

## **Contingency Plan Quarterly Report on Ambient Monitoring Results**

Third Quarter 2022

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MWRA gathers data near the outfall discharge location in Massachusetts Bay on various Contingency Plan thresholds related to its Deer Island Treatment Plant (DITP) NPDES discharge permit. This report shows ambient monitoring results for Contingency Plan thresholds that became available in July through September 2022. Previous Contingency Plan reports are available at <http://www.mwra.state.ma.us/harbor/html/contingency.htm>.

Included in the report are 2022 summer bottom-water dissolved oxygen, spring/summer (May through July) nuisance algae abundances, depth of oxygenation in sediment, and flounder liver disease results. There were two Contingency Plan threshold exceedances in this report — results of Stellwagen Basin bottom-water dissolved oxygen percent saturation collected from the August water column survey exceeded warning level threshold and background value, and an *Alexandrium* exceedance from the late June water column survey.

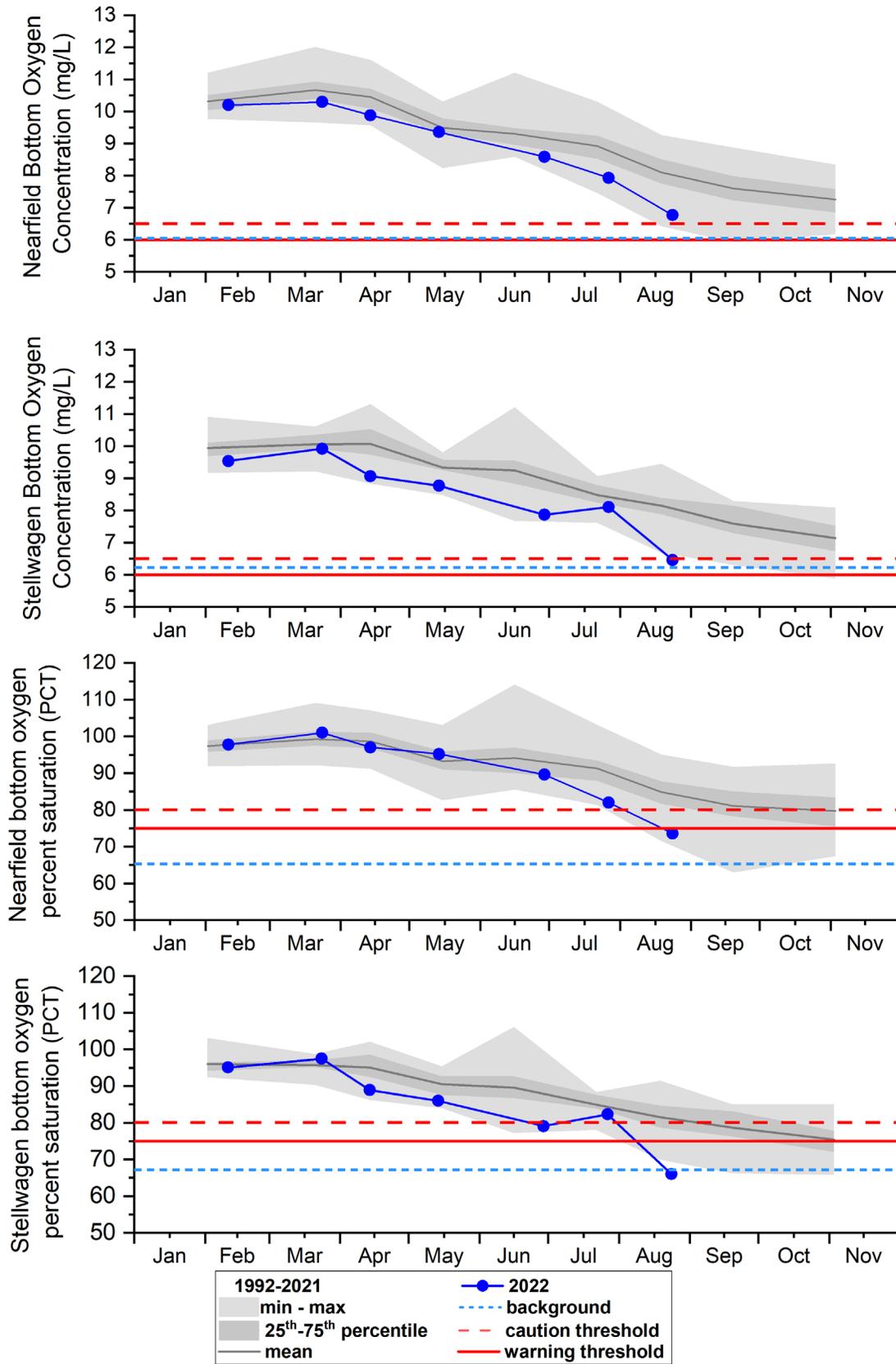
### **DISSOLVED OXYGEN (DO) – June- August 2022**

