

# Contingency Plan Quarterly Report on Ambient Monitoring Results Third Quarter 2023

---

MWRA gathers data on various Contingency Plan thresholds near the outfall location in Massachusetts Bay. These thresholds are part of the Deer Island Treatment Plant (DITP) NPDES discharge permit. This report presents ambient monitoring results for Contingency Plan thresholds that became available in July through September 2023. Previous Contingency Plan reports are available at <https://www.mwra.com/harbor/html/contingency.htm>

Included in the report are the results of 2023 summer and early fall bottom-water dissolved oxygen, flounder liver disease, spring/summer (May through July) nuisance algae abundances, and depth of oxygenation in sediment. There were two Contingency Plan caution threshold and two warning threshold exceedances in this report – results of Stellwagen Basin bottom-water dissolved oxygen concentration collected from the July and September water column surveys exceeded caution level and background value, and Stellwagen Basin bottom-water dissolved oxygen percent saturation collected from these two surveys exceeded warning level threshold and background value.

## DISSOLVED OXYGEN (DO) – June- September 2023

DO thresholds are tested on results collected in the bottom water from nearfield (stations within 7.5 kilometers from the outfall) and Stellwagen Basin stations during June through October each year. During this period, warmer temperatures cause lower solubility, and water column stratification can further reduce dissolved oxygen concentration and saturation in bottom water.

The DO caution and warning level thresholds are based on state water quality standards that were in effect during the baseline monitoring period. To reflect the level of natural fluctuation, background level thresholds were established from measurements collected during the baseline sampling between 1992 and September 2000 from the two areas.

During June to September 2023, four routine water column surveys were conducted. There were caution threshold and background value exceedances of dissolved oxygen concentrations, and warning threshold and background value exceedances of dissolved oxygen saturations at the Stellwagen Basin station from the July and September surveys. The exceedances require regulatory and public notification under the Contingency Plan (see notice [https://www.mwra.com/harbor/pdf/20230811\\_amx.pdf](https://www.mwra.com/harbor/pdf/20230811_amx.pdf) and [https://www.mwra.com/harbor/pdf/20230929\\_amx.pdf](https://www.mwra.com/harbor/pdf/20230929_amx.pdf) ).

There is currently no evidence these exceedances are related to the Deer Island Treatment Plant outfall discharge. A large bloom of brown algae *Tripos muelleri* in the Gulf of Maine this summer may have contributed to these threshold exceedances and the low dissolved oxygen concentrations and saturations observed in the bottom water in both the nearfield and Stellwagen Basin during June and July surveys (Figure 1). The prolonged and strong stratification in the water column through September caused exceedances of these thresholds again in September even after slight increases in dissolved oxygen and saturation in the August survey, which could be due to a temporary breakdown of stratification during storms on August 8 and 25.

During the period, average dissolved oxygen concentrations from nearfield sites were all above the warning threshold and the background value. Although dissolved oxygen percent saturation in the nearfield was below the warning threshold during surveys from June to September, and the dissolved oxygen concentration in

nearfield was below the caution threshold during the September survey, they were all above their background values. So there were no threshold exceedances in nearfield.

