

Buckhorn Lake (BHR) Water Quality Summary

Summary of 2020 Water Quality Results

Buckhorn Lake had no exceedances of Kentucky's water quality criteria at the tailwater (BHR10000). When compared with USEPA's recommended nutrient criteria, total phosphorus (TP) levels at all sample locations exceeded the criteria, and one sample (taken from the tailwater) exceeded the USEPA recommended total nitrogen criteria. TSI categories from all three indices ranged from oligotrophic to hypereutrophic. There were no cyanobacteria samples collected that exceeded 100,000 cells/mL. While cell counts were not indicative of HABs at the time of sampling, the high TP levels could indicate some potential for HAB development in the lake.

2020 Activities

In 2020, one sampling event was conducted at Buckhorn Lake. Field data and chemical samples were collected at all sampling locations (Figure 1). Chlorophyll and phytoplankton were collected at all reservoir sites, and zooplankton samples were collected at the damsite (BHR20001).

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

Exceedances of KY State Water Quality Criteria

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

Tailwater Temperature and DO Conditions

Tailwater temperature data was compared to KY state water quality criteria for temperature and to the Louisville District's temperature guide curve for Buckhorn Lake (Figure 2a). While tailwater temperature never exceeded the KY

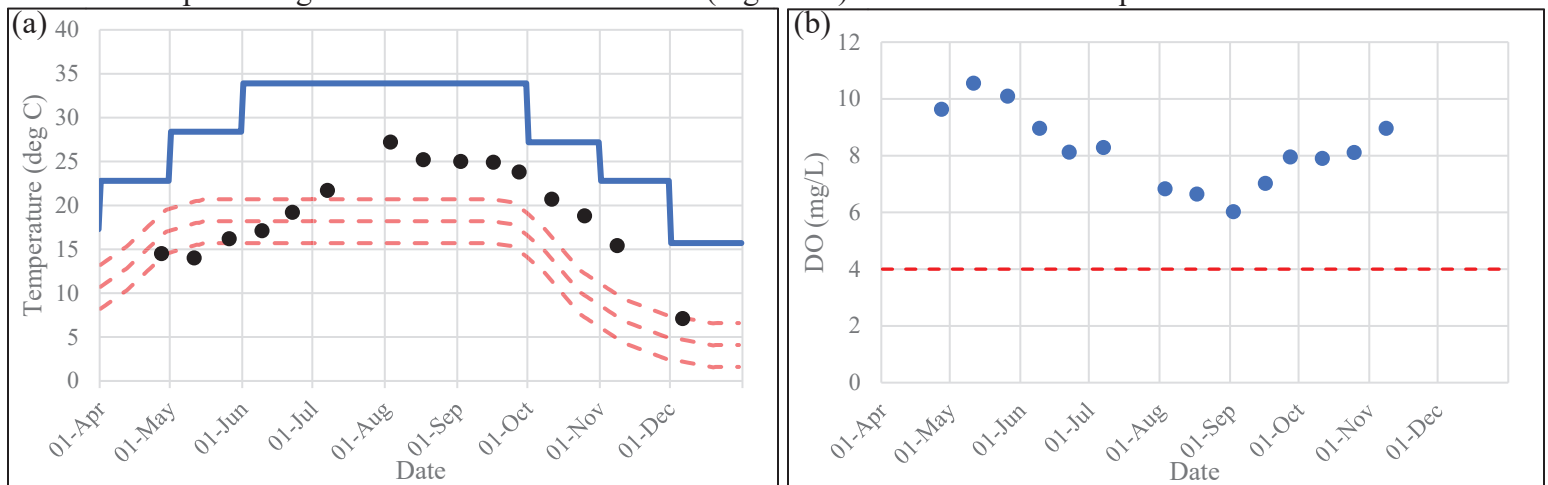


Figure 2. Buckhorn Lake tailwater temperature and dissolved oxygen data. (a) Tailwater temperature data collected in 2020 is represented by the black dots. The temperature guide curve is represented by the dashed red lines, and the blue line represents the KY water quality criteria for temperature. (b) Tailwater dissolved oxygen data collected in 2020 is represented by the blue dots. The KY water quality criteria for DO is represented by the dashed red line.

