Water Quality Lab
Heidelberg College
310 E. Market Street
Tiffin, Ohio 44883

www.heidelberg.edu/WQL

Reports from the Ohio Tributary Monitoring Program

Program Description

The Ohio Tributary Monitoring Program is an ongoing activity of the Water Quality Laboratory, currently funded primarily by the State of Ohio through the Department of Natural Resources. The program provides highly detailed data on concentrations of a wide range of water quality constituents at stations near the mouths of the major rivers in Ohio. At present, the program includes seven stations, which together cover about 51% of Ohio's land area.

History

The Ohio Tributary Monitoring Program has its roots in efforts during the 1970's to cure Lake Erie of accelerated cultural eutrophication, which was leading to anoxic conditions in the Central Basin in the summer, nuisance algal growth along shorelines, mass mortality of alewives, and beach closures due to bacterial contamination. Excess nutrient loadings to the lake were identified as the major cause of the problems, phosphorus was chosen as the nutrient to manage, and goals were set for phosphorus loadings which would return the lake to a healthier state. As improvements in sewage treatment plants reduced phosphorus loadings into the lake, it became clear that phosphorus entering the lake from tributaries would also need to be reduced in order to meet the target loads.

Dr. David Baker, founder of the Water Quality Lab, had already begun studying sediment and nutrient loads in the Sandusky River, and had concluded that these loads were substantially larger than previously suspected. With this background, studies of Lake Erie tributary loadings at Heidelberg were expanded, and a regular program of high-frequency sampling focused on rainfall runoff events in the tributaries was designed and implemented using automatic samplers. The monitoring equipment was housed in U.S. Geological Survey gaging stations, in order that high-quality flow data would be available to allow calculation of pollutant loadings. Samples were analyzed for sediment, nutrients, and major ions.

This program has gradually expanded through the years. In the early 1980s, stations on the Cuyahoga and Grand were added to those on the Sandusky and Maumee, and pesticides were added to the parameter list. Sampling on the Huron River and on various sub-basins of the Maumee and Sandusky was carried out during part of

this time. As sources of funding shifted, some stations were added and some were dropped, but a core group of stations has been in operation nearly continuously for up to 25 years. In the mid-1990s, a relatively stable pattern of funding for the monitoring program was established through the State of Ohio, and it became possible to add stations to reflect the water quality characteristics of rivers draining into the Ohio River.

The Ohio Tributary Monitoring Program has produced research level datasets on water quality in Ohio watersheds that are the most extensive and detailed datasets of their type anywhere. Several station records include analyses on more than 10,000 samples. The importance of these datasets is widely recognized in the research and regulatory communities.

Other sources of funding support a similar monitoring station on the River Raisin at Monroe, Michigan, stations on Rock Creek and Honey Creek, sub-basins of the Sandusky River, and pesticide monitoring at all of the stations.

Station Descriptions

Basic information about the stations in the Ohio Tributary Monitoring Program is shown in Table 1. The station locations are shown in Figure 1.

Table 1. Characteristics of the seven major Ohio Tributary Monitoring Program stations

River	Drainage Area above Station (sq.mi.)	Land use above station, by percent*			
		Agri-culture**	Urban	Wooded	Other***
Maumee R. at Waterville USGS 04193500	6,330	89.9	1.2	7.3	1.6
Sandusky R. near Fremont USGS 04198000	1,253	84.1	0.9	13.0	2.0
Cuyahoga R. at Independence USGS 04208000	708	30.4	9.6	50.1	9.9
Grand R. at Painesville USGS 04212100	686	40.0	0.9	45.2	13.1
Muskingum R. at McConnelsville USGS 03150000	7,420	52.0	1.7	43.4	2.9
Scioto R. at Chillicothe USGS 03231500	3,854	80.2	4.6	12.9	2.3
Great Miami R. below Miamisburg USGS 03271601	2,685	82.1	4.7	10.3	2.9