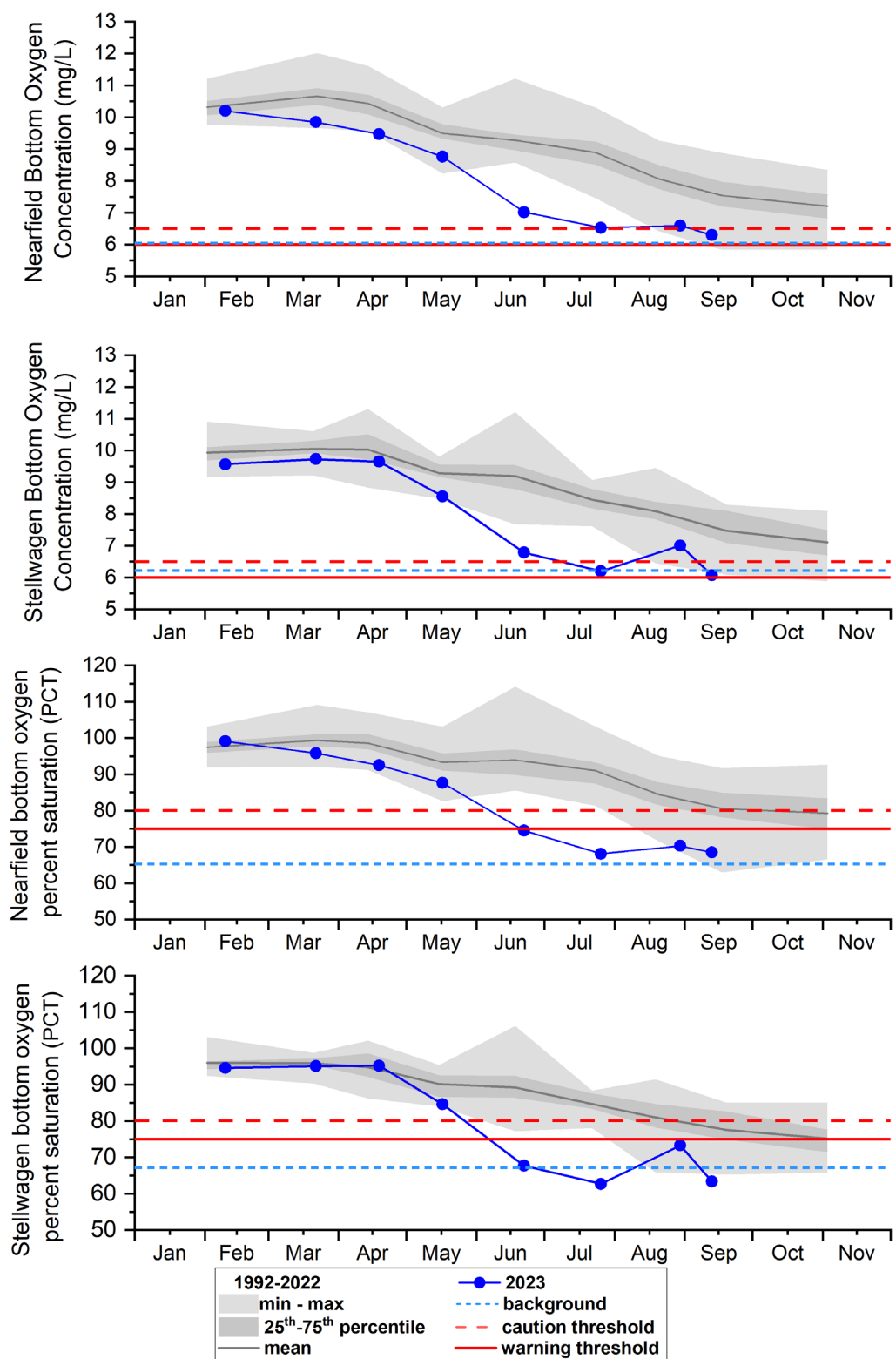


Figure 1. Bottom dissolved oxygen concentration and percent saturation in nearfield and Stellwagen Basin

## FISH AND SHELLFISH

### Flounder liver disease – April – May 2023

The prevalence in winter flounder (*Pseudopleuronectes americanus*) of centrotubular hydropic vacuolation (CHV), a liver disease associated with contaminant exposure and considered a precursor to liver tumors, is a useful measure of the effects of pollution in the coastal waters. In Boston Harbor, rates of this disease were historically quite high but dropped considerably during the 1990s.

The Caution Level threshold for the prevalence of flounder CHV liver disease is 45%, which is based on measurements collected from Boston Harbor during the baseline period (1991-2000). Since Massachusetts Bay monitoring began in 1991, prevalence of the CHV near the outfall site has been much lower than the threshold. The result for 2023 is 6.9% from the flounder survey conducted on April 24, May 11 and May 30, which is one of the lowest among observations after the discharge was diverted from Boston Harbor to Massachusetts Bay, and much lower than that observed at the site during the baseline period (Figure 2).

