

## Background on Water Column Parameters Shown in the Graphs:

There are key chemical and physical measures that are indicators of the condition of a tidal water body. When collected over time, these parameters can identify the trophic state of the system. Trophic state is a description of the amount of productivity in the system. Productivity is important to the yield of natural resources such as bay scallops and quahogs from a pond. However, there can be too much of a “good thing” when the pond produces too much biomass that robs the water column of dissolved oxygen and in extreme cases produce large rafts of decaying algae that causes odors and fish kills. This condition is often described as being eutrophic.

The measures include **chlorophyll pigment** that is an indicator of the microscopic algae population in the water column. The depth at which the Secchi disk can no longer be seen is the **extinction depth** and indicates the light penetration through the water column. The more fine particles like phytoplankton in the water column the lower the light penetration and the shallower the extinction depth. The amount of **dissolved oxygen** is a key necessity for the animals living in a pond. It is affected by the algae population but also by the amount of organic matter that is decaying in the pond. The amount of **nitrogen** in the water column in all forms indicates whether a system is over-productive and if the nitrogen input from the watershed is excessive. There are many other approaches to characterize the condition of a pond including population studies of the benthic organisms (quahogs, worms etc.), distribution and amount of aquatic plants and fish population. The parameters evaluated here are those that determine the viability of the aquatic plant and animal communities. In evaluating the data presented for each pond, the rating system devised by the Buzzard’s Bay Program is helpful. Our goals should be to avoid zero point ratings and to maintain average ratings above a 60% score. The ratings are summarized in Table 1. Seasonal variation is the rule and year-to-year changes in water quality, in response to weather and even changes in the Gulf Stream may be substantial.

**Table 1: Buzzard’s Bay Eutrophication Index**

Parameter	Zero Score	Perfect Score
Oxygen Saturation (lowest 1/3 observed)	40% saturation or less	90% saturation or more
Transparency (Secchi disk)	0.6 meters or less	3 meters or more
Phytoplankton pigments	10 parts per billion or more	3 ppb or less
Dissolved inorganic nitrogen (DIN)	10 micromolar (0.14 ppm) or more	1 micromolar or less
Total organic nitrogen (TON)	0.6 ppm or more	0.28 ppm or less

In reviewing the charts, we suggest that you apply a desirable goal for these water bodies as follows:

- ❖ maintain ratings that are above 60% of the perfect score value for DO saturation and Secchi depth and

- ❖ less than 60% of the zero score value for pigments, DIN and TON for the growing season.

The application of any rating system to such a diverse group of ponds is prone to misinterpretation. The caveat to the text that follows is that these ratings will change as the amount of specific information we have increases. The rating system will be refined specifically for each pond during the Massachusetts Estuaries Project study of these systems.

#### CHILMARK POND:

This pond is very different in terms of circulation than most tidal ponds in that it is cut open to the sea periodically, remains tidal from as little as a few days to as many as a month or more and then the inlet closes and the pond gradually freshens as it receives stream and groundwater input that refills it. When the pond is open to the ocean, tidal circulation replaces the water in the pond system every 15 days. When the pond is closed to the ocean, the exchange time ranges from 60 days to well over 100 days. This allows the nitrogen to be circulated repeatedly into producing new generations of phytoplankton and building up large amounts of organic matter. The implications for salinity and water quality are enormous.

The area covered by water varies with the height of the Ponds that depends on the state of the inlet through the barrier beach. The area of the ponds during an open pond was determined (Wilcox, 2001) from aerial photographs (3/25/98 flight with scale at 1 inch is 1042 feet) using planimeter. The Upper Pond measured 33.07 acres (1.44 million square feet) and the Lower Pond was 145.54 acres (6.34 million square feet) at low water. When the Lower Pond is at its highest (about 5 feet NGVD), a large area of wetlands is flooded (Long Point, Allen Point and the area around Gilbert's Cove). The wetland area was measured by planimeter from aerial photos (1998) at 79.8 acres that brings the Lower Pond (including the connecting channel to the Upper Pond) to a total surface area of 241 acres when it is at its highest stage. The Upper Pond at that stage approaches 35 to 40 acres. The Upper Pond is exclusively a fresh water body except during extreme storm conditions. The Lower Pond is brackish for most of the time and may develop salinity near the Atlantic Ocean during the unusual times when the inlet remains open for extended periods of time.

