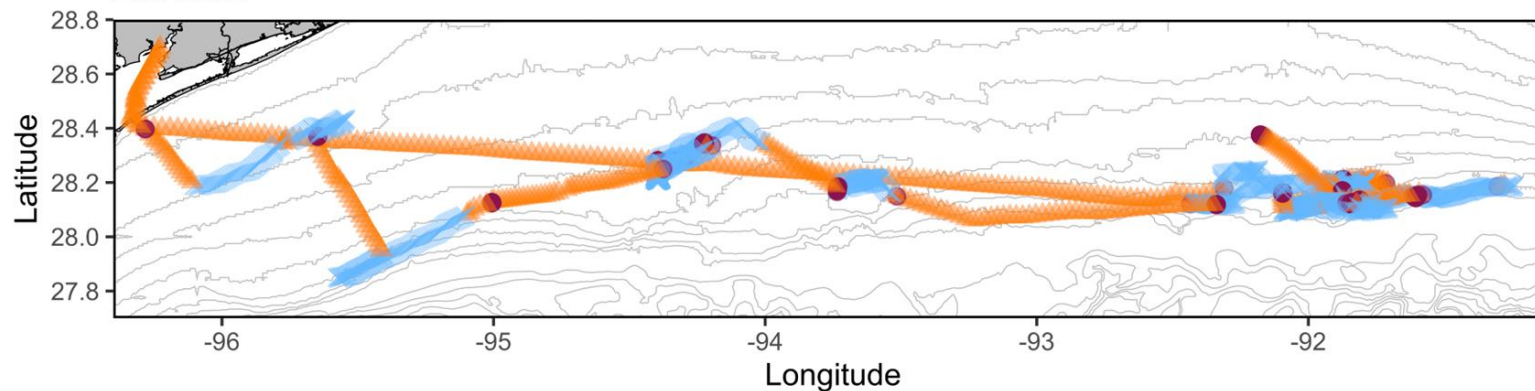


0.03 tow days

Box#:28852

Zen cELB

Zen

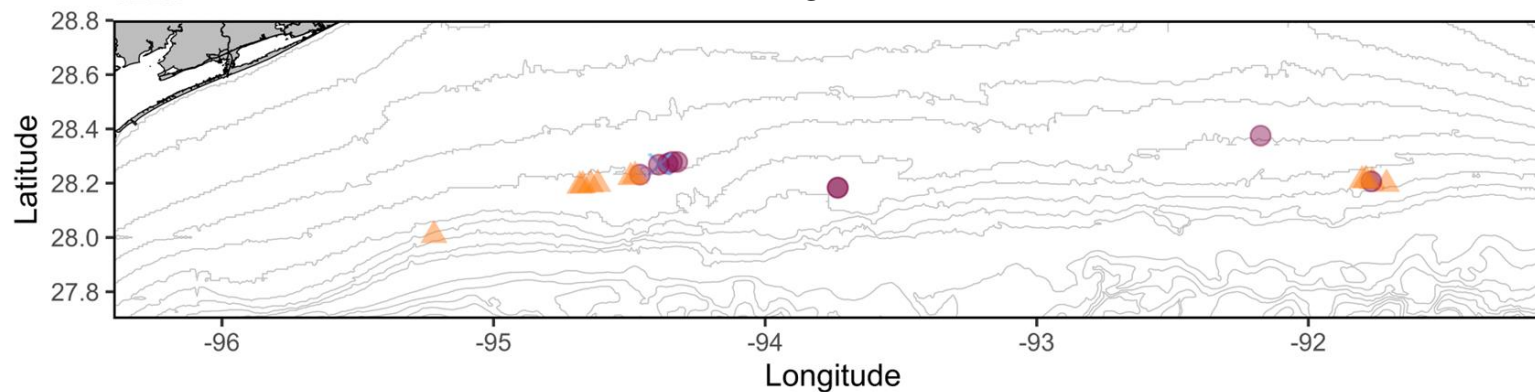


9.93 tow days

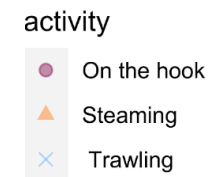