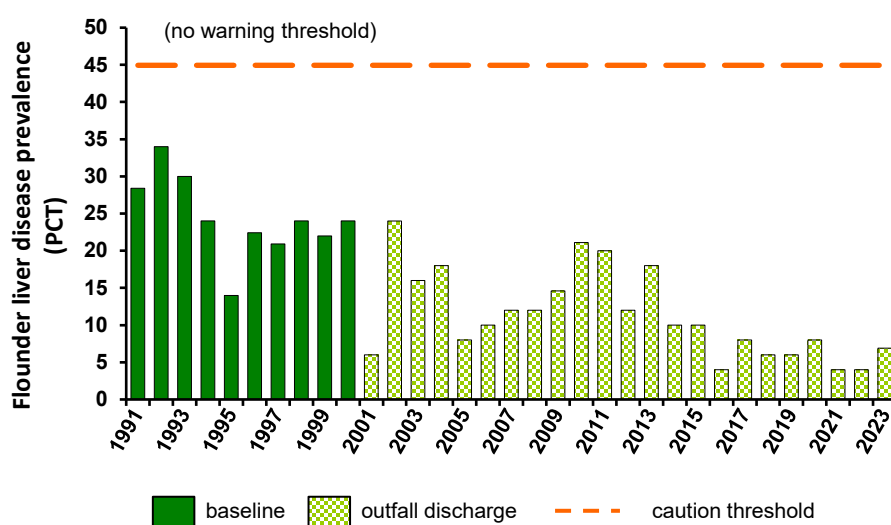


Figure 2. Flounder liver disease prevalence at outfall site (1991 - 2023)

## NUISANCE ALGAE

### ALEXANDRIUM – June - September 2023

The [nuisance algae](#) *Alexandrium catenella* (“*Alexandrium*”) can cause paralytic shellfish poisoning (PSP, or “red tide”) in Massachusetts Bay. MWRA measures *Alexandrium* abundance using a molecular probe (NA1) thought to be specific to the *Alexandrium* red tide species *tamarensis*, *catenella*, and *fundyense*<sup>1</sup>.

MWRA also checks observations of shellfish PSP toxicity from state fisheries agencies and other regional monitoring programs to track *Alexandrium* blooms in Massachusetts Bay and the Gulf of Maine region.

During summer and early fall 2023, there were no *Alexandrium* cells detected in either nearfield or farfield (reference stations) from the surveys in June, July, August, and September. Data from August and September are preliminary because they have not yet gone through the complete set of quality assurance checks.

<sup>1</sup> <https://doi.org/10.1016/j.dsr2.2005.06.015>

Only a sample with 100 or more cells of *Alexandrium* per liter from a nearfield station would constitute an exceedance under the Contingency Plan.

In Figure 3 below, we compare the 2023 results of *Alexandrium* abundance in samples collected from nearfield stations through September against those from all prior years since 1992. Due to reductions in the number of surveys conducted each year<sup>2</sup>, the historical results encompass more time-points than shown for the current year.