The Pond contains some small oyster beds located along the barrier beach on the south side. It has a herring population of unknown size. The Upper Pond provides suitable spawning habitat. The excessive productivity in the system makes it unsuitable for eelgrass. In fact, the eelgrass beds probably died out a very long time ago.

In the charts, you will note the following:

- The distribution of DIN in the Pond reflects the sources of nitrogen. Values are highest at station 7 where the fresh water from the Upper Pond enters the Lower. Early in the summer, DIN at Station 1 is somewhat elevated reflecting fresh water recharge from groundwater in the Wade's Cove. With limited tidal exchange to remove it to the ocean, the nitrogen drives a highly productive system.
- During the growing season, TON at all stations exceeds upper limits for tidal ponds. This is a reflection of the limited tidal exchange that the south-shore great ponds experience.
- Pigments associated with chlorophyll-bearing phytoplankton in the water column are elevated during a large portion of the sampling period. Station 7, at the point where the fresh water discharge from the western (Upper) pond enters the eastern (Lower) pond is too high throughout. This is a result of the availability of nitrogen that forces the system to produce excess biomass.
- Dissolved oxygen saturation throughout the pond was generally above 80% throughout the sampling period. The excessive amount of organic matter as indicated by TON emphasizes the need to get some overnight data to see whether the saturation levels drop due to respiration and decay.
- The highly productive system loads the water column with phytoplankton and other microscopic organisms that reduce the sunlight penetration. As a result, the Secchi extinction depth is shallow throughout the sampling period.

A more detailed report entitled *Martha's Vineyard Water Quality Survey-Summer 2003* will be posted on the Commission's website.

### **Edgartown Great Pond:**

This pond is very different in terms of circulation than most tidal ponds in that it is cut open to the sea periodically, remains tidal from as little as a few days to as many as a month or more and then the inlet closes and the pond gradually freshens as it receives stream and groundwater input that refills it. When the pond is open to the ocean, tidal circulation replaces the water in the pond system every 13 days. When the pond is closed to the ocean, the exchange time ranges from 60 days to well over 100 days. This allows the nitrogen to be circulated repeatedly into producing new generations of phytoplankton and building up large amounts of organic matter. The implications for salinity and water quality are enormous.

The area of the system varies from the closed-inlet situation where the Pond fills with groundwater and reaches 895 acres to the tidal condition where it covers only 462 acres. The Pond contains oyster beds that have recently stabilized after a significant decline due to the oyster disease dermo. There are also widely varying numbers of soft-shelled clams and blue claw crabs.

During 2003, the inlet to the ocean was very successful persisting from early June, just after the 2 June sampling through 22 July.

### **In the charts, you will note the following:**

- ❖ During 2003, the Total Organic Nitrogen varied from near the desirable target of less than 0.4 milligrams per liter to well above that value and exceeding the zero point value at all stations during late August and early September. The Cove stations generally have more TON than the stations in or near the main body of the Pond.
- ❖ The variation between Cove stations and mid-Pond stations is even more dramatic for this parameter reflecting the increased dominance of fresh groundwater input toward the head of each Cove. The mid-Pond stations are generally at the desirable target of 6 micromoles per liter while the Cove stations are generally above that level and well above the zero point value at some stations for much of the sampling period.
- ❖ Total pigment concentration increases at all stations toward the end of August and is at or above the desired goal of 6 micrograms per liter at all stations by the end of the sampling period.
- ❖ Secchi extinction depth is lower in a cove station like EGP8 in Jobs Neck Cove than in a more central station like EGP2 at the southern end of Mashacket Cove. In the more central stations, the extinction depth met the desirable goal of 1.8 meters or more throughout the sampling period. In the Coves, the depth was less than desirable but above the zero point value.
- ❖ The dissolved oxygen saturation in the deeper water declined following the closing of the inlet in late July. The decline was dramatic at station EGP3 at the south end of Wintucket Cove and at station EGP10 in Jane's Cove.

