

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)

The 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, support programs that increase public awareness of, and support for Wells Reserve research, education, and resource management.

For more information please visit:

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

The trends summarized in this report reflect changes that occurred in the Webhannet and Little River estuaries between 2007-2019, and do not necessarily reflect long-term climatic trends.

2019 HIGHLIGHTS

.....

Water and air temperatures were **warmer** in July and slightly **colder** in winter compared to historical seasonal averages.

.....

pH was lower—or **more acidic**—than historical averages at 3 of our 4 water quality sites.

.....

Dissolved oxygen was **higher** than the historical average in the Webhannet estuary and about **average** in the Little River.

.....

Chlorophyll levels were **higher** than historical seasonal averages in May through November at 3 of our 4 water quality sites.

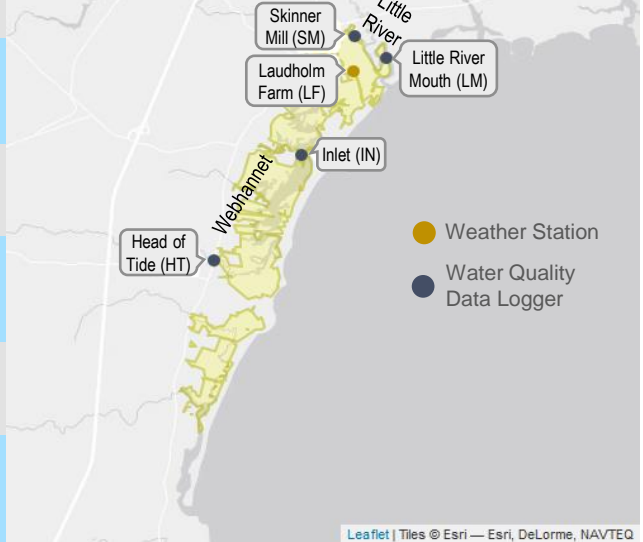
Water quality issues influence human and environmental health. The more we monitor our water, the better we will be able to recognize and prevent problems.



HOW IS OUR ESTUARY CHANGING?

- **Air Temperature and Precipitation** have not changed significantly since 2007.
- **Water Temperature** has been increasing at the Little River mouth since 2007.
- **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 2007-2019

X Insufficient Data ↑ Increasing — Not Changing ↓ Decreasing

Weather & Climate – What is the Difference?

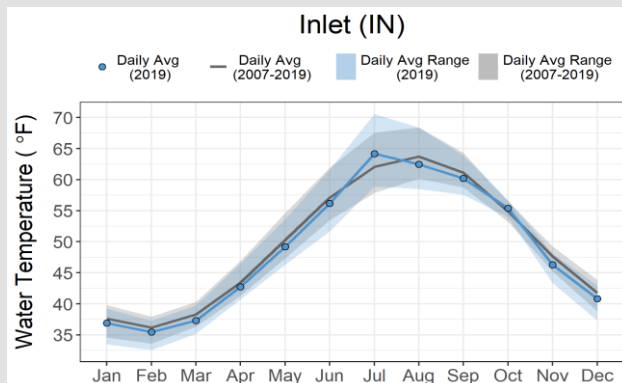
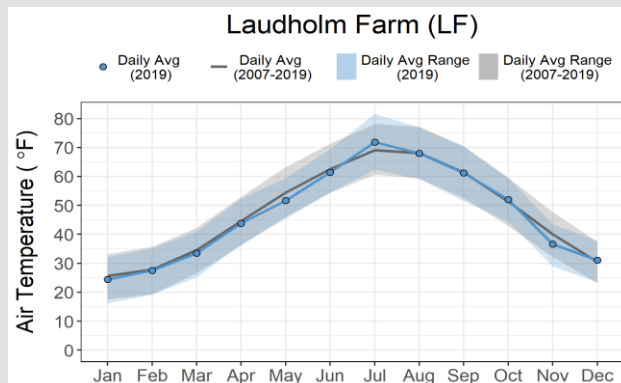
WEATHER is what you see outside on any particular day in terms of precipitation, temperature, humidity, cloudiness, visibility and wind.



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

Air and Water Temperature



In 2019, air temperatures were warmer in July and slightly colder in several other months compared to historical seasonal averages.

