AUGUST 20, 2024

JULY

LONG ISLANND SOUND WATER QUALITY AND HYPOXIA MONITORING PROGRAM

HYJUL24 HYPOXIA SURVEY

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2024 Sampling Schedule

The 2024 Long Island Sound Sampling began on 2 January 2024. All cruises were completed as scheduled so far. The HYJUL24 Survey was successfully completed aboard the RV Patricia Lynn. This vessel has been instrumental in allowing us to carry out our detailed assessments, ensuring that we collect accurate and comprehensive data. The HYJUL survey started on July 15, 2024 and finished July 16, 2024. During the summer, our focus is on delivering precise information that will contribute to our ongoing efforts in tracking and mitigating hypoxia and other environmental challenges in the Sound. The WQAUG24 was completed from Jul 29, 2024 to Aug 1, 2024 and HYAUG24 was completed Aug 12, 2024 to Aug 14, 2024. WQSEP24 is set to be on time according to the scheule for the last week of August.

RV JOHN DEMPSEY

The RV John Dempsey will be available for the WQ and HY surveys until September when fall trawl surveys begin.

The contract for the new research vessel was finalized. Hull construction is anticipated to begin in mid-October.

If you have any questions or want more information on the Dempsey or the Lynn, please contact Matthew Lyman at: matthew.lyman@ct.gov.

Hypoxia

Dissolved Oxygen Summary

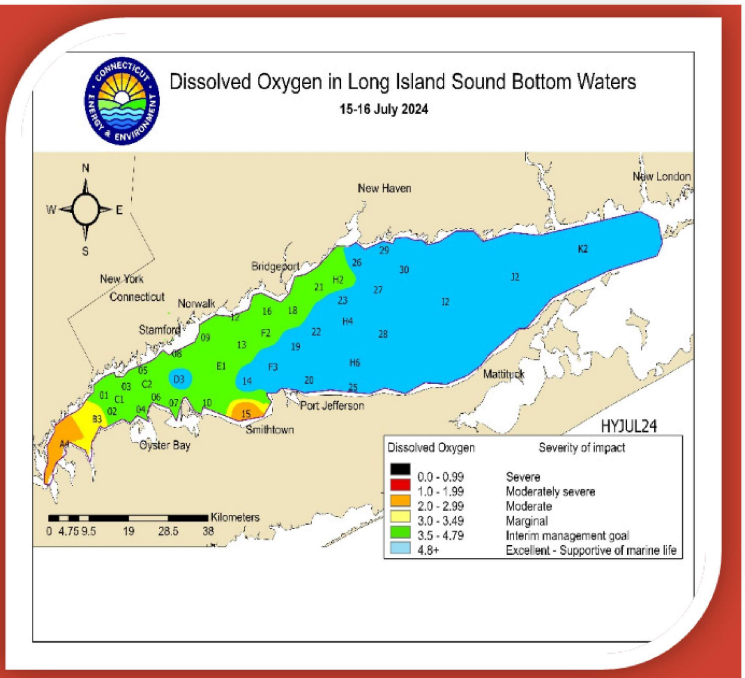
HYJUL24

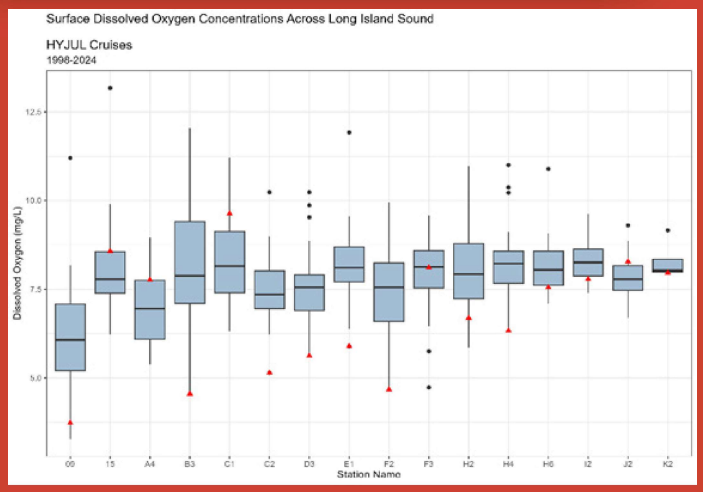
CT DEEP sampled 41 stations during the HYJUL24 survey that was conducted 15-16 July 2024 aboard the R/V Patricia Lynn. The lowest dissolved oxygen (DO) recorded during this survey was at Station A4 with a concentration of 2.42 mg/L. The next lowest DO occurred at Station 15 with a concentration of 2.78 mg/L. No other stations were below 3.0 mg/L; B3 was below 3.5 mg/L and 20 stations were below 4.8 mg/L.

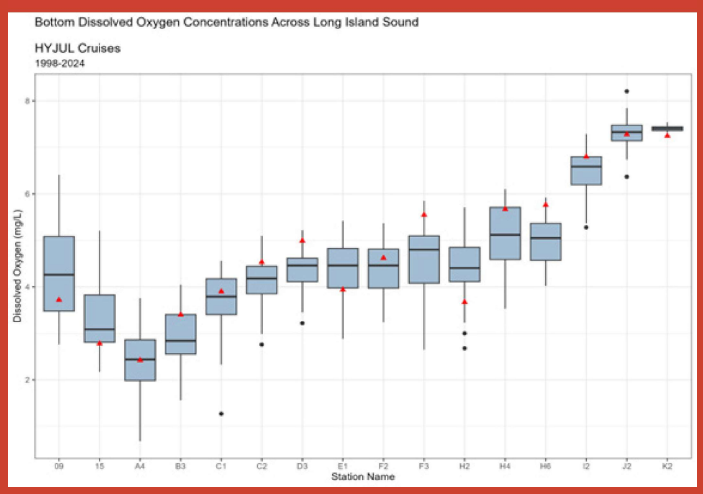
These numbers are higher than 2023 when DO at Station A4 was 1.85 mg/L. During the HYJUL22 and HYJUL21 surveys the lowest DO were 2.77 and 3.32 mg/L, respectively, at Station A4.
In 2024, 72.1 km2 (27.84 mi2) of bottom water had concentrations below 3.0 mg/L. An additional 738.4 km2 (285.1 mi2) had concentrations between 3.0 mg/L and 4.8 mg/L.

