National Fish and Wildlife Foundation
Gulf Environmental Benefit Fund
Quarterly Progress Report

2023-04-18

Contents

Easygrants ID: 54029
Project Title: Recovery and Resilience of Oyster Reefs in the Big Bend of Florida
Organization: University of Florida
Project Term: 12/01/2016 - 11/30/2024
Reporting Quarter: Ending April 2023

0.1 General statement of project status and implementation.

This report includes work accomplished from December 2022 through April 2023. We have completed the standard winter line transect sampling and water quality sampling. A preliminary summary and analyses of oyster count data is included in the Appendix.

To date, this project is within budget and timeline.

ii. Updates on individual tasks.

Task 1. Planning and Permitting
A. Work performed on Task 1.

All work on this task was completed by January of 2018.

B. Performance of Task 1 as against the Task 1 Budget.

All subtasks in Task 1 have been completed on schedule or ahead of schedule, and we remain within budget.

C. Existing or anticipated problems with implementation of Task 1.

We consider this part of the project completed.

Task 2. Develop Adaptive Monitoring Plan
A. Work performed on Task 2.

The Adaptive Management Plan for this project should be seen, at minimum, as a living document and an active, constant process.

An updated version of the Adaptive Management Plan, and Biological Sampling Plan, were completed in June 2020. The biological sampling related to the standard water monitoring sampling efforts was completed this quarter. This work was informed by the adaptive management plan. For example, the variability in oyster counts observed in each stratum (substrate, harvest status, location) collected in each winter sampling period is incorporated into our estimate of the number of samples required to achieve a known power of detecting change of particular magnitude for each sampling period (i.e., winter 2022-2023). The sampling effort for winter 2022-2023 was updated near the mid-point of the sampling season based on observed count data collected during the first half of the winter sampling. Details of this adaptive approach are included in a peer-reviewed publication.

Moore JF, Pine III WE. 2021. Bootstrap methods can help evaluate monitoring program performance to inform restoration as part of an adaptive management program. PeerJ 9:e11378 https://doi.org/10.7717/peerj.11378

B. Progress made towards Task 2 milestones.

Updating of the adaptive management plan, biological sampling plan, and elevation data. NFWF requested permission to share the adaptive management plan with FWC and as far as we know that was done.

C. Performance of Task 2 as against the Task 2 Budget.

Task 2 appears to be within the timeline and budget set out in the proposal.

D. Existing or anticipated problems with implementation of Task 2.

We do not anticipate any problems with implementation of Task 2.

Task 3. Preconstruction Monitoring
A. Work performed on Task 3.

All phases of preconstruction monitoring have been completed as of December 2018.

B. Progress made towards Task 3 milestones.

All subtasks within Task 3 have been completed.

C. Performance of Task 3 as against the Task 3 Budget.

This task appears to be well within budget and the schedule of spending as identified in the proposal.

D. Existing or anticipated problems with implementation of Task 3.

This task is completed.

Task 4. Construction
A. Work performed on Task 4.

All construction activities were completed by November of 2018, so no new work is reported here on construction activities.

B. Progress made towards Task 4 milestones.

All aspects of reef construction were completed as of November 30, 2018.

C. Performance of Task 4 as against the Task 4 Budget.

This task has been completed on schedule, and within budget.

D. Existing or anticipated problems with implementation of Task 4.

No problems are anticipated with the implementation of Task 4, which is complete.

Task 5. Post-Construction Monitoring
A.Work performed on Task 5.

We continued the water quality sampling program until March 9, 2023 and then discontinued the program by retrieving the array. The decommissioning of the water quality array occurred several weeks after the last winter monitoring sample. Data have been uploaded into the relational database used to track these data, and we continuously work to develop relationships between water quality data, survey information, and oyster populations (Task 7). Water quality information is publicly available and summarized on the website http://lcroysterproject.github.io/oysterproject/. We created a Zenodo repository and posted a copy of all oyster count data to this repository as described in our data management plan.

http://zenodo.org/communities/uf_ifas_oysterproject/?page=1%size=20

This repository will also store code used to complete analyses of various aspects of this project. This is an ongoing effort.

B. Progress made towards Task 5 milestones.
. Postconstruction biological sampling of oyster density and size on all study reefs completed for each winter sampling period. Data for the current (winter 2022-2023) sampling period have been entered and summarized, and preliminary summaries are included as an Appendix.

. GF Young Surveyors completed post-construction elevation sampling in winter/spring 2020-2021. We have received this data and are currently processing the survey results. We had hoped to complete a manuscript on these data this quarter but have been delayed due to staffing shortages.

. Water quality conditions throughout this quarter were nominal. River discharge was below normal.

. The Appendix report identifies all sampling completed during winter 2022-2023. We tuned sampling efforts throughout the season based on observed counts within each stratum. For the No Harvest/No Restoration (N_N), we had difficulty identifying sites to sample because sites identified from the available GIS do not appear to still exist. We have communicated to our agency partners that a good next step, which we may collaborate with them this summer, is to revisit known sites we have sampled in the last three yeras to see if they still exist. We also note that winter 2022-2023 was the first period when the restored sites had higher counts than the unrestored sites.

C. Performance of Task 5 as against the Task 5 Budget. This task is within schedule and budget.

D. Existing or anticipated problems with implementation of Task 5. There are some gaps for this reporting period in the water quality monitoring due to missing data from the original sensor array or errors in the recorded observations by the sensors. This is primarily for water quality stations 2 and 5. We suspect these sensors were vandalized. This is the second quarter we have experienced these issues in this project. We have made significant progress in modeling the water quality data (salinity) based on river discharge and wind information (M. Richardson, PhD student), and we will be able to present some of these results in the December 2023 report. This modeling framework will help compensate for missing water quality observations apparent in the data summaries included in this report.

We have employed a rotating crew of local oyster harvesters to assist with all water quality and field sampling efforts. We also have the cooperation of FWC staff, who have also worked with us to complete oyster sampling efforts.

We have a small amount of field work planned for the second quarter of 2023 to complete sampling for Nate Rogers' MS degree.

Task 6. Outreach and Education Work performed on Task 6.

Subtask 6.1. Preconstruction outreach and education
Since construction has been completed there is no new information to report.

Subtask 6.2. Post-construction education and outreach We maintain two public educational displays about the Lone Cabbage restoration project at high traffic boat ramps in Cedar Key and Suwannee.

We primarily update public information about the project through the various electronic and social media produced by the Nature Coast Biological Station in Cedar Key https://ncbs.ifas.ufl.edu/. The public can view data for water quality, oyster landings, and river discharge via the project Shiny App available here https://lcroysterproject.github.io/oysterproject/

A. Progress made towards Task 6 milestones.

PI Pine traveled to the American Fisheries Society Southern Division meeting to present the results of oyster restoration efforts as part of a symposium. Pine met multiple times this quarter with FWC cooperators planning oyster restoration projects on the phone and in Tallahassee. Pine also presented an update on the Lone Cabbage Project to the Suwannee Oystermen's Association and presented a seminar as part of the UF Department of Wildlife Ecology seminar series. The seminar is available here https://tinyurl.com/bddhmuvt. Grad students N. Rogers presented his ongoing MS thesis research at the UF-sponsored North Florida Marine Science Symposium.

B. Performance of Task 6 as against the Task 6 Budget.

This task appears to be within the budget proposed and on schedule.

C. Existing or anticipated problems with implementation of Task 6.

We do not anticipate any problems with the implementation of Task 6.

Task 7. Data Management

A. Work performed on Task 7.

We continue to work with the UF Library Academic Resource Computing (LARC) team for technical assistance related to data storage for water quality, oyster count, and elevation data. Maintaining modern data collection and storage systems facilitates our ability to analyze data rapidly and inform project decision-making. This was demonstrated to NFWF staff during their site visit in December 2021.

B. Progress made towards Task 7 milestones.

Database efforts for water quality and oyster count data are in place and operational. Effort continues to integrate GF Young's and others' survey information (pre and post-construction) into a common framework. We created a Zenodo repository for oyster count data.
https://zenodo.org/communities/uf_ifas_oysterproject/?page=1&size=20

C. Performance of Task 7 as against the Task 7 Budget.

We are currently proceeding as scheduled for Task 7 and are within budget.

D. Existing or anticipated problems with implementation of Task 7.

None anticipated.

Task 8. Project Administration

A. Work performed on Task 8.

Subtask 8.1. Tracking expenditures
The project is underspend. We reconcile budget vs. expenditure every six months and review project status and progress with admin staff.

Subtask 8.2. Managing staff Two graduate students (Nate Rogers and Matthew Richardson) are supported in whole or part by this award. Former post-doc Jennifer Moore has resigned to open an ecological consulting business. We are contracting with her for continuing technical assistance (30-40 hours per month). We will also coordinate with Amanda Morgan for editorial, reporting, and manuscript assistance to help address staff shortages (<10 hours per month as needed). We will work with NFWF to transfer funds from the unspent salary from the vacant biological scientist to cover contracted costs for Moore and Morgan. NFWF has approved this transfer via email, and NFWF is waiting on EasyGrants update. We continue to employ one PhD level staff as an hourly employee to occasionally assist with analyses.

Subtask 8.3. Coordination Coordination has been carried out through as-needed meetings and communications among the three principal investigators, graduate students, and the UF Libraries data management group (LARC).

Previous and continuing coordination activities with projects external to this one have included coordination with county plans for additional oyster restoration activities (Sturmer, Pine), coordination with research planned for the Lower Suwannee National Wildlife Refuge hydrological restoration project (Allen), antipoaching activities and oyster management by the Florida Fish and Wildlife Conservation Commission (Pine, Sturmer), coordination with sampling of fishes on the Lone Cabbage Reef by Nature Coast Biological Station and the Florida Fish and Wildlife Conservation Commission (Allen), coordination with aquaculture activities in the area (Sturmer), coordination with Florida's Oyster Integrated Mapping and Monitoring Project (OIMMP, Pine), participation in oyster research and restoration planning efforts by other entities in the region (FWC, TNC, UF, Sturmer, Pine, Allen).

PI-Pine will be leaving UF employment in 2023. Pine will continue to lead project efforts to completion. The transition data has yet to be finalized. We will be working with NFWF staff this quarter to develop a suitable solution in the future for grant administration and completion.

Subtask 8.4. Reporting During this period, we have submitted requests for reimbursement for the April 2023 reporting period and have completed the quarterly report for the April reporting period.

B. Progress made towards Task 8 milestones.

. Fiscal reports and requests for reimbursement completed. . Quarterly report completed through April 2023. . Management and training graduate students, and oyster harvesters.

C. Performance of Task 8 as against the Task 8 Budget.

This Task appears to be within the Task 8 budget, and on schedule.

D. Existing or anticipated problems with implementation of Task 8.

None.

0.2 Submission schedule for payment requests.

UF has submitted payment requests quarterly and we plan to continue this schedule.

0.3 Any other information necessary for NFWF's evaluation of the Project's progress as measured against the Project Description, Budget, and Project schedule.

We have included a draft analysis of the oyster count data, including winter 2022-2023 sampling as an Appendix. Teams of commercial oyster harvesters and FWC staff completed sampling. Oyster harvesters participated in all sampling efforts and were a critical fieldwork component. They were reliable and accurate in their data collection efforts. The commercial harvesters appreciated the opportunities to work on the monitoring efforts because of spatial closures of the oyster fishery related to Salmonella contamination. We have irregular as needed phone calls with NFWF staff.

0.4 Project products and deliverables produced during the applicable reporting period.

See the Appendix for draft analyses of the oyster count data. Summaries of water quality are provided in subsequent sections. Two draft manuscripts were circulated to NFWF staff for courtesy review period as we prepare to submit for peer-review and journal publication.

1 Water Quality Quarterly Figures

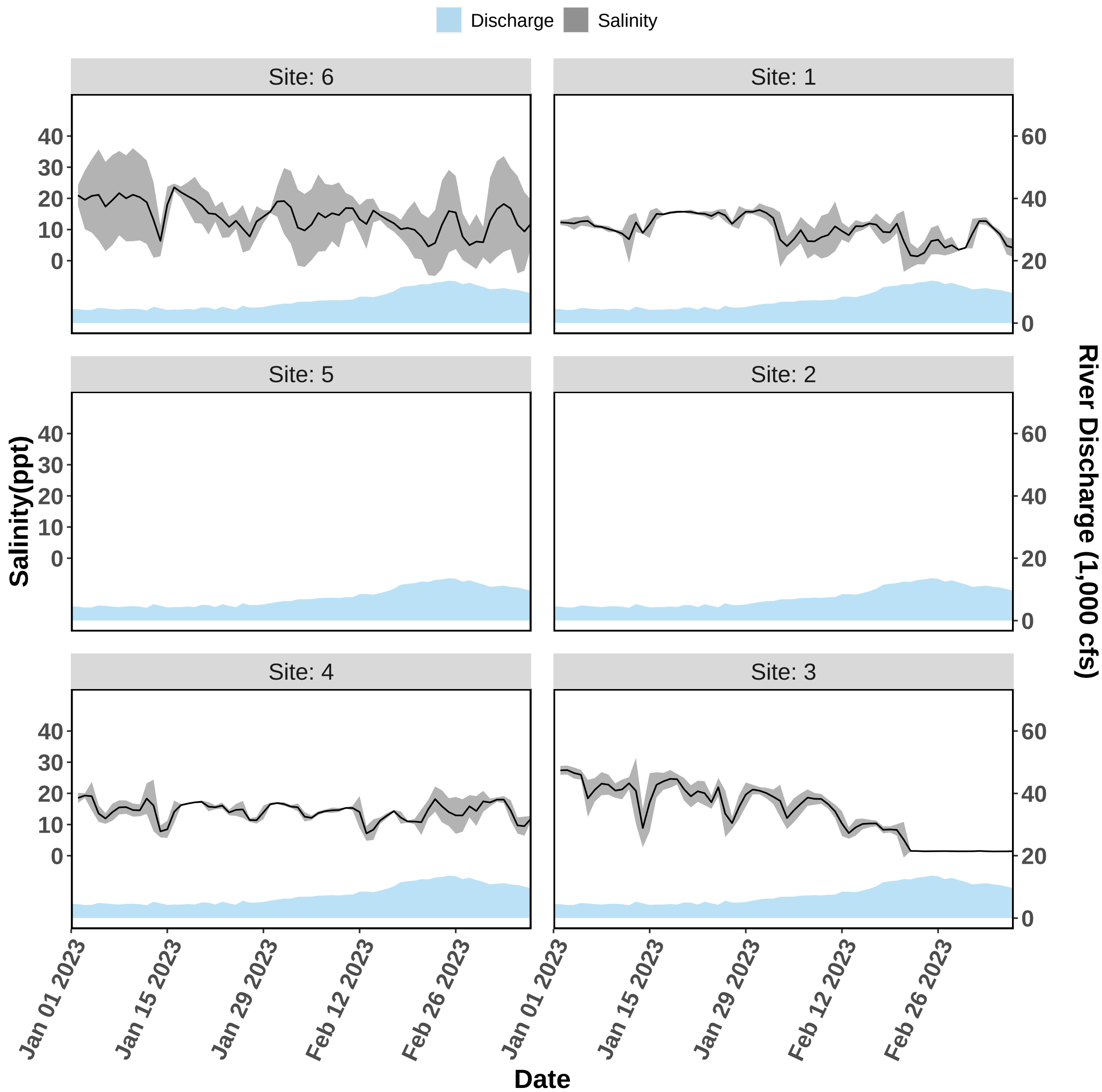


Figure 1-1. Salinity and river discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The right column of figures (Sites 1-3) represent the eastern side of the Lone Cabbage Reef restoration site. The left column of figures (Sites 4-6) represent the western side of the Lone Cabbage Reef restoration site. The primary y-axis is Salinity (ppt, parts per thousand), and the secondary y-axis is Suwannee River discharge (CFS, cubic feet per second) measured at USGS Wilcox station 02323500 on the Suwannee River. River discharge is graphed as a daily mean in the light blue filled shape near the bottom of each graph. Daily mean salinity values (black line) are depicted using a 95% confidence interval (grey shaded region). Missing river discharge or salinity values are due to corrupt readings or missing equipment.

