General Information

2021-07-12

Contents

1 NFWF Quarterly Report

i. General statement of project status and implementation.

This report includes work accomplished during October through December 2020.

Implementation continues to be mostly smooth and the monitoring phase of our project is progressing in a timely fashion.

To date, this project is on track both in budget and within 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 I 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 currently have no existing or anticipated problems with completion of Task 1 and 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 in reality, as an active, constant process.
An updated version of the Adaptive Management Plan, and Biological Sampling Plan, were completed in June 2020. The elevation and biological sampling plans continue to evolve as we have now completed the second winter season of postconstruction oyster sampling, and ongoing water quality sampling. The variability displayed by each of the strata (substrate, harvest status, location) collected in the 2019/20 winter has been incorporated into our estimates of numbers samples required to achieve a known power of detecting change of particular magnitude for the 2020/2021 sampling period.
B. Progress made towards Task 2 milestones.

Updating of adaptive management plan, biological sampling plan, and work on updating elevation sampling plan.

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

Task 2 appears to be well within the timeline and budget as 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 Monitorin
A. Work performed on Task 5.

Water quality and spat sampling. We have continued water quality and spat monitoring during the reporting period.

2 Water Quality Quarterly Figures

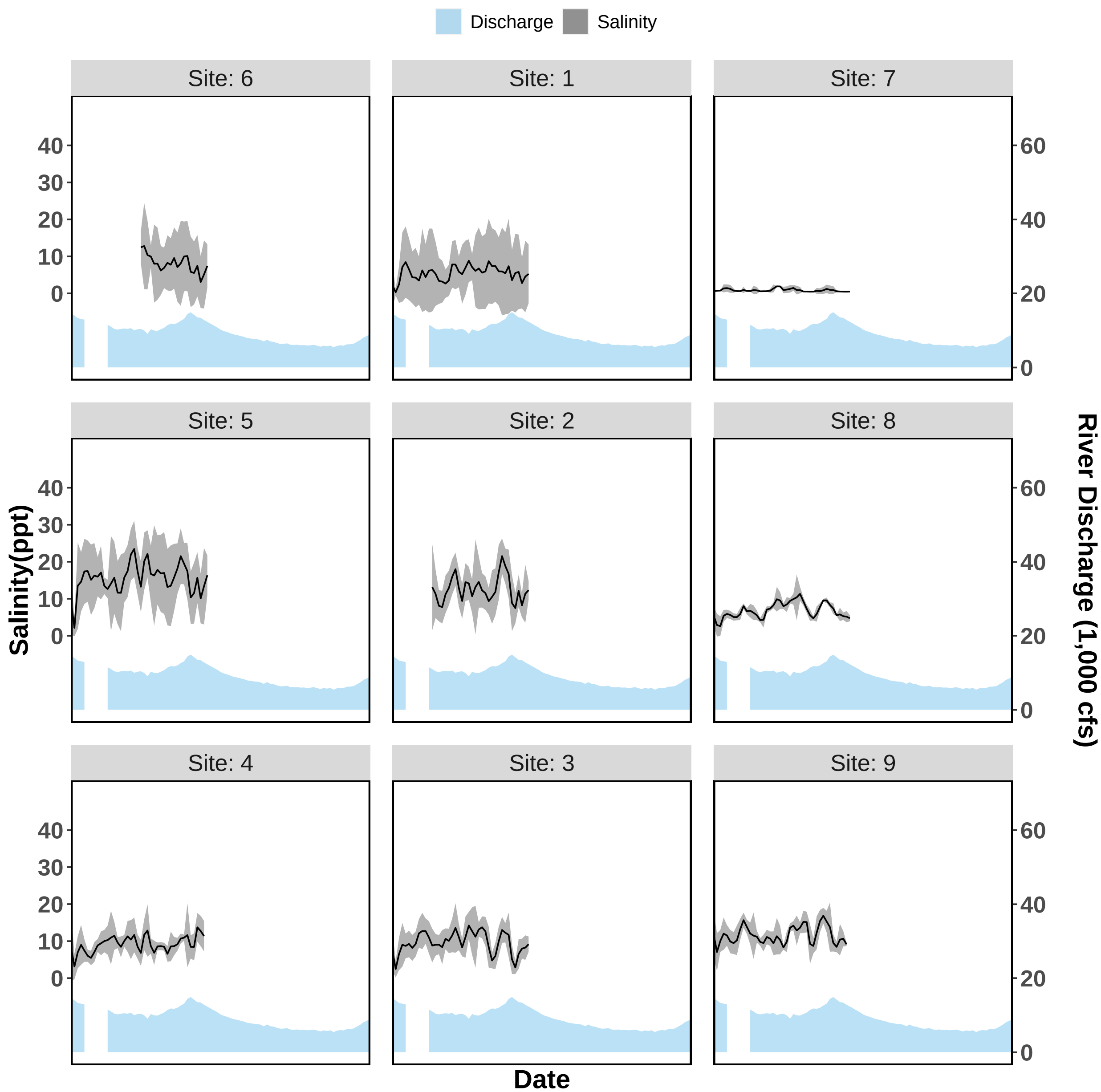

Figure 2-1. Salinity and river discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north,

and right of page as east. The center 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 right column of figures (Sites 7-9) represent sensors closest to shore in an area where salinity may be influenced by restoring Lone Cabbage Reef. The first two columns from the west (Sites 1-6) represent the inshore and offshore sides of the restoration reef. 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 values are due to corrupt readings or missing equipment.

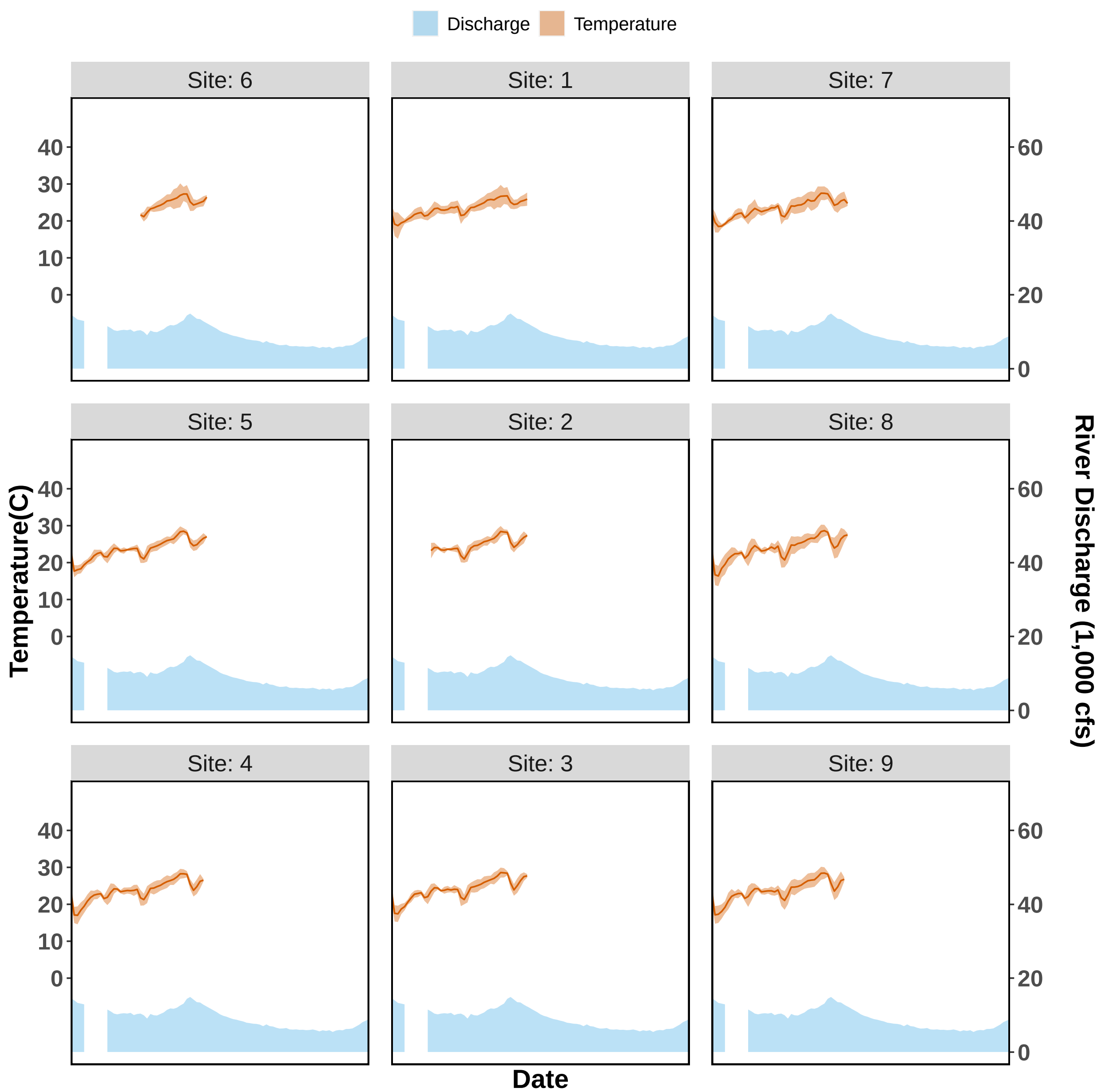

Figure 2-2. Temperature and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The center column of figures (Sites 1-3) represent the eastern side of the Lone Cabbage Reef restoration site. The left column of figures (Sites 4-6) represent the western side of the Lone

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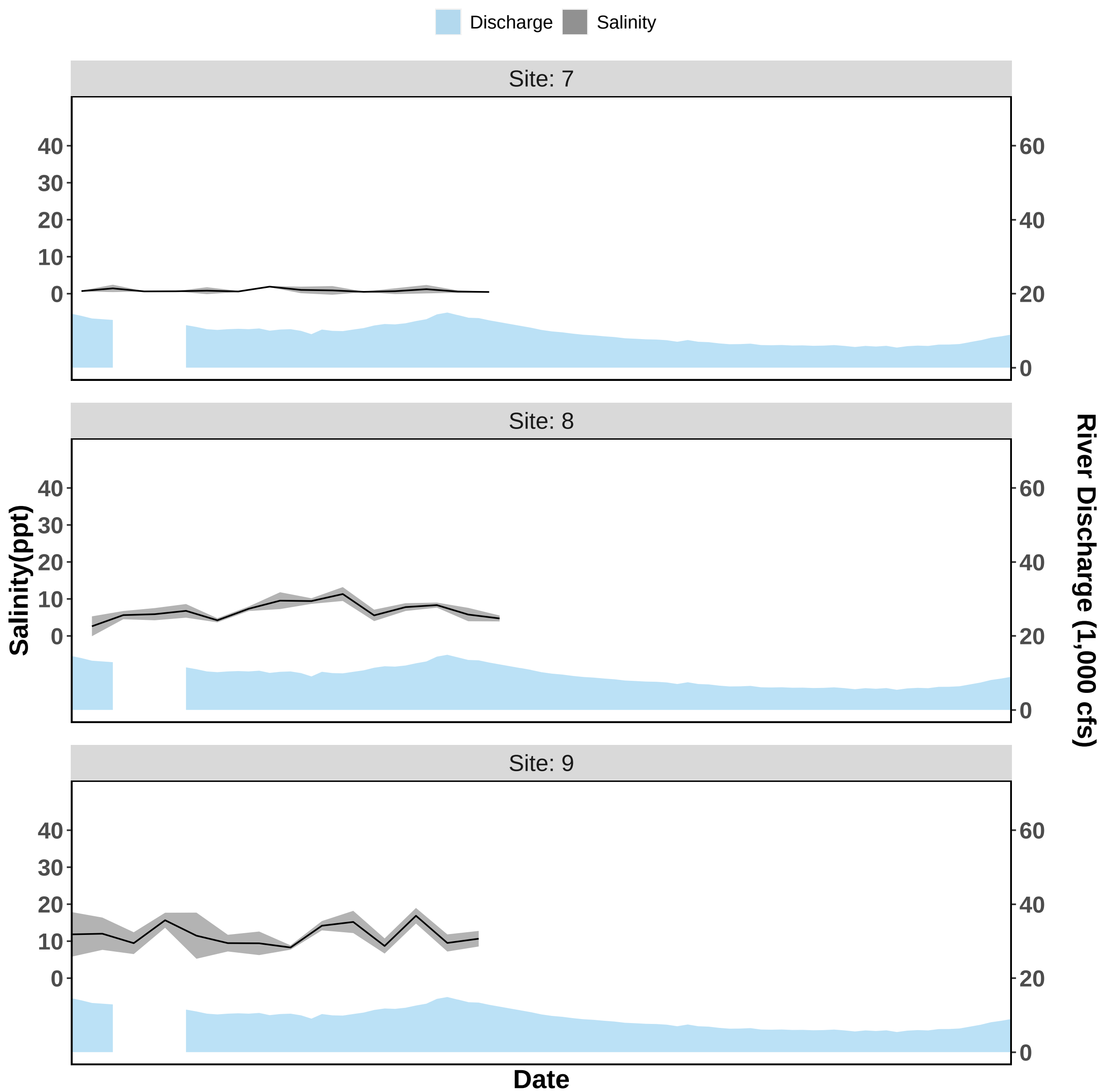

Figure 2-3. Salinity and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The figures (Sites 7-9) represent sensors close to shore in an area where salinity may be influenced by restoring Lone Cabbage Reef. 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

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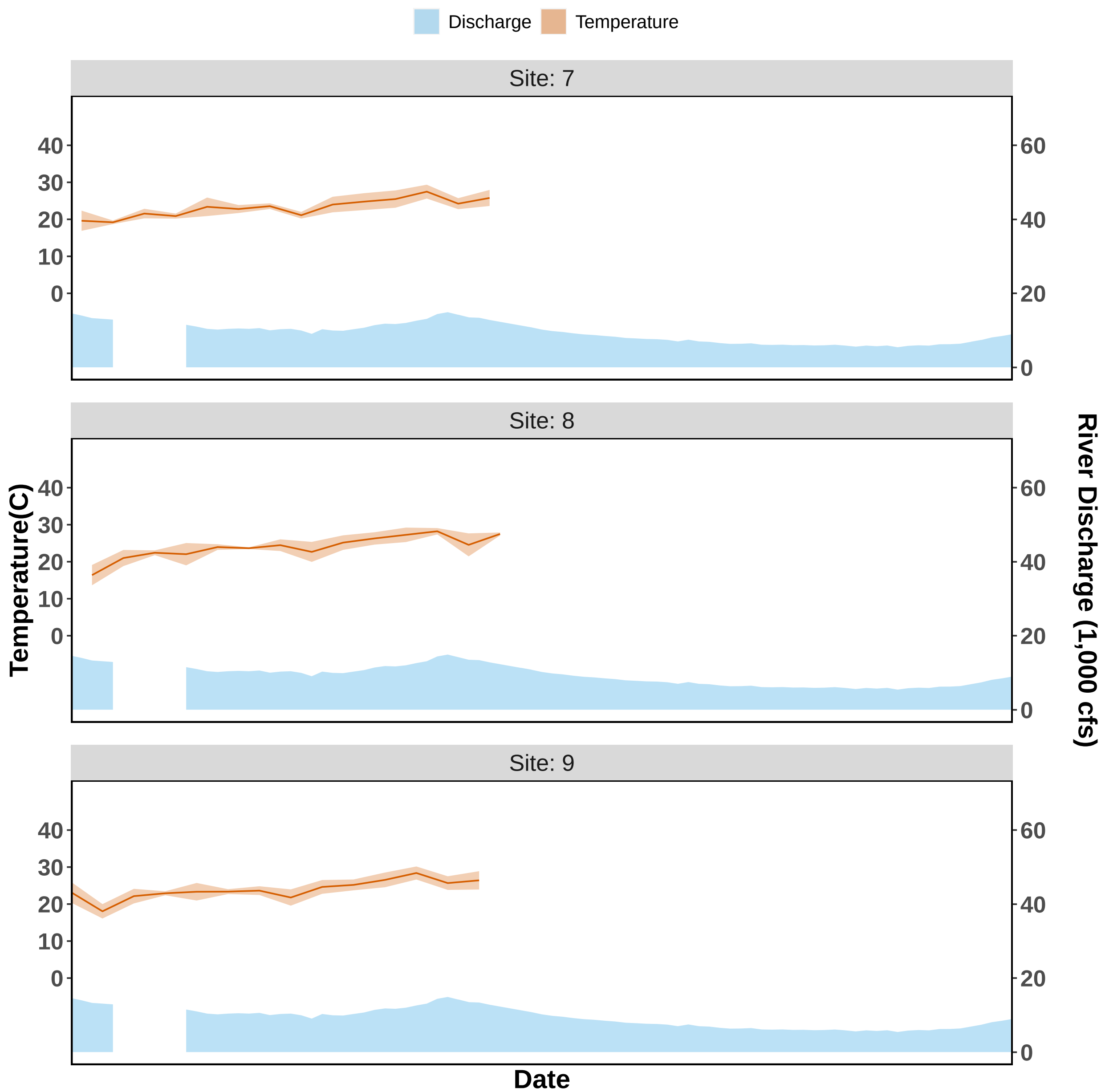

