Contingency Plan Quarterly Report on Ambient Monitoring Results

Fourth 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 October through December 2023. Previous Contingency Plan reports are available at: http://www.mwra.state.ma.us/harbor/html/contingency.htm.

This report includes the results of 2023 October bottom-water dissolved oxygen; summer and autumn nuisance algae abundances; summer water column chlorophyll; and benthic biodiversity. Three threshold exceedances reported here. Dissolved oxygen concentrations exceeded the warning-level threshold in nearfield and the caution-level threshold in Stellwagen Basin in October, and chlorophyll concentrations exceeded the summer caution-level threshold.

DISSOLVED OXYGEN (DO)

The DO thresholds are tested on results collected in the bottom-water from sampling stations in the Massachusetts Bay nearfield (five stations within 7.5 kilometers from the outfall) and Stellwagen Basin (one station) during June through October each year. During these months, the water column is typically stratified. As a result of stratification, there is no physical mechanism for the water below the thermocline to be reaerated through exchange with the atmosphere, and natural biological consumption processes, enhanced by warm summer temperatures, cause DO concentration to decline in bottom-waters.

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 baseline sampling between 1992 and September 2000 from the two areas.

DISSOLVED OXYGEN CONCENTRATION AND PERCENT SATURATION – October 2023

In October 2023, low bottom-water oxygen levels previously observed in September remained or decreased. Consequently, there were Contingency Plan threshold exceedances of DO concentration in the nearfield and Stellwagen Basin, which included a warning-level exceedance for DO concentration in the nearfield and a caution-level exceedance for DO concentration in Stellwagen Basin (Figure 1). These exceedances were reported to EPA, DEP, and the public as required under the Contingency Plan.[1] There is currently no evidence this exceedance is related to the Deer Island Treatment Plant outfall discharge[1].

