

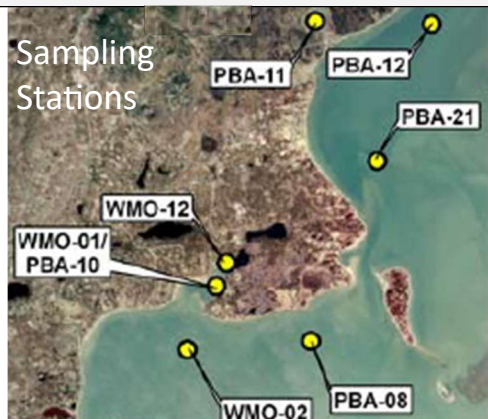
Northwest Pleasant Bay

Orleans, MA

2001-2023 Water Quality Summary

ESTUARY SETTING

Northwest Pleasant Bay is located in southern Orleans and includes a number of terminal ponds (Pah Wah, Quanset, and Little Quanset), as well as the sentinel station for the whole Bay (PBA12). Pleasant Bay is shared between Orleans, Brewster, Harwich, and Chatham and is connected through a dynamic inlet along a barrier beach to the Atlantic Ocean. The location and size of the inlet(s) have a large impact on water quality. During the 2006 Pleasant Bay Massachusetts Estuaries Project (MEP) ecosystem assessment the system inlet was in Chatham Harbor, but in 2007 a new northern inlet formed east of Strong Island. Historical reviews showed that inlets in the current location gradually move back to the southern location. The 2007 inlet location increased the impact of tides and improved water quality conditions throughout the system, but did not alter the target MEP nitrogen concentrations for restoring acceptable conditions. The MEP noted significant impairments in the terminal basins and established a number of threshold concentrations for selected basins.



WATER COLUMN SAMPLING HISTORY

Water column sampling in Pleasant Bay began in 1995 and 2000-2005 data from 35 stations was used in the MEP assessment. 2015-2019 data from 27 stations

was used in a 2021 MEP update. The MEP and the 2021 update were refined ecosystem assessments, but with different levels of data collection. The MEP included review of sediment habitat and species, macroalgal accumulation and continuous dissolved oxygen (DO), while the 2021 repeated tidal and sediment N measurements. Current and recent summer sampling occurs 4-5 times each year throughout the system. Sampling includes DO and temperature readings and lab assays for chlorophyll-a (CHL), ortho-phosphorus, and particulate and dissolved species of nitrogen.

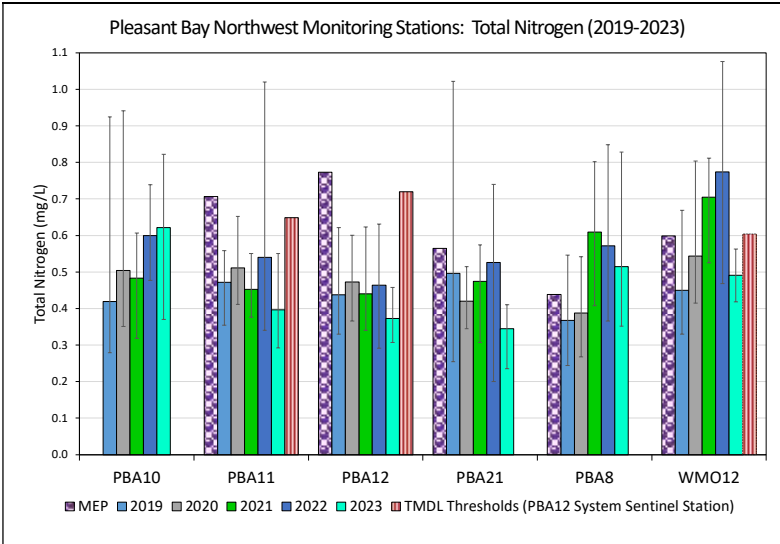
2023 WATER QUALITY STATUS

Water quality conditions have varied with changes in the system inlet. 2019-2023 total nitrogen (TN) concentrations at the bay-wide sentinel station (PBA12) and Pah Wah Pond (PBA11) were less than the MEP threshold goals, but Little Quanset TN levels matched the MEP impaired levels. This pattern of TN levels generally matched 2013-2017 averages. It is clear that tidal changes and watershed nitrogen loading inputs are still altering water quality and sediment conditions. Coordinated management efforts through the Pleasant Bay Alliance anticipate that as the system inlet moves back toward its pre-2007 position, water quality conditions will gradually become more impaired again and current wastewater planning is using the pre-2007 conditions as a baseline for evaluating nitrogen management strategies. Since all water column sampling has been completed using the same protocols, data throughout the historical record can be compared. In addition, since all protocols were approved by MassDEP, all data may be used in regulatory decisions. MassDEP approved system-specific nitrogen limits (or TMDLs) for various portions of Pleasant Bay in 2007.

