

Monroe Lake (MNR) Water Quality Summary

Summary of 2020 Water Quality Results

Monroe Lake had no exceedances of IN's water quality criteria at the tailwater (MNR10000). Total phosphorus levels at all sample locations exceeded the USEPA nutrient criteria, and 10 out of 18 samples exceeded the total nitrogen criteria. The mean TSI category for all three indices classified the lake as eutrophic, indicating a high level of biological activity. Finally, our sampling showed cyanobacteria cell counts over 100,000 cells/mL in 10 out of 17 samples and, based on their own sampling, IDEM issued HAB Advisory alert levels at both SRAs in 2020. The elevated nutrient levels and eutrophic TSI classification indicate there is a high potential for HAB development in the lake.

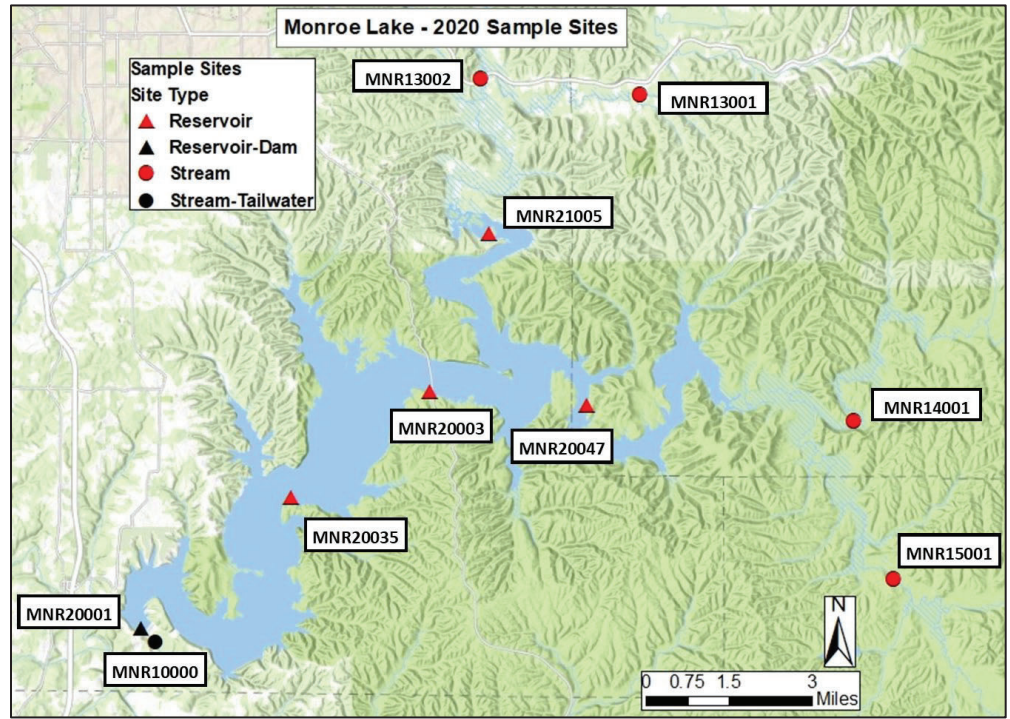


Figure 1. Water quality sampling locations for Monroe Lake in 2020.

2020 Activities

In 2020, one sampling event was conducted at Monroe Lake. Field data and chemical samples were collected at all sample sites (Figure 1). Chlorophyll and phytoplankton were collected at all reservoir sites, and zooplankton samples were collected at the damsite (MNR20001).

Additionally, temperature and dissolved oxygen (DO) profiles were collected by the project staff at the damsite and tailwater approximately every two weeks from late May through early November.

Exceedances of IN State Water Quality Criteria

There were no exceedances of IN state water quality criteria at the tailwater.

