GREAT BAY ESTUARY: WEATHER & WATER QUALITY TRENDS

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

Photo by Amanda Gacchetti

Great Bay National Estuarine Research Reserve (GBNERR)

The Great Bay NERR is a complex embayment and New Hampshire's largest estuarine system, encompassing all of Great Bay and Little Bay as well as the tidal portions of seven rivers: Bellamy, Cocheco, Lamprey, Oyster, Salmon Falls, Squamscott and Winnicut. The Great Bay Reserve includes diverse land and water areas, including salt marshes, mudflats, tidal creeks, rocky intertidal shores, eelgrass beds, and upland forests and fields. The Bay's cultural heritage is equally diverse, from paleo-Indian villages dating from 6,000 years ago to colonial transportation and industrial use, to a proposed oil refinery in 1973. For more information, please visit: For more information go to:

http://greatbay.org/

2022 HIGHLIGHTS

Great Bay experienced drought conditions during the late spring and summer.

Drought decreased freshwater inputs, leading to considerably higher salinities.

Drought also considerably decreased nitrogen and sediment concentrations, leading to improved water quality and clarity.

Eelgrass meadows appeared to recover in parts of Great Bay from improved water quality.

Great Bay National Estuarine Research Reserve

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**.

NOAA

HOW IS OUR ESTUARY CHANGING?

Precipitation was low in the spring and summer, leading to drought in NH and New England.

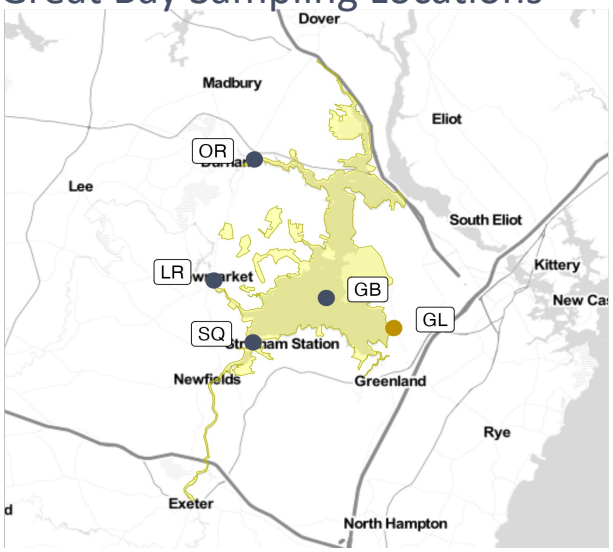
Salinity increased at all four sampling locations during the dry summer months.

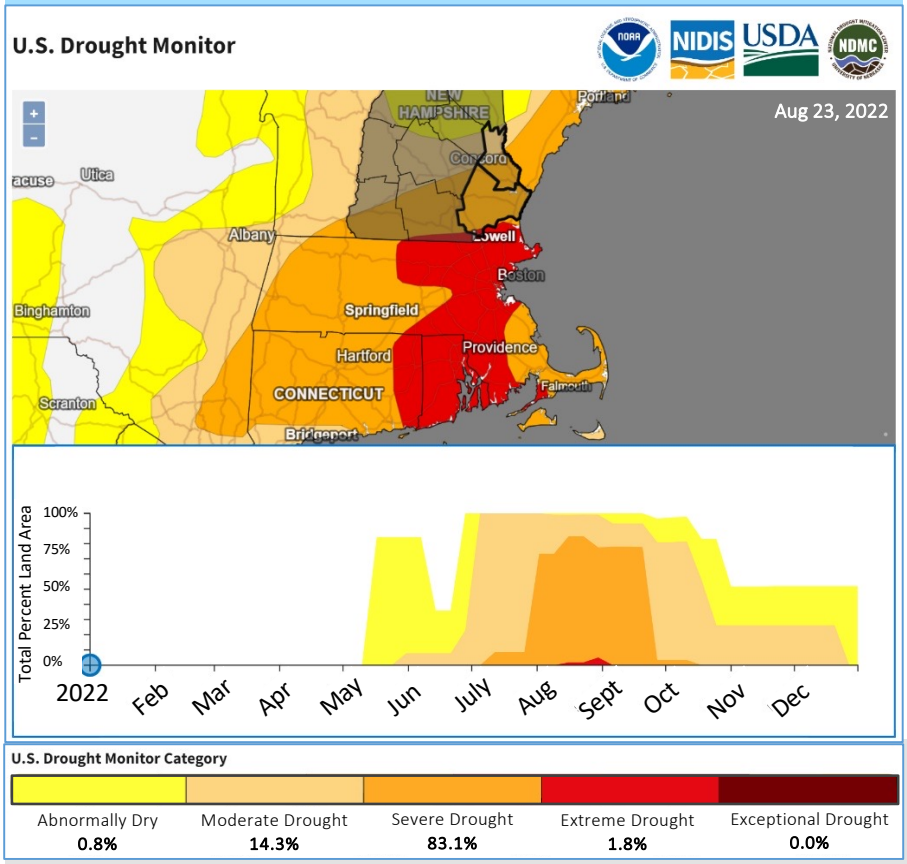
Air Temperature was above the long-term historical average in the summer and winter months.

