



Synthesis of Environmental Conditions and Potential Effects on Key Fishery Resources in the Chesapeake Bay

Fall 2025 Seasonal Summary

Fall 2025 Headlines

- In September, surface water temperatures were lower than average. The difference from average was greater in the southern Bay than in the northern Bay. Water temperatures in October and November were generally near average.
- Cooler temperatures and higher oxygen levels likely improved habitat, growth, migration, and forage conditions for striped bass, blue crabs, oysters, and menhaden.
- The onset of La Niña could affect Bay conditions and living resource outcomes into the winter and early 2026.

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

	Winter 2024–25	Spring 2025	Summer 2025	Fall 2025
Striped Bass	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Blue Crabs	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Oysters	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Bay Anchovy	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow	WT, DO, Sal, Flow
Summer Flounder	WT, DO, 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 potential 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



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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.

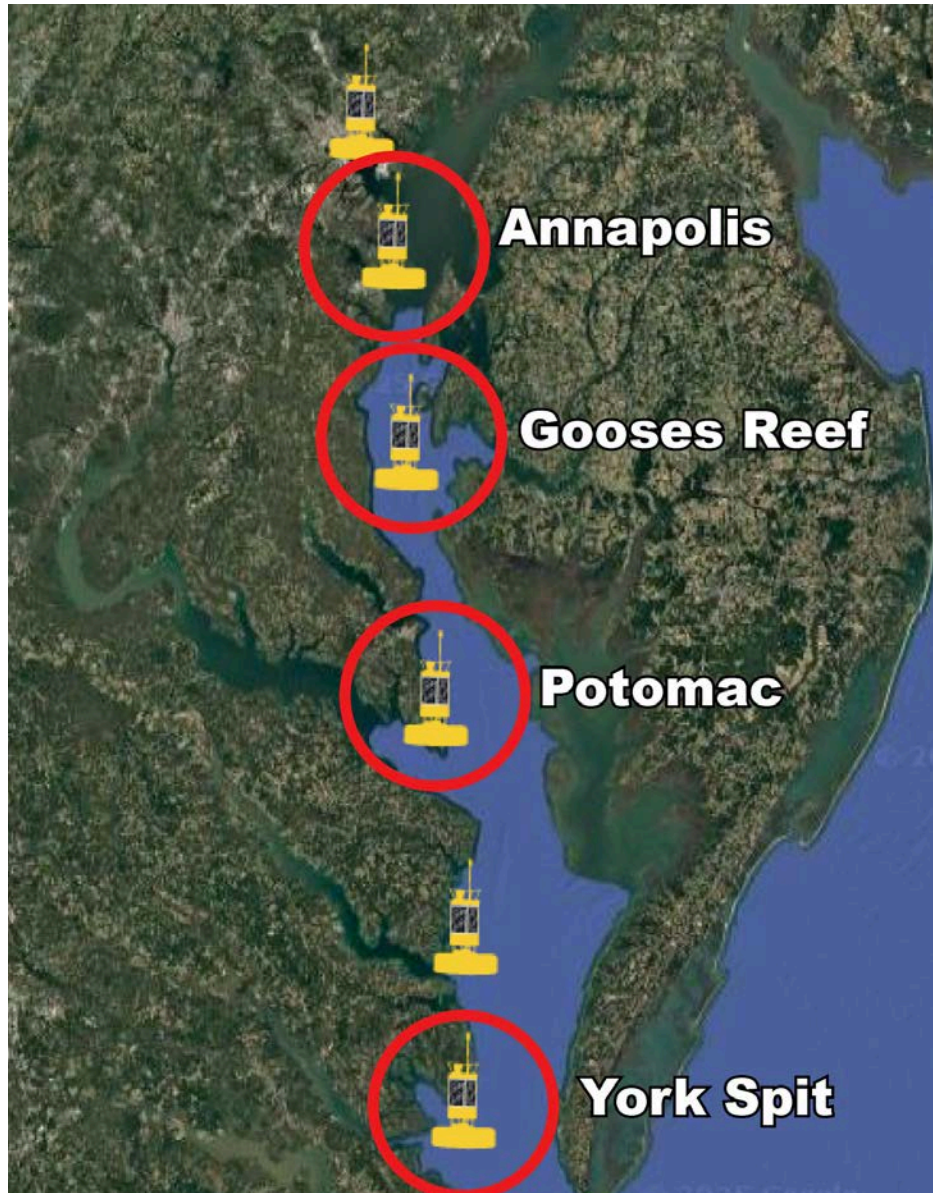


Figure 1. Map of Chesapeake Bay Interpretive Buoy System (CBIBS) observation platforms. The buoys used in these summaries are Annapolis, Gooses Reef, Potomac, and York Spit.



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Water Temperature

Overall surface water temperatures dropped at all buoy stations from the mid 70°Fs to about 50°F degrees over the fall. Surface water temperatures as observed by satellites and buoys were lower than average in September, with differences from average temperatures greater in the lower Bay compared to the upper Bay (Figures 2–6). Coastal waters were also cooler than normal, which may have influenced water temperature in the lower Bay. The cooler waters follow cooler August air temperatures in Maryland, which were among the lowest since 1895.

