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

Winter 2023-24 Seasonal Summary

Winter 2023-24 Headlines

- **Water temperature was generally above average. Warmer water can help blue crabs survive over the winter.**
- **Salinity was below average for much of the winter. This can allow invasive blue catfish, which prefer lower salinity, to move into new areas and expand their range.**
- **In some areas of the watershed, precipitation was the highest for December-February since 2007. High rainfall leads to more flow, which can lead to striped bass spawning success.**

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

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

**Summer Flounder was added to this table in fall 2023. It represents an estuarine dependent federally managed species.*

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.

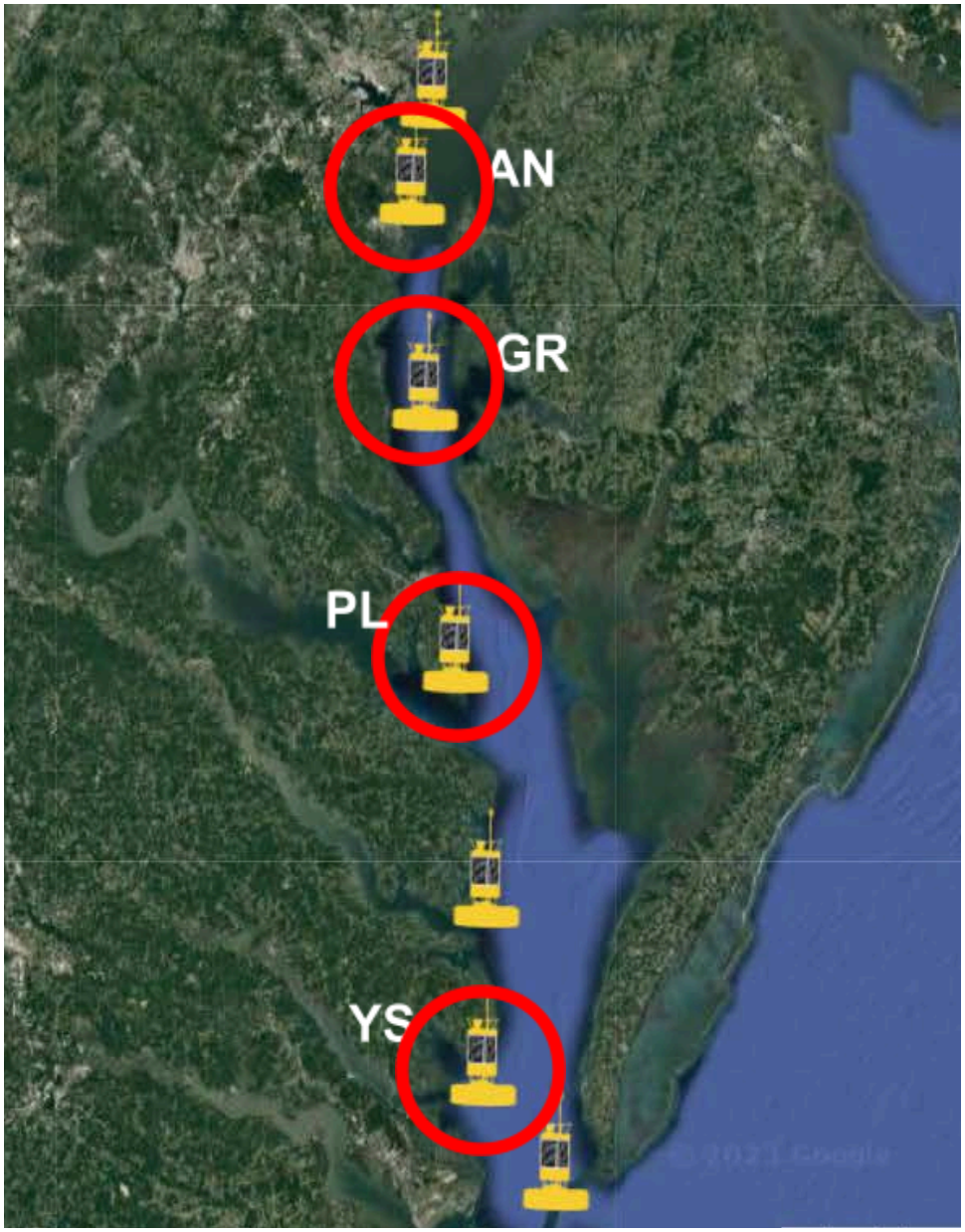

Figure 1. Map of Chesapeake Bay Interpretive Buoy System (CBIBS) observation platforms. The buoys used in these summaries are AN (Annapolis), GR (Gooses Reef), PL (Potomac), and YS (York Spit).

Water Temperature

Sea surface temperature anomalies from NOAA satellites show the entire Chesapeake Bay being warmer this winter compared to the long-term average (2007-2023). Water temperature at all buoy locations was generally warmer than average from mid December until mid January. Water temperatures then cooled to below average by late January. This was followed by a warming pattern from the beginning of February to March for the Annapolis, Gooses Reef, and Potomac CBIBS buoys. Water temperature at the York Spit buoy was below average from mid February to March.