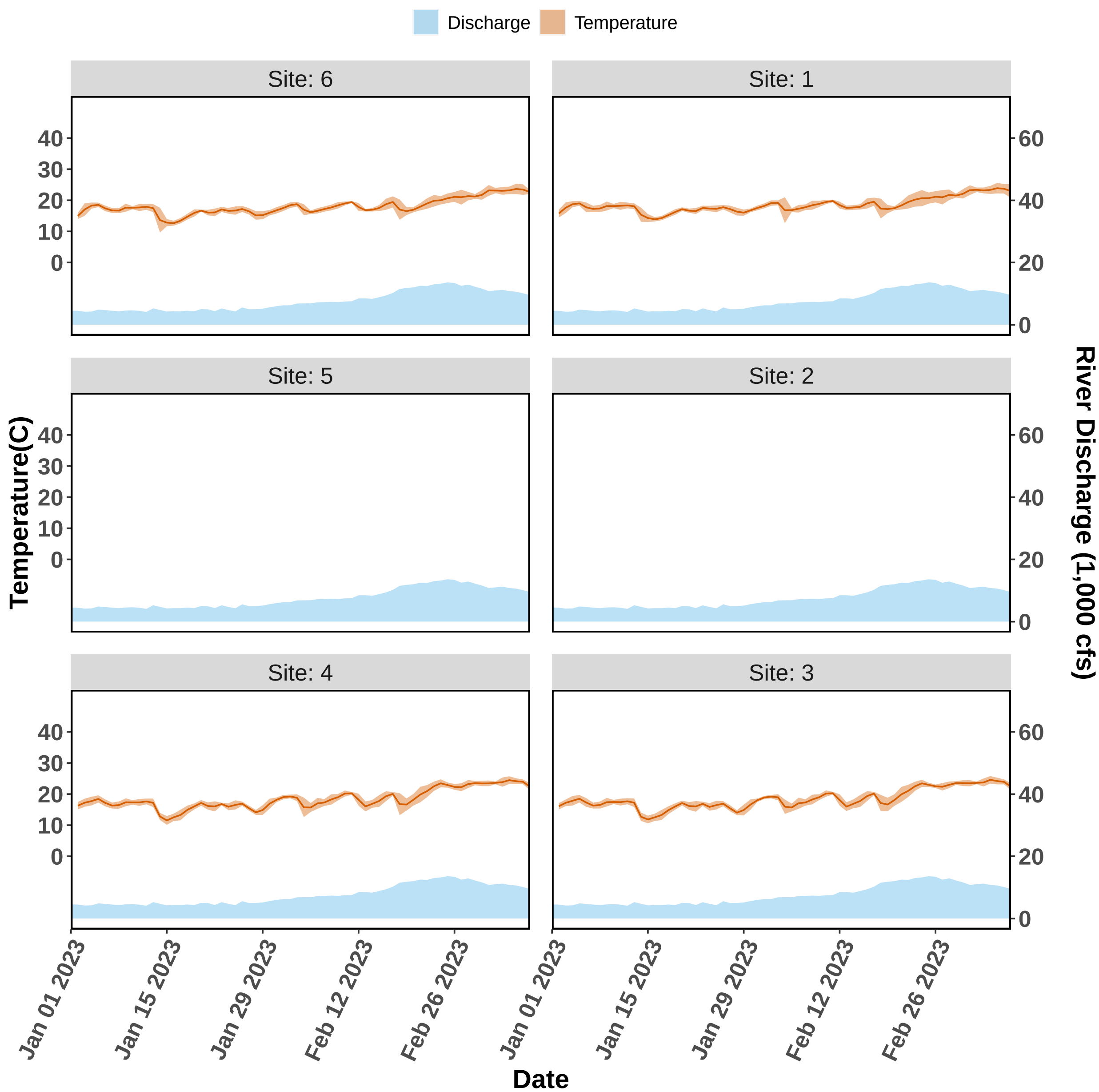


Figure 1-2. Temperature and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The right column of figures (Sites 1-3) represent the eastern side of the Lone Cabbage Reef restoration site. The left column of figures (Sites 4-6) represent the western side of the Lone Cabbage Reef restoration site. The primary y-axis is Temperature (C, Celsius), and the secondary y-axis is Suwannee River discharge (CFS, cubic feet per second) measured at USGS Wilcox station 02323500 on the Suwannee River. River discharge is graphed as a daily mean in the light blue filled shape near the bottom of each graph. Daily mean temperature values (orange line) are depicted with a 95% confidence interval (shaded orange region). Missing river discharge or temperature values are due to corrupt readings or missing equipment.

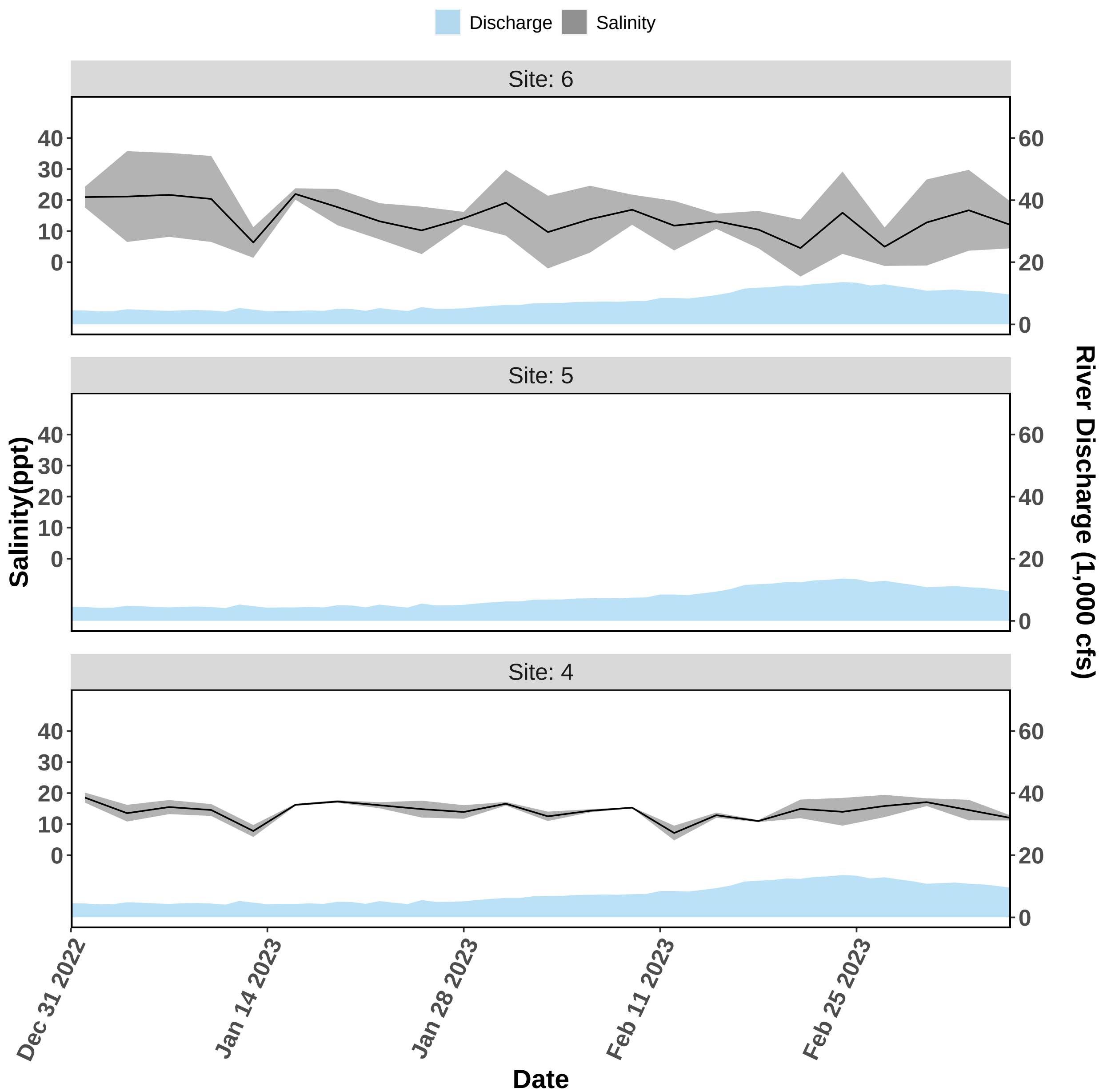


Figure 1-3. Salinity and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The figures (Sites 4-6) represent the western side of the Lone Cabbage Reef restoration site. The primary y-axis is Salinity (ppt, parts per thousand), and the secondary y-axis is Suwannee River discharge (CFS, cubic feet per second) measured at USGS Wilcox station 02323500 on the Suwannee River. River discharge is graphed as a daily mean in the light blue filled shape near the bottom of each graph. Daily mean salinity values (black line) are depicted using a 95% confidence interval (grey shaded region). Missing river discharge or salinity values are due to corrupt readings or missing equipment.

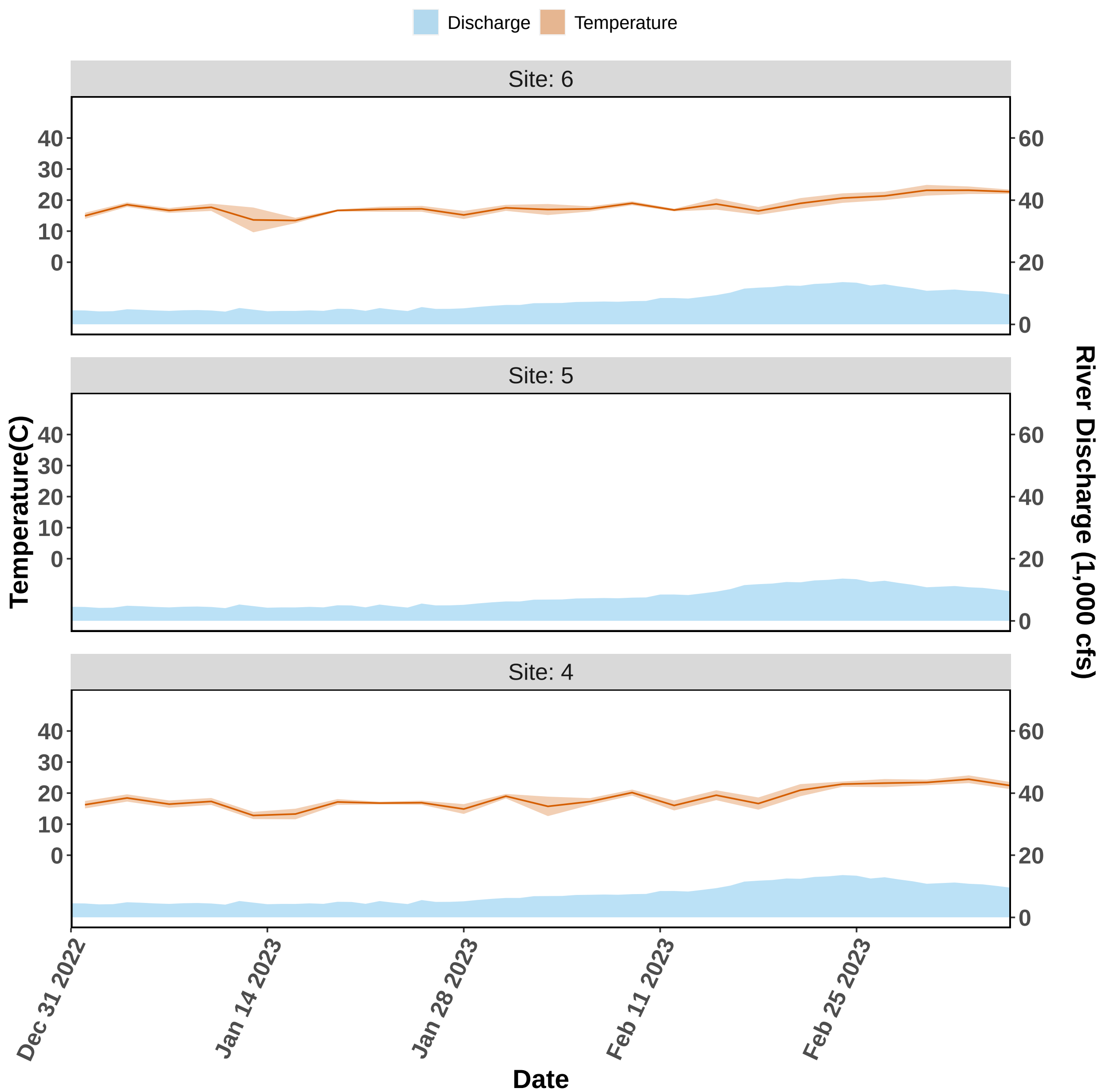


Figure 1-4. Temperature and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The figures (Sites 4-6) represent the western side of the Lone Cabbage Reef restoration site. The primary y-axis is Temperature (C, Celsius), and the secondary y-axis is Suwannee River discharge (CFS, cubic feet per second) measured at USGS Wilcox station 02323500 on the Suwannee River. River discharge is graphed as a daily mean in the light blue filled shape near the bottom of each graph. Daily mean temperature values (orange line) are depicted with a 95% confidence interval (shaded orange region). Missing river discharge or salinity values are due to corrupt readings or missing equipment.

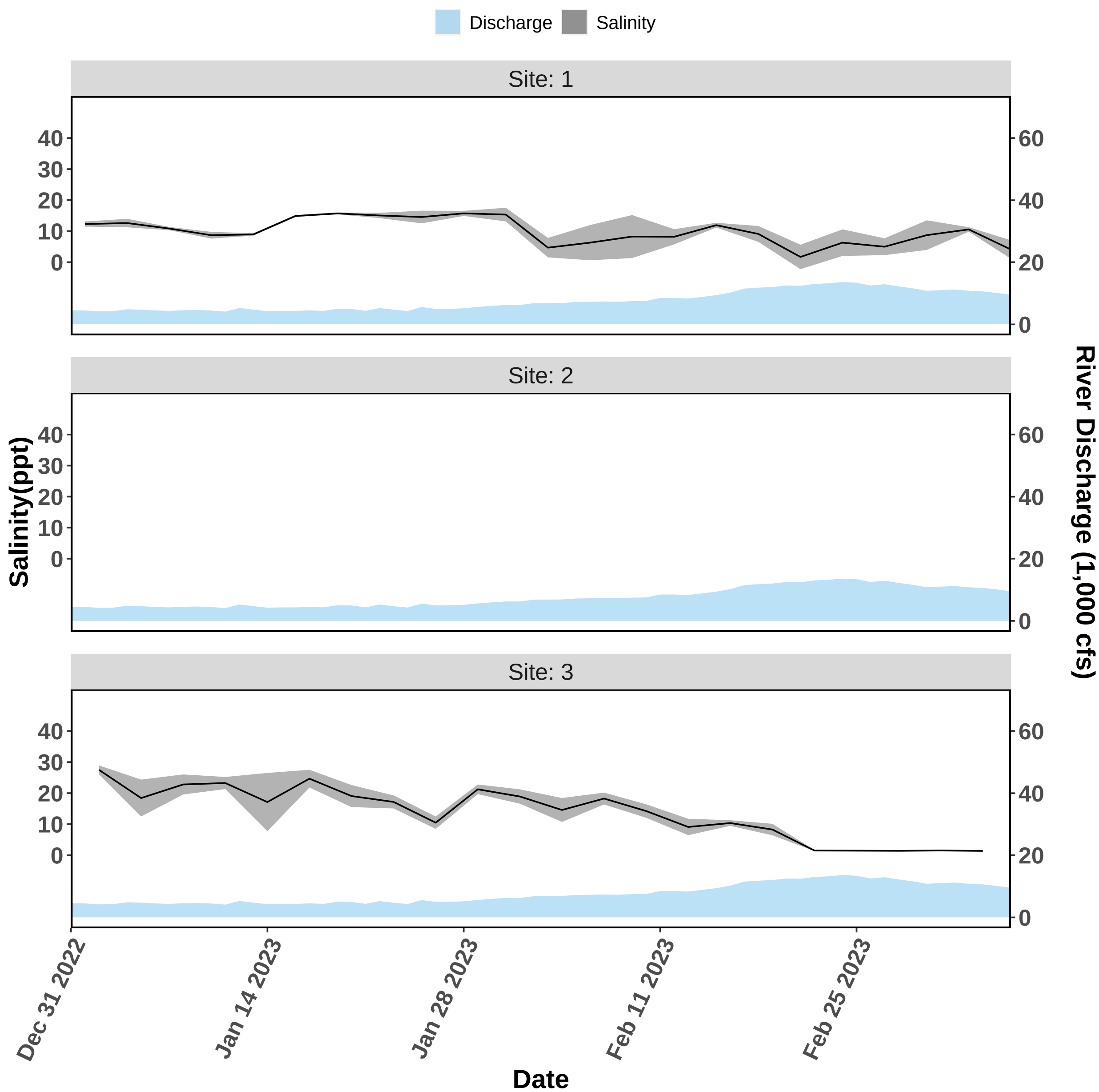


Figure 1-5. Salinity and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. The figures (Sites 1-3) represent the eastern side of the Lone Cabbage Reef restoration site. The primary y-axis is Salinity (ppt, parts per thousand), and the secondary y-axis is Suwannee River discharge (CFS, cubic feet per second) measured at USGS Wilcox station 02323500 on the Suwannee River. River discharge is graphed as a daily mean in the light blue filled shape near the bottom of each graph. Daily mean salinity values (black line) are depicted using a 95% confidence interval (grey shaded region). Missing river discharge or salinity values are due to corrupt readings or missing equipment.