Comparatively, over the past five years, in 2023, 108.8 km2 (42.01 mi2) of bottom water had concentrations below 3.0 mg/L and an additional 514 km2 (198.46 mi2) of bottom water had concentrations below 4.8 mg/L (but above 3 mg/L). In 2022, 48.6 km2 of bottom water had concentrations below 3.0 mg/L and an additional 176.65 km2 of bottom water had concentrations below 4.8 mg/L (but above 3 mg/L). In 2021, 0 km2 of bottom water had concentrations below 3 mg/L and 522.7 km2 had concentrations below 4.8 mg/L. During the HYJUL20 survey, there were 1476.9 km2 of bottom water that had DO concentrations less than 4.8 mg/L, and 144.4 km2 were less than 3.0 mg/L. Comparatively, in 2019 there were 511.8 km2 of bottom water with DO concentrations less than 4.8 mg/L, and 46.1 km2 of bottom water was less than 3.0 mg/L.

Preliminary data from this survey and prior 2024 cruises are available in WQX and on the UCONN ERDDAP site.

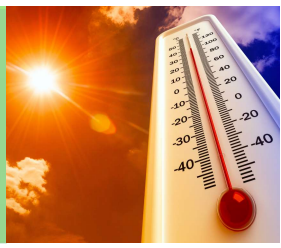


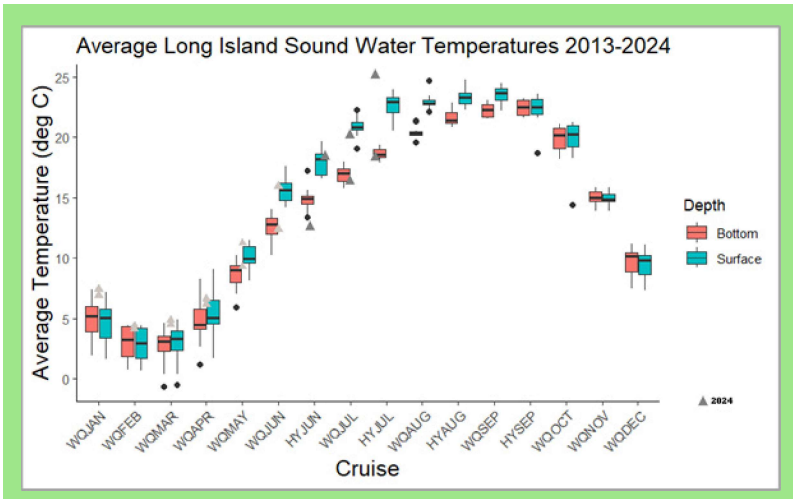




HYJUL24

Temperature Data Summary





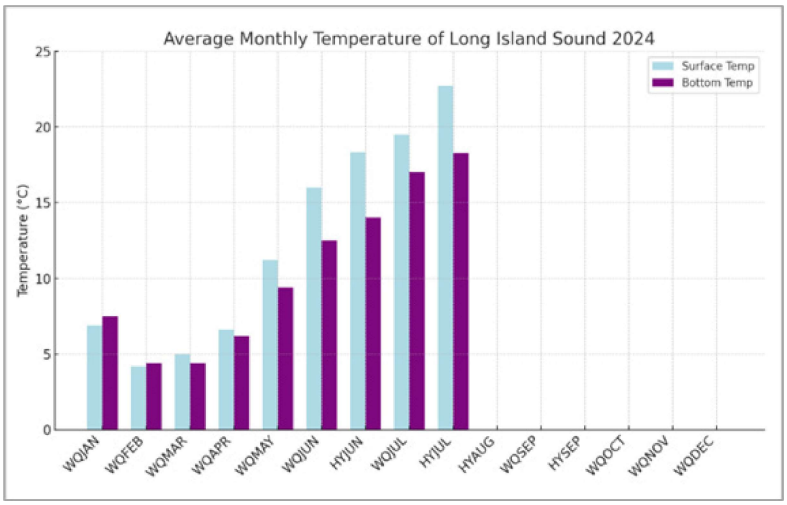
Delta T (ΔT)

The DEEP's monitoring program records water temperatures and salinity during its hypoxia monitoring cruises to help estimate the extent of favorable conditions for the onset and ending of hypoxia. Water temperature plays a major role in the timing and severity of the summer hypoxia event. Water temperature differences in the western Sound during the summer months are particularly influential in contributing to the difference in dissolved oxygen content between surface and bottom waters.

Delta T (ΔT) is the difference between the surface and bottom water temperature. Differences in water temperature contribute to stratification and exacerbate hypoxic conditions. In general, the shallower coastal stations tended to have the smallest temperature differences, as they are more susceptible to mixing, weather, and anthropogenic influences (human caused Influences). The greater the delta T, the greater the potential for hypoxia to be more severe.

Bottom and surface water temperatures continue to rise with 2.93°C increase of average surface temperatures from 19.81°C during WQJUL24 to 22.74°C during HYJUL24 and a 1.18°C increase of average bottom temperatures from WQJUL24 (17.09°C) to HYJUL24 (18.27 °C).

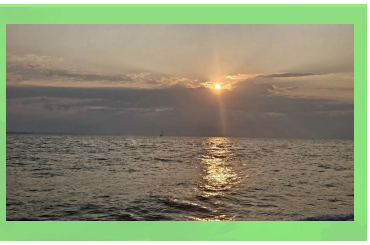
The maximum surface water temperature during the HYJUL24 survey occurred at Station F3 (24.76°C) while the maximum bottom water temperature occurred at Station 29 (20.91°C). The maximum surface water temperature during the HYJUL23 survey occurred at Station 04 (25.48°C) while the maximum bottom water temperature occurred at Station H2 (22.82°C).



The greatest temperature difference between the surface and bottom waters during the HYJUL24 survey was 6.81°C, measured at Station 03. The smallest temperature difference was -0.02°C at Station F2.
ΔT's averaged 4.47°C during the HYJUL24 survey.

