

Contingency Plan Report Fourth Quarter 2015

Ambient Monitoring

MWRA gathers data near the discharge outfall location in Massachusetts Bay on various thresholds in the Contingency Plan related to its Deer Island outfall NPDES discharge permit. **This report shows** ambient monitoring **results** relevant to Contingency Plan thresholds **that became available in October-December 2015**. These include data that were collected both before and during this time period from nuisance algae, water column dissolved oxygen, water column chlorophyll, flounder tissue chemistry, and benthic infauna diversity. There was one contingency plan threshold exceedance for the summer seasonal abundance of the nuisance alga *Phaeocystis* during this time. Previous Contingency Plan reports are available at: <http://www.mwra.state.ma.us/harbor/html/contingency.htm>.

NUISANCE ALGAE – SUMMER 2015

PHAEOCYSTIS and PSEUDONITZSCHIA

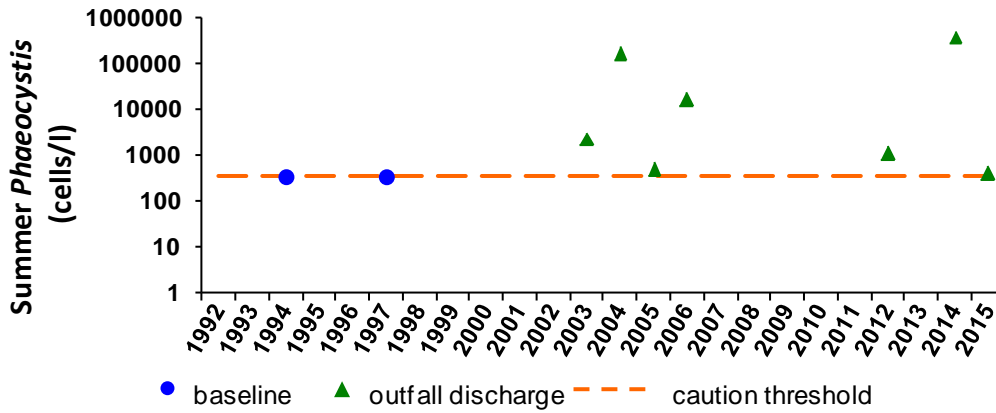
For both *Phaeocystis* and *Pseudonitzschia*, seasonal abundances of these [nuisance algae](#) are compared against threshold values derived from the 95 percentile of seasonal baseline means. This report compares the summer seasonal means for surveys done in May, June, July, and August 2015 against threshold values.

Of the eight plankton samples collected in the nearfield on May 11, 2015 a single sample contained the nuisance alga *Phaeocystis*, at an abundance of about 13,000 cells per liter in a mid-depth sample. It was not observed in any other nearfield samples collected from May through August. Despite this, the summer average abundance for the nearfield was 408 cells per liter, which was above the summer threshold value of 357 cells per liter. This triggered a Contingency Plan exceedance, which is reported at http://www.mwra.state.ma.us/harbor/pdf/20151113_amx.pdf. Though only the one nearfield sample contained *Phaeocystis*, it was also present in five out of twelve samples collected from farfield samples on the May survey. *Phaeocystis* was not observed in any nearfield or farfield samples collected during the following three summer surveys. Due to past similar summer exceedances, OMSAP requested MWRA evaluate alternative thresholds that might be less prone to triggering an exceedance for results that do not indicate ecological concerns.

In 2015, as in most other pre- and post-diversion years, the nuisance algae *Pseudonitzschia* did not exceed the nuisance algae thresholds during summer. Average nearfield abundance remained well below the threshold.

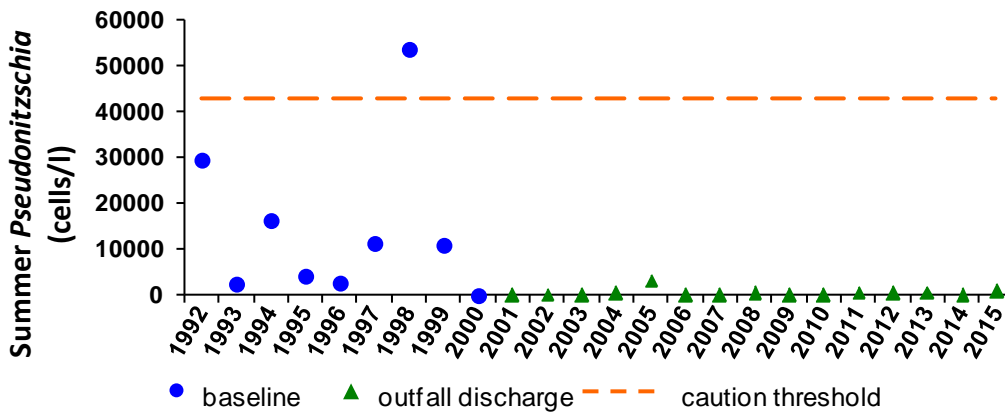
In the figures below, we compare *Phaeocystis* and *Pseudonitzschia* data to the nuisance algae thresholds for the summer seasonal threshold. The graphs include data since the start of the monitoring program in 1992; however, the seasonal average values for 1992-2010 are calculated using a subset of all results reflecting the modified design that began in 2011, i.e. four summer surveys. This enables us to better compare the threshold results across years.

