Synthesis of Environmental Impacts on Key Fishery Resources in the Chesapeake Bay

Fall 2024 Seasonal Summary

Fall 2024 Headlines

- **Dissolved oxygen was generally below average at both the surface and the bottom for much of the fall. Low dissolved oxygen may have affected blue crab movement and habitat use.**
- **Salinity started the season below average, but it increased as precipitation and flow remained low. Lower salinities can hurt oyster reproduction and spat sets.**

Summary of Impacts of Environmental Conditions on Species from Most Recent Four Seasons

	Winter 2023-24	Spring 2024	Summer 2024	Fall 2024
Striped Bass	WT, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Blue Crabs	WT, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Oysters	WT, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Bay Anchovy	WT, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Summer Flounder	WT, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow

WT = Water Temperature
Sal = Salinity
Flow = Streamflow

DO = Dissolved Oxygen
Green = Potentially positive impact
Red = Potentially negative impact
Black = Neutral or unknown impact

Purpose

The National Oceanic and Atmospheric Administration's (NOAA) Chesapeake Bay Office (NCBO) develops seasonal summaries of water-quality parameters in the Chesapeake Bay to provide fisheries managers and the public information about recent environmental conditions, how they compare with long-term averages, and how these conditions might affect key fishery resources such as striped bass (*Morone saxatilis*), blue crab (*Callinectes sapidus*), eastern oysters (*Crassostrea virginica*), and summer flounder (*Paralichthys dentatus*). The intent is to provide information linking changes in environmental conditions to effects on living resources that can inform ecosystem-based management at state and regional levels. The seasons are defined as winter (December-February), spring (March-May), summer (June-August), and fall (September-November).

The primary data sources for these seasonal summaries are the NOAA Chesapeake Bay Interpretive Buoy System (CBIBS) for real-time, surface water temperature and salinity information at four locations throughout the Chesapeake Bay (Figure 1); the NOAA CoastWatch Program for Bay-wide, satellite-based sea surface temperature (SST) anomalies; the NOAA National Weather Service PREcipitation Summary and Temperature Observations (PRESTO) reports for regional precipitation and air temperature information; the National Centers for Environmental Information for precipitation data; and the U.S. Geological Survey (USGS) National Water Information System for local streamflow information at various locations throughout the Bay. In summer, the Chesapeake Bay Environmental Forecast System (CBEFS)

provides estimates of the volume and duration of seasonal hypoxia. NCBO uses these seasonal summaries to develop an annual synthesis for inclusion in the Mid-Atlantic State of the Ecosystem Report, which is developed by the Northeast Fisheries Science Center and presented to the Mid-Atlantic Fishery Management Council each year.

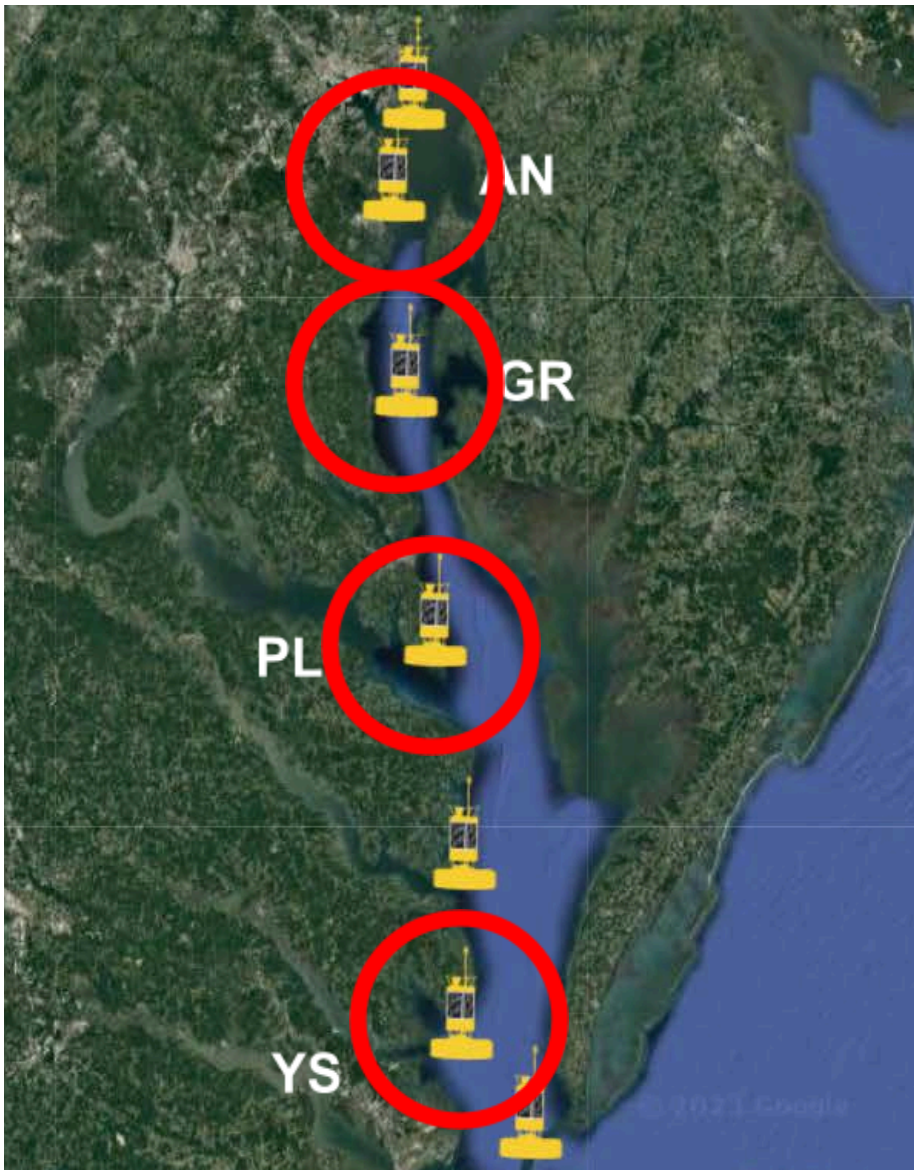

Figure 1. Map of Chesapeake Bay Interpretive Buoy System (CBIBS) observation platforms. The buoys used in these summaries are AN (Annapolis), GR (Gooses Reef), PL (Potomac), and YS (York Spit).

Water Temperature

Satellite sea surface temperature anomalies (Figure 2) show small differences throughout the Bay, with slight increases over the long term average in the southern and northern portions and slight decreases over the long-term average in areas of the Potomac and Choptank rivers and Tangier Sound.

