Sesachacha Pond
Annual Report
2004

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EXECUTIVE SUMMARY

Sesachacha Pond is a coastal eutrophic salt pond located on the northeast part of Nantucket Island. The unique physical characteristics of Sesachacha Pond permit high salinities to be maintained when the pond is properly flushed to the sea via mechanical excavation.

In recent years due to poor openings and general precipitation there has been a trend in freshening of the pond causing degradation to winter flounder and blue back herring habitat. The reduced salinity and increased nutrient concentrations combined with warm water temperatures has caused an overall decline in marine fisheries.

The pond must remain open to the ocean for at least 6 days in the spring (figures 2 & 3) to ensure a proper volumetric exchange of water. During this spring opening, total nitrogen and phosphorus were reduced in May and June while salinity increased to 1998 concentrations (figure 4). The fall openings are less significant to maintaining adequate water quality.

Nitrogen and phosphorus increased through the spring and reached eutrophic levels in July, 0.7mg/l and 0.05mg/l respectively. Total organic nitrogen was generated in the pond while phosphorus entered the pond through the watershed. Secchi depths were low all year. Nutrients were not exported out of the pond in the fall of 2003 or 2004.

Sesachacha Pond has been placed on the 1998 Massachusetts 303D list for impaired water bodies. Sesachacha Pond has been included in the Massachusetts Estuaries Project to determine TMDL's for the pond and watershed areas.

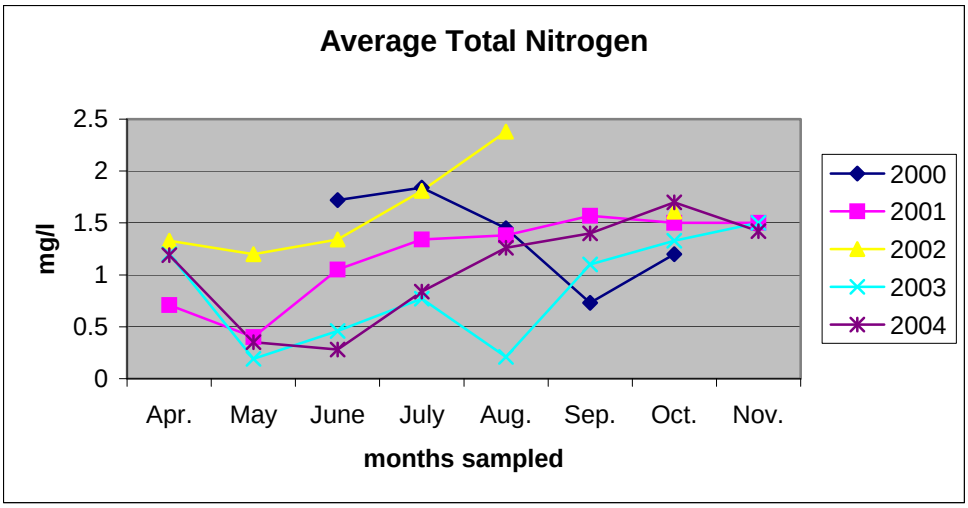
INTRODUCTION:

Sesachacha Pond has been monitored since 1980 for water quality conditions by a variety of agencies. Historically, Sesachacha was opened to the ocean seasonally to enhance marine fisheries. Pond openings were discontinued for ten years during the 1980s. The absence of the openings resulted in an environmental change, moving from marine to a fresh water ecosystem. Public demand caused political pressures at the federal level to grant a home rule petition to open the great ponds.

Due in part to the watershed/pond ratio, water quality conditions in Sesachacha Pond is a reflection of the success or failure of pond openings. In spring 1991, Sesachacha Pond was opened to the sea. Due to inadequate opening practices, water quality in the pond did not improve in 1991 and 1992. In 1993, pond-opening methodology was revised. In 1993, water quality and marine fisheries in Sesachacha began to improve with an observable increase in marine fish diversity. Salinity and dissolved oxygen concentrations increased and stabilized through the most of the 1990s. In 1998 and through 2002, the pond began to freshen, nutrients increased and water clarity diminished due to lack of tidal flushing during the pond openings. Water quality degradation

resulted in fish kills, phytoplankton blooms and poor water clarity. Total nitrogen in 2000-2002 exceeded eutrophic levels for most months sampled. After the spring pond openings in 2003 and 2004, there was an initial reduction in total nitrogen. Nitrogen increased through the fall of 2004 to reach 1.7mg/l, eutrophic levels and secchi depths did not improve. In 2004, nitrogen remained low in May and June but increased to eutrophic levels in July.

