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

Spring 2022 Seasonal Summary

Spring 2022 Headlines

- **Average to below-average water temperatures and occasional peaks in freshwater flow throughout the spring suggest favorable conditions for striped bass spawning and recruitment in 2022.**
- **Increased salinities at the beginning of the oyster spawning season provide a conducive environment for larval 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 to 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) 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, which is developed by the Northeast Fisheries Science Center and presented to the Mid-Atlantic Fishery Management Council each year.

Water Temperature

Ocean remote-sensing products from NOAA's CoastWatch Program show that the Chesapeake Bay overall experienced a relatively average spring compared to the previous decade, but with some notable spatial variation (Figure 1). While the upper and lower regions of the Bay experienced nearly inconsequential increases in water temperature overall, the deeper waters of the mid-Bay appeared to be cooler than average in spring 2022. Observations from the CBIBS buoys provide insight into these anomalies across the Bay at a finer temporal scale (Figure 2). The mid-Bay buoys, Gooses Reef and Potomac, indicate approximately average water temperatures throughout the season with some slight declines from mid-April to mid-May as seen in the satellite imagery. The Annapolis and York Spit buoys, in the upper and lower Bay respectively, show slightly above-average water temperatures in March before fluctuating around the lower end of time series averages for the remainder of the season.

The overall below-average to average water temperatures in spring 2022 may indicate suitable spawning and recruitment habitat for Chesapeake Bay striped bass (*Morone saxatilis*). Cooler spring temperatures have been associated with increased recruitment success of striped bass larvae due to improved spawning habitat and increased spawning opportunities (Secor & Houde 1995, Peer & Miller 2014, Fabrizio et al. 2017) and resource availability matching. The generation time of copepod prey increases in cooler temperatures, allowing these prey to remain in the estuary in high abundances when striped bass larvae hatch (Devreker et al. 2006, Millette et al. 2019). Matching the timing of prey

presence is key to larval survival because feeding opportunities are maximized. The average to cooler-than-average water temperatures this spring indicate good conditions for improved striped bass recruitment success in 2022. However, it is important to note that other environmental conditions such as freshwater flow also affect striped bass recruitment in the Chesapeake Bay.

Salinity

Salinity observations from the NOAA CBIBS buoys in spring 2022 varied markedly both across the Bay and throughout the season (Figure 3). At the northern buoy locations, Annapolis and Gooses Reef, salinity was below average for the majority of the time period, with increases to above-average levels in early April and late May. The variation in salinity was more pronounced at Annapolis compared to Gooses Reef. At the southern buoys, Potomac and York Spit, salinity was above average until mid-April, at which point salinity increased to fluctuate around the averages with some short periods of below-average salinity, particularly in early May.

Salinity is typically an important driver of oyster (*Crassostrea virginica*) recruitment and survival in the Chesapeake Bay, with increased salinity resulting in higher juvenile oyster abundance (Kimmel et al. 2014). Although salinity varied at each location throughout the spring, all locations experienced higher salinities in late May, when oysters typically start spawning (Shumway 1996). If average to above-average salinities continue into the summer, oysters in the Bay will likely experience increased growth, recruitment, and survival in 2022. Other environmental conditions such as water temperature will also continue to play an important role in oyster success going into the fall surveys.

Freshwater Flow

River discharge data collected by the U.S. Geological Survey (USGS) show below-average flow throughout most of spring 2022, with the exception of three small peaks in mid-March, mid-April, and early May, and a very large peak in early April (Figure 4; USGS 01492500 Sallie Harris Creek, MD). The NOAA National Weather Service (NWS) PREcipitation Summary and Temperature Observations (PRESTO) reports indicated below-average precipitation levels in March 2022, with a minor snowfall event on March 12 that likely accounts for the small peak in March. The April 2022 report showed major storm systems—a prolonged high-precipitation event on April 5 and a nor'easter that occurred on April 18—accounting for the two peaks in April.

In addition to water temperature, survival of early life stages of striped bass in the Chesapeake Bay is strongly correlated with freshwater flow (Martino & Houde 2010, Millette et al. 2019, North & Houde 2003). High-flow regimes push zooplankton prey downstream, where they get trapped in the estuarine turbidity maximum with striped bass larvae. This spatio-temporal overlap allows striped bass larvae to feed on zooplankton prey during this critical life stage, increasing striped bass survival and recruitment success. Although freshwater flows were primarily below average throughout spring 2022, the occasional peaks (especially in April) in combination with cooler water temperatures could indicate an average year for striped bass recruitment in the Chesapeake Bay.

Figures

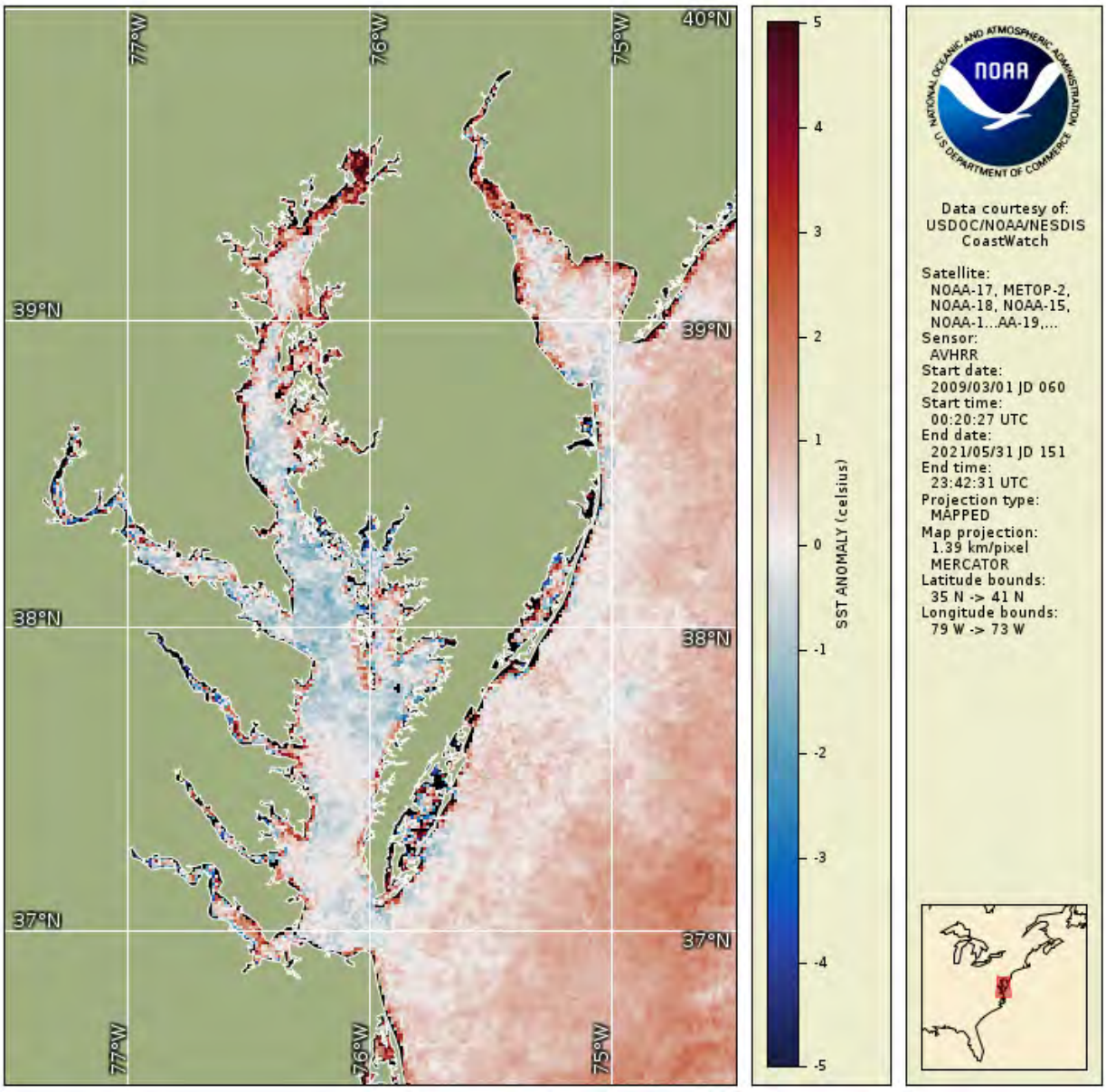

Figure 1. Sea surface temperature (SST) anomalies observed by NOAA satellites from March to May 2022 relative to the average of this seasonal period from 2009 to 2021.