**ECOSYSTEM STATUS:
Some impairments, more
impairments anticipated**

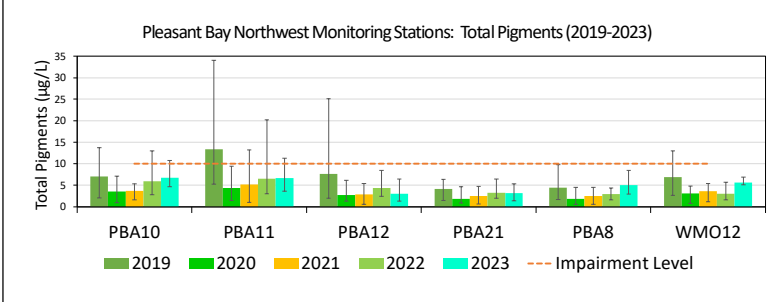
Pleasant Bay Massachusetts Estuaries Project report is available on the MassDEP website:

<https://www.mass.gov/doc/pleasant-bay-system-orleans-chatham-brewster-harwich-ma-2006/download>



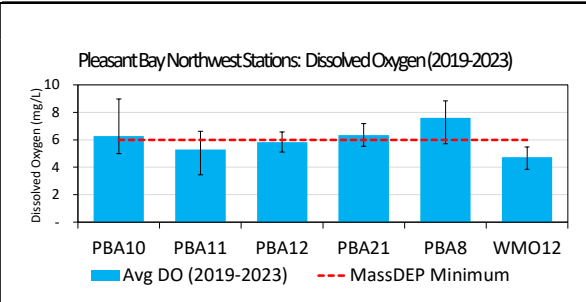
TOTAL NITROGEN

Nitrogen is a limiting nutrient in salt marsh and estuary ecosystems and is necessary for plant, phytoplankton, and algae growth, but excessive N can be harmful. Based on the 2007 MEP ecosystem assessment of Pleasant Bay, a total nitrogen (TN) concentration of 0.72 mg/L at station PBA12 was recommended as a maximum level in order to maintain a healthy Bay ecosystem with other levels in key terminal ponds. A 2021 review of available water column data showed TN levels tend to fluctuate over multi-year periods. 2019-2023 TN levels at Northwest stations tend to be less than MEP/TMDL thresholds except for Little Quanset Pond.



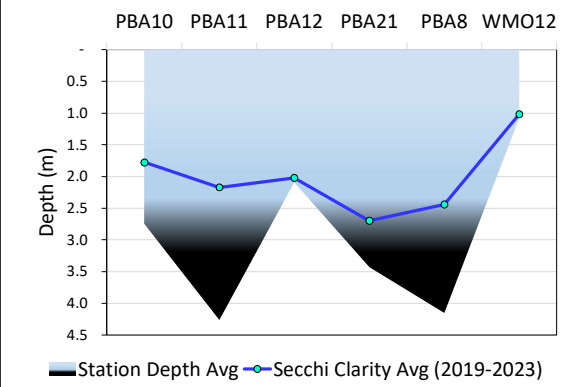
TOTAL PIGMENTS

The primary pigments used for photosynthesis by microscopic plants floating in water are summed for the total pigment concentration, which can be used as a measure of the amount of phytoplankton. Excessive levels generally correspond to higher nutrient levels, but these relationships can get complex when eelgrass has disappeared, much like the Northwest portions of Pleasant Bay. 2019-2023 average pigment levels at PBA12 increased from 2013-2017, while comparisons at other Northwest stations varied, likely due to changing tidal characteristics.



Dissolved Oxygen

DO concentrations in Northwest stations typically vary by depth with generally acceptable levels near the surface and frequent low levels near the sediments. MEP continuous deep readings consistently logged low DO levels less than the MassDEP regulatory minimum of 6 mg/L. 2019-2023 deep DO levels at the Northwest pond stations were generally between 3 and 5 mg/L, while shallow levels were generally between 5 and 6 mg/L.



Water Clarity

Water clarity measured with a Secchi disk is an easy way to measure how deep light can penetrate into an estuary water column. Clarity is an indirect measure of phytoplankton density and where plants can grow well on the bottom of an estuary. Because the depth in an estuary will vary with the tide, measuring the total depth is also an important monitoring task when measuring clarity. 2019-2023 clarity in the Northwest Bay stations tends to be ~2.5 m, but tends to be 0.4 to 0.7 m less in the pond stations.