Box#:49395

cELB

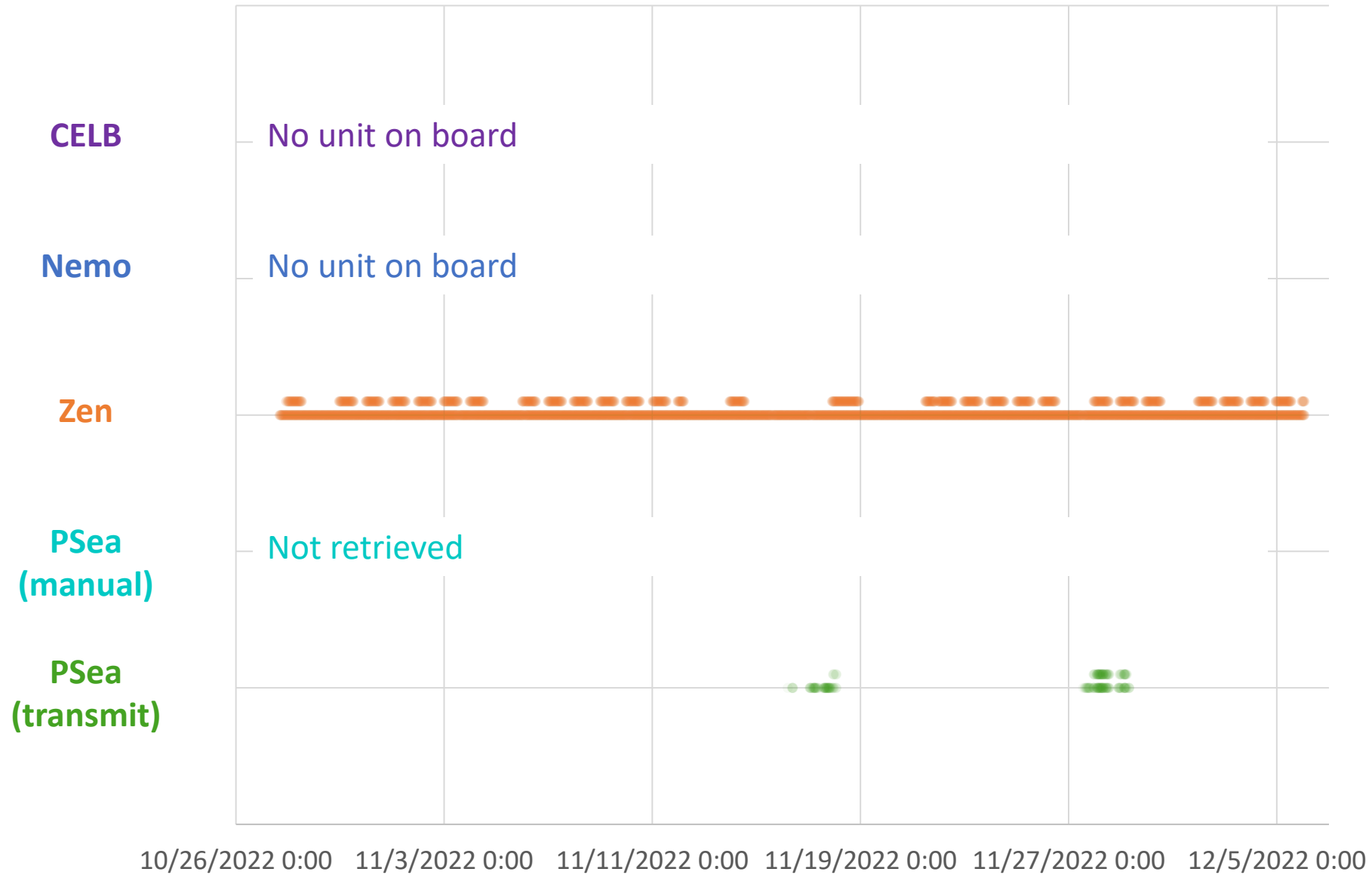
cELB



0.03 tow days



# Estimated Tows (upper), Collected Data (lower)



