Long Island Sound Water Quality and Hypoxia Monitoring Program

June

HYJUN24 Hypoxia Survey

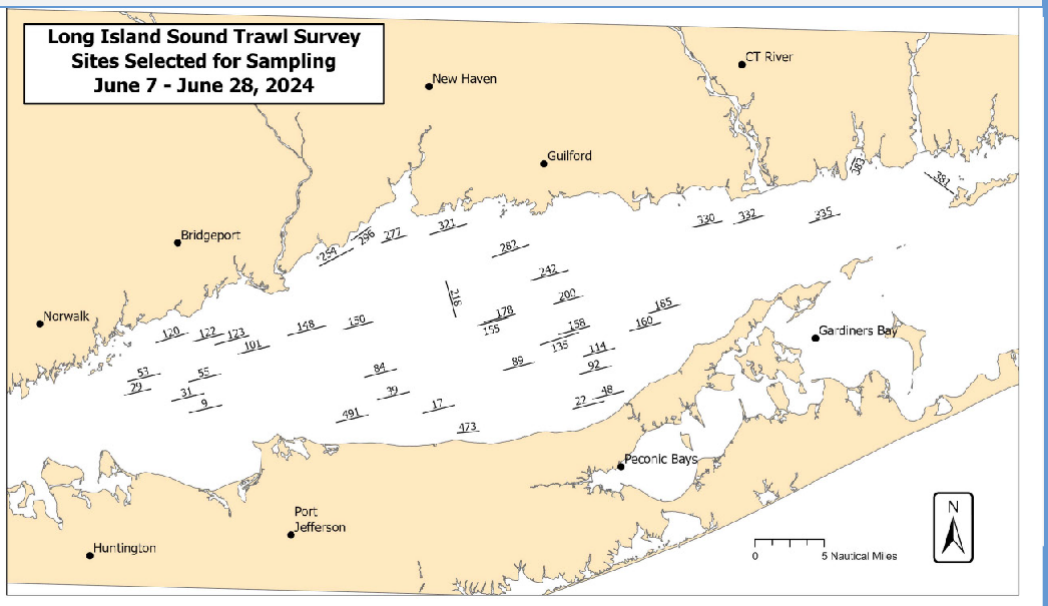
July 8, 2024

Dempsey Update

The John Dempsey will be available for the WQ and HY surveys until September when fall trawl surveys begin. We are back to full capacity and are kicking summer off in high gear. If you have any questions or want more information on the Dempsey, please contact Matthew Lyman at: matthew.lyman@ct.gov.

2024 Sampling Schedule

The 2024 Long Island Sound Sampling began on 2 January 2024. All cruises were completed as scheduled so far. The HYJUNE24 survey started on 17 June 2024 and finished on 18 June 2024 with the help of the use of the RV Patricia Lynn. The WQJUL24 survey kicked off 27 June 2024 and finished 3 July 2024 aboard the RV John Dempsey as well. Click the link to learn more about the program and our sampling schedule: Long Island Sound Water Quality and Hypoxia Monitoring Program Overview (ct.gov)



Hypoxia

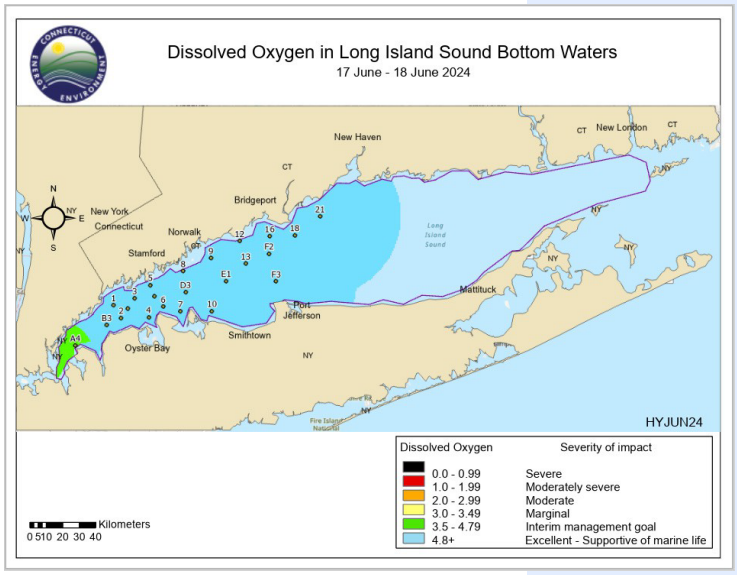
Dissolved Oxygen Summary

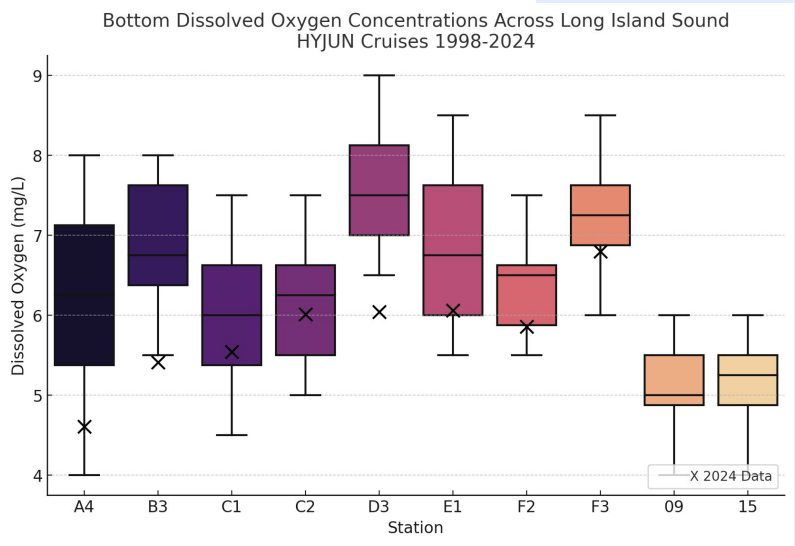
Preliminary data from this survey and prior 2024 cruises are available in Excel spreadsheet format as well as on the [UCONN ERDDAP](#) site.

