Miacomet Pond
Annual Report
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Introduction:

Miacomet Pond is located on the southwest portion of Nantucket Island. Miacomet Pond has a surface area of 47.29 acres and a watershed area of 970.61 acres. The pond is long and narrow extending an approximate mile in length. Heavy development has occurred in the watershed changing the characteristics of the pond's hydrology and water quality.

Development has altered two natural processes, (1) nitrogen/phosphorus cycles and (2) flooding. The change in land use has increased nitrogen and phosphorus concentration in the groundwater and inhibited or redirected the direction of groundwater flow. Housing densities have inhibited the percolation of precipitation, and have occupied large volumes of land previously open to groundwater filtration. Sedimentation and erosion has also increased as a result of the construction; roofs, lawns, driveways, and roads have also increased surface runoff volume. Physical manipulation by one Pond abutter has caused the pond to be narrowed and restricted.

Nutrient loading in Miacomet Pond has accelerated the eutrophication process. Deeper bottom areas are filled with decaying plant material. The shallowness of the pond prohibits a large storage of water. Large increases in precipitation combined with an already high groundwater level will flood the watershed rapidly. Nutrients carried by sediments and water flow advance the growth of nuisance vegetation in and around the pond. The pond will continue to shrink in over all volume while increasing the incidence of flooding over time.

METHODS:

Miacomet Pond is monitored by the Marine & Coastal Resources Department for water chemistry. Temperature, dissolved oxygen, salinity, clarity and overall depth are measured at two sites. *Nutrient information was collected and analyzed 5 times this year at two sites.*

There are four established sampling sites in Miacomet Pond. Site 1 is located at the north side of the pond near Mrs. Burchell's house. This site is closest to the wetland inlet of the northeast side of the pond. Site 1a is farther north towards the head of the pond. This site is very shallow generally only one-foot depth. Site 2 is located at the foot of the pond. Site 2a is half way between site 1 and site 2.

Surface Drainage Basin:

Miacomet Pond's water quality is directly related to its watershed characteristics. Important watershed characteristics are defined as area, soil types and erodibility, types of vegetative cover.

Area:
Miacomet Pond is 47.29 acres; the watershed area is 970.61 acres

Soil type and erodability:
The soil association in the watershed area is classified as "Evesboro association". The Evesboro association is one nearly level and gently sloping, excessively drained, where sand soils were formed in outwash deposits. At the southeast portion of the watershed area, the soil association is "Riverhead-Katama association". This classification is defined, as nearly level, well-drained, sand soils formed in glacial till and in outwash deposits.

Miacomet Pond possesses Evesboro and River-Katama soil type associations. These soil types are rapidly drained and have an excessively high permeability. According to the Soil Survey of Nantucket County, Massachusetts, this soil type has few options for septic tanks, and leach fields. Seepage of the effluent through the substratum causes the hazard of groundwater contamination. Nutrients seeping into the groundwater flow directly into the pond, accelerating the eutrophication process. With a high permeability, the erodability of soils is low. However, the paved road adjacent to the pond poses a problem. This paved road is tilted at an angle such that surface water run-off, with all its associated contaminant drains directly into the pond. This road also has fourteen breaks, which allow sediments to enter the pond during heavy rains. Sediment "fans" are observed at each one of these breaks.

Vegetative cover in the pond:
Ceratophyllum demersum (coontail), Ruppia maritima (widgeon-grass), Potamogeton pusillus (thin-leaf pondweed), Potamogeton perfoliatus (clasping-leaved pondweed), Vallisneria americana (water celery), Utricularia (bladderwort), Najas (naiad), Lemna (duckweed), Decodon verticillatus (water willow)

Vegetative cover fringing along pond:
Solanum dulcamara (bittersweet nightshade), Typha latifolia (cattail), Phragmites communis (reed)

Vegetative cover information provided by Nantucket Resource Management Plan, March 1990 and "Diagnostic Water Quality and Aquatic Assessment for Miacomet Pond, Aquatic Control Technology, 1997. In ponds with higher nutrients, macrophytes are more abundant and weedy species more prevalent. Miacomet Pond is nutrient stressed and considered eutrophic.

Miacomet Pond has several species of aquatic vegetation that are considered nuisance weeds. Those aquatic plants include coontail, water celery, pondweed, and clasping leaved pondweed. Infestations of nuisance weeds are a result of suitable habitat. Once plants are considered nuisance, it is difficult to reduce their biomass. Nearly all rooted plants derive nutrients from sediments. Weed infestation makes it difficult for fish species to forage, boats to maneuver, and anglers to fish. Weed infestation reduces the diversity of fish species in the pond. Game fish cannot maneuver through the weeds to

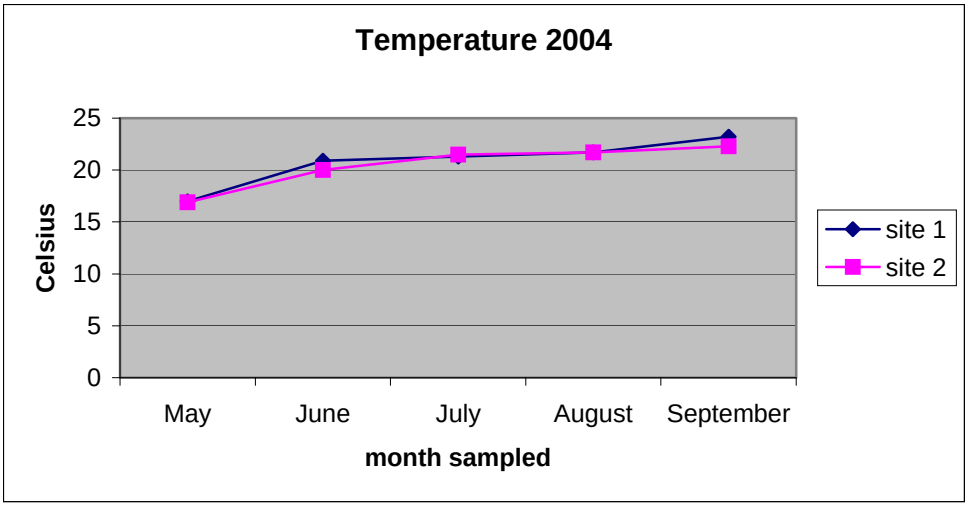
forage limiting feeding success. High concentrations of weeds cause dissolved oxygen levels to fluctuate harming fish communities.

