Environmental Quality Department
Massachusetts Water Resources Authority
10/1/2020

Contingency Plan Quarterly Report
on Ambient Monitoring Results
Third Quarter 2020

MWRA gathers data near the outfall discharge location in Massachusetts Bay on various thresholds in the Contingency Plan 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 2020. Previous Contingency Plan reports are available at http://www.mwra.state.ma.us/harbor/html/contingency.htm.

Results in this report include 2020 flounder liver disease, depth of oxygenation in sediment, spring/summer (May through July) nuisance algae abundances, and summer/early fall dissolved oxygen results. There are no Contingency Plan threshold exceedances in this report.

FISH AND SHELLFISH

Flounder liver disease – May 2020

The prevalence in winter flounder (*Pseudopleuronectes americanus*) of centrotubular hydropic vacuolation, 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 prevalence of flounder liver disease Caution Level threshold 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 2020 is 8% from a survey conducted on May 11, which is near the low end of the range of post-diversion observations, and much lower than that observed at the site during the baseline period (Figure 1).

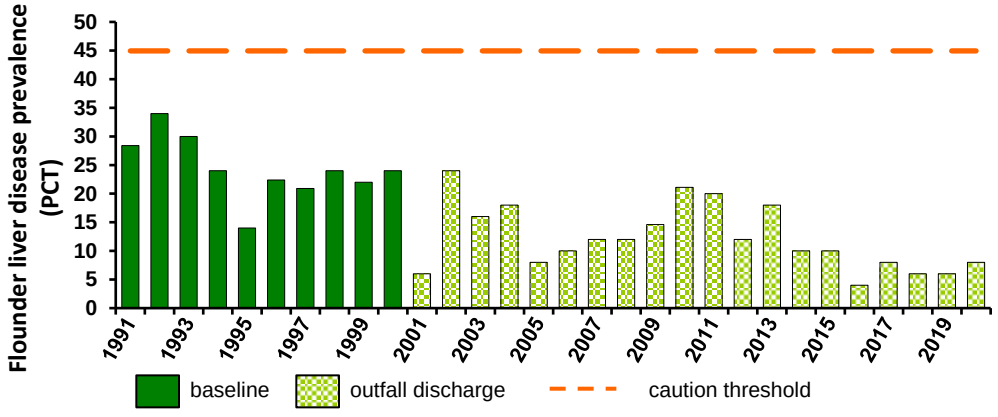

Figure 1. Flounder liver disease prevalence at outfall site (1991 - 2020)

SEDIMENT DEPTH OF OXYGENATION

Sediment redox potential discontinuity depth – August 2020

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. After outfall discharge began in September 2000, sediments remained highly oxygenated, with annual RPD's usually deeper than the average measured during baseline monitoring (See http://www.mwra.state.ma.us/harbor/pdf/2019q3cpqamb.pdf).

Following discussions among MWRA, OMSAP members, regulators, and the public, and with OMSAP's endorsement, EPA indicated its approval of MWRA's proposed interim modifications to the Ambient Monitoring Plan, which went into effect for 2020 monitoring. The discussions concluded that some components of MWRA's monitoring had fully answered all of the questions they were designed to address. One of the affected studies was the monitoring of nearfield sediments using sediment-profile images, which was not conducted in 2020.

While precise RPD depth estimates are therefore not available, MWRA continues to estimate the depth of sediment oxygenation from sediment samples collected for benthic invertebrate community analysis at 11 stations near MWRA's outfall (the nearfield) and at three reference stations (the farfield). Observations from the August 12, 2020 benthic monitoring (below) confirm that healthy levels of sediment oxygenation persist in nearfield sediments.

The apparent redox potential discontinuity (aRPD) was measurable at four of the 14 stations. The aRPD was detectable at NF12[1] and NF22 where the depth of the aRPD was 3.0 cm, and NF24 and FF12 where the aRPD depth was 4.0 cm. 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.

NUISANCE ALGAE

ALEXANDRIUM – summer (May – July) 2020

The nuisance algae *Alexandrium catenella* ("*Alexandrium*") can cause paralytic shellfish poisoning (PSP, "red

[1] All stations listed are in the nearfield.

tide") in Massachusetts Bay. MWRA measures *Alexandrium* abundance in its monitoring program, and checks observations of shellfish PSP toxicity from state fisheries agency and other regional monitoring programs to keep track of the course of Gulf of Maine *Alexandrium* blooms.