CBIBS observations show water temperatures overall steadily declining from 80°F to near 50°F from September to November as expected (Figures 3, 4, 5, and 6). However, there are notable cooler temperatures compared to the long-term average at Annapolis, Gooses Reef, and Potomac in September (no observations were available from York Spit until mid October). Water temperature was above the long-term average at Annapolis, Gooses Reef, and York Spit during November 2024 (no observations were available from Potomac during this period).

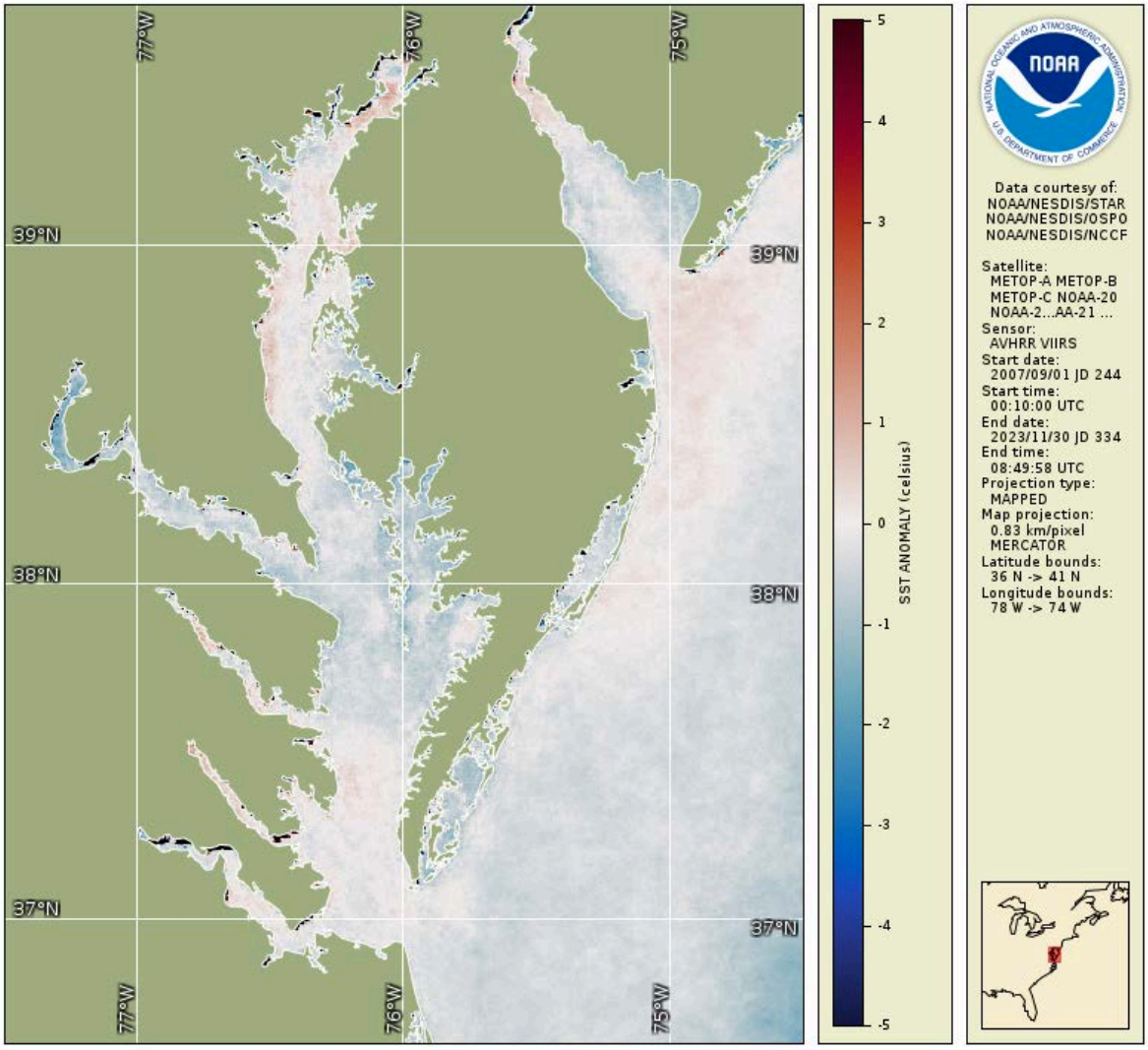

Figure 2. Sea surface temperature (SST) anomalies observed by NOAA satellites September–November 2024 relative to the average of this seasonal period 2007–2023.

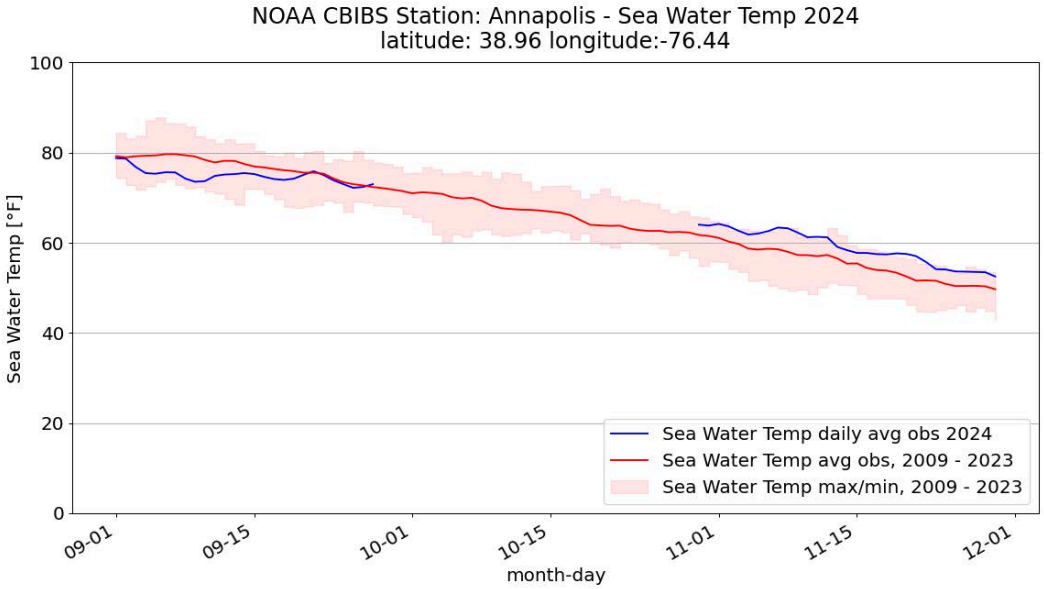

Figure 3. Surface water temperatures at the Annapolis CBIBS buoy September–November 2024 relative to the long-term average (2009–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