Water Temperature at all four sampling locations was also above the long-term historical average.

Water Quality improved throughout the Bay, with decreases in nitrogen and turbidity.

Great Bay Sampling Locations





Weather & Climate – What is the Difference?

WEATHER is what you see outside on any particular day in terms of precipitation, temperature, humidity, cloudiness, visibility and wind.

CLIMATE tells us the average daily weather for an extended period of time (years, decades, centuries) at a certain location.

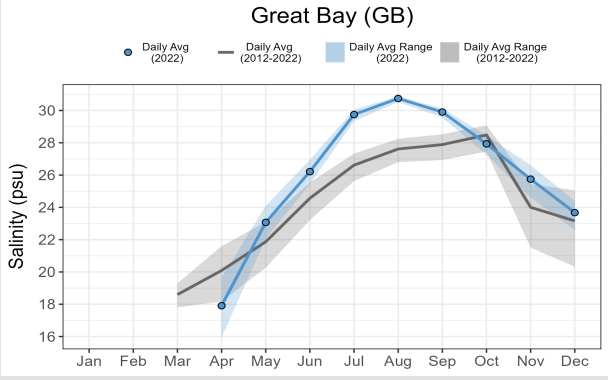
Drought

Drought conditions in coastal New Hampshire counties (outlined in black above) ranged from abnormally dry in May to severe/extreme drought in August and September.

This short but extreme drought resulted in record-low streamflow and groundwater levels throughout New England.

The weather station in Greenland, NH (left) collects data that allows scientists to track real-time changes in weather and climate.

Weather Can Have A Major Impact On Water Quality

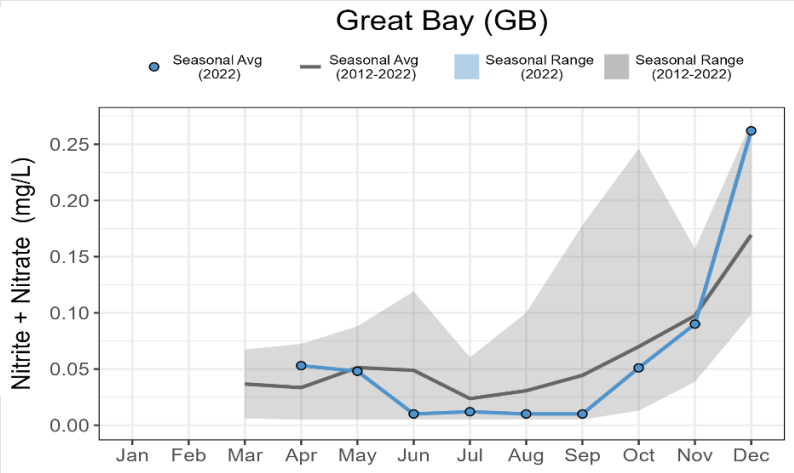


Drought conditions in the spring and summer led to a drastic increase in salinity during the summer across all four sampling locations.

How Does Water Quality Affect Eelgrass?

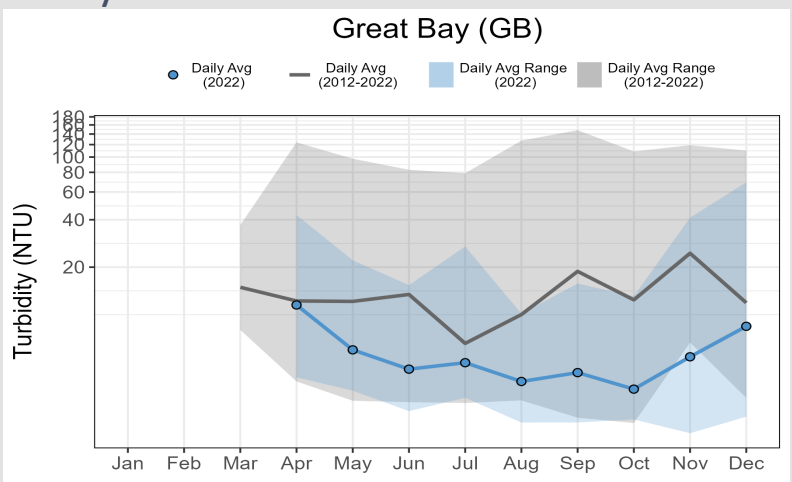
Eelgrass (*Zostera marina)* is an important indicator of water quality and a vital part of Great Bay Estuary. Healthy eelgrass beds provide oxygen, improve water quality and are essential habitat for marine creatures. In 2022, eelgrass meadows recovered from large losses due to historically high rainfall and degraded water quality in 2021. Drought conditions in 2022 decreased nitrogen and turbidity, leading to improved water quality throughout the Bay.

