

## Contingency Plan Report Fourth Quarter 2013

### Ambient Monitoring

---

MWRA gathers data from the outfall location in Massachusetts Bay on various thresholds in its Deer Island outfall discharge permit. This report shows relevant ambient monitoring results that became available in the October-December 2013 time period. There were two contingency plan threshold exceedances for sediment biodiversity.

#### SEDIMENT BIODIVERSITY - 2013

##### ***DIVERSITY***

The annual survey of sediment-dwelling communities in 2013 showed that two measures of [benthic diversity](#) exceeded their thresholds.

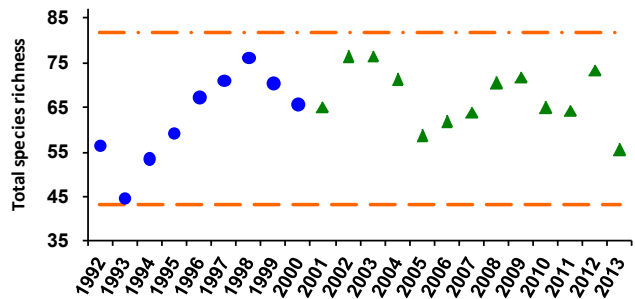
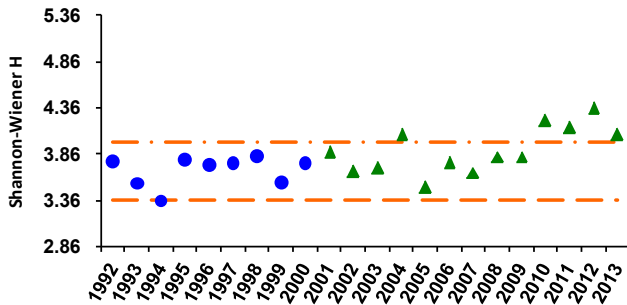
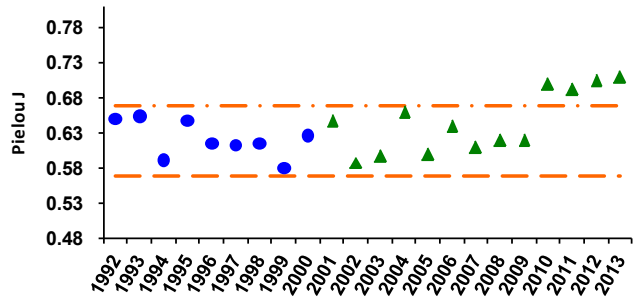
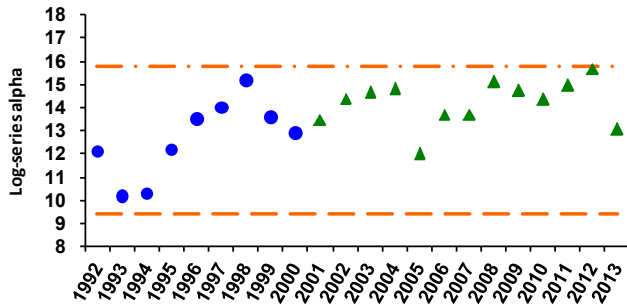
Calculations of diversity in the bottom-dwelling community in the August 2013 monitoring data showed two measures above their upper diversity thresholds, triggering notification under the Contingency Plan (see [http://www.mwra.state.ma.us/harbor/pdf/20131213\\_amx.pdf](http://www.mwra.state.ma.us/harbor/pdf/20131213_amx.pdf).) MWRA samples the animals that live in the mud near the outfall every summer and measures the numbers and kinds of animals living there. These measurements are used in four indicators of biodiversity. In 2013, as in [2010](#), [2011](#), and [2012](#) two of those four measures were slightly higher than the upper diversity threshold (there are upper and lower thresholds corresponding to the 97.5th percentile and 2.5th percentile of the baseline mean.) That is, the community was more diverse than in baseline, before the outfall came on-line.

Other measures of the sediment animal community health including the other two diversity indices, sediment oxygenation, sediment quality, and the abundance of animals, showed no indication that excessive sediment enrichment was occurring, or that there has been a decline in sediment community health. The number of opportunistic animals remains extremely low. Therefore, all indications so far are that the increased diversity is a normal fluctuation of the sediment animal population.