The report for last quarter noted that results from June *Alexandrium* samples activated rapid-response *Alexandrium* surveys this year. This report includes the results from all surveys conducted through July 31. Results from surveys on July 9 and July 14 documented that the bloom had ended, with *Alexandrium* counts from both nearfield and offshore stations all well below 100 cells per liter, so the Contingency Plan threshold of 100 cells per liter for nearfield stations was not exceeded this year. Preliminary results for the August and September water column surveys (not shown) also confirmed that the 2020 bloom was over.

In the figures below, we compare nearfield *Alexandrium* data to the threshold for each sample collected at nearfield stations through July 2020. The first figure includes data since the start of the monitoring program in 1992. To better display recent values, the second figure shows data for 2020 only, including four regular surveys and two special surveys through July. Note logarithmic scale for each graph.

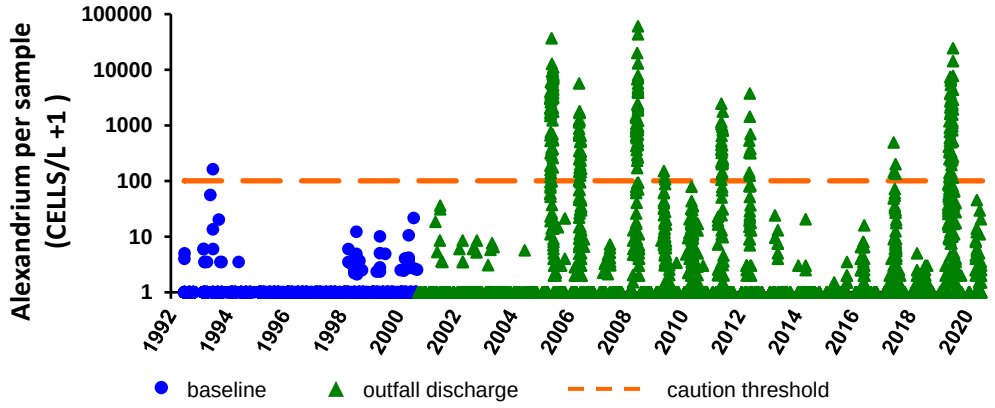

Figure 2. *Alexandrium* cell counts per sample in Nearfield (1992-2020)

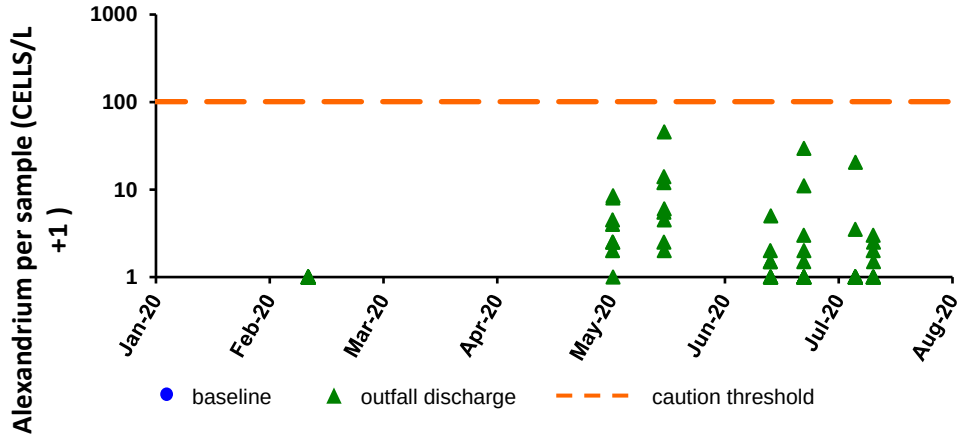

Figure 3. *Alexandrium* cell counts per sample in Nearfield 2020

***Alexandrium* per-sample abundance (cells/liter)**

Caution threshold	100
Summer 2020	45*

* maximum of all nearfield samples collected May – July 2020

***PHAEOCYSTIS* – summer (May - July) 2020**

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. This quarter, results from May to July 2020 became available.

The figure below shows the 2020 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, the historical seasonal pattern encompasses more time-points than shown for the current year.

Both the timing and magnitude of survey mean *Phaeocystis* abundance from May to July 2020 was within the range of the historical seasonal pattern.

