Friends of the Bay
Volunteer Water Quality Monitoring Program
1999 Annual Report

Friends of the Bay
P.O. Box 564
Oyster Bay, NY 11771
(516) 922-6666
e-mail: bay@friendsofthebay.org
web site: www.friendsofthebay.org

Acknowledgements

Friends of the Bay would like to thank the individuals and organizations that make our water quality monitoring program possible.

The McAllister Family - Donald Jr., Maureen and Liane McAllister, residents of Centre Island, generously offered to fund the purchase of Baywatch II in memory of their parents Donald Sr. and Betty. In 1990, in the memory of Betty McAllister, Donald Sr., Liane, Donald Jr. and Maureen helped the United States Fish and Wildlife Service purchase a boat. This boat enabled the Service to become more actively involved in protecting the Oyster Bay National Wildlife Refuge. Three years later, in the memory of Donald McAllister Sr., Liane, Donald Jr. and Maureen purchased "Baywatch" Friends of the Bay's first boat.

Carolina Skiff - Carolina Skiff provided the brand new 19' Carolina Skiff Semi-V Hull boat at a 50% discount. The "semi-v" hull provides a stable work platform for volunteers to conduct water quality monitoring, education programs, harbor clean-ups, and for members of the press to photograph events.

Evinrude - Evinrude through its government sales office enabled Friends of the Bay to purchase the 70 horsepower 4-stroke engine for 40% off the regular price. We are particularly pleased that we were able to purchase the more environmentally friendly 4-stroke engine, which burns 31% less fuel than a 2-stroke engine, does not discharge oil into the bay and meets the EPA 2006 emissions regulations.

Frank M. Flower and Sons Oyster Company – Dwight and Dave Relyea and Joseph Zahtila owners of Frank M. Flower and Sons Oyster Company have provided dock space, boats and logistical support for Friends of the Bay's monitoring program since 1992.

The DuBois Family – Carol and her daughter Caroline DuBois financed the operation of "Baywatch II" during the 1999 season.

Oyster Bay Marine Center – John McGrane and his staff assisted in the delivery of the boat from Carolina Skiff.

Bay Marine Services – John Hickey and his staff prepared the boat for launching including installing the engine, sanding and painting the boat bottom and launching the boat.

Bridge Marina - Richard Valicenti provides discounted parts and service to Baywatch II.

Pine Island Etch and Sign – Les Marbles prepared and applied the Friends of the Bay graphics.

Tow/Boat US and North Shore Diving Services – Mitch Kramer has graciously agreed to support "Baywatch II" in "any way he can." (Let's hope we don't need his towing services any time soon.)

Nassau County Department of Health - Working with John Jacobs enabled Friends of the Bay to collect bacteria samples in Mill Neck Creek and have them analyzed by the County Laboratory.

Water Quality Monitoring Work Group - As a participant in the Water Quality Monitoring Work Group Friends of the Bay's program has benefited from the collective knowledge of numerous individuals and organizations from around Long Island Sound. We are especially indebted to Carol DiPaolo and the Coalition to Save Hempstead Harbor for their continued support.

Volunteers -

Belle Downey Smith	Judith Hershon	Craig Minsky
Stephanie MacCallum	David MacCallum	Susie Theroux
Rod O'Connor	Audie O'Connor	Vincent Lofaro
Del Barreto		

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Introduction

Exciting things are happening around Oyster Bay and Cold Spring Harbor. The Village of Bayville, as part of their *Local Waterfront Revitalization Program*, is aggressively implementing measures to prevent contaminated run-off from entering the Bay. The New York Clean Water/Clean Air Bond Act is enabling Nassau County to install a small sewage treatment plant in Mill Neck Creek and the Oyster Bay Sewage Treatment Plant to upgrade its facility to remove nitrogen. How will these changes affect water quality? Friends of the Bay monitors water quality once a week from mid-June through October to find out.

The Long Island Sound Study (LISS), a cooperative effort of the federal, state and local governments concluded that low dissolved oxygen (hypoxia) is the most serious threat to the health of the ecosystem. As part of budgetary cutbacks, the Nassau County Department of Health eliminated all dissolved oxygen and bacterial testing from their water-testing program that was not required to monitor bathing beaches in 1993. The New York State Department of Environmental Conservation still monitors bacteria to ensure the safety of shellfishing areas.

Started in 1987 as a small group of citizens concerned about the impact of a proposed massive development on Oyster Bay's waterfront, Friends of the Bay has grown into a powerful voice representing over 3,000 area residents and businesses. "Working to keep the oyster in Oyster Bay", we are committed to the preservation of Oyster Bay and Cold Spring Harbor and our surrounding upland communities. Specifically, "our mission is to promote community awareness of the need to preserve water quality and marine life in the Bay, to assure the aesthetic, economic and recreational value of Oyster Bay and Cold Spring Harbor and to ensure that development in the watershed is compatible with the needs of a healthy ecosystem". As a representative of the local citizenry, we have developed a wide range of programs that expand public knowledge concerning issues in the bay. One of our most important programs is the volunteer water quality monitoring program.

Friends of the Bay has initiated a volunteer water quality testing program to fill the void left by county cutbacks. This program was developed in cooperation with the United States Environmental Protection Agency, New York State Department of Environmental Conservation, local governments and other volunteer monitoring groups around Long Island Sound. Friends of the Bay considers the program a necessary component in the effort to preserve the Oyster Bay –Cold Spring Harbor ecosystem, and hopes to increase public awareness of local threats to water quality. The water quality program of Friends of the Bay is being conducted to:

1. Provide high quality data to continue the dissolved oxygen-testing baseline established by the Nassau County Department of Health in 1972
2. Screen for water quality impairments
3. Educate and involve citizens in surface water quality protection
4. Continue to watchdog harbor activities
5. Assist local, state and federal agencies in harbor management

This program enables trained volunteers working along side environmental scientists, to monitor various components of the marine ecosystem. Volunteers track a number of features in the bay these include water temperature, clarity, salinity, dissolved oxygen and coliform bacteria. Measuring these parameters enables Friends of the Bay to better understand changes within the local marine ecosystem.

Dissolved Oxygen - Like humans, marine animals need oxygen to breathe. The less dissolved oxygen in the water, the more difficult it is for marine life to survive. Oxygen levels can become dangerously low from hypoxic conditions, causing fish to leave the area or in extreme cases leading to mortality of fish and many other forms of marine life. Oxygen is depleted when nutrients such as nitrogen and phosphorous (found in road run-off, lawn fertilizers and pet wastes) run into nearby surface waters. Unnaturally high level of nutrients lead to algae blooms. When this excessive amount of algae dies, it sinks to the bottom and is decomposed by bacteria. The bacteria consume large amounts of oxygen while decomposing the algal bloom thereby, reducing the amount available for fish and other living organisms in bottom waters. Oxygen is measured using a dissolved oxygen meter and is recorded in milligrams per liter (mg/L) which is equivalent to parts per million (ppm). Table 1 explains the consequences of low dissolved oxygen levels.

Table 1: Consequences of Low Dissolved Oxygen

Dissolved Oxygen	Consequences
> 5.0 mg/L	**Meets NYS Standard** for dissolved oxygen – few adverse effects on marine life
4.0 mg/L	Reduce survival of crab and lobster larvae by 30%
3.0 mg/L	**Hypoxia** – affect the growth of crabs and lobsters. Fish avoid the area.
2.5 mg/L	Growth reduced in grass shrimp, summer flounder and lobster.
2.0 mg/L	Sharply reduced growth. Lowest safe dissolved oxygen level for many juvenile organisms
1.5 mg/L	Very high lethal effects on fish, shrimp and lobster.
0.0 mg/L	**Anoxia** – Intolerable environment for nearly all marine organisms (Zimmer 1996)

Water Temperature - The temperature of the water and salinity determines the amount of oxygen water can hold. Water temperature is measured in degrees Celsius. The warmer or more saline the water the less oxygen it can hold before it becomes saturated. The percent saturation is the amount of oxygen actually in the water compared to what the water can hold at that temperature and/or salinity (Dexter and Harris 1992). Algae growth is also affected by water temperature, growth is more favorable as water temperatures rise. Temperature is measured on the dissolved oxygen meter.

Salinity - Salt content of water is the primary factor in determining the variety of marine organisms that can survive in a particular body of water. Salinity is measured in parts of salt per thousand parts of water (ppt or 0/00) (Fisher 1993). Salinity also contributes to stratification of the water; i.e., the colder more dense saline waters lie beneath the warmer less dense fresh water. This stratification can prevent oxygenated surface waters in the photic zone from replenishing bottom waters lacking dissolved oxygen. The salinity in Oyster Bay and Cold Spring Harbor is usually around 26 ppt and never above 30ppt. In comparison the open ocean has a salinity of 35 ppt. Fluctuations in salt content can be attributed to fresh water inputs (i.e streams), runoff, precipitation, and tidal flushing.

Water Clarity - The clarity of the water determines the photic zone or how deep sunlight penetrates. This will determine the deepest point at which oxygen producing plants will grow. Low water clarity can also be indicative of an algae bloom. Algae blooms can reduce the amount of sunlight reaching plants attempting to grow lower in the water column. Alternatively poor water clarity can also indicate the presence of suspended sediments, eroded soil, and/or microscopic organisms. These conditions can limit photosynthesis, inhibit the breathing of fish by clogging the gills, and adversely affect filter feeding organisms (i.e. clams, oysters, mussels).

Coliform Bacteria - The Nassau County Department of Health and the New York State Department of Environmental Conservation use coliform bacteria to open or close swimming beaches and shellfish beds respectively. High coliform bacteria levels indicate the presence of intestinal waste from warm-blooded animals such as humans. Friends of the Bay, in partnership with the Village of Bayville and Nassau County Department of Health, collected samples in Mill Neck Creek and delivered them to the County lab to be analyzed.

Establishing baseline conditions will be particularly important to measure changes following the installation of a new package wastewater treatment plant for 46 homes in Oak Neck Creek and other efforts to improve water quality. The goal of this effort is to identify and correct pollution sources and thereby, obtain a water quality level that supports a seasonally certified shellfishing area.

