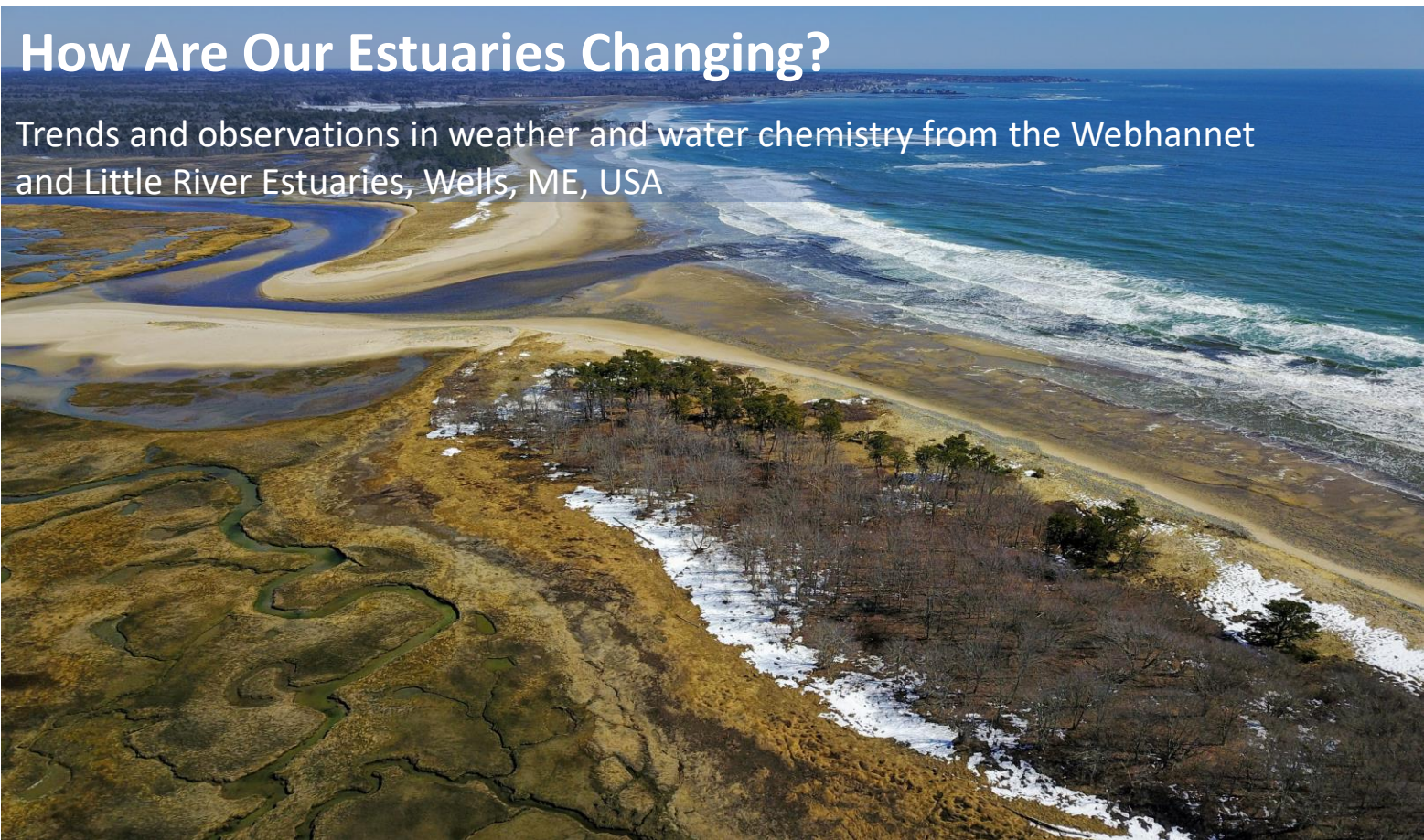


How Are Our Estuaries Changing?

Trends and observations in weather and water chemistry from the Webhannet and Little River Estuaries, Wells, ME, USA



Wells National Estuarine Research Reserve (WNERR)

Wells NERR protects fields, forests, freshwater wetlands, salt marsh, and sandy beach on the densely populated southern coast of Maine. Reserve facilities are situated at historic Laudholm Farm, settled in 1642 and occupied by only four families over the ensuing 350 years. The Laudholm Trust, with about 2,500 members, develops programs that increase public awareness of, and support for, Wells Reserve research, education, and resource management. For more information visit:

<http://www.wellsreserve.org/>

The trends summarized in this report reflect changes that occurred in Wells, ME between 2007-2020 and do not necessarily reflect long-term climatic trends.

2020 HIGHLIGHTS

.....
Water and air temperatures were **warmer** in summer and winter compared to historical seasonal averages.

.....
Total **precipitation** was **lower** than historical averages, with a severe drought in the summer of 2020.

.....
Dissolved oxygen was **lower** than the historical average at the two head-of-tide sites, and about average at the two inlet sites.