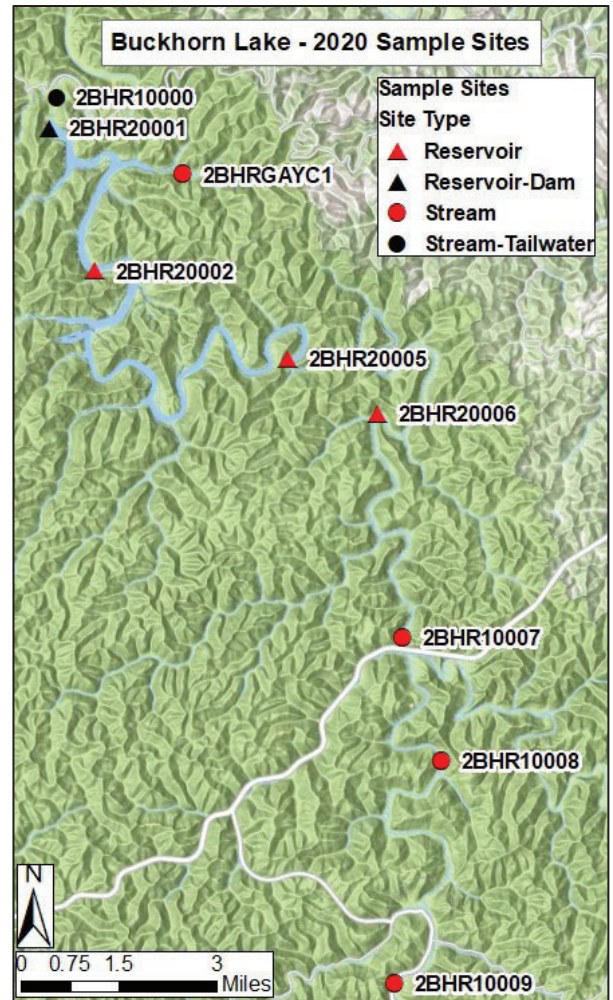


Figure 1. Water quality sampling locations for Buckhorn Lake in 2020.

state criteria for temperature, tailwater temperature fell outside the guide curve from August through early November. However, profile data indicates that the reservoir did not contain adequate cold water necessary to meet the guide curve, so no operation changes could have been made to mitigate this issue. Tailwater dissolved oxygen temperatures were compared to state criteria for DO (Figure 2b). Tailwater DO remained above minimum DO criteria 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 all sites were higher than historical medians and were at or above the top of the distribution of historical values for each location. Also, 2020 TP levels at all locations were above the USEPA recommended nutrient criteria for the respective locations.

Total Nitrogen

2020 TN values were generally lower than historical medians and were at or below the distribution of historical values for each location. Only one 2020 TN value (at the tailwater site) exceeded the USEPA recommended nutrient criteria.

Cyanobacteria Data, HABs and Trophic State Index

Cyanobacteria Data

12 phytoplankton samples were collected from various depths at 3 sites. Total cyanobacteria cell counts at all sample locations did not exceed 100,000 cells/mL (guideline value for moderate health risk from the World Health Organization's

