IOWA DEPARTMENT OF NATURAL RESOURCES

LEADING IOWANS IN CARING FOR OUR NATURAL RESOURCES

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# 2015 Lake Water Quality Summary

Iowa's lakes are an important water resource. They support excellent fisheries, provide a home to numerous plants and animals, create recreational opportunities for Iowans and tourists, and in some cases, supply Iowans with drinking water. Statewide water quality monitoring is important so that we can better understand the health and status of our lakes.

The Iowa DNR Monitors 138 publically-owned lakes three times each summer, once in early summer (May-June), once in mid-summer (July), and once in late summer (August-September). Lakes are monitored for a number of chemical and biological parameters. Descriptions of parameters can be found in the "Descriptions of water quality parameters 2015" document. Table 1 shows the range of the water quality values for the 2015 sampling season. Results from monitoring are used to inform Iowan's about water quality in their lakes, used to track trends in water quality in order to target individual lakes for restoration activities, as well as used to perform Water Quality Assessments on lakes as mandated by the Federal Clean Water Act.

Weather has a large impact on water quality in lakes. Drought conditions that started in 2014 persisted across much of the state until the end of March. Starting in April and continuing through the summer, frequent rainfall events eliminated the drought conditions throughout the state. The southeastern and central part of the state received above average rainfall (see Figure 1). Total annual rainfall for the state was 8.1 inches above average, with peak precipitation occurring in May. Late spring rains affected Iowa lakes by bringing excess nutrients to the lakes just prior to the algae's peak growing season. Excess nutrients allow the algae to continue to grow in abundance throughout the growing season. This can be seen by the increasing average monthly amount of chlorophyll a pigment collected from the lake water (see Figure 2). Visible algae blooms can be observed at chlorophyll a concentrations as low as 10 µg/L.

