



Long Island Sound Water Quality Monitoring Program

September 2025

**From the Connecticut Department of Energy and Environmental Protection
(WQSEP25)**

Rachel Levinson
Kaleb Boudreaux

Background

Hypoxia is a condition in which low or depleted dissolved oxygen concentrations are observed in the waters of Long Island Sound (LIS). Hypoxia impacts up to half of the LIS waters each summer. The primary cause of hypoxia is excess nitrogen from human sources. These sources include sewage treatment plant discharges, storm water runoff and atmospheric deposition.

The water temperature of Long Island Sound plays a crucial role in influencing hypoxia levels through several interconnected mechanisms. As water temperature increases, its ability to dissolve oxygen decreases, meaning warmer water naturally holds less dissolved oxygen. Additionally, higher temperatures elevate the metabolic rates of aquatic organisms, leading to increased oxygen consumption and further depletion of oxygen levels. Thermal stratification during warmer months results in a less dense, warmer layer sitting atop a denser, cooler layer, preventing the mixing of oxygen-rich surface waters with the deeper layers. This lack of mixing can isolate the bottom layers from essential oxygen, leading to hypoxia. Warmer temperatures also contribute to increased nutrient runoff from surrounding lands, enriching the water with nitrogen and phosphorus, which stimulate the growth of algae and phytoplankton. When these algae die and decompose, the process consumes a significant amount of oxygen, exacerbating hypoxia. Furthermore, higher temperatures boost the biological oxygen demand due to heightened activity levels of bacteria and microorganisms decomposing organic matter, further reducing oxygen levels. Consequently, the combination of reduced oxygen solubility, thermal stratification, enhanced nutrient runoff, eutrophication, and increased biological oxygen demand due to warmer water temperatures creates conditions where dissolved oxygen levels fall below the thresholds necessary to support healthy marine life, resulting in hypoxic zones in Long Island Sound.

Dissolved oxygen (DO) levels below 3.0 mg/L are considered hypoxic in LIS. Hypoxic conditions cause impairment and, in some cases, death to aquatic life. Some studies have found DO can become limiting below 4.8 mg/L for sensitive fish species, while more tolerant species are not affected until DO falls below 2.0 mg/L (Simpson et. al., 1995, 1996).

Since 1991, the Connecticut Department of Energy and Environmental Protection (CT DEEP) has conducted an intensive [water quality monitoring program](#) on Long Island Sound (LIS). The program is funded through a grant from the [U.S. Environmental Protection Agency's \(EPA\) Long Island Sound Partnership](#). Data from the surveys are used to quantify and identify annual trends and differences in water quality parameters relevant to hypoxia, in particular nutrients, temperature, and chlorophyll. These data are also used to evaluate the effectiveness of the LIS management programs' efforts to reduce anthropogenic nitrogen inputs, since nitrogen is a primary contributor to the excessive algae growth that leads to hypoxia in LIS.

During the summer (June - September), surveys across LIS are conducted at bi-weekly intervals to better define the areal extent and duration of hypoxia. During these surveys stations are sampled for in-situ parameters including dissolved oxygen, temperature, pH, and salinity. The [sampling calendar](#) lists the expected survey dates.

The WQSEP25 survey was conducted August 25th - August 28th 2025 aboard the R/V John Dempsey. A total of 17 stations were sampled.