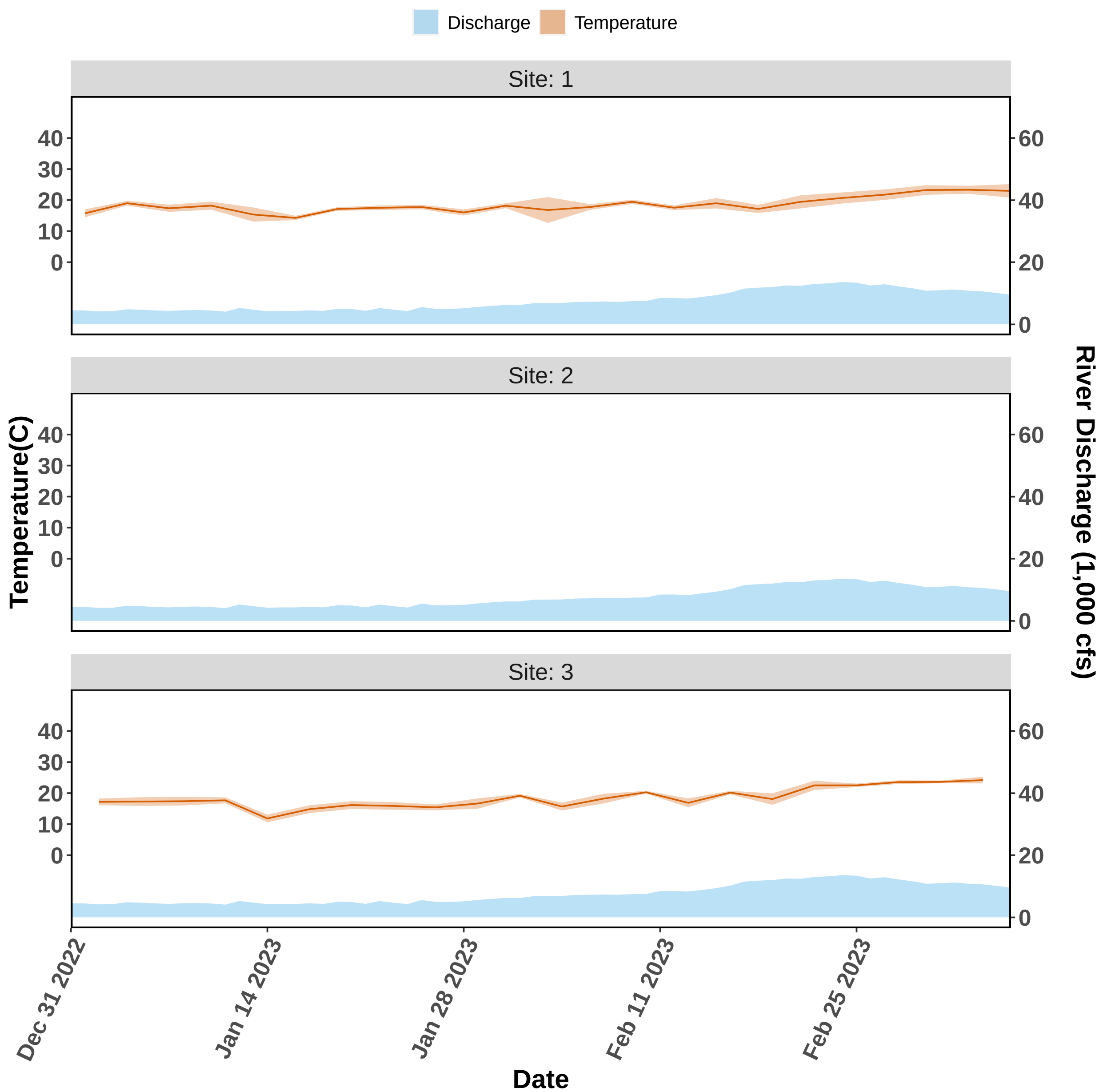


Figure 1-6. Temperature and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. The figures (Sites 1-3) represent the eastern side of the Lone Cabbage Reef restoration site. The primary y-axis is Temperature (C, Celsius), and the secondary y-axis is Suwannee River discharge (CFS, cubic feet per second) measured at USGS Wilcox station 02323500 on the Suwannee River. River discharge is graphed as a daily mean in the light blue filled shape near the bottom of each graph. Daily mean temperature values (orange line) are depicted with a 95% confidence interval (shaded orange region).

2 River Discharge Figures

For all of the figures within this chapter, the areas of color represent percentiles where each percentile is a value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it. For example, on the map of daily streamflow conditions a river discharge at the 90th percentile is equal to or greater than 90 percent of the discharge values recorded on this day of the year during all years that measurements have been made. In general, a percentile greater than 75 is considered above normal, a percentile between 25 and 75 is considered normal, and a percentile less than 25 is considered below normal. The percentiles are based on the period of record for this gauge station.

These data are retrieved via the `waterData` package in R made available by U.S. Geological Survey (USGS). These data are collected at the USGS 02323500 Suwannee River station near Wilcox, Florida. This site is located in Levy County, Florida (latitude 29.58968 and longitude -82.93651 in degrees).

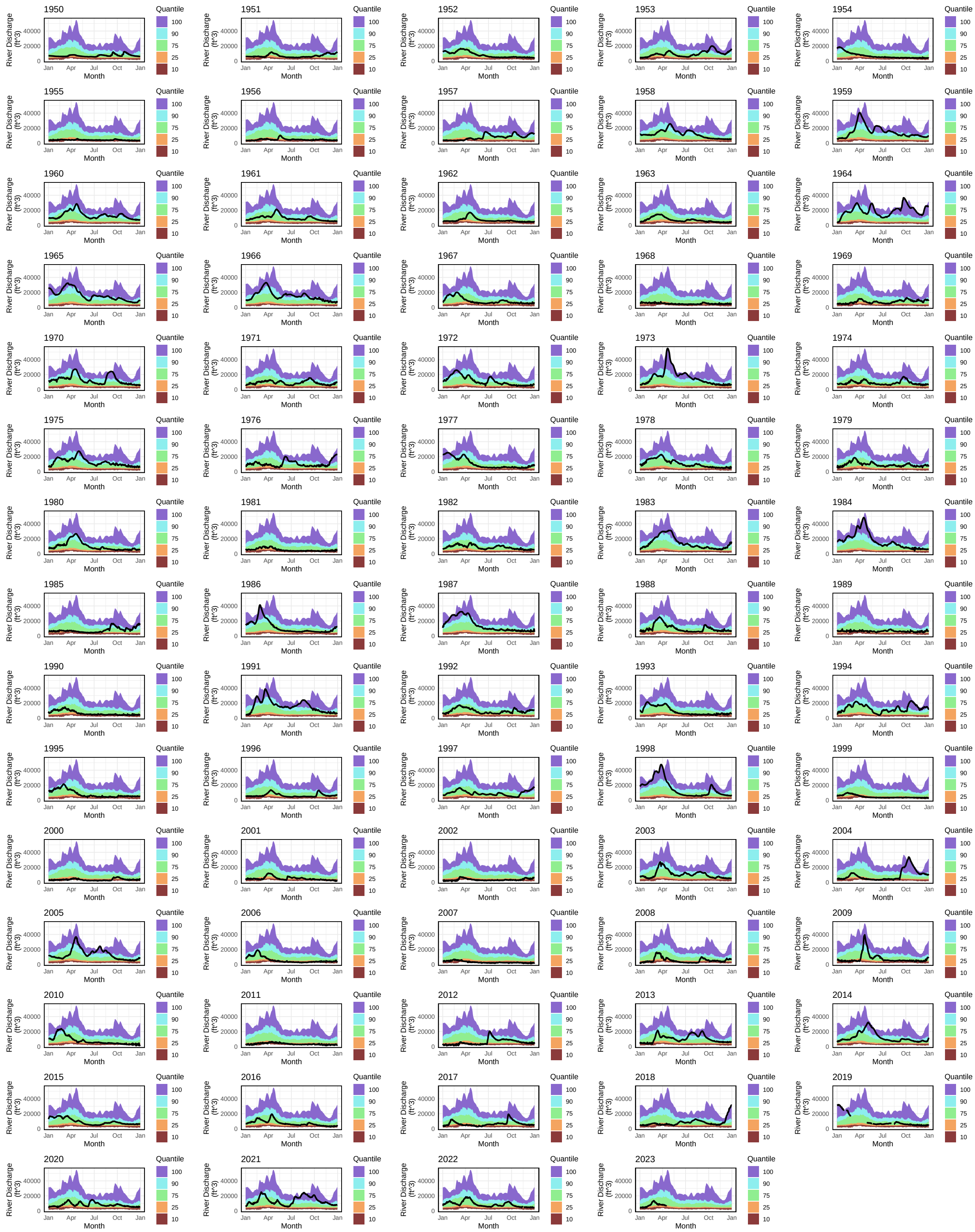


Figure 2-1. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS 02322500) for the years 1950-2022 (solid black line).

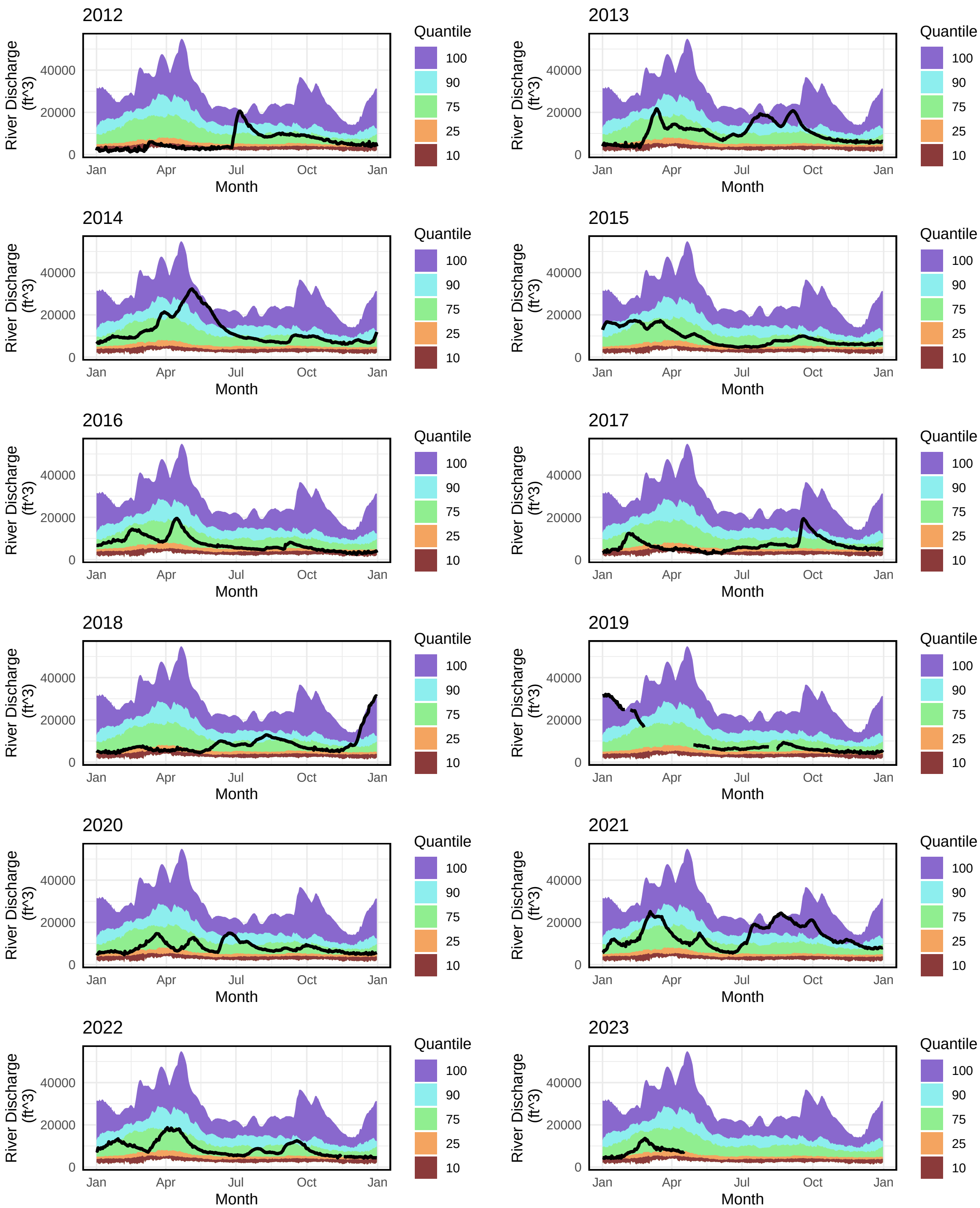


Figure 2-2. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS 02322500) for the years 2012-2023 (solid black line).

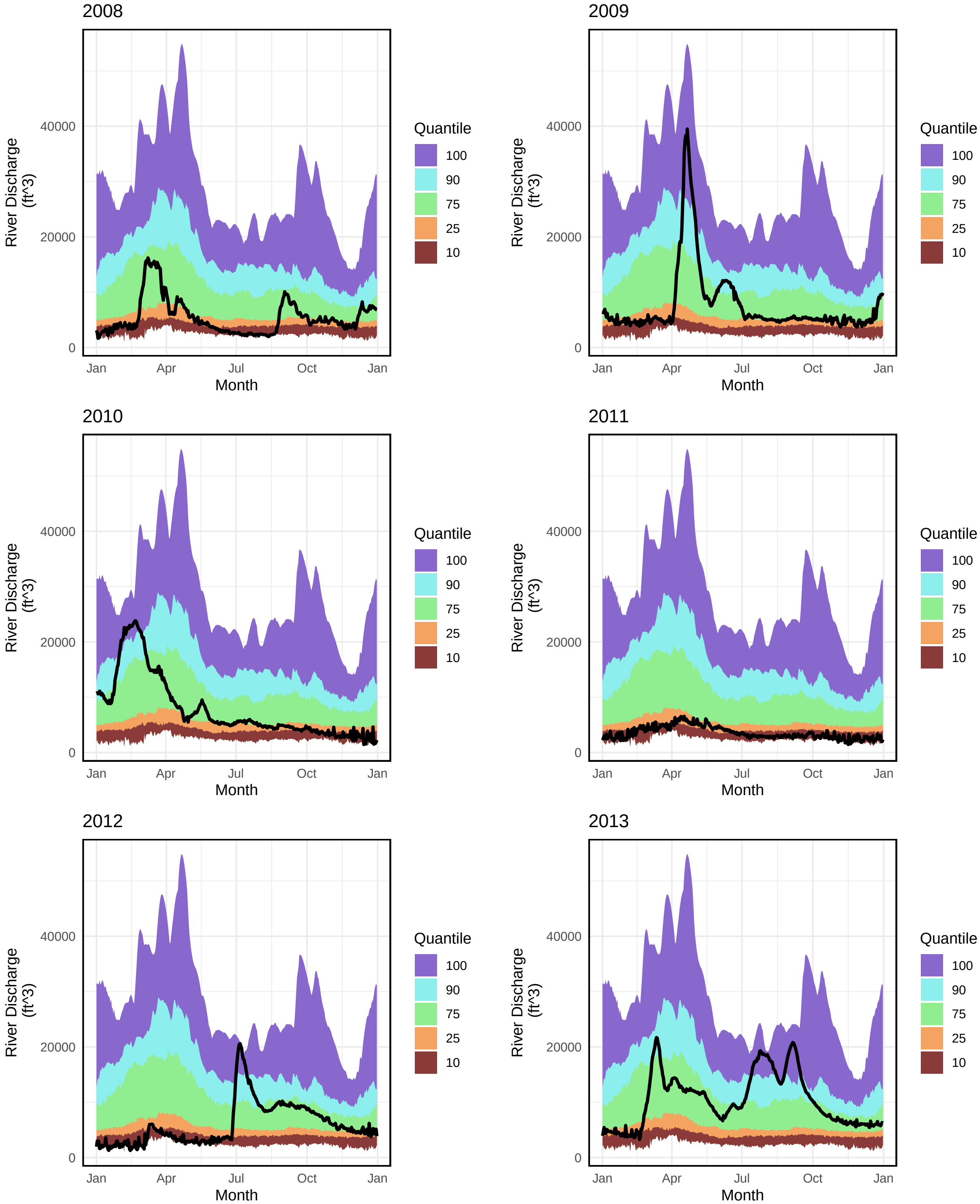


Figure 2-3. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS 02322500) for the years 2008-2013 (solid black line) representing the years preceding observed extreme low discharge conditions 2010-2012.