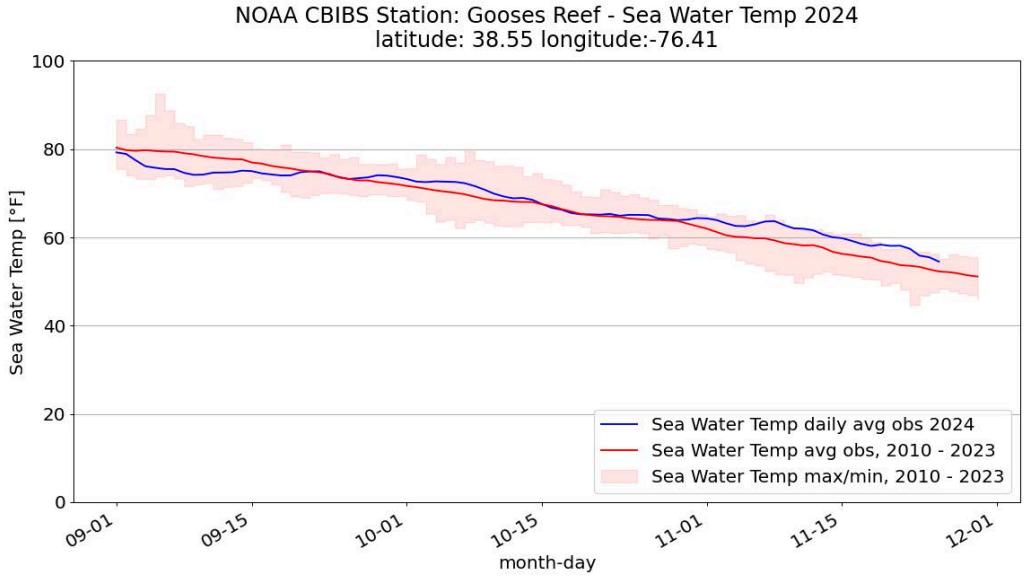

Figure 4. Surface water temperatures at the Gooses Reef CBIBS buoy September–November 2024 relative to the long-term average (2010–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

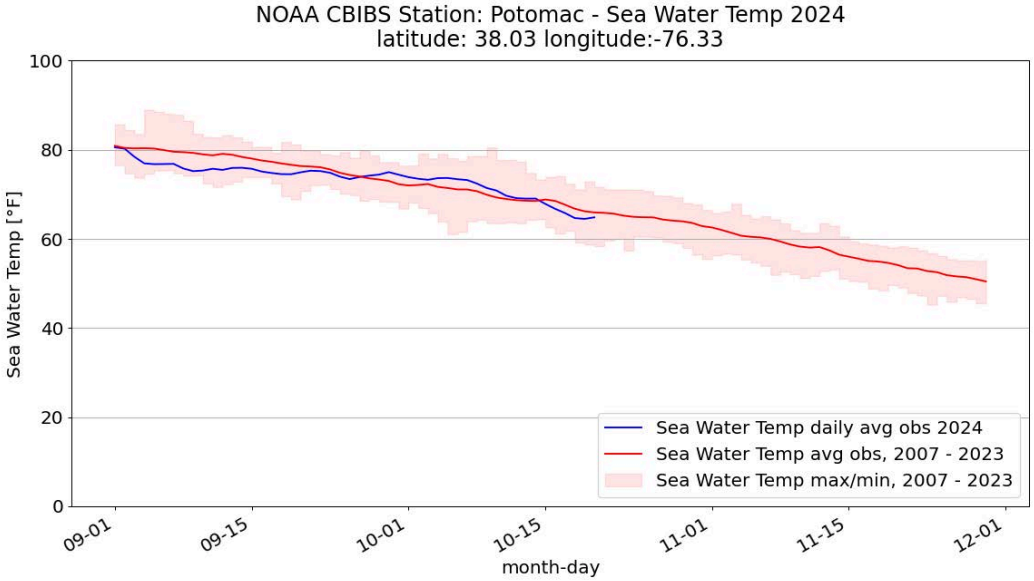

Figure 5. Surface water temperatures at the Potomac CBIBS buoy September–November 2024 relative to the long-term average (2007–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

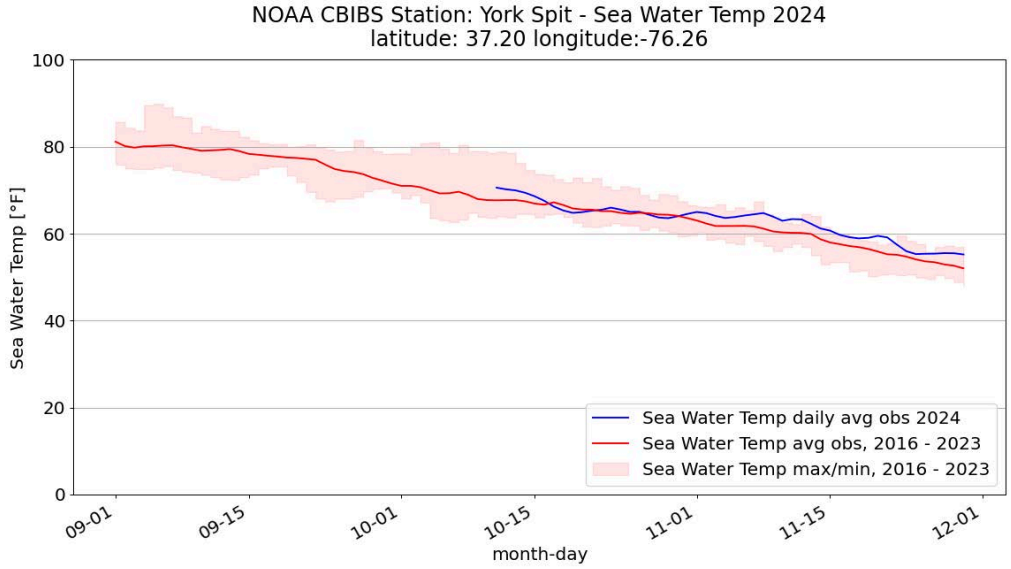

Figure 6. Surface water temperatures at the York Spit CBIBS buoy September–November 2024 relative to the long-term average (2007–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

Salinity

CBIBS observations show salinity increased from below the long-term average early and mid-September to average or slightly above average in late September and early October at the Annapolis and Gooses Reef NOAA CBIBS buoys (Figures 7 and 8). From October through November, salinity was above the long-term average at these buoys (where observations were available). The Potomac buoy shows increasing salinity from September into October, with some variability from early to mid October (Figure 9). The York Spit buoy saw salinity increase from below the long-term average from mid October to mid November and then roughly average salinity for the last half of November (Figure 10). There were some gaps in observation at Annapolis, Potomac, and York Spit during the September to November time period.