The similar 2010 exceedance of the same two diversity indices was evaluated and discussed at the June 2010 meeting of EPA's Outfall Monitoring Science Advisory Panel (OMSAP), with details of the evaluation included in the [2010 Outfall Benthic Monitoring Report](#). The 2011 and 2012 exceedances were discussed at the April 2013 OMSAP meeting, and evaluated in more detail in the [2011 Outfall Benthic Monitoring Report](#) and [2012 Outfall Benthic Monitoring Report](#), respectively. Those evaluations found that the 2010-2012 exceedances probably represented natural fluctuations in the infaunal communities, and were not influenced by the outfall. Thus far, the 2013 data support the same conclusion. Given the strong year-to-year similarity normally observed in infaunal communities during MWRA's monitoring, it is not surprising that similar exceedances in the same parameters were observed in the 2013 monitoring as were seen in the past three years.

For each diversity measure, the graphs below show the annual average for sediment samples collected within seven kilometers of the outfall discharge since 1992. The results shown for 1992-2003, and 2011-2013 are from the current eleven monitoring stations (which are a subset of the stations sampled 1992-2003), reflecting the modified design that began in 2011. Data from 2004 through 2010 are the averages for the odd- or even-year stations sampled then, as not all of the 11 nearfield stations currently sampled were sampled in those years. This enables us to better compare the threshold results across years.

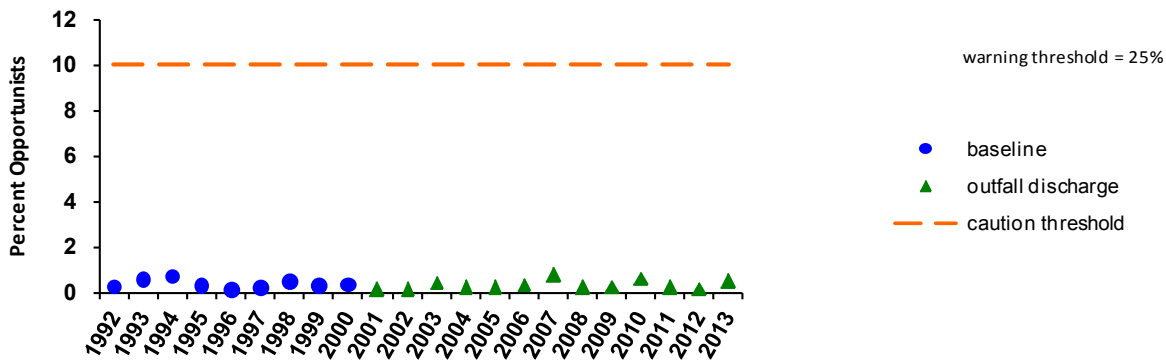
The threshold levels varied slightly through the monitoring period because of the differing station sets; for simplicity only the current thresholds are shown. (Although it appears that there was an exceedance of the Shannon-Weiner H' threshold in 2004, the threshold in effect at that time was slightly higher, so there was no exceedance.) The previous reports are at <http://www.mwra.state.ma.us/harbor/html/archive.htm#cpqamb>.



● baseline      ▲ outfall discharge      — lower caution threshold      - - - upper caution threshold

### OPPORTUNISTS

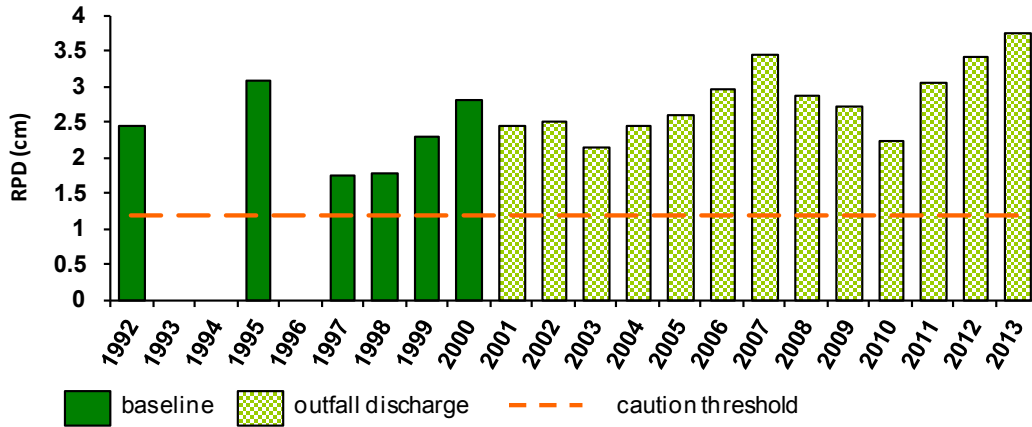
The annual sampling in 2013 showed that the numbers of [opportunistic benthic organisms](#) remain normal at the outfall site and did not exceed the caution threshold of 10% of the total population. The warning threshold is 25% of the total population.



