

Rock Harbor

Orleans, MA

2001-2023 Water Quality Summary

ESTUARY SETTING

Rock Harbor is an 80 acre salt marsh northwest of Route 6 that has a created, regularly dredged, harbor basin that is connected to Cape Cod Bay. The marsh creek is connected to Cedar Pond and is the town line between Orleans and Eastham. The 2008 Massachusetts Estuaries Project (MEP) ecosystem assessment noted that the salt marsh was healthy, but the harbor basin was significantly impaired by low dissolved oxygen (DO), thick algal mats on the bottom, and degraded sediment habitats. MEP staff concluded that total nitrogen (TN) concentrations should be limited to 0.5 mg/L at the downstream edge of the salt marsh (*i.e.*, sentinel station WMO-17) in order to restore ecological health throughout the system.



WATER COLUMN SAMPLING HISTORY

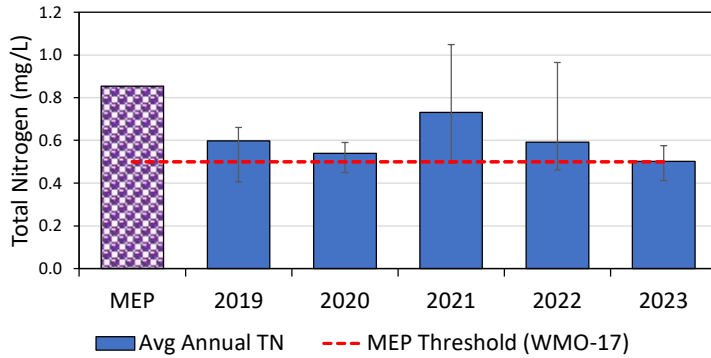
Marsh water column sampling began in 2001 at the four WMO stations, but has been limited to WMO-15 since 2006. Sampling results from 2001-2006 were used in the MEP assessment, which was a refined ecosystem assessment including review of sediment habitat and species, macroalgal accumulation and continuous dissolved oxygen (DO) and tidal measurements. Cedar Pond and its stream outflows have been monitored intermittently since 2002 and consistently since 2018 as part of the implementation of the 2013 Cedar Pond Management Plan. Recent summer sampling at WMO-15 occurs 4-5 times each year. 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

Previous reviews of Rock Harbor water quality showed conditions are highly variable because of the regular dredging of the harbor basin and its inlet, as well as Cedar Pond manipulations prior to 2013. Dredging in the Harbor improves tidal flow, which reduces TN levels, while Town Cedar Pond management efforts to lower salinity levels and move the regional power lines have also reduced how much TN is exported to Rock Harbor. Recent Rock Harbor monitoring results (2019-2023) show that TN levels continue to be higher than the recommended MEP level, but TN levels tend to be lower than when the MEP assessment was completed. Review of other water column sampling factors (*e.g.*, DO, pigments) show that the system has not worsened, but also has not improved enough to meet the MEP threshold. Since all water column sampling has been completed using the same MEP protocols, data throughout the historical record can be compared. In addition, since all MEP protocols were approved by the state Department of Environmental Protection (MassDEP), all data may be used in regulatory decisions. MassDEP has not established a system-specific nitrogen limit (or TMDL) for Rock Harbor.

ECOSYSTEM STATUS:
Impaired System

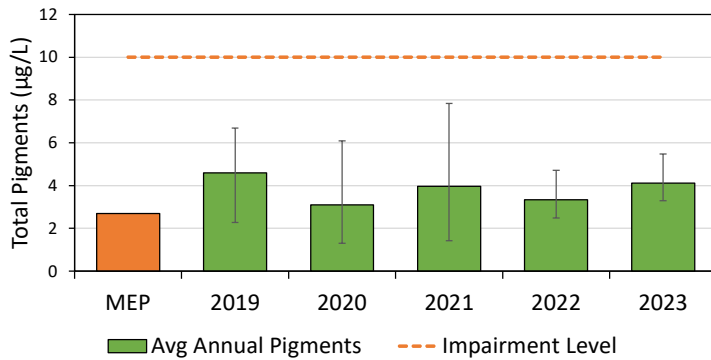
Rock Harbor: Total Nitrogen (WMO-15)



TOTAL NITROGEN

Nitrogen is a limiting nutrient in salt marsh estuary ecosystems and is necessary for plant, phytoplankton, and algae growth, but excessive N can be harmful. Based on the 2008 MEP ecosystem assessment of Rock Harbor, a total nitrogen concentration of 0.5 mg/L at the WMO-17 sampling station was recommended as a maximum level in order to maintain a healthy Rock Harbor ecosystem. Average annual concentrations at WMO-15, which is closer to the inlet, have been above this level in all recent years.

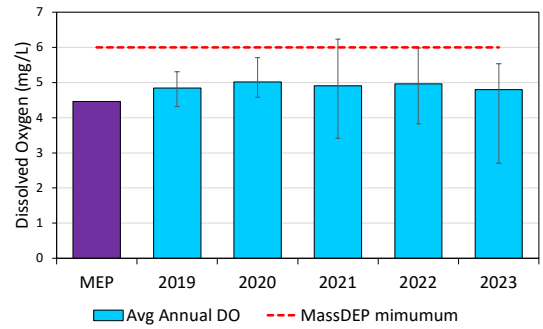
Rock Harbor: Total Pigments (WMO-15)



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 bottom algal mats, like those in Rock Harbor, are part of the ecosystem. Recent pigment levels in Rock Harbor have been generally moderately impaired and relatively consistent with MEP average (2001-2006).

Rock Harbor: Dissolved Oxygen (WMO-15)



Dissolved Oxygen

DO concentrations in Rock Harbor will vary notably by location in the system because of the combination of a salt marsh creek and a harbor basin. Salt marsh DO levels will tend to be lower because of the enriched conditions, while the Harbor basin may have acceptable DO in the upper water column, but impaired levels close to the sediments. MassDEP has a regulatory minimum DO level of 6 mg/L for SA waters like Rock Harbor, but provides flexibility for natural variability. Recent individual mid-depth DO levels at WMO-15 have ranged from 2.7 to 6.3 mg/L, which is relatively consistent with previous monitoring history (3 to 5 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. All recent measurements of clarity at WMO-15 have shown light penetrating through the whole water column to the bottom (*i.e.*, the Secchi disk was clearly seen on the bottom).