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

***Winter 2022-2023 Seasonal Summary***

## Winter 2022-2023 Headlines

- **Warmer water temperatures may reduce blue crab overwintering mortality.**
- **High salinities in the lower Bay suggest good winter habitat conditions for bay anchovy.**

### Purpose

The 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. 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; Figure 1) and the NOAA CoastWatch Program. CBIBS buoys are located throughout the Bay and provide real-time water quality information such as water temperature and salinity (in addition to meteorological and other data). The NOAA CoastWatch Program uses satellite data to provide observations of sea surface temperature anomalies throughout the Bay. NCBO uses these seasonal summaries to develop an annual synthesis for inclusion in the Mid-Atlantic State of the Ecosystem Report. This report is developed by the Northeast Fisheries Science Center and presented to the Mid-Atlantic Fishery Management Council each year.

### Water Temperature

Sea surface temperature (SST) anomalies observed by NOAA CoastWatch satellites indicate above-average water temperatures throughout the Chesapeake Bay in winter 2022-2023 (Figure 2). Observations from four CBIBS buoys provide insight into the finer-scale temperature fluctuations throughout the season (Figure 3). All four buoys across the Bay show average to above-average water temperatures throughout most of December before experiencing a notable decline in late December to early January. Temperatures increased again in early January and remained above average for the rest of the season.

The NOAA National Weather Service (NWS) PREcipitation Summary and Temperature Observations (PRESTO) report for December 2022 indicated record-low air temperatures on December 24 as an arctic outbreak passed through the region, causing the notable decline in water temperatures. In January and February 2023, however, a lack of cold air movement resulted in record-high air temperatures and the above-average water temperatures observed by NOAA later in the season.

Winter water temperatures affect the overwintering mortality rate of blue crabs (*Callinectes sapidus*) in the Chesapeake Bay. Warmer temperatures, like those observed throughout the Bay in winter 2022-2023, typically favor blue crabs by maintaining a low (<3%) overwintering mortality rate (Rome et al. 2005, Bauer & Miller 2010a,b, Hines et al. 2010). Although the overall warm temperatures throughout the season may suggest a lower overwintering mortality rate for blue crabs, the cold snap in late December-early January may have caused a significant mortality event. The effect of extreme short-term changes in environmental conditions (e.g., cold snaps, heat waves) on blue crab mortality has not been

closely examined, but sudden drops in temperature have been associated with mortality events in previous years. Blue crab overwintering mortality rates and abundance estimates will be determined in the spring with the completion of the 2023 Winter Dredge Survey. Temporally explicit overwintering mortality estimates may provide insight into the effect of the cold snap on the blue crab population.

Salinity

Salinity observations from the NOAA CBIBS buoys indicated above-average salinity throughout winter 2022-2023, particularly in the lower Chesapeake Bay (i.e., Potomac, York Spit; Figure 4). At the Annapolis and Gooses Reef buoys in the upper Bay, salinity was primarily above average throughout December and then fluctuated around the average for the remainder of the season.

Salinity is one of several key environmental factors that determine suitable winter habitat for bay anchovy (*Anchoa mitchilli*), an ecologically important forage species in the Chesapeake Bay. Surface salinities greater than 23.7 psu characterize good winter habitat for bay anchovy in the lower Bay (Fabrizio et al. 2020). The above-average salinities observed at the Potomac and York Spit buoys may indicate good habitat conditions, at least in terms of salinity, for bay anchovy. Availability of suitable winter habitat is significantly correlated with bay anchovy abundance such that good winter conditions could result in higher bay anchovy abundance and, consequently, more food for predators such as striped bass (*Morone saxatilis*). Although salinity was above average in winter 2022-2023, other environmental factors (e.g., dissolved oxygen concentrations, bottom sediment composition) are also important indicators of suitable habitat. It is unclear which drivers are the most influential for bay anchovy abundance.

Freshwater Flow

River discharge data collected by the U.S. Geological Survey (USGS) and precipitation information in the NWS PRESTO reports corroborate the CBIBS salinity observations in the Chesapeake Bay in winter 2022-2023 (Figure 5). Streamflow was predominantly below average throughout the season, with several peaks corresponding to high-precipitation events in mid-late December and one in late January. The below-average freshwater flows into the Bay, and the consequent above-average salinities, likely provided good habitat conditions for bay anchovy in winter 2022-2023.