The graph shows the annual average for sediment samples collected within seven kilometers of the outfall discharge since 1992, calculated in the same manner as for the diversity thresholds. This enables us to better compare the threshold results across years. Earlier reports are at <http://www.mwra.state.ma.us/harbor/html/archive.htm#cpqamb>.

### SEDIMENT ENRICHMENT - 2013

The 2013 annual sediment monitoring showed that the RPD depth was the deepest yet observed at the outfall site and did not exceed the threshold (did not fall below the minimum RPD threshold; see explanation below.)



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.)

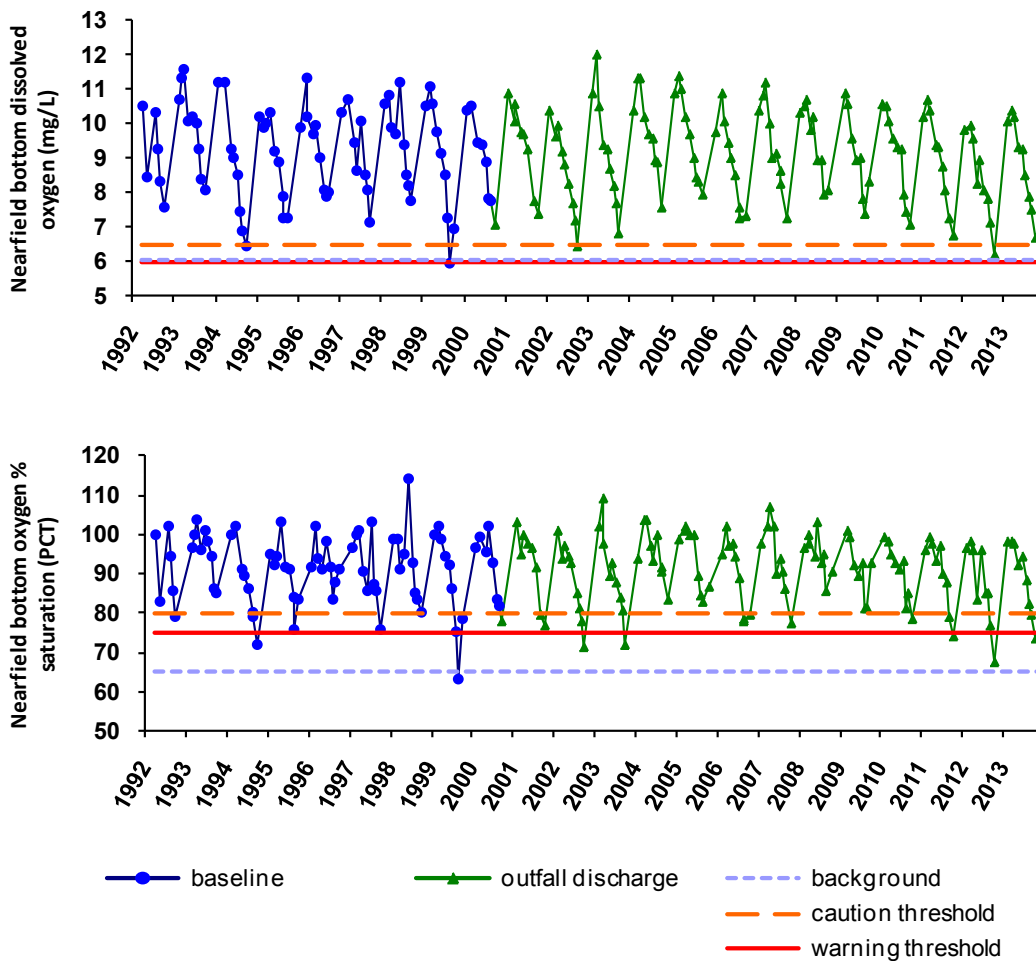
## DISSOLVED OXYGEN (DO) – October 2013

Measurements of dissolved oxygen (DO) concentration and percent saturation in autumn 2013 did not fall below background levels and thus did not exceed thresholds.