Nitrogen



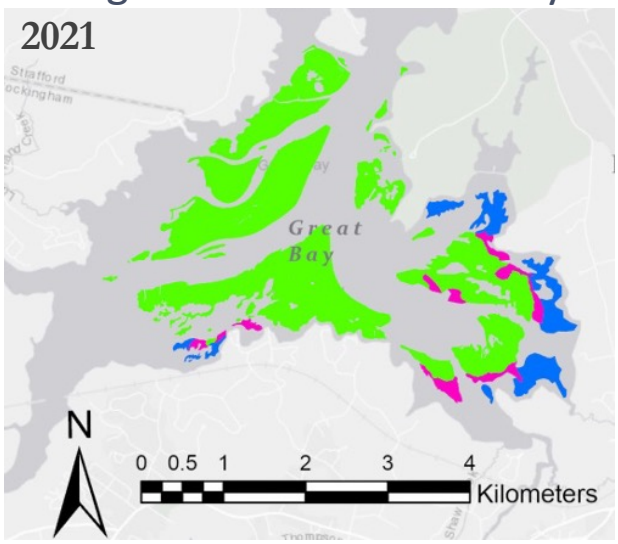
Inorganic Nitrogen (Nitrate + Nitrite) is a common measure of water quality. Nitrogen levels were lower at all sampling locations in the summer, presumably from drought. High rainfall can degrade water quality by carrying in excess nitrogen and sediments from runoff through streams into the Bay.

Turbidity



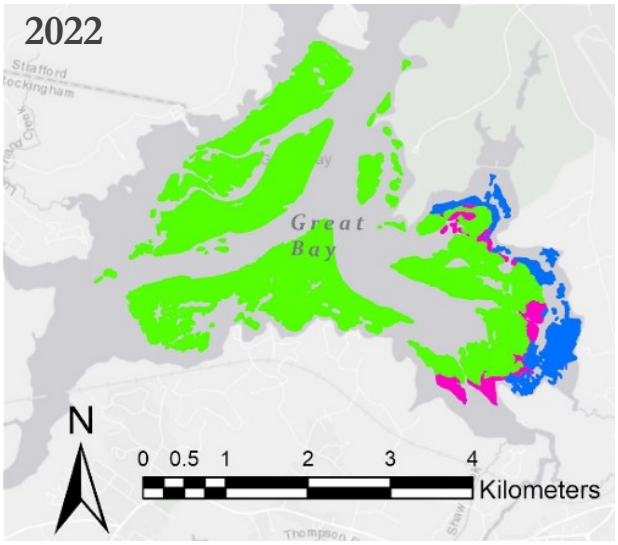
Turbidity is a measure of how clear the water is. It often increases with rain, storms and runoff, which blocks light from reaching eelgrass. In 2022, turbidity decreased across all sampling locations, making conditions more favorable for eelgrass.

How Weather Can Affect Eelgrass Cover in Great Bay



Eelgrass distribution increased by 129 acres from a historically wet year in 2021 (top) to a drought year in 2022 (bottom).

*Data sourced from Piscataqua Region Estuaries Partnership (PREP) *Eelgrass Distribution in the Great Bay Estuary and Piscataqua River for 2021 and 2022* Reports.



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 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

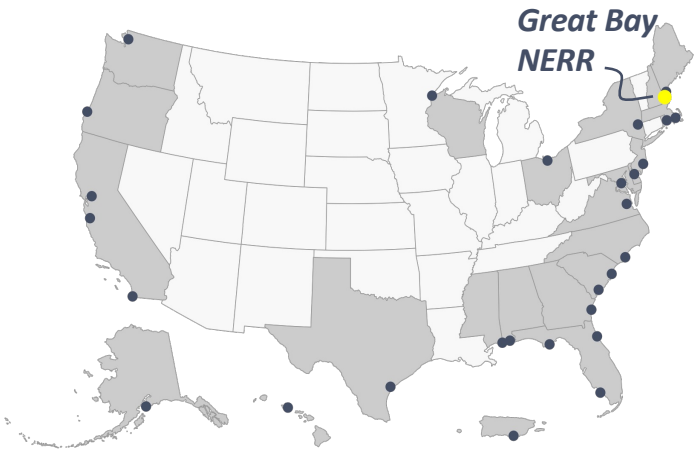
Up to two-thirds of the nation's commercial fish and shellfish spend some part of their life cycle in an estuary or depend on this resource for food.

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://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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Great Bay NERR- providing the science needed for today and tomorrow

Great Bay National Estuarine Research Reserve