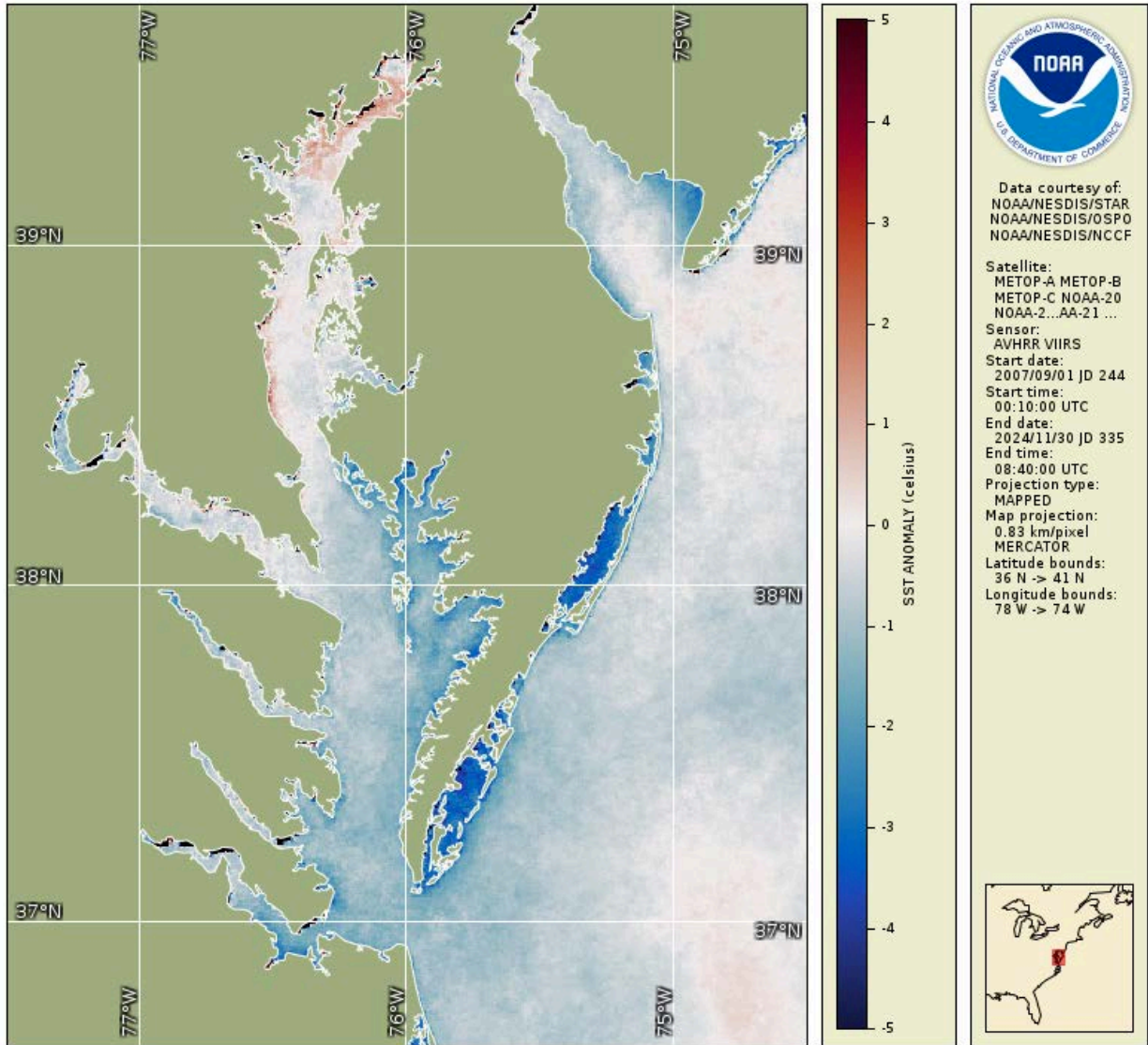


Figure 2. Sea surface temperature (SST) anomalies for September–November 2025, as observed by multiple satellites, relative to the average of this seasonal period 2007–2024. Individual satellite overpasses are composited daily, then averaged seasonally. More information on the method is [available](#).



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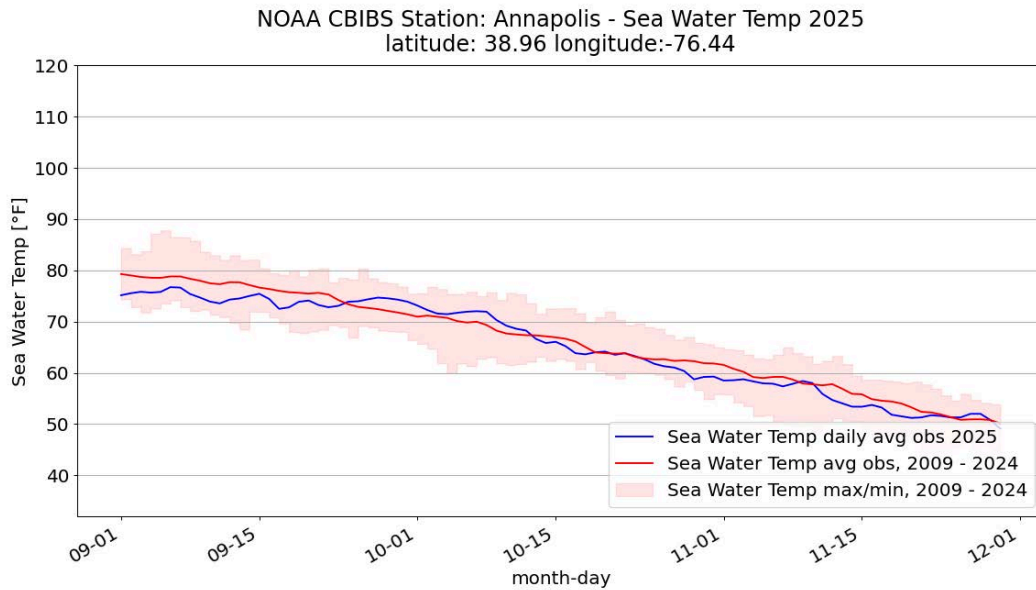


Figure 3. Surface water temperatures at the Annapolis CBIBS buoy September–November 2025 relative to the long-term average (2009–2024). The shaded area represents the full range of observations (minimum to maximum) over the time period.

