

# Contingency Plan Report Fourth Quarter 2006

## 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 the fourth quarter (October-December) 2006 time period. There were two exceedances of a Contingency Plan threshold, for summer chlorophyll and for the nuisance algae *Phaeocystis*.

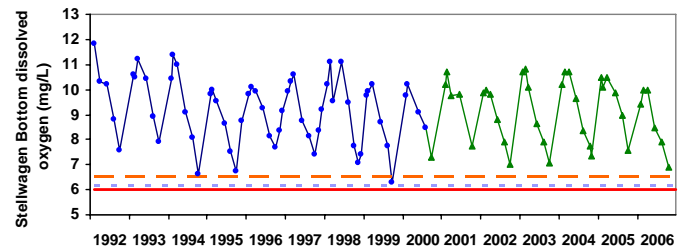
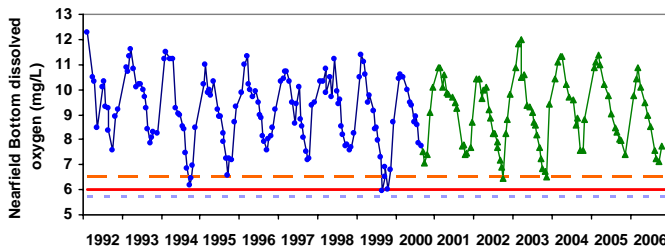
### DISSOLVED OXYGEN (DO) – October 2006

Measurements of dissolved oxygen (DO) concentration and percent saturation in early fall 2006 did not fall below background levels and thus did not exceed thresholds.

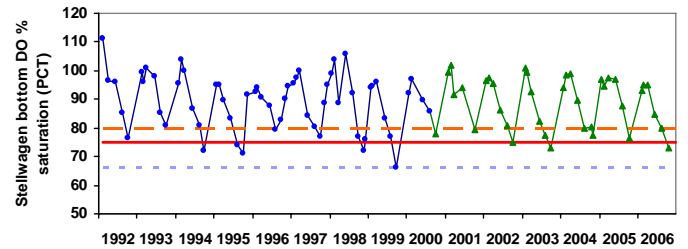
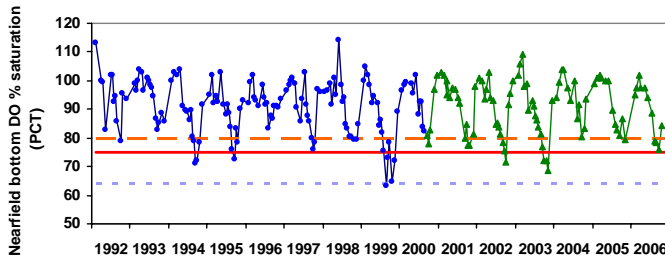
**NEARFIELD DO**

**STELLWAGEN BASIN DO**

**CONCENTRATION**



**% SATURATION**

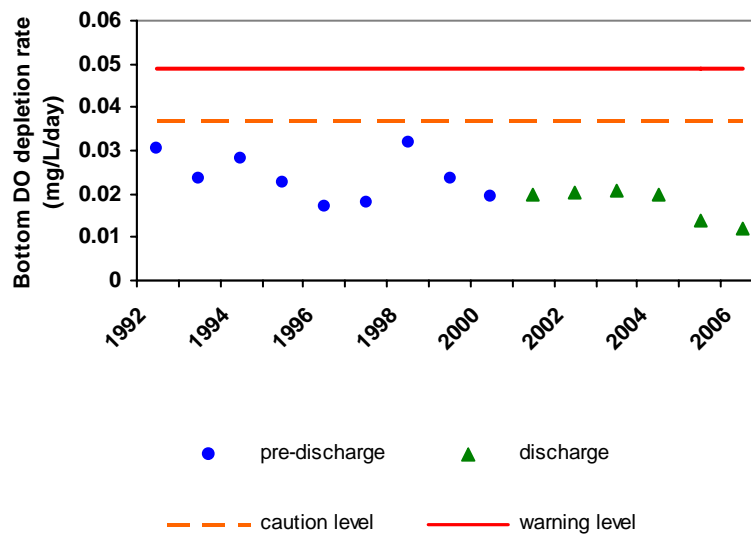


● pre-discharge    
 ▲ discharge    
 - - - background level    
 - - - caution level    
 — warning level

The current reporting period for [dissolved oxygen thresholds](#) is October 2006. During this period there was one nearfield survey and one farfield survey. Oxygen levels were similar to those seen in most 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.