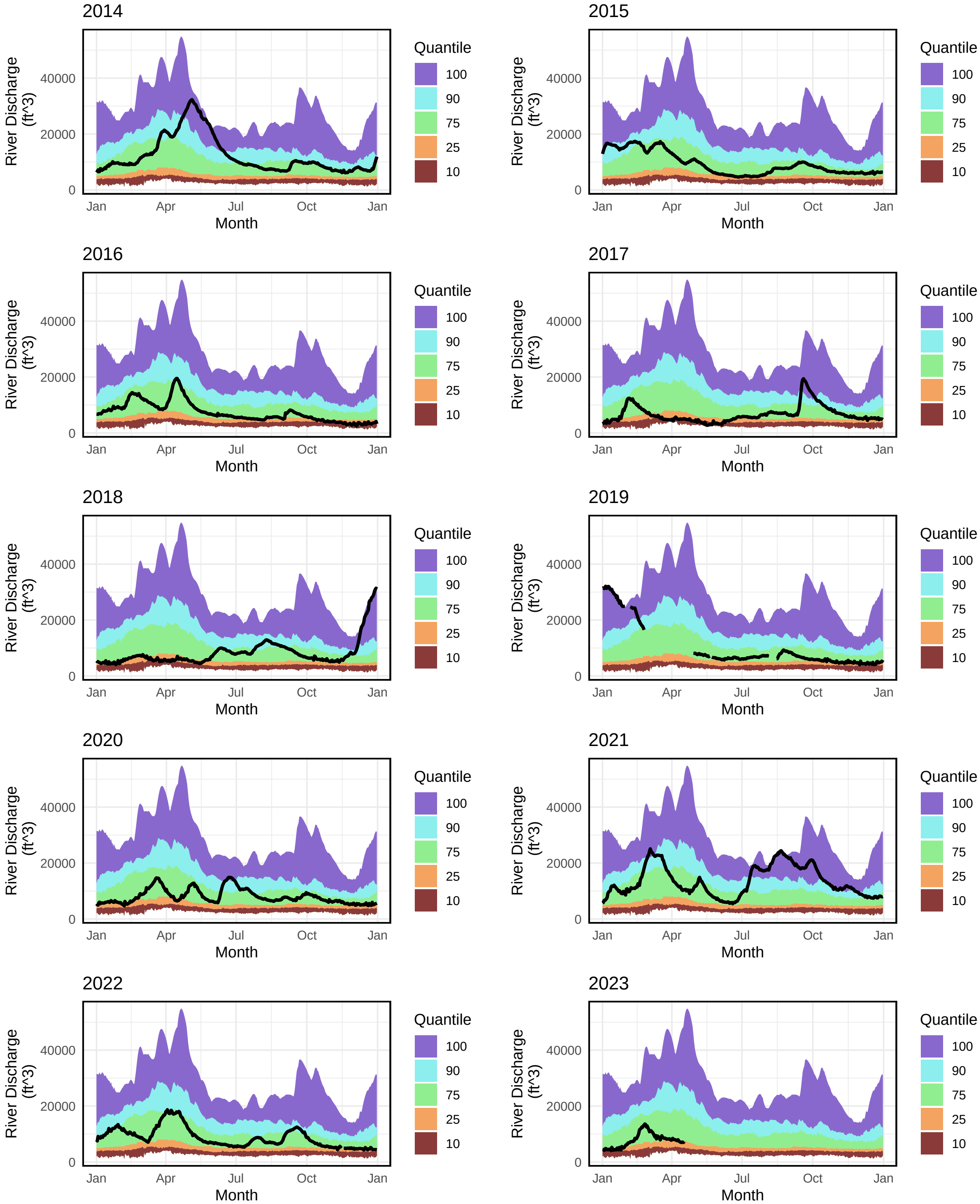


Figure 2-4. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS 02322500) for the years 2014-2023 (solid black line) representing the years since 2010-2012 low flow conditions including the initiation of the Lone Cabbage Reef restoration project.

3 Transect Report

3.1 Overview

This report provides summary statistics and figures for ongoing transect sampling. The first section of the report focuses on the current sampling (Winter 2022-2023) and how the collected data compare to last year's sampling (Winter 2021-2022). So far 14 days have been sampled this season. The second half of the report gives summaries of all of the data that have been collected since the beginning of the project (2010-05-27). In total, 158 days have been sampled over this entire project.

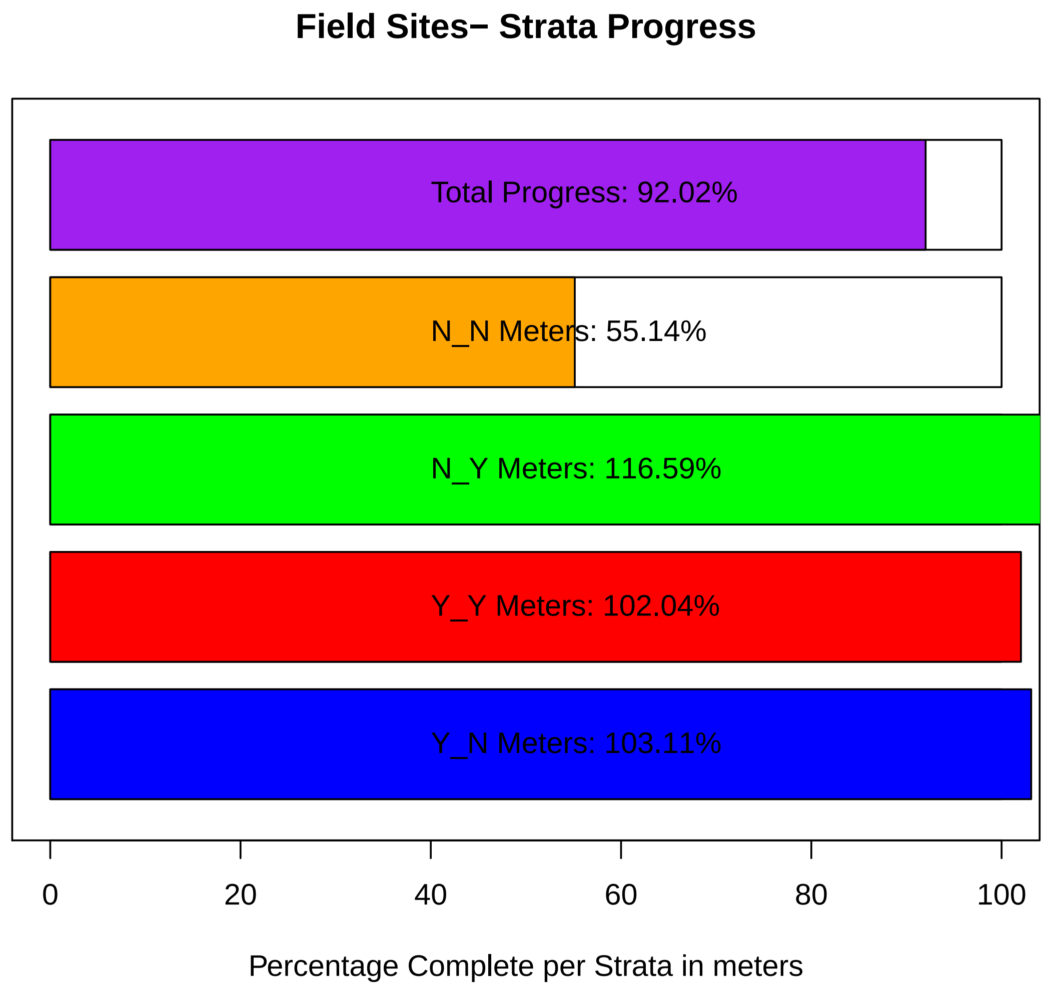
3.1.1 Definition of Localities and Strata

LOCALITY	LOCATION
BT	Big Trout
CK	Cedar Key
CR	Corrigan's Reef
HB	Horseshoe Beach
LC	Lone Cabbage
LT	Little Trout
NN	No Name

STRATA	DEFINITION
Y_N	Yes Harvest, No Rock
Y_Y	Yes Harvest, Yes Rock
N_N	No Harvest, No Rock
N_Y	No Harvest, Yes Rock
N_PILOT	No Harvest, Pilot Rocks

3.2 Current Sampling (progress)

Here, we provide a progress bar showing how much of the sampling has been completed for this season, plus summary tables and plots comparing live counts and density of oysters between this current season and last year. **The current sampling period is period 26, and last year's sampling period is period 24.**



STRATA	Meters Completed
Y_N	342.33
Y_Y	871.4
N_N	216.13
N_Y	728.66

Table 4-1. - Displaying the total meters surveyed during period 26 per strata.

3.2.1 Summary Plots for Periods 20, 22, 24, and 26

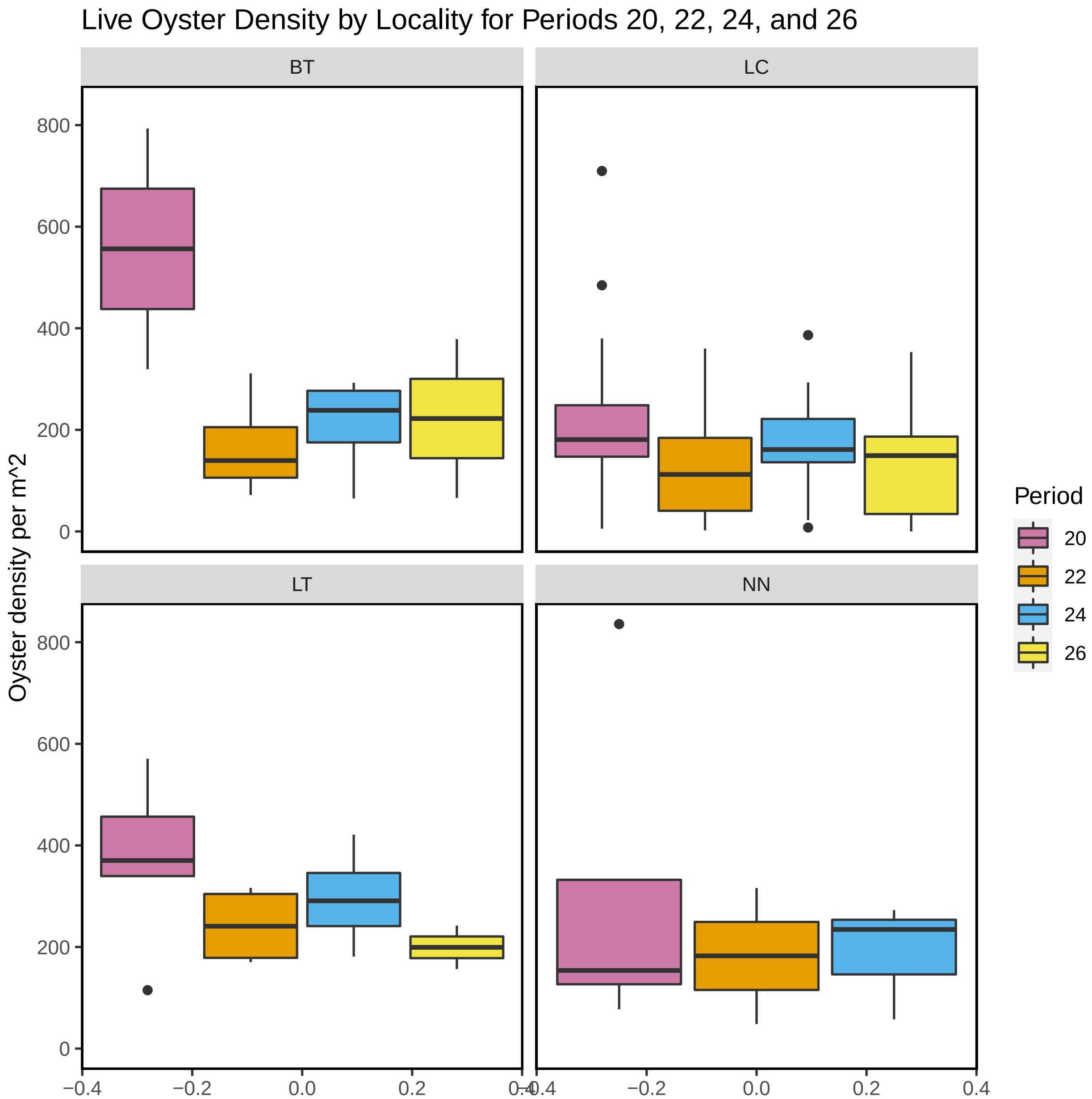


Figure 4-1.- Calculated live oyster density by locality for periods 20 (Winter 2019-2020), 22 (Winter 2020-2021), 24 (Winter 2021-2022), and 26 (Winter 2022-2023) with the last sample date of period 26 as 2023-02-06.

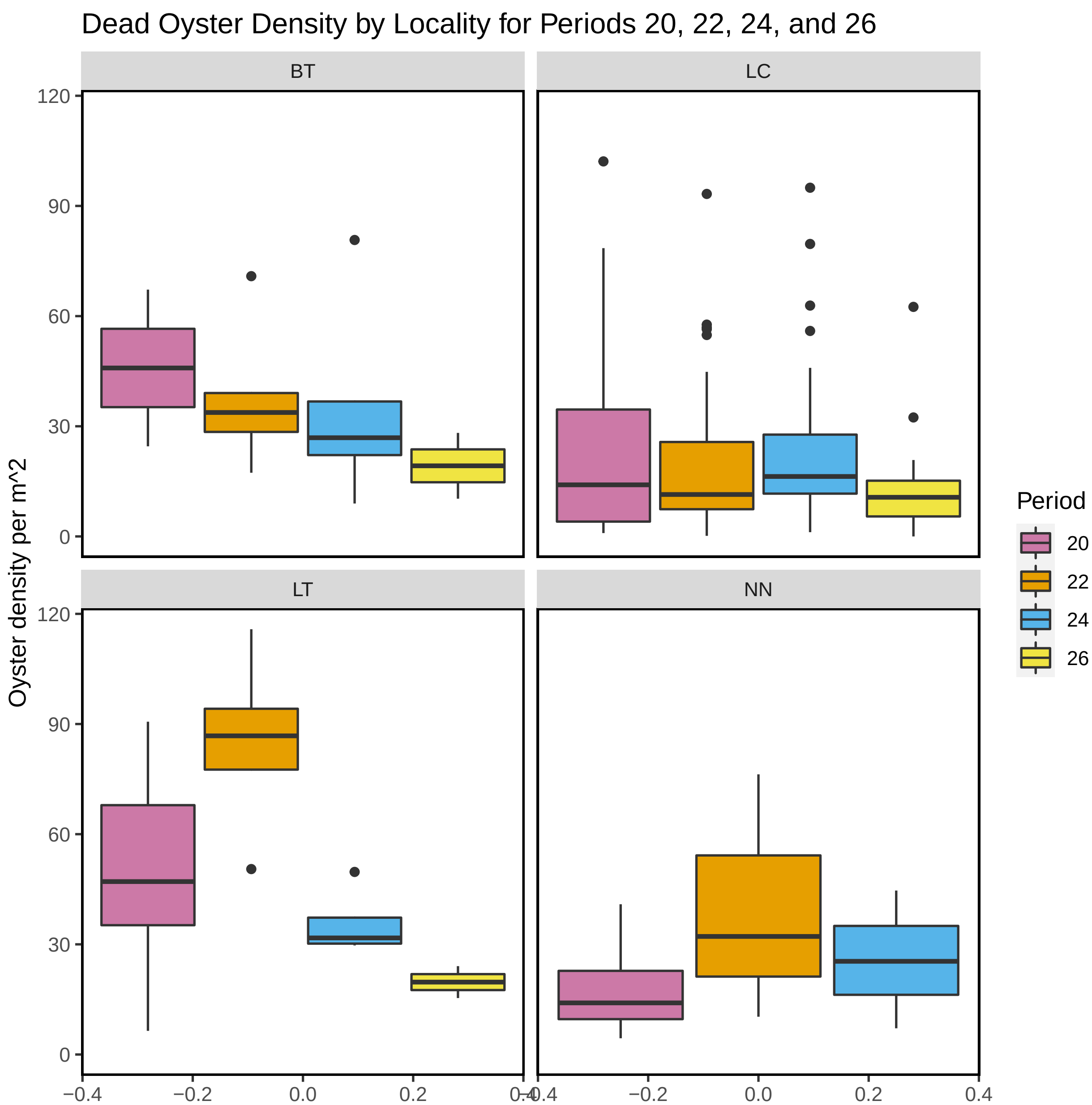


Figure 4-2.- Calculated dead oyster density by locality for periods 20 (Winter 2019-2020), 21 (Winter 2020-2021), 24 (Winter 2021-2022), and 26 (Winter 2022-2023) with the last sample date of period 26 as 2023-02-06.