A more detailed report entitled *Martha's Vineyard Water Quality Survey-Summer 2003* will be posted on the Commission's website.

## Farm Pond:

Farm Pond is a 33-acre tidal pond. The watershed is dense but largely seasonal residential with on-site wastewater disposal. The northern and northwestern parts of the watershed are high density.

The tidal signal is severely reduced in transit through the culvert beneath Beach Road. An approximate 2-foot tide range in Nantucket Sound is reduced to 0.31 feet within the Pond (Wilcox and Dripps, 1999 unpublished). The volume of the Pond at mid-tide was determined to be 4.465 million cubic feet and the tidal prism to be 0.44 cubic feet (Wilcox and Dripps, unpublished). The estimated time for 95% tidal exchange is 15 days. This figure could be significantly reduced by enlarging the culvert, adding a second one or replacing it with bridge or large box culvert.

The Pond now contains a significant eelgrass bed in the southern two thirds. The eelgrass is heavily coated with epiphytes and is at some risk (Hempy and Wilcox, 1998). It probably continues to thrive mainly because the Pond is so shallow (most is less than 4 feet deep).

The Pond may have a limited herring population. It also contains quahogs and soft-shelled clams.

### In the charts, you will note the following:

- Dissolved inorganic nitrogen concentrations cycle up and down through the sampling period. They are a little too high during early August and again late in the month.
- Total Organic Nitrogen concentrations in the water column are above acceptable levels throughout the sampling period.
- Chlorophyll and other pigments are too high toward the end of the sampling period.
- Dissolved oxygen saturation follows a cycle similar to the DIN cycle. It reaches values that are below our goals for tidal ponds. The low values recorded and the high TON concentrations indicate the need to obtain continuous overnight information for this system.
- The Pond is so shallow that Secchi extinction depths could not be obtained.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.

### James Pond:

This pond is very different in terms of circulation than most tidal ponds in that it is cut open to the sea periodically, remains tidal from as little as a few days to as many as a month or more and then the inlet closes and the pond gradually freshens as it receives stream and groundwater input that refills it. During 2003, the Pond was opened to Vineyard Sound on 12 April and showed a clear tidal signal through 23 April when the inlet closed. The tide range averaged about 0.15 feet. A second inlet was made on 12 May and persisted for about 7 days. During that time the tide range reached a maximum of 0.3 feet but averaged less than 0.2 feet. The tide was diurnal, having one high and one low tide each day. In comparison the tide range at Lambert's Cove Beach averaged about 2.1 feet. The limited tide and prolonged non-tidal periods allow the nitrogen to be circulated repeatedly into producing new generations of phytoplankton and building up large amounts of organic matter. The implications for salinity and water quality are enormous.

The area of the system varies from the closed-inlet situation where the Pond fills with groundwater to the tidal condition where it covers. The average is about 41 acres. In the past, the Pond has produced some soft-shelled clams in the tidal flats near the inlet. There is a small herring run that typically begins earlier than any other runs on the Vineyard. The system has a large rooted aquatic plant population that died out in late June or early July to create a dissolved oxygen crisis and a strong odor of decay on and near the pond shore.

The watershed of the Pond is approximately 435 acres in area containing low density residential only a few significant wastewater sources. The system appears to be naturally eutrophic.

### In the charts, you will note the following:

- ❖ During 2003, the Total Organic Nitrogen exceeds the zero point value throughout the sampling period.
- ❖ Most stations show a steady increase in inorganic nitrogen over the course of the sampling period. The values measured are at or better than the desirable goal probably due to rapid conversion into biomass that shows up as TON.
- ❖ Total pigment concentration exceeds the zero point value throughout the sampling period.
- ❖ Secchi extinction depth measurements could only be made where the water depth was adequate. On 14 July the depth was not sufficient to get a reading although the extinction depth would have been more than 1.2 meters. At both stations JMS3 and JMS4 the extinction depth decreased over the sampling period to the zero point value.
- ❖ The dissolved oxygen saturation in the deeper water declined was highly variable reflecting times where excess plant material produced large amounts of oxygen where the water was shallow and times where the decay of biomass lowered oxygen content well below desirable levels.