Table 2: Coliform Bacteria Standards

	Shellfishing Open	Swimming Open
Total Coliform	LOG AVG 30 days <70/100ml or if < 10% of samples do not exceed 5,000 *mpn/100 ml*	LOG AVG 30 days < 2,400/100ml
Fecal Coliform	LOG AVG 30 days <14/100 ml or if no one sample is > 1,000 *mpn/100 ml*	LOG AVG 30 days < 200/100ml

This report was prepared to summarize the results of the 1999 monitoring season and to provide recommendations to improve the program for next year. This document will be distributed to: the Long Island Sound Study office, New York State Department of Environmental Conservation, Nassau County Department of Health, Town of Oyster Bay

Division of Environmental Control, Long Island Sound Water Quality Monitoring Work Group, surrounding villages, and other interested parties.

Methods

Dissolved Oxygen - Water Temperature - Salinity

Friends of the Bay measured dissolved oxygen using a Yellow Springs Instruments Model 58 Dissolved Oxygen meter, and salinity and temperature using a Yellow Spring Instruments Model 33 Salinity-Conductivity-Temperature meter. These meters are widely used by professionals and volunteer monitors for their accurate readings and ease-of-use. (For the 2000 season both the YSI Model 58 and Model 33 have been replaced by the YSI Model 85, which handles all three tests.)

Prior to each, use the membrane on the dissolved oxygen probe was checked for air bubbles or desication and changed if necessary. The volunteers allowed the meters to warm up for 15 minutes before the Model 58 Dissolved Oxygen Meter was air calibrated and the Model 33 Salinity-Conductivity-Temperature Meter was red-lined. Additional information about instrument calibration is available in the manuals for each of these instruments or in Friends of the Bay's *Draft Quality Assurance Project Plan*.

Water Clarity

Water Clarity is measured using an 8" Secchi Disk, which is a plastic disk colored black and white in alternating quadrants. The disk is lowered on a line into the water with the sun at the observer's back, off the shaded side of the boat. The disk is lowered until it disappears from sight. The point where the line meets the water is noted. The disk is then raised until the disk just becomes visible. Once again the point where the line meets the water is noted. The disk is retrieved and the two points are calculated from the surface of the disk to each point on the line. The average of these two points is recorded as the "secchi depth" (Fisher 1993).

During the 1999 season only the point where the disk reappeared was noted and measured in inches using a plastic yardstick. In future testing seasons the line will be calibrated with markings every one tenth of a meter and the average of the two points will be used to determine the secchi depth.

Coliform Bacteria

Samples are collected by Friends of the Bay in plastic Wh*irl-Packs,* stored in a cooler with ice and transported immediately to the Nassau County Department of Health's laboratory in Hempstead. Information collected at the time of each sample includes: time sample was taken; water temperature (degrees Celsius); air temperature (degrees Celsius); wind direction (1 of 8 directions); wind speed (estimate in 5 mph increments); wave height (.5' increments); weather conditions (on a predetermined 1-6 scale); and, any unusual conditions (i.e. odors, fish kills, water color). Nassau County Department of Health add in tidal stage and rain data.

Monitoring Locations

Friends of the Bay monitors six sites throughout Oyster Bay and Cold Spring Harbor for dissolved oxygen. Each site is monitored one day per week, once at sunrise and again in the late afternoon. The locations tested include: Mill Neck Creek; West Harbor midway between the east and west shores; Roosevelt Beach two hundred yards north off of the flag pole in Roosevelt Park; Buoy "4" near Plum Point at the entrance to Cold Spring Harbor and Oyster Bay; and two sites in Cold Spring Harbor (see Appendix #1).

Four water samples are collected to test for bacteria including: one from the main channel of Mill Neck Creek (same as dissolved oxygen station above MNC-1), one at the confluence of the two branches of Mill Neck and Oak Neck Creek (MNC-2), one as close to Beaver Dam (south) as possible to reach at low tide (MNC-3) and one as far north in Oak Neck Creek as possible to reach at low tide (MNC-4).

Results and Analysis

Dissolved Oxygen - Temperature - Salinity

Although no single test can accurately predict the health of this complex ecosystem, dissolved oxygen is a good indicator of the overall condition of the water. Friends of the Bay's monitoring indicates that every site failed to meet the New York State Standard of 5 mg/L at least once during the morning sampling. In the afternoon, samples Plum Point and Cold Spring Harbor North and South failed to meet the standard at least once. In addition, Cold Spring Harbor North was hypoxic (dissolved oxygen less than 3.0 mg/L) in the morning 43% of the sampling days (three of seven times) and Cold Spring Harbor South was hypoxic on 70% of the sampling days (seven of ten times).

The dissolved oxygen data summarized in Table 4 and in Appendix #2 shows daily and seasonal fluctuations common in dissolved oxygen. Overall dissolved oxygen levels in Oyster Bay and Cold Spring Harbor appear to be lowest in July and August, not coincidentally when the water is the warmest (See Table 3).

Table 3: Monthly Water Temperature Averages

Location	Average Water Temperature (°C)					Location Average
	June	July	August	September	October	
Mill Neck Creek	23.63	25.27	24.58	21.67	15.22	22.07
West Harbor	23.97	23.79	24.12	21.67	16.00	21.91
Roosevelt Beach	21.70	23.26	24.17	21.77	16.13	21.41
Plum Point	19.50	22.17	23.32	21.70	16.65	20.67
Cold Spring Harbor North	N/A	21.70	23.24	21.57	16.57	20.77
Cold Spring Harbor South	20.10	22.70	23.56	21.67	16.33	20.87
Monthly Averages	21.78	23.15	23.83	21.67	16.15	21.32

The average bottom dissolved oxygen was 5.80 mg/L for the morning samples and 6.78 mg/L for the afternoon samples. The overall average (morning and afternoon) bottom dissolved oxygen was 6.29 mg/L. Mill Neck Creek had the highest dissolved oxygen averaging at 7.17 mg/L. Cold Spring Harbor South had the lowest dissolved oxygen reading averaging at 5.05 mg/L with two samples as low as 1.76mg/L.

The high average of dissolved oxygen levels in Mill Neck Creek and lower readings in the southern part of Cold Spring Harbor may be influenced by the order in which the sites are sampled. Routinely we travel to the Cold Spring Harbor location, our furthest point, first to allow the dissolved oxygen and salinity meter to warm up. Sampling the same location first each time means we are consistently witnessing lower readings at Cold Spring Harbor south than at other locations. Mill Neck Creek, for example, may be tested as much as two hours later. In this time the photosynthetic activity of the algae stimulated by the sun can raise the dissolved oxygen levels. Friends of the Bay will test Cold Spring Harbor several hours after the morning sample during the 2000-monitoring season to examine the affect time of day has on the sample.

Table 4: Dissolved Oxygen Summary

Location	Average (mg/L)		Total # of Samples		# of Samples Below NYS Standard (5.0 mg/L)	# of Samples Below Hypoxia (3.0 mg/L)
	A.M.	P.M.	A.M.	P.M.		
Mill Neck Creek	6.50	8.36	15	9	2	0
West Harbor	6.38	7.38	15	10	2	0
Roosevelt Beach	6.04	7.18	16	10	4	0
Plum Point	6.11	6.47	16	7	5	0
Cold Spring Harbor North	5.20	5.47	15	7	10	3
Cold Spring Harbor South	4.58	5.81	16	10	13	7

Mid-season we began using a recently donated Yellow Springs Instruments Model 85 dissolved oxygen and salinity meter along side the Yellow Springs Instruments Model 58 and Model 33. Initial results indicated salinity on the Model 33 meter was lower than the Model 85 which was more consistent with historic salinity readings around 26 ppt.

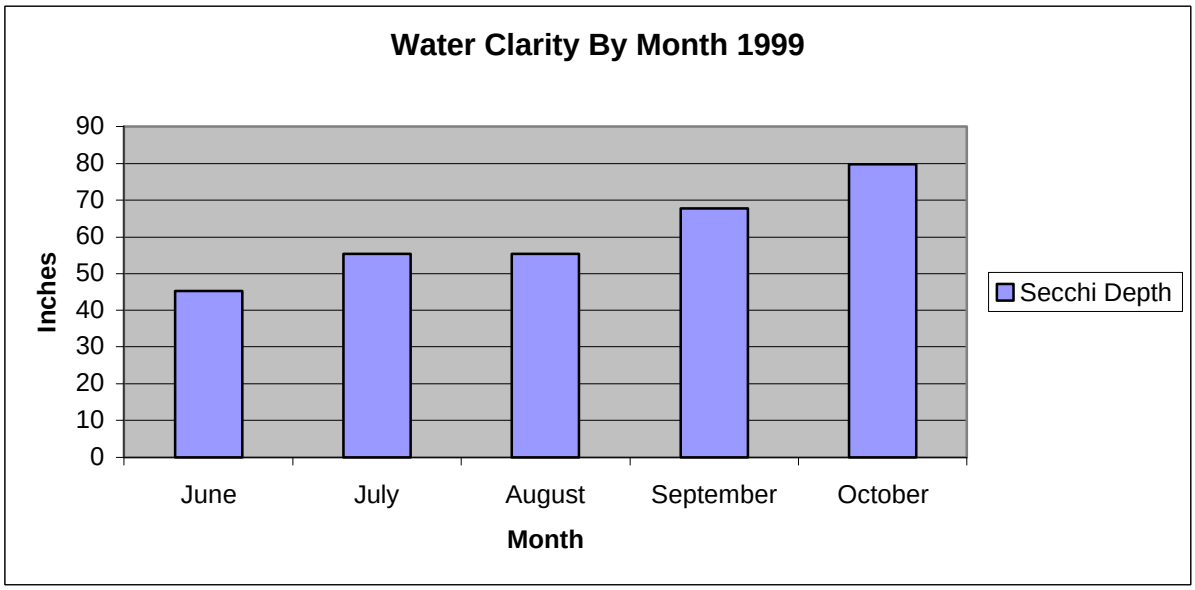
Unfortunately, the severing of the Model 85's cable literally cut short the use of the probe for the rest of the season. Consequently, from the beginning of September we estimated salinity to be 26 ppt at each location for the remainder of the season. Approximating salinity affects the accuracy of dissolved oxygen data and will be avoided next season.

Water Clarity

Secchi depth readings also show seasonal variation expected in an estuary. The warmer water during June, July and August leads to high levels of phytoplankton and algae. These organisms reduce water clarity. As the water temperature drops in September and October Secchi depth readings increased (see Table 5 and chart below).