HYJUL24

Weather

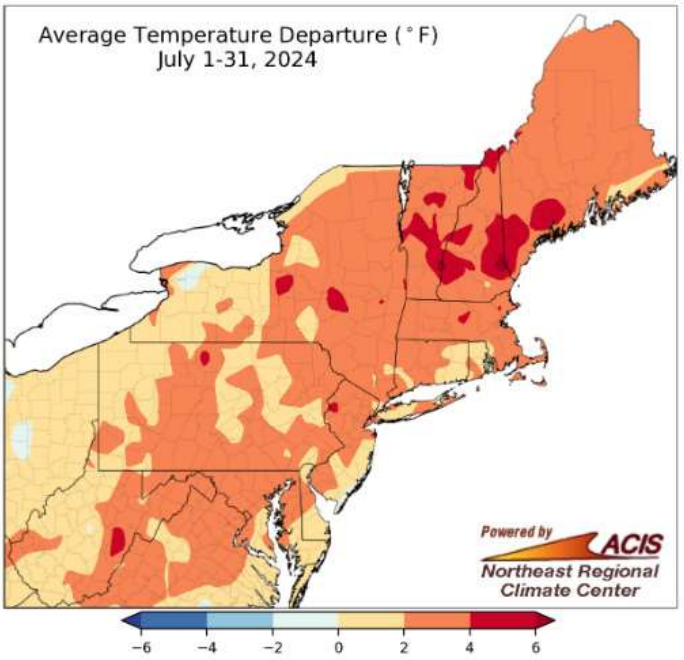


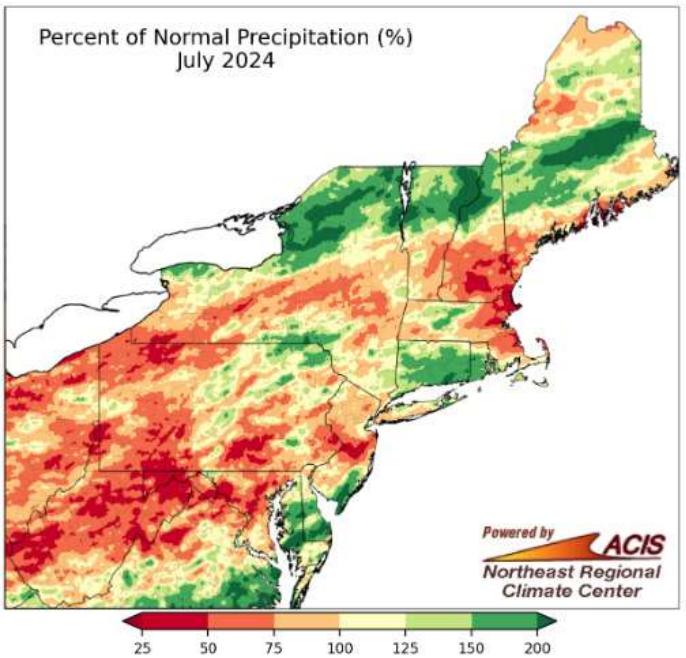
July 2024 was an exceptional month in terms of temperature, significantly surpassing typical summer heat. Notably, July 2024 ranked among the 20 hottest Julys on record for 33 of the Northeast's 35 major climate sites. Furthermore, it was among the 20 all-time hottest months ever recorded for 28 of those sites. In Connecticut, Hartford experienced its hottest month on record, with data dating back to 1905. This unprecedented heat was mirrored across the region, including Long Island Sound, where elevated water temperatures were observed. The HYJUL24 Hypoxia Survey, conducted from July 15th to 16th, 2024, in Long Island Sound, was directly influenced by these extreme temperatures. The July average temperatures at key climate sites ranged from 0.5°F above normal at LaGuardia Airport, NY, to a remarkable 4.8°F above normal in Syracuse, NY. Across Connecticut and Long Island Sound, temperatures followed this trend, with averages ranging from near normal to up to 6°F above normal. These significant temperature increases are part of an ongoing pattern of warmer-than-normal months in the region. More detailed information and additional statistics about July's extreme heat can be found in the **NRCC's extreme weather blog**.

In July 2024, extreme precipitation events significantly impacted northern New York and northern New England, resulting in widespread flooding and substantial damage. The remnants of Tropical Storm Beryl were particularly influential, triggering severe flash flooding that led several Vermont waterways to reach near-record levels. For example, Lowville, NY, recorded 6.02 inches of rainfall within a single day, the highest on record since observations began in 1891. Northeastern Vermont experienced an acute rainfall and flooding event on July 30, with St. Johnsbury accumulating 8.41 inches of precipitation in just 24 hours. This event may represent the highest daily precipitation total for July in Vermont's history and possibly the second highest for any month, contributing to a preliminary total of 17.73 inches for the month—potentially the second highest July total recorded in the state.

Regionally, precipitation across the Northeast exhibited substantial variability, ranging from less than 50% to more than 200% of normal. Among the 35 major climate sites in the region, July 2024 precipitation ranged from 31% of normal in Baltimore, MD, to 177% of normal in Binghamton, NY. A total of 28 of these sites recorded below-normal precipitation, with this July ranking among the 13 driest on record at five major climate sites, while also ranking among the 10 wettest for two others.

In Connecticut, Hartford and Bridgeport recorded significantly above-average precipitation. Hartford received 4.84 inches of rainfall, equivalent to 116% of its typical July total, indicating a substantial surplus. Bridgeport experienced even higher precipitation, with 4.63 inches recorded, amounting to 139% of normal, positioning it among the wetter locations in the Northeast for the month. These elevated precipitation levels in Connecticut stand in stark contrast to the drier conditions observed elsewhere in the region.



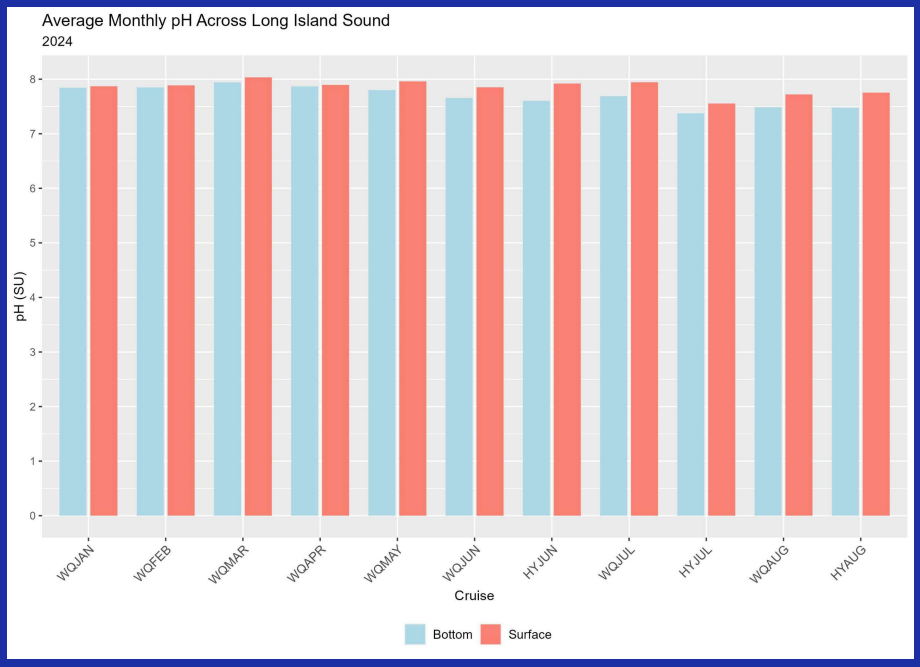


All data and images were from the Northeast Regional Climate Center's website. Please visit http://www.nrcc.cornell.edu/ for more information.