[1] https://www.mwra.com/harbor/pdf/20231103_amx.pdf

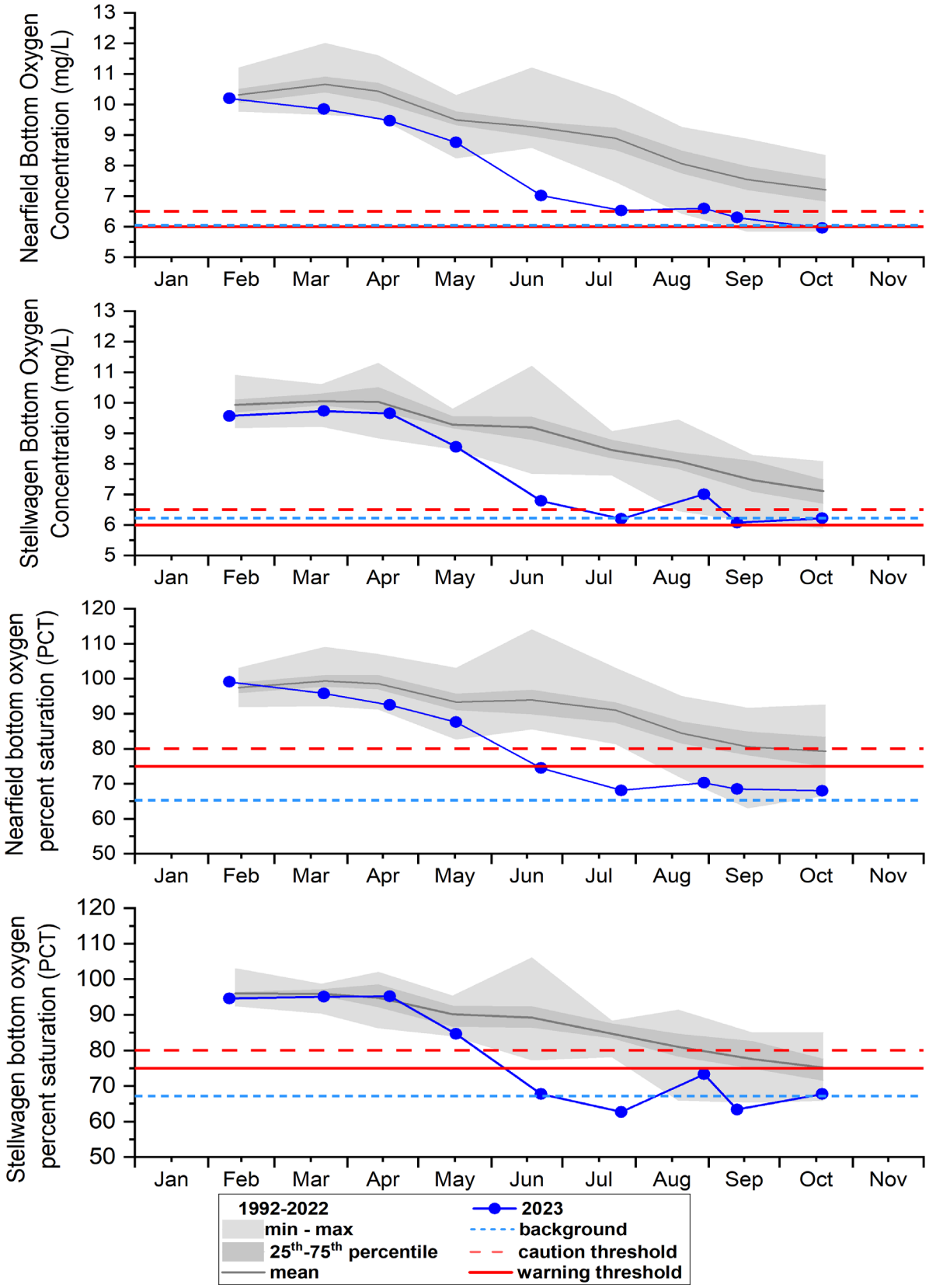

Figure 1. DO concentration and percent saturation 2023 seasonal progression results compared to 1992-2022 historical results in the nearfield and Stellwagen Basin.

DISSOLVED OXYGEN DEPLETION RATE – (June – October) 2023

An additional dissolved oxygen threshold is the nearfield bottom-water dissolved oxygen depletion rate, which measures the rate at which oxygen in the bottom-water decreases during the water column stratified period from June to October. During this period, the dissolved oxygen concentrations in the bottom-water usually decrease to lower levels. Even if the concentration measurements remain healthy, an excessively rapid decline could signal a future problem. The lower the depletion rate, the better it is for marine organisms, because more oxygen remains in the bottom-water through the summer season.

The Contingency Plan threshold values for the oxygen depletion rate are based on the measurements from the baseline years; the caution threshold is the value at 1.5 times of the baseline mean rate, while the warning threshold is twice that of the baseline mean rate.

The nearfield DO depletion rate during the 2023 stratified period was 0.008 mg/L/day (Figure 2), which was the lowest in all previous years before and after the diversion of the discharge from Boston Harbor to Massachusetts Bay, and well below the caution-level threshold of 0.037 mg/L/day and the warning-level threshold of 0.049 mg/L/day. Even though the historical low bottom-water DO concentrations were observed during surveys in June and July (Figure 1), which could be due to the regional-wide *Tripos muelleri* bloom, the low depletion rate since June indicated that there was little further decrease of the bottom DO level through October.