Tailwater Temperature and DO Conditions

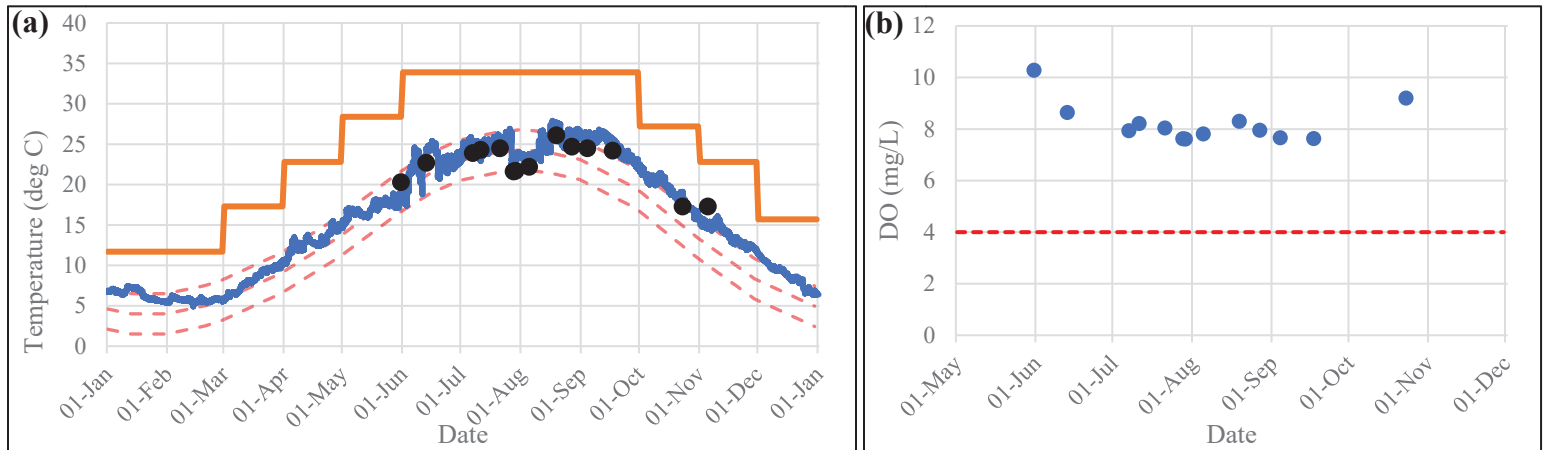


Figure 2. Monroe Lake tailwater temperature and DO data. (a) Tailwater temperature data collected by project staff in 2020 is represented by the black dots. The blue line represents USGS gage data (provisional) from a gage downstream from the project. The temperature guide curve is represented by the dashed red lines, and the orange line represents the IN water quality criteria for temperature. (b) Tailwater dissolved oxygen data collected in 2020 is represented by the blue dots. The IN water quality criteria for DO is represented by the dashed red line.

Tailwater data was compared to IN state water quality criteria for temperature and to the Louisville District's temperature guide curve for Monroe Lake (Figure 2a). Tailwater temperature did not exceed the state criteria for temperature at any time; however, tailwater temperatures fell outside the guide curve in early June and much of the time mid-August through the end of the year (mostly minor deviations from the guide curve). The WQ Program will use these findings to inform future operational decisions to improve performance of downstream temperature management wherever possible. Tailwater dissolved oxygen levels were compared to the state criteria for DO (Figure 2b). Tailwater DO did not exceed state criteria at any time throughout the year.

Nutrient Analyses

Nutrient data, including total nitrogen (TN) and total phosphorus (TP) data, were collected at all sample sites in 2020. The 2020 TP and TN values were compared to historical data from 2012 through 2019 (Figure 3). The TP and TN values at each site were compared to their respective USEPA recommended criteria. Nutrient levels are an area of concern because elevated nutrients can lead to high biological activity, especially with respect to HABs.

Total Phosphorus

2020 TP values at Monroe Lake were near or below historical medians at all sites, except for three sites which had elevated 2020 TP levels compared to historical values. Also, 2020 TP levels at all sites were above the USEPA recommended nutrient criteria for the respective locations.

Total Nitrogen

2020 TN values at Monroe Lake were generally at or below the historical TN median. However, when compared to USEPA nutrient criteria, 10 out of 18 samples were above the recommended TN criteria in 2020.