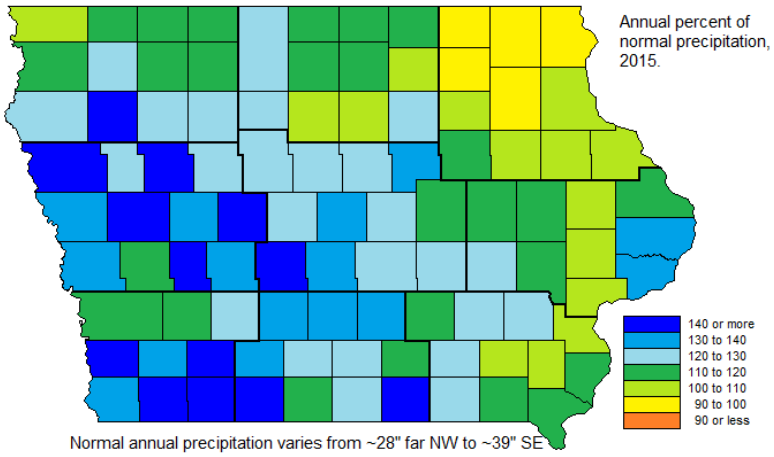


**Figure 1. Image from the 2015 IDNR Water Monitoring Summary**

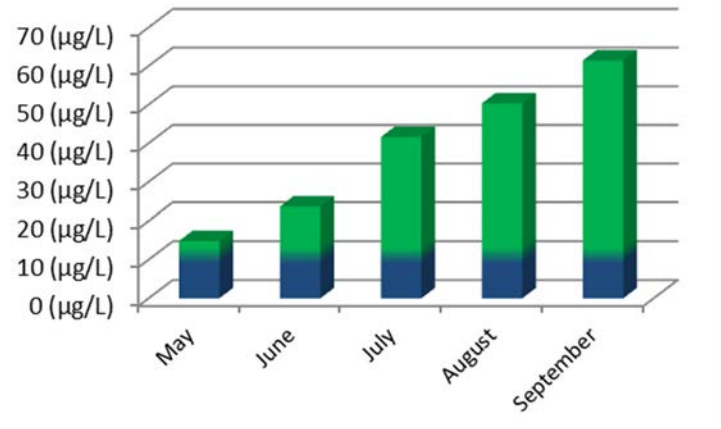


**Figure 2. 2015 Monthly Average Chlorophyll a.**

Water quality observed at Iowa's lakes was about average in 2015. Water clarity, observed for all 138 lakes monitored, averaged 3.6 feet (1.1 meters) in 2015, compared to the long-term average from 2000-2015 of 3.9 feet (1.2 meters). 36% of all of the lakes monitored had above average water clarity (Secchi depth) in 2015 (Figure 2). Changes in average water clarity can be attributed to a number of things, including changes in weather, timing of sampling relative to rainfall or algae bloom formation, or improvements or degradation of overall lake water quality. Concentrations of total phosphorus, the most common limiting nutrient in freshwater systems, were also below

average in 2015. The average concentration in 2015 was 104.5 µg/L, as compared to the 2000-2015 average of 107.4 µg/L. The majority of Iowa lakes are considered very nutrient rich, or eutrophic. Concentrations greater than 30 µg/L can lead to visible algae blooms in lakes. Of the lakes monitored, 64% had lower than average total phosphorus concentration in 2015 (Figure 3). Chlorophyll *a*, a pigment found in algae, was also monitored in 2015. Chlorophyll *a* measurements are frequently used as a substitute for estimating the concentration of algae present in a lake. The average concentration of chlorophyll a observed in 2015 was 40 µg/L, as compared to the 2014 average of 43 µg/L and 2000-2015 combined long term average of 40 µg/L. 57% of the lakes sampled in 2015 had lower than average chlorophyll a concentrations (Figure 4). Water quality parameters measured in 2015 are summarized in more detail in Table 1.

**Table 1. 2015 Water Quality Parameter ranges**

| Water Quality Parameter | Average Value | Minimum Value | Percentiles | | | Maximum Value |
|---|---|---|---|---|---|---|
| | | | 25th | 50th | 75th | |
| **Total Phosphorus as P (µg/L)** | 104.5 | 14.6 | 43.7 | 79.5 | 136.4 | 614.1 |
| **Orthophosphate as P (µg/L)** | 22.3 | < 4.3 | < 4.3 | < 4.3 | 11.1 | 478.0 |
| **Total Kjeldahl Nitrogen (mg/L)** | 1.4 | < 0.16 | 0.9 | 1.2 | 1.6 | 5.7 |
| **Nitrate +Nitrite as N (mg/L)** | 1.34 | < 0.06 | < 0.06 | < 0.06 | 0.85 | 22.55 |
| **Ammonia (µg/L)** | 65 | < 16.8 | < 16.8 | < 16.8 | 75 | 662 |
| **Total Suspended Solids (mg/L)** | 15.9 | < 1.4 | 6.2 | 11.4 | 19.0 | 198.0 |
| **Inorganic Suspended Solids (mg/L)** | 7.5 | < 1.4 | 1.8 | 3.5 | 8.0 | 169.0 |
| **Volatile Suspended Solids (mg/L)** | 8.3 | < 1.4 | 2.9 | 6.2 | 10.8 | 103.5 |
| **Dissolved Organic Carbon (mg/L)** | 17.5 | 2.7 | 5.2 | 7.4 | 30.0 | 63.6 |
| **Temperature (˚C)** | 22.8 | 13.0 | 21.0 | 23.1 | 25.2 | 31.0 |
| **Dissolved Oxygen (mg/L)** | 9.4 | 0.1 | 7.2 | 8.7 | 10.4 | 30.1 |
| **pH** | 8.4 | 6.8 | 8.1 | 8.3 | 8.6 | 9.8 |
| **Turbidity (NTU)** | 15.0 | < 0.3 | 4.8 | 9.6 | 19.5 | 149.9 |
| **Secchi Depth (m)** | 1.1 | 0.2 | 0.5 | 0.8 | 1.4 | 10.0 |
| **Chlorophyll a (µg/L)** | 40 | <1 | 12 | 29 | 53 | 269 |
| **Phytoplankton Wet Mass (mg/L)** | 73.4 | <1 | 9.5 | 29.6 | 77.2 | 1,332.6 |
| **Zooplankton Dry Mass (mg/L)** | 220.5 | 4.4 | 61.2 | 141.0 | 286.0 | 1,916.8 |