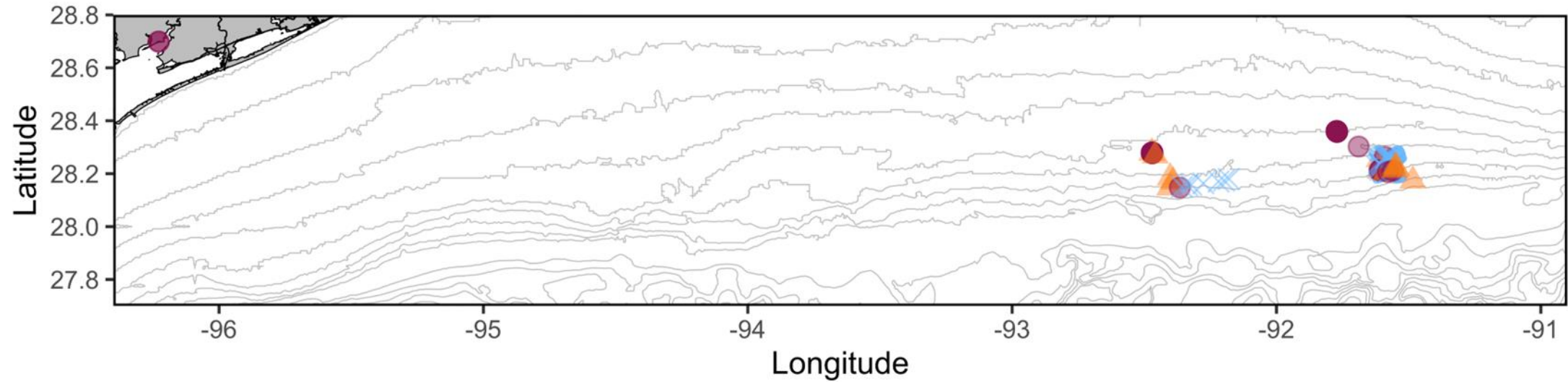


# Shrimping Activity

Box#:17039

P-Sea WindPlot

Psea Transmitted

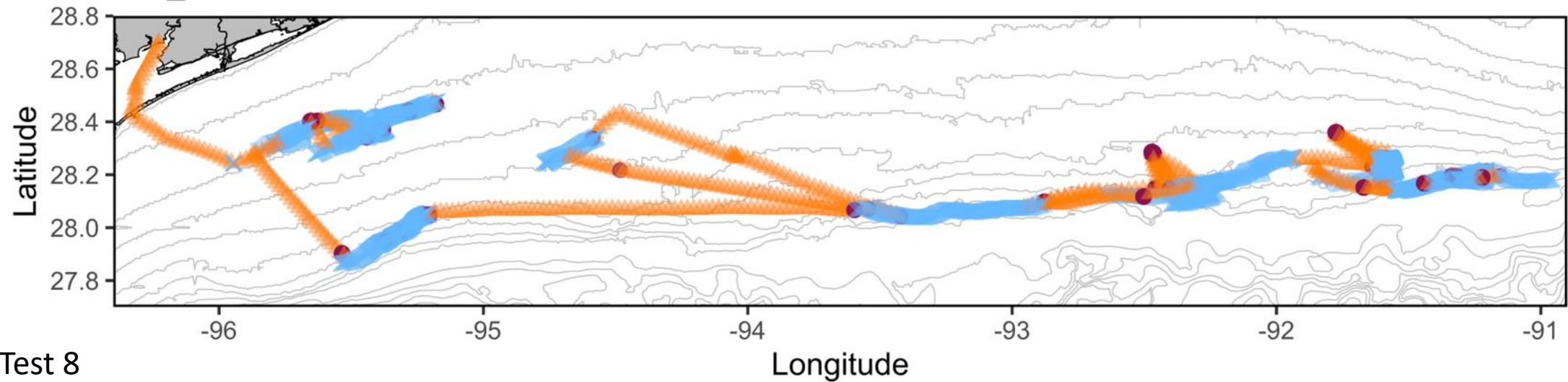


1.04 tow days

Box#:29374

