ESTUARY TRENDS: WEATHER & WATER QUALITY

Resilient estuaries and coastal watersheds - where human and natural communities thrive.

Waquoit Bay National Estuarine Research Reserve (NERR)

This reserve is located on the south shore of Cape Cod, Massachusetts and contains open waters, salt and freshwater marshes, barrier beaches, sand dunes, rivers, mixed pine and oak forests, and sandplain grasslands.

Waquoit Bay, approximately 825 acres, is the dominant water feature and once supported one of the most diverse estuarine fish communities in the state. Waquoit Bay is still important to commercial and recreational shellfish and finfish fisheries. For more information go to:

http://www.waquoitbayreserve.org/

2016 HIGHLIGHTS

It was drier - precipitation was below the long-term historical average

It was hotter – August and September air temperatures were higher than the long-term historical average

Dissolved inorganic nitrogen (DIN) concentrations were low for most of the year at all locations

Consistent with previous years, an algal bloom occurred in the summer at the Childs River location

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?

Precipitation has decreased over the last ten years (but has increased since the 1980s)

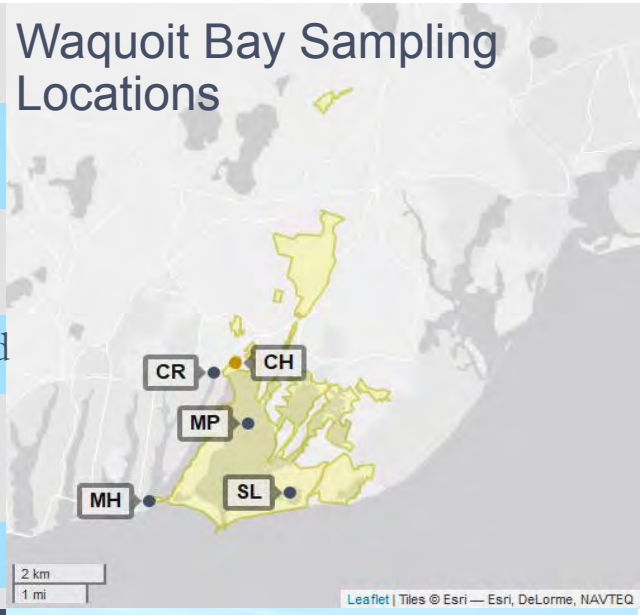
Water Temperature is increasing

Dissolved Inorganic Nitrogen is relatively unchanged

Chlorophyll-a (phytoplankton proxy) is increasing at Menauhant

Dissolved Oxygen is decreasing

Waquoit Bay Sampling Locations



Trends in Weather & Water Quality*

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

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

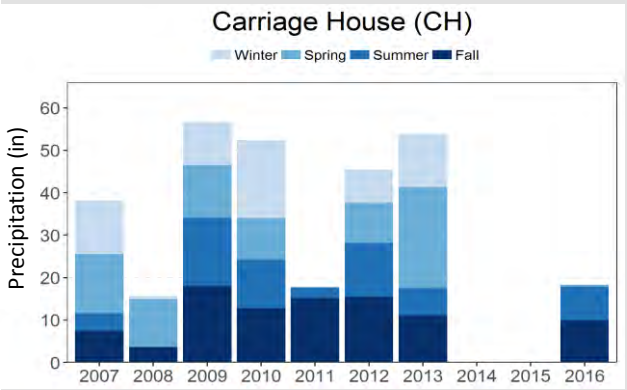
Location ID	Location Name	Ortho-phosphate	Ammonium	Nitrate/Nitrite	Chlorophyll-a
CR	Childs River	—	—	—	—
MH	Menauhant	↓	—	—	↑
MP	Metoxit Point	—	—	—	—
SL	Sage Lot	—	—	↑	—

** Based on data collected from 2007-2016*

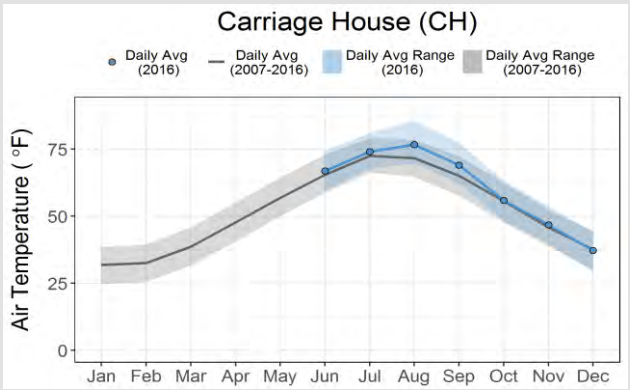
X Insufficient Data ↑ Increasing — Not Changing ↓ Decreasing

Weather Can Have A Major Impact On Water Quality

Precipitation & Air Temperature



Precipitation was ~12 inches less than the long-term historical average in 2016



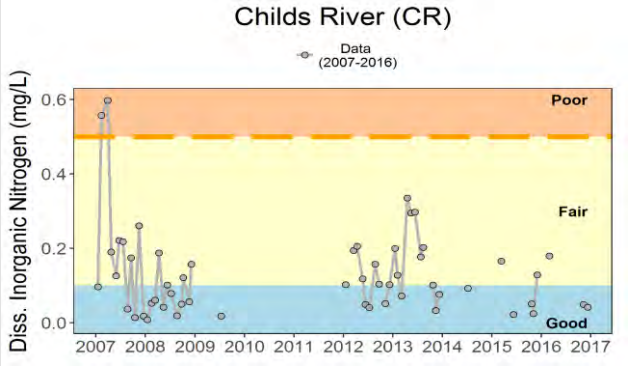
Air Temperature was hotter in August and September in 2016 compared to the long-term historical average

Weather data helps scientists and managers understand water circulation patterns, plant growth, shellfish and fish distribution, storm frequency and intensity and much more…

Do We Have Too Many Nutrients In The Water?