Warmer water temperatures in the winter may reduce overwintering mortality for blue crabs. Warmer and wetter conditions can affect the timing and spatial/seaward extent of plankton blooms (Harding et al, 2016). Warmer waters could cause these blooms to occur earlier, and wetter conditions could cause blooms to extend further toward the mouth of the Bay.

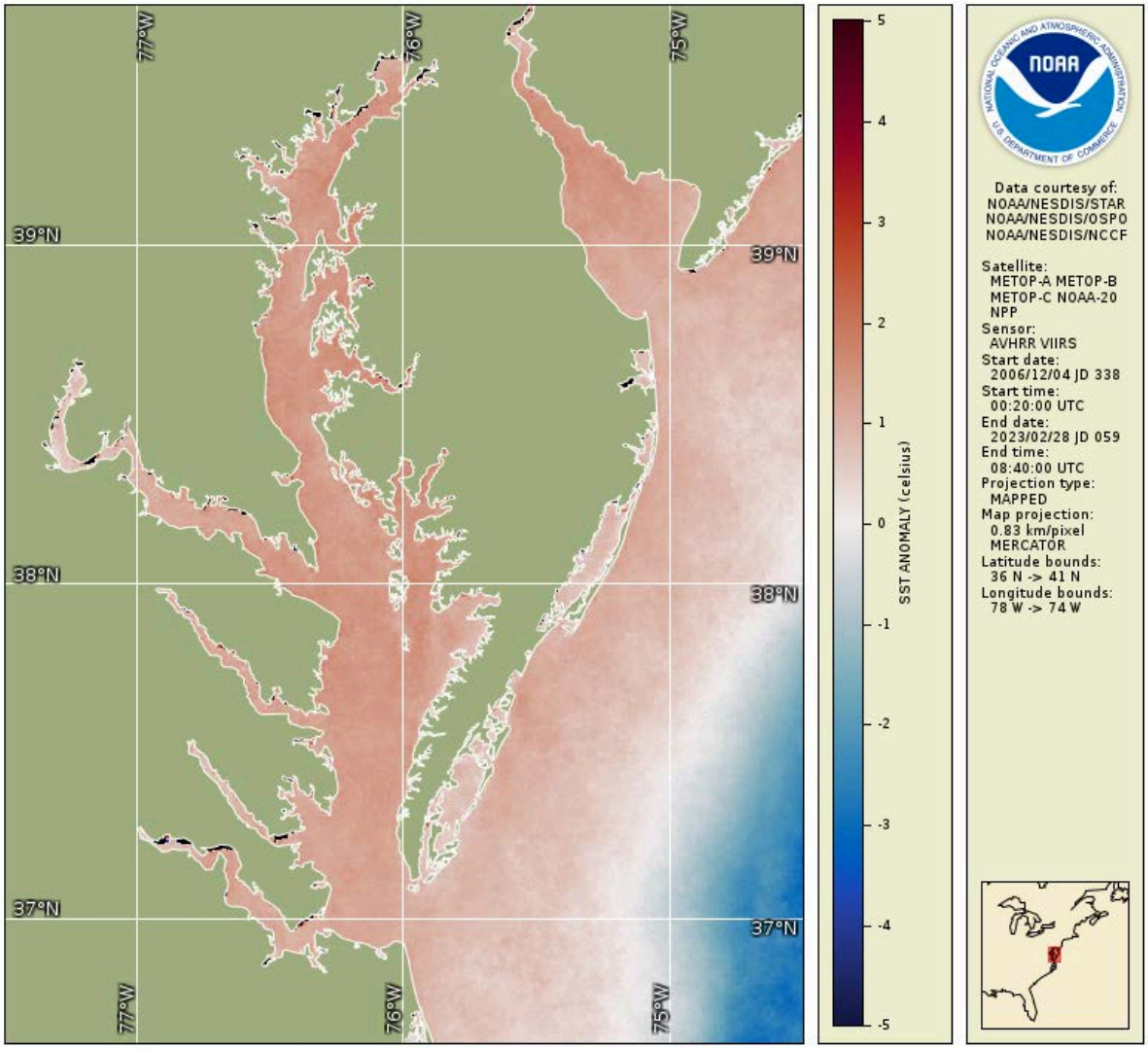

Figure 2. Sea surface temperature (SST) anomalies observed by NOAA satellites December 2023–February 2024 relative to the average of this seasonal period 2007–2023.