Zen\_cELB

Zen

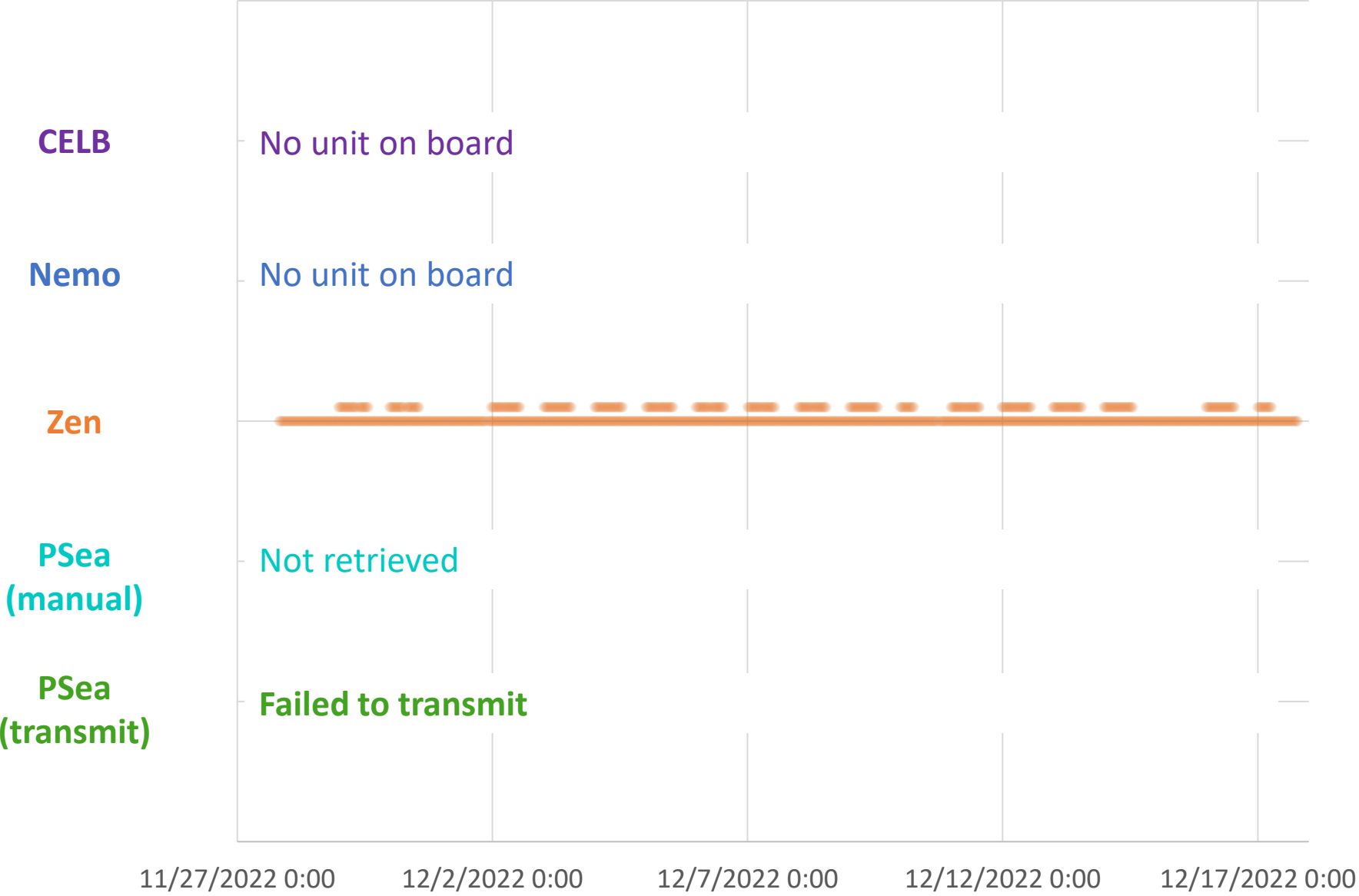


17.08 tow days

activity

- On the hook
- Steaming
- Trawling

Estimated Tows (upper), Collected Data (lower)

