

TOWN OF NANTUCKET NATURAL RESOURCES DEPARTMENT

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Executive Summary

Water Quality Assessment of Nantucket's Harbors and Great Ponds

2019

Abstract:

The executive summary reviews the water quality monitoring results of the estuarine sampling undertaken through the ongoing Nantucket Island-Wide Water Quality Monitoring Program. The program is a multi-year collaboration between the Town of Nantucket (TON) Natural Resources Department and the Coastal Systems Program within the University of Massachusetts-Dartmouth, School for Marine Science and Technology.

The objectives of the monitoring program are:

1. To determine the present (2019) ecological health of each of the main salt ponds and estuaries within the Town of Nantucket,
2. To gauge (as historical data allows, 2010-2019) the decline or recovery of various salt ponds and embayments over the long-term (also part of TMDL compliance), and
3. To provide the foundation (and context) for development of potential alternatives for nutrient and resource management and quantitative measures of success.

Introduction:

As increasing numbers of people occupy coastal watersheds, the associated coastal waters receive increasing pollutant loads. Coastal embayments throughout the Commonwealth of Massachusetts are becoming nutrient enriched. The primary nutrient causing the increasing impairment of our coastal embayments is nitrogen, with its primary sources being wastewater disposal, and nonpoint source runoff that carries nitrogen (*e.g.*, fertilizers) from a range of other sources.

Nantucket proactively monitors the quality of its water systems to develop action plans to ensure public safety and strengthen the islands ecosystems. As in previous years, this annual Water Quality Technical Memorandum summarizes the water quality monitoring results of the estuarine sampling undertaken through the ongoing Nantucket Island-wide Water Quality Monitoring Program. Water sample collection and analysis has been performed according to specific protocols developed at the outset of the monitoring first started in 2010, such that year to year results would be cross comparable from one Nantucket estuary to another. The sampling program focuses on the summer/early fall months (June - September) as this time frame is typically representative of worst case water quality conditions and the basis for habitat management decisions.

The physical/environmental parameters measured in the estuaries during the 2019 sampling season included: total depth, Secchi depth (light penetration), temperature, conductivity/salinity, general weather (rain, cloudiness, etc.), wind force and direction, dissolved oxygen levels and observations of moorings, birds, shell fishing and unusual events (fish kills, algal blooms, etc.). Laboratory analyses of estuarine waters included: salinity, nitrate + nitrite, ammonium,

dissolved organic nitrogen, particulate organic carbon and nitrogen, chlorophyll-*a* and pheophytin-*a* and orthophosphate.

Trophic State of Nantucket Estuaries:

The trophic state of an estuary is a quantitative indicator of its nutrient related ecological health and is based on key ecological metrics: concentrations of inorganic and organic Nitrogen, water clarity, lowest measured concentrations of dissolved oxygen, and Chlorophyll-*a* pigments (proxy for phytoplankton biomass/blooms). Nutrient related trophic health scales generally range from Oligotrophic (healthy-low nutrient) to Mesotrophic (showing some signs of deterioration of health due to nutrient enrichment) to Eutrophic (habitats significantly impaired and degraded, high levels of nutrients and organic matter and community shifts). The Trophic Health Index Score used here is a standard numerical scale based on criteria for open water embayments and uses the above mentioned measured parameters to create a habitat quality scale (Howes et al. 1999, <http://www.savebuzzardsbay.org>).

Results:

Table 1. Summary of present status and trends of water/habitat quality of estuaries based on 2019 water quality monitoring data reconciled against historic data collected from 2010-2018 and MA Estuaries Project (MEP) nutrient threshold analyses undertaken for each system except Miacomet Pond.

Embayment	TMDL	Status	Trend	Trophic Health Score	Remedial Actions
Nantucket Harbor	0.35mg/L (0.36mg/L Polpis)	Approaching N target	Improving	High quality	Planned sewerage
Madaket Harbor	0.45 mg/L	Approaching N target	Improving	High-moderate quality	Landfill remediation
Hummock Pond	0.50mg/L	Significantly impaired	Variable	Moderate-fair quality	Pond openings
Long Pond	0.80mg/L	Approaching N target	Improving	Fair quality	Landfill remediation
Miacomet Pond	0.60mg/L (not regulated)	Significantly impaired	Unchanged	Moderate-fair quality	Potential dredging/chemical treatment of nutrient laden sediment
Sesachacha Pond	0.60mg/L	Moderate improvement	Variable	Moderate-fair quality	Pond openings