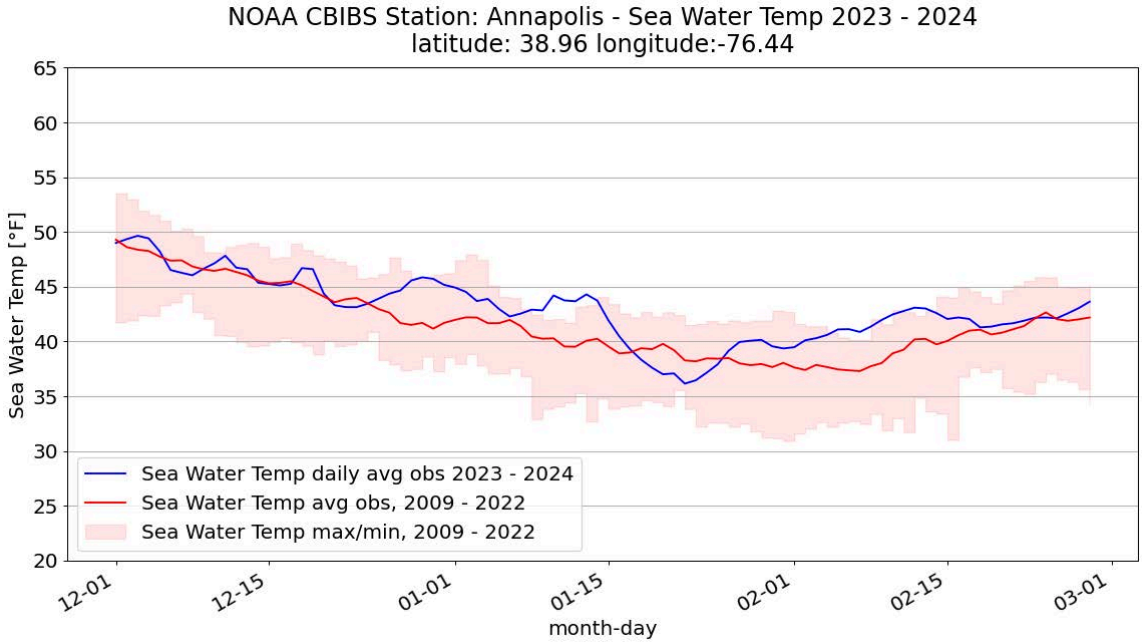

Figure 3. Surface water temperatures at the Annapolis buoy December 2023–February 2024 relative to the long-term average (2009–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

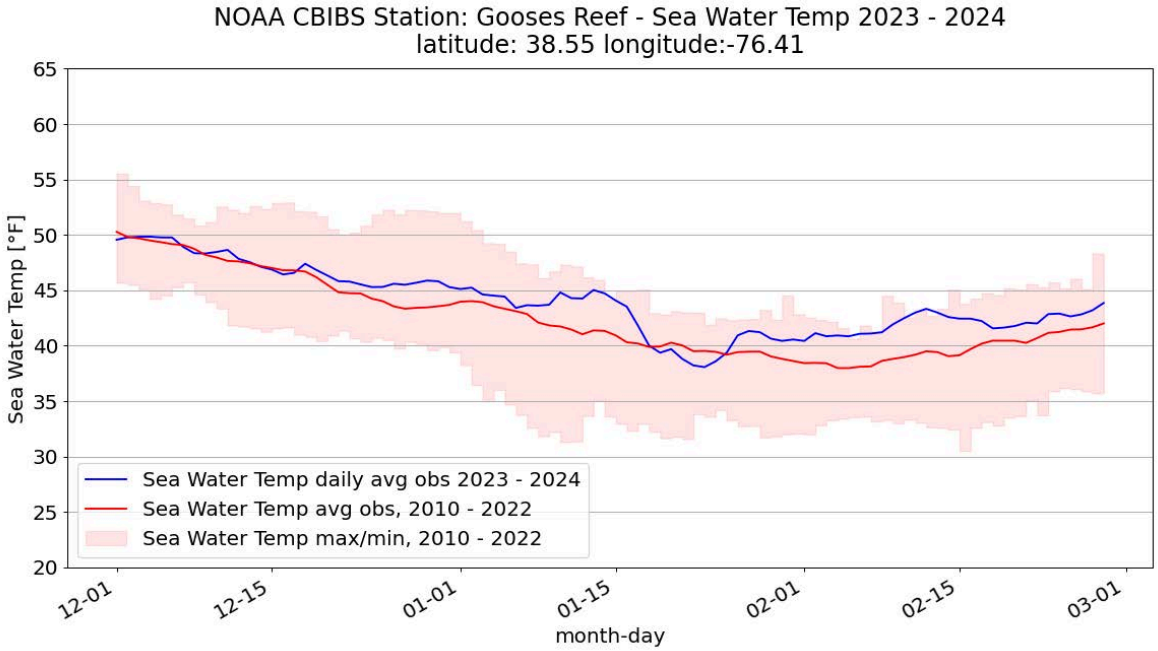

Figure 4. Surface water temperatures at the Gooses Reef buoy December 2023–February 2024 relative to the long-term average (2010–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