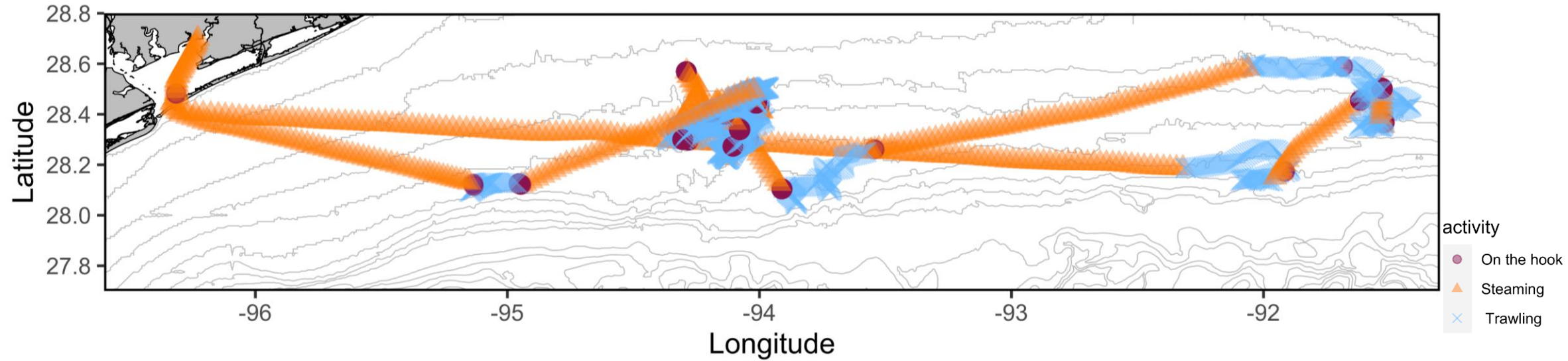


Box#:26252

Zen cELB

## Shrimping Activity

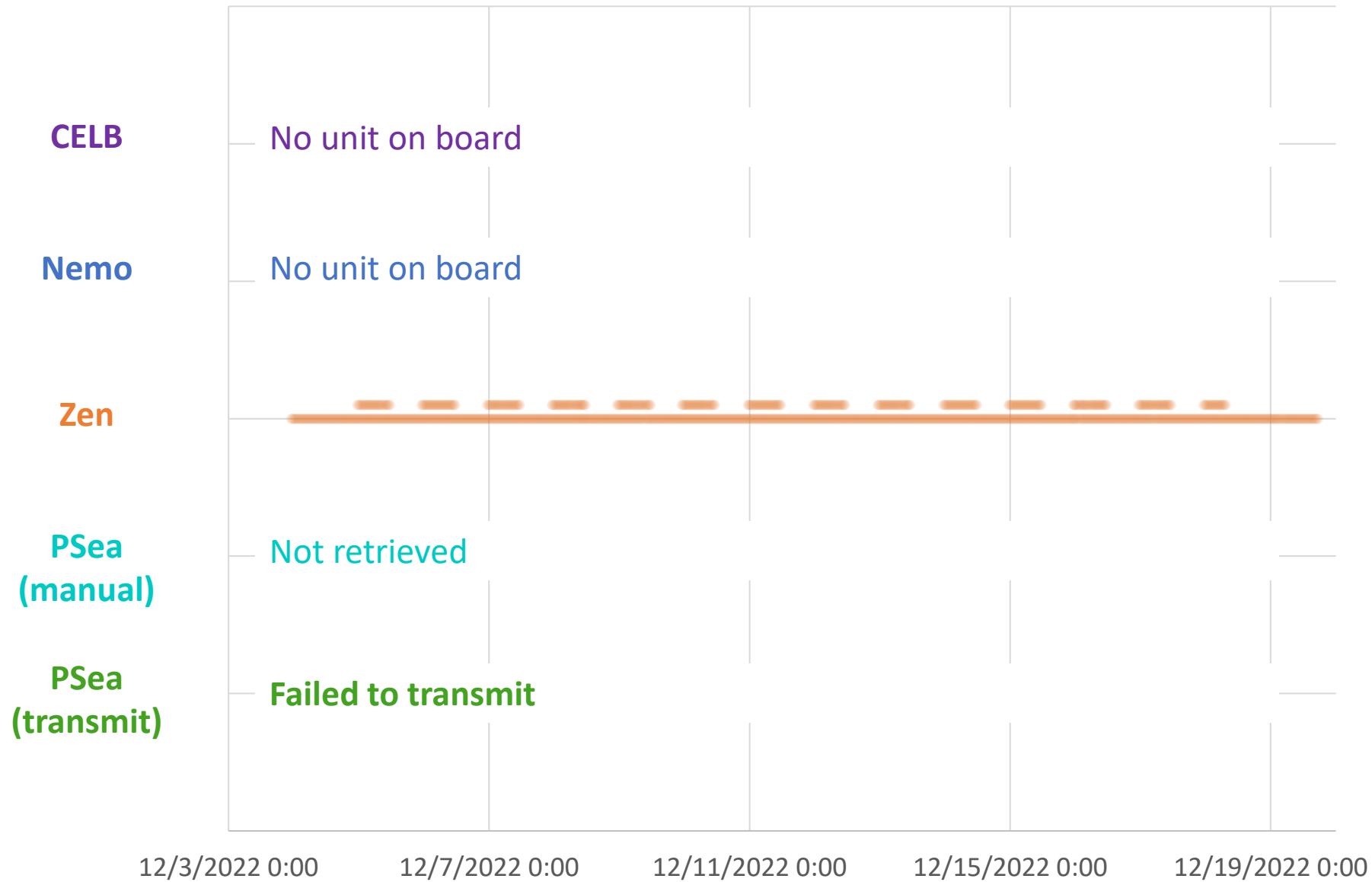
Zen



Test 9

9.28 tow days