Figures

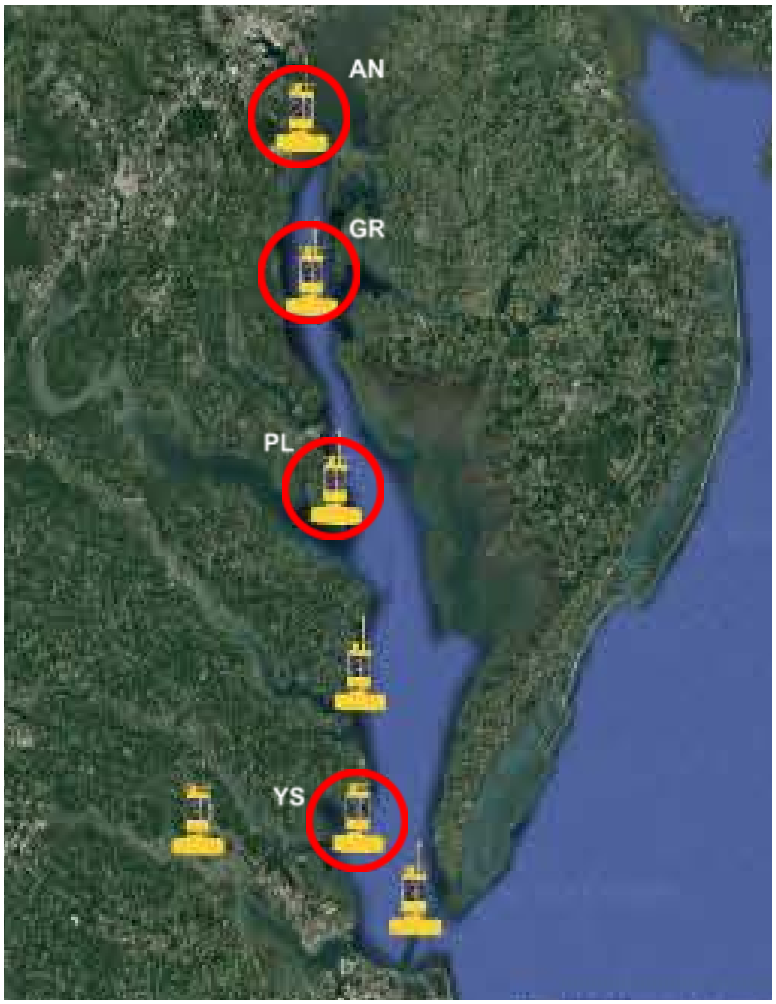


Figure 1. Map of active Chesapeake Bay Interpretive Buoy System (CBIBS) observation platforms. The buoys used in these summaries are AN (Annapolis), GR (Gooses Reef), PL (Potomac), and YS (York Spit).

