

Hummock Pond  
Annual Report  
2004

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## Introduction:

Hummock pond is a eutrophic coastal pond located on the southwest side of Nantucket Island. Hummock is approximately 142 acres in size with a surface drainage basin of approximately 2,227 acres and a groundwater drainage basin of approximately 2,000 acres.

The surface drainage basin extends north and east of the head of Hummock. The basin encompasses Maxy's Pond, Crooked Lane, and one third of Sunset Hill. The surface divide extends south to Academy Hill School, "Five Corners", part of Prospect Cemetery, and encompasses Burnt Swamp. The surface divide then follows the configuration of the pond to Cisco Beach extending just north of Hummock Pond Road.

The groundwater drainage basin starts north of Rams Pasture and follows in a northward direction reaching Capaum Pond. The divide stretches east to West Chester Street encompassing "No Bottom Pond" and to the southwest through Burnt Swamp, Rotten Pumpkin Pond, and Larrabee Swamp and to Cisco Beach.

Hummock Pond accumulates water during the winter and generally floods in the spring. Flooded conditions of Hummock Pond can reach Millbrook Swamp and Madaket Road. During flooded conditions, the surface area of the pond increases from 140 acres to approximately 425 acres (Kortman and Knoecklein 1994).

Hummock Pond is opened to the sea twice per year to alleviate flooded conditions and to enhance marine fisheries. In addition, pond openings decrease nutrient concentrations and remove organic matter that accumulates in the pond from the bordering wetlands. Based on nutrient concentrations, Hummock pond has impaired water quality.

## Methods:

Tracy Curley and Keith Conant monitored water quality in Hummock Pond from April to November this year. Temperature, dissolved oxygen, salinity, secchi depth, water depth and nutrient concentrations are measured at two established sites depending on weather conditions. Nutrient constituents are processed by Envirotech Laboratories located in Sandwich, MA. George Knoecklein, Northeast Aquatic Research, is investigating in conjunction with the town biologists the merit of opening Hummock Pond to the ocean annually.

Hummock Pond has seven established sites in the pond. The four sites, which are consistently monitored, are located from the boat launch to the foot of the pond. This year sites 1, 3, and 5 were sampled.

Site 1 is located at the foot of Hummock Pond. This site is closest to the ocean and generally remains brackish throughout the year. The average depth is approximately 9ft. The bottom sediment is sand.

Site 3 is northward in a wider section of the pond. The water depth is approximately 6ft. The bottom sediment is mud.

Site 5 is located in front of the osprey nest. Water depth is approximately 6 feet.

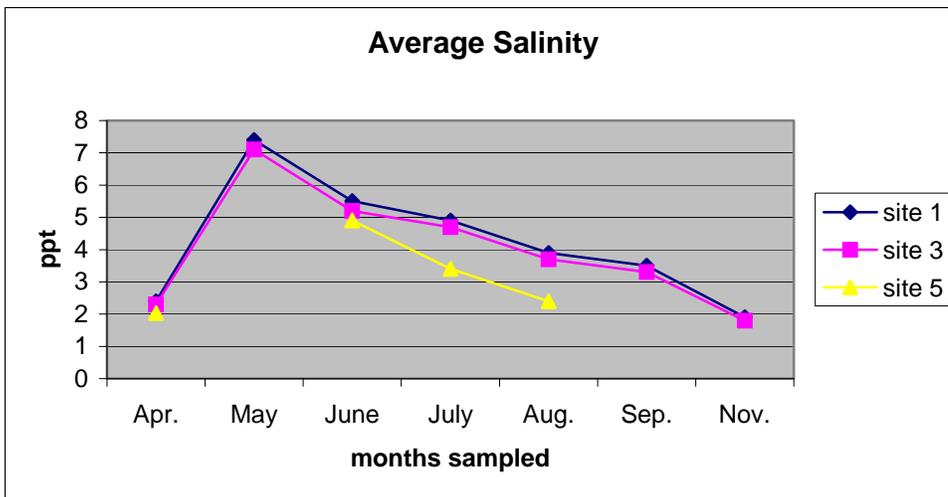
Sampling consisted of recording temperature, dissolved oxygen, and salinity at one-depth intervals. Secchi was recorded at each site. At mid depth water was taken for nutrient analysis. Nitrate, nitrite, TKN, total nitrogen, and phosphorus were calculated.

Prior to the spring opening, Hummock was approximately 2 feet higher in elevation. Hummock Pond was opened to the ocean on April 21<sup>st</sup> and October 22, 2004. The spring opening lasted 9 days and the fall opening, 4 days.