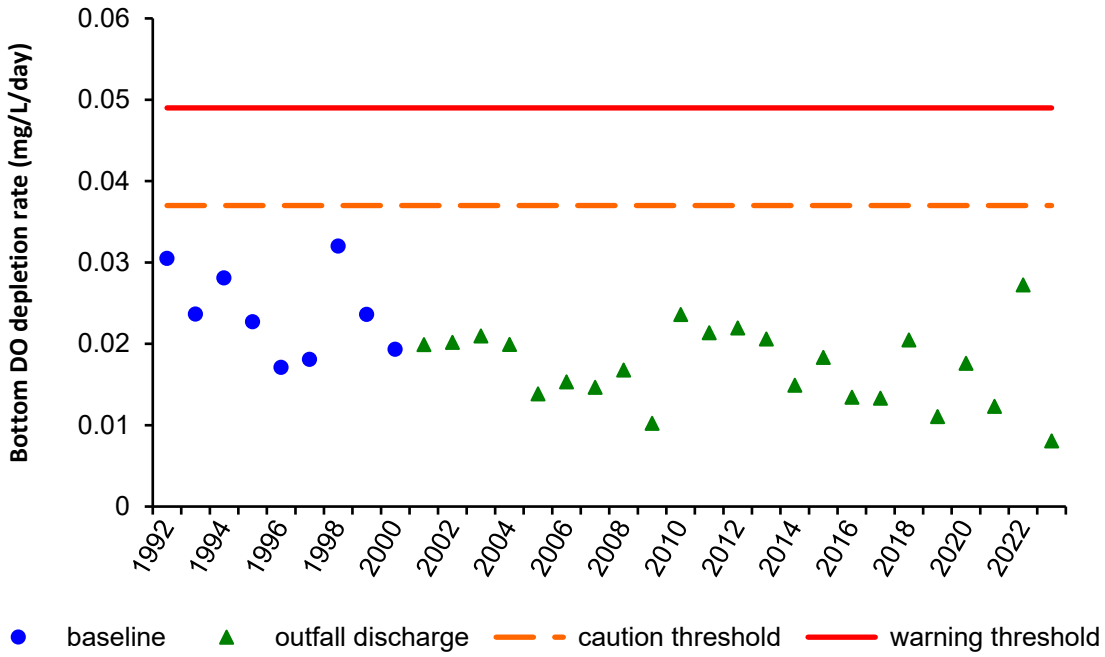

Figure 2. Bottom oxygen depletion rate in the nearfield (1992 – 2023)

NUISANCE ALGAE

PSEUDO-NITZSCHIA – summer (May – August) 2023

There were no *Pseudo-nitzschia* threshold exceedances for summer 2023. For *Pseudo-nitzschia* nuisance algae species, the caution level threshold values were derived from the 95th percentile of seasonal baseline means, and seasonal mean abundances at nearfield stations are compared against threshold values.

During summer 2023, *Pseudo-nitzschia* was observed with low abundance in multiple samples from nearfield stations. The summer mean abundance of 591 cells per liter was well below the caution level threshold of 43,100 cells per liter.

Figure 3 shows the *Pseudo-nitzschia* caution level thresholds for summer and the mean abundance data for that season from since the start of the monitoring program in 1992.

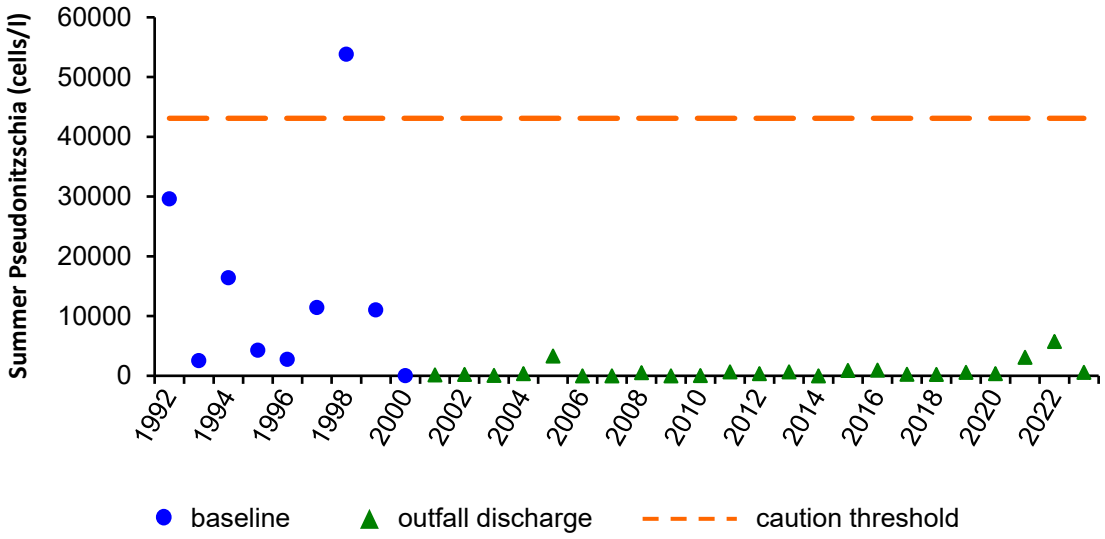

Figure 3. Nearfield *Pseudo-nitzschia* cell concentrations (summer 1992-2023)

PHAEOCYSTIS – autumn (August – September) 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 *P. pouchetii* compared to its historical results.

