



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

Spring 2023 Seasonal Summary

Spring 2023 Headlines

- **Early warming and low freshwater flows suggest less favorable conditions for striped bass recruitment in 2023.**
- **Above-average temperatures in some areas and above-average salinities may benefit oyster growth and recruitment.**

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

Following a warmer-than-average winter, sea surface temperature (SST) anomalies observed by NOAA CoastWatch satellites indicate that the Chesapeake Bay experienced an average spring relative to the previous two decades overall, but with some slightly higher temperatures in the mid to upper Bay (Figure 2). Observations from the CBIBS buoys show similar trends but at a finer temporal scale (Figure 3). All four buoys across the Bay observed average water temperatures throughout the season, except for warmer periods in early March and mid-late April. These above-average temperatures were particularly pronounced at the mid to upper Bay buoys (i.e., AN, GR, PL) as corroborated by the satellite imagery. The NOAA National Weather Service (NWS) PREcipitation Summary and Temperature Observations (PRESTO) reports for [March](#) and [April](#) 2023 also indicated above-average air temperatures for the Washington, D.C., and Baltimore, Maryland, area.

Environmental factors such as water temperature often play an important role in regulating biological and ecological processes in aquatic ecosystems (e.g., spawning, growth, migration). In the Chesapeake Bay, mature striped bass (*Morone saxatilis*) typically spawn when water temperatures are between about 55°F and 68°F (Secor & Houde 1995). These temperature thresholds likely maximize larval growth, survival, and recruitment both directly and indirectly through zooplankton prey availability (Secor & Houde 1995, Martino & Houde 2010, Millette et al. 2019). Although water temperatures in spring 2023 were relatively average overall, the warmer period in April may have initiated striped bass spawning earlier than usual (Figures 3B, 3C). Changes in spawning timing have been linked to increasing water



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temperatures that may negatively affect striped bass recruitment (Peer & Miller 2014), but other environmental factors such as freshwater flow also play an important role.

Warming spring temperatures also initiate growth and spawning of eastern oysters (*Crassostrea virginica*) in the Bay. When spring water temperatures reach 50°F, oysters typically start to feed and grow, and at 60°F, spawning begins (Shumway 1996). Although the timing of the oyster feeding and growth threshold was similar in 2023 to the previous decade's average, the warm period in April may have initiated early spawning for oysters as well (Figure 3). Early spawning could suggest a longer growing season for oysters if conditions remain suitable through the season.

Salinity

Salinity observations from the NOAA CBIBS buoys revealed continued above-average salinities throughout spring 2023, particularly in the lower Bay (i.e., PL, YS; Figure 4). At the Annapolis (AN) and Gooses Reef (GR) buoys, the majority of the season saw above-average salinities, but there were some periods in April and early May when salinity fell to average levels.

Salinity is another important environmental factor that influences oyster recruitment and survival in the Chesapeake Bay, with increased salinity resulting in higher juvenile abundance (Kimmel et al. 2014). The above-average salinities throughout the Bay in spring 2023 were likely conducive to oyster growth, recruitment, and survival throughout the season. However, prevalence and infection intensities of oyster disease (i.e., Dermo, MSX) also increase as salinity increases. At 15 ppt, MSX becomes infectious and Dermo infections become intense and fatal; at 20 ppt, MSX mortality increases significantly (VIMS 1996). In spring 2023, salinities were at an all-time high near the Potomac River, surpassing 15 ppt, which could lead to higher localized oyster mortality as a result of infection (Figure 4C).

Freshwater Flow

River flow 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 spring 2023 (Figure 5). This spring was one of the driest on record and resulted in below-average flow throughout the season. Notable peaks in flow at the Susquehanna and Patuxent rivers occurring in late April-early May correspond to heavy rains experienced throughout the region at the end of April.

In addition to water temperature, survival of early life stages of striped bass is dependent upon high flows that trap zooplankton prey in the estuarine turbidity maximum, providing optimal feeding opportunities for the larvae (Martino & Houde 2010, Millette et al. 2019, North & Houde 2003). The below-average flows throughout spring 2023 could suggest less suitable conditions for striped bass recruitment in the Chesapeake Bay.