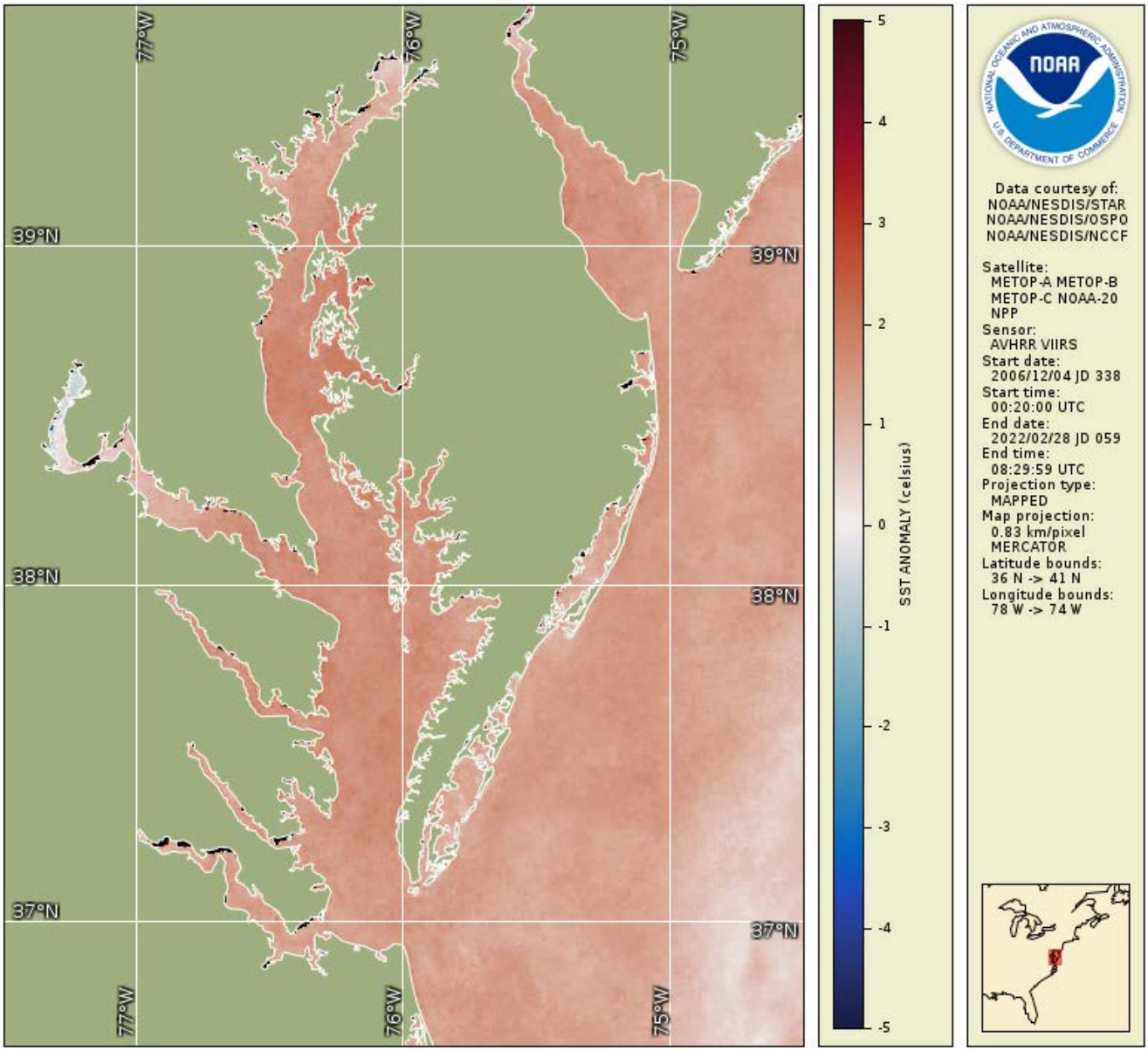


Figure 2. Sea surface temperature (SST) anomalies observed by NOAA and European satellites from December 2022 to February 2023 relative to the average of this seasonal period from 2006 to 2022.