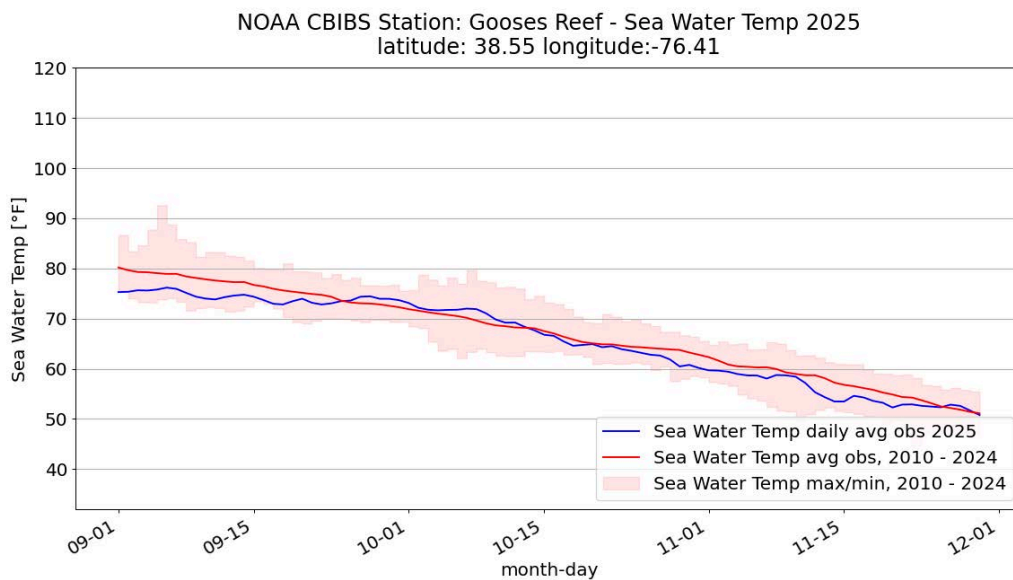


Figure 4. Surface water temperatures at the Gooses Reef CBIBS buoy September–November 2025 relative to the long-term average (2010–2024). The shaded area represents the full range of observations (minimum to maximum) over the time period.



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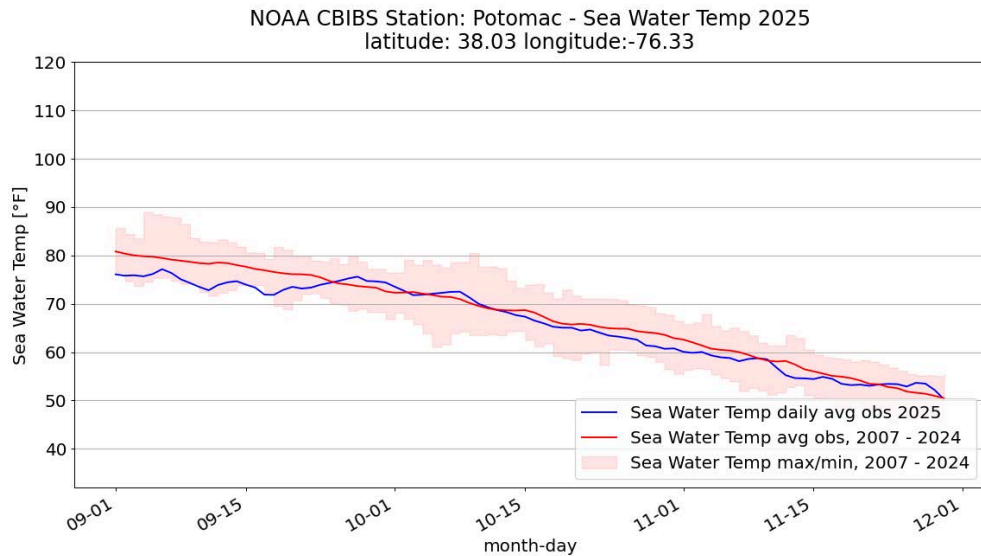


Figure 5. Surface water temperatures at the Potomac CBIBS buoy September–November 2025 relative to the long-term average (2007–2024). The shaded area represents the full range of observations (minimum to maximum) over the time period.

