

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 2000-2021 and do not necessarily reflect long-term climatic trends.

2021 HIGHLIGHTS

.....
Water and **air temperature** were **warmer** than historical averages, particularly in Spring.

.....
The **summer** was **rainier** than it had been in 11 years compared to historical seasonal averages.

.....
Salinity was **lower** in Summer and **higher** in Spring compared to historical seasonal averages.

.....
pH was lower (**more acidic**) in Summer compared to historical seasonal averages.

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 temperature have been **increasing** since 2007 at all sites.

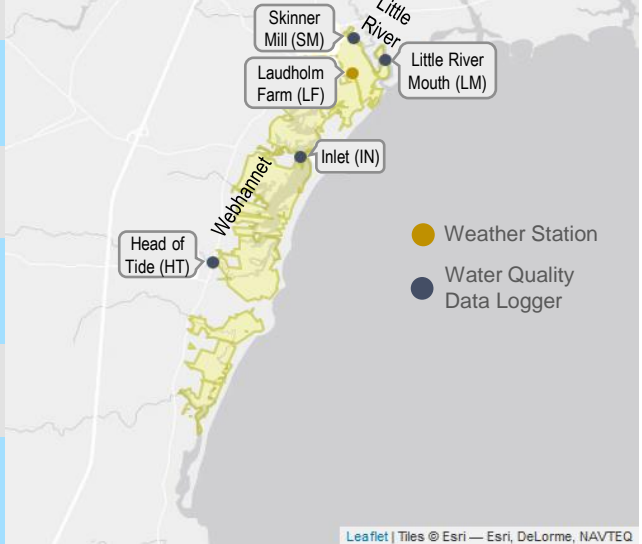
Nutrients have continued to **increase** since 2007 at 3 out of 4 sites.

Salinity has continued to **increase** since 2007 at 3 out of 4 sites.

Turbidity has been **decreasing** since 2000 at the Webhannet Inlet.

Dissolved oxygen has been **decreasing** in the Little River and **increasing** at the Webhannet Inlet.

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
HT	Head of Tide	↑	↑	↑	↑	—
IN	Inlet	—	—	↑	↓	—
LM	Little River Mouth	↑	↑	↑	↑	—
SM	Skinner Mill	↑	↑	↑	↑	—

*Based on data collected from 2000-2021.

X Insufficient Data ↑ Increasing — Not Changing ↓ Decreasing

Weather & Climate – What is the Difference?

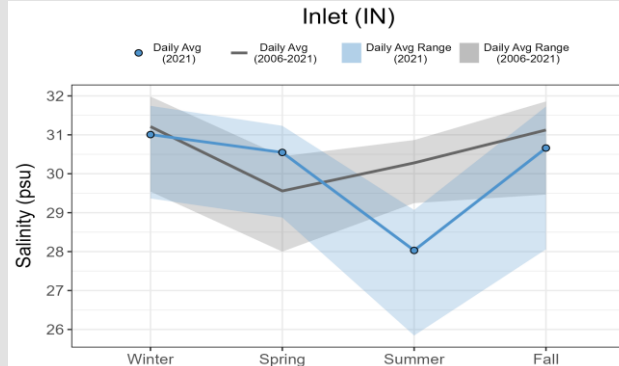
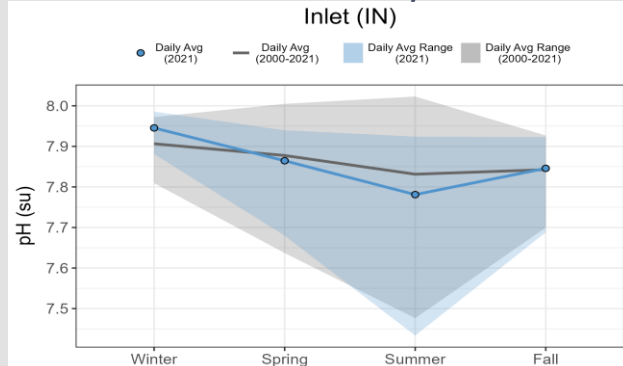
WEATHER is what you see outside on any particular day in terms of precipitation, temperature, humidity, cloudiness, visibility and wind.



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

Rain & Water Chemistry



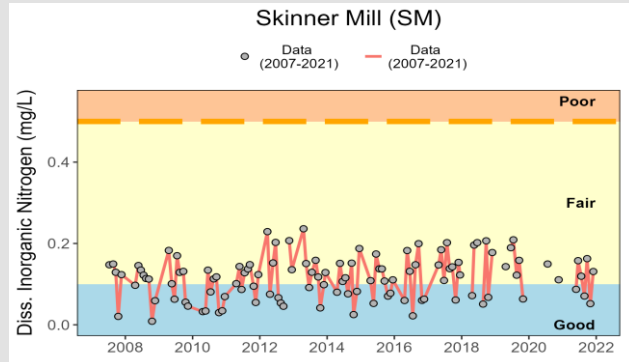
Weather data helps scientists and managers understand water circulation patterns, plant growth, shellfish and fish distribution, storm frequency and intensity and much more...