.....
Salinity was **higher** in the summer and fall compared to historical seasonal averages at 3 of our 4 water quality sites.

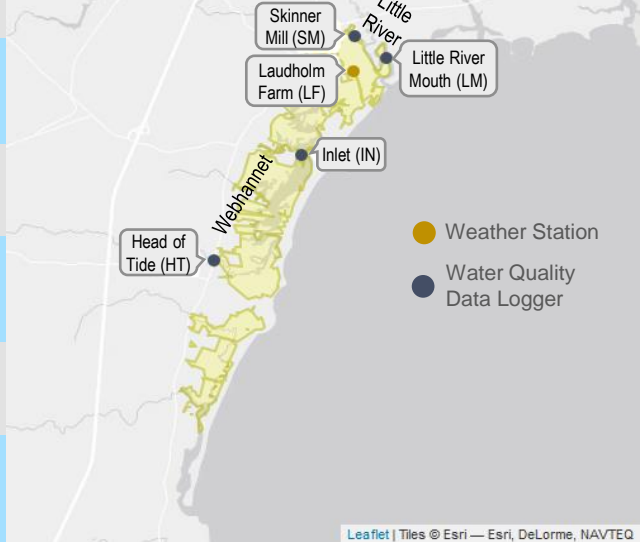
Water quality issues influence human and environmental health. The more we monitor our water, the better we will be able to recognize and prevent problems.



HOW IS OUR ESTUARY CHANGING?

- **Air Temperature and Precipitation** have not changed significantly since 2007.
- **Water Temperature** has been **increasing** since 2007 at 3 out of 4 sites.
- **Nutrients** have been **increasing** since 2007 at 3 out of 4 sites.
- **Salinity** has been **increasing** since 2007 at 3 out of 4 sites.
- **Dissolved Oxygen** has been **decreasing** since 2007 at 3 out of 4 sites.

Wells Sampling Locations



Trends in Weather & Water Quality*

Location ID	Location Name	Air Temperature	Precipitation
LF	Laudholm Farm	—	—

Location ID	Location Name	Water Temperature	Salinity	Dissolved Oxygen	pH	Turbidity
HT	Head of Tide	↑	↑	↓	↑	↓
IN	Inlet	—	↓	↑	↓	↓
LM	Little River Mouth	↑	↑	↓	↓	—
SM	Skinner Mill	↑	↑	↓	↑	—

Location ID	Location Name	Ortho-phosphate	DIP	Nitrite + Nitrate	Ammonium	Chlorophyll-a
HT	Head of Tide	↑	↑	↑	↑	↓
IN	Inlet	—	—	↑	↓	↓
LM	Little River Mouth	↑	↑	↑	↑	—
SM	Skinner Mill	↑	↑	↑	↑	—

*Based on data collected from 2007-2020.

X Insufficient Data
 ↑ Increasing
 — Not Changing
 ↓ Decreasing

Weather & Climate – What is the Difference?

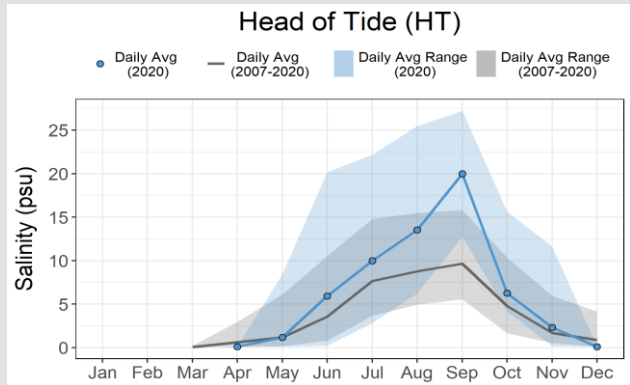
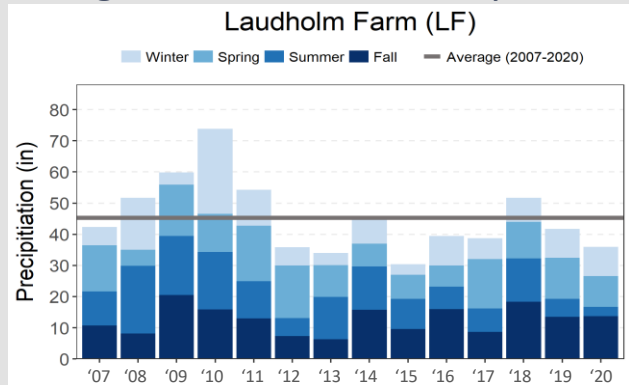
WEATHER is what you see outside on any particular day in terms of precipitation, temperature, humidity, cloudiness, visibility and wind.