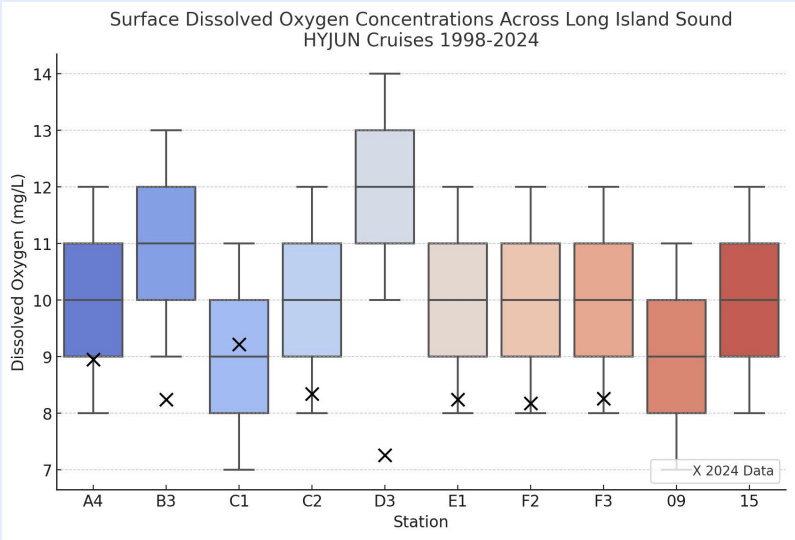
Dissolved oxygen (DO) concentrations in the bottom waters of Long Island Sound remained above 4 mg/L in the June 2024 Hypoxia Survey. The lowest concentration measured was 4.61 mg/L taken at Station A4. The highest was 9.22 mg/L measured at Station C1 from the Surface.

Last year, during the HYJUN23 survey, DO in the bottom water at Station A4 was 6.38 mg/L. Of the 26 bottom waters measurements recorded at Station A4 between 1998 and 2023, the median concentration was 6.88 mg/L with a range of 2.84 to 9.02 mg/L. The mean was 6.88 mg/L.

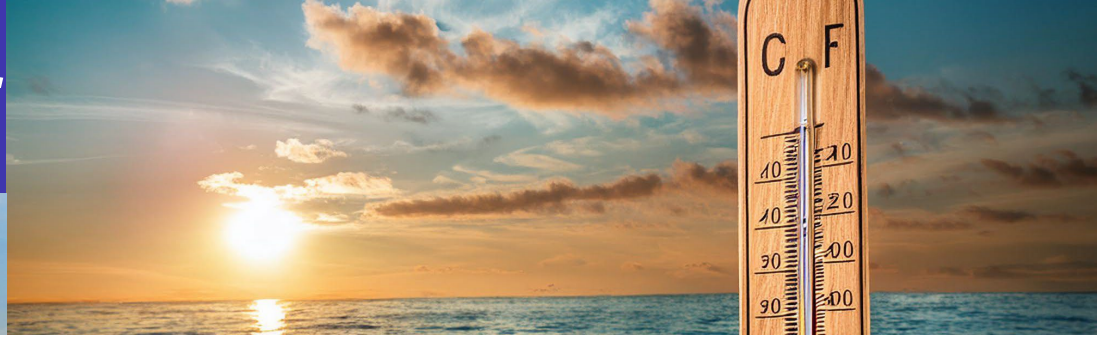
Leading up to the HYJUN23 survey, A4 had concentrations of 8.35 mg/L in May and 6.45 mg/L in June.

