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 ARE THE TIVOLI BAYS CHANGING?

Precipitation is decreasing.

Air Temperature is not changing.

Water Temperature is increasing.

Chloride is increasing.

Algae (Chlorophyll-a) decreased at Tivoli North, Tivoli South, and Stony Creek, but stayed the same at Saw Kill.

Trends in Weather & Water Quality*

*Tivoli Bays Component Site

<table>
<thead>
<tr>
<th>Location ID</th>
<th>Location Name</th>
<th>Air Temp</th>
<th>Rainfall</th>
<th>Water Temp</th>
<th>Salinity</th>
<th>Dissolved Oxygen</th>
<th>Chloride</th>
<th>Sulfate</th>
<th>Ortho-phosphate</th>
<th>Ammonium</th>
<th>Nitrate</th>
<th>Chlorophyll-a</th>
<th>Pheophytin-a</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>Field Station</td>
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<td>SK</td>
<td>Saw Kill</td>
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<td>SC</td>
<td>Stony Creek</td>
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<tr>
<td>TN</td>
<td>Tivoli North</td>
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<td>TS</td>
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</tr>
</tbody>
</table>

*Based on data collected from 2007-2018
All other data collected from 1991-2018

Weather Can Have A Major Impact On Water Quality

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

Precipitation was ~12 to 20 inches less than the long-term historical average during 2013 to 2017, but slightly higher in 2018.
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.

Do HRNERR data show climate change impacts?

The impacts of climate change, particularly sea level rise, are projected to be more extreme in the Mid-Atlantic region of the United States than in other areas of the world. HRNERR data do not show an increasing trend in air temperature, but do show an increase in water temperature. In 2017, HRNERR installed a tide station at Turkey Point (near the Tivoli Bays). Data from this station will be used to monitor changes in water level over time. Long-term data sets are extremely useful tools for monitoring future impacts of climate change to local ecosystems.

Tivoli Bays Component Site

**Saw Kill (SK)**

Chloride has been accumulating in Hudson River tributaries. Potential causes include road salt, septic wastes, and water softeners. Life in the tributaries could be adversely affected.

**Tivoli North Bay (TN)**

Chlorophyll-a measures algal growth. Harmful algal blooms (HABs) occur when excessive algae release toxins. In recent years, chlorophyll-a levels and algal growth have remained low.

Estuarine organisms, including, mammals, birds, fish, and crustaceans, have different tolerances and responses to the impacts of climate change. Shifts in temperature and water level could alter estuarine habitats. The types and locations of aquatic plants could change. These changes could impact how organisms use habitats for protection, food sources, and breeding grounds.
Why Estuaries Matter

<table>
<thead>
<tr>
<th>Economic Impacts</th>
<th>Community Benefits</th>
<th>Healthy Ecosystems</th>
<th>Habitat Diversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal shoreline counties provided 53 million jobs and contributed $7.4 trillion (nearly 44%) of the nation’s gross domestic product in 2012.</td>
<td>Estuaries protect coastal communities by reducing flooding and storm surge impacts, enhancing water quality, and providing commercial and recreational benefits.</td>
<td>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.</td>
<td>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.</td>
</tr>
</tbody>
</table>

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/

More Information...

For Citizen Science
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 Sarah Fernald sarah.fernald@dec.ny.gov (845) 889-4745

Hudson River NERR - providing the science needed for today and tomorrow