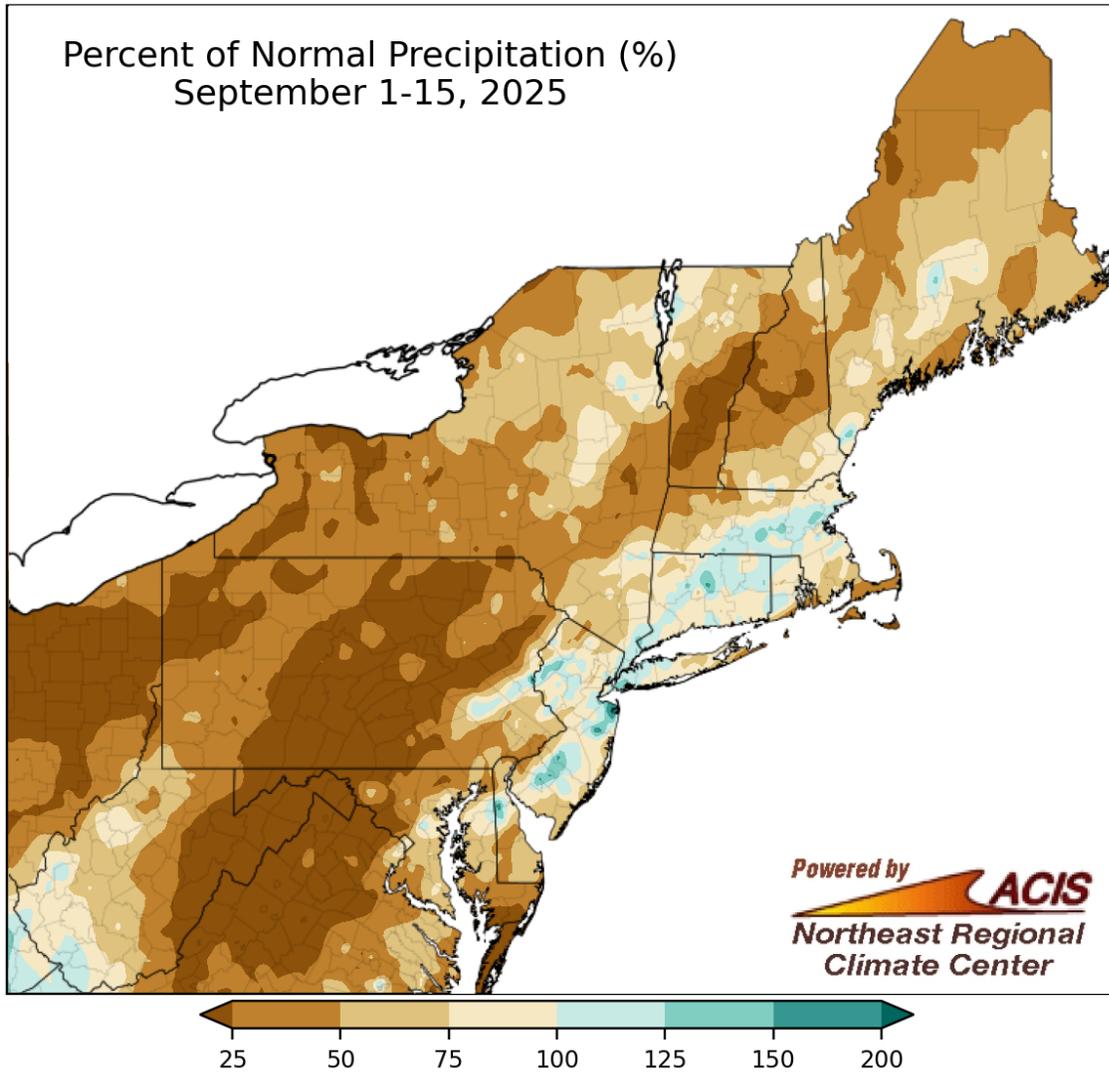
Weather

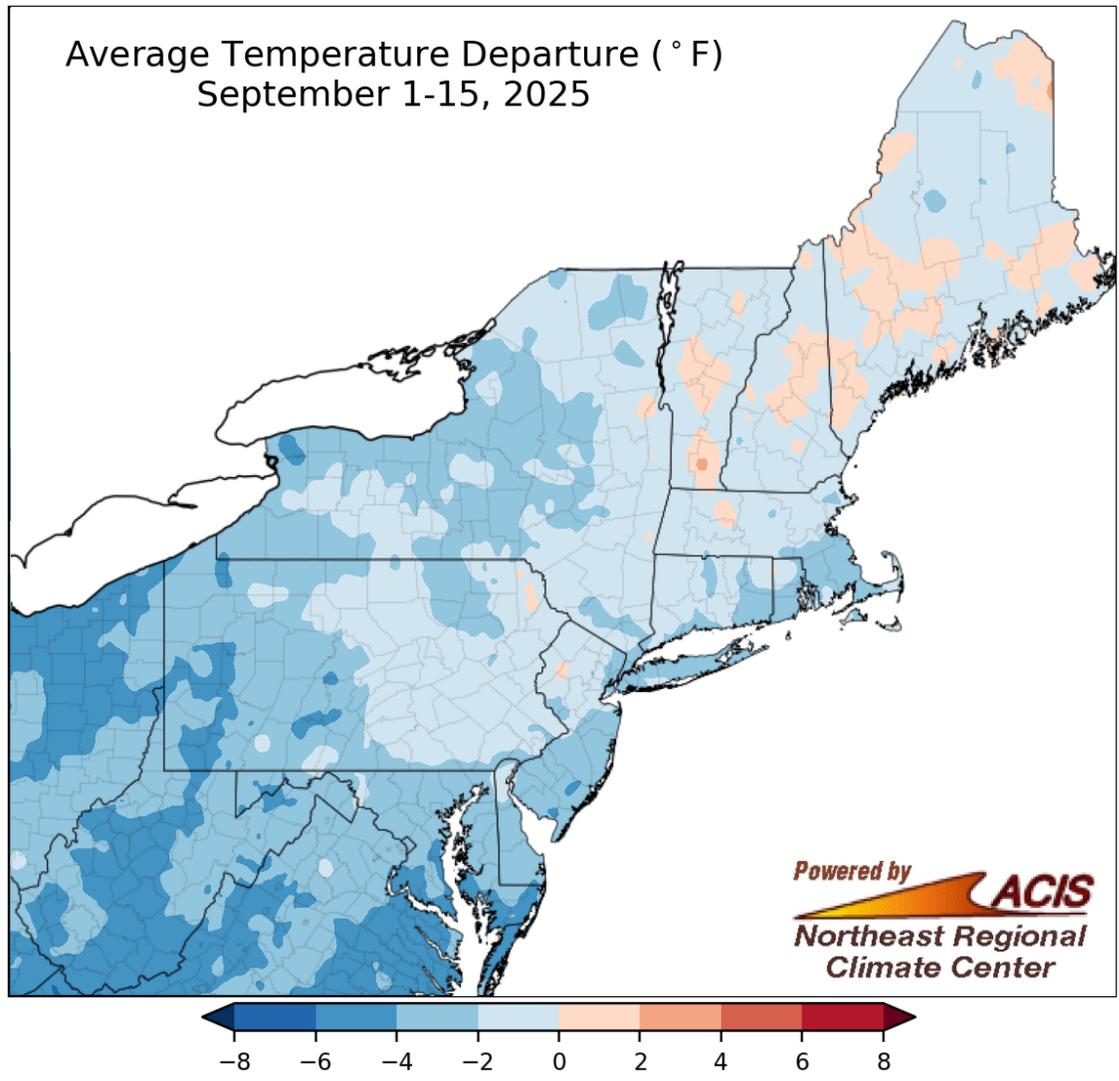
Precipitation and temperature are important factors to keep track of in order to determine the effects it will have on the environment. Increased precipitation has an impact on human safety such as increased flooding in vulnerable municipalities across the Northeast. Precipitation also decreases salinity in estuaries which effects sensitive organisms that use that environment as a nursery. However, decreased precipitation will lead to droughts and dryness which can negatively effect crops and increase the risk of forest fires especially with warmer temperatures. Besides forest fire risks, increased temperatures can also lead to stronger storms that will damage many coastal communities.

Bridgeport, CT experienced a cooler than normal first half of September with an average temperature of 65.2 °F, which is -3.5 °F below normal, ranking it their 8th coolest September 1-15 period on record. Similarly, Hartford, CT had an average temperature of 64.8 °F, which is -3.0 °F below normal, ranking this their 12th coolest. Meanwhile in New York, Islip saw an average temperature of 67.1 °F, which is -2.5 °F below normal, ranking it their 15th coolest. LaGuardia Airport, NY had the least amount of temperature change with an average of 71.5 °F, which is -2.0 °F below normal, ranking this September 1-15 their 10th coolest. However, like the others, JFK Airport, NY also saw a cooler period with an average of 71.2 °F, which is -2.2 °F below normal, ranking it their 11th coolest of all time. Overall, all stations had a decrease in temperature compared to normal for the first half of September.

Precipitation across these locations was notably low overall, contributing to drier conditions. In Bridgeport, CT, rainfall totaled 0.85 inches, which is 26% of normal (3.27 in), making this the 6th driest September 1-15 on record. Similarly, Hartford, CT received 1.02 inches of rain, which is 25% of normal (4.08 in), ranking it their 4th driest. New York stations showed a comparable dryness. In Islip, NY, it rained 1.45 inches, which is 43% of normal (3.37 in), ranking this their 9th driest period. LaGuardia Airport, NY had even less with 0.92 inches, which is 21% of normal (4.38 in), placing it among the 20 driest at 3rd. JFK Airport, NY totaled 1.05 inches, which is 27% of normal (3.89 in), making this their 5th driest September 1-15. Overall, the monitored stations were predominantly dry, with all below 50% of normal precipitation.

NRCC Graphics for September 16, 2025



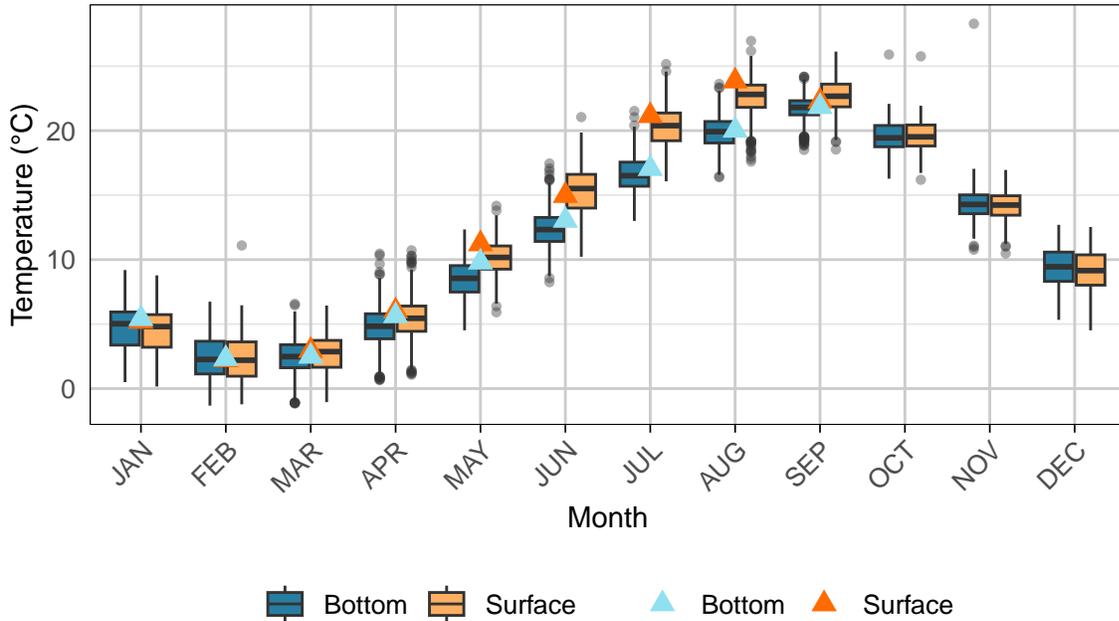


Temperature

The graph below displays the range and median of the average monthly surface (orange boxes) and bottom (blue boxes) water temperature of Long Island Sound as recorded by CTDEEP during the year-round water quality surveys from 1991-present. The graph also displays the average temperature for the current survey (orange and blue triangles).

Long Island Sound Water Temperatures

Since 1991 (WQ surveys only)



Delta T (ΔT) represents the difference between surface and bottom water temperatures. Variations in water temperature contribute to stratification, which in turn exacerbates hypoxic conditions. Typically, shallower coastal stations exhibit the smallest temperature differences due to their increased susceptibility to mixing, weather, and anthropogenic influences. The greater the Delta T, the higher the potential for severe hypoxia.

Overall, across the 17 stations analyzed, bottom temperatures showed a mild increase with an average change of $+0.27^{\circ}\text{C}$. Stations like K2 ($+0.98^{\circ}\text{C}$) and M3 ($+0.86^{\circ}\text{C}$) showed the strongest increases, which are notable for their highest temperature change since last year. In contrast, surface temperatures experienced a decrease with an average change of -0.64°C , pointing to widespread cooling at the surface level. Notable drops occurred at several stations. These include F2 (-1.41°C), F3 (-1.46°C), E1 (-1.22°C), and H4 (-1.16°C).