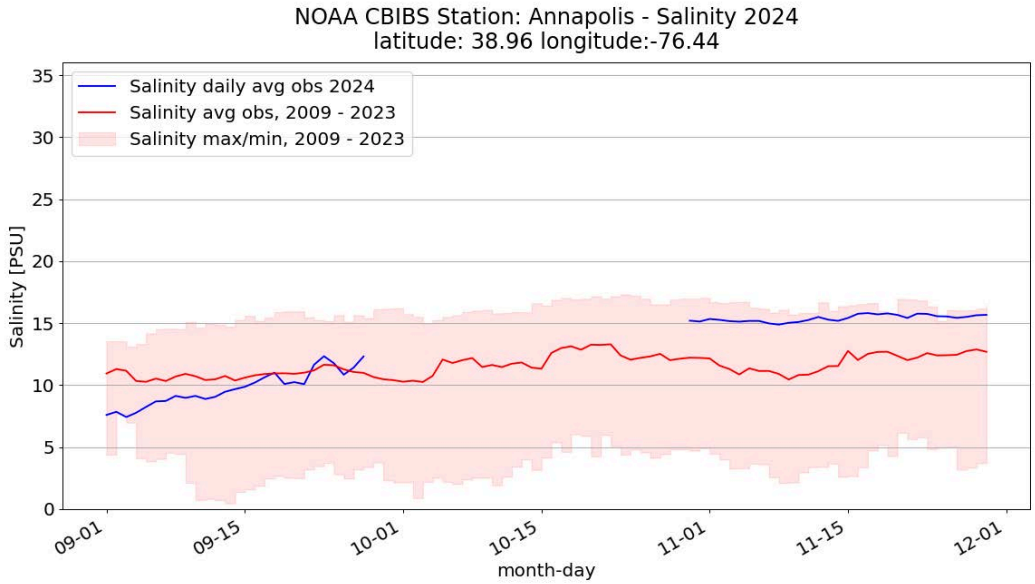

Figure 7. Salinity observations at the Annapolis CBIBS buoy September–November 2024 (blue line) relative to the average at each buoy over this seasonal period 2009–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

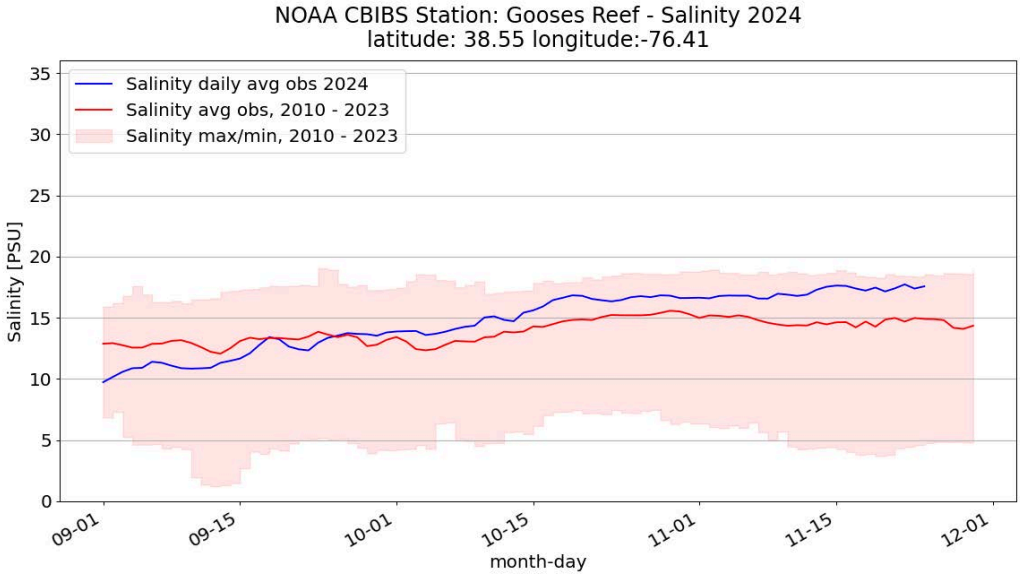

Figure 8. Salinity observations at the Gooses Reef CBIBS buoy September–November 2024 (blue line) relative to the average at each buoy over this seasonal period 2010–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

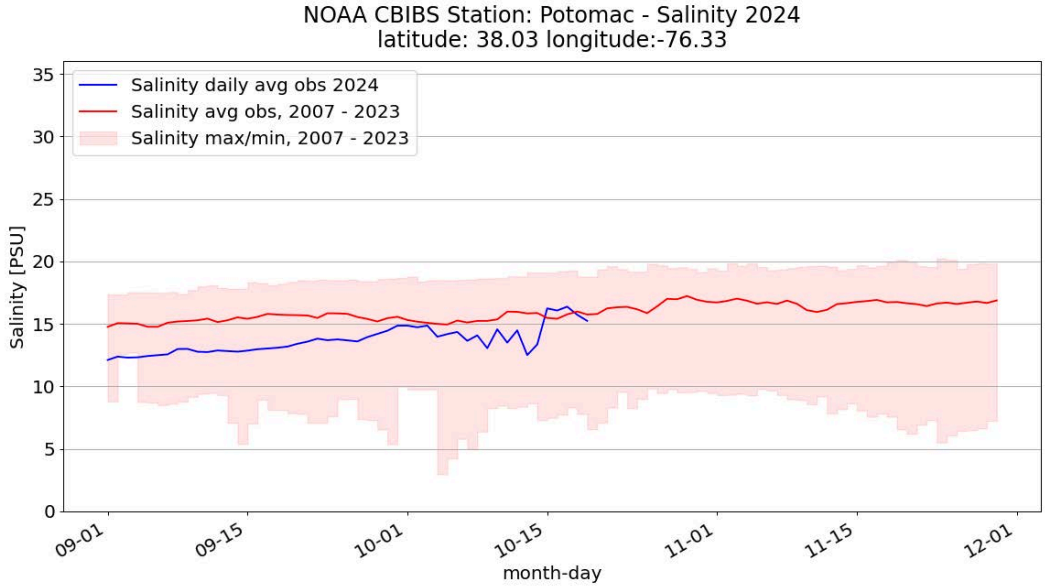

Figure 9. Salinity observations at the Potomac CBIBS buoy September–November 2024 (blue line) relative to the average at each buoy over this seasonal period 2007–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

