2026 Western Lake Erie Harmful Algal Bloom (HAB) Forecast

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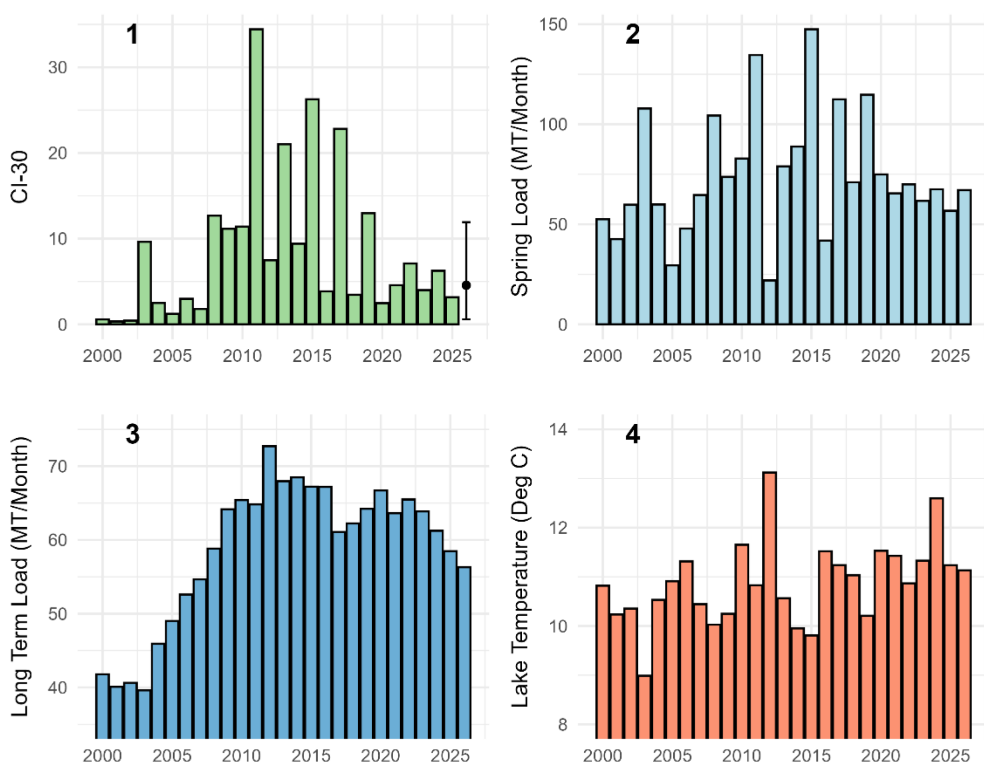
Forecast summary: A Harmful Algal Bloom of 4.56 Cyanobacteria Index (CI-30) is predicted for the western basin of Lake Erie in 2026, with a 95% predictive interval of 0.59 – 11.92 CI. This forecast is significantly lower than the 2000-2025 average (8.61 CI), and only about 13% of the 2011 maximum. This forecast is a contribution to NOAA's ensemble bloom prediction.

Our model is the latest in a series of Bayesian models developed to forecast western Lake Erie cyanobacterial blooms from spring phosphorus loading (Obenour et al. 2014; Bertani et al. 2016; Manning et al. 2019; Scavia et al. 2021; Scavia et al. 2023). The model is an adaptation of the one described in Scavia et al. 2026 that includes estimates of the impact of internal phosphorus recycling by including the bioavailable phosphorus load from previous years, similar to that used by Ho and Michalak (2015). This linear, segmented model predicts HAB extent as a function of the load with slopes before and after a model-estimated change point. Predicted HAB extent is then adjusted by a multiplicative factor that increases with the spring lake surface temperature, so that warmer springs amplify, and cooler springs dampen, the load-driven prediction. We calibrated the model with the maximum 30-day average CI (CI-30) HAB observations from 2000 to 2025 (Stumpf et al. 2016; Stumpf, pers. comm.) and loading of bioavailable phosphorus. The model explained 83% of the interannual variability. It also explained 74% of the interannual variability in a leave-one-out cross validation.



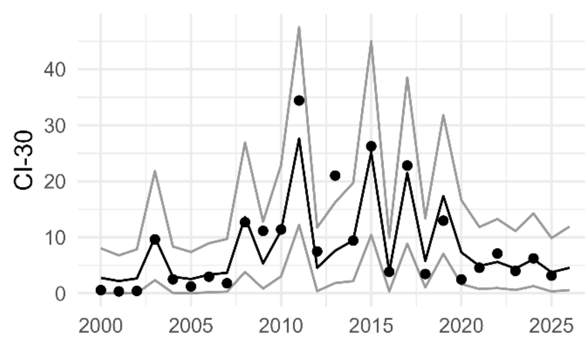
The mean bloom observations with forecasts (1), Spring phosphorus loads (2), Long term loads (3), Spring lake temperature (4). Error bars represent 95% predictive intervals. The spring load and spring lake temperature are averaged across months from tw through July, where tw (month) is a calibrated parameter that can be fractional.

Phosphorus loads: Daily TP and DRP loads were downloaded from Heidelberg University's National Center for Water Quality Research (https://ncwqr.org/) and aggregated to monthly loads. Bioavailable P was estimated as DRP plus a fraction of particulate P (TP-DRP), where the faction was determined during model calibration.

Lake temperature: Daily Lake Temperature was downloaded from the Great Lakes Surface Environmental Analysis (GLSEA, https://coastwatch.glerl.noaa.gov/statistics/average-surface-water-temperature-glsea/) and averaged to monthly average temperature.

HAB extent estimates: The HAB model was calibrated to the CI-30 in Western Lake Erie from 2000 to 2025. The CI-30 index is based on processing satellite image spectra specific for cyanobacteria (Stumpf et al. 2016).

HAB model calibration:. Calibration was based on Bayesian inference using a Markov Chain Monte Carlo (MCMC) sampling algorithm implemented with the statistical software R with version 4.3.3 (R Core Team, 2025) and the NIMBLE package with version 1.3.0 (de Valpine et al. 2017, de Valpine P et al. 2026). Detailed information on the MCMC algorithm settings, chain convergence evaluation, parameter prior distributions, the weighted spring load, the long term load, lake temperature, and the Box-Cox transformation can be found in Scavia et al. 2026.



Calibrated HAB Model. The black dots are the average CI-30. The black line indicates the prediction. The grey lines are the 95% credible

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