



# ESTUARY TRENDS: WEATHER & WATER QUALITY

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

## North Inlet - Winyah Bay National Estuarine Research Reserve (NERR)

Most of the reserve is located on Hobcaw Barony, a 16,000 acre property of the Baruch Foundation designated for conservation, research, and education. It includes North Inlet and Winyah Bay and encompasses tidal and transitional marshes, oyster reefs, beaches, coastal forest, and open water. North Inlet is an ocean-dominated estuary that features high water quality, extensive salt marshes, and a small forested watershed that is relatively undeveloped. In contrast, Winyah Bay is a brackish-water estuary that drains four major rivers and the third largest watershed on the East Coast, and is greatly influenced by forestry and other human activities. For more information go to:

<http://www.northinlet.sc.edu/>

## 2018 HIGHLIGHTS

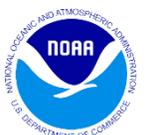
.....  
Summer 2018 was **wet!** We had more rain than the long-term historical average

.....  
Inland storms led to **extended freshwater discharge** from Winyah Bay and **low salinity** for much of the Fall

.....  
**Dissolved oxygen** in Winyah Bay dropped following hurricane Florence but recovered within a few weeks

.....  
Levels of **chlorophyll-a** are **not changing** over the long-term, but high concentrations occur naturally each summer

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?

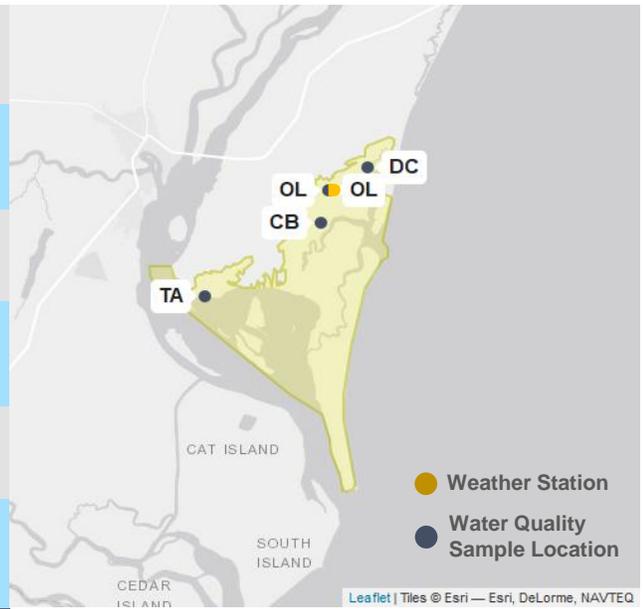
**Precipitation** is not changing but is annually variable

**Air Temperature** is increasing

**Phosphorus** (ortho-phosphate) is not changing

**Dissolved Oxygen** is not changing

**Salinity** is decreasing at all locations



## Trends in Weather & Water Quality\*

Location ID	Location Name	Air Temperature	Precipitation
OL	Oyster Landing	↑	—

Location ID	Location Name	Water Temperature	Salinity	Dissolved Oxygen	pH	Turbidity
CB	Clambank	—	↓	—	—	↑
DC	Debidue Creek	↑	↓	—	↓	—
OL	Oyster Landing	↑	↓	—	↓	↑
TA	Thousand Acre	—	↓	—	↓	—

Location ID	Location Name	Ortho-phosphate	Ammonium	Nitrite	Nitrate	Chlorophyll -a
CB	Clambank	—	↑	—	—	—
DC	Debidue Creek	—	↑	—	↑	—
OL	Oyster Landing	—	↑	—	—	↑
TA	Thousand Acre	—	—	—	↑	—

\*Based on data collected from 2009-2018

X Insufficient Data   ↑ Increasing   — Not Changing   ↓ Decreasing

## Weather & Climate – What is the Difference?

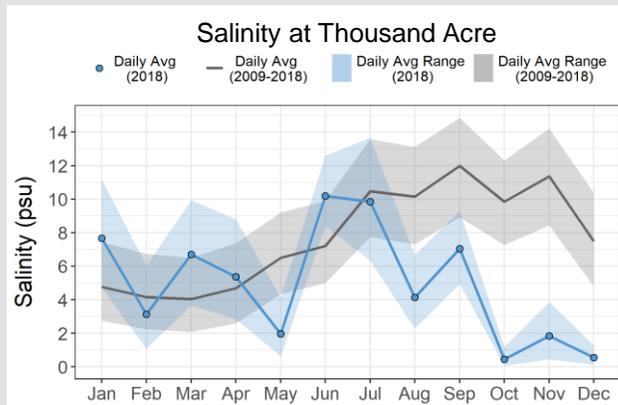
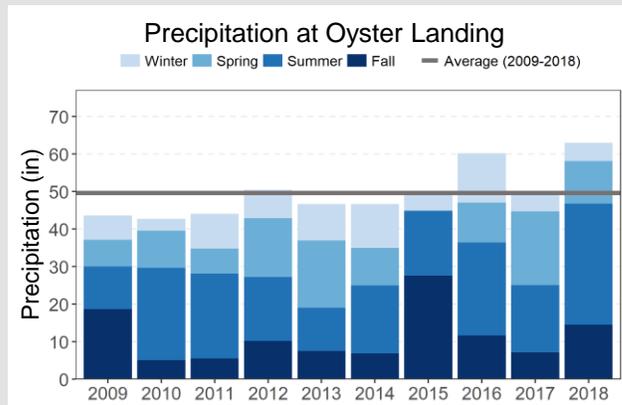
**WEATHER** is what you see outside on any particular day in terms of precipitation, temperature, humidity, cloudiness, visibility and wind.



