

Cagles Mill Lake (2018)

Water Quality Takeaways

- High potential for harmful algal blooms
- No exceedances of state water quality criteria
- Closely followed established temperature targets

General Information and Water Quality

Cagles Mill Lake (CMR) is located in Putnam and Owen counties in Indiana. The dam was built by the Louisville District US Army Corps of Engineers (LRL) for the primary purpose of flood control and became operational in June 1953. The dam site is located at river mile 2.8 of Mill Creek.

Water quality (WQ) in the tailwater is assessed by analyzing 2018 data for exceedances of WQ criteria established by the IN Department of Environmental Management (IDEM). No criteria were exceeded in the tailwater (2CMR10000; Figure 1). However, CMR exceeded the USEPA's recommended criteria for total phosphorus, total nitrogen, and turbidity. This is common among IN lakes but can contribute to harmful algal blooms.

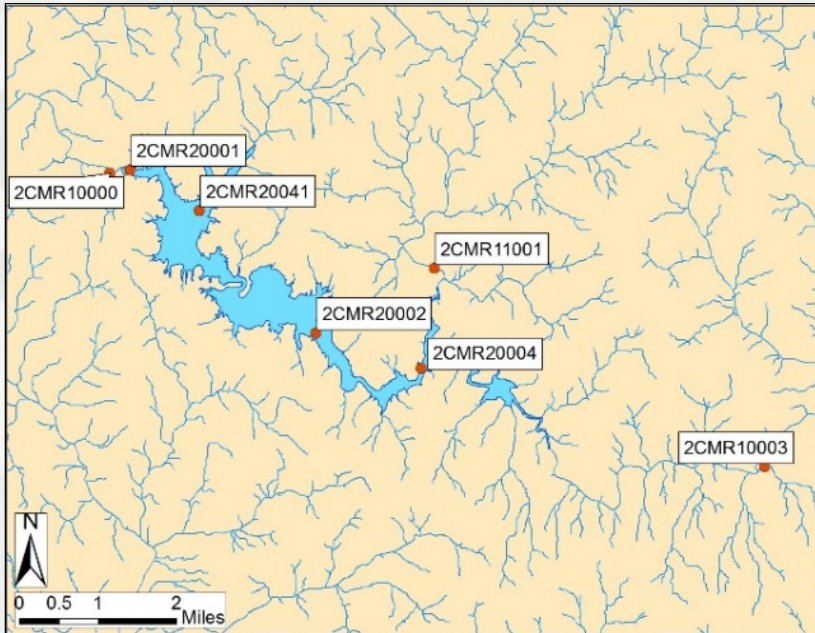


Figure 1. CMR sample sites in 2018 for field and chemical data.

Tailwater Conditions

Temperature and dissolved oxygen (DO) profile data are regularly collected from LRL lakes and tailwaters. This data informs water control engineers on how to best use existing selective withdrawal capabilities to meet downstream WQ targets. WQ targets are established by each lake's Water Control Plan (WCP) and state criteria. Figure 2a shows a time series graph of the 2018 tailwater (2CMR10000; Figure 1) water temperature compared with the guide curve from the lake's WCP. CMR closely followed the established temperature targets. Figure 2b shows a 2018 time series graph of the lake's tailwater DO data with the applicable state criteria (blue line). CMR met established state water quality criteria for dissolved oxygen.

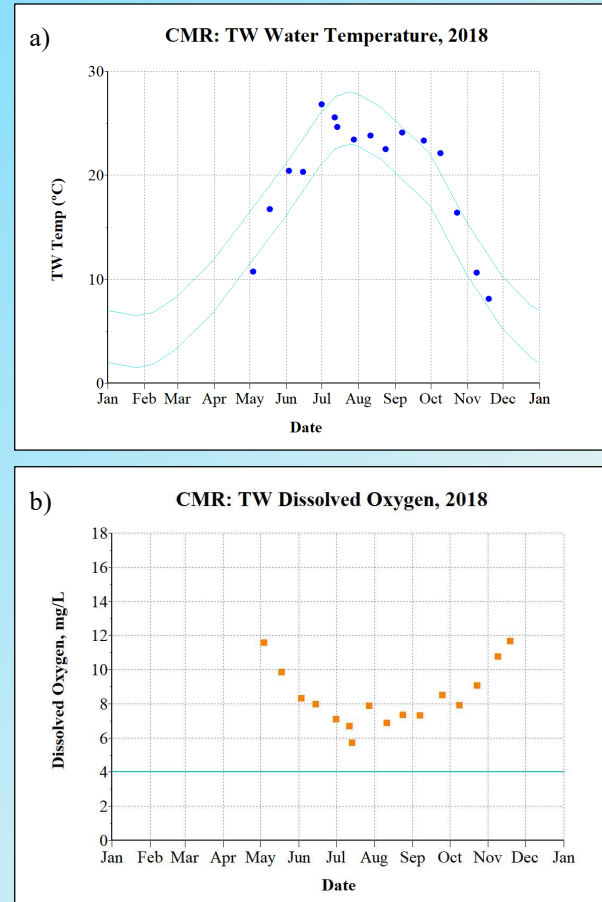


Figure 2. CMR time series data collected from the tailwater (2CMR10000; Figure 2): a) water temperature; and b) dissolved oxygen.



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Reservoir Conditions and Operations

Below (Figure 3a and b) are time series contour plots of CMR profile data collected at the damsite (2CMR20001; Figure 1) in 2018. The figures show the progression of temperature and dissolved oxygen availability throughout the year. CMR temperature profile data collected in 2018 (Figure 3a) indicates that the reservoir thermally stratifies and retains cold water throughout the summer. Additionally, Figure 3b indicates that the reservoir is adequately oxygenated.

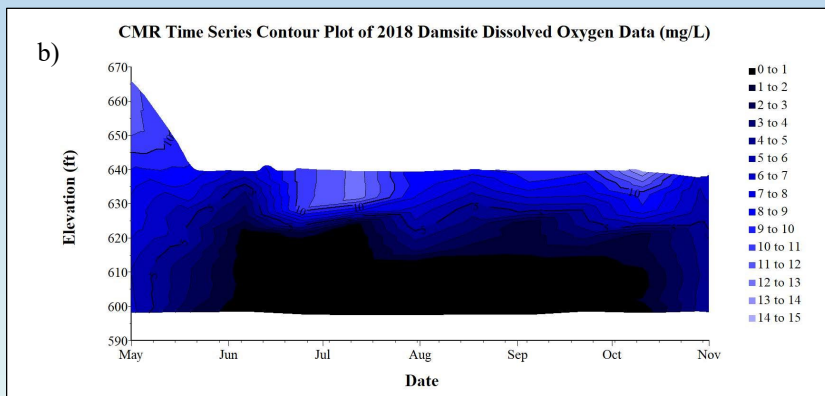
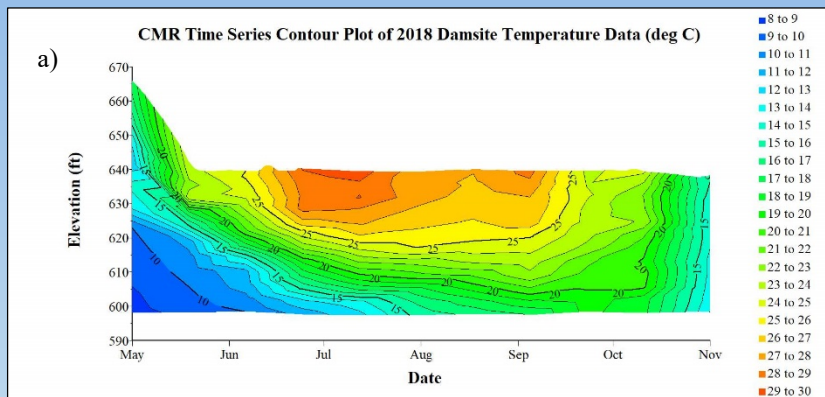


Figure 3. CMR time series data collected from the damsite (2CMR20001; Figure 1) during 2018: a) water temperature; and b) dissolved oxygen.

Reservoir Biological Conditions

Trophic State Index (TSI) was calculated using values from Secchi Depth, Chlorophyll-a, and Total Phosphorus analyses. The TSI values below were calculated for multiple sites with the 2018 data. The results shown in Table 1 suggest that CMR is at a minimum eutrophic (TSI score from 51-69). This means that CMR has a high concentration of nutrients, which can be detrimental to life in the lake in multiple ways.

Table 1. TSI scores and trophic states for samples collected at CMR.

Site	TSI Score	Trophic State
2CMR20001	64	Eutrophic
2CMR20002	72	Hyper-eutrophic
2CMR20004	79	Hyper-eutrophic
2CMR20041	66	Eutrophic

Phytoplankton (algae and cyanobacteria) and green plants are the base of the food chain in aquatic ecosystems. Phytoplankton also have a large impact on humans via harmful algal blooms (HABs) which are caused by an over-abundance of cyanobacteria.

2018 Phytoplankton Phyla by Density at 2CMR20001

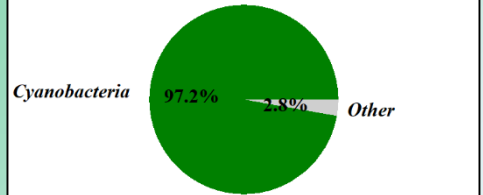


Figure 4. 2018 phytoplankton community at 2CMR20001.

Figure 4 illustrates the abundance of cyanobacteria relative to the other types of phytoplankton collected from the damsite in summer 2018. The chart shows that cyanobacteria dominated the phytoplankton community in density (cells/L). These results indicate that HABs have the potential to be problematic at CMR.

Harmful Algal Blooms (HABs) in IN are addressed by the IN Department of Natural Resources (IDNR) and the IN Department of Environmental Management (IDEM) in the IDNR HAB Response Standard Operating Procedure. The LRL WQ Program supports the state agencies efforts by reporting visual HAB indicators via the IN State Department of Health Algal Bloom Notification Form.