In Summer 2021, Wells received more rain than any summer since 2010, in strong contrast to the drought of Summer 2020. Rain and droughts impact water quality of our local estuaries. During heavy rain, estuaries receive extra freshwater input which can contribute to lower salinity, higher turbidity, and lower pH (more acidic). During the extra rainy Summer of 2021, Wells estuaries experienced lower pH and salinity compared to historical seasonal averages at all 4 monitoring sites.

Too Much of a Good Thing?

Phytoplankton (aka microalgae) are tiny, plant-like organisms that need nutrients (nitrogen and phosphorus) to grow. Phytoplankton are critical to estuary and ocean health as they form the base of the marine food web. However, some conditions, such as excess nutrients, can cause phytoplankton blooms which can negatively impact human health, close fishery harvest areas, and decrease the dissolved oxygen available to other underwater life.

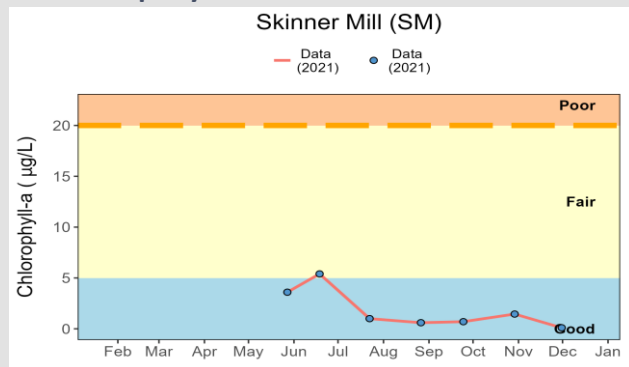
Nutrients



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

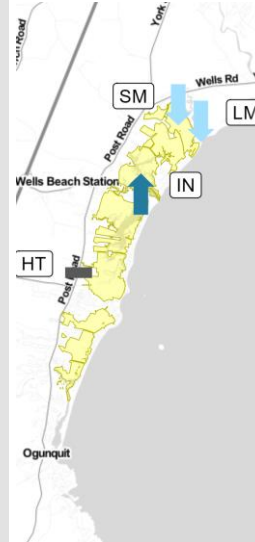
While nutrients in our estuaries are necessary for phytoplankton growth, too many nutrients can cause detrimental blooms. So nutrient levels are closely monitored in many waterbodies. Wells NERR monitors for several forms of nitrogen (DIN, ammonium, nitrite, nitrate) and phosphorus (DIP, orthophosphate) at 4 sites. Data since 2007 show these nutrients increasing over time at 3 sites, with levels fluctuating between the Fair to Good range.

Chlorophyll



Chlorophyll-*a* is a pigment present in photosynthesizing organisms that scientists use to measure phytoplankton abundance in our estuaries. Sudden increases in chlorophyll levels can indicate phytoplankton blooms which can have negative impacts on ecosystems and human health. Monthly chlorophyll data from 2021 illustrates one such bloom that occurred in the Little River estuary in June, which coincided with an increase in nitrogen.

How is Oxygen Changing?



Dissolved oxygen (DO) has been decreasing in the Little River since 2007. DO mostly remained within the Good range in 2021, but occasionally dipped into the Fair range during Summer and Fall. Among other factors influencing DO, increasing nutrients can result in more phytoplankton blooms that use up large amounts of oxygen.

How You Can 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 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.

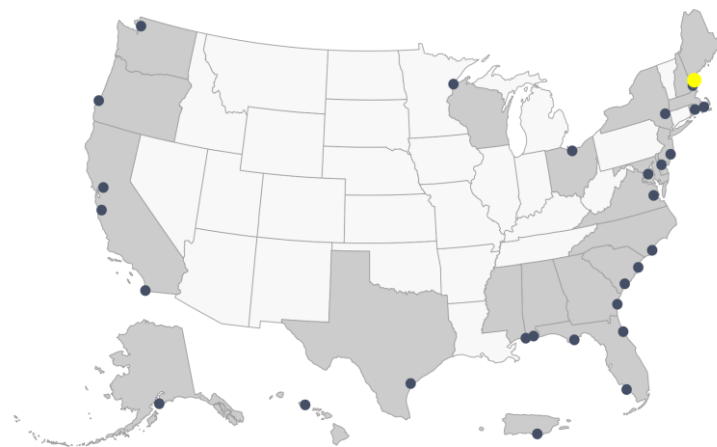
Habitat Diversity



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 30 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