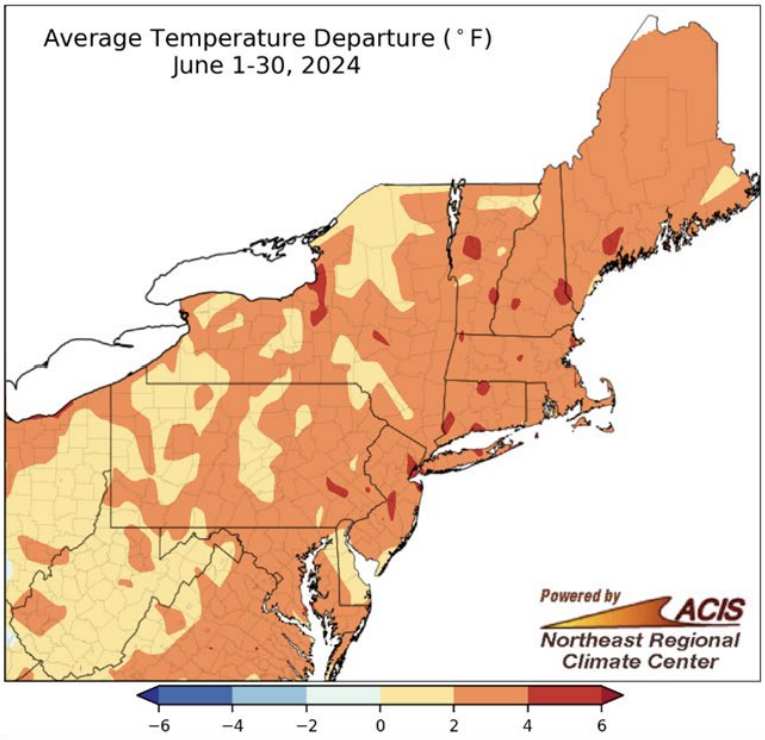


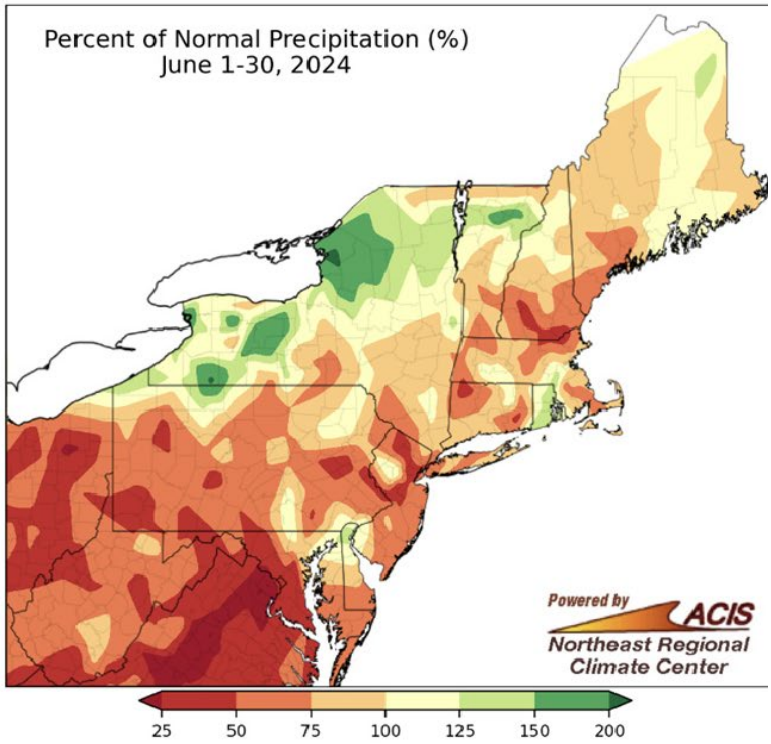




Weather







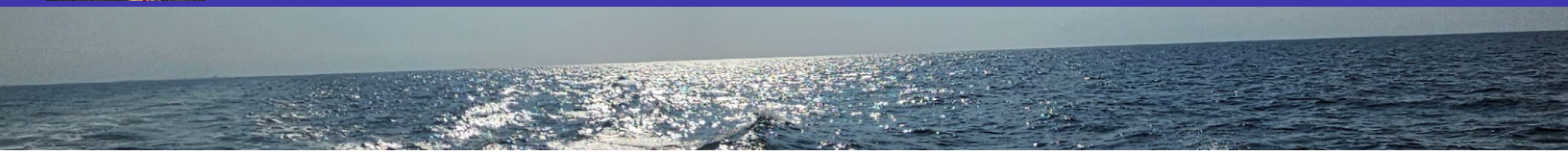
All data and images were from the Northeast Regional Climate Center's website. Please visit **http://www.nrcc.cornell.edu/** for more information.

June 2024 brought a sizzling start to the summer in the Northeast, including 35 major climate sites, with average temperatures ranging from near normal to 6ºF above normal. During the HYJUN24 Survey, June's average temperatures ranged from 1.8ºF above normal in Portland, Me, and Allentown, PA, to 5.2 ºF above normal in Hartford, CT. June was a hot record for four major climate sites, including Islip, NY; Caribou, ME; Hartford, CT; and Bridgeport, CT. The Northeast experienced a heatwave from 17-23 June with the highest temperatures ranging from 90ºF to 100ºF. Precipitation ranged from less than 25% to 200% of typical levels. Severe thunderstorms hit the Northeast causing damage from 17-13 June as well, with another round of thunderstorms moving through New England on 26 June.

Hartford, CT, had an above average 5.2°F departure from the normal temperature of 68.9°F. The average temperature for the month of June was 74.1°F, with its highest temperature reaching 98°F as recorded on June 20th. This record beat the 97 °F high-temperature record recorded back in 2012. Hartford also experienced 66% of normal precipitation at 2.81 inches versus a typical 4.28 inches of rainfall in June.

Bridgeport, CT, had an above-average temperature of 72.6°F, a 3°F departure from the normal of 69.6°F, this June. Precipitation was 93% of normal, with an average of 3.5 inches compared to a normal 3.77 inches in June. Islip, NY, also had an above-average temperature. There was a 3°F departure from a normal temperature of 69.0°F, with the average temperature in Islip, NY this June being 72°F. For precipitation, Islip, NY had 61% of normal precipitation at 2.44 inches.

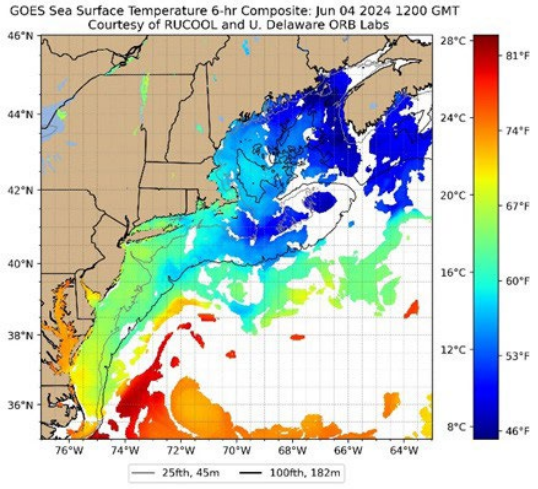
Sea Surface Temperature

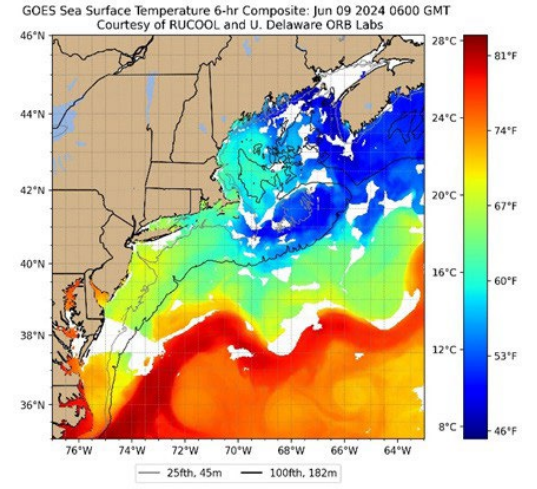


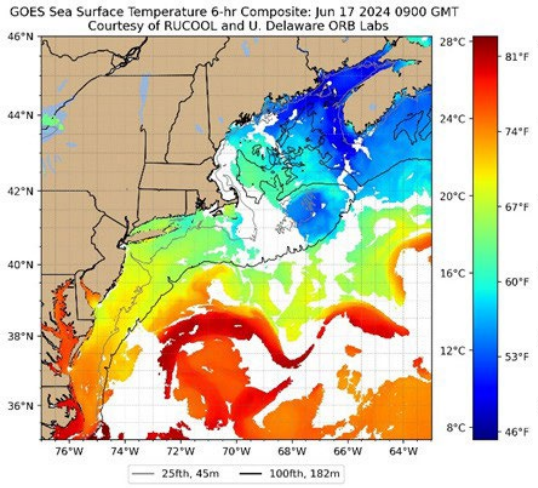
Sea Surface temperature data from Rutgers University IMCU Coastal Ocean Conservation Lab illustrates how currents and fronts impact water temperatures in the Sound and offshore. We will be switching to the NOAA SST in upcoming newsletters as part of the LIS Remote Sensing Project (see pg.6).