Phaeocystis – summer 2015



| Summer <i>Phaeocystis</i> mean abundance (cells/liter) | |
|---|-----|
| Caution threshold | 357 |
| Summer 2015 seasonal mean | 408 |
| Note log scale; years with no data had zero summer average <i>Phaeocystis</i> | |

Pseudonitzschia – summer 2015



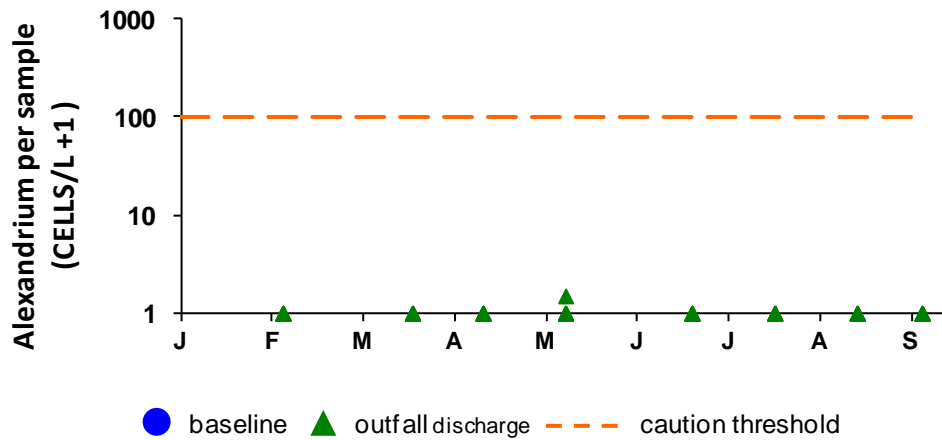
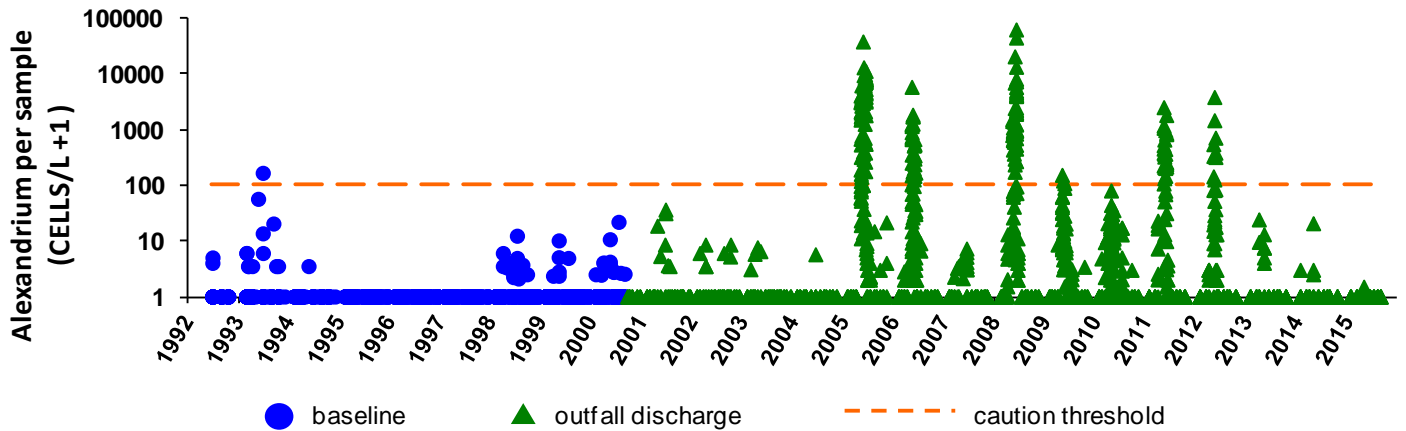
| Summer <i>Pseudonitzschia</i> mean abundance (cells/liter) | |
|--|-------|
| Caution threshold | 43100 |
| Summer 2015 seasonal mean | 925 |

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.

