

# How Are Our Estuaries Changing?

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



Photo Credit: Sue Bickford

## Wells National Estuarine Research Reserve (WNERR)

The Wells NERR protects fields, forests, freshwater wetlands, salt marshes, and sandy beaches 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, raises funds and hosts public events that increase awareness of, and support for, Wells Reserve research, education, and resource management initiatives.

### Our Vision:

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

For more info please visit:

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

## 2018 HIGHLIGHTS

.....  
It was **wetter** - Precipitation was greater than it had been since 2011, and slightly above the long-term average.  
.....

Water temperatures were **warmer** in the summer and **colder** in the early winter compared to historical seasonal averages.  
.....

**Dissolved oxygen** was **lower** than the historical average at the two sites in the Little River Estuary.  
.....

**Chlorophyll** levels were **lower** than historical averages, with the exception of an algae bloom in September 2018.



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** is increasing at two locations.

**Nutrients** (NH<sub>4</sub>, NO<sub>2</sub>, DIN, DIP, PO<sub>4</sub>) are increasing at three out of four locations.

**Salinity** is increasing at three out of four locations.

**Dissolved Oxygen** is decreasing at three 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	—	↑	↓	↑	—

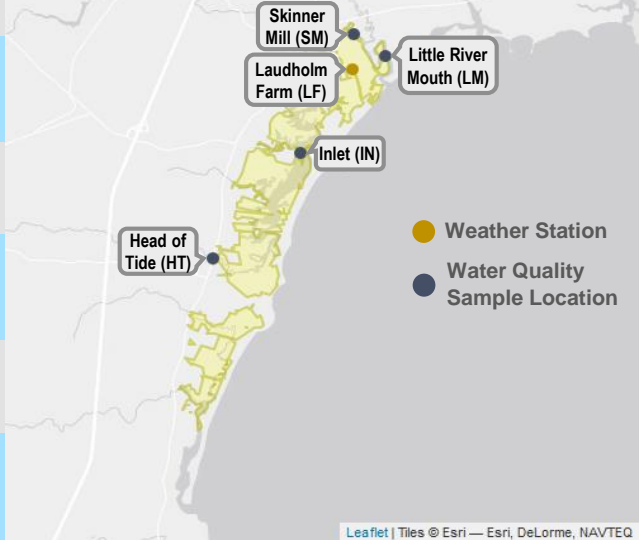
  

Location ID	Location Name	Ortho-phosphate	Ammonium	Nitrite + Nitrate	Phosphorus (DIP)	Chlorophyll-a
HT	Head of Tide	↑	↑	↑	↑	↓
IN	Inlet	—	↓	↑	—	↓
LM	Little River Mouth	↑	↑	↑	↑	—
SM	Skinner Mill	↑	↑	↑	↑	—

\*Based on data collected from 2007-2018

↑ Increasing    — Not Changing    ↓ Decreasing

## Wells Sampling Locations



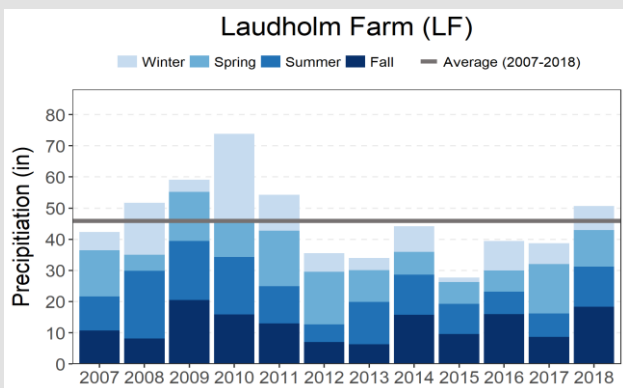
## Weather & Climate – What is the Difference?

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



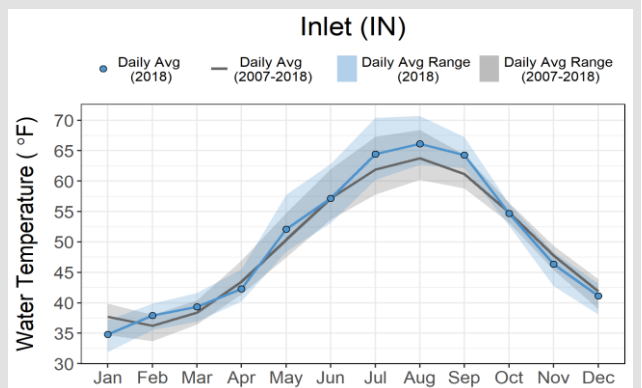
**CLIMATE** tells us the average daily weather for an extended period of time (years, decades, centuries) at a certain location.