An additional threshold measure of dissolved oxygen is the rate at which oxygen is depleted during the stratified summer period. The current reporting period for oxygen depletion rate is summer, 2006, defined as June - October. The DO depletion rate for the summer of 2006 was the lowest yet observed, and did not exceed the threshold.

**DO Depletion Rate – summer 2006**

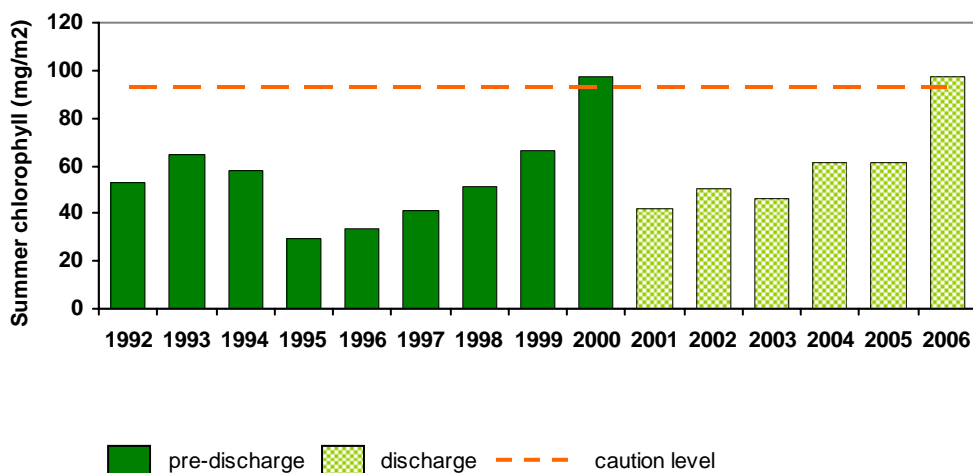


Even if dissolved oxygen concentrations remain healthy, an excessively rapid rate of decrease could signal a future problem. A low rate indicates DO dropped only slowly. The threshold for DO depletion rate is based on a change from the baseline; the caution threshold is a rate faster than 1.5 times the baseline mean rate, while the warning threshold is twice the baseline mean rate.

## CHLOROPHYLL – SUMMER, AUTUMN, ANNUAL 2006

There was an exceedance of the seasonal [chlorophyll threshold](#) in the summer 2006 season, defined as May-August. (See [notification](#)). The nearfield mean areal average chlorophyll in summer 2006 was 97 mg/m<sup>2</sup>, slightly above the corresponding caution level threshold of 93 mg/m<sup>2</sup>. There was no exceedance of the autumn or annual thresholds.

### SUMMER CHLOROPHYLL



The figure compares chlorophyll data for summer 2006, which included four surveys, to the summer threshold. The graph includes data since the start of the monitoring program in 1992.

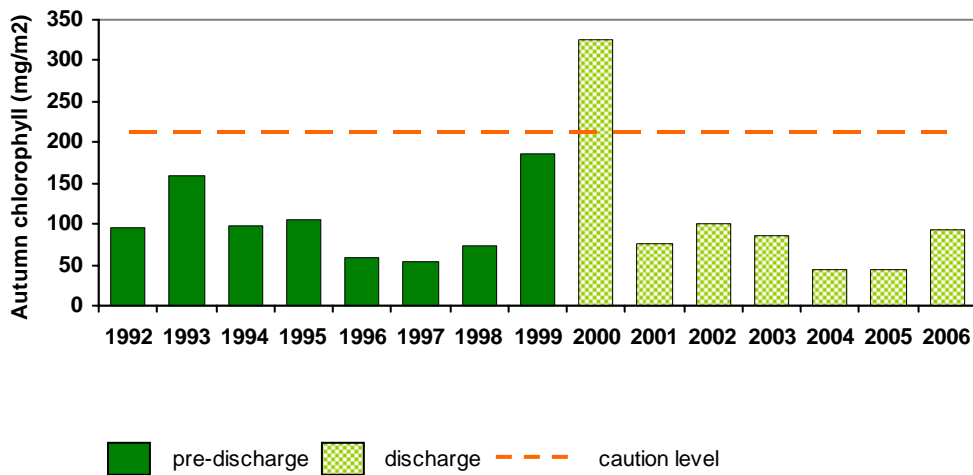
There are no indications of adverse impacts of this level of chlorophyll. Plankton samples showed that the phytoplankton community was dominated by one species, the chain-forming diatom *Dactyliosolen fragilissimus*. Cell counts were high but not higher than have been seen occasionally before, including during the pre-discharge period. These diatoms are not considered harmful or nuisance algal species. Furthermore, oxygen levels in the outfall nearfield bottom waters in summer and fall were normal (see “dissolved oxygen” graphs, above). The August 2006 sediment survey showed deep sediment oxygenation (see “sediment enrichment”, below).