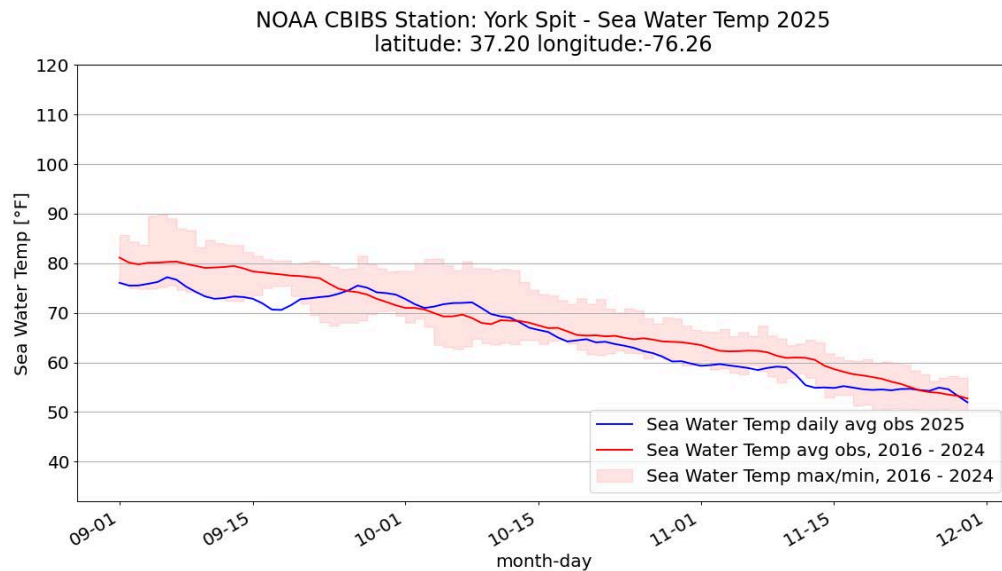


Figure 6. Surface water temperatures at the York Spit CBIBS buoy September–November 2025 relative to the long-term average (2007–2024). The shaded area represents the full range of observations (minimum to maximum) over the time period.



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Salinity

Salinity at Annapolis and Gooses Reef CBIBS buoys increased throughout the fall following a similar pattern to the long-term average. However, salinity at these two buoys was several PSUs above the long-term average during this time period (Figures 7 and 8). Salinity was more variable at the Potomac and York Spit CBIBS buoys. The Potomac CBIBS buoy observed lower-than-average salinity in early September followed by an overall increase through November—enough so that salinity was above average (Figure 9).

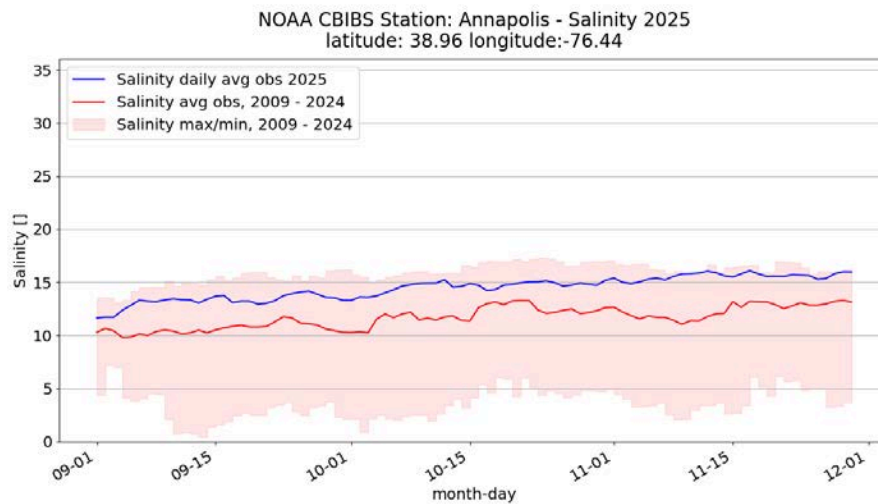


Figure 7. Salinity observations at the Annapolis CBIBS buoy September–November 2025 (blue line) relative to the average at each buoy over this seasonal period 2009–2024 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

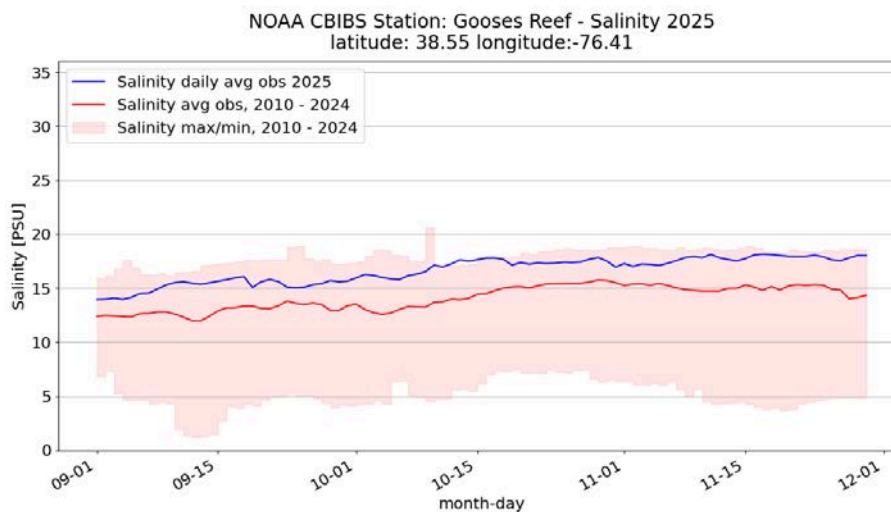


Figure 8. Salinity observations at the Gooses Reef CBIBS buoy September–November 2025 (blue line) relative to the average at each buoy over this seasonal period 2010–2024 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.