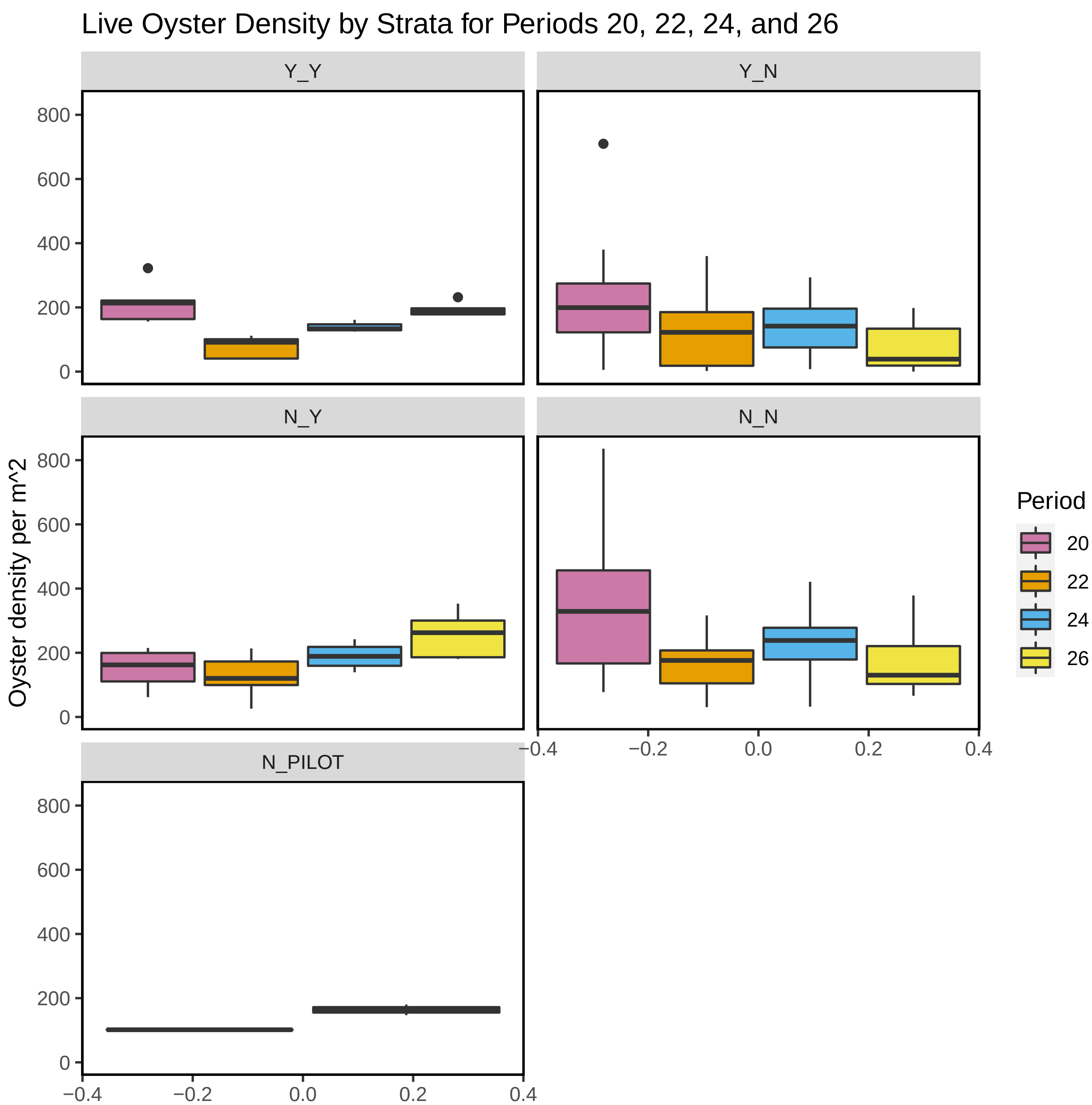


Figure 4-3.- Calculated live oyster density by strata for periods 20 (Winter 2019-2020), 22 (Winter 2020-2021), 24 (Winter 2021-2022), and 26 (Winter 2022-2023) with the last sample date of period 26 as 2023-02-06.

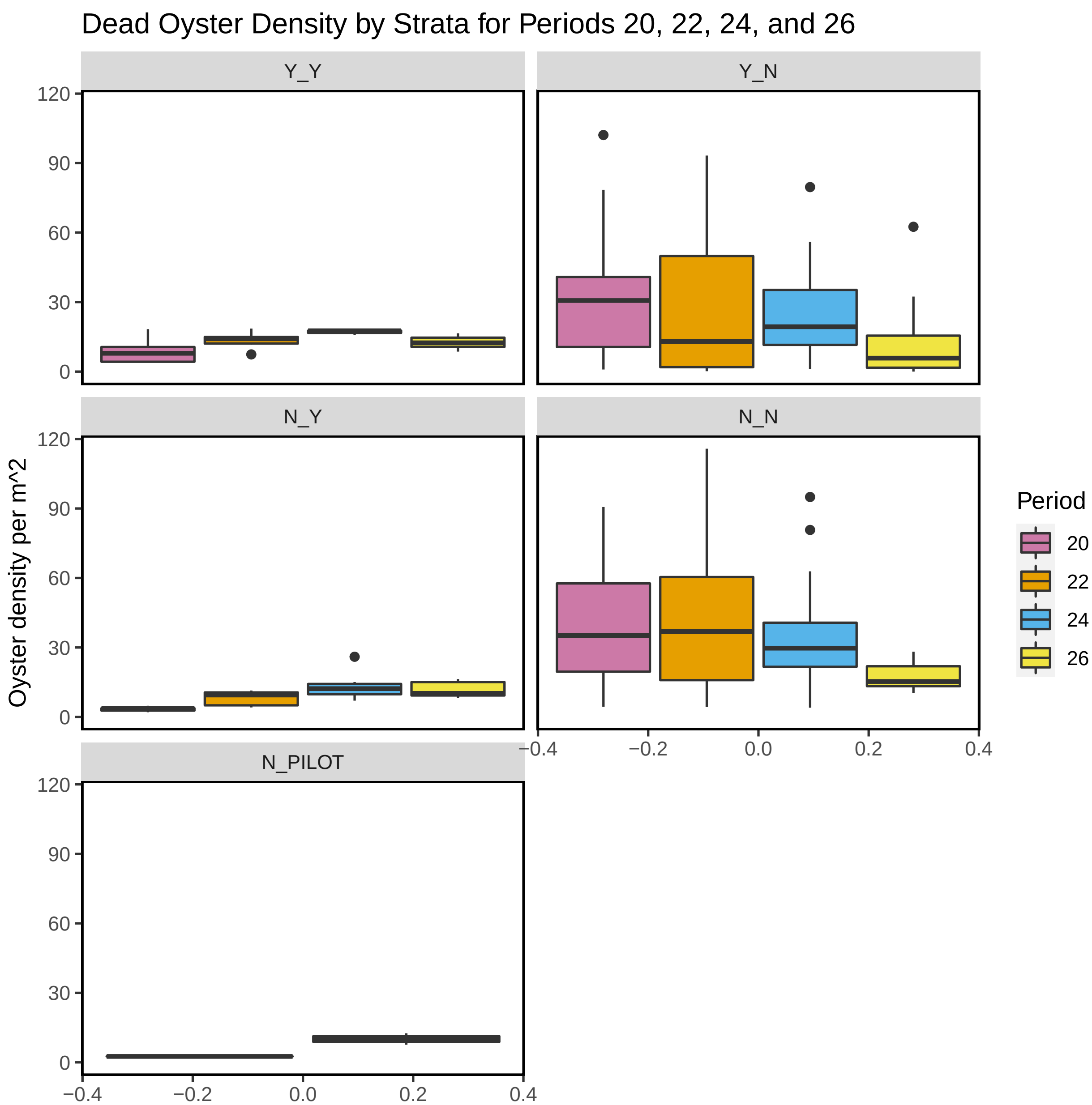


Figure 4-4.- Calculated dead oyster density by strata for periods 20 (Winter 2019-2020), 22 (Winter 2020-2021), 24 (Winter 2021-2022), and 26 (Winter 2022-2023) with the last sample date of period 26 as 2023-02-06.

The following summary plot is calculated in R using the `geom_density` (https://ggplot2.tidyverse.org/reference/geom_density.html) statistical function in `ggplot`. The `geom_density` function computes and draws kernel density estimates, which is then represented as a smoothed version of a histogram.

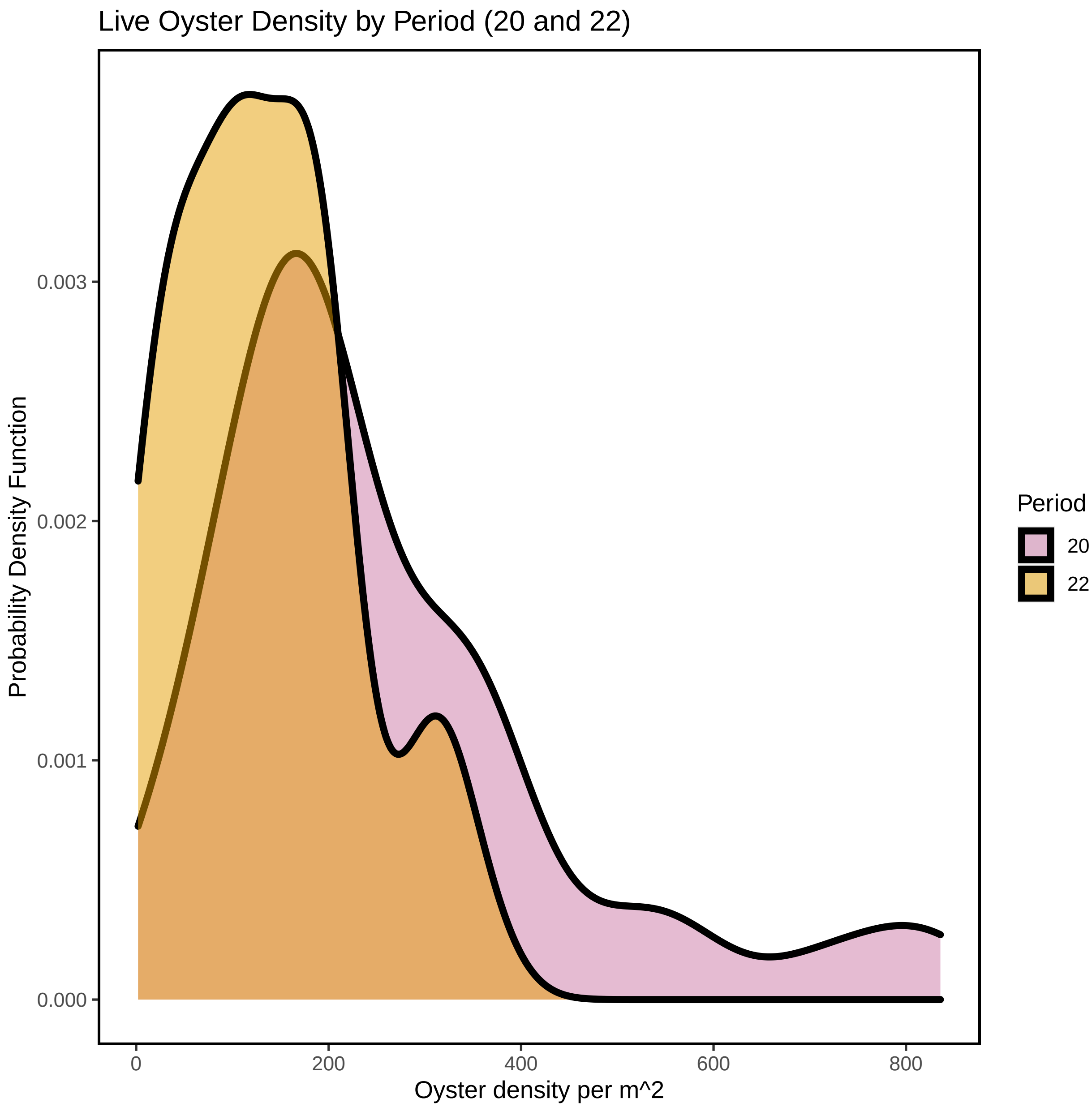


Figure 4-5.- Calculated live oyster density by periods 20 (Winter 2019-2020) and 22 (Winter 2020-2021) using a probability density function.

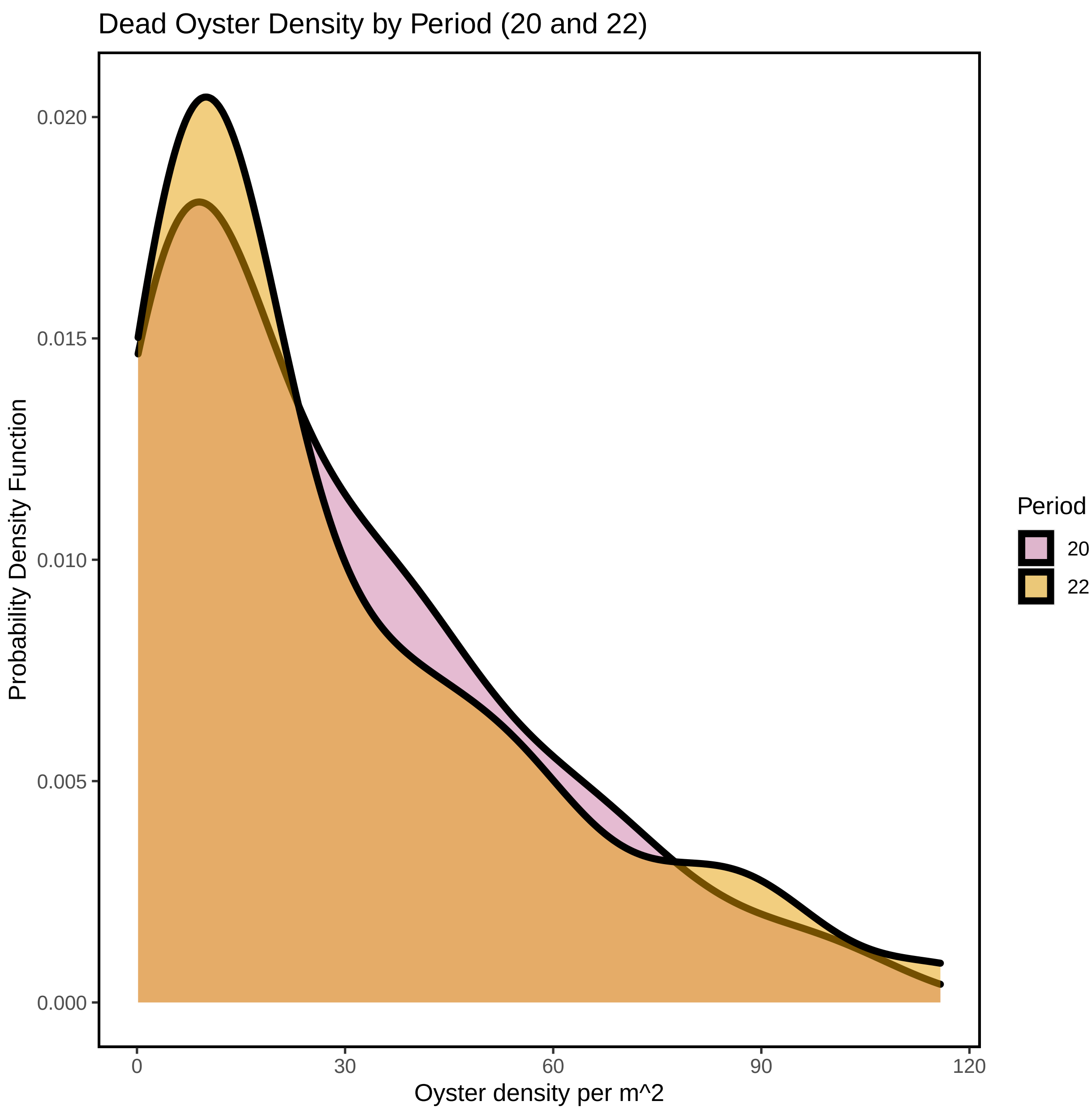


Figure 4-6.- Calculated dead oyster density by periods 20 (Winter 2019-2020) and 22 (Winter 2020-2021) using a probability density function.