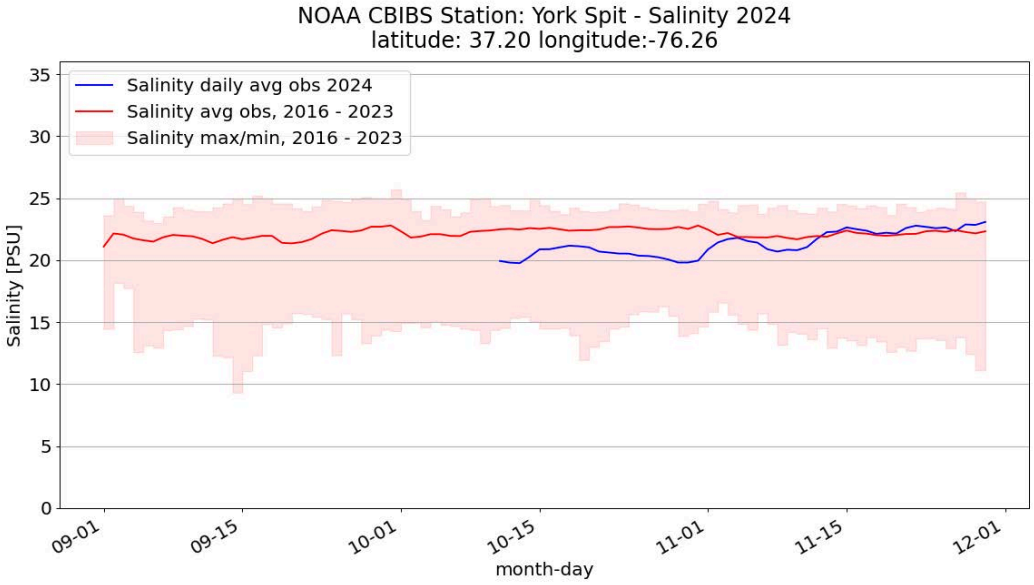

Figure 10. Salinity observations at the York Spit CBIBS buoy September–November 2024 (blue line) relative to the average at each buoy over this seasonal period 2007–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

Precipitation and Freshwater Flow

According to precipitation data from NOAA's National Centers for Environmental Information, rainfall amounts for tidewater Virginia and southern Maryland were the third and first lowest, respectively, since 2007 (Figures 11 and 12). Lower precipitation results in lower freshwater flow to the Bay (Figure 13). Lower precipitation resulted in higher salinity towards the end of fall, as observed by the CBIBS buoys (Figures 7, 8, 9, and 10).

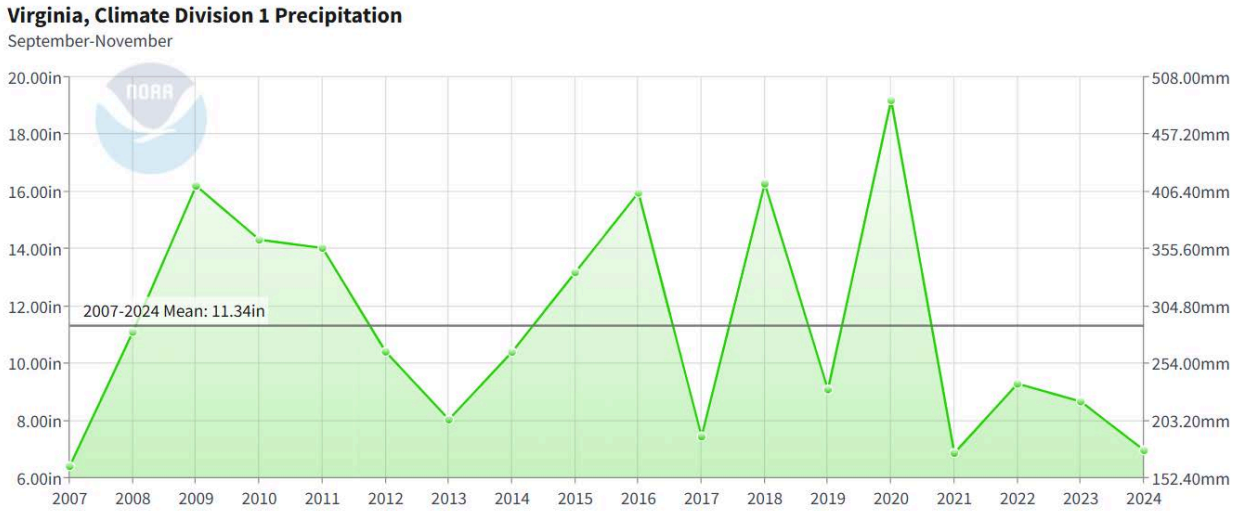

Figure 11. Precipitation data from 2007–2024 for September–November for Tidewater Virginia. Data from NOAA Centers for Environmental Information.

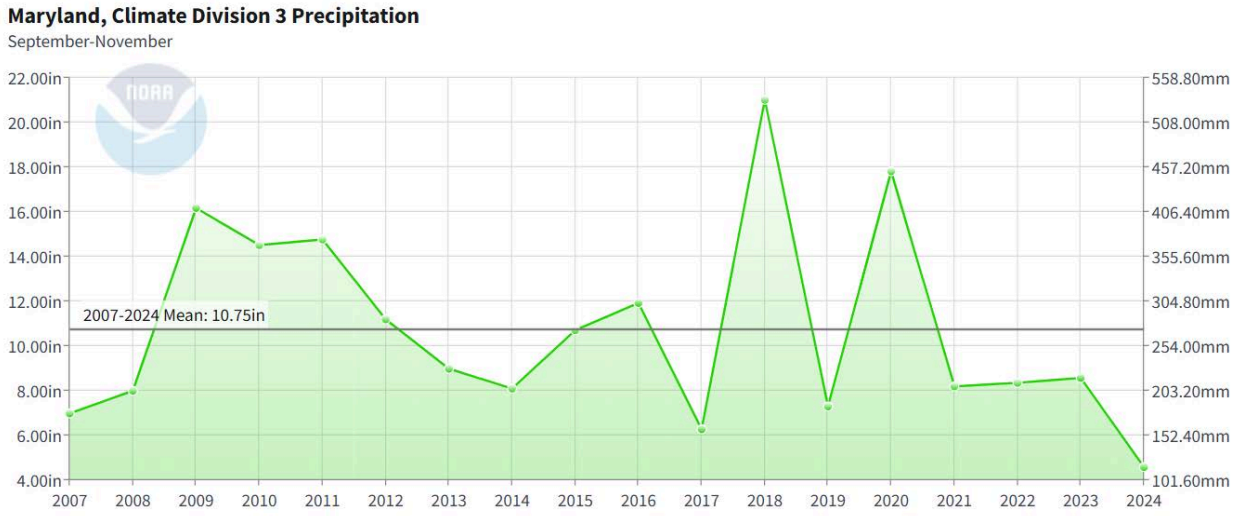

Figure 12. Precipitation data from 2007–2024 for September–November for southern Maryland. Data from NOAA Centers for Environmental Information.