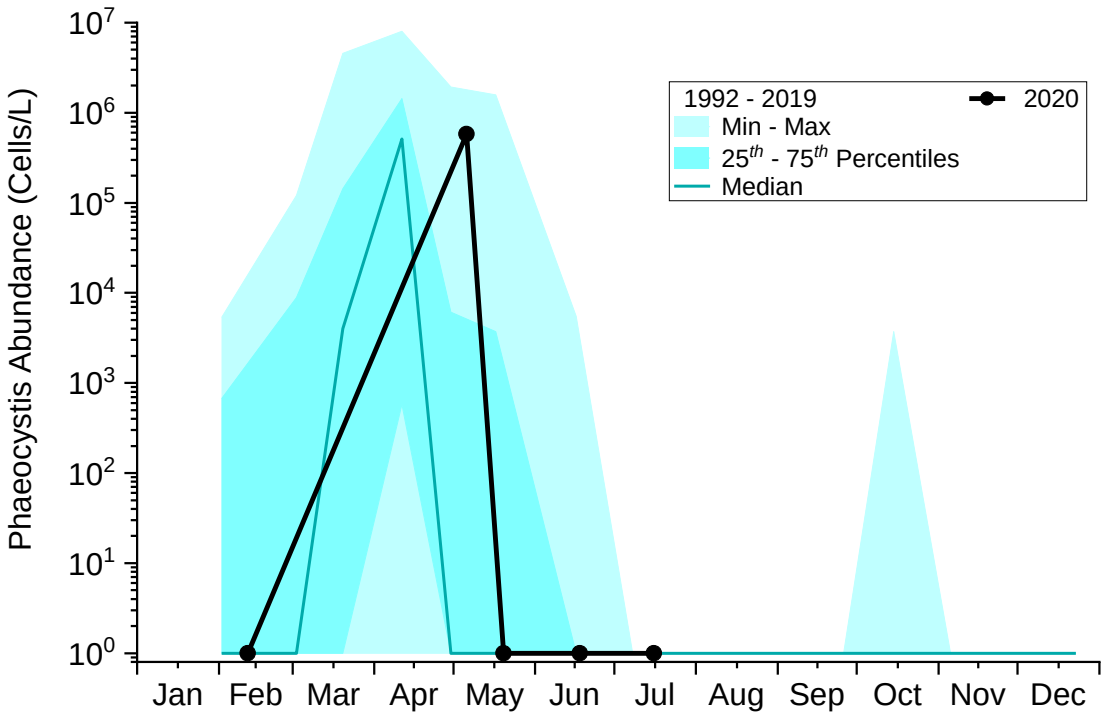

Figure 4. Nearfield Survey Mean abundance of *Phaeocystis* (1992 – 2020)

DISSOLVED OXYGEN (DO) – June - September 2020

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 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 - September 2020, results from four regular water column surveys show that bottom-water oxygen percent saturation and concentration in both the nearfield and in Stellwagen Basin are within the range observed in previous years. Oxygen percent saturation was somewhat lower than normal both in the vicinity of the outfall and in Stellwagen Basin in late summer. However, the results were well above background levels measured in the areas during baseline sampling between 1992 and September 2000. There were no threshold exceedances during this period (Figure 5 - Figure 8).