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Figures

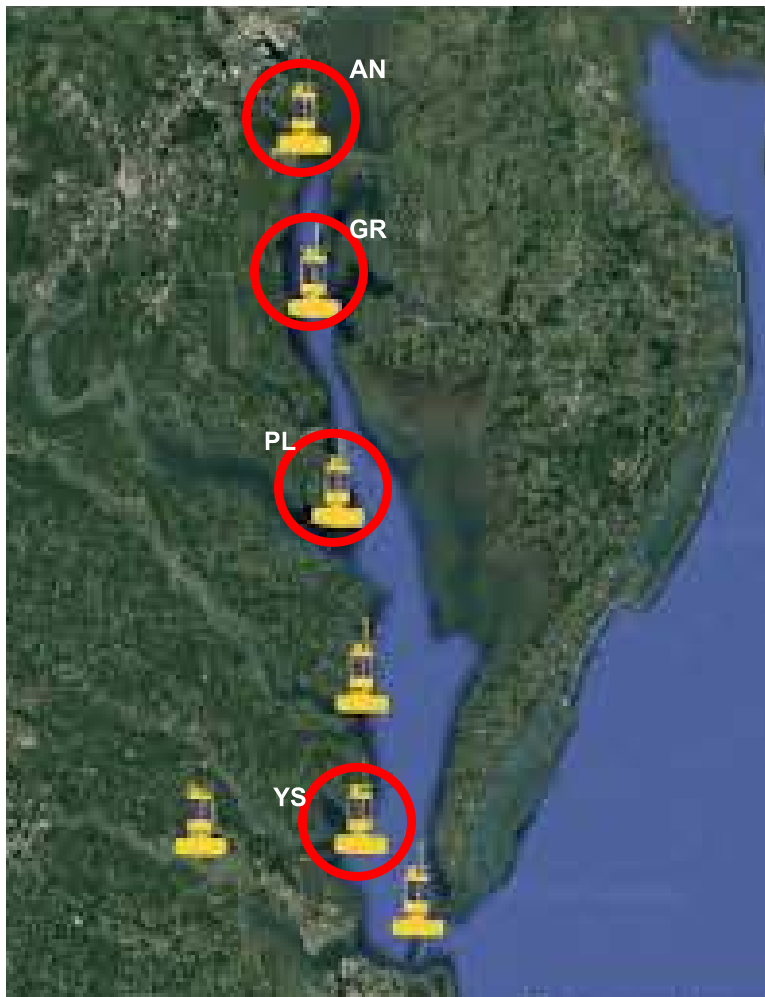


Figure 1. Map of active Chesapeake Bay Interpretive Buoy System (CBIBS) observation platforms. The buoys used in these summaries are AN (Annapolis), GR (Gooses Reef), PL (Potomac), and YS (York Spit).



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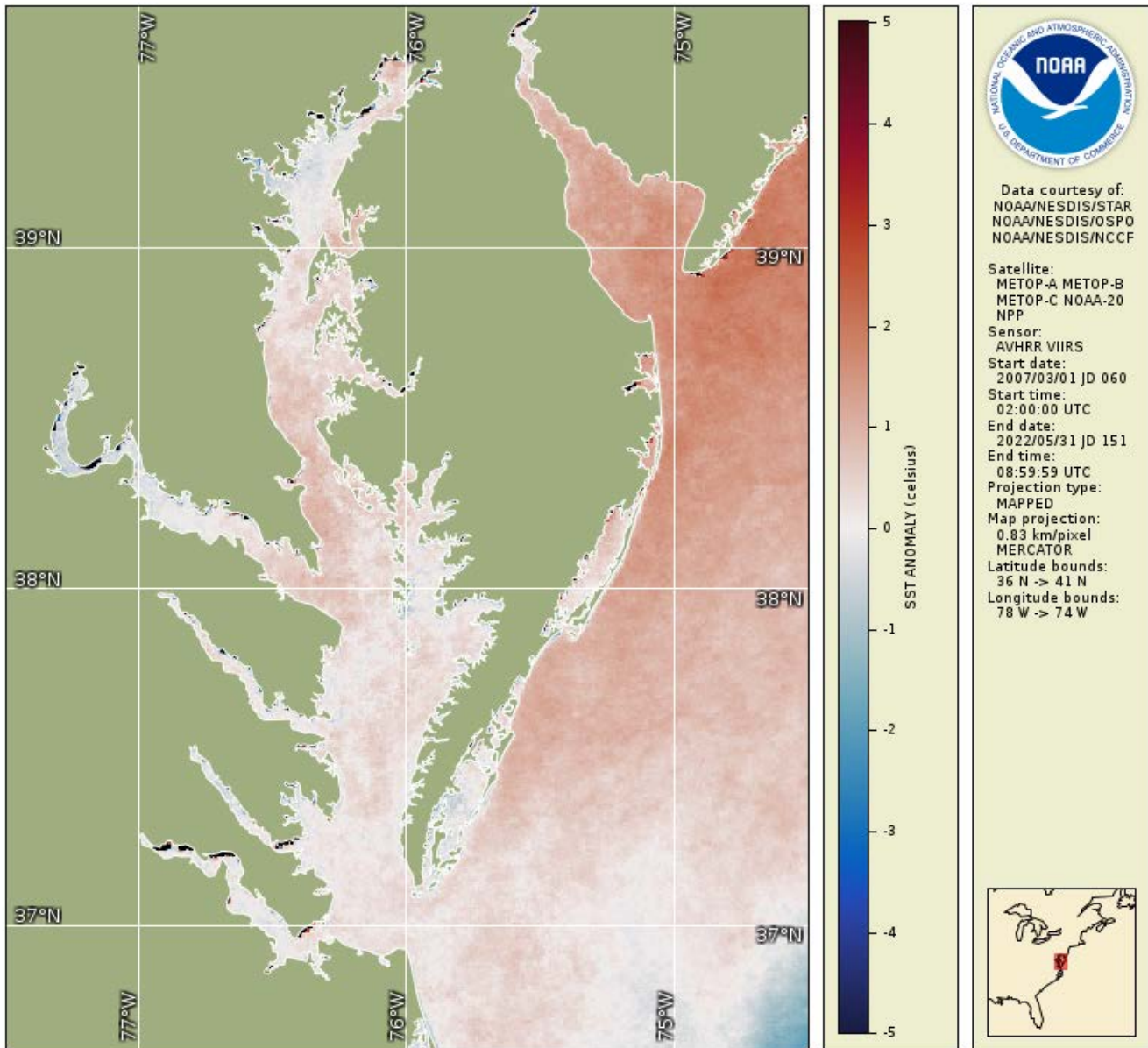