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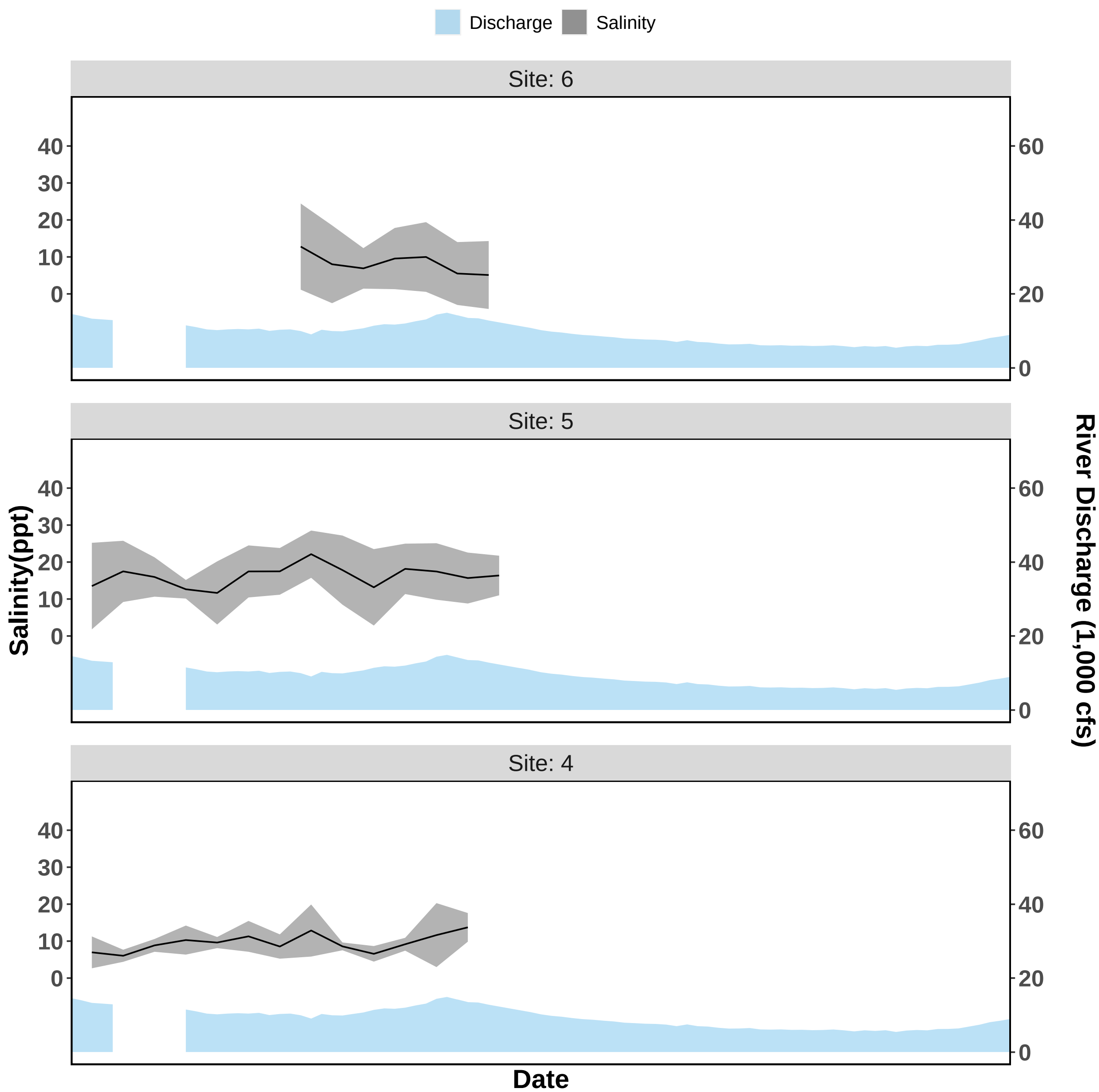


Figure 2-5. Salinity and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The figures (Sites 4-6) represent the western side of the Lone Cabbage 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 values are due to corrupt readings or missing equipment.

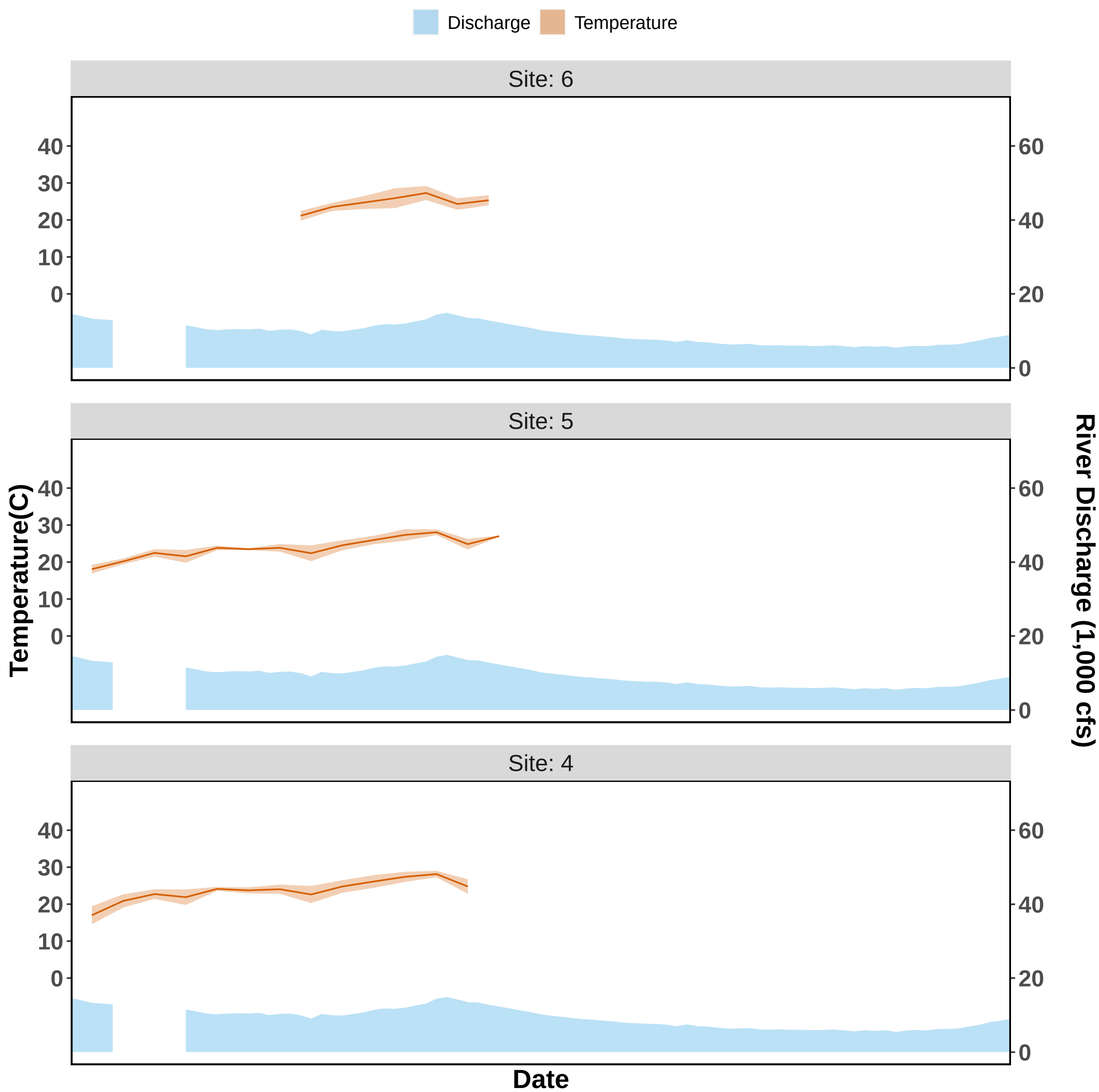


Figure 2-6. Temperature and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. Each graph represents a sensor location, with top of page as north, and right of page as east. The figures (Sites 4-6) represent the western side of the Lone Cabbage 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 values are due to corrupt readings or missing equipment.

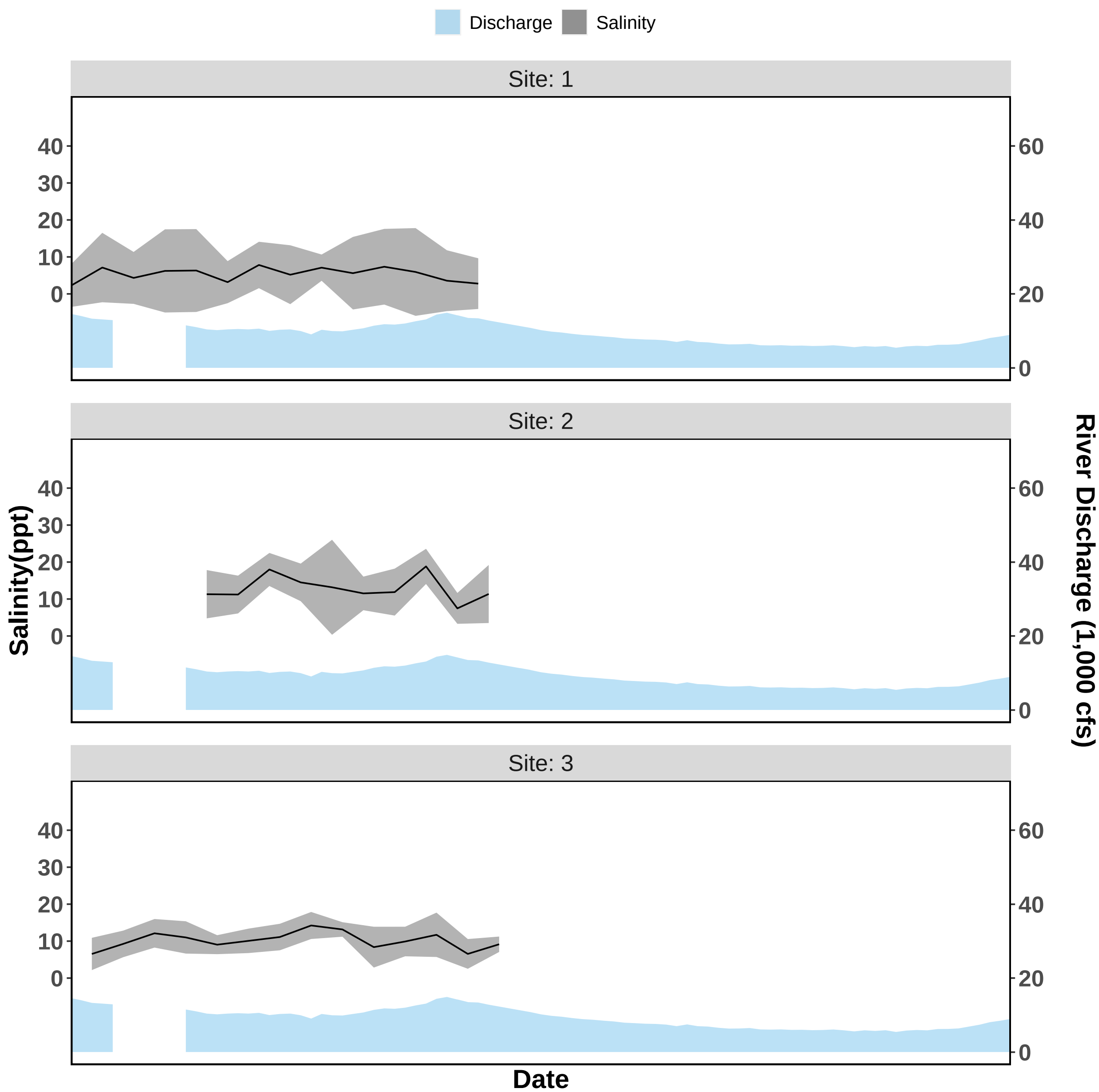


Figure 2-7. Salinity and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. The figures (Sites 1-3) represent the eastern side of the Lone Cabbage Reef restoration site. The primary y-axis is Salinity (ppt, parts per thousand), and the secondary 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 values are due to corrupt readings or missing equipment.