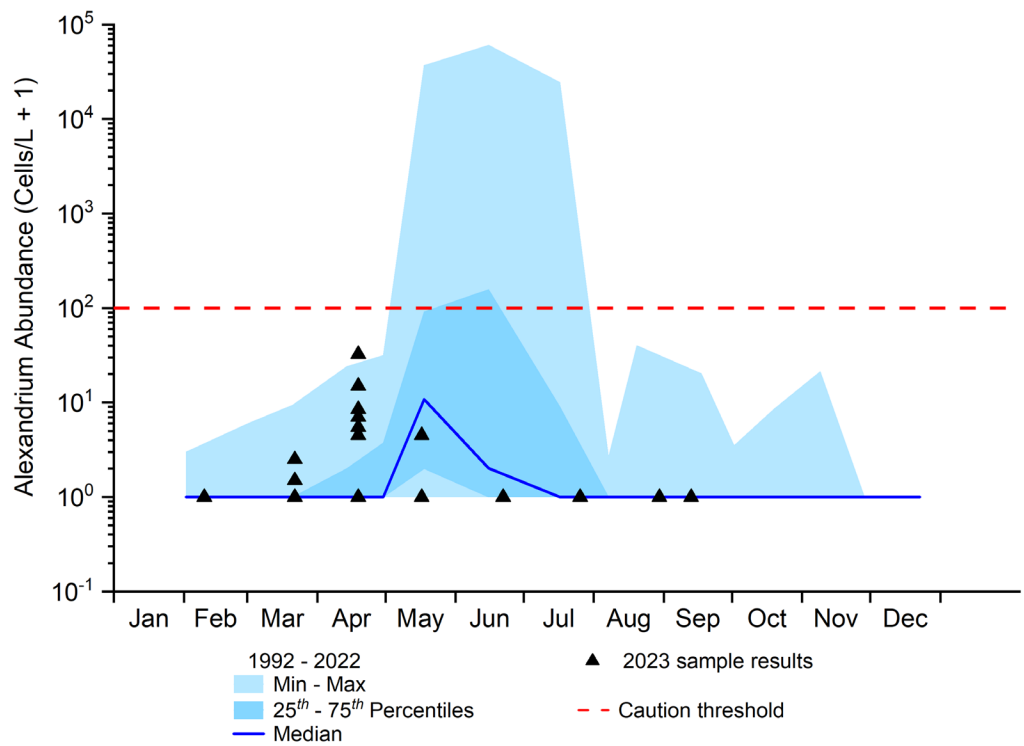


Figure 3. Cell abundance of *Alexandrium* in water samples from nearfield stations (1992 – 2023)

### PHAEOCYSTIS – February - July 2023

In February 2017, EPA approved changes in the Contingency Plan to remove the threshold for the seasonal abundance of the nuisance alga *Phaeocystis pouchetii* in the nearfield water column. During bloom conditions, *Phaeocystis* can form large, gelatinous colonies, which may accumulate as foam as they disintegrate on beaches. Evaluations of prior threshold exceedances for this species have indicated that they resulted from natural fluctuations in Massachusetts Bay, do not represent degradation, were not a result of MWRA’s discharge, and have not occurred in concentrations that would pose problems for recreation. MWRA agreed to continue to report each quarter on nearfield survey mean abundances of *Phaeocystis pouchetii* compared to its historical seasonal pattern.

<sup>2</sup> There were two major modifications to the ambient monitoring plan for the outfall in 2004 and 2010; the numbers of surveys and monitoring stations were reduced through these revisions. More information can be found at: <https://www.mwra.com/harbor/enquad/pdf/2010-04.pdf> <https://www.mwra.com/harbor/enquad/pdf/2004-ms-92.pdf>

Figure 3 shows the 2023 spring/summer survey mean *Phaeocystis* results against the seasonal background for all prior years since 1992. Due to reductions in the number of surveys conducted each year<sup>2</sup>, the historical seasonal pattern encompasses more time-points than shown for the current year.

No *Phaeocystis pouchetii* cells were observed in samples collected during surveys in February to July 2023 (Figure 4).