## 2004 Water Quality Monitoring Results

### Salinity:

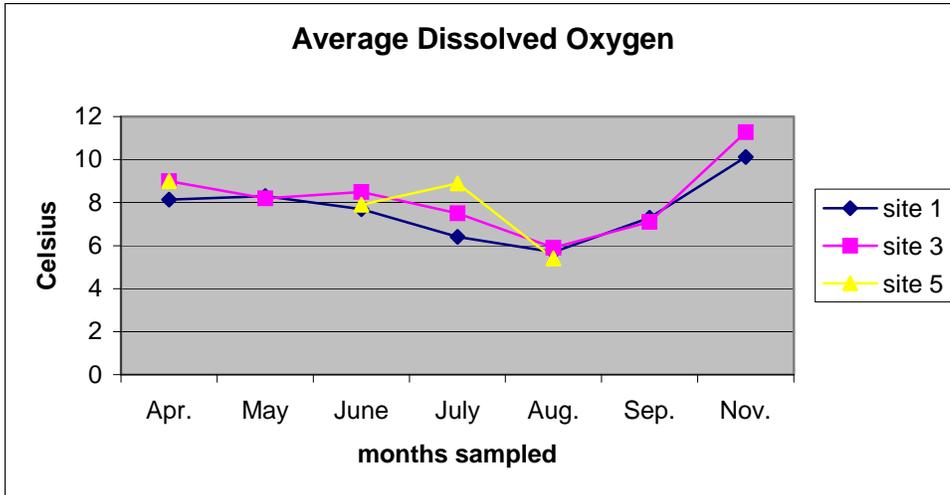
Hummock contained very low salinity (2 ppt) in April prior to the spring pond opening. The pond increased in salinity to 7ppt after the opening. The length of time the pond remains open to the ocean determines the initial salinity change in the pond. This year, Hummock reached half the salinity as in past years when the pond had been open for 2 to 3 weeks. Salinity decreased throughout the summer as the pond filled with groundwater. The pond salinity was 3.5 ppt in September prior to the fall opening. Hummock pond, located in the outwash plains, cannot maintain saline conditions due to the physical configuration of the pond.



The recorded salinity range of Hummock was 1.9 ppt (closer to the head) to 7.4 ppt (near the foot) for the sample year. During the spring opening, the ocean fills approximately half the pond (site 1 to site 5). Groundwater and surface water fill the head of the pond (site 6 to site 7). A salinity gradient occurs in Hummock Pond forming a wedge. The foot of the pond retains the largest salinity while the head continues to become fresh.

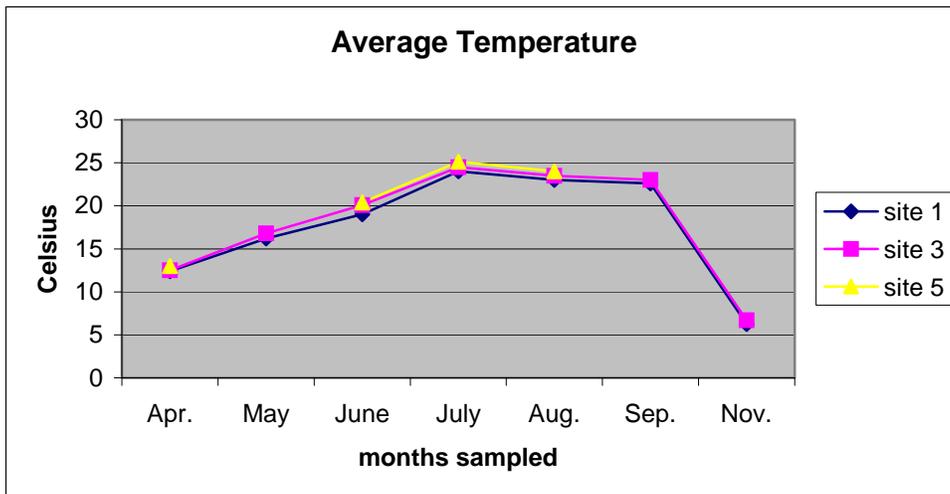
### Dissolved Oxygen:

Dissolved oxygen concentrations are at maximum in the winter, due to cooler water temperatures. The minimum dissolved oxygen concentrations are observed during the summer months when dissolved oxygen concentrations range between 4mg/l and 6mg/l. The greatest fluctuations in dissolved oxygen concentrations are probably due to salinity gradients at each site. Dissolved oxygen increases again in the fall.