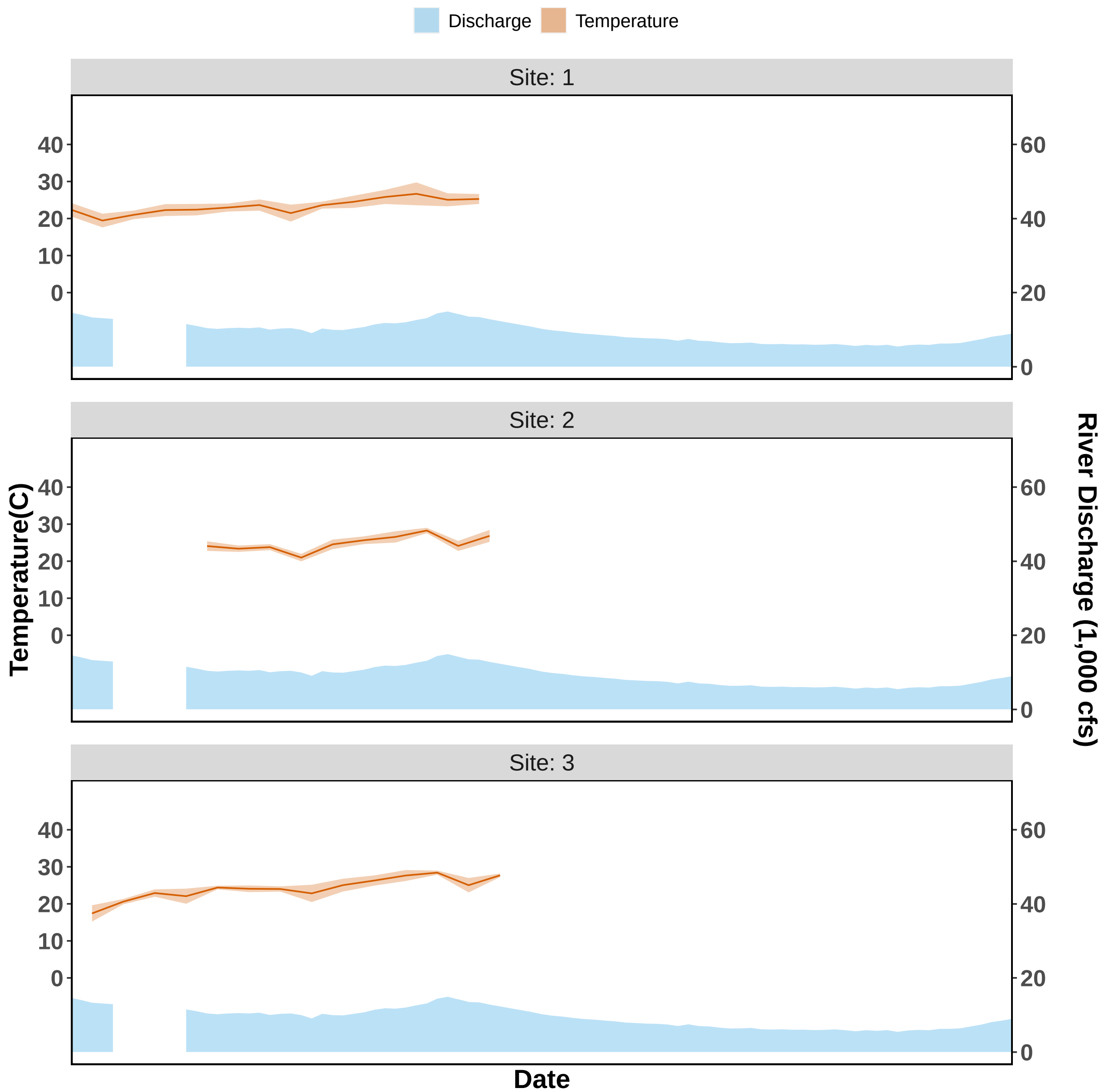
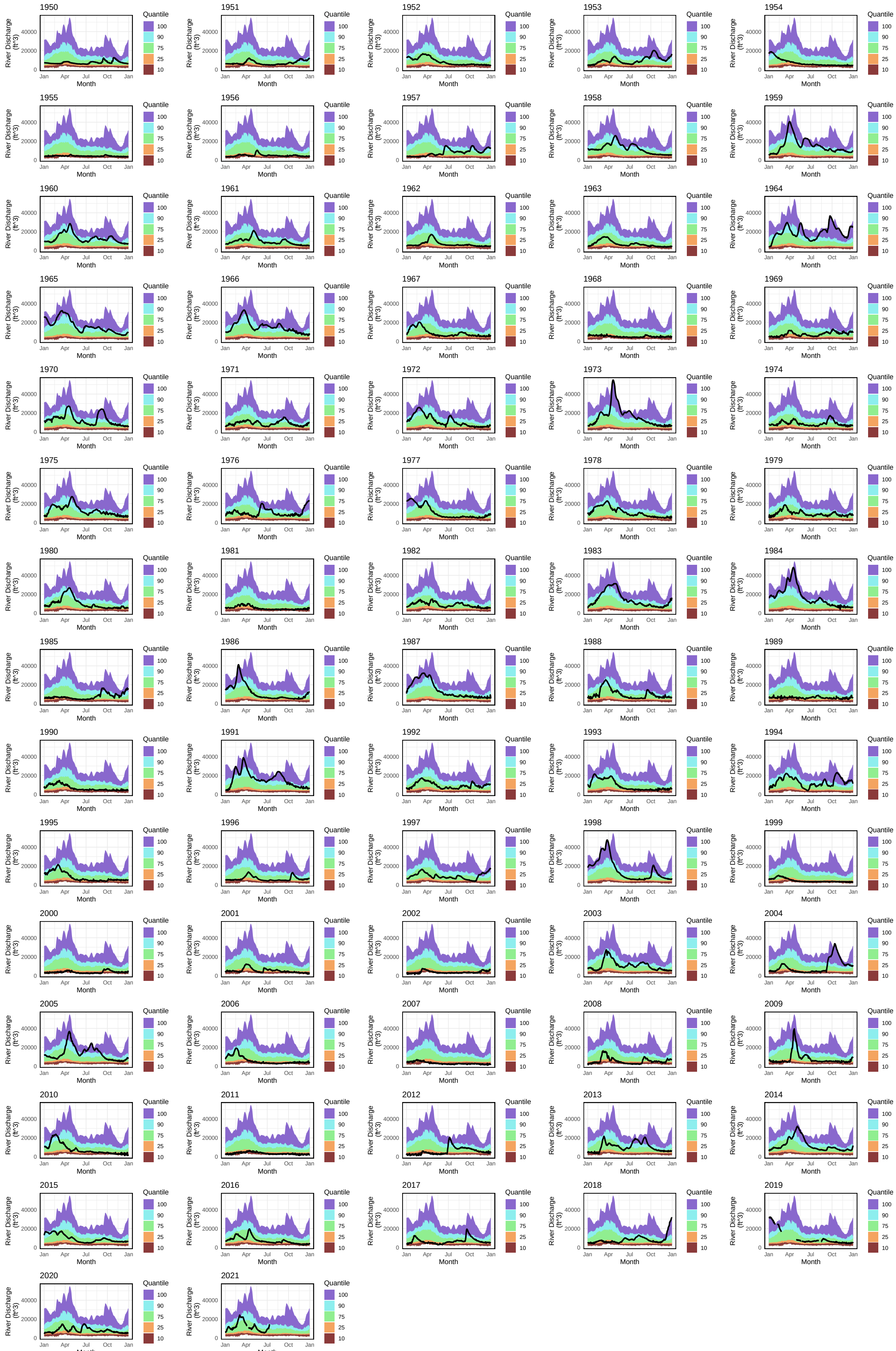


Figure 2-8. Temperature and discharge data collected from autonomous sensors from the Lone Cabbage Reef restoration site near Suwannee, FL. The figures (Sites 1-3) represent the eastern side of the Lone Cabbage Reef restoration site. The primary y-axis is Temperature (C, Celsius), and the secondary y-axis 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).

3 River Discharge Figures

A 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.

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).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2017
2018
2019
2020
2021
River Discharge (ft^3)
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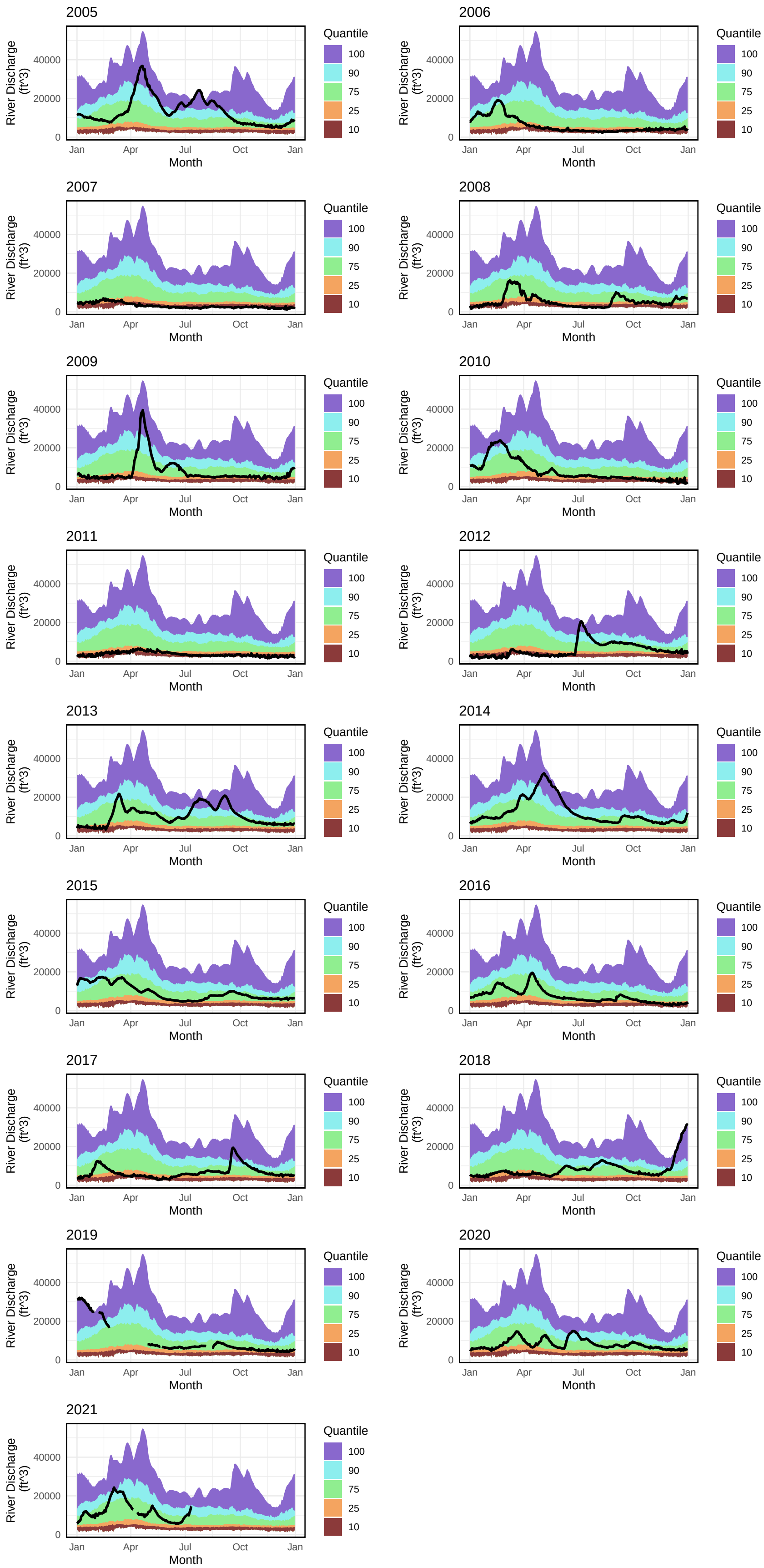
20000
40000
Jan
Apr
Jul
Oct
Jan
Month
Quantile
100
90
75
25
10

Figure 3-1. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS 02322500) for the years 2005-2021 (solid black line). 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.



2005
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2017
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2019
2020
2021
River Discharge (ft^3)
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40000
Jan
Apr
Jul
Oct
Jan
Month
Quantile
100
90
75
25
10

Figure 3-2. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS 02322500) for the years 2005-2021 (solid black line). 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.

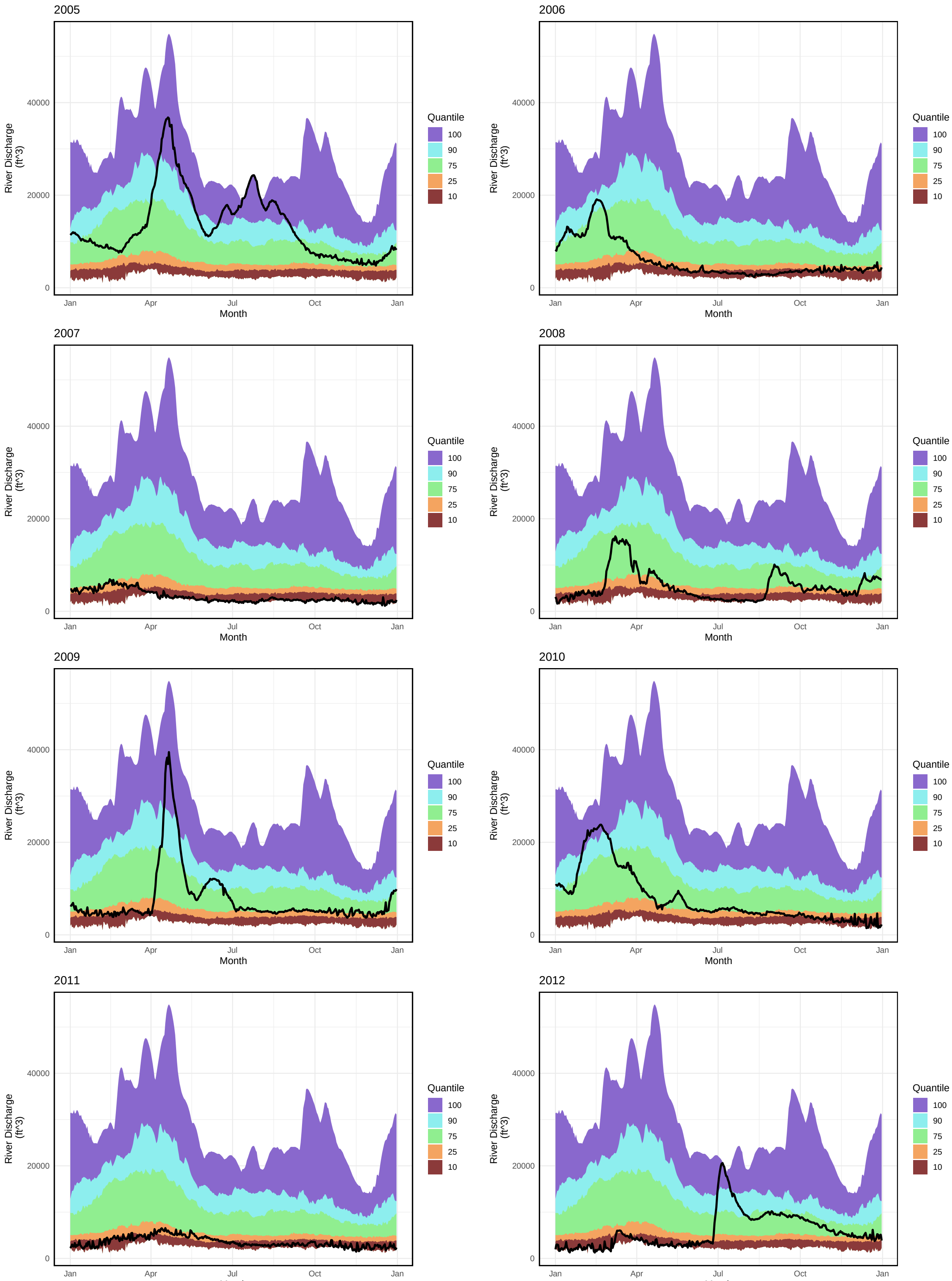

Figure 3-3. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS

02322500) for the years 2005-2012 (solid black line) representing the years preceding observed extreme low discharge conditions 2010-2012. 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.