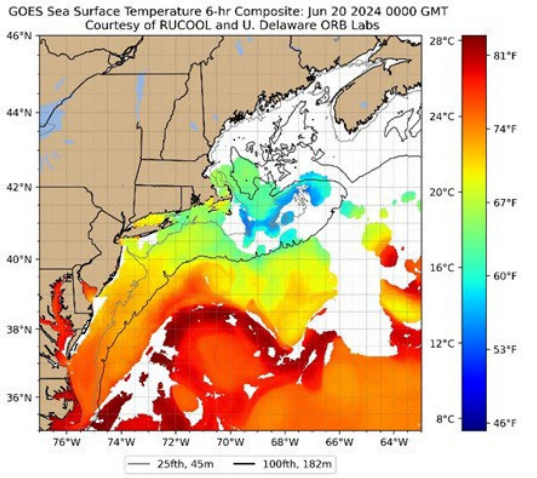
In the first image (left), taken on June 4th, the waters in Long Island Sound are around 15.5ºC-20ºC (60ºF-68ºF). The second image on June 9th shows SST between 17ºC-20.5ºC (62.5ºF-68.9ºF).

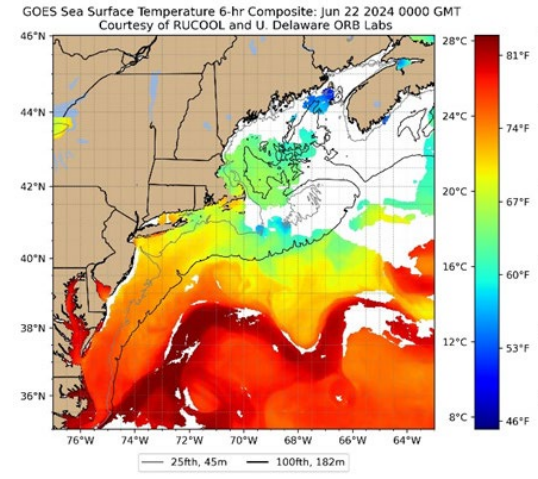
In the following four images (left) there is a gradual increase in SST in the Long Island Sound with notable variations reflecting broader climate trends and localized environmental factors. Early in the month, temperatures averaged around 18ºC (64ºF), which is consistent with historical data for this period. However, a gradual warming trend was observed, with temperatures reaching up to 22ºC (72ºF) by the end of June. This increase can be attributed to prolonged periods of sunlight and relatively calm weather conditions, which enhance solar heating of the water surface. Additionally, the influx of warmer waters from the Atlantic Ocean carried by the Gulf Stream and tidal exchanges has contributed to the overall rise in sea temperatures. These changes are significant for local marine ecosystems, influencing species distribution, breeding cycles, and the overall health of Long Island Sound.

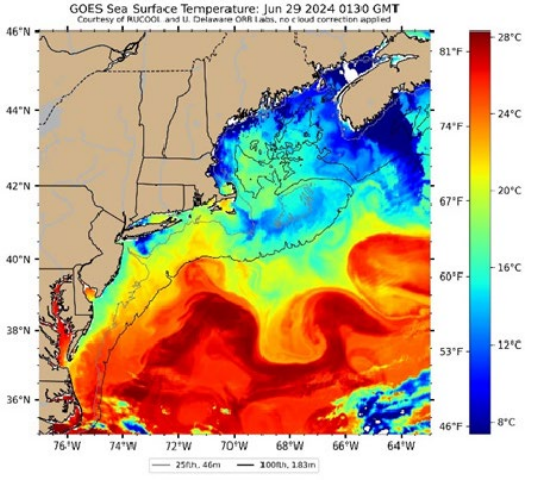












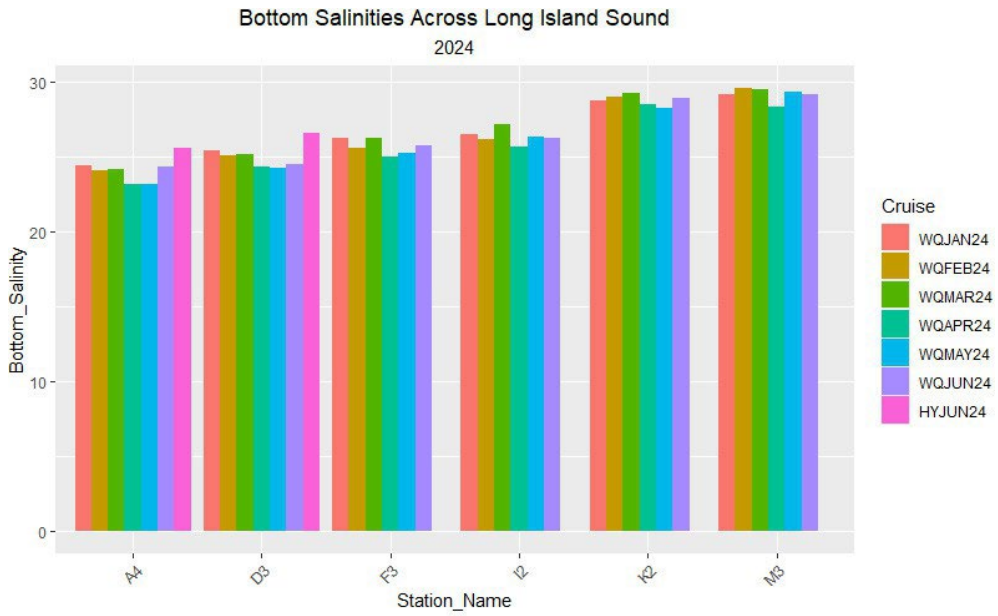
More information about sea surface temperature can be found on the Rutgers University Satellite Imagery website, **Sea Surface Temperature - IMCS Coastal Ocean Observation Lab (rutgers.edu)**