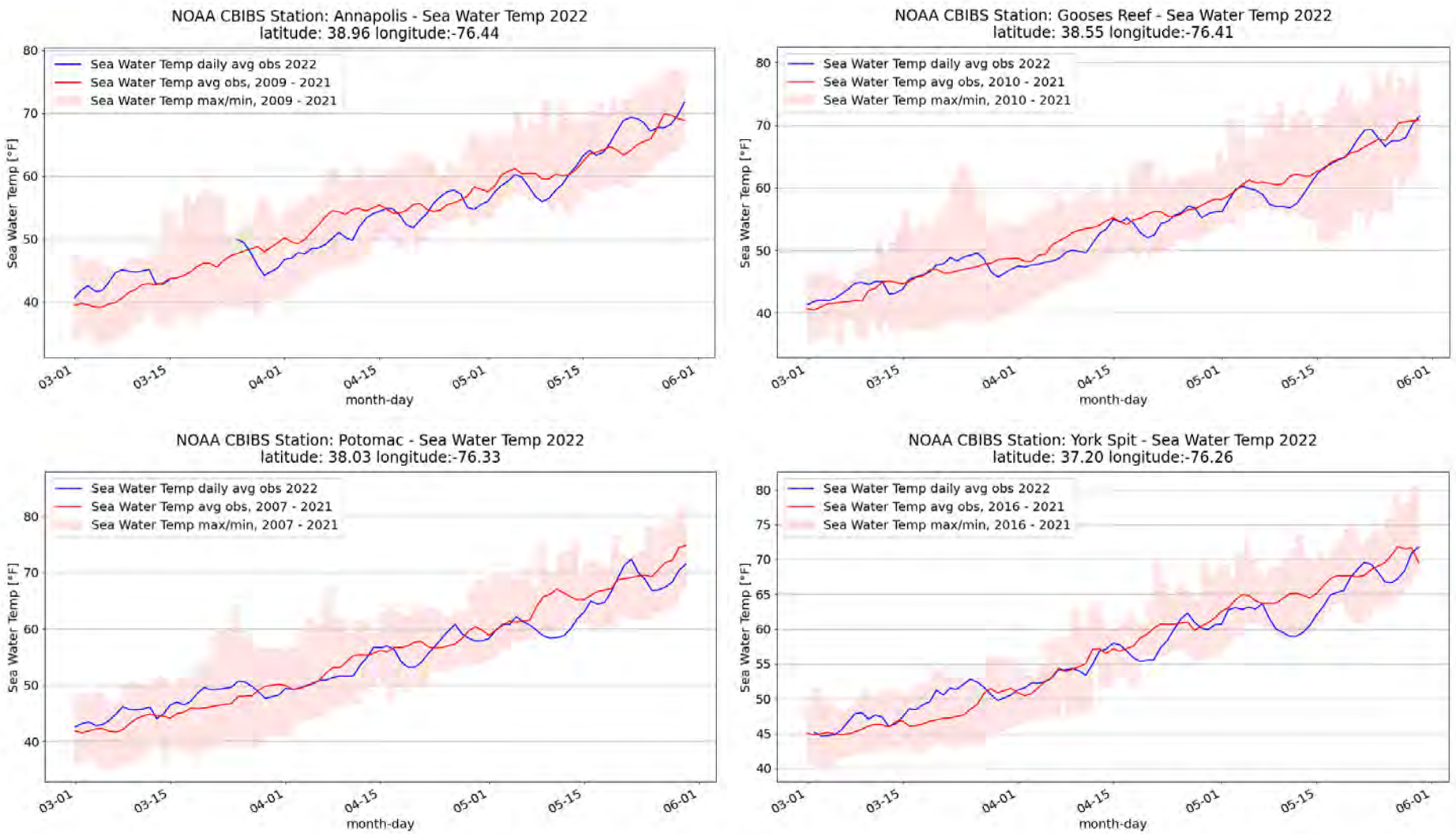

Figure 2. Water temperature observations at four NOAA CBIBS buoys (Annapolis, Gooses Reef, Potomac, York Spit) from March to May 2022 (blue line) relative to the average at each buoy over this seasonal period from 2007 to 2021 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