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

Weather Can Have A Major Impact On Water Quality

Droughts & Water Chemistry



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

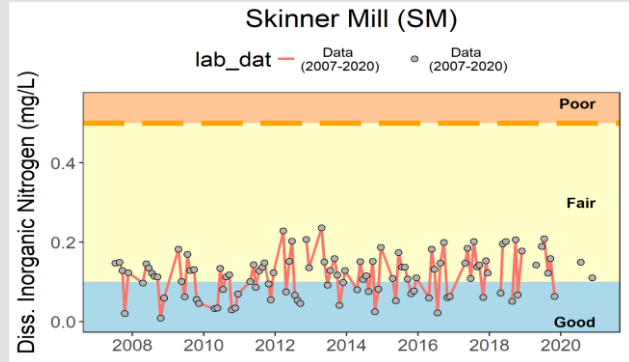
In 2020, Wells experienced less rainfall than historical averages, with a severe drought in the summer. Precipitation and droughts impact the water quality of our local estuaries.

During drought, estuaries receive less freshwater input and runoff. As a result, our estuaries experienced higher than average salinities, lower turbidity, and higher pH during Summer 2020.

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. These blooms can decrease the dissolved oxygen underwater life needs to survive, negatively impact human health, and close fishery harvest areas.

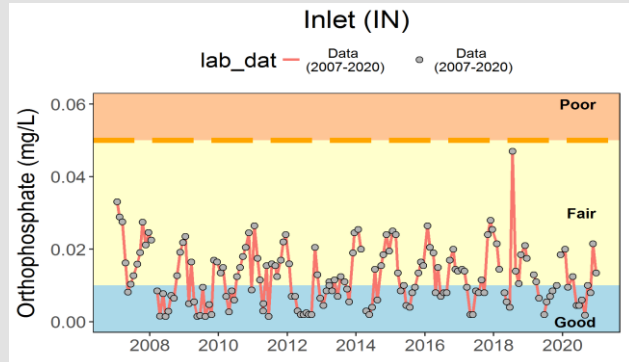
Nitrogen



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

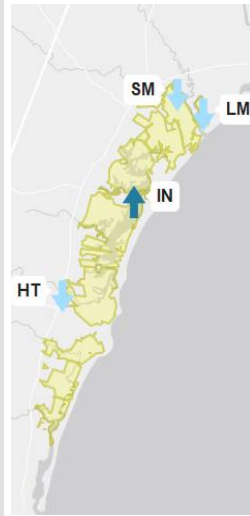
Dissolved inorganic nitrogen (DIN) is a type of nitrogen phytoplankton need to grow. At Wells NERR, data show that DIN concentrations have been increasing since 2007 at 3 out of 4 sites. The Webhannet inlet is the only site where DIN has not significantly changed over time, possibly because this site is not as heavily influenced by runoff inputs of nitrogen. Other forms of nitrogen—nitrate and ammonium—have also been increasing. Nitrogen levels have remained within the Fair to Good range at all sites since 2007.

Phosphorus



Phosphorus is also important for the growth of phytoplankton. Several forms—orthophosphate and DIP—have been increasing since 2007 at 3 out of 4 sites. The Webhannet inlet is the only site where phosphorus has not significantly changed. Phosphorus has remained within the Fair to Good range, though there was a spike in phosphorus in 2018 in the Webhannet inlet that came close to the Poor range. Orthophosphates are found in a variety of cleaning products and can be monitored as an indicator of failing septic systems nearby. Other phosphorus sources include agricultural runoff and lawn fertilizers.

How is Oxygen Changing?



Dissolved oxygen (DO) has been decreasing since 2007 at 3 out of 4 sites. DO mostly remained within the Fair to Good range in 2020. However, two sites are experiencing an increasing number of Poor DO days. Along with other factors influencing DO, increasing nutrients can result in more frequent phytoplankton blooms that use up large amounts of oxygen.

Small Changes You Can Make To Help

- Limit use of fertilizers and pesticides and apply responsibly.
- Use compost as fertilizer in gardens.
- Collect pet droppings.
- Plant trees and rain gardens.
- Redirect downspouts away from impervious surfaces like driveways and sidewalks.
- Wash cars and boats on the 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.

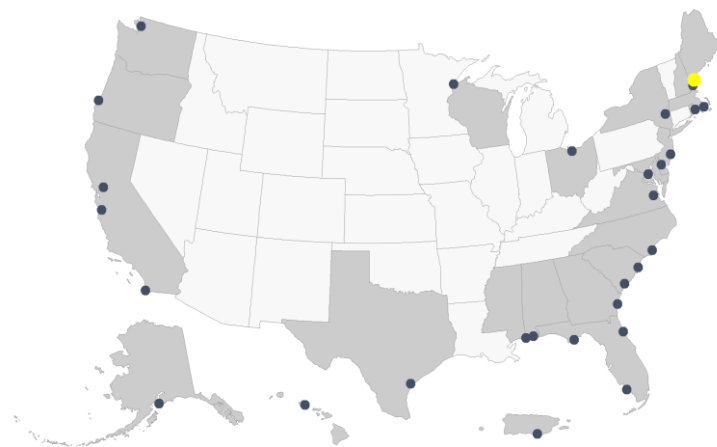
Habitat Diversity



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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Wells NERR - providing the science needed for today and tomorrow