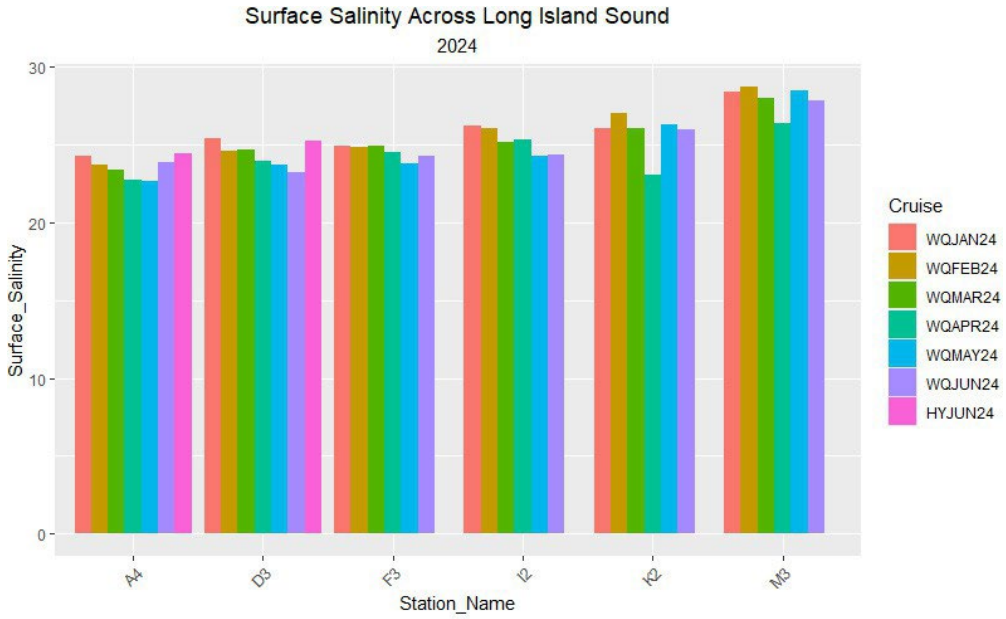
Salinity

Surface salinities across Long Island Sound generally decrease slightly from January through May due to snow melting and spring rains. The less dense freshwater will float on top of the denser saltwater contributing to stratification and impacting hypoxia. Additionally, nutrients carried by the runoff fuel phytoplankton growth. Surface and bottom water salinities in 2024 were constant across much of the Sound.

Surface salinity values for HYJUN24 were below the 2009-2024 average for Station A4 and above the average for Station D3. Bottom salinity values during the HYJUN23 survey were below the 2009-2024 average for both Station A4 and Station D3. (See table below).

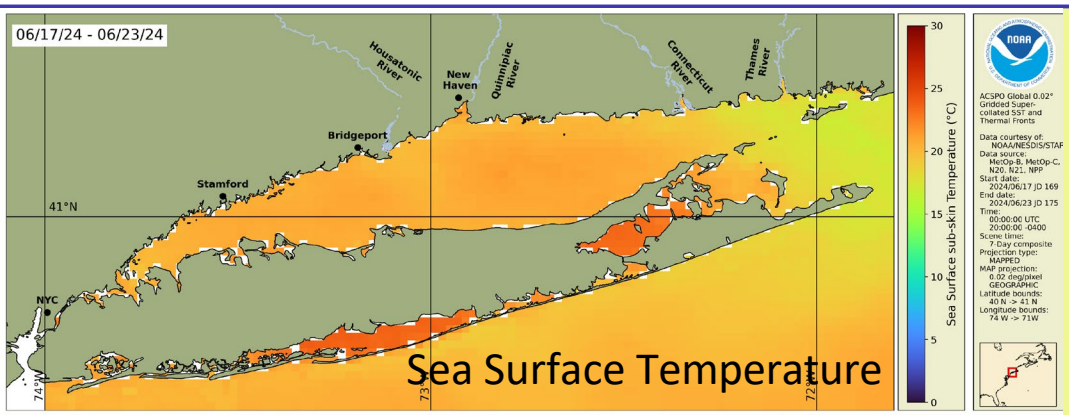
	A4	D3
2024 Surface	*24.46*	*26.6*
2009-2024 Average Surface	*25.07*	*25.97*
2024 Bottom	*25.55*	*25.2*
2009-2024 Average Bottom	*25.81*	*26.73*

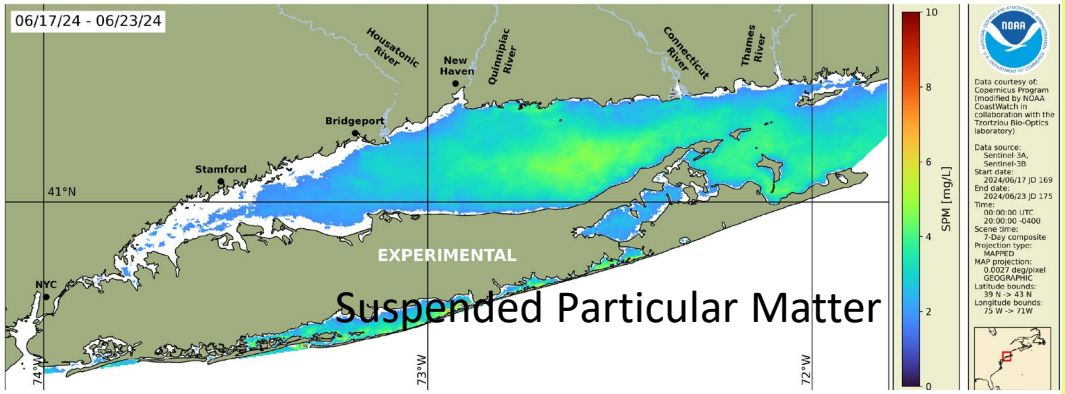




Note: HYJUN23 only sampled two of the six stations represented (A4 & D3)

Remote Sensing in Long Island Sound





An exciting multidisciplinary ecological project is currently in progress, funded by the Sea Grant programs of New York (NYSG) and Connecticut (CTSG) and the U.S. Environmental Protection Agency (EPA) through the Long Island Sound Study (LISS).

This vital initiative, led by the **Tzortziou Bio-Optics laboratory**, aims to develop satellite algorithms and products while collecting optical, biogeochemical, and ecological measurements in the Sound. The ultimate goal is to significantly enhance the monitoring, assessment, and management of estuarine water quality, ecological processes, and ecosystem stressors, including eutrophication, hypoxia, and algal bloom growth.

A primary objective of this project is to create practical and interoperable satellite data products and services that can be utilized by various stakeholders to improve the health, management, and sustainability of the Sound.

