prepared by W. Leo, S.Y. Liang, and S. Carroll, MWRA

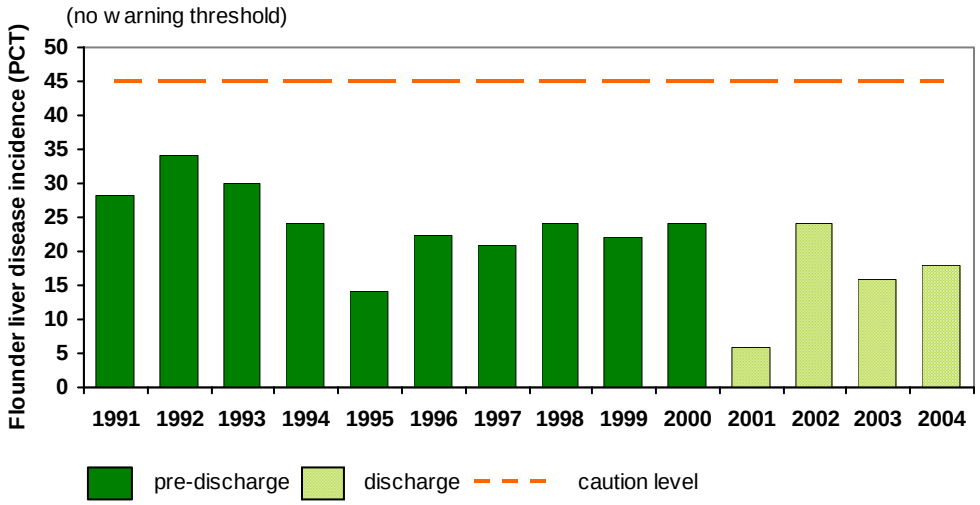
Contingency Plan Report
Third Quarter 2004

Ambient Monitoring

MWRA gathers data from the outfall location in Massachusetts Bay on various thresholds outlined in its Deer Island outfall discharge permit. This report shows relevant ambient monitoring results that became available in July-September 2004.

FLOUNDER LIVER DISEASE - 2004

The prevalence of liver disease at the outfall site in 2004 was similar to baseline years and did not exceed the threshold. Flounder are sampled annually in April.

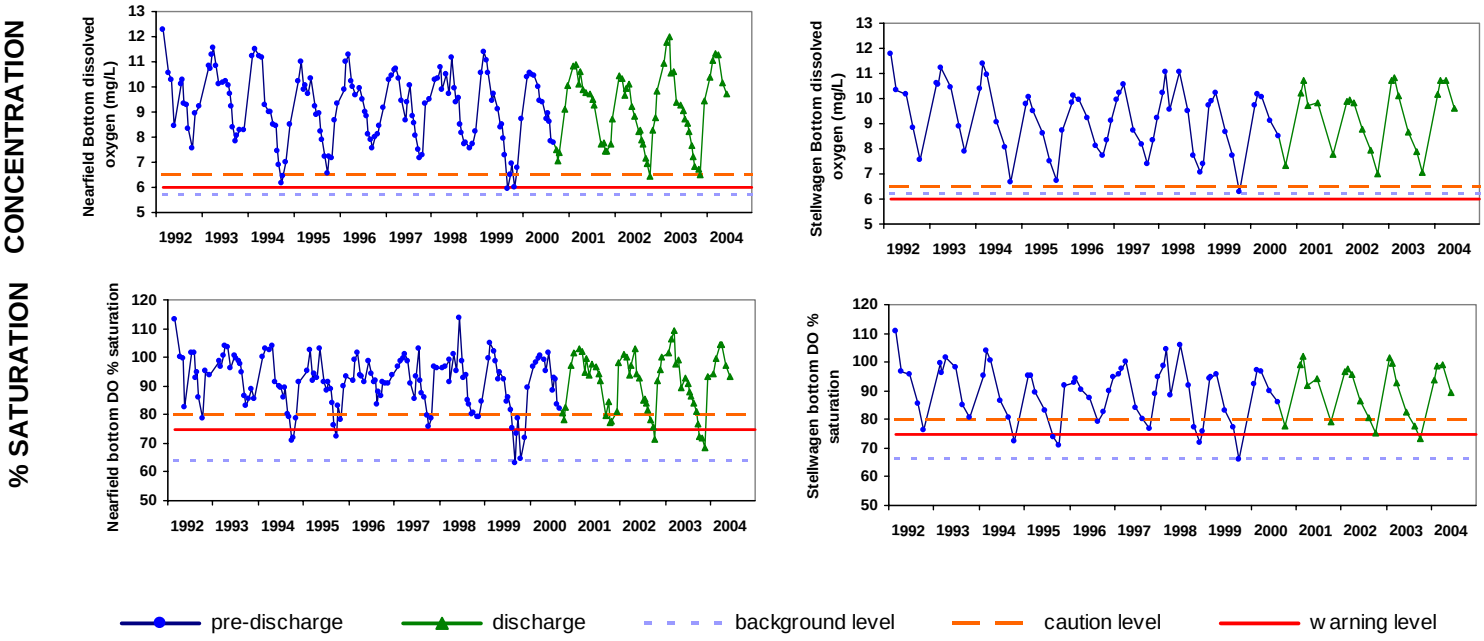


One measure of the effects of pollution is the incidence of disease in winter flounder. The flounder liver disease threshold value (dashed line) is based on data from Boston Harbor during the baseline monitoring period (1991-2000). In the harbor, flounder liver disease rates were historically quite high but dropped considerably during the late 1980s. Since Massachusetts Bay monitoring began, prevalence of an early-stage liver disease near the new outfall has been much lower than the threshold. If the prevalence of liver disease at the outfall site were to approach that seen in Boston Harbor in the 1990's, a caution level threshold would be exceeded.

DISSOLVED OXYGEN – June 2004

Measurements of dissolved oxygen (DO) concentration and percent saturation in early summer 2004 did not fall below background levels and thus did not exceed thresholds.

NEARFIELD **STELLWAGEN BASIN**



The concentration of dissolved oxygen (DO) in the water indicates the balance between production by algae and consumption by aquatic organisms and the decomposition of organic matter. Excessive organic matter may result in oxygen depletion, which may in turn adversely affect the aquatic ecosystem. The amount of oxygen that the water can hold is related to water temperature, salinity, and pressure; thus, the percent saturation of dissolved oxygen is a measure that takes these factors into account. Monitoring locations for which there are DO thresholds include the "nearfield," the group of stations within about three miles from the outfall, and "Stellwagen Basin," a deep area nine miles east of the outfall. DO thresholds apply to the part of the year when the water column is stratified, *i.e.* from June - October. The current reporting period for dissolved oxygen thresholds is June 2004. During this period there was one nearfield/farfield survey.

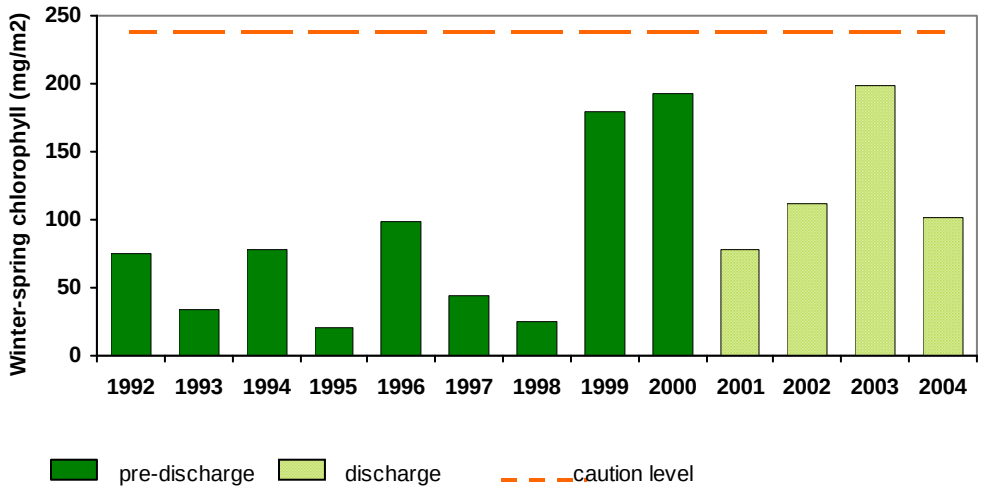
Dissolved oxygen concentration and percent saturation naturally fell below 6 mg/l on occasion during the baseline period. The state standard, on which the thresholds were based, allows an exception to numerical thresholds if background conditions are lower, as is the case here; thus, the threshold is not exceeded unless the value falls below the threshold and below background.

Oxygen levels were similar to those seen in several baseline years. The graphs above include data since the start of the monitoring program in 1992, and reflect the natural fluctuation of DO and percent saturation, which is typically lowest in early autumn.

CHLOROPHYLL – January-April 2004

The nearfield mean areal average chlorophyll in winter/spring 2004 was 101 mg/m^2, well below the caution level threshold[1] for winter/spring of 238 mg/m^2, and similar to the levels in the winter/springs of 1996 and 2002.

WINTER/SPRING



Chlorophyll is a measure of the amount of microscopic plants (phytoplankton or algae) in the water. In Massachusetts Bay, production of algae is the basis of the food web. However, excessive growth of algae can lead to undesirable consequences, such as oxygen depletion at depth due to decomposition of organic matter. Effluent from the outfall is rich in nutrients, and therefore could potentially cause excessive algal growth.

There are annual and seasonal chlorophyll thresholds for the "nearfield," the group of stations within about three miles from the outfall that are most likely to be affected by nutrient-rich effluent. Because the levels of chlorophyll in the water naturally vary over the year, there are separate thresholds for different seasons. In most years, Massachusetts Bay experiences a “spring bloom” characterized by high chlorophyll levels as lengthening days provide enough sunlight for algae to grow quickly. Chlorophyll typically drops in summer, as the nutrients in well-lit surface waters are used up. When the weather cools, the surface and bottom waters mix, which usually gives rise to a “fall bloom” as nutrient-rich bottom waters are mixed up into the well-lit surface layers. As the days become short, chlorophyll levels drop again since there is not enough light for algae to grow.

In this report, we compare post-discharge chlorophyll data to the thresholds for winter/spring 2004 (January through April), which included four surveys. The graphs include data since the start of the monitoring program in 1992.

[1] Threshold recalculated for new survey schedule: in 2004, MWRA implemented a new outfall sampling design, which included dropping one survey in the winter-spring. The baseline means and the thresholds (the 95th percentile of the baseline mean) were recalculated mathematically deleting baseline data corresponding to the dropped surveys. The recalculated winter-spring threshold for chlorophyll is higher than the old threshold of 182 mg/m^2. On the graph, the 2001-2003 results are calculated using the new survey schedule, and thus differ from the then-effective threshold results, which were reported in earlier quarterly reports.

NUISANCE ALGAE – January-August 2004

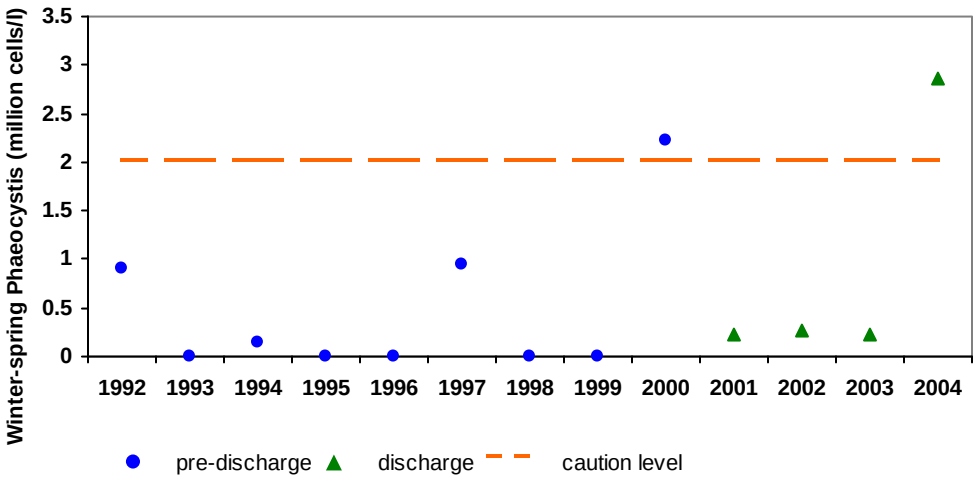
Phaeocystis pouchetii exceeded the threshold in winter/spring 2004; the very low summer contingency plan threshold was also exceeded. (See http://www.mwra.state.ma.us/harbor/pdf/20040723amx.pdf).

Pseudonitzschia was present only at low abundances in the nearfield in winter/spring 2004, well below the threshold.

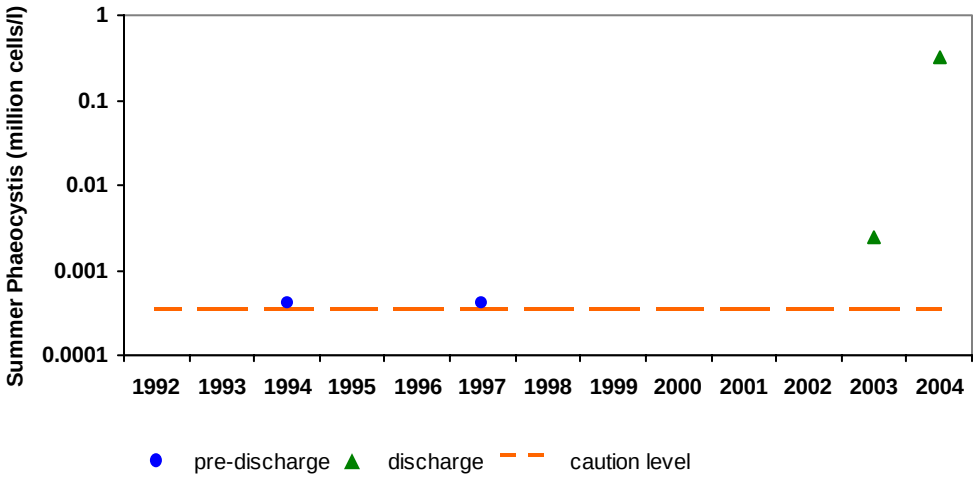
No samples of *Alexandrium tamarense* exceeded the threshold of 100 cells/liter during the present reporting period (winter through early summer 2004.)

PHAEOCYSTIS

Winter-spring

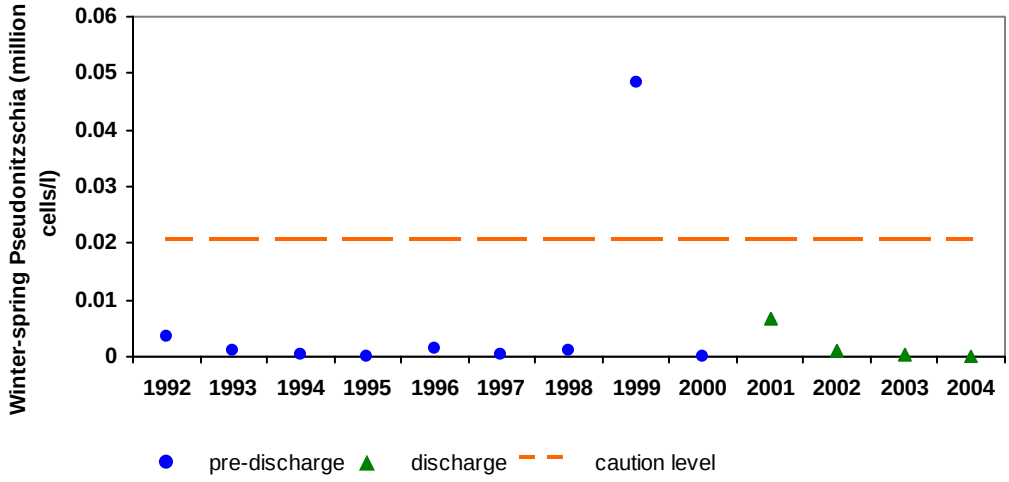


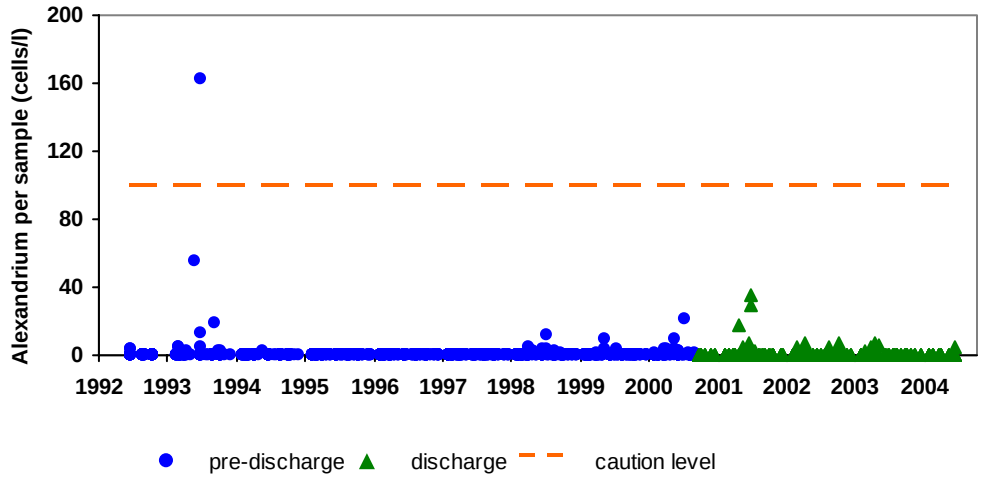
Summer



Note logarithmic scale. Years with no data point had zero average *Phaeocystis*.

PSEUDONITZSCHIA





Nuisance algal blooms are less predictable than the normal, beneficial algal blooms that produce oxygen and food for marine life; some nuisance blooms did occur during the baseline monitoring period. There is public concern that effluent nutrients could feed a red tide bloom in the vicinity of the new outfall, or otherwise increase the abundance of nuisance algae. Therefore, the Contingency Plan has thresholds for abundance of *Alexandrium*, *Phaeocystis pouchetii*, and *Pseudonitzschia*, which are triggered if the abundance of any of these becomes unusually high.

In this report, we compare post-discharge *Phaeocystis* and *Pseudonitzschia* data to the thresholds[1] for winter/spring 2004 (January through April), which included four surveys, and for *Phaeocystis,* the results for summer 2004 (four surveys) as well. We also compare the per-sample results for *Alexandrium* in the six January-June surveys to the threshold.

[1] Threshold recalculated for new survey schedule: in 2004, MWRA implemented a new outfall sampling design, which included dropping one survey in the winter-spring and two in the summer. The baseline means and the thresholds (the 95th percentile of the baseline mean) were recalculated mathematically deleting baseline data corresponding to the dropped surveys. The recalculated winter-spring thresholds for *Phaeocystis* and *Pseudonitzschia* happen to be unchanged from their former values. The summer *Phaeocystis threshold* is very slightly higher. On the graph, the 2001-2003 results are calculated using the new survey schedule, and thus differ from the then-effective threshold results, which were reported in earlier quarterly reports.

PHAEOCYSTIS

Phaeocystis pouchetii blooms usually occur during February to April but can occur at any time. The species is not toxic, but individual cells can aggregate in gelatinous colonies that may be poor food for zooplankton. *Phaeocystis* exceeded the threshold in winter/spring 2004. Because a remnant of the bloom still remained in mid-May, MWRA accelerated reporting on the rest of the summer samples. Although no *Phaeocystis* was detected in these later samples, the very low summer contingency plan threshold was also exceeded. (See http://www.mwra.state.ma.us/harbor/pdf/20040723amx.pdf).

There were no indications of adverse impacts from this bloom. Zooplankton communities were generally within the normal range and bottom water dissolved oxygen levels continue to be relatively high into September (>8 mg/L). Right whales were present in Cape Cod Bay during the spring in relatively abundant numbers, and levels of the zooplankton *Calanus*, the locally preferred prey of right whales, were normal to abundant based on Center for Coastal Studies data. There is no obvious association between the magnitude or duration of the 2004 *Phaeocystis* bloom and MWRA's outfall.

Winter/spring *Phaeocystis* mean abundance (cells/liter)	
Caution threshold	2,020,000
Winter/spring 2004	2,870,000

Summer *Phaeocystis* mean abundance (cells/liter)	
Caution threshold	357
Summer 2004	164,000

PSEUDONITZSCHIA

Pseudonitzschia multiseries blooms can occur during November to March and produce domoic acid, which can cause a condition known as amnesic shellfish poisoning. The group of algae including the toxic species *Pseudonitzschia multiseries*, the closely related *Pseudonitzschia pungens*, and any unidentified *Pseudonitzschia* species was present only at low abundances in the nearfield in winter/spring 2004, well below the threshold.

Winter/spring *Pseudonitzschia* mean abundance (cells/liter)	
Caution threshold	21,000
Winter/spring 2004	11

ALEXANDRIUM

Alexandrium tamarense typically may bloom during April to June and can cause paralytic shellfish poisoning, known as PSP or red tide; it has been periodically found in Massachusetts since the 1970s. Toxicity is generally not found in shellfish until much higher cell counts are seen in the overlying waters. In the winter and spring of 2004 *Alexandrium* cells (*Alexandrium tamarense* plus unidentified *Alexandrium* spp.) were observed in only one sample; 5 cells in a June nearfield sample.

January-June *Alexandrium* per-sample abundance (cells/liter)	
Caution threshold	100
Jan.-June 2004*	5

*** maximum of all samples collected between January 1, 2004 and June 30, 2004.**