## Weather Can Have A Major Impact On Water Quality



Long-term data show no significant upward or downward trend in precipitation since 2007. However, in 2018, precipitation was at its highest in seven years.

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

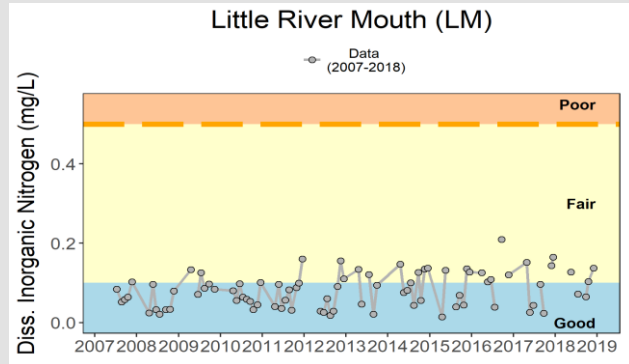


Water temperature is affected by changes in weather and ocean currents. In 2018, water temperatures were warmer in summer and colder in winter compared to historical averages.

# 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.

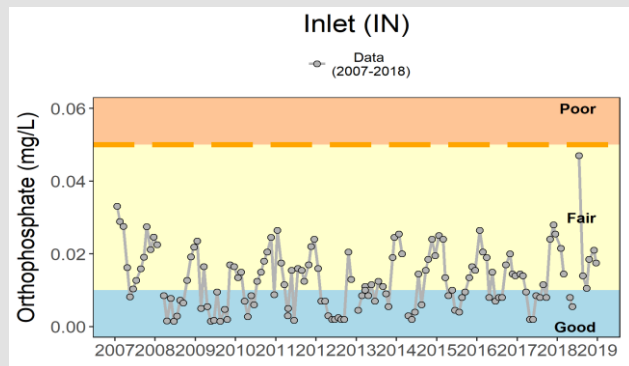
## Nitrogen



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

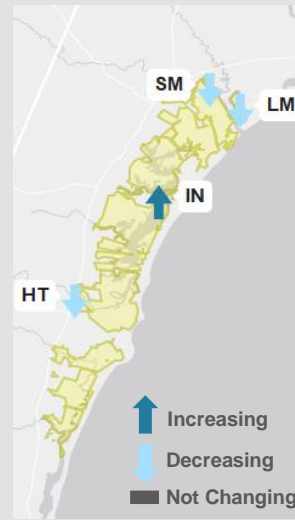
Nitrogen is an important nutrient that phytoplankton need to grow. Data show that concentrations of several forms of nitrogen (DIN,  $\text{NH}_4$ ,  $\text{NO}_2 + \text{NO}_3$ ) have been increasing over the long-term at three sites. The Webhannet Inlet is the only site where nutrients are not significantly changing, possibly because this site is not as heavily influenced by runoff inputs of nitrogen. Nitrogen concentrations have remained within the Fair to Good range at all locations.

## Phosphorus



Phosphorus is another nutrient that is important for the growth of phytoplankton. Data show that concentrations of several forms of phosphorus (orthophosphate and DIP) have been increasing over time at three sites. The Webhannet Inlet is the only site where phosphorus is not significantly changing. Phosphorus concentrations have remained within the Fair to Good range at all sites. However, there was a spike in phosphorus in the Webhannet Inlet in 2018 that came close to the Poor range. This may have been due to a sudden input of runoff, such as from a septic system, agriculture, or fertilizer.

## 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 in the summers. Along with other factors that affect DO, increasing nutrients can cause 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.

Photo Credit: Laura Crane

## 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.

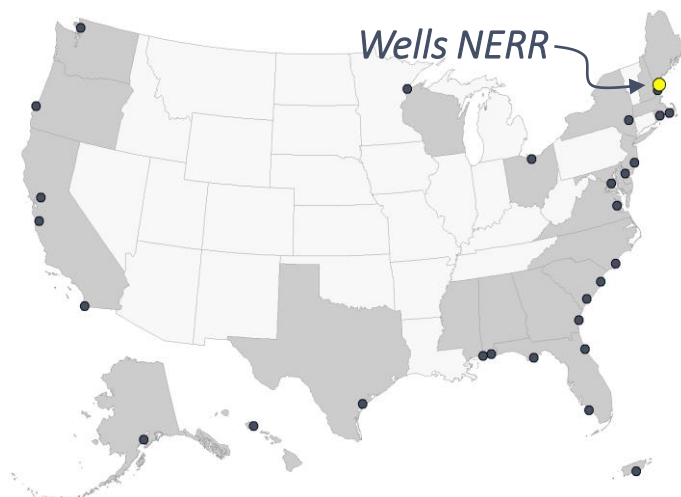
## Habitat Diversity



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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