Figure 2. Sea surface temperature (SST) anomalies observed by NOAA and European satellites from March to May 2023 relative to the average of this seasonal period from 2007 to 2022.



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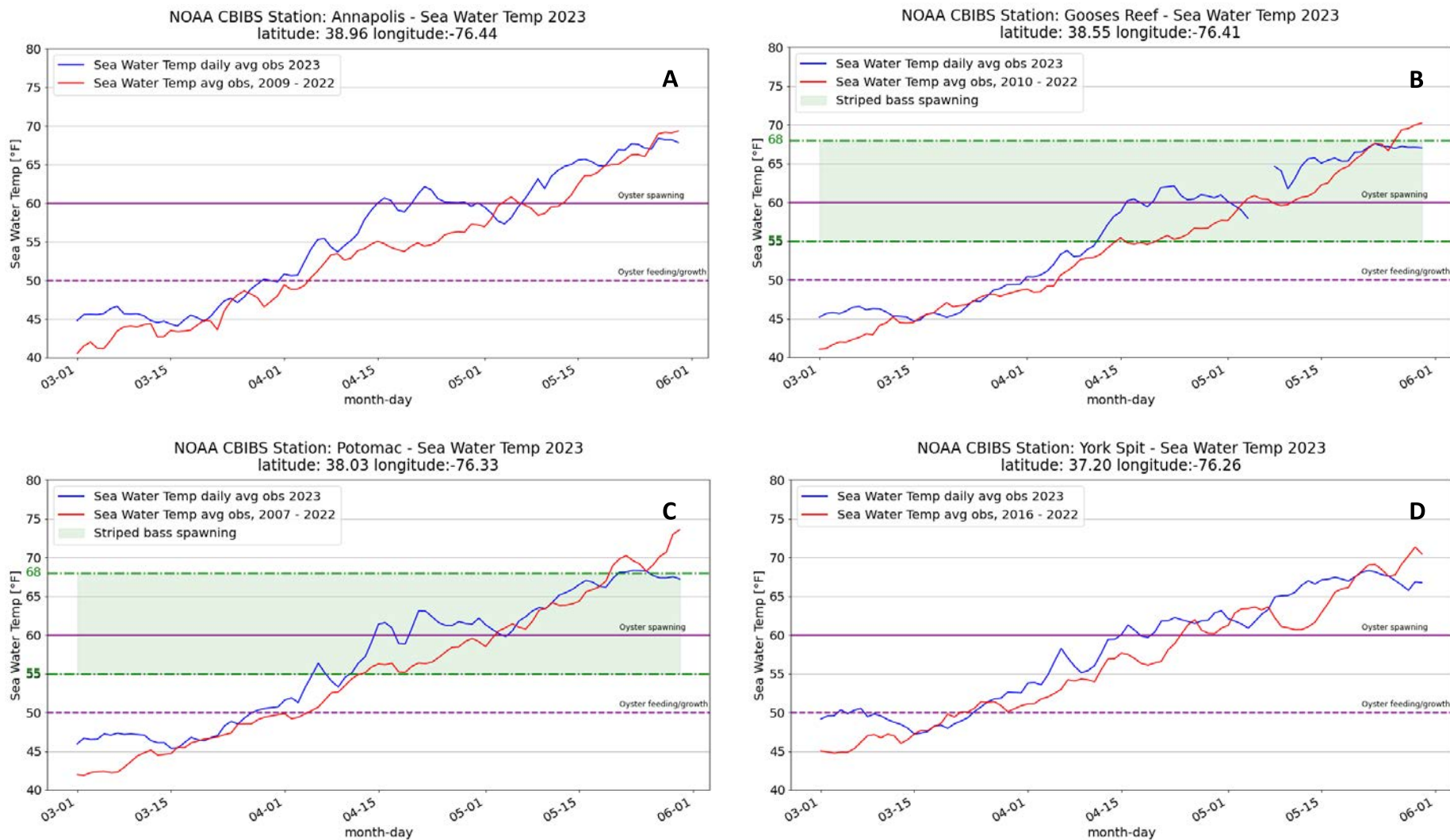