µg/L – micrograms per liter (parts per billion) mg/L – milligrams per liter (parts per million)
NTU – Nephelometric Turbidity Units < - less than detection limit shown
Note: This summary only includes data collected as a part of the Iowa DNR ambient lake monitoring program. Raw chemical data available through IASTORET: http://programs.iowadnr.gov/iastoret/

The frequency and intensity of algae blooms varied widely throughout the summer of 2015. Periods of heavy rainfall in the late spring and early summer pushed high concentrations of nitrogen and phosphorus into Iowa's lakes. These pulses of nutrients have the potential to fuel intense algae blooms under the right conditions and increase the abundance on algae in the lake water as seen in Figure 2. Large cyanobacteria (blue-green algae) blooms are commonly observed in the late summer

and thrive in stagnant water, under hot conditions. While the amount of nutrients entering the lakes in spring were high, the average nutrient concentrations were lower previous years averages and the combined long term average which led to a slightly smaller average population of algae in Iowa lakes for the 2015 sampling season.

## 2015 Relative to Other Years

While 138 lakes are monitored as a part of the Ambient Lake Monitoring program, it is difficult to categorize all of the water quality information for every lake monitored in a short summary. Table 2 outlines the 2015 average of several water quality parameters measured at 20 of the most popular lakes in Iowa and shows whether or not the lake's overall water quality was better or worse than average (based on the data collected at each of these lakes) The table also shows whether each lake, on average, has better or worse water quality than the combined long term average for each parameter.

**Table 2. Top 20 lakes water quality averages for 2015**

| Lake Name | Total Phosphorus (µg/L) | Nitrate + Nitrite as N (mg/L) | Secchi Transparency (ft),(m) | Total Suspended Solids (mg/L) | Chlorophyll *a* (µg/L) | Better or worse in 2015 | Above or below average |
|---|---|---|---|---|---|---|---|
| Saylorville Lake | 117 | 11.42 | 2.6(ft), 0.8(m) | 15 | 11.6 | Worse | Below |
| West Okoboji Lake | 17 | < 0.06 | 25.6(ft), 7.8(m) | < 1.4 | < 0.06 | Better | Below |
| Coralville Reservoir | 217 | 7.46 | 2.0(ft), 0.6(m) | 19 | 8.3 | Better | Below |
| Clear Lake | 48 | < 0.06 | 2.6(ft), 0.8(m) | 17 | 23.3 | Better | Below |
| Big Creek Lake | 52 | 7.89 | 7.9(ft), 2.4(m) | 3 | 4.4 | Better | Below |
| East Okoboji Lake | 61 | < 0.06 | 4.6(ft), 1.4(m) | 8 | 16.8 | Better | Below |
| Lake Red Rock | 144 | 7.76 | 4.3(ft), 1.3(m) | 10 | 7.2 | Better | Below |
| Big Spirit Lake | 37 | < 0.06 | 7.5(ft), 2.3(m) | 5 | 16.3 | Better | Below |
| Lake Macbride | 62 | 0.37 | 2.3(ft), 0.7(m) | 9 | 39.4 | Worse | Below |
| Rathbun Lake | 60 | 0.44 | 1.6(ft), 0.5(m) | 13 | 11.8 | Worse | Below |
| Storm Lake | 94 | 0.73 | 1.3(ft), 0.4(m) | 35 | 8.7 | Worse | Below |
| Pleasant Creek Lake | 31 | < 0.06 | 7.2(ft), 2.2(m) | 5 | 26.3 | Better | Below |
| Brushy Creek Lake | 30 | 17.90 | 7.2(ft), 2.2(m) | 3 | 12.3 | Better | Below |
| George Wyth Lake | 43 | < 0.06 | 3.3(ft), 1.0(m) | 9 | 43.4 | Same | Below |
| Lake Manawa | 123 | < 0.06 | 1.3(ft), 0.4(m) | 40 | 93.0 | Worse | Above |
| Easter Lake | 82 | < 0.06 | 2.3(ft), 0.7(m) | 15 | 30.5 | Better | Below |
| Lake Ahquabi | 95 | 3.36 | 3.0(ft), 0.9(m) | 12 | 62.0 | Better | Below |
| Black Hawk Lake | 61 | < 0.06 | 4.3(ft), 1.3(m) | 8 | 27.8 | Better | Below |
| Three Mile Lake | 35 | 0.75 | 3.3(ft), 1.0(m) | 10 | 29.8 | Worse | Below |
| Lake Geode | 70 | 2.01 | 3.6(ft), 1.1(m) | 11 | 19.5 | Worse | Below |