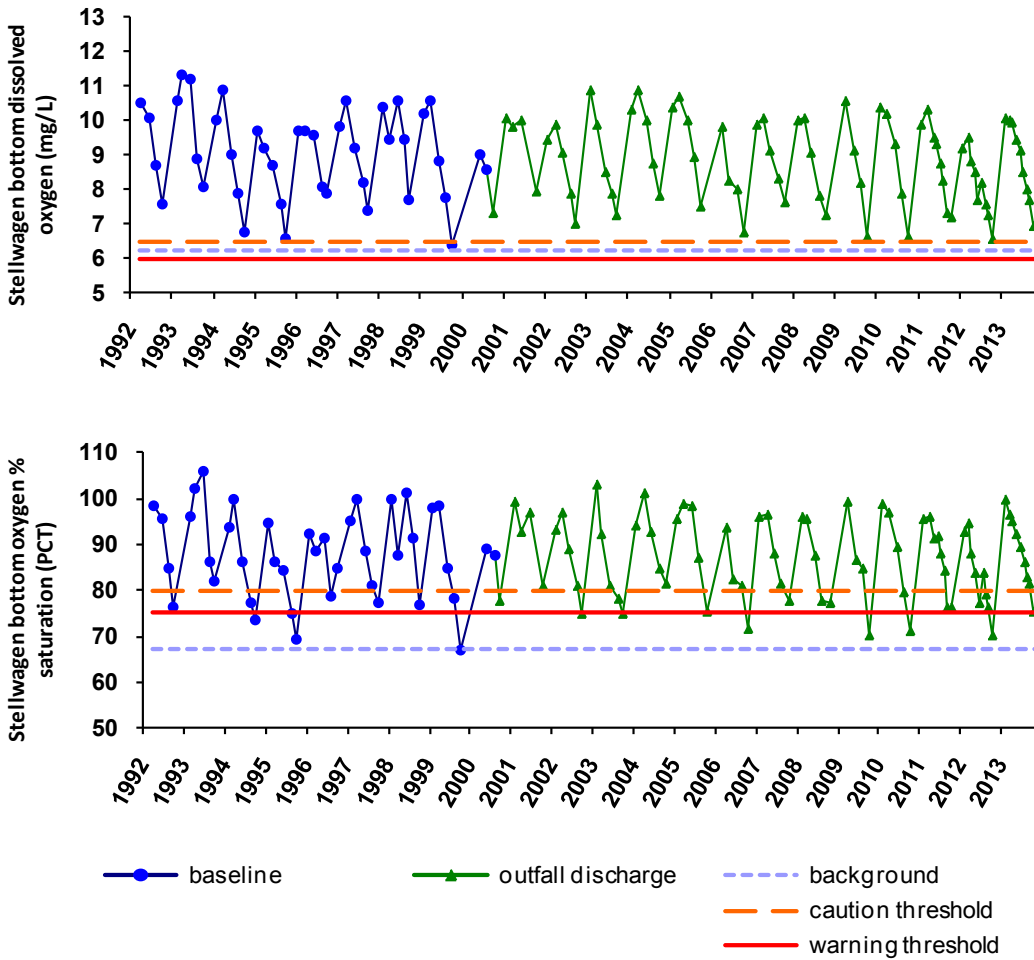
The current reporting period for [dissolved oxygen thresholds](#) is October 2013. During this period there was one survey. The graphs below show the natural annual fluctuation of DO and percent saturation, which is typically lowest in early autumn. The 1992-2010 data shown are a subset of all data reflecting the modified design that began in 2011, *i.e.* nine surveys per year, and one station rather than four in Stellwagen Basin. This enables us to better compare the threshold results across years. The previous reports are at <http://www.mwra.state.ma.us/harbor/html/archive.htm#cpqamb>.