The DO thresholds are tested on results collected in the bottom water from nearfield 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.

From June – August 2022, three routine water column surveys were conducted. There was one dissolved oxygen threshold exceedance during the period. Results of bottom-water oxygen percent saturation collected in Stellwagen Basin from the August survey were below both the warning threshold and background value, requiring regulatory and public notification under the Contingency Plan (see notice [https://www.mwra.com/harbor/pdf/20220926\\_amx.pdf](https://www.mwra.com/harbor/pdf/20220926_amx.pdf)). There is currently no evidence this exceedance is related to the Deer Island Treatment Plant outfall discharge.

Average dissolved oxygen concentrations from nearfield and from Stellwagen Basin stations were above warning thresholds and their background values. Although dissolved oxygen percent saturation in the nearfield was below the warning threshold and the dissolved oxygen concentration in Stellwagen Basin was below the caution threshold during the August survey, they were all above their background levels. So there were no other threshold exceedances (Figure 1).



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

## NUISANCE ALGAE

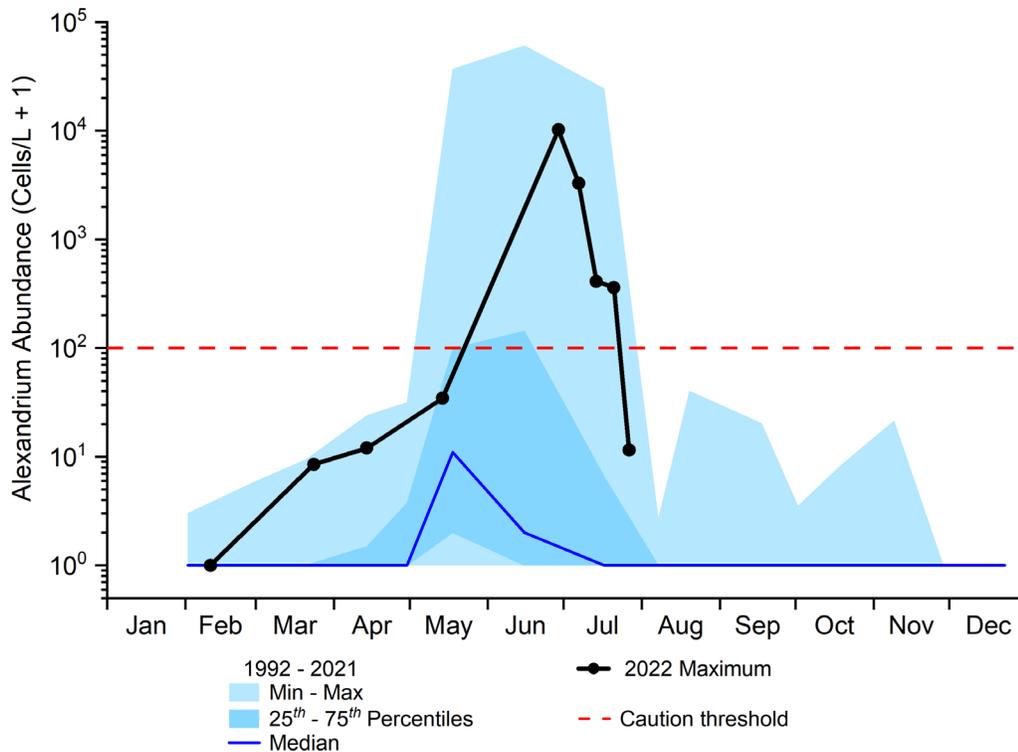
### ***ALEXANDRIUM* – May - July 2022, including three rapid response surveys**