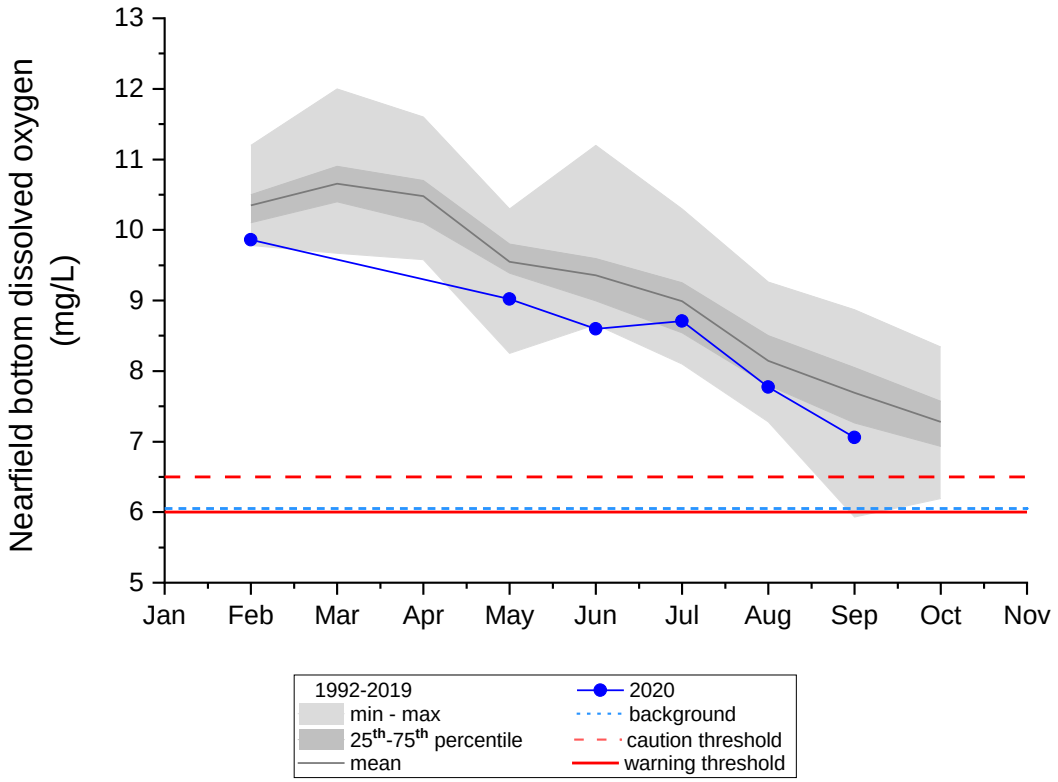

Figure 5. Bottom dissolved oxygen in Nearfield (1992 – 2020)

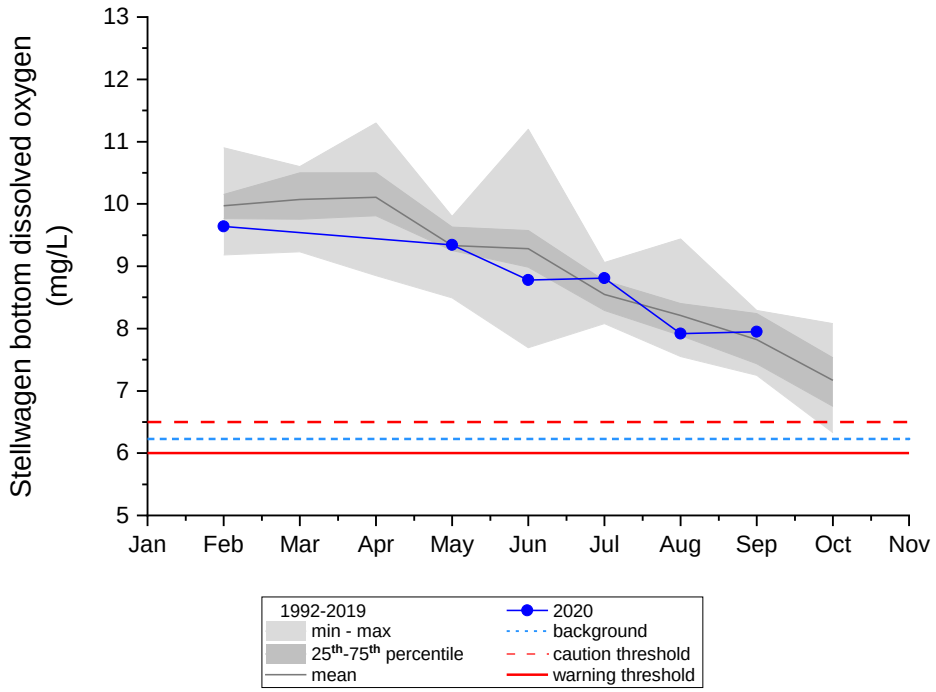

Figure 6. Bottom dissolved oxygen in Stellwagen Basin (1992 – 2020)

