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**WATER QUALITY AND BOTTOM LANDS ASSESSMENT OF EAST HAMPTON
TOWN TRUSTEE WATER BODIES, 2022**

A PROPOSAL BY PROFESSOR CHRIS GOBLER, STONY BROOK UNIVERSITY, MAY 2022

Since 2013 the Gobler Laboratory has been monitoring the East Hampton Town Trustee waterways, building the most robust, long-term water quality data set available on the south fork of Long Island. Through these efforts, problem areas have been identified and prioritized for remediation. For example, before there was the Friends of Georgica Pond, there was the East Hampton Town Trustees water quality monitoring data set that inspired one of the most aggressive water quality improvement programs in East Hampton. The Gobler Lab identified water quality impairment in Accabonac Harbor, inspiring the formation of the Accabonac Protection Committee. Similarly, the Head of Three Mile Harbor has been identified as a highly impaired water body, and multiple efforts for mitigating run-off and high nitrate groundwater have been proposed and implemented by the Town. Continued monitoring is identifying additional regions in need of attention and have inspired proposals to improved water quality via the East Hampton Town's Community Preservation Fund. Ongoing efforts are needed to maintain the long-term data set such that the efficacy of remediation efforts can be identified, and future remedial efforts can be properly shaped and targeted. For example, on-going microbial source track that identified sources of fecal contamination can be used to lessen such bacterial loads to ultimately improve water quality. Measuring the actual concentrations of nitrogen in the water column will identify regions where mitigating nutrient loading may be most needed. Sensitive to these ideas and following a robust discussion with the Trustees regarding needs for 2022, this proposal outlines a plan to continue careful monitoring of all systems as well as to obtain more detailed information regarding systems with impairments to better assess the factors controlling trends in water quality in Town Trustee waters in 2022.

OBJECTIVES:

1. Water quality in marine and freshwater bodies across East Hampton Town including measurements of temperature, salinity, chlorophyll *a*, dissolved oxygen, and the harmful algae including the PSP-causing dinoflagellate *Alexandrium* and the ichthyotoxin dinoflagellate, *Cochlodinium* in marine waters and toxic blue-green

algae in freshwaters. This objective will follow previous approaches. For 2022, two sites in Little Northwest Creek will be sampled.

2. Quantify nitrogenous nutrients in marine waters. Total levels of nitrogen, nitrate, and ammonium will be quantified within all marine waters on a monthly basis. Concentrations of total nitrogen will be compared to the Peconic Estuary Program's goal of 0.4 mg/L for ecosystem health whereas nitrate and ammonium concentrations will be compared to neighboring water bodies.

3. Microbial source tracking of indicator and pathogenic bacteria for Napeague Harbor, Accabonac Harbor (stations 6 and 7, as well as a mid-point station) and Three Mile Harbor (Gann Road and Head of Harbor, and 'downstream' paired sampling sites). While measurements of fecal coliform bacteria provide an indication of fecal contamination, the ultimate source of such contamination is unknown. For this objective, following a seasonal of fecal coliform bacteria monitoring, selected samples displaying high levels of contamination will be analyzed via digital PCR to determine if fecal bacteria originate from humans, dogs, birds, deer, or other animals. This will be done at four sites in Three Mile Harbor and three stations in Accabonac Harbor.

4. Spatial water quality mapping cruises. Cruises will be performed across Three Mile Harbor, Accabonac Harbor, and Napeague Harbor during summer using an autonomous vehicle with an emphasis on back bay regions.

5. Provide fine temporal scale water quality monitoring of Three Mile Harbor and Napeague Harbor. Three Mile Harbor hosted significant harmful algal blooms (HABs) and experienced extended periods of hypoxia in 2013 - 2021. Recently, Napeague Harbor has displayed some hypoxia. In 2022, the temporal dynamics of temperature and dissolved oxygen will be assessed within the Head of the Harbor, the back of Napeague Harbor and near the inlet of Napeague Harbor. Methodological details appear below.

7. Sediment survey of Accabonac Harbor. Sediment type, organic matter content, thickness of muds, abundance of macrophytes, and estimated sediment nutrient flux will be quantified at more than 20 locations across Accabonac Harbor with more concentrated samples around the Louse Point boat launch and culvert region to the north.

8. Event response sampling. Through the year, sampling of specific water bodies can be performed on request.

8. Provide a final report and final presentation in early 2023 that interprets all findings with regard to scientific literature as well as local, state, and federal regulations. This mimics what has been done in prior years.

Methods and approach

The 2022 sampling season will run from May through October. Sampling will be done twice per month, with the exceptions of Georgica Pond, which will be sampled near weekly. Sampling will include 12 marine sites within Napeague Harbor (two sites), Accabonac Harbor (three sites), Hog Creek (two sites), Three-Mile Harbor (three sites), Fresh Pond (one site), and Northwest Creek (one site); and six freshwater sites within Georgica Pond (four sites), Wainscott Pond (one site), and Hook Pond (one site; Figure 1). In addition, a site between sites 6 and 7 in Accabonac Harbor will be used for microbial source tracking and paired site further from marinas will be sampled near Gann Road and within the Head of Three Mile Harbor. For 2022, two sites in Little Northwest Creek will be sampled, one in the Creek and out at the outflow of the Creek into the Peconic Estuary.