* Source: ODNR Division of Real Estate and Land Management

** Includes open urban/suburban areas such as lawns

*** Includes shrub/scrub lands, open water, non-forested wetlands, barren ground

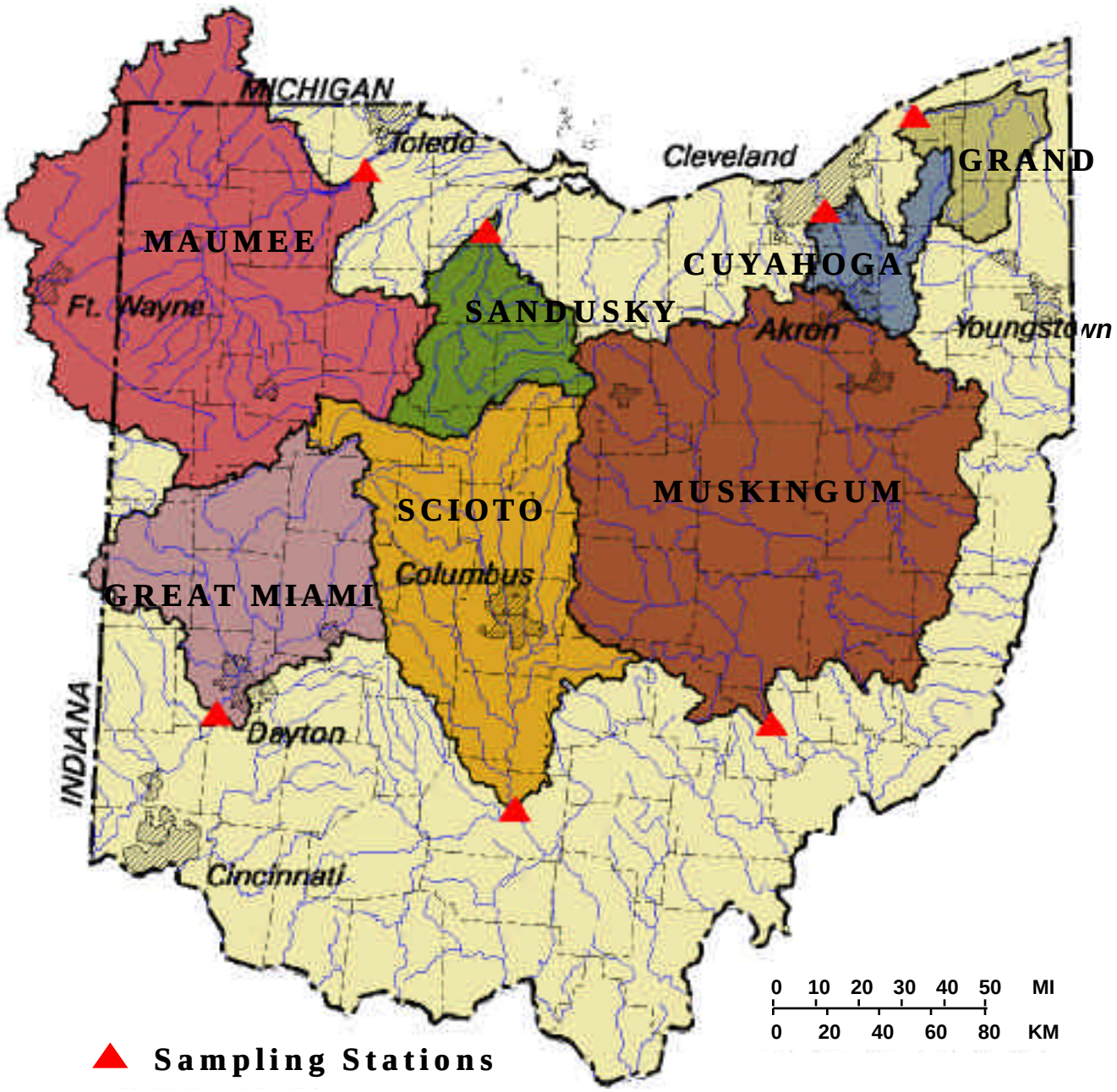

Figure 1. Locations of the Ohio Tributary Monitoring Program stations

Sampling Schedule, Parameters, and Methods

Parameters for the Ohio Tributary Monitoring Program are listed by group in Table 2, along with the current analytical methodology and a method reference. At all stations except the Muskingum, nutrient samples are taken three times per day