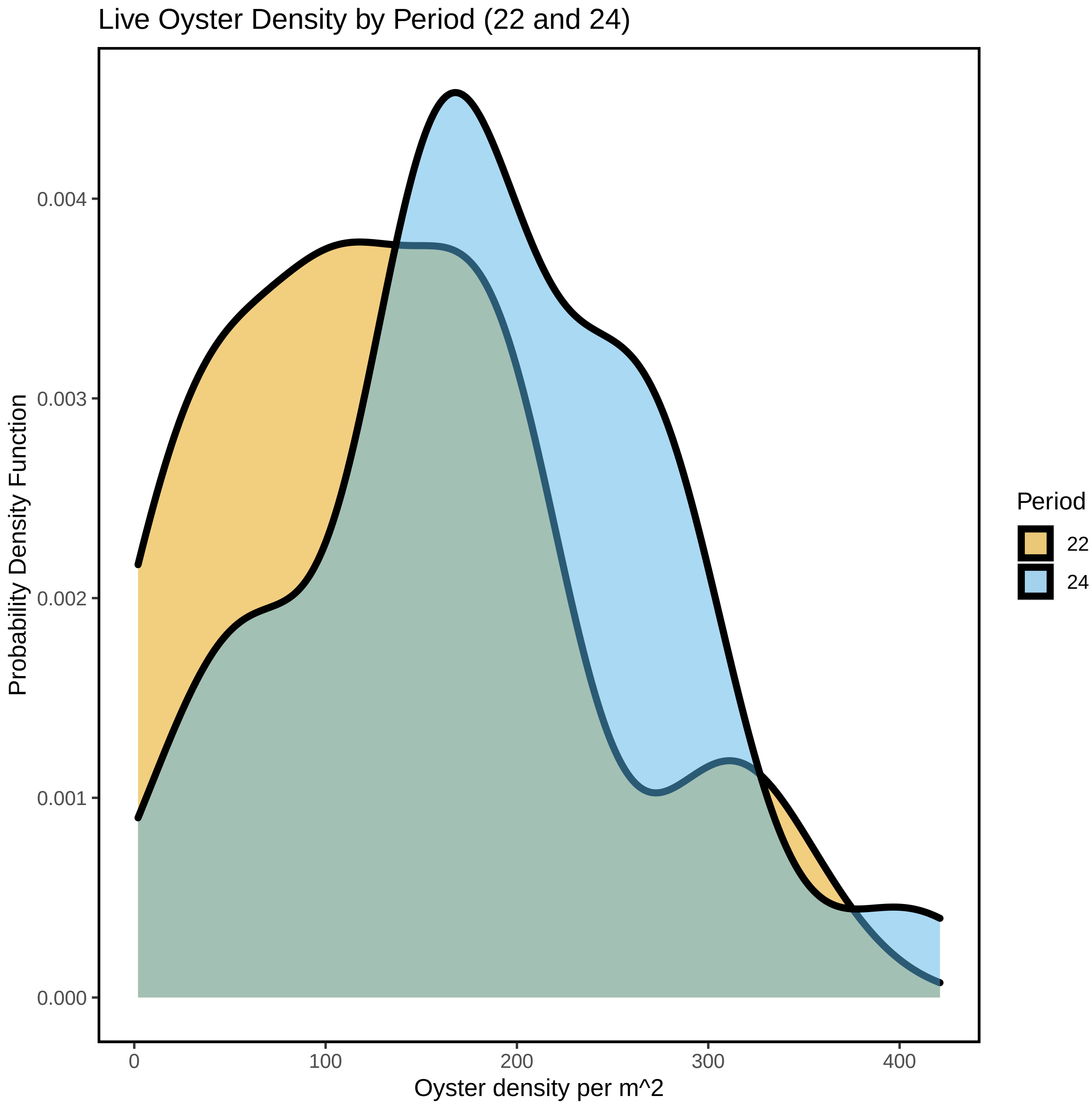


Figure 4-7.- Calculated live oyster density by periods 22 (Winter 2020-2021) and 24 (Winter 2021-2022) using a probability density function.

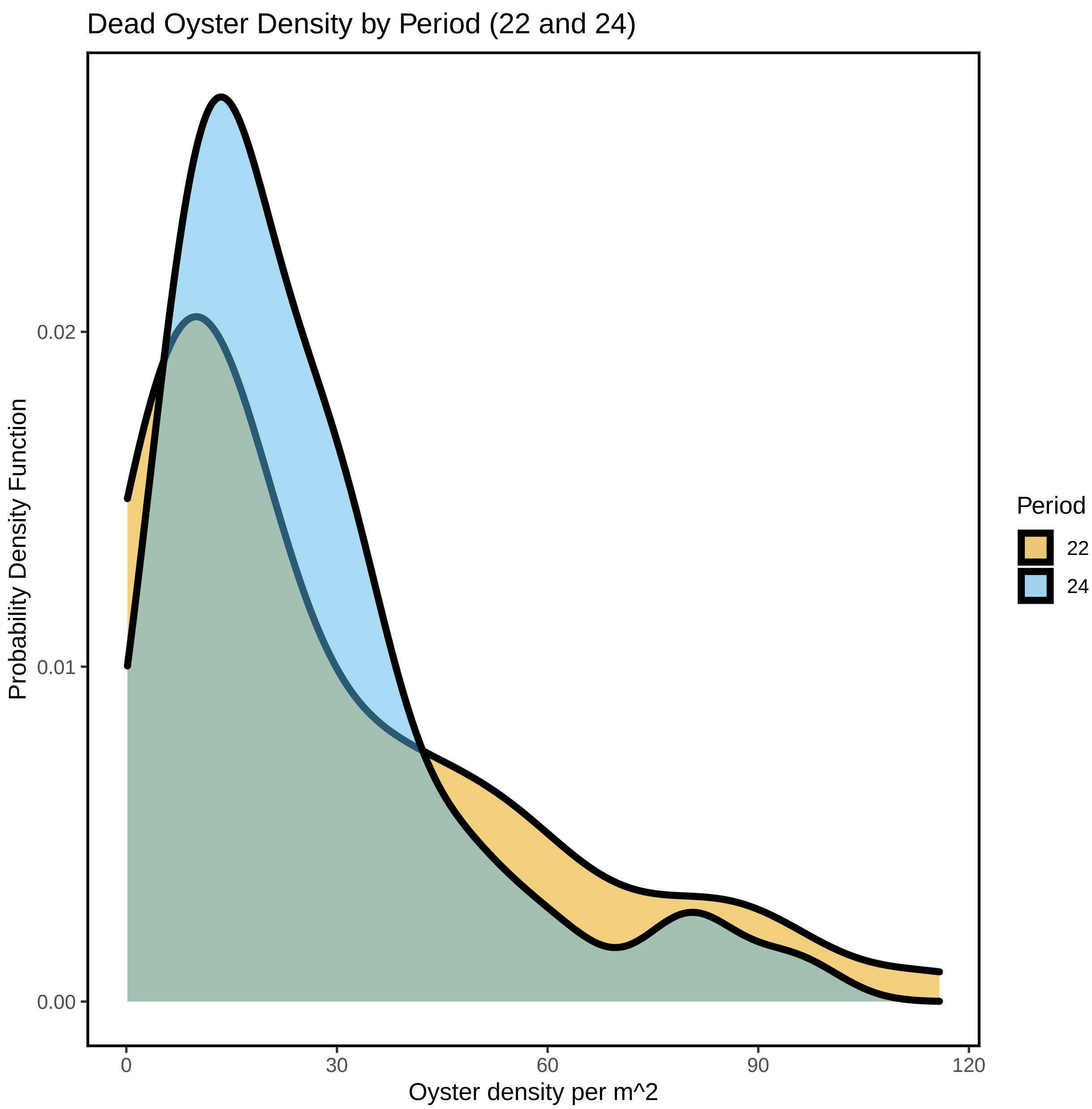


Figure 4-8.- Calculated dead oyster density by periods 22 (Winter 2020-2021) and 24 (Winter 2021-2022) using a probability density function.

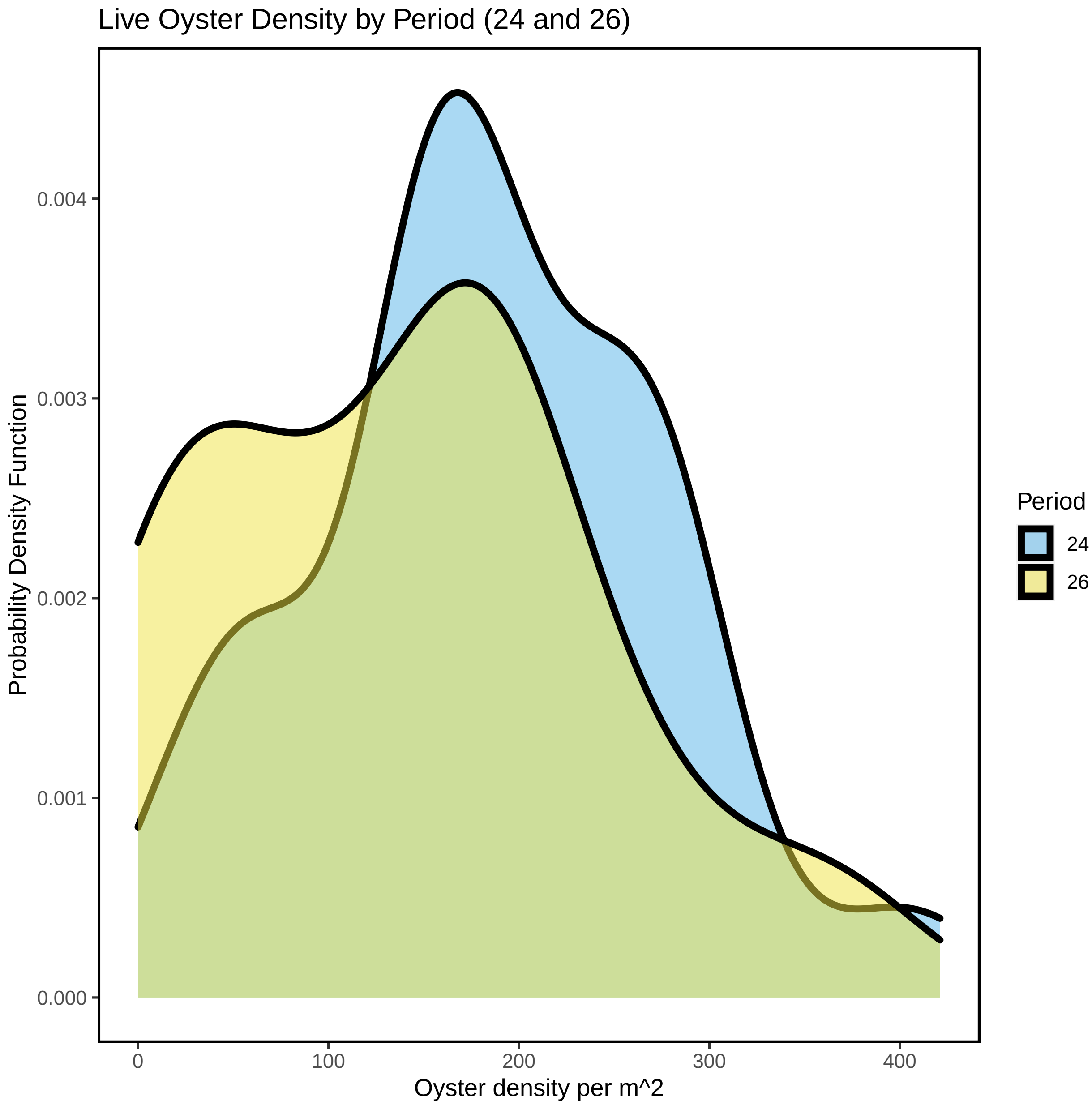


Figure 4-9.- Calculated live oyster density by periods 24 (Winter 2021-2022) and 26 (Winter 2022-2023) using a probability density function with the last sample date of period 26 as 2023-02-06.

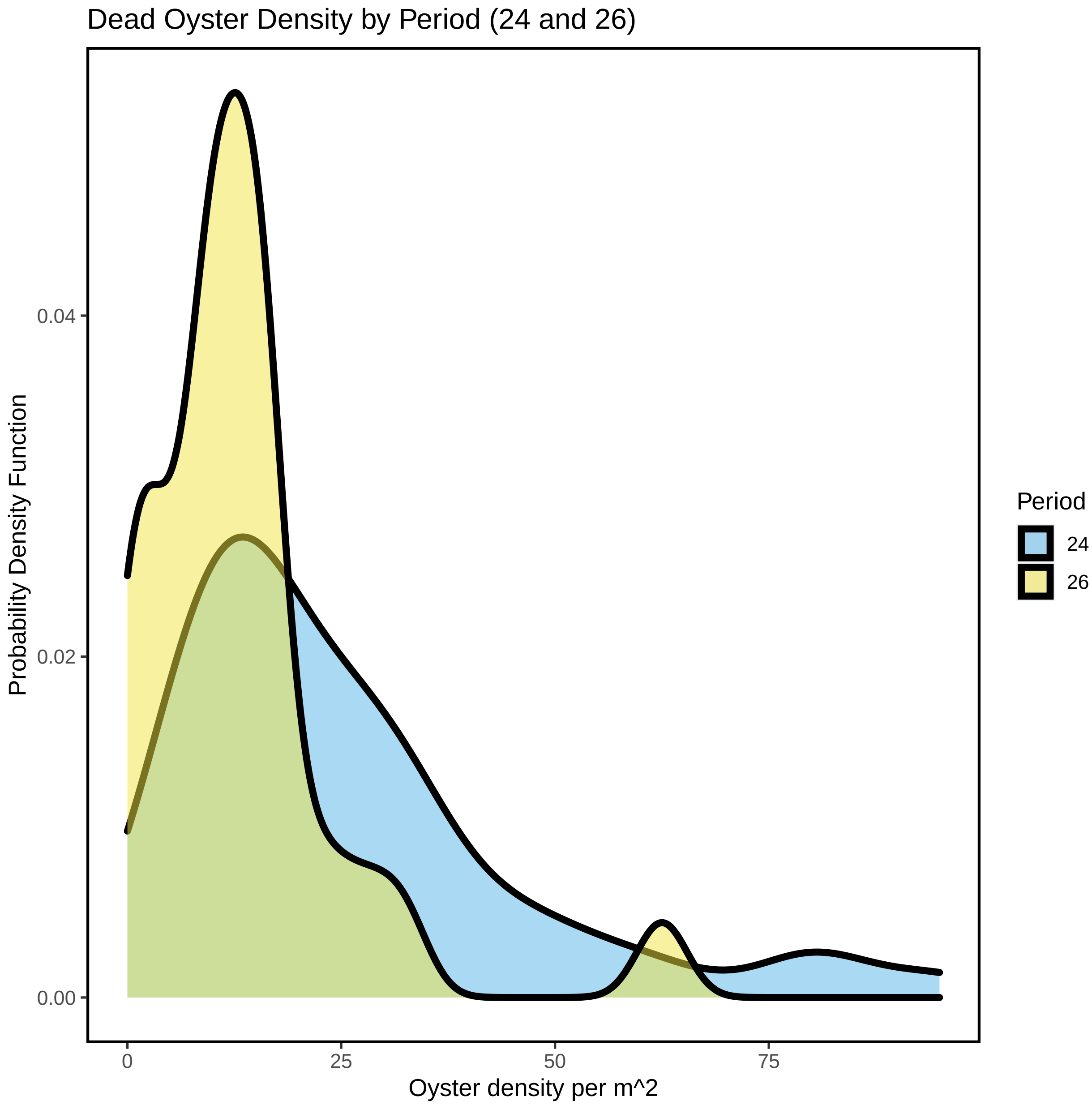


Figure 4-10- Calculated dead oyster density by periods 24 (Winter 2021-2022) and 26 (Winter 2022-2023) using a probability density function with the last sample date of period 26 as 2023-02-06.

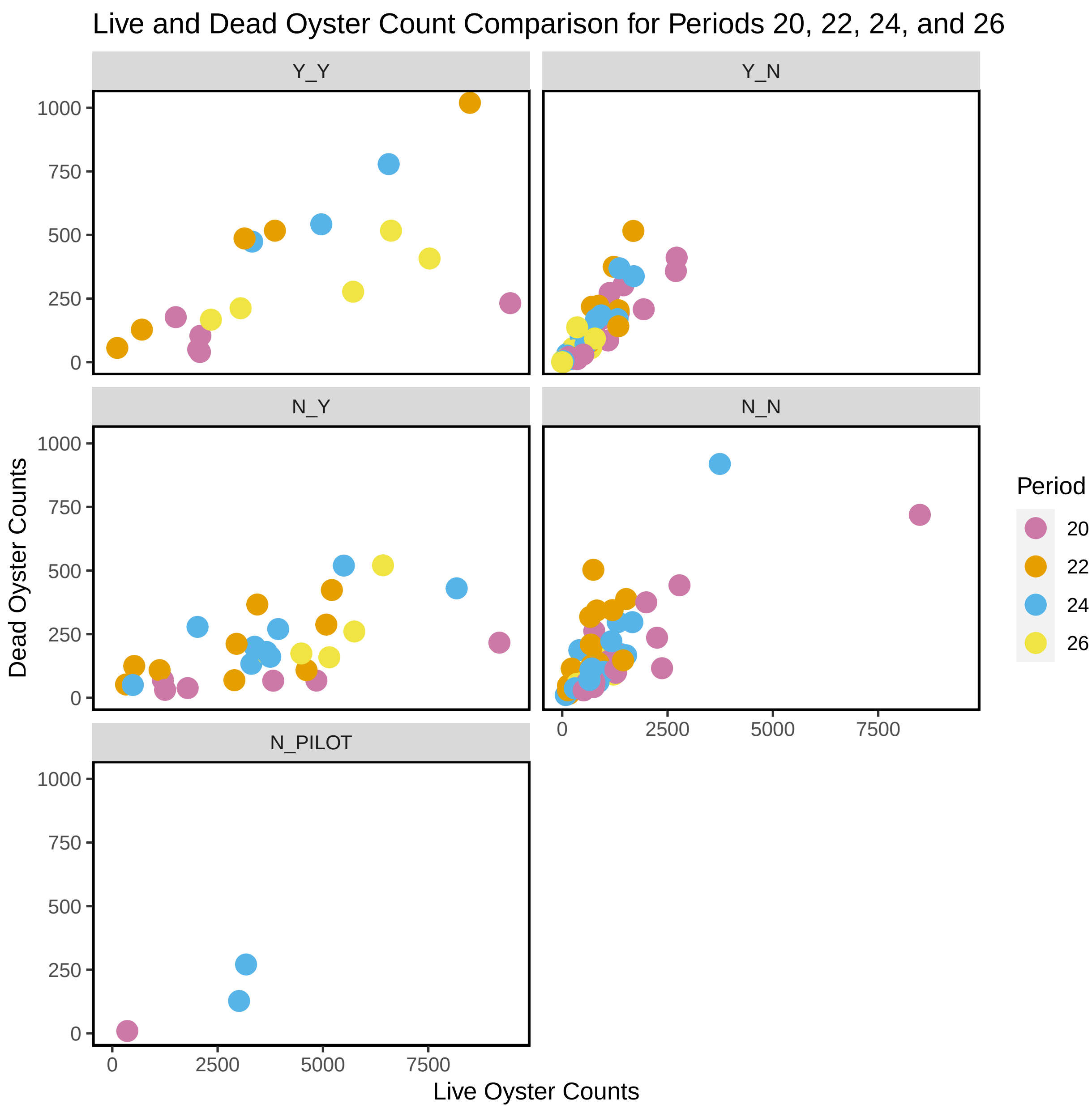


Figure 4-11.- Live and dead oyster count comparison by periods 20 (Winter 2019- 2020), 22 (Winter 2020-2021), 24 (Winter 2021-2022), and 26 (Winter 2022-2023), last sample date of period 26 as 2023-02-06.