The [nuisance algae](#) *Alexandrium catenella* (“*Alexandrium*”) can cause paralytic shellfish poisoning (PSP, “red tide”) in Massachusetts Bay. MWRA measures *Alexandrium* abundance in its monitoring program, and checks observations of shellfish PSP toxicity from state fisheries agencies and other regional monitoring programs to keep track of the course of Gulf of Maine *Alexandrium* blooms.

There are no indications the 2022 exceedance is related to the DITP outfall discharge. The results available so far indicate that a portion of the coastal population of *Alexandrium* north of Cape Ann was transported into Massachusetts Bay by winds and currents, leading to the result observed. On June 21, high PSP (Paralytic Shellfish Poisoning) toxicity levels were observed in both north shore and south shore areas, which caused the shellfish bed closure along the coast of Massachusetts Bay on June 23. The high PSP levels also triggered the *Alexandrium* Rapid Response surveys (ARRS). Two extra ARRS stations were included in the regular water column survey on June 28. During this survey, six of ten samples collected from nearfield stations (stations within 7.5 kilometers from the outfall) had *Alexandrium* abundance over 100 cells per liter with highest abundance of 10,180 cells per liter from a surface sample. This exceedance of the Contingency Plan threshold of 100 cells per liter requires notification under the Contingency Plan (see notice <https://www.mwra.com/harbor/pdf/20220705amx.pdf>).

Three *Alexandrium* Rapid Response surveys were conducted weekly on July 6, July 13 and July 20. More samples from these surveys had *Alexandrium* abundance over 100 cells per liter. However, by the end of July the *Alexandrium* bloom had subsided bay wide. In results from the routine water column survey on July 26 and preliminary results from the routine survey on August 23, *Alexandrium* counts in samples from nearfield and farfield stations (reference stations) were all well below 100 cells per liter. The very low cell counts from the end of July and August surveys show that the *Alexandrium* bloom in Massachusetts Bay had ended for this year. On July 11, the PSP levels in Massachusetts Bay were reported well below 80ug/100g, and limited shellfish growing areas and shellfish species were re-open for harvesting since July 13. On September 17, the PSP closures were lifted for all shellfish beds along the coast of Massachusetts Bay.

In the figure below, we compare the 2022 survey maximum of nearfield *Alexandrium* results collected through July 2022 against the sample results from all prior years since 1992. Due to reductions in the number of surveys conducted each year, the historical results encompass more time-points than shown for the current year.



**Figure 2. Nearfield sample abundance of *Alexandrium* (1992 – 2022)**

### ***PHAEOCYSTIS* – summer (May-July) 2022**

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 results.

Figure 3 shows the 2022 survey median *Phaeocystis* results against the results from all prior years since 1992. Due to reductions in the number of surveys conducted each year, the historical results encompass more time-points than shown for the current year.

There were no *Phaeocystis* cells detected from May to July 2022.