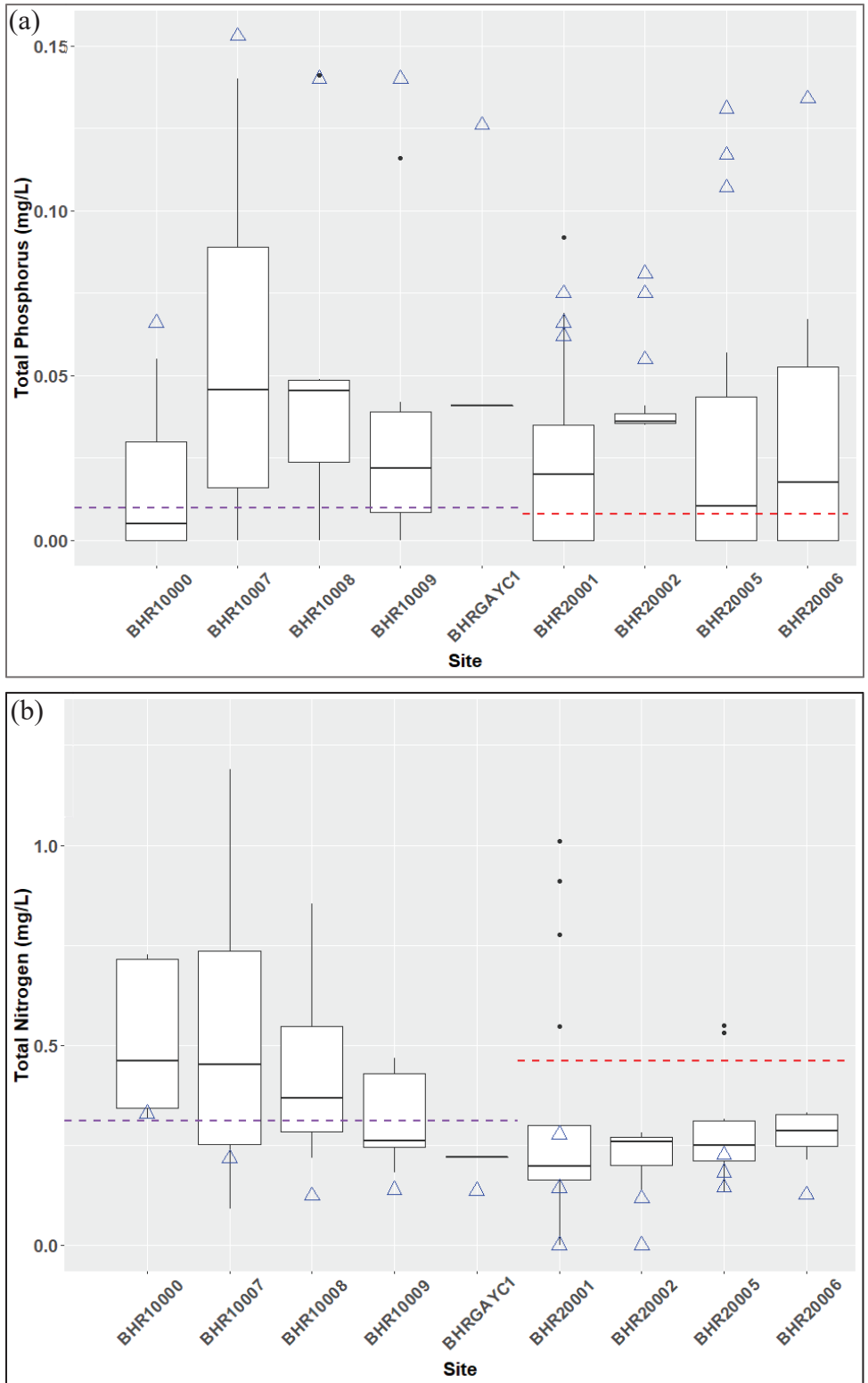


Figure 3. Comparison of Buckhorn Lake's 2020 nutrient data to historical samples. Boxplots represent data collected in 2012-2019 and blue triangles represent 2020 data. Purple and red dotted lines represent USEPA recommended nutrient criteria for streams and reservoirs, respectively. (a) Comparison of total phosphorus data. (b) Comparison of total nitrogen data. One historical outlier (value = 2.81 mg/L) was excluded to make the plot easier to interpret.

Guidelines for Safe Recreational Water Environments [2003]).

Harmful Algal Bloom (HAB) Response

KY Division of Water (KDOW) is the lead agency for HAB response in Kentucky. KDOW did not issue any advisories for HABs at Buckhorn Lake in 2020.

Trophic State Index (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 Buckhorn Lake (Table 1). The mean categories of the three indices ranged from mesotrophic to hypereutrophic, indicating varying levels of biological activity potential.

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

	Mean Score (range)	Mean Category (range)
TSI(SD)	50 (44-57)	Mesotrophic (Mesotrophic-Eutrophic)
TSI(CHL)	34 (31-45)	Oligotrophic (Oligotrophic-Mesotrophic)
TSI(TP)	69 (62-75)	Hypereutrophic (Eutrophic-Hypereutrophic)