Figure 4 shows the 2023 survey mean 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[2].

No *P. pouchetii* cells were observed in samples collected during surveys in August to September 2023 (Figure 4).

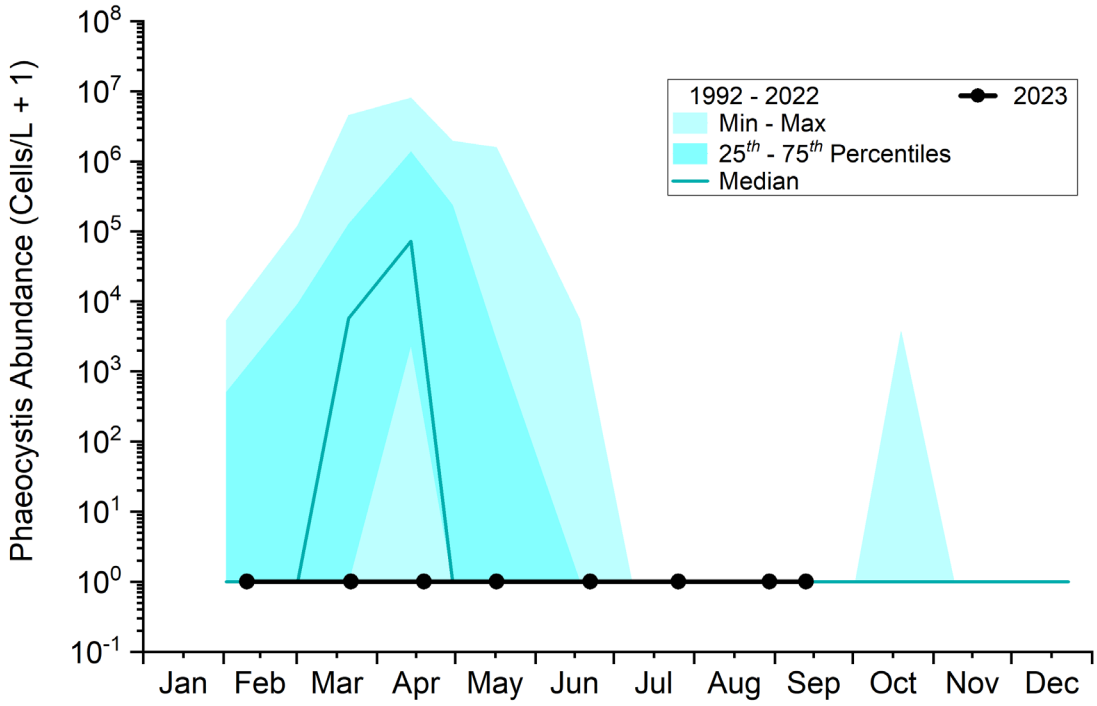

Figure 4. Nearfield Survey Mean abundance of *Phaeocystis* (1992 – 2023)

CHLOROPHYLL – summer (May – August) 2023

The chlorophyll seasonal caution level threshold value was derived from the 95th percentile of seasonal baseline means. Seasonal mean chlorophyll concentration at nearfield stations are compared against threshold values. The caution level threshold is 89 mg/m^2 for the summer season.

There was a chlorophyll threshold exceedance for summer 2023 (Figure 5). The summer nearfield mean areal chlorophyll was 163 mg/m^2, which exceeded the summer caution level thresholds of 89 mg/m^2. This exceedance was reported to EPA, DEP, and the public as required under the Contingency

[2] 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

Plan[3]. There is currently no evidence that this exceedance is related to the Deer Island Treatment Plant outfall discharge. A large bloom of the dinoflagellate species *Tripos muelleri* in the Gulf of Maine this summer may have contributed to this threshold exceedance.

