

WAQUOIT BAY WATER QUALITY TRENDS: 2002 - 2024

Waquoit Bay National Estuarine
Research Reserve (WBNERR)



ABOUT SWMP

As part of the National Estuarine Research Reserve System (NERRS), WBNERR participates in the NERRS System-Wide Monitoring Program (SWMP). The primary mission of SWMP is to measure short-term variability and long-term changes in the water quality, biological systems, and land-use/land-cover characteristics of estuaries. All findings in this publication come from SWMP data.

For more information go to:
<https://waquoitbayreserve.org/>

2024 SUMMARY

.....
Waquoit Bay is warming. Both water and air temperatures increased significantly between 2002 - 2024 time period.

.....
Symptoms of eutrophication, from decreased dissolved oxygen concentrations to increased algal growth, continue to plague Waquoit Bay even as it seems that ambient nutrient concentrations are falling.

.....
Turbidity (cloudiness) of the waters in Waquoit Bay increased between 2002 – 2024, potentially related to the loss of eelgrass and the increase of algal growth.



Water quality issues influence human and environmental health.
The more we monitor our water, the better we will be able to
recognize and prevent problems.



HOW IS OUR ESTUARY CHANGING?

Air and Water Temperatures have both risen since observations began in 2002.

Dissolved Oxygen concentrations decreased at three of four sampling sites.

Chlorophyll-a concentrations also increased at three of four sites

Turbidity has increased throughout the bay, likely factoring into the decrease in eelgrass.



Trends in Weather & Water Quality From 2002 - 2024

Location ID	Location Name	Air Temperature	Precipitation
CH	Carriage House	↑	—

Location ID	Location Name	Ortho-phosphate	Ammonium	Diss. Inorganic Nitrogen	Chlorophyll-a
CR	Childs River	↓	↓	—	—
MH	Menauhant	↓	↓	↓	↑
MP	Metoxit Point	↓	↓	↓	↑
SL	Sage Lot	↓	↓	↓	↑

Location ID	Location Name	Water Temperature	Salinity	Dissolved Oxygen	pH	Turbidity
CR	Childs River	↑	↑	—	—	↑
MH	Menauhant	↑	↑	↓	↓	↑
MP	Metoxit Point	↑	↑	↓	↓	↑
SL	Sage Lot	↑	—	↓	↓	↑