Table 5: Secchi Depth Summary

Location	Average Secchi Depth (inches)					Location
	June	July	August	September	October	Average
Mill Neck Creek	32	45	43	45	72	47
West Harbor	46	57	57	59	83	60
Roosevelt Beach	40	59	54	70	76	57
Plum Point	59	59	65	90	89	72
Cold Spring Harbor North		58	57	76	85	69
Cold Spring Harbor South	49	54	55	67	73	60
Monthly Averages	45	55	55	68	80	61



Coliform Bacteria

Sampling for the Nassau County Department of Health was added in September to develop a baseline understanding of bacteria levels and to pinpoint the reasons that Mill Neck Creek was closed year-round to shellfishing in the early 1980's. Initial test results confirm that bacteria levels exceed the shellfishing standard, but do meet the bathing beach standards (see Appendix #3). The bacteria levels are believed to be within a range that would enable the area to return to seasonal shellfishing if the water quality is improved slightly. Testing bacteria in Mill Neck Creek over the course of the entire 2000 season will provide a more complete picture of the conditions in this area.

Watchdog Activities

Friends of the Bay's presence on the bay is an important part of the water quality monitoring program. Aboard "Baywatch II" we are able to track conditions in the harbor. We collect floatable debris (e.g. aluminum cans, wood) and report any unusual conditions to the appropriate authorities. On the morning of July 30th we observed and reported to the Department of Environmental Conservation a fish kill of approximately 20 adult menhaden (*Brevoortia tyrannus*) just east of the Bayville Bridge and a dead snapping turtle in Mill Neck Creek just west of the Bridge.

Education and Awareness
The curious looking monitoring equipment and the highly visible "Friends of the Bay" graphics on *Baywatch II* spark numerous inquiries from fellow boaters. These opportunities enable us to briefly explain what we are doing, provide them with Friends of the Bay literature (e.g. newsletter, description of water monitoring), and invite them to help us keep the bay healthy.

Discussion and Recommendations

The 1999 season was the longest, most consistent monitoring season Friends of the Bay has compiled. In the process we learned many things that will help us improve the program in the future.

Tidal vs. Temporal Influences on Dissolved Oxygen
Friends of the Bay was the only monitoring group around Long Island Sound that tested dissolved oxygen twice within the same twenty-four hour period. This was done to detect the difference between dissolved oxygen levels in the morning after oxygen producing plants have been inactive at night and in the afternoon following a full day of photosynthesis.

After discussion with several experts, Friends of the Bay concluded that consistently collecting data from each site at or near its lowest point will provide the necessary reference point from which we can analyze the data. Next testing season Friends of the Bay will only test once a week beginning at sunrise on the same day, and in the same site order each week.

Invest in Equipment
Investment in Friends of the Bay's water quality monitoring program this year has given it a tremendous boost. The generous donation of a brand new 19' Carolina Skiff by the McAllister Family of Centre Island has not only increased Friends of the Bay's presence on the water, but having a boat solely for our use improves the consistency of existing testing, and allows us to develop new programs. In addition, the boat can hold up to ten volunteers and its low sidewalls makes water testing safer and easier.

Friends of the Bay upgraded the Yellow Springs Instrument Model 85 dissolved oxygen and salinity meter to a 50' cable when it was repaired.

Institutionalize Program
Reinvigorating Friends of the Bay's water quality-monitoring program this year was facilitated by the existing documents describing the program. A written account of what the program entailed is important especially if the program coordinator or volunteers change frequently. Friends of the Bay should continue to develop a Quality Assurance Project Plan and submit it to the United States Environmental Protection Agency for approval.

Develop Partnerships

Nassau County Department of Health, volunteers and Friends of the Bay's first college intern, Craig Minsky were invaluable this monitoring season. The partnership with Nassau County Department of Health made it possible to examine water quality in Mill Neck Creek more closely, and added credibility to our efforts. Involving volunteers facilitated taking samples, and provided a fun, educational opportunity for individuals to get involved in protecting the bay. We will develop a program for recruiting, training and monitoring with volunteers.

Friends of the Bay, thanks to the John Jacobs from the Nassau County Department of Health, will be able to expand the bacteria sampling to include all our dissolved oxygen testing locations beginning in mid-April, and continuing through October.

Take Action

Providing data useful to a variety of users provides an incentive for volunteer monitors. This year data was provided to Frank M. Flower and Sons, who were concerned about the possible correlation between water temperature and the surprising outbreak of *vibro parahemaliticus* of 1998. In addition Friends of the Bay also reports unusual occurrences such as the fish kill we observed in July.

Friends of the Bay will continue to look for opportunities to put our water quality monitoring data into action. For example, as a result of the high coliform counts in Mill Neck Creek and previous studies indicating possible failing septic systems (e.g. Oyster Bay Outstanding Natural Coastal Area Draft Management Plan) we applied for and were awarded a United States Environmental Protection Agency Long Island Sound Study education grant. This effort will promote maintenance of Onsite Wastewater Treatment systems surrounding Mill Neck Creek.

Conclusion

Friends of the Bay looks forward to working with volunteers, government agencies and fellow not-for-profit organizations in the 2000 monitoring season. Together we will be able to continue to improve and expand our monitoring efforts. Hopefully these efforts will provide the link to show how investment in water quality protection is improving Oyster Bay and Cold Spring Harbor.

For further information about Friends of the Bay's Volunteer Water Quality Monitoring Program or other Friends of the Bay activities, call (516) 922-6666 or e-mail: bay@friendsofthebay.org

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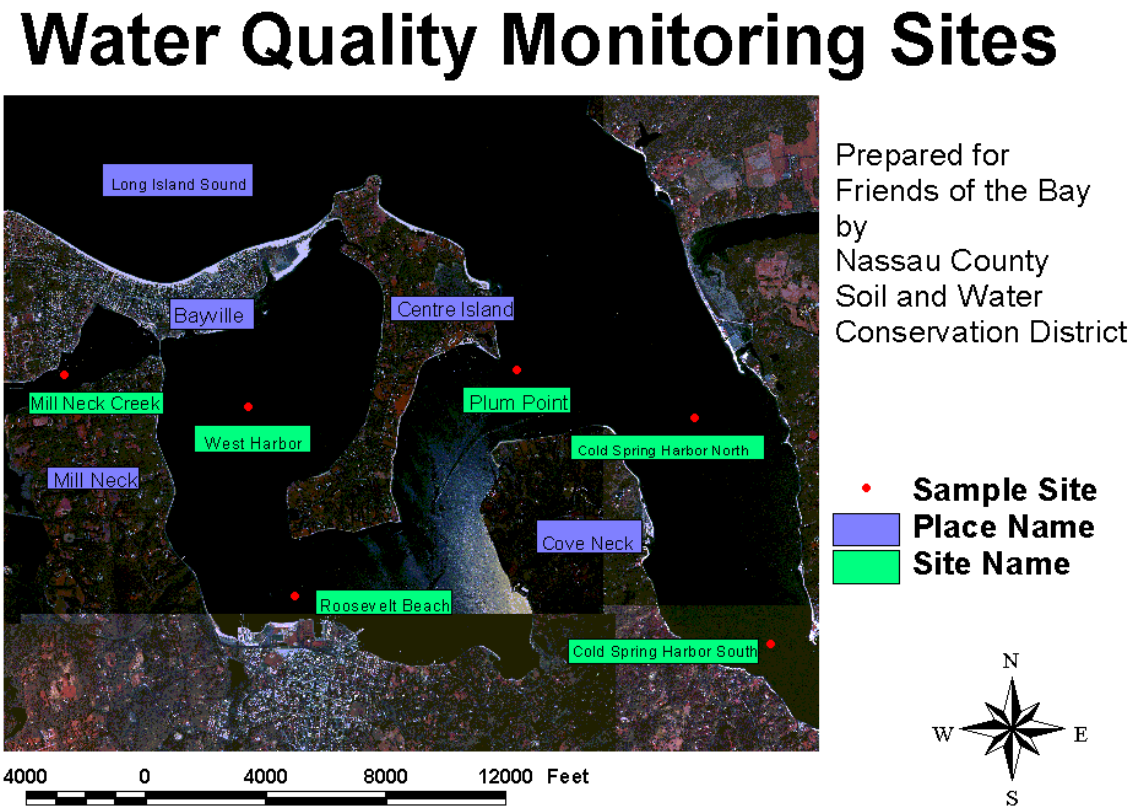
Appendix 1: Map of Monitoring Locations

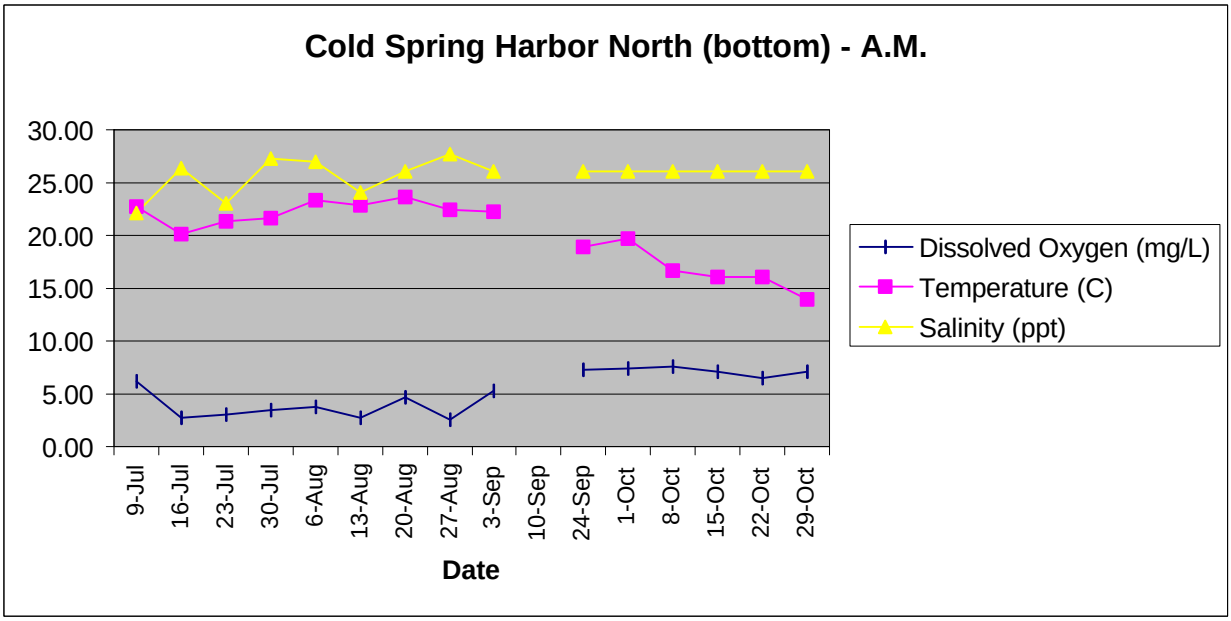


Note: Of the four bacteria sampling locations in Mill Neck Creek only the one from the main channel labeled *Mill Neck Creek* (MNC-1) appears on this map. The other locations are further west (to the left) then this aerial photograph shows. These sites include MNC-2 at the confluence of the two branches of Mill Neck and Oak Neck Creek, MNC-3 which is as close to Beaver Dam (south) as possible to reach at low tide and MNC-4 which is as far north in Oak Neck Creek as possible to reach at low tide.

Appendix 2: Dissolved Oxygen Data & Graphs

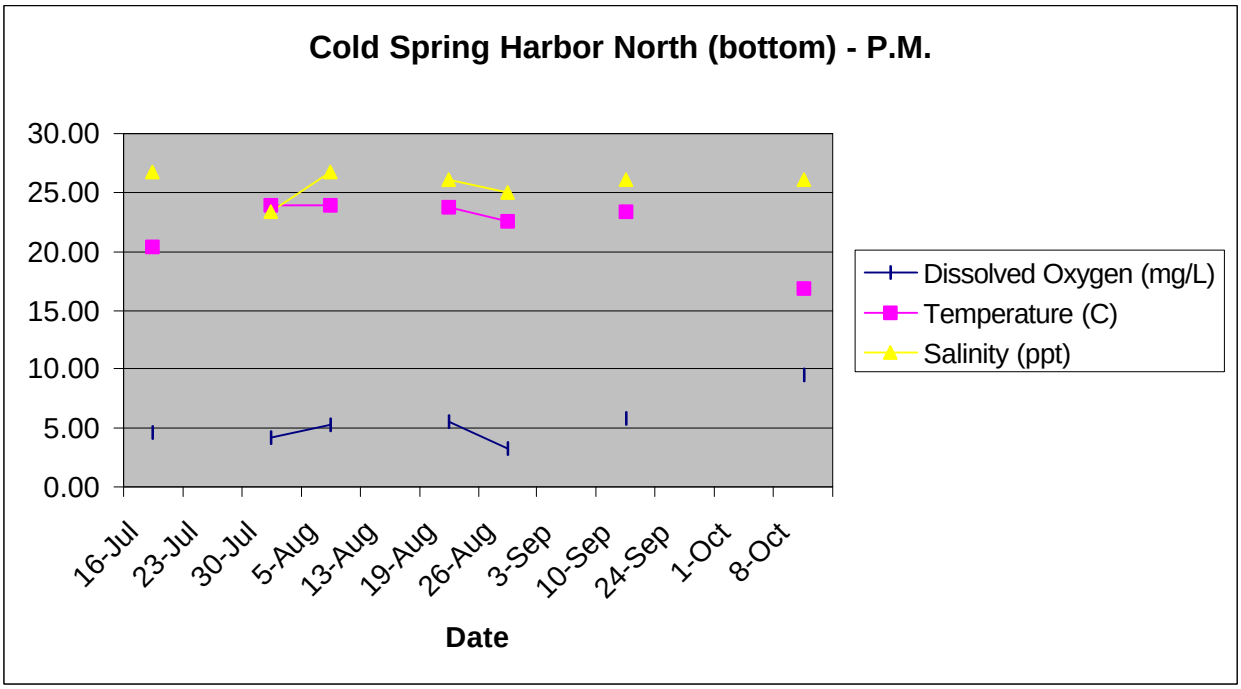
Cold Spring Harbor North (bottom) - A.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun				
28-Jun				
9-Jul	22.8	22.1	6.28	52
16-Jul	20.2	26.4	2.74	70
23-Jul	21.3	23.0	3.10	71
30-Jul	21.6	27.3	3.51	42
6-Aug	23.4	27.0	3.78	59
13-Aug	22.9	24.1	2.71	64
20-Aug	23.7	26.0	4.66	60
27-Aug	22.5	27.8	2.62	54
3-Sep	22.3	26.0	5.36	57
10-Sep				
24-Sep	19.0	26.0	7.30	106
1-Oct	19.7	26.0	7.50	90
8-Oct	16.7	26.0	7.57	90
15-Oct	16.0	26.0	7.19	72
22-Oct	16.1	26.0	6.45	72
29-Oct	14.0	26.0	7.16	116
Average	**20.1**	**25.7**	**5.20**	**72**



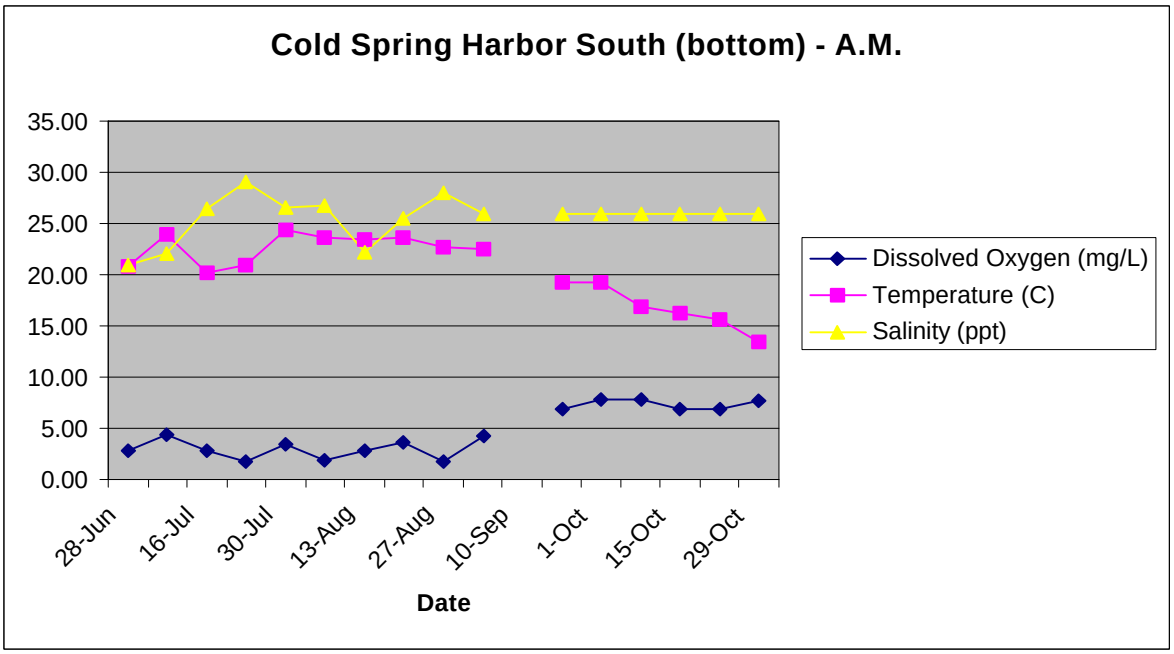
Cold Spring Harbor North (bottom) - P.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun				
28-Jun				
9-Jul				
16-Jul	20.4	26.7	4.56	55
23-Jul				
30-Jul	23.9	23.3	4.23	57
5-Aug	23.9	26.8	5.24	65
13-Aug				
19-Aug	23.7	26.1	5.56	46
26-Aug	22.6	25.0	3.32	52
3-Sep				
10-Sep	23.4	26.0	5.83	66
24-Sep				
1-Oct				
8-Oct	16.9	26.0	9.56	72
15-Oct				
22-Oct				
29-Oct				
Average	**22.1**	**25.7**	**5.47**	**59**



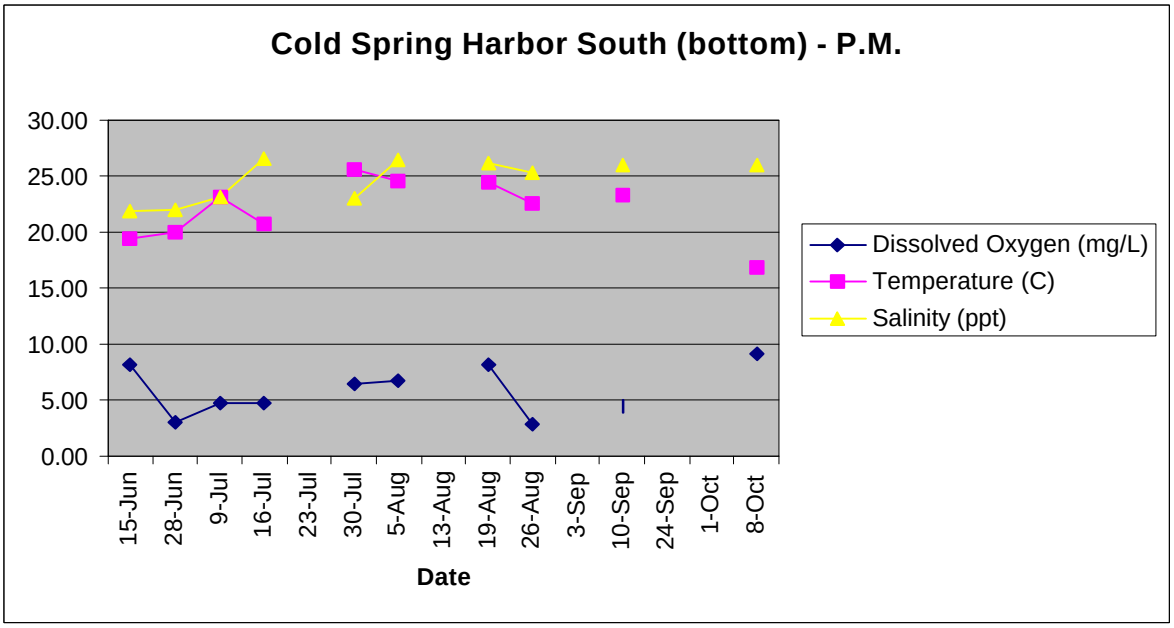
Cold Spring Harbor South (bottom) - A.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun				
28-Jun	20.8	21.0	2.85	39
9-Jul	23.9	22.1	4.40	40
16-Jul	20.2	26.4	2.75	51
23-Jul	21.0	29.1	1.76	76
30-Jul	24.3	26.5	3.41	52
6-Aug	23.6	26.7	1.90	54
13-Aug	23.5	22.2	2.83	65
20-Aug	23.6	25.5	3.58	56
27-Aug	22.6	28.0	1.76	57
3-Sep	22.5	26.0	4.20	56
10-Sep				
24-Sep	19.2	26.0	6.82	80
1-Oct	19.2	26.0	7.88	90
8-Oct	16.8	26.0	7.85	72
15-Oct	16.2	26.0	6.84	44
22-Oct	15.6	26.0	6.86	80
29-Oct	13.4	26.0	7.61	80
Average	**20.4**	**25.6**	**4.58**	**62**



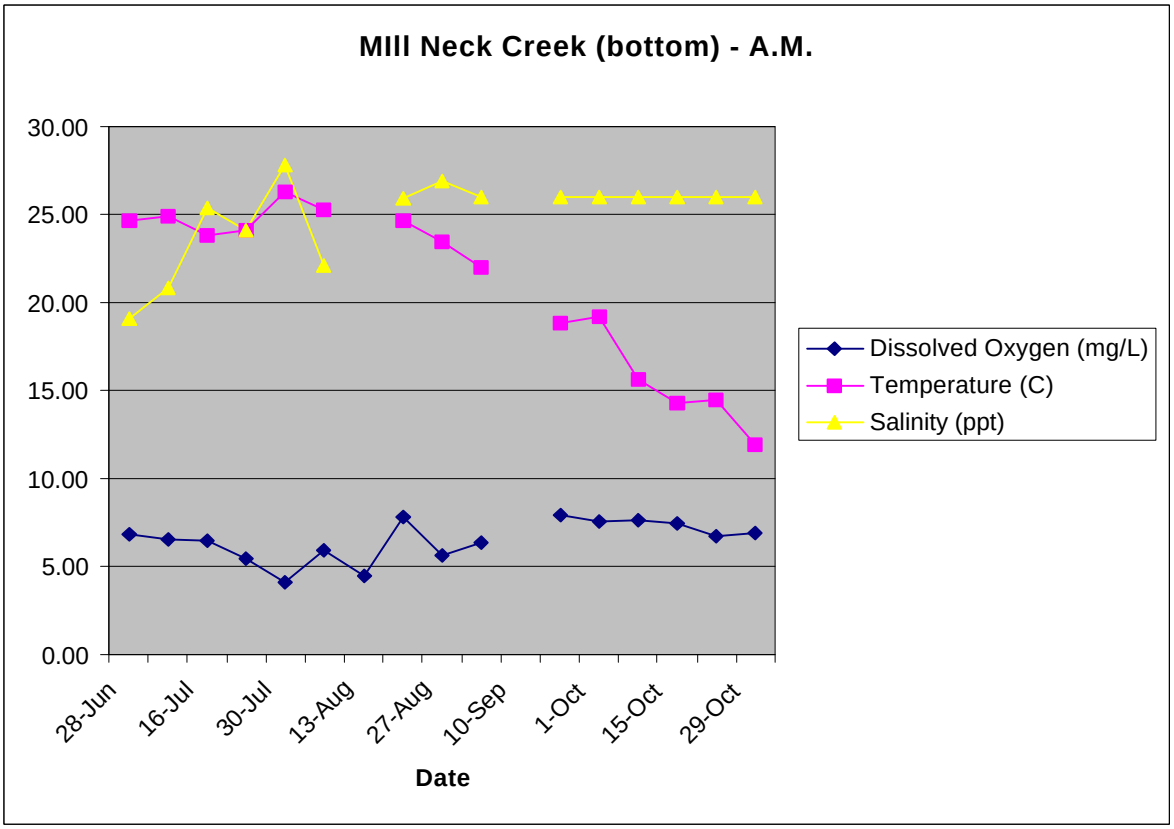
Cold Spring Harbor South (bottom) - P.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun	19.5	21.8	8.20	66
28-Jun	20.0	22.0	2.98	41
9-Jul	23.2	23.2	4.68	62
16-Jul	20.7	26.6	4.67	44
23-Jul				
30-Jul	25.6	23.0	6.40	51
5-Aug	24.6	26.4	6.69	58
13-Aug				
19-Aug	24.4	26.2	8.10	49
26-Aug	22.6	25.3	2.86	43
3-Sep				
10-Sep	23.3	26.0	4.39	64
24-Sep				
1-Oct				
8-Oct	16.8	26.0	9.08	72
15-Oct				
22-Oct				
29-Oct				
Average	**22.1**	**24.7**	**5.81**	**55**



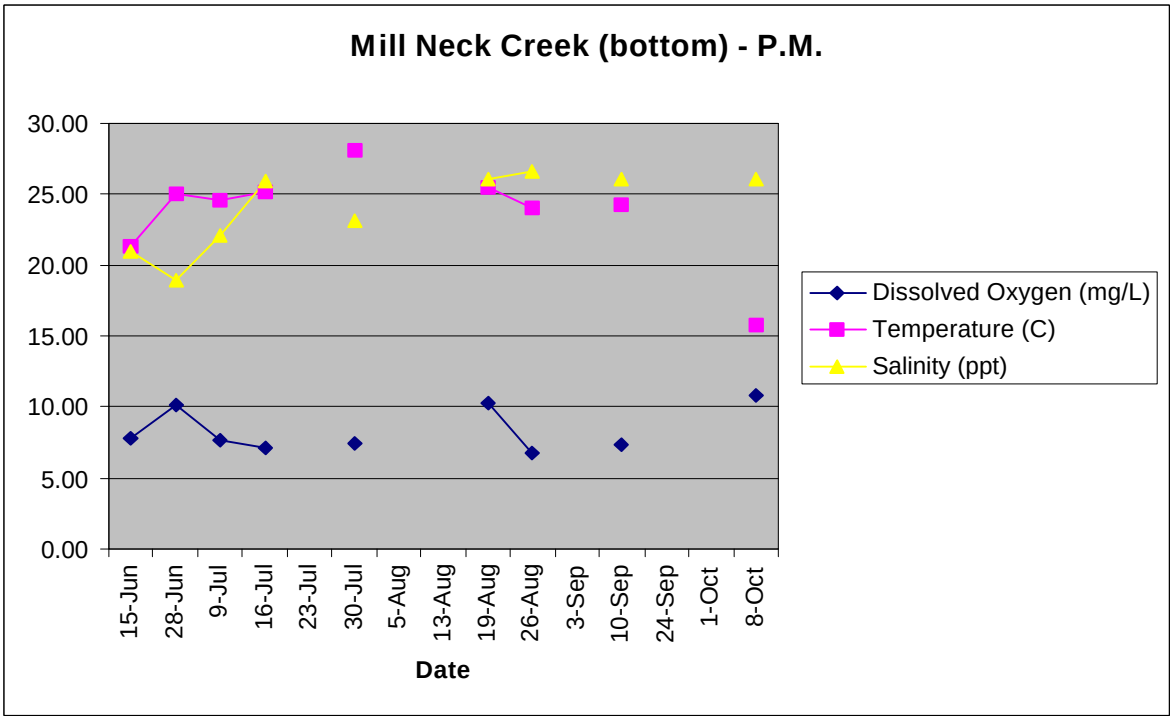
Mill Neck Creek (bottom) - A.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun				
28-Jun	24.6	19.1	6.83	29
9-Jul	24.9	20.8	6.57	44
16-Jul	23.8	25.4	6.50	52
23-Jul	24.1	24.1	5.49	63
30-Jul	26.3	27.8	4.11	51
5-Aug	25.3	22.1	5.89	54
13-Aug			4.50	
20-Aug	24.6	25.9	7.82	44
27-Aug	23.5	26.9	5.67	44
3-Sep	22.0	26.0	6.32	48
10-Sep				
24-Sep	18.8	26.0	7.95	50
1-Oct	19.2	26.0	7.59	63
8-Oct	15.6	26.0	7.61	72
15-Oct	14.3	26.0	7.49	54
22-Oct	14.5	26.0	6.75	98
29-Oct	11.9	26.0	6.90	B
Average	**20.9**	**24.9**	**6.50**	**55**



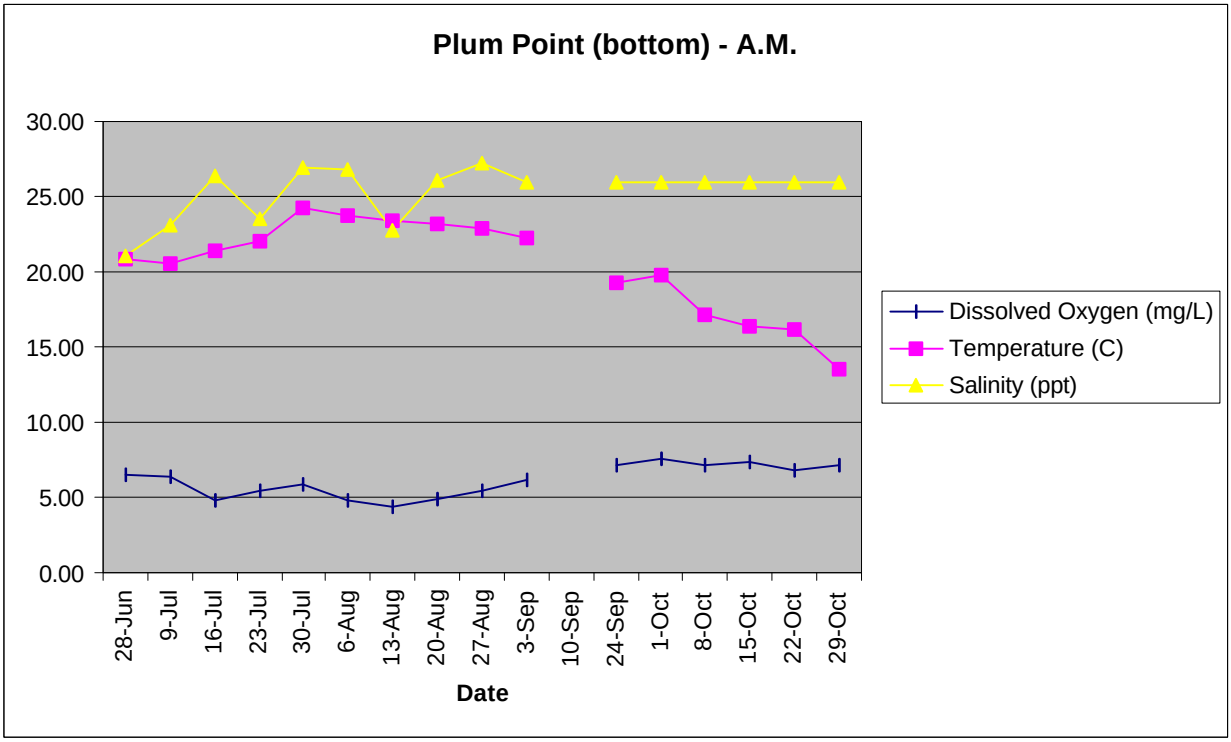
Mill Neck Creek (bottom) - P.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun	21.3	21.0	7.78	49
28-Jun	25.0	19.0	10.10	18
9-Jul	24.6	22.1	7.64	40
16-Jul	25.1	25.9	7.14	32
23-Jul				
30-Jul	28.1	23.1	7.50	31
5-Aug				
13-Aug				
19-Aug	25.5	26.0	10.24	
26-Aug	24.0	26.6	6.73	29
3-Sep				
10-Sep	24.2	26.0	7.36	38
24-Sep				
1-Oct				
8-Oct	15.8	26.0	10.79	B
15-Oct				
22-Oct				
29-Oct				
Average	**23.7**	**24.0**	**8.36**	**34**



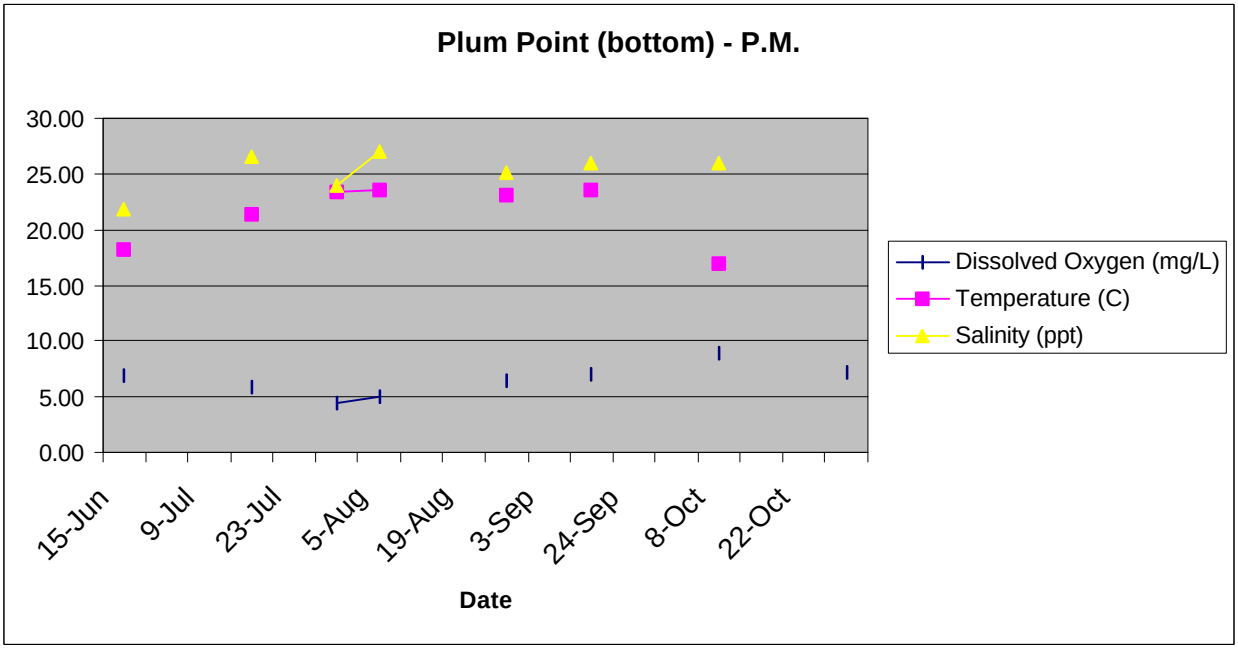
Plum Point (bottom)- A.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun				
28-Jun	20.8	21.1	6.47	51
9-Jul	20.5	23.1	6.42	61
16-Jul	21.4	26.4	4.82	63
23-Jul	22.0	23.5	5.45	76
30-Jul	24.3	26.9	5.80	52
6-Aug	23.7	26.8	4.82	58
13-Aug	23.4	22.8	4.32	66
20-Aug	23.2	26.1	4.92	56
27-Aug	22.9	27.2	5.42	
3-Sep	22.2	26.0	6.18	81
10-Sep				
24-Sep	19.3	26.0	7.16	103
1-Oct	19.8	26.0	7.60	96
8-Oct	17.1	26.0	7.16	90
15-Oct	16.4	26.0	7.31	72
22-Oct	16.2	26.0	6.83	80
29-Oct	13.5	26.0	7.15	98
Average	**20.4**	**25.4**	**6.11**	**74**



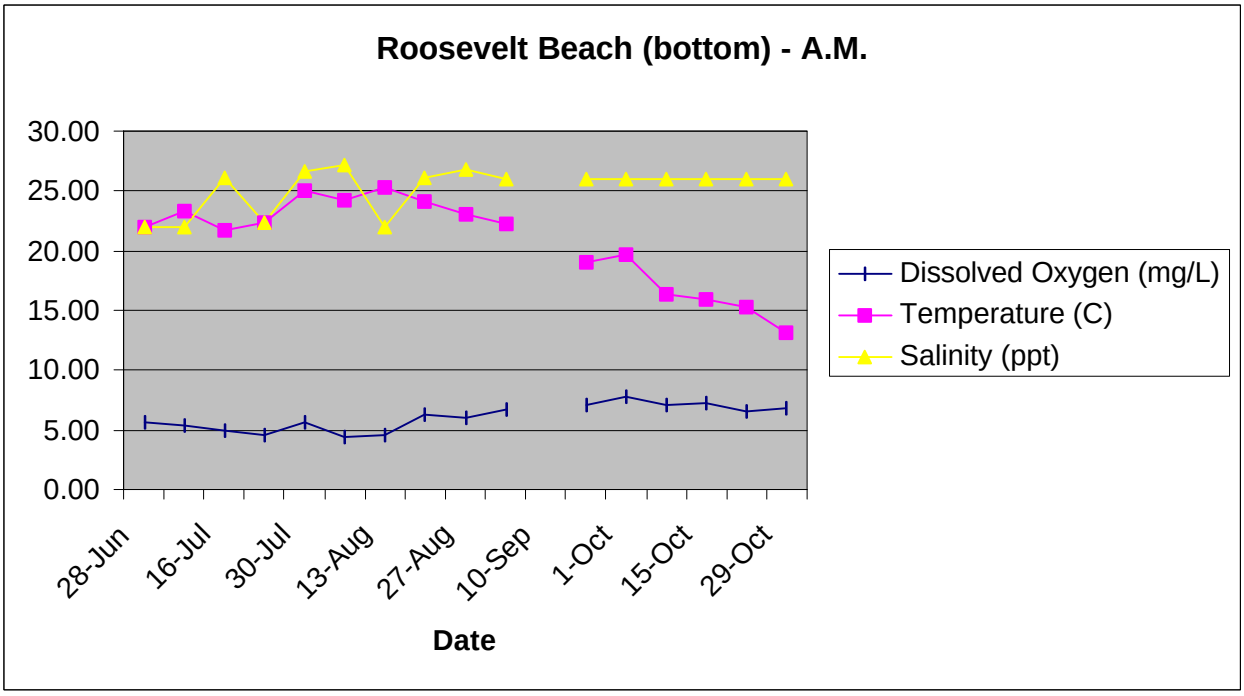
Plum Point (bottom)- P.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun	18.2	21.8	6.88	66
28-Jun				
9-Jul				
16-Jul	21.4	26.6	5.84	53
23-Jul				
30-Jul	23.4	24.0	4.44	51
5-Aug	23.6	27.0	5.09	64
13-Aug				
19-Aug				
26-Aug	23.1	25.1	6.43	82
3-Sep				
10-Sep	23.6	26.0	7.10	86
24-Sep				
1-Oct				
8-Oct	16.9	26.0	8.86	96
15-Oct				
22-Oct				
29-Oct			7.15	
Average	**21.5**	**25.2**	**6.47**	**71**



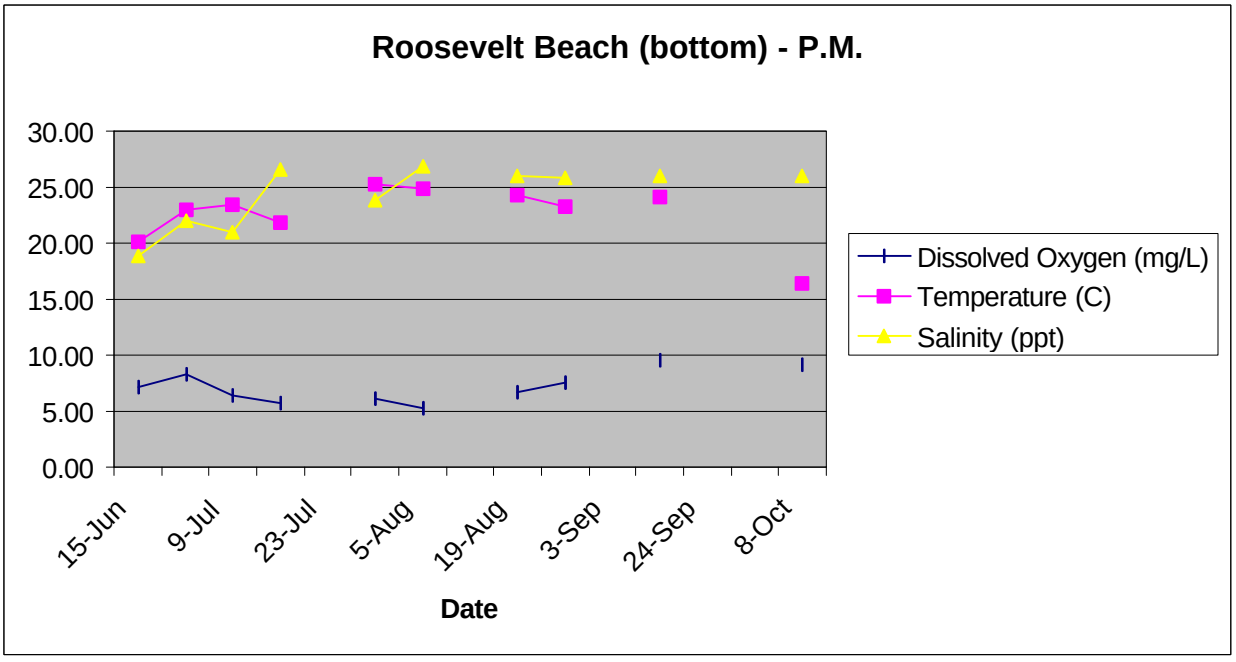
Roosevelt Beach (bottom) - A.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun				
28-Jun	22.0	21.9	5.68	28
9-Jul	23.3	22.0	5.34	51
16-Jul	21.7	26.1	4.92	54
23-Jul	22.3	22.4	4.53	65
30-Jul	25.0	26.7	5.65	59
6-Aug	24.3	27.2	4.36	66
13-Aug	25.3	22.0	4.50	34
20-Aug	24.1	26.1	6.29	58
27-Aug	23.1	26.8	6.06	64
3-Sep	22.2	26.0	6.65	
10-Sep				
24-Sep	19.0	26.0	7.10	70
1-Oct	19.7	26.0	7.76	B
8-Oct	16.4	26.0	7.09	72
15-Oct	15.9	26.0	7.29	B
22-Oct	15.3	26.0	6.57	80
29-Oct	13.1	26.0	6.84	B
Average	**20.8**	**25.2**	**6.04**	**58**



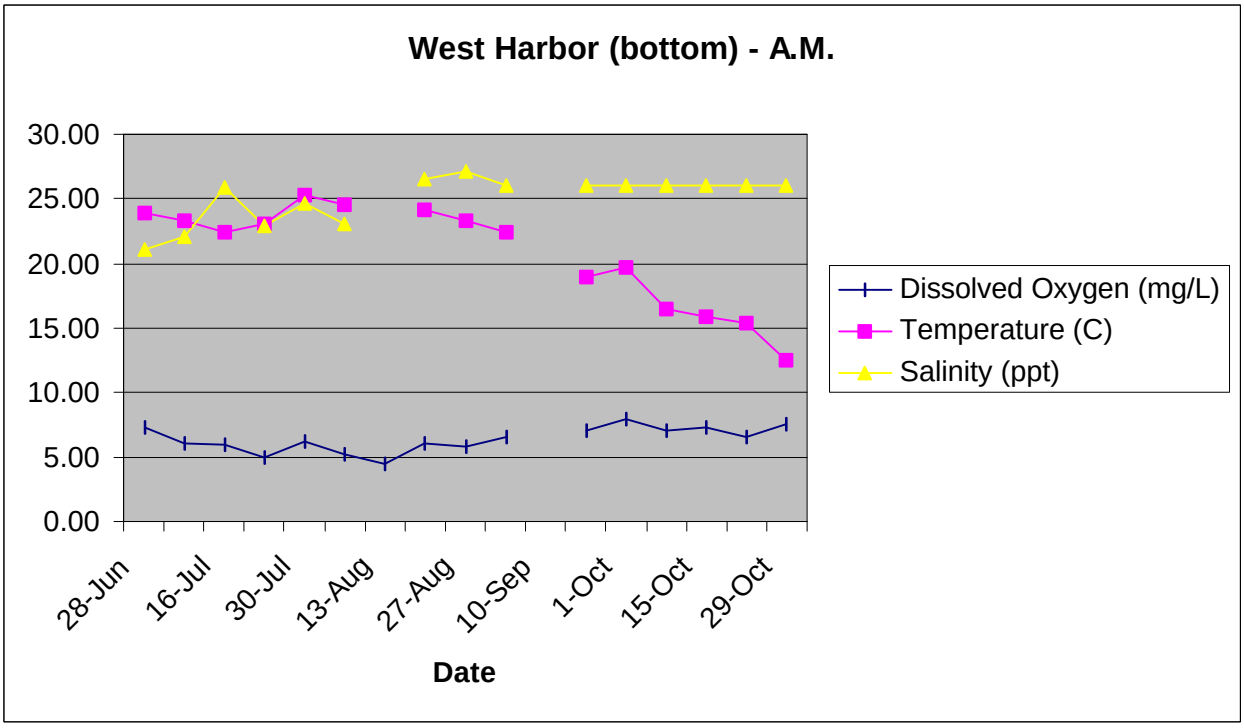
Roosevelt Beach (bottom)- P.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun	20.1	18.8	7.10	52
28-Jun	23.0	22.0	8.24	41
9-Jul	23.4	21.0	6.36	56
16-Jul	21.8	26.6	5.70	64
23-Jul				
30-Jul	25.3	23.8	6.13	64
5-Aug	24.8	26.8	5.30	64
13-Aug				
19-Aug	24.3	26.0	6.66	50
26-Aug	23.3	25.8	7.57	45
3-Sep				
10-Sep	24.1	26.0	9.52	B
24-Sep				
1-Oct				
8-Oct	16.4	26.0	9.17	B
15-Oct				
22-Oct				
29-Oct				
Average	**22.7**	**24.3**	**7.18**	**55**



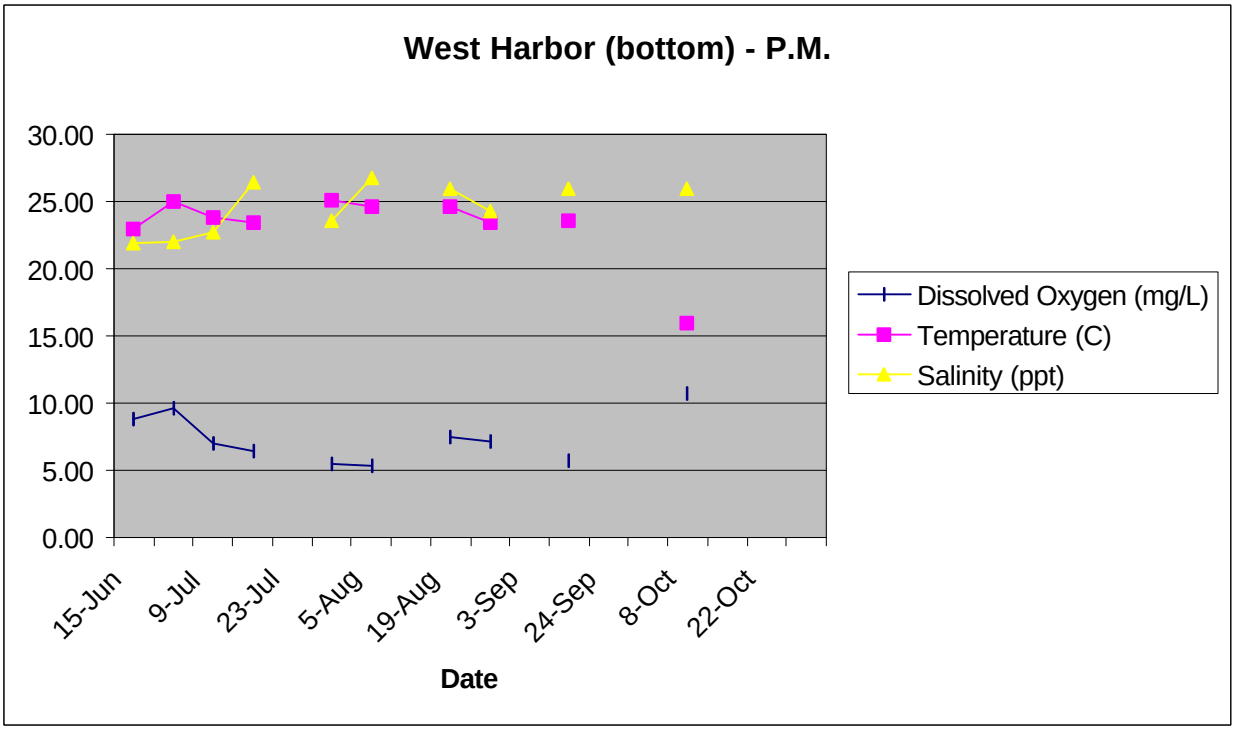
West Harbor (bottom) - A.M.

Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun				
28-Jun	23.9	21.1	7.36	40
9-Jul	23.3	22.1	6.07	36
16-Jul	22.5	25.9	5.92	54
23-Jul	23.0	22.9	4.90	65
30-Jul	25.3	24.7	6.20	51
5-Aug	24.5	23.0	5.19	66
13-Aug			4.42	
20-Aug	24.2	26.5	6.03	
27-Aug	23.3	27.2	5.84	52
3-Sep	22.4	26.0	6.61	64
10-Sep				
24-Sep	19.0	26.0	7.10	70
1-Oct	19.7	26.0	7.95	81
8-Oct	16.5	26.0	7.08	72
15-Oct	15.9	26.0	7.31	90
22-Oct	15.4	26.0	6.56	98
29-Oct	12.5	26.0	7.53	B
Average	**20.8**	**25.0**	**6.38**	**65**



