

Patoka Lake (PRR) Water Quality Summary

Summary of 2020 Water Quality Results

Patoka Lake had no exceedances of IN's water quality criteria at the tailwater (PRR10000). Total phosphorus at all sample locations and total nitrogen levels in over half of the sample locations exceeded the USEPA nutrient criteria. The mean TSI category for all three indices was eutrophic, indicating a high level of biological activity. Finally, our sampling showed cyanobacteria cell counts over 100,000 cells/mL in 17 out of 23 samples at the time of sampling. The elevated nutrient levels and eutrophic TSI classification indicate there is a high potential for HAB development in the lake.

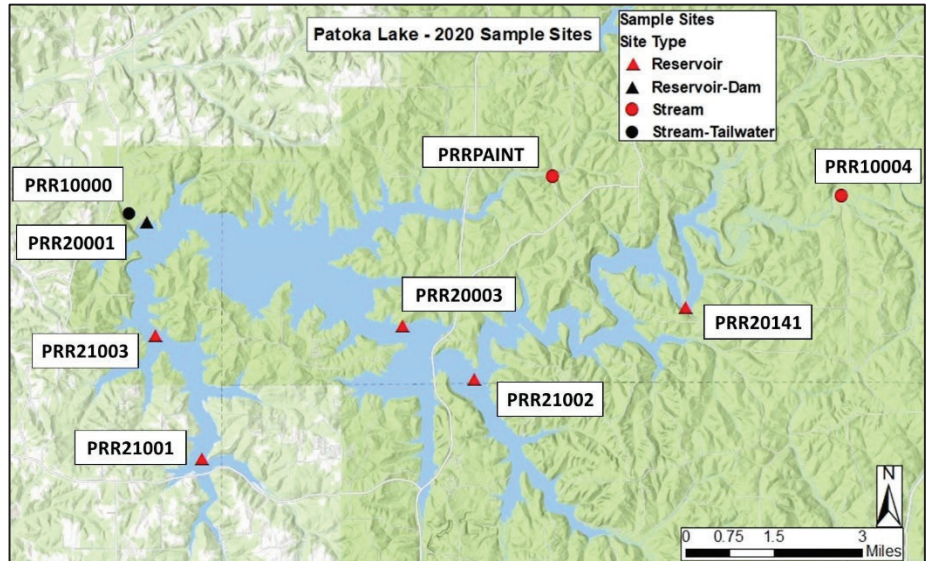


Figure 1. Water quality sampling locations for Patoka Lake in 2020.

2020 Activities

In 2020, one sampling event was conducted at Patoka Lake. Field data and chemical samples were collected at all nine sites (Figure 1). Chlorophyll and phytoplankton were collected at six sites, and zooplankton samples were collected at the damsite (PRR20001).

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 mid-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

Tailwater data was compared to IN state water quality criteria for temperature and to the Louisville District's temperature guide curve for Patoka Lake (Figure 2a). Tailwater temperature did not exceed the state criteria for