Chlorophyll for the remainder of the year did not exceed thresholds.

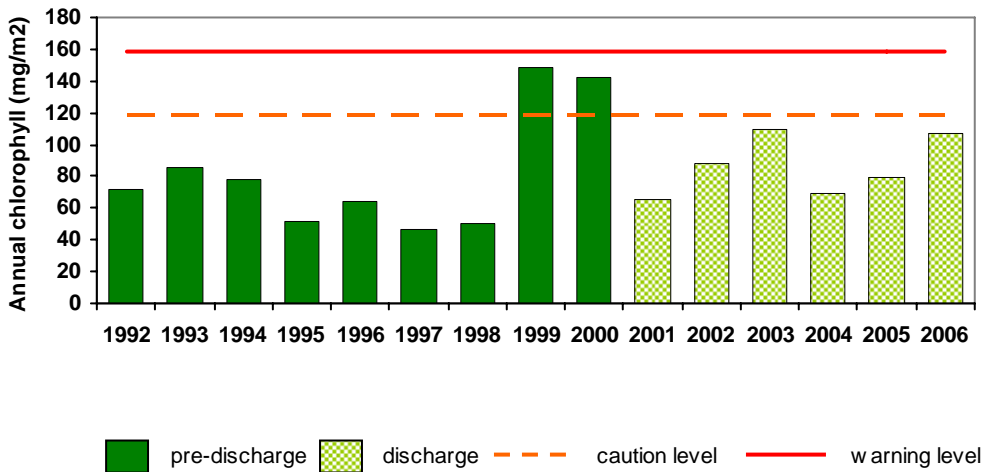
The nearfield mean areal average chlorophyll in autumn 2006 (September-November) was 94 mg/m<sup>2</sup>, below the caution level threshold for autumn of 212 mg/m<sup>2</sup>, and similar to the levels in the autumns of 1994-95. The 2006 annual average was 107 mg/m<sup>2</sup>, higher than many recent years but below the caution and warning thresholds for annual average chlorophyll of 118 and 158 mg/m<sup>2</sup>, respectively.

The figures below compare chlorophyll data for autumn 2006, which included four surveys, and data for all of 2006, to the corresponding thresholds. The graph includes data since the start of the monitoring program in 1992.