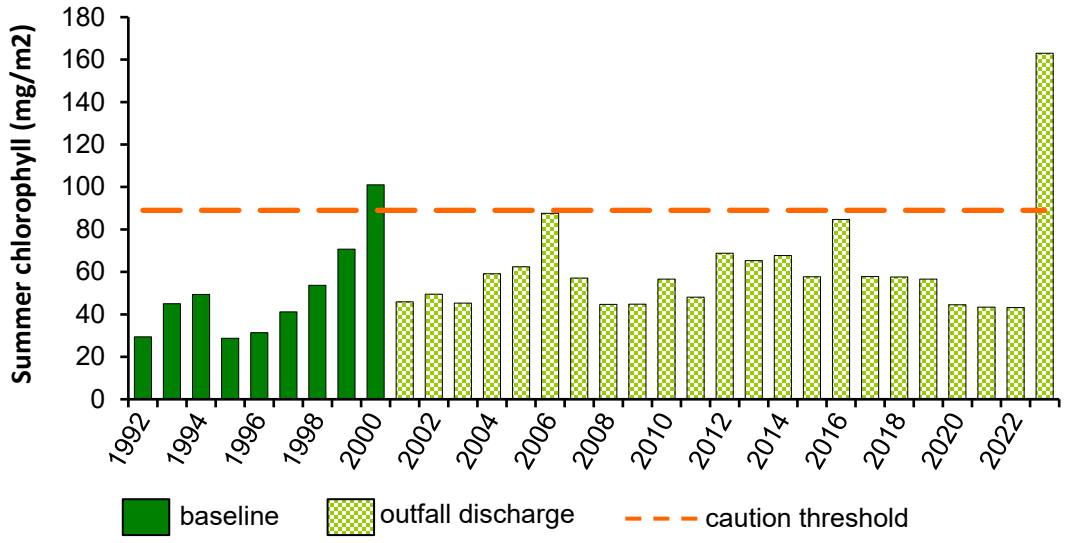

Figure 5. Nearfield summer mean areal chlorophyll-a concentrations (1992-2023)

SEDIMENT BIODIVERSITY - 2023

Every summer MWRA collects samples to measure the condition of the benthic community (organisms living on and in the sea floor) near the outfall. These measurements are used to calculate four indicators of sediment biodiversity and the proportion of opportunistic animals in the benthic community. The latter is an important indicator of benthic habitat quality; opportunistic animals are found to predominate in degraded sediments.

DIVERSITY

In 2023, all four biodiversity indicators show that the sediment habitat in the vicinity of the outfall support highly diverse populations of benthic species (Figure 6). All indicators are above the Contingency Plan caution level thresholds, indicating a healthy benthic community. The caution level thresholds are calculated as the 2.5th percentile of the baseline mean measurements of these indicators.

