

2007 National Lakes Assessment – Michigan Results

In the summer of 2007 the Michigan Department of Environmental Quality (MDEQ) participated in the first-ever baseline study of the condition of the nation's lakes. The U.S. Environmental Protection Agency (EPA)-sponsored National Lakes Assessment (NLA) Survey examined ecological, water quality and recreational indicators in lakes across the country. Using a statistical survey design, lakes were selected at random to represent the condition of the larger population of lakes across the lower 48 states. A total of 1,028 lakes were sampled for the NLA, representing about 50,000 lakes nationwide. In Michigan, 50 lakes were sampled; representing approximately 6,600 lakes 10 acres size statewide (Fig. 1).

Field crews collected samples using the Same methods at all lakes to ensure that results can be compared across the country, as well as statewide. MDEQ staff and U.S. EPA researchers analyzed thousands of measurements on the Michigan lakes, including water quality indicators such as nutrients, dissolved oxygen and chlorophyll-a; biological indicators such as phytoplankton and zooplankton; recreational indicators such as algal toxins and pathogens; and physical habitat indicators such as lakeshore and shallow water habitat cover.

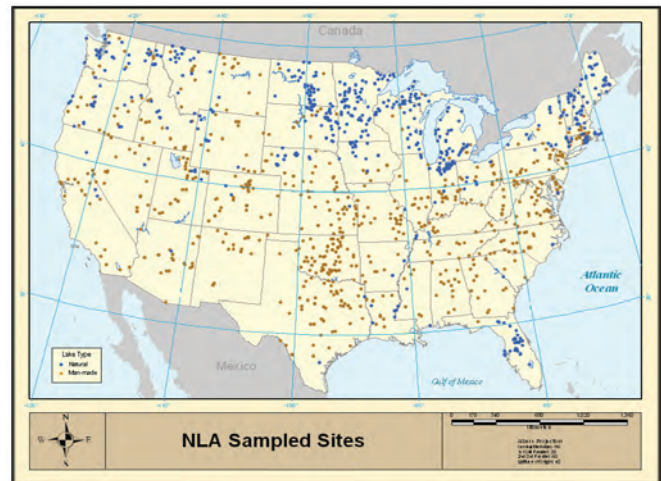


Figure 1. NLA Survey Lakes

What are the Key Findings of the NLA-Michigan?

Biological Health

The NLA-Michigan finds that 86% of Michigan's lakes support healthy communities when compared to least disturbed "reference" sites (Fig. 2). Another 10% of lakes are in fair condition, while only 3% are in poor biological condition. This rating is based on an index of phytoplankton and zooplankton taxa loss – the percentage of taxa observed (O) compared to those that are expected (E), based on conditions at least-disturbed "reference" lakes.

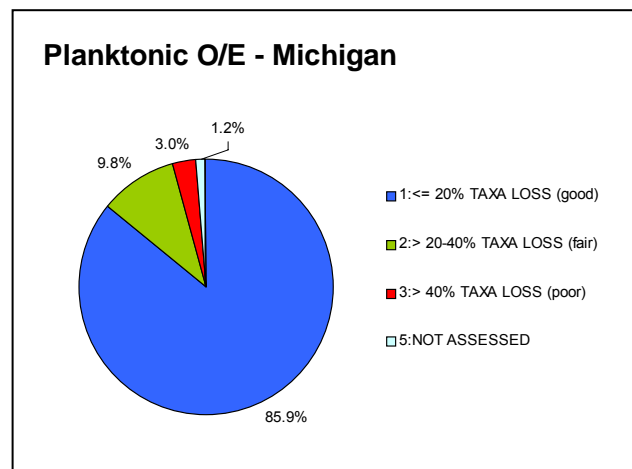


Figure 2. Biological Condition of Michigan Lakes

Lake Condition Stressors

The survey measured a set of key stressors to lake condition to determine their extent across the nation as well as statewide. Each lake stressor or indicator was classified as either

“good”, “fair”, or “poor” relative to the conditions found in the set of “reference” sites established for the NLA survey.