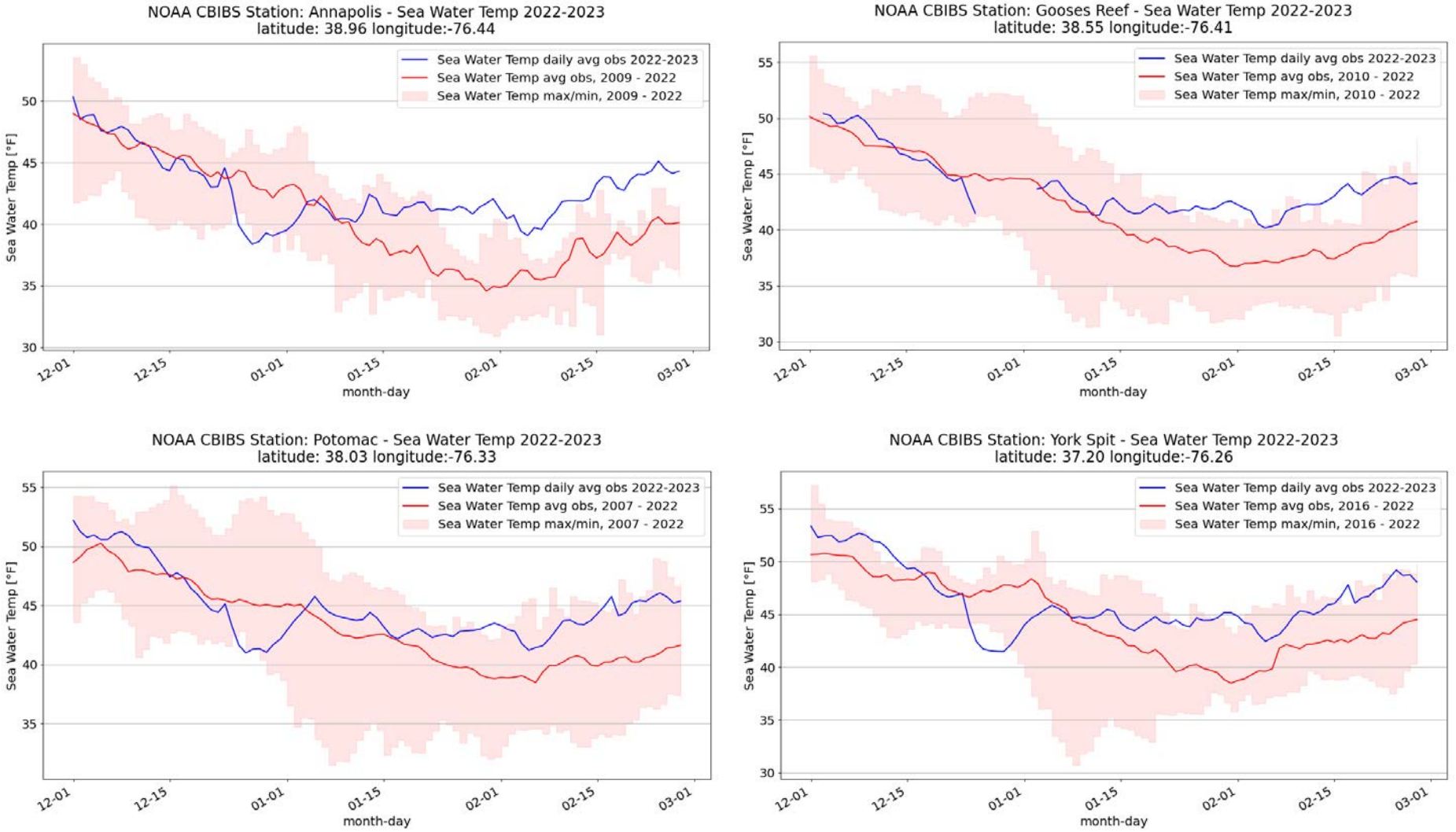


Figure 3. Water temperature observations at four NOAA CBIBS buoys (Annapolis, Gooses Reef, Potomac, York Spit) from December 2022 to February 2023 (blue line) relative to the average at each buoy over this seasonal period from 2007 to 2022 (red line). The shaded area represents the range of observations (minimum to maximum) over the time period.