**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

### Precipitation & Salinity



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

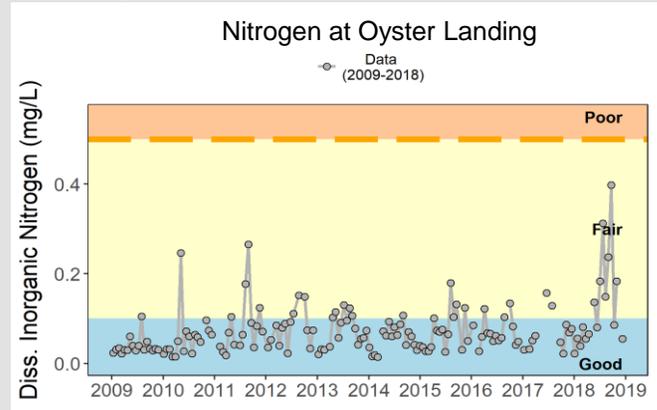
Rainfall in Summer 2018 was the highest in the past 10 years

During the Fall, salinity at all sites was consistently below the long-term average

# 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.

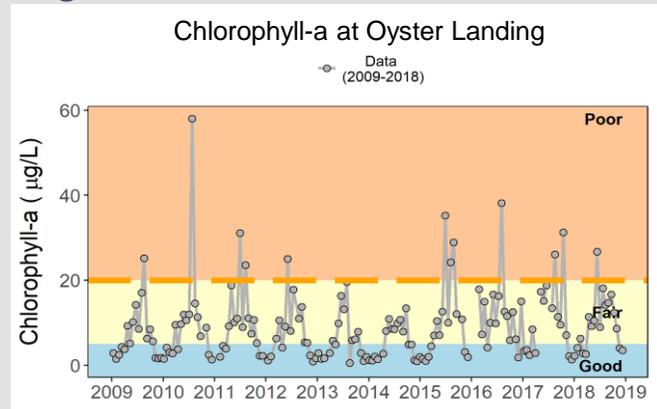
## Nitrogen



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

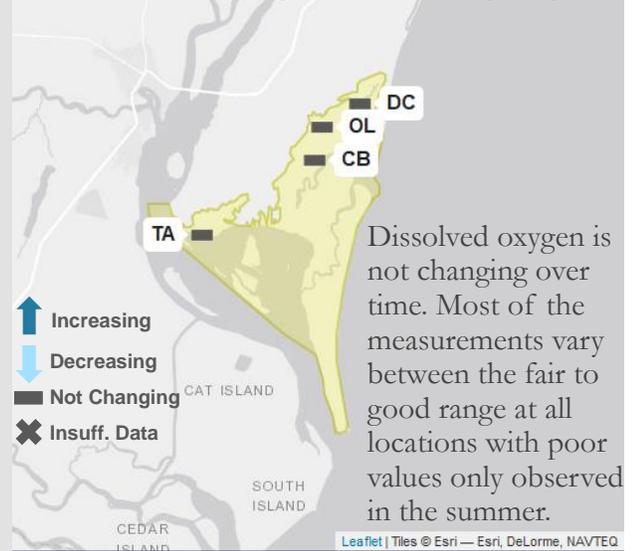
Dissolved inorganic nitrogen (DIN) is the type of nitrogen in the water phytoplankton need to grow. At North Inlet-Winyah Bay NERR, data show that DIN concentrations are increasing over the long-term at three locations. While most of the measurements are still in the good range and no locations exceed the critical threshold, 2018 had high levels of DIN compared to the previous 10 years.

## Algae



Phytoplankton growth is measured by chlorophyll a concentrations. At NI-WB NERR, chlorophyll a levels are not changing over the long-term. In 2018, most of the measurements were in the fair range, with peak concentrations occurring between June-September. Threshold values developed at the national level may not reflect natural dynamics for all estuaries, such as North Inlet.

## How is Oxygen Changing?



## 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 Dr. Robert Dunn  
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North Inlet-Winyah Bay NERR - providing the science needed for today and tomorrow