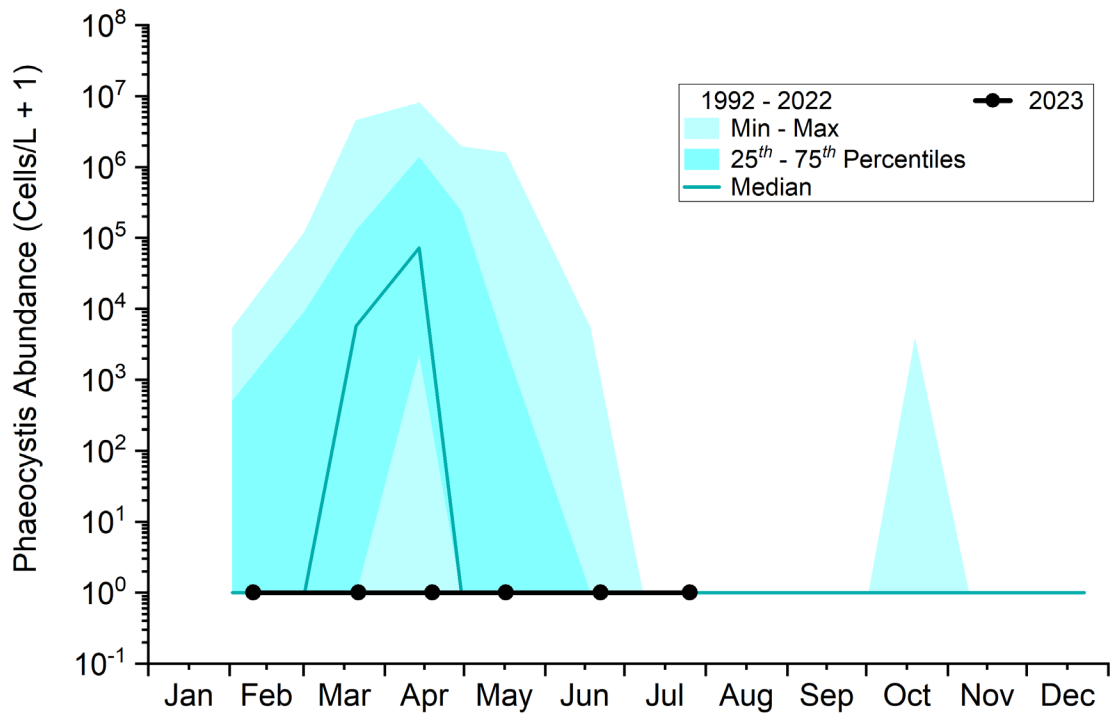


Figure 4. Nearfield Survey Mean abundance of *Phaeocystis* (1992 – 2023)

## SEDIMENT DEPTH OF OXYGENATION

### Sediment redox potential discontinuity depth – August 2023

The thickness of the oxygenated layer in sediment is called the redox potential discontinuity (RPD) depth, which is an effective measure of benthic habitat quality. 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 or smother the bottom-dwelling community. Such areas have a thin or nonexistent oxygenated layer.

Through 2019, MWRA’s monitoring estimated the RPD depth in sediments using sediment-profile images, cross-sections of the upper several centimeters of the sediment taken with a special mud-penetrating prism and camera. A caution level threshold was set at half the mean measured in the baseline period. Because sediments remained highly oxygenated, with annual RPD’s usually deeper than the average measured during baseline monitoring, EPA approved MWRA’s proposed modifications including ending monitoring of nearfield sediments using sediment-profile images<sup>3</sup>.

<sup>3</sup> [https://www.mwra.com/harbor/pdf/20201113\\_amp.pdf](https://www.mwra.com/harbor/pdf/20201113_amp.pdf)

While this change means RPD depth estimates from sediment-profile images are not available, MWRA continues to estimate the depth of sediment oxygenation from sediment samples collected for benthic invertebrate community analysis.

Observations from the benthic monitoring survey on August 7, 2023 on confirm that healthy levels of sediment oxygenation persist in nearfield sediments. The apparent redox potential discontinuity (aRPD, visually assessed RPD) was measurable at five of the 14 stations. The aRPD was detectable at NF12, NF21, and NF22, where the depth of the aRPD was 1.0 cm, and aRPD depth of 0.5 cm was detected at NF10 and FF12<sup>4</sup>. No stations appeared to have anoxic surface sediments (i.e., black with an odor of hydrogen sulfide and few or no infaunal organisms); and presumably the oxic to suboxic sediment layer extended below the depth of grab penetration at stations where the aRPD was not detectable.

---

<sup>4</sup> All stations listed are considered nearfield stations.