A more detailed report entitled *Martha's Vineyard Water Quality Survey-Summer 2003* will be posted on the Commission's website.

### **Lagoon Pond:**

The Lagoon Pond is fully tidal with a tide range of 1.75 feet. The Pond averages about 9 feet in depth although the West Arm probably is less than half that on average. The estimated flushing time to remove and exchange 95% of the pond water with Vineyard Sound water is 8.8 days. However, the Lagoon has a series of deep-water basins that are separated by sand bars and appear to be isolated from the main circulation pattern. This is supported by an accumulation of organic matter and deep-water anoxia in the southern most of these basins. The implications for tidal flushing are not clear.

The watershed of the Pond is approximately 3916 acres in area containing residential and some significant wastewater sources including the high school. Sewage collection along Beach Road has removed a source of nitrogen from the West Arm of the Lagoon. Eelgrass beds declined in area by over 50% between a survey in 1995 and a follow-up in 2001.

### **In the charts, you will note the following:**

- ❖ During 2003, the Total Organic Nitrogen exceeded the zero point value only on three occasions at three different sampling sites.
- ❖ Dissolved inorganic nitrogen was at or better than the desirable target of 6 micromoles per liter over the course of the sampling period.
- ❖ Total pigment concentration was well below the zero point value throughout the sampling period.
- ❖ Secchi extinction depth over the sampling period was well above the zero point value and generally at or better than the desirable target of 2 meters.
- ❖ The dissolved oxygen saturation in the deep water shows a strong difference between the north end of the Pond (stations LGP8 and 9) where saturation levels were at or above 60% throughout the sampling period and the south end of the Pond where the values were below 60% throughout.

A more detailed report entitled *Martha's Vineyard Water Quality Survey-Summer 2003* will be posted on the Commission's website.

## Menemsha Pond:

The watershed is 1793 acres as indicated from the Assessor's data and 1856 acres as measured by planimeter from the USGS Squibnocket quad sheet.

Menemsha Pond is a fully tidal pond of 665 acres in area. The average depth is 4.7 feet. It is connected to Nashaquitsa Pond (90 acres) via a restricted channel. A large culvert under South Road joins Stonewall Pond (30 acres) to Nashaquitsa. The total system is 784 to 790 acres or 34.41 million square feet. The tidal prism on a daily basis is over 166 million cubic feet. Compared with this large volume, the daily fresh water input of 0.647 million cubic feet is insignificant and will not be used in determining flushing.

The flushing time for the system is less than 0.95 days for tidal volume to equal mid tide volume and the estimated time required for 95% flushing is 3.2 days. Vigorous tidal exchange removes the nitrogen load from the watershed quite rapidly.

The Pond is an important source of bay scallops, quahogs and soft-shelled clams to the Towns of Chilmark and Aquinnah. It includes the largest herring run on the Vineyard at its southeast corner. The Herring Creek provides access to the spawning area in Squibnocket Pond. The Pond now also includes the Wampanoag Tribe's aquaculture project growing several million oysters with seed started in their hatchery.

The data presented for Menemsha Pond were collected by the Wampanoag Tribe's Department of Natural resources.

### In the charts, you will note the following:

- In mid-August, the DIN concentrations are higher than desirable at MEN 2 and MEN7. At MEN2 the elevated levels probably relate to the nearby watershed containing numerous residences and some commercial enterprises that dispose of wastewater on site. At MEN7 the increased concentration may be due to somewhat restricted circulation that allows fresh water to become a more important component in the water column. At MEN1, the elevated results may result from sampling in the ebb plume from the Pond at a time when it carried

MEN2 influenced water. Pigment concentrations are acceptable throughout the sampling period.