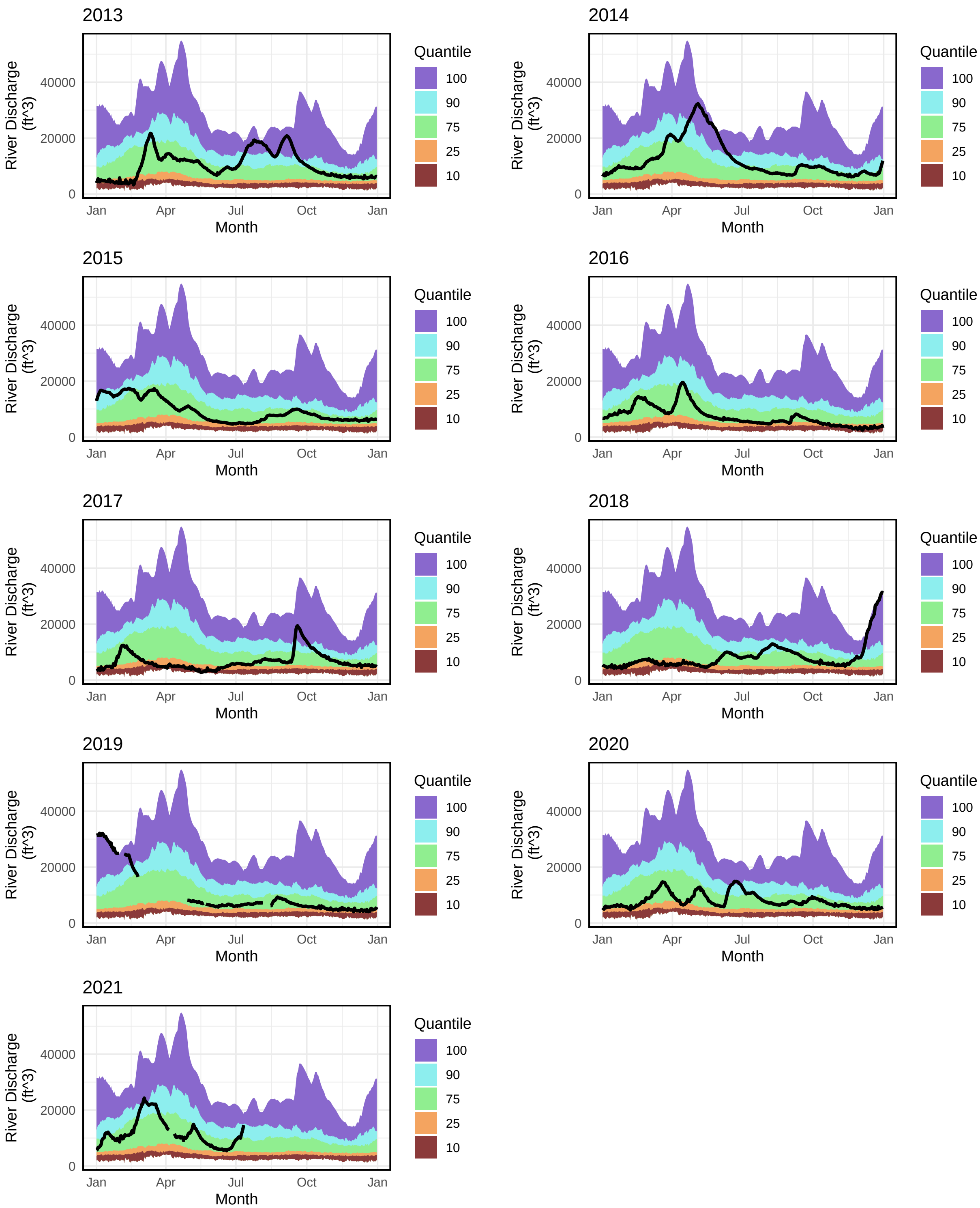

Figure 3-4. River discharge (by convention CFS, y axis) from the USGS Wilcox, Florida gauge (USGS 02322500) for the years 2013-2021 (solid black line) representing the years since 2010-2012 low flow conditions including the initiation of the Lone Cabbage Reef restoration project. The areas of color represent 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

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4 Transect Report

4.1 Overview

This report provides summary statistics and figures for ongoing transect sampling. The first section of the report focuses on the current sampling (Winter 2020-2021) and how the collected data compare to last year's sampling (Winter 2019-2020). So far 25 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, 118 days have been sampled over this entire project.

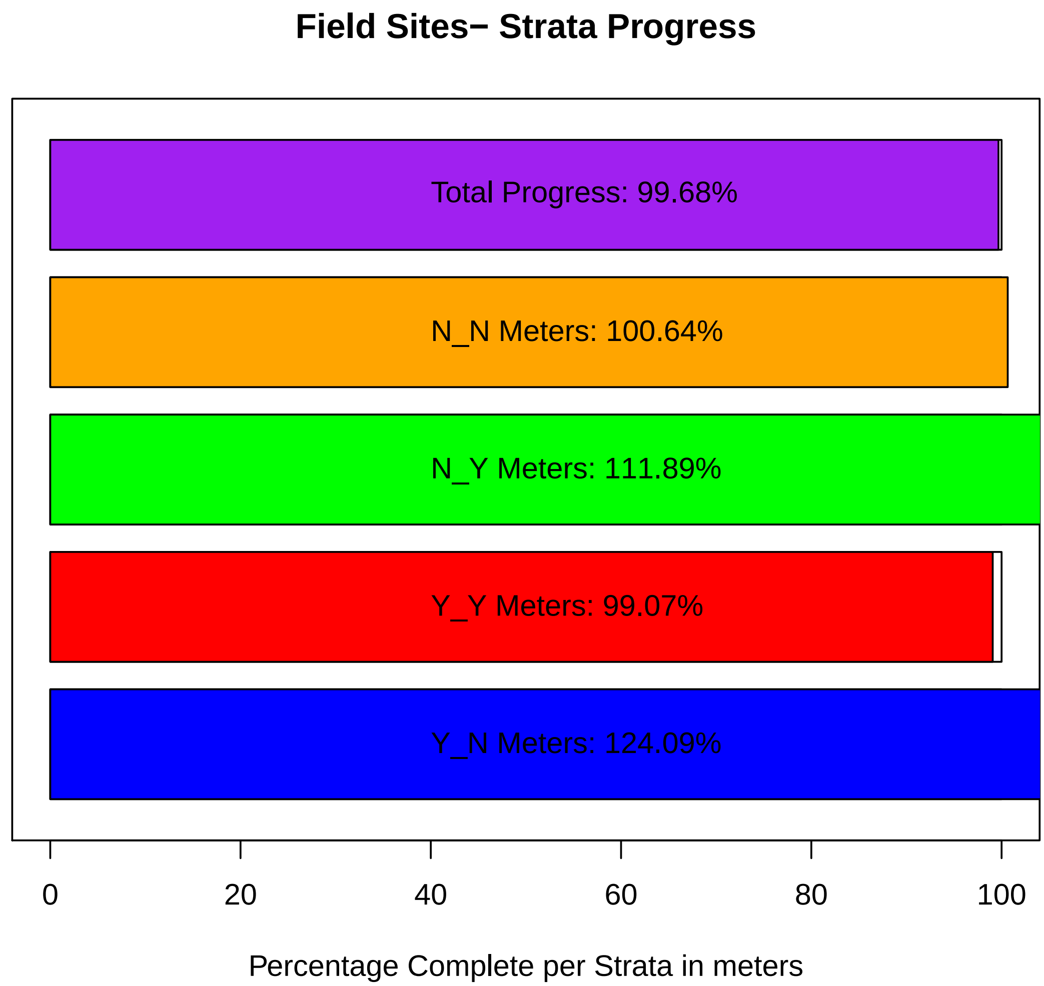
4.1.1 Definition of Localities and Strata

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

4.2 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 22, and last year's sampling period is period 20.**



STRATA	Meters Completed
Y_N	424
Y_Y	1138.3
N_N	543
N_Y	1183

Table 4-1. - Displaying the total meters surveyed during period 22 per strata.

4.2.1 Summary Plots for Periods 18, 20 and 22

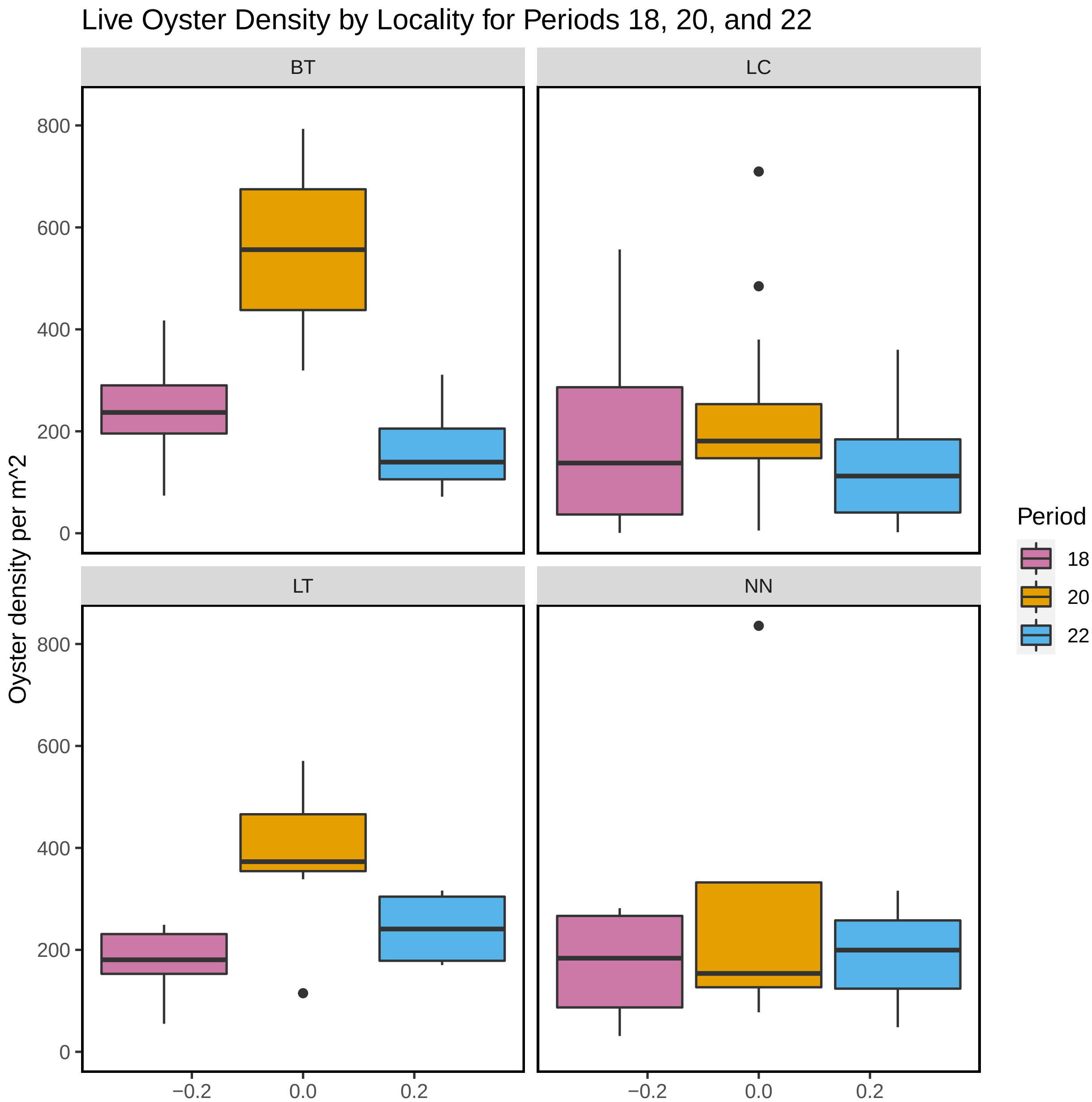


Figure 4-1.- Calculated live oyster density by locality for periods 18 (Winter 2018-2019), 20 (Winter 2019-2020) and 22 (Winter 2020-2021) with the last sample date of period 22 as 2021-02-26.

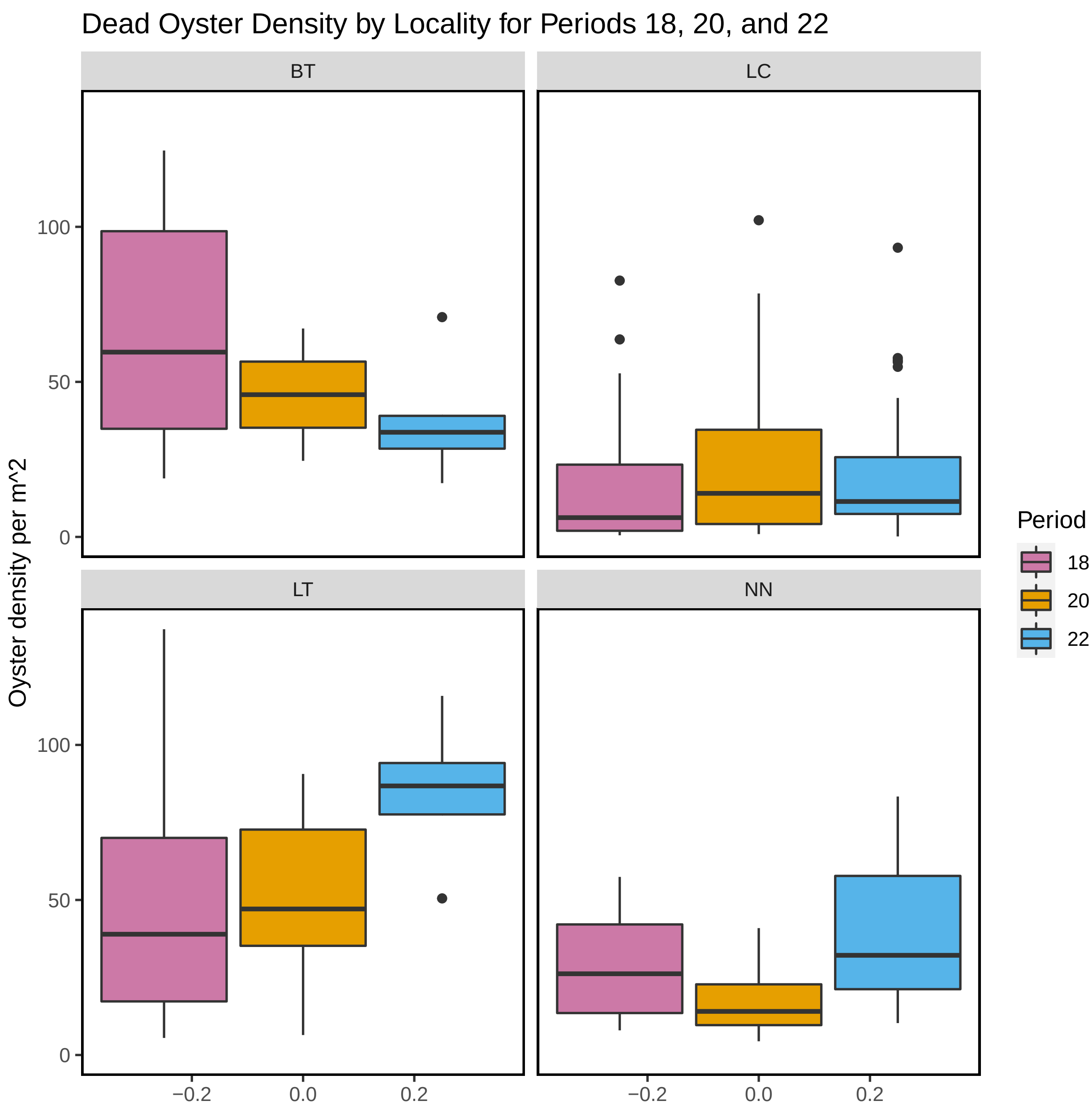


Figure 4-2.- Calculated dead oyster density by locality for periods 18 (Winter 2018-2019), 20 (Winter 2019-2020) and 22 (Winter 2020-2021) with the last sample date of period 22 as 2021-02-26.