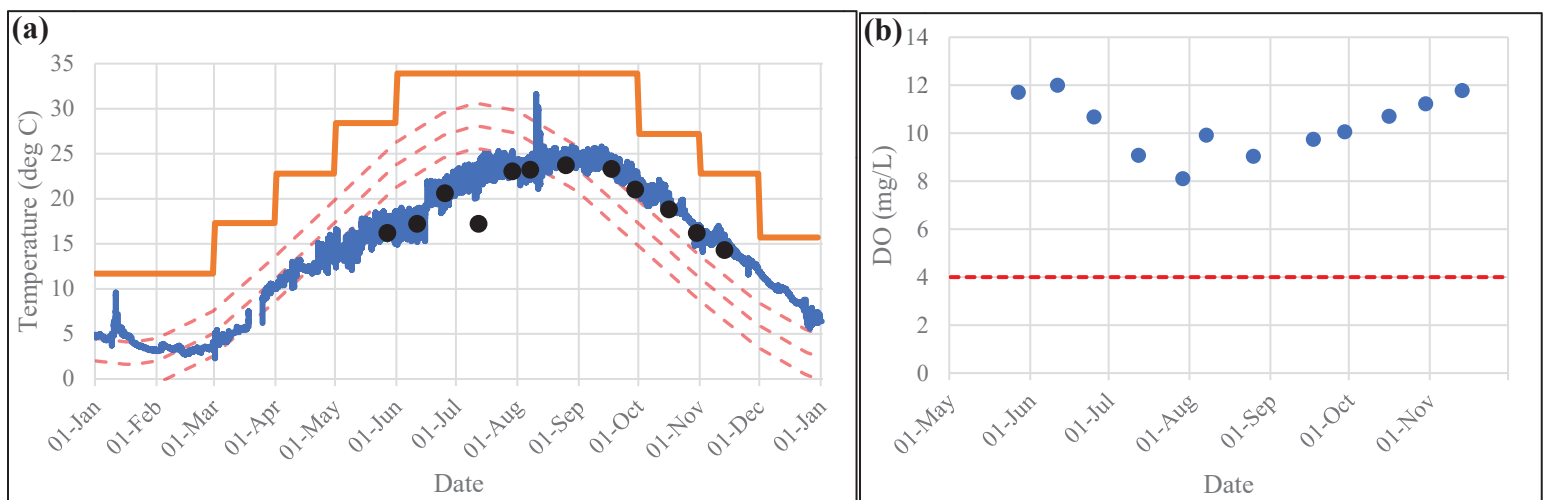


Figure 2. Patoka Lake tailwater temperature and DO data. (a) Tailwater temperature data collected by project staff in 2020 is represented by the black dots. The blue line represents USGS gage data (provisional) from a gage downstream from the project. The temperature guide curve is represented by the 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.

temperature at any time; however, tailwater temperature fell outside the guide curve mid-January, mid-April through mid-August, and early September through the end of the year. During January and from late October to the end of the year, the reservoir was de-stratified; therefore, nothing could be done operationally to maintain guide curve during those times. Additionally, maintenance issues with the selective withdrawal gates limited the capacity to operate for temperature in 2020. 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 did not exceed state criteria at any time throughout the year (Figure 2b).

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 Patoka Lake were above the historical medians and at the top of historical distributions at all sites, except one. Also, 2020 TP levels were above the USEPA recommended nutrient criteria at all sites.

Total Nitrogen

2020 TN values at Patoka Lake were near or below the historical medians in 13 out of 19 samples. Also, 2020 TN levels in 11 out of 19 samples were above the USEPA recommended nutrient criteria for the respective locations.

Cyanobacteria Data, HABs, and Trophic State Index

Cyanobacteria Data

23 phytoplankton samples were collected at various depths from 6 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 17 out of 23 samples collected from 5 sites. None of these samples