- Despite the tidal flushing, TON is elevated beyond the recommended limit at those locations where circulation is more restricted (MEN5 and MEN7) or where there are larger sources of inorganic nitrogen like Menemsha Basin (MEN2).
- The content of chlorophyll and other related pigments in the water column is low throughout the sampling period.
- The dissolved oxygen record in the lower part of the water column is acceptable throughout the summer sampling period.
- The Secchi records are not available at this time.

A more detailed report entitled *Martha's Vineyard Water Quality Survey-Summer 2003* will be posted on the Commission's website.

## Oak Bluffs Harbor:

The Harbor is a 30-acre tidal water body connected to Nantucket Sound by an inlet fixed by stone jetties. The Harbor is an important mooring area and a point for passenger ferries to unload during the summer months. Sunset Lake, a 5-acre tidal water, drains into the Harbor by a 3-foot by 10-foot box culvert under Lake Avenue. The Harbor receives road runoff from a stormwater collection system that includes a large impervious area. The watershed was recently sewered removing a large nitrogen source from wastewater. Residual nitrogen still moving from the groundwater into the system may have influenced water quality in 2003. A considerable area of the watershed includes moderate density residential and will not be sewered.

The tide range recorded in 2001 averaged 1.9 feet in the Harbor and 1.84 feet in Sunset Lake (Taylor, 2003). The Harbor and Sunset Lake have a mean depth of 2.6 meters. Old water is flushed out and replaced by new, Sound water (95%) over a period of 6.5 days.

### In the charts, you will note the following:

- Dissolved inorganic nitrogen concentrations are highest in Sunset Lake (OBH1). DIN is above desirable concentrations during August but only on 18 August does it exceed the 10 micromole per liter limit for tidal ponds.
- Total Organic Nitrogen concentrations in the water column are higher than desirable throughout the study but only reach the limit at OBH1 and OBH2 once during the sampling period.
- Chlorophyll and other pigments are higher than desirable during the sampling period but only exceed the limit at OBH2 and OBH4 once during the sampling period.
- Dissolved oxygen saturation is below desirable levels in the deeper water only once but the presence of relatively high TON concentrations indicates the need to obtain continuous overnight information for this system.
- Secchi extinction depths were less than the 2-meter desirable limit during mid-August. They were always better than the zero-point value.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.

### **Pocha Pond:**

Pocha Pond is a 115-acre tidal water body that is connected with Edgartown Outer Harbor and Nantucket Sound by way of a narrow elongate water body (the Lagoon) and Cape Poge Pond. The Pond is fringed by salt marsh that is particularly extensive on the inland side (300 acres, Gaines 1998). At one time, it was a fresh water body that was separated from the northern half of the Lagoon by a dike where herring access was provided.

The Pond watershed is low density residential on average but higher density in the area known as the Enos lots and toward the Wasque end of the Pond. A horse farm including hayland and pastureland is also within the watershed. The Trustees of reservations, the MV Land Bank and Sheriff's Meadow Foundation own substantial open space within the watershed.

Bottom sediment in the majority of the system is highly organic muck, becoming sandier toward East Beach, the north-to-south barrier beach that separates the Pond from Nantucket Sound. The Pond is less than 2 meters in depth throughout and probably averages somewhat less than 3 feet. The Pond produces some blue mussels and limited amounts of soft-shelled clams and quahogs. The Lagoon is deeper and with more vigorous tidal flow produces bay scallops.

### **In the charts, you will note the following:**

- ❖ Total Organic Nitrogen concentrations are higher at the stations further into the system (PCA 2 and 3) that is those more remote from tidal exchange with Cape Poge. Concentrations at PCA 2 and 3 are higher than desirable reflecting excess productivity.
- ❖ Dissolved Inorganic Nitrogen values follow a similar pattern to TON. The concentrations are somewhat higher than desirable levels.
- ❖ Total Pigment concentrations are good at all stations throughout the sampling period.
- ❖ Secchi readings could only be collected at station PCA1, as the rest of the Pond is too shallow. The extinction depths are acceptable at PCA1 throughout the period.
- ❖ Dissolved oxygen saturation values are at acceptable values throughout the sampling period.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.

## Cape Poge Pond:

Cape Poge Pond is a 1520-acre tidal pond that is a highly productive source of bay scallops for the Town of Edgartown. It is connected to Poucha Pond by way of a 95-acre water body called the Lagoon (Gaines, 1998).

The Pond has a tide range of about 2 to 2.25 feet (Wilcox, 2000, unpublished data). Gaines reports that about 1/3 of the pond is over 2 meters in depth and 2/3 less than 2 meters.

The Pond has extensive eelgrass beds in the water where sunlight penetration is good. Some decline was noted in the eelgrass bed area over the period from 2000 to 2002. The cause is not clear. Cape Poge also produces soft-shelled clams and quahogs.

The watershed for the system as a whole (including the Lagoon and Poucha Pond) is about 1480 acres of upland, 350 acres of barrier beach and 468 acres of salt marsh (Gaines, 1998) and includes low and moderate density residential development.

### In the charts, you will note the following:

- ❖ Total Organic Nitrogen concentrations are elevated early in the sampling period in the southern end of the Pond. In general TON values are near the desirable goal.
- ❖ Inorganic nitrogen (DIN) is higher at the outlet from Poucha Pond and in Shear Pen Pond where confined water bodies are more influenced by the addition of DIN from groundwater or precipitation. DIN at the other stations is low.
- ❖ Chlorophyll pigments concentrations are very good throughout the sampling period at all stations.
- ❖ Secchi extinction depths are good throughout the sampling period indicating good light penetration.
- ❖ Dissolved oxygen saturation in the deep water is above 80% throughout the sampling period.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.

### **Sengekontacket Pond:**

The watershed of Sengekontacket Pond is 4472 acres in the Towns of Oak Bluffs, West Tisbury and Edgartown. The watershed is largely residential but also includes a portion of the Vineyard Golf Club and much of the Farm Neck Golf Club. The area around Trapp's Pond is a sub-watershed to Sengekontacket and receives groundwater from the outskirts of Edgartown including part of the Edgartown Golf Club and the Upper Main Street and Vineyard haven Road commercial area.

### **Sengekontacket physical character:**

Sengekontacket Pond is a shallow, 700-acre coastal salt pond and is connected by a culvert to Trapp's Pond a 44-acre tidal water body. Old flood tidal flat sand deposits that formed before the inlets were fixed by jetties occupy a large portion of the pond causing the average depth of the Pond to be 0.9 meters or 3 feet.

Sengekontacket is vigorously circulated by the tides that average 2 feet in range and produce a flushing rate of about 2.33 days for removal of 95% of the old pond water to the Sound.

Trapp's Pond has restricted tidal exchange due to the culvert under Beach Road. The tide range in Trapp's Pond averages 0.55 feet.

Sengekontacket Pond is an important source of bay scallops, quahogs and soft-shelled clams to the Towns of Oak Bluffs and Edgartown. There is a large population of blue crabs associated with the area around the culvert under beach Road that connects to Trapp's Pond. The eelgrass in Sengekontacket was largely lost during the late 1980's and early 1990's. The exact cause is not known although the pattern of the remaining eelgrass (found only in Trapp's Pond and in the western end of Majors Cove) implies that wasting disease may have been the cause. This disease is caused by a slime net organism and was the cause of a major die-off in the northeast during the 1930's. Eelgrass is a crucial component of the estuarine habitat that is of key importance to shellfish and juvenile finfish. The MV Commission with funding support from the Friends of Sengekontacket and the Farm Neck Foundation have conducted trial restoration projects using seed from the plants growing in Trapp's Pond.