Conclusion:

The Town of Nantucket has been working for decades to protect and more recently restore its estuaries and their aquatic resources. At present and based on the 2010 - 2019 water quality database developed under the Island-wide unified water quality monitoring program, activities to lower nitrogen enrichment and its negative impacts to water and habitat quality have been planned and implementation is ongoing in four estuarine systems: Nantucket Harbor (raised jetties and planned sewerage), Madaket/Long Pond (lined landfill cells and future potential dredging), Sesachacha Pond (biannual openings), Hummock Pond (biannual openings). In addition, the TON’s recent fertilizer application by-law should reduce nutrient inputs into Nantucket’s embayments. As a result, it is anticipated that the efficacy of these management activities should be seen in the present and future water quality monitoring results.

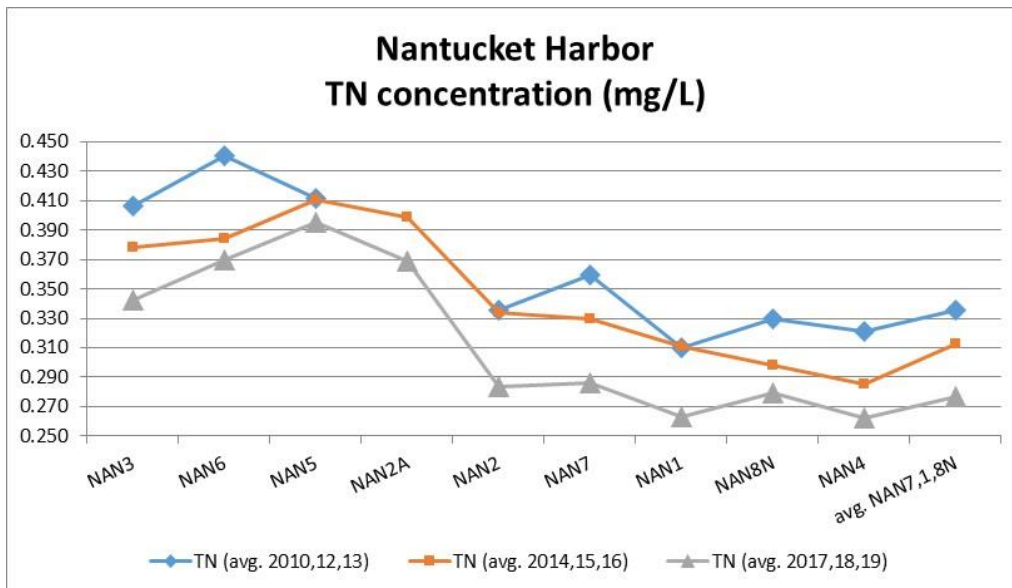


Figure 1. Temporal trends in Nantucket Total Nitrogen levels at all stations. Note that in all cases the 2017-2019 levels are lower than the earliest grouping with 2014-2016 being in the middle. TN levels have declined harbor-wide over the past 10 years due to nitrogen mitigation strategies implemented by the Town.