Nearfield oxygen levels were low in October 2013, but similar to those seen in a few baseline years.

### NEARFIELD

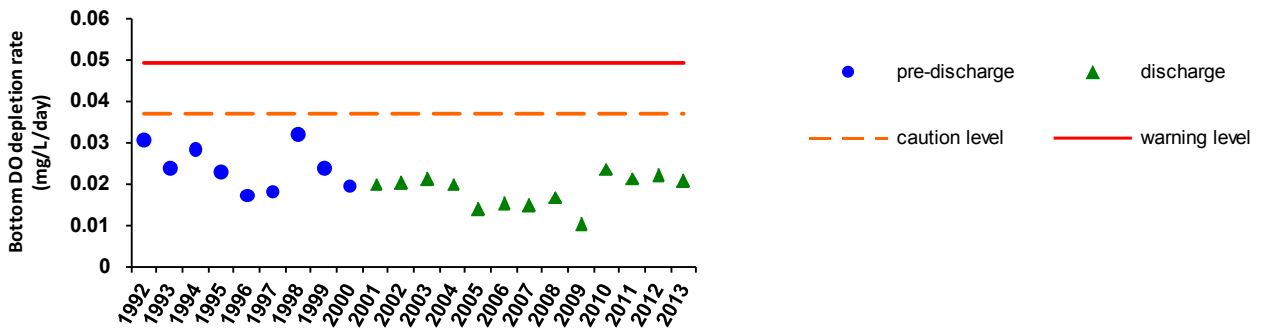


**STELLWAGEN BASIN**



**DO DEPLETION RATE – summer 2013**

An additional threshold measure of dissolved oxygen is the rate at which bottom water oxygen is depleted during the stratified summer period. The current reporting period for oxygen depletion rate is summer 2013, defined as June -October. The DO depletion rate for the summer of 2013 was higher than some other post-discharge years, but typical of pre-discharge summers and well below the threshold.



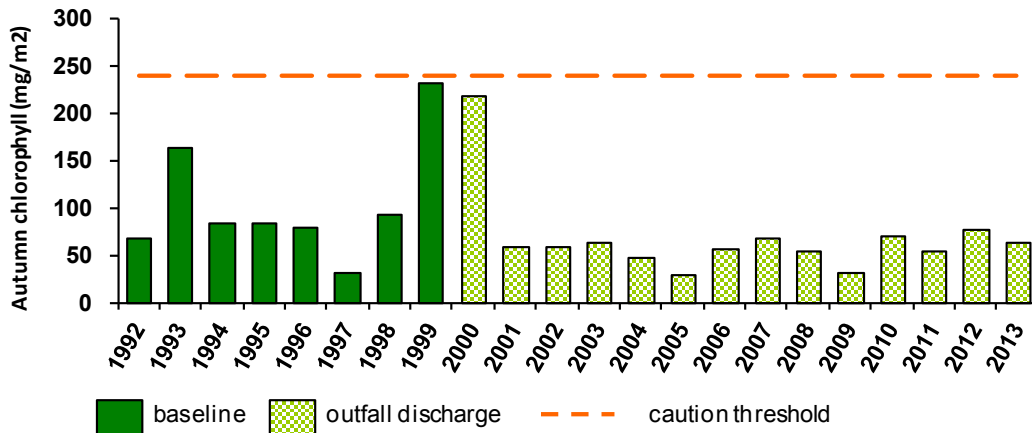
Even if dissolved oxygen concentrations remain healthy, an excessively rapid rate of decrease could signal a future problem. A low rate indicates DO dropped only slowly. The threshold for DO depletion rate is based on a change from the baseline rate; the caution threshold is a rate faster than 1.5 times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