**AUTUMN CHLOROPHYLL**



**ANNUAL CHLOROPHYLL**



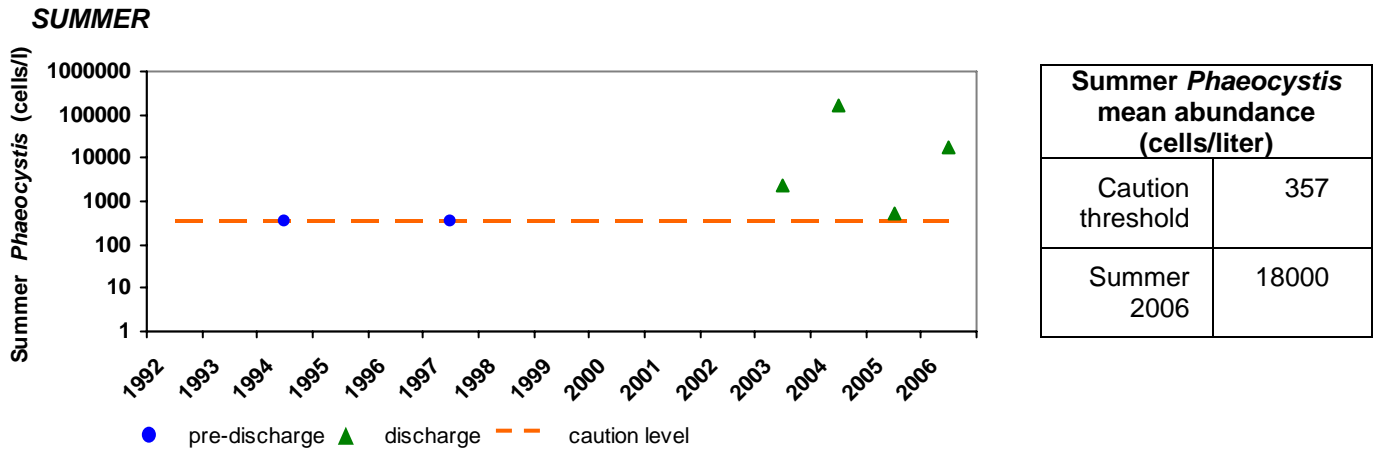
## NUISANCE ALGAE – SUMMER 2006

In the figures below, we compare *Phaeocystis* and *Pseudonitzschia* data to the [nuisance algae thresholds](#) for summer 2006 (May through August), which included four surveys. We also compare *Alexandrium* data to the threshold for each sample in July and August 2006 (January-June data were reported in the previous quarter's report.)

There was a threshold exceedance for *Phaeocystis* but not for *Pseudonitzschia* or *Alexandrium*.

### PHAEOCYSTIS

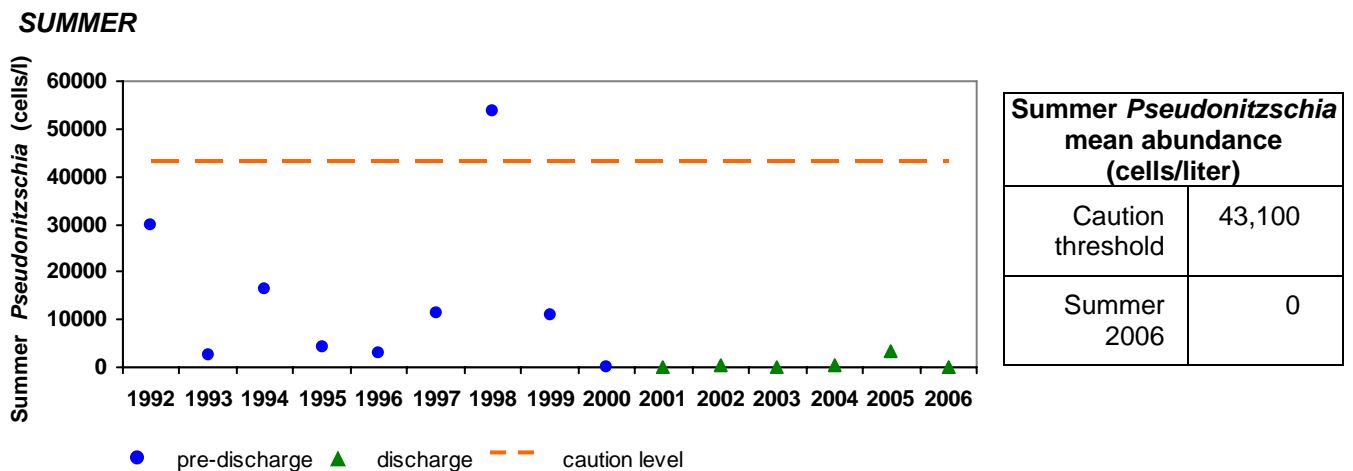
As in other recent years, *Phaeocystis pouchetii* exceeded the very low summer threshold in summer 2006 (See [notification](#)). Three out of four samples collected in the nearfield on May 17, 2006 contained moderate numbers of cells of *Phaeocystis*, apparently the “tail end” of the relatively small *Phaeocystis* bloom that occurred this spring. A recent report<sup>1</sup> evaluated regional *Phaeocystis* blooms through 2005 and concluded that persistence of cells past May 1 in recent years probably results from a delay in water column warming in recent years, rather than to some outfall effect. No *Phaeocystis* cells were observed in June, July, or August samples.