So far in 2015, *Alexandrium* has been almost entirely absent from Massachusetts Bay. Final data have been received for MWRA water column monitoring surveys in September, and preliminary results have been reported for October. No *Alexandrium* cells were detected this September, when abundance of this species is historically low in Massachusetts Bay. In preliminary results from October 2015, *Alexandrium* cells were observed in half of the 20 samples collected at very low numbers (1-3 cells/L), thus a threshold exceedance is unlikely for the remainder of 2015.

In the figures below, we compare *Alexandrium* data to the threshold for each sample in September 2015. The first includes data since the start of the monitoring program in 1992. To better display recent values, the second figure shows data for 2015 only (Note logarithmic scale for each graph).



| September <i>Alexandrium</i> per-sample abundance (cells/liter) | |
|---|-----|
| Caution threshold | 100 |
| September 2015 | 0* |
| * maximum of all samples collected September 9, 2015 | |

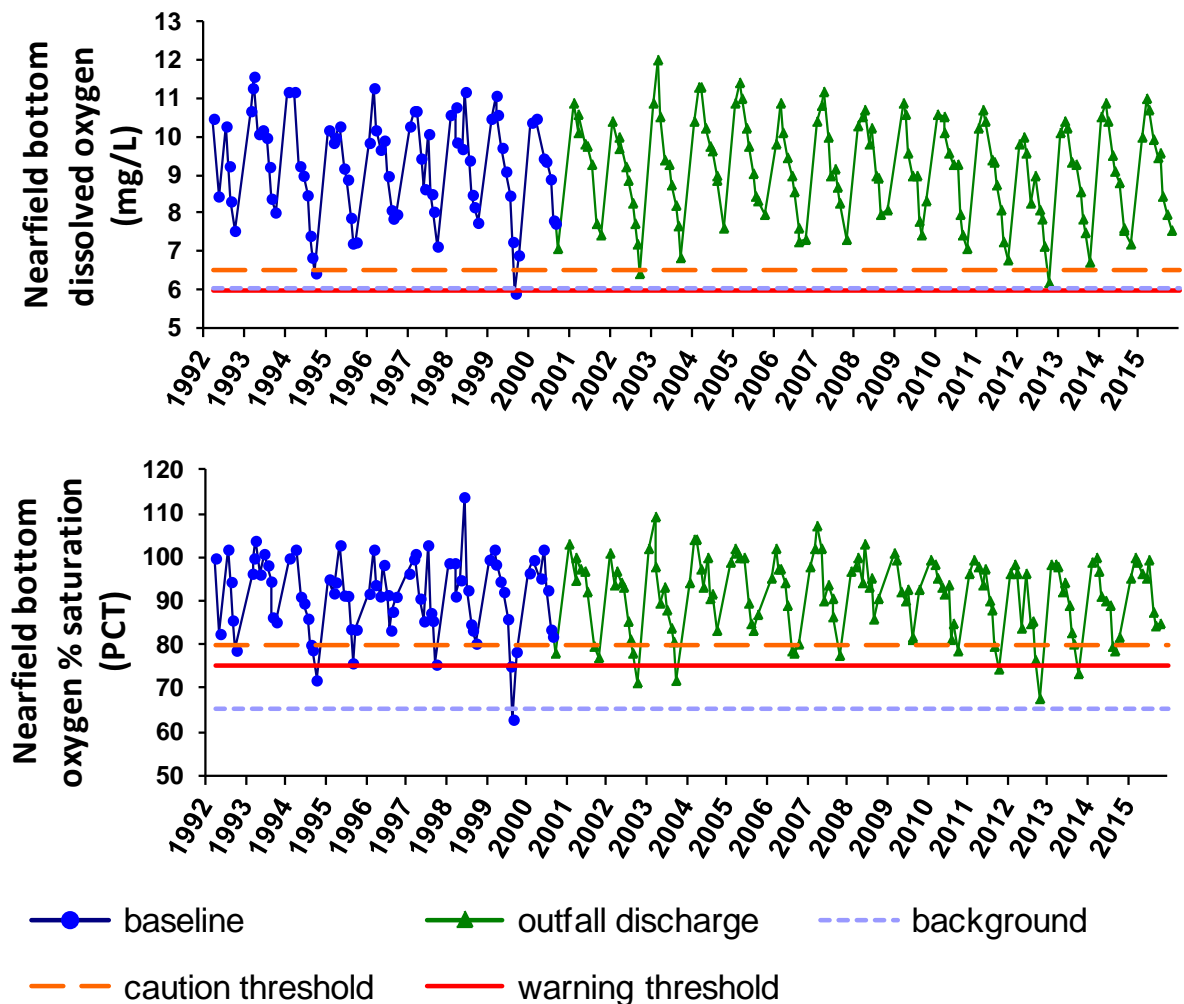
DISSOLVED OXYGEN (DO) –October 2015

Measurements of dissolved oxygen (DO) concentration and percent saturation in fall 2015 did not fall below background levels and thus did not exceed thresholds.