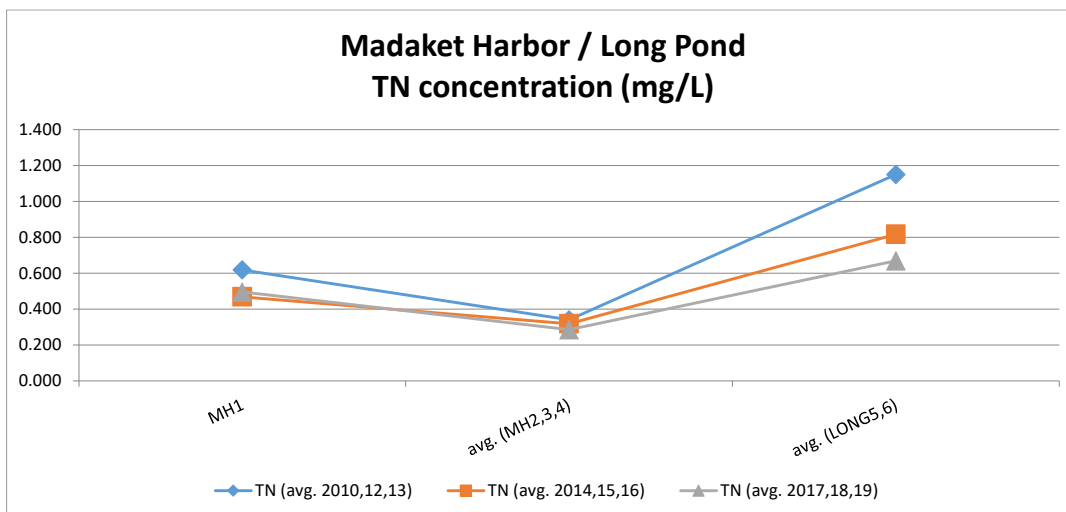


Figure 2. TN levels in Madaket Harbor main basin (MH-2,3-4), Hither Creek (MH-1) and Long Pond (stations Long 5 & 6) over the past decade. Note that in all cases the 2017-2019 levels are similar to (but slightly lower than) the earlier grouping in Hither Creek and Madaket Harbor. In contrast Long Pond shows significant reductions in over time.

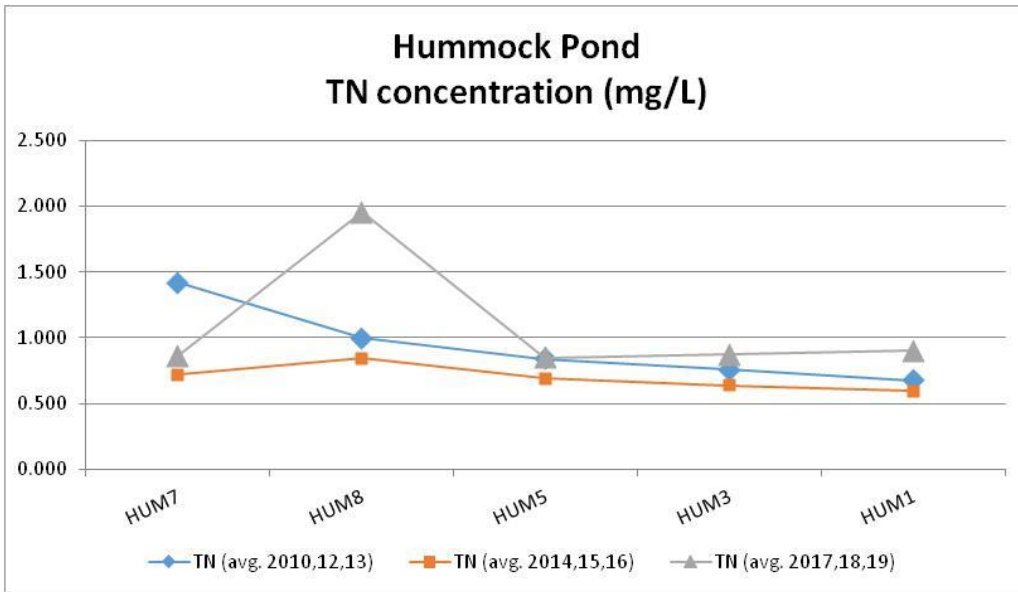


Figure 3. Change in TN level in Hummock Pond main basin (HUM-1,3,5,7) and the Head of Hummock basin (HUM-7) over the past decade grouped to reduce the variation to see if any trends existed. Note that the 2014-2016 (most successful pond openings) showed the highest water quality (lowest TN levels) throughout the pond, while the previous period and recent period had higher TN levels.