Additionally, July 2024 was characterized by several severe weather events, including a preliminary estimate of 23 tornadoes in New York, potentially marking the highest number of tornadoes recorded in any month since records began in 1950. The region also experienced widespread haze due to smoke from wildfires burning in the western United States and Canada.

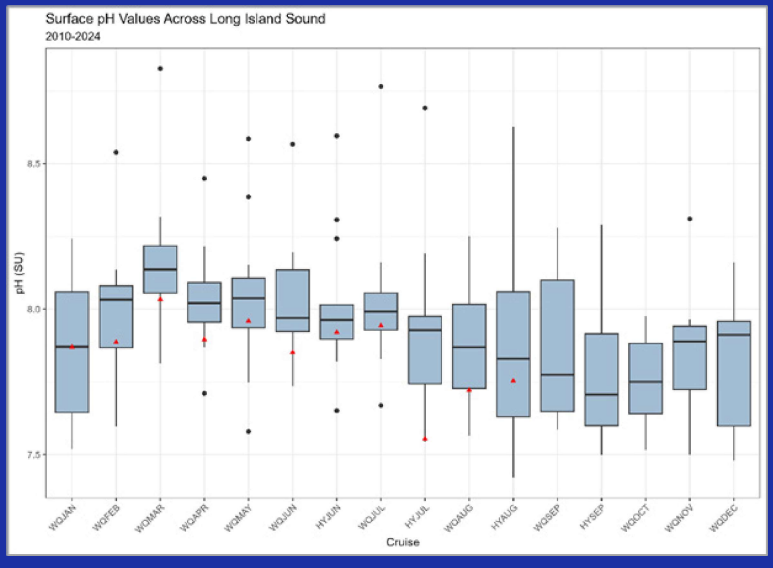
HYJUL24

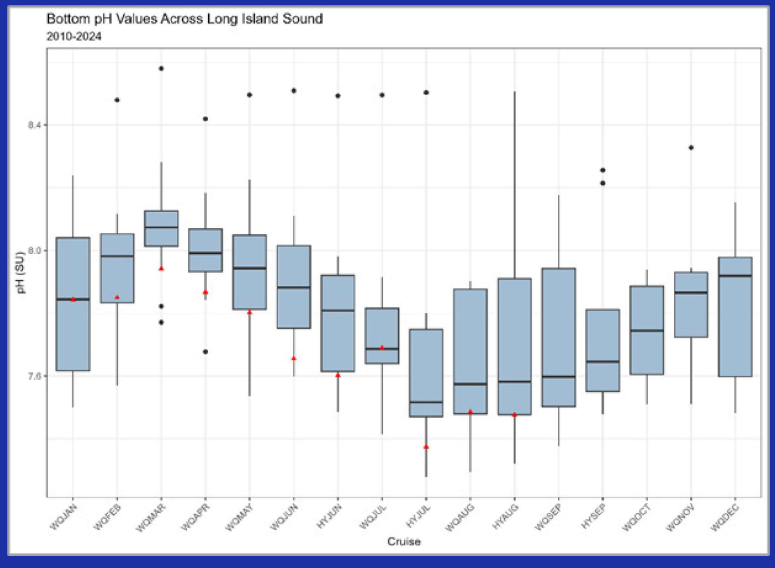
pH Levels Across Long Island Sound



The average surface and bottom pH from all the stations across LIS during the HYJUL24 survey were 7.58 and 7.35 SU, respectively. The lowest bottom pH was 7.13 (Station A4), the highest bottom pH was 7.59 (Station J2), the lowest surface pH was 7.16 (Station 16), and the highest surface pH was 7.79 (Station C1).

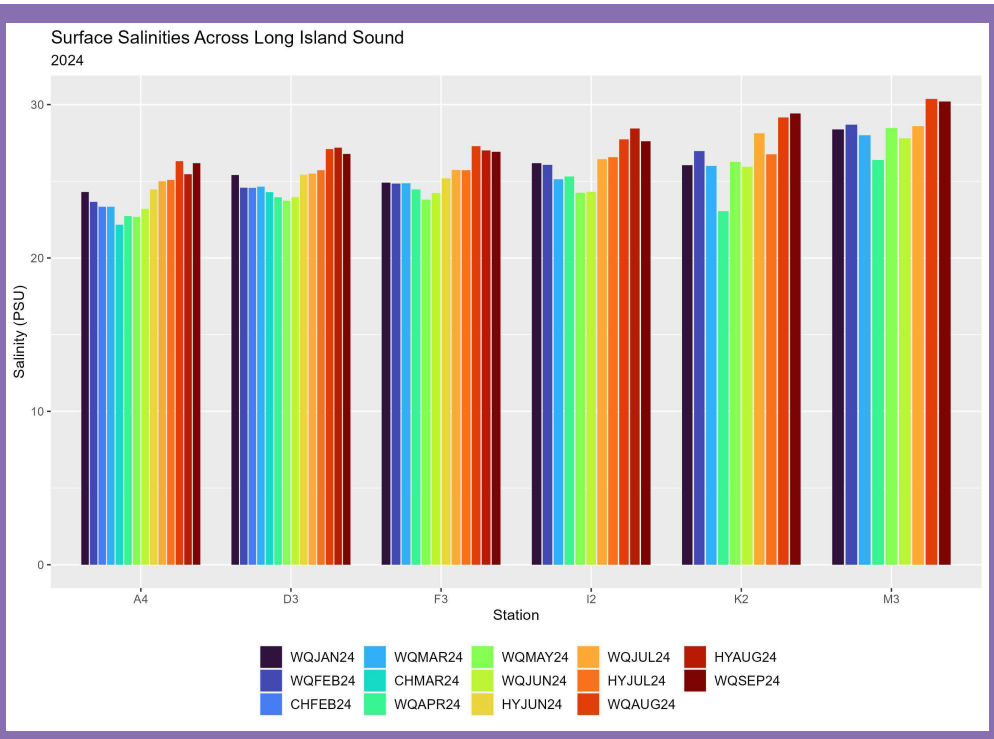
The average surface and bottom pH graphs below for all the cruises from 2010 to date only include the 17 year-round water quality stations.