## CHLOROPHYLL – September-November 2013 and Annual 2013

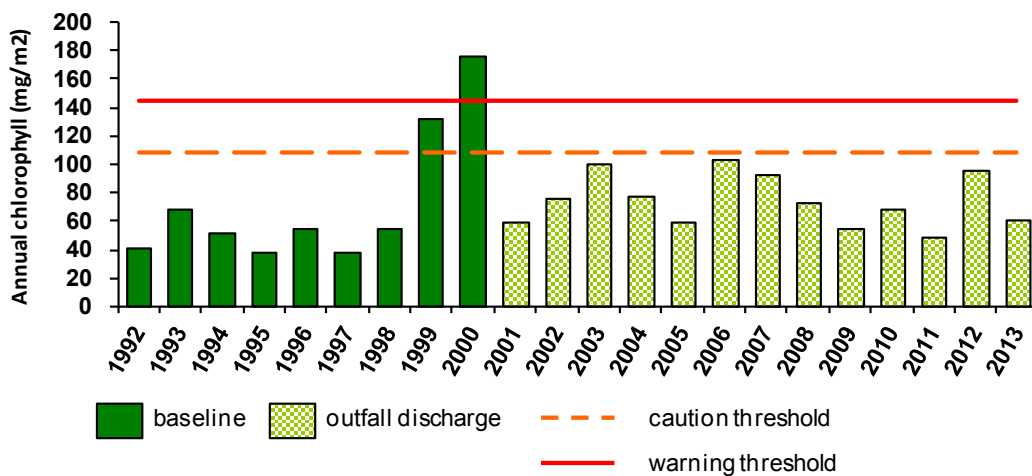
There were no [chlorophyll threshold](#) exceedances for either autumn 2013 or for the entire year. The nearfield mean areal average chlorophyll in autumn 2013 was 64 mg/m<sup>2</sup>, well below the caution level threshold for autumn of 239 mg/m<sup>2</sup> and in the lower end of the range typical of the pre-discharge period. The 2013 annual average was 61 mg/m<sup>2</sup>, well below the caution and warning thresholds for annual average chlorophyll of 108 and 144 mg/m<sup>2</sup>, respectively. Both autumn and annual results were similar to other years in the pre-diversion and post-diversion periods.

The figures below compare chlorophyll data for autumn (September-October), which includes two surveys, and data for the entire year, to the corresponding thresholds. The graph includes data since the start of the monitoring program in 1992; however, the seasonal average values for 1992-2010 are calculated using a subset of all results reflecting the current monitoring design, *i.e.* two autumn surveys. This enables us to better compare the threshold results across years. The previous reports are at <http://www.mwra.state.ma.us/harbor/html/archive.htm#cpqamb>.

### Autumn



### Annual



## NUISANCE ALGAE – SUMMER and AUTUMN 2013

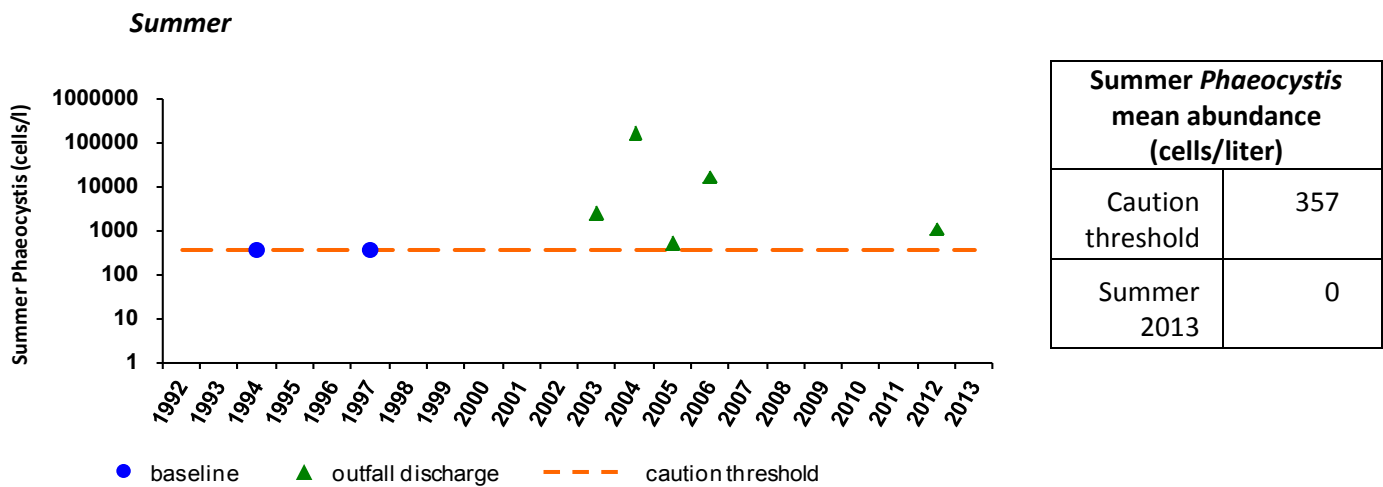
There were no threshold exceedances for *Phaeocystis*, *Pseudonitzschia*, or *Alexandrium*.