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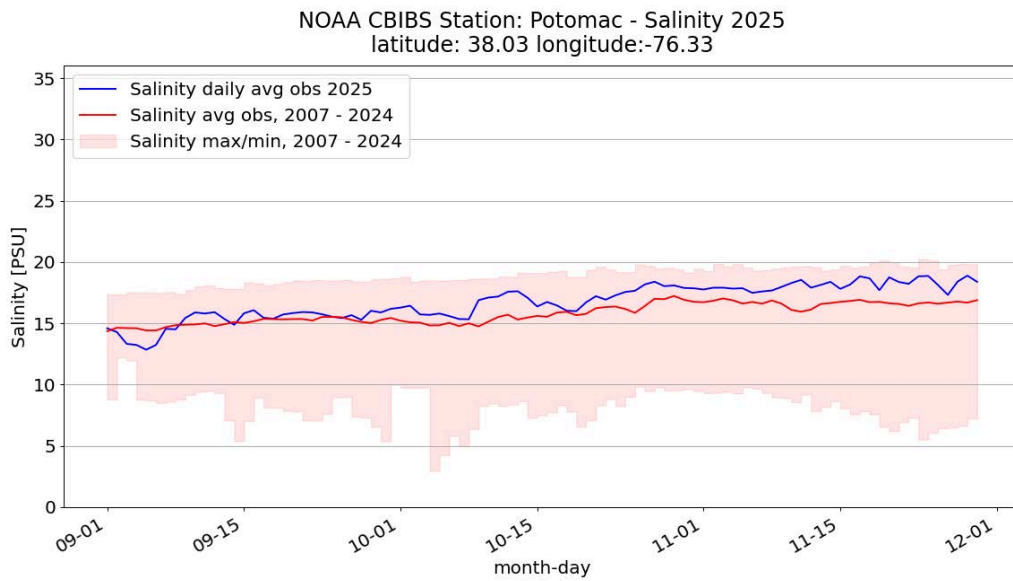


Figure 9. Salinity observations at the Potomac CBIBS buoy September–November 2025 (blue line) relative to the average at each buoy over this seasonal period 2007–2024 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period.

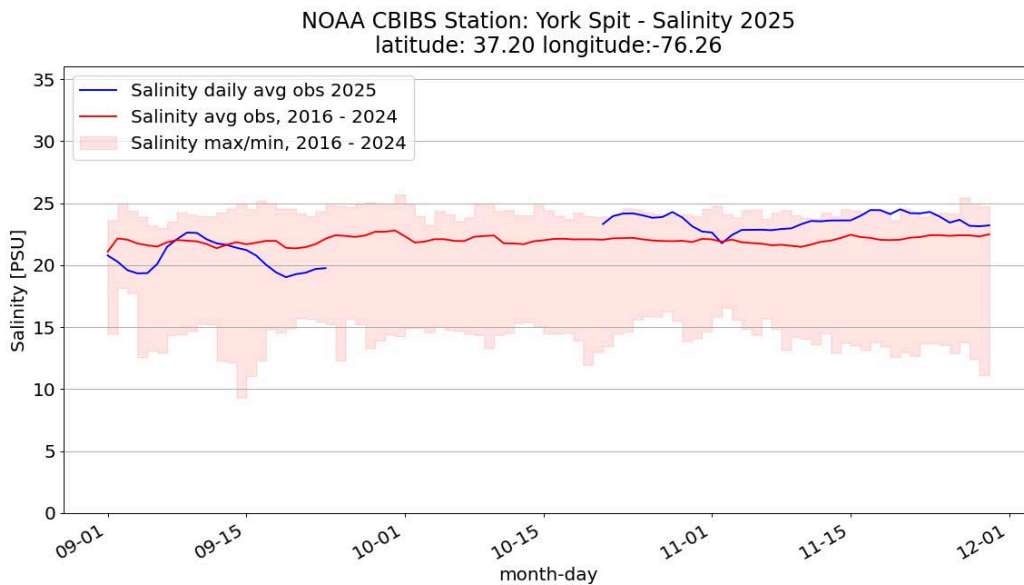


Figure 10. Salinity observations at the York Spit CBIBS buoy September–November 2025 (blue line) relative to the average at each buoy over this seasonal period 2007–2024 (red line). The shaded area represents the full range of observations (minimum to maximum) over the time period. Gaps in data are due to a failed salinity sensor.



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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 seventh and third 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 toward the end of fall, as observed by the CBIBS buoys (Figures 7–10).

Virginia, Climate Division 1 Precipitation

September–November



Figure 11. Precipitation data from 2007–2025 for September–November for Tidewater Virginia. Data from NOAA Centers for Environmental Information.

Maryland, Climate Division 3 Precipitation

September–November

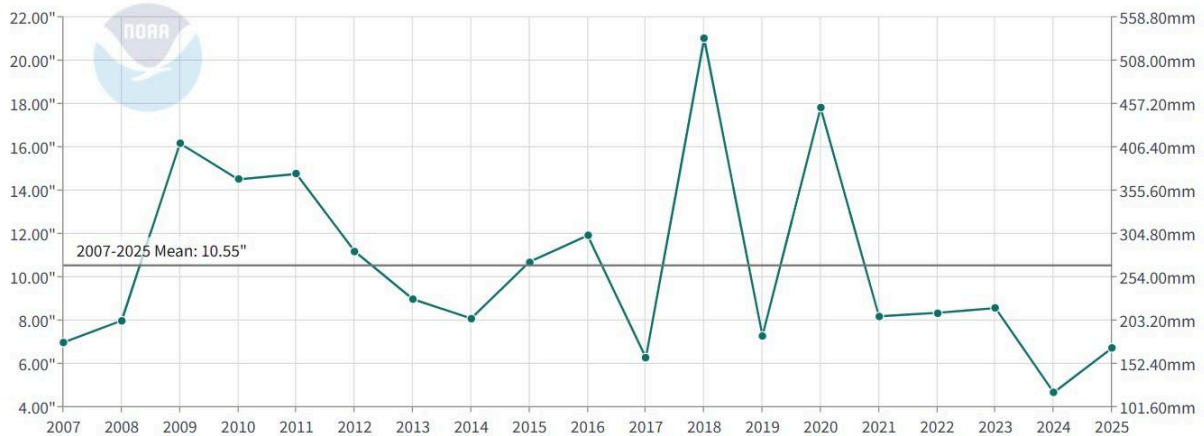


Figure 12. Precipitation data from 2007–2025 for September–November for southern Maryland. Data from NOAA Centers for Environmental Information.