In the charts, you will note the following:

- Dissolved inorganic nitrogen values exceed guidance levels during the early September sampling round at SKT8 off the Boulevard in Ocean Heights where a large number of residences with on-site wastewater disposal are found in the watershed. The DIN concentration also exceeds the guidance value at SKT2 located off the Farm Neck Golf Club and the residences in the watershed that utilize on-site wastewater disposal. In Major's Cove at sampling station SKT4, the DIN almost hits the guidance level.
- TON concentrations exceed the guidance limit at sampling stations SKT4 and SKT8 during most of August. At SKT2, the TON concentration nearly reaches the guidance level during early August.
- Pigment concentration exceeds the guidance specification at SKT8 during much of August and at SKT4 on 19 August.
- The dissolved oxygen saturation in the deep water is acceptable during the sampling period.
- Because the Pond is shallow Secchi extinction depths are difficult to acquire. The reading obtained at SKT8 on 12 August is low. The other readings are acceptable.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.

## Squibnocket Pond

The acreage for the Squibnocket Pond watershed from the Assessor's data is 1303 acres and 1239 acres as measured on the USGS topographic map. The Pond is 603 acres in area and averages 4.7 feet in depth.

Gaines (1990) found the pond to average 10 parts per thousand salinity indicating it to be about 2/3 fresh water and 1/3 saline, Menemsha Pond water based on measurements in May and August 1989.

Wilcox (2001) estimated the volume of the Pond at 175 million cubic feet (4.98 million cubic meters). The Pond volume was derived by measuring the area between each pair of bathymetric contours and this figure multiplied by the average depth. The contours are those prepared by the Wampanoag Tribe (Walsh et al, 1979). Given the lack of a clear tidal cycle during November 1999 and April 2000, Wilcox (2001) suggested that the exchange time be based on the time required for the fresh water inputs to the system to equal the pond volume. This figure is 354 days. Additional tidal data is a priority to determine the average annual conditions.

Squibnocket Pond is a valuable herring resource. These fish are important food fish for bass and bluefish. They may also stimulate higher phytoplankton populations by feeding on the small zooplankton that graze on the phytoplankton. The Pond also contains sizable oyster beds that have not yet been fully utilized as a commercial shellfish resource.

The data presented for Squibnocket Pond were collected by the Wampanoag Tribe's Department of Natural resources.

### **In the charts, you will note the following:**

- Dissolved Inorganic Nitrogen concentration at most stations decreases as the growing season progresses. The DIN is converted into biomass and appears as increased TON at some of the stations. At station SQB1, on 7 August a high value for DIN at nearly 20 micromoles per liter may reflect a sampling or lab error or could represent a real value due to limited mixing of a parcel of water.

- The limited tidal exchange allows nitrogen addition from watershed runoff and rainfall to stimulate excess production that manifests as high Total Organic Nitrogen. TON exceeds the upper guidance limits at all stations during the sampling period. The content of chlorophyll and other related pigments in the water column is low throughout the sampling period.
- Chlorophyll concentrations are acceptable throughout the sampling period. The fact that TON is high but chlorophyll is not may indicate that non-chlorophyll bearing forms dominate the plankton population.
- Station SQB 3 is located at the center of the Pond where the water depth is approximately 5 meters. Dissolved oxygen in the deeper water column was supersaturated on July 31. This implies the potential for very low overnight saturation and emphasizes the need to get some continuous measurements during the summer. The record for the remainder of the summer was low but acceptable on 8/7 and good on 8/25.
- The Secchi records are not available at this time.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.

### **Tisbury Great Pond:**

This pond is very different in terms of circulation than most tidal ponds in that it is cut open to the sea periodically, remains tidal from as little as a few days to as many as a month or more and then the inlet closes and the pond gradually freshens as it receives stream and groundwater input that refills it. When the pond is open to the ocean, tidal circulation replaces the water in the pond system every 12.6 days. When the pond is closed to the ocean, the exchange time ranges from 60 days to well over 100 days. This allows the nitrogen to be circulated repeatedly into producing new generations of phytoplankton and building up large amounts of organic matter in the water column. The implications for salinity and water quality are enormous.