Figure 1: Average total nitrogen for 2000-2004



Increased development to the north of Sesachacha Pond has increased nutrient loading into Sesachacha Pond. Surface runoff and groundwater carry nitrogen and phosphorus to the pond changing water chemistry. This accelerated eutrophication process has made pond openings more critical in maintaining good water quality. A proper exchange of nutrient latent pond water with alkaline-rich ocean water is important in maintaining good water quality for marine life.

Sampling Procedures and Equipment

Site 1: near Quidnet village approximately 1000 ft from shore
Site 2: deep water off shack approximately 1000 ft from shore to northwest
Site 3: near boat launch approximately 100 ft from shore
Site 4: deep water to southeast approximately 1200 ft from shore

Sampling protocol:
Sesachacha is sampled beginning in April through November. Temperature, dissolved oxygen and salinity were measured using a YSI 85. Measurements were recorded every 3-ft. Secchi depth was measured with a standard white secchi disk. A van dorhn was

used to collect water at mid depth for nutrient analysis. Envirotech Laboratories conducted the nutrient analysis.

Results and discussion:

Salinity

In order for Sesachacha Pond to maintain its salinity, the pond must remain open for at least 6 days in the spring for a proper exchange of salt water. The fall opening appears to be less significant in maintaining salinity than in the spring *(Figure 2).* If the total days open are combined for spring and fall, the overall salinity is dependent on primarily the spring opening (*Figure 3*). For example, in 2001 the total number of days open to the ocean was 10 and yet the salinity remained on average around 14ppt. In 2003, the pond was open for 6 days in the spring and the salinity rebounded to 21ppt on average.

In 2004, Sesachacha was opened for 25 days in the spring providing proper volumetric exchange to maintain salinity around 28ppt throughout the summer/fall.

The overall salinity in Sesachacha Pond ranged from 16.7 ppt to 30.6 ppt. Salinity tended to be stable vertically and horizontally in the water column. Salinity increased by 14 ppt as a result of the spring opening and decreased by 0.4 ppt after the fall opening.

After the fall opening, numerous soft shell clams shells were observed in the former high tide area. Although the soft shell clams were dead, the size of the shell has doubled since 1997. The shell size had reached approximately 20 mm this year prior to death.

The salinity in Sesachacha has reached a concentration that will supports adult winter flounder. Although winter flounder eggs can survive in a salinity range of 10ppt to 30ppt, there may not be many adults left to spawn in the pond. As a result of precipitation, poor pond openings, and groundwater infiltration, the pond's fish species have been reduced.

Figure 2: The number of days open to ocean in the spring and fall. Average salinity for years sampled.