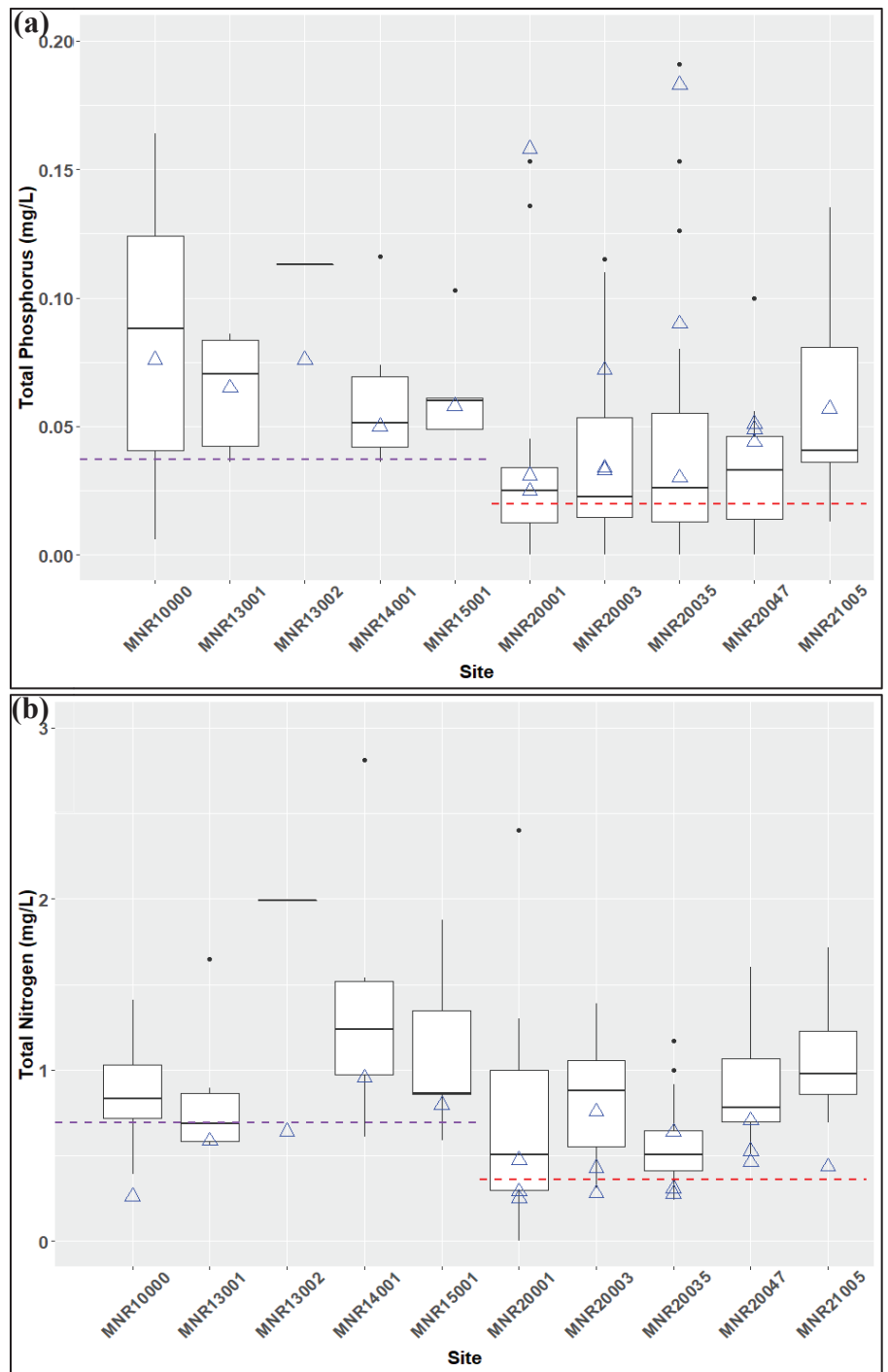


Figure 3. Comparison of 2020 Monroe Lake nutrient data to historical samples and nutrient criteria. Boxplots represent data collected in 2012-2019 and blue triangles represent 2020 data. Purple and red dotted lines represent USEPA recommended nutrient criteria for streams and reservoirs, respectively. (a) Comparison of total phosphorus data. Four historical outliers were excluded to make the plot easier to interpret (outlier values ranged from 0.22 to 0.31 mg/L). (b) Comparison of total nitrogen data. One historical outlier was excluded to make the plot easier to interpret (value of outlier was 21.049 mg/L).

Cyanobacteria Data, HABs, and Trophic State Index

Cyanobacteria Data

17 phytoplankton samples were collected at various depths from 5 sites. Total cyanobacteria cell counts exceeded 100,000 cells/mL (guideline value for moderate health risk from the World Health Organization's Guidelines for Safe Recreational Water Environments [2003]) in 10 out of 17 samples collected from 4 sites. None of these samples exceeded 1,000,000 cells/mL. These results indicate Monroe Lake had cell count levels potentially indicative of a HAB at the time of sampling.

Harmful Algal Bloom (HAB) Response

IDEM is the lead agency for HAB response in Indiana. IDEM samples State Recreation Areas (SRA) biweekly during the recreation season and issues appropriate HAB alert level based on the results. IDEM issued HAB Advisory alert levels at the Paynetown SRA from 7/31/20 through 9/4/20 and at Fairfax SRA from 8/14/20 through 9/4/20. The Advisory alert level indicates that cell counts were over 100,000 cells/mL, but toxin levels did not meet thresholds for the Caution or Closed alert levels. At an Advisory alert level, the following precautions apply: swimming and boating permitted; avoid contact with algae; don't drink the water; and shower after you swim.

TSI

The trophic state indices for Secchi depth [TSI(SD)], chlorophyll-*a* [TSI(CHL)], and total phosphorus [TSI(TP)] were calculated for five reservoir sites at Monroe Lake (Table 1). The mean category of all three indices was eutrophic, indicating a high level of biological activity.

Table 1. Summary of calculated trophic state indices at Monroe Lake.

	Mean Score (range)	Mean Category (Range)
TSI(SD)	60 (45-75)	Eutrophic (Mesotrophic-Hypereutrophic)
TSI(CHL)	57 (46-67)	Eutrophic (Mesotrophic-Hypereutrophic)
TSI(TP)	56 (51-62)	Eutrophic (Moderately Eutrophic-Eutrophic)