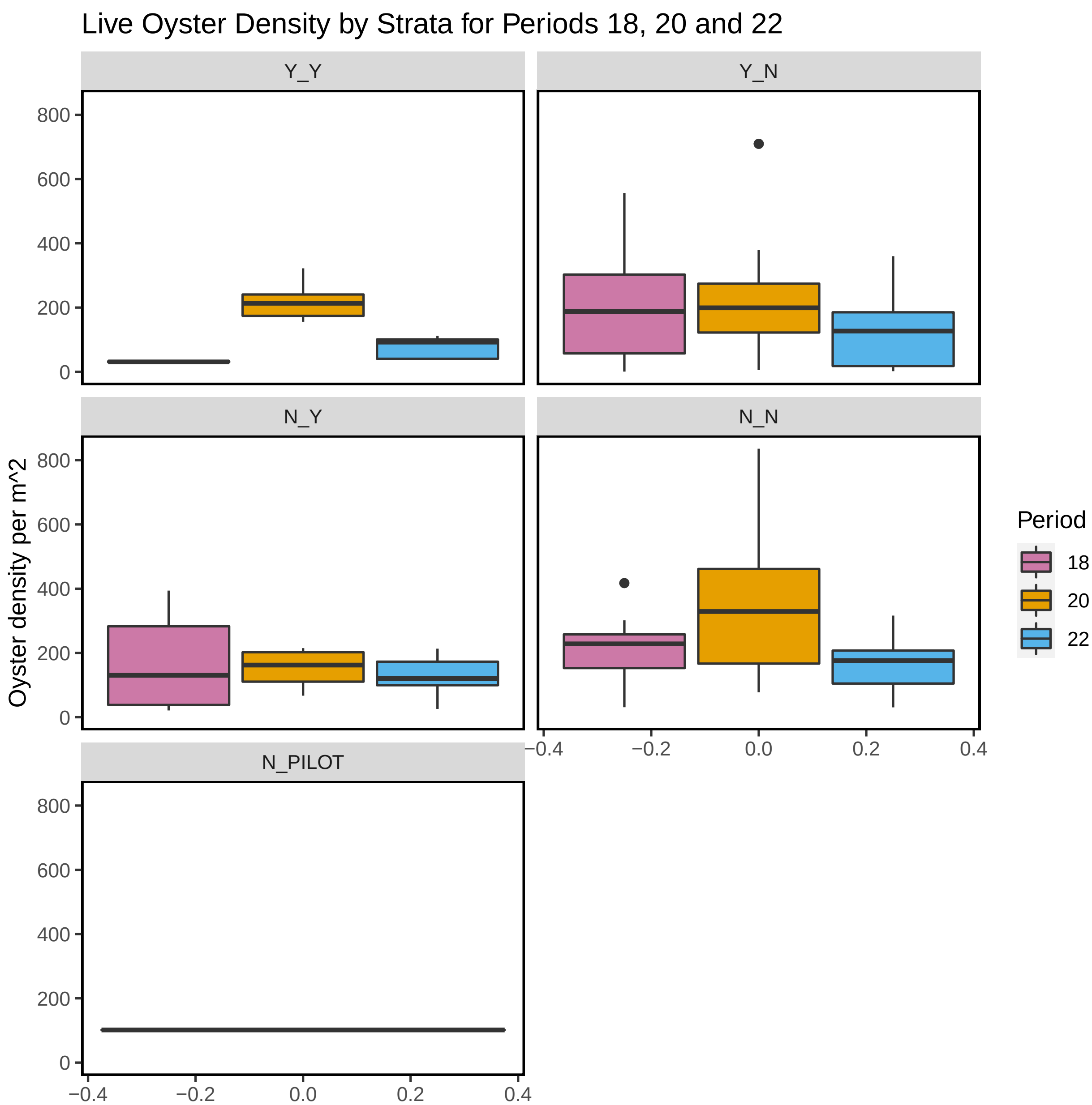


Figure 4-3.- Calculated live oyster density by strata for periods 18 (Winter 2018-2019), 20 (Winter 2019-2020) and 22 (Winter 2020-2021) with the last sample date of period 22 as 2021-02-26.

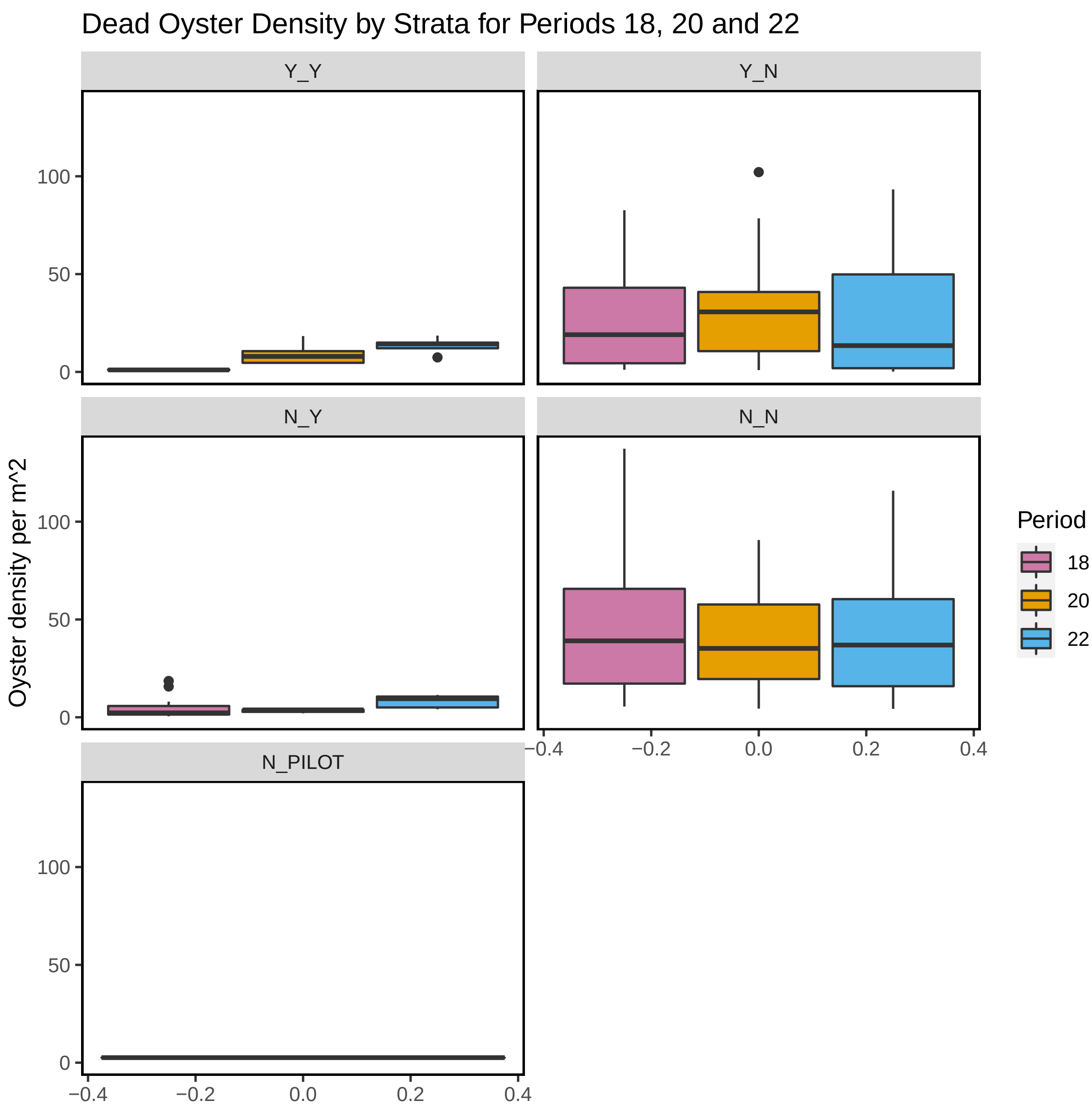


Figure 4-4.- Calculated dead oyster density by strata for periods 18 (Winter 2018-2019), 20 (Winter 2019-2020) and 22 (Winter 2020-2021) with the last sample date of period 22 as 2021-02-26.

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.

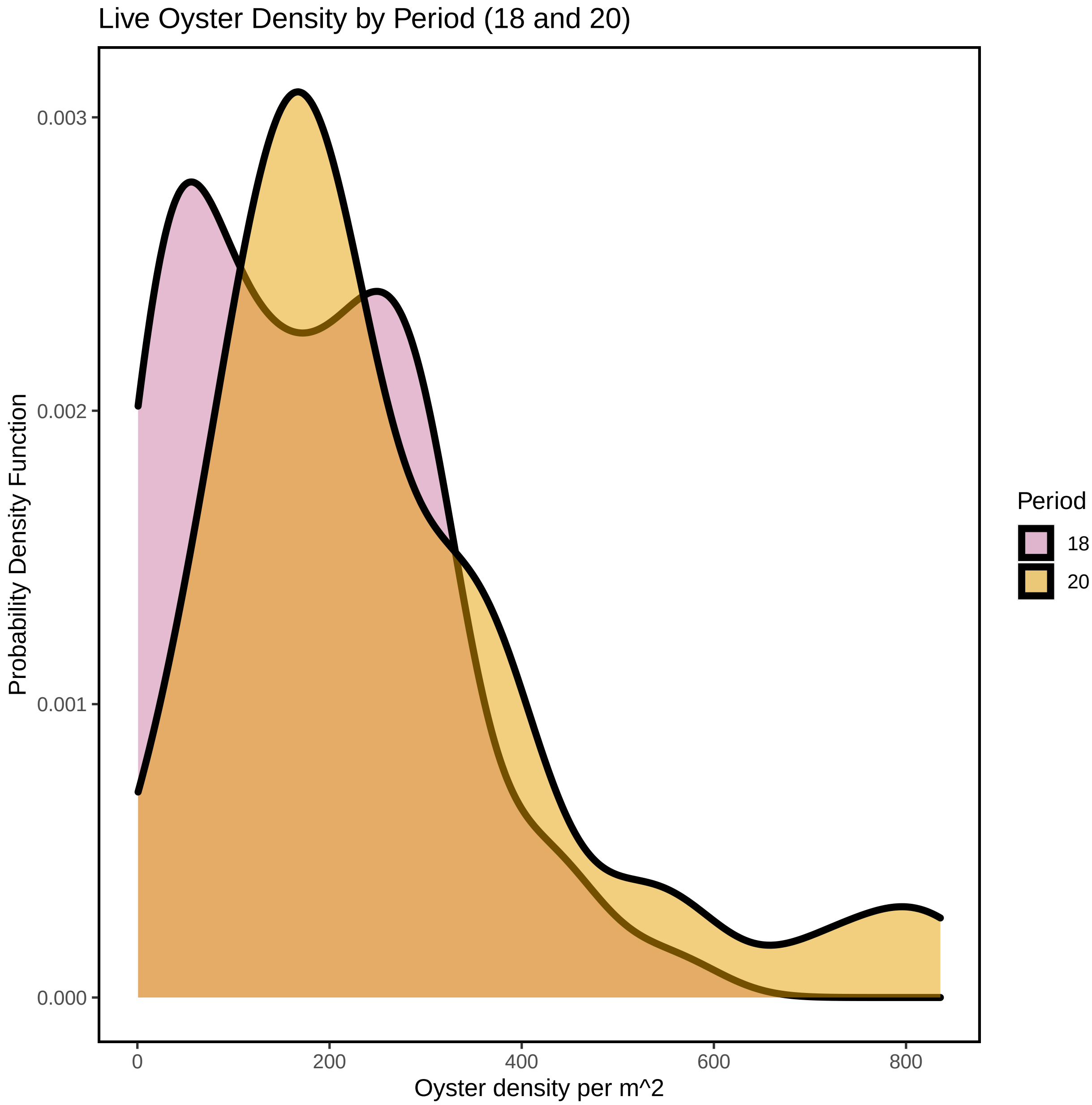


Figure 4-5.- Calculated live oyster density by periods 18 (Winter 2018-2019) and 20 (Winter 2019-2020) using a probability density function with the last sample date of period 22 as 2021-02-26.

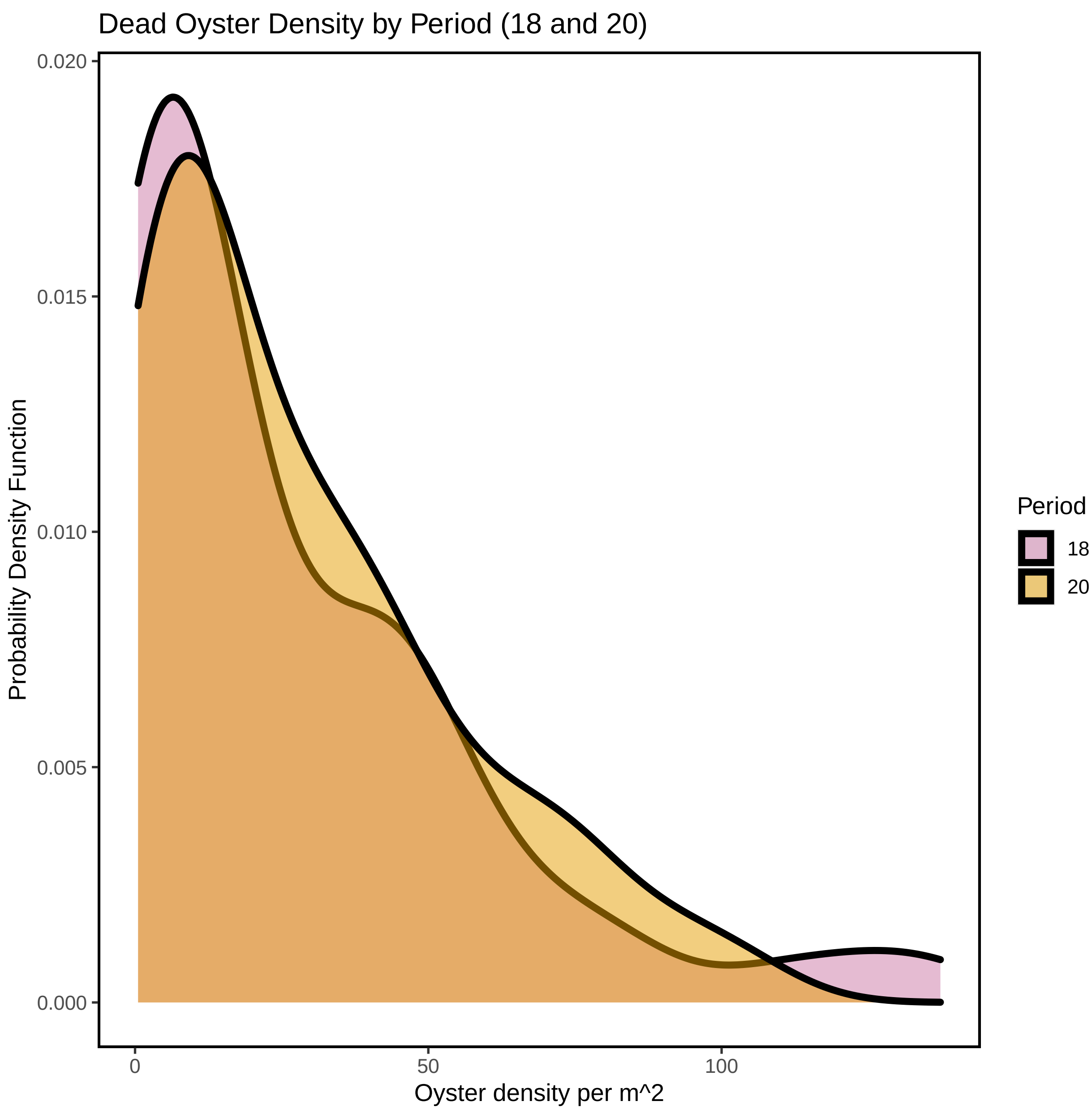


Figure 4-6.- Calculated dead oyster density by periods 18 (Winter 2018-2019) and 20 (Winter 2019-2020) using a probability density function with the last sample date of period 22 as 2021-02-26.