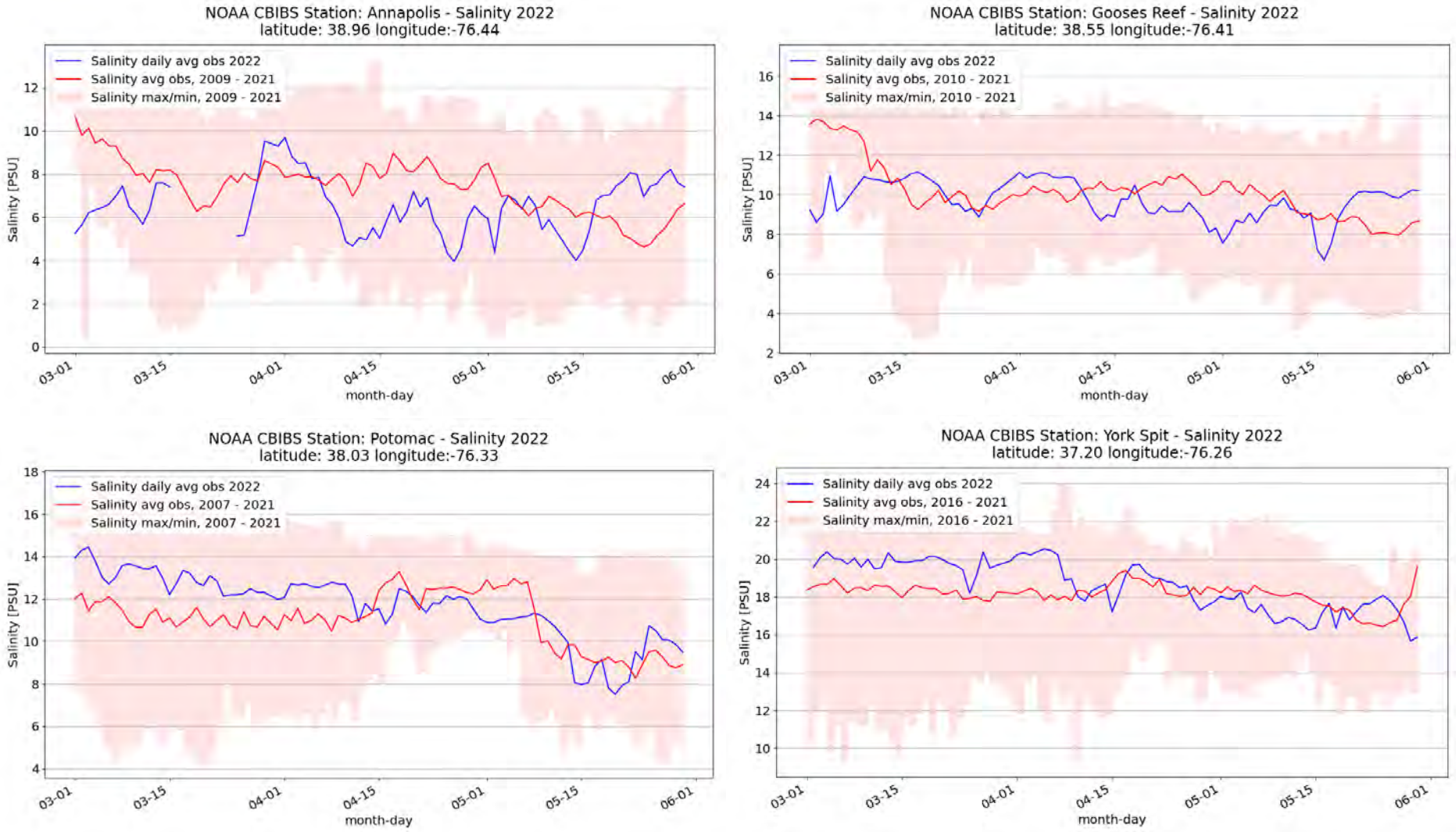

Figure 3. Salinity observations at four NOAA CBIBS buoys (Annapolis, Gooses Reef, Potomac, York Spit) from March to May 2022 (blue line) relative to the average at each buoy over this seasonal period from 2007 to 2021 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