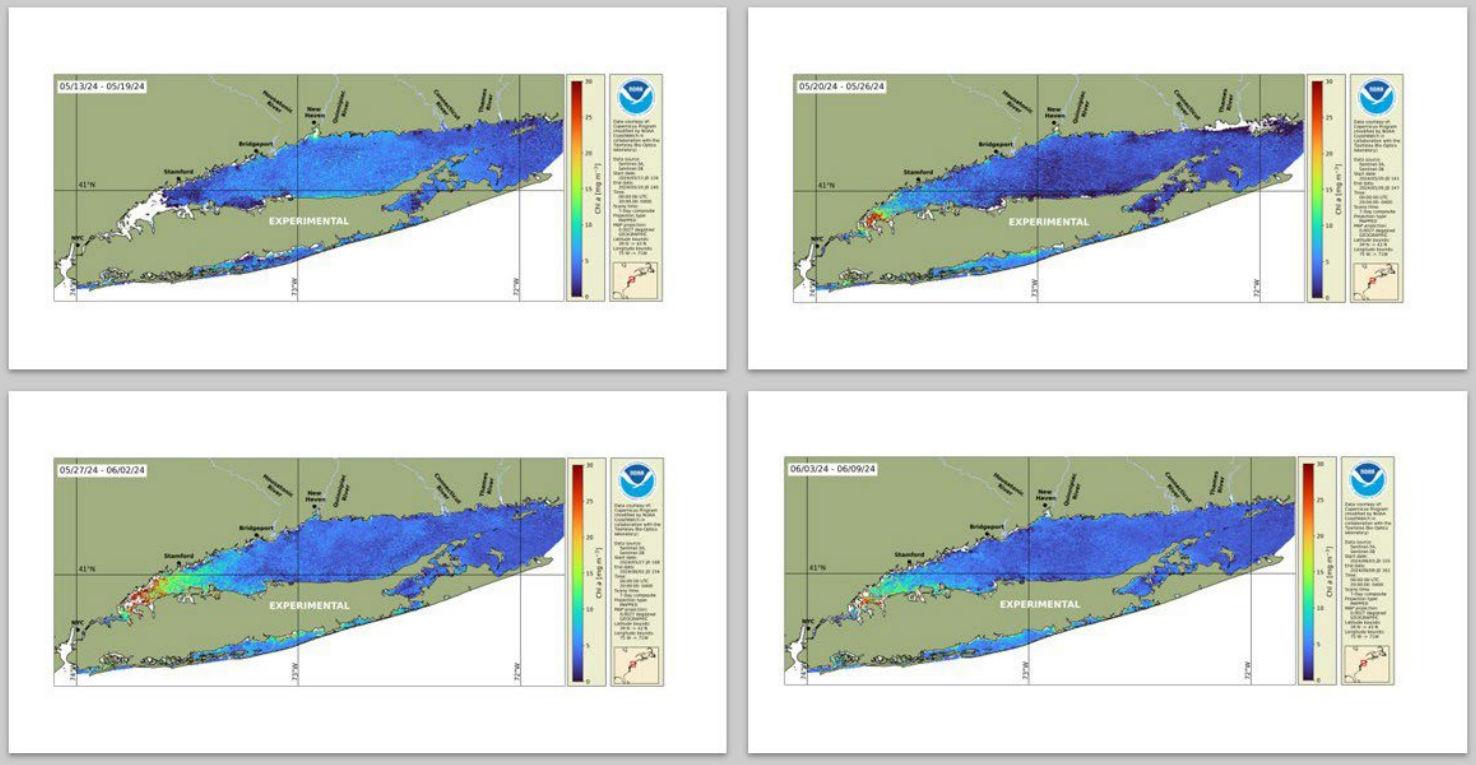
Federal, state, and local water quality monitoring programs play a crucial role in assessing the health of nearshore waters. These programs utilize various indicators such as chlorophyll a (Chl a), water clarity, turbidity, and dissolved organic carbon (DOC) to evaluate water quality in areas like Long Island Sound (LIS). We are actively working on developing satellite-derived products for these key parameters, specifically tailored for LIS. Additionally, our focus includes the development of new products for monitoring harmful algal blooms (HABs), such as the detection of red/brown tide and the retrieval of multiple phytoplankton pigments. To achieve this, we use satellite imagery at different resolutions ranging from 1km to 10–30m. Our collaboration with **NOAA CoastWatch** ensures that our satellite products are transformed into actionable information for LIS stakeholders. Leveraging the CoastWatch interactive data portals allows for easy access, analysis, and visualization of a wide array of data collections including sea surface temperature, ocean color, sea surface height, wave heights, ocean winds, salinity, and visible imagery, which can complement our newly developed products.

Chlorophyll A (Chl a) Concentrations Across the Sound

Since 1991, the Connecticut Department of Energy and Environmental Protection (CTDEEP) has been diligently monitoring the concentration of chlorophyll a (Chl a) across Long Island Sound. To gather comprehensive data, grab samples are systematically collected at 17 stations, both 2 meters below the surface and 5 meters above the sediment. In addition to grabbing samples, in situ Chl a data is meticulously collected during water column profiles using a YSI EXO multi-parameter sonde at all stations, with a note of caution regarding its use. These valuable data are readily available for download from the **Water Quality Portal** or the **UCONN ERDDAP**.

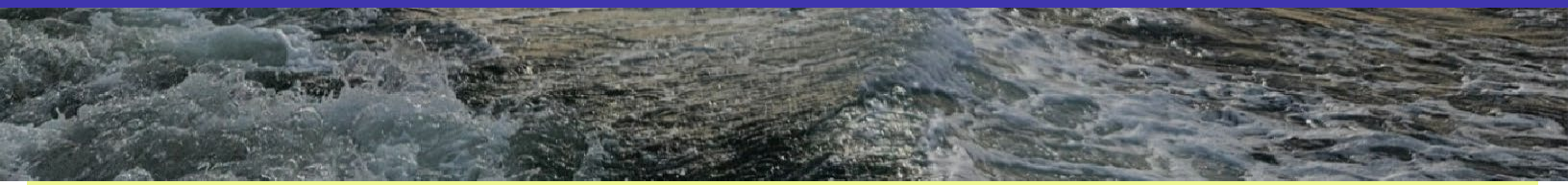
To further enhance the data collection efforts, grab samples are also meticulously collected and analyzed for phytopigments at 10 stations, employing High-Performance Liquid Chromatography (HPLC) for robust analysis. Additionally, to expand the scope of monitoring, a recent collaboration with the Remote Sensing group has resulted in the collection of an extra grab sample at a depth of 0.5 meters. This additional collection is aimed at assisting with algorithm validation at select sites, and its implementation varies by survey across the Sound.