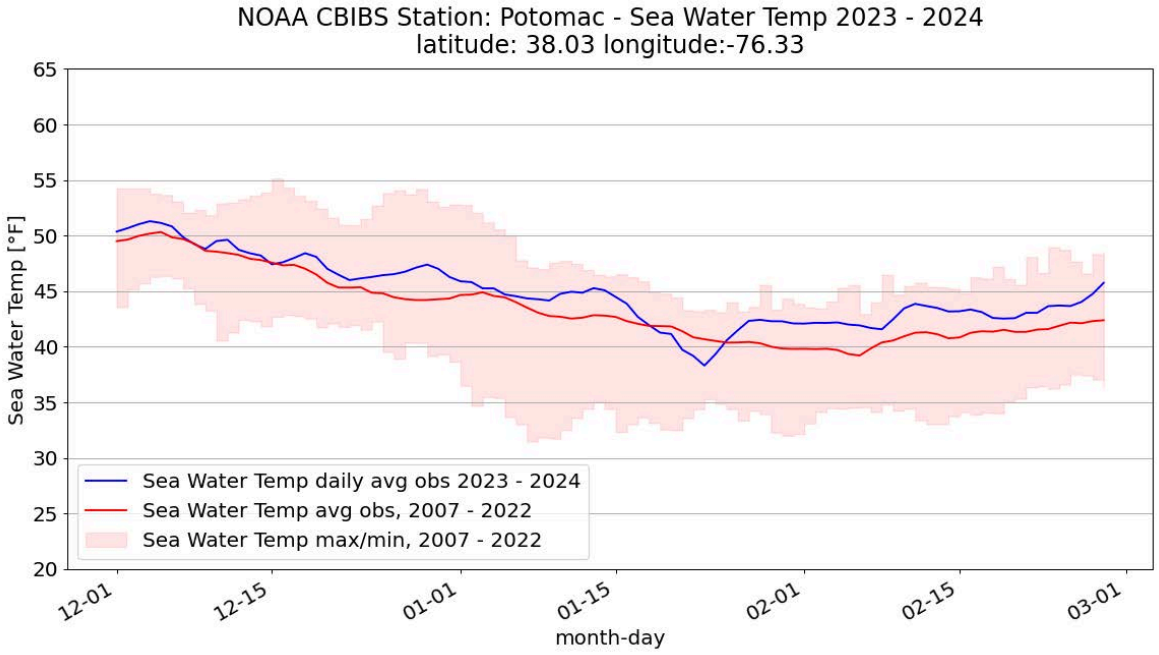

Figure 5. Surface water temperatures at the Potomac buoy December 2023–February 2024 relative to the long-term average (2007–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

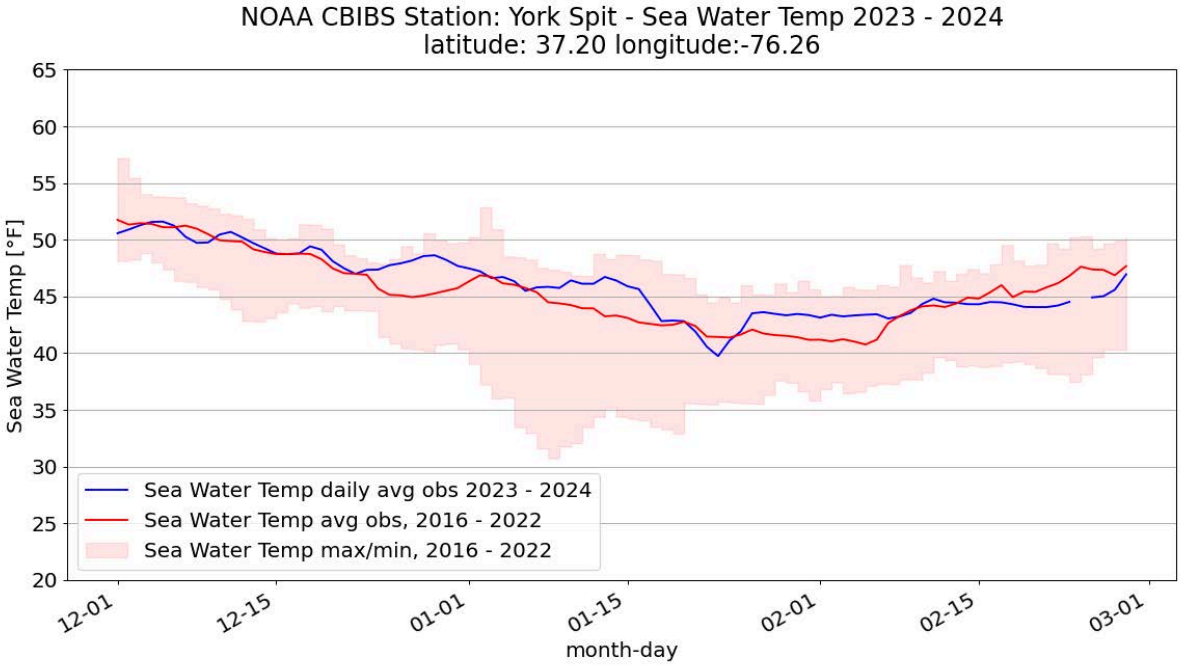

Figure 6. Surface water temperatures at the York Spit buoy December 2023–February 2024 relative to the long-term average (2016–2023). The shaded area represents the full range of observations (minimum to maximum) over the time period.