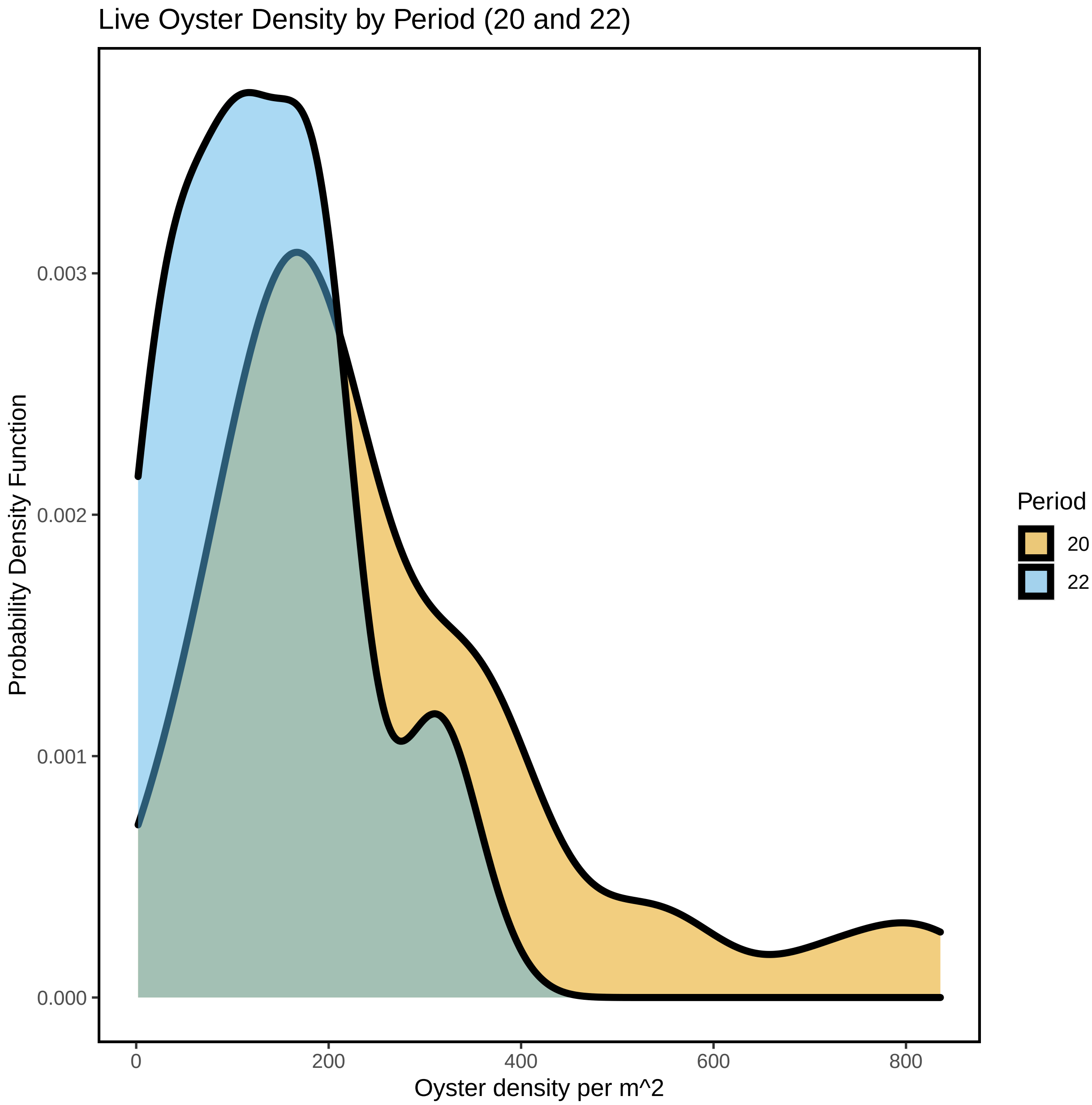


Figure 4-7.- Calculated live oyster density by periods 20 (Winter 2019-2020) and 22 (Winter 2020-2021) using a probability density function with the last sample date of period 22 as 2021-02-26.

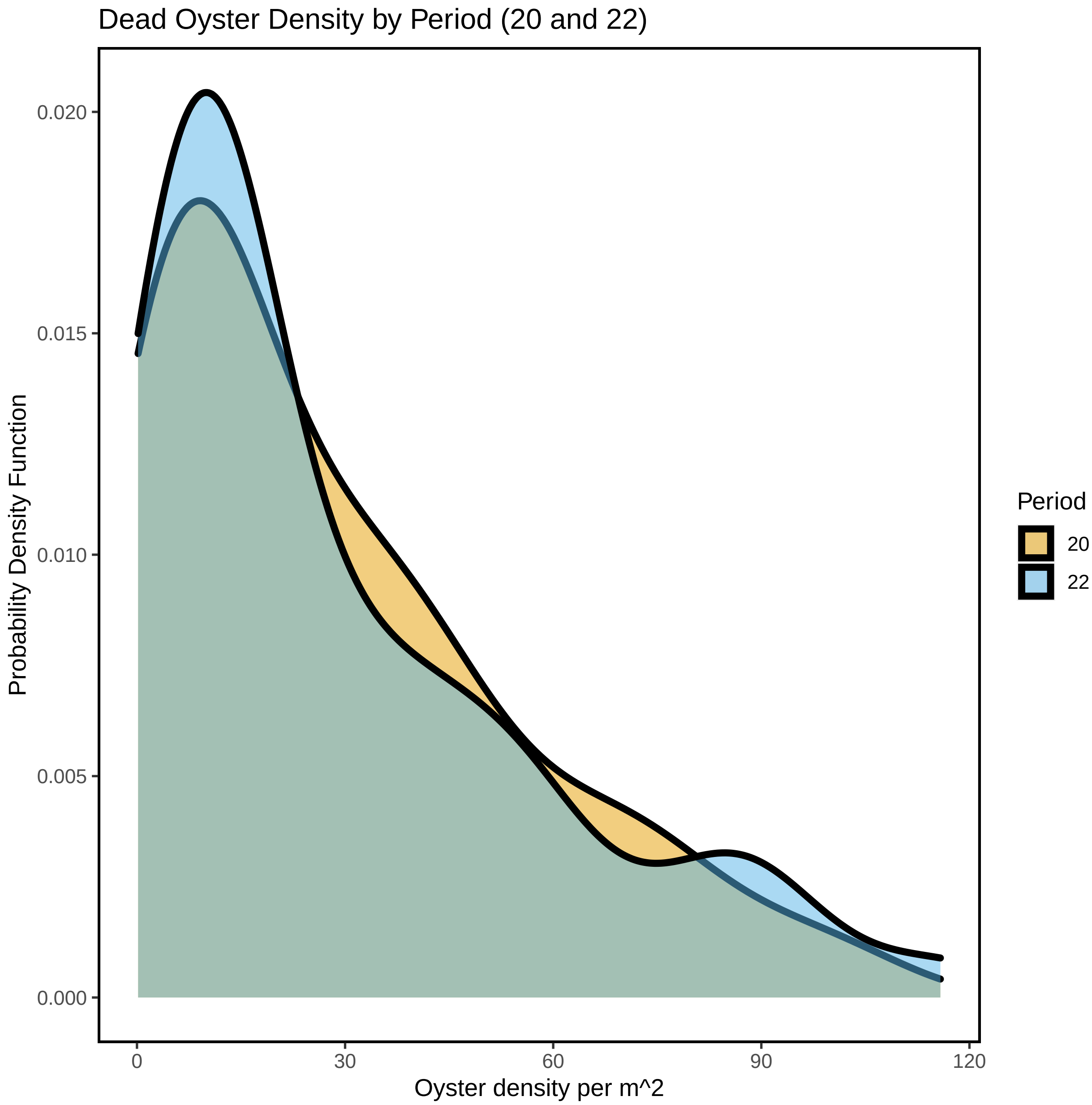


Figure 4-8.- Calculated dead oyster density by periods 20 (Winter 2019-2020) and 22 (Winter 2020-2021) using a probability density function with the last sample date of period 22 as 2021-02-26.

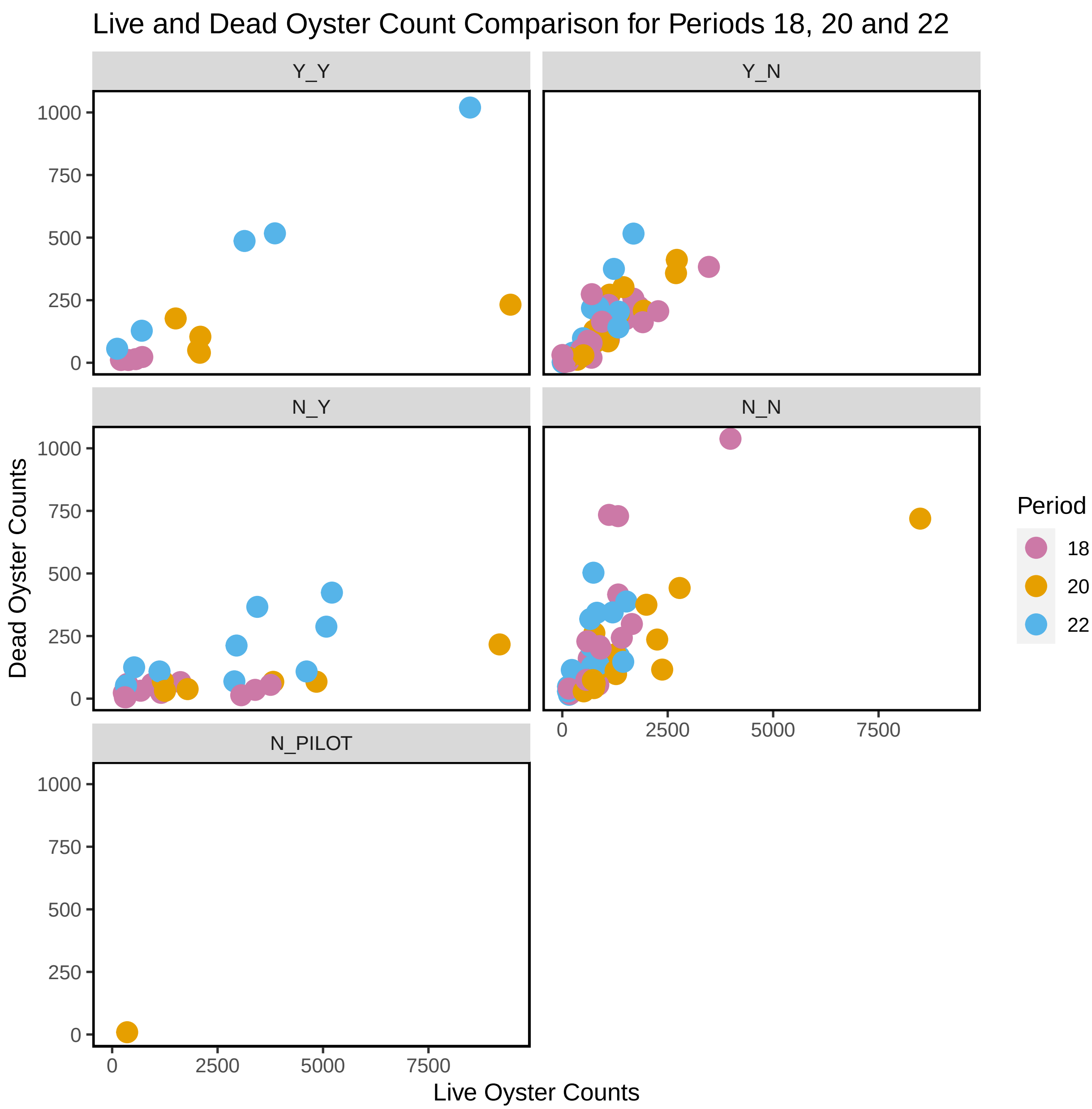


Figure 4-9.- Live and dead oyster count comparison by periods 18 (Winter 2018- 2019), 20 (Winter 2019-2020) and 22 (Winter 2020-2021), last sample date of period 22 as 2021-02-26.