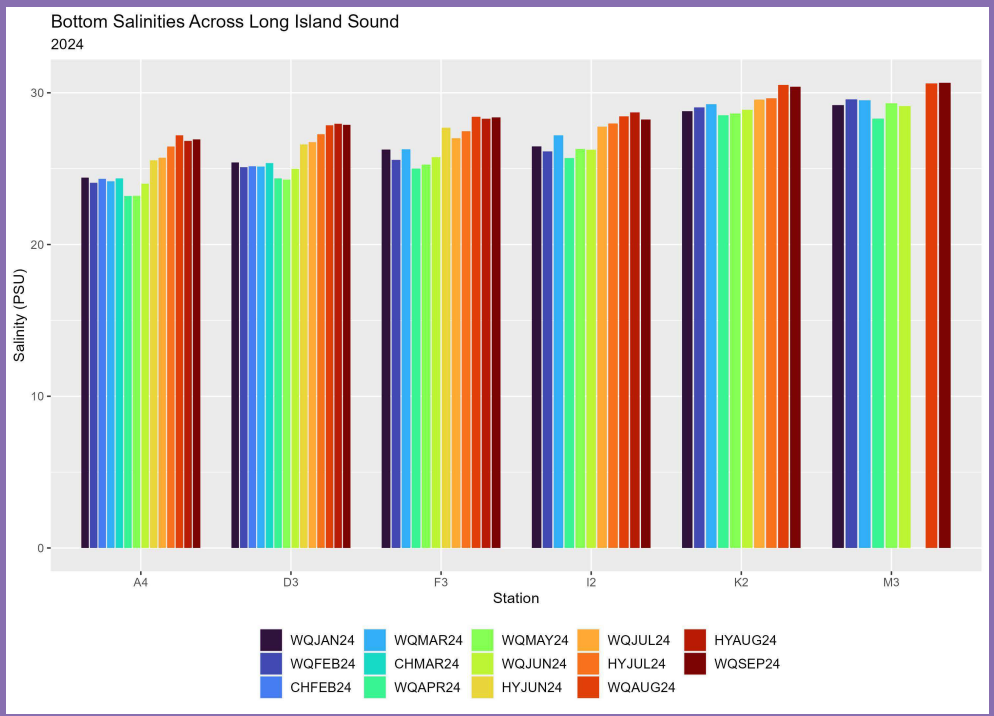




HYJUL24

Salinity





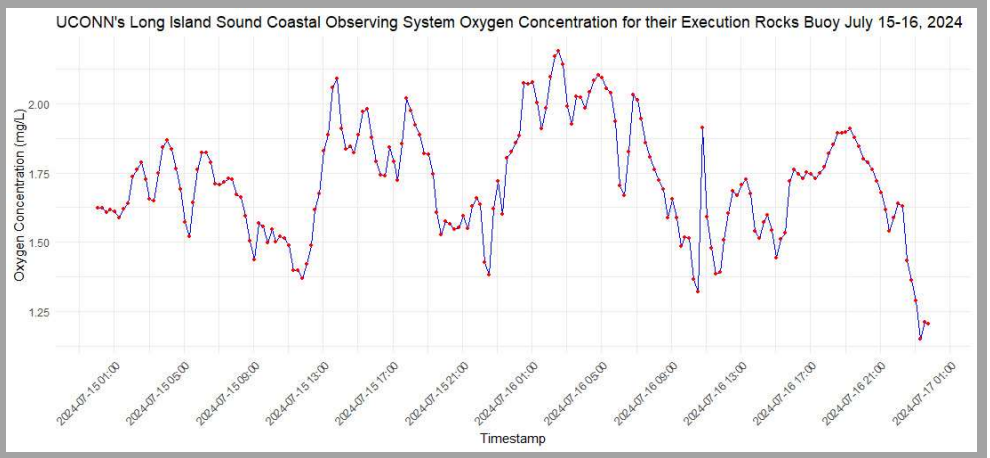
	A4	D3
2024 Surface	25.09	25.72
2009-2024 Average Surface	25.79	26.48
2024 Bottom	26.61	27.28
2009-2024 Average Bottom	26.58	27.51

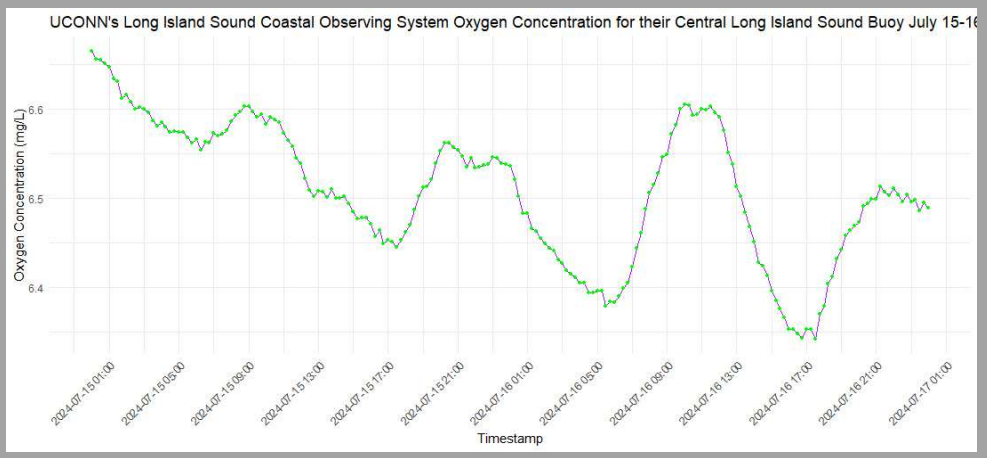
Surface salinities across Long Island Sound generally decrease slightly from January through May due to snow melt and spring rains. The less dense freshwater will float on top of the denser saltwater contributing to stratification and impacting hypoxia. Additionally, nutrients carried by runoff fuel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