Salinity

Salinity observations at the Annapolis, Gooses Reef, Potomac, and York Spit CBIBS buoys decreased to below average over the winter. The most pronounced declines occurred at Annapolis and Gooses Reef in mid December to early January (Figures 7, 8). This was followed by an increase through mid January and another decline in mid January that persisted until mid February. At the Potomac and York Spit buoys, salinity in general remained above average until January and then declined to below average in mid January (Figures 9, 10). This decline persisted through March. The declines in salinity were likely driven by higher-than-average precipitation in Maryland and Virginia relative to the long-term mean for December to February (Figures 11, 12).

Salinity below about 14 practical salinity units (PSU) is tolerable by invasive blue catfish. When salinity drops below this value, as seen at the Annapolis, Gooses Reef, and Potomac CBIBS buoys, blue catfish are able to move into these areas and expand their range for feeding. This could impact their prey sources.

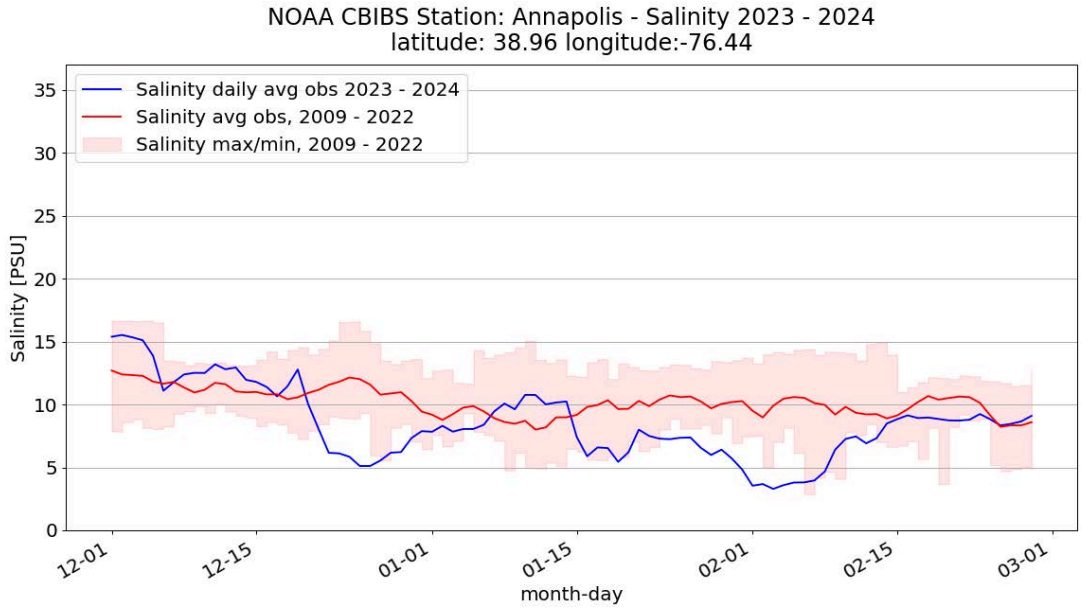

Figure 7. Salinity observations at the Annapolis CBIBS buoy December 2023–February 2024 (blue line) relative to the average at each buoy over this seasonal period 2009–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

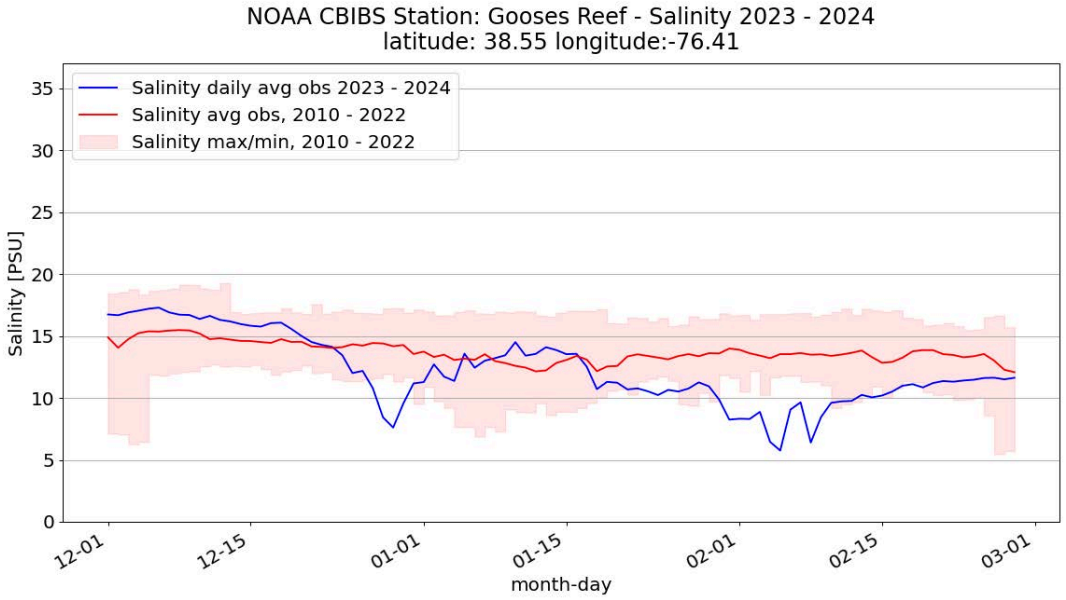

Figure 8. Salinity observations at the Gooses Reef CBIBS buoy December 2023–February 2024 (blue line) relative to the average at each buoy over this seasonal period 2010–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

