**Supporting Information**

*Methods for the 1999 trend estimate* For the three trend measures that are not flow-normalized (time-weighted mean concentration [TWMC], flow-weighted mean concentration [FWMC], and load) we used the annual values for each of the years, 1990 through 1999, as published by Heidelberg University (these are the values shown on the plots in the two graphs in left columns of Figure 4). The trend slopes are computed using the Thiel-Sen1,2 slope estimate — which is closely related to the Mann-Kendall trend test — and its 90 percent confidence intervals are computed as described by Hollander and Wolfe3 (p. 424-426). For the flow-normalized estimates, the computations used the entire data set of samples collected during water years 1981 through 1999 but the trends evaluated only included the years 1990 through 1999. The data prior to 1990 are included in the estimation because they help constrain the estimates during the 1990–1999 trend period. The EGRET package4 used stationary flow normalization (generalized flow normalization is only appropriate when the trends being evaluated are greater than about 20 years). The *runPairs* function of EGRET was used. We computed confidence intervals using the bootstrap procedure in the EGRETci package5, implemented with the function *runPairsBoot* using 500 bootstrap replicates.

**References**

(1) Theil, H. A Rank-Invariant Method of Linear and Polynomial Regression Analysis. In *Henri Theil’s contributions to economics and econometrics*; Springer, 1992; pp 345–381.

(2) Sen, P. K. Estimates of the Regression Coefficient Based on Kendall’s Tau. *Journal of the American statistical association* **1968**, *63* (324), 1379–1389.

(3) Hollander, M.; Wolfe, D. A. *Nonparametric Statistical Methods*; John Wiley & Sons: New York, 1999.

(4) Hirsch, R. M.; De Cicco, L. A. *User Guide to Exploration and Graphics for RivEr Trends (EGRET) and DataRetrieval: R Packages for Hydrologic Data*; 2328–7055; US Geological Survey, 2015.

(5) Hirsch, R. M.; Archfield, S. A.; De Cicco, L. A. A Bootstrap Method for Estimating Uncertainty of Water Quality Trends. *Environmental Modelling & Software* **2015**, *73*, 148–166. https://doi.org/10.1016/j.envsoft.2015.07.017.

**Table S1.** The three streams in the present study are all tributaries to Lake Erie with daily flow data from the USGS and at least daily nutrient data from Heidelberg University National Center for Water Quality Research.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Station** | **Latitude** | **Longitude** | **Drainage Area (km2)** | **USGS stream gauge ID** |
| Maumee River | 41°30'00" | 83°42'46" | 16,395 | 04193500 |
| River Raisin | 41°57'38" | 83°31'52" | 2,699 | 04176500 |
| Cuyahoga River | 41°23'43" | 81°37'48" | 1,831 | 04208000 |

**Supplementary Figure Captions**

**Figure S1**. TP concentration (top row) comparison between flow-normalized concentration from WRTDS, flow-weighted mean concentrations, and time-weighted mean concentrations. Flux (bottom row) is calculated the traditional way (dark blue) or using WRTDS to flow-normalize (light blue). Pearson correlation coefficients match point color schemes.

**Figure S2**. SRP concentration (top row) comparison between flow-normalized concentration from WRTDS (gray), flow-weighted mean concentrations (orange), and time-weighted mean concentrations (purple). Flux (bottom row) is calculated the traditional way (dark blue) or using WRTDS to flow-normalize (light blue). Pearson correlation coefficients match point color schemes.

**Figure S3**. TN concentration (top row) comparison between flow-normalized concentration from WRTDS, flow-weighted mean concentrations, and time-weighted mean concentrations. Flux (bottom row) is calculated the traditional way (dark blue) or using WRTDS to flow-normalize (light blue). Pearson correlation coefficients match point color schemes.

**Figure S4**. Nitrate/nitrate concentration (top row) comparison between flow-normalized concentration from WRTDS, flow-weighted mean concentrations, and time-weighted mean concentrations. Flux (bottom row) is calculated the traditional way (dark blue) or using WRTDS to flow-normalize (light blue). Pearson correlation coefficients match point color schemes.

**Figure S5**. TKN concentration (top row) comparison between flow-normalized concentration from WRTDS, flow-weighted mean concentrations, and time-weighted mean concentrations. Flux (bottom row) is calculated the traditional way (dark blue) or using WRTDS to flow-normalize (light blue). Pearson correlation coefficients match point color schemes.

A screenshot of a cell phone

Description automatically generated

**Figure S1**.

A screenshot of a cell phone

Description automatically generated

**Figure S2**.

A screenshot of a social media post

Description automatically generated

**Figure S3**.

A screenshot of a cell phone

Description automatically generated

**Figure S4**.

A close up of a piece of paper

Description automatically generated

**Figure S5**.