Spatial Distribution of Bottom Water Dissolved Oxygen Levels

During the WQSEP25 survey, two stations had DO concentrations below 3.0 mg/L. Area estimates are below:

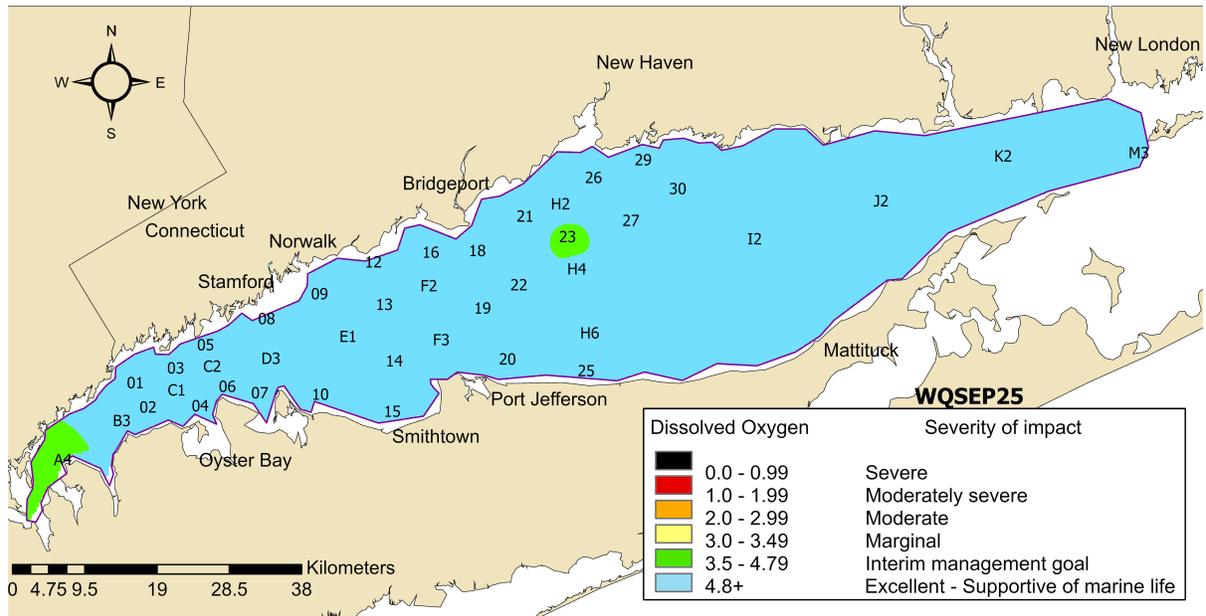
0 km² below 3 mg/L

0 km² between 3 mg/L and 3.5 mg/L

61.6 km² (23.78 mi²) between 3.5 and 4.8 mg/L



Dissolved Oxygen in Long Island Sound Bottom Waters 25-28 August 2025



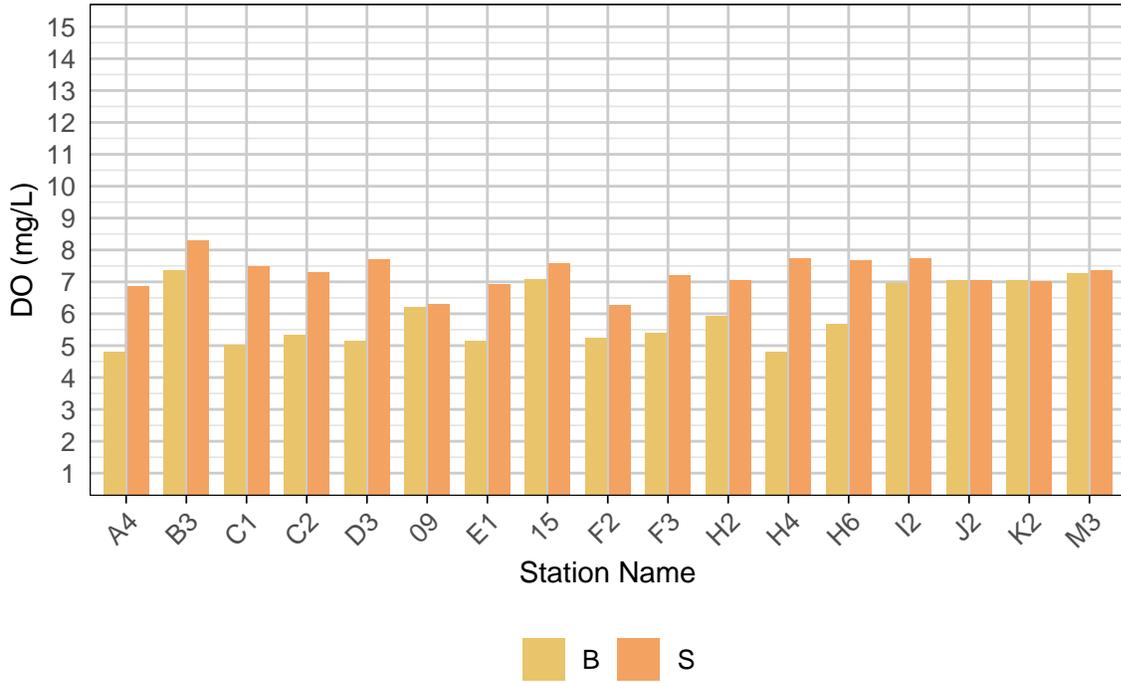
Dissolved Oxygen

In the WQSEP25 survey, the average surface Dissolved Oxygen (DO) concentration was 7.10 mg/L and the average bottom DO concentration was 5.77 mg/L. The highest surface DO concentration was 8.29 at Station B3, and the lowest surface DO was 5.53 at Station 16. The highest bottom DO concentration was 7.19 mg/L at Station 25 and the lowest bottom DO was 4.60 at Station A4. Zero stations had a surface or bottom dissolved oxygen concentration below 3 mg/L, which is considered hypoxic.

Measured Dissolved Oxygen level across the Long Island Sound by station

Dissolved Oxygen Concentrations Across the Long Island Sound

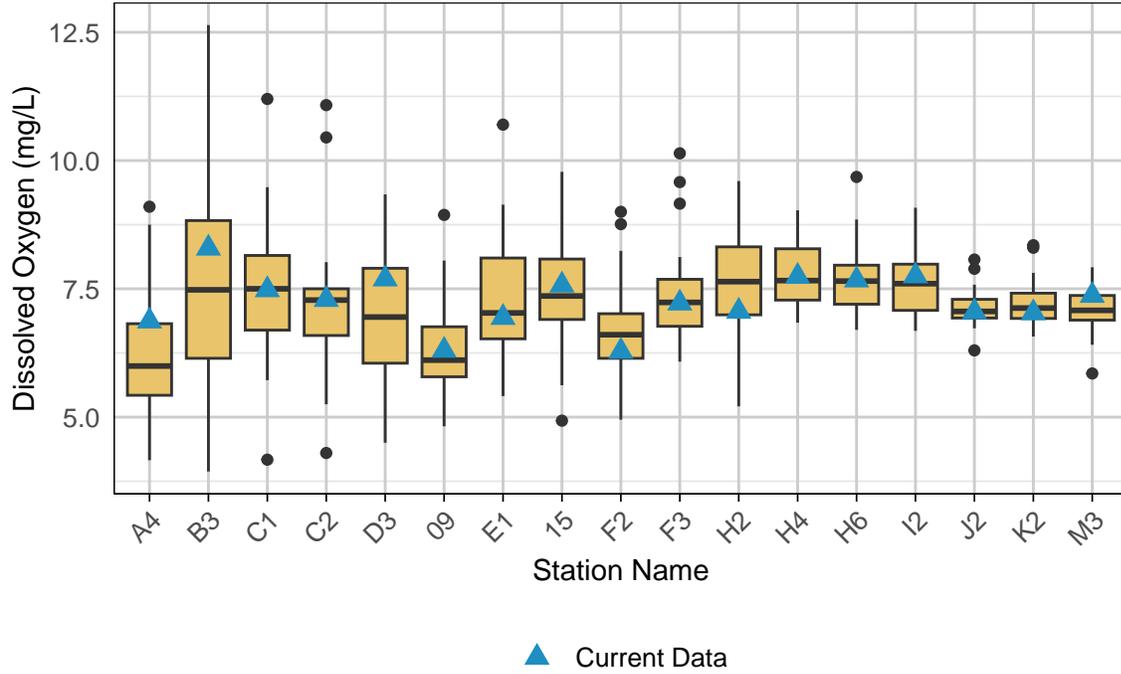
WQSEP25



Comparing the average Long Island Sound DO values at each station for each month since 1991