Similar to the national estimates, the most wide spread stressors measured in Michigan lakes are related to habitat. Figure 3 shows the percentage of lakes in Michigan that assessed as poor (i.e. less than 5% of the low end of the NLA “reference” lakes distribution) for each of the key stressors measured during the NLA survey. By far, lakeshore habitat and physical lakeshore complexity are major stressors for Michigan lakes. Nutrients and turbidity show lesser but significant impact, while salinity/conductivity, acid neutralizing capacity, and dissolved oxygen stressors as measured in the NLA are minor in Michigan lakes statewide.

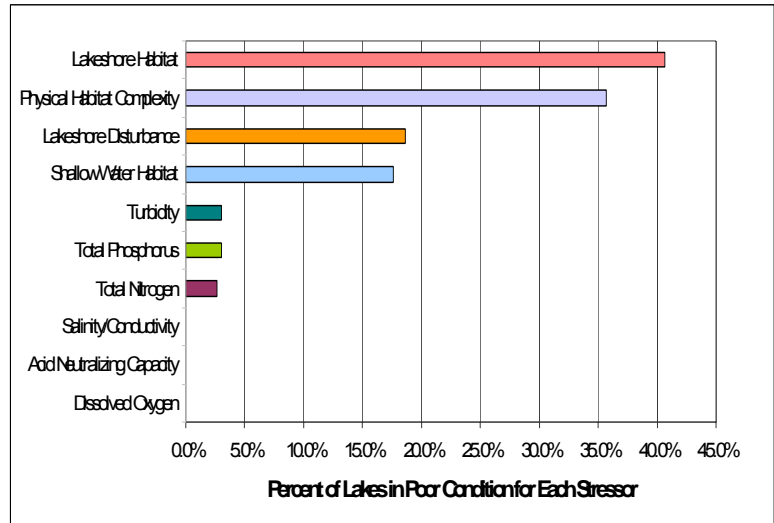
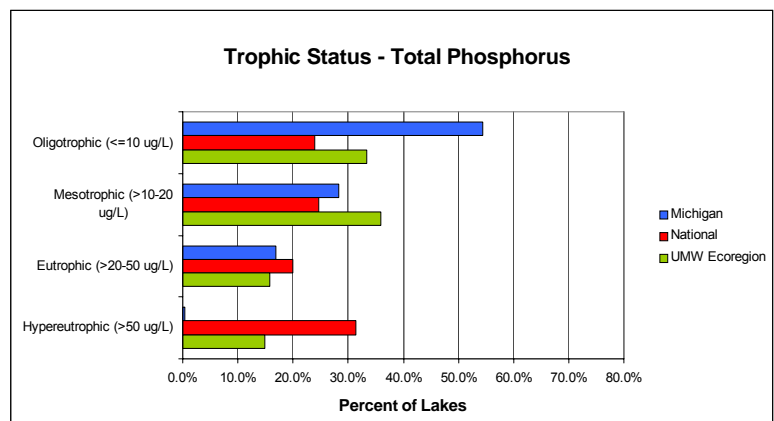
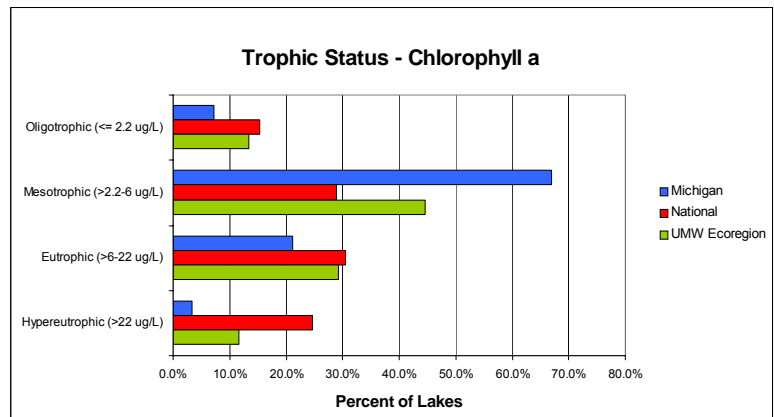


Figure 3. Extent of Stressors in Michigan Lakes

Trophic Condition

Another approach the NLA used to assess the condition of lakes is in respect to their primary biological productivity, or trophic status. Figures 4 and 5 illustrate the trophic status distribution in Michigan lakes compared to lakes across the nation and lakes in the Upper Midwest (UMW) ecoregion based on chlorophyll-a and total phosphorus indicators. These results indicate that 83-84% of Michigan lakes are low (oligotrophic) to moderately (mesotrophic) productive and less than 4% exhibit excessive biological productivity (hypereutrophic).