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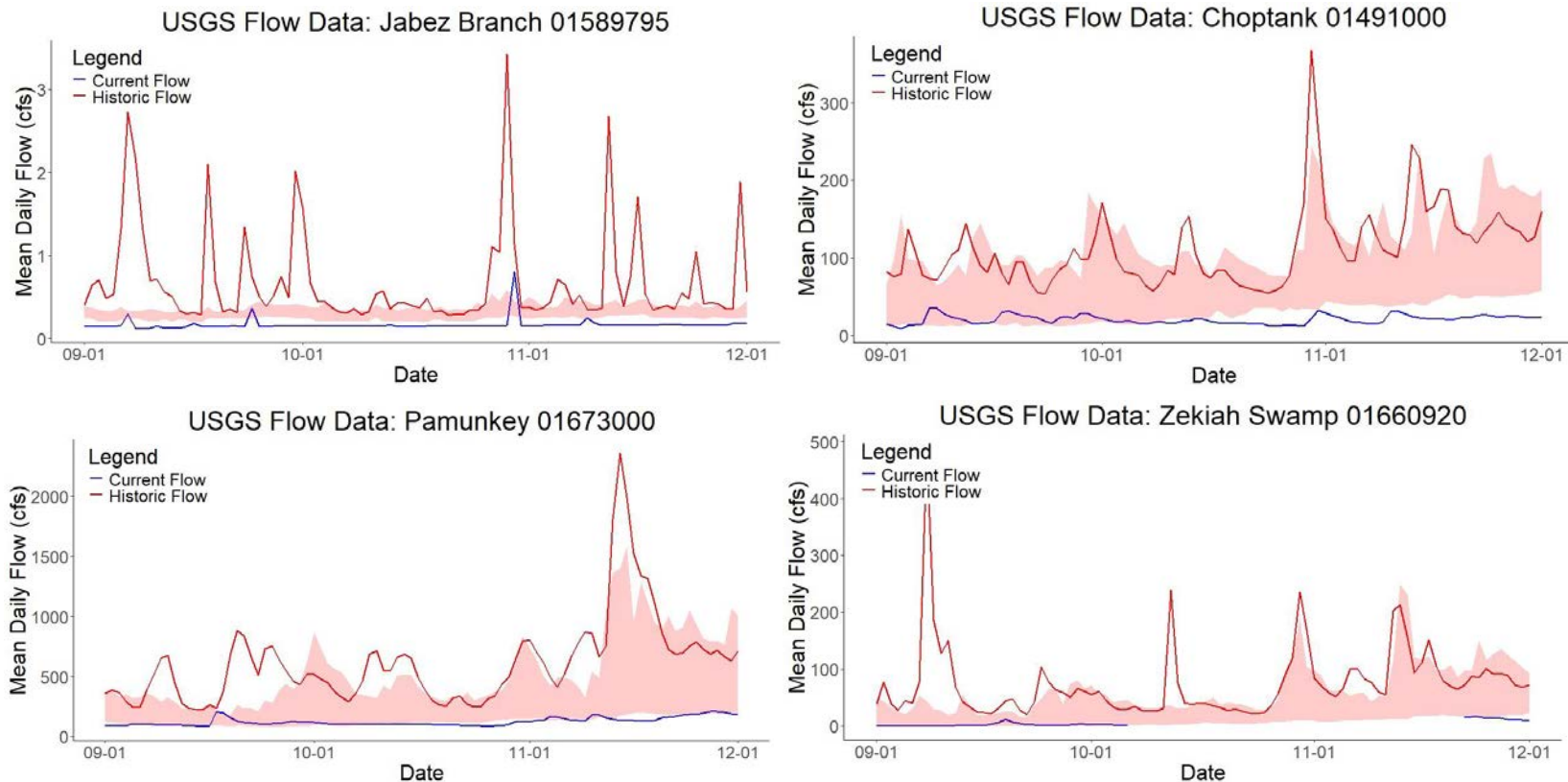


Figure 13. Daily mean streamflow observations (discharge, cubic feet/second) from the upper to lower Chesapeake Bay at U.S. Geological Survey monitoring sites at the (A) Jabez Branch, Severn River (B) Choptank River, (C) Pamunkey River, and (D) Zekiah Swamp, Potomac River throughout fall 2025 relative to the daily averages over this seasonal period from 2000–2024. The red shading indicates the interquartile range (25%-75%), where 50% of the historical values fall. These locations were chosen because they are fairly near the CBIBS Annapolis, Gooses Reef, York Spit, and Potomac locations respectively. There is a roughly month-long gap in data from Zekiah Swamp due to problems with the sensor.



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Dissolved Oxygen

According to the Virginia Institute of Marine Science’s 2025 [Chesapeake Bay Dead Zone Report](#), a relatively low amount of hypoxia persisted through September, when water-mixing winds and cooling temperatures contributed to hypoxia ending for the year. However, observations from hypoxia observing stations at Sharps Island and Lower Choptank observed generally lower dissolved oxygen levels than the historical mean from September to early October (Figures 14 and 15). Data after early October was not available due to the lapse in government appropriations prohibiting sensor maintenance.