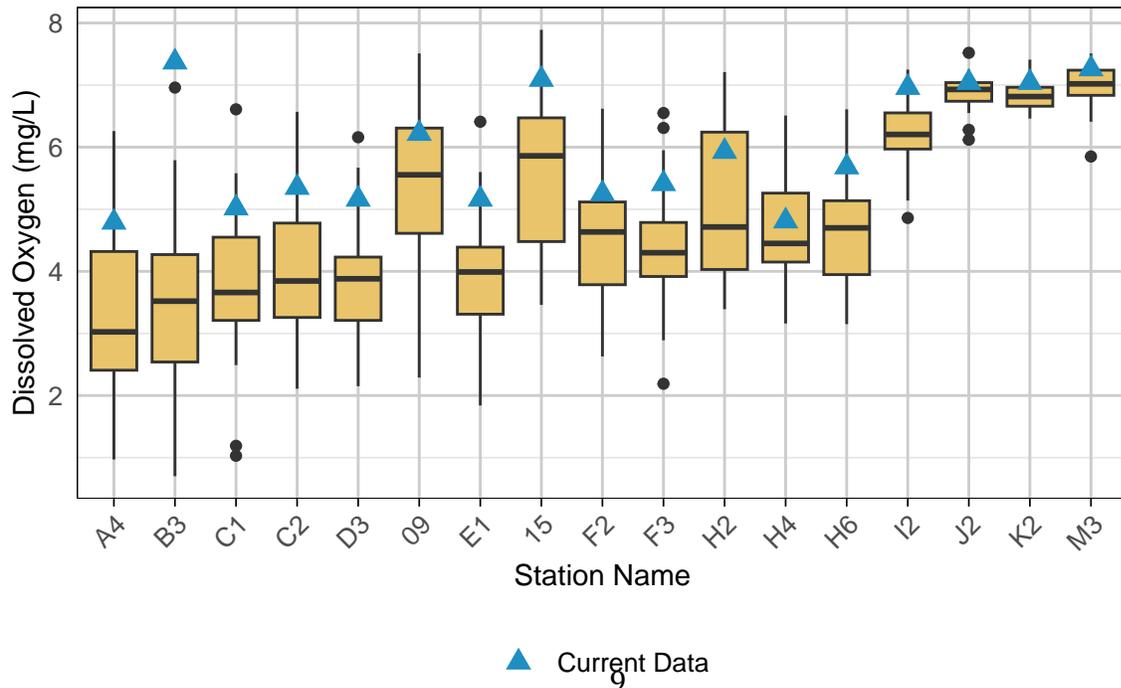
Surface Dissolved Oxygen Concentrations Across the Long Island Sound

For this month, every year since 1991 (WQ surveys only)



Bottom Dissolved Oxygen Concentrations Across the Long Island Sound

For this month, every year since 1991 (WQ surveys only)

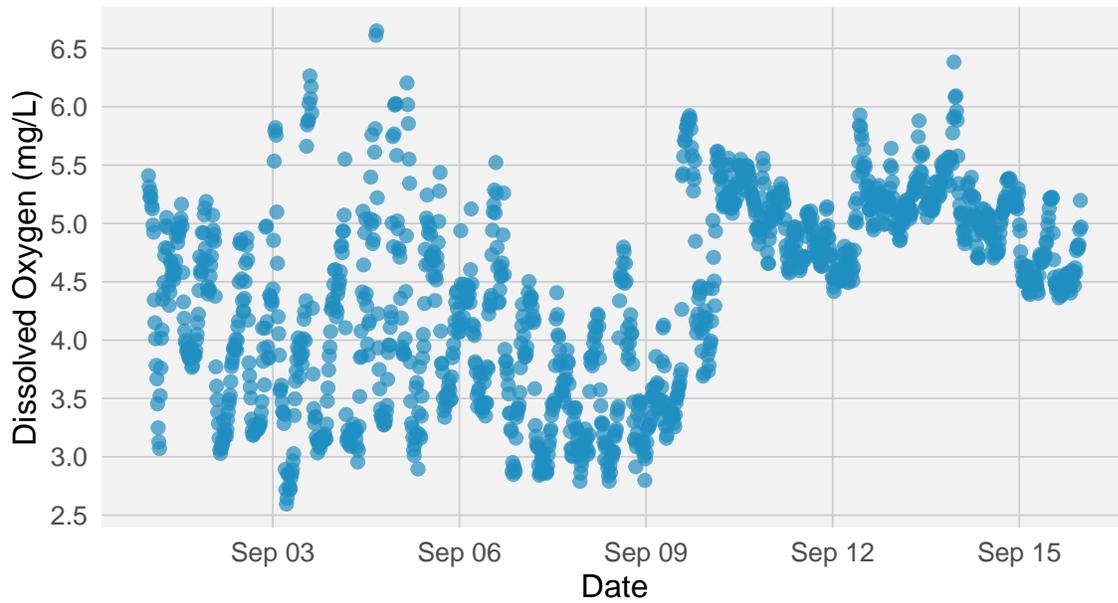


Recent Dissolved Oxygen Levels at EXRX, WLIS, and ARTG Stations

The Long Island Sound Integrated Coastal Ocean Observing System (LISICOS) collects and reports real-time continuous meteorological, water quality, and wave height data. The system is operated and maintained by the University of Connecticut with funding from the Long Island Sound Partnership and the Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS). The following graphs depict time series data from the LISICOS buoys (downloaded from the UCONN ERDDAP server) for the period surrounding the WQSEP25 survey.