General water quality measurements obtained for each site included salinity, temperature, and dissolved oxygen levels measured with a handheld YSI 556 probe. Onset HOBO data loggers will be also deployed in Three-Mile Harbor and Napeague Harbor to continuously record temperature and dissolved oxygen levels over time. Additionally, water will be collected at each of these sites and analyzed for chlorophyll *a*. The pigment chlorophyll *a*, which serves as an analog for algal biomass, will be measured by filtering whole water through glass fiber filters, extracting the collected pigment from the filter with acetone, and measuring the fluorescence (Parsons et al., 1984). The microbial source tracking sites will be also sampled for fecal coliform bacteria and *Enterococci* bacteria from July through September. *Enterococci* will be quantified using the IDEXX Enterolert & Quanti-Tray/2000 sampling kits, giving MPN per 100mL. The Gobler Lab has NYS Department of Health certification for the analysis of fecal coliform bacteria. For microbial source tracking sites listed above, selected samples will be analyzed via digital PCR to determine if fecal bacteria originate from humans, dogs, birds, deer, or other animals as described in prior reports.

To assess the abundance of harmful algae, several marine sites will be sampled more comprehensively with each harbor / system having at least one such site. These sites will be those located furthest from their respective inlets in areas that are more prone to elevated nutrient levels and the proliferation of algae. All four Georgica Pond sites for this study will be treated as such.

Spatial water quality mapping cruises will be performed across Three Mile Harbor, Accabonac Harbor, and Napeague Harbor during summer using an autonomous vehicle equipped with a YSI EXO2 sondes that continuously measures temperature, salinity, pH, dissolved oxygen, chlorophyll *a*, and blue-green fluorescence. Cruises will seek to cover all parts of each system and resulting maps of water quality will be constructed. Time and methods permitting, fall cruises will also be performed.

The harmful “rust tide” dinoflagellate *Cochlodinium*, known for causing fish kills, will be monitored from July through October. Whole water will be collected and preserved with Lugol’s iodine and cells will be counted on a Sedgewick-Rafter slide under a microscope. *Alexandrium fundyense*, a toxic marine dinoflagellate responsible for paralytic shellfish poisoning, will be sampled from April through May. Samples will be filtered through a 20µm sieve, back washed into a 15mL centrifuge tube, and preserved in formalin and methanol. Cell densities will be determined by marking the cells with an oligonucleotide probe, and counting with an epifluorescent microscope, as detailed in Hattenrath et al. (2010).

At the six freshwater sites (four in Georgica, one in Wainscott, and one in Hook Pond) samples will be collected for the quantification of chlorophyll *a*, temperature, salinity, and dissolved oxygen as described above. Additionally, each site will be sampled for blue-green algae (cyanobacteria), using a FluoroProbe with live samples. This device also permits the quantification of brown, green, and cryptophytic algae. Freshwater samples with high levels of blue-green algae will be preserved with Lugol’s iodine solution, and identified using a microscope as described above. Freshwater samples with high levels of blue-green algae will be analyzed for levels of the toxin, microcystin, using an Enzyme-Linked Immunosorbent Assay (ELISA).

The telemetry monitoring buoy will be redeployed in southern Georgica Pond from spring through fall. The buoy uploaded real-time water quality data of temperature, salinity, pH, dissolved oxygen, chlorophyll *a*, and blue-green fluorescence. The sensors for chlorophyll *a* and blue-greens are not as sensitive as the discrete sampling methods, but displayed trends parallel those measurements.

Sediment surveys in Accabonac Harbor will be performed via a combination of box cores and Ponar grabs. Grain size analyses will be performed to characterize sediment type. Depths of muds will be quantified via a vertical probe method. Organic matter content will be quantified via loss-on-ignition methods. The abundance of seaweeds and macrophytes will be assessed using specialized bottom rake. Sediment nutrient fluxes will be quantified via core incubations and/or regression analyses.

Cost: \$74,844 will cover the costs of personnel, fringe benefits, University overhead, supplies, travel, and equipment for this project. The true costs of the project are greater, as there will be more than a half dozen other individuals working on this project who will be covered from other grants.

Category	Amount
Lab Technician	\$ 32,000
Fringe benefits (via SBU)	\$ 13,440
Travel (land and sea)	\$ 2,000
Materials and supplies	\$ 8,000
Indirect costs from SBU	\$ 19,404
Total	\$ 74,844

External support: Georgica Pond, Fort Pond

Support has been obtained from the Friends of Georgica Pond since 2015 to enhance the level of monitoring and research performed within this water body. The specific projects supported for 2022 by FOGP represents a >\$70,000 commitment. In addition, of the work listed in this document, FOGP pays for two of the four sampling sites, the telemetry buoy, toxin analyses, and bacterial analyses that are not performed nor supported at the other freshwater sites. Similarly, support from the Concern Citizens of Montauk will provide samples from Fort Pond for 2022.

Map of sampling sites: