

PLEASANT BAY CITIZEN WATER QUALITY MONITORING PROGRAM INTERIM REPORT 2000-2008



Pleasant Bay Resource Management Alliance
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PLEASANT BAY ALLIANCE CITIZEN WATER QUALITY MONITORING PROGRAM INTERIM REPORT 2000-2008



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The success of the Pleasant Bay program rests with the dedication of its past and present volunteers who spend many hours training, testing water quality using visual, optical and electronic instruments, collecting water samples at surface and bottom and transporting samples to the laboratory for analysis.

The Alliance offers special thanks to the following individuals who over the years have coordinated volunteer monitoring activities for all stations: George Olmsted, Martha Stone, Bob Wineman, Peg Wineman, Heinz Proft, Bill Coleman, Carolyn Kennedy and Judy Scanlon. The Alliance would also like to express its appreciation to Dr. Robert Duncanson for his technical expertise and guidance.

We would also like to thank the many past and present citizen volunteers who are listed below. It is the tremendous contributions of time, energy and experience of our many volunteers and contributors that accounts for the ultimate success of the program. Thank you!



Photo courtesy of Jan Schneider

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1. INTRODUCTION

The Pleasant Bay Resource Management Alliance is pleased to present this *Interim Report* of water quality data gathered under the *Pleasant Bay Citizen Water Quality Monitoring Program*. Given the high degree of public interest and volunteer support for our program, the Alliance issues periodic interim reports to provide citizens with a summary of data collected. This report summarizes data collected between 2000 (the program's first monitoring season) and 2008 (the most recent year for which data are available.) Previous *Interim Reports* were issued covering data from the 2000 and 2001 monitoring seasons, respectively, and in 2004 the Alliance issued a report summarizing all data collected through 2003.

The nine consecutive years of data compiled in this report have made a significant contribution to our understanding of nutrient-related water quality conditions in Pleasant Bay. Data collected by the program were integrated into the analysis conducted by the Massachusetts Estuaries Project (MEP). The MEP confirmed and illuminated many of the same findings demonstrated by data presented in previous *Interim Reports*. Notably, the MEP documented signs of nutrient-related stress throughout the system and found that thirteen of seventeen subembayments exhibited some level of impaired or degraded habitat health due to an excess of nitrogen.

The MEP analysis provided the technical basis for the development of Total Nitrogen Total Maximum Daily Loads (TMDLs). TMDLs are the regulatory threshold levels of a pollutant—in this case nitrogen—that a water body can assimilate and remain healthy. TMDLs are established by the Massachusetts Department of Environmental Protection and are approved by the U.S. Environmental Protection Agency. Data collected by the water quality monitoring program have provided a firm foundation for planning nutrient management strategies on a watershed wide basis. In the coming years the water quality monitoring program will continue to play an important role in evaluating and monitoring the effectiveness as nutrient management strategies are implemented.

This *Interim Report* contains the following sections:

Section 2 provides an overview of the *Pleasant Bay Citizen Water Quality Program*, including program methods and purposes. Those interested in more detail on program methods are referred to the text of the *Pleasant Bay Citizen Water Quality Monitoring Program Quality Assurance Project Plan (QAPP)*, which is available at www.pleasantbay.org.

Section 3 provides a summary of findings for the Eutrophication Index, Total Nitrogen, Pigment Concentration and Dissolved Oxygen (DO).

Appendix A presents data for each station in chart form.

Appendix B provides averages of each data parameter for each station in tabular form.

Appendix C describes how the eutrophication index is calculated.

This report is intended to provide interested citizens and local officials with a compendium of data in an easily readable format. It does not provide a detailed assessment of trends based on rigorous statistical analyses.

2. BACKGROUND AND METHODS

2.A BACKGROUND

The Pleasant Bay Citizen Water Quality Monitoring Program is an outgrowth of the *Pleasant Bay Resource Management Plan* adopted by the watershed towns in 1998, and updated in 2003 and 2008. In 1999, with the support of grants from the Executive Office of Environmental Affairs and the Friends of Pleasant Bay, the Alliance designed the bay-wide monitoring program, developed a draft Quality Assurance Project Plan (QAPP)¹, and purchased state-of-the-art monitoring equipment. The Alliance, in cooperation with the Friends of Chatham Waterways and Orleans Water Quality Task Force, helped to recruit and train more than 150 volunteers to monitor field conditions and collect water quality samples throughout the Bay.

Monitoring under the Alliance program occurred at sixteen locations in 2000-2001. In 2002 five more stations were added by the Alliance to provide additional data necessary for modeling of the Bay through the Massachusetts Estuaries Project (MEP). These stations were further augmented by stations located in the Bay and maintained by the Towns of Orleans and Chatham. All stations with data included in this report are listed in Table 1 and shown on Figure 1. Table 2 lists additional stations that were temporarily monitored to gather data for the Massachusetts Estuaries Project. At the height of monitoring for the MEP there were 36 stations located throughout the Bay. Following the release of the MEP Technical Report for Pleasant Bay in May 2006, the number of stations monitored under the Alliance program was reduced to nineteen and in 2007 further reduced to sixteen. With the completion of the MEP, the Town of Chatham reduced the number of its monitoring stations, and the Town of Orleans concluded its monitoring in the Bay, although some of the Orleans' stations were subsumed under the Alliance's program. At this time, the Alliance program encompasses stations previously funded by the respective towns, CM-13 in Chatham and WMO-3, -5, -6 and -10 in Orleans.

Samples are collected at two depths (one-half meter below surface and one-half meter above bottom) for all but five stations (PBA-5, -5A, WMO-3, -5, -6) which are shallow and are monitored at mid-depth. During each sampling event stations are randomly selected for duplicate sampling as specified in the QAPP. Once collected, water samples are transported to the School for Marine Science and Technology (SMAST) Laboratory at the University of Massachusetts-Dartmouth campus for nutrient analysis.

The formation of a second inlet in Nauset Beach in 2007 was a significant physical change which occurred during the period of data collection. An updated hydrodynamic (flushing) study undertaken in 2008 concluded that the new inlet had increased tide range by 7/10 of a foot and increased the tidal prism (the volume of water exchanging with the Atlantic Ocean) by 14 percent. Water quality modeling based on the updated hydrodynamic model concluded that although water column nitrogen concentrations improved in some areas of the system such as Little Pleasant Bay, the change was not sufficient to meet TMDL threshold concentrations at sentinel stations. It is also noted that the water quality improvements would not persist indefinitely and could be expected to diminish if the second inlet were to migrate southward in a pattern consistent with historical cycles of barrier beach geomorphology.

¹ The Massachusetts Department of Environmental Protection approved a final QAPP in 2000.

2.B PROGRAM OBJECTIVES

Water quality data from the Pleasant Bay program is used to meet the following program objectives:

- ✧ Provide comprehensive and reliable data on water quality conditions in the Bay, with emphasis on nutrient levels;
- ✧ Monitor nitrogen-loading trends by calculating the eutrophication index for each sampling location;
- ✧ Provide the eutrophication index and other data for use in policy, regulatory and educational applications; and
- ✧ Provide data necessary for on-going modeling and monitoring in support of local and regional nutrient management efforts.

Table 1. Pleasant Bay Sampling Locations Included in this Report

ID Number	Name	Sponsor	Data Years in Report
PBA-1	Chatham Harbor	PBA	2000-2006
PBA-2	Bassing Harbor	PBA	2000-2004
PBA-3	Inner Ryders Cove	PBA	2000-2008
CM-13	Outer Ryders Cove	Chatham	2000-2008
CM-14	Frost Fish Creek	Chatham	2000-2005
PBA-4	Crow's Pond	PBA	2000-2008
PBA-5	Muddy Creek	PBA	2000-2008
PBA-5A	Muddy Creek-Upper	PBA	2002-2008
PBA-6	Big Bay-SW	PBA	2000-2005
PBA-7	Big Bay-Mid	PBA	2000-2005
PBA-8	Big Bay-NE	PBA	2000-2008
PBA-9	Round Cove	PBA	2000-2008
PBA-10	Quanset Pond	PBA	2000-2008
PBA-11	Paw Wah Pond	PBA	2000-2008
PBA-12	Namequoit-South	PBA	2000-2008
PBA-13	Namequoit-North	PBA	2000-2008
PBA-14	Arey's Pond	PBA	2000-2006
PBA-15	Kescayogansett Pond	PBA	2000-2008
PBA-16	Meetinghouse Pond	PBA	2000-2006
PBA-17A	Atlantic Ocean Control	PBA	2005-2008
PBA-18	Allen's/Ministers Point	PBA	2002-2005
PBA-19	Nickersons Neck	PBA	2002-2005
PBA-20	Strong Island	PBA	2002-2005
PBA-21	Little Pleasant Bay	PBA	2002-2005
WMO-3	Pochet Mouth	PBA	2006-2008**
WMO-5	Pochet Upper	PBA	2006-2008***
WMO-6	Namequoit River Mid	PBA	2006-2008**
WMO-10	River @ Rattles Dock*	PBA	2006-2008**

*WMO-10 is called "Meetinghouse Pond" in the MEP Technical Report for Pleasant Bay (2006.)

**2003-2004 Data available from Town of Orleans

***2003-2005 Data available from Town of Orleans

Table 2. Pleasant Bay Sampling Locations Not Included in this Report**

ID Number	Name	Sponsor	Data Years Available
WMO-2	Pleasant Bay off Quanset	Orleans	2003-2004
WMO-4	Pochet-Mid	Orleans	2003-2004
WMO-7	Namequoit River-Mouth	Orleans	2003-2004
WMO-8	Lower River	Orleans	2003-2004
WMO-9	Mid River	Orleans	2003-2005
WMO-12*	Little Quanset Pond	Orleans	2003-2004
WMO-13	Stream from Duck Marsh	Orleans	2003-2004
WMO-43	Pilgrim to Lonnie's Stream	Orleans	2003-2004

*WMO 12 will be monitored by the Alliance beginning in 2010.

**2003-2004 Data available from Town of Orleans

1.C PARAMETERS

Data from the Pleasant Bay program are used to calculate the Eutrophication Index for each station. The index is a single number used to characterize the relative water quality of a given embayment. Nitrogen, phytoplankton pigment concentrations and DO are components of the index. A description of how the index is calculated is found in Appendix C. Eutrophication is the oversupply of nutrients to a water body and can cause waters to become very clouded or murky, resulting in the loss of photosynthetic plants (e.g. eelgrass) and further oxygen depletion due to the decomposition of increased organic matter. While not a direct threat to human health, eutrophication can cause aquatic plants and animals to die. The index is widely accepted as a tool for describing the impact of excessive nutrients from surrounding land uses and for monitoring the general condition of the Bays water quality, and has been used by the Buzzards Bay Baywatcher's program since 1992.

Most of the water quality parameters monitored by the Alliance are necessary to calculate the index. Total depth, salinity, and temperature, while not used in the index, are also important water quality indicators. The following is a list of parameters measured by the program and their relationship to eutrophication.²

Salinity, Temperature, and Dissolved Oxygen (DO) are essential water quality parameters and are relatively easy and inexpensive to collect. Oxygen concentrations (mg/l and % saturation) and temperature are measured with YSI 550 Dissolved Oxygen (DO) meters. Surface salinity measurements are made using an optical refractometer to calibrate DO meters. Oxygen is produced by plants, algae and other photosynthetic organisms (e.g. cyanobacteria) and is consumed through the respiration of animals, plants and microbes at night and the decomposition of organic matter. Oxygen levels are generally lowest in the early morning.

Secchi Depth is a measurement of water transparency. A black and white disc known as a Secchi disk is lowered into the water. The average depth at which the disk disappears and reappears from view is the Secchi depth. A Secchi depth measurement is an indirect measure of light availability for photosynthesis by aquatic plants such as algae and eelgrass. Suspended sediments and too much algae growing in the water due to excessive nutrients will reduce the Secchi depth.

Phytoplankton Pigments (Chlorophyll-a, Phaeophytin) are found in living and dead phytoplankton (microalgae) that turn waters green or brown, reducing sunlight penetration.

² Baywatchers II nutrient related water quality of Buzzards Bay embayments: a synthesis of Baywatchers monitoring 1992-1998, December 1999.

Dissolved Inorganic Nitrogen (DIN) is found in three forms: ammonia (NH₃), nitrite (NO₂) and nitrate (NO₃). DIN is usually found at low concentrations in coastal waters because aquatic plants and algae quickly take up these forms.

Particulate Organic Nitrogen (PON) is nitrogen that has been incorporated into microscopic floating plants, known as phytoplankton, and microscopic floating animals, or zooplankton. DIN is usually efficiently converted into PON in coastal waters.

Dissolved Organic Nitrogen (DON) is a mixture of soluble organic nitrogen compounds (e.g., amino acids, urea) released by decaying organic matter. DON is an organic form of nitrogen that will pass through a filter.

Total Organic Nitrogen (TON) is the sum of PON and DON.

Total Nitrogen (TN) is the combination of organic (TON) and inorganic (DIN) nitrogen, and will be high in an estuary that is eutrophic (nutrient enriched).

Particulate Organic Carbon (POC) is one measure of the quantity of plant/animal life in the water column.

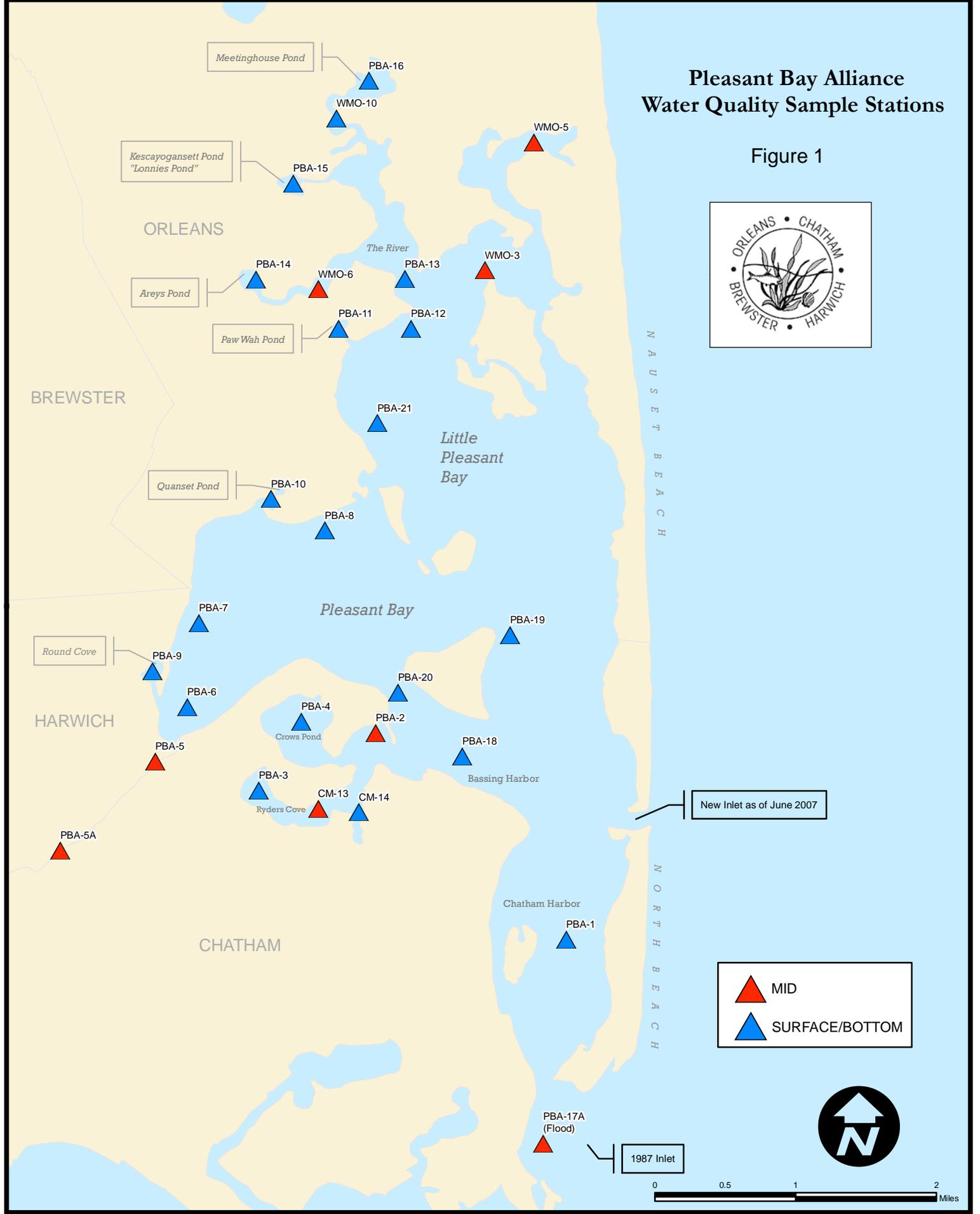
1.D QUALITY CONTROL

Quality control procedures for the program are detailed in the *Pleasant Bay Citizen Water Quality Monitoring Program Quality Assurance Project Plan (QAPP)*. The QAPP provides specifications for volunteer training, the handling and transport of samples, duplicate sampling to evaluate the statistical reliability of samples, and instrument testing, inspection and maintenance. The QAPP was approved by the Massachusetts Department of Environmental Protection in 2000.

As noted above, duplicate samples are randomly selected during each monitoring event. The sample recovery rate for all monitoring seasons has exceeded 90%. Duplicate samples have averaged 10% of total samples over the period.

Pleasant Bay Alliance Water Quality Sample Stations

Figure 1



	MID
	SURFACE/BOTTOM



3. SUMMARY OF FINDINGS

This section summarizes a general overview of findings based on the data collected. Data are presented in chart form for each station in Appendix A, and in summary tabular form in Appendix B of this report. *It should be noted that the findings, figures and summary tables presented in this report were prepared based on a limited analysis of all the station data (including the averaging of surface and bottom measurements and duplicate sample results).*

You will note that there are some values missing from the figures. These are not included because either (a) data were collected under a separate town program or (b) the samples were not collected for some reason or did not meet the quality control standards for the program. Overall, an insignificant number of values were left out for the latter reason.

3.A EUTROPHICATION INDEX

As noted above, the Eutrophication Index is a composite of several water quality parameters that provides an overall indication of the effects of nutrients in an estuarine system. Detail on how the index is calculated is provided in Appendix C. The index is related to water quality conditions in the following table:

Table 3. Water Quality Condition Based on Eutrophication Index

Water Quality Condition	Eutrophication Index
Good to Excellent	65-100
Fair	35-65
Eutrophic	<35

Source: Baywatchers II nutrient related water quality of Buzzards Bay embayments: a synthesis of Baywatchers monitoring 1992-1998, December 1999.

3.A.1 Southern Embayments

The index for Outer Ryder’s Cove (CM-13) between 2005-2008 was in the good to excellent range, showing improvement over the prior five years of data (2000-2004) when the index registered in the fair range. In Inner Ryder’s Cove (PBA-3) the index in 2008 returned to fair conditions as it had been in 2000-2001, following six years at the poor range (2002-2006.) Crow’s Pond (PBA-4) showed steady incremental improvement over the entire nine years, beginning with an index in the poor range in 2000, followed by seven years with an index in the fair range (2001-2007), and an index in the good to excellent range in 2008. Tidally restricted embayments such as Frost Fish Creek (CM-14) and Muddy Creek (PBA-5, PBA-5A) had indices consistently in the poor range for the nine-year period.

Stations initiated in 2002 at Strong Island-Northeast, Nickerson’s Neck and Allen’s (Minister’s) Point, which are closer to the source of incoming ocean waters, registered in the fair to good range consistently.

3.A.2 Big Bay and Mid Embayments

Indices for Big Bay Southwest (PBA-6), Big Bay Middle (PBA-7) and Big Bay Northeast (PBA-8) were fairly consistent over the period of data collection. Big Bay Northeast showed a marked improvement in 2008, when the index rose well into the good to excellent range. The other two stations were discontinued prior to the 2006 season. There was little change in the adjacent embayments. Round Cove (PBA-9) consistently hovered in the poor to fair range, while Quanset Pond (PBA-10) was consistently in the fair range.

3.A.3 Little Bay and Northern Embayments

Marked improvement was noted for Paw Wah Pond (PBA-11), which had indices in the poor range 2000-2006, and saw sizable incremental reaches into the fair range in 2007 and 2008. Otherwise, stations in the Little Bay (PBA-21) and northern embayments were consistent, with some modest improvements in 2008. Namequoit South (PBA-12) and North (PBA-13) were consistently in the fair range with one good reading in Namequoit South in 2008. However, Namequoit River (WMO-6), Arey's Pond (PBA-14), Kescayogansett Pond (PBA-15) and Meetinghouse Pond (PBA-16) and River at Rattles Dock (WMO-10) had indices consistently in the poor range. River at Rattles Dock (WMO-10) showed modest improvement in the River in 2008.

3.B TOTAL NITROGEN

Pleasant Bay is an estuary, a place where coastal waters and fresh waters meet. Estuaries are extremely sensitive to the effects of nitrogen. It is not the nutrients themselves that cause problems, but the increased plant growth they cause. Certain algae—opportunistic seaweeds and phytoplankton—become so abundant that they shade the bottom and decrease light penetration to the bottom available to aquatic plants such as eelgrass. As the plants die and decay they use up oxygen and the plant remains settle to the bottom. This excessive production and decay can reduce the amount of oxygen in the water column and can ultimately lead to anoxic (no oxygen) or hypoxic (low oxygen) conditions. Even short periods of low oxygen can cause serious damage to bottom dwelling organisms and eventually lead to further losses of plant and animal species.

Nitrogen travels to an estuary through the groundwater or over the land as run-off. It can take years for nitrogen traveling via groundwater to reach a receiving water body. Thus, even if development stopped today, higher nitrogen levels would continue to arrive in the estuary over a long period of time.

The multi-year data confirms that the Bay is receiving nitrogen from watershed development through groundwater inflows and surface runoff. At all stations Total Nitrogen exceeded background levels found in Atlantic Ocean waters, or 0.29 mg/L. Total Nitrogen measures nitrogen in three forms: Dissolved Inorganic (DIN), Particulate Organic (PON) and Dissolved Organic (DON). The thresholds for Pleasant Bay estuarine restoration established by the Massachusetts Estuaries Project focus on bioactive nitrogen (only DIN and PON.) The threshold of bioactive nitrogen for eelgrass restoration is 0.16 mg/L. The threshold for benthic infauna health is 0.21 mg/L. Measures above thresholds indicate that bioactive nitrogen exceeds the level health for eelgrass or benthic infauna, respectively. There are two eelgrass sentinel stations, where the threshold for bioactive Nitrogen is 0.16 mg/L: One sentinel station is the average of results at Inner (PBA-3) and Outer Ryder's Cove (CM-13) and the other is Namequoit Point South (PBA-12.) Bioactive nitrogen consistently exceeded the threshold level at the Chatham combined station but dipped below the threshold level at Namequoit Point-South (PBA 12) in 2001, 2005, 2006 and 2008. There are eight benthic infauna sentinel stations: Muddy Creek (PBA-5), Round Cove (PBA-9),

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Paw Wah Pond (PBA-11), Kescayogansett Pond (PBA-15), Namequoit River Upper (WMO-6), River at Rattles Dock (WMO-10), Pochet Upper (WMO-5) and Little Quanset Pond (WMO-12, which is not part of the Alliance program.) The level of bioactive nitrogen met or exceeded the threshold of 0.21 mg/L at the stations monitored by the Alliance.

3. C PIGMENT CONCENTRATIONS

Phytoplankton is the group of small, mainly microscopic, plants and algae that is suspended in the water column. Phytoplankton "blooms" result from over-stimulation caused by excessive nutrients. Excessive phytoplankton growth reduces the amount of light that is able to penetrate the water. Submerged aquatic vegetation, such as eelgrass, suffers when insufficient light is available for photosynthesis.

Phytoplankton pigment concentrations are measured as phaeophytin and chlorophylla. The National Oceanographic and Atmospheric Administration (NOAA) National Estuarine Survey found that phytoplankton levels above 5 ug/L (parts per billion) are indicative of impacts from watershed development. In 2001, all but four sampling locations exceeded 5 ug/L.

Stations in well-flushed portions of the system tended to have pigment concentrations close to the 5 ug/L NOAA threshold. These stations included: Chatham Harbor (PBA-1), Bassing Harbor (PBA-2), Namequoit Point South (PBA-12)

Stations located where flushing is more restricted tended to have much higher pigment concentrations, as much as two to four times the levels indicated by the NOAA threshold. These stations include: Inner (PBA-3) and Outer Ryders Cove (CM-13), Frost Fish Creek (CM-14), Crows Pond (PBA-4), Muddy Creek (PBA-5, 5A), Round Cove (PBA-9), Quanset Pond (PBA-10), Paw Wah Pond (PBA-11), Arey's Pond (PBA-14), Kescayogansett (PBA-15), Meetinghouse Pond (PBA-16) and River at Rattles Dock (WMO-10.)

3.D DISSOLVED OXYGEN

Dissolved oxygen (DO) is a measure of the amount of oxygen dissolved per given volume of water and is generally expressed as milligrams (oxygen) per liter (water), or "mg/L". Measures of 3 mg/L and below indicate that there is not enough oxygen and that plants and animals exist in extremely stressful conditions that may result in die off and relocation of some species. Measures of 6 mg/L and above indicate "pristine" water quality conditions as defined by state standards. Pleasant Bay is a state-classified "Outstanding Resource Waters-SA". The quality standards for keeping SA waters "pristine" is that they are suitable for shellfish harvesting without depuration; they provide excellent habitat for fish and other aquatic life and wildlife and for secondary (e.g., boating) and primary (e.g., swimming) contact recreation; and they have excellent aesthetic value.

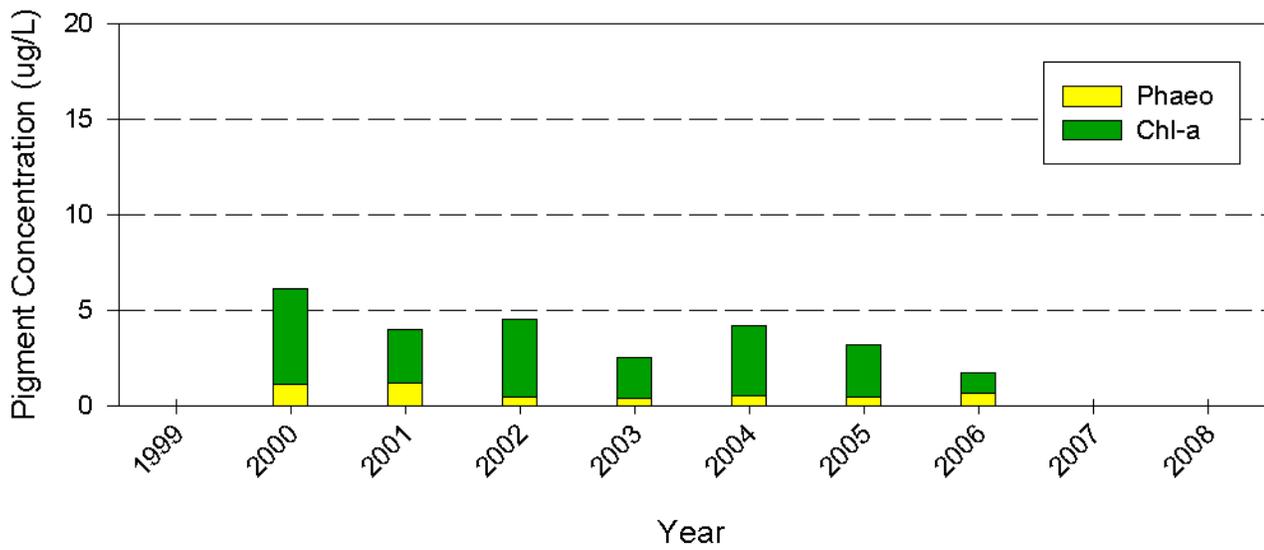
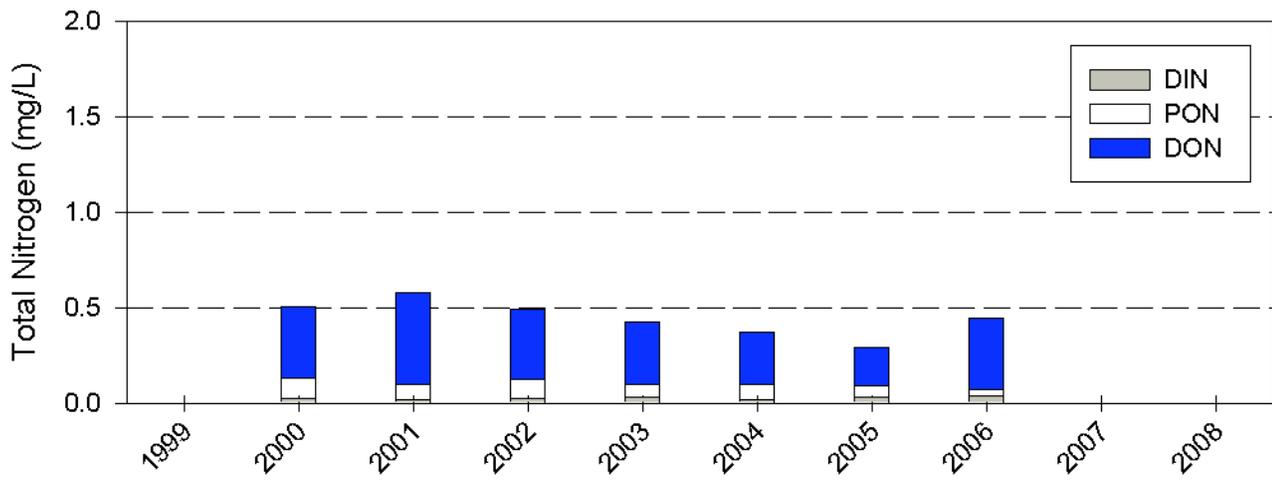
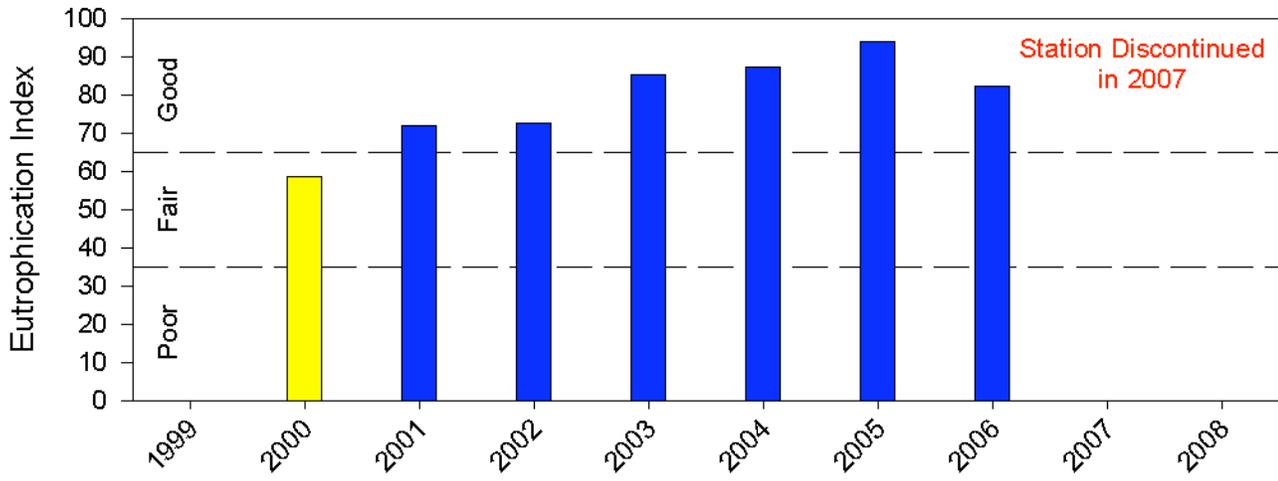
DO levels are also reported as percent saturation. Percent saturation measures DO as a percent of what the water could theoretically hold at a given temperature and salinity. The theoretical maximum DO saturation is 100 percent. Levels below 60 percent are warning levels and below 40 percent are danger levels.

DO levels were fairly consistent for all stations without a discernable trend. However it is noteworthy that bottom-level DO measurements improved in Meetinghouse Pond (PBA-16) in 2006 and in Paw Wah Pond (PBA-11) in 2007-08.

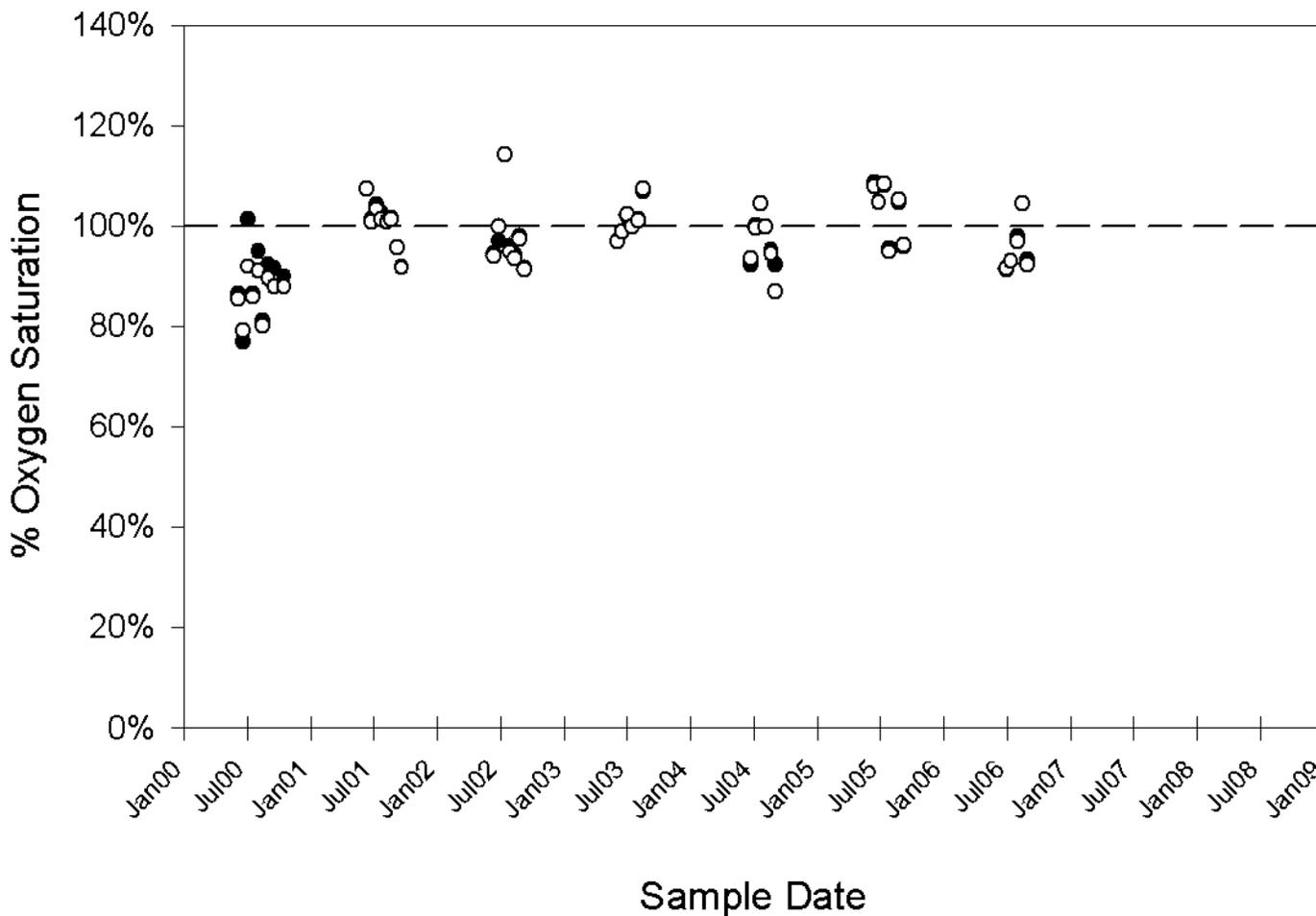
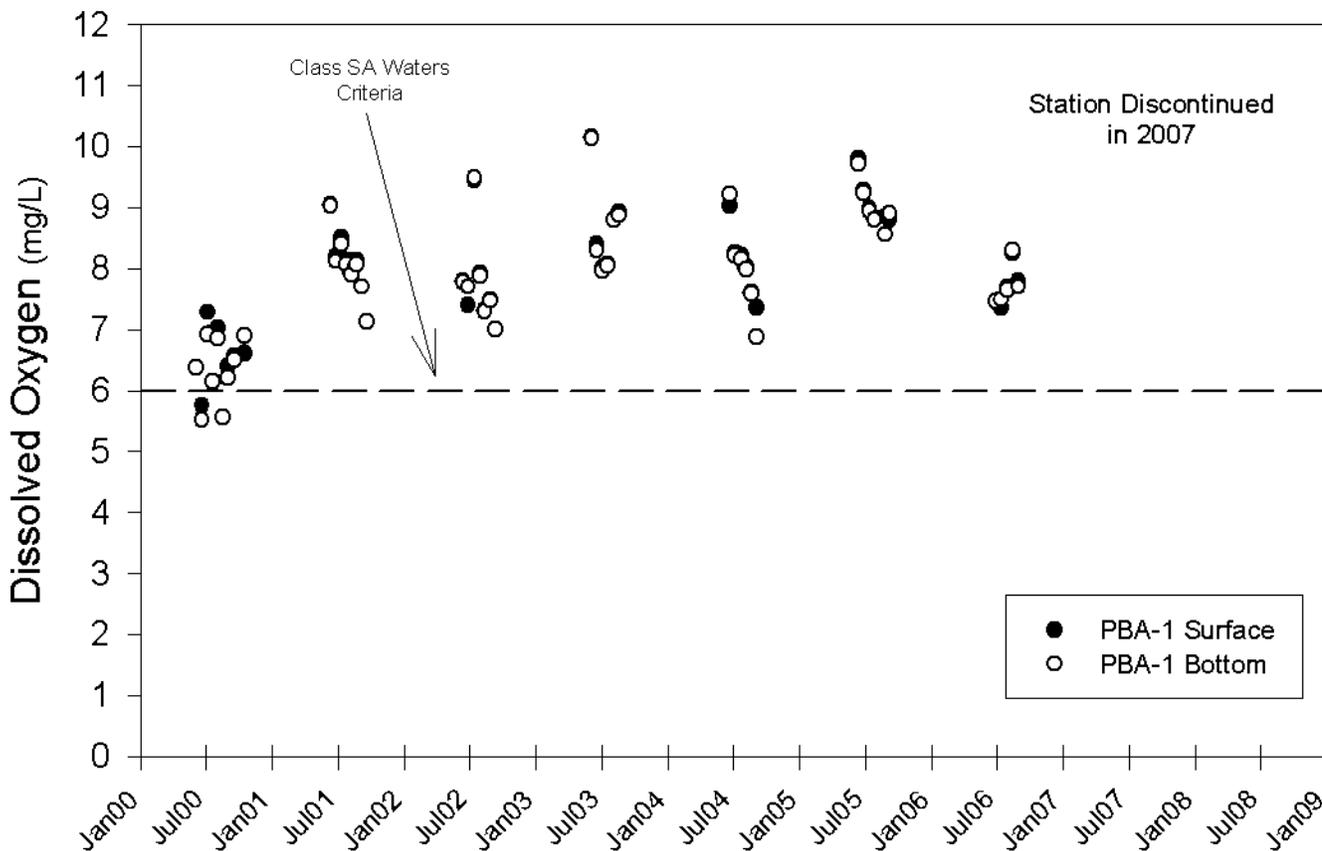
APPENDIX A: DATA FIGURES BY STATION

Two pages of figures are provided for each monitoring station. One of the pages shows three charts depicting the Eutrophication Index, Total Nitrogen, and Pigment Concentration for each year for which data was collected at the station. The other page presents dissolved oxygen data two ways, as percent oxygen saturation and as measured in milligrams per liter (mg/L.)

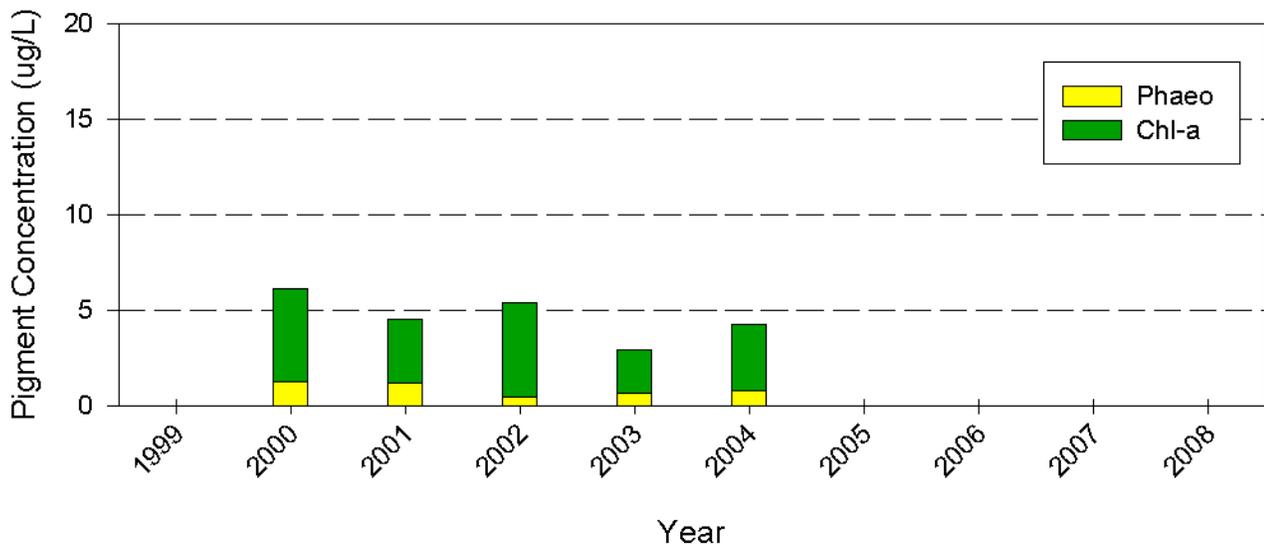
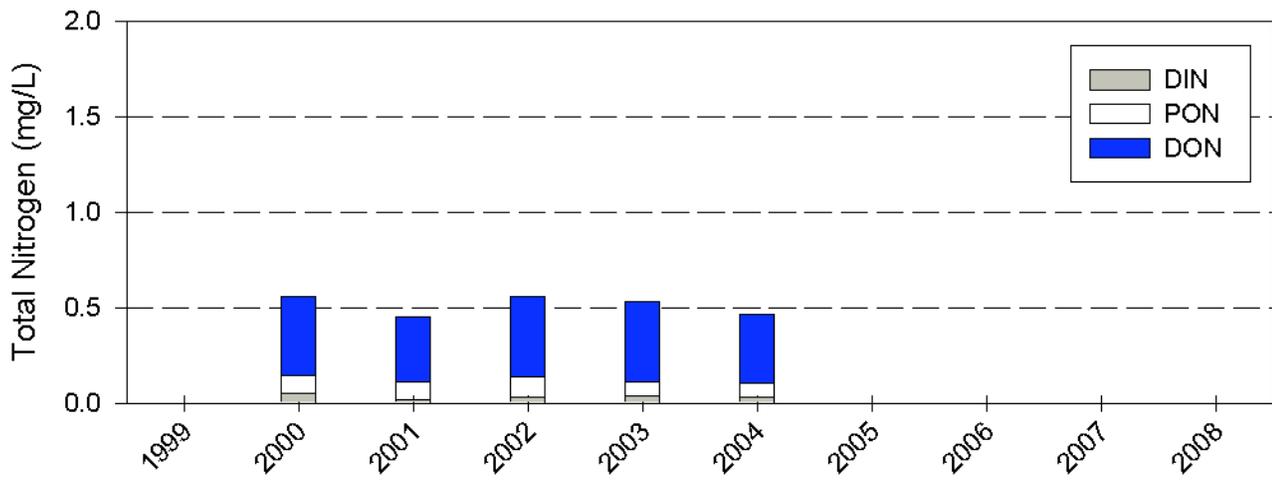
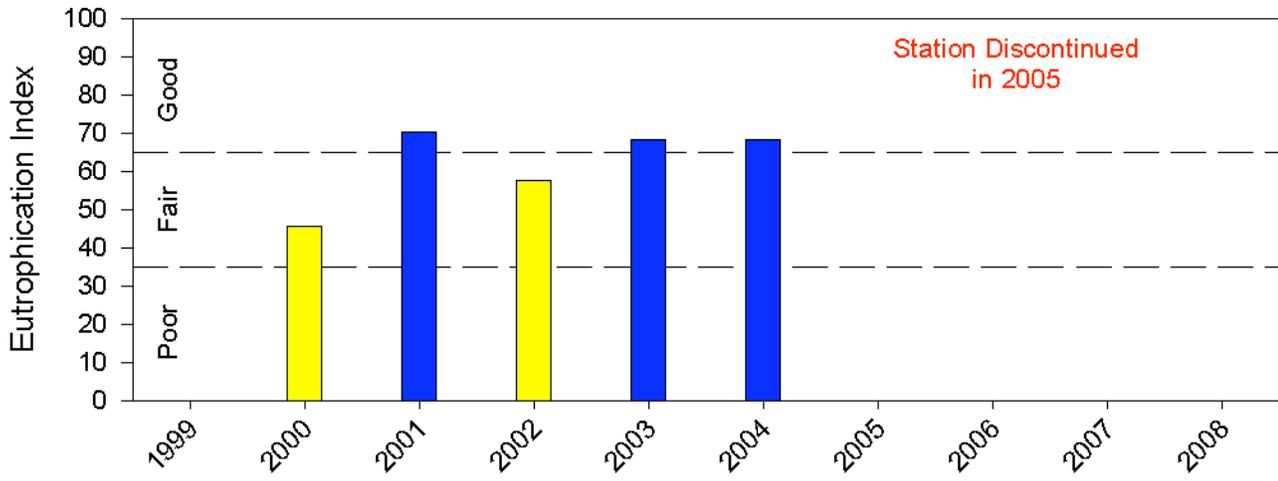
Chatham Harbor (PBA-1)



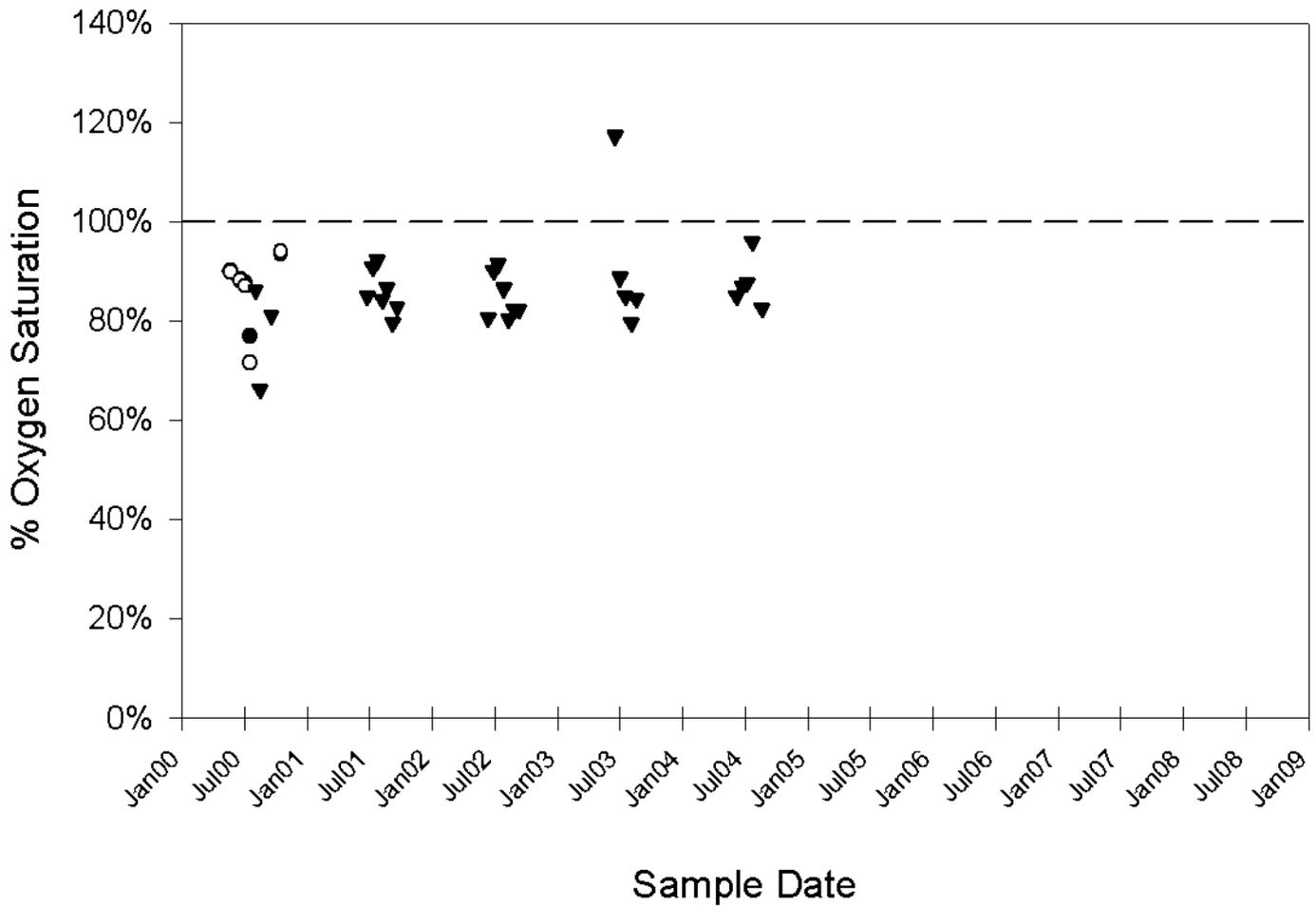
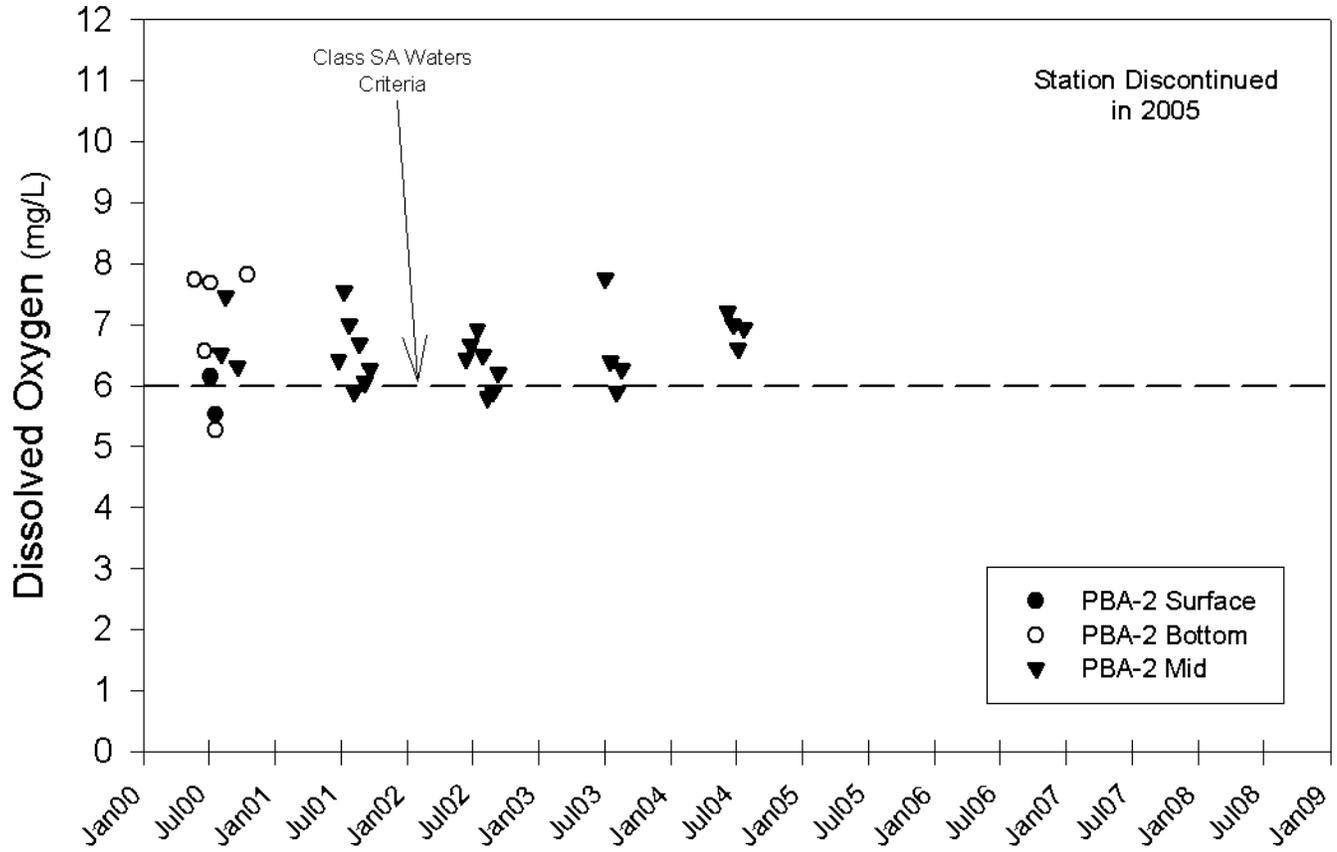
Chatham Harbor (PBA-1)



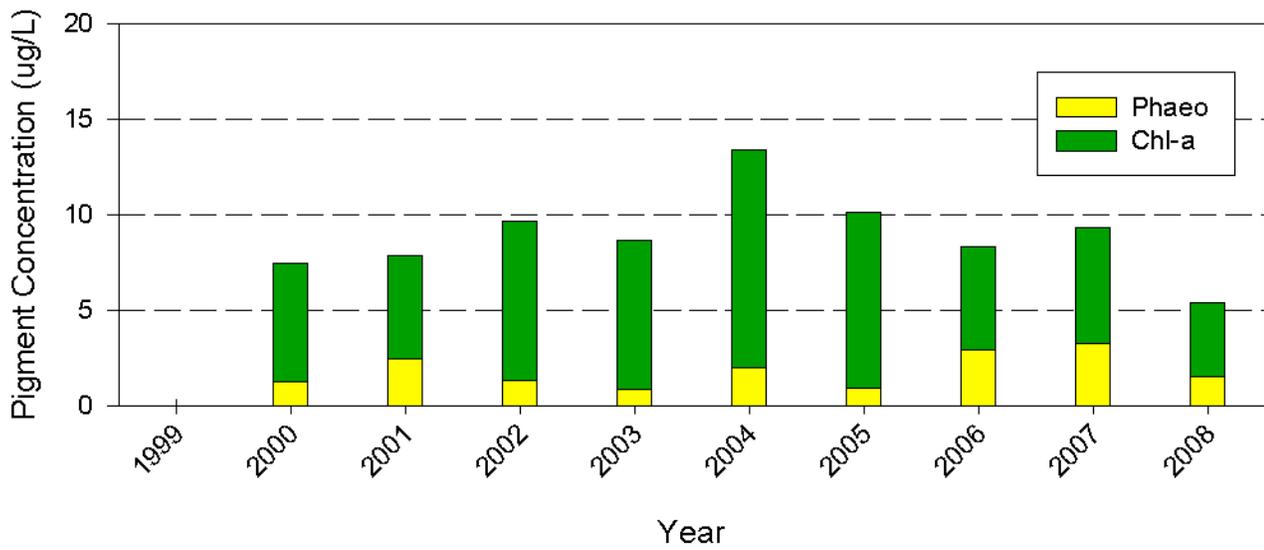
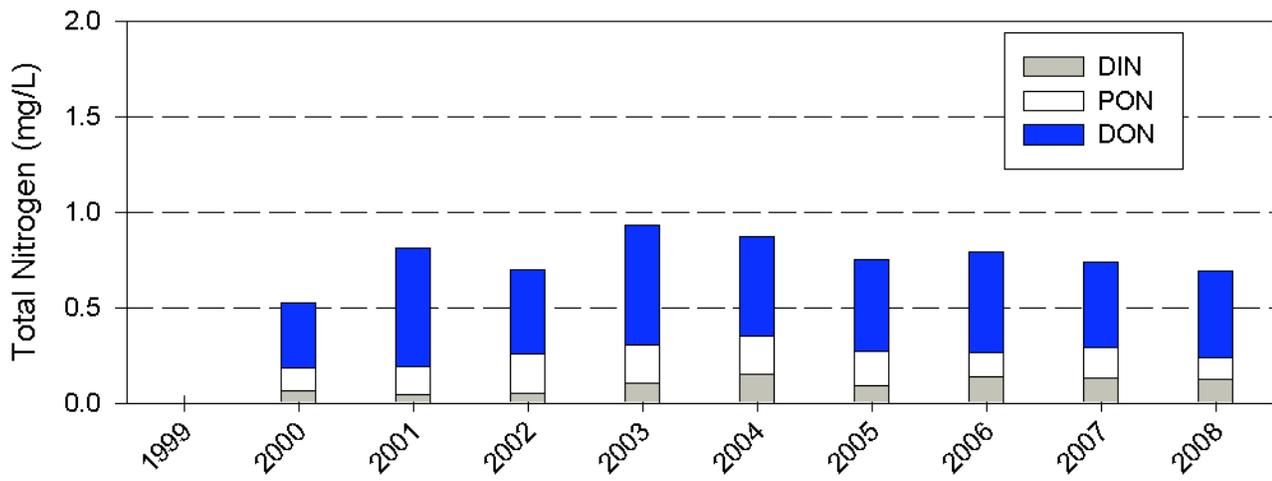
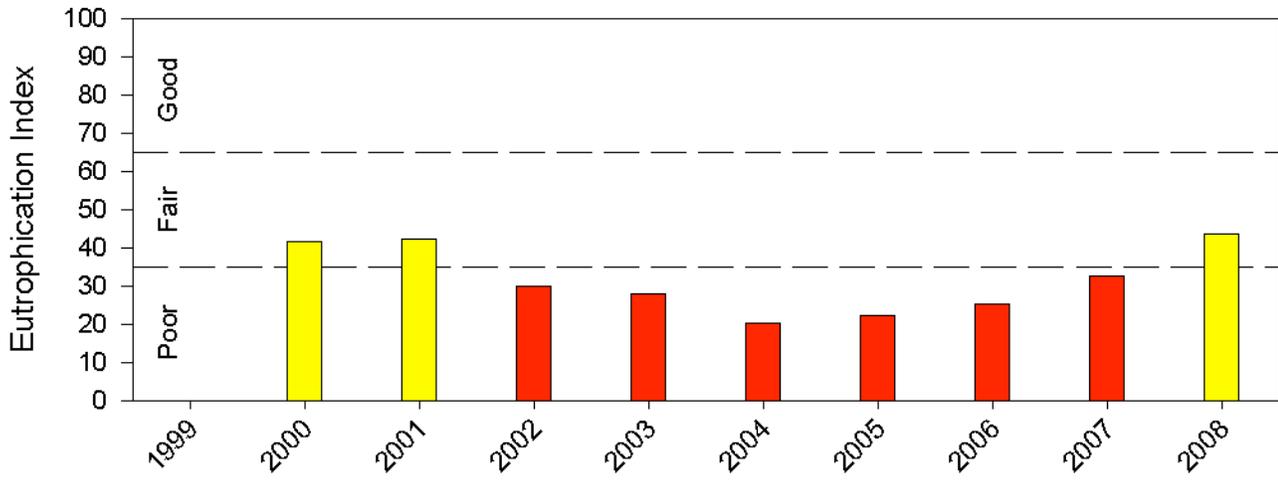
Bassing Harbor (PBA-2)



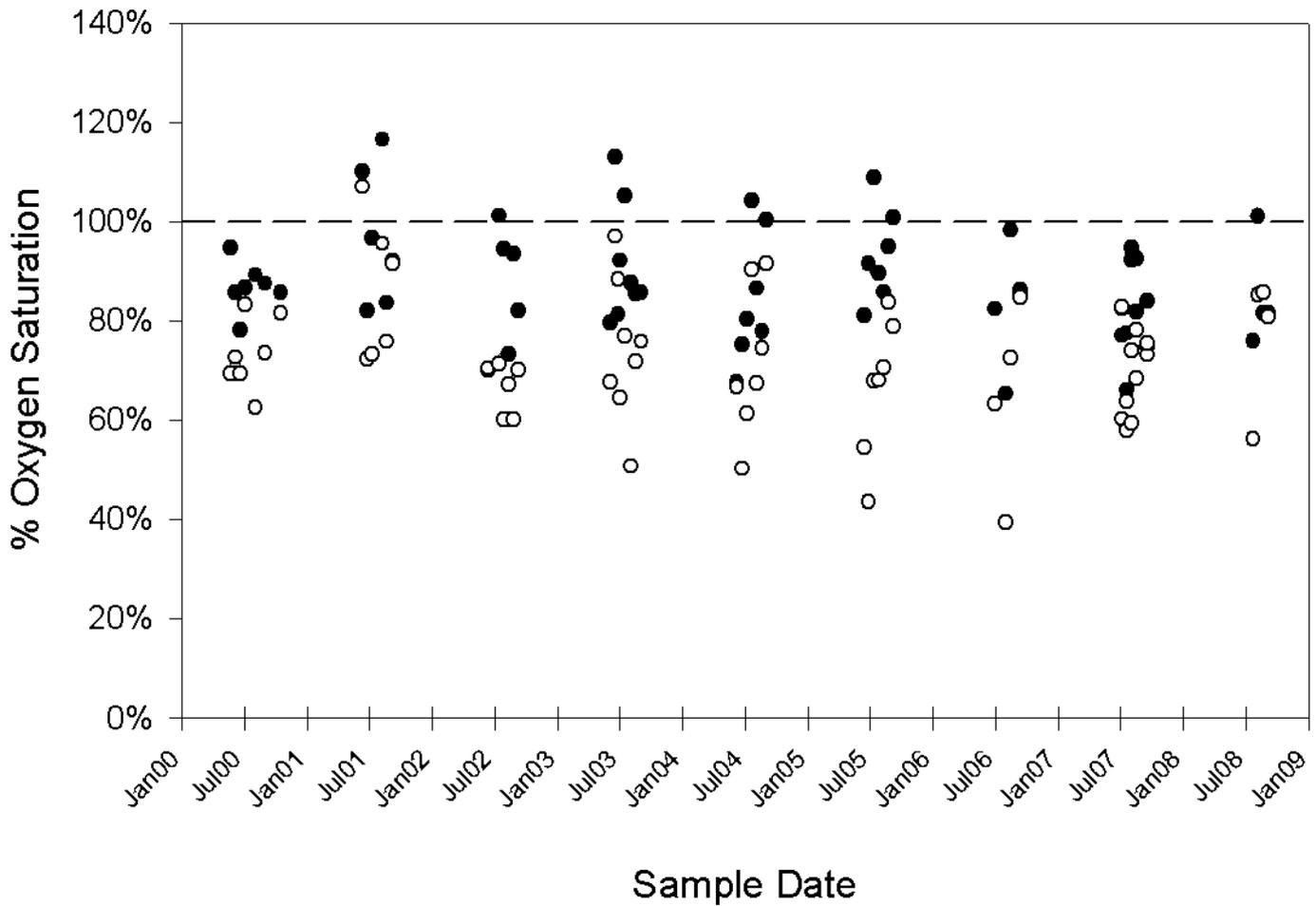
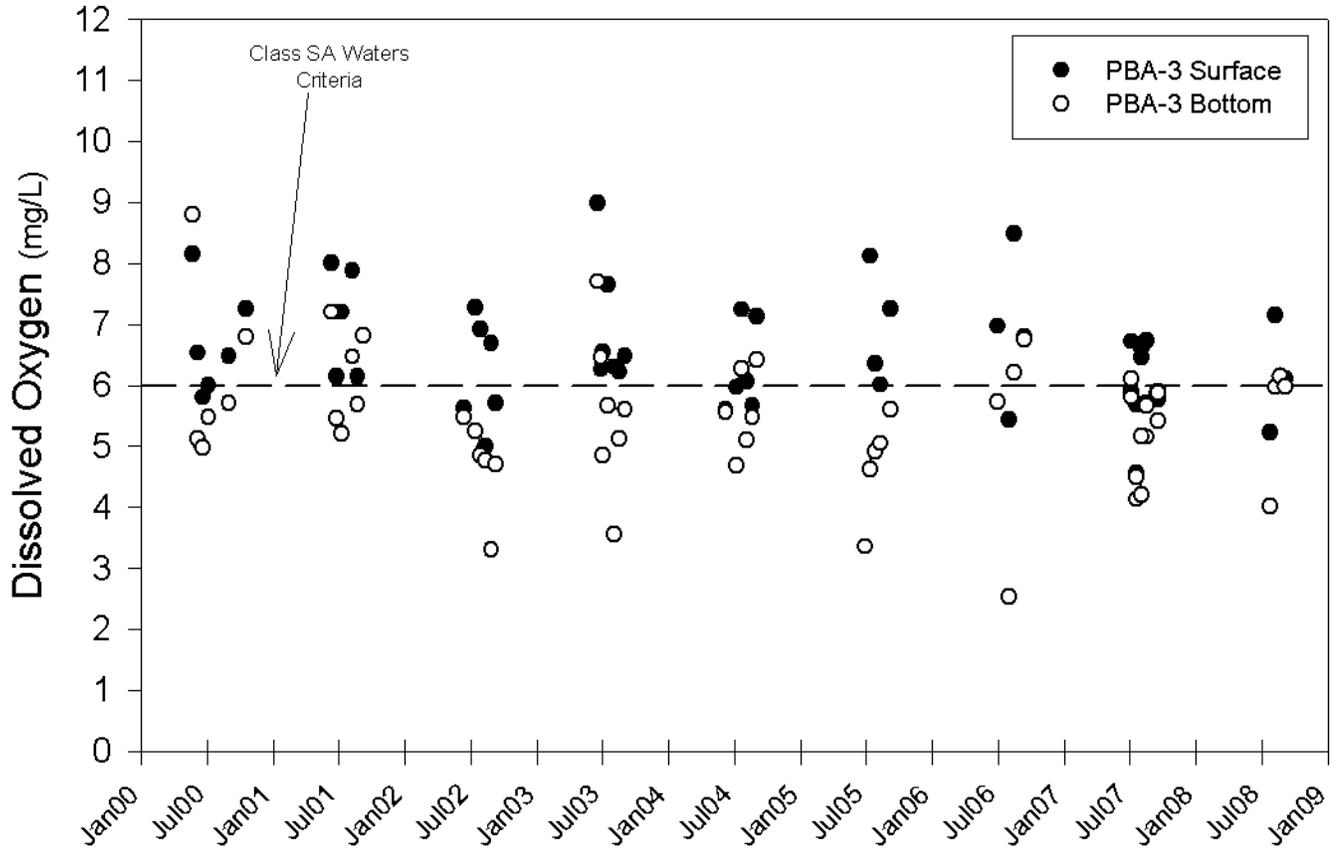
Bassing Harbor (PBA-2)



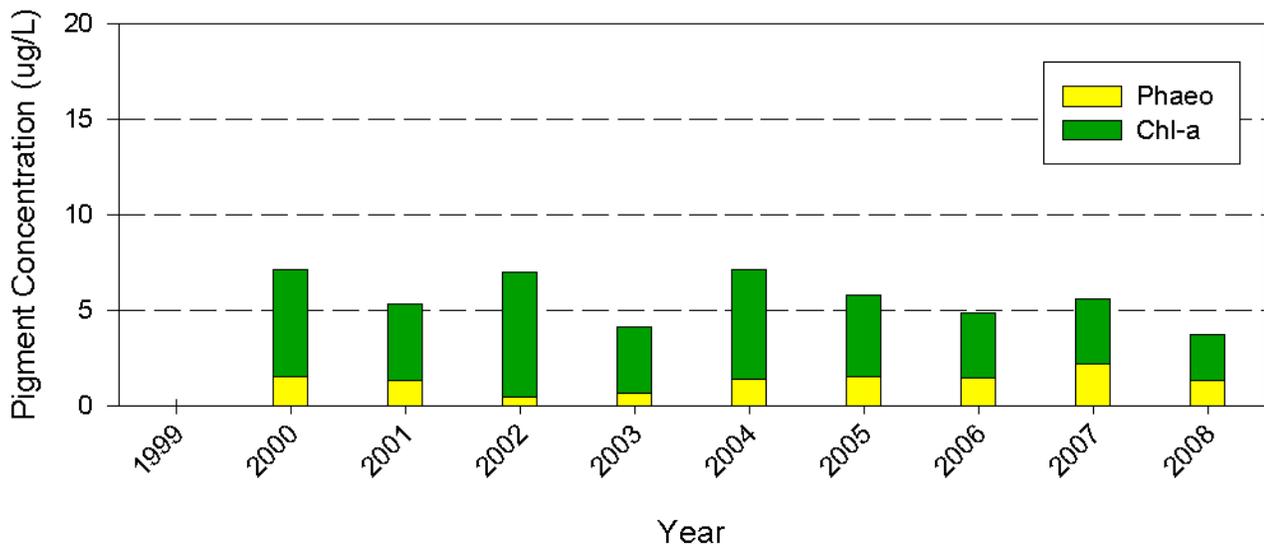
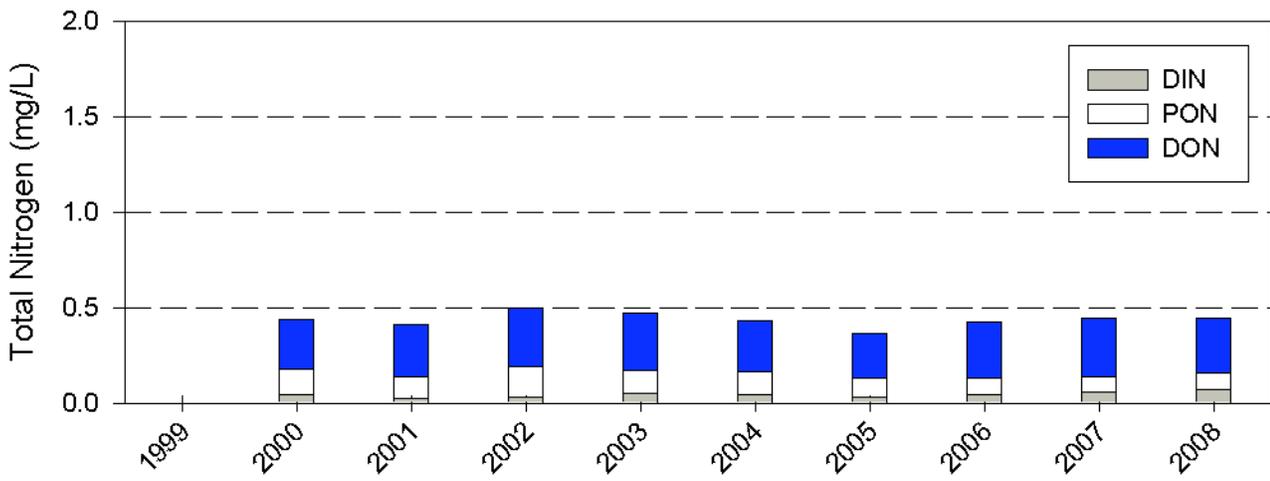
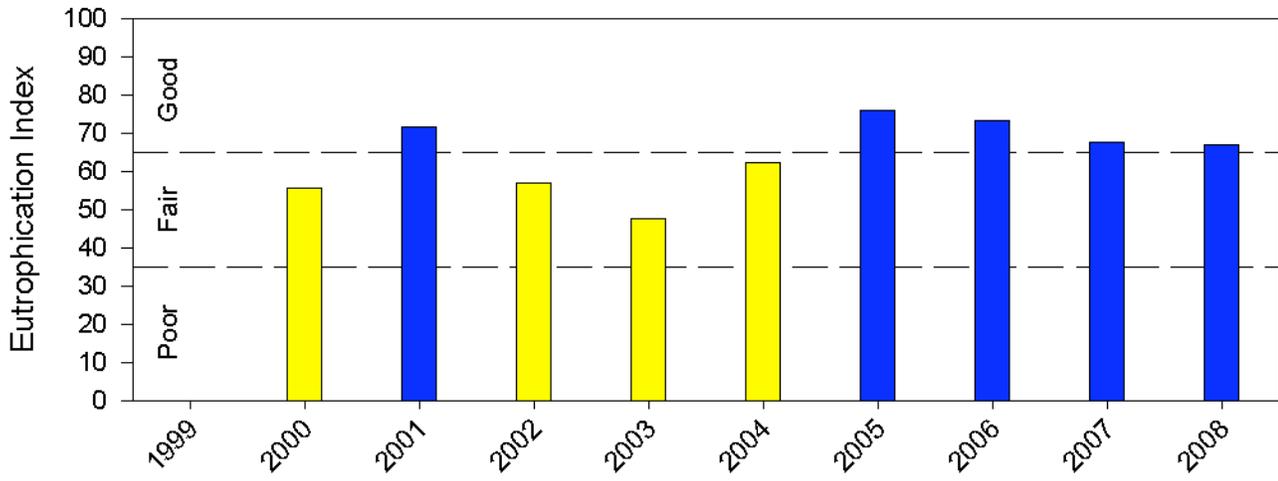
Inner Ryder's Cove (PBA-3)



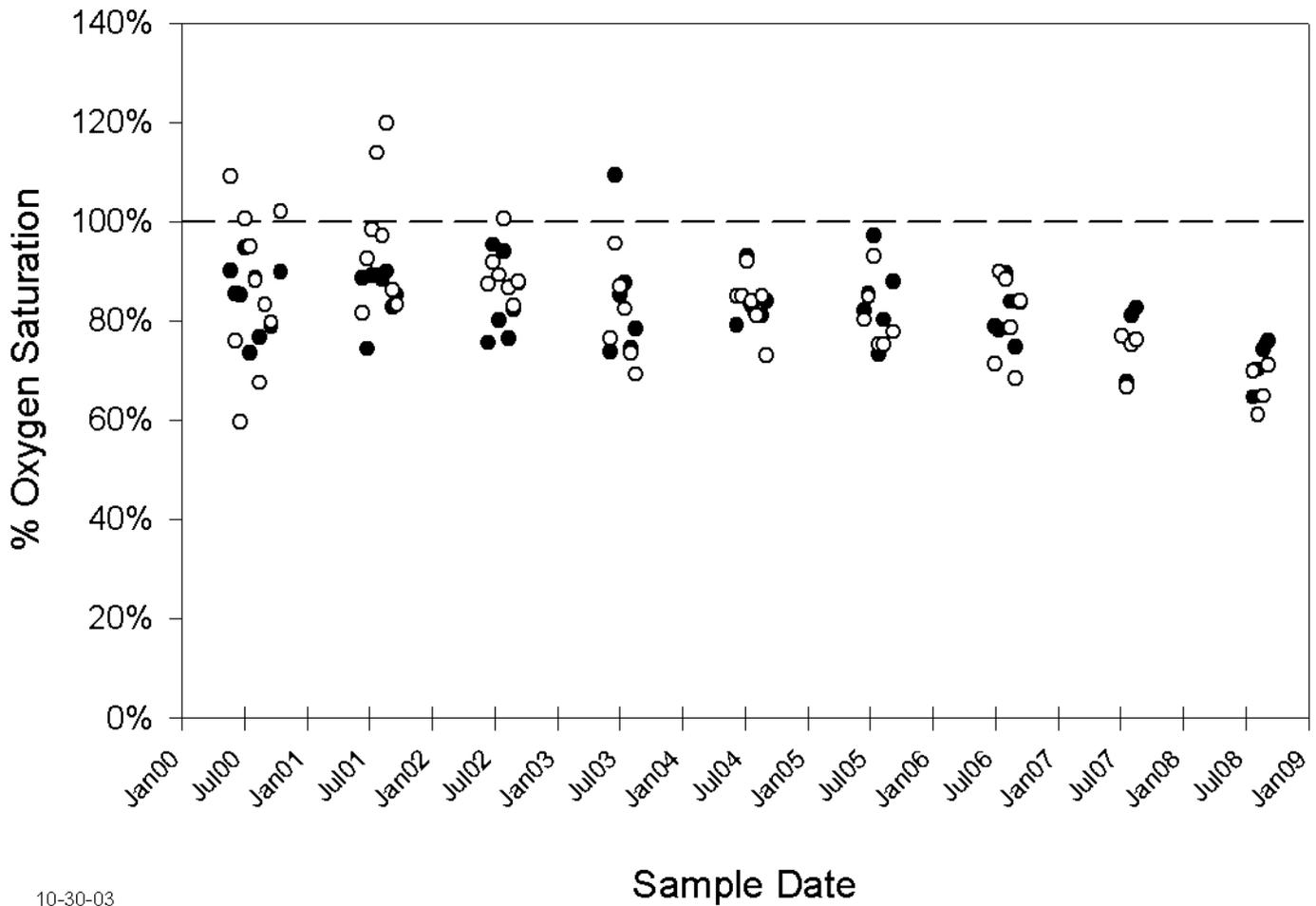
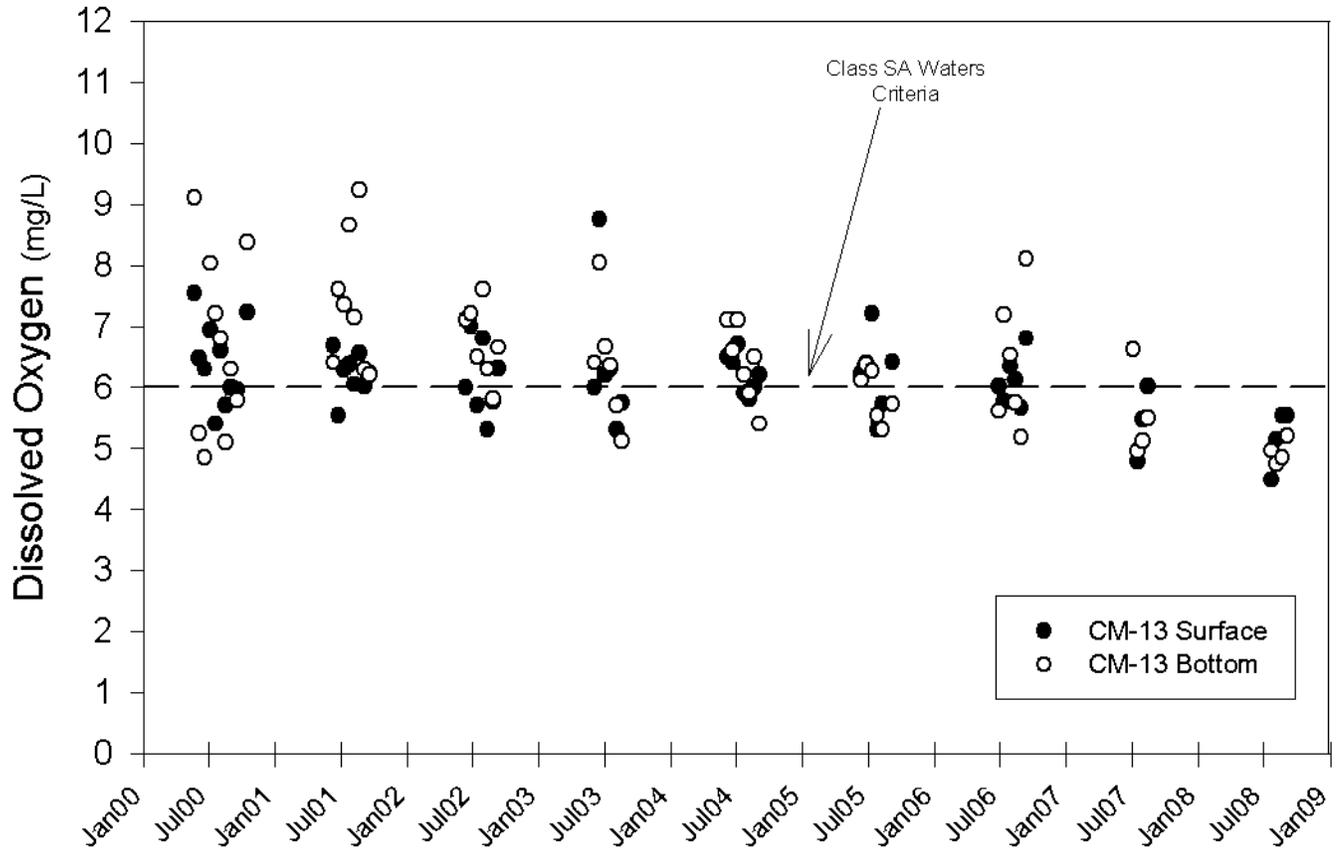
Ryder's Cove - Inner (PBA-3)



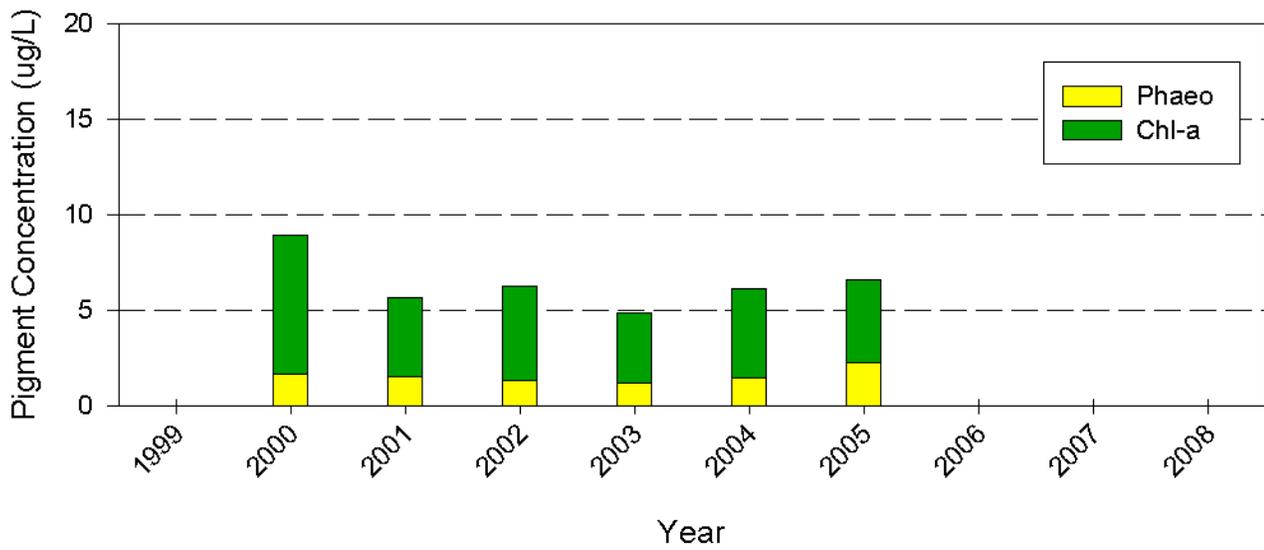
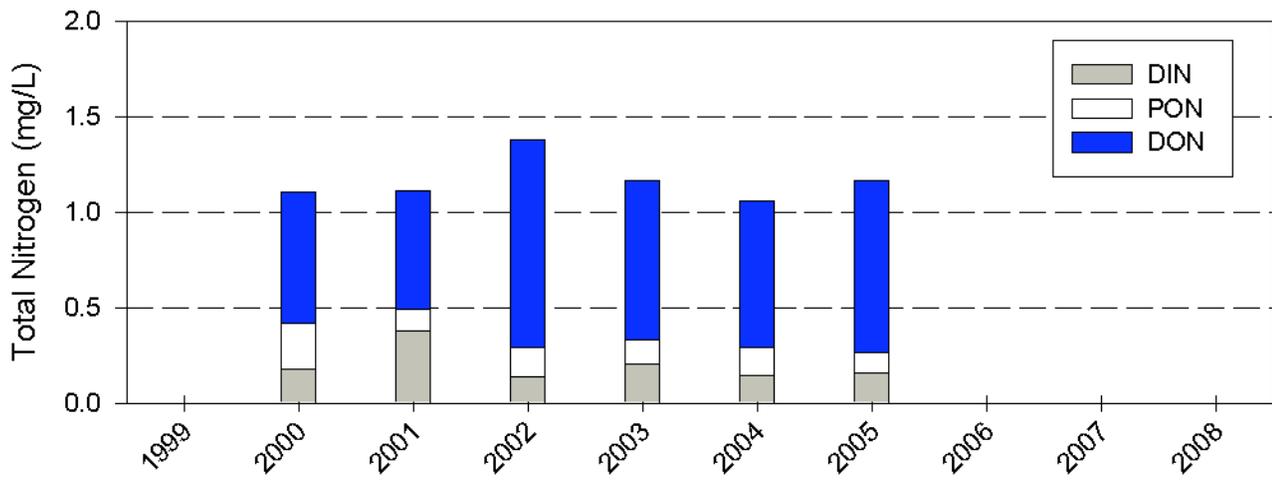
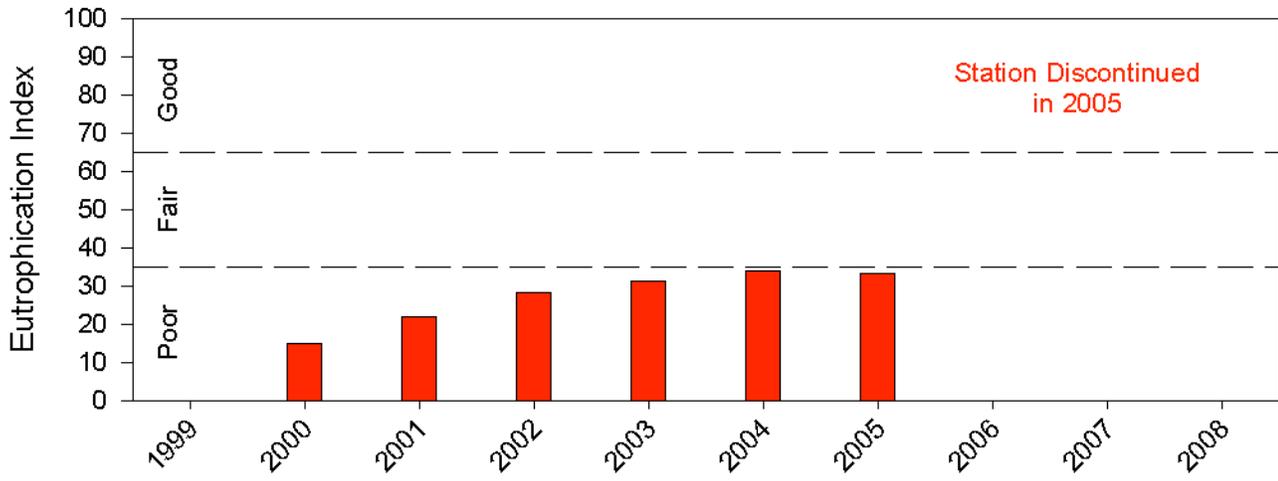
Outer Ryder's Cove (CM-13)



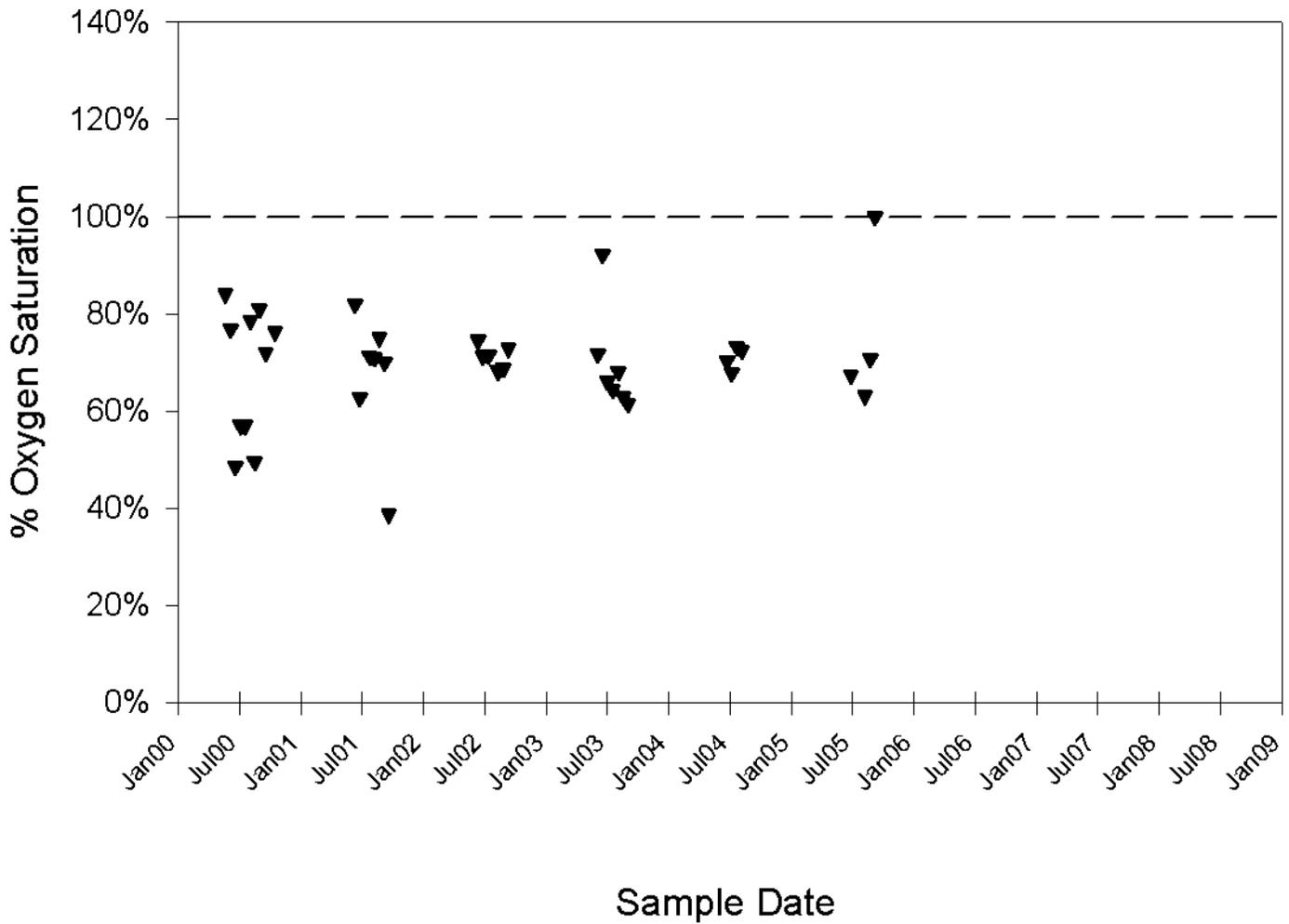
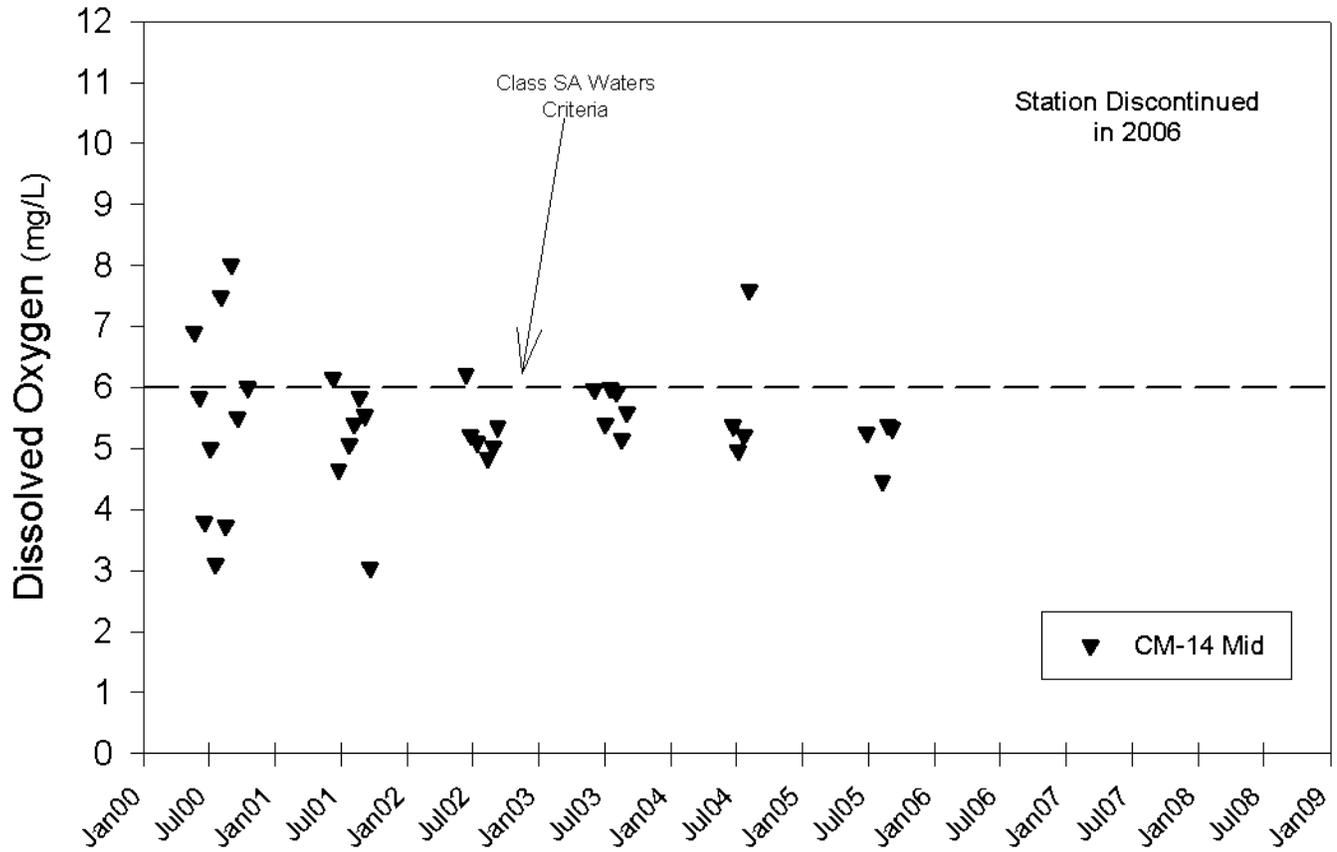
Outer Ryder's Cove (CM-13)



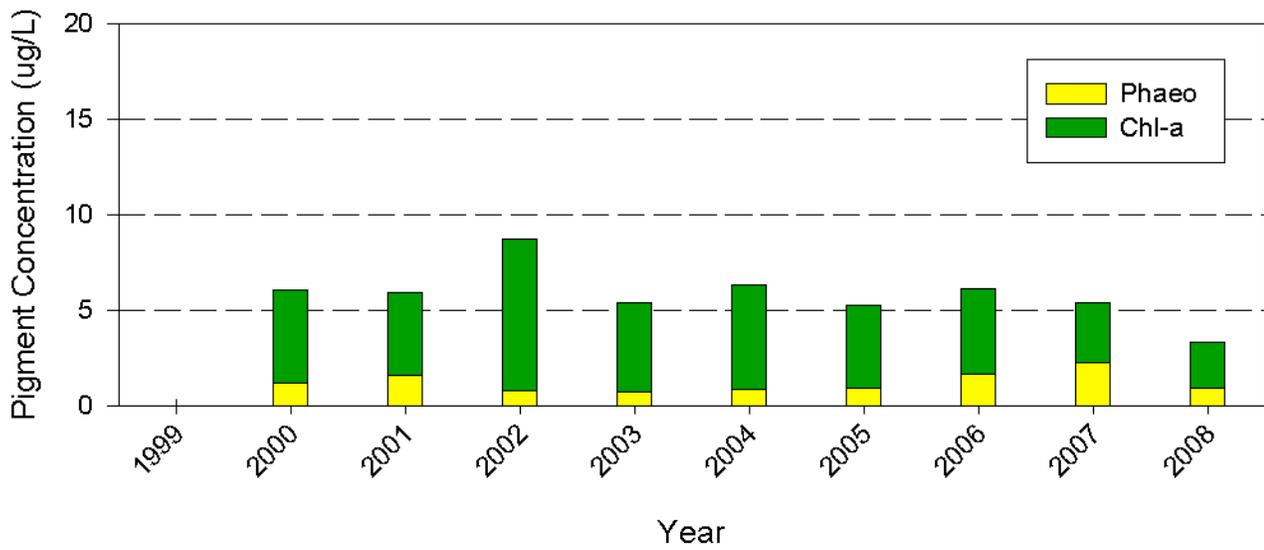
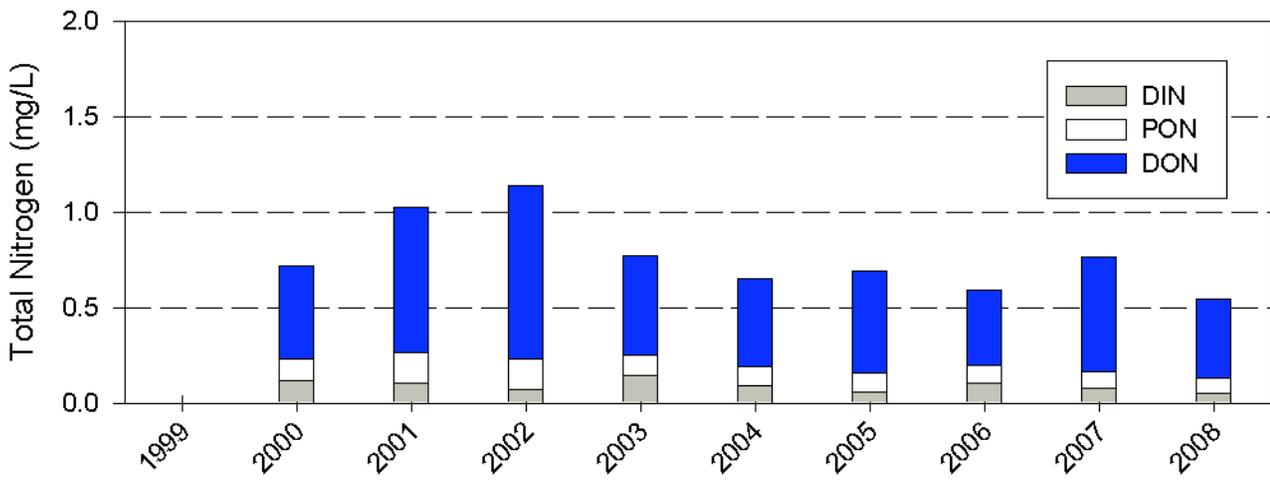
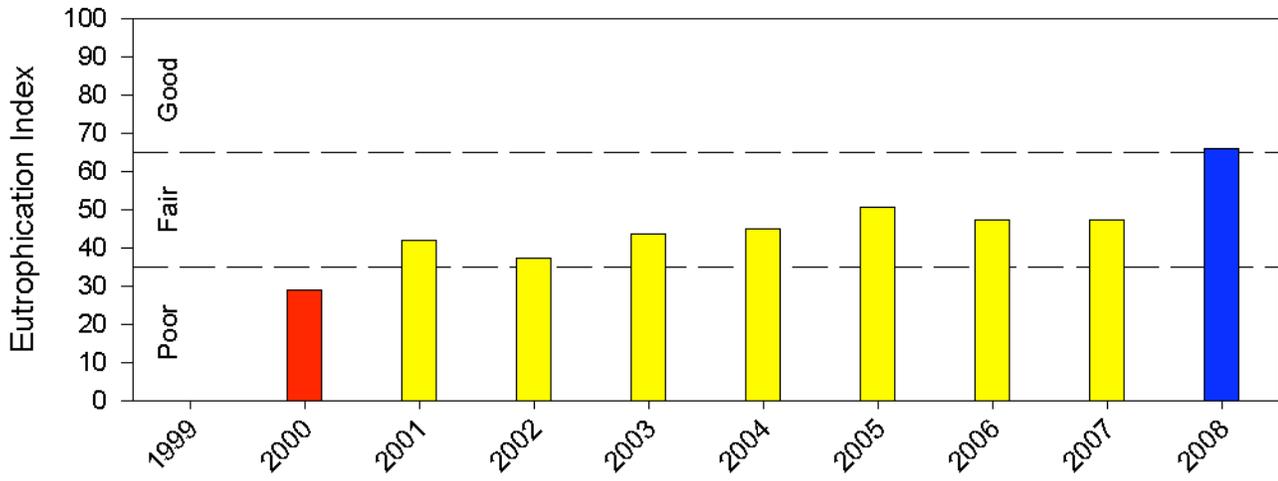
Frost Fish Creek (CM-14)



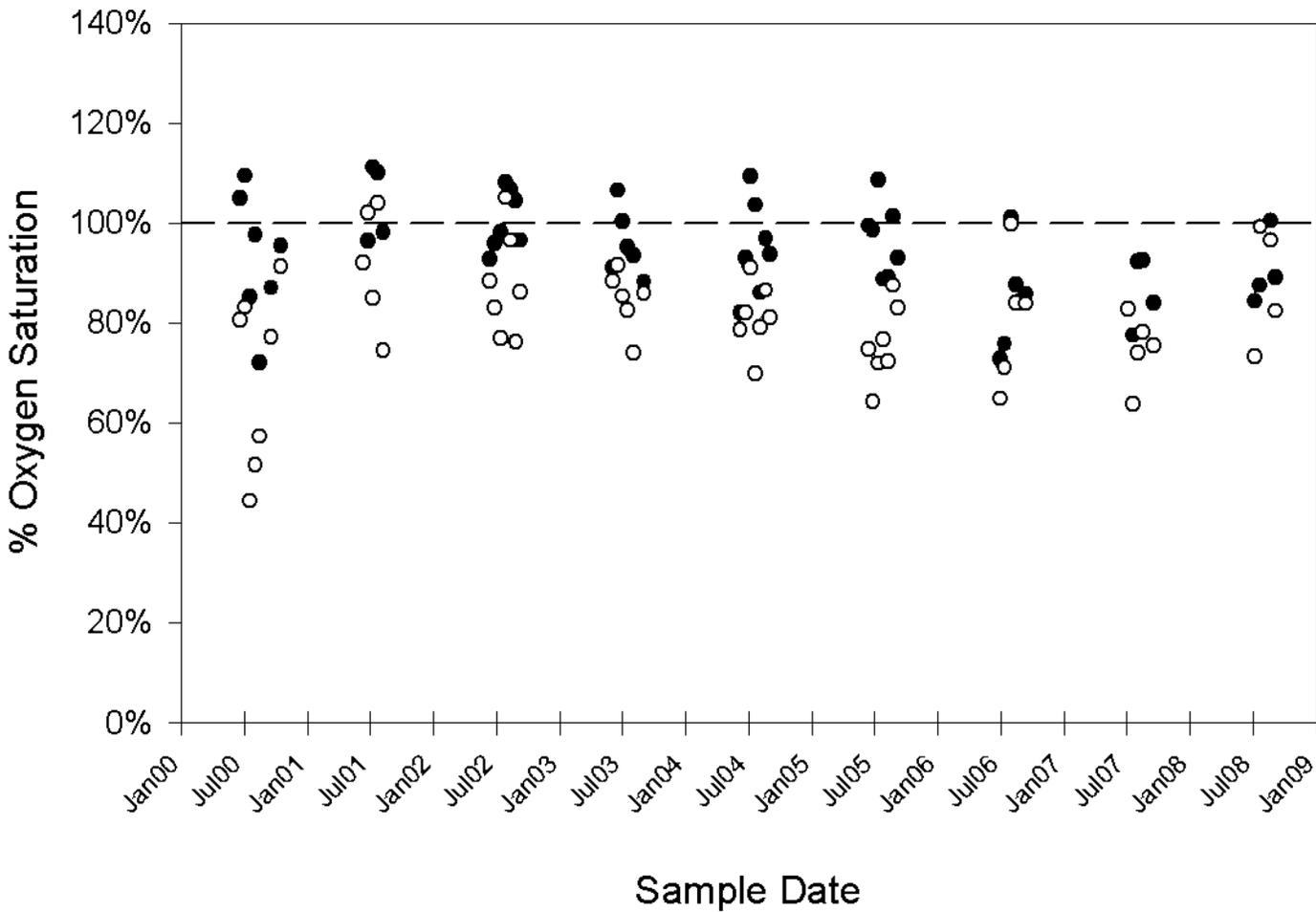
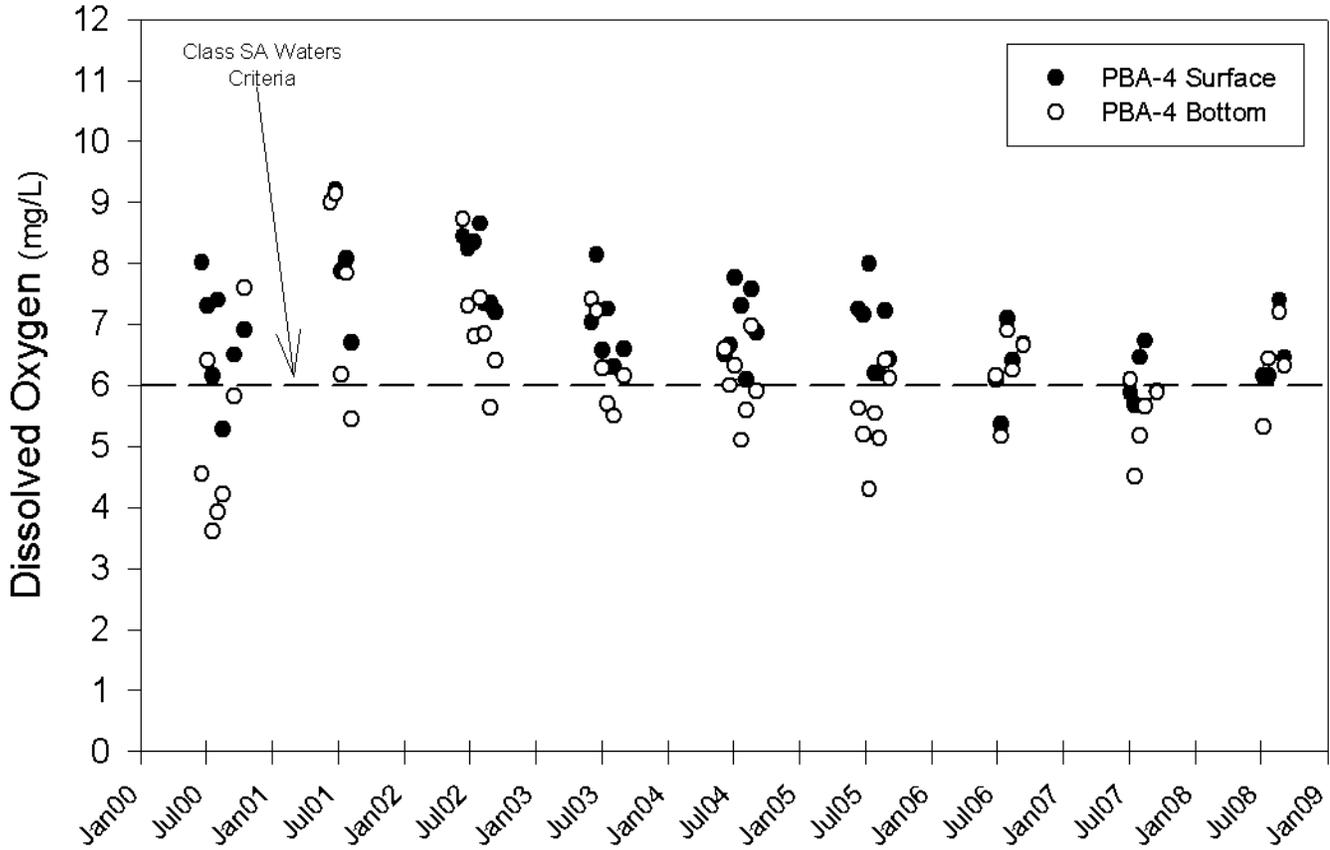
Frost Fish Creek (CM-14)



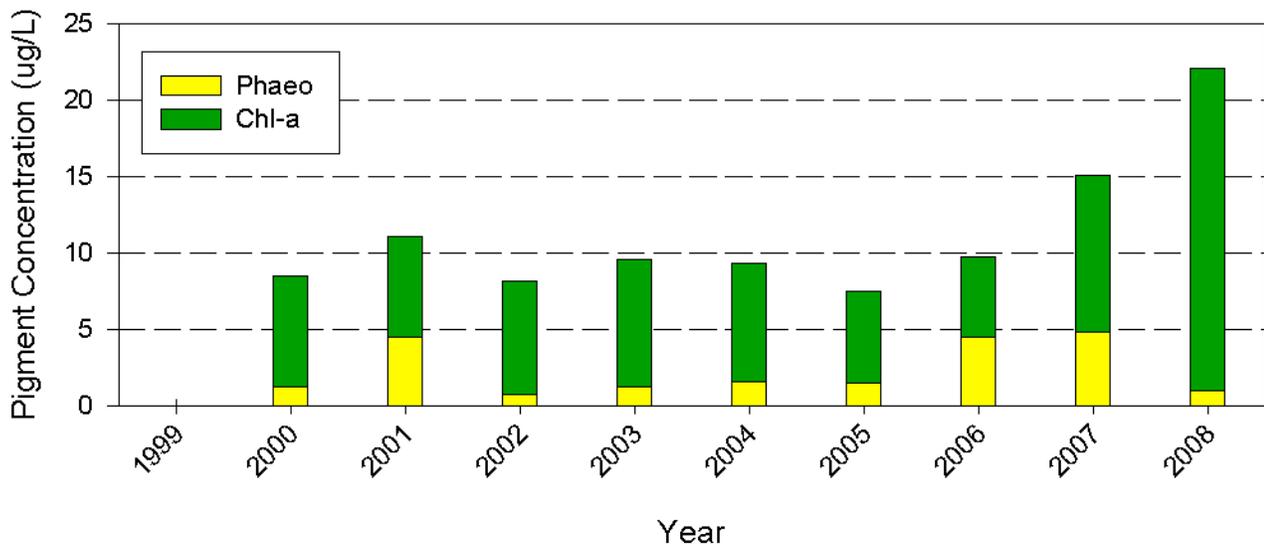
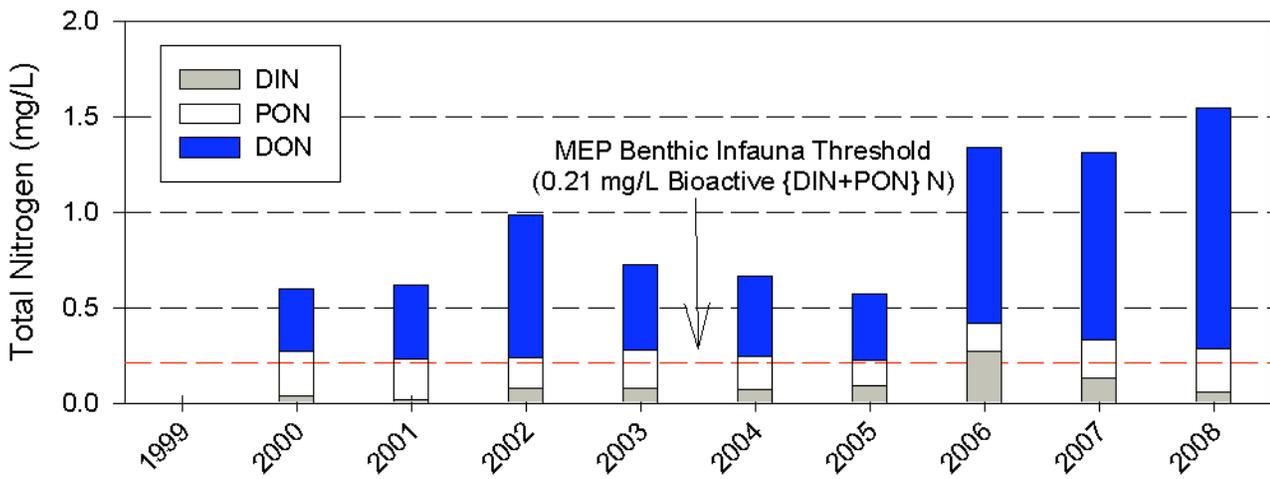
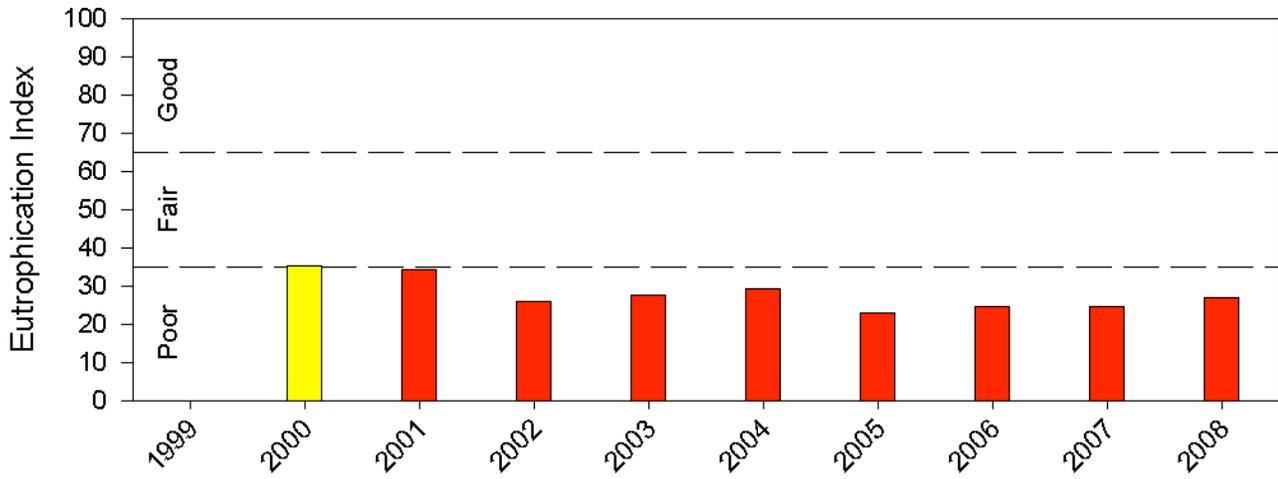
Crows Pond (PBA-4)



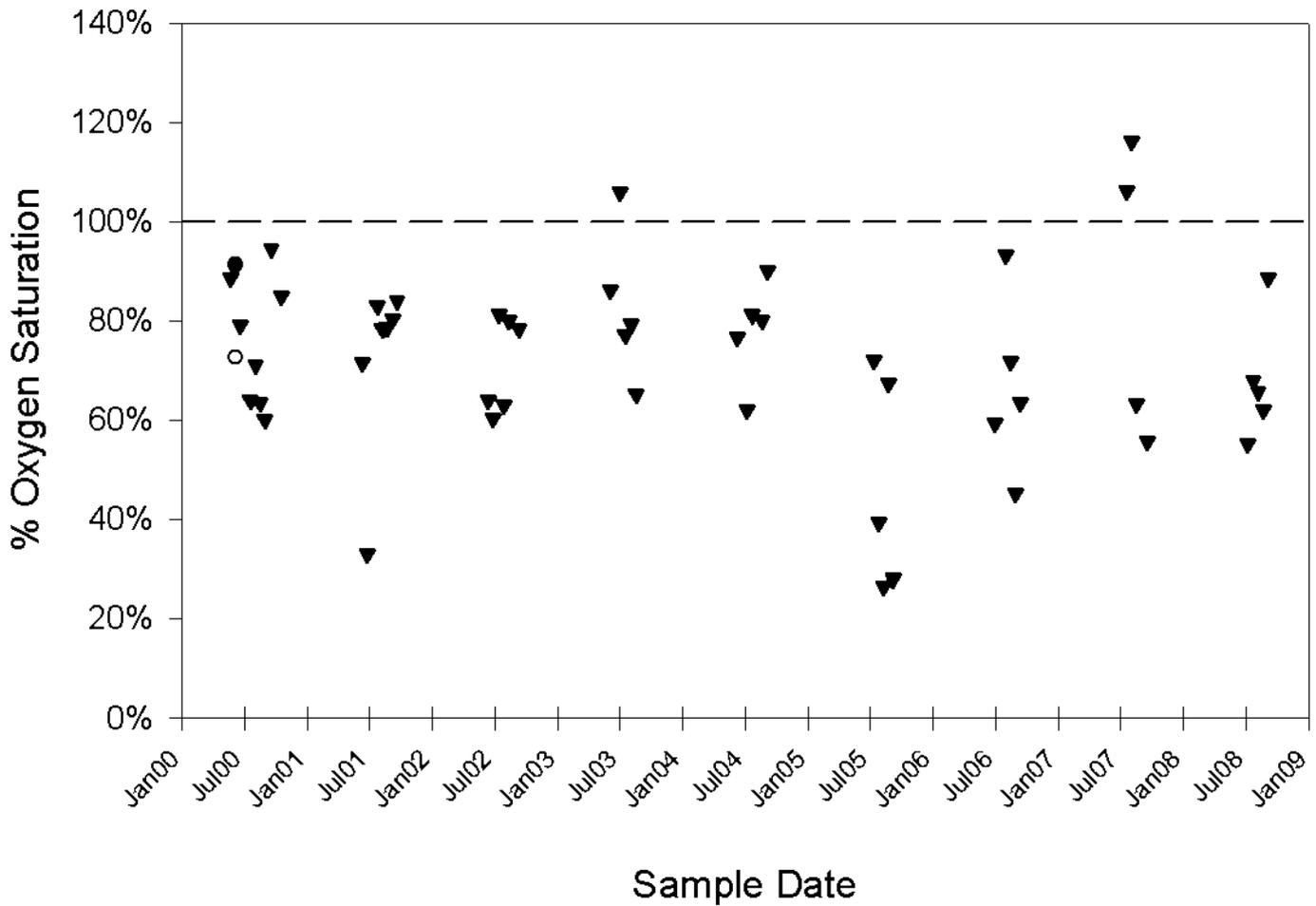
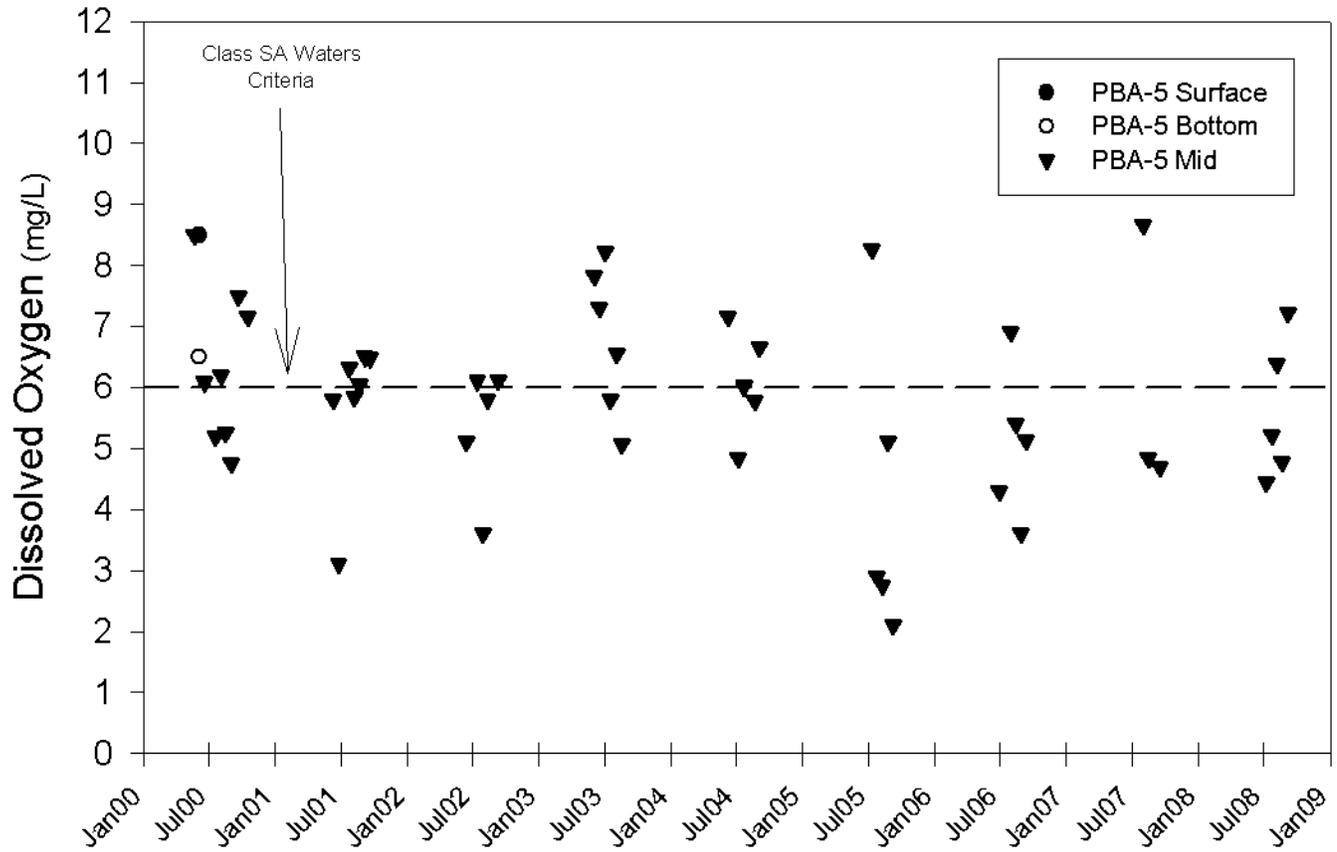
Crows Pond (PBA-4)



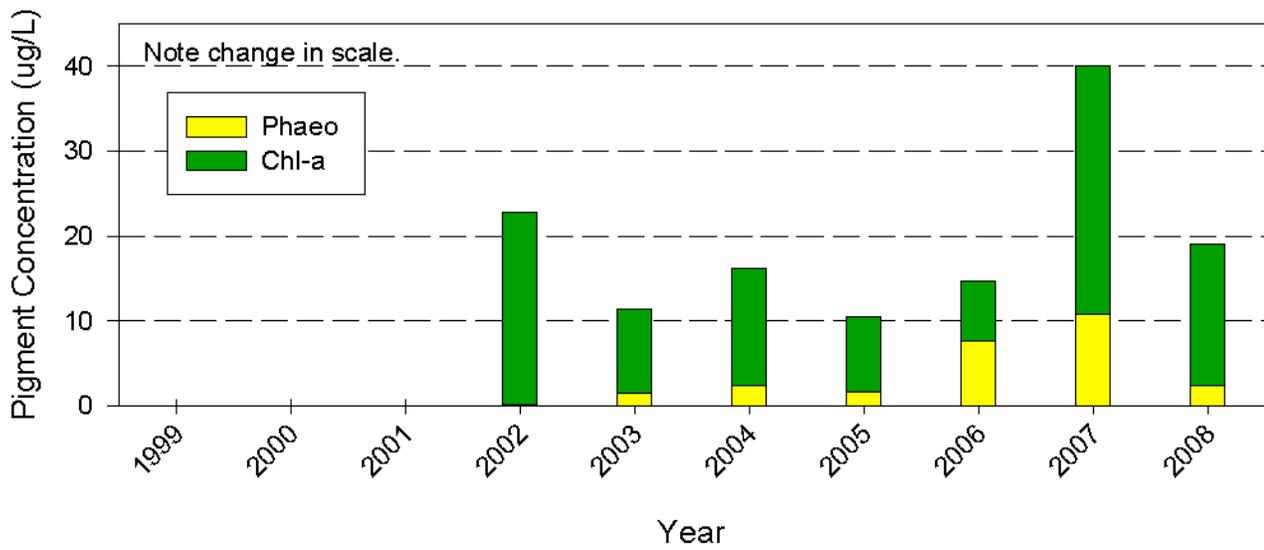
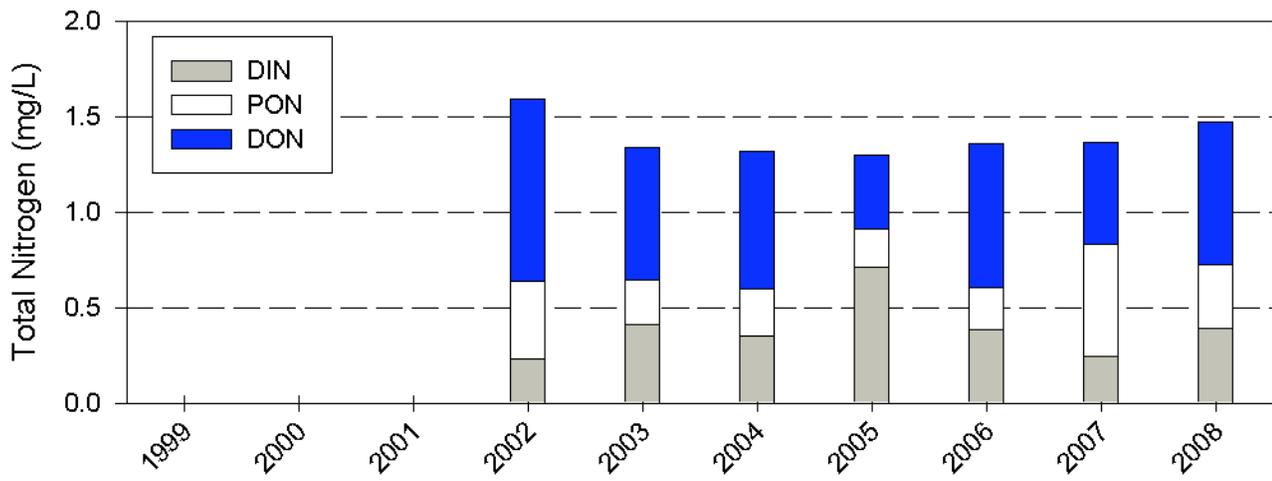
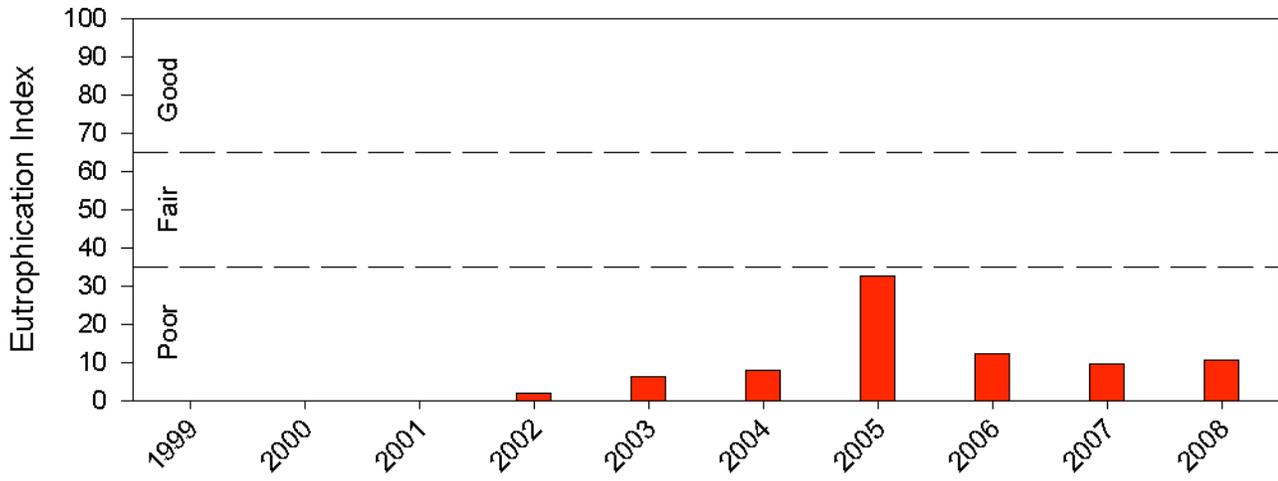
Muddy Creek (PBA-5)



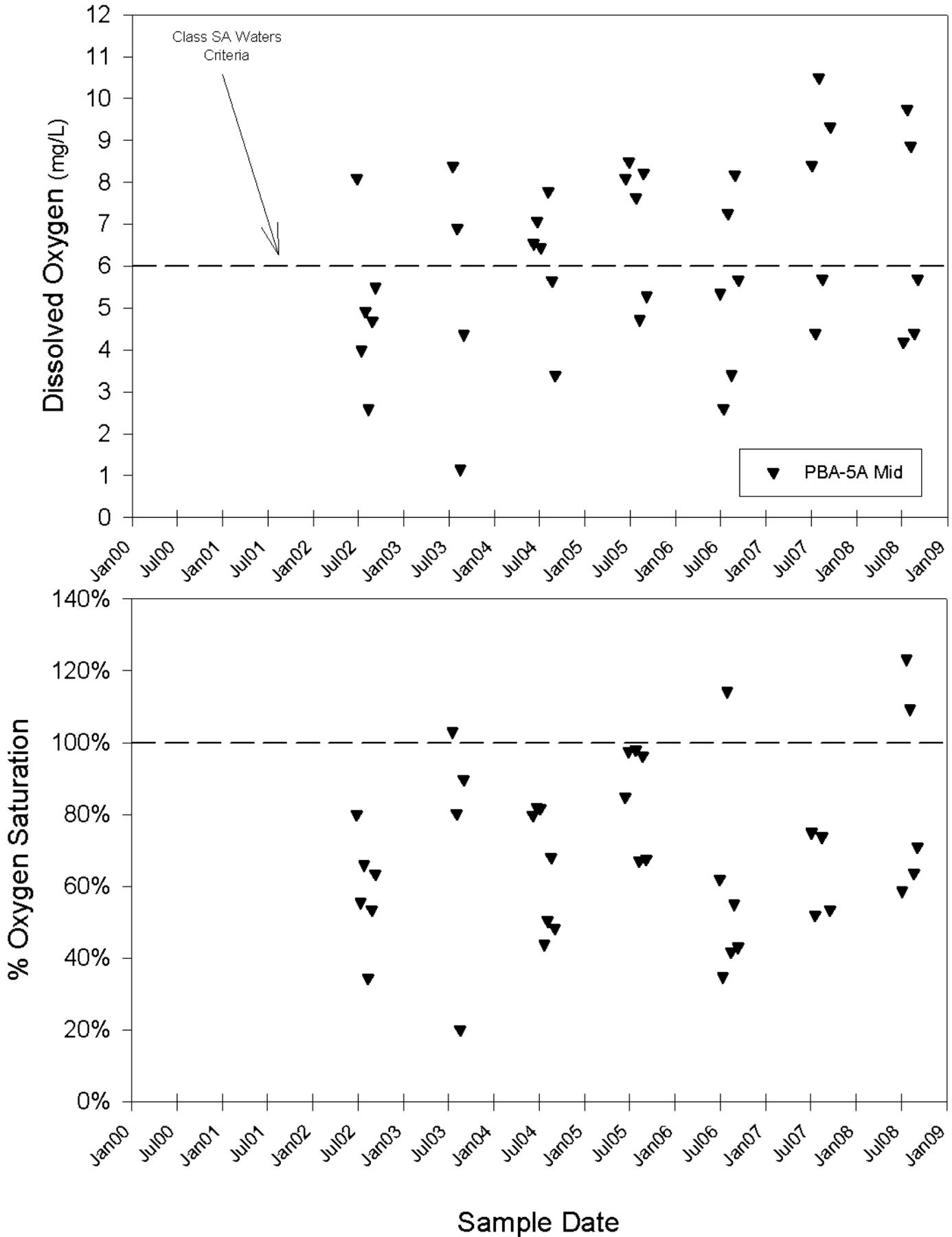
Muddy Creek (PBA-5)



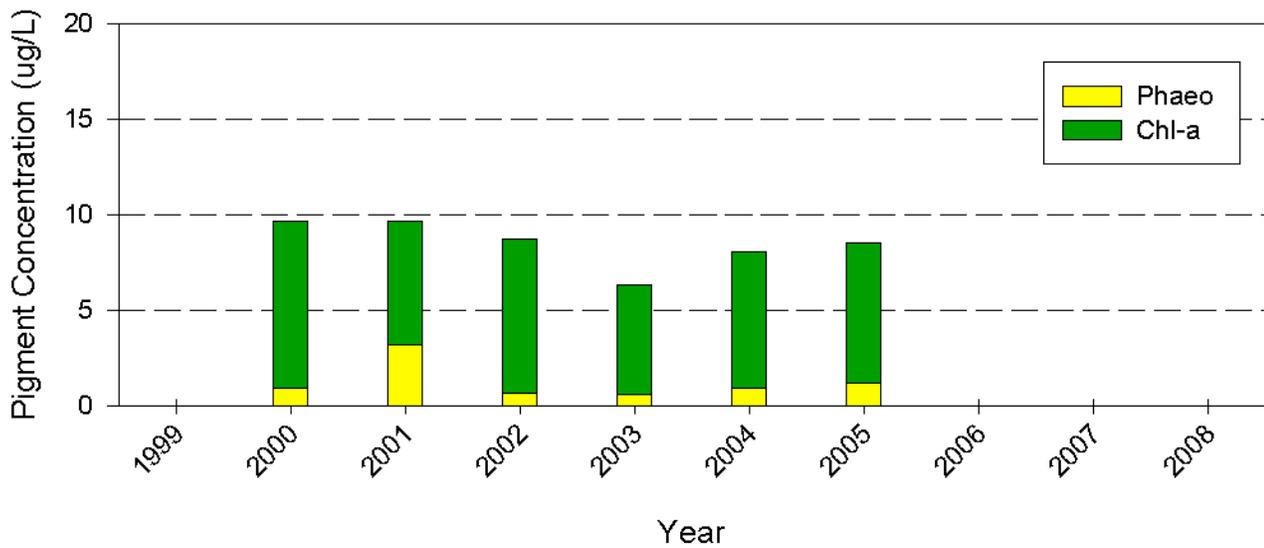
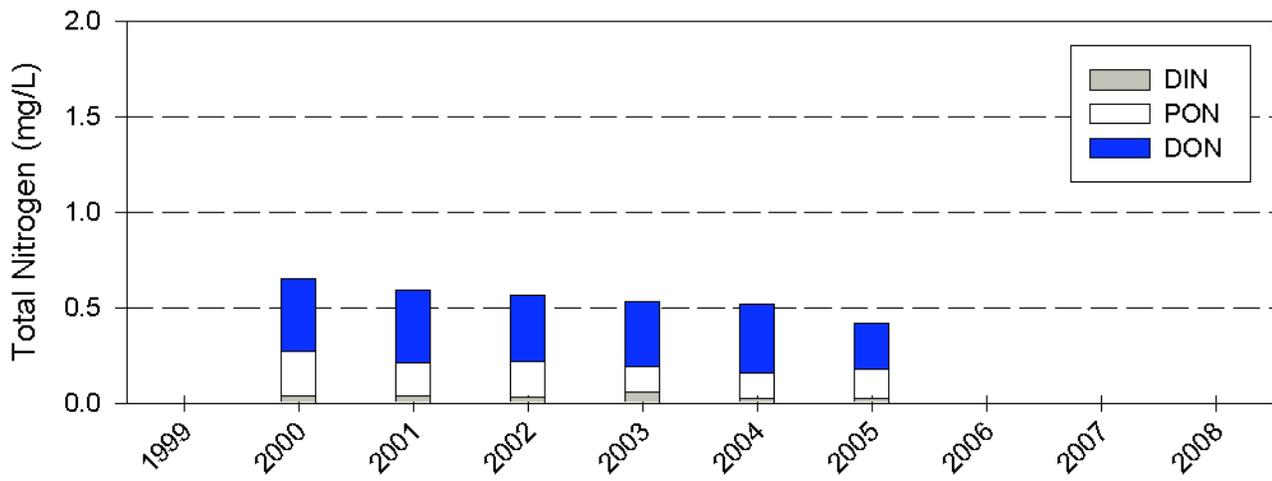
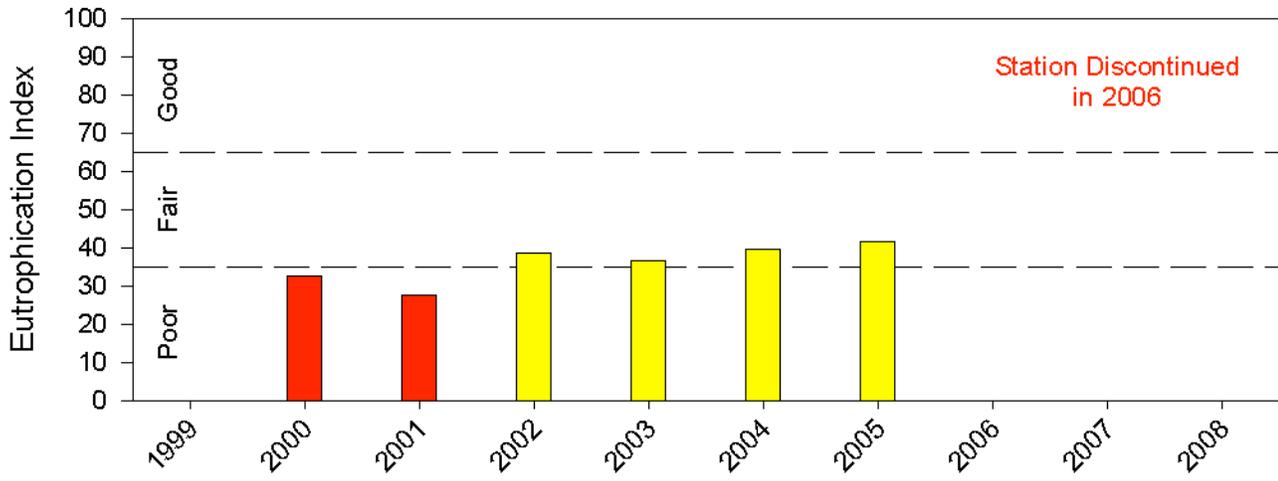
Muddy Creek - Upper (PBA-5A)



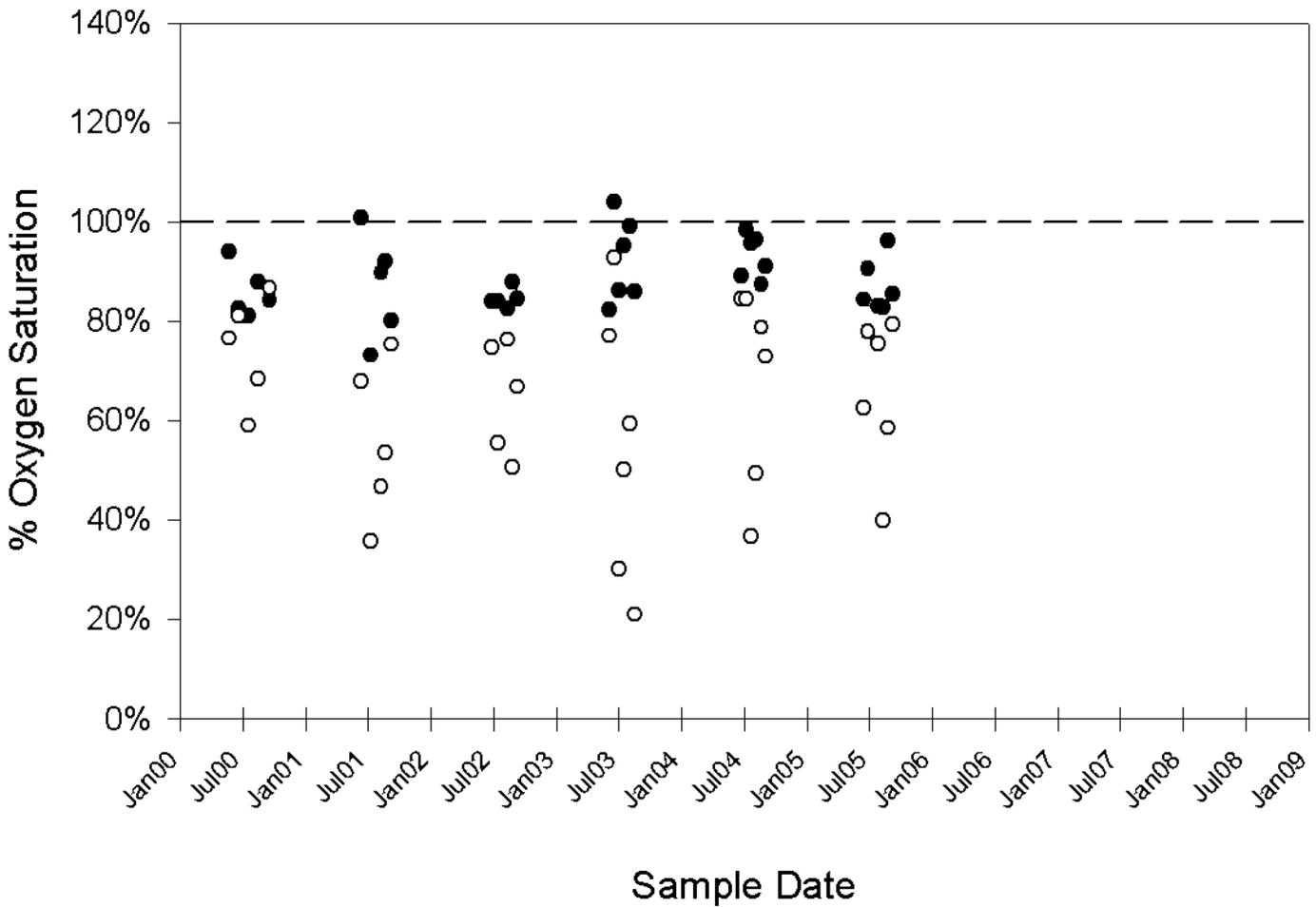
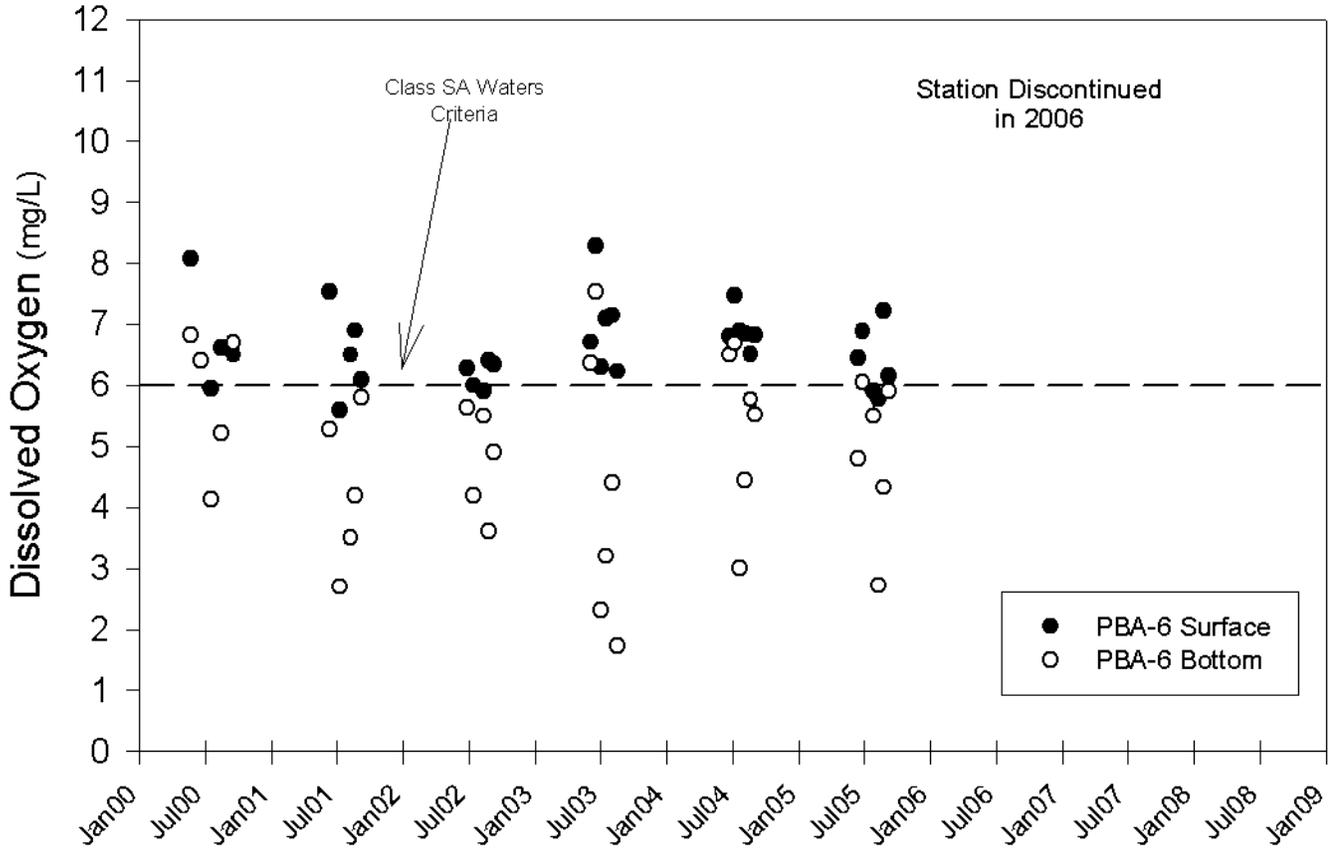
Muddy Creek - Upper (PBA-5A)



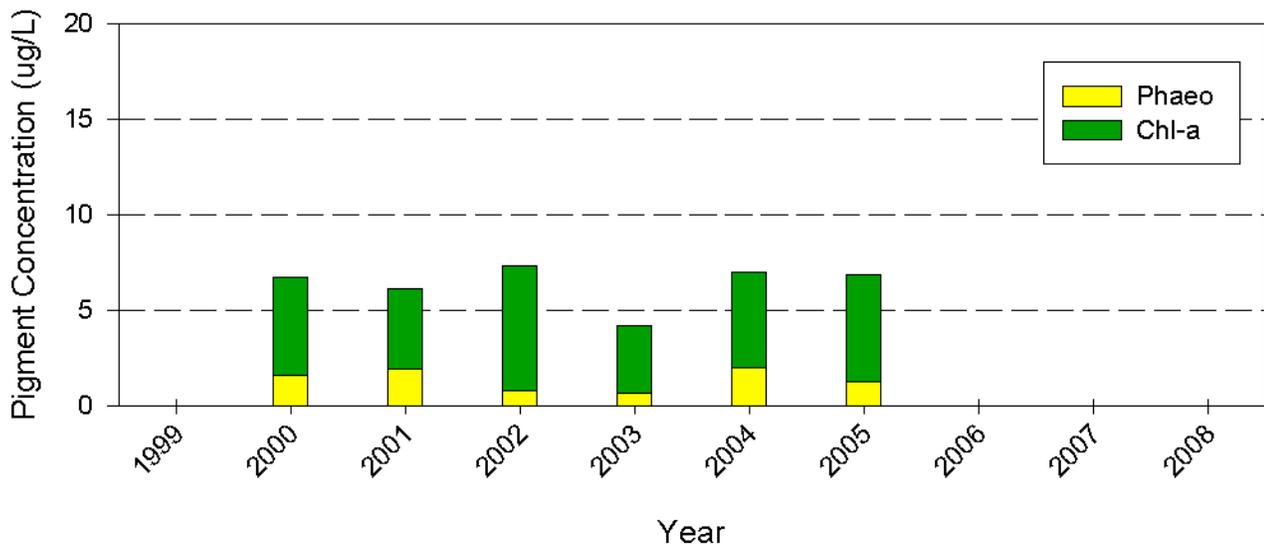
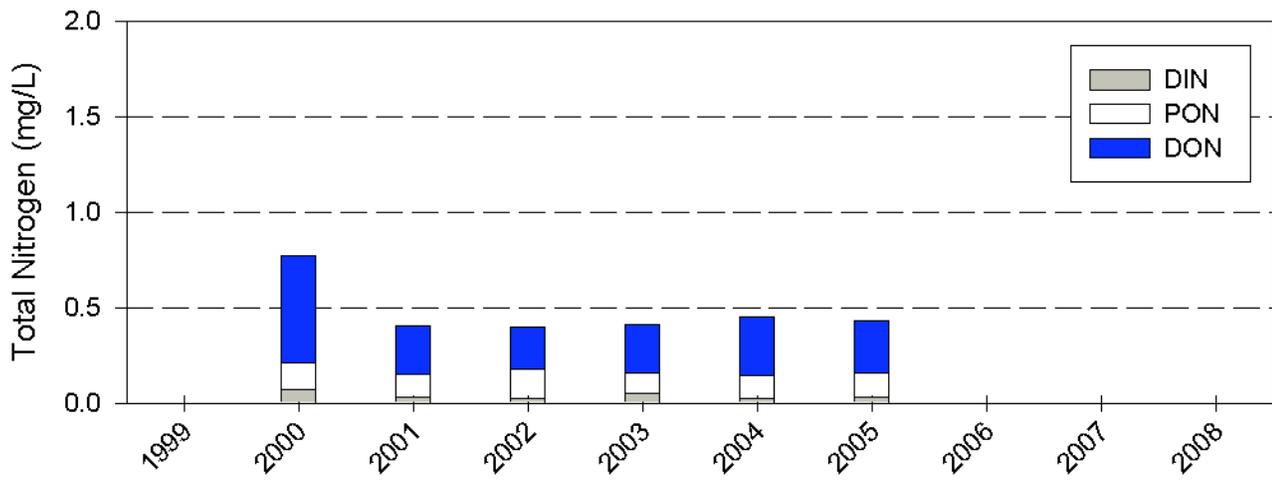
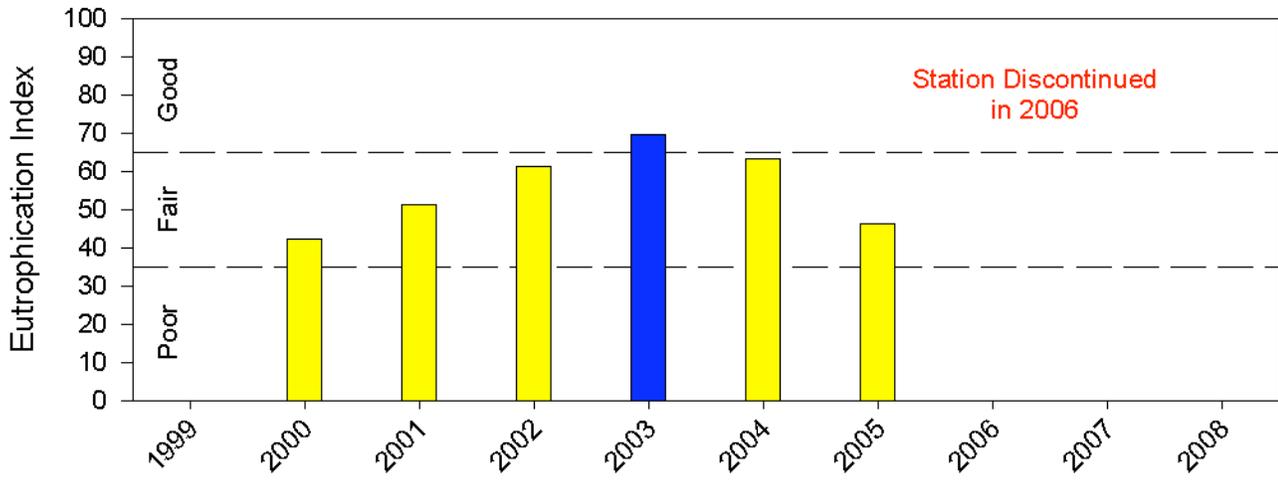
Big Bay - SW (PBA-6)



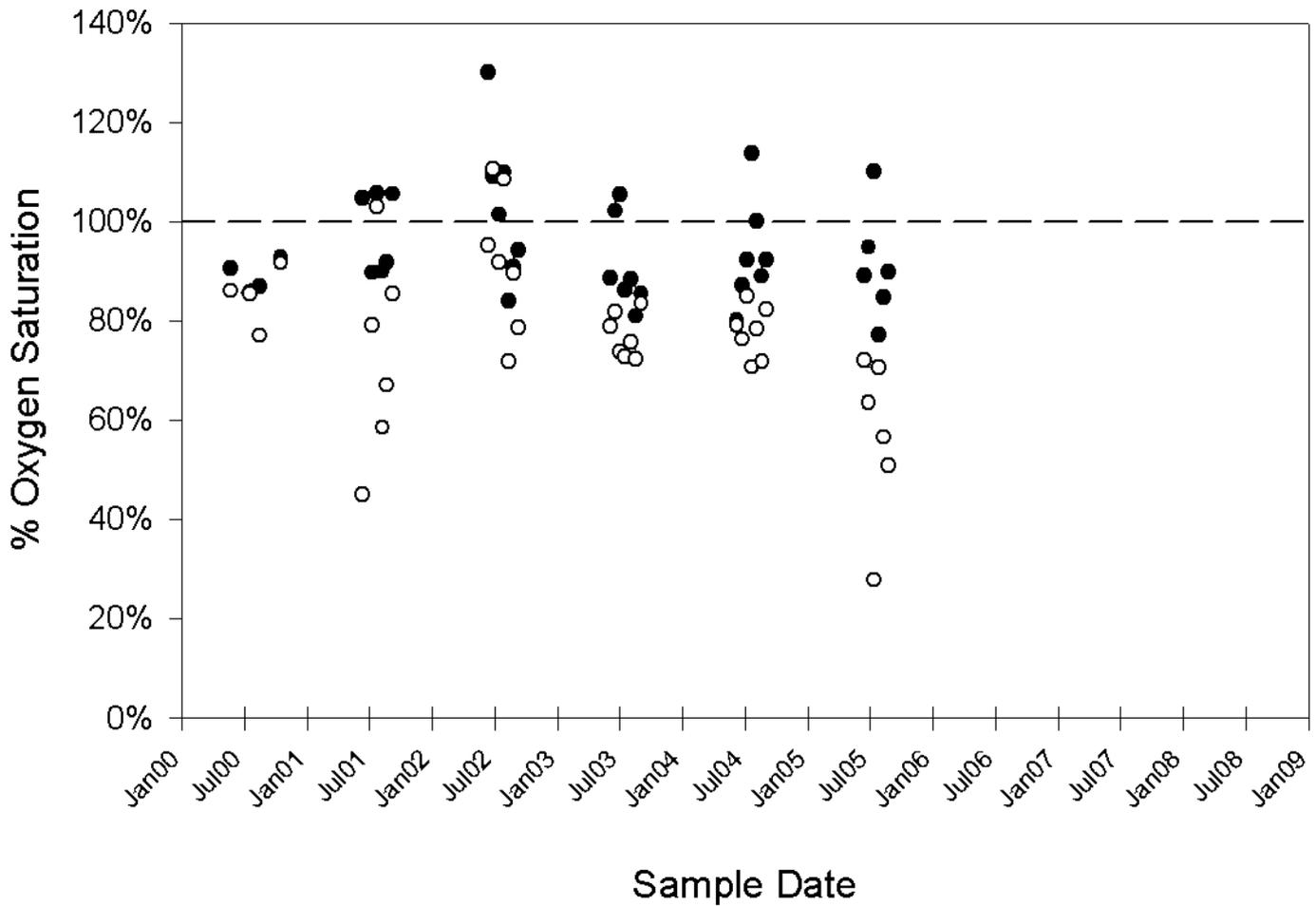
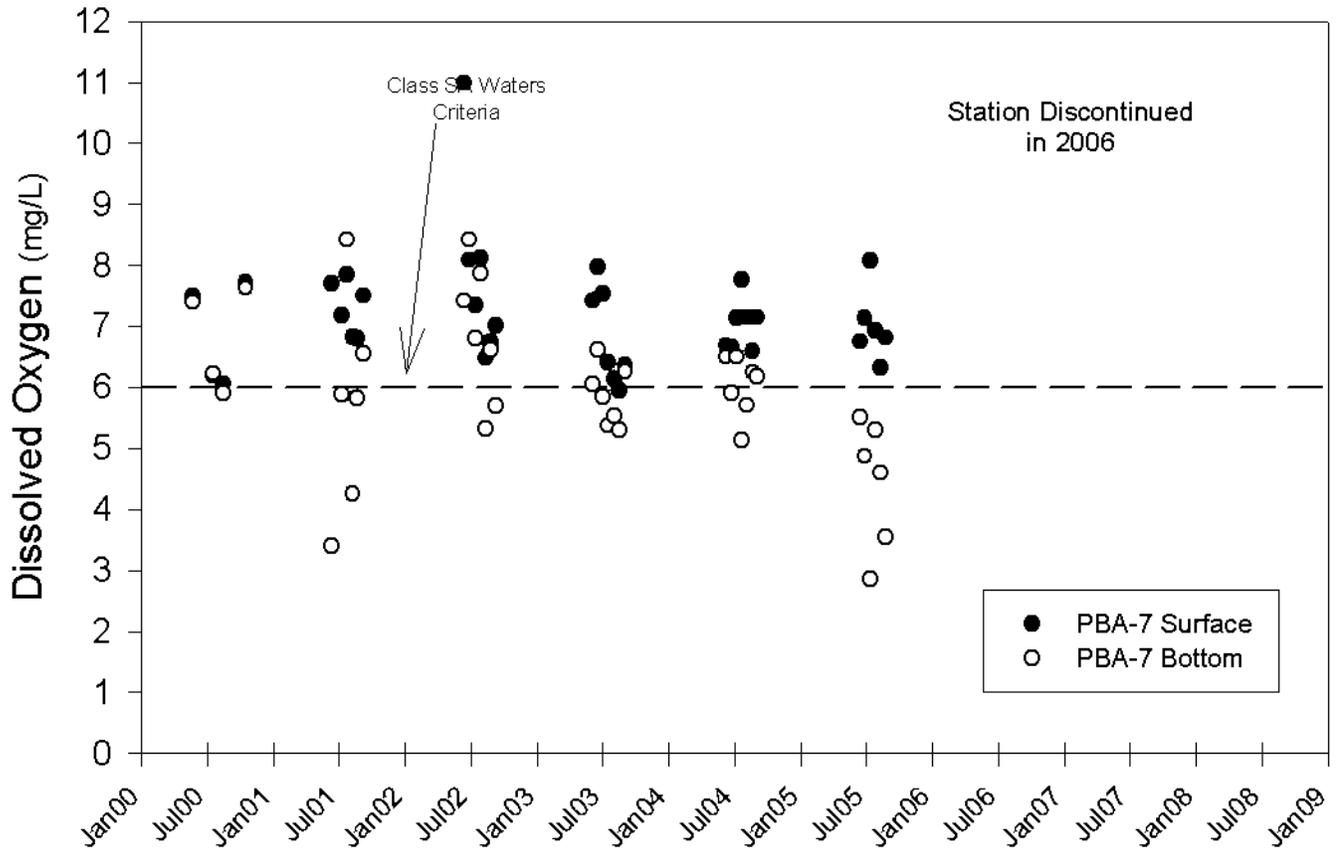
Big Bay - SW (PBA-6)



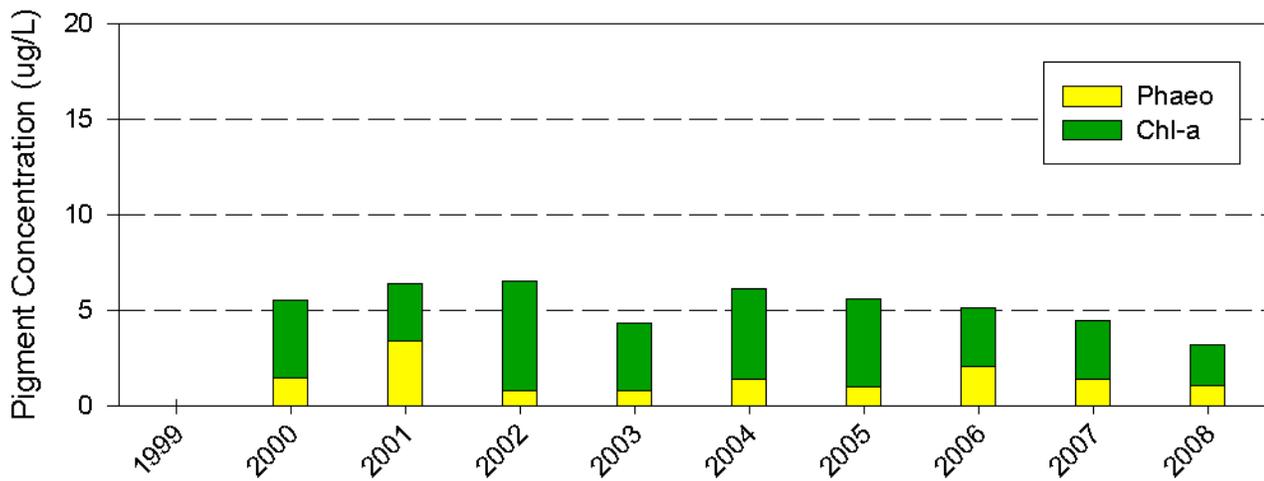
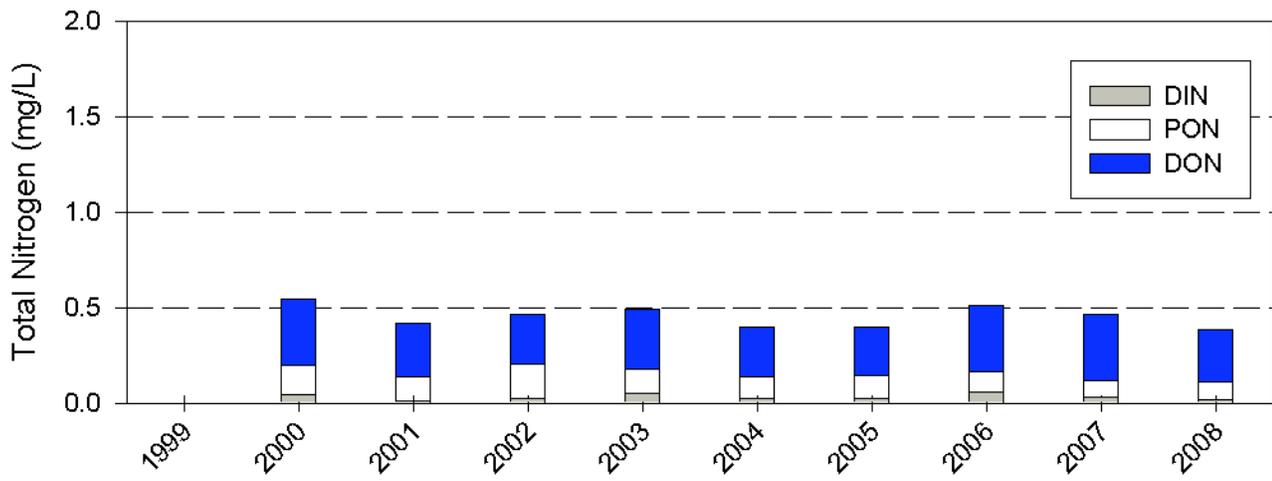
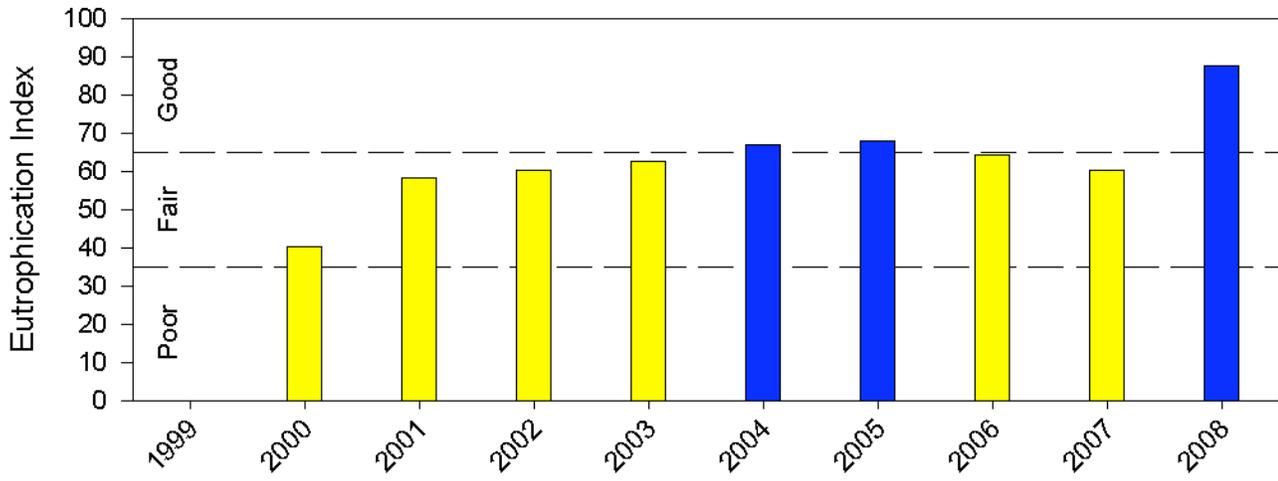
Big Bay - Mid (PBA-7)



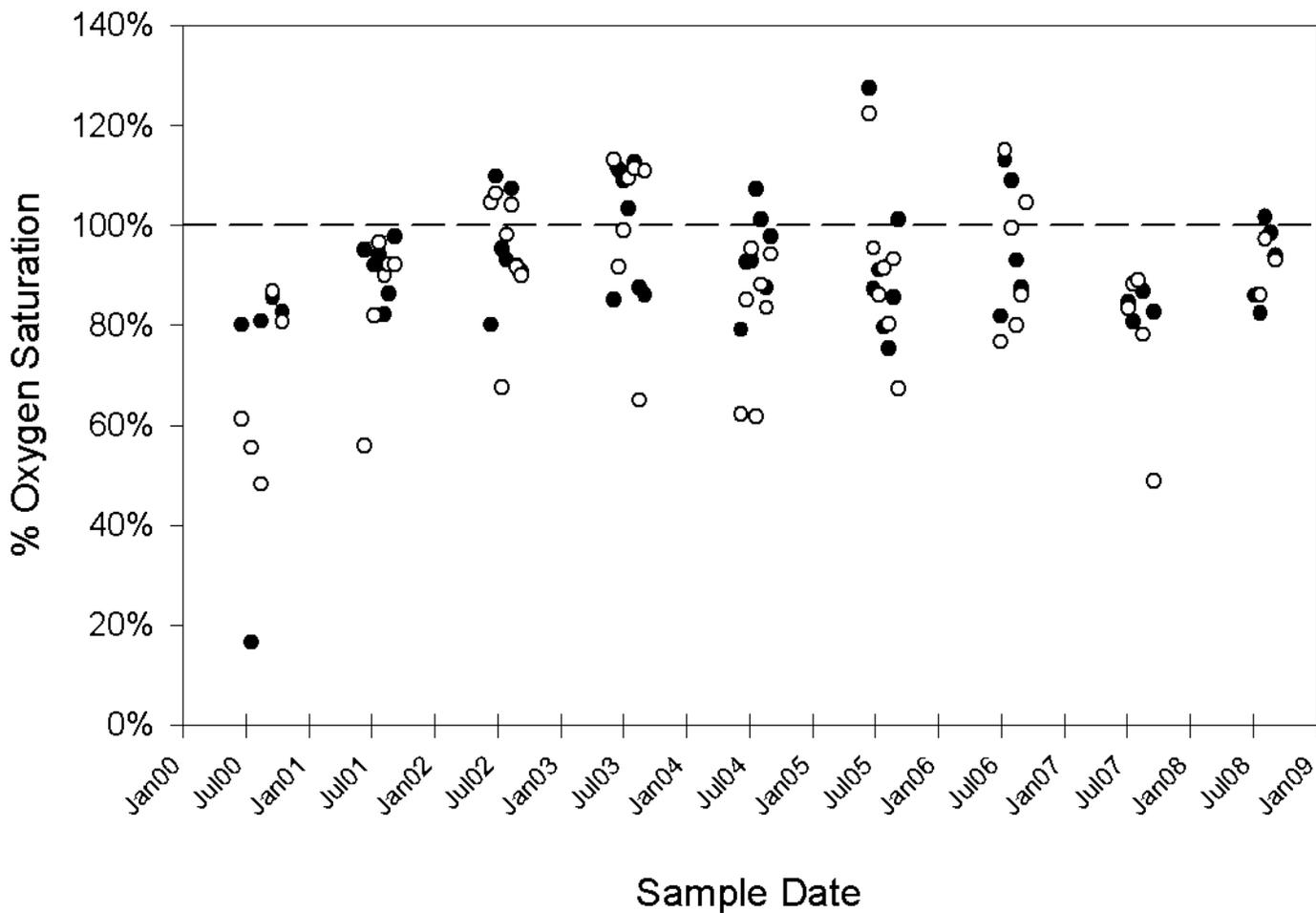
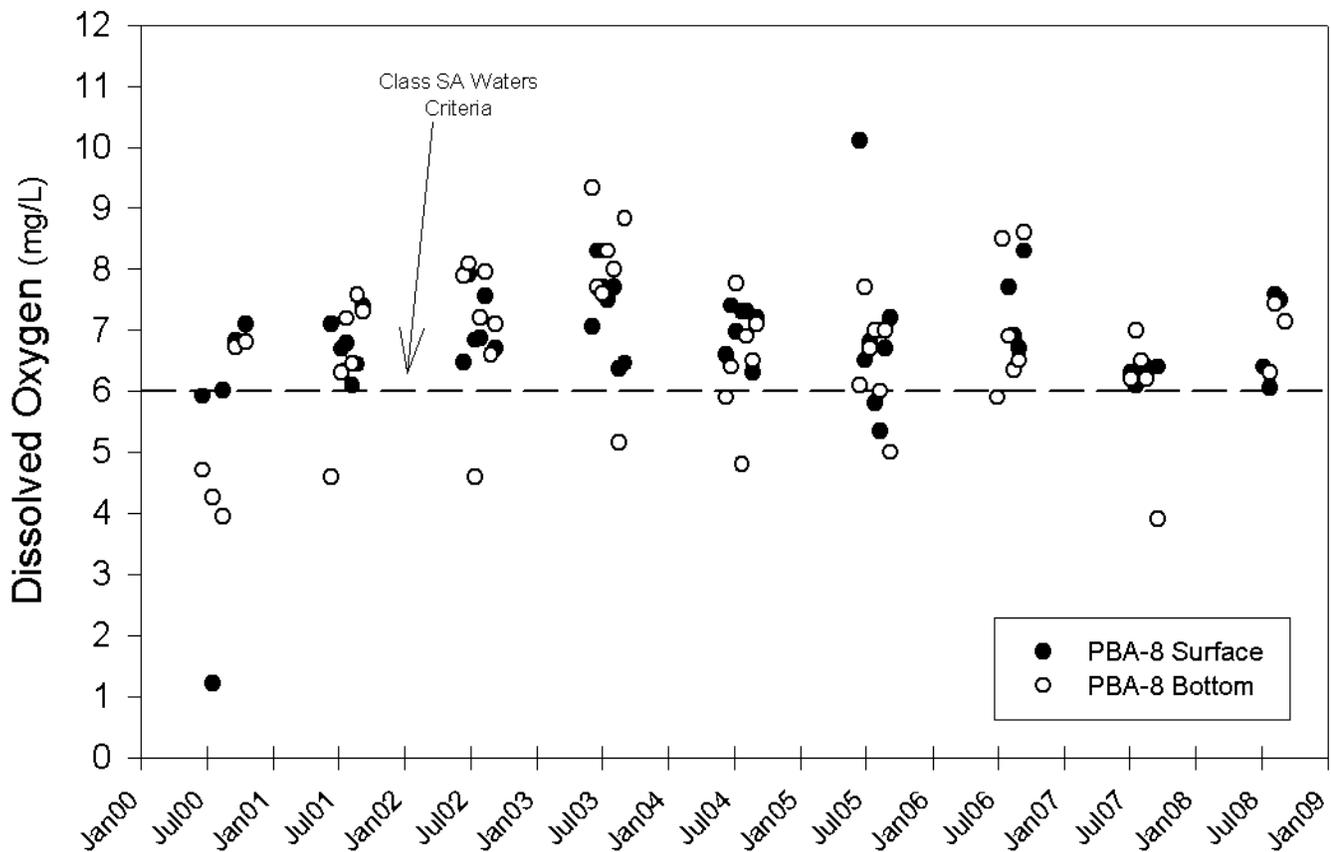
Big Bay - Mid (PBA-7)



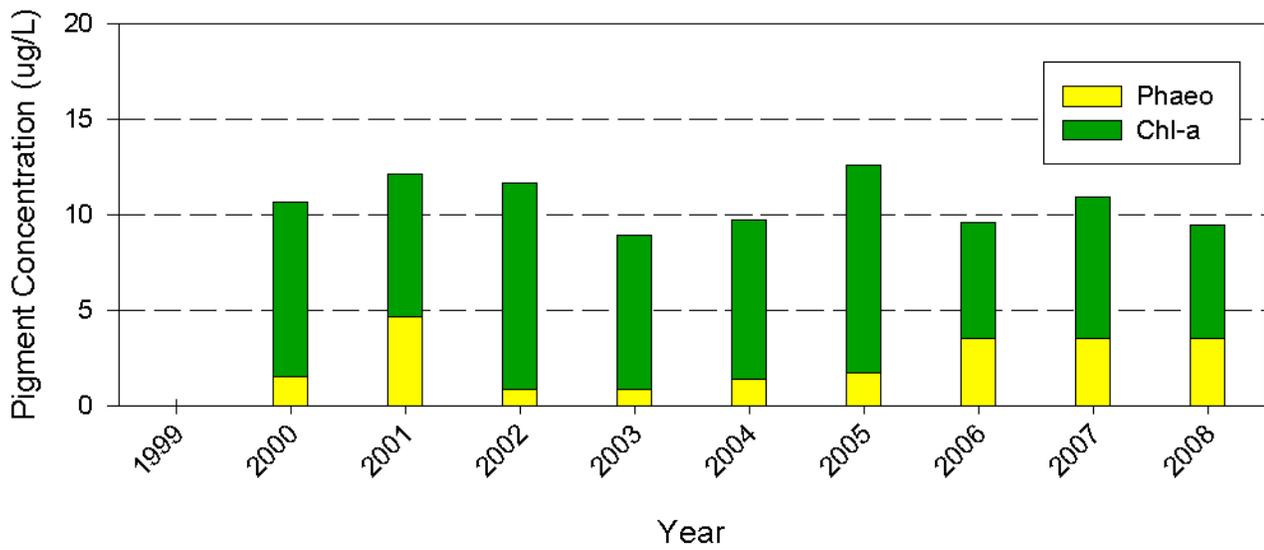
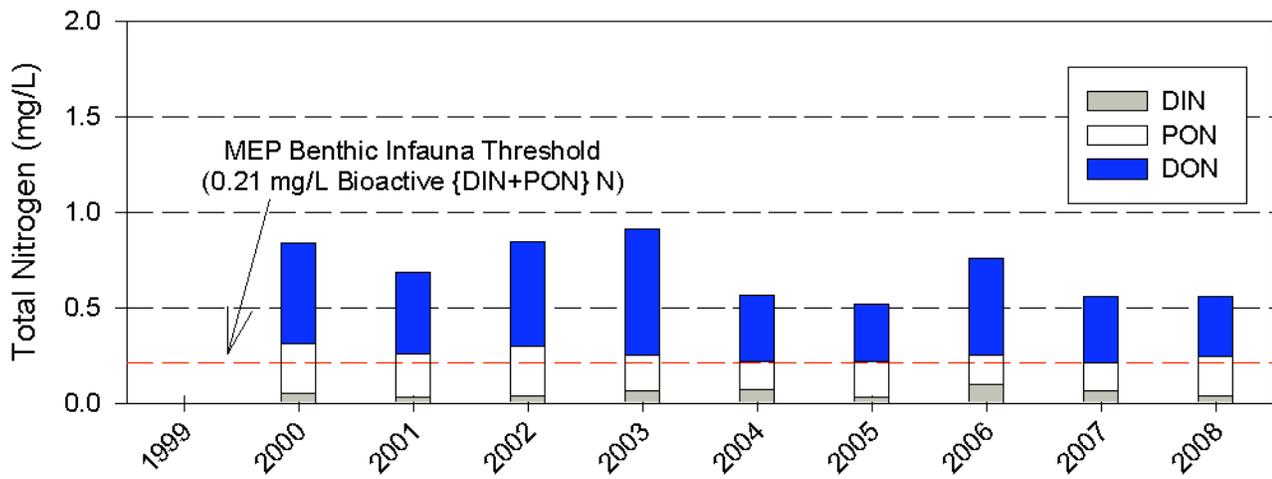
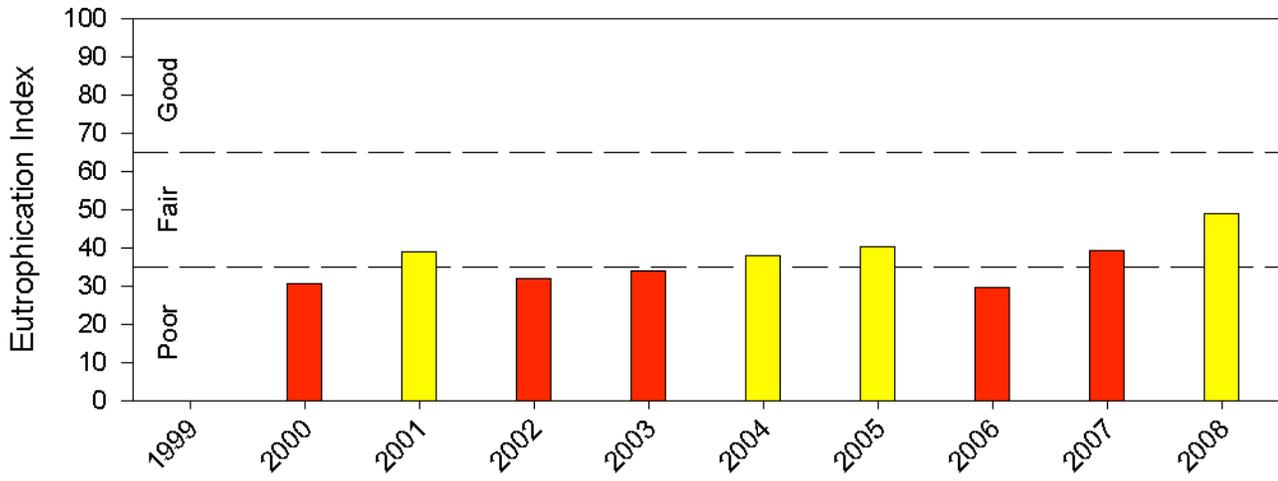
Big Bay - NE (PBA-8)



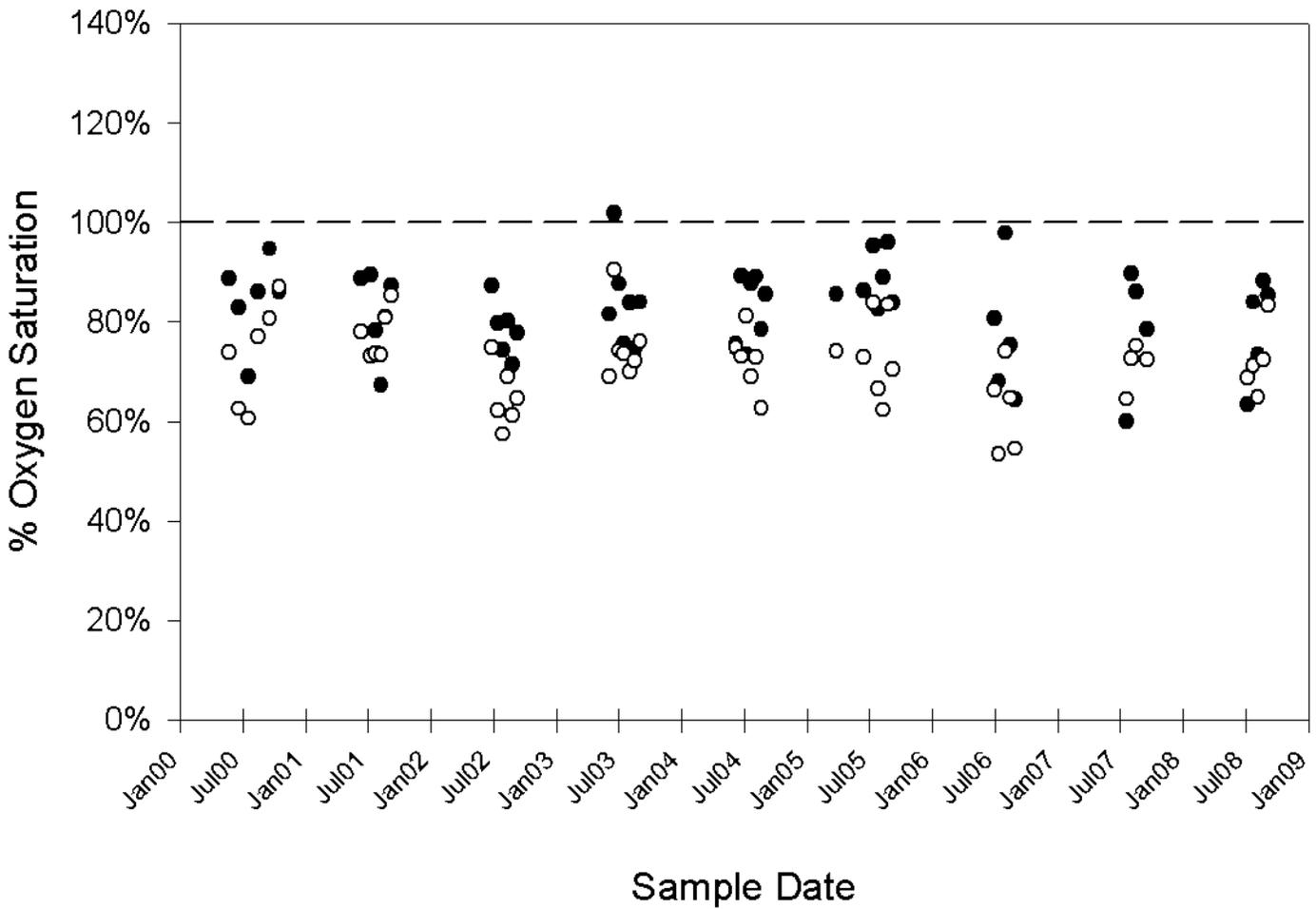
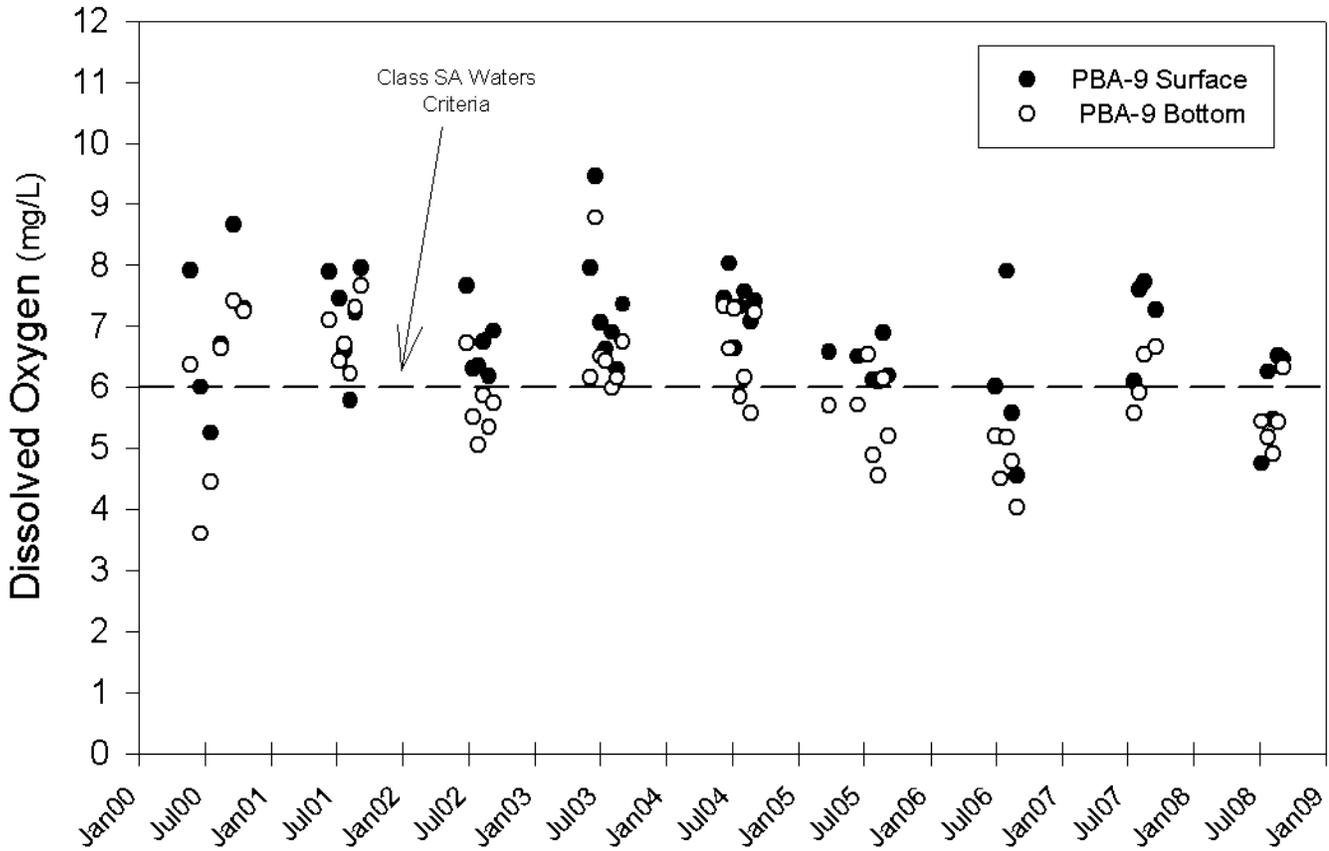
Big Bay - NE (PBA-8)



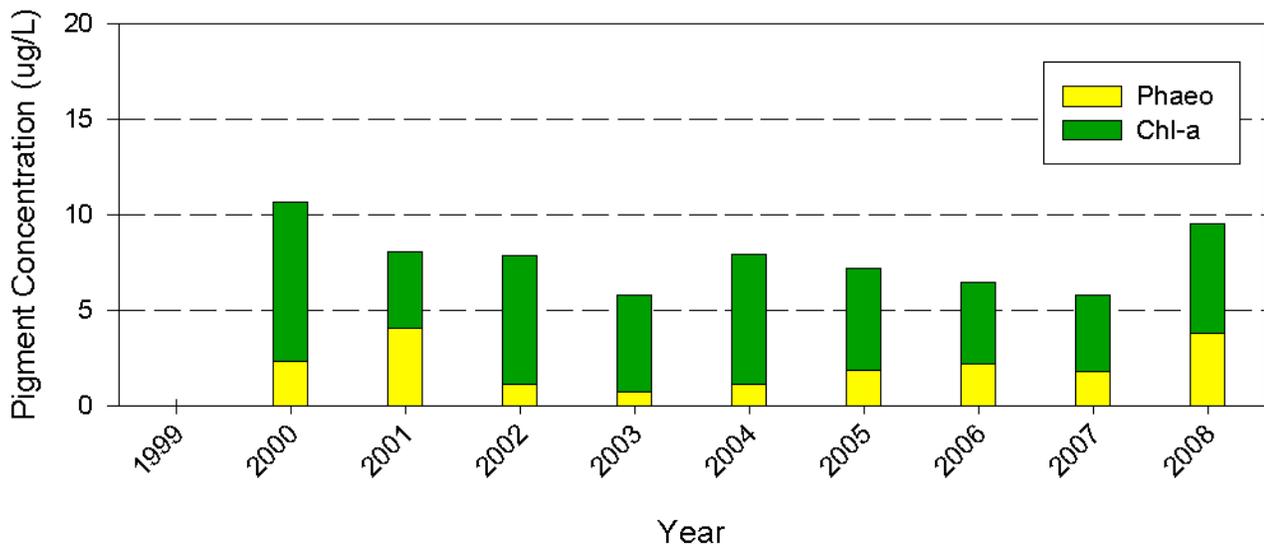
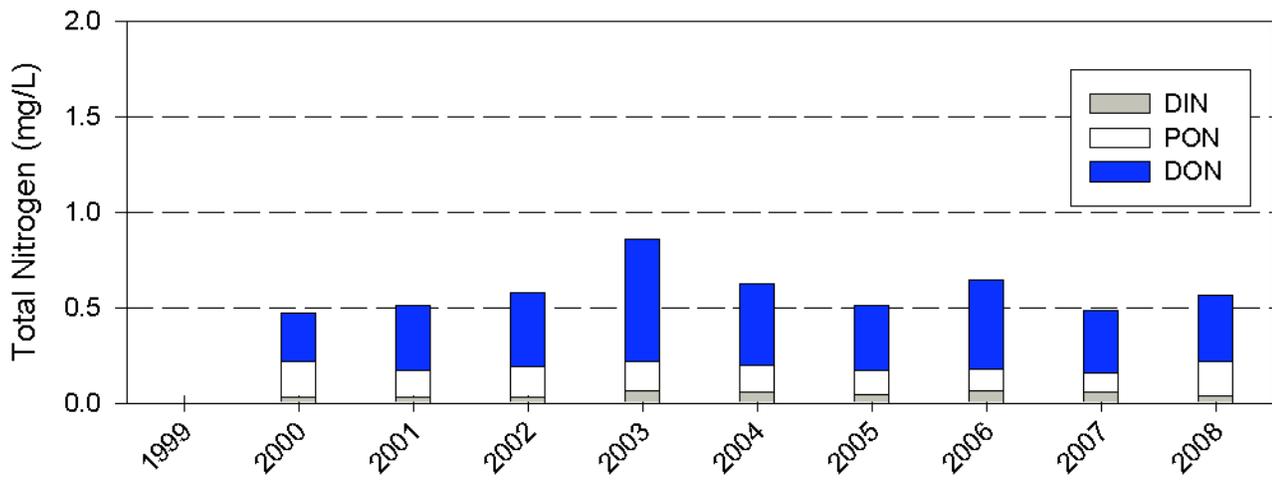
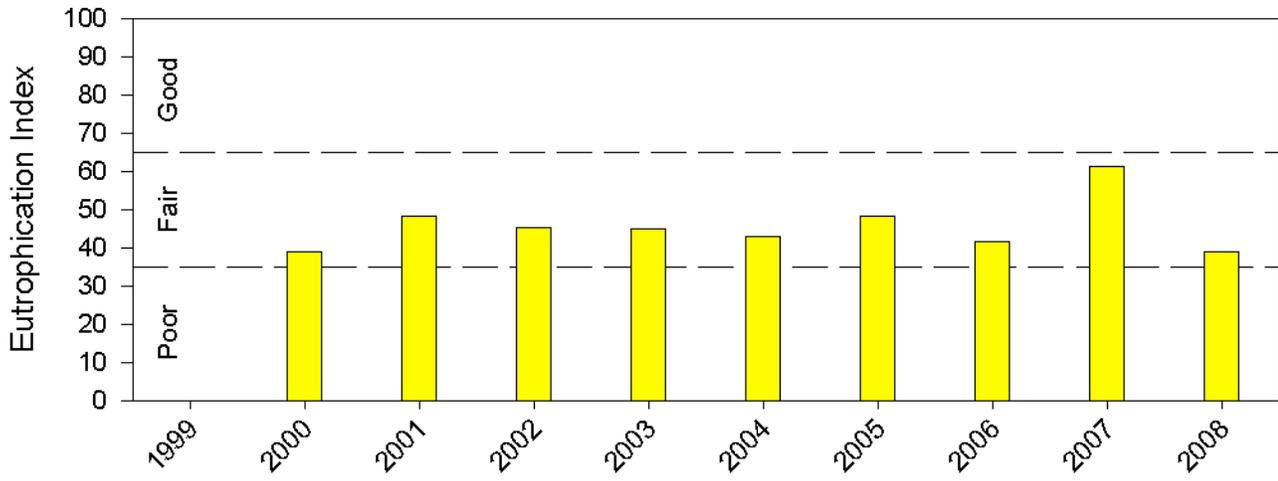
Round Cove (PBA-9)



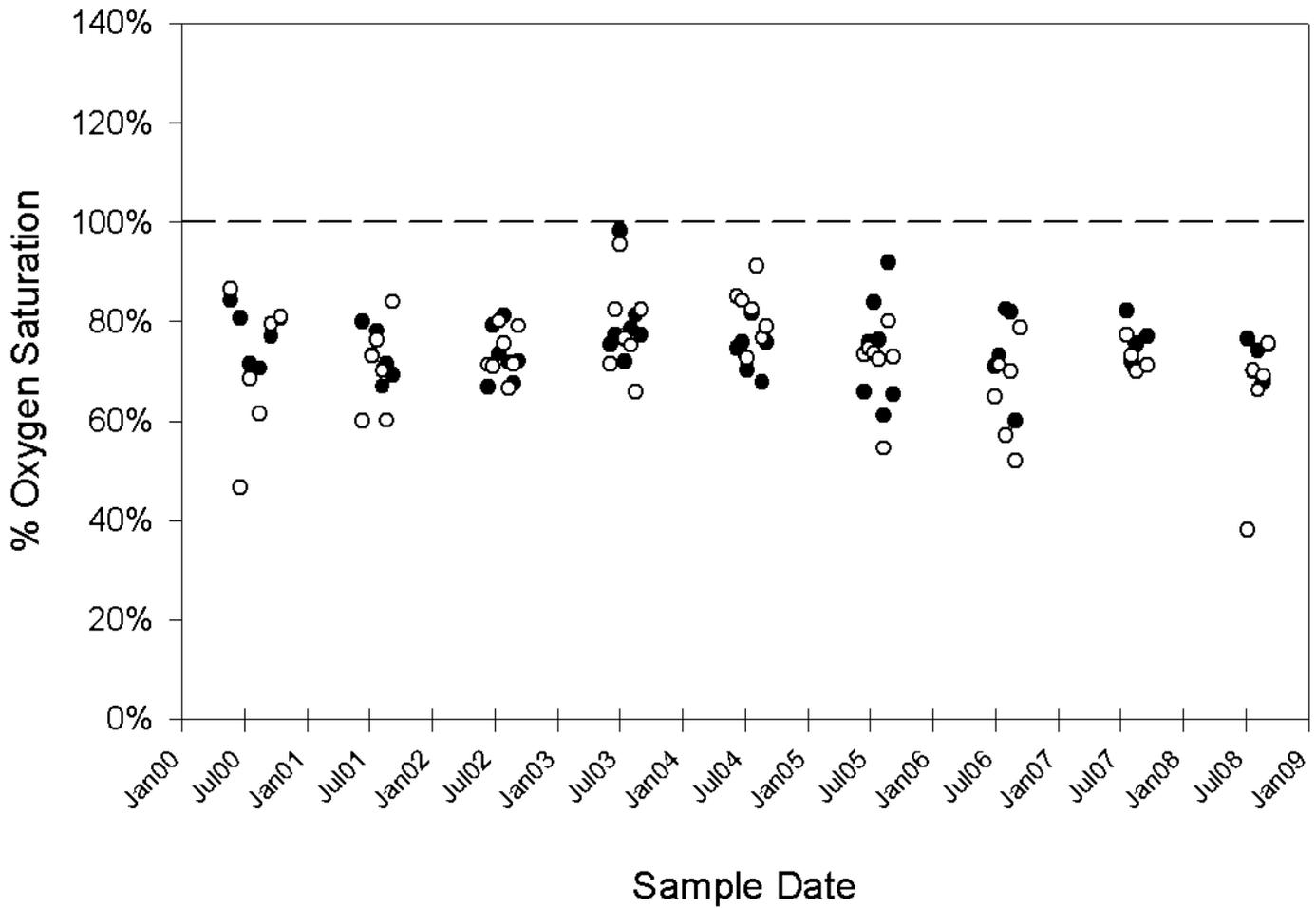
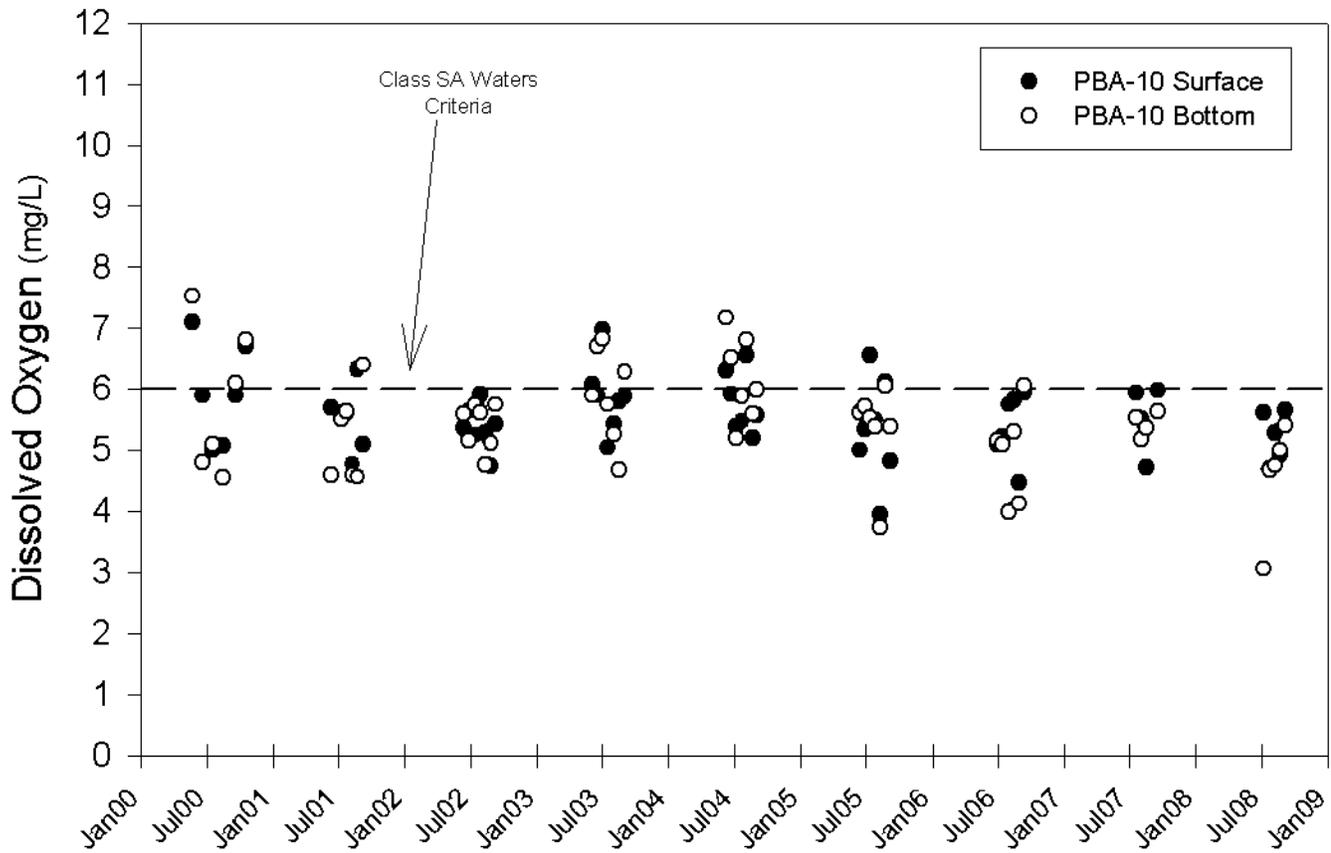
Round Cove (PBA-9)



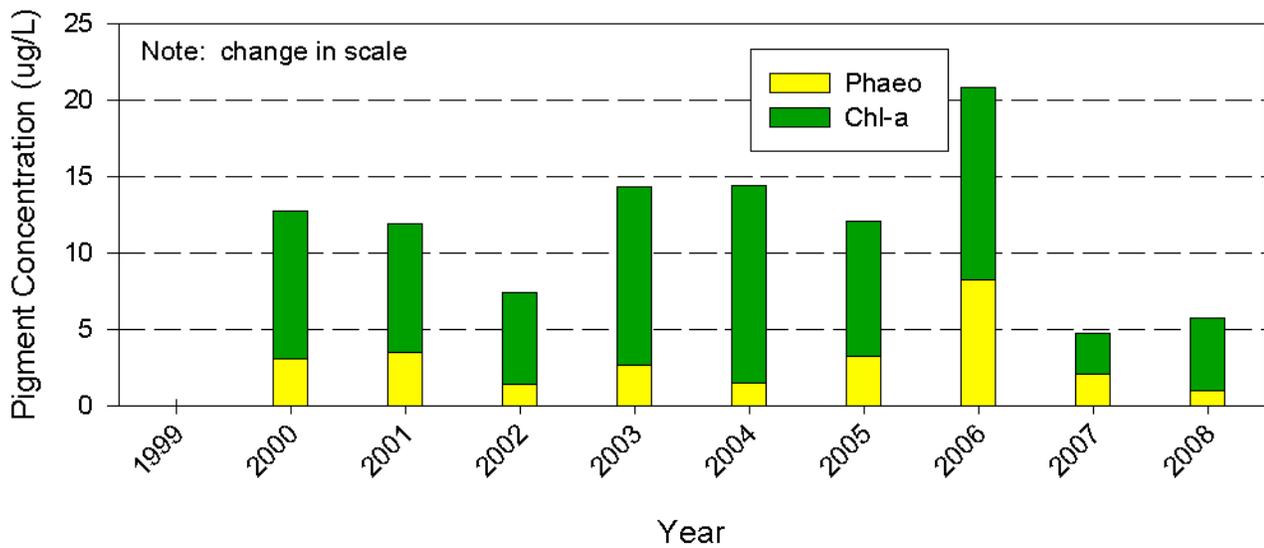
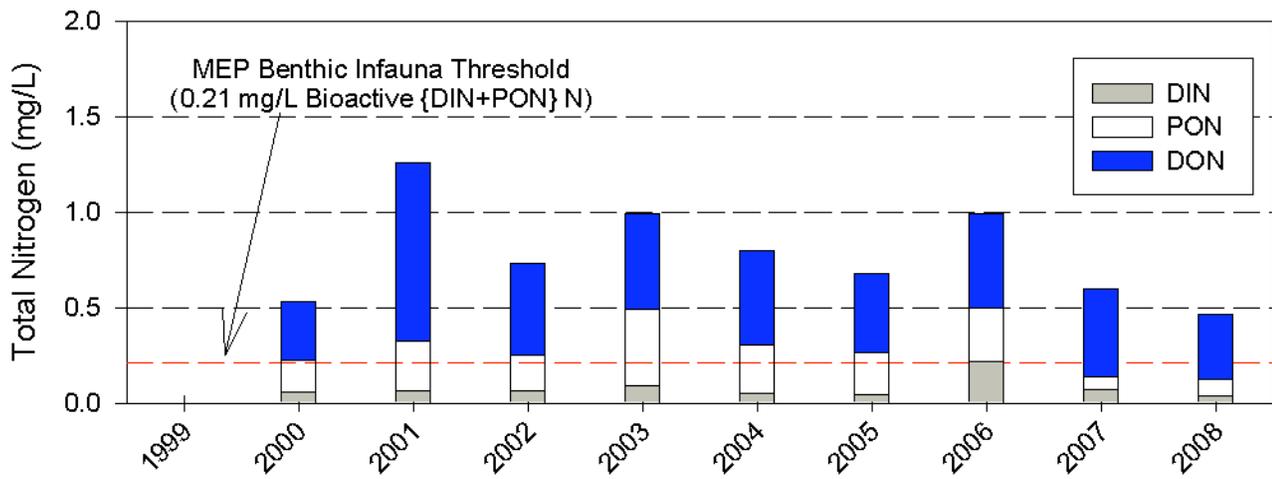
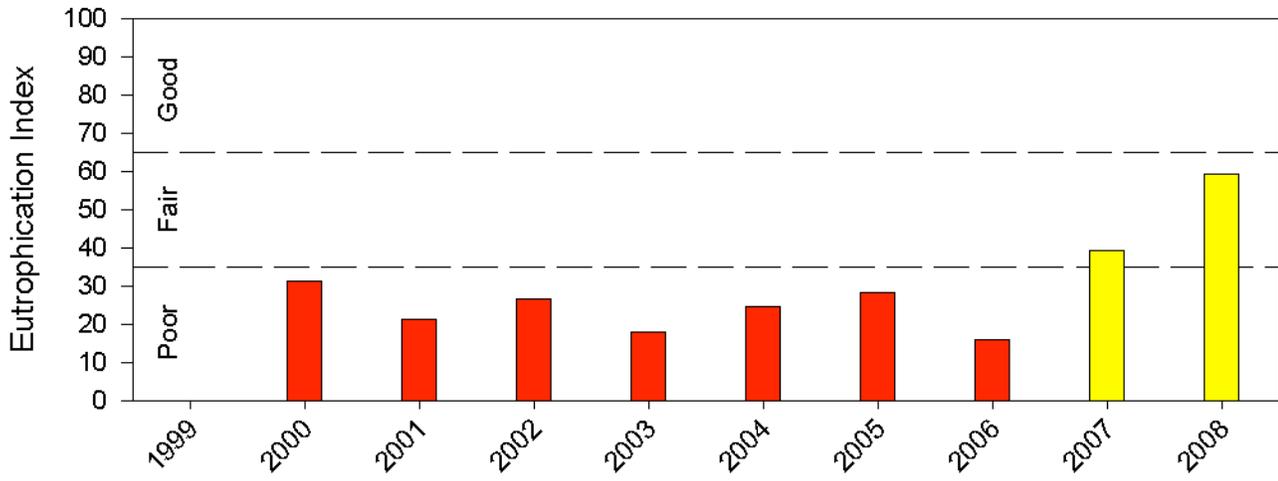
Quanset Pond (PBA-10)



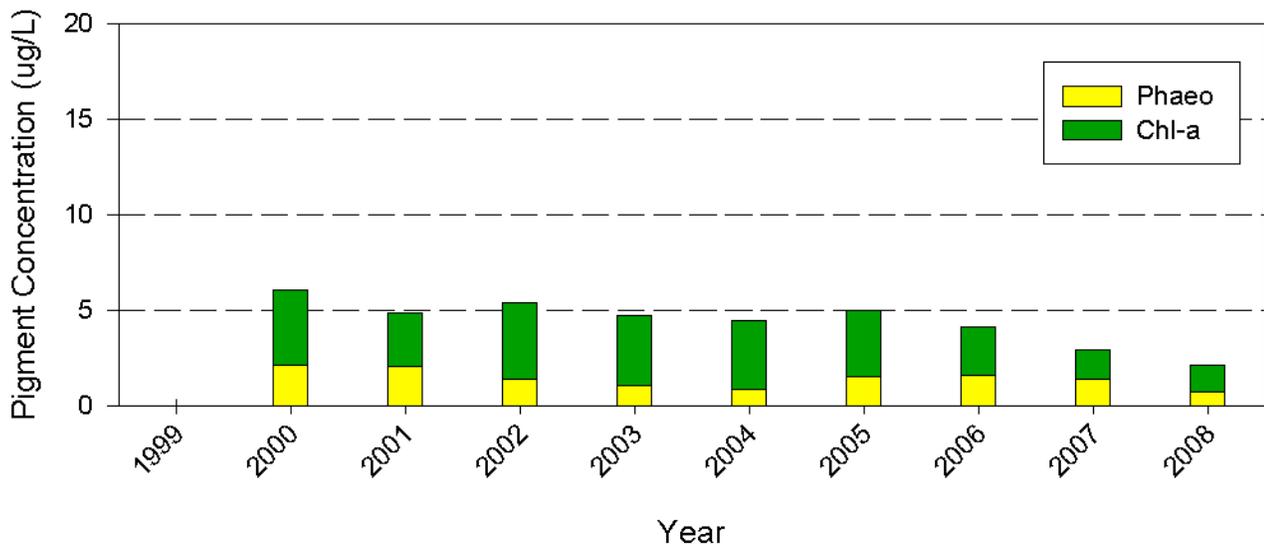
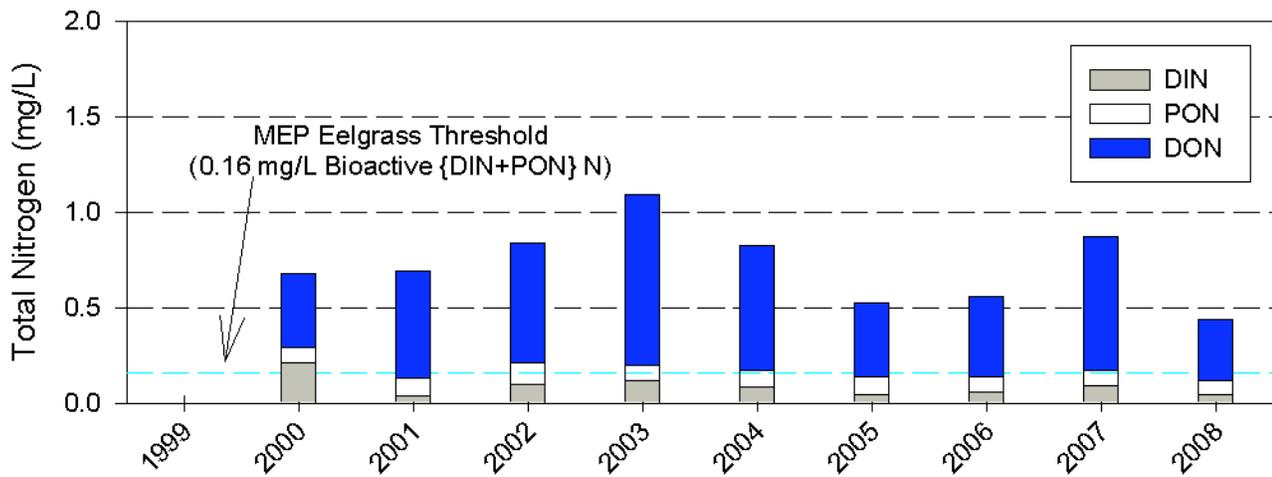
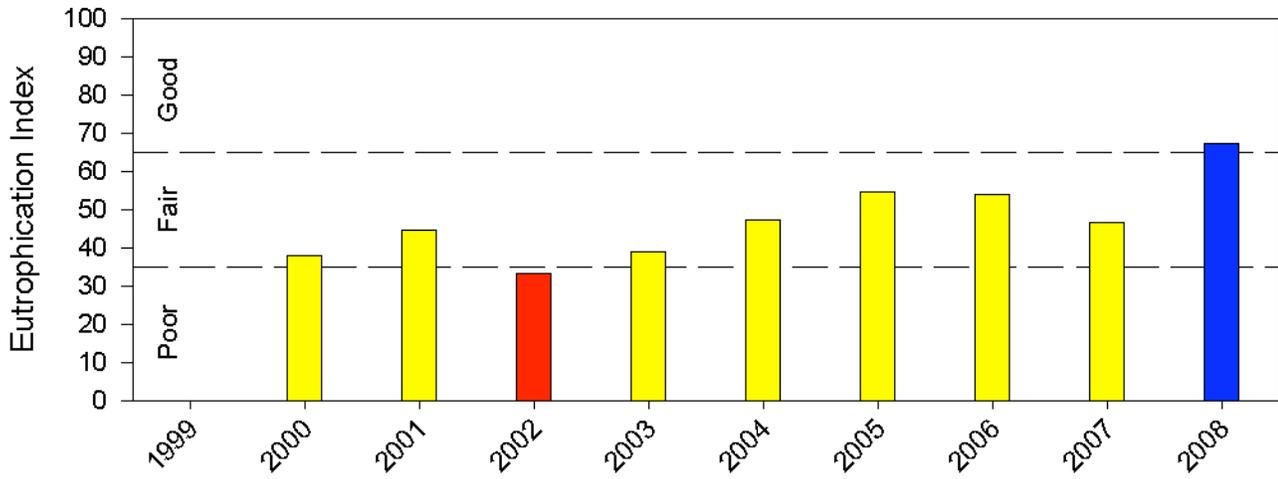
Quanset Pond (PBA-10)



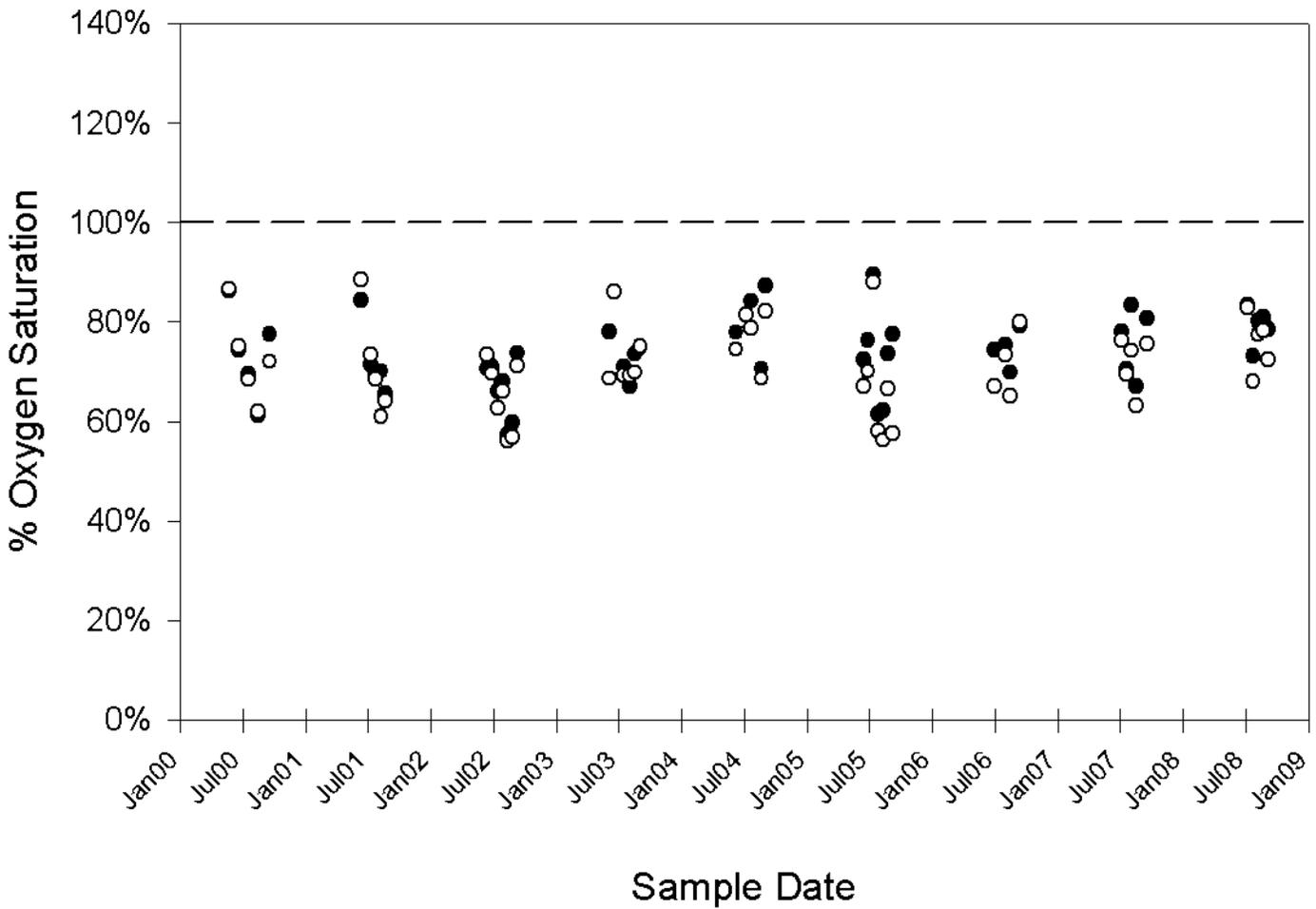
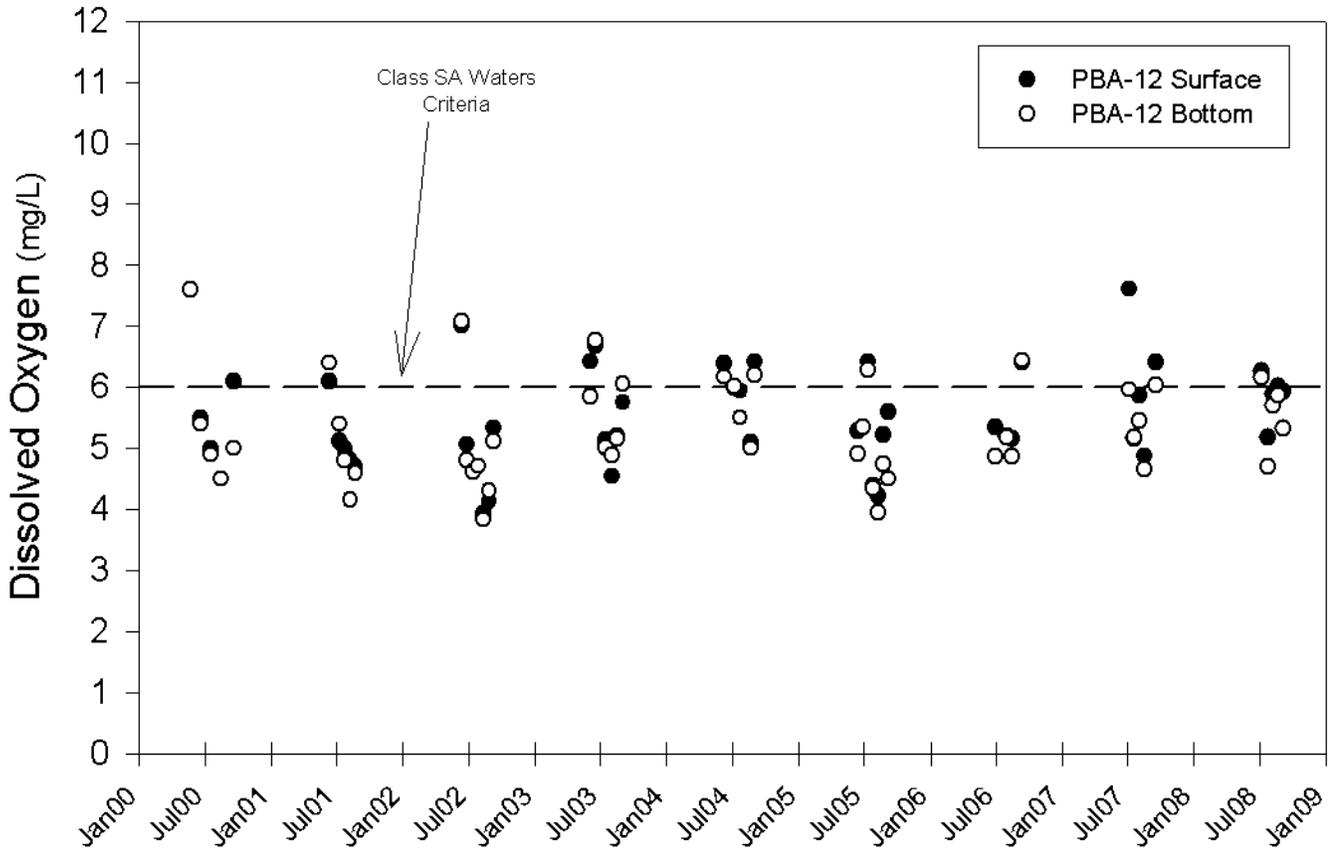
Paw Wah Pond (PBA-11)



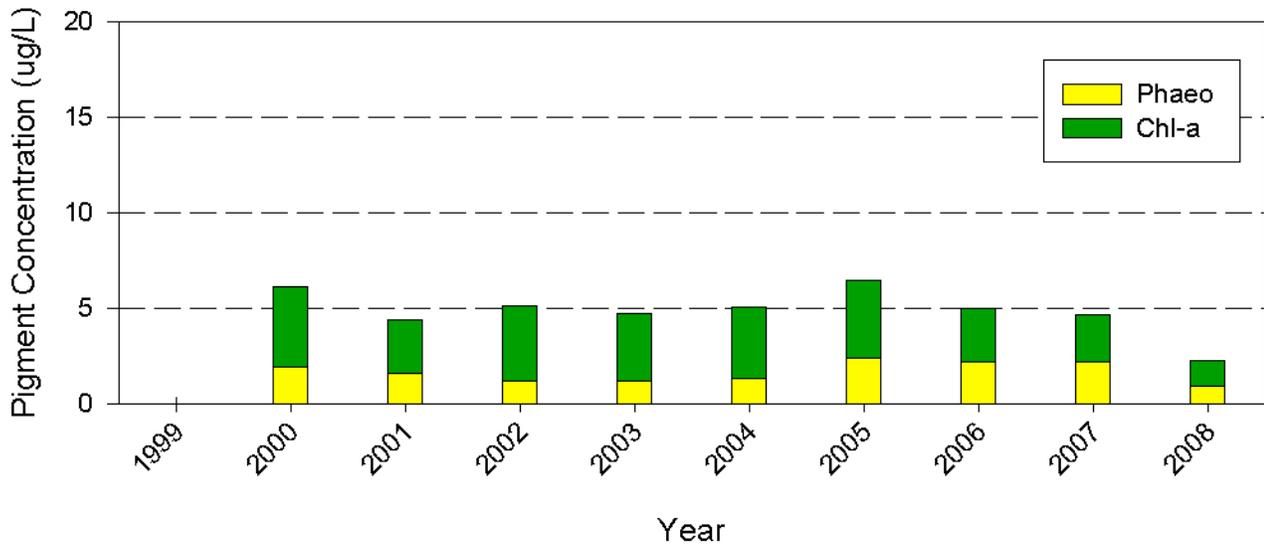
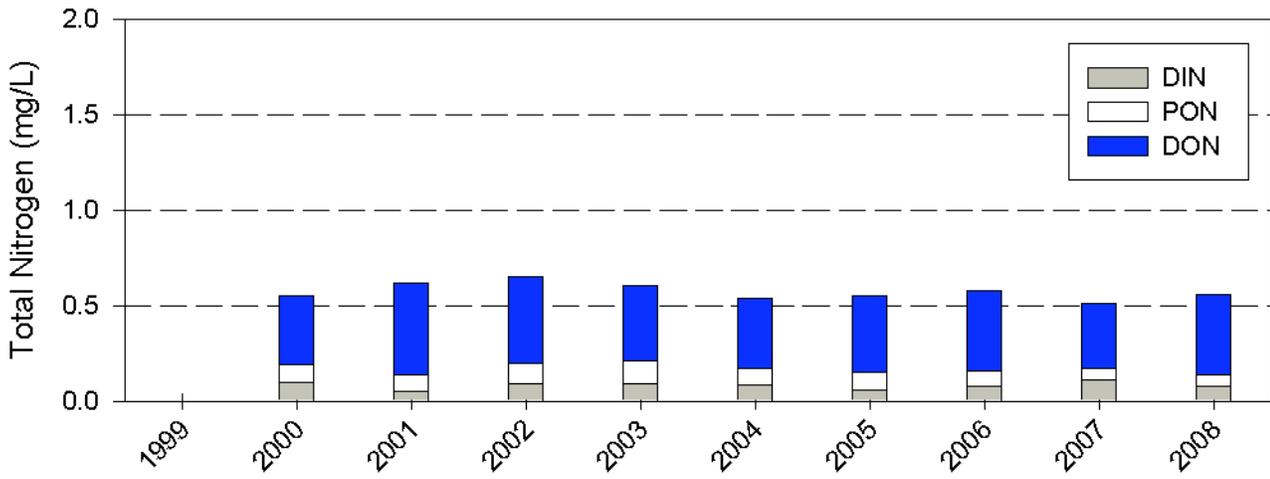
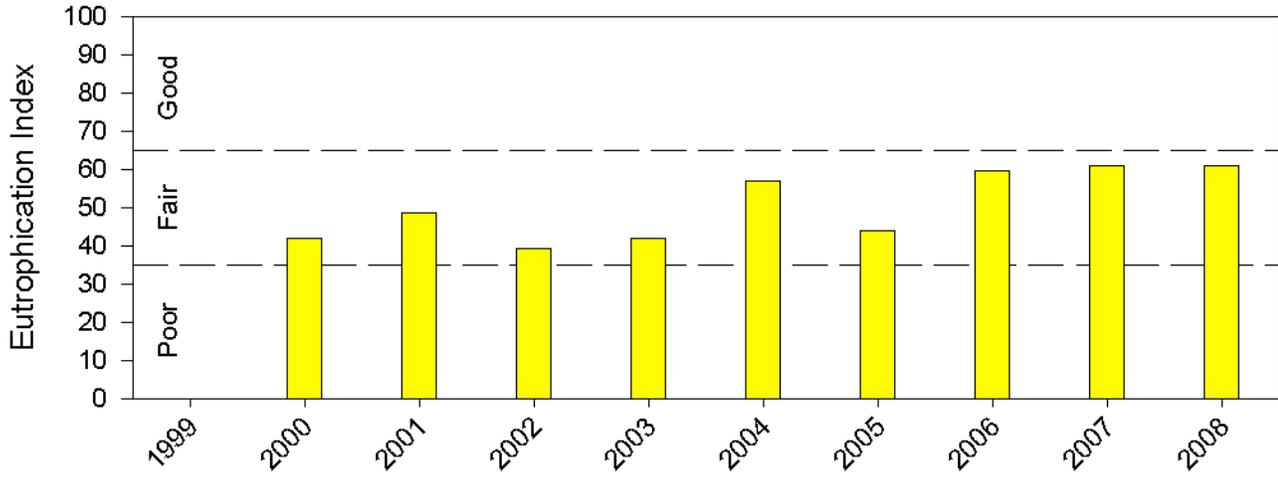
Namequoit Point - South (PBA-12)



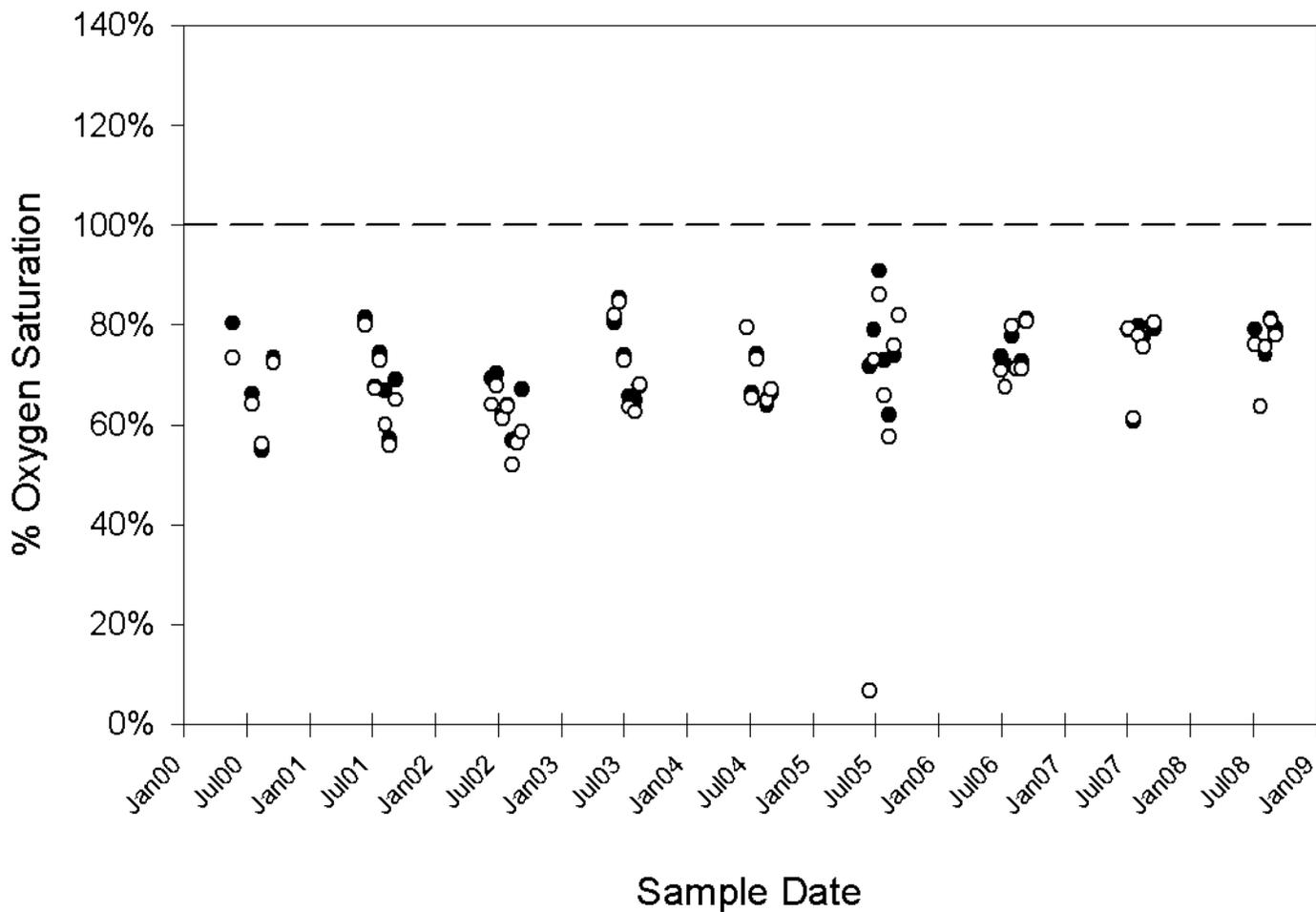
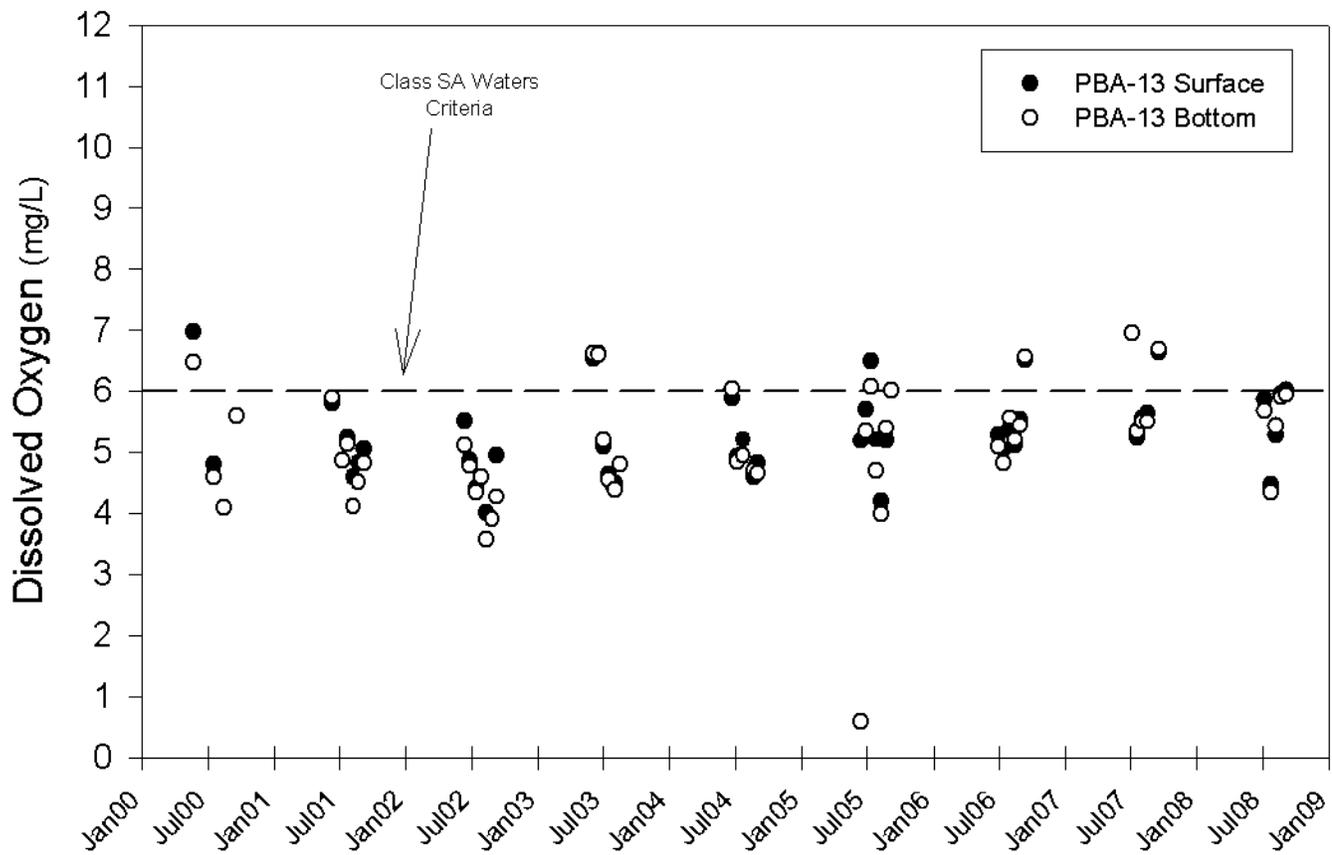
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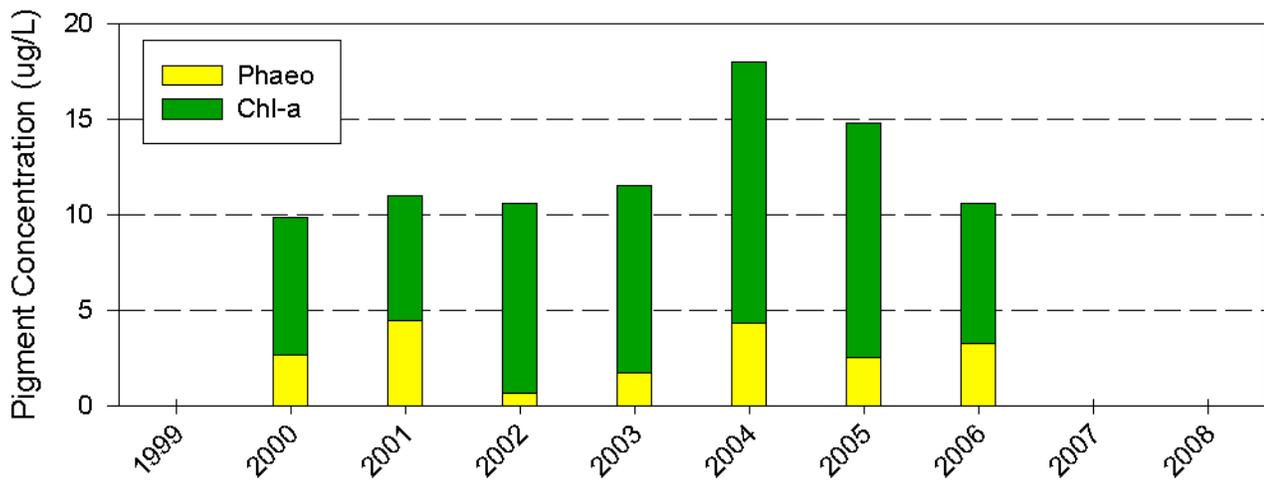
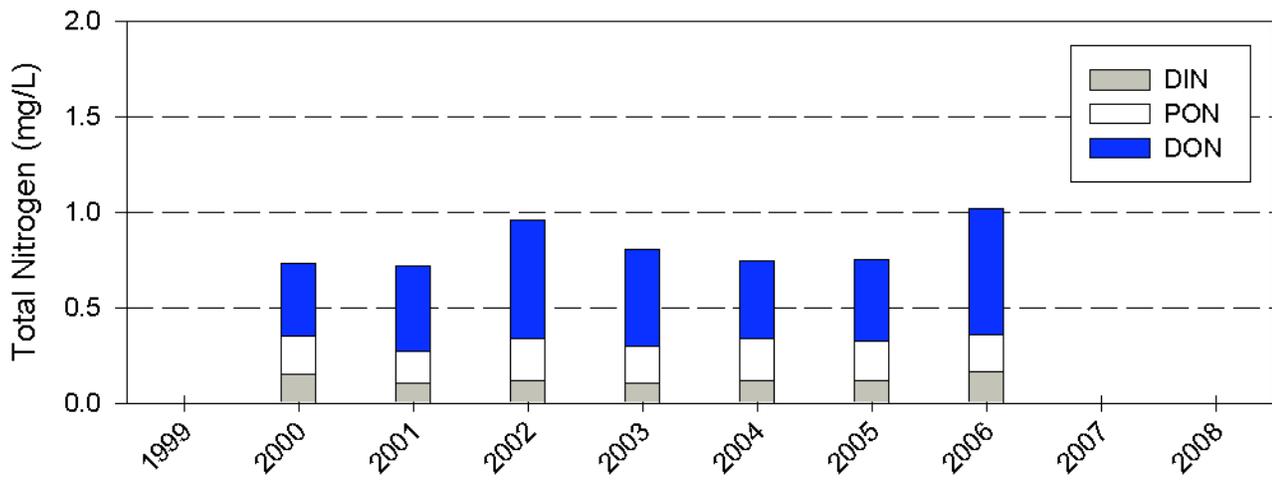
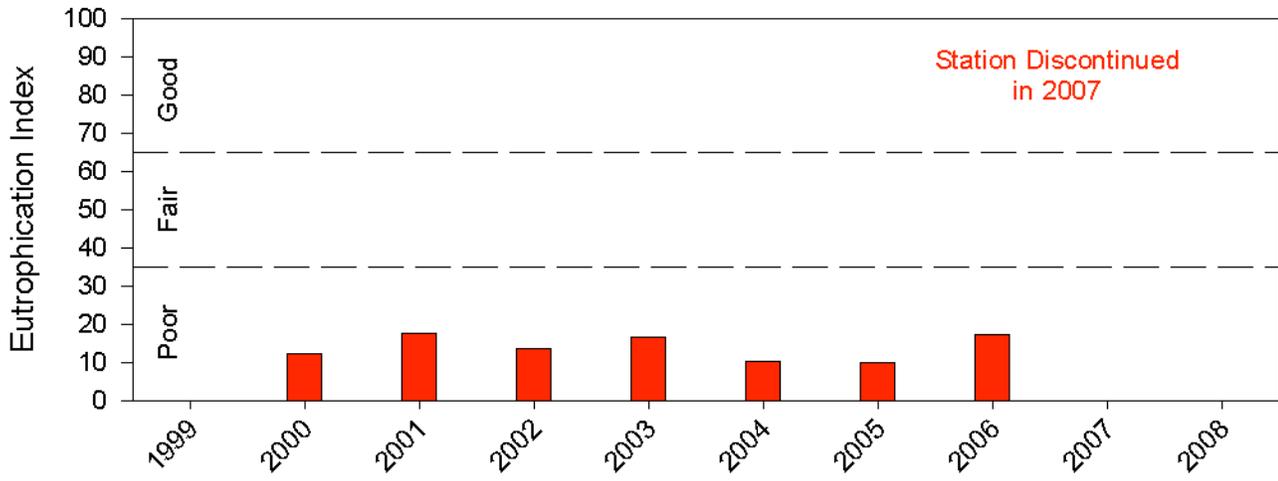
Namequoit Point - North (PBA-13)



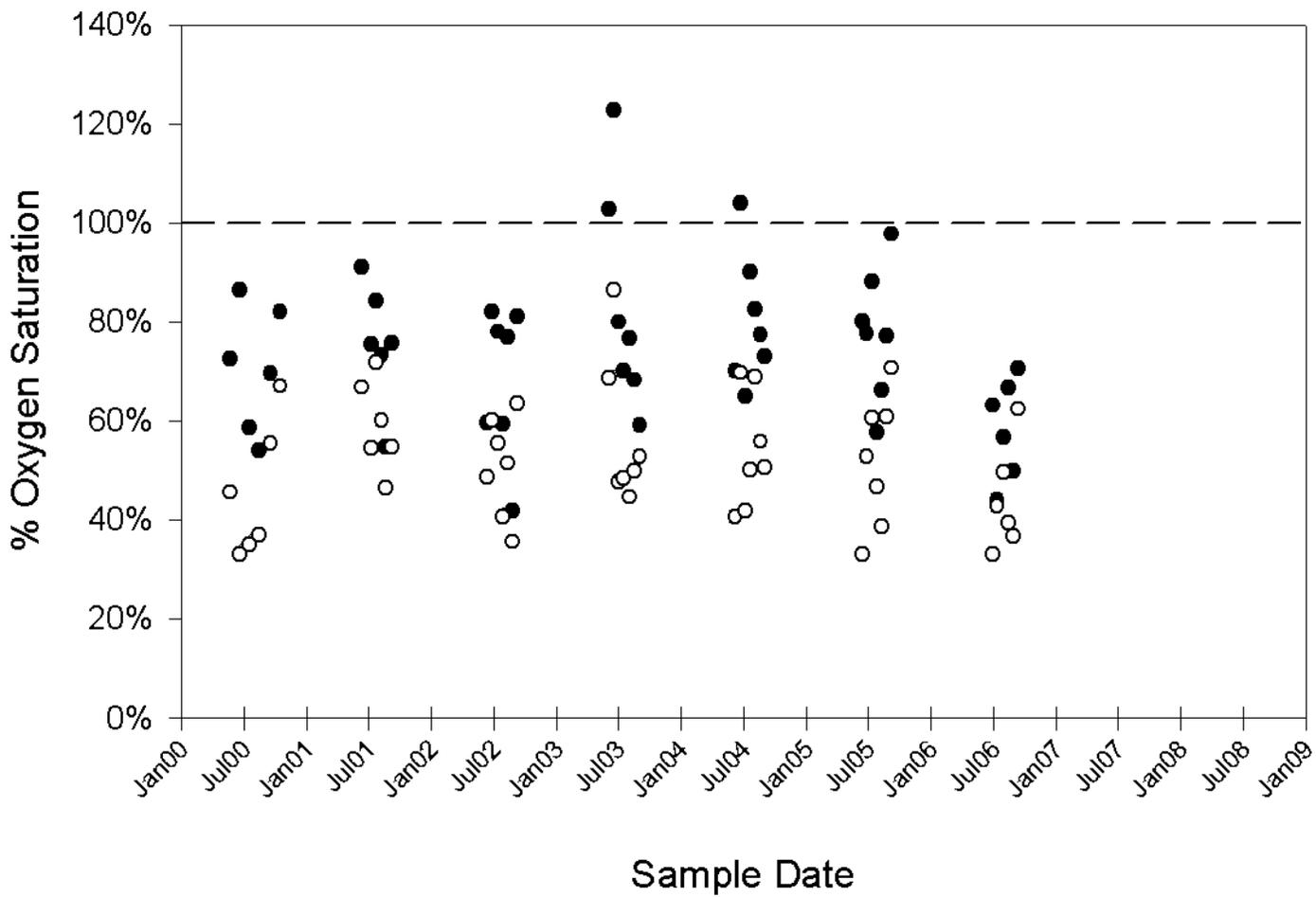
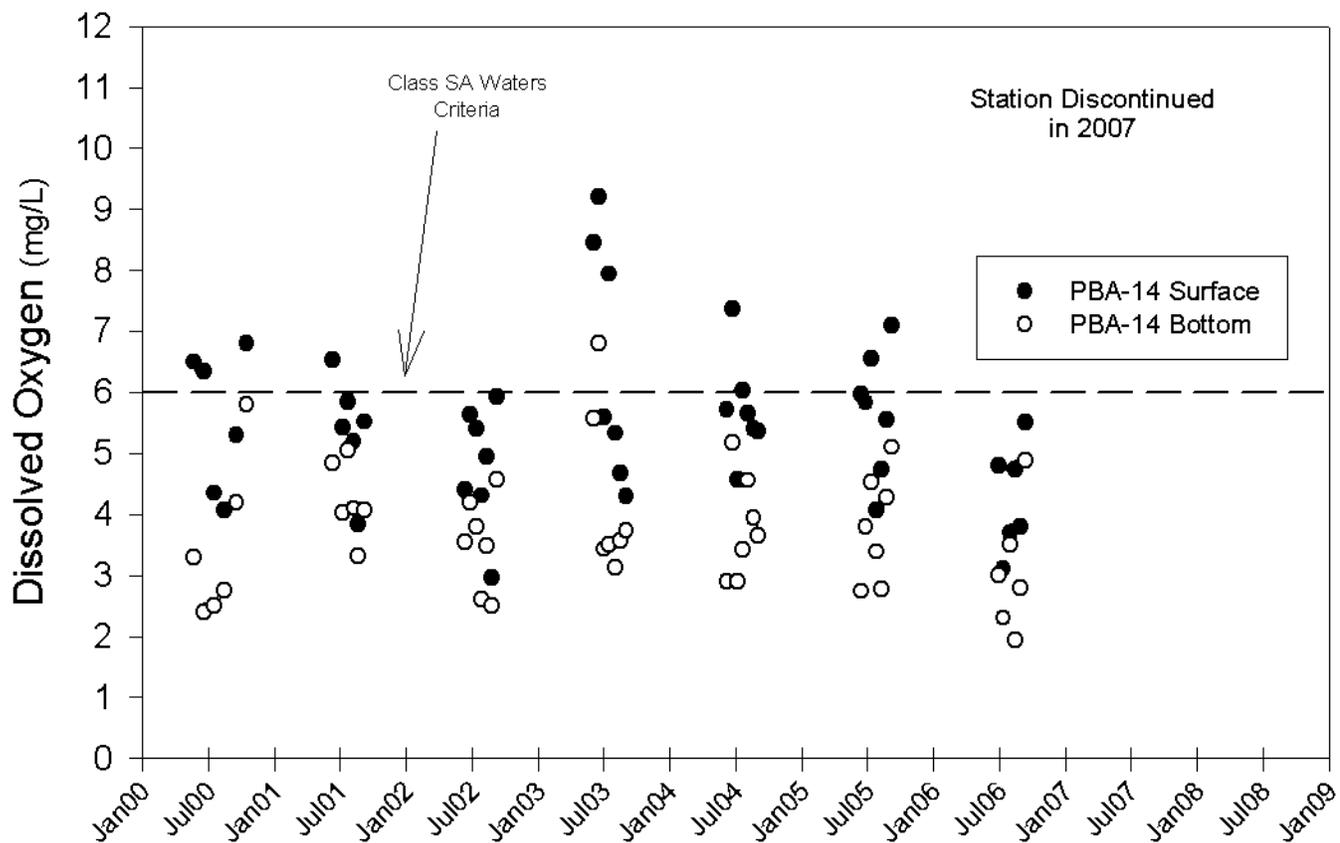
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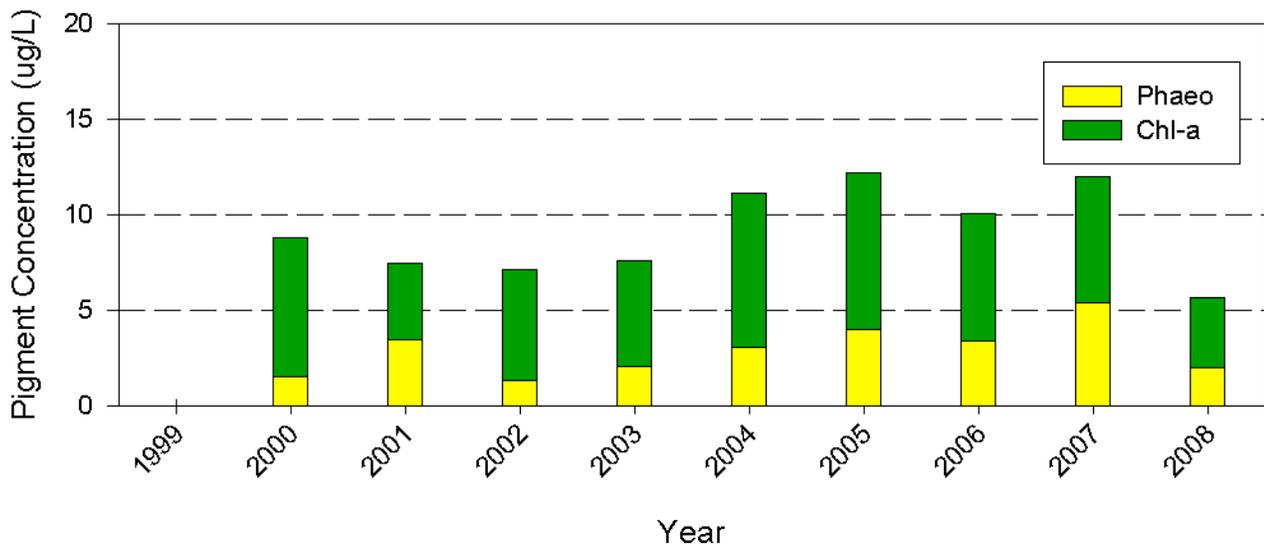
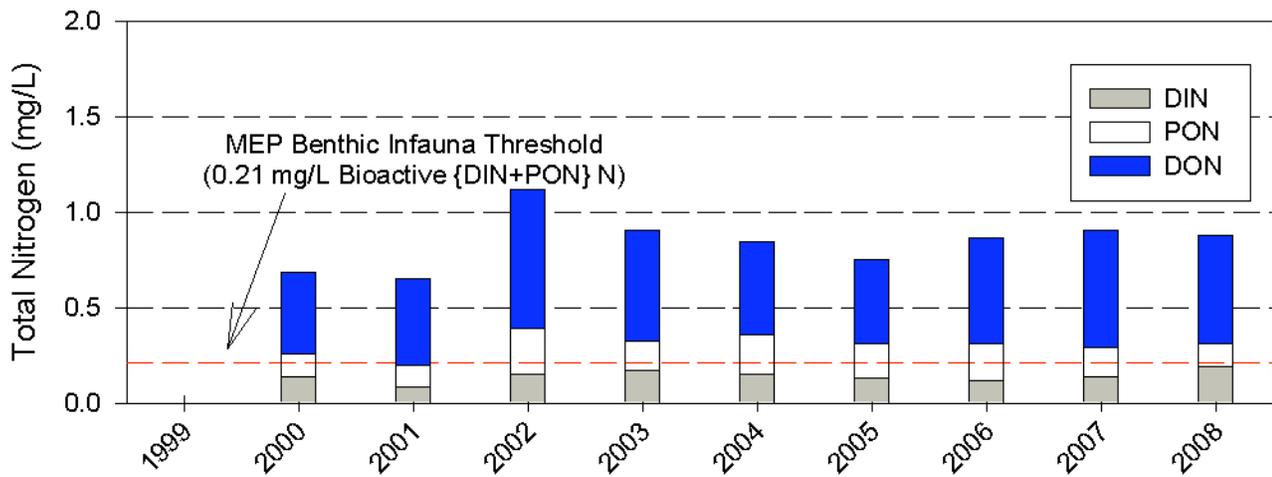
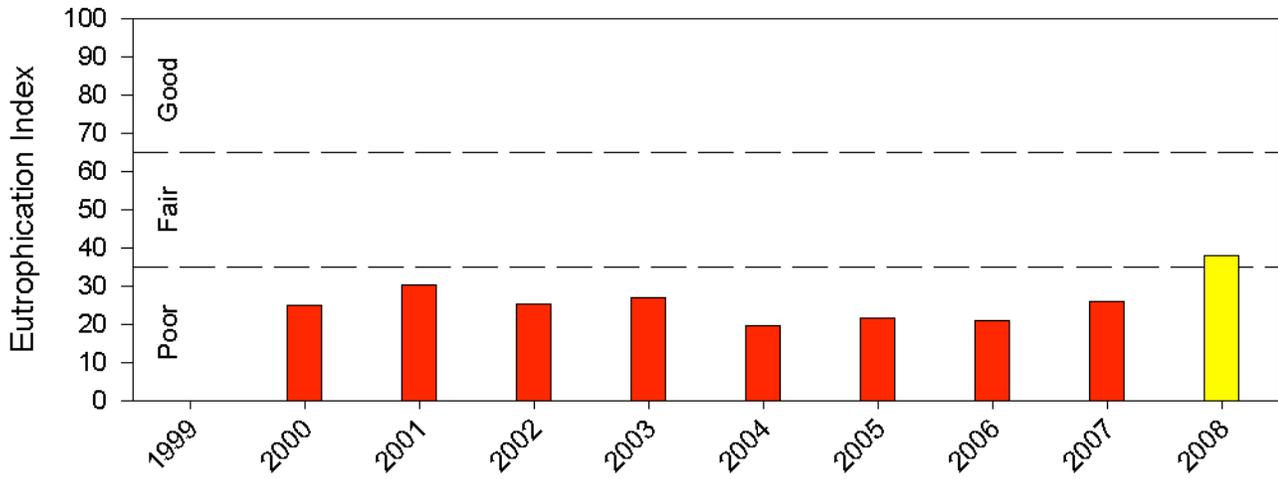
Arey's Pond (PBA-14)



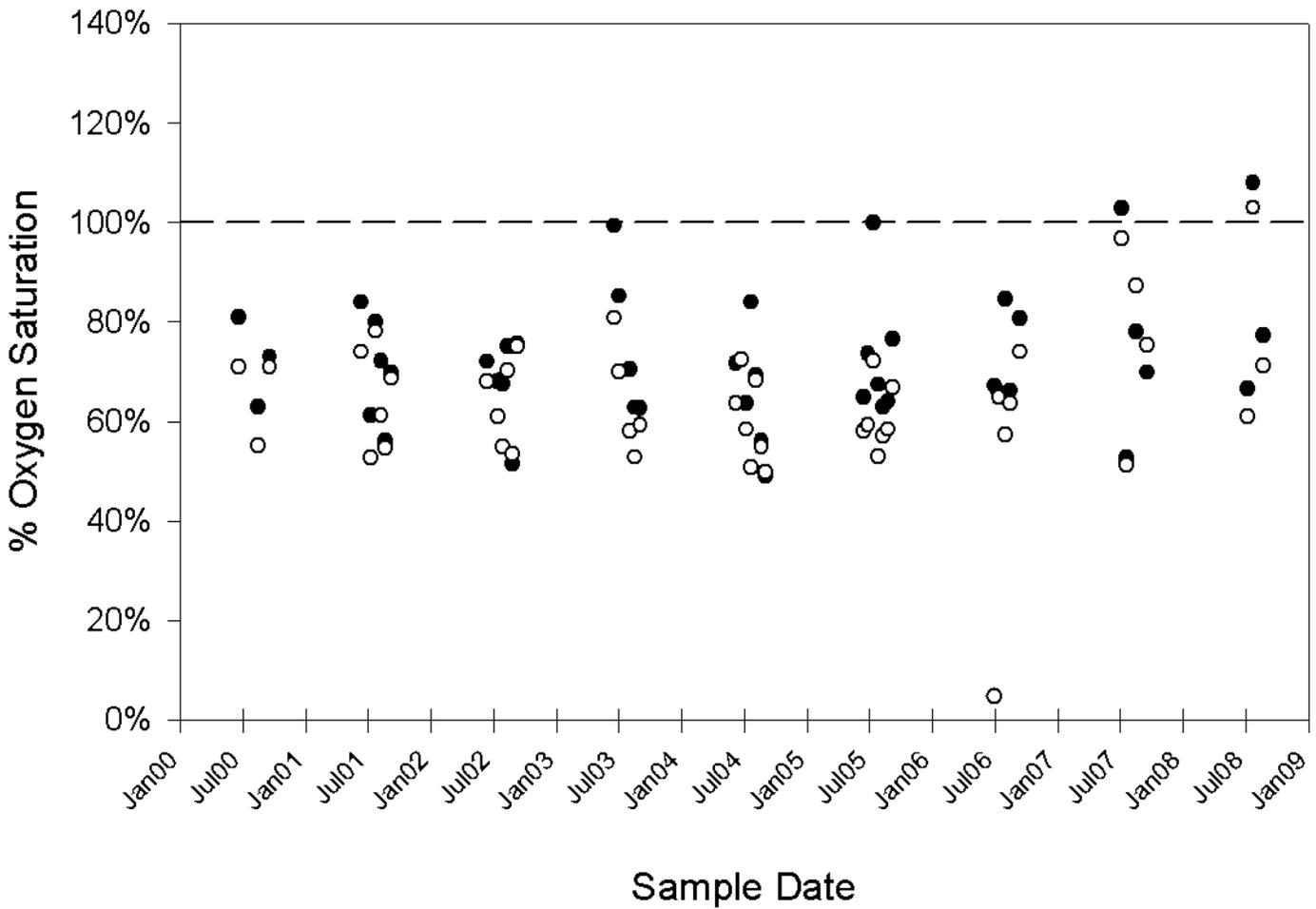
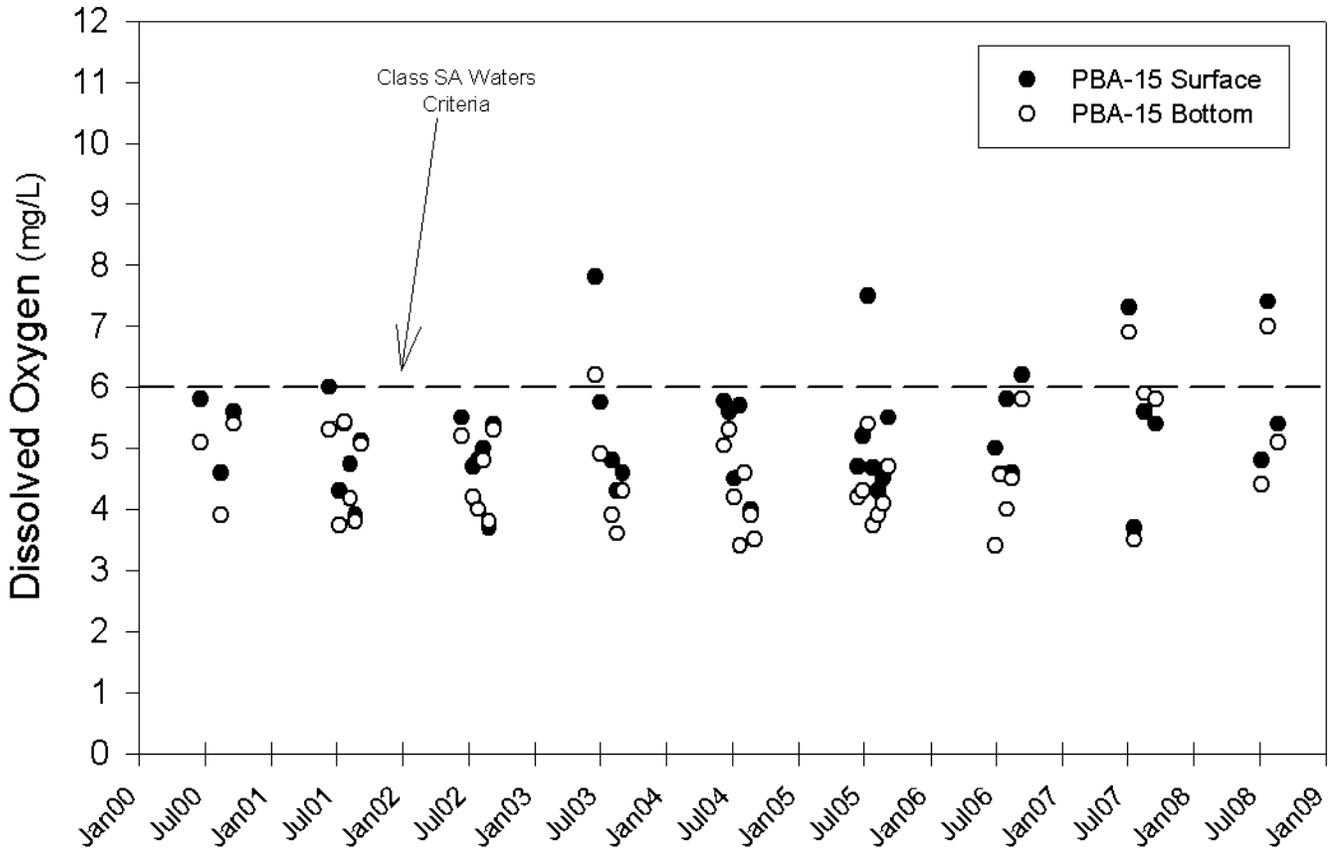
Arey's Pond (PBA-14)



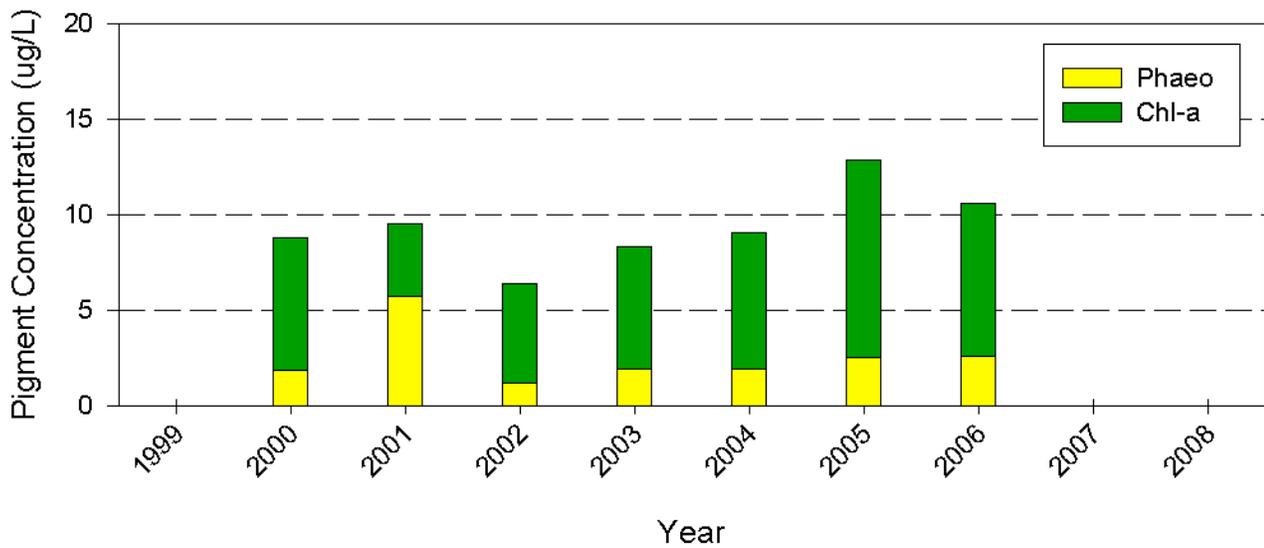
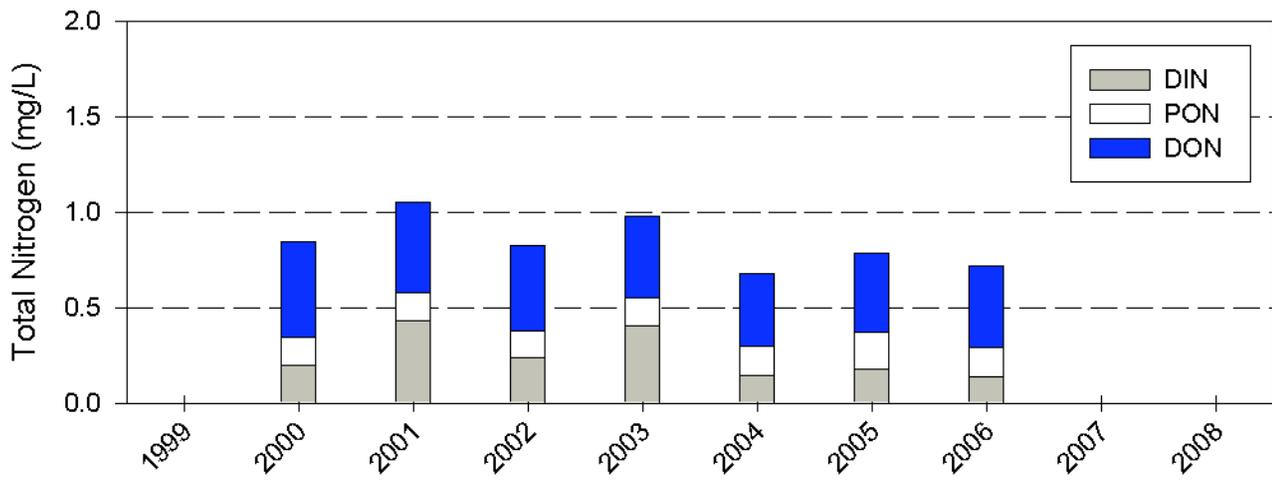
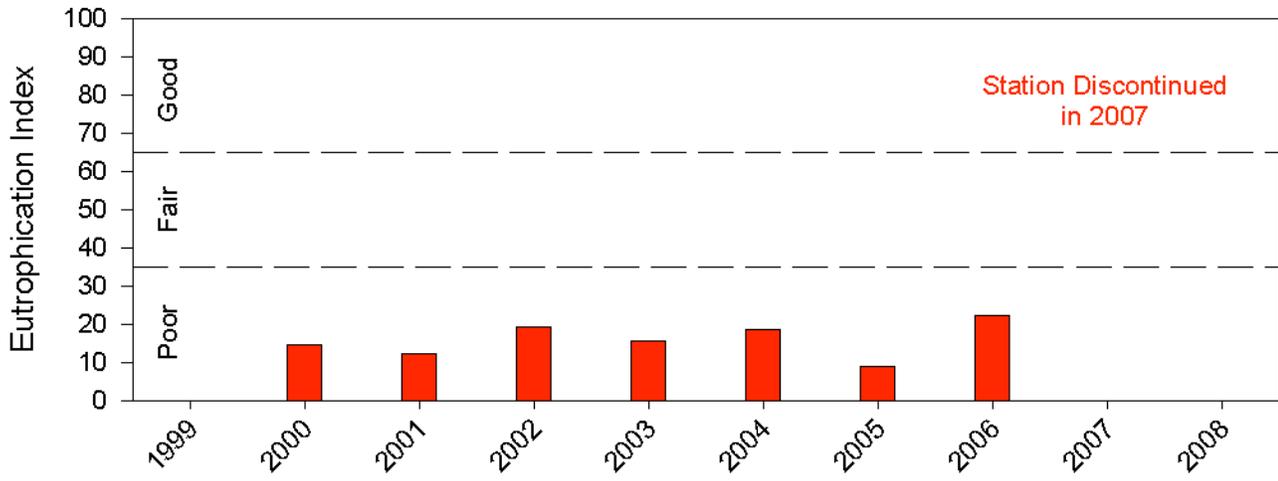
Kescayo Gansett Pond (PBA-15)



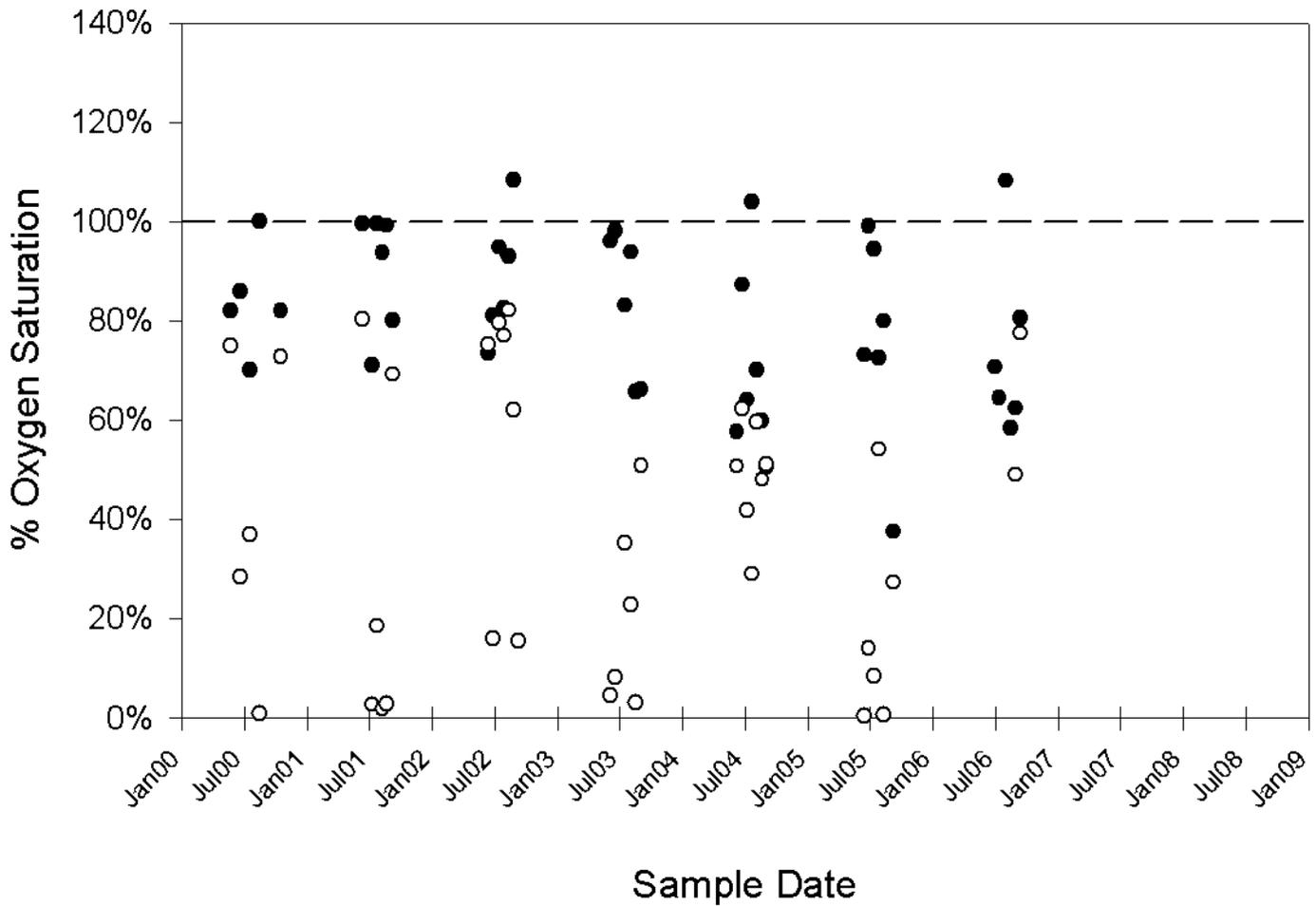
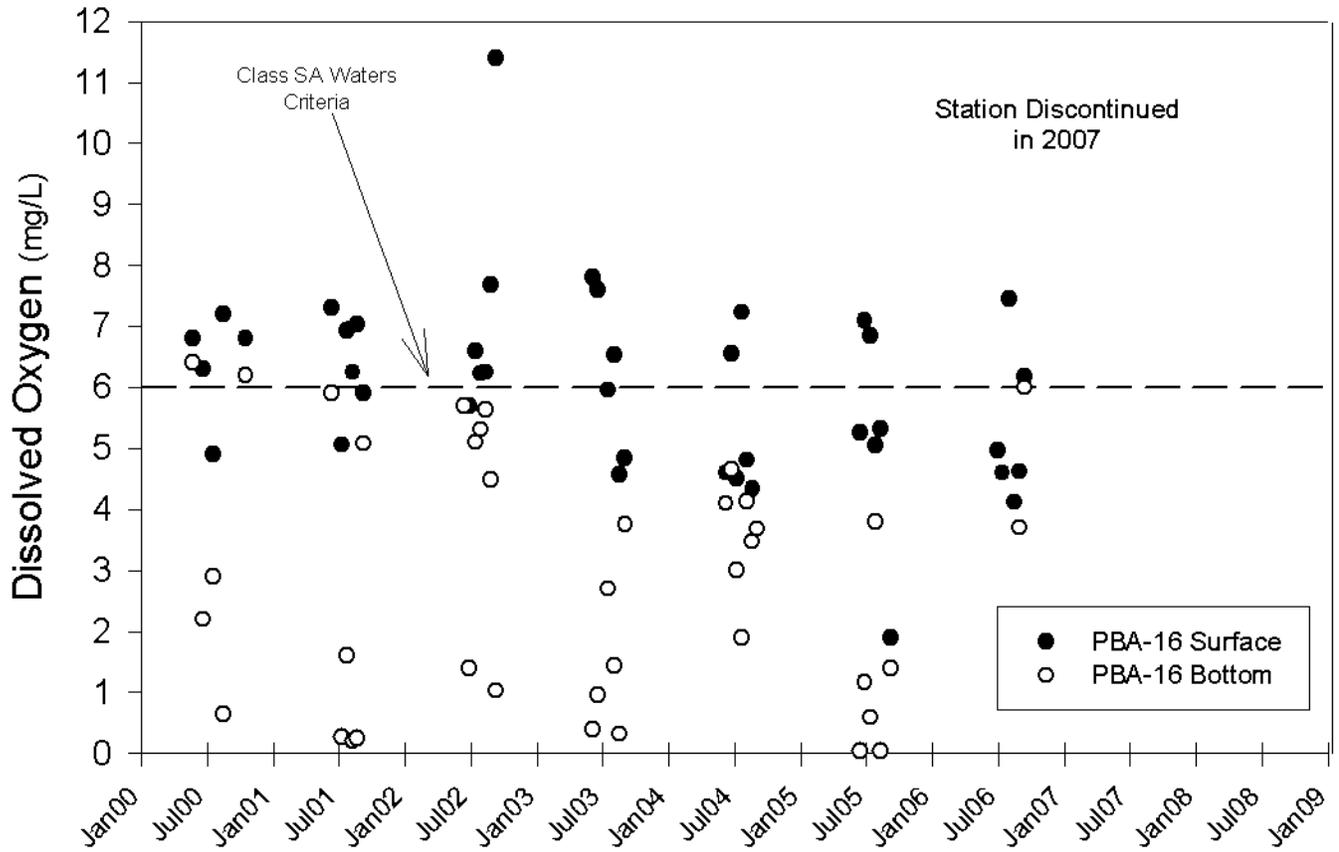
Kescayo Gansett Pond (PBA-15)



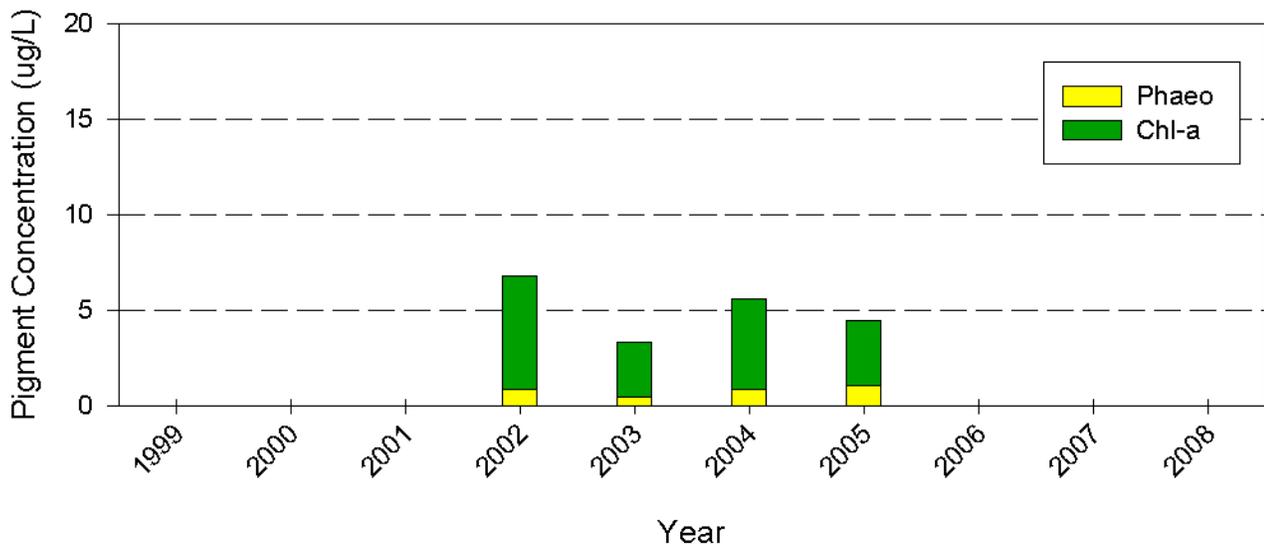
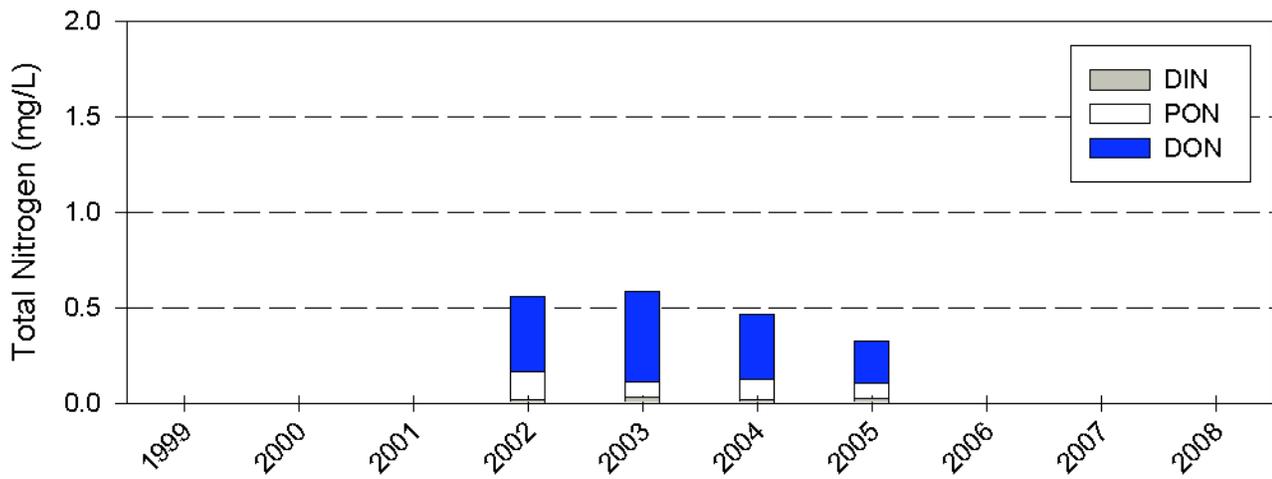
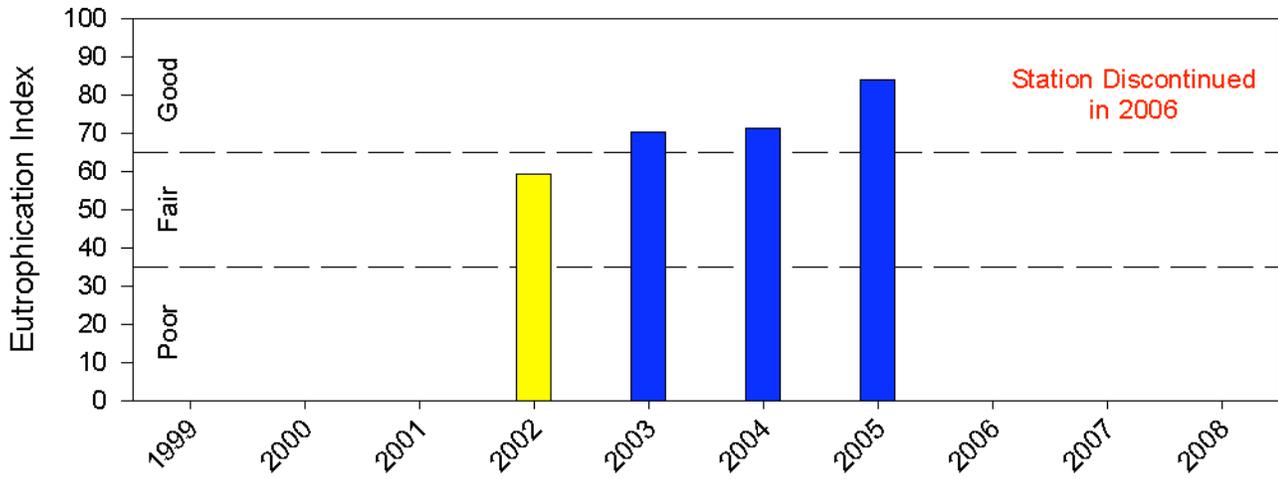
Meetinghouse Pond (PBA-16)



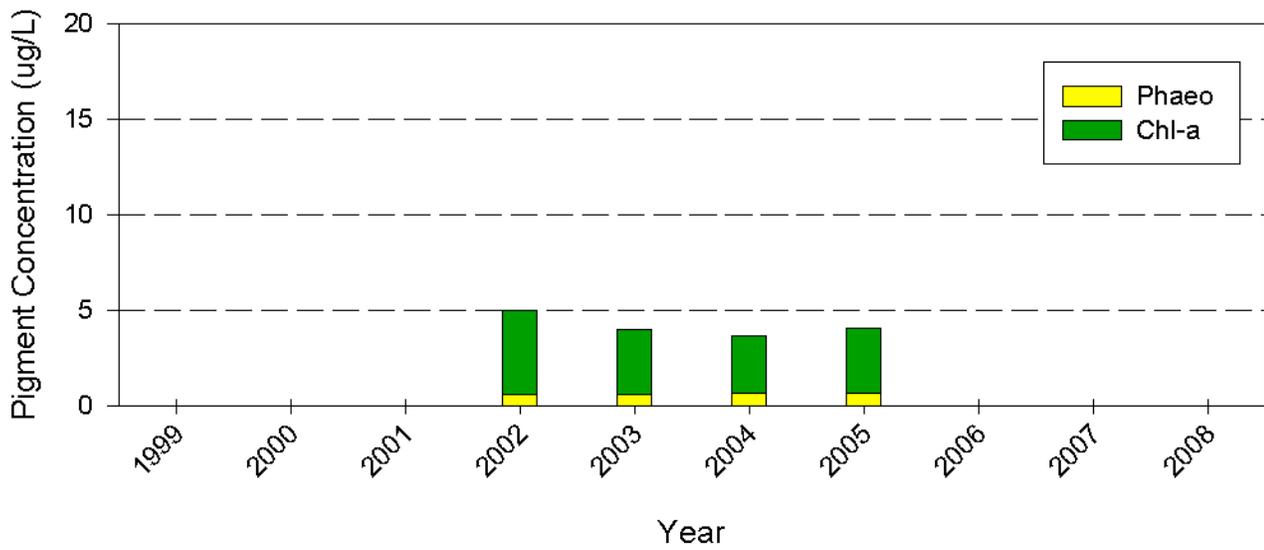
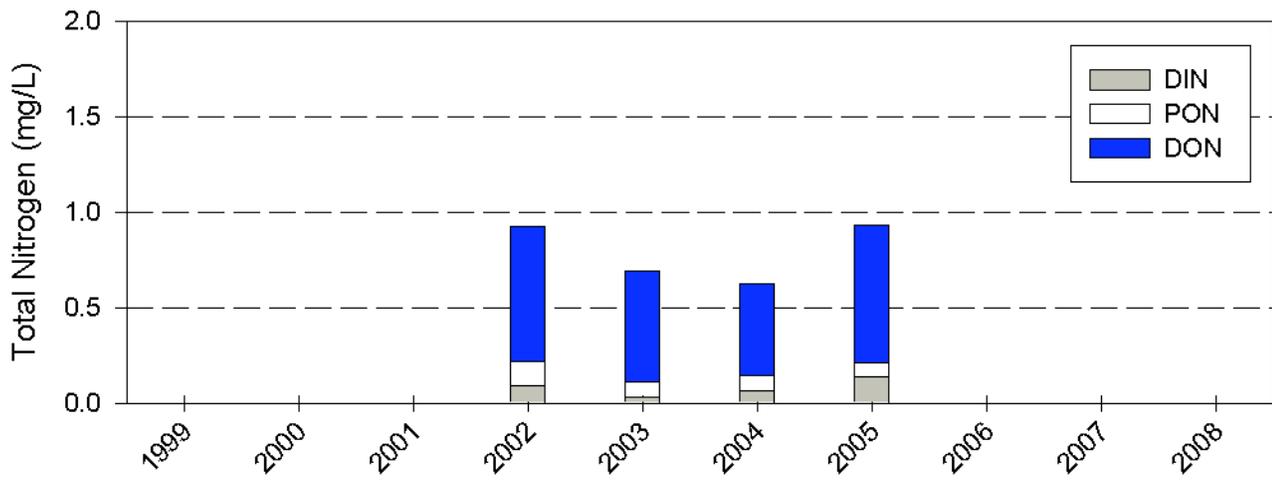
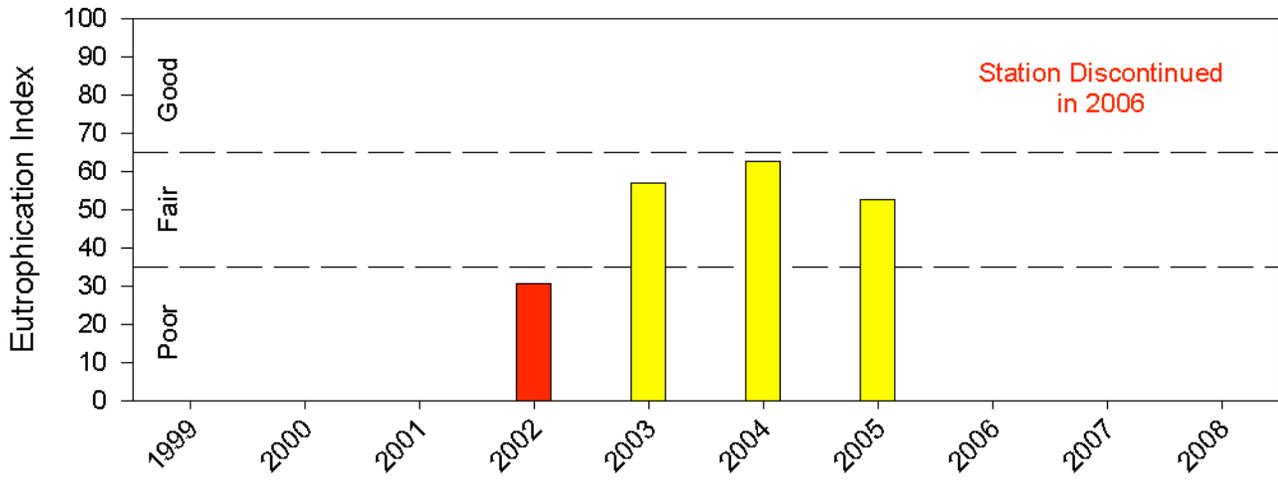
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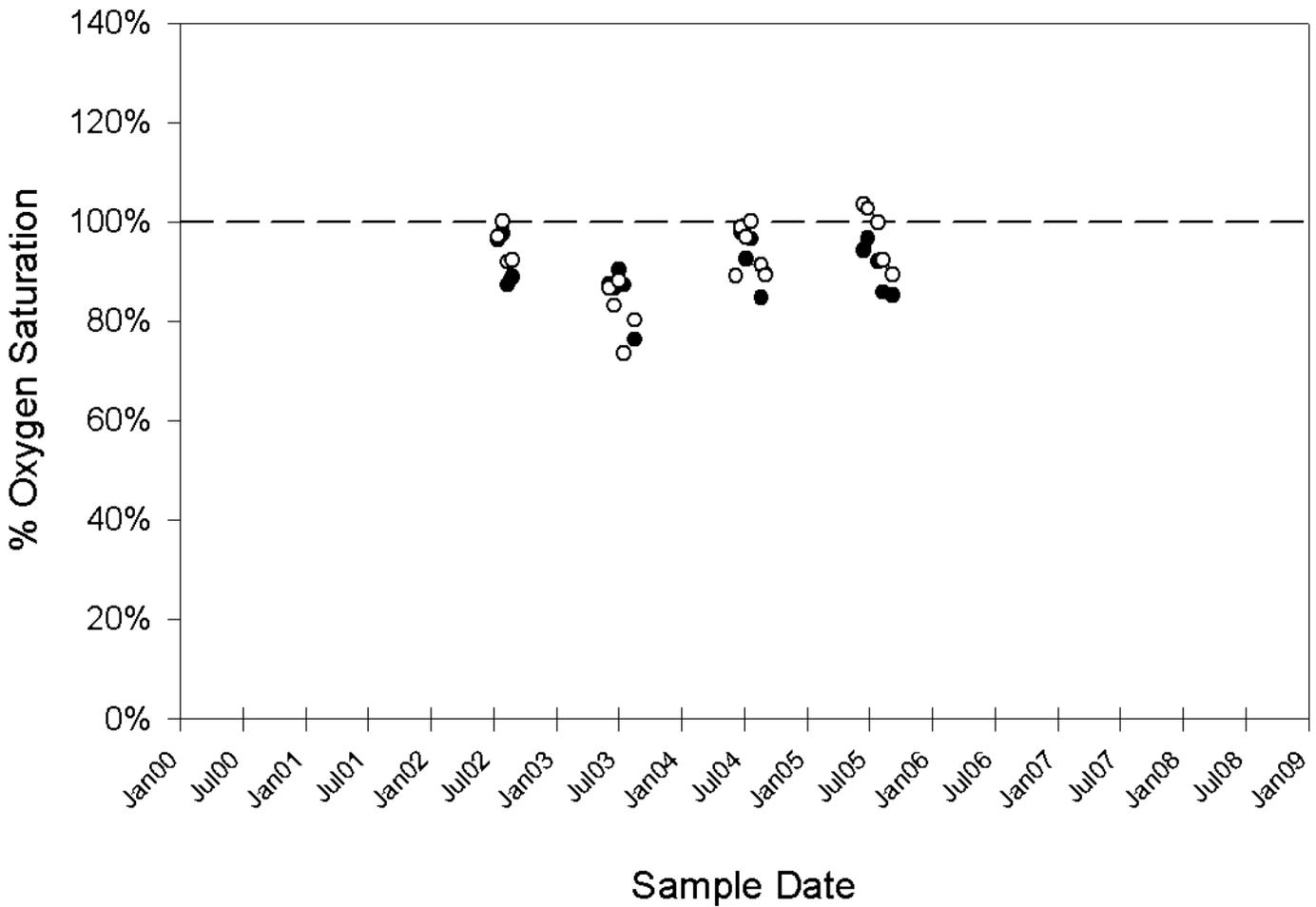
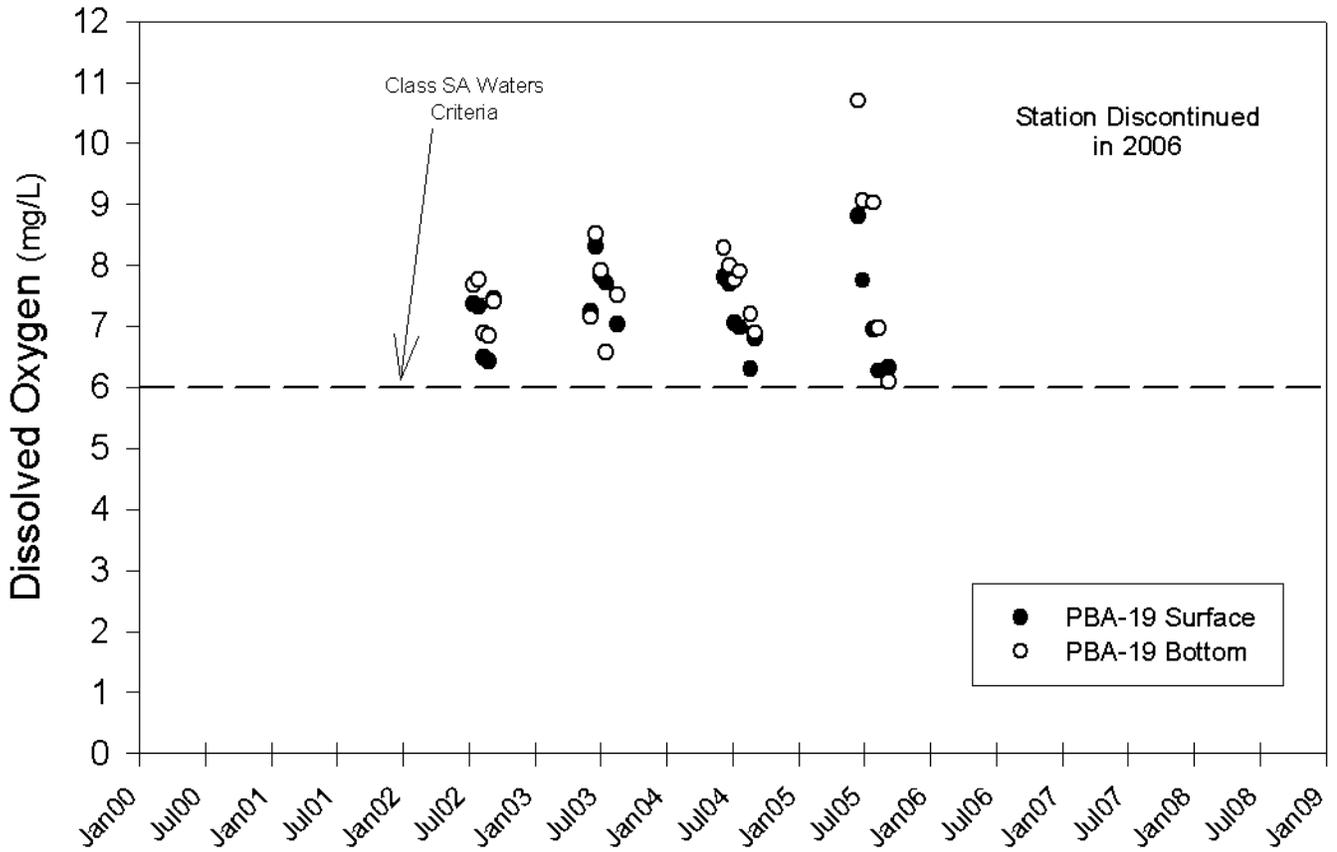
Allen Point (aka Ministers Point) (PBA-18)



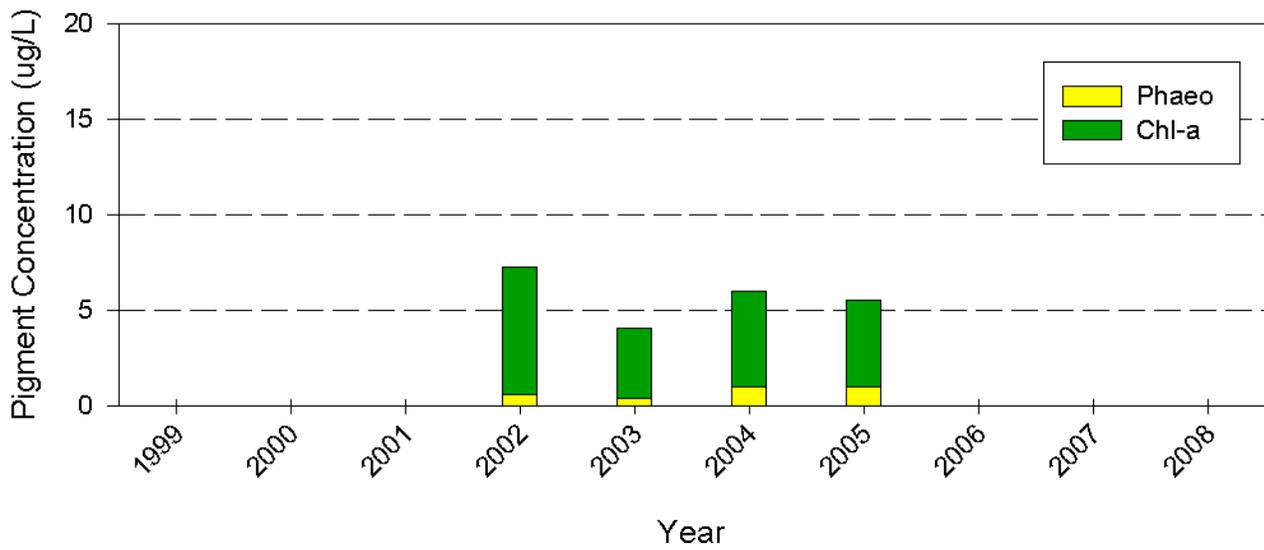
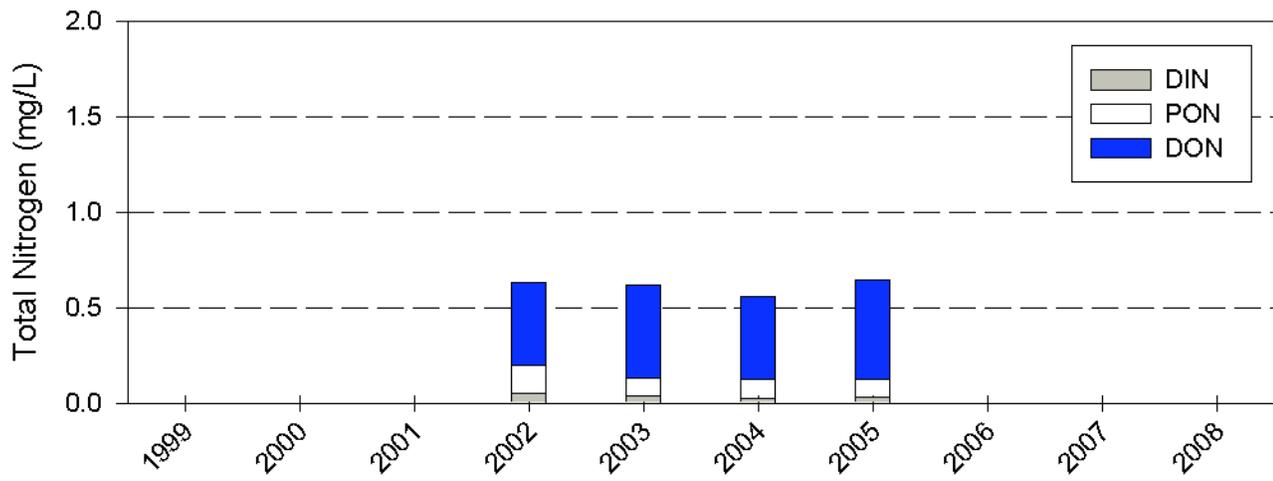
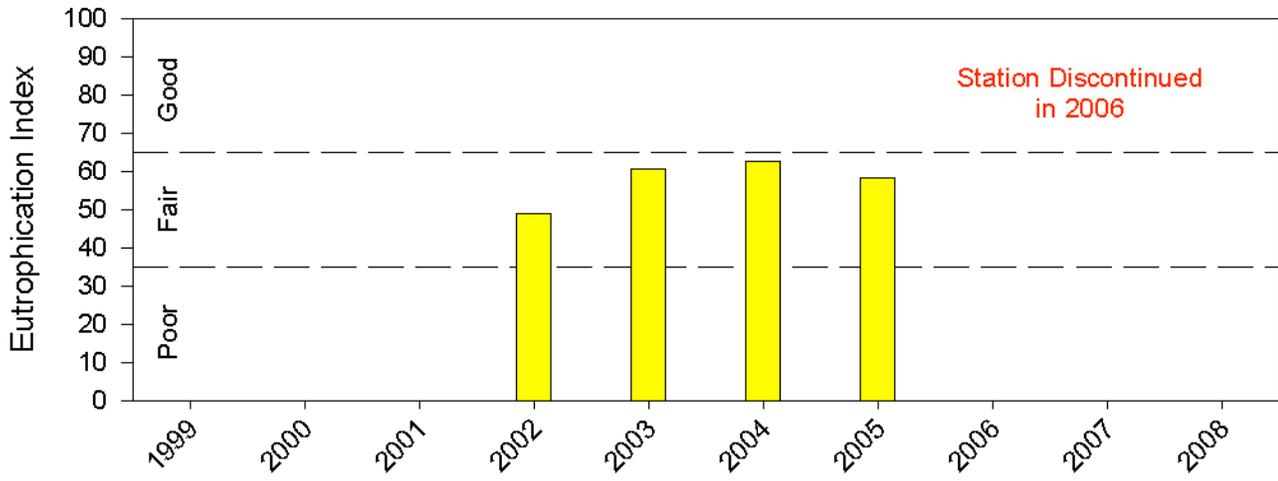
Strong Island - Northeast (PBA-19)



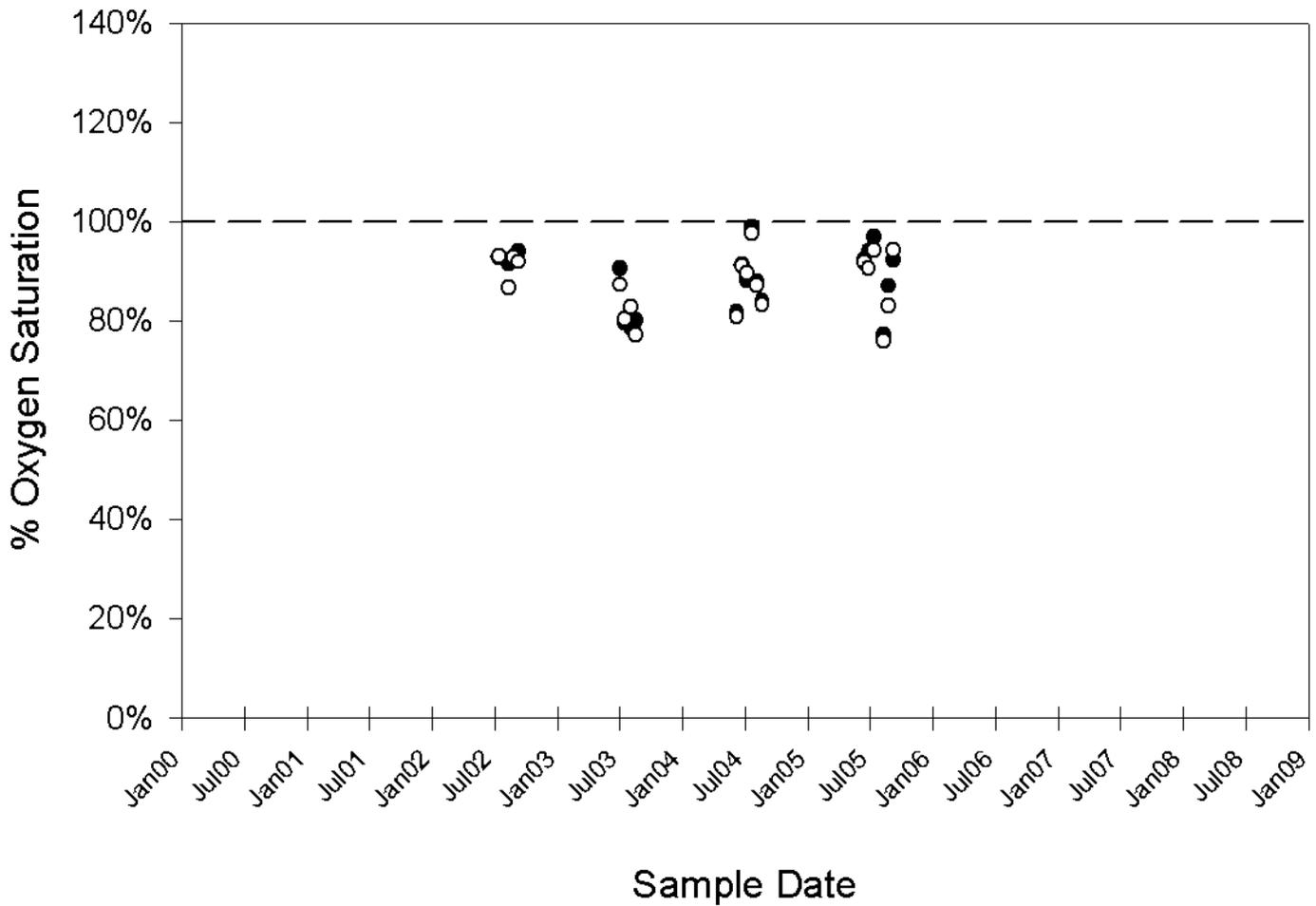
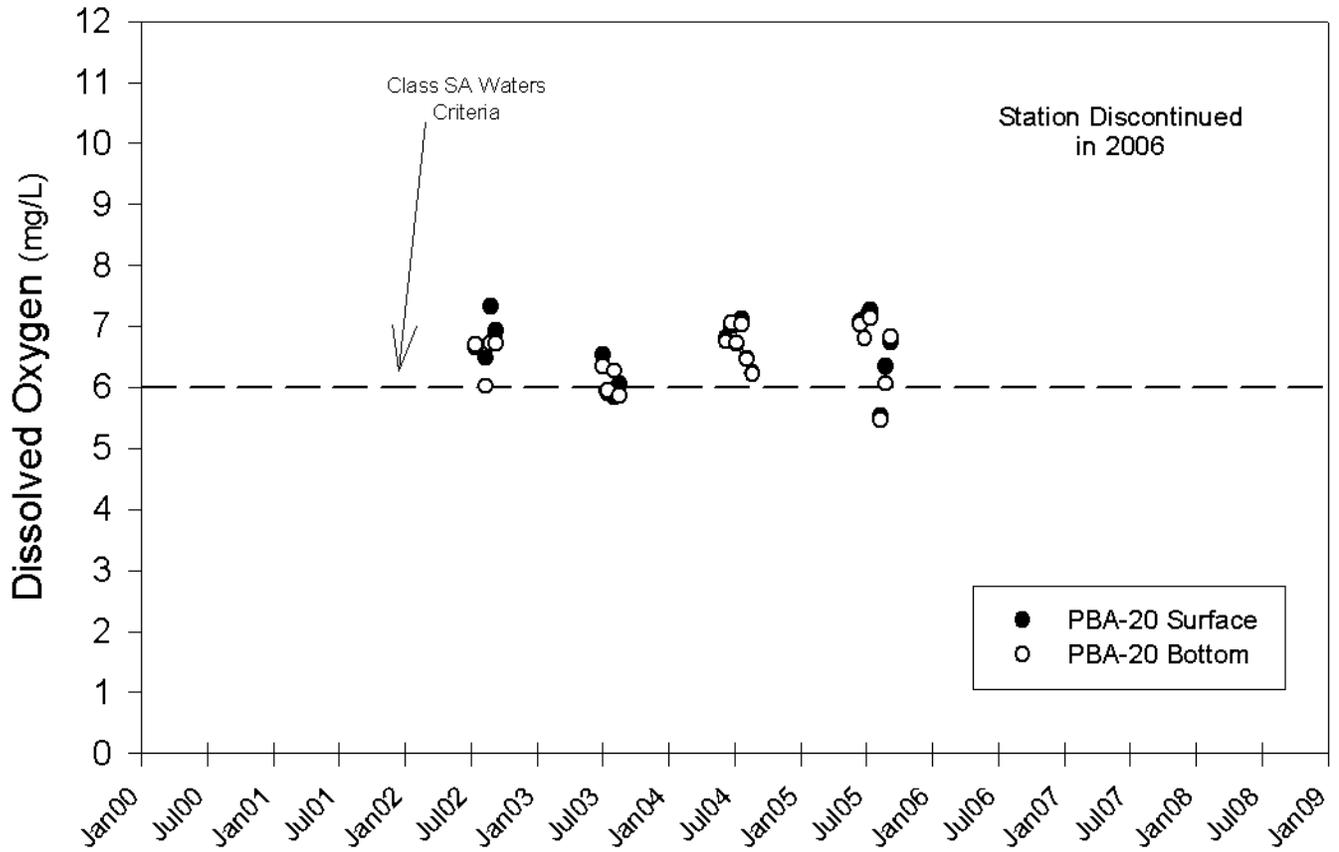
Strong Island - NE (PBA-19)



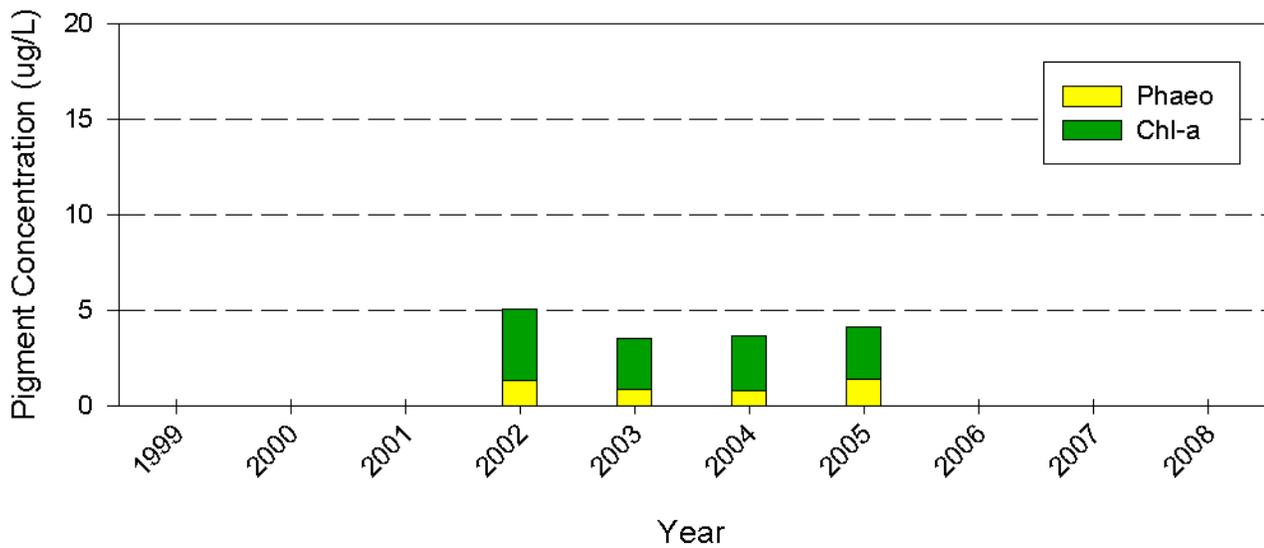
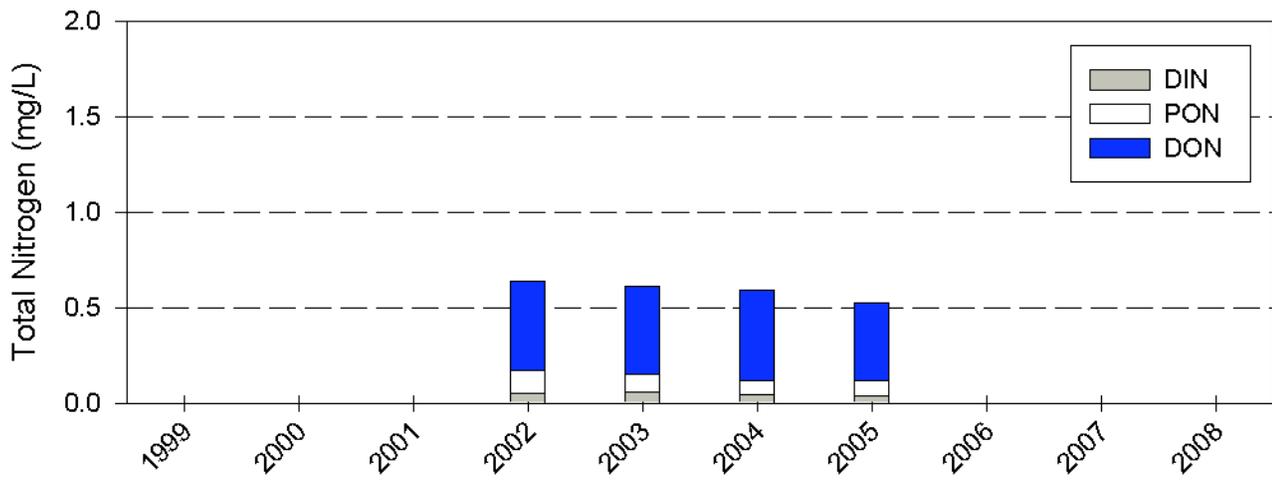
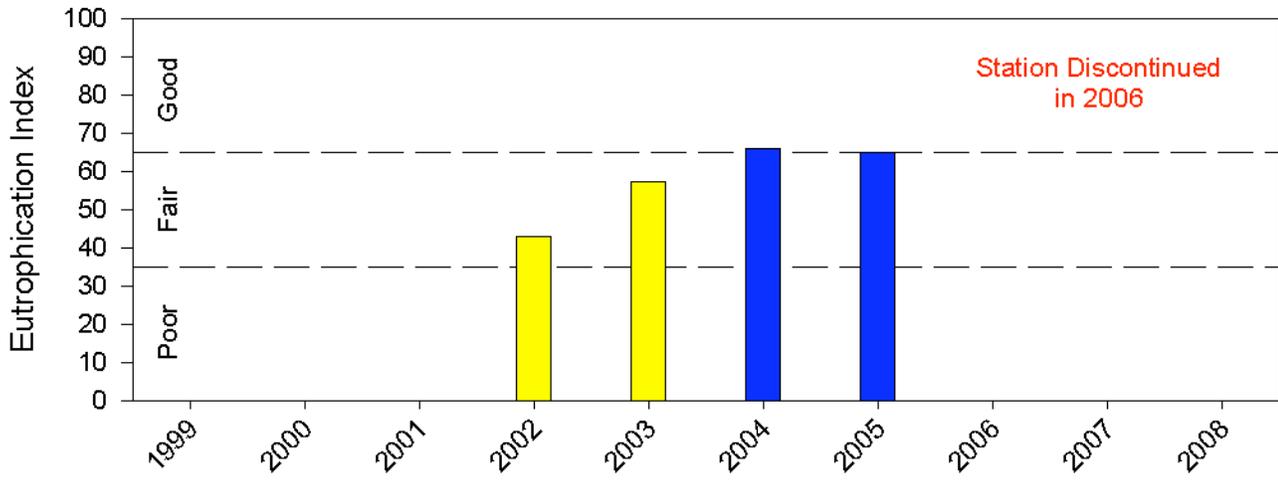
Nickersons Neck (PBA-20)



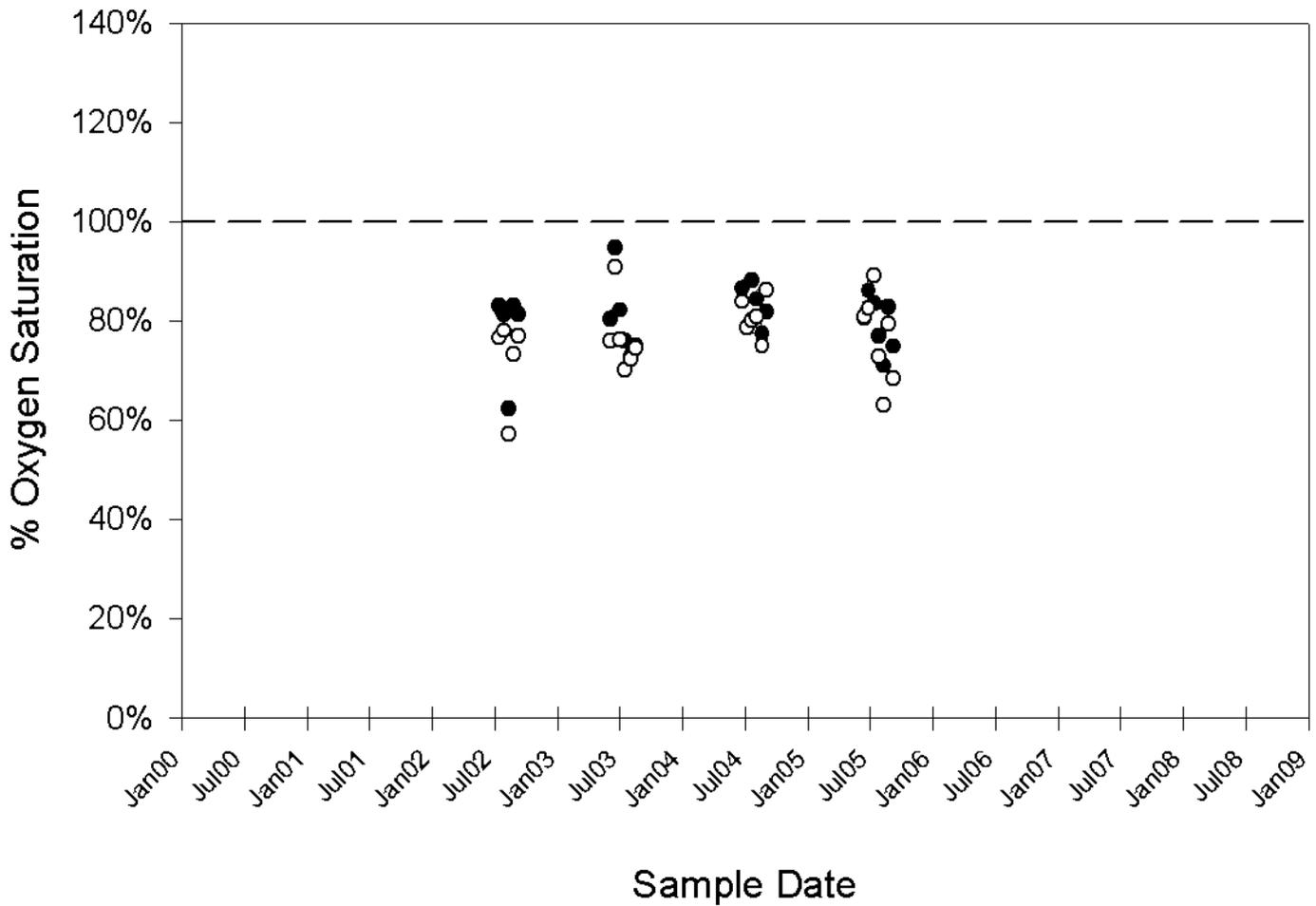
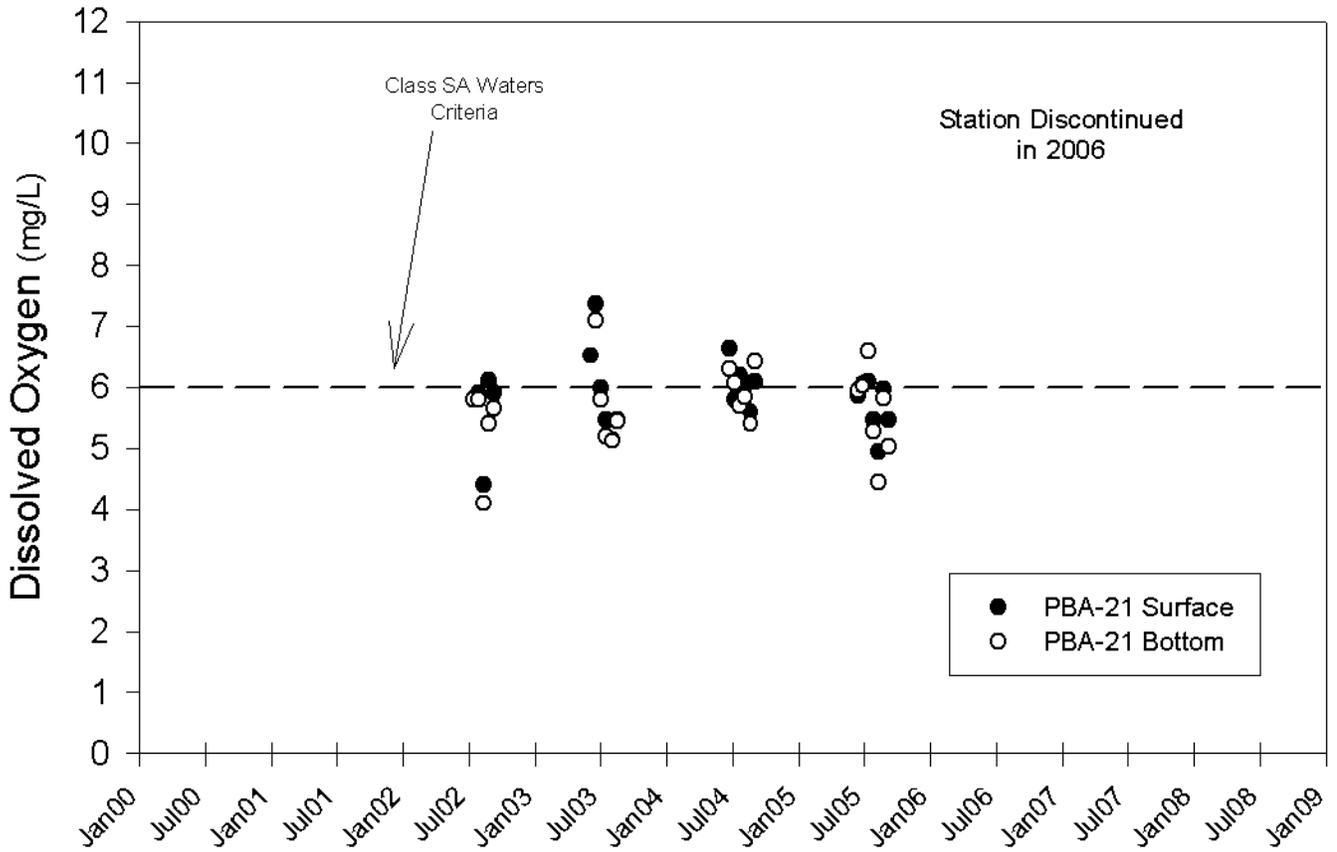
Nickerson Neck (PBA-20)



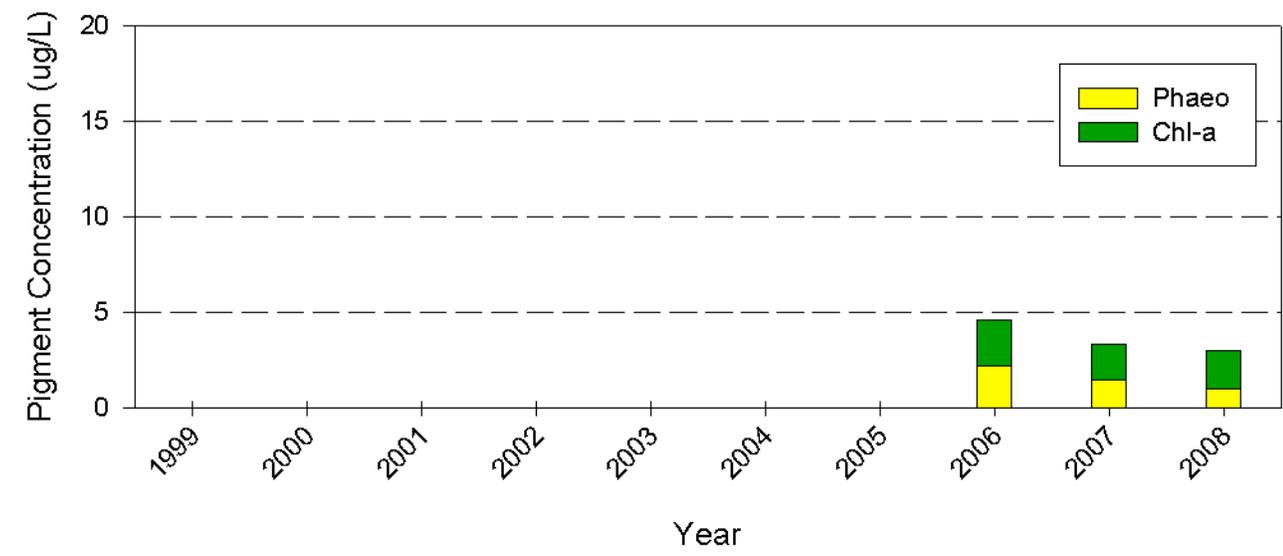
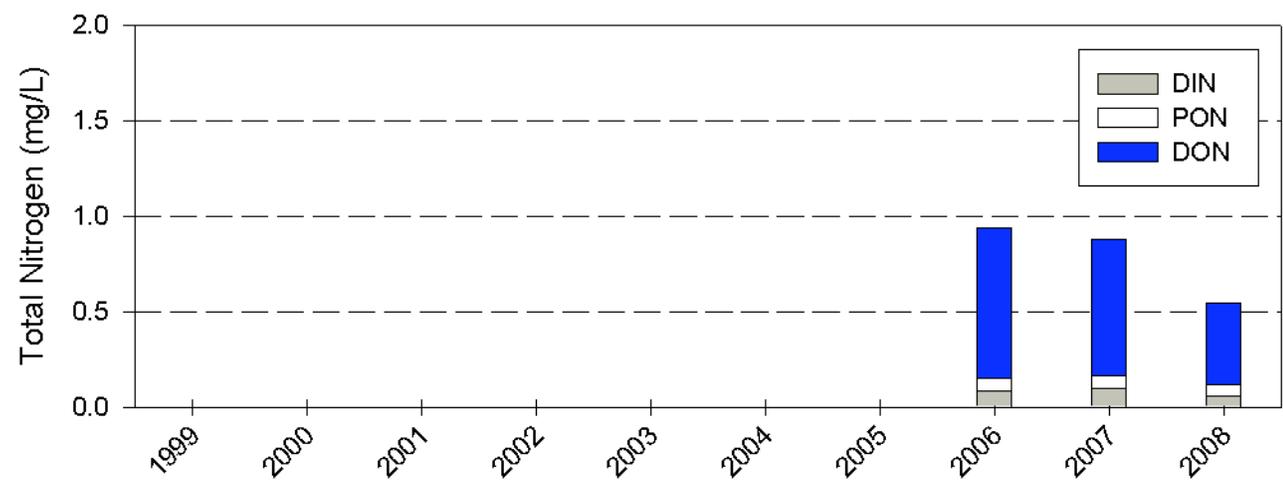
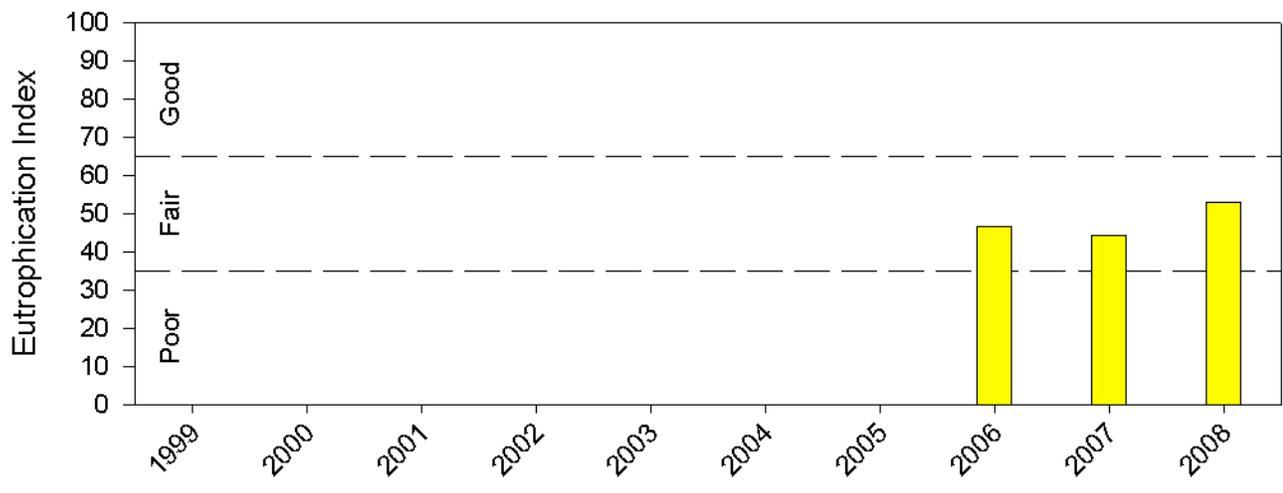
Little Pleasant Bay (PBA-21)



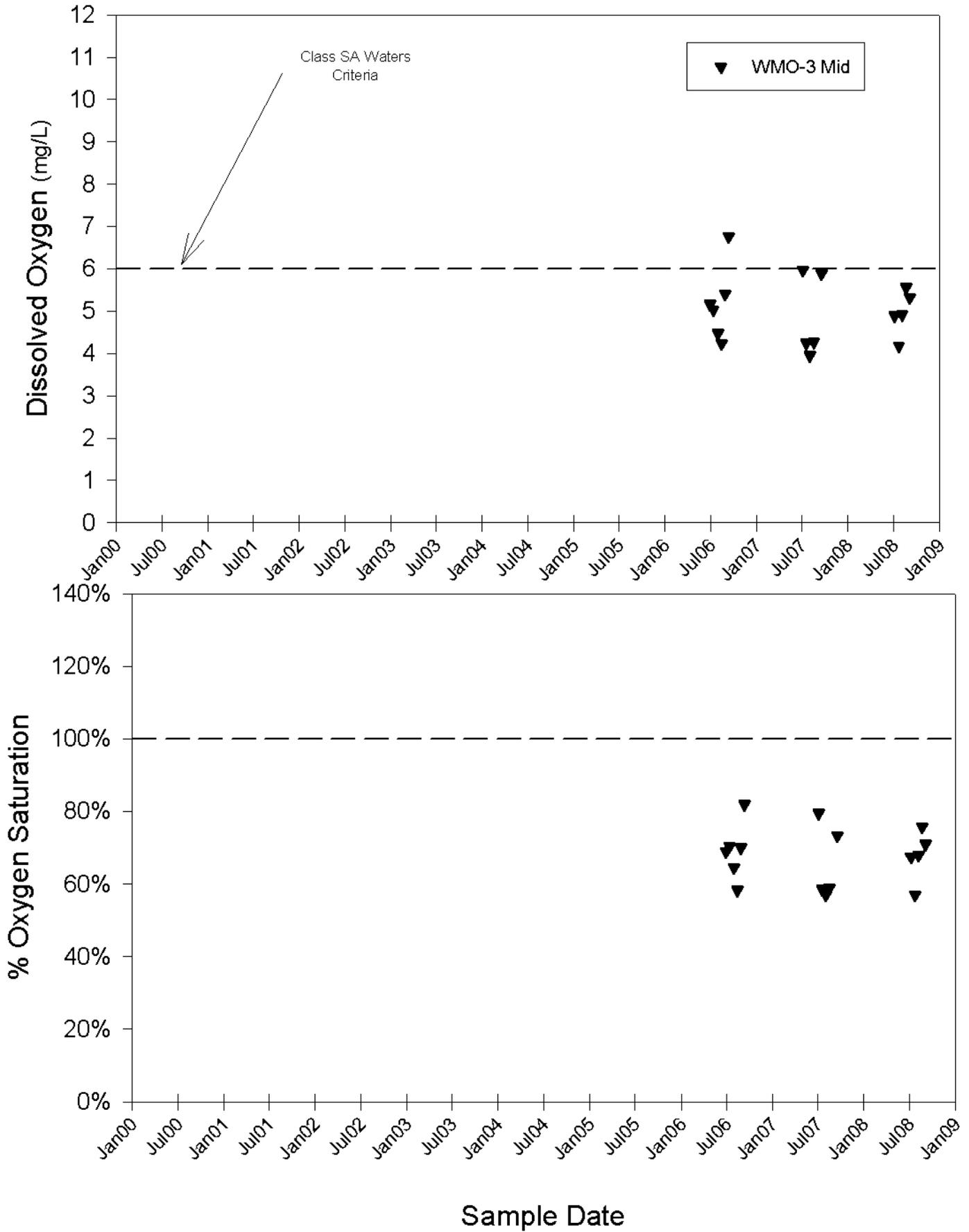
Little Pleasant Bay (PBA-21)



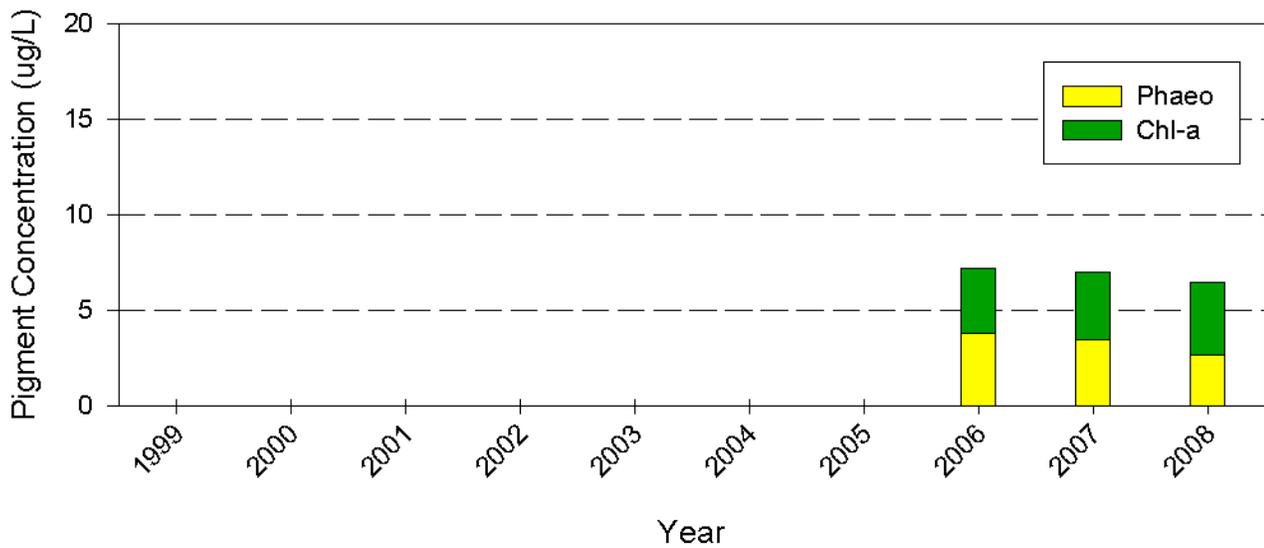
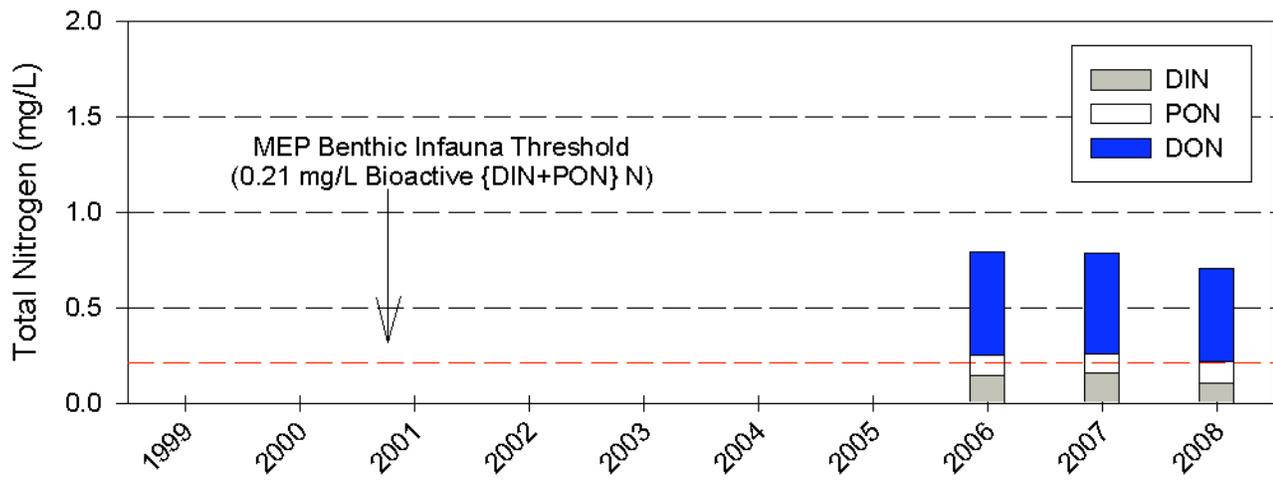
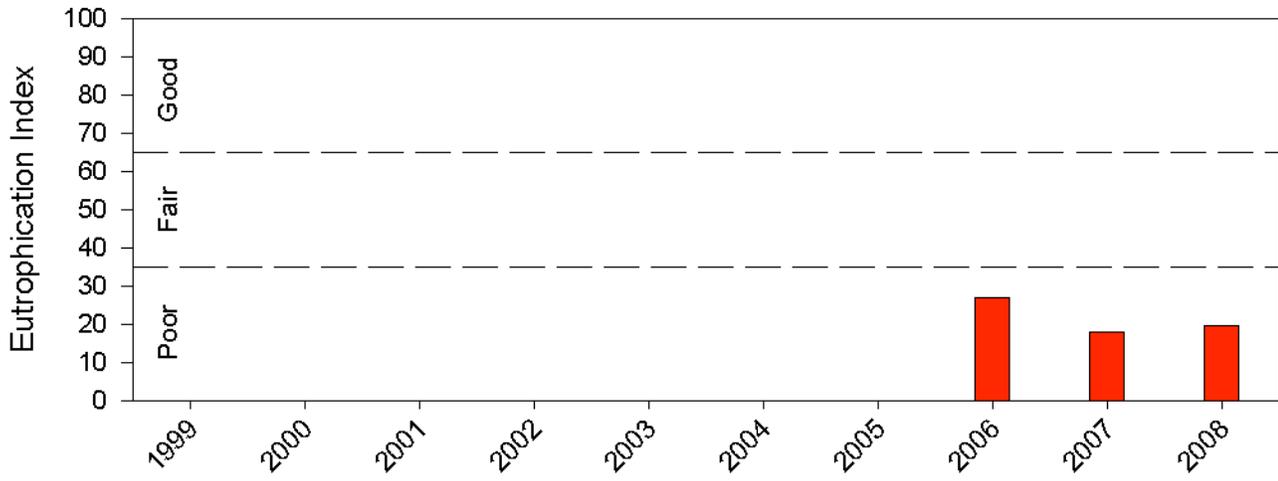
Pochet-Mouth (WMO-3)



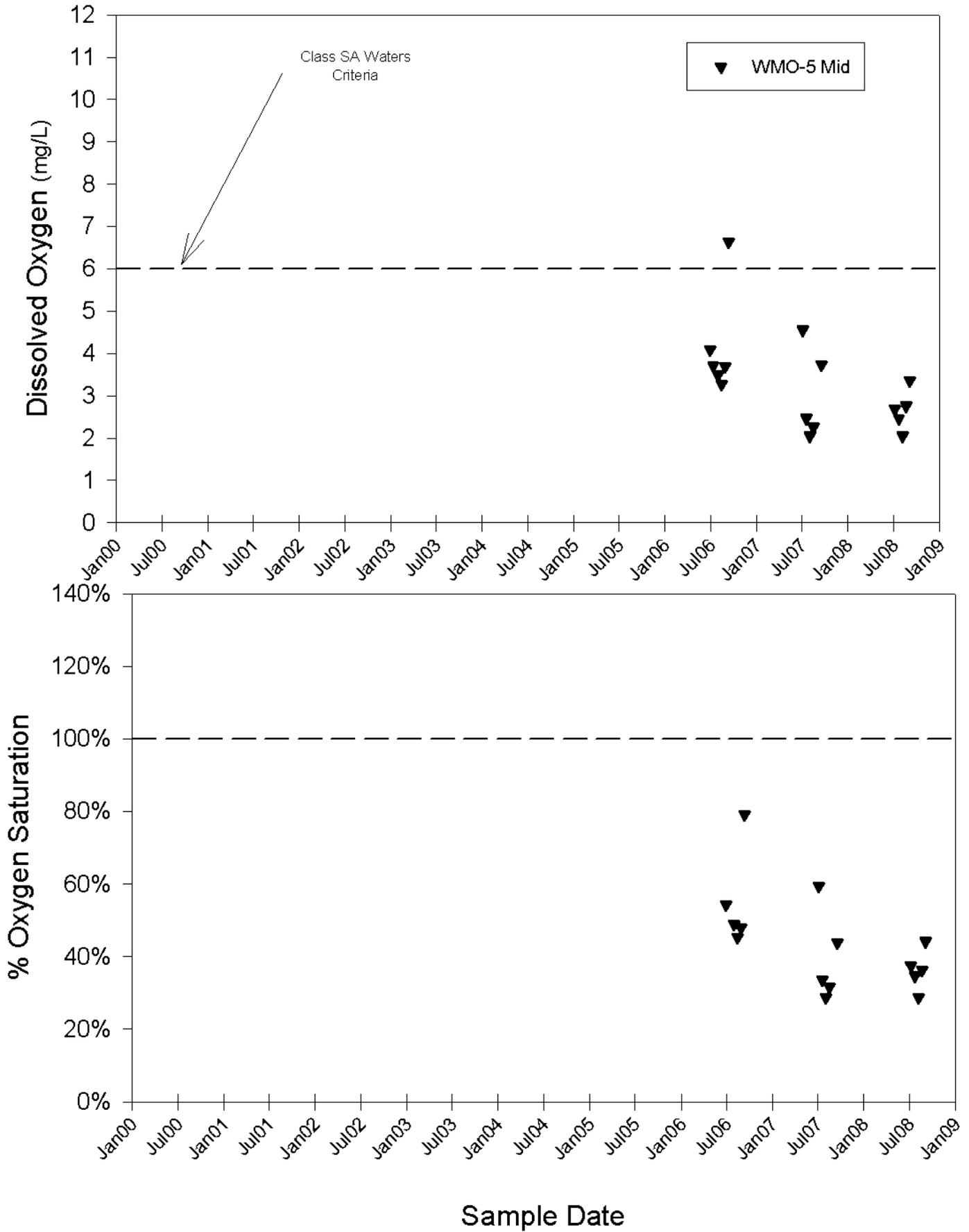
Pochet Mouth (WMO-3)



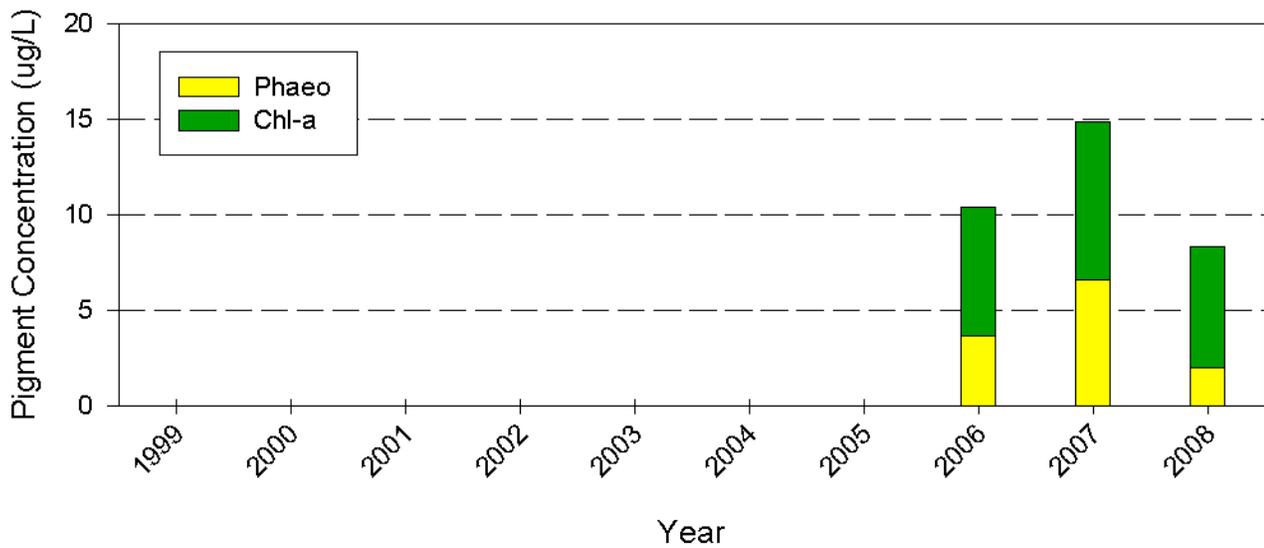
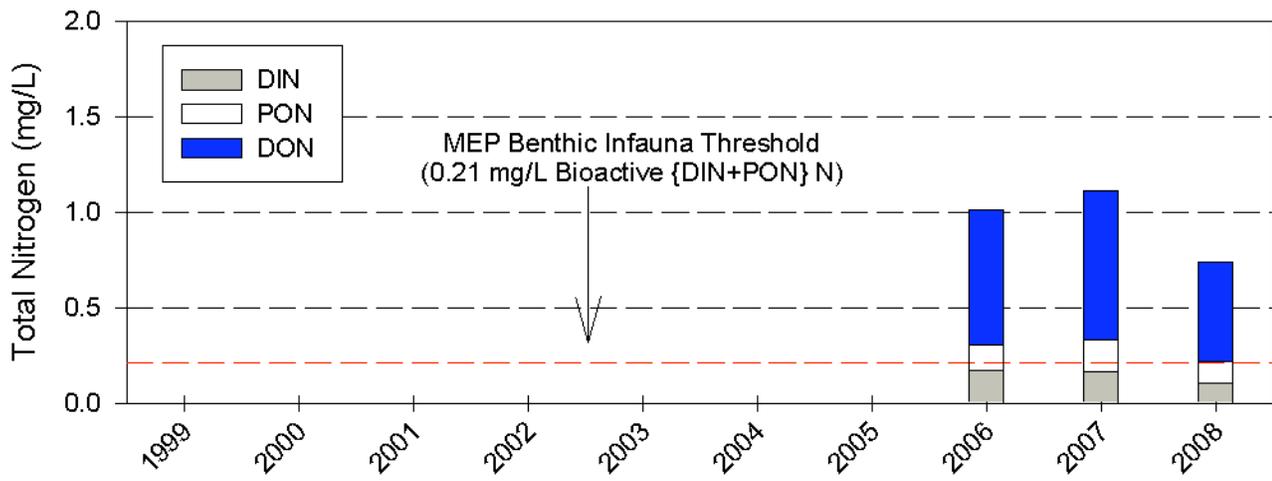
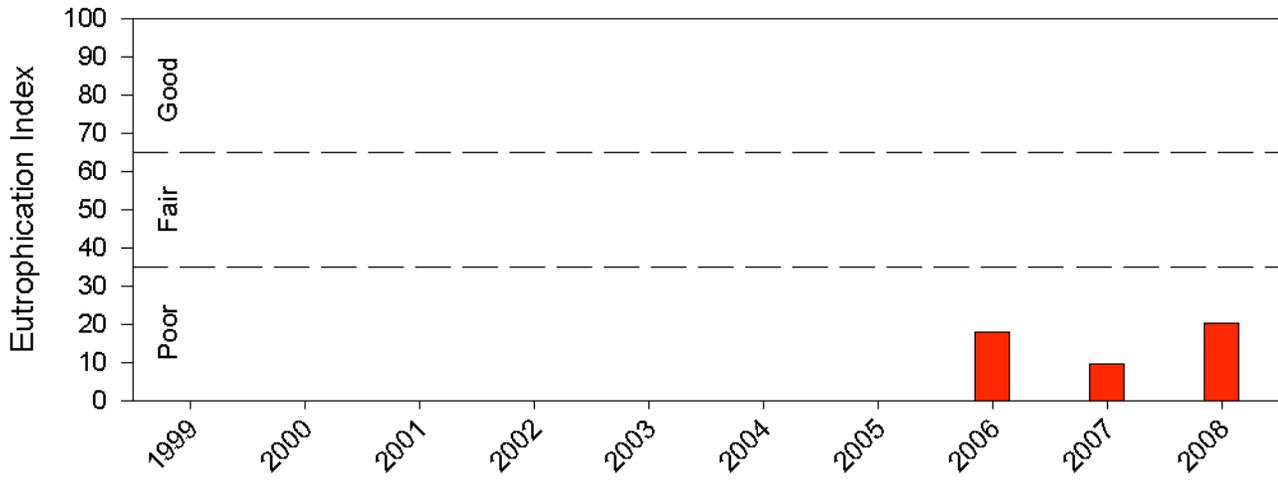
Pochet-Upper (WMO-5)



Pochet Upper (WMO-5)

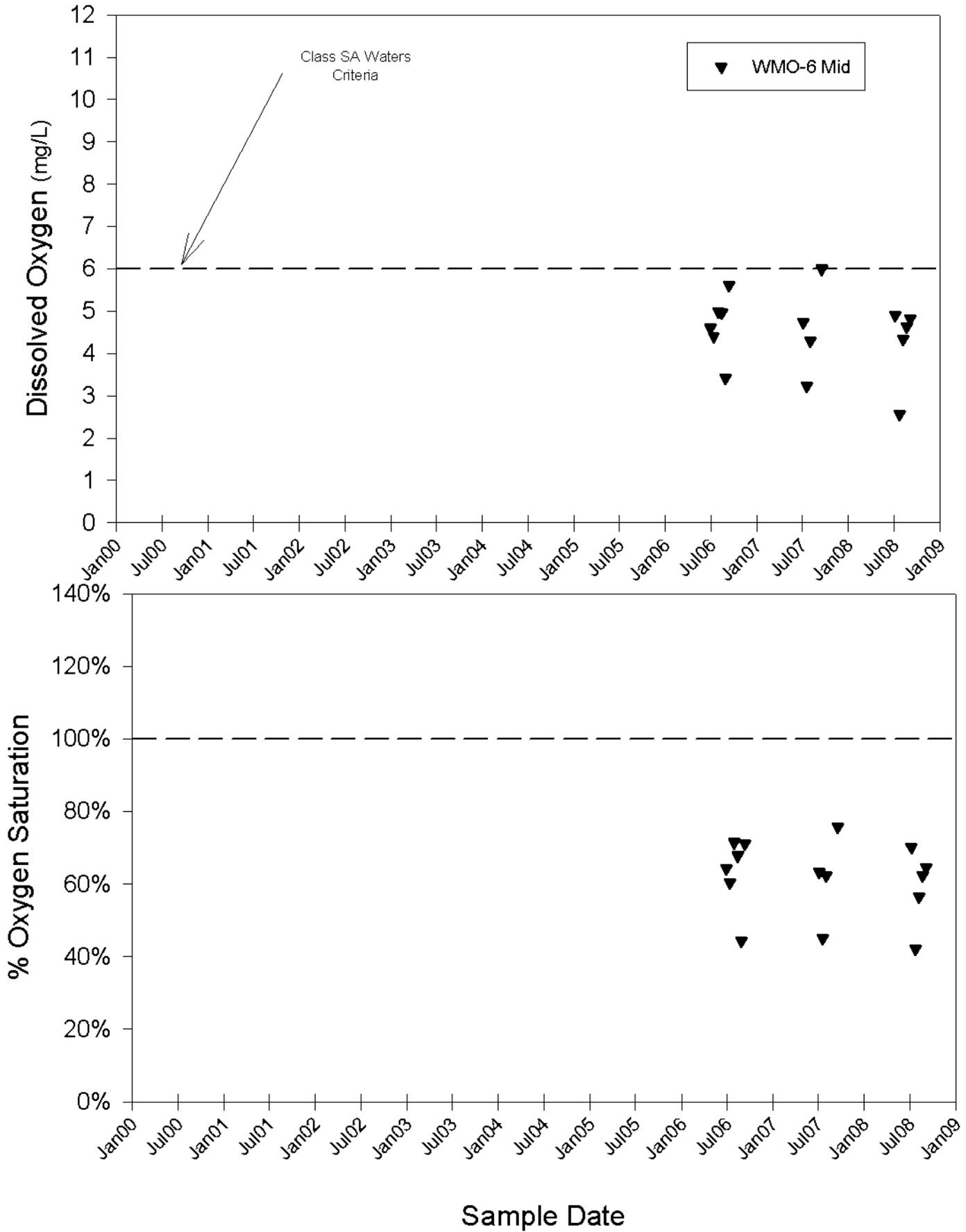


Namequoti River - Upper (WMO-6)



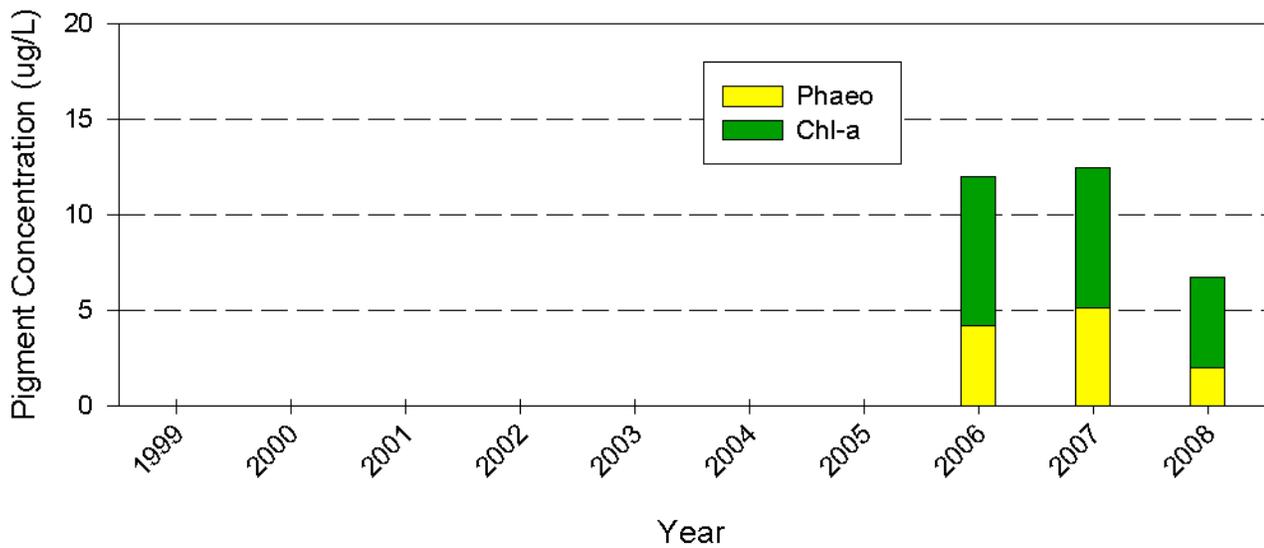
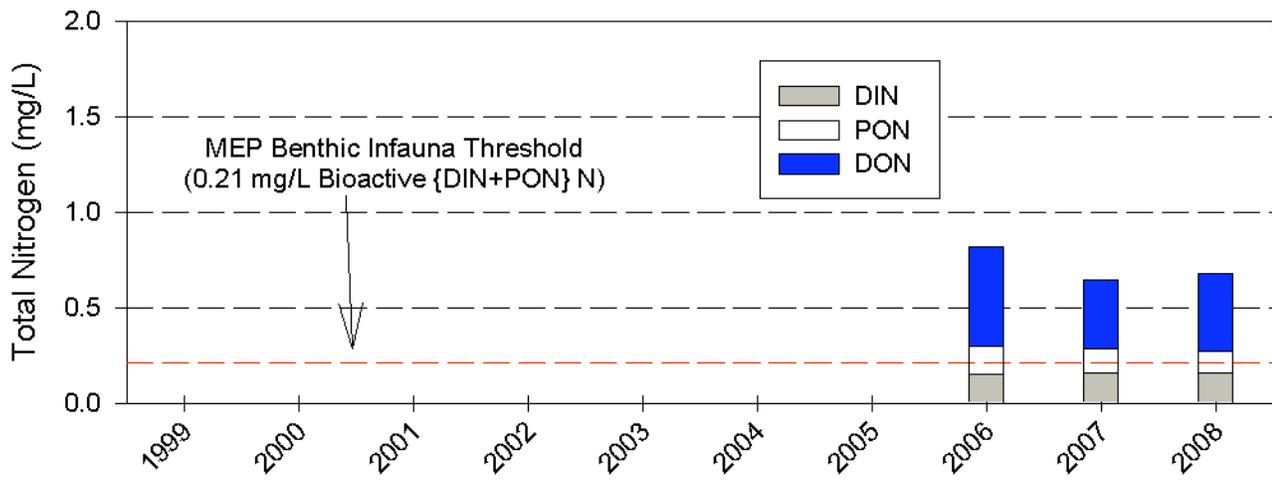
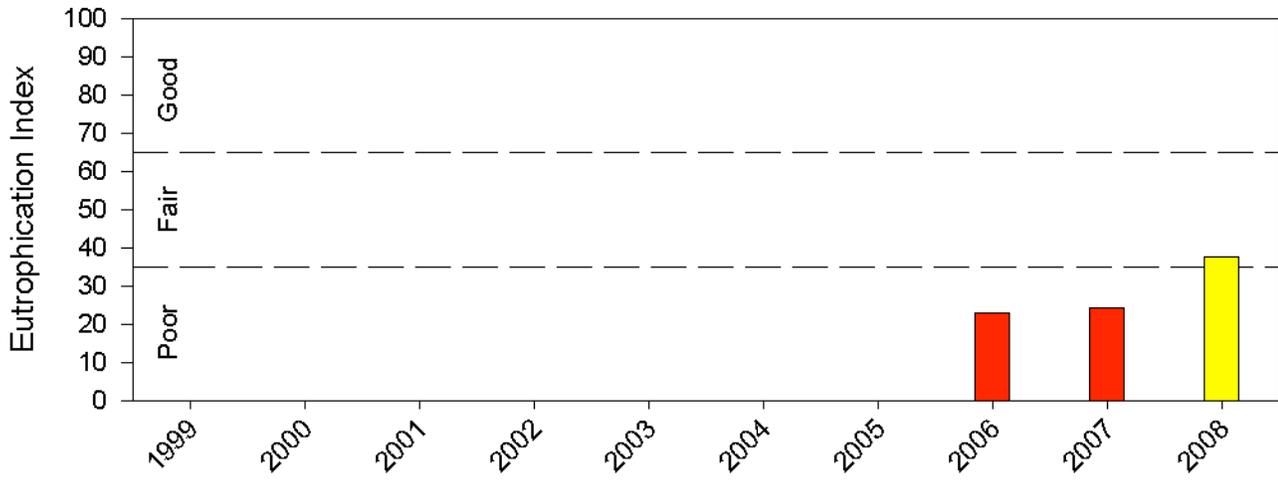
Year

Namequoit River - Upper (WMO-6)

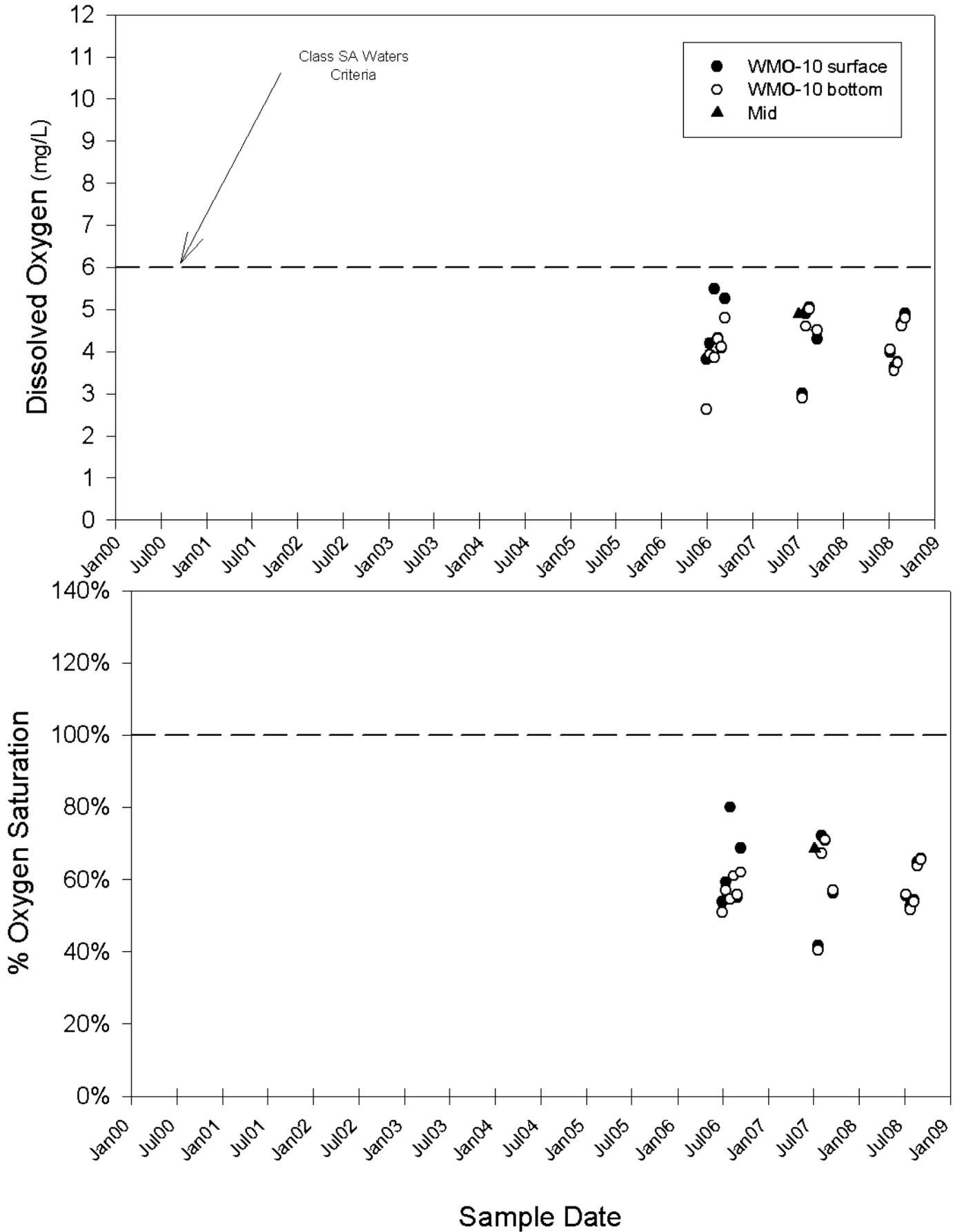


River at Rattles Dock (WMO-10)

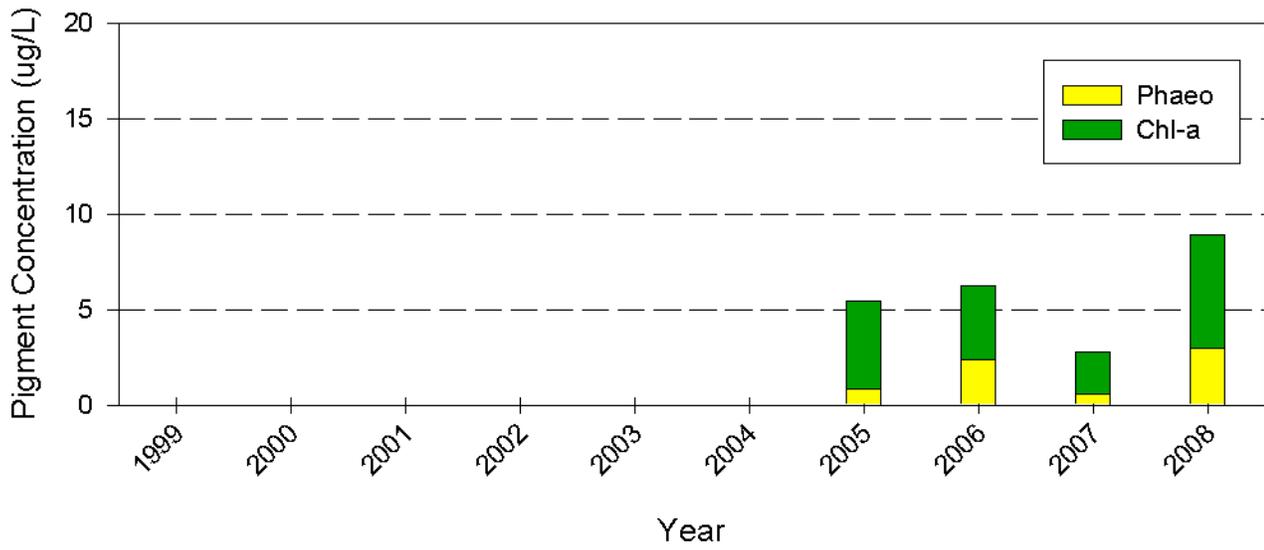
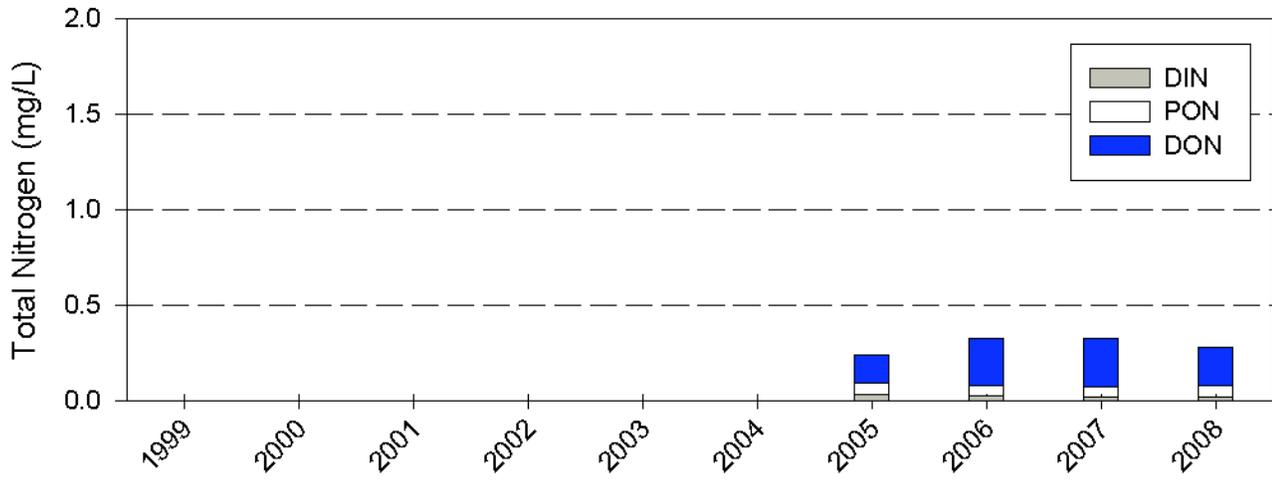
(aka Meetinghouse Pond - Outer)



River at Rattles Dock (WMO-10) (aka Meetinghouse Pond - Outer)



Chatham Harbor *Flood Tide* (PBA-17A)



APPENDIX B. SUMMARY MATRIX OF DATA FOR ALL STATIONS

Pleasant Bay 2008 Station Summary

Station		Field Temp. (°C)	Lab Salinities (ppt)	Field DO % Saturation	Field DO (mg/L)	Secchi AVG. (m)	PO4 mg/L	NH4 mg/L	NOX mg/L	DIN mg/L	DON mg/L	PON mg/L	TON mg/L	TN mg/L	POC mg/L	Chla ug/L	Phaeo ug/L	Total Pigment ug/L
CM-13 Outer Ryder's Cove	Average	24.6	31.0	75.7	5.1	2.3	0.033	0.062	0.010	0.072	0.289	0.083	0.372	0.444	0.459	2.418	1.301	3.719
	Std. Deviation	4.0	0.6	17.2	0.5	0.3	0.009	0.032	0.004	0.033	0.029	0.015	0.040	0.041	0.072	0.753	0.637	0.955
PBA-3 Inner Ryder's Cove	Average	22.4	30.8	81.5	6.0	2.3	0.035	0.091	0.032	0.123	0.451	0.113	0.563	0.686	0.557	3.843	1.538	5.381
	Std. Deviation	1.0	0.4	11.5	0.7	0.3	0.008	0.055	0.044	0.063	0.115	0.015	0.119	0.133	0.089	0.563	0.989	1.236
PBA-4 Crows Pond	Average	21.7	31.2	88.4	6.4	2.4	0.026	0.046	0.006	0.052	0.412	0.081	0.493	0.545	0.462	2.369	0.957	3.326
	Std. Deviation	1.4	0.5	8.5	0.6	0.2	0.004	0.021	0.002	0.022	0.118	0.009	0.118	0.128	0.034	0.832	0.560	0.984
PBA-5 Muddy Creek	Average	22.1	25.7	66.9	5.5	1.5	0.053	0.038	0.019	0.057	1.261	0.225	1.487	1.543	1.157	21.048	1.025	22.073
	Std. Deviation	1.5	2.8	11.4	1.1	0.3	0.055	0.063	0.026	0.087	1.707	0.020	1.719	1.806	0.198	11.325	0.894	11.131
PBA-5A Muddy Creek - Upper	Average	24.2	12.8	81.7	6.2	0.7	0.028	0.141	0.246	0.388	0.746	0.333	1.080	1.467	1.630	16.648	2.377	19.025
	Std. Deviation	1.1	2.2	27.6	2.5	0.3	0.011	0.085	0.113	0.131	0.168	0.053	0.190	0.133	0.213	2.812	3.293	4.553
PBA-8 Big Bay - NE	Average	19.9	31.4	108.1	8.3	2.7	0.018	0.018	0.002	0.020	0.268	0.093	0.361	0.381	0.530	2.190	1.032	3.222
	Std. Deviation	0.8	0.6	23.4	2.1	0.6	0.006	0.014	0.002	0.015	0.027	0.032	0.045	0.048	0.180	0.657	0.364	0.898
PBA-9 Round Cove	Average	21.6	30.5	75.9	5.7	1.8	0.023	0.023	0.017	0.040	0.316	0.201	0.517	0.557	1.049	5.946	3.530	9.476
	Std. Deviation	1.2	0.7	8.6	0.6	0.3	0.004	0.021	0.019	0.033	0.047	0.070	0.089	0.078	0.403	1.771	2.017	3.297
PBA-10 Quanset Pond	Average	21.4	31.2	68.6	4.9	2.0	0.025	0.028	0.009	0.037	0.345	0.183	0.528	0.565	0.995	5.724	3.799	9.208
	Std. Deviation	0.8	0.5	10.2	0.7	0.1	0.003	0.028	0.007	0.026	0.098	0.059	0.094	0.089	0.371	3.690	2.920	6.024
PBA-11 Paw Wah Pond	Average	22.0	30.4	80.2	5.9	2.3	0.047	0.026	0.008	0.034	0.340	0.091	0.431	0.465	0.509	4.796	0.952	5.845
	Std. Deviation	1.8	0.5	31.5	2.6	0.2	0.010	0.016	0.004	0.019	0.065	0.053	0.067	0.078	0.261	6.560	0.442	6.306
PBA-12 Namequoit Point - South	Average	21.0	31.3	76.6	5.7	1.8	0.039	0.039	0.005	0.044	0.324	0.072	0.396	0.441	0.465	1.424	0.703	2.059
	Std. Deviation	0.9	0.6	7.7	0.6	0.3	0.010	0.009	0.002	0.009	0.032	0.018	0.031	0.035	0.149	0.552	0.295	0.762
PBA-13 Namequoit Point - North	Average	21.8	31.2	75.1	5.5	2.7	0.056	0.070	0.008	0.078	0.415	0.062	0.477	0.555	0.391	1.349	0.910	2.259
	Std. Deviation	1.3	0.3	6.5	0.6	0.4	0.010	0.029	0.003	0.030	0.136	0.015	0.141	0.155	0.111	0.345	0.569	0.825
PBA-15 Kescayogansett Pond	Average	23.9	30.6	82.7	6.0	1.5	0.099	0.166	0.026	0.192	0.563	0.119	0.681	0.873	0.639	3.693	2.002	5.695
	Std. Deviation	1.0	0.3	14.8	1.0	0.0	0.016	0.056	0.005	0.059	0.136	0.037	0.118	0.144	0.174	1.649	0.949	1.907
WMO-10 Meetinghouse Pond - Outer	Average	23.8	30.5	57.7	4.1	2.1	0.095	0.125	0.029	0.154	0.412	0.113	0.526	0.680	0.602	4.688	2.028	6.716
	Std. Deviation	1.4	0.3	5.5	0.5	0.2	0.017	0.019	0.004	0.021	0.069	0.022	0.067	0.074	0.080	3.150	0.772	3.391
WMO-3 Pochet - Mouth	Average	21.3	31.5	69.2	5.1	1.4	0.062	0.051	0.004	0.055	0.429	0.060	0.490	0.545	0.380	1.989	0.988	2.977
	Std. Deviation	1.3	0.4	7.0	0.5	0.1	0.011	0.019	0.001	0.020	0.113	0.014	0.114	0.116	0.071	1.148	0.590	1.626
WMO-5 Pochet - Upper	Average	21.6	30.3	36.3	2.7	0.7	0.167	0.091	0.015	0.106	0.487	0.108	0.595	0.701	0.639	3.832	2.649	6.481
	Std. Deviation	1.9	0.8	5.0	0.4	0.1	0.022	0.020	0.005	0.020	0.042	0.016	0.050	0.058	0.074	1.546	2.363	3.556
WMO-6 Namequoit River - Upper	Average	23.5	29.8	60.2	4.2	1.2	0.082	0.083	0.020	0.104	0.518	0.112	0.630	0.733	0.577	6.332	1.973	8.305
	Std. Deviation	1.1	0.5	9.2	0.9	0.2	0.017	0.013	0.007	0.016	0.037	0.061	0.057	0.045	0.300	5.126	1.166	5.779
PBA-17A Atlantic Ocean -Flood	Average	ND	30.3	ND	ND	ND	0.009	0.010	0.006	0.016	0.195	0.067	0.261	0.277	0.399	5.974	2.937	8.182
	Std. Deviation	ND	1.9	ND	ND	ND	0.001	0.004	0.005	0.007	0.014	0.006	0.016	0.011	0.048	4.857	3.791	7.714

Pleasant Bay 2007 Station Summary

Station		Temp. (°C)	Lab Salinities (ppt)	DO % Sat	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/L	NOX mg/L	DIN mg/L	DON mg/L	PON mg/L	TON mg/L	TN mg/L	POC mg/L	Chla ug/L	Phaeo ug/L	Total Pigments ug/L	
PBA-3	Ryder's Cove - Inner	Average	22.53	29.91	69.73	5.23	1.99	0.035	0.116	0.016	0.132	0.444	0.158	0.602	0.734	0.839	6.068	3.265	9.333
		Std Deviation	1.93	0.38	11.15	0.92	0.42	0.010	0.101	0.026	0.125	0.190	0.121	0.272	0.271	0.650	3.455	1.770	3.573
PBA-4	Crows Pond	Average	21.56	30.56	78.81	5.71	2.41	0.034	0.073	0.007	0.080	0.601	0.085	0.686	0.766	0.481	3.139	2.253	5.392
		Std Deviation	2.19	0.34	8.55	0.63	0.66	0.007	0.040	0.005	0.042	0.267	0.013	0.266	0.294	0.088	0.977	1.069	1.665
PBA-5	Muddy Creek	Average	22.58	19.08	85.18	6.07	1.27	0.040	0.088	0.041	0.128	0.977	0.203	1.180	1.308	1.155	10.201	4.854	15.055
		Std Deviation	2.30	2.65	30.25	2.25	0.16	0.016	0.079	0.050	0.121	0.598	0.101	0.684	0.631	0.674	8.731	5.688	13.069
PBA-5A	Muddy Creek - Upper	Average	23.82	13.24	81.06	7.67	0.78	0.024	0.041	0.202	0.243	0.537	0.585	1.122	1.365	3.025	29.220	10.787	40.007
		Std Deviation	2.40	4.42	40.57	2.54	0.28	0.015	0.041	0.167	0.200	0.201	0.371	0.557	0.441	1.875	15.343	8.371	22.414
PBA-8	Big Bay - NE	Average	20.30	31.01	81.31	6.16	1.87	0.024	0.029	0.002	0.031	0.347	0.086	0.433	0.464	0.496	3.059	1.402	4.461
		Std Deviation	1.89	0.40	10.93	0.75	0.48	0.004	0.014	0.001	0.014	0.230	0.022	0.243	0.243	0.159	1.120	0.462	1.240
PBA-9	Round Cove	Average	21.64	29.95	76.02	6.76	1.60	0.029	0.038	0.023	0.061	0.347	0.147	0.495	0.555	0.784	7.398	3.529	10.927
		Std Deviation	1.79	0.65	9.47	0.78	0.38	0.007	0.018	0.019	0.029	0.103	0.028	0.085	0.103	0.134	2.740	1.476	3.170
PBA-10	Quanset Pond	Average	21.27	30.65	74.35	5.40	2.12	0.031	0.056	0.003	0.059	0.326	0.095	0.421	0.481	0.525	4.036	1.793	5.829
		Std Deviation	1.90	0.38	3.86	0.43	0.08	0.003	0.032	0.001	0.032	0.143	0.015	0.155	0.153	0.083	0.760	0.406	0.927
PBA-11	Paw Wah Pond	Average	22.40	29.43	73.86	5.26	0.92	0.065	0.058	0.011	0.069	0.460	0.070	0.530	0.599	0.435	2.714	2.046	4.760
		Std Deviation	2.09	0.63	8.82	0.75	0.23	0.010	0.038	0.005	0.038	0.166	0.015	0.174	0.162	0.060	1.330	1.065	2.343
PBA-12	Namequoit Pt. - S	Average	20.23	30.56	73.18	5.69	1.55	0.052	0.086	0.006	0.092	0.695	0.079	0.774	0.866	0.542	1.542	1.381	2.923
		Std Deviation	2.41	0.37	6.54	0.81	0.49	0.007	0.047	0.003	0.048	0.339	0.037	0.331	0.357	0.333	0.409	0.431	0.665
PBA-13	Namequoit Pt. - N	Average	20.98	30.18	75.85	6.11	2.53	0.069	0.099	0.008	0.107	0.337	0.066	0.403	0.509	0.417	2.525	2.164	4.689
		Std Deviation	2.81	0.31	7.12	0.69	0.81	0.003	0.057	0.004	0.060	0.119	0.018	0.125	0.153	0.101	1.712	2.089	3.622
PBA-15	Kescayo Gansett Pond	Average	22.59	29.58	77.90	5.56	1.66	0.109	0.117	0.017	0.134	0.616	0.155	0.770	0.905	0.872	6.594	5.396	11.990
		Std Deviation	2.19	0.50	16.90	1.19	0.53	0.017	0.042	0.010	0.046	0.260	0.064	0.275	0.269	0.404	6.091	6.781	7.971
PBA-17A	Chatham Harbor - Flood	Average	ND	27.92	ND	ND	ND	0.009	0.015	0.008	0.022	0.254	0.049	0.303	0.325	0.284	2.183	0.584	2.767
		Std Deviation	ND	0.97	ND	ND	ND	0.004	0.007	0.009	0.014	0.050	0.005	0.048	0.050	0.033	0.539	0.223	0.549
CM-13	Ryder's Cove - Outer	Average	21.62	30.09	73.90	5.55	2.40	0.034	0.051	0.004	0.054	0.304	0.085	0.389	0.444	0.463	3.350	2.225	5.575
		Std Deviation	2.10	0.31	5.58	0.66	0.38	0.005	0.007	0.002	0.009	0.090	0.033	0.114	0.111	0.165	1.140	1.094	1.361
WMO-3	Pochet - Mouth	Average	20.47	30.27	66.82	5.03	1.65	0.069	0.089	0.010	0.099	0.712	0.063	0.774	0.873	0.384	1.864	1.466	3.330
		Std Deviation	3.25	0.73	9.72	0.96	0.10	0.013	0.015	0.006	0.018	0.146	0.013	0.156	0.152	0.083	1.053	1.023	0.984
WMO-5	Pochet - Upper	Average	19.95	28.18	40.20	3.14	0.63	0.165	0.140	0.019	0.159	0.521	0.101	0.622	0.781	0.615	3.497	3.464	6.961
		Std Deviation	3.80	1.51	11.34	1.01	0.25	0.038	0.069	0.009	0.078	0.122	0.025	0.130	0.124	0.129	1.267	1.746	1.389
WMO-6	Namequoit River - Upper	Average	23.22	27.78	62.28	4.29	0.82	0.104	0.142	0.021	0.162	0.786	0.165	0.951	1.113	0.810	8.325	6.561	14.886
		Std Deviation	3.07	0.50	17.19	1.16	0.10	0.014	0.078	0.010	0.088	0.200	0.060	0.215	0.213	0.261	4.430	4.440	4.982
WMO-10	Meetinghouse Pond - Outer	Average	23.51	29.25	57.09	4.09	1.76	0.104	0.135	0.024	0.159	0.358	0.126	0.485	0.644	0.676	7.333	5.127	11.997
		Std Deviation	2.67	0.50	13.60	0.93	0.39	0.014	0.072	0.013	0.081	0.031	0.051	0.071	0.054	0.239	6.570	2.400	6.055

Pleasant Bay 2006 Station Summary

Station		Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/L	NOX mg/L	DIN mg/L	DON mg/L	PON mg/L	TON mg/L	TN mg/L	POC mg/L	Chla ug/L	Phaeo ug/L	Total Pigments ug/L
PBA-1 Chatham Harbor	Average	15.10	31.26	95.98	7.71	4.04	0.018	0.025	0.009	0.034	0.370	0.039	0.408	0.442	0.242	1.053	0.696	1.749
	Std Deviation	5.06	0.86	4.94	0.33	0.27	0.007	0.014	0.007	0.016	0.157	0.009	0.165	0.155	0.048	0.468	0.459	0.640
PBA-3 Ryders Cove-Inner	Average	21.50	29.48	76.32	6.24	1.98	0.051	0.108	0.028	0.136	0.527	0.130	0.657	0.793	0.655	5.390	2.926	8.316
	Std Deviation	2.97	1.28	16.60	1.54	0.33	0.028	0.108	0.075	0.121	0.167	0.076	0.185	0.159	0.324	2.688	1.073	3.192
PBA-4 Crows Pond	Average	22.01	29.76	86.46	6.28	1.87	0.044	0.050	0.054	0.104	0.397	0.090	0.487	0.592	0.498	4.444	1.677	6.121
	Std Deviation	2.48	1.08	11.23	0.62	0.48	0.016	0.030	0.131	0.120	0.062	0.010	0.064	0.123	0.062	1.775	1.078	1.731
PBA-5 Muddy Creek	Average	21.16	23.90	66.56	5.05	1.45	0.065	0.207	0.054	0.270	0.925	0.145	1.065	1.669	0.749	5.285	4.455	9.740
	Std Deviation	2.65	5.12	17.70	1.28	0.21	0.020	0.139	0.029	0.116	0.309	0.031	0.314	0.809	0.140	4.865	3.856	6.693
PBA-5A Muddy Creek-Upper	Average	22.70	10.02	58.52	4.86	1.00	0.025	0.094	0.290	0.384	0.754	0.220	0.974	1.358	1.237	6.987	7.692	14.680
	Std Deviation	2.75	2.72	28.97	1.86	0.00	0.016	0.060	0.094	0.114	0.321	0.148	0.384	0.429	0.668	2.117	11.826	12.700
PBA-8 Big Bay-NE	Average	20.81	30.48	95.84	7.23	1.76	0.050	0.051	0.004	0.055	0.344	0.109	0.453	0.508	0.708	3.092	2.032	5.124
	Std Deviation	2.57	1.04	13.43	1.04	0.65	0.014	0.034	0.002	0.035	0.064	0.075	0.095	0.112	0.648	1.643	1.098	1.570
PBA-9 Round Cove	Average	22.15	29.25	69.94	12.95	1.51	0.050	0.061	0.038	0.099	0.504	0.152	0.656	0.755	0.802	6.107	3.522	9.628
	Std Deviation	1.76	1.26	13.03	15.87	0.32	0.015	0.032	0.029	0.042	0.128	0.054	0.110	0.136	0.233	3.382	0.823	3.816
PBA-10 Quanset Pond	Average	21.61	29.94	68.40	5.04	1.78	0.055	0.056	0.009	0.065	0.466	0.115	0.581	0.645	0.615	4.231	2.230	6.461
	Std Deviation	2.11	1.52	10.79	0.71	0.25	0.015	0.030	0.004	0.031	0.084	0.027	0.092	0.090	0.097	1.549	0.878	1.832
PBA-11 Paw Wah Pond	Average	21.82	29.27	62.70	4.58	2.17	0.214	0.206	0.011	0.217	0.489	0.281	0.770	0.987	1.440	12.536	8.278	20.814
	Std Deviation	2.82	1.54	21.75	1.67	0.46	0.458	0.523	0.005	0.521	0.155	0.529	0.664	1.182	2.625	28.560	12.247	39.333
PBA-12 Namequoit Pt.-S	Average	21.50	29.15	73.06	5.43	1.28	0.078	0.051	0.007	0.057	0.422	0.076	0.498	0.555	0.446	2.527	1.606	4.133
	Std Deviation	3.31	2.16	5.45	0.64	0.20	0.029	0.020	0.004	0.022	0.072	0.026	0.089	0.105	0.126	1.460	0.718	2.011
PBA-13 Namequoit Pt.-N	Average	21.43	29.78	75.08	5.62	2.36	0.092	0.068	0.008	0.076	0.426	0.077	0.504	0.579	0.469	2.811	2.194	5.005
	Std Deviation	3.32	1.59	4.81	0.63	0.61	0.030	0.027	0.005	0.030	0.084	0.028	0.092	0.114	0.131	1.791	0.915	2.352
PBA-14 Areys Pond	Average	24.25	25.90	50.20	3.56	1.61	0.132	0.134	0.031	0.165	0.661	0.192	0.853	1.018	0.894	7.362	3.231	10.593
	Std Deviation	2.48	1.72	12.56	1.10	0.53	0.030	0.059	0.013	0.051	0.173	0.089	0.193	0.223	0.365	2.572	1.760	2.814
PBA-15 Kescayo Gansett Pond	Average	23.78	27.43	62.84	4.84	1.62	0.137	0.099	0.015	0.114	0.553	0.195	0.748	0.862	1.058	6.636	3.412	10.048
	Std Deviation	2.77	2.08	22.04	0.87	0.56	0.038	0.059	0.007	0.063	0.130	0.095	0.211	0.227	0.731	4.205	1.481	4.372
PBA-16 Meeting House Pond	Average	22.85	28.00	71.38	5.21	1.64	0.131	0.113	0.024	0.137	0.431	0.149	0.580	0.717	0.714	8.003	2.608	10.611
	Std Deviation	2.69	1.86	18.04	1.24	0.39	0.038	0.064	0.016	0.079	0.045	0.063	0.098	0.075	0.243	4.919	1.161	4.877
PBA-17A Chatham Harbor-Flood	Average	ND	30.12	ND	ND	ND	0.008	0.014	0.015	0.029	0.245	0.050	0.295	0.324	0.313	3.853	2.364	6.217
	Std Deviation	ND	1.22	ND	ND	ND	0.005	0.006	0.016	0.022	0.037	0.010	0.040	0.048	0.062	3.154	4.789	6.330
CM-13 Ryders Cove-Outer	Average	20.35	29.61	81.19	6.42	2.68	0.048	0.037	0.004	0.041	0.295	0.087	0.383	0.423	0.512	3.407	1.487	4.894
	Std Deviation	2.53	1.11	6.58	0.90	0.38	0.019	0.021	0.003	0.024	0.030	0.041	0.056	0.071	0.374	1.412	0.662	1.525
WMO-3 Pochet-Mouth	Average	21.87	29.46	69.02	5.18	1.70	0.105	0.080	0.005	0.085	0.790	0.064	0.854	0.939	0.369	2.414	2.204	4.618
	Std Deviation	3.26	1.21	7.83	0.88	ND	0.024	0.027	0.002	0.029	0.154	0.019	0.147	0.152	0.105	0.599	1.165	1.711
WMO-5 Pochet-Upper	Average	21.52	28.43	55.10	4.14	1.00	0.194	0.130	0.012	0.143	0.541	0.107	0.649	0.792	0.626	3.440	3.779	7.219
	Std Deviation	3.48	2.07	13.81	1.25	ND	0.076	0.056	0.008	0.061	0.041	0.053	0.058	0.046	0.313	1.490	0.949	2.306
WMO-6 Namequoit River-Upper	Average	23.00	27.50	63.23	4.66	1.23	0.128	0.154	0.015	0.169	0.704	0.137	0.840	1.009	0.670	6.706	3.656	10.362
	Std Deviation	3.09	1.49	10.21	0.72	0.16	0.037	0.063	0.006	0.061	0.266	0.061	0.276	0.304	0.245	3.243	1.229	4.148
WMO-10 Meetinghouse Pond Outer @ Rattles Dock	Average	23.53	27.56	59.90	4.28	1.69	0.136	0.123	0.025	0.148	0.517	0.150	0.667	0.815	0.726	7.823	4.170	11.993
	Std Deviation	2.51	1.98	7.89	0.74	0.40	0.033	0.073	0.015	0.087	0.179	0.060	0.198	0.237	0.227	3.888	2.701	4.345

Pleasant Bay 2005 Station Summary

Station		Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/L	NOx mg/L	DIN mg/L	DON mg/L	PON mg/L	TON mg/L	TN mg/L	POC mg/L	Chla ug/L	Phaeo ug/L	Total Pigments (ug/L)
PBA-1 Chatham Harbor	Average	13.34	31.36	104.42	9.04	3.58	0.011	0.014	0.013	0.027	0.204	0.059	0.263	0.290	0.347	2.717	0.464	3.181
	Std Deviation	2.81	1.31	4.63	0.40	0.47	0.006	0.012	0.021	0.026	0.096	0.011	0.095	0.109	0.063	0.889	0.341	0.914
PBA-3 Ryders Cove	Average	22.71	29.33	79.96	5.80	2.03	0.039	0.082	0.008	0.091	0.480	0.181	0.661	0.751	0.951	9.187	0.932	10.120
	Std Deviation	1.42	1.25	17.81	1.39	0.50	0.020	0.081	0.006	0.086	0.149	0.064	0.161	0.190	0.448	3.346	1.333	3.729
PBA-4 Crows Pond	Average	22.58	30.37	88.16	6.29	1.99	0.035	0.052	0.007	0.060	0.532	0.100	0.631	0.691	0.562	4.355	0.922	5.276
	Std Deviation	1.35	1.32	10.99	0.89	0.26	0.012	0.031	0.003	0.033	0.207	0.032	0.210	0.233	0.164	1.754	0.669	1.563
PBA-5 Muddy Creek	Average	22.65	19.63	44.62	3.77	0.90	0.032	0.046	0.046	0.092	0.344	0.132	0.476	0.568	0.691	5.942	1.524	7.466
	Std Deviation	1.42	2.18	22.48	1.59	0.18	0.019	0.042	0.037	0.071	0.086	0.035	0.072	0.118	0.164	3.874	0.694	3.719
PBA-5A Muddy Creek-Upper	Average	23.20	8.00	90.17	7.45	2.38	0.020	0.037	0.674	0.711	0.381	0.202	0.582	1.293	1.101	8.809	1.703	10.512
	Std Deviation	1.52	3.10	18.79	1.78	3.08	0.019	0.021	0.532	0.534	0.134	0.116	0.228	0.424	0.586	6.576	1.418	5.934
PBA-6 Big Bay-SW	Average	21.59	30.75	75.09	5.85	1.45	0.024	0.022	0.004	0.026	0.246	0.148	0.394	0.420	0.813	7.339	1.211	8.550
	Std Deviation	1.51	1.45	15.66	1.30	0.20	0.016	0.020	0.002	0.021	0.070	0.030	0.069	0.070	0.113	2.035	1.037	2.434
PBA-7 Big Bay-Mid	Average	20.47	30.28	73.88	5.73	1.60	0.027	0.025	0.003	0.028	0.273	0.127	0.401	0.429	0.731	5.596	1.244	6.840
	Std Deviation	0.54	1.44	22.24	1.56	0.41	0.016	0.027	0.002	0.028	0.091	0.074	0.116	0.109	0.344	2.545	0.950	2.872
PBA-8 Big Bay-NE	Average	21.19	30.80	91.68	6.71	1.75	0.028	0.016	0.004	0.020	0.249	0.126	0.375	0.395	0.749	4.645	0.979	5.624
	Std Deviation	1.82	1.43	16.54	1.22	0.28	0.013	0.010	0.002	0.010	0.067	0.054	0.076	0.082	0.384	1.280	0.469	1.581
PBA-9 Round Cove	Average	22.06	29.69	81.98	7.37	1.41	0.023	0.014	0.015	0.029	0.303	0.188	0.490	0.520	0.981	10.885	1.738	12.624
	Std Deviation	1.45	1.53	10.23	5.49	0.17	0.012	0.011	0.019	0.022	0.060	0.027	0.070	0.076	0.146	4.367	0.919	4.544
PBA-10 Quanset Pond	Average	22.26	29.54	72.96	5.34	1.75	0.035	0.032	0.009	0.041	0.342	0.128	0.470	0.511	0.690	5.334	1.896	7.230
	Std Deviation	1.21	1.37	9.35	0.77	0.31	0.017	0.022	0.004	0.023	0.082	0.044	0.074	0.073	0.202	3.908	0.818	4.145
PBA-11 Paw Wah Pond	Average	22.78	28.92	61.84	4.53	2.24	0.072	0.034	0.010	0.044	0.413	0.217	0.630	0.674	1.120	8.778	3.284	12.061
	Std Deviation	2.16	1.27	30.21	2.13	0.52	0.026	0.030	0.007	0.031	0.097	0.161	0.186	0.190	0.796	9.550	3.281	11.943
PBA-12 Namequoit Pt.-S	Average	22.69	30.46	69.34	5.12	1.63	0.059	0.039	0.005	0.045	0.383	0.093	0.476	0.521	0.538	3.440	1.557	4.997
	Std Deviation	1.16	1.52	10.75	0.71	0.30	0.027	0.011	0.002	0.013	0.110	0.039	0.124	0.125	0.198	1.919	0.634	2.067
PBA-13 Namequoit Pt.-N	Average	23.45	29.42	69.91	5.01	2.17	0.074	0.042	0.012	0.054	0.395	0.096	0.493	0.546	0.538	4.107	2.364	6.471
	Std Deviation	1.02	1.42	20.35	1.46	0.64	0.036	0.021	0.008	0.028	0.128	0.039	0.129	0.121	0.180	1.918	1.614	3.097
PBA-14 Areys Pond	Average	24.41	26.53	64.82	4.74	1.18	0.094	0.099	0.016	0.115	0.423	0.209	0.632	0.747	0.985	12.302	2.512	14.814
	Std Deviation	1.16	1.55	18.51	1.35	0.23	0.040	0.068	0.008	0.072	0.079	0.090	0.124	0.106	0.355	8.950	1.980	8.377
PBA-15 Kescayo Gansett Pond	Average	24.29	28.21	66.71	4.72	1.43	0.096	0.112	0.017	0.130	0.442	0.179	0.622	0.751	0.990	8.209	3.963	12.172
	Std Deviation	1.26	1.70	11.71	0.97	0.22	0.037	0.046	0.009	0.051	0.095	0.056	0.108	0.124	0.343	5.788	2.963	6.706
PBA-16 Meeting House Pond	Average	26.85	28.43	48.31	3.27	1.23	0.127	0.158	0.016	0.173	0.415	0.193	0.609	0.782	1.054	10.350	2.547	12.897
	Std Deviation	6.50	1.63	34.19	2.56	0.38	0.069	0.183	0.012	0.166	0.112	0.116	0.175	0.178	0.724	10.309	2.241	9.574
PBA-18 Ministers Point-N	Average	19.49	30.18	83.25	6.42	2.32	0.024	0.016	0.005	0.021	0.220	0.080	0.299	0.321	0.452	3.398	1.033	4.431
	Std Deviation	2.22	0.92	9.09	0.88	0.78	0.010	0.006	0.005	0.009	0.073	0.021	0.079	0.083	0.112	0.882	0.544	1.285
PBA-17A Chatham Harbor-Flood	Average	ND	31.17	ND	ND	ND	0.013	0.022	0.011	0.033	0.147	0.061	0.203	0.236	0.357	4.618	0.809	5.428
	Std Deviation	ND	1.06	ND	ND	ND	0.005	0.012	0.011	0.016	0.052	0.012	0.052	0.055	0.071	3.710	0.963	4.367
PBA-19 Strong Island-NE	Average	18.21	31.43	92.96	7.53	2.13	0.022	0.119	0.016	0.135	0.723	0.073	0.796	0.930	0.414	3.394	0.643	4.036
	Std Deviation	3.78	1.22	6.52	1.52	0.45	0.011	0.130	0.016	0.131	0.349	0.017	0.346	0.367	0.082	0.912	0.924	1.224
PBA-20 Nickersons Neck	Average	21.41	30.45	87.22	6.50	2.15	0.030	0.022	0.004	0.026	0.520	0.095	0.615	0.641	0.563	4.575	0.978	5.554
	Std Deviation	1.36	1.22	8.02	0.64	0.32	0.012	0.011	0.002	0.010	0.479	0.021	0.491	0.499	0.108	0.549	0.503	0.875

Pleasant Bay 2005 Station Summary

Station		Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/L	NOx mg/L	DIN mg/L	DON mg/L	PON mg/L	TON mg/L	TN mg/L	POC mg/L	Chla ug/L	Phaeo ug/L	Total Pigments (ug/L)
PBA-21 Little PB	Average	22.48	30.05	77.91	5.64	2.27	0.047	0.029	0.006	0.036	0.406	0.079	0.485	0.521	0.445	2.767	1.388	4.155
	Std Deviation	1.12	1.24	7.26	0.57	0.52	0.020	0.016	0.004	0.017	0.171	0.030	0.167	0.178	0.133	1.088	0.507	1.427
CM-13 Ryders Cove	Average	22.12	29.17	82.64	6.05	2.54	0.035	0.023	0.003	0.027	0.235	0.101	0.342	0.369	0.557	4.300	1.520	5.819
	Std Deviation	1.33	1.12	7.35	0.55	0.66	0.019	0.014	0.001	0.014	0.035	0.045	0.063	0.059	0.240	1.859	1.488	2.206
CM-14 Frost Fish Cr.	Average	22.52	26.98	65.74	5.23	1.23	0.051	0.090	0.063	0.153	0.903	0.110	1.013	1.166	0.615	4.336	2.233	6.569
	Std Deviation	1.04	5.31	3.60	0.46	0.36	0.023	0.052	0.075	0.114	0.491	0.065	0.466	0.465	0.353	3.167	1.507	4.657

Pleasant Bay 2004 Station Summary

Station		Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/l	NOx mg/l	DIN mg/L	DON mg/L	PON mg/l	TON mg/L	TN mg/L	POC mg/l	Chla ug/L	Phaeo ug/L	Total Pigments ug/L
PBA-1 Chatham Harbor	Average	16.85	30.68	96.89	8.04	2.67	0.015	0.011	0.004	0.015	0.276	0.078	0.354	0.370	0.443	3.690	0.509	4.199
	Std Deviation	1.40	0.80	5.34	0.65	0.40	0.005	0.007	0.005	0.008	0.180	0.030	0.184	0.180	0.131	2.622	0.639	3.116
PBA-2 Bassing Harbor	Average	19.60	30.76	88.12	6.93	1.37	0.030	0.024	0.003	0.028	0.362	0.074	0.435	0.463	0.415	3.433	0.820	4.253
	Std Deviation	2.95	0.87	5.12	0.25	0.40	0.012	0.013	0.002	0.013	0.178	0.011	0.176	0.182	0.054	0.901	0.504	1.147
PBA-3 Ryder Cove-Inner	Average	21.60	29.99	77.65	5.89	1.95	0.034	0.114	0.036	0.150	0.526	0.197	0.722	0.872	1.042	11.366	2.000	13.365
	Std Deviation	2.55	0.59	14.55	0.74	0.55	0.020	0.086	0.043	0.117	0.288	0.091	0.359	0.347	0.469	7.121	3.139	7.640
PBA-4 Crows Pond	Average	20.89	30.44	87.49	6.50	2.12	0.032	0.077	0.014	0.091	0.454	0.102	0.563	0.655	0.563	5.420	0.899	6.378
	Std Deviation	2.74	1.12	10.42	0.72	0.43	0.015	0.040	0.023	0.052	0.170	0.021	0.181	0.214	0.092	2.020	1.244	1.912
PBA-5 Muddy Creek Lower	Average	20.79	21.75	78.74	6.19	1.13	0.031	0.047	0.030	0.071	0.419	0.173	0.592	0.663	0.869	7.736	1.569	9.305
	Std Deviation	2.87	4.51	8.43	0.87	0.18	0.015	0.022	0.023	0.037	0.256	0.082	0.330	0.334	0.371	2.600	0.898	2.382
PBA-5A Muddy Creek Upper	Average	21.66	14.01	64.84	6.15	0.95	0.044	0.069	0.283	0.352	0.721	0.244	0.966	1.318	1.336	13.759	2.359	16.119
	Std Deviation	3.61	5.86	17.00	1.52	0.04	0.019	0.031	0.180	0.179	0.244	0.162	0.309	0.347	0.771	14.411	2.100	15.752
PBA-6 Big Bay-SW	Average	20.73	30.29	80.44	6.11	1.72	0.027	0.019	0.004	0.023	0.355	0.137	0.493	0.515	0.761	7.139	0.932	8.071
	Std Deviation	1.51	1.01	19.13	1.26	0.31	0.006	0.012	0.003	0.013	0.234	0.028	0.248	0.247	0.159	3.422	0.880	3.513
PBA-7 Big Bay-Mid	Average	20.08	30.77	85.75	6.54	1.81	0.029	0.023	0.002	0.025	0.302	0.120	0.423	0.448	0.688	5.021	1.999	7.020
	Std Deviation	2.33	0.66	10.92	0.65	0.39	0.007	0.015	0.001	0.015	0.147	0.043	0.166	0.162	0.301	2.576	4.652	5.693
PBA-8 Big Bay-NE	Average	19.59	30.72	88.42	6.78	2.21	0.028	0.022	0.004	0.025	0.261	0.109	0.370	0.395	0.628	4.741	1.381	6.122
	Std Deviation	3.08	1.00	12.91	0.74	0.38	0.010	0.013	0.003	0.013	0.079	0.022	0.085	0.080	0.121	1.875	1.025	2.255
PBA-9 Round Cove	Average	20.62	30.12	78.28	6.96	1.68	0.030	0.045	0.025	0.070	0.346	0.145	0.493	0.563	0.779	8.299	1.423	9.722
	Std Deviation	2.68	0.79	8.44	0.68	0.25	0.008	0.020	0.017	0.022	0.087	0.036	0.105	0.093	0.174	5.065	1.110	4.753
PBA-10 Quanset Pond	Average	20.86	30.04	78.18	5.89	1.87	0.036	0.049	0.006	0.055	0.429	0.139	0.568	0.623	0.700	6.803	1.129	7.932
	Std Deviation	2.59	1.00	7.17	0.62	0.28	0.007	0.042	0.002	0.041	0.116	0.045	0.132	0.135	0.118	2.804	1.345	3.205
PBA-11 Paw Wah Pond	Average	21.57	29.59	59.19	4.66	2.09	0.066	0.041	0.008	0.049	0.493	0.255	0.748	0.797	1.687	12.910	1.467	14.377
	Std Deviation	2.84	0.86	30.07	2.18	0.41	0.026	0.017	0.003	0.018	0.116	0.186	0.187	0.185	1.732	11.542	1.641	11.528
PBA-12 Namequoit Pt.-S	Average	21.06	30.26	78.69	5.87	1.59	0.059	0.072	0.008	0.080	0.653	0.089	0.742	0.823	0.526	3.609	0.883	4.492
	Std Deviation	3.41	0.83	5.92	0.51	0.24	0.026	0.027	0.005	0.029	0.270	0.025	0.257	0.259	0.120	1.805	0.742	1.785
PBA-13 Namequoit Pt.-N	Average	20.80	29.92	69.51	5.03	2.33	0.077	0.072	0.009	0.081	0.365	0.088	0.453	0.534	0.516	3.706	1.330	5.036
	Std Deviation	6.34	1.04	5.89	0.50	0.50	0.021	0.024	0.005	0.027	0.083	0.024	0.075	0.086	0.112	2.088	0.734	1.918
PBA-14 Areys Pond	Average	23.89	27.53	67.07	4.76	1.16	0.096	0.100	0.014	0.114	0.408	0.221	0.636	0.753	1.102	13.677	4.303	17.980
	Std Deviation	3.25	0.61	18.25	1.29	0.10	0.036	0.048	0.006	0.047	0.139	0.061	0.146	0.140	0.286	5.638	5.429	8.850
PBA-15 Kescayo Gansett Pond	Average	23.09	28.77	62.73	4.52	1.47	0.109	0.130	0.017	0.147	0.488	0.207	0.695	0.842	1.251	8.051	3.067	11.118
	Std Deviation	2.79	0.84	9.66	0.78	0.35	0.058	0.048	0.011	0.056	0.190	0.208	0.371	0.356	1.485	5.642	2.283	5.550
PBA-16 Meeting House Pond	Average	23.26	28.27	54.87	3.94	1.37	0.099	0.119	0.022	0.141	0.379	0.155	0.542	0.683	0.831	7.116	1.954	9.070
	Std Deviation	2.74	2.26	17.85	1.27	0.35	0.030	0.062	0.015	0.074	0.079	0.083	0.110	0.100	0.366	5.492	1.463	5.687
PBA-18 Minister Point-North	Average	19.14	30.73	84.04	6.44	1.87	0.022	0.011	0.004	0.014	0.339	0.110	0.449	0.463	0.588	4.702	0.860	5.562
	Std Deviation	2.80	0.73	3.34	0.19	0.13	0.008	0.006	0.002	0.006	0.116	0.017	0.118	0.118	0.100	1.607	1.239	2.532
PBA-19 Strong Island-NE	Average	18.30	30.68	92.90	7.39	2.01	0.023	0.047	0.015	0.062	0.477	0.083	0.554	0.619	0.470	2.986	0.672	3.658
	Std Deviation	3.13	1.03	4.88	0.60	0.25	0.012	0.036	0.025	0.045	0.074	0.016	0.083	0.088	0.104	1.578	0.629	1.880
PBA-20 Nickersons Neck	Average	19.52	30.6	88.39	6.74	1.94	0.026	0.018	0.004	0.022	0.433	0.103	0.535	0.557	0.559	4.982	1.027	6.009
	Std Deviation	3.24	0.9	5.72	0.35	0.18	0.009	0.014	0.003	0.014	0.208	0.025	0.217	0.212	0.127	2.177	1.358	3.005

Pleasant Bay 2003 Station Summary

Station		Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/L	NOX mg/l	DIN mg/L	DON mg/L	PON mg/L	TON mg/L	TN mg/L	POC mgC/L	Chla ug/L	Phaeo ug/L	Total Pigment ug/L	
PBA-1	Chatham Harbor	Average	14.4	31.0	100.5	8.7	3.4	0.018	0.022	0.007	0.029	0.322	0.071	0.387	0.416	0.445	2.144	0.392	2.470
		Std Deviation	2.2	0.5	4.4	0.8	0.7	0.017	0.016	0.009	0.021	0.148	0.021	0.154	0.159	0.145	1.769	0.092	1.635
PBA-2	Bassing Harbor	Average	20.2	30.5	91.0	7.7	1.9	0.025	0.030	0.006	0.036	0.420	0.071	0.491	0.527	0.441	2.290	0.643	2.933
		Std Deviation	1.5	1.3	15.0	2.7	0.2	0.006	0.008	0.003	0.007	0.103	0.009	0.107	0.108	0.085	0.719	0.166	0.847
PBA-3	Inner Ryder's Cove	Average	21.1	29.2	82.0	6.4	1.8	0.033	0.099	0.007	0.106	0.627	0.196	0.811	0.916	1.145	7.758	0.894	8.317
		Std Deviation	2.8	1.1	16.5	1.5	0.3	0.012	0.115	0.007	0.117	0.294	0.100	0.323	0.405	0.440	2.824	0.837	2.574
PBA-4	Crows Pond	Average	20.4	30.1	90.2	6.7	2.2	0.029	0.099	0.044	0.143	0.519	0.110	0.629	0.772	0.696	4.634	0.735	5.212
		Std Deviation	2.8	0.9	8.3	0.8	0.4	0.011	0.082	0.088	0.153	0.224	0.056	0.205	0.219	0.244	1.657	0.914	1.678
PBA-5	Muddy Creek	Average	20.8	19.5	87.1	6.8	1.2	0.029	0.042	0.033	0.075	0.443	0.205	0.648	0.722	1.153	8.306	1.275	9.156
		Std Deviation	3.3	2.9	17.2	1.2	0.1	0.025	0.073	0.043	0.105	0.169	0.065	0.194	0.228	0.348	5.072	1.152	4.900
PBA-5A	Muddy Creek - Upper	Average	22.6	10.6	103.3	8.0	1.0	0.035	0.062	0.349	0.411	0.692	0.235	0.927	1.338	1.274	9.812	1.530	10.905
		Std Deviation	2.8	5.0	55.8	5.0	0.1	0.022	0.054	0.222	0.239	0.268	0.118	0.364	0.332	0.500	6.494	0.740	6.069
PBA-6	Big Bay - SW	Average	19.5	29.8	73.6	5.6	1.9	0.033	0.048	0.007	0.055	0.341	0.136	0.476	0.531	0.771	5.710	0.630	6.159
		Std Deviation	2.8	0.7	27.3	2.2	0.3	0.014	0.028	0.006	0.032	0.081	0.045	0.091	0.106	0.226	2.583	0.568	2.445
PBA-7	Big Bay - Mid	Average	20.0	30.1	84.0	6.3	2.5	0.032	0.039	0.008	0.047	0.256	0.110	0.366	0.413	0.661	3.546	0.636	4.098
		Std Deviation	2.7	0.5	10.0	0.8	0.3	0.010	0.023	0.011	0.024	0.052	0.031	0.064	0.064	0.186	1.117	0.425	0.998
PBA-8	Big Bay - NE	Average	19.9	29.9	99.6	7.6	2.0	0.030	0.045	0.004	0.049	0.318	0.126	0.444	0.493	0.736	3.520	0.800	4.259
		Std Deviation	3.0	1.0	14.6	1.1	0.4	0.010	0.035	0.004	0.036	0.091	0.060	0.121	0.110	0.278	1.727	0.626	1.422
PBA-9	Round Cove	Average	20.4	29.1	79.6	7.0	1.5	0.032	0.038	0.025	0.063	0.657	0.188	0.796	0.854	1.034	8.089	0.836	8.745
		Std Deviation	2.7	1.2	9.2	1.0	0.2	0.013	0.027	0.023	0.039	0.231	0.058	0.291	0.290	0.274	3.417	0.562	3.196
PBA-10	Quanset Pond	Average	21.0	28.9	79.2	5.9	1.9	0.038	0.051	0.007	0.057	0.637	0.157	0.793	0.851	0.846	5.071	0.732	5.620
		Std Deviation	3.1	1.6	8.7	0.7	0.1	0.012	0.026	0.007	0.025	0.289	0.043	0.295	0.295	0.173	1.839	0.442	1.614
PBA-11	Paw Wah Pond	Average	21.8	28.4	54.3	5.2	1.9	0.094	0.085	0.007	0.092	0.501	0.399	0.899	0.992	2.238	11.656	2.660	13.366
		Std Deviation	3.3	1.3	37.8	3.5	0.4	0.064	0.154	0.007	0.155	0.124	0.395	0.460	0.498	2.520	14.303	2.655	13.788
PBA-12	Namequoit Point - South	Average	21.5	29.6	74.4	5.6	1.5	0.061	0.109	0.007	0.116	0.891	0.080	0.961	1.076	0.492	3.650	1.079	4.729
		Std Deviation	3.1	0.9	6.0	0.7	0.3	0.023	0.056	0.006	0.059	0.187	0.029	0.181	0.214	0.144	3.106	1.402	4.325
PBA-13	Namequoit Point - North	Average	16.2	28.7	61.8	4.6	1.3	0.083	0.076	0.013	0.089	0.394	0.118	0.512	0.601	0.663	3.565	1.186	4.751
		Std Deviation	10.3	1.8	29.9	2.3	0.7	0.037	0.033	0.010	0.038	0.086	0.079	0.115	0.102	0.351	2.698	0.876	3.312
PBA-14	Arey's Pond	Average	21.6	26.3	69.8	5.2	1.4	0.105	0.089	0.013	0.102	0.512	0.192	0.704	0.807	1.037	9.787	1.744	11.094
		Std Deviation	3.0	1.5	22.7	1.9	0.2	0.044	0.075	0.010	0.080	0.188	0.061	0.196	0.182	0.273	5.258	0.909	4.531
PBA-15	Kescayogansett Pond	Average	24.1	28.3	70.0	5.0	1.7	0.105	0.149	0.018	0.167	0.580	0.157	0.727	0.894	0.947	5.467	2.099	7.006
		Std Deviation	2.2	1.2	13.4	1.2	0.2	0.046	0.143	0.009	0.149	0.194	0.086	0.191	0.230	0.673	2.674	2.122	2.870
PBA-16	Meeting House Pond	Average	21.5	28.2	58.3	3.9	1.3	0.272	0.386	0.016	0.403	0.430	0.147	0.566	0.854	0.815	6.349	1.953	7.650
		Std Deviation	4.5	1.0	34.8	2.7	0.1	0.255	0.470	0.012	0.466	0.137	0.060	0.170	0.365	0.239	5.480	2.077	4.670

Station			Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/L	NOX mg/l	DIN mg/L	DON mg/L	PON mg/L	TON mg/L	TN mg/L	POC mgC/L	Chla ug/L	Phaeo ug/L	Total Pigment ug/L
PBA-18	Ministers Point - North	Average	18.4	30.2	84.5	6.6	2.8	0.024	0.024	0.005	0.029	0.475	0.081	0.556	0.585	0.498	2.862	0.445	3.218
		Std Deviation	2.7	1.0	3.2	0.3	0.5	0.008	0.011	0.004	0.015	0.137	0.024	0.154	0.151	0.145	1.661	0.252	1.490
PBA-19	Strong Island - Northeast	Average	19.2	30.4	84.6	7.9	1.9	0.027	0.026	0.003	0.028	0.577	0.085	0.662	0.690	0.524	3.405	0.599	3.943
		Std Deviation	2.7	0.5	6.1	0.9	0.8	0.010	0.025	0.004	0.026	0.270	0.016	0.272	0.274	0.118	1.662	0.258	1.759
PBA-20	Nickersons Neck	Average	19.8	29.9	83.3	6.3	2.3	0.029	0.032	0.005	0.037	0.488	0.093	0.581	0.618	0.542	3.671	0.403	3.973
		Std Deviation	2.3	0.7	4.2	0.4	0.8	0.010	0.019	0.003	0.020	0.297	0.016	0.292	0.294	0.116	1.457	0.202	1.374
PBA-21	Little Pleasant Bay	Average	21.0	29.9	78.4	5.4	2.1	0.040	0.051	0.006	0.057	0.459	0.092	0.552	0.608	0.570	2.700	0.839	3.539
		Std Deviation	3.2	0.7	7.5	1.7	0.5	0.017	0.022	0.004	0.023	0.148	0.028	0.158	0.164	0.168	0.768	0.152	0.878
CM-13	Outer Ryder's Cove	Average	19.8	29.6	78.5	6.4	2.0	0.025	0.041	0.005	0.047	0.298	0.122	0.420	0.466	0.668	3.455	0.676	4.131
		Std Deviation	3.1	0.9	17.3	1.1	0.1	0.007	0.028	0.005	0.032	0.089	0.034	0.104	0.110	0.165	0.874	0.516	1.192
CM-14	Frost Fish Creek	Average	21.4	26.5	69.6	5.7	1.2	0.042	0.108	0.096	0.204	0.834	0.123	0.957	1.161	0.747	3.650	1.189	4.839
		Std Deviation	1.6	3.2	10.5	0.3	0.3	0.010	0.063	0.147	0.174	0.228	0.040	0.243	0.205	0.255	1.043	0.796	1.324

Pleasant Bay 2004 Station Summary

Station		Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO (mg/L)	Secchi Depth (m)	PO4 mg/L	NH4 mg/l	NOx mg/l	DIN mg/L	DON mg/L	PON mg/l	TON mg/L	TN mg/L	POC mg/l	Chla ug/L	Phaeo ug/L	Total Pigments ug/L
PBA-21 Little PB	Average	21.66	30.54	81.73	6.01	2.44	0.043	0.037	0.005	0.042	0.468	0.077	0.545	0.587	0.452	2.885	0.783	3.667
	Std Deviation	1.67	0.86	4.05	0.36	0.45	0.010	0.017	0.003	0.018	0.148	0.018	0.155	0.154	0.104	1.228	0.637	1.226
CM-13 Ryder Cove-Outer	Average	20.57	30.27	83.00	6.24	2.38	0.032	0.040	0.006	0.046	0.267	0.120	0.389	0.434	0.649	5.787	1.373	7.259
	Std Deviation	2.70	0.92	5.06	0.49	0.32	0.015	0.022	0.003	0.025	0.069	0.036	0.077	0.075	0.177	2.884	1.412	3.187
CM-14 Frost Fish Creek	Average	19.33	25.36	70.95	5.79	1.18	0.047	0.094	0.051	0.146	0.765	0.144	0.909	1.055	0.897	4.699	1.434	6.133
	Std Deviation	4.02	6.19	2.44	1.22	0.17	0.022	0.038	0.055	0.080	0.373	0.059	0.379	0.386	0.582	1.485	1.461	1.795

Station		Temp. (°C)	Lab Salinity (ppt)	DO % Sat.	DO mg/L	Secchi Depth (m)	PO4 mg/L	NH4 mg/L	NOX mg/L	DIN mg/L	DON mg/L	PON mg/L	Total Org. N mg/L	Total N mg/L	POC mg/L	Chla ug/L	Phaeo ug/l	Total Pig. ug/L	
	Standard Deviation	0.8	0.9	3.2	0.2	0.1	0.006	0.004	0.004	0.006	0.169	0.024	0.175	0.177	0.131	1.066	0.331	1.080	
PBA-19	Strong Island - Northeast	Average	19.3	31.3	82.0	7.2	2.1	0.023	0.088	0.004	0.092	0.710	0.124	0.966	1.077	0.703	4.433	0.572	5.005
		Standard Deviation	1.7	0.6	25.6	0.5	0.2	0.005	0.152	0.003	0.151	0.444	0.023	0.391	0.529	0.157	0.890	0.330	0.711
PBA-20	Nickerson Neck	Average	21.6	31.6	91.8	6.7	1.9	0.028	0.041	0.008	0.049	0.427	0.151	0.577	0.627	0.818	6.698	0.565	7.263
		Standard Deviation	0.8	0.3	2.2	0.3	0.3	0.006	0.061	0.003	0.059	0.199	0.028	0.187	0.201	0.140	1.400	0.456	1.285
PBA-21	Little Pleasant Bay	Average	21.9	29.6	75.3	5.5	1.8	0.039	0.046	0.006	0.051	0.468	0.117	0.585	0.636	0.693	3.723	1.341	5.064
		Standard Deviation	0.7	3.3	8.9	0.7	0.4	0.006	0.014	0.003	0.034	0.332	0.025	0.333	0.347	0.113	1.071	0.394	1.094
CM-13	Outer Ryder's Cove	Average	21.2	30.3	86.9	6.4	1.6	0.025	0.021	0.007	0.028	0.306	0.163	0.472	0.500	0.884	6.527	0.471	6.998
		Standard Deviation	2.7	1.6	7.1	0.7	0.5	0.011	0.014	0.003	0.013	0.202	0.028	0.204	0.212	0.131	2.816	0.476	2.791
CM-14	Frost Fish Creek	Average	20.9	29.8	71.8	5.3	1.1	0.040	0.126	0.014	0.139	1.090	0.151	1.240	1.380	0.802	4.955	1.310	6.265
		Standard Deviation	2.6	1.7	2.7	0.5	0.3	0.013	0.116	0.012	0.118	0.242	0.032	0.231	0.256	0.127	1.753	0.470	1.554

Pleasant Bay 2000 Station Summary

Station		Temp C	Lab Salinity ppt	D.O mg/L	D.O. % Sat.*	Secchi depth (m)	PO4 mgP/L	NH4 mgN/L	NO3 mgN/L	DIN* mgN/L	DON mgN/L	PON mgN/L	Total Org.N* mgN/L	Total N* mgN/L	POC mgC/L	Chla ug/L	Phaeo ug/L	Total Pig.* ug/L	
PBA-1	Chatham Harbor	Average	22.3	29.4	6.3	87.6	1.5	0.018	0.015	0.007	0.022	0.373	0.108	0.481	0.503	0.587	5.008	1.107	6.115
		Standard Deviation	2.3	3.1	0.5	6.3	0.6	0.007	0.009	0.005	0.012	0.176	0.046	0.188	0.197	0.238	1.791	0.822	2.294
PBA-2	Bassing Harbor	Average	20.0	28.7	6.5	83.6	1.4	0.028	0.039	0.014	0.053	0.412	0.092	0.504	0.558	0.552	4.855	1.267	5.963
		Standard Deviation	1.5	2.0	0.8	8.5	0.3	0.013	0.037	0.005	0.040	0.164	0.040	0.183	0.211	0.234	1.735	0.800	2.230
PBA-3	Inner Ryder's Cove	Average	21.2	29.4	5.7	76.1	1.9	0.043	0.050	0.013	0.063	0.343	0.118	0.457	0.516	0.623	6.169	1.281	7.451
		Standard Deviation	1.5	1.8	0.6	11.0	0.2	0.021	0.043	0.010	0.047	0.184	0.059	0.178	0.186	0.281	2.391	1.330	3.316
PBA-4	Crows Pond	Average	20.5	28.9	6.1	83.8	2.0	0.029	0.083	0.036	0.118	0.487	0.111	0.598	0.716	0.626	4.931	1.162	6.093
		Standard Deviation	1.5	2.6	1.7	21.7	0.4	0.015	0.080	0.033	0.100	0.321	0.049	0.331	0.385	0.311	1.677	0.980	2.079
PBA-5	Muddy Creek	Average	20.6	25.5	6.2	74.1	1.2	0.035	0.023	0.013	0.036	0.329	0.232	0.562	0.597	1.194	7.270	1.216	8.486
		Standard Deviation	1.6	2.2	1.2	12.1	0.3	0.013	0.017	0.015	0.029	0.080	0.113	0.083	0.076	0.533	4.952	1.184	4.156
PBA-6	Big Bay - SW	Average	19.9	29.3	6.0	78.8	1.5	0.037	0.032	0.007	0.039	0.382	0.228	0.611	0.650	1.274	8.726	0.938	9.547
		Standard Deviation	1.3	2.9	0.9	10.0	0.3	0.007	0.027	0.009	0.035	0.150	0.121	0.224	0.226	0.813	6.965	0.617	6.511
PBA-7	Big Bay - Mid	Average	20.0	29.9	6.3	84.7	1.8	0.039	0.052	0.017	0.069	0.559	0.142	0.700	0.769	0.748	5.192	1.568	6.761
		Standard Deviation	1.7	1.9	0.4	4.4	0.3	0.009	0.034	0.009	0.042	0.118	0.027	0.119	0.117	0.125	1.171	0.872	1.779
PBA-8	Big Bay - NE	Average	20.2	30.3	5.0	64.3	1.5	0.032	0.027	0.015	0.042	0.350	0.154	0.504	0.546	0.798	4.060	1.451	5.511
		Standard Deviation	1.5	1.5	1.9	24.2	0.1	0.006	0.014	0.011	0.015	0.099	0.024	0.106	0.102	0.116	1.440	0.796	1.986
PBA-9	Round Cove	Average	20.4	28.8	6.1	76.7	1.5	0.031	0.027	0.020	0.048	0.522	0.264	0.786	0.834	1.465	9.125	1.542	10.667
		Standard Deviation	1.1	2.1	1.6	11.9	0.2	0.008	0.016	0.013	0.019	0.147	0.157	0.220	0.225	0.939	9.077	1.295	9.355
PBA-10	Quanset Pond	Average	20.5	29.1	5.3	69.5	1.8	0.037	0.028	0.002	0.030	0.255	0.184	0.439	0.469	0.940	8.339	2.315	10.365
		Standard Deviation	1.4	2.2	0.6	11.2	0.2	0.005	0.023	0.003	0.023	0.052	0.111	0.131	0.134	0.509	11.096	1.526	10.474
PBA-11	Paw Wah Pond	Average	21.3	28.6	4.8	64.3	2.0	0.061	0.047	0.012	0.059	0.305	0.164	0.468	0.527	0.921	9.601	3.100	12.314
		Standard Deviation	1.4	2.3	1.1	15.2	0.4	0.015	0.033	0.009	0.041	0.076	0.104	0.164	0.146	0.559	10.833	3.196	11.931
PBA-12	Namequoit Point - South	Average	21.0	29.5	5.1	70.0	1.6	0.073	0.082	0.129	0.211	0.382	0.081	0.463	0.674	0.521	3.917	2.147	6.064
		Standard Deviation	1.8	1.6	0.5	5.9	0.4	0.015	0.050	0.174	0.202	0.129	0.043	0.126	0.179	0.132	3.143	1.658	4.759
PBA-13	Namequoit Point - North	Average	21.0	29.2	4.8	64.9	2.1	0.070	0.075	0.025	0.100	0.360	0.092	0.452	0.552	0.511	4.196	1.942	6.137
		Standard Deviation	1.7	2.0	0.6	6.7	0.4	0.016	0.033	0.011	0.041	0.111	0.029	0.118	0.107	0.135	2.470	1.138	3.387
PBA-14	Arey's Pond	Average	21.9	26.5	4.0	53.6	1.4	0.087	0.109	0.039	0.148	0.379	0.200	0.579	0.726	1.006	7.196	2.671	9.333
		Standard Deviation	1.4	2.2	1.4	18.5	0.3	0.018	0.050	0.015	0.055	0.072	0.073	0.105	0.118	0.361	5.684	1.333	5.105
PBA-15	Kscayo Gansett Pond	Average	22.2	28.6	5.1	69.0	1.6	0.079	0.102	0.032	0.135	0.424	0.123	0.547	0.682	0.680	7.258	1.556	8.815
		Standard Deviation	1.7	2.9	0.7	8.9	0.2	0.016	0.022	0.013	0.025	0.122	0.030	0.133	0.127	0.145	6.588	1.158	6.618
PBA-16	Meeting House Pond	Average	21.4	29.1	4.4	58.8	1.6	0.231	0.166	0.029	0.195	0.502	0.149	0.651	0.846	0.894	6.940	1.835	8.775
		Standard Deviation	1.8	1.4	2.3	33.5	0.3	0.416	0.121	0.011	0.119	0.464	0.072	0.466	0.552	0.464	4.354	1.617	4.139
CM-13	Outer Ryder's Cove	Average	20.0	28.3	6.2	82.2	2.5	0.032	0.034	0.008	0.043	0.265	0.132	0.397	0.440	0.686	5.611	1.509	7.120
		Standard Deviation	1.7	2.9	0.8	10.5	0.4	0.015	0.025	0.005	0.029	0.073	0.037	0.058	0.065	0.189	1.534	1.358	2.281
CM-14	Frost Fish Creek	Average	20.8	28.7	5.3	58.7	1.2	0.048	0.147	0.029	0.176	0.682	0.243	0.925	1.101	1.470	7.269	1.646	8.915
		Standard Deviation	2.2	1.6	1.7	25.2	0.4	0.015	0.112	0.020	0.116	0.284	0.102	0.236	0.296	0.741	4.141	1.180	4.948

APPENDIX C: CALCULATING THE EUTROPHICATION INDEX

The Eutrophication Index is a generalized indicator of water quality based on the mean score for the five parameters listed in the following table.

Table 4. Eutrophication Index Parameters

Parameter	0 point Value		100 point Value	
Oxygen saturation	40	%	90	%
Transparency (Secchi disk depth)	0.6	m	3	m
Chlorophyll	10	ug/l	3	ug/l
Dissolved Inorganic Nitrogen	10	uM	1	uM
Total Organic Nitrogen	0.6	ppm	0.28	ppm

The score for each parameter equals

$$(\ln(\text{value}) - \ln(0 \text{ pt. value})) / (\ln(100 \text{ pt. value}) - \ln(0 \text{ pt. value})) * 100$$

For example, the oxygen saturation score for a water body with an oxygen saturation of 45% would equal:

$$((\ln(45) - \ln(40)) / (\ln(90) - \ln(40))) * 100 = ((3.81) - (3.69)) / ((4.50) - (3.69)) * 100 = 0.12 / .81 * 100 = 14.5$$

Oxygen saturation values 90% and greater (100 point) receive a score of 100 while values of 40% and lower (0 point) receive a zero.

Scores for the other four parameters are similarly calculated. Each parameter is given equal weight in the Eutrophication Index. Eutrophication Index calculations are then related to water quality conditions through the following scale.

Table 3. Water Quality Condition Based on Eutrophication Index

Water Quality Condition	Eutrophication Index
Good to Excellent	65-100
Fair	35-65
Eutrophic	<35

Source: Baywatchers II nutrient related water quality of Buzzards Bay embayments: a synthesis of Baywatchers monitoring 1992-1998, December 1999.