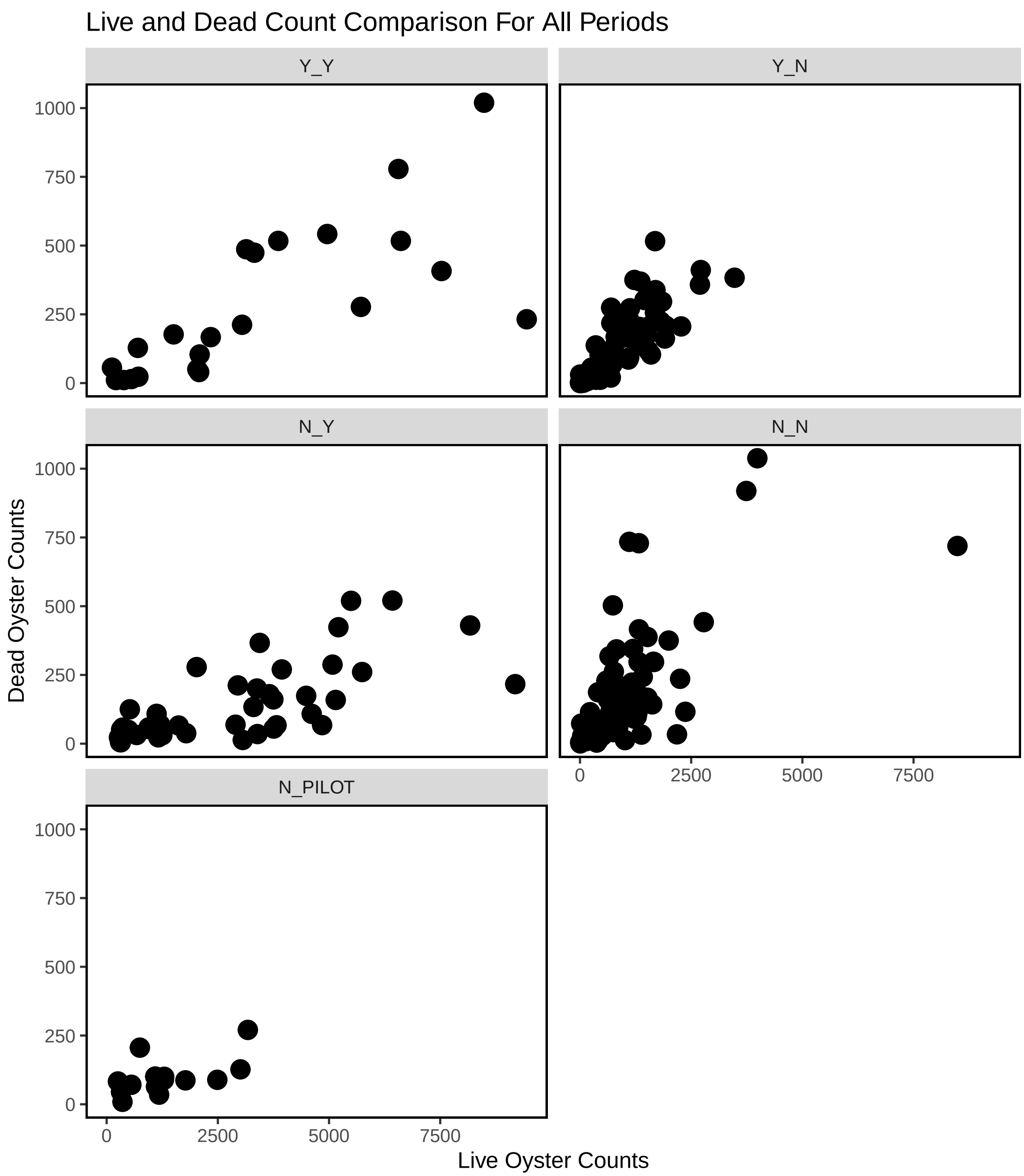


Figure 4-12.- Live and dead oyster comparison for all periods, last sample date of period 26 is 2023-02-06.

4 River Discharge Heatmaps

Suwannee River discharge is known to influence salinity in Suwannee Sound (Orlando et al. 1993) and lags between Suwannee River discharge and oyster counts have been observed (Moore et al. 2020). River discharge is essentially a second "treatment" in this restoration project (after the rebuilding of the reef) because it is the freshwater from the Suwannee River that Lone Cabbage Reef is thought to detain thus possibly promoting lower salinity. River discharge patterns in the Suwanee River basin may be changing over decadal scales due to changing climate, as is hypothesized for large rivers in the Gulf of Mexico (Neupane et al. 2019). For the period of record for the USGS Wilcox gauge (02323500) which begins in October 1930, we created a "heat map" that demonstrates for each month and year the deviation in river discharge (as a percentage) from the period of record average.

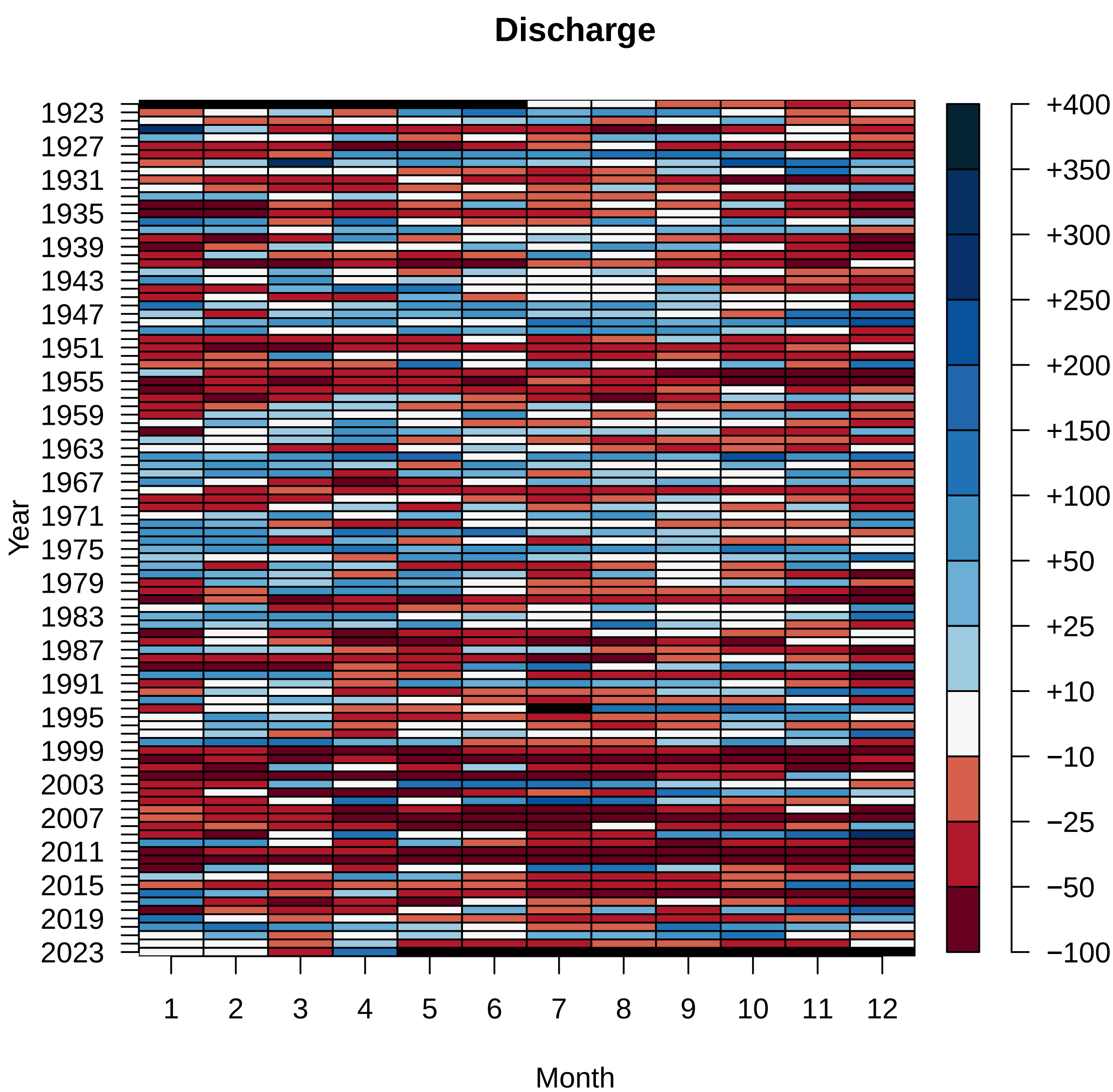


Figure 3-1. Heat map of Suwannee River deviations in mean daily discharge by year and month from USGS Wilcox gauge (02322500) for the period of record measured as deviation from the average by month

for period of record. White color for a given month and year is a month when river discharge is similar (with +/- 10%) to the period of record average, while blue to dark blue colors represent increasing discharge levels deviating as a percentage from the long-term average. Red to dark red colors conversely equal increasingly low discharge levels (below the period of record average). The black colors are months when data are not available.

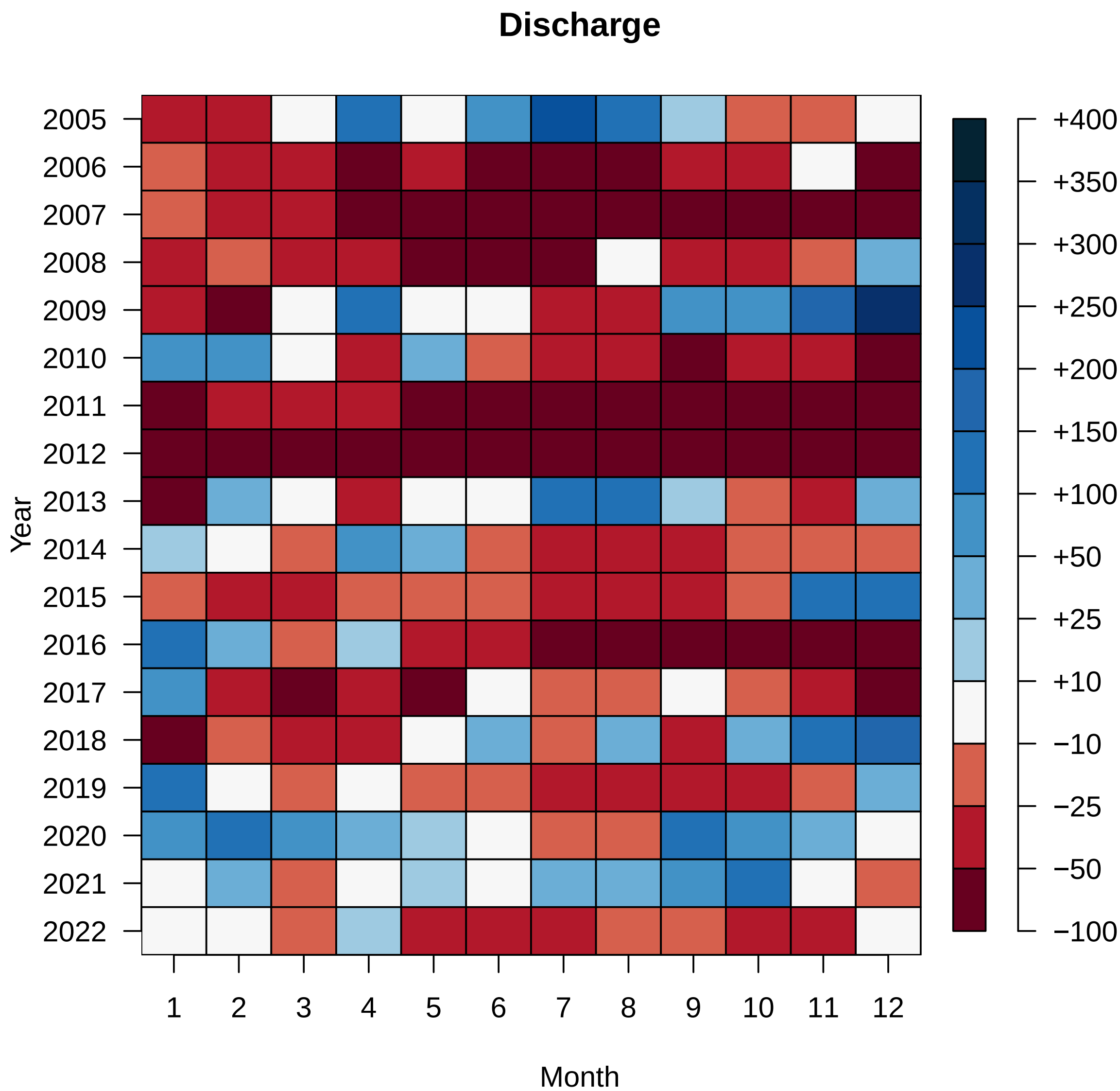


Figure 3-2. Heat map of Suwannee River deviations in mean daily discharge by year and month from USGS Wilcox gauge (02323500) for 2005-2021 measured as deviation from the average by month for period of record. White color for a given month and year is a month when river discharge is similar (with +/- 10%) to the period of record average, while blue to dark blue colors represent increasing discharge levels deviating as a percentage from the long-term average. Red to dark red colors conversely equal increasingly low discharge levels (below the period of record average). The black colors are months when data are not available.

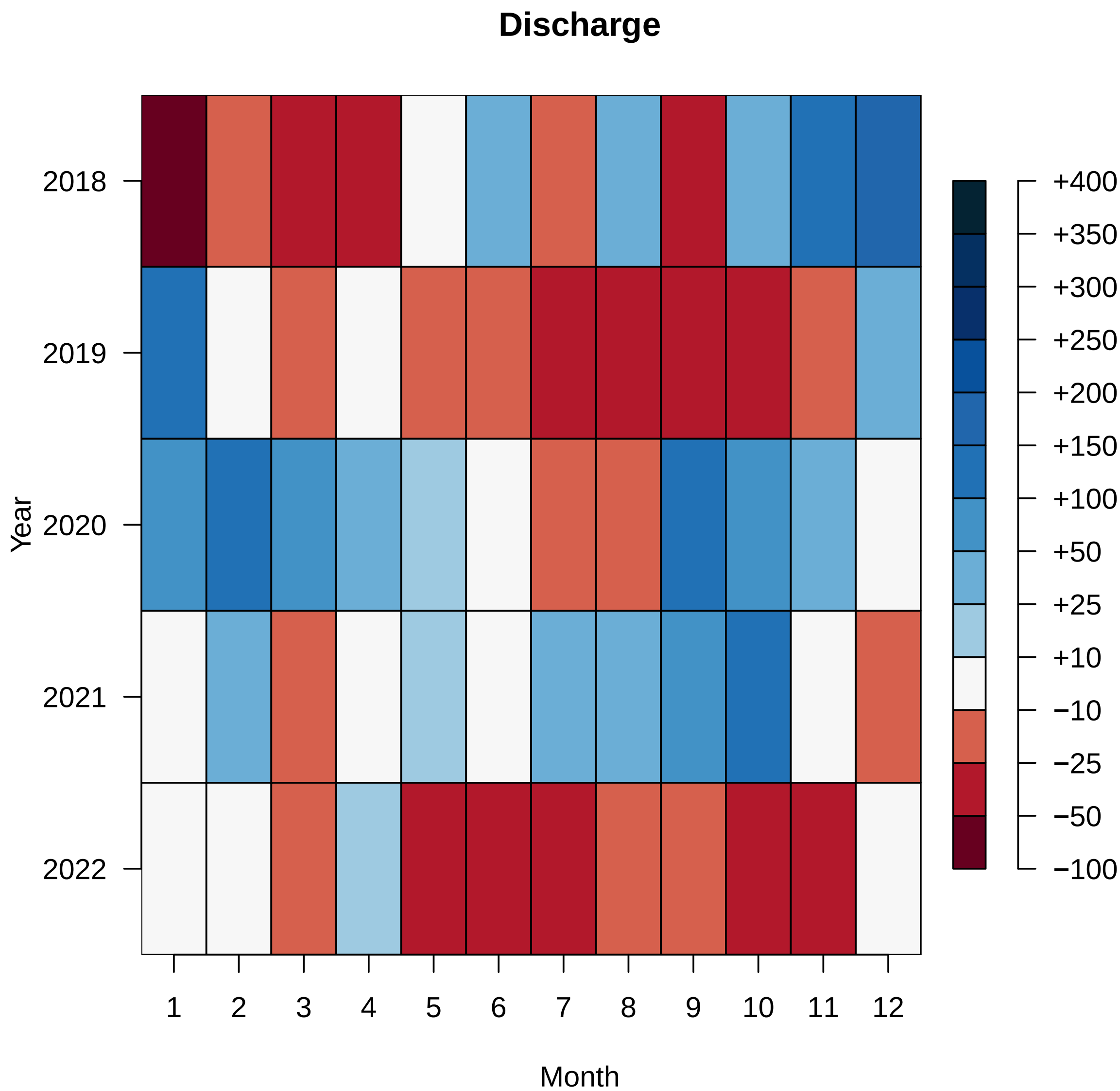


Figure 3-3. Heat map of Suwannee River deviations in mean daily discharge by year and month from USGS Wilcox gauge (02323500) for 2018-2021 measured as deviation from the average by month for period of record. White color for a given month and year is a month when river discharge is similar (with +/- 10%) to the period of record average, while blue to dark blue colors represent increasing discharge levels deviating as a percentage from the long-term average. Red to dark red colors conversely equal increasingly low discharge levels (below the period of record average). The black colors are months when data are not available.