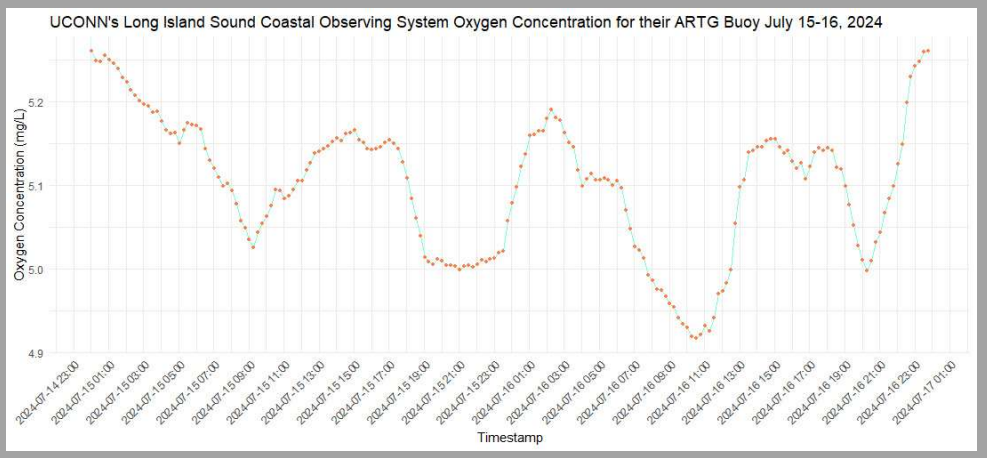
Surface salinity values during the HY JUL24 survey were slightly below the 2009-2024 average for Station A4 and bottom salinity values were slightly above the 2009-2024. 2024 averages for surface and bottom salinity were within ~0.3 PSU of 2009-2024 averages at Station D3.

UCONN's Long Island Sound Coastal Observing System

HYJUL24







The Long Island Sound Integrated Coastal Observing System (LISCOS) was established in 2003 as a component of the Northeast Regional Association of Coastal Ocean Observing Systems. The system was conceptualized as part of a water quality monitoring program that combined the traditional ship-based point sampling surveys with continuous, real-time sampling stations. LISICOS continuously monitors in situ water quality parameters and meteorological parameters at up to eight stations across the Sound. Sensors are attached to a moored buoy at various depths (surface, mid, bottom). Data are transmitted every 15 minutes in realtime via satellite where they are stored in a database and uploaded to the LISCOS website. The system is maintained by the University of Connecticut.

The data collected from UCONN's Execution Rocks, Central Long Island Sound, and ARTG Buoys provides critical insights into the dissolved oxygen (DO) levels across different regions of Long Island Sound on a continuous basis. Together, with our ship based surveys, these data are used to characterize the extent and duration of hypoxic conditions across Long Island Sound.

The DO levels during the HYJUL24 survey (July 15-16) at Execution Rocks fluctuated between 1.62 mg/L and 2.09 mg/L, well below the threshold of 3 mg/L designated in CT and NY water quality standards.. The ARTG Buoy registered intermediate oxy en concentrations, ranging from 4,92 mg/L to 5.26 mg/L. In contrast, the Central Long Island Sound Buoy recorded higher DO levels, ranging from 6.383 mg/L to 6.665 mg/L, indicating a more favorable oxygen environment capable of supporting a healthy iodiversity and stable ecosystem.

Explore the progression of hypoxic conditions through the LISICOS Climatology page or the ERDDAP mapper.

Remote Sensing in Long Island Sound

HYJUL24

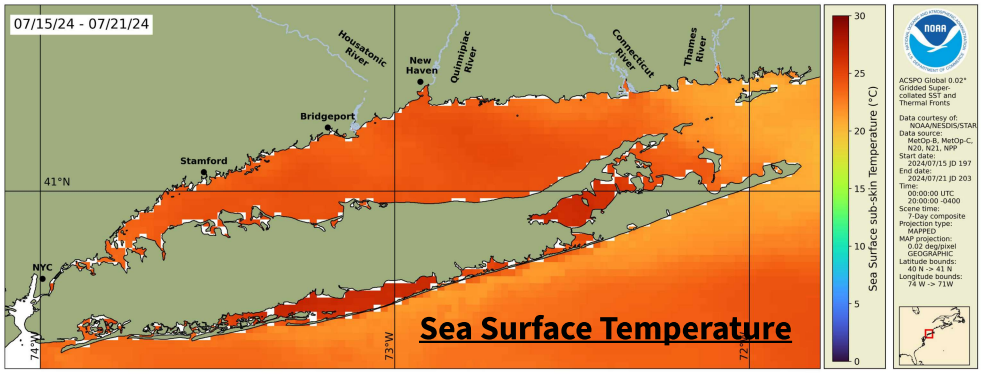
The New York and Connecticut Sea Grant programs use satellite algorithms and collect optical, biogeochemical, and ecological data from Long Island Sound. Satellite remote sensing products monitor surface temperature, suspended particular matter, chlorophyll a, ocean color, and colored dissolved organic matter. This work utilizes satellite imagery at varying resolutions, ranging from 1 km to 10–30 m. Through collaboration with [NOAA CoastWatch], we ensure that these satellite products are converted into actionable data.

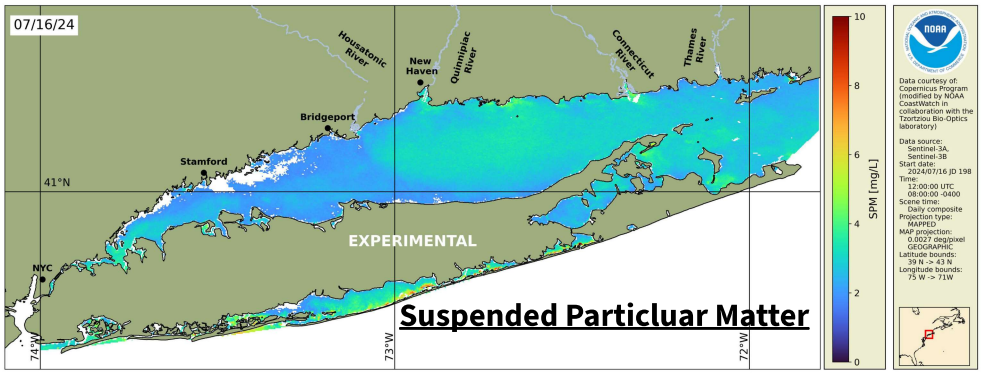
Recent remote sensing data from HYJUL24 regarding Sea Surface Temperature (SST) shows only a slight difference between the western and eastern sections of the Sound, with temperatures ranging from about 20°C to 23°C . This slight variation is indicative of localized heating and reduced water circulation in the urbanized western region.