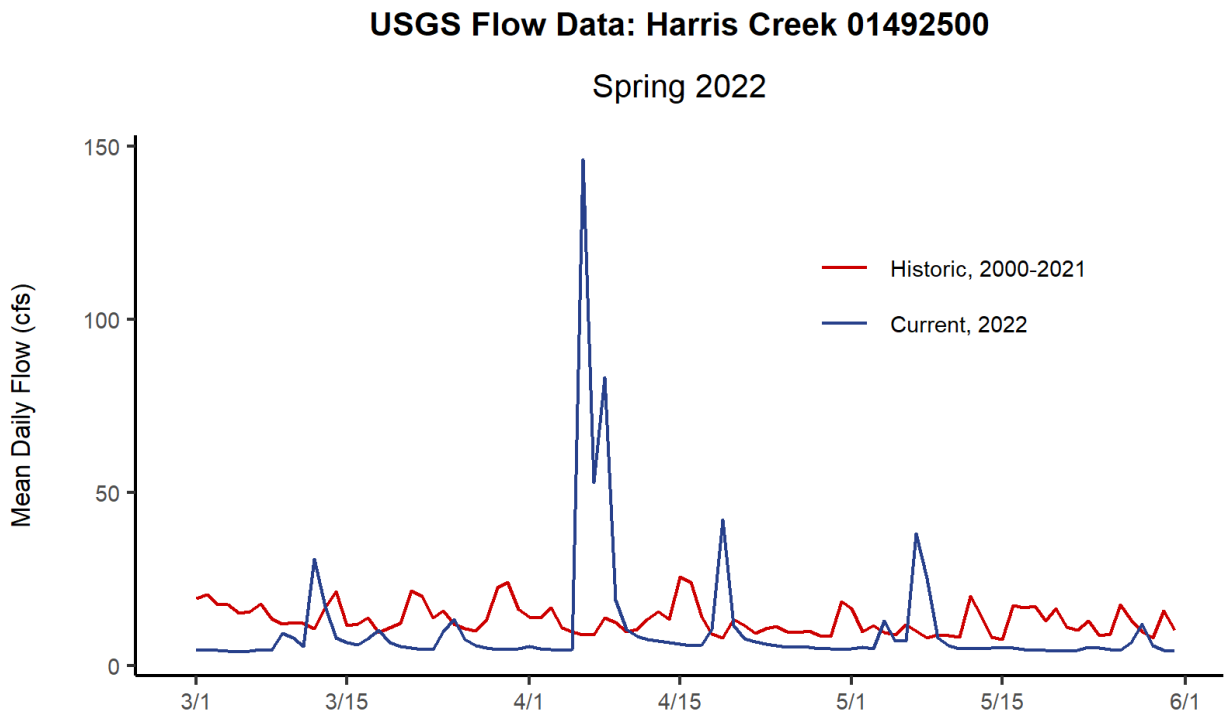

Figure 4. Mean daily streamflow (discharge, cubic feet/second) at the USGS monitoring site in Harris Creek, Maryland, throughout spring 2022 relative to the daily averages over this seasonal period from 2000 to 2021.

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