Note: Lake popularity (total number of household trips) was determined using the CARD survey data from 2002-2005.
*How the majority of parameters for the 2015 averages compared to the 2000-2015 long-term parameter averages for this lake.
** How the majority of parameters for 2000-2015 long-term averages for these lakes compared to the combined long-term averages for all lakes sampled (Combined long-term averages for all Iowa lakes sampled as a part of the Ambient Lake Monitoring Program are as follows: total phosphorus concentration: 107.4 µg/L, average Secchi transparency: 1.2 m, average chlorophyll a concentration: 40 µg/L).

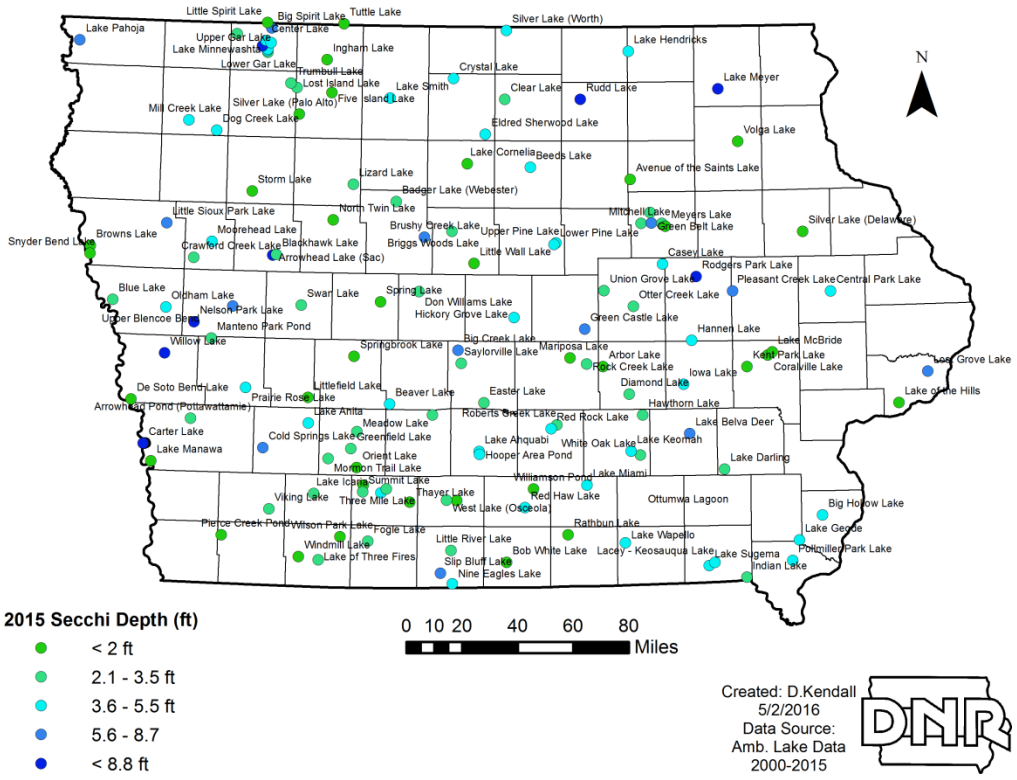


**Figure 3.2015 Average water clarity as measured by Secchi disc.**