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

### PSEUDONITZSCHIA

*Pseudonitzschia* was not observed in the nearfield in summer 2006.



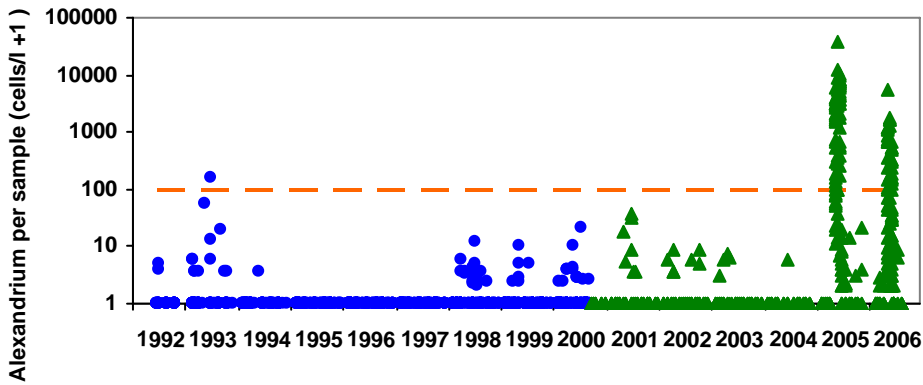
<sup>1</sup> Libby PS, Borkman DG, Hunt CD and Brawley JW. 2006. 2005 Nutrient Issues Review. Boston: Massachusetts Water Resources Authority. Report 2006-02. 65 p.

## ALEXANDRIUM

The nuisance algae *Alexandrium* (“red tide”) can cause paralytic shellfish poisoning (PSP) in Massachusetts Bay. MWRA measures *Alexandrium* abundance in its monitoring program, and also checks state fisheries agency observations of shellfish PSP toxicity to keep track of the course of Gulf of Maine *Alexandrium* blooms.

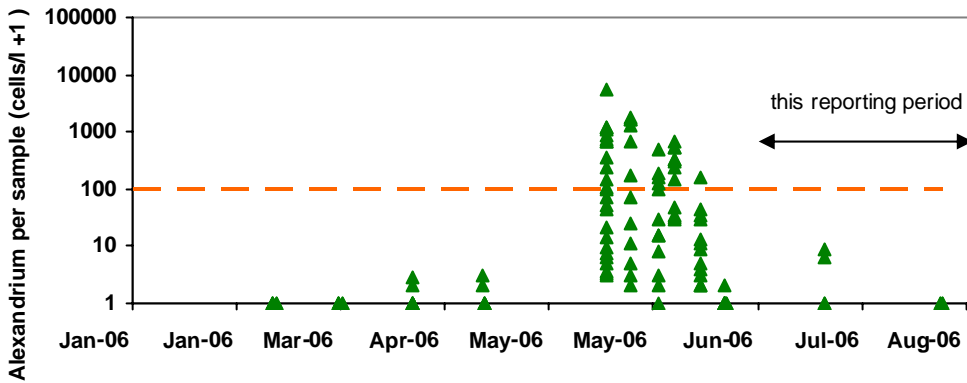
During the months covered by this quarter's report, (July and August) *Alexandrium* cells (*Alexandrium fundyense*) were observed in two samples, but neither exceeded the threshold value.

In late spring 2006 there was an unusually robust *Alexandrium* bloom throughout the southern Gulf of Maine including Massachusetts Bay. The bloom subsided in Massachusetts Bay in early July. The figure below includes nearfield data from routine surveys through summer 2006, plus four special surveys in May and June 2006. The second figure shows the course of the 2006 bloom.