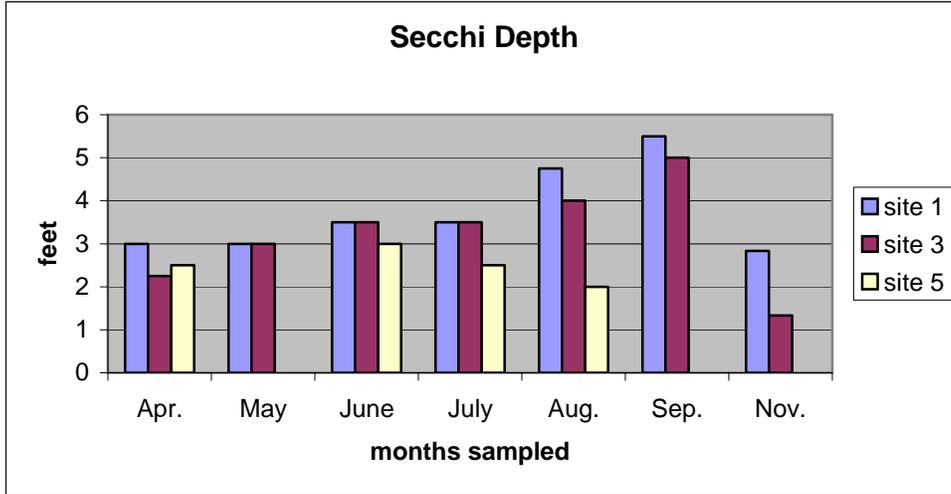
### Temperature:

Hummock pond was frozen in January and February. Temperature was 2C or below. Temperature increased during the spring with slightly cooler water on the bottom. Water temperature peaked in July reaching maximum average temperature of 23C. Temperature cooled in the fall following the annual temperature curve. Temperature decreased each subsequent month to reach average temperature of 6.5 C, the last month sampled.

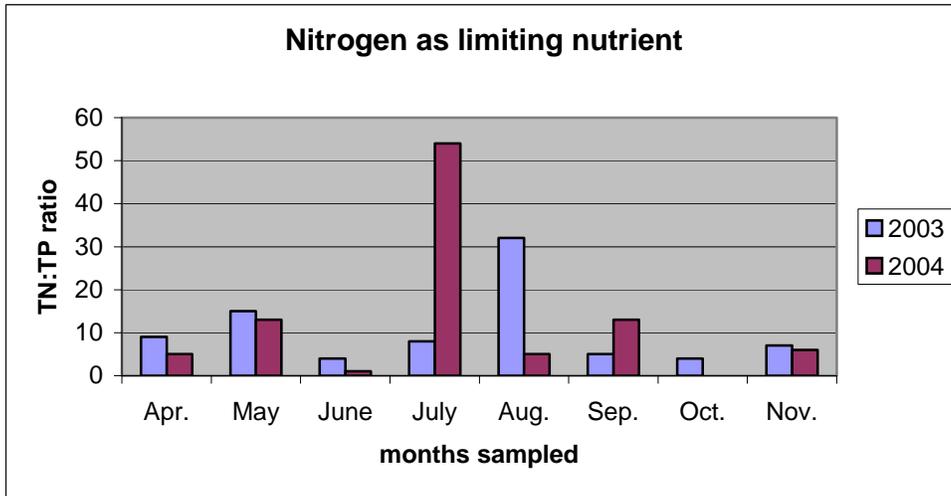


### Secchi Depth:

Secchi depths were lowest prior and post pond openings. The pond openings did not reduce nitrogen concentrations. Secchi depth increased throughout the spring and summer reaching the maxima in September. Secchi depth was lowest in November caused by phytoplankton bloom.