In the figures below, we compare *Phaeocystis* and *Pseudonitzschia* data to the [nuisance algae thresholds](#) for summer 2013 (May through August), which included four surveys, and autumn 2013 (September – October), which included two surveys. We also compare *Alexandrium* data to the threshold for each sample in August – October 2013. (January – July *Alexandrium* data were reported in earlier quarterly reports.)

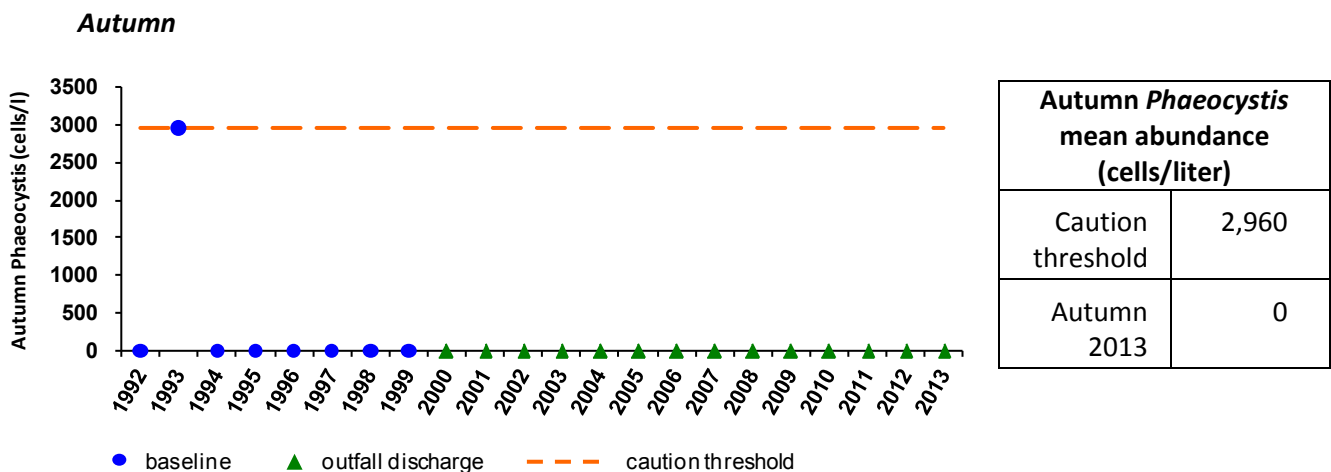
The graphs include data since the start of the monitoring program in 1992; however, the seasonal average values for 1992-2010 are calculated using a subset of all results reflecting the modified design that began in 2011, *i.e.* two rather than four autumn surveys. This enables us to better compare the threshold results across years. The previous reports are at <http://www.mwra.state.ma.us/harbor/html/archive.htm#cpqamb>.

### PHAEOCYSTIS

*Phaeocystis pouchetii* was not observed in the nearfield in summer or autumn of 2013.



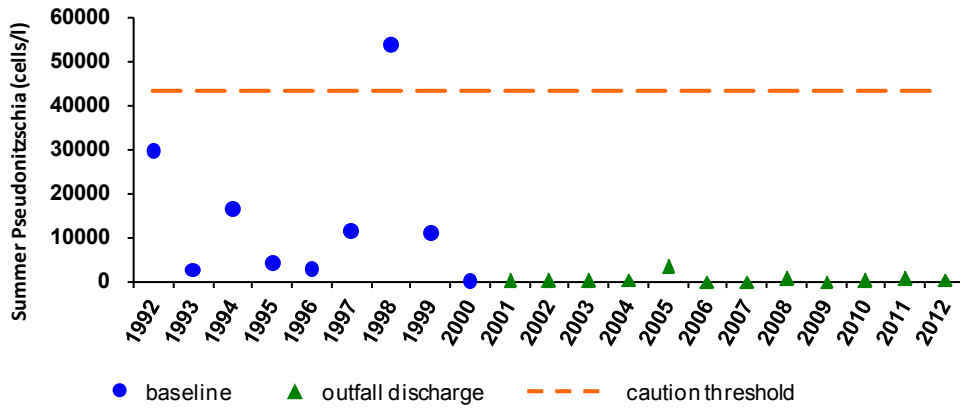
Note logarithmic scale. Years with no data point had zero summer average *Phaeocystis*.