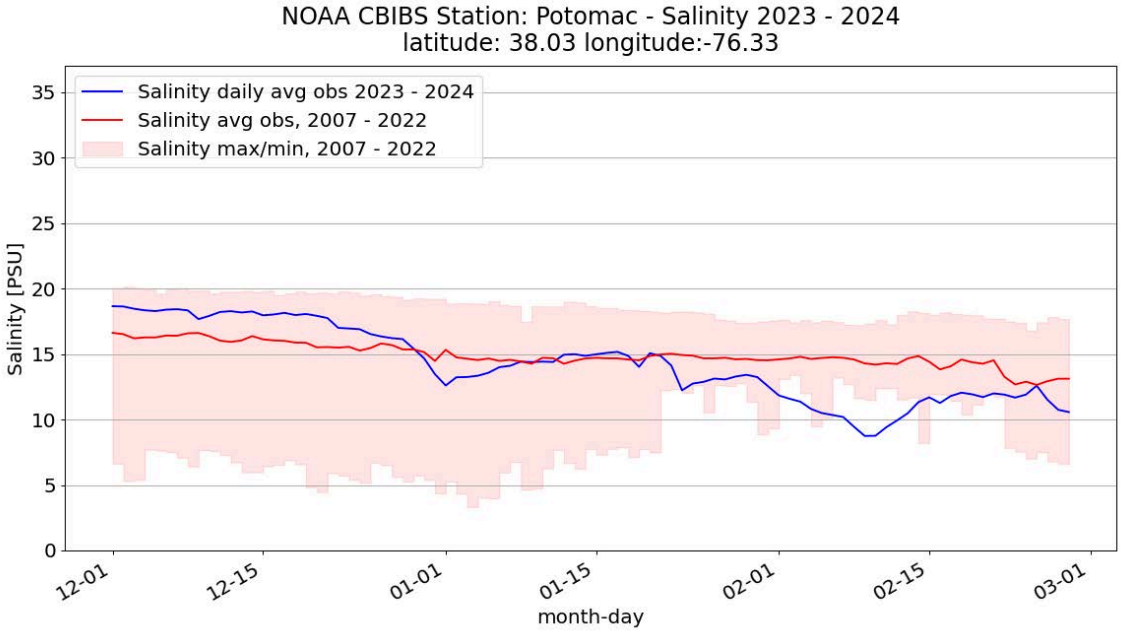

Figure 9. Salinity observations at the Potomac CBIBS buoy December 2023–February 2024 (blue line) relative to the average at each buoy over this seasonal period 2007–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

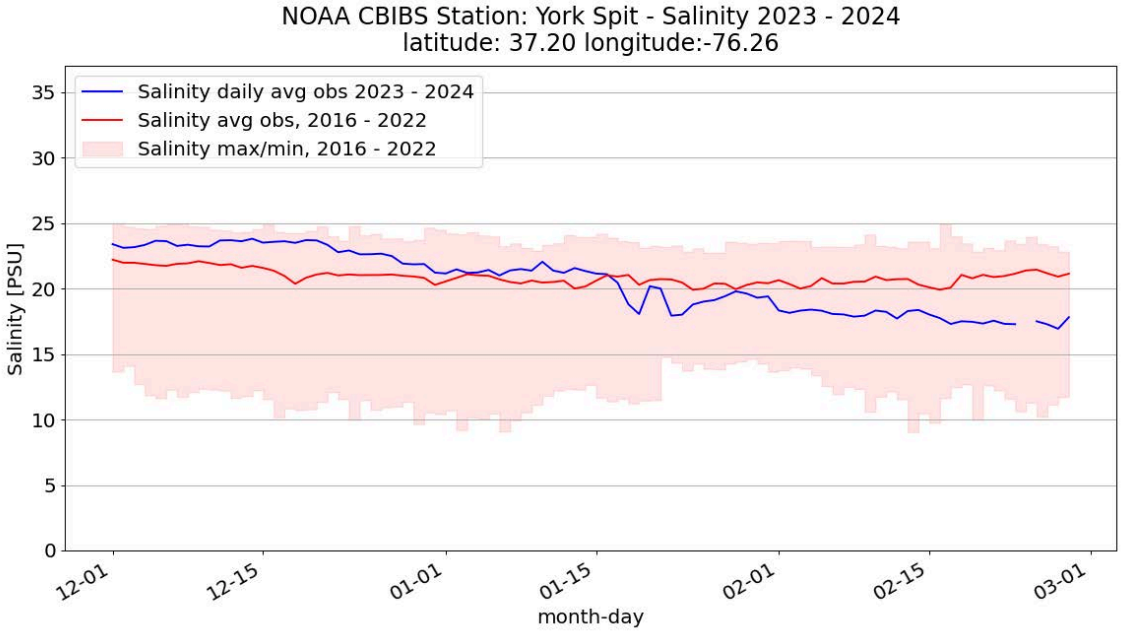

Figure 10. Salinity observations at the York Spit CBIBS buoy December 2023–February 2024 (blue line) relative to the average at each buoy over this seasonal period 2016–2023 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