Dissolved Oxygen – EXRX

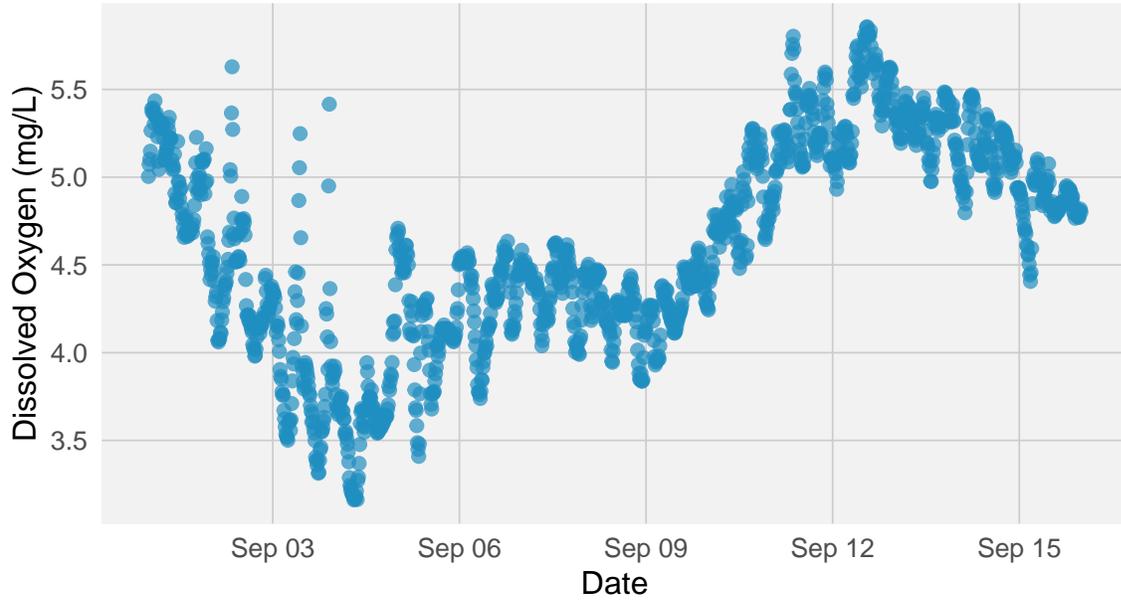
Sep 01 – Sep 15, 2025



Data source: LISICOS ERDDAP Accessed on 2025-09-25

Dissolved Oxygen – WLIS

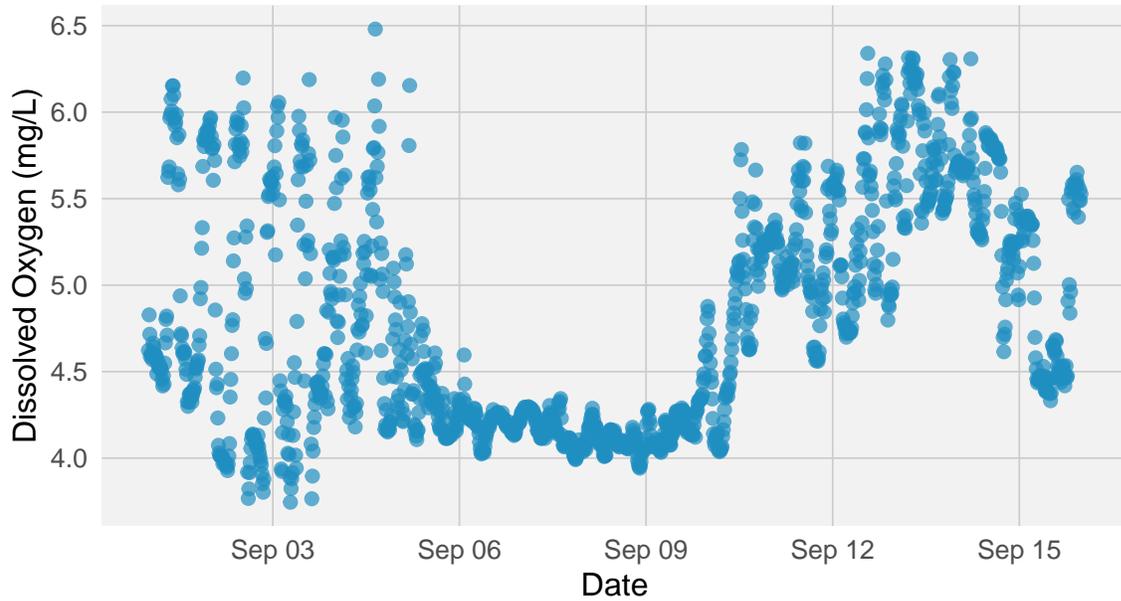
Sep 01 – Sep 15, 2025



Data source: LISICOS ERDDAP Accessed on 2025-09-25

Dissolved Oxygen – ARTG

Sep 01 – Sep 15, 2025



Data source: LISICOS ERDDAP Accessed on 2025-09-25

pH

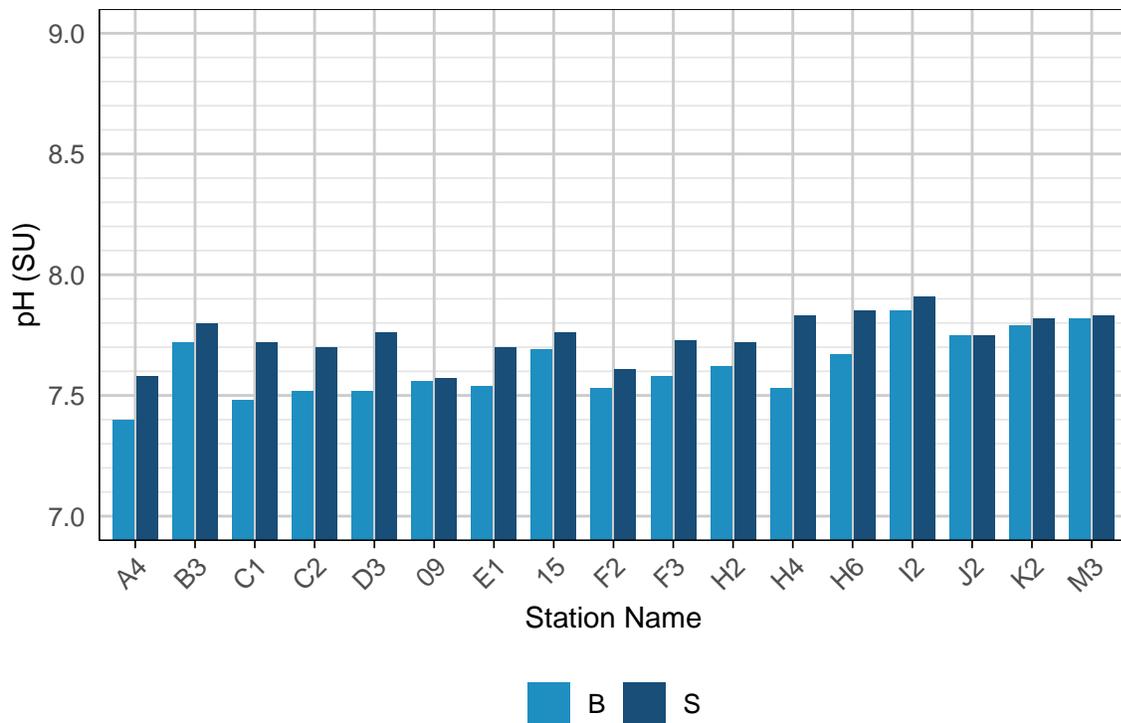
Ocean acidification has detrimental effects on marine life. Waters with a lower pH value, and therefore a greater acidity, have fewer carbonate ions. Calcifying species use available carbonate ions to produce their calcium carbonate shells. Therefore, ocean acidification harms the growth of calcifying species. This includes certain species of clams, oysters, and coral. Studies also show that increased ocean acidity can stunt the growth of many fish species.

The average acidity of the ocean is around 8.1. This is a 0.06 decrease since 1985. However, the average pH of the Long Island Sound has been found to decrease by 0.04 each decade - a much more drastic change.¹

The average surface and bottom pH from all stations across the LIS during the WQSEP25 survey were 7.74 and 7.62 respectively. The highest surface pH was 7.91 at Station I2, and the lowest surface pH was 7.57 at Station O9. The highest bottom pH was 7.85 at Station I2 and the lowest bottom pH was 7.4 at Station A4.

pH Across Long Island Sound

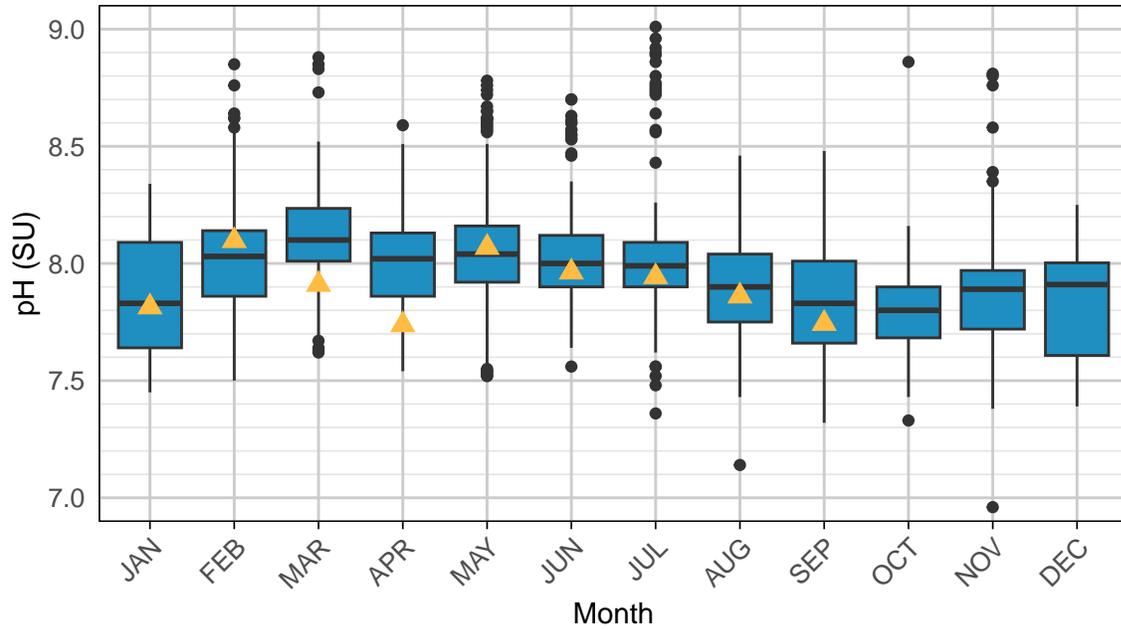
WQSEP25



Comparing the average Long Island Sound pH values for each month since 2010

Surface pH Values Across the Long Island Sound

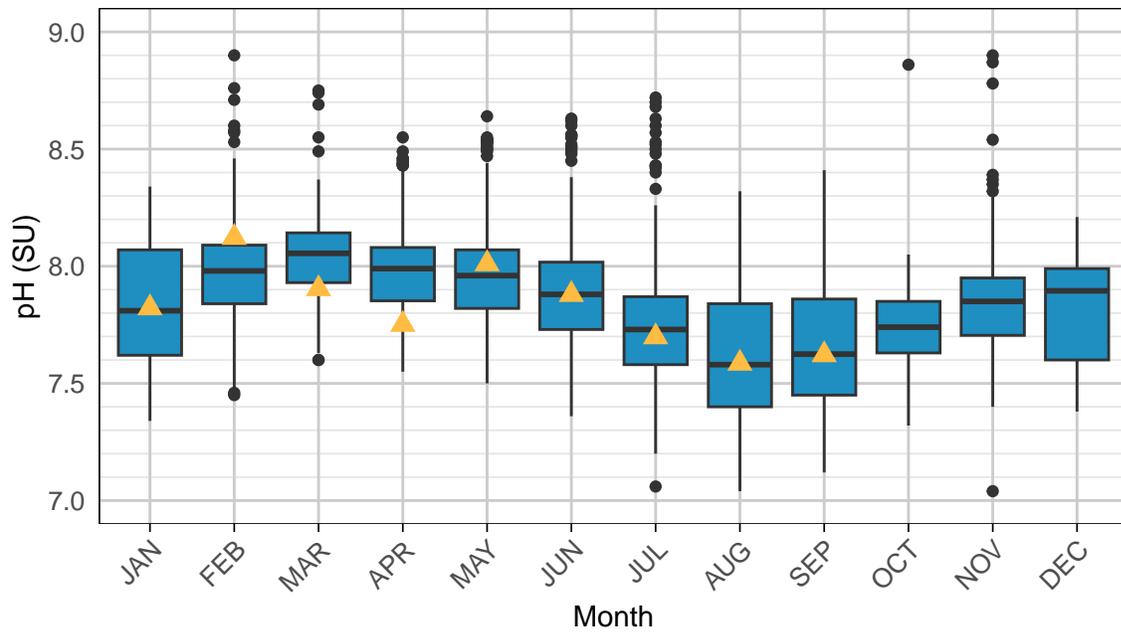
Since 2011 (WQ surveys only)



▲ 2025 Data

Bottom pH Values Across the Long Island Sound

Since 2011 (WQ surveys only)



▲ 2025 Data

Salinity

The Long Island Sound is an estuary, meaning its waters are a mix of both fresh and salt water. This is referred to as brackish water. The salt water is supplied by the Atlantic Ocean, while the majority of LIS fresh water comes from three major Connecticut Rivers: the Thames, the Connecticut, and the Housatonic - from east to west.⁴ Estuaries are considered to be some of the most ecologically productive ecosystems on Earth.⁴

Many species rely on estuaries for breeding and nursing their young. Furthermore, many major marine species that spend most of their time in the ocean spend part of their life cycles within an estuary. This includes salmon, herring, and oysters.³ The average salinity of the Long Island Sound is approximately 28 PSU, compared to the ocean, which has a higher average salinity of 35 PSU.