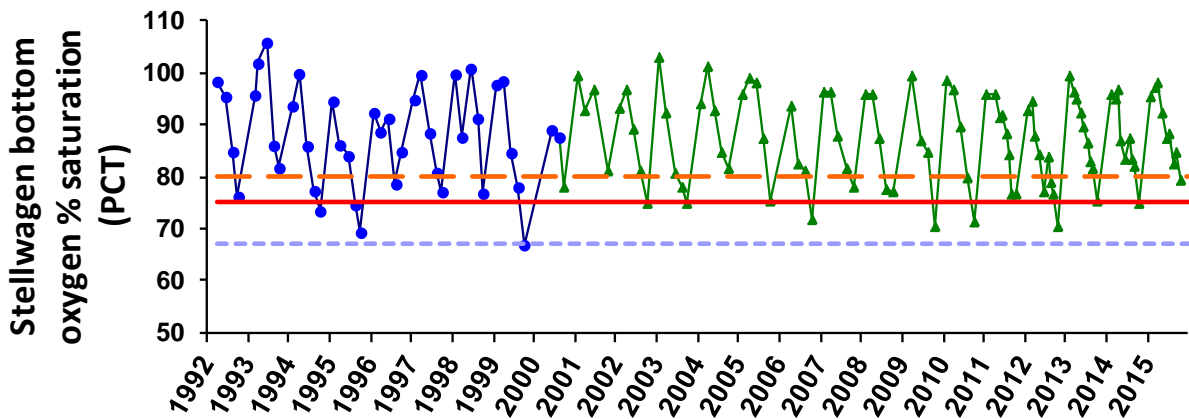
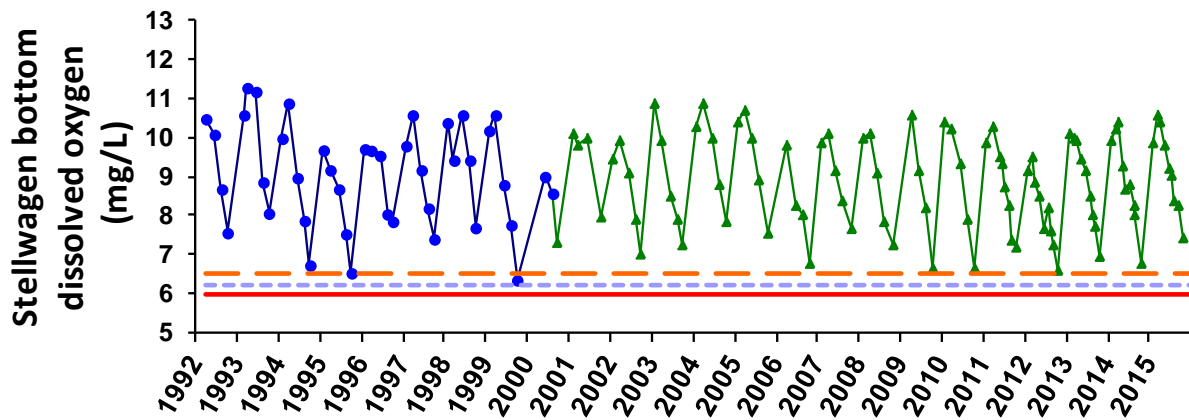
The current reporting period for [dissolved oxygen thresholds](#) is October 2015. During this period there was one survey. The graphs below show the natural annual fluctuation of DO and percent saturation, which are typically lowest in early autumn. The 1992-2010 data shown are subsets of all data reflecting 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.

Nearfield bottom-water oxygen levels for October 2015 were higher than in the previous three years, but comparable to many baseline and post-discharge years.