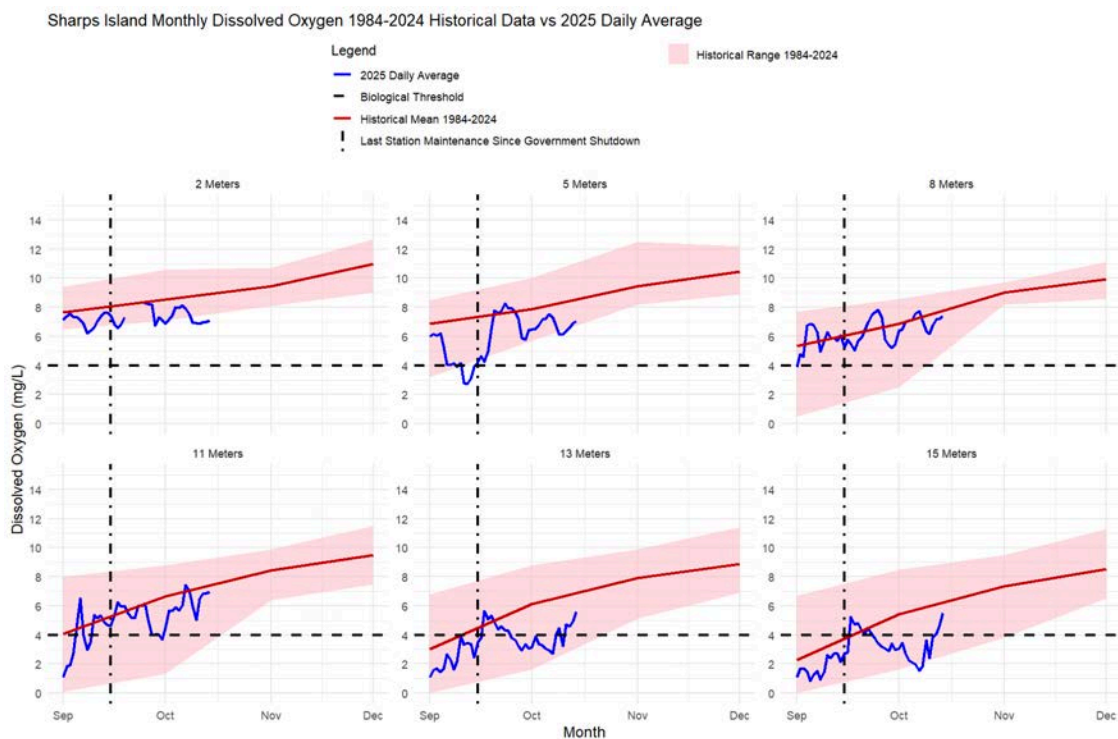


Figure 14. Dissolved oxygen (DO) daily averages at the Sharps Island buoy for September–November 2025 compared with long-term averages (1984–2024) from the DNR CB4.2C fixed monthly monitoring station. The shaded area represents the historical range (minimum to maximum) of DO observations from the CB4.2C station, while the red line represents the historical mean. The 2025 daily average DO is shown by the blue line, and the horizontal black dashed line represents the biological threshold, marking the point at which aquatic life may alter its behavior to avoid low DO areas. Gaps in dissolved oxygen data are the result of station outages, sensor outages, or sensor data that does not meet QA/QC standards.



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Lower Choptank Monthly Dissolved Oxygen 1984-2024 Historical Data vs 2025 Daily Average

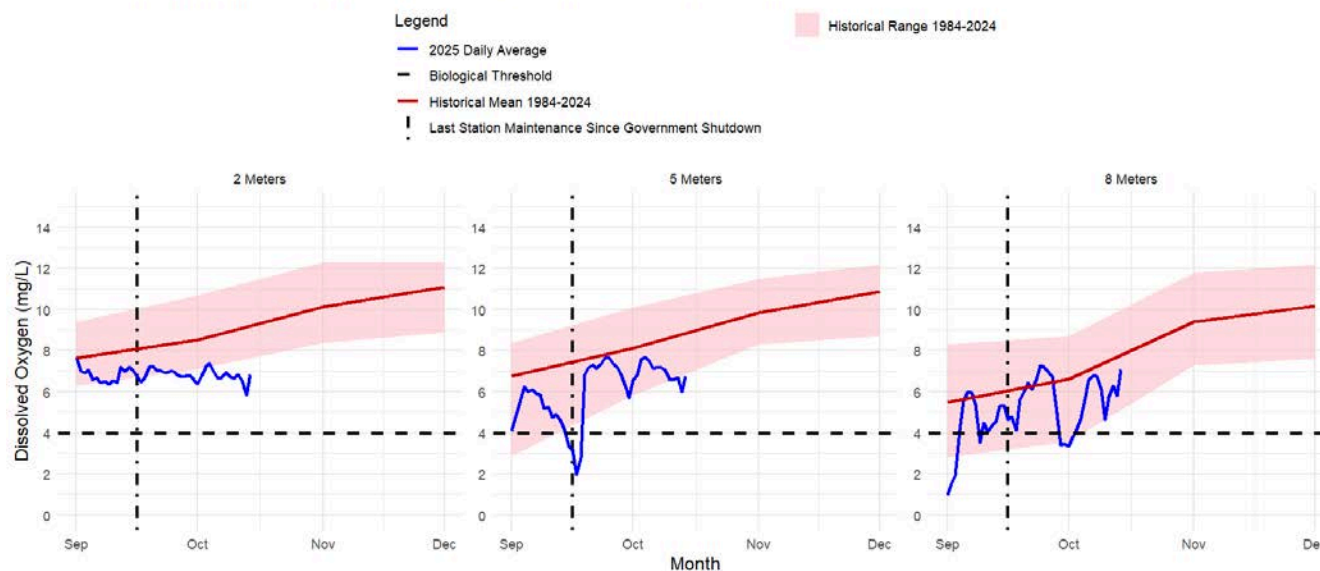


Figure 15. Dissolved oxygen (DO) daily averages at the Lower Choptank buoy for September–November 2025 compared with long-term averages (1984–2024) from the DNR EE2.1 fixed monthly monitoring station. The plots are separated by sensor depth, with the 8-meter plot using historical data from a 7-meter 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 2025 daily average DO is shown by the blue line, and the horizontal black dashed line represents the biological threshold, marking the point at which aquatic life may alter its behavior to avoid low DO areas. Gaps in dissolved oxygen data are the result of station outages, sensor outages, or sensor data that does not meet QA/QC standards.