[3] https://www.mwra.com/harbor/pdf/20231208_amx.pdf

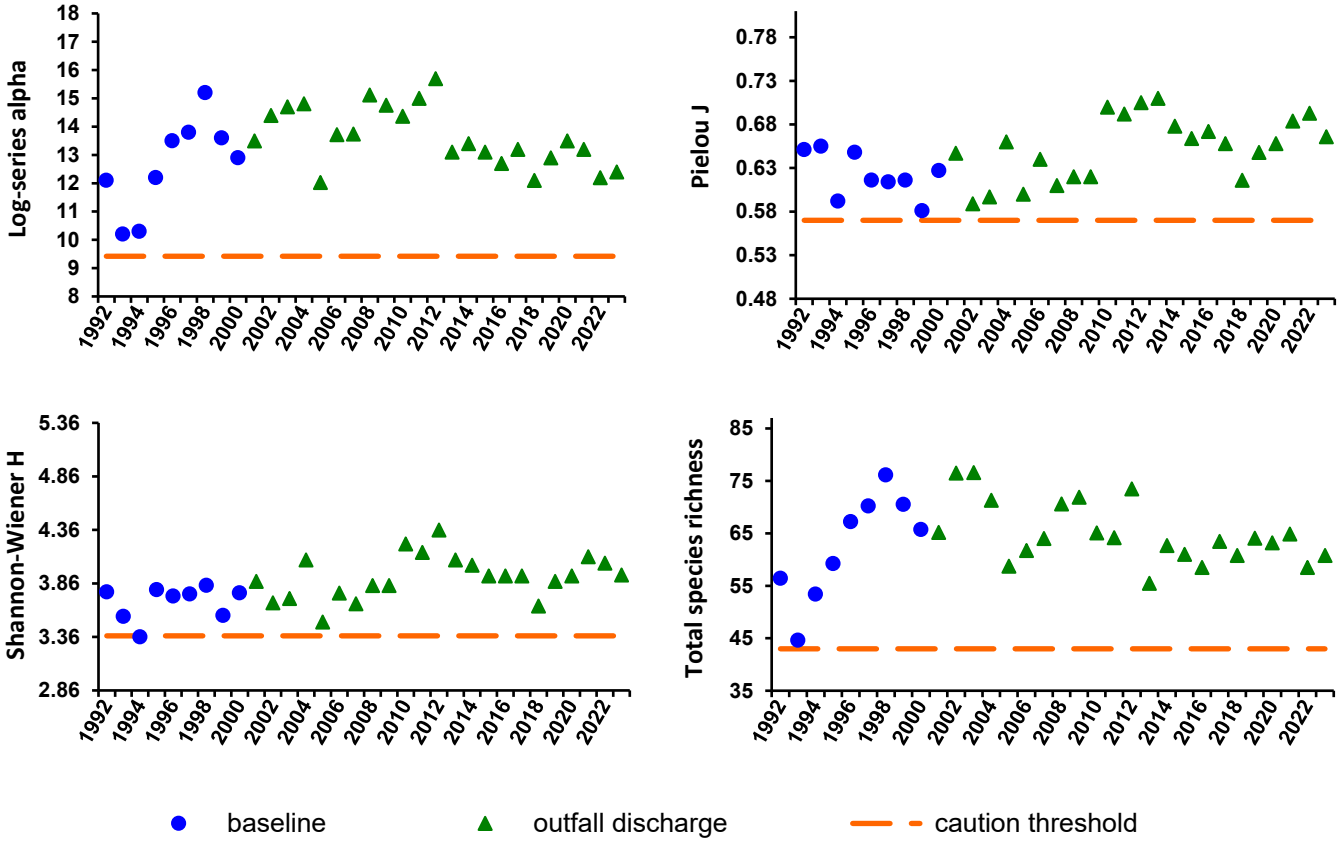

Figure 6. Nearfield benthic biodiversity indicators (1992 – 2023)

OPPORTUNISTS

In 2023, the average percent opportunists was low (0.2%) and within the range of previous years in both before (baseline) and after the diversion of the discharge from Boston Harbor to Massachusetts Bay, and remains far below the caution level threshold of 10% of the total population (Figure 7).

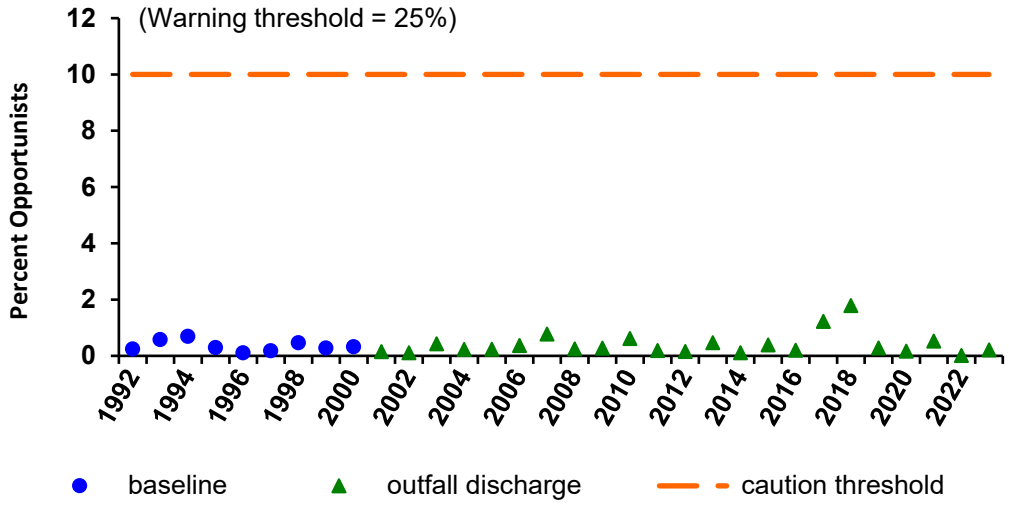

Figure 7. Percent opportunists in nearfield (1992 – 2023)