NEARFIELD



STELLWAGEN BASIN

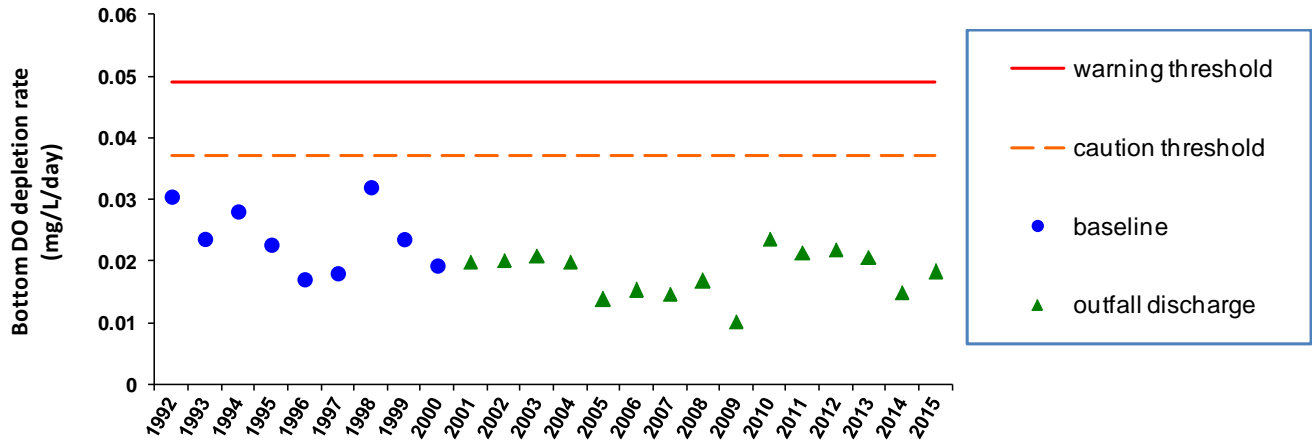


- baseline
- ▲ outfall discharge
- background
- - - caution threshold
- warning threshold

DO DEPLETION RATE – summer 2015

An additional threshold measure of dissolved oxygen is the rate at which oxygen is depleted during the stratified summer period. 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.

The current reporting period for oxygen depletion rate is summer 2015, defined as June -October. The DO depletion rate for the summer of 2015 was similar to other post-discharge years, but lower than most summers and well below the threshold.