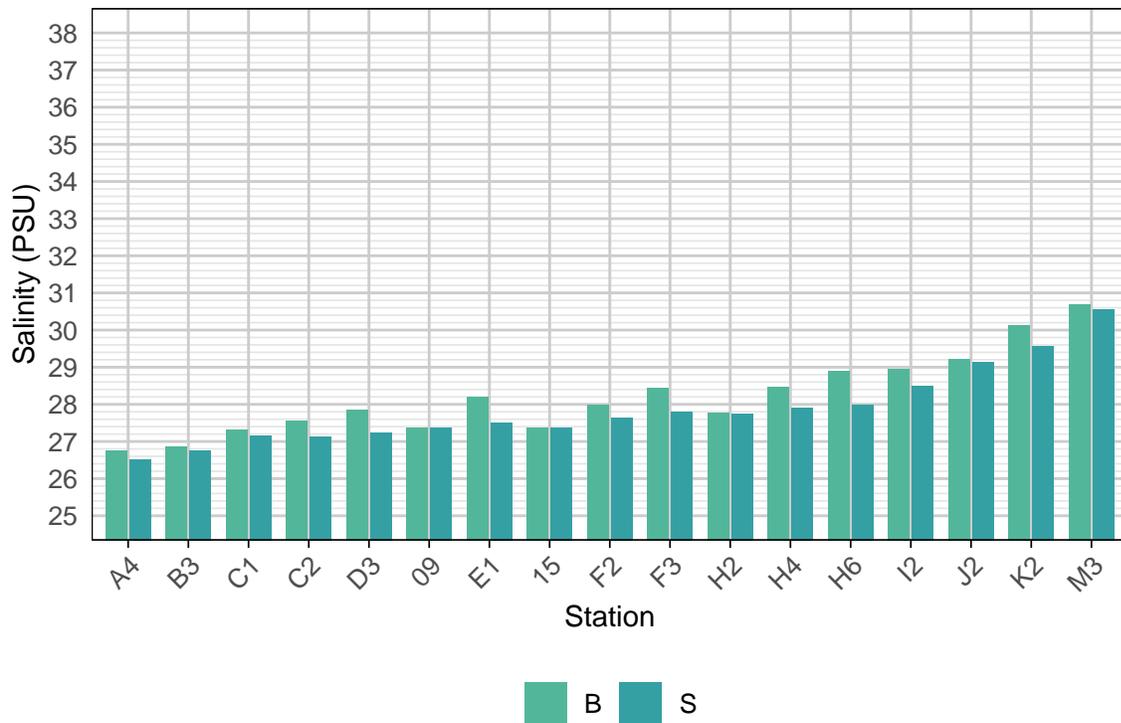
The average surface and bottom salinities from all stations across the LIS during the WQSEP25 survey were 27.87 PSU and 28.23 PSU respectively. The highest surface salinity was 30.55 PSU at Station M3, and the lowest surface salinity was 26.51 PSU at Station A4. The highest bottom salinity was 30.68 PSU at Station M3 and the lowest bottom salinity was 26.77 PSU at Station A4.

Average salinity across the Long Island Sound by station

Eastern stations near the Atlantic Ocean tend to have higher salinities due to ocean exchange.

Salinity Across Long Island Sound

WQSEP25

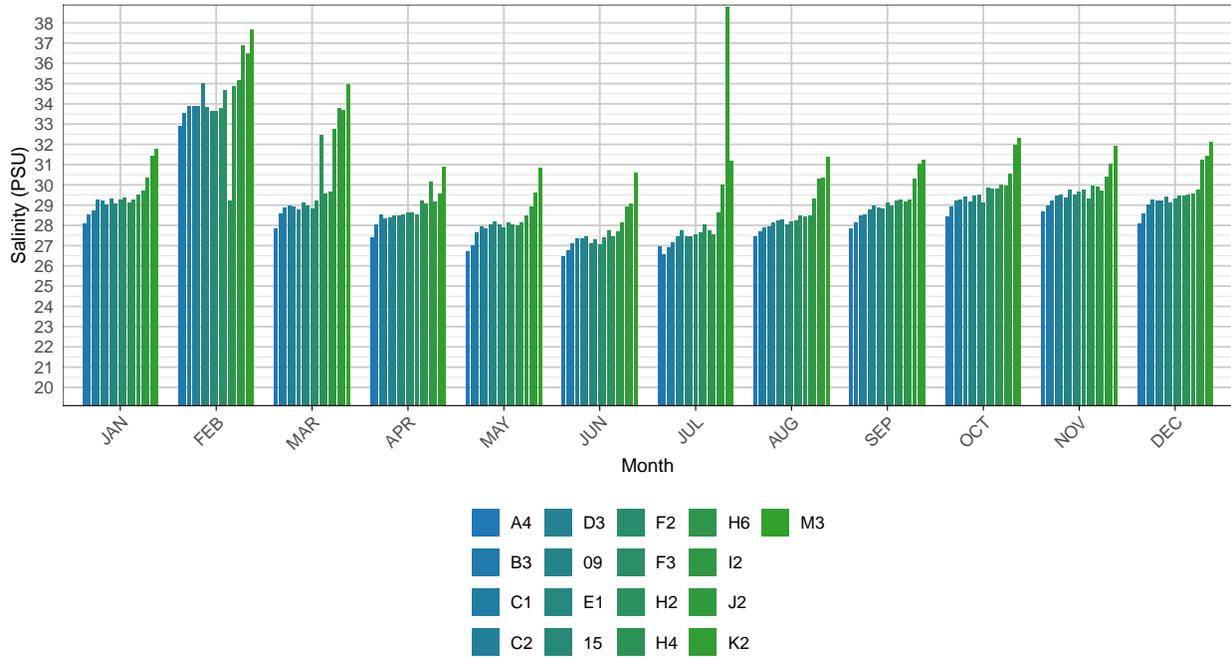


Changes in salinity throughout the year

Surface salinities generally decrease slightly from January through May due to snow melt and spring rains.

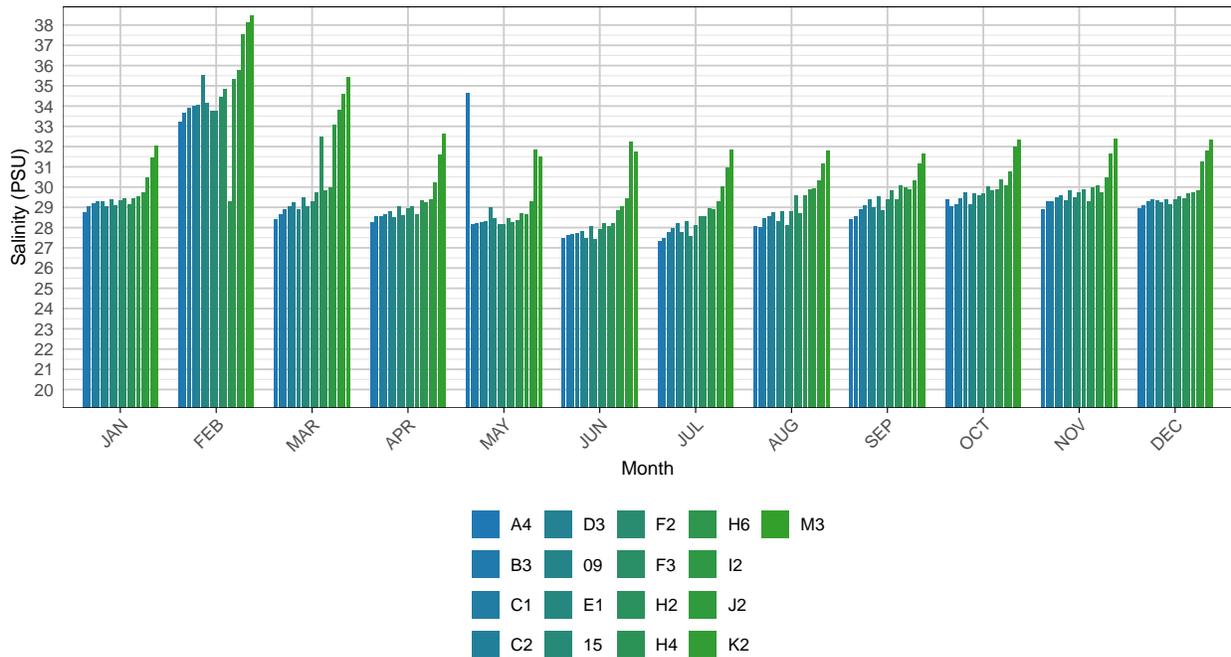
Average Surface Salinity by Station and Month