Since August 2002, CTDEEP has also been gathering data on phytoplankton community composition by characterizing phytopigments using HPLC. HPLC analyses are conducted at the University of Maryland Horn Point Lab. Data are available upon request. HPLC data are being used in the development of the LIS algorithms for remote sensing products.



The NOAA CoastWatch Program created a video of weekly **LIS chlorophyll a concentrations** obtained from the OLCI satellite and interpreted using the LIS optimized algorithm from January to April 2024 and have not been updated for June yet. Additional parameter videos for the same timeframe include **CDOM (Colored Dissolved Organic Matter)** and **SPM (Suspended Particulate Matter)**.

Temperature Data Summary and Delta T



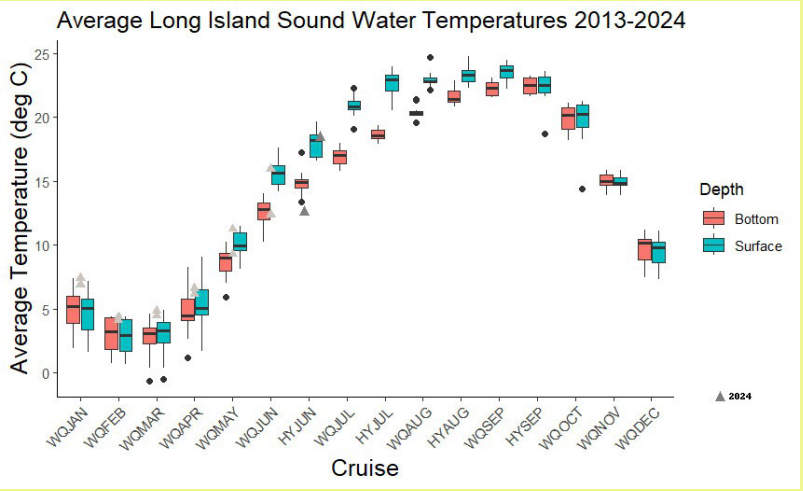
Bottom and Surface water temperatures have risen as reflected on the WQJUN24 survey, but more so with HYJUN24. **There was a subtle 1.93°C increase in average surface temperatures and a 1.6°C increase in average bottom temperatures from WQJUN24 to HYJUN24.**

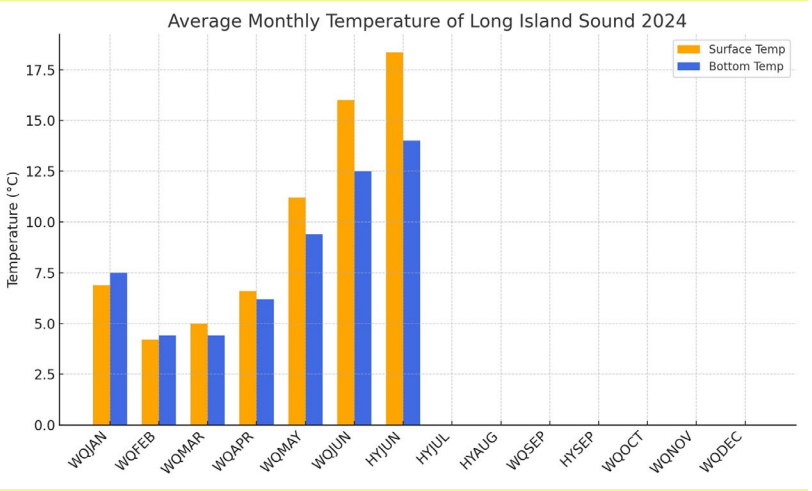
The maximum surface water temperature during the HYJUN24 survey was at Station C1 (18.91°C), while the maximum bottom water temperature occurred at Station F3 (15.73°C).

Delta T (∆T) 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.

HYJUN24 began this summer's monitoring program for DEEP specifically focused on hypoxia (dissolved oxygen levels). **Delta T's (∆T) averaged 3.9°C, during the HYJUN24 survey, an increase of 0.85 from the WQJUN24 ∆T average of 3.05°C . The greatest temperature difference between surface and bottom waters for HYJUN24 was 5.72°C at Station C1, and the smallest temperature difference was 2.68°C at Station 04.**

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.





UCONN's Long Island Sound Coastal Observing System

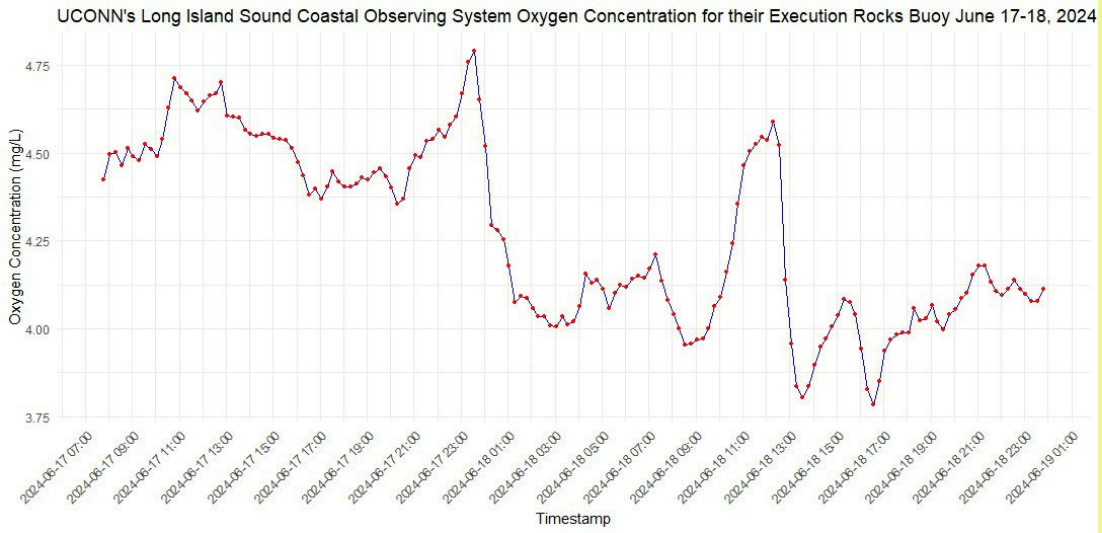
The UCONN Long Island Sound Integrated Coastal Observing System (LISICOS) oxygen concentration buoys are vital for monitoring hypoxia in Long Island Sound, where low oxygen conditions can adversely affect marine ecosystems. By providing real-time data on dissolved oxygen levels, these buoys facilitate the mapping of hypoxic zones, enabling the Connecticut Department of Energy and Environmental Protection (DEEP) to implement timely management interventions. Furthermore, the data supports research on the drivers of hypoxia, including nutrient runoff, and serves as an early warning system for environmental degradation. This continuous monitoring contributes to informed decision-making, stakeholder collaboration, and long-term trends analysis, ultimately aiding in the preservation and sustainable management of coastal resources. For more information about the UCONN Long Island Sound Integrated Coastal Observing System, you can visit **UCONN LISICOS**.