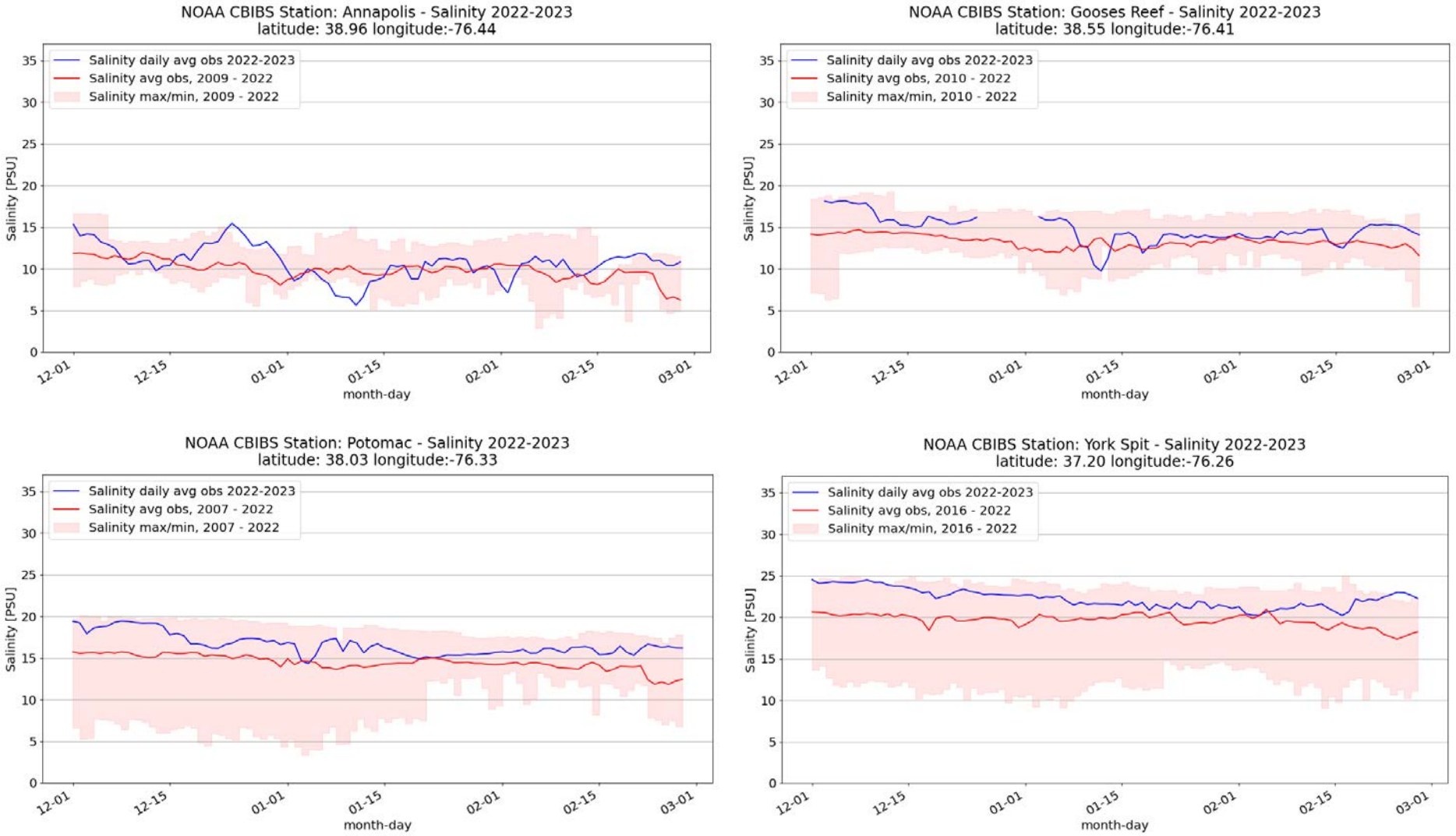


Figure 4. Salinity observations at four NOAA CBIBS buoys (Annapolis, Gooses Reef, Potomac, York Spit) from December 2022 to February 2023 (blue line) relative to the average at each buoy over this seasonal period from 2007 to 2022 (red line). The shaded area represents the range of observations (minimum to maximum) over the time period.

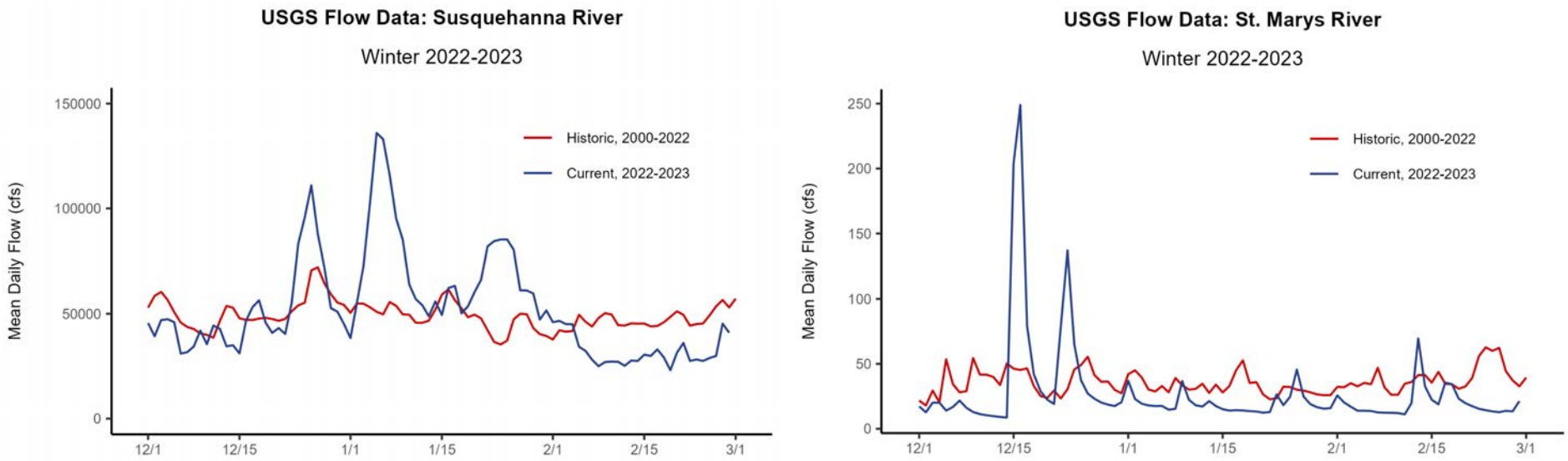


Figure 5. Daily mean streamflow observations (discharge, cubic feet/second) at USGS monitoring sites at the Susquehanna and St. Marys rivers throughout winter 2022-2023 relative to the daily averages over this seasonal period from 2000 to 2022.

Literature Cited

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