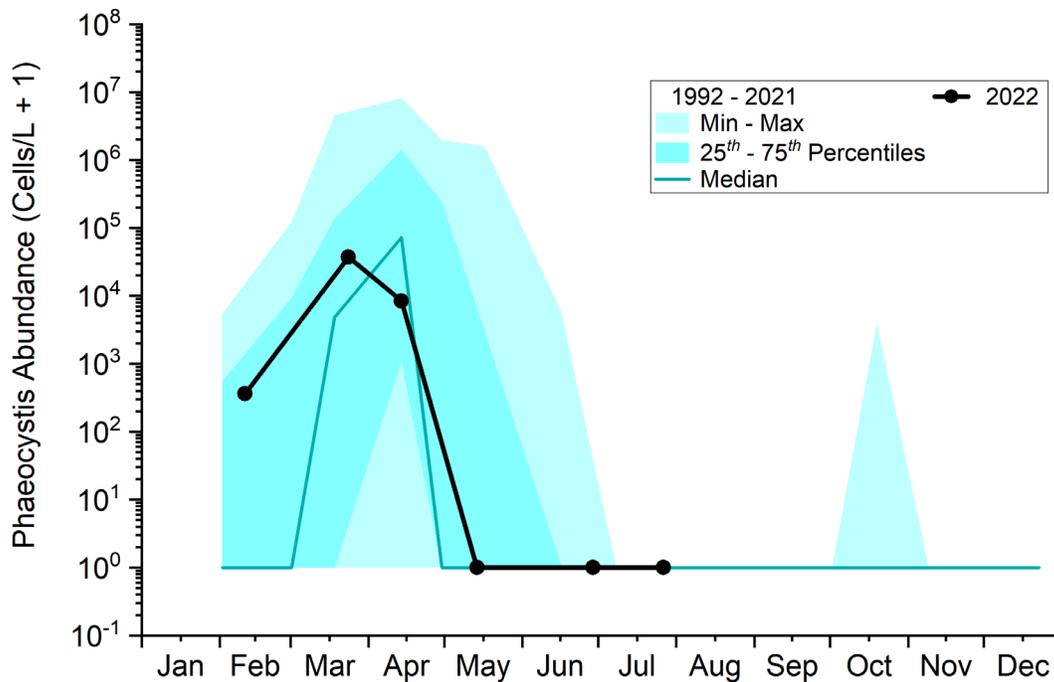


Figure 3. Nearfield Survey Mean abundance of *Phaeocystis* (1992 – 2022)

## SEDIMENT DEPTH OF OXYGENATION

### Sediment redox potential discontinuity depth – August 2022

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>1</sup>.

<sup>1</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.

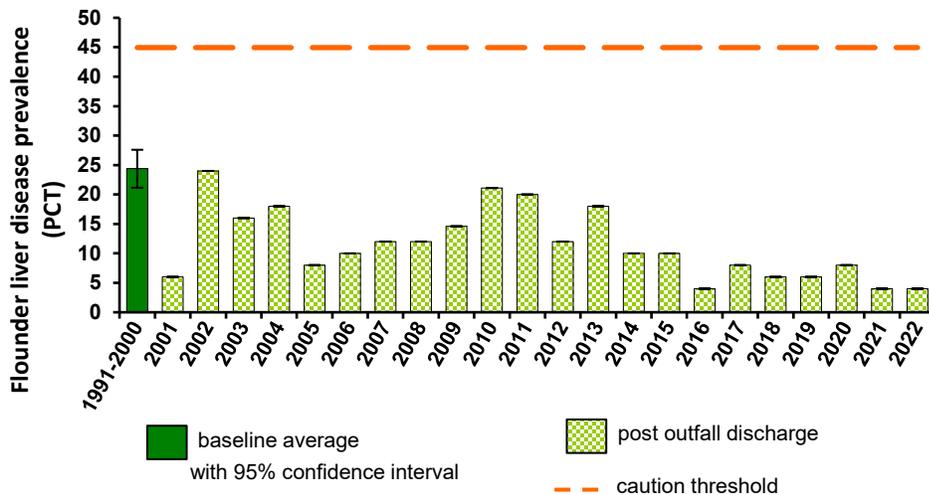
Observations from the August 3, 2022 benthic monitoring confirm that healthy levels of sediment oxygenation persist in nearfield sediments. The apparent redox potential discontinuity (aRPD, visually assessed RPD) was measurable at five of the 14 stations. The aRPD was detectable at NF21, NF22, NF24 and FF12, where the depth of the aRPD was 1.0 cm, and aRPD depth of 0.5 cm was detected at FF12<sup>2</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.

## FISH AND SHELLFISH

### Flounder liver disease – April 2022

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 early-stage liver disease near the outfall site has been much lower than the threshold. The result for 2022 is 4% from the flounder survey conducted on April 25, which is one of the lowest among the post-diversion observations, and much lower than that observed at the site during the baseline period (Figure 4).



**Figure 4. Flounder liver disease prevalence at outfall site (1991 - 2022)**

<sup>2</sup> All stations listed are considered nearfield stations.