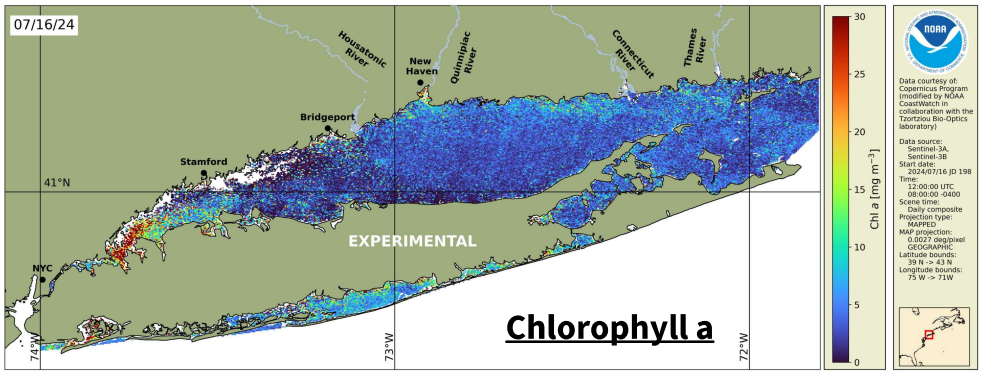
Suspended Particulate Matter (SPM) concentrations tell a similar story. The western Sound, particularly around New York City, exhibit elevated SPM levels around 4 mg/L. The same is true in the New Haven and and Quinnipiac River region of the Central Sound with concentrations running eastern specifically near Guilford and the Connecticut River. In Long Island, NY concentrations also peaked near 4 mg/L in Gardiners Bay and Napeague Bay.

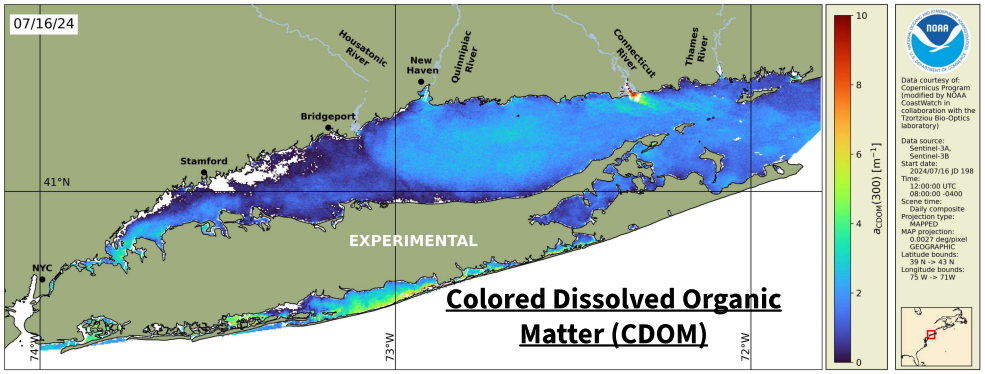
Chlorophyll a concentrations, serve as a proxy for phytoplankton abundance. Western Long Island Sound shows chlorophyll levels of 25-30 mg/m^3, significantly higher than the 5-10 mg/m^3 observed in the eastern Sound.

Similarly, Colored Dissolved Organic Matter (CDOM) levels are twice as high in the western Sound, with concentrations peaking near NYC, and the Housatonic and Connecticut Rivers. The mouth of the Connecticut River especially showed elevated levls of above 8m. These increased concentrations in the CT River may have dirrectly been influenced from flooding that occured in the upper watershed as a result of tropical cyclone, Beryl that produced heavy rainfall just days before the HYJUL24 survey. This organic matter, originating from both natural sources and urban runoff, reduces water clarity and can affect light penetration.









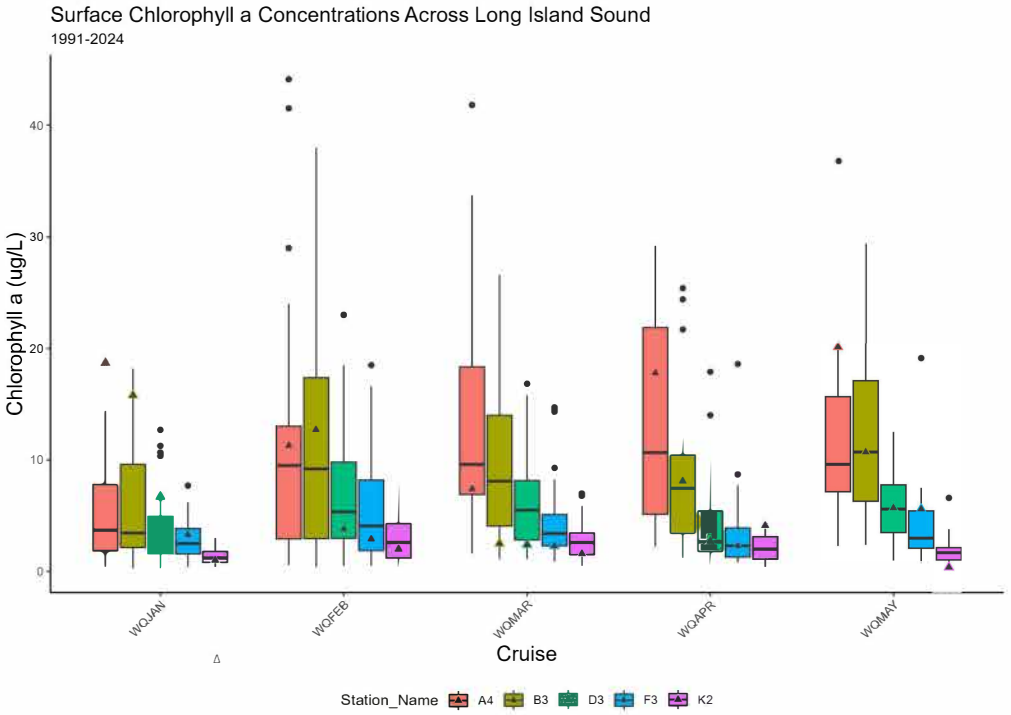
HYJUL24

Chlorophyll a

Since 1991, the Connecticut Department of Energy and Environmental Protection (CTDEEP) has systematically monitored chlorophyll a (Chl a) concentrations in Long Island Sound. Grab samples are collected at 17 stations, both 2 meters below the surface and 5 meters above the sediment, to ensure comprehensive spatial coverage. In situ Chl a measurements are also collected during water column profiling using a YSI EXO multi-parameter sonde at all stations, though caution is advised regarding its use. These data are accessible via the Water Quality Portal or UCONN ERDDAP.

To complement these efforts, grab samples for phytopigment analysis are collected at 10 stations and analyzed using High-Performance Liquid Chromatography (HPLC) for detailed characterization. A recent collaboration with the Remote Sensing group has introduced the collection of additional grab samples at a depth of 0.5 meters to support algorithm validation for select sites. The frequency of this collection varies by survey.

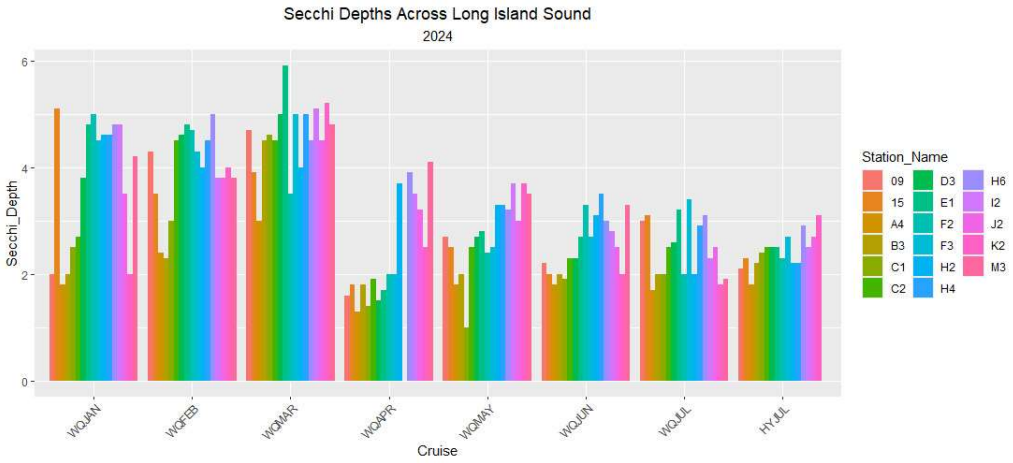
Since August 2002, CTDEEP has also been monitoring phytoplankton community composition by characterizing phytopigments through HPLC. These analyses are conducted at the University of Maryland's Horn Point Lab, with data available upon request. The HPLC data are being utilized to develop Long Island Sound-specific algorithms for remote sensing products.

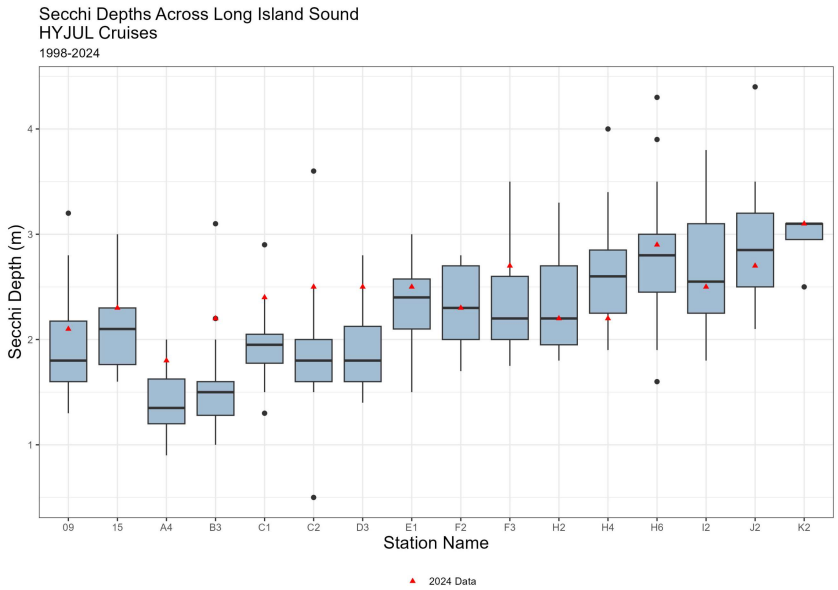


Chlorophyll is a pigment found in plants that gives them their green color. It allows plants to absorb light from the sun and convert it to chemical energy during photosynthesis. In photosynthesis, carbon dioxide and water are combined to produce sugar giving off oxygen as a byproduct. Microscopic plants, called phytoplankton, form the basis of the food web in Long Island Sound. Water temperature, nutrient concentrations, and light availability all factor into the amount of phytoplankton biomass found in the Sound. These figures examine spring (February-April) surface chlorophyll-a data from three stations (B3, D3, and F3) in the Western/Central portion of LIS from 1991 to 2024. Data from February, March, and April 2012 and 2013 are not included due to a lab calibration error. Data was not collected in April of 2020 due to the COVID-19 pandemic. Chl a thresholds have not been adopted for LIS by the LISS Science and Technical Advisory Committee or the States of CT and NY.

HYJUL24

Secchi Depths





To assess the water clarity across Long Island Sound, Secchi disks are used at each station. The black and white disk is lowered into the water column until such a depth is reached that the black and the white quarters can no longer be differentiated. This is called the Secchi depth.

The Long Island Sound Report Card
developed by Save the Sound utilizes the
following water clarity depths thresholds:

1. >2.28 m (A- to A+; 90-100)
2. 2.12 to <2.28 (B- to B+; 80-89)
3. 1.95 to <2.12 (C- to C+; 70-79)
4. 1.8 to <1.95 (D- to D+; 60-69)
5. 0 to <1.8 (F; <60)

Secchi depths were taken at 16 stations during HYJUL24 as M3 was not taken during this survey. The depths recorded ranged from 1.8 meters (Station A4) to 3.1 meters (Station K2).

In Report Card terms, 11 stations were in the A range (>2.28m), 3 stations were in the B range (1.12m to <2.28m), 1 station was in the C range (1.95 to <2.12), and 1 station was in the D range (1.8 to <1.95). No stations failed.

For more information on the Long Island Sound Water Quality Monitoring Program please visit:
Long Island Sound Water Quality and Hypoxia Monitoring Program Overview (ct.gov)

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