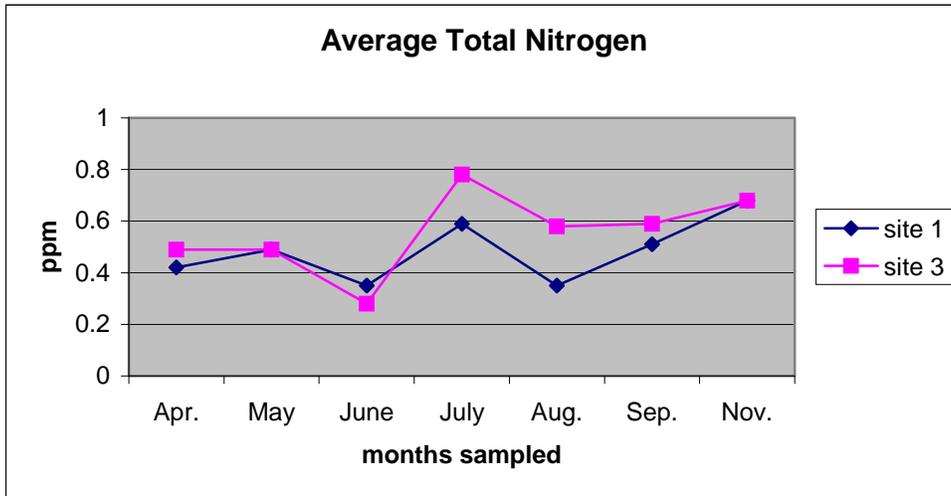


The Redfield ratio was calculated for the composition of sites 1 and 3 for 2003 and 2004. Ratios less than 16 suggest that addition of inorganic nitrogen will stimulate phytoplankton production. In August 2003 and possibly May 2003, the limiting nutrient for phytoplankton production was switched from nitrogen to phosphorus. In July 2004, the limiting nutrient was switched from nitrogen to phosphorus.



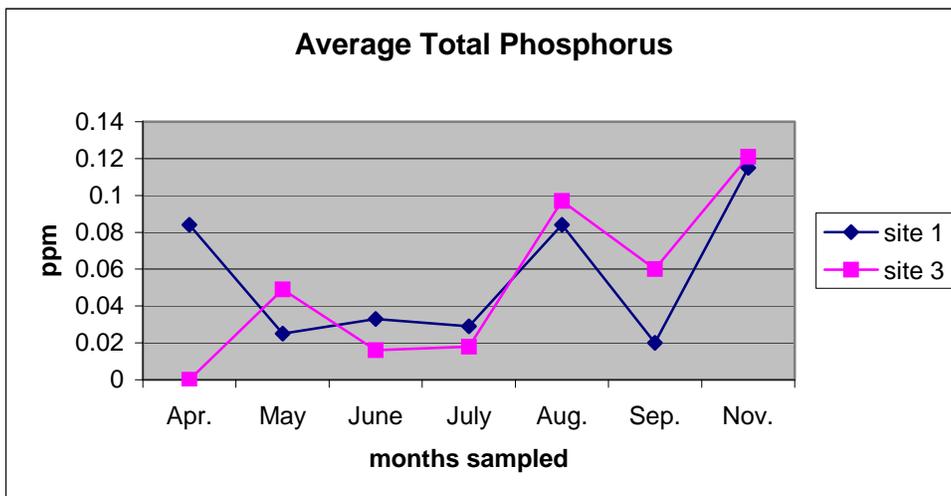
### Total Nitrogen:

Total nitrogen above 0.7mg/l is eutrophic. Total nitrogen was below eutrophic conditions for month sampled with the exception of July (0.78 ppm) and November (0.68 ppm). In July, the nitrogen:phosphorus ratio was 54 indicating the pond was phosphorus limited. All the nitrogen sampled was organic nitrogen with the exception of July 27<sup>th</sup> and November 18<sup>th</sup>.



### Total Phosphorus:

Total phosphorus ranged from non detect in April at the site 3 to 0.084ppm at site 1. The typical range for phosphorus has been 0.010 mg/l to 0.11 mg/l. Phosphorus is generally lower in the spring and increases in the summer. Generally phosphorus is in the greatest concentration prior to fall opening. This year phosphorus peaked in August and November.



## Conclusions:

It is unclear whether opening Hummock Pond improves water quality based on the following conclusions for water quality data in 2004:

- 1) Hummock pond is generally nitrogen limited with the exception of July.
- 2) Dissolved oxygen is highest prior to spring opening in April and in November.
- 3) Organic nitrogen was highest in the summer.
- 4) Inorganic nitrogen peaked in November.
- 5) Total nitrogen was highest in July and November.
- 6) Secchi depth ranges between 1 and 5 feet. Secchi depth decreased after fall opening.
- 7) Dissolved oxygen was highest prior to spring and after fall openings. In November, high dissolved oxygen was due to phytoplankton bloom.
- 8) Dissolved oxygen remained at acceptable levels this season.

After the spring opening, phosphorus increased and nitrogen remained static. Phosphorus entered the pond through the watershed. Nitrogen was being generated in the pond. Nitrogen is incorporated into the plant tissue during the growing season. Nitrogen reached eutrophic levels in July and November. Phosphorus reached eutrophic levels in April, September and November.

Opening Hummock Pond may not improve water quality or marine fisheries. Opening Hummock Pond for flood control at this point appears to be the only tangible reason to open the pond. Further investigation of ocean water quality conditions prior to pond openings should be determined.