Table 2. Analytes, Analytical Equipment, and Methods of the Ohio Tributary Monitoring Program

Analytical Group	Equipment	Method Reference*
Suspended Sediment	Mettler Balance	EPA Method 160.2
Nutrients and major ions		
Total phosphorus	Technicon AAII	EPA Method 365.3
Total Kjeldahl nitrogen	Technicon AAII	EPA Method 351.2
Ammonia nitrogen	Technicon TRAACS	EPA Method 350.1
Soluble reactive phosphorus	Technicon TRAACS	EPA Method 365.3
Silica	Technicon TRAACS	EPA Method 370.1
Specific Conductance	Technicon TRAACS	EPA Method 120.1
Nitrate nitrogen	Dionex Ion Chromatograph	EPA Method 300.1
Nitrite nitrogen	Dionex Ion Chromatograph	EPA Method 300.1
Chloride	Dionex Ion Chromatograph	EPA Method 300.1
Fluoride	Dionex Ion Chromatograph	EPA Method 300.1
Sulfate	Dionex Ion Chromatograph	EPA Method 300.1
Current generation pesticides EPTC Butylate Phorate Simazine Atrazine Terbufos Fonofos Metribuzin Alachlor Linuron Metolachlor Chlorpyrifos Cyanazine Pendamethalin Acetochlor	Gas Chromatography/ Mass Spectroscopy (GC/MS) using a Varian Saturn II	EPA Draft Method 507, solid phase extraction
Current generation herbicides Atrazine Alachlor Metolachlor Cyanazine	Immunoassay, Ohmicron RPA1 reader and tubes	Ohmicron Methods
Metals (major) Calcium Magnesium Sodium Potassium Strontium Barium Aluminum Iron Trace metals Copper Cadmium Lead Manganese Zinc	Varian Liberty 100 ICP, with ultrasonic nebulizer	Standard Methods for the Examination of Water and Wastewater, 17th edition, Method 3120

*Methods for Analysis of Water and Wastes, EPA 600/4-79-020, Cincinnati, OH, 1979

using refrigerated ISCO autosamplers. Sample bases are changed once per week. All samples from storm runoff events are analyzed. One sample per day is analyzed for samples taken during low flow periods. The Muskingum River is sampled manually once per day, samples are sent to the lab weekly, and all samples are analyzed.

Between April 15 and August 15, pesticide samples are taken at the Maumee and Sandusky stations using a separate autosampler pumping into glass bottles. Three samples per day are analyzed from storm runoff events, and two samples per week during low flow periods. At the Scioto and Great Miami stations, pesticides are analyzed three times per day using the nutrient samples and immunoassay procedures. In addition, a weekly manual sample is analyzed using GC/MS. Pesticide samples are taken manually once a week at the Cuyahoga and Grand stations, and twice a week at the Muskingum station. All of these samples are analyzed using GC/MS.

Between August 15 and April 15, two samples per month are collected at each station and analyzed using GC/MS.

Uses of the Data

The data are used for many purposes. Central among these are calculating annual loads of nutrients, sediment, and pesticides. The WQL makes these calculations on a routine basis annually. Data are also provided to the International Joint Commission (IJC) for their use in calculating phosphorus loads into Lake Erie. According to the IJC, the detail and quality of the information provided from this program are largely responsible for the high reliability of the whole lake load estimates. Data are also provided to the Lake Erie LAMP program, and to the Lake Erie and Miami NAWQA programs of the USGS. The data are also the focus of a major retrospective study funded by the USDA, the Lake Erie Agricultural Systems for Environmental Quality program. A dozen or more data requests from other researchers ranging from graduate students to government scientists are filled each year.

The data also provide detailed perspectives on the responses of large non-point source dominated watersheds to the meteorological events which drive the hydrology and aquatic chemistry of the river. Recent papers published by WQL staff members in the scientific literature include studies of annual loads of nutrients and pesticides, trends in loads and concentrations of nutrients, and relationships between water quality and watershed size.

References

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For more information, contact R. Peter Richards, Director of the Water Quality Lab, at (419) 448-2240 or prichard@heidelberg.edu