Tracking Lake Recovery

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Muskegon Lake has a long history of environmental impairment, stretching back to the lumber era in the mid 1800s and continuing through the industrial period of the 20th century. These collective abuses landed the lake on the International Joint Commission's list of 43 designated Areas of Concern (AOC) in the Great Lakes region. Yet until recently, there was a surprising lack of information on the ecology of Muskegon Lake. A detailed and long-term understanding of the lake ecology is essential for both the wise management of this vital coastal ecosystem and scientific justification to be removed from the AOC list.

In 2003, AWRI initiated a long-term monitoring program in Muskegon Lake. An endowment fund at the Community Foundation for Muskegon County, started through the generosity of donors in the greater Muskegon region, helps defray the costs of this project. As a resident on the lake, AWRI feels both a responsibility and an obligation to monitor and research the ecological health of this water body. This information is being used to track the restoration and recovery of the lake and, ultimately, demonstrate that it meets the criteria to be removed from the AOC list. The monitoring program is designed both to provide consistent, scientifically rigorous information and to accommodate the information needs of the community.

The main goals of the monitoring program are to:

1. Observe short-term and long-term changes in the ecological health of Muskegon Lake.
2. Understand the mechanisms behind the changes we see in the lake's ecology.
3. Integrate Muskegon lake ecology to the watershed level, and to society at large.
4. Use the information generated from this study to remove (de-list) Muskegon Lake as one of the Areas of Concern (AOC) in the Great Lakes.

Six sites (Figure 1) are sampled for water quality 3 times per year for a suite of physical, chemical, and biological parameters. Chemical/physical parameters include nutrients (nitrogen and phosphorus), dissolved oxygen, temperature, light transmittance, and Secchi depth (a proxy for water clarity). Biological sampling includes measurements of the algal, benthic invertebrate, and fish communities.

As a complement to the long-term monitoring program, the Muskegon Lake Observatory (www.gvsu.edu/wri/buoy) was established in 2011 (Figure 1). The observatory consists of a buoy system that collects continuous water quality,

hydrology, and meteorological data during the ice-free period.

Each year the monitoring results are communicated to the community in the form of a water quality dashboard based on key water quality indicators. The goal of the dashboard is to provide a visual representation of the current status and historical trends in Muskegon Lake water quality, by rating each indicator along a scale from desirable (green) to undesirable (red) conditions. Each scale also includes a category that indicates the water quality goal for the lake is being met (yellow). The indicators include total phosphorus, chlorophyll *a*, Secchi disk depth, and dissolved oxygen. The total phosphorus dashboard for 2014 is shown here as an example (Figure 2).

More information about the Muskegon Lake Long-Term Monitoring program can be found on the AWRI website: www.gvsu.edu/wri/director/muskegonlake
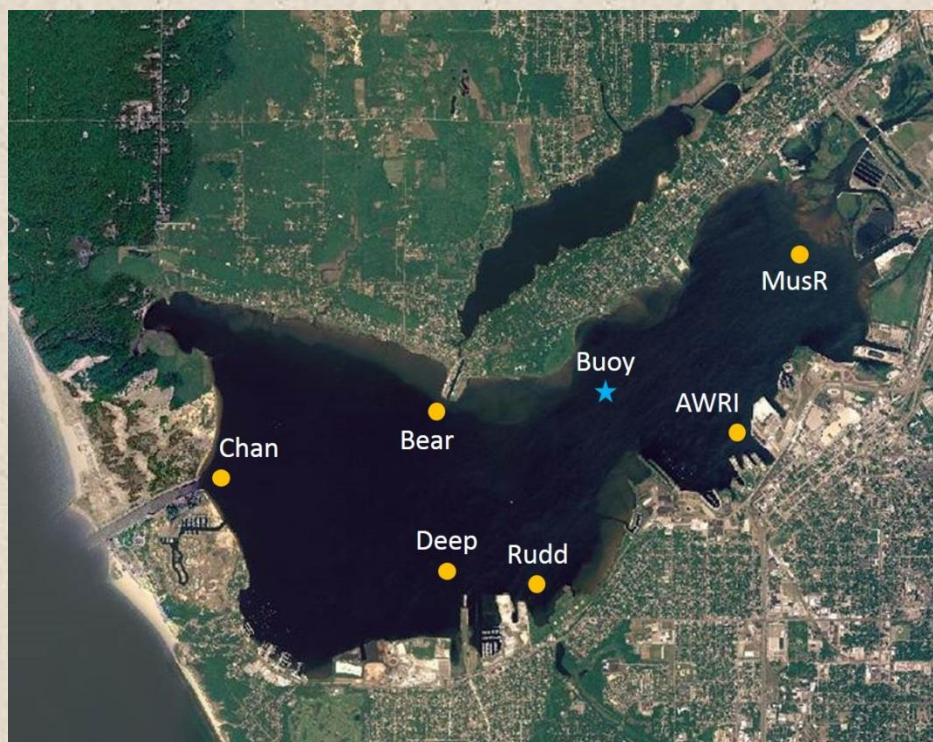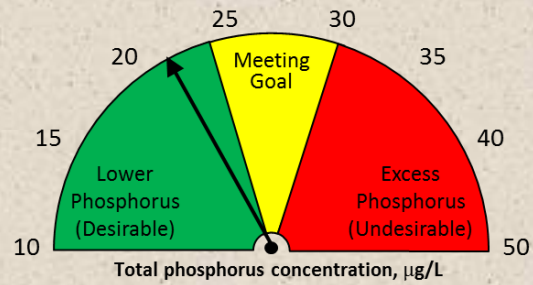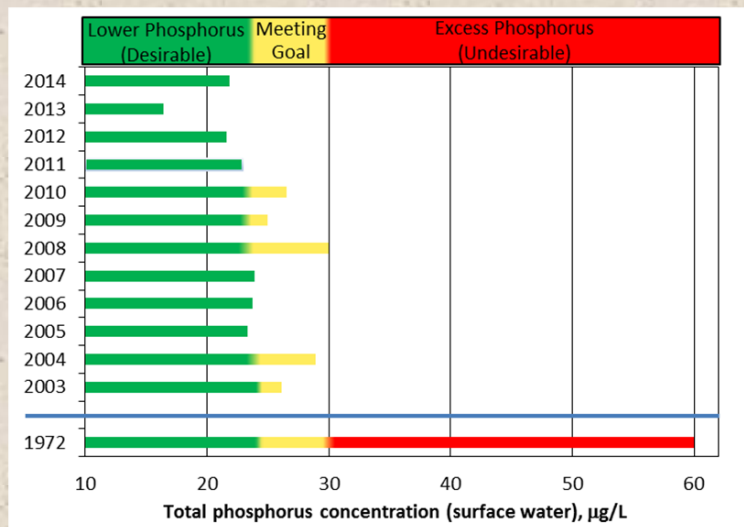

Figure 1. Map of Muskegon Lake with long-term monitoring locations (yellow dots) and the location of the Muskegon Lake Observatory buoy.

Current status (2014)

Total phosphorus concentration, μg/L

Historical Status (1972, 2003-2014)

Total phosphorus concentration (surface water), μg/L

Data sources: Freedman et al. (1979); Muskegon Lake Long-term Monitoring Program, Steinman et al. (2008) and A. Steinman/M. Ogdahl (unpublished data)