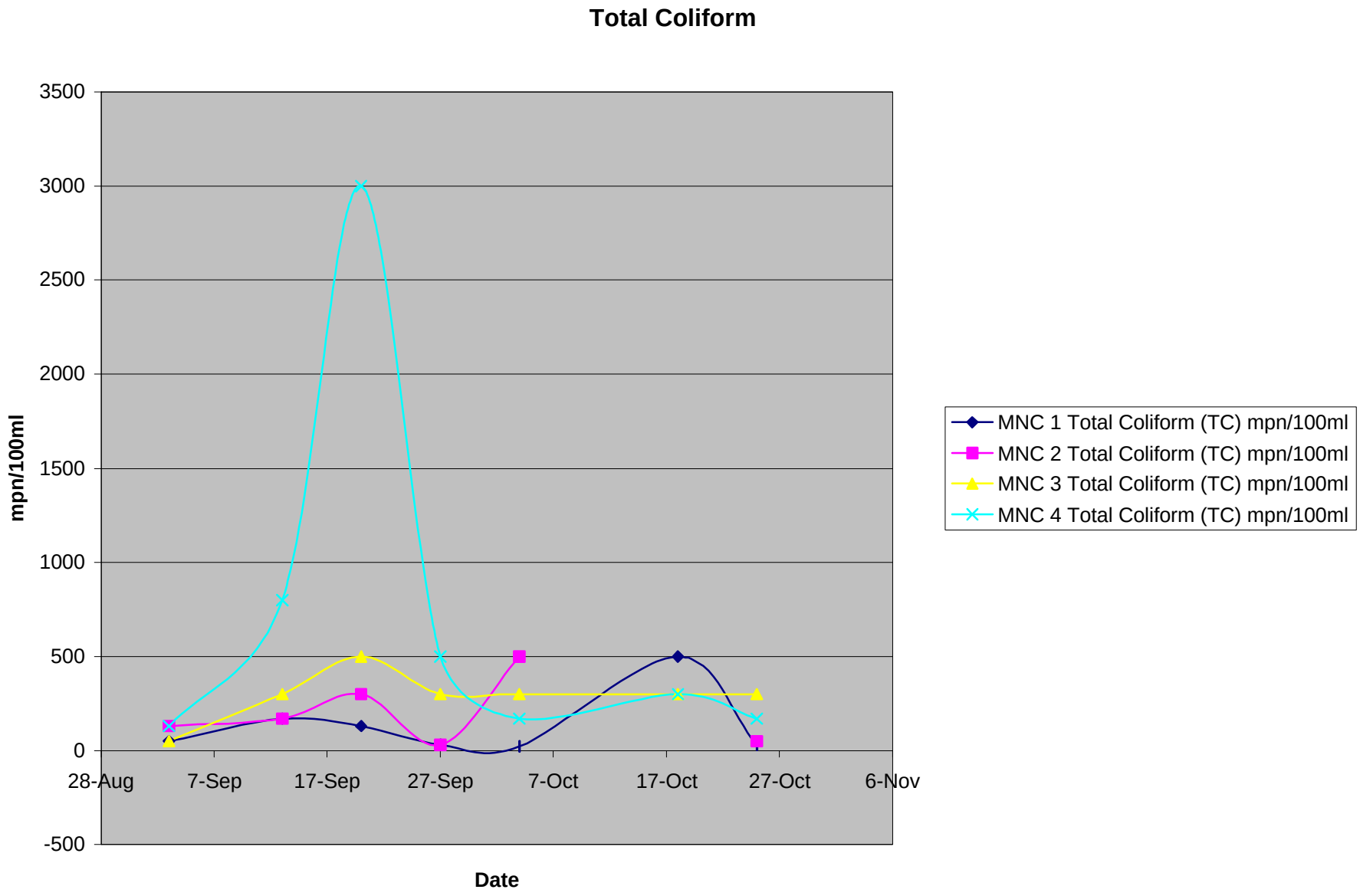
West Harbor (bottom) - P.M.

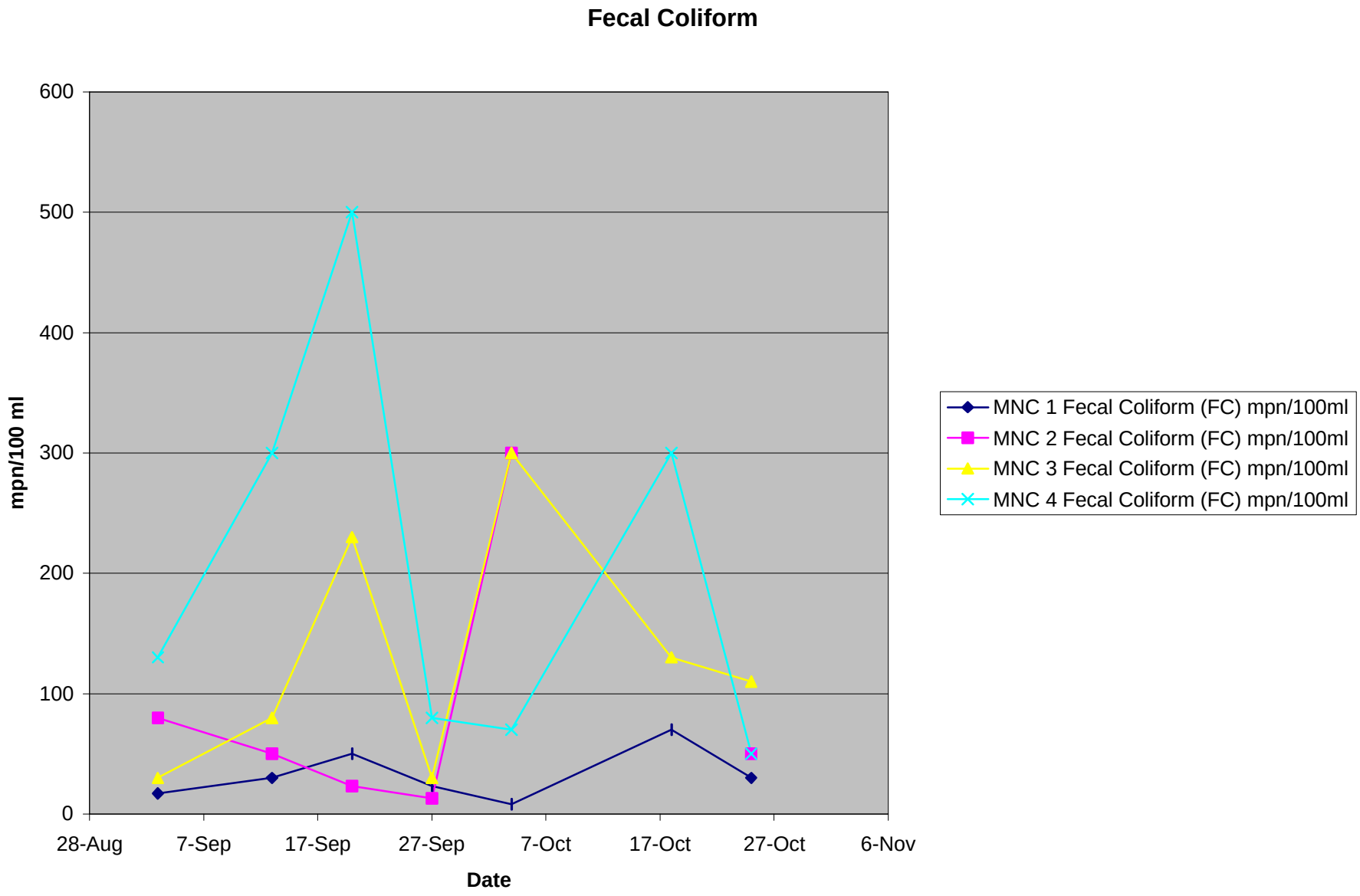
Date	Temperature (C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Secchi Depth (inches)
15-Jun	23.0	21.9	8.76	58
28-Jun	25.0	22.0	9.62	41
9-Jul	23.8	22.7	7.06	85
16-Jul	23.5	26.4	6.39	
23-Jul				
30-Jul	25.1	23.6	5.53	51
5-Aug	24.6	26.8	5.34	64
13-Aug				
19-Aug	24.6	26.0	7.50	
26-Aug	23.5	24.3	7.15	44
3-Sep				
10-Sep	23.6	26.0	5.74	42
24-Sep				
1-Oct				
8-Oct	16.0	26.0	10.72	72
15-Oct				
22-Oct				
29-Oct				
Average	**23.3**	**24.6**	**7.38**	**57**



Appendix 3: Bacteria Data and Graphs

Location	Parameter	Date							Locations	Log AVG (9/3 - 10/4)	Log AVG (9/13 - 10/18)	Log AVG (9/20 - 10/25)
		3-Sep	13-Sep	20-Sep	27-Sep	4-Oct	18-Oct	25-Oct				
MNC 1	*Total Coliform (TC) mpn/100ml*	50	170	130	30	22	500	30	**MNC 1 - TC**	*59.24*	*93.88*	*66.36*
MNC 1	*Fecal Coliform (FC) mpn/100ml*	17	30	50	23	8	70	30	**MNC 1 - FC**	*21.59*	*28.66*	*28.66*
MNC 2	*Total Coliform (TC) mpn/100ml*	130	170	300	30	500		50	**MNC 2 - TC**	*158.31*		*130.78*
MNC 2	*Fecal Coliform (FC) mpn/100ml*	80	50	23	13	300		50	**MNC 2 - FC**	*51.40*		*46.79*
MNC 3	*Total Coliform (TC) mpn/100ml*	50	300	500	300	300	300	300	**MNC 3 - TC**	*232.20*	*332.27*	*332.27*
MNC 3	*Fecal Coliform (FC) mpn/100ml*	30	80	230	30	300	130	110	**MNC 3 - FC**	*86.94*	*116.57*	*124.24*
MNC 4	*Total Coliform (TC) mpn/100ml*	130	800	3000	500	170	300	170	**MNC 4 - TC**	*483.85*	*571.94*	*419.59*
MNC 4	*Fecal Coliform (FC) mpn/100ml*	130	300	500	80	70	300	50	**MNC 4 - FC**	*161.30*	*190.67*	*133.24*
	Shellfishing	**Swimming**							**Key:**	Bold Italics = meets swimming and shellfishing standards		
Total Coliform	LOG AVG 30 days <70/100ml	LOG AVG 30 days < 2,400/100ml								**Bold = meets shellfish standards**		
Fecal Coliform	LOG AVG 30 days <14/100ml	LOG AVG 30 days < 200/100ml								*Italics = meets swimming standards*		
		Total Coliform - 10% > 5,000 *mpn/100ml*										
		Fecal Coliform - any one sample > 1,000 *mpn/100ml*										


Total Coliform
3500
3000
2500
2000
1500
1000
500
0
-500
mpn/100ml
28-Aug
7-Sep
17-Sep
27-Sep
7-Oct
17-Oct
27-Oct
6-Nov
Date
MNC 1 Total Coliform (TC) mpn/100ml
MNC 2 Total Coliform (TC) mpn/100ml
MNC 3 Total Coliform (TC) mpn/100ml
MNC 4 Total Coliform (TC) mpn/100ml


Fecal Coliform
600
500
400
300
200
100
0
mpn/100 ml
28-Aug
7-Sep
17-Sep
27-Sep
7-Oct
17-Oct
27-Oct
6-Nov
Date
MNC 1 Fecal Coliform (FC) mpn/100ml
MNC 2 Fecal Coliform (FC) mpn/100ml
MNC 3 Fecal Coliform (FC) mpn/100ml
MNC 4 Fecal Coliform (FC) mpn/100ml