Figure 3. Water temperature observations at four NOAA CBIBS buoys (Annapolis, Gooses Reef, Potomac, York Spit) from March to May 2023 (blue line) relative to the average at each buoy over this seasonal period from 2007 to 2022 (red line). The green shaded area represents the temperature range for striped bass spawning in two key spawning areas of the Chesapeake Bay (55–68°F). The dashed purple line represents the temperature threshold for the onset of oyster feeding and growth (50°F); the solid purple line represents the temperature threshold for the onset of oyster spawning (60°F). Note that these are surface temperatures and oysters reside on the bottom.



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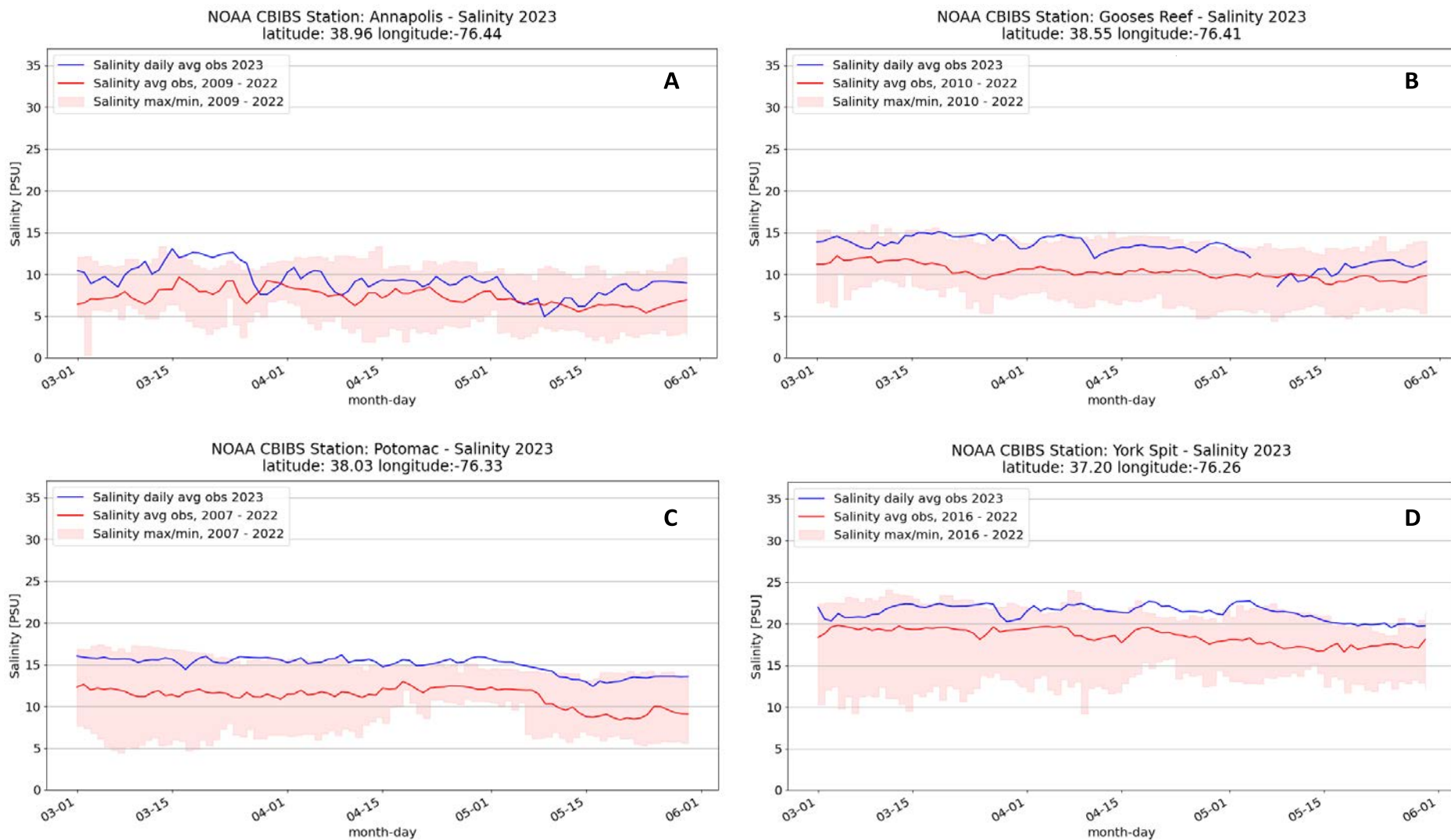