Figures 4 and 5. Trophic Condition of Michigan Lakes (Chlorophyll-a and Total Phosphorus indicators)



Recreational Condition

An important aspect of lake health includes suitability for public use and recreation. As part of the NLA, three indicators of potential risk from harmful algae were evaluated, including microcystins, an algal toxin; cyanobacteria, a type of algae (bluegreen algae) that can produce algal toxins; and chlorophyll-a, a measure of all algae present.

Results for Michigan show that microcystins levels were present in about the same percent of lakes as they are nationally (approximately 30% for all lakes), But slightly greater than found in the UMW ecoregion lakes (Fig. 6). However, for each of the indicators of risk, Michigan lakes showed a lower percentage of lakes in the moderate risk category when compared to the nation and UMW ecoregion results and no lakes in the high risk category.

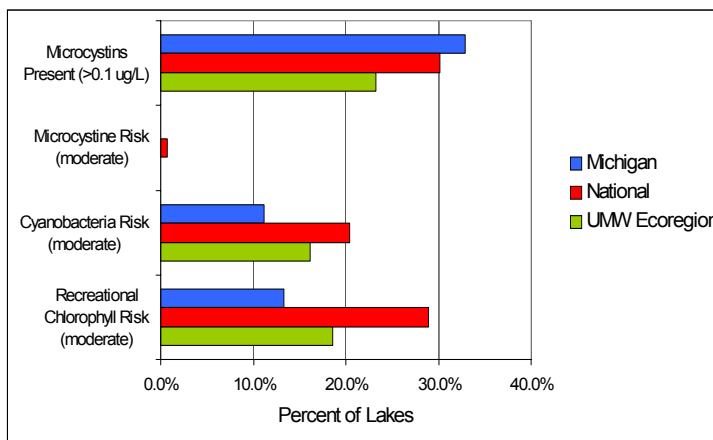


Figure 6. Recreational Condition (Harmful Algae Risk) of Michigan Lakes

The thresholds (low, moderate, and high risk) associated with each indicator of potential risk are based on the World Health Organization criteria as indicated in Table 1.

Table 1. World Health Organization Thresholds of Risk Associated with Potential Exposure to Cyanotoxins.

Indicator (units)	Low Risk of Exposure	Moderate Risk of Exposure	High Risk of Exposure
Chlorophyll-a (ug/L)	< 10	10 - < 50	> 50
Cyanobacteria cell counts (#/L)	< 20,000	20,000 – < 100,000	≥ 100,000
Microcystin (ug/L)	< 10	10 - ≤ 20	> 20

Chemical Condition

The chemical condition of Michigan and UMW ecoregion lakes is a consequence of their glacial origin and Great Lakes basin geology. The dominant limestone geology and thick glacial deposits in Michigan’s Lower Peninsula and eastern Upper Peninsula establishes the base chemistry and buffering capacity for the mostly hard-water lakes in this region while the Canadian Shield igneous bedrock and sandstone geology of the western UP creates a much different water chemistry pattern with a greater percentage of soft-water lakes.

Water concentration of total phosphorus in Michigan lakes is low as compared to all UMW ecoregion lakes while total nitrogen concentration is similar. Chlorophyll-a levels are also lower for Michigan lakes as compared to all lakes in the UMW ecoregion. The relative phosphorus-rich to phosphorus-poor south to north lakes distribution pattern previously found for the Lower Peninsula is reinforced by the NLA results. Michigan’s Upper Peninsula lakes show a more variable pattern for nutrients. These patterns are mirrored by the chlorophyll-a results.

Next Steps

The next round of the NLA Survey is scheduled for summer 2012. The MDEQ will again participate in the Survey and likely conduct a state-scale assessment to add to the 2007 NLA-Michigan findings.

For more information on the NLA Survey see: <https://www.epa.gov/national-aquatic-resource-surveys/nla>; and the *Michigan National Lakes Assessment Project: Summary of Results* Project Report (Bednarz 2011)

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