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Lakes Presenting Risk for Exposure to Harmful Algal Toxins



(Photo on left) Massive Algal Bloom in the St. Johns River, Florida. Photo by Bill Yates (Photo on right) Sign alerting citizens that an algal bloom in the area has potentially made direct contact with water unsafe. Photo by Mike Tate, Kansas Department of Health and Environment, Bureau of Water, Technical Services Section

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About this indicator

One of the potential effects of excess nutrients in lakes is the overgrowth of cyanobacteria, also known as blue-green algae, which produce toxins (cyanotoxins) that are harmful to people's health and can kill fish, mammals and birds. When the density of such harmful organisms leads to the presence of scum on the lake surface or discoloration of the water, they are known as harmful algal blooms (HABs). The frequency and severity of HABs has been linked to increased nutrient loading from human activities (Lopez *et al.* 2008), and cyanobacterial HABs are considered one of the clearest indicators of excess nutrient concentrations (Paerl and Fulton, 2006). Cyanobacteria can produce neurotoxins (nervous system), hepatotoxins (liver) and dermatotoxins (skin), posing a threat to human health when blooms occur in drinking water supplies. Additionally, cyanotoxins in recreational waters can pose a danger to people, pets, and livestock when they come in contact with the water.

The data presented here pertain to cyanobacteria, and not other algae which may produce toxins. The data in this indicator are the number of lakes sampled in each state for cyanobacteria during EPA's 2007 National Lakes Assessment, and the number of lakes (out of those sampled) which presented moderate to high risk conditions for exposure to cyanotoxins. Conditions were considered to present a moderate to high health risk if the water quality sample had cyanobacteria populations equal to or greater than 20,000 cells/mL, a threshold set by the World Health Organization in its *Guidelines for Safe Recreational Water Environments*. Scum formation becomes more likely at 100,000 cells/mL.

Number of state lakes sampled for cyanobacteria and the number, out of those sampled, which presented a moderate to high risk of exposure to harmful algal toxins called cyanotoxins.

These lakes are estimated to have cyanobacteria cell counts of $\geq 20,000$ cells/mL.

State	# of lakes with moderate to high risk conditions for exposure to cyanotoxins	Total # of lakes sampled
Alabama	0	14
Alaska	No data	No data
Arizona	2	22

State	# of lakes with moderate to high risk conditions for exposure to cyanotoxins	Total # of lakes sampled
Arkansas	2	11
California	2	21
Colorado	4	34
Connecticut	0	16
Delaware	4	9
Florida	8	27
Georgia	2	16
Hawaii	No data	No data
Idaho	13	35
Illinois	13	21
Indiana	22	56
Iowa	4	22
Kansas	0	29
Kentucky	2	11
Louisiana	2	16
Maine	1	32
Maryland	0	7
Massachusetts	0	13

State	# of lakes with moderate to high risk conditions for exposure to cyanotoxins	Total # of lakes sampled
Michigan	7	58
Minnesota	19	66
Mississippi	1	11
Missouri	13	28
Montana	10	45
Nebraska	13	44
Nevada	5	23
New Hampshire	0	17
New Jersey	3	10
New Mexico	5	17
New York	0	15
North Carolina	11	21
North Dakota	23	44
Ohio	6	22
Oklahoma	12	55
Oregon	2	37
Pennsylvania	3	20

State	# of lakes with moderate to high risk conditions for exposure to cyanotoxins	Total # of lakes sampled
Rhode Island	1	14
South Carolina	0	7
South Dakota	29	41
Tennessee	4	12
Texas	26	56
Utah	8	28
Vermont	0	13
Virginia	11	26
Washington	13	37
West Virginia	1	12
Wisconsin	8	35
Wyoming	0	26

Note - data should not be used to make statewide estimates of the percent of lakes presenting risk for exposure to cyanotoxins.

Source: EPA's 2007 National Lakes Assessment (2009).

Download the [Toxins data table \(excel\)](#) (2 pp, 14 K)

Source of data

1. U.S. EPA. 2009. 2007 National Lakes Assessment: A Collaborative Survey of the Nation's Lakes. EPA 841-R-09-001. Office of Water and Office of Research and Development. Washington, DC.

Data source information

Data are from the EPA's 2007 National Lakes Assessment: a Collaborative Survey of the Nation's Lakes (2010). In this study, the EPA conducted a national survey of the condition of lakes, reservoirs and ponds, which included sampling for cyanobacteria. At each lake site, a sample was taken at a single station located at the deepest point in the lake, which would be expected to minimize the chance for false positives. Users may download the report and all the raw data directly from the EPA's National Lakes Assessment website (see link below), from the table entitled "Lake Recreational Condition Estimates."

What to consider when using these data

The lakes sampled for the 2007 National Lakes Assessment were chosen in a random, probability based manner. However, while the base funding for the survey provided for the sampling of enough sites to make national and regional scale estimates of lake conditions, most states could not sample enough sites to allow for generation of state-level estimates. Therefore, the data shown here should not be extrapolated to make state-wide estimates of the percent of lakes presenting risk of exposure to cyanotoxins. Users should also take into account that the lake samples were collected for the survey at particular times during the summer of 2007, and the levels of cyanobacteria are affected by spatial, temporal and climatic variables, such as season, temperature, and level of precipitation. Future assessments will continue to inform on the risk of exposure in different parts of the country.

References and links to other data sources

1. Graham, J.L., Loftin, K.A., and Kamman, N. 2009. Monitoring recreational freshwaters. LakeLine. Vol. 29, pp. 18-24.
2. Lopez, C.B., Jewett, E.B., Dortch, Q., Walton, B.T., and Hudnell, H.K. 2008. Scientific Assessment of Freshwater Harmful Algal Blooms. Interagency Working Group on Harmful Algal Blooms, Hypoxia and Human Health of the Joint Subcommittee on Ocean Science and Technology, Washington, DC.
3. Hoagland, P. and Scatasta, S. 2006. The economic effects of harmful algal blooms, in Ecology of Harmful Algae, Graneli, E., Turner, J.T. (Eds.): Ecological Studies Series. Springer-Verlan, Heidelberg. Vol. 189, Chap. 30, pp. 391-402.
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5. The World Health Organization. 2003. Guidelines for Safe Recreational Water Environments: Coastal and Fresh Waters. Vol 1. Geneva.
6. Chorus, I. and Bartram, J. 1999. Toxic cyanobacteria in water: a guide to their public health consequences, monitoring and management. Published on behalf of WHO by E & FN Spon/Chapman & Hall, London.
7. U.S. EPA. National Rivers and Streams Assessment.
8. U.S. EPA. Wadeable Streams Assessment.
9. U.S. EPA. National Coastal Condition Reports.

10. U.S. EPA. National Wetland Condition Assessment.

11. National Oceanic and Atmospheric Administration. National Ocean Service
- Harmful Algal Blooms: Simple Plants With Toxic Implications.

LAST UPDATED ON JANUARY 18, 2018