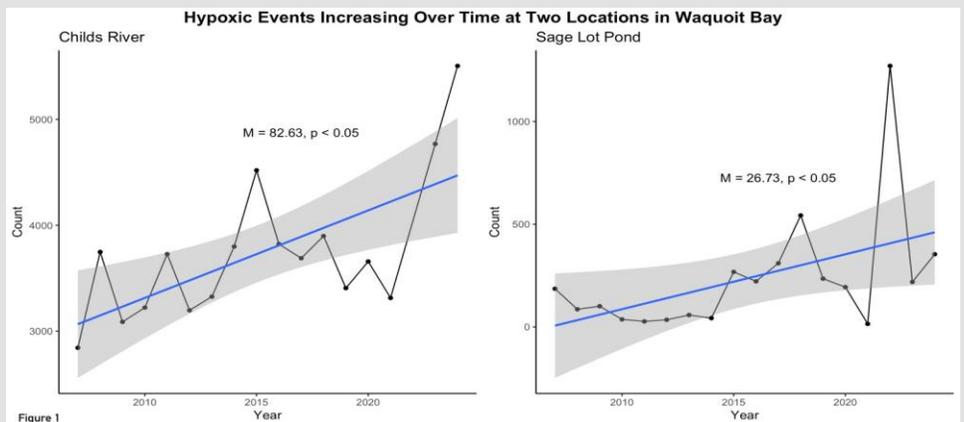
X Insufficient Data

↑ Increasing

— Not Changing

↓ Decreasing

A Closer Look at Dissolved Oxygen

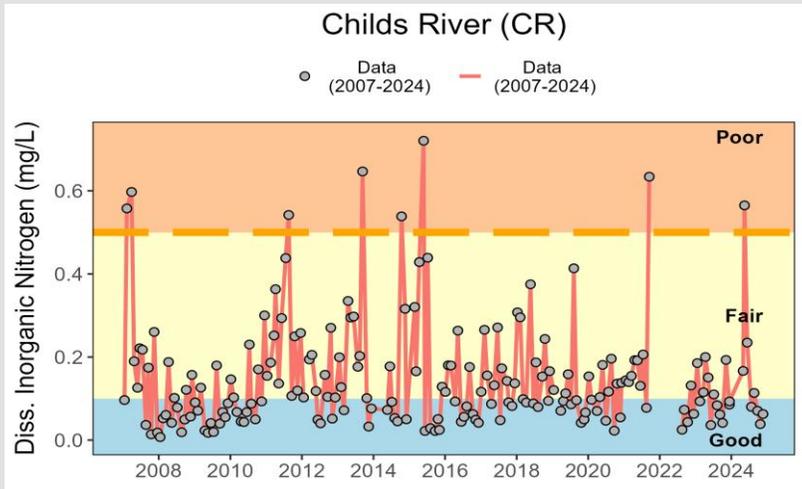


Dissolved oxygen concentrations decreased perceptibly between 2002-2024 at every site except for the Childs River (above, left). Further analysis (above right) showed that at both the Childs River and Sage Lot, the number of hypoxic events increased. Hypoxia was defined as water with dissolved oxygen concentrations < 3 mg/L. Hypoxic waters have so little oxygen that it significantly stresses and even kills organisms living in the area that are unable to escape the conditions.

Do We Have Too Many Nutrients In The Water?

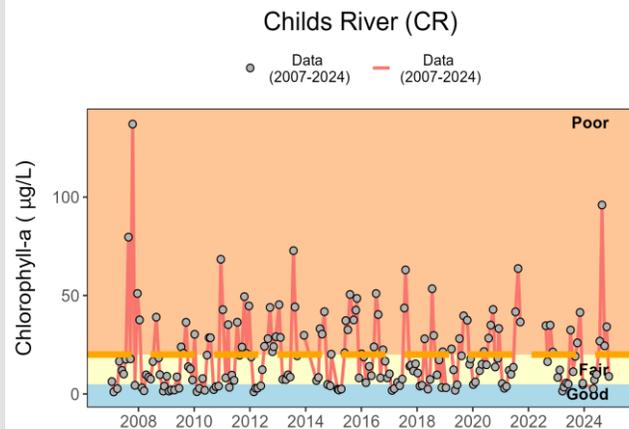
Microalgae (also called phytoplankton) are tiny, plant-like organisms that are critical to estuarine and ocean health. To grow, they consume nutrients like dissolved forms of nitrogen and phosphorus. However, excessive nutrient conditions can cause phytoplankton blooms, which can close fisheries and negatively impact human health as well as eelgrass populations. Additionally, when these blooms die, the decomposition process takes up the dissolved oxygen in the water that life needs to survive.

Dissolved Inorganic Nitrogen (DIN) and the Microalgae/Phytoplankton Response



At the Childs River station, where DIN concentrations have been decreasing slightly, DIN is made up mostly of nitrates (NO_x) and smaller amounts of Ammonium (NH_4). They remain mostly in either the "Fair" (0.1-0.5 mg/L) or "Good" (0-0.1 mg/L) range and only sporadically spiking into the "Poor" (>0.5 mg/L) range. It is possible that the decreasing DIN concentrations are being driven by fewer amounts of the non-dominant form of nitrogen, ammonium (NH_4) ending up in the bay.

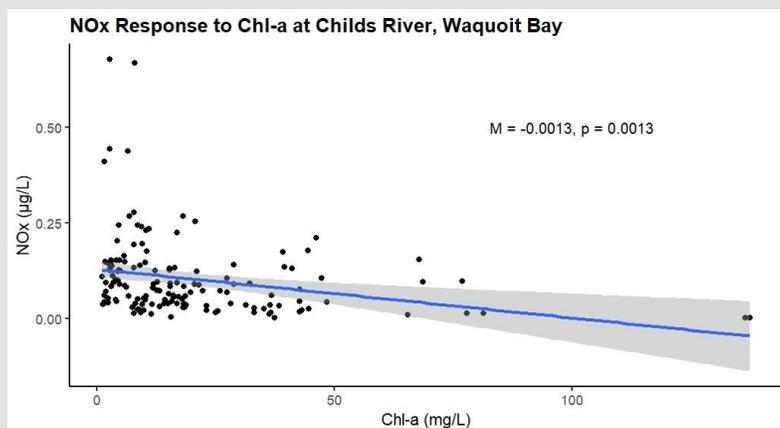
Chlorophyll and Microalgae



Chlorophyll-a concentrations tell us about amounts of microalgae/phytoplankton growth. Even though DIN concentrations (left) remain mostly in the "Fair" or "Good" ranges, chlorophyll-a concentrations frequently exceed the critical threshold of 20 $\mu\text{g/L}$, indicating unhealthy amounts of microalgae and phytoplankton.

Small Actions You Can Take That Help

- Support public sewer initiatives and innovative septic system alternatives.
- Limit use of fertilizers/pesticides, and instead use compost as garden fertilizer.
- Collect pet droppings.
- Plant trees and rain gardens.
- Redirect downspouts away from impervious surfaces like driveways and sidewalks.
- Wash cars and boats on your lawn – not the driveway.



Analysis of SWMP nutrient data at the Childs River, where DIN is mostly made up of nitrates, shows that increases in Chlorophyll are associated with lower nitrate concentrations. So it is also possible that this DIN decrease could instead be due to the increase in chlorophyll, with nitrates still being delivered to the bay and spurring increased algae growth, which then consume those nitrates and remove them from the water, reducing their ambient concentration.

Why Estuaries Matter

Economic Impacts



Coastal shoreline counties provided 54.6 million jobs and contributed \$9.6 trillion (nearly 45%) of the nation's gross domestic product in 2020.

Community Benefits



Estuaries protect coastal communities by reducing flooding and storm surge impacts, enhancing water quality, and providing commercial and recreational benefits.

Healthy Ecosystems



Up to two-thirds of the nation's commercial fish and shellfish spend some part of their life cycle in an estuary or depend on this resource for food.

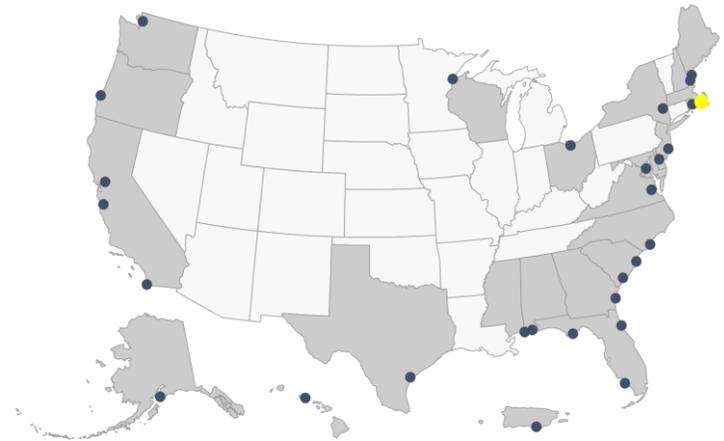
Habitat Diversity



Habitat types include shallow open waters, freshwater/salt marshes, swamps, sandy beaches, mud/sand flats, rocky shores, oyster reefs, mangrove forests, river deltas, tidal pools and seagrasses.

Tracking The Health of Our Estuaries 24/7

The **NERRS** is a partnership program between NOAA and the coastal states to manage designated reserves. More than 1.3 million acres of estuarine land and water are protected. Each reserve is managed on a daily basis by a lead state agency or university with input from local partners. The health of every reserve is continuously monitored by the **System Wide Monitoring Program (SWMP)**. SWMP is a **robust, long-term, and versatile** monitoring program that uses the NERRS network to intensively study estuarine reference sites for evaluating ecosystem function and change. Reserve-generated data and information are available to local citizens and decision makers. For more information, go to: <https://coast.noaa.gov/nerrs/>



NERRS is a network of 29 coastal reserves established for long-term research, education and stewardship.

More Information...

For Stakeholders

Access data at the System Wide Monitoring Program (SWMP) Graphing Application website:

<https://cdmo.baruch.sc.edu/dges/>

For Scientists

Access data at the Centralized Data Management Office (CDMO) website:

<https://cdmo.baruch.sc.edu/>

Have Questions?

Contact Theophilos Collins
theophilos.j.collins@mass.gov
774-255-4275