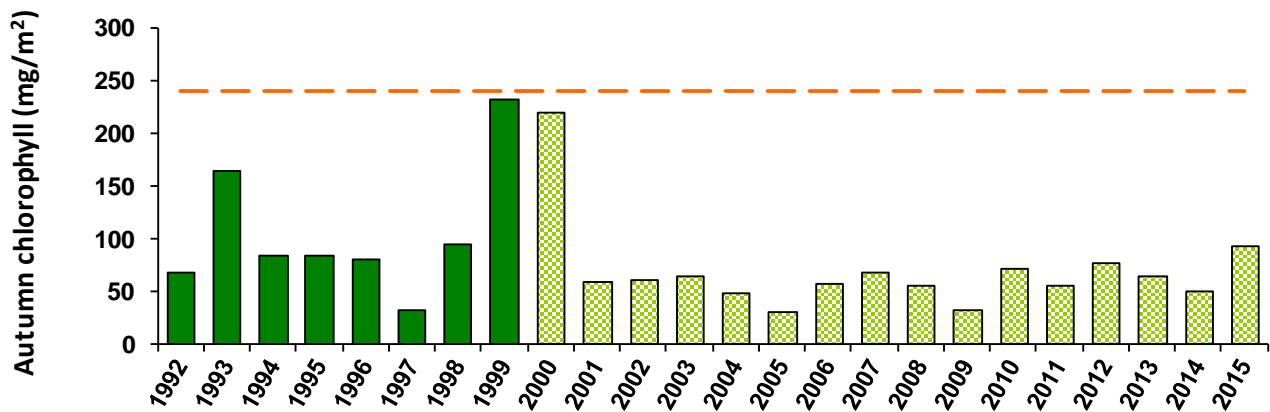


CHLOROPHYLL – September-November 2015 and Annual 2015

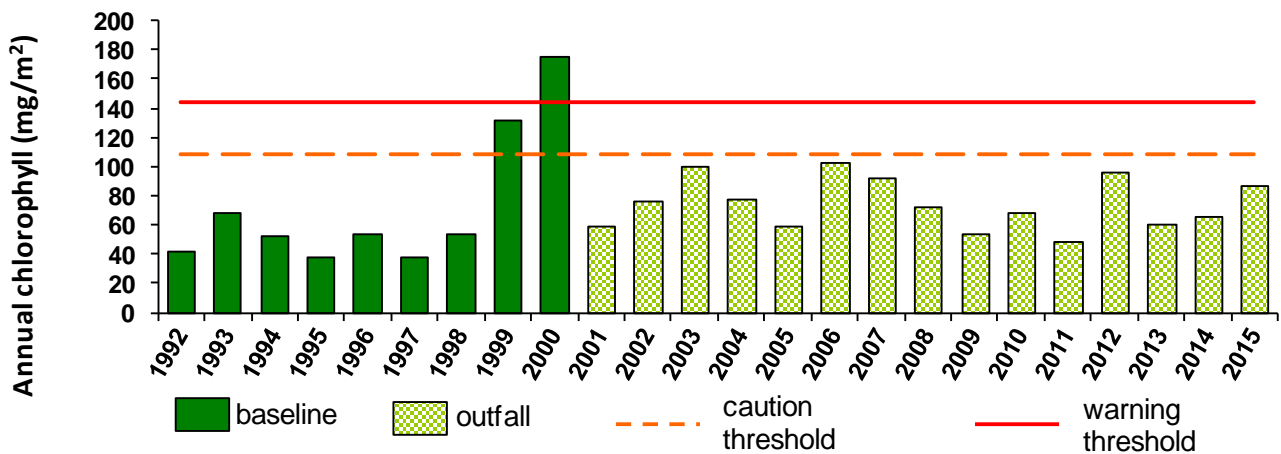
There were no [chlorophyll threshold](#) exceedances for either autumn 2015 or for the entire year. The nearfield mean areal average chlorophyll in autumn 2015 was 94 mg/m², well below the caution level threshold for autumn of 239 mg/m² and in the range of other years in the pre-discharge period. The 2015 annual average was 87 mg/m², below the caution and warning thresholds for annual average chlorophyll of 108 and 144 mg/m², respectively. Both autumn and annual results were similar to other moderately-high-chlorophyll years in the pre-diversion and post-diversion periods.

The figures below compare chlorophyll data for autumn 2015 (September-October), which included two surveys, and data 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 modified design that began in 2011, *i.e.* two autumn surveys. This enables us to better compare the threshold results across years.

Autumn



Annual



FISH AND SHELLFISH TISSUE CONTAMINATION - FLOUNDER 2015

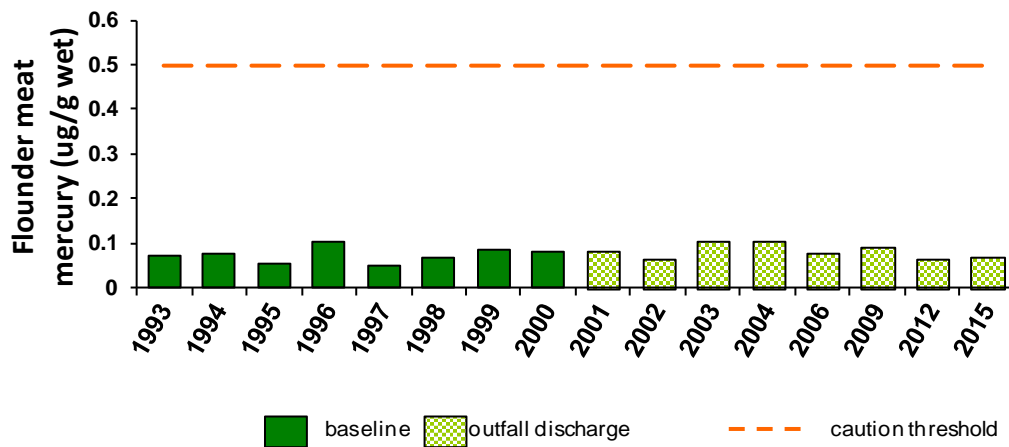
The fish tissue contamination thresholds are designed to identify unexpected effects on marine life. There were no exceedances of flounder tissue contamination thresholds in 2015.