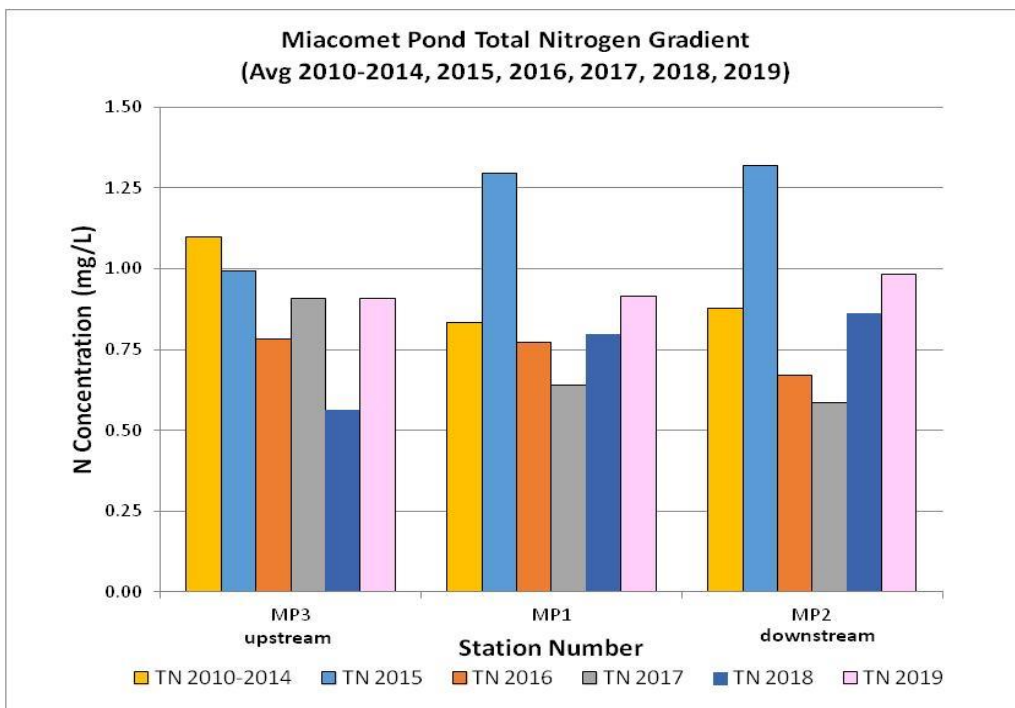


Figure 4. Summer average total nitrogen levels by station over time in freshwater Miacomet Pond. As a freshwater pond a regulatory TMDL target for nitrogen or phosphorus has yet to be established. Miacomet Pond remains a nutrient degraded system in 2019.

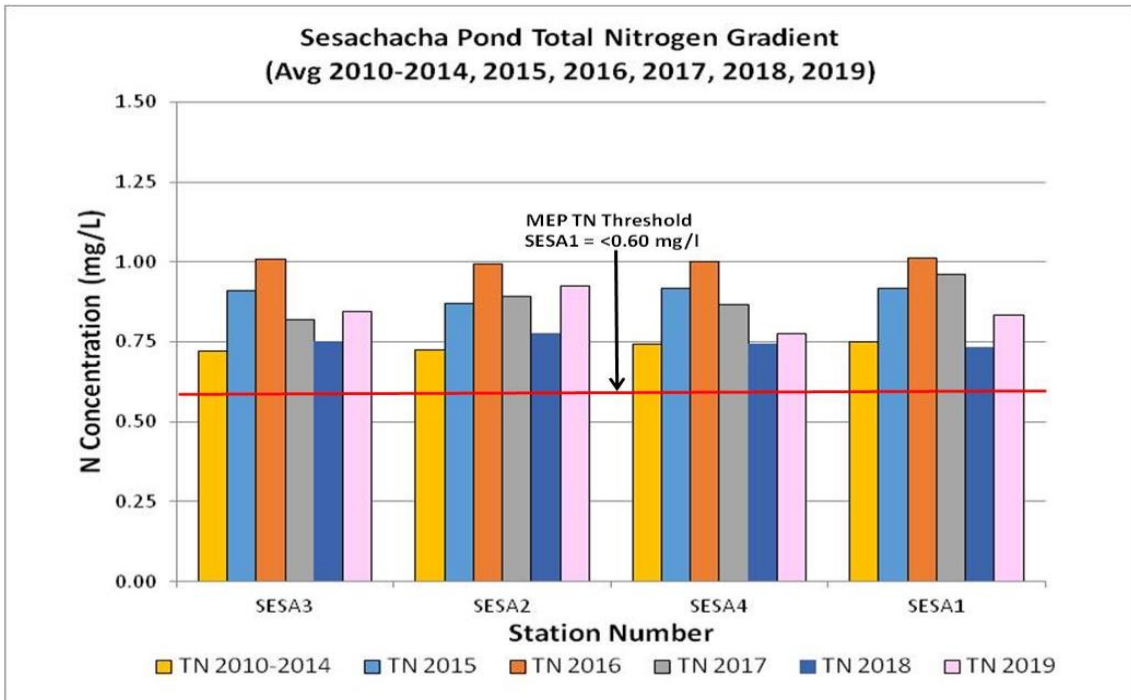


Figure 5. Total nitrogen levels by station over time in Sesachacha Pond, horizontal line is the TMDL Total Nitrogen (TN) level. Longer openings in 2010-2014 resulted in lower TN levels, recent opening attempts are again being more successful (2018), but TN levels remain above the target level.