There were significant fluctuations in oxygen concentration at the Execution Rocks buoy during the HYJUN24 period. The concentration peaks around 4.75 mg/L and drops as low as 3.75 mg/L. as depicted to the right. There appears to be a diurnal pattern, with oxygen levels rising during certain times of the day and falling at other times, possibly reflecting the photosynthetic activity of aquatic plants and algae, which produce oxygen during daylight hours and consume it during the night.

There are sharp drops in oxygen concentration on June 18th, which could indicate periods of higher oxygen consumption or lower production. This might be due to factors like increased respiration by organisms or physical processes such as stratification in the water column.

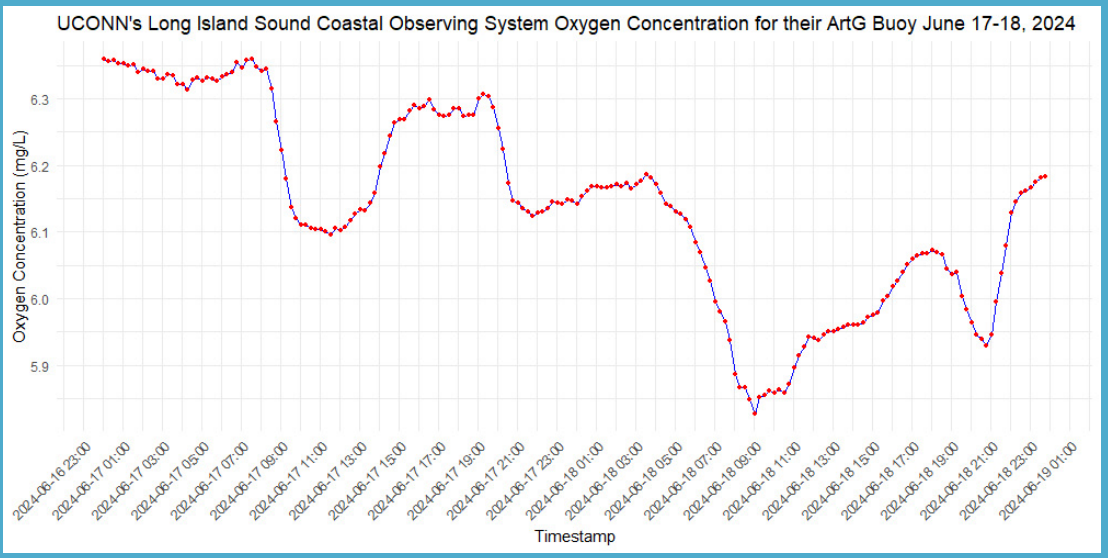
The drop in oxygen levels to near 3.75 mg/L is particularly concerning. In Long Island Sound, hypoxia (low oxygen levels) is a recurring problem, especially in the summer months. Oxygen levels below 3 mg/L can be harmful to marine life, leading to "dead zones" where few organisms can survive.

Prolonged periods of low oxygen can stress fish, invertebrates, and other aquatic organisms, affecting biodiversity and the overall productivity of the Sound.



The data to the right was presented specifically from the ArtG buoy between June 17 and June 18, 2024. The oxygen concentration shown in the graph hovers between approximately 5.9 mg/L and 6.3 mg/L, indicating a relatively stable environment. This level is generally higher than what was observed at the Execution Rocks buoy, which suggests that this location might be less prone to hypoxia during this period. There is noticeable variability in the oxygen levels, with a decline observed during certain times of the day. However, the variations are not as drastic as those seen in other regions of Long Island Sound, indicating a relatively healthier oxygen regime. Similar to the other buoy data, the graph reflects a pattern where oxygen levels fluctuate daily, likely corresponding to the photosynthetic activities of phytoplankton and the respiration rates of aquatic organisms. The relatively higher and more stable oxygen levels at this buoy suggest that this particular area of Long Island Sound might be more resilient to oxygen depletion.

By comparing the data from the ArtG buoy with other buoys, such as Execution Rocks, areas can identify that are more susceptible to oxygen stress and prioritize them for conservation efforts. The findings can guide environmental management practices aimed at preventing hypoxia in the Sound.



Closing summary
HYJUN24

The HYJUN24 survey conducted by the Connecticut Department of Energy and Environmental Protection's Long Island Sound Water Quality and Hypoxia Monitoring Program offers invaluable insights into the complex dynamics of hypoxia within Long Island Sound. The data gathered during this monitoring period underscores the persistence of hypoxic conditions, which continue to pose significant challenges to the ecological health of this vital estuarine system.

The survey results illuminate critical patterns in the spatial and temporal distribution of dissolved oxygen levels, providing a foundation for ongoing research and management strategies aimed at mitigating hypoxia's impact on marine biodiversity. The rigorous data collection and analysis performed by our team not only contribute to the broader scientific understanding of hypoxic events but also inform the development of adaptive management practices that are essential for preserving the integrity of Long Island Sound's ecosystems.

The continued success of the Hypoxia Monitoring Program relies on the collaboration of our scientific community and stakeholders, whose collective efforts are paramount in addressing the environmental challenges facing Long Island Sound.

For more information:

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

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