Precipitation and Freshwater Flow

December through February were wetter than average for Maryland and Virginia according to the precipitation data (Figures 11, 12). According to the precipitation data, southern Maryland had its highest, and Tidewater Virginia had its third highest, levels of rainfall for December–February since 2007. This corresponds to peaks in flow above the historic flow for all selected USGS stations (Figure 13). Higher precipitation and corresponding flow increase habitat for spawning fish such as striped bass. Higher rainfall and flow also reduce salinity as observed by the buoys above. If flows stay high and temperatures increase gradually into spring, striped bass may benefit.

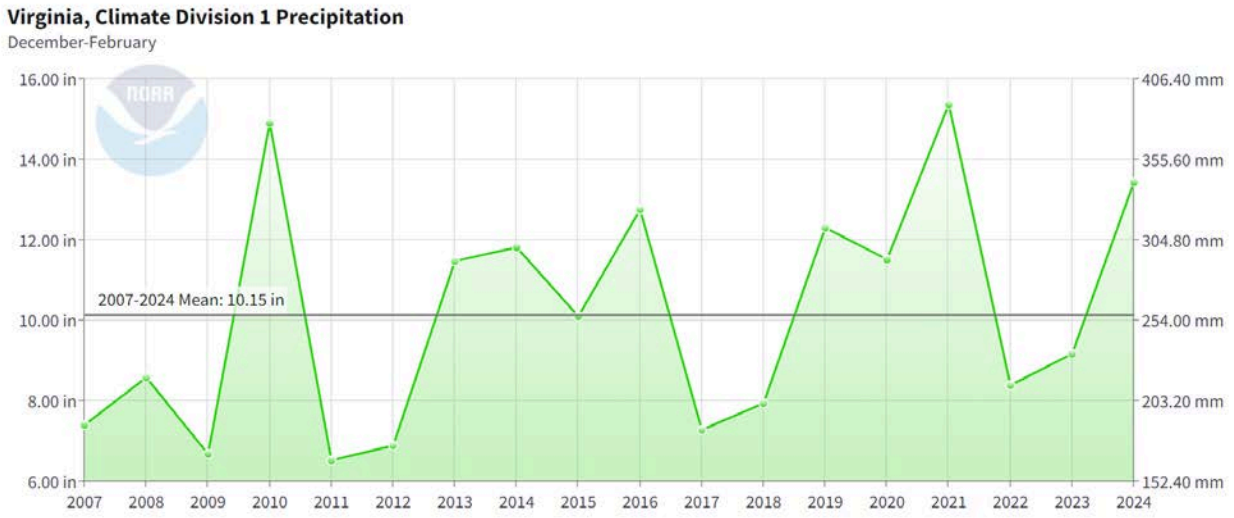

Figure 11. Precipitation data from 2007–2024 for December–February for Tidewater Virginia. Data from NOAA Centers for Environmental Information.