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Potential Effects of Anomalous Spring Conditions on Living Resources

Striped Bass

Fall's cooler water temperatures can provide some relief for striped bass after summertime heat. In typical warm summers, striped bass face a "habitat squeeze" when they are forced out of deep, cool waters because of low oxygen (hypoxia) and pushed out of surface waters because they are too hot (often exceeding their stress threshold of 82.4°F). Lower temperatures in September 2025 could have expanded their usable habitat. Cooler water holds more dissolved oxygen, which directly reduces physiological stress and the likelihood of disease-related mortality, such as from mycobacteriosis, which is more lethal in warm, hypoxic conditions (Groner et al., 2018). Cooler water can also affect foraging behavior by allowing fish to linger in [shallow nearshore areas](#) for longer periods during the morning and evening. In warmer years, they are forced to retreat to deeper, less accessible water.

Water temperature is a primary driver of fish movement. Striped bass begin to feed heavily on baitfish like menhaden and silversides in the fall to store energy. While slightly cooler water might keep resident fish active and healthy, significantly colder water can trigger an earlier migration of the larger fish that enter the Chesapeake Bay from the Atlantic Ocean.

Cooler conditions heading into winter have been linked to [stronger juvenile recruitment](#) because they slow the development of key prey such as copepods, ensuring a better match between food availability and hungry striped bass larvae in the spring.

Recreational fishing reports from fall 2025 documented successful catches of striped bass throughout the Chesapeake Bay in October, particularly in the upper Bay ([Maryland Department of Natural Resources, October 2025](#)). Late November found striped bass in deeper waters (40 feet or more) ([Maryland Department of Natural Resources, November 2025](#)).

Menhaden

Cooler water and improved oxygen conditions allow menhaden schools to occupy a much larger portion of the Bay's mainstem and tributaries without being squeezed into the surface layer, where they are most vulnerable to predators and heat stress. When menhaden are less stressed by heat and hypoxic water, they remain more available in the middle to upper water column. This can provide a reliable, high-energy food source for predators such as osprey and striped bass.

According to recreational fishing reports from fall 2025, the decrease in water temperature encouraged menhaden and other bait fish to begin exiting the tidal rivers and head down the Bay. Reports found striped bass positioned over deep channel edges to intercept bait fish including menhaden ([Maryland Department of Natural Resources, October 2025](#)).

Blue Crab

Crabs grow by shedding their shells (molting). If late summer and early fall are cooler than normal, the time between molts increases. This can mean that fewer crabs reach harvestable size before the season slows down. Watermen often capitalize on a late-season surge of adult male crabs. Cooler water can delay this surge, as it takes longer for the summer juveniles to reach maturity. Cooler-than-normal temperatures in the fall can trigger an earlier move toward the deeper channels of the mainstem Bay. This often shifts the best crabbing locations from the shallow rivers and creeks to deeper water sooner than expected. As they do for menhaden, cooler temperatures help crabs conserve energy. Instead of



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burning calories to stay cool, they can focus on building up fat and protein stores needed to survive the winter.

Oysters

This fall's cooler temperatures and higher oxygen levels were likely beneficial to oysters. Cooler waters tend to reduce disease prevalence, and [more-oxygenated water](#) allows oysters to filter water more effectively, which helps them put more energy into adding tissue weight for the winter. Higher salinity aids reproduction and spat sets but can also increase disease. Increase in disease may have been offset by cooler temperatures.

La Niña

La Niña is the cool phase of a larger climate cycle known as the El Niño-Southern Oscillation (ENSO). While it begins with cooling water in the Pacific Ocean, it triggers a chain reaction in the atmosphere that shifts weather patterns across North America. In 2025, La Niña conditions were observed forming in September, marking the end of a neutral period that had persisted since March.

In October, NOAA officially issued a [La Niña Advisory](#), confirming that the cool phase was present and expected to persist through the Northern Hemisphere winter. La Niña typically favors [near to above-normal winter temperatures](#) for the mid-Atlantic. While La Niña typically brings drier and warmer winters to the southern United States, its effects on the mid-Atlantic are often characterized by increased variability, including sharp cold snaps and shifts in salinity.

La Niña conditions in late 2025 and early 2026 may alter the survival, growth, and migration of the Bay's striped bass, blue crabs and menhaden.

Historically, cold winters and cool, wet springs are the best indicators for a strong year class of striped bass. The sharp cold fronts seen in November 2025 may have been beneficial; they help trigger a more synchronized spawn and slow the metabolism of key prey including copepods, ensuring food is available when larvae hatch.

Blue crabs spend the winter buried in the mud and are highly sensitive to acute cold stress (Rome et al., 2005). If La Niña brings extreme cold snaps (like the record snowfall in Norfolk in November 2025), mortality rates could increase. Higher salinity levels in the winter are generally better for crab survival, as they are less stressed than in very fresh, cold water.

La Niña conditions can alter the coastal currents that are responsible for pushing menhaden larvae from the Atlantic shelf into the nursery areas of the Chesapeake Bay (Buchheister et al., 2016). If late winter remains drier than average (a common La Niña trait), it could lead to higher salinity in the tributaries, which generally benefits juvenile menhaden survival.



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