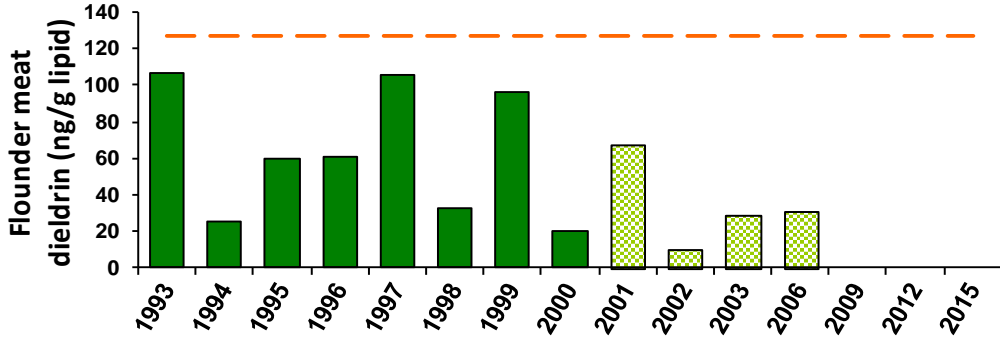
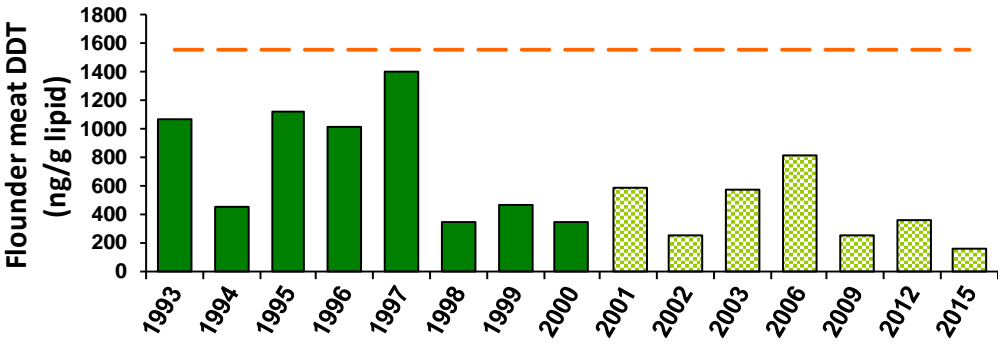
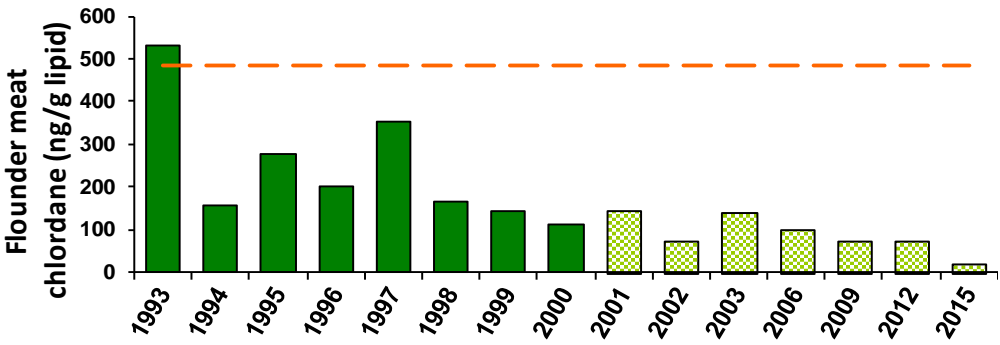
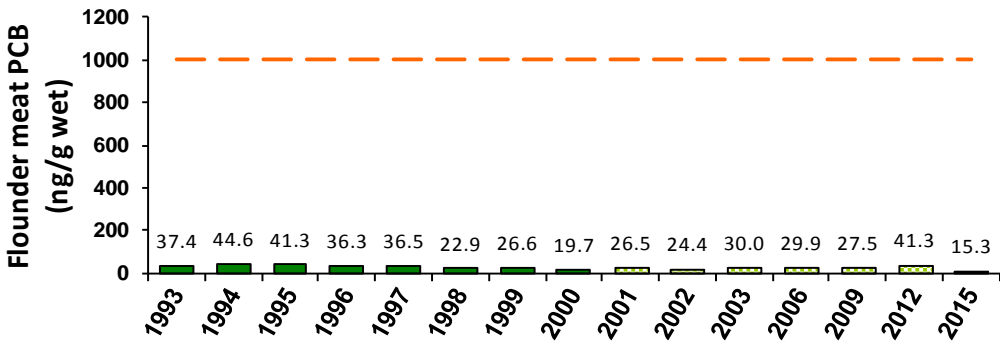
Contaminants are measured in three species of seafood: flounder, lobster, and mussels. For mercury and PCBs in flounder, lobster, and mussels, caution and warning thresholds are set at 50% and 80% of the FDA action limits. The threshold for lead in mussels is based on EPA risk assessment of lead in drinking water. Other fish/shellfish tissue contamination thresholds are based on change from baseline conditions at the outfall site.

Data available this quarter include tissue contamination in winter flounder from the outfall site. Tissue chemistry results for lobster and mussel samples will be available by the end of next quarter.

FLOUNDER

Flounder were sampled at the outfall site in April 2015. Flounder meat mercury contamination remained low and similar to other years. PCBs, chlordane, and DDTs were lower in 2015 than measured in all previous years. Dieldrin was not detected again in 2015 as was the case for the last two years in which flounder tissue chemistry was analyzed (2009 and 2012).