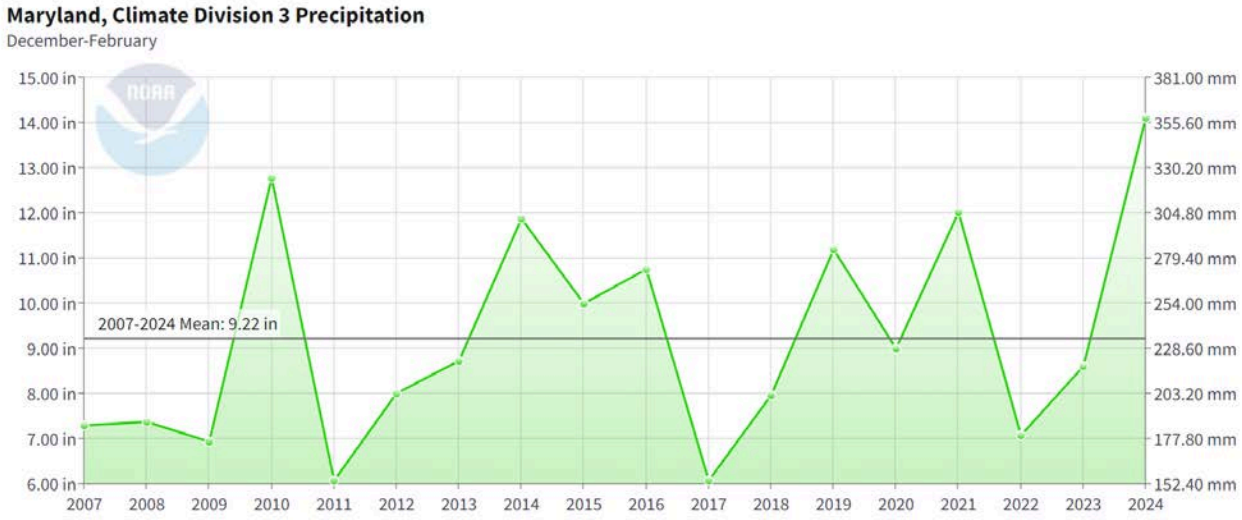

Figure 12. Precipitation data from 2007–2024 for December–February for southern Maryland. Data from NOAA Centers for Environmental Information.

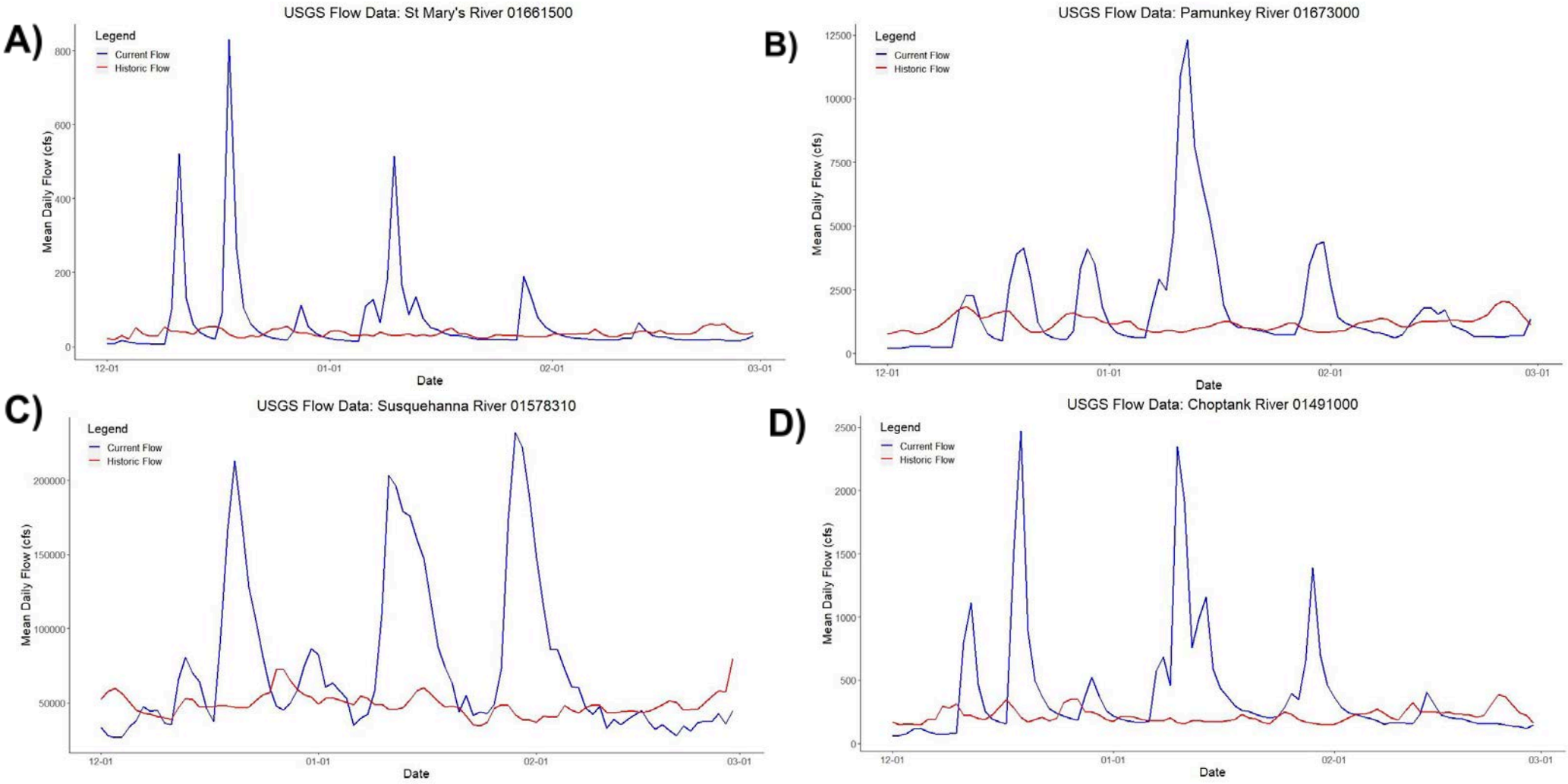

Figure 13. Daily mean streamflow observations (discharge, cubic feet/second) at USGS monitoring sites at the (A) St. Mary's, (B) Pamunkey, (C) Susquehanna (D), and Choptank rivers throughout winter 2023-2024 relative to the daily averages over this seasonal period from 2001–2022.

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