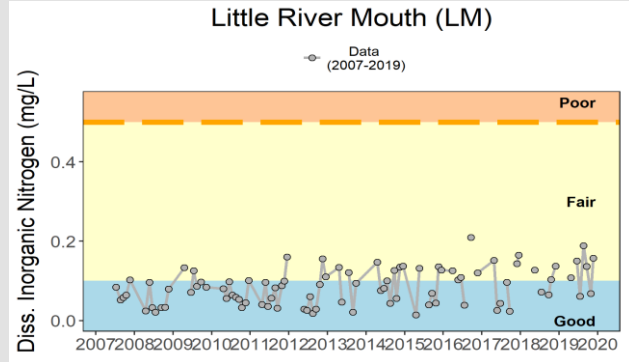
Water temperature is affected by weather and ocean currents. In 2019, water was warmer in July and slightly colder in most other months compared to historical monthly averages.

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 that underwater life needs to survive, negatively impact human health, and close fishery harvest areas.

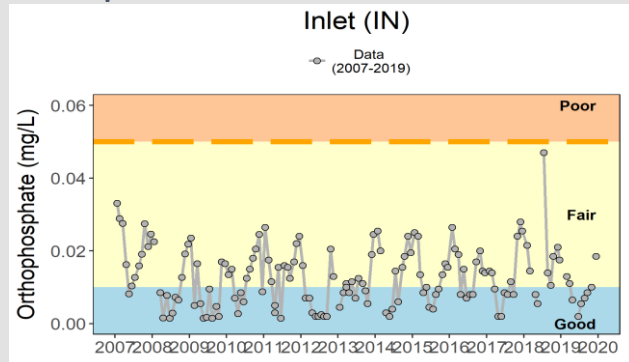
Nitrogen



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

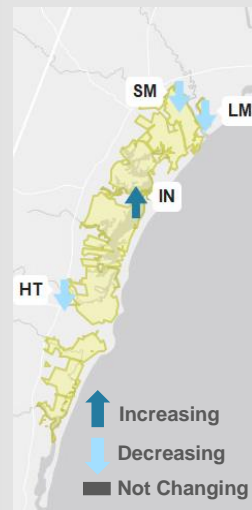
Dissolved inorganic nitrogen (DIN) is a type of nitrogen in the water phytoplankton need to grow. At Wells NERR, data show that DIN concentrations have been increasing since 2007 at 3 out of 4 sites. The Webhannet inlet is the only site where DIN has not been significantly changing over time, possibly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

Phosphorus



Phosphorus is also important for the growth of phytoplankton. Several forms of phosphorus (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. However, there was a spike in phosphorus in the Webhannet inlet in 2018 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, but occasionally dropped into the Poor range during summer and fall. Along with other factors influencing DO, increasing nutrients can result in more phytoplankton blooms that use up large amounts of oxygen.

Small Changes You Can Make To Help

- Limit use of fertilizers/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 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.

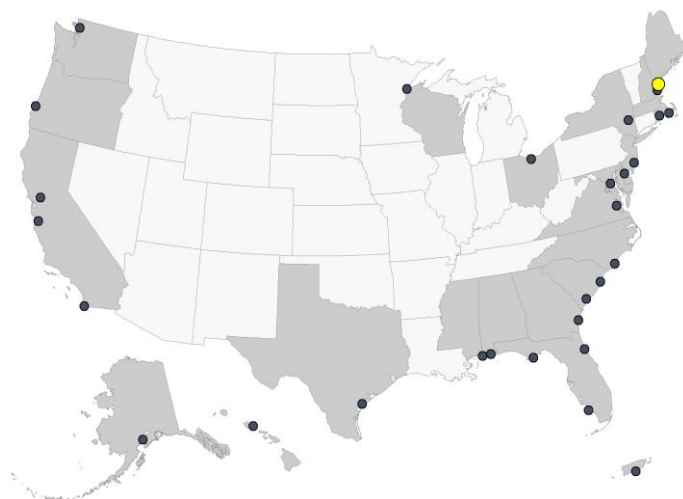
Habitat Diversity



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?

Contact Jeremy Miller
jmiller@wellnerr.org
207-646-1555 ext 122

Wells NERR - providing the science needed for today and tomorrow