SEDIMENT BIODIVERSITY - 2015

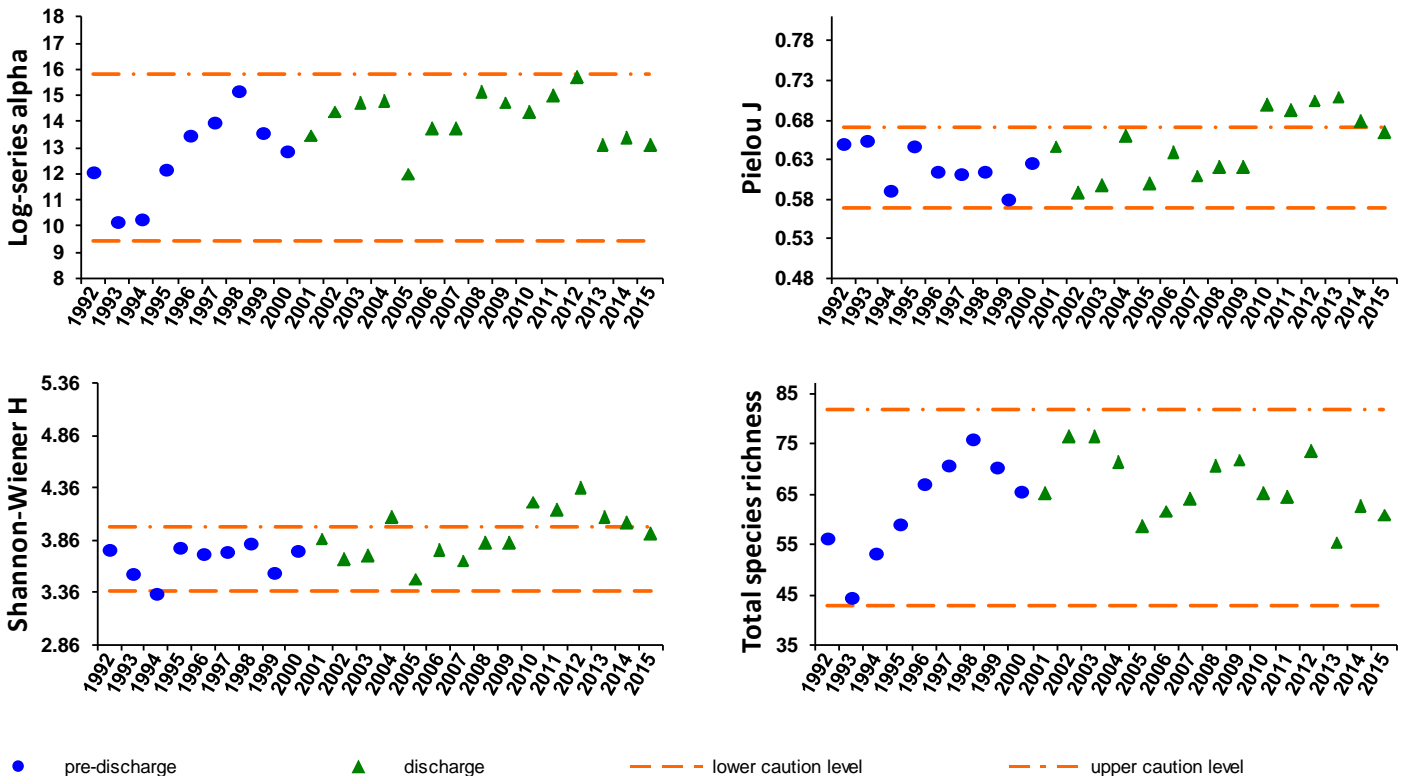
MWRA samples the animals that live in the mud near the outfall every summer and measures the numbers and kinds of animals living there. These measurements are used in four indicators of biodiversity. In 2015, these indicate that, in vicinity of the outfall, the ability of the sediment and habitat to support diverse populations of infauna remains high and within the bounds of Contingency Plan thresholds. The number of opportunistic animals, which would be expected to increase in degraded sediments, remains extremely low.

DIVERSITY

For each [diversity measure](#), the graphs show the annual average for sediment samples collected within seven kilometers of the outfall discharge since 1992. The results shown for 1992-2003 and 2011-2015 are from the current eleven monitoring stations (which are a subset of the stations sampled 1992-2003), reflecting the modified design that began in 2015. 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 to values corresponding to the 97.5th percentile and 2.5th percentile of the baseline mean.

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).

Although both Pielou's J' and Shannon Wiener H' exceeded the upper range thresholds five years in a row, from 2010 to 2014, neither parameter exceeded the threshold in 2015.



OPPORTUNISTS

The annual sampling in 2015 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.