Since 1991 (WQ surveys only)



Average Bottom Salinity by Station and Month

Since 1991 (WQ surveys only)



Secchi Disk Depth

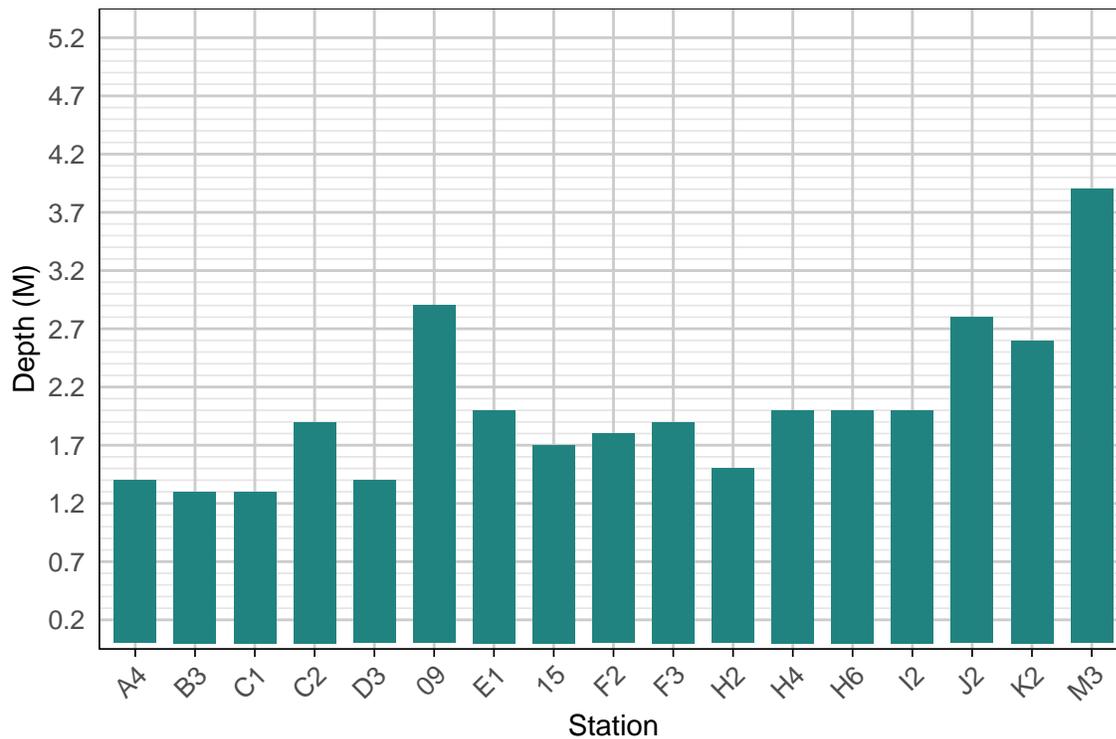
Secchi disks are used to measure the transparency of a water body. They are lowered into the water until they are no longer visible to the observer. The depth of disappearance, also called the Secchi depth, is indicative of the water clarity.⁵ Clarity is reduced as the presence of suspended solids, plankton, and organic matter increases.

The average secchi disk depth from all stations across the LIS during the WQSEP25 survey was 2 m. The greatest disk depth was 3.9 m at station M3. The lowest disk depth was 1.3 m at Stations B3 and C1.

Secchi disk depths at different stations across the Long Island Sound

Secchi Depths Across Long Island Sound

WQSEP25



The Long Island Sound Report Card developed by Save the Sound through the LIS partnership utilizes the following thresholds:²

Secchi Depth Grading Thresholds

Grade	Depth Range (meters)	Score Equivalent
A	> 2.28	90–100%
B	2.12 – 2.28	80–90%

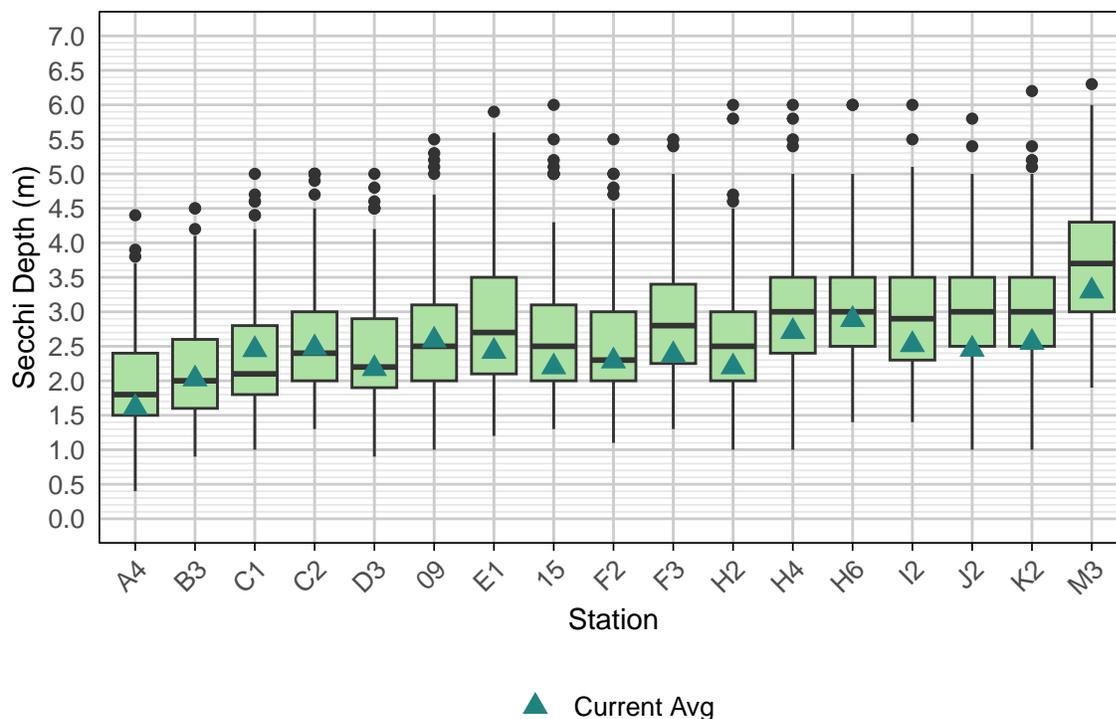
Grade	Depth Range (meters)	Score Equivalent
C	1.95 – 2.12	70–80%
D	1.80 – 1.95	60–70%
F	< 1.80	< 60%

In the WQSEP25 survey, 4 stations received a grade of A, 4 stations received a grade of C, 2 stations received a grade of D, 7 stations received a grade of F.