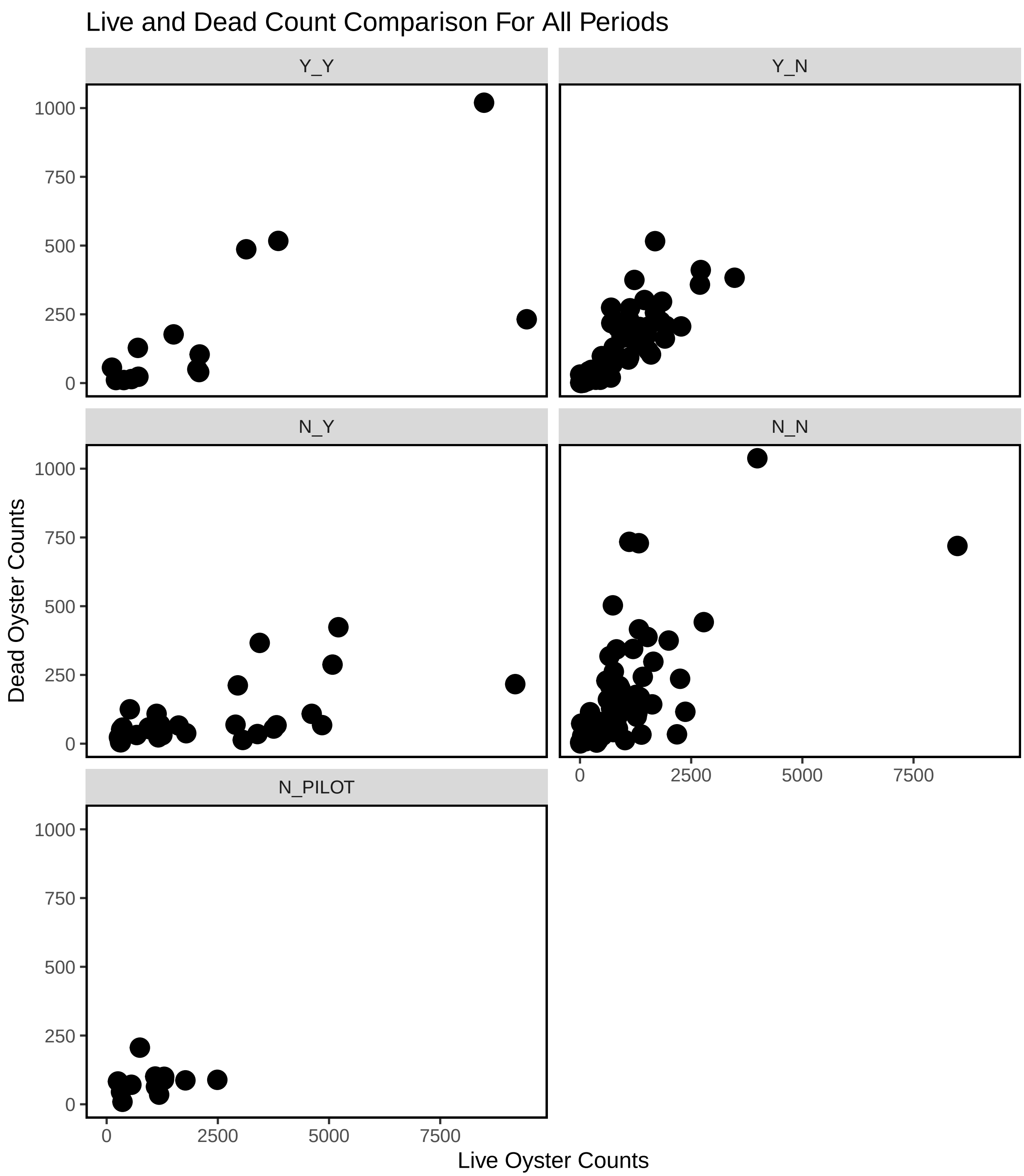


Figure 4-10.- Live and dead oyster comparison for all periods, last sample date of period 22 is 2021-02-26.

5 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.

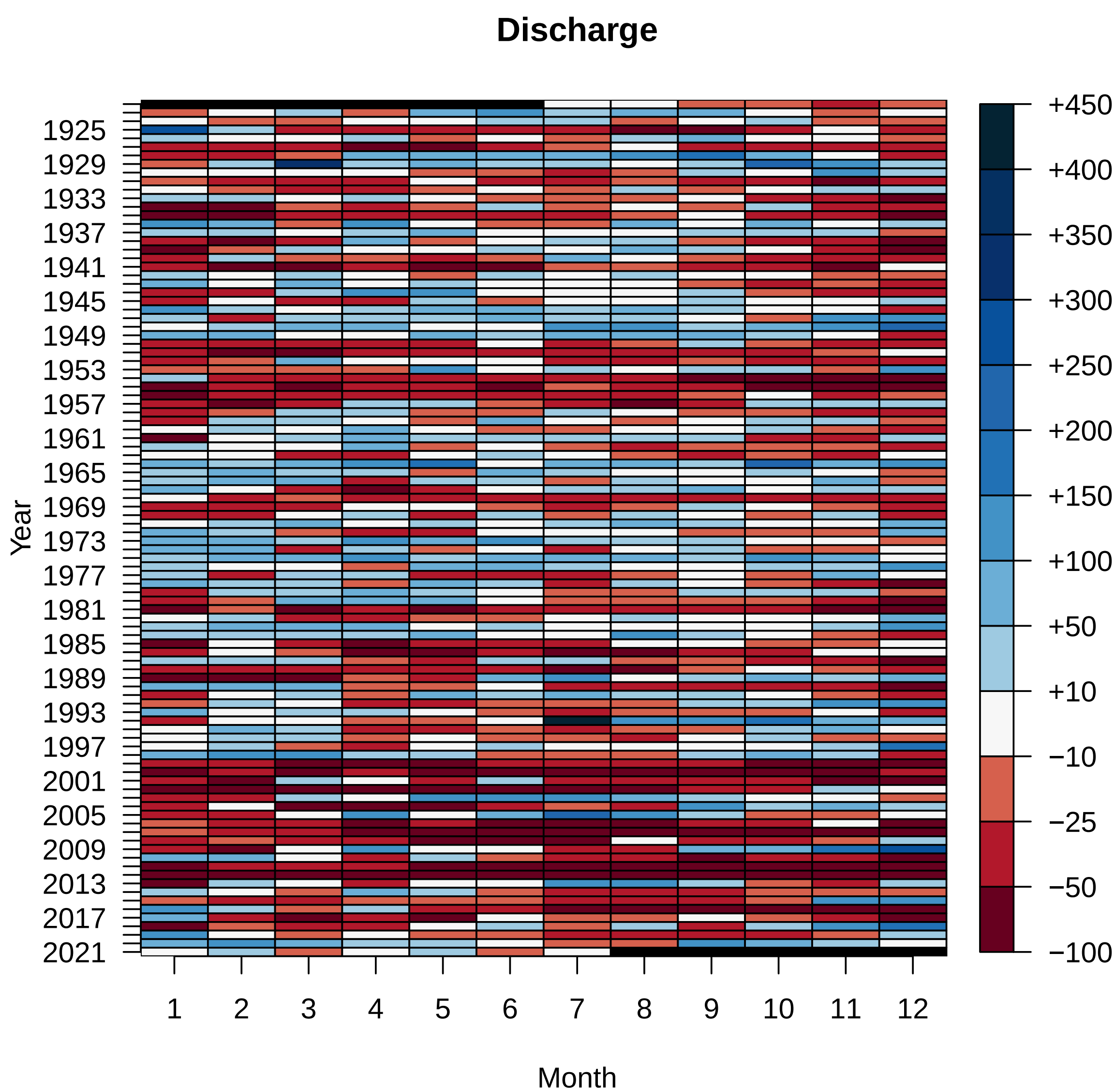


Figure 5-1. Heat map of Suwannee River deviations in mean daily discharge by year and month from USGS Wilcox gauge (02322500) for the period of record measured as deviation from the average by month

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.

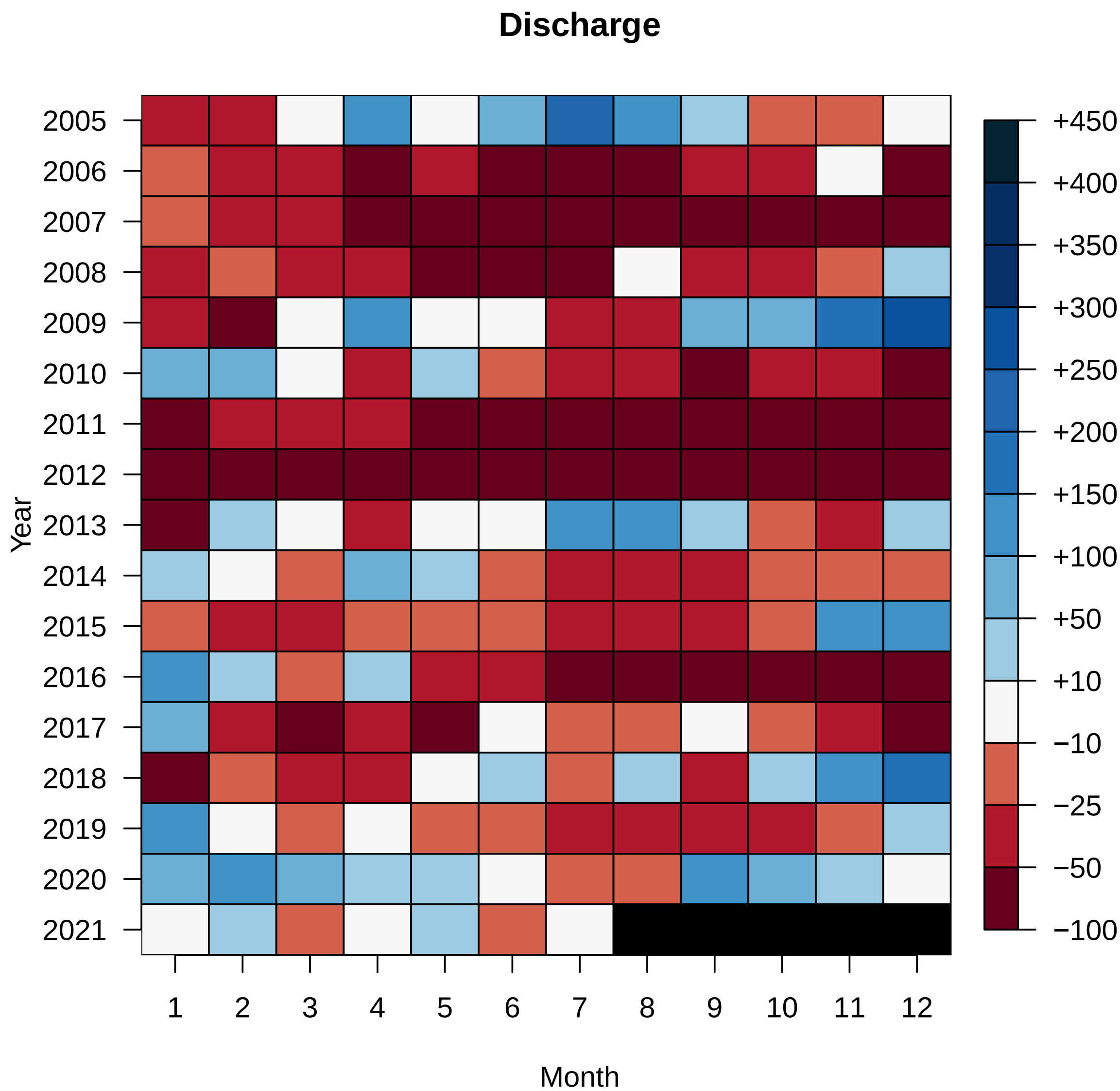


Figure 5-2. Heat map of Suwannee River deviations in mean daily discharge by year and month from USGS Wilcox gauge (02323500) for 2005-2021 measured as deviation from the average by month for period of record. White color for a given month and year is a month when river discharge is similar (with +/- 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.

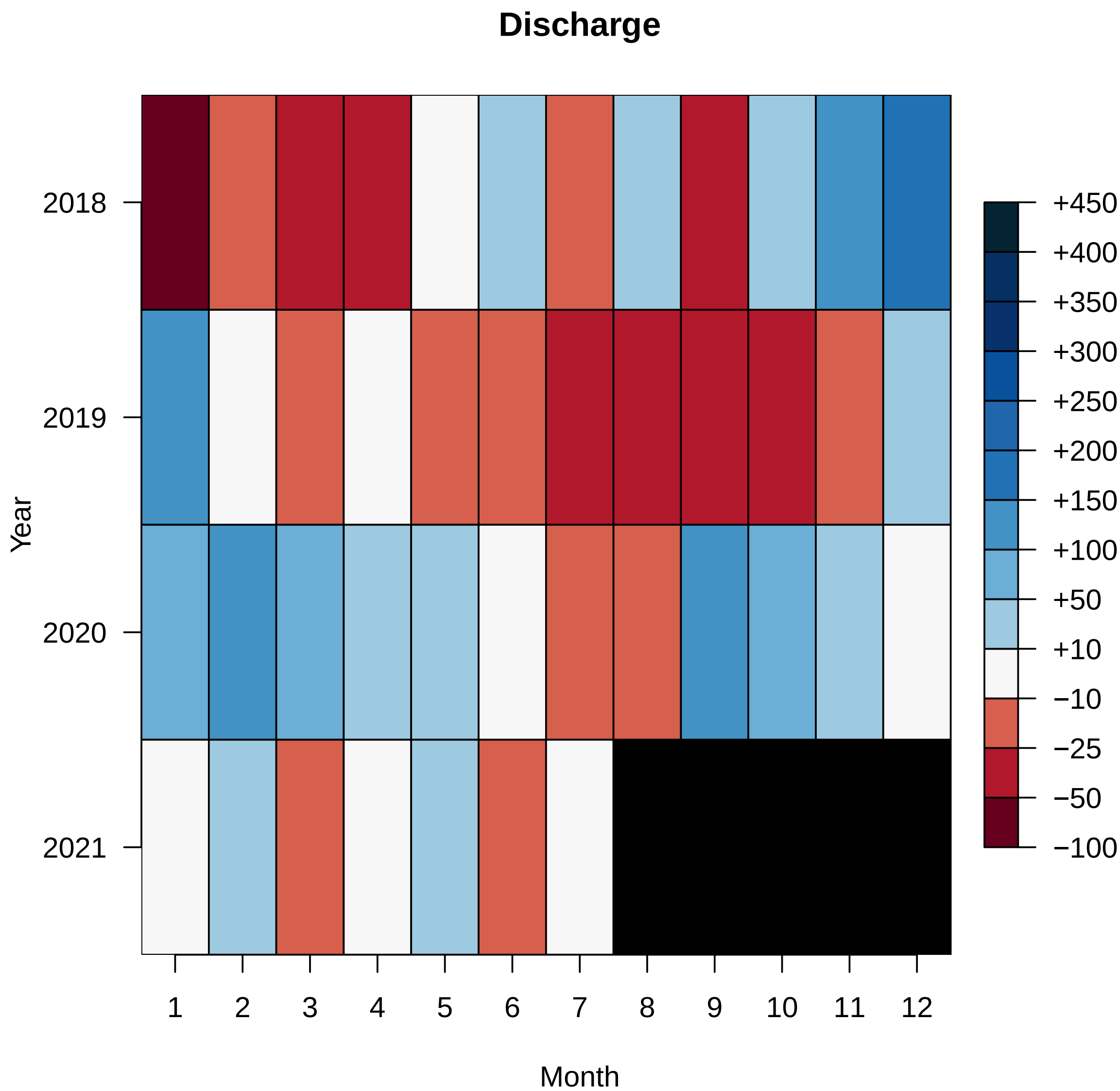


Figure 5-3. Heat map of Suwannee River deviations in mean daily discharge by year and month from USGS Wilcox gauge (02323500) for 2018-2021 measured as deviation from the average by month for period of record. White color for a given month and year is a month when river discharge is similar (with +/- 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.

6 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, and this is selected in the FWC Commercial Fisheries Landings Summaries website.