Figure 4. Salinity observations at four NOAA CBIBS buoys (Annapolis, Gooses Reef, Potomac, York Spit) from March to May 2023 (blue line) relative to the average at each buoy over this seasonal period from 2007 to 2022 (red line). The shaded area represents the range of observations (minimum to maximum)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



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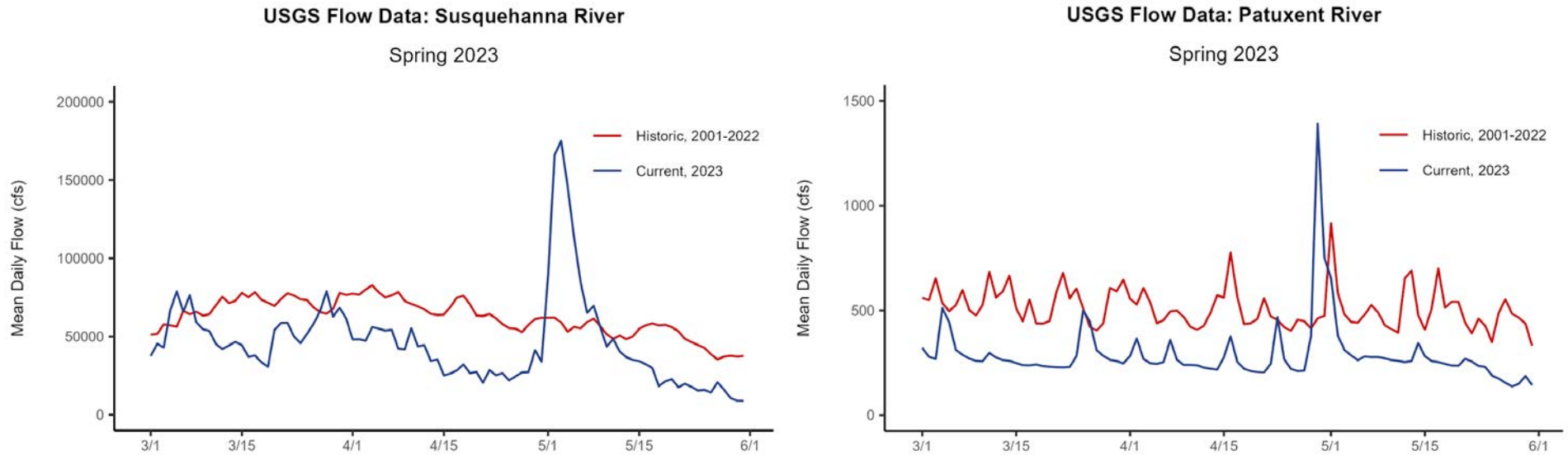


Figure 5. Daily mean streamflow observations (discharge, cubic feet/second) at USGS monitoring sites at the Susquehanna and Patuxent rivers throughout spring 2023 relative to the daily averages over this seasonal period from 2001 to 2022.



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