## Estimated Tows (upper), Collected Data (lower)

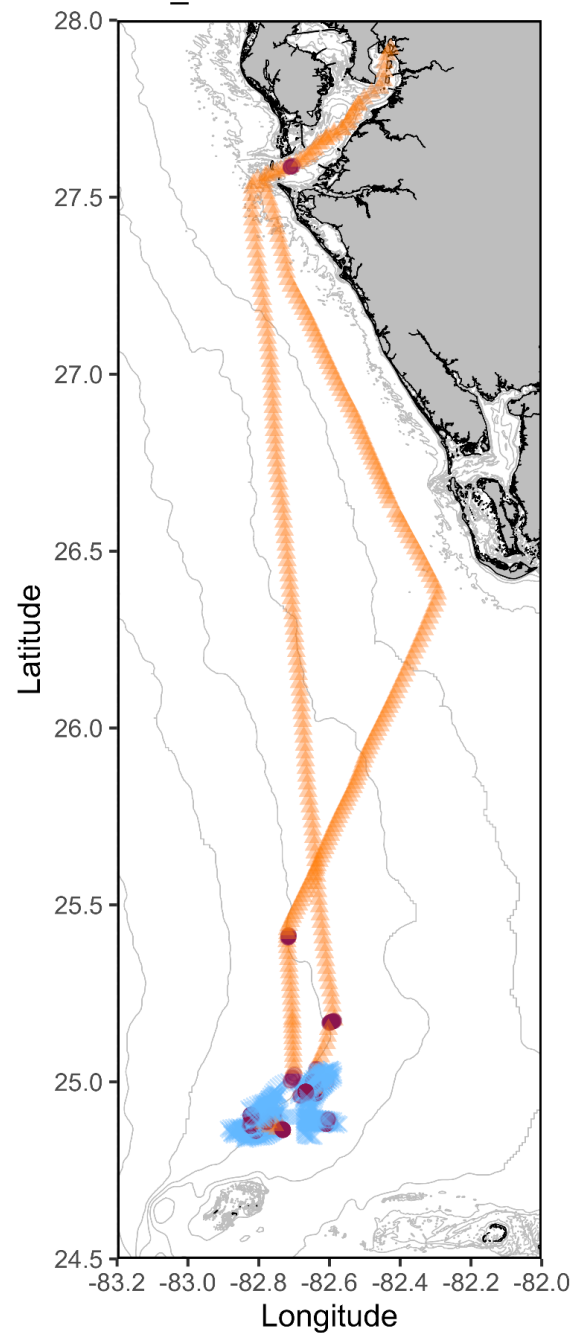


Box#:29103

Zen\_cELB

Zen

# Shrimping Activity



7.15 tow days