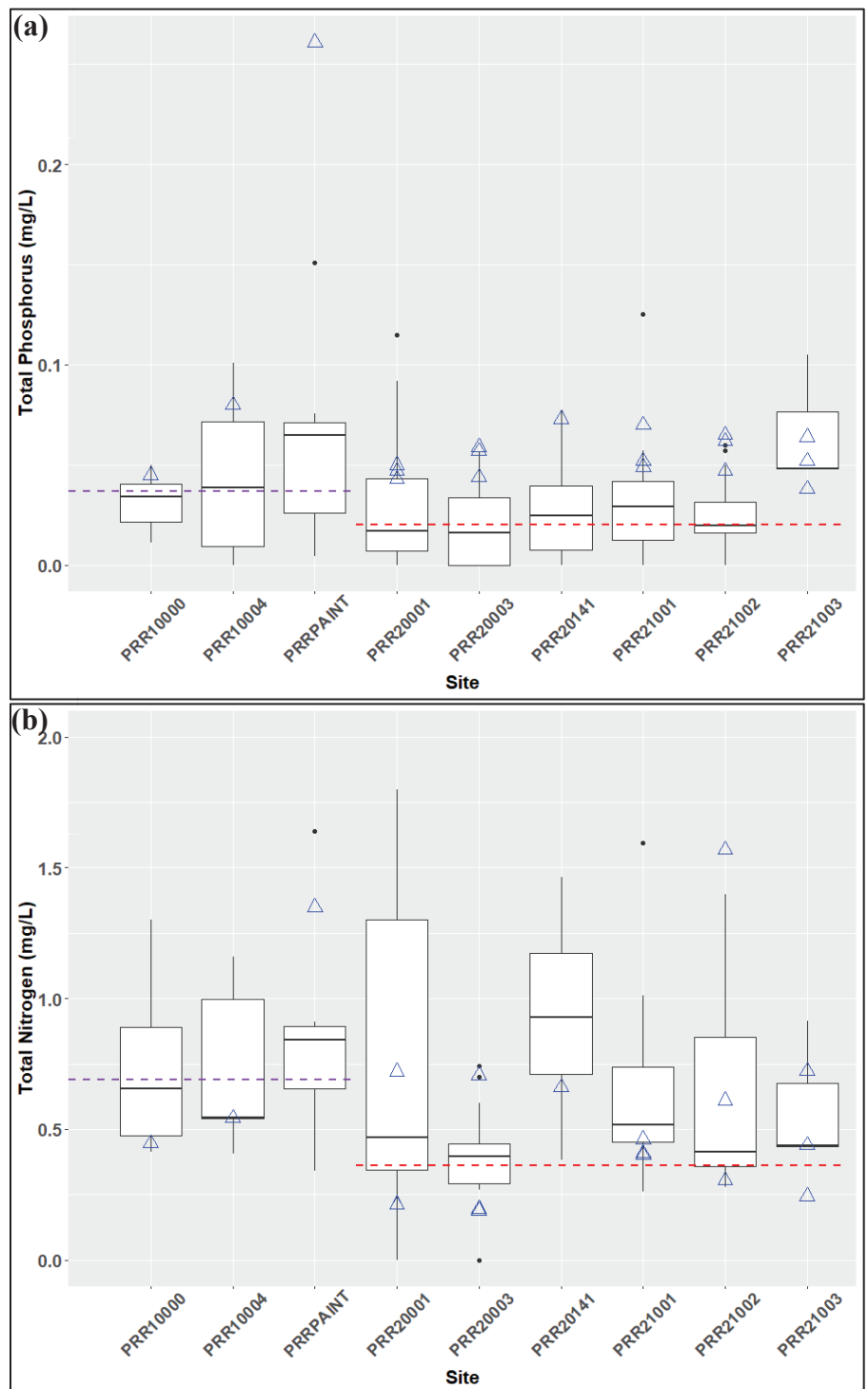


Figure 3. Comparison of Patoka Lake 2020 nutrients data to historical samples and nutrient criteria. Boxplots represent data collected in 2012-2019 and blue triangles represent 2020 data. Purple and red dotted lines represent USEPA recommended nutrient criteria for streams and reservoirs, respectively. (a) Comparison of total phosphorus data. (b) Comparison of total nitrogen data. Three outliers (values ranging from 2.2-2.894 mg/L) were removed to make the graph easier to interpret.

exceeded 1,000,000 cells/mL. These results indicate Patoka 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 (SRAs) biweekly during the recreation season and issues appropriate HAB alert level based on the results. IDEM issued HAB Advisory alert levels at the Patoka SRA Beach from 7/17/20 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 six reservoir sites at Patoka 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 Patoka Lake.

	Mean Score (range)	Mean Category (Range)
TSI(SD)	56 (48-76)	Eutrophic (Mesotrophic-Hypereutrophic)
TSI(CHL)	57 (50-64)	Eutrophic (Mesotrophic-Eutrophic)
TSI(TP)	60 (57-66)	Eutrophic (Eutrophic-Hypereutrophic)