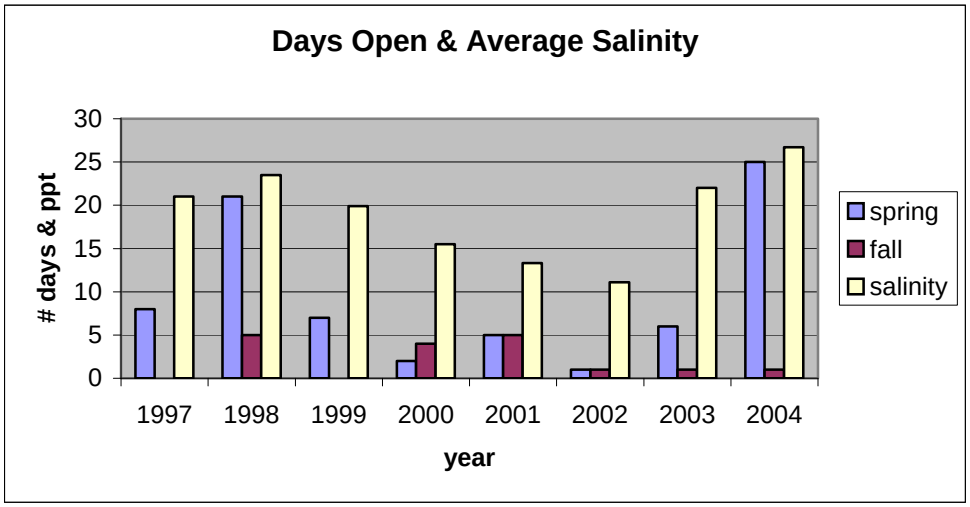


Figure 3: The total number of days open to ocean compared to average salinity

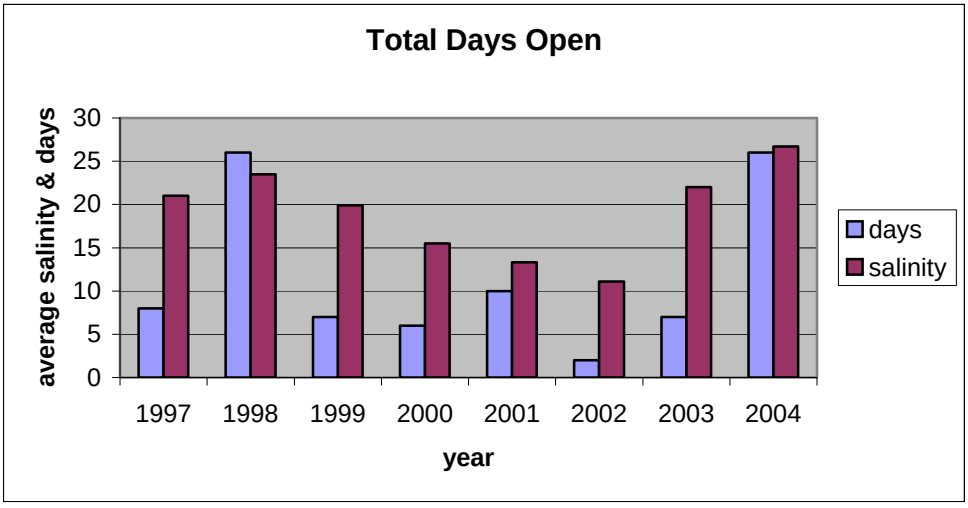
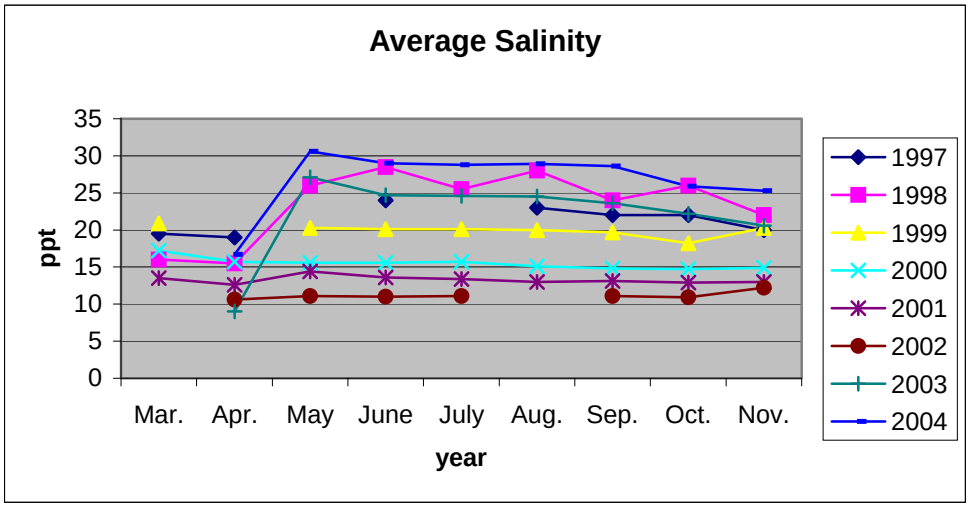


Figure 4: Average Salinity of Sesachacha Pond 1997-2004



Nitrogen

Total nitrogen levels recorded this year ranged from 0.28 ppm to 1.7 ppm. The spring opening caused an initial reduction in nitrogen in 2003 and 2004. Total nitrogen concentrations, which exceed 0.7 mg/l, indicate enriched conditions. In the months of April, July, August, September, October, and November, Sesachacha had high concentrations of nitrogen.

Nitrogen is limited in Sesachacha Pond and limits primary production of aquatic plants. As nitrate levels increase, phytoplankton, macroalgae (seaweed), epiphytes (plants that attach) reproduce. The greater the concentration of nitrogen in the water column, the more plants will grow. When these plants die, bacteria use dissolved oxygen from the water column to decompose the organic plant matter. Oxygen depletion can result in ecosystem stress.

Nitrate concentrations were below detection with the exception of July and August. This may be due to nutrient rich groundwater filling the pond after the draining. Nitrogen is accumulating in Sesachacha Pond.

Secchi Depth

Secchi depth is a general indication of available dissolved oxygen in the water body. There is generally enough dissolved oxygen for fish survival at three times the secchi depth. Secchi depth was high in May and June and dissolved oxygen levels were suitable for fish growth and reproduction.