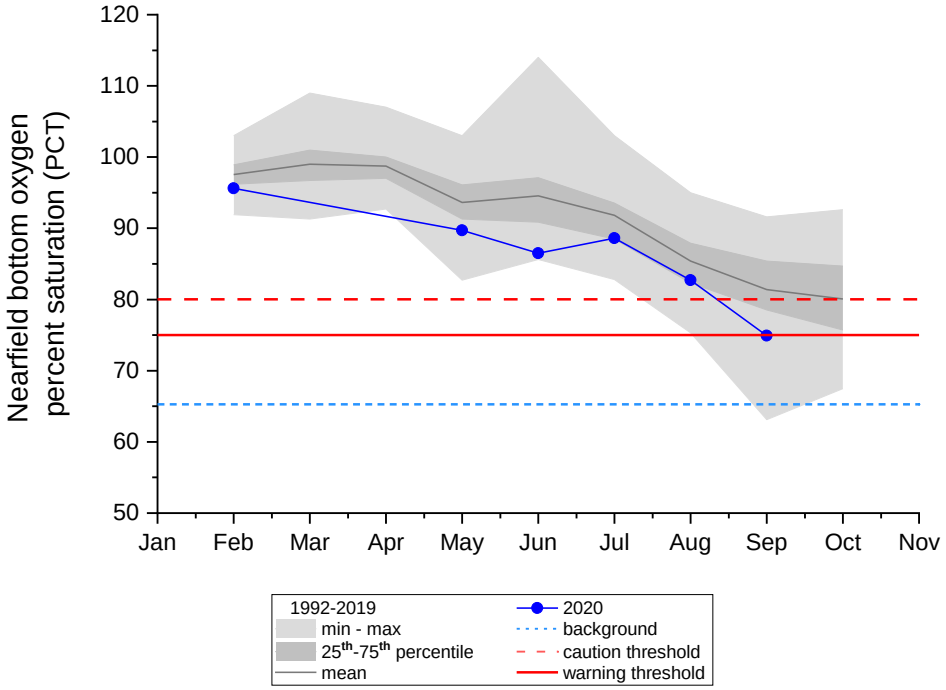

Figure 7. Bottom oxygen percent saturation in Nearfield (1992 -2020)

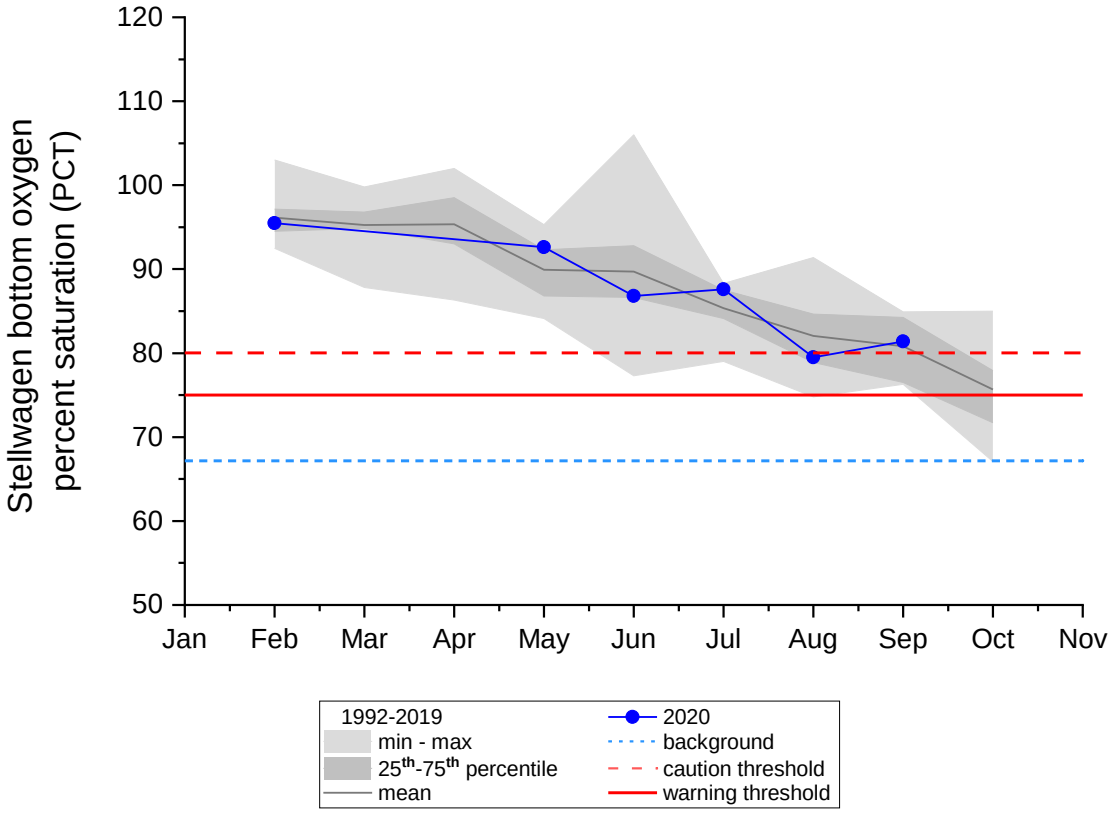

Figure 6. Bottom oxygen percent saturation in Stellwagen Basin (1992 -2020)