Including Black Point Pond and the channel connecting it to the Great Pond, the Pond covers about 800 acres in area at high pond. The elevation of the Pond may drop from this level by over 4 feet when it is connected to the ocean. The Pond area at this time is approximately 663 acres in area.

The tide range in the Pond averages about 0.6 feet. The large watershed contributes an enormous amount of fresh water that adds to the outflow to the ocean and aids in keeping the Pond open to the ocean longer than either Edgartown Great or Chilmark Ponds. In 2003, the Pond was opened to the ocean on January 15, March 20, May 16, June 28 and October 3. The total time when the Pond was tidal was in excess of 100 days. In 2002, the Pond was tidal for 215 days.

The Pond contains oyster beds that have recently declined due to the oyster disease, dermo. The Pond also produces soft-shelled clams and a large but variable blue crab population.

### **In the charts, you will note the following:**

During 2003, the May 16 opening had only persisted for 11 days setting the stage to repeat the opening. The Pond was opened to the ocean on June 28 and remained tidal through July 26.

- ❖ During the sampling period, Total Organic Nitrogen rises at all stations except TGP13 situated in the middle of the southern basin closest to the inlet. TON concentrations are above acceptable levels for most of the sampling period and exceed the zero point value mid-August through mid-September.

- ❖ Dissolved Inorganic Nitrogen values are higher in the Coves (TGP10 and TGP14) nearer to the sources of fresh water discharge and lower in the main basin (TGP13). The first three weeks in August brought over 5 inches of rain adding inorganic nitrogen as direct fall on the Pond as well as increased runoff. This leads to a peak in DIN for the sampling round on August 25.
- ❖ Chlorophyll pigments were well above the zero point value for the latter half of the sampling period and were very close to that value during the earlier sampling rounds.
- ❖ The Secchi extinction depth decreases steadily from acceptable levels to zero point values over the course of the sampling period. This reflects the increase in phytoplankton as indicated by the TON and pigment concentrations that interfere with light penetration.
- ❖ The dissolved oxygen saturation shows a strong decrease with depth at station TGP 12. This phenomenon occurs where the deeper water is isolated from the air overnight and the oxygen in the water is gradually used up. A similar situation developed at TGP14 (not shown) but did not develop at TGP13 where wind circulation may have prevented this by mixing the water column.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.

## Tashmoo Pond:

Tashmoo Pond is a 270-acre tidal pond situated on the north shore of Martha's Vineyard. It has a mean depth of 1.3 meters (4.25 feet) but reaches maximum depth in excess of 12 feet below mean sea level. The tide range is 0.61 meters (2.0 feet) (MVC, 2003). The Pond is flushed through a man-made channel to Vineyard Sound that is stabilized by stone groins. Approximately 3.2 days are required to exchange 95% of the water in the system with Vineyard Sound.

The Pond was a fresh water body called lake Tashmoo (and still is by many) with a narrow meandering channel emptying into Vineyard Sound. Today, the tide flows through an inlet fixed by jetties that were created during a Corps of Engineers dredging project that turned the Lake to an estuarine water body.

Tashmoo pond includes a large seasonal mooring field. It is a limited source of bay scallops to the Town of Tisbury and also produces some soft-shelled clams and quahogs. There is a herring run into the Upper Pond that is fresh water.

### In the charts, you will note the following:

- Dissolved Inorganic Nitrogen concentration at all stations decreases as the growing season progresses. The concentration at all stations is acceptable throughout the sampling period.
- The TON concentration at all stations is acceptable throughout the sampling period.
- Chlorophyll concentrations are acceptable throughout the sampling period. The concentration is higher toward the south end of the pond (TSH3) where tidal circulation is less vigorous and the fresh water input in the form of springs and the Upper Pond discharge are more important.
- Dissolved oxygen saturation in the deeper water is at acceptable levels throughout the sampling period.
- The Secchi extinction depth is acceptable throughout the study period.

A more detailed report entitled Martha's Vineyard Water Quality Survey-Summer 2003 will be posted on the Commission's website.