5 Oyster Landings Figures

This data set is manually updated by the oyster landings data located here: https://public.myfwc.com/FWRI/PFDM/ReportCreator.aspx. The Commercial Fisheries Landings Summaries allows the user to select the date year range and oysters (as the Species).

The Suwannee counties used in these figures are TAYLOR, DIXIE, and LEVY.
The Apalachicola counties used iin these figures are FRANKLIN and WAKULLA.

The State of Florida data are all of the counties in Florida where oysters are landed, and this is selected in the FWC Commercial Fisheries Landings Summaries website.

Data shown in the plots from the current year are considered provisional and only contain reported data up until this point in the year.

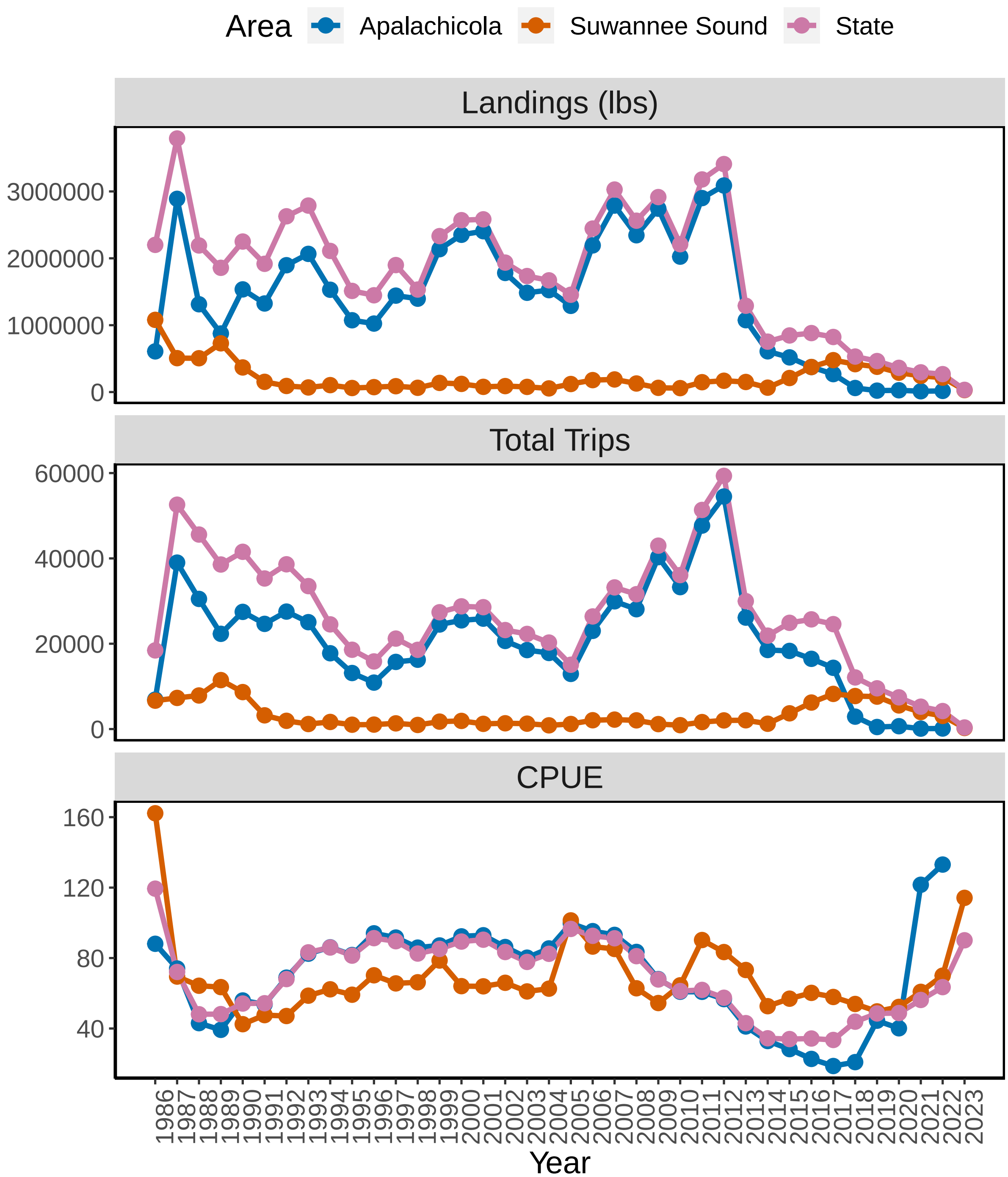


Figure 4-1. Figure of oyster landings (lbs), total trips, and cost per unit effort (CPUE) for Apalachicola (blue line), Suwannee Sound (orange), and the State of Florida (pink) for years 1986 to 2023.

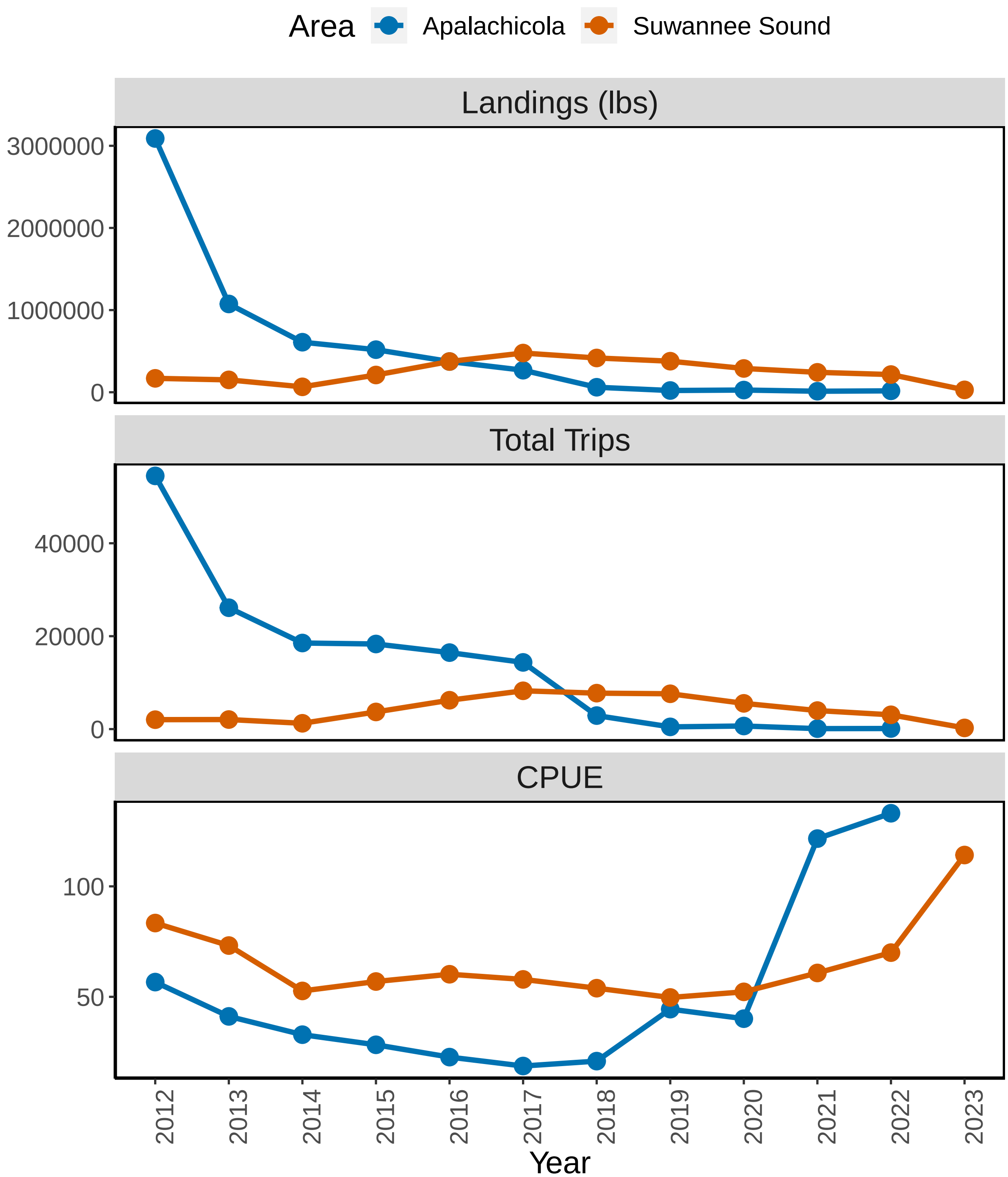


Figure 4-2. Figure of oyster landings (lbs), total trips, and cost per unit effort (CPUE) for Apalachicola (blue line), Suwannee Sound (orange) for years 2012 to 2023.

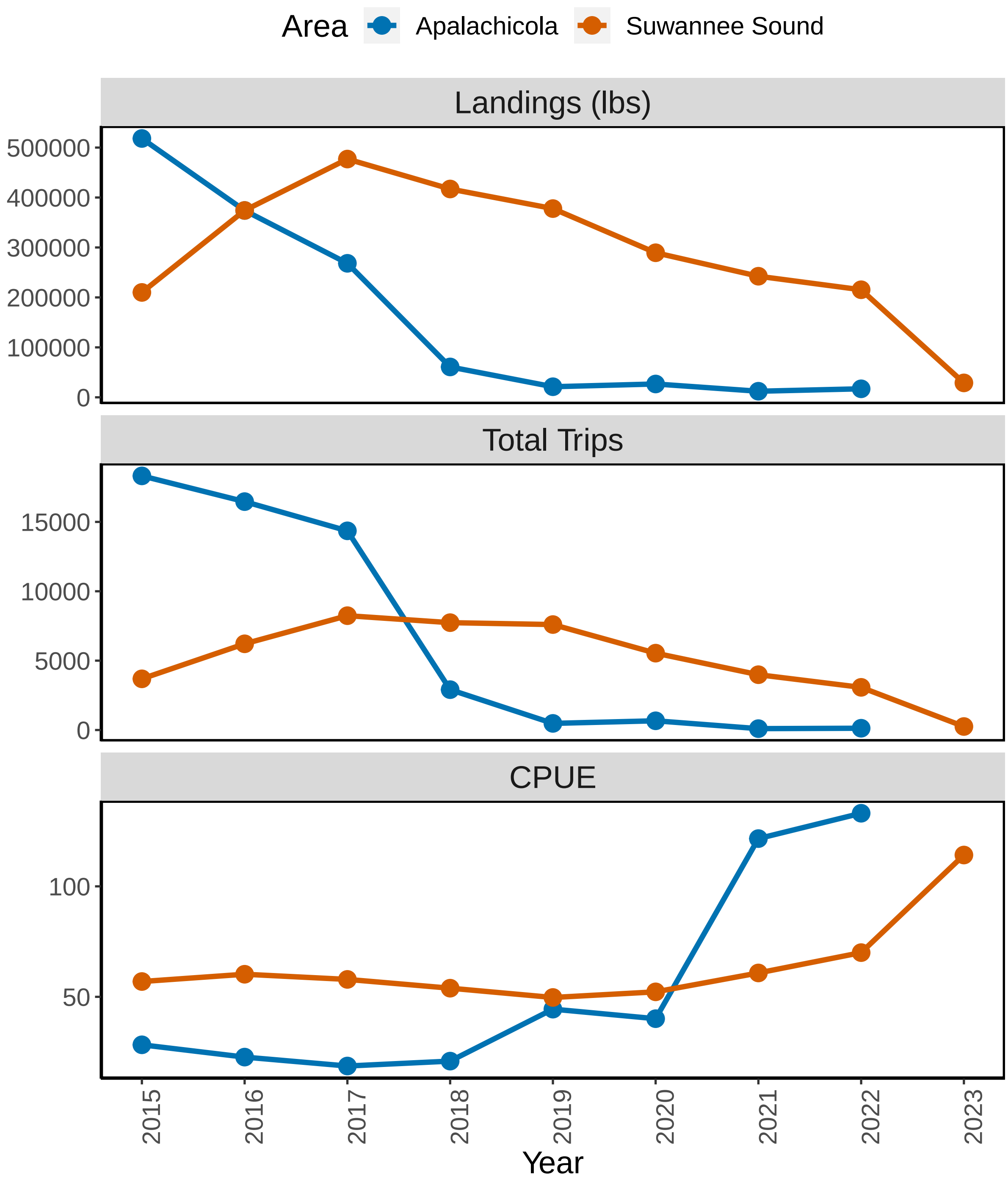
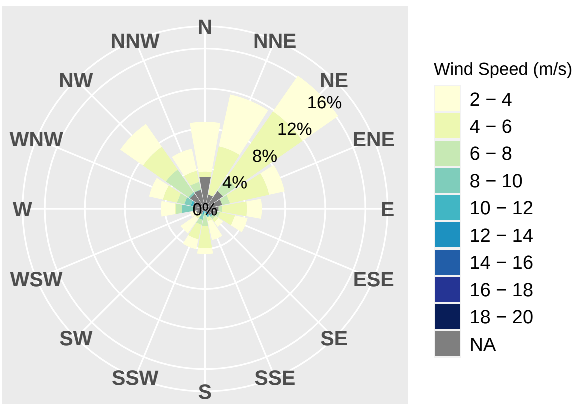


Figure 4-3. Figure of oyster landings (lbs), total trips, and cost per unit effort (CPUE) for Apalachicola (blue line), Suwannee Sound (orange) for years 2015 to 2023.

6 Quarterly Windrose

A



B

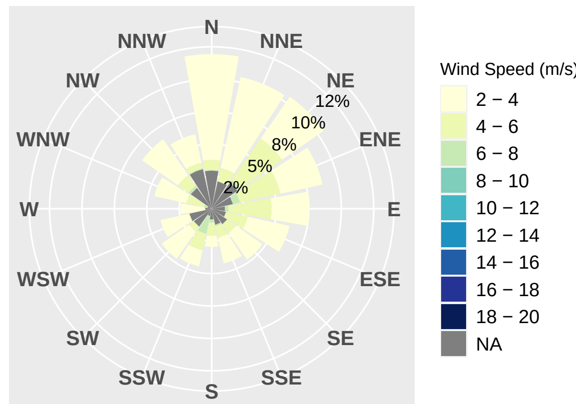


Figure 5-1. A wind rose visualizes the frequency of winds blowing from a specific direction of a desired Date Range. The data used for this figure were collected via the `rnoaa` R Package at station CDRF1 (Cedar Key, Florida). The legend represents the wind speed ranging from low (2-4 m/s) to high (18-20 m/s) wind speeds. The cardinal directions on the outer part of the wind rose indicate the direction of the wind. The Frequency is displayed as the lowest to highest percentage frequency of a wind speed occuring in a given direction, by the size of the wind magnitude polygon. Wind data are updated periodically through USGS (monthly basis).A) Windrose from January 1, 2022 to January 31, 2022, B) Windrose from February 1, 2022 to February 28, 2022, C) Windrose from March 1, 2022 to March 31, 2022.