Water Quality Results:

Temperature:

The water temperature progressed through the typical heating curve with the pond frozen in the winter. Temperatures increased through the spring and peaked in the summer, and cooled in the fall. The highest water temperature was in August. The foot of the pond was slightly cooler than the head. Temperature was slightly cooler on the bottom than at the surface.

Figure 1

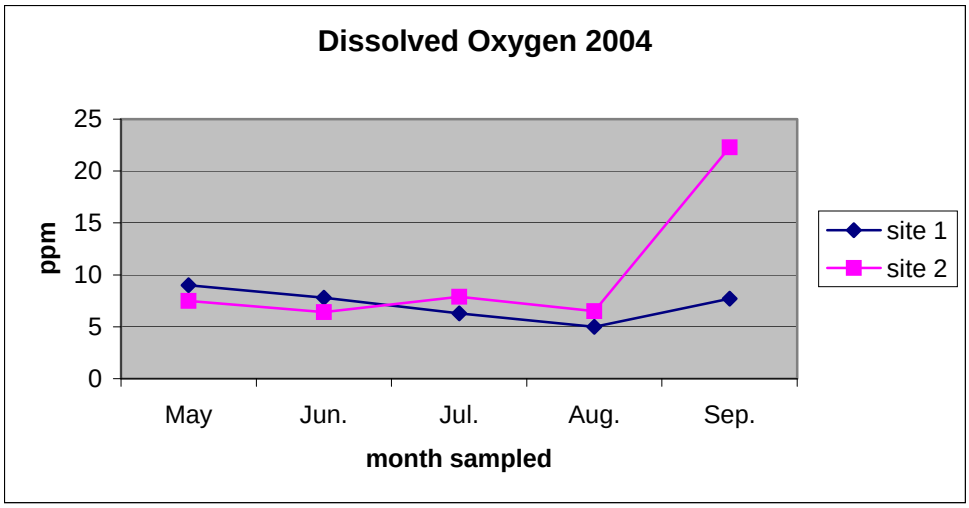


There was a weak thermocline observed at site 1 for the June and July sampling events. Solar radiation warmed the surface water while cooler groundwater filled the bottom layer of the pond.

Dissolved Oxygen:

Dissolved oxygen in Miacomet Pond appeared more erratic than in 2002. In 2002, the average dissolved oxygen followed a curve decreasing slightly in the summer and increasing in the fall. In 2003, the average dissolved oxygen decreased sharply in July, increased in August. Opening Miacomet Pond, changed dissolved oxygen causing greater fluctuations in dissolved oxygen concentrations (figure 2 & 3). Nitrogen and

phosphorus concentrations were decreased through direct export out of the pond on May 12 and 20th. The pond opening increased the turbidity of the pond possibly resuspending bound nutrients into the water column. Filling with pond with groundwater increased nutrient concentrations.



Dissolved oxygen decreased first in the bottom layers of water. In June, at site 1a, dissolved oxygen was lower on the bottom than sites 1 and 2. Site 1a is located towards the head of the pond where groundwater filling accounts for most of the pond volume. June contained more dissolved oxygen at the bottom than found in 2002. July had the lowest dissolved oxygen concentrations for months sampled with an anoxic layer sitting at the bottom of the pond. Generally, the low dissolved oxygen layer starts at the water sediment interface and expanded upwards and outwards as water temperature increases.

Dissolved oxygen in September was low. However, there may have been a malfunction in the YSI dissolved oxygen meter. All September oxygen readings were low for all areas sampled including Nantucket Harbor. Generally in September, as water temperature cools, the water column will regain dissolved oxygen levels.

Low dissolved oxygen concentrations cause the respiratory and metabolic activity of fish to be limited. The minimum amount of dissolved oxygen for survival varies with the time of exposure and fish species. Low oxygen levels make fish more susceptible to diseases. According to most state and federal standards minimum oxygen requirements for most fish do not fall below 5 mg/l. The minimum oxygen requirement for fish at a water temperature of 20 ºC is 7.8 mg/l; below this mark fish health is compromised. Dissolved oxygen levels were below 5 mg/l in July and August in the bottom layers of water.

For the average dissolved oxygen concentrations, there was enough oxygen above mid depth in the pond for fish to survive. On the average, dissolved oxygen concentration was above 5 mg/l for most months sampled. Oxygen increased as water temperature decreased.

Figure 2

Figure 3

Nutrients

Most of the nitrogen measured was organic (TKN). Organic nitrogen is a measure of nitrogen in the form of plant material. The high concentration of nitrogen usually coincides with the low secchi depth measurements. Nitrogen was lower at site 1 in 2003 than in 2002 with the exception of July. Total phosphorus was equivalent in 2002 and 2003 with the exception of the fall. Total phosphorus was much higher in October 2002 than September 2003.

Figure 4: Nutrient Concentrations for 2002
Figure 5: Nutrient Concentrations for 2003

There was a reduction of nitrogen in site 2 as a result of the pond openin