Flow data from USGS stations in reaches of the Severn, Choptank, Pamunkey, and Potomac rivers show at or below historical flows from September through November (Figure 13). There was one exception in the Pamunkey River at the beginning of October where flow spiked above historical values for a brief period of time.

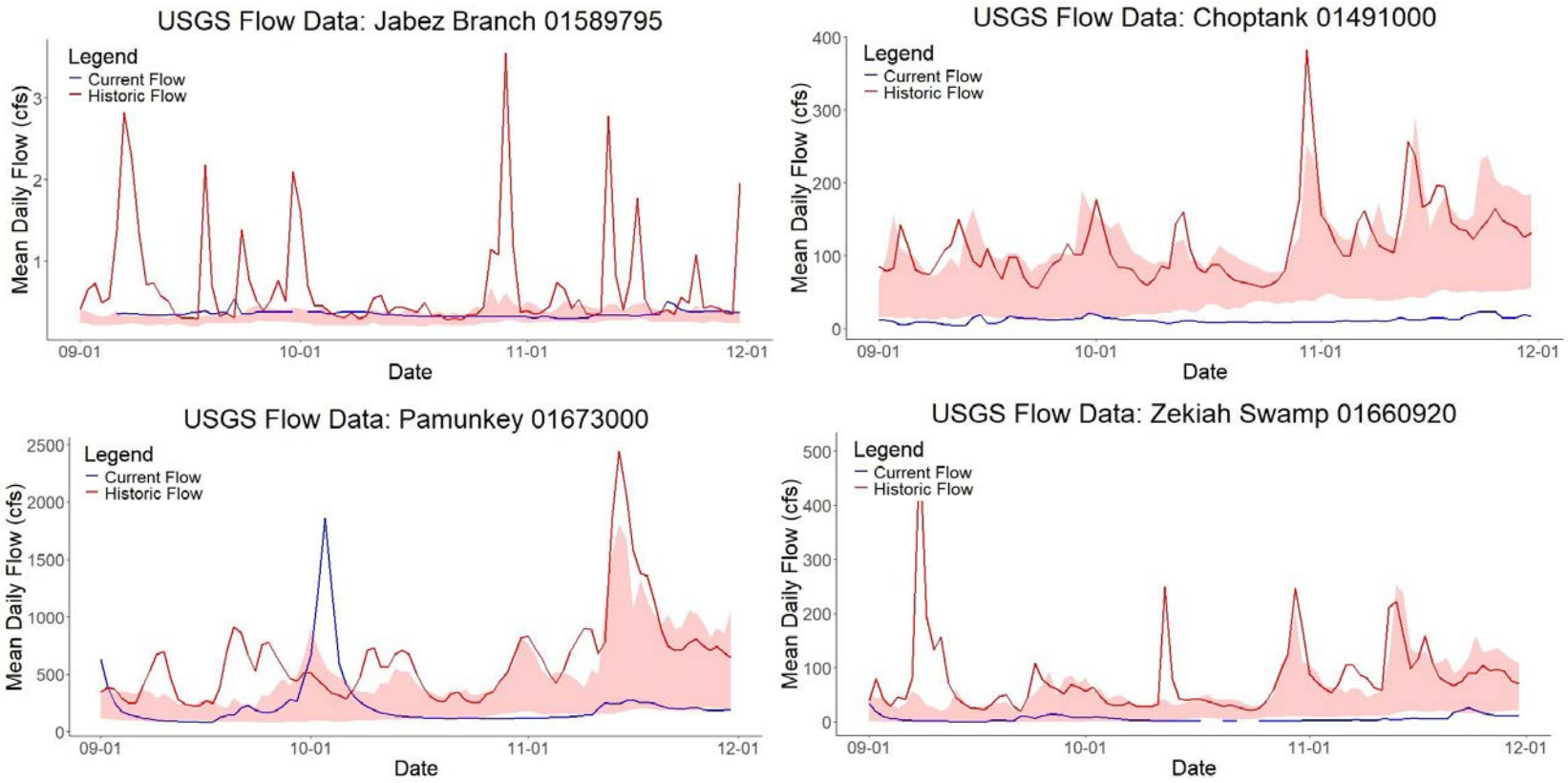

Figure 13. Daily mean streamflow observations (discharge, cubic feet/second) from the upper to lower Chesapeake Bay at U.S. Geological Survey monitoring sites at the (A) Jabez Branch, Severn River (B) Choptank River, (C) Pamunkey River, and (D) Zekiah Swamp, Potomac River throughout fall 2024 relative to the daily averages over this seasonal period from 2000–2023. The red shading indicates the interquartile range (25%-75%), where 50% of the historical values fall.

Dissolved Oxygen

The NOAA Chesapeake Bay Office deployed hypoxia monitoring buoys in three locations (Lower Choptank, Lower Potomac, and Sharps Island) in 2024. All stations consistently measure dissolved oxygen (DO) at 2m, 5m, and 8m depths every 10 minutes. Stations located in deeper water have sensors at additional depths. In this document, daily averages from the hypoxia monitoring buoys are compared to monthly ranges from the long-term monitoring record at the closest sampling location.

DO levels were below the historical mean for much of the fall but remained above a 4mg/L biological threshold at all stations from the surface down to 5 meters. DO measured at or below 8 meters dropped under 4mg/L several times at the Lower Choptank and Lower Potomac stations throughout the fall. DO remained below 4mg/L from September until mid October at 13 and 15 meter depths at the Sharps Island location. Across the Bay, a relatively low amount of hypoxia persisted from September into early October, according to the 2024 Chesapeake Bay Dead Zone Report. Depleted oxygen levels in bottom waters affects benthic/bottom-dwelling organisms. Species that are more mobile avoid these areas.

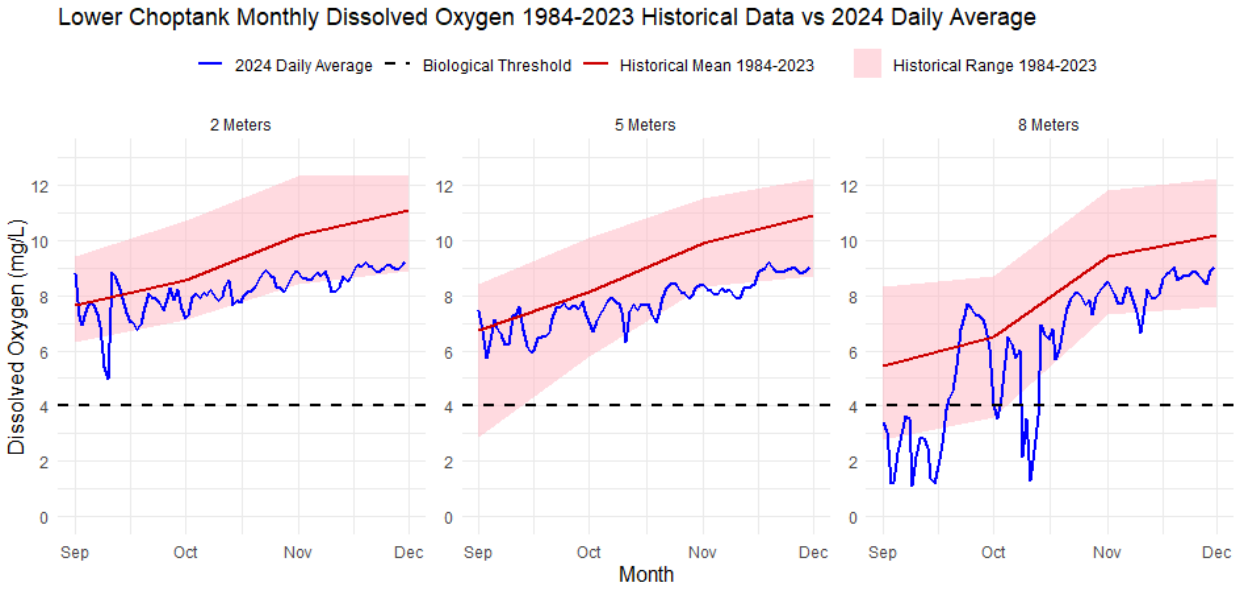

Figure 15. Dissolved oxygen (DO) daily averages at the Lower Choptank buoy for September to November 2024 compared with long-term averages (1984-2023) from the DNR EE2.1 fixed monthly monitoring station. The plots are separated by sensor depth, with the 8-meter plot using historical data from a 7-meter depth due to the absence of 8-meter historical data. The shaded area represents the historical range (minimum to maximum) of DO observations from the EE2.1 station, while the red line represents the historical mean. The 2024 daily average DO is shown by the blue line, and the black dashed line represents the biological threshold, marking the point at which aquatic life may alter its behavior to avoid low DO areas.

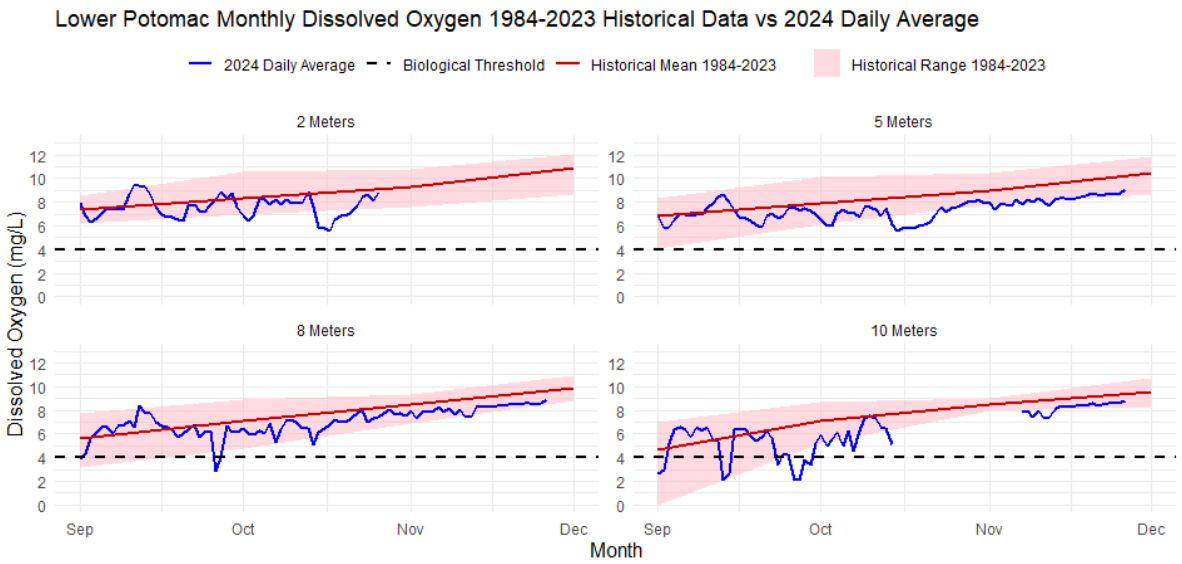

Figure 16. Dissolved oxygen (DO) daily averages at the Lower Potomac buoy for September to November 2024 compared with long-term averages (1984-2023) from the DNR LE2.3 fixed monthly monitoring station. The plots are separated by sensor depth. The shaded area represents the historical range (minimum to maximum) of DO observations from the LE2.3 station, while the red line represents the historical mean. The 2024 daily average DO is shown by the blue line, and the black dashed line represents the biological threshold, marking the point at which aquatic life may alter its behavior to avoid low DO areas.

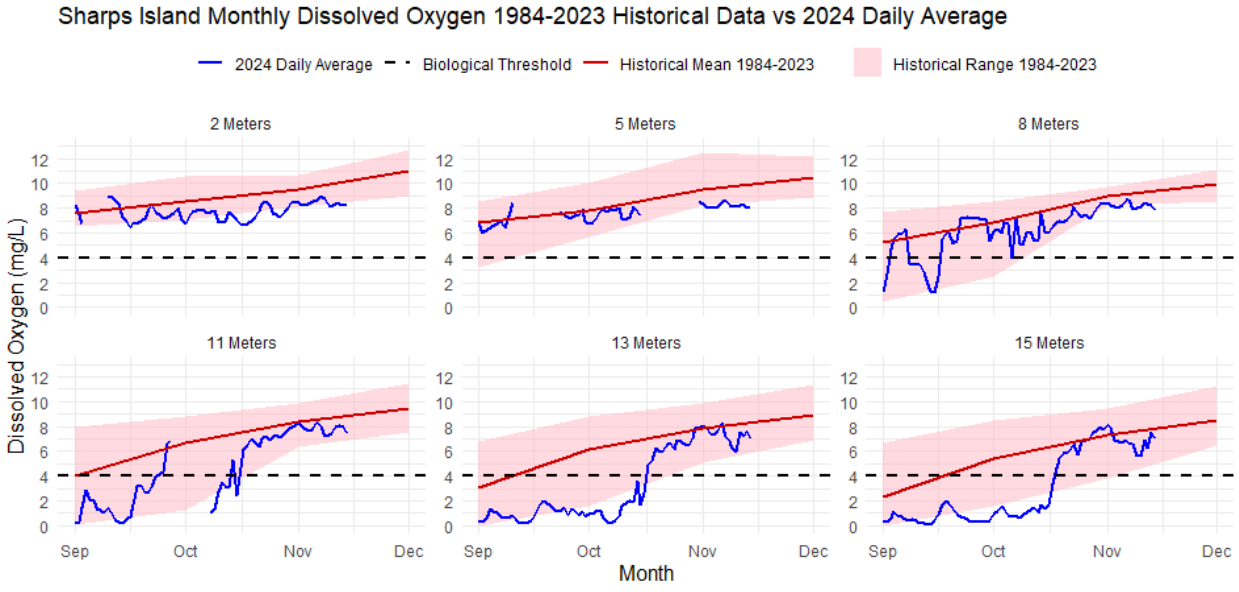

Figure 17. Dissolved oxygen (DO) daily averages at the Sharps Island buoy for September to November 2024 compared with long-term averages (1984-2023) from the DNR CB4.2C fixed monthly monitoring station. The plots are separated by sensor depth. The shaded area represents the historical range (minimum to maximum) of DO observations from the CB4.2C station, while the red line represents the historical mean. The 2024 daily average DO is shown by the blue line, and the black dashed line represents the biological threshold, marking the point at which aquatic life may alter its behavior to avoid low DO areas.

Potential Effects of Anomalous Conditions on Living Resources

Striped Bass
No specific information to report.

Oysters
Lower salinities can negatively affect reproduction and spat sets, but survey data were not published at the time of this report.

Blue Crab
Temperature and salinity conditions most likely had little effect on blue crab; however, low DO extending into the fall at some locations may have affected movement and habitat use.

Fish and invertebrate sampling conducted by the NOAA Chesapeake Bay Office at Poplar Island shows differences in relative abundance of resident and transient species between restored marsh cells and reference sites compared to long-term relative abundances at these sites (Figures 18 and 19). These differences were not analyzed to determine if environmental factors affected the catch of some species over others.

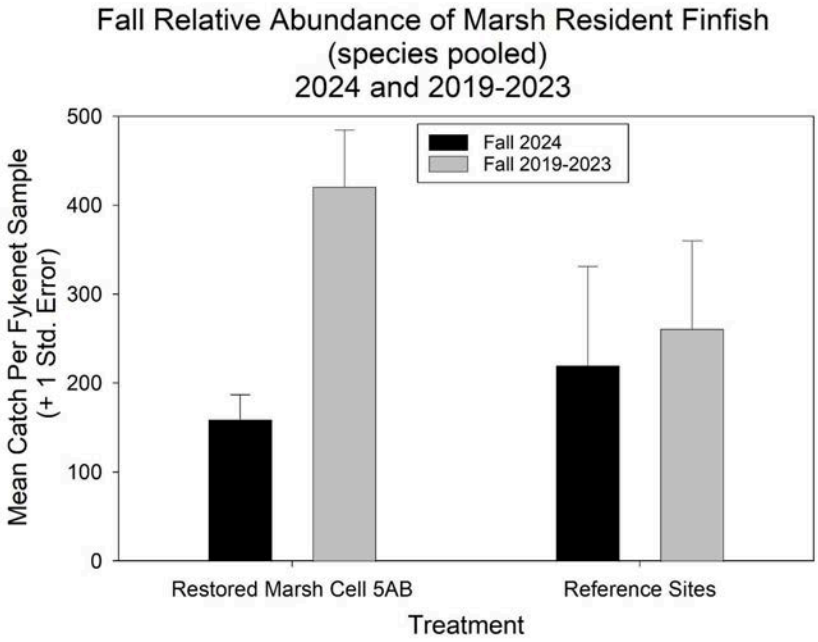

*Figure 18. In fyke net sampling of marsh-resident finfish species at Poplar Island, the mean 2024 relative abundance in restored marsh cell 5AB was significantly lower than the long-term mean (2019-2023) due to elevated numbers of mummichogs (*Fundulus heteroclitus*) collected in fall 2019, 2021, and 2023.*

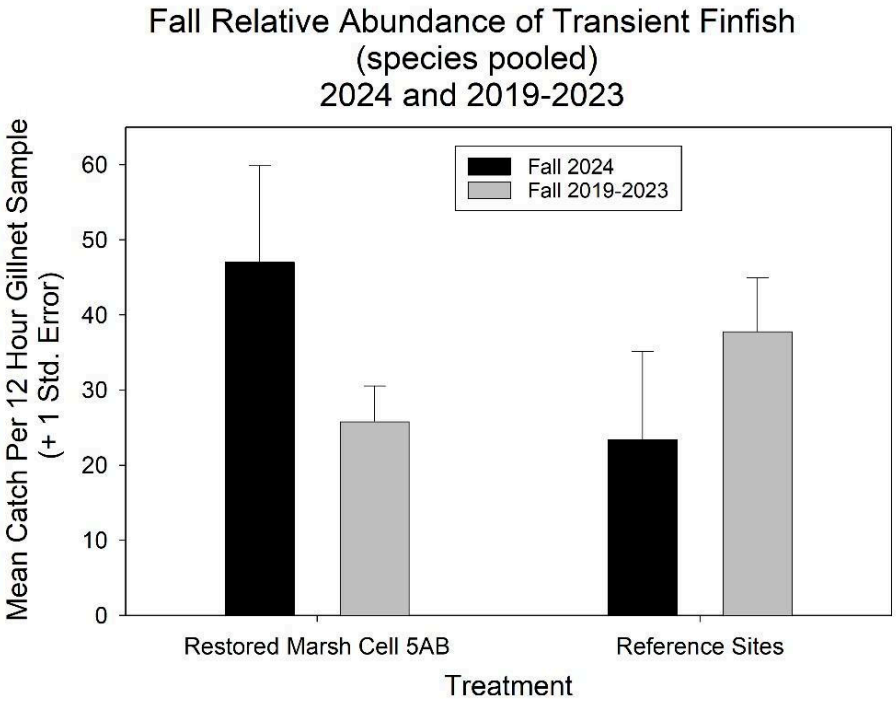

*Figure 19. In gillnet sampling of transient finfish species at Poplar Island, the mean 2024 relative abundance in restored marsh cell 5AB was greater than the long-term mean (2019-2023) due to elevated numbers of gizzard shad (*Dorosoma cepedianum*) and white perch (*Morone americana*) in the collections.*