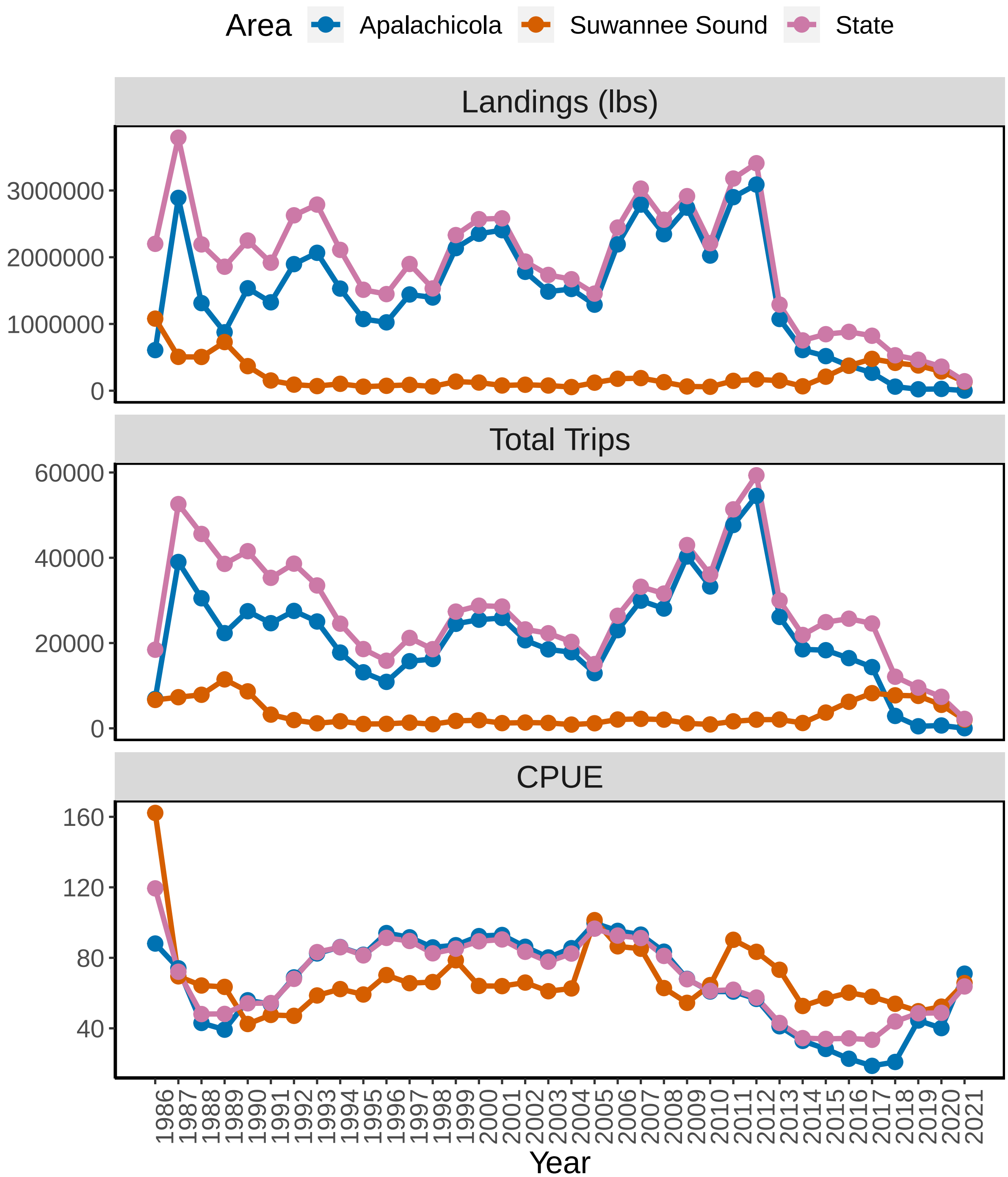


Figure 6-1. Figure of oyster landings (lbs), total trips, and cost per unit effort (CPUE) for Apalachicola (blue line), Suwannee Sound (orange), and the State of Florida (pink) for years 1986 to 2021.

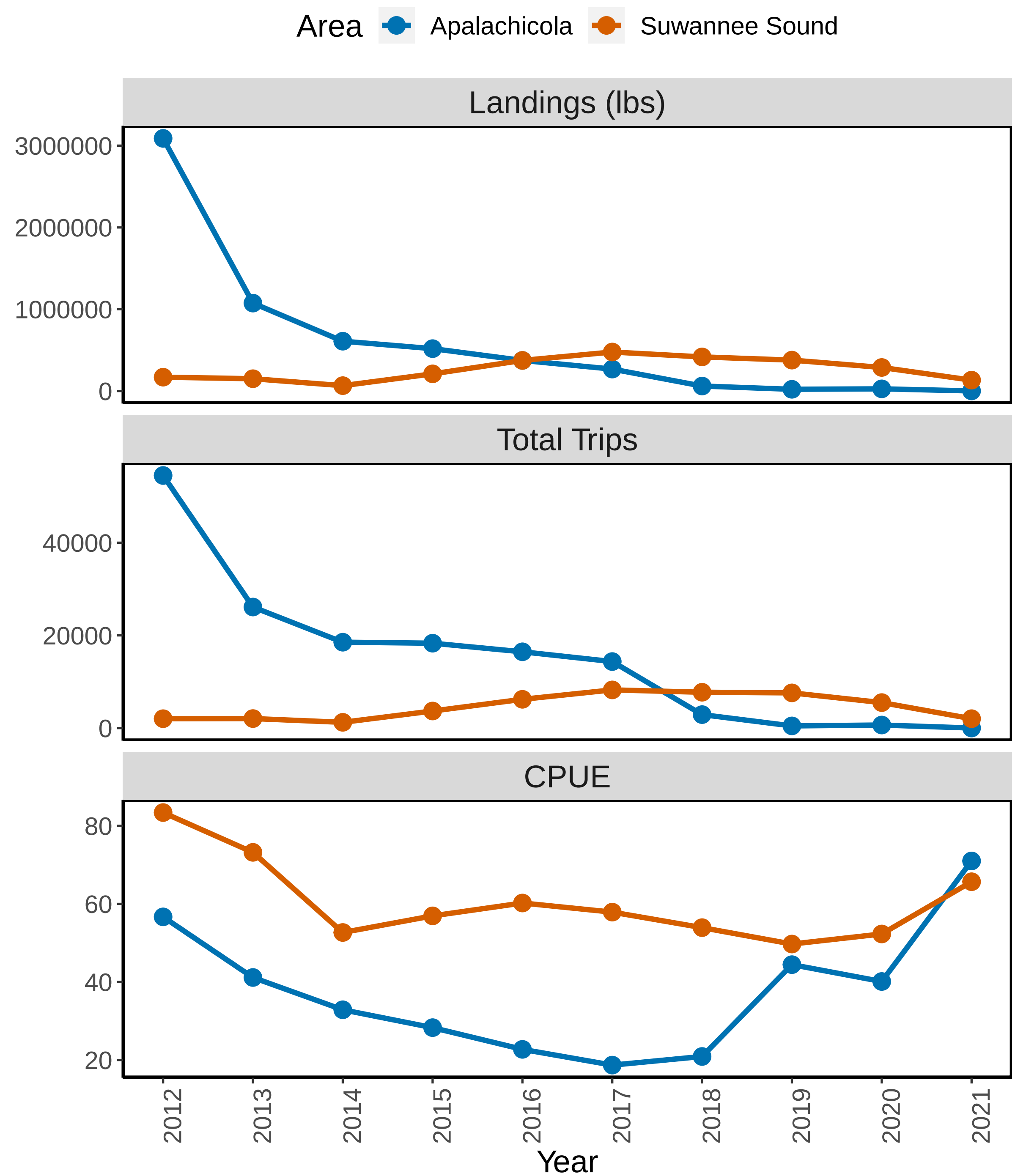


Figure 6-2. Figure of oyster landings (lbs), total trips, and cost per unit effort (CPUE) for Apalachicola (blue line), Suwannee Sound (orange) for years 2012 to 2021.

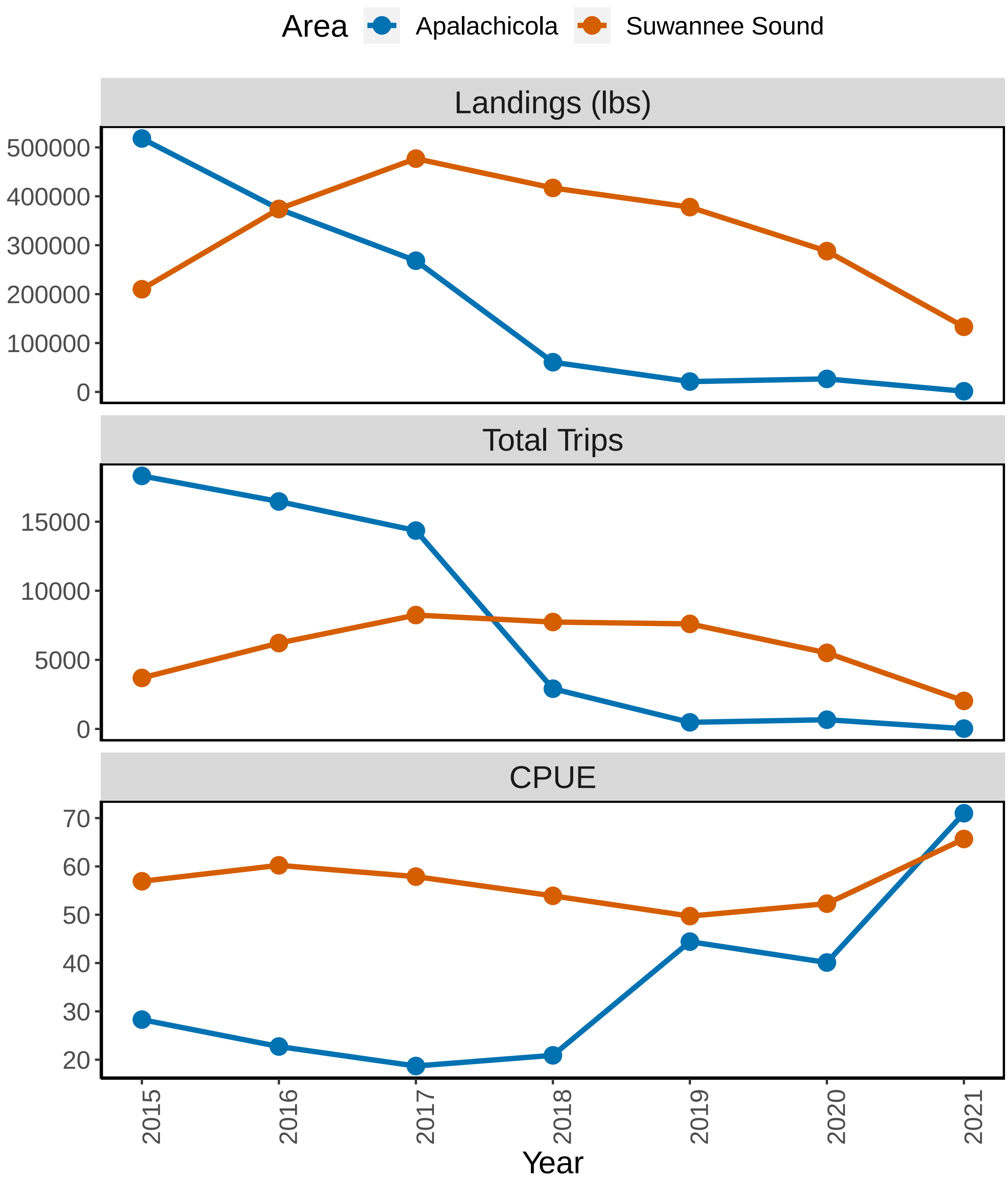


Figure 6-3. Figure of oyster landings (lbs), total trips, and cost per unit effort (CPUE) for Apalachicola (blue line), Suwannee Sound (orange) for years 2015 to 2021.

7 Quarterly Windrose

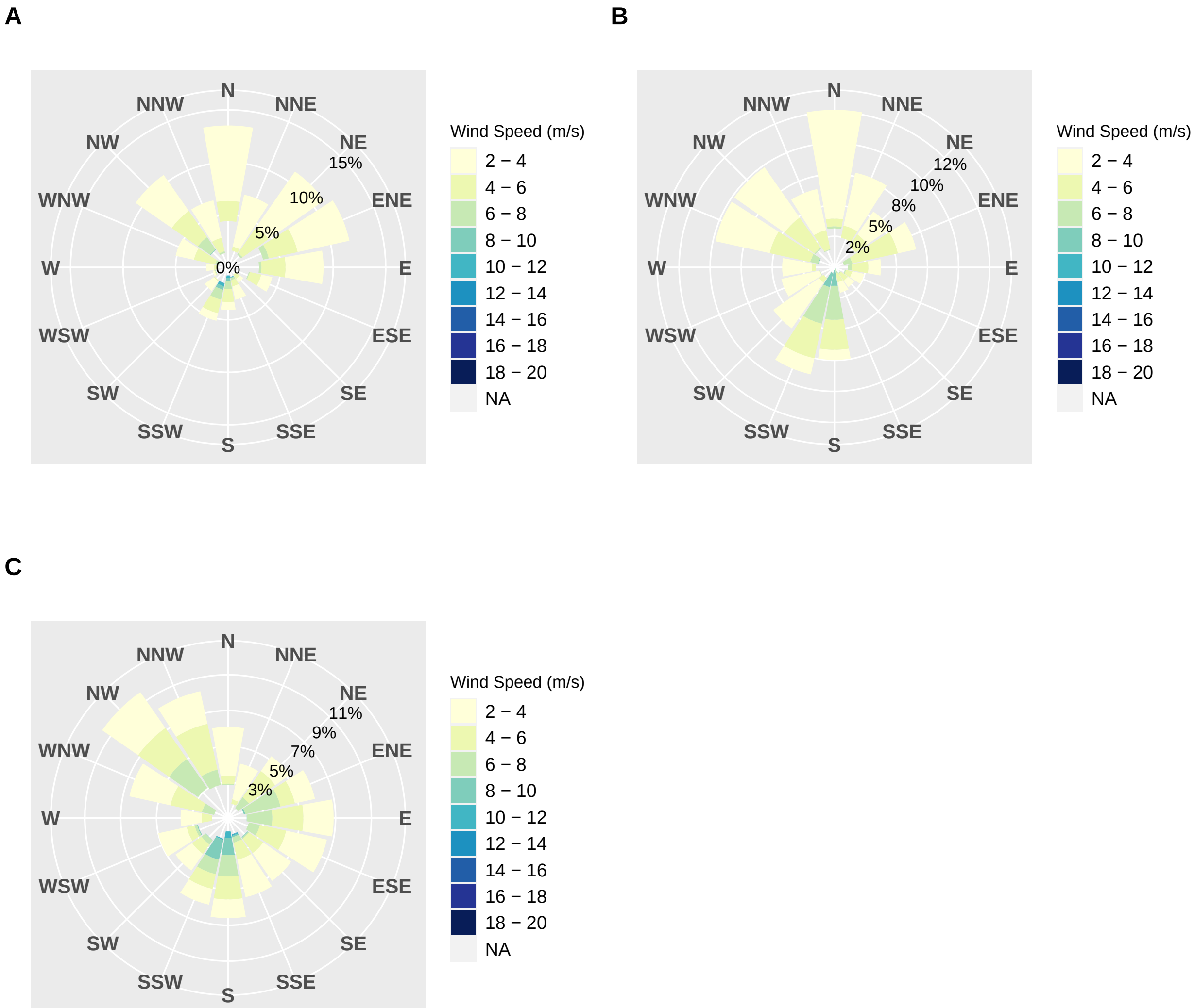


Figure 7-1. A wind rose visualizes the frequency of winds blowing from a specific direction of a desired Date Range. The data used for this figure were collected via the `rnoaa` R Package at station CDRF1 (Cedar Key, Florida). The legend represents the wind speed ranging from low (2-4 m/s) to high (18-20 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 December 1, 2020 to December 31, 2020, B) Windrose from Janauary 1, 2021 to January 31, 2021, C) Windrose from February 1, 2021 to February 28, 2021.