## PSEUDONITZSCHIA

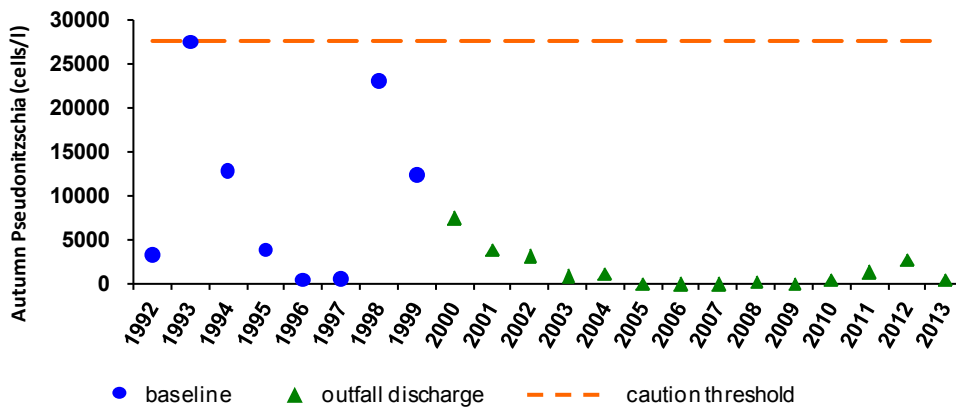
*Pseudonitzschia* was observed only at very low levels in the summer and autumn of 2013.

### Summer



Summer <i>Pseudonitzschia</i> mean abundance (cells/liter)	
Caution threshold	43,100
Summer 2013	667

### Autumn



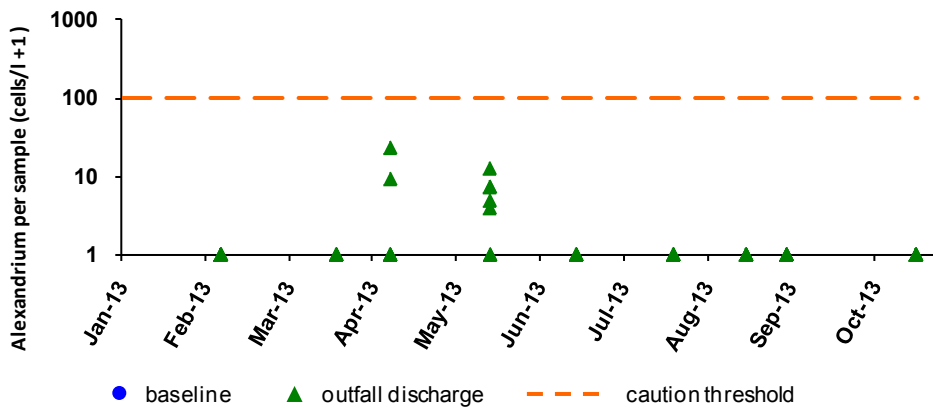
Autumn <i>Pseudonitzschia</i> mean abundance (cells/liter)	
Caution threshold	27,500
Autumn 2013	490



**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.

As reported previously, in spring 2013 there was an *Alexandrium* bloom along the coast of Maine and New Hampshire, but unlike several recent years, the bloom had little effect in Massachusetts Bay. By June 2013, the bloom had subsided. Results through July were reported in previous quarterly reports; this report includes results for August through October. The figure below includes results for each 2013 nearfield sample (Note logarithmic scale for graph.)



August-October <i>Alexandrium</i> per-sample abundance (cells/liter)	
Caution threshold	100
August- October 2013	0*
* maximum of all samples collected between August 1 and October 31, 2013	