Looking at the change in Secchi depth since 2000

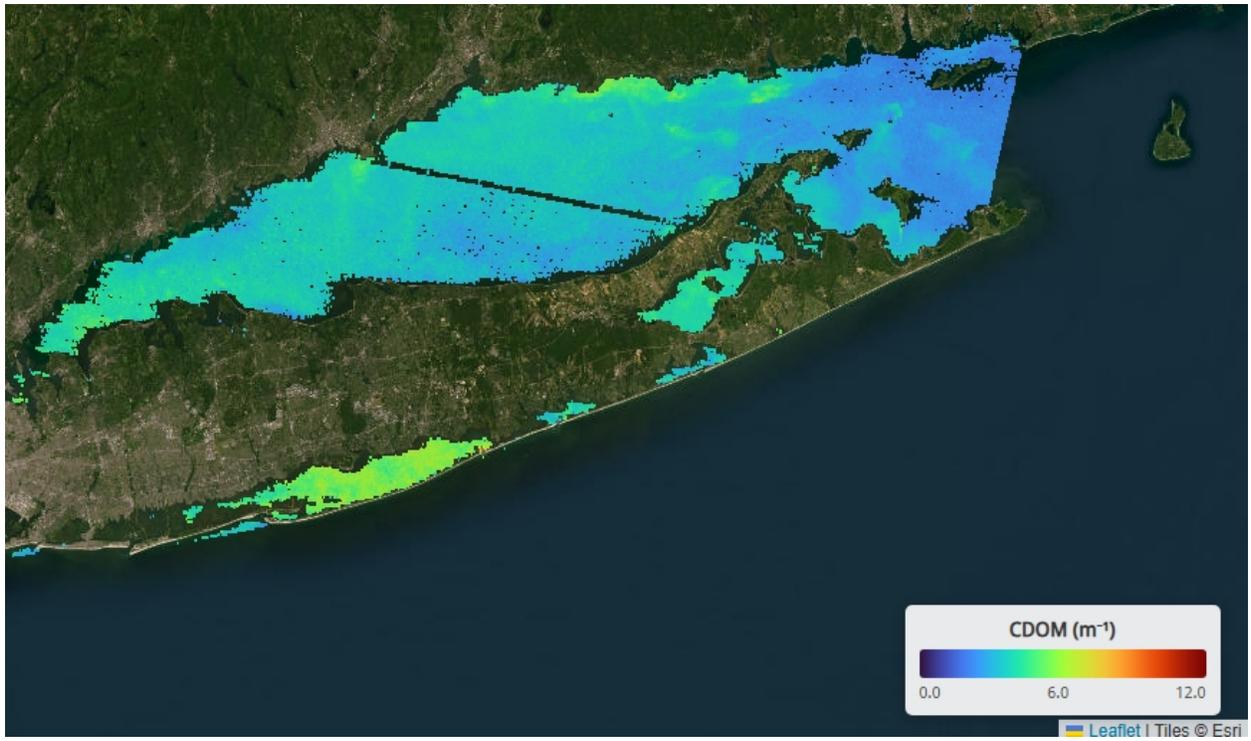
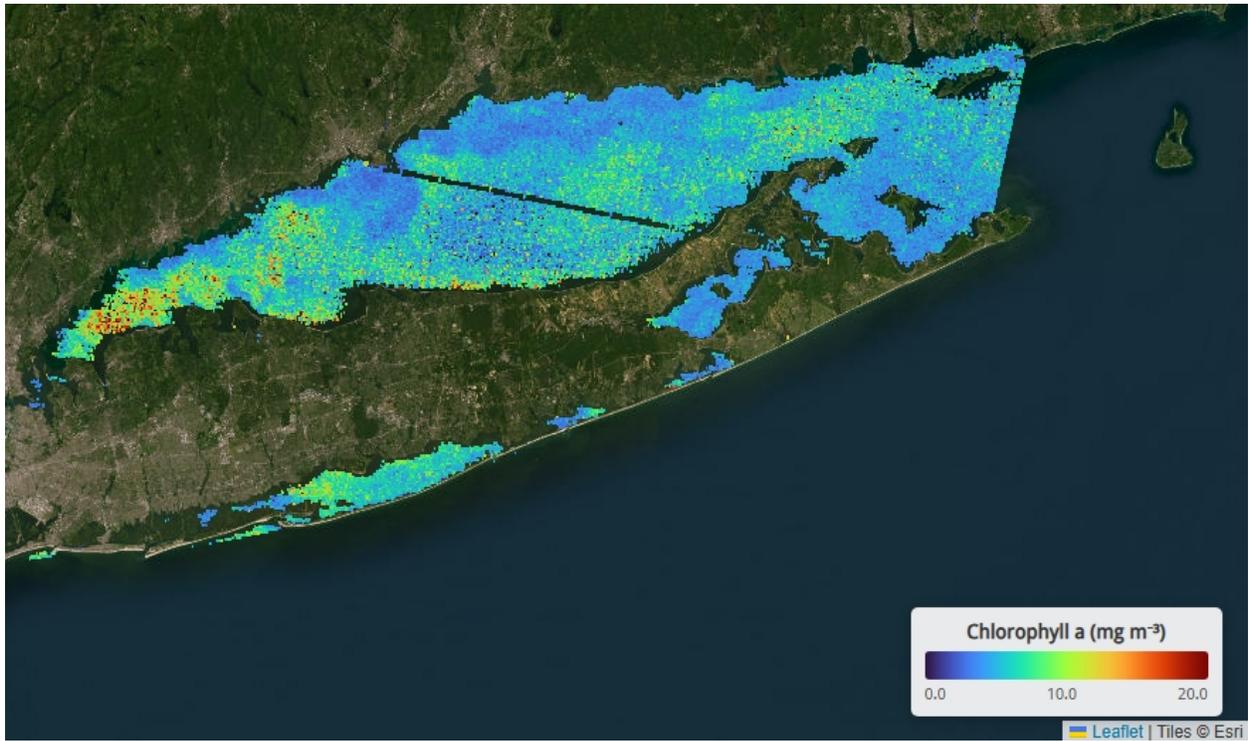
Secchi Depths Across the Long Island Sound

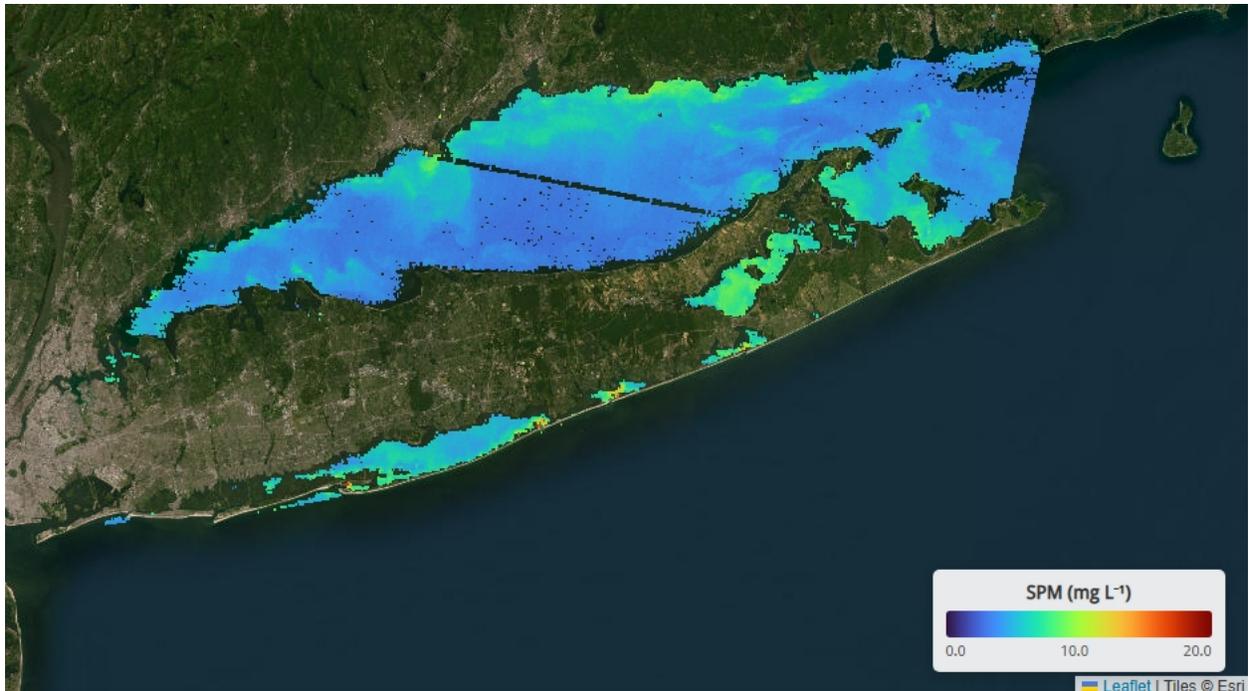
Since 2000 (WQ surveys only)



Remote sensing- CHLA, CDOM, SPM

The [LIS Ocean Color Website](#) curated by the Tzortziou Bio-optics Lab at the City University of New York displays Long Island Sound optimized chlorophyll (CHLA), colored dissolved organic matter (CDOM), and suspended particulate matter (SPM) remote sensing imagery. The images below were collected during the WQSEP survey and excerpted from the website. CHLA imagery provides a measure of plankton biomass. CDOM and SPM provide a measure of turbidity.





For more information: Please visit the Long Island Sound Water Quality and Monitoring Program website at: <https://portal.ct.gov/deep/water/lis-monitoring/lis-water-quality-and-hypoxia-monitoring-program-overview>

Or contact us: Katie.Obrien-Clayton@ct.gov 79 Elm Street Hartford, CT 06106 (860) 424-3176

References

- ¹ “Climate Explained: Ocean Acidification.” Save the Sound, Save the Sound, 30 Oct. 2023, www.savethesound.org/2023/10/23/climate-explained-ocean-acidification/.
- ² “Long Island Sound Report Card.” Save the Sound, www.savethesound.org/report-card. Accessed 13 June 2025.
- ³ “Life in an Estuary.” National Ocean and Atmospheric Association, U.S. Department of Commerce, 25 Mar. 2025, www.noaa.gov/education/resource-collections/marine-life/life-in-estuary.
- ⁴ Van Patten, Peg, et al. “Sound Facts.” UConn.Edu, Connecticut Sea Grant, 2009, seagrant.uconn.edu/wp-content/uploads/sites/1985/2020/09/SoundFactsFinal.2009.pdf.
- ⁵ “What Is a Secchi Disk?” The Robert Carlson Secchi Dip-In, North American Lake Management Society (NALMS), www.nalms.org/secchidipin/monitoring-methods/the-secchi-disk/what-is-a-secchi-disk/. Accessed 13 June 2025.