July-August <i>Alexandrium</i> per-sample abundance (cells/liter)	
Caution threshold	100
Late summer 2006	9*
* maximum of all samples collected between July 1, 2006 and August 31, 2006	

● pre-discharge ▲ discharge - - - caution level

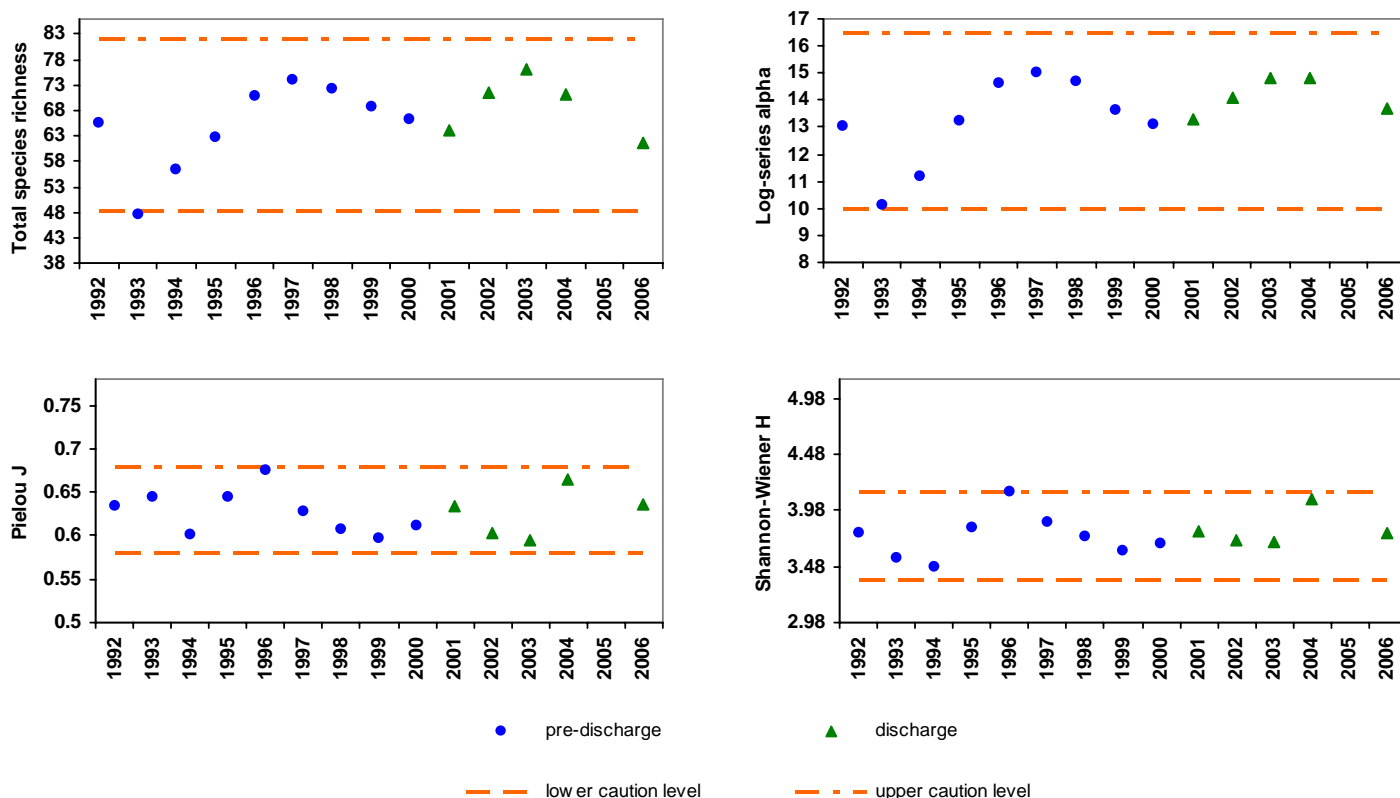


● pre-discharge ▲ discharge - - - caution level

## SEDIMENT BIODIVERSITY - 2006

### DIVERSITY

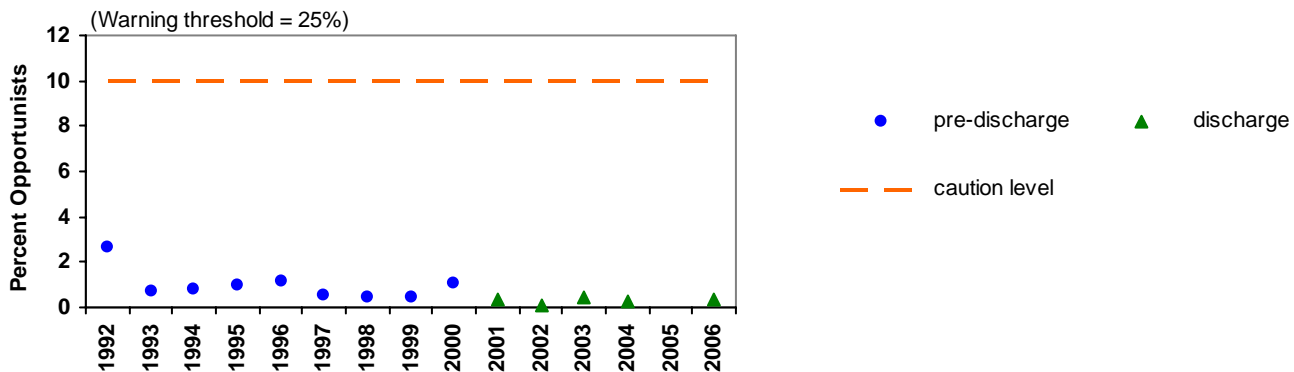
The annual survey of sediment-dwelling communities in 2006 showed that the benthic diversity was normal at the outfall site, and did not exceed any of the [benthic diversity thresholds](#).



For each diversity measure, the graphs show the annual average for sediment samples collected within seven kilometers of the outfall discharge since 1992. No data are shown for 2005 because a different set of stations was sampled in that year.

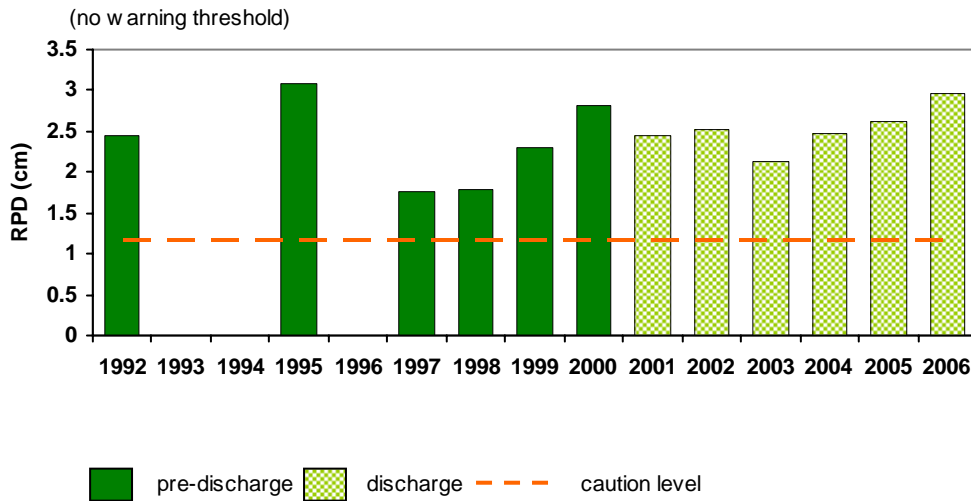
### OPPORTUNISTS

The annual sampling in 2006 showed that the numbers of [opportunistic benthic organisms](#) remain normal at the outfall site and did not exceed the caution threshold of 10% of the total population.



## SEDIMENT ENRICHMENT - 2006

The 2006 annual sediment monitoring showed that the RPD depth was normal at the outfall site and did not exceed the threshold (did not fall below the minimum RPD threshold.)



The depth of the oxygenated layer in marine sediment is a measure of ecosystem health. A diverse bottom-dwelling community includes organisms that mix water and oxygen down into the sediment. In an over-enriched environment, organic material deposited on the sediment surface can use up the available oxygen and smother the bottom-dwelling community. Such areas, including some areas of Boston Harbor, have a thin or nonexistent oxygenated layer. The thickness of the oxygenated layer is called the redox potential discontinuity (RPD) depth. In MWRA's monitoring program, the RPD depth is estimated from sediment-profile images, cross-sections of the upper several centimeters of the sediment taken with a special mud-penetrating prism and camera. The threshold for RPD is half the mean measured in the baseline period (that is, if the thickness of the oxygenated layer fell to less than half the thickness measured pre-discharge, a caution threshold would be exceeded.)