Phytoplankton (also called microalgae) are tiny, plant-like organisms that need nutrients (nitrogen and phosphorus) to grow. Phytoplankton are critical to estuarine and ocean health. However, some conditions, such as excess nutrients, can cause phytoplankton blooms. The blooms can decrease the dissolved oxygen underwater life needs to survive, negatively impact human health, and close fishery harvest areas. In our area, these excess nutrients come from wastewater, fertilizers, and the burning of fossil fuels.

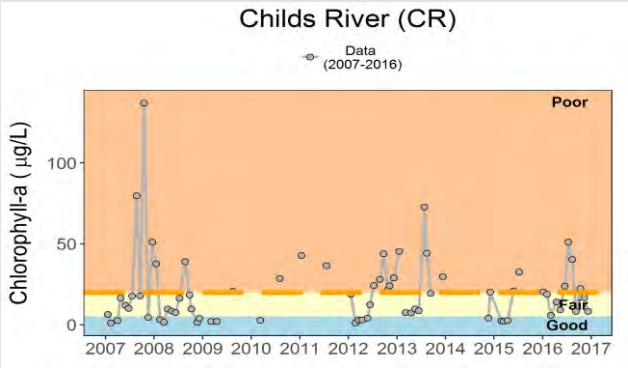
Nitrogen



A critical threshold value is used to determine if a water quality measurement is at a level where negative impacts may occur.

Dissolved inorganic nitrogen (DIN = ammonium + nitrate + nitrite) is the type of nitrogen in the water which phytoplankton need to grow. At Waquoit Bay NERR, data show that DIN concentrations are not changing over the long-term at any of the four sites. Most of the measurements are in the fair to good range. The critical threshold of 0.5 mg/L has not been exceeded at Childs River since 2007.

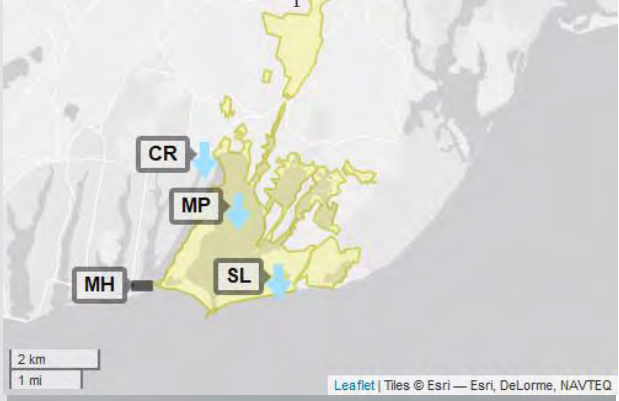
Phytoplankton



Phytoplankton growth is measured by chlorophyll-a concentrations. At Waquoit Bay NERR, data show that chlorophyll-a levels are not changing over the long-term at three locations, and are increasing at one location. Most of the measurements are in the fair to good range, except for those collected at the Childs River. Concentrations at the Childs River frequently exceed the critical threshold of 20 µg/L.

How is Oxygen Changing?

Dissolved oxygen decreased at Childs River, Metoxit Point, and Sage Lot. The timing of hypoxic (low oxygen) events often occurs during periods of higher water temperatures and increased human presence in the area.



Small Changes You Can Make To Help

- Support diverse forms of wastewater treatment
- Limit use of fertilizers and pesticides , use compost instead
- Support land conservation initiatives
- Collect pet droppings
- Plant trees and rain gardens
- Redirect downspouts away from impervious surfaces like driveways and sidewalks
- Wash cars and boats on lawn and not the driveway

Water Quality is a MAJOR Driver of Ecosystem Change

What happens on the land affects the quality of the water and the health of the plants and animals that live in the estuary.

Why Estuaries Matter

Economic Impacts

Coastal shoreline counties provided 53 million jobs and contributed $7.4 trillion (nearly 44%) of the nation's gross domestic product in 2012.

Community Benefits

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

Healthy Ecosystems

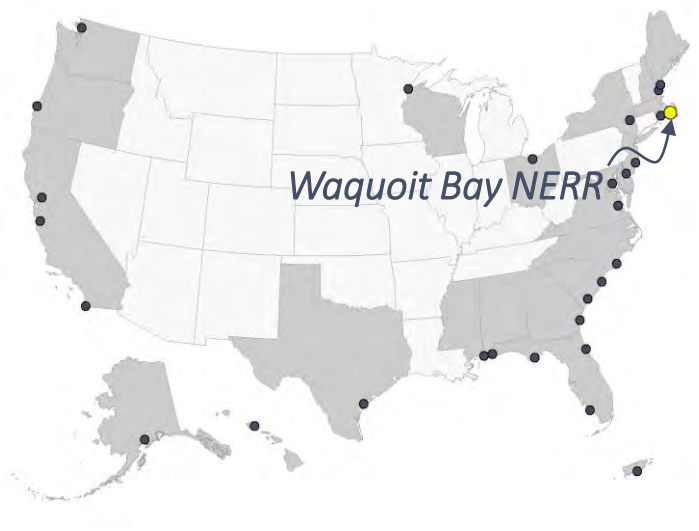
Up to two-thirds of the nation's commercial fish and shellfish spend some part of their life cycle in an estuary or depend on this resource for food.

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://coast.noaa.gov/swmp/**

For Scientists

Access data at the Central Data Management Office (CDMO) website: **http://www.nerrsdata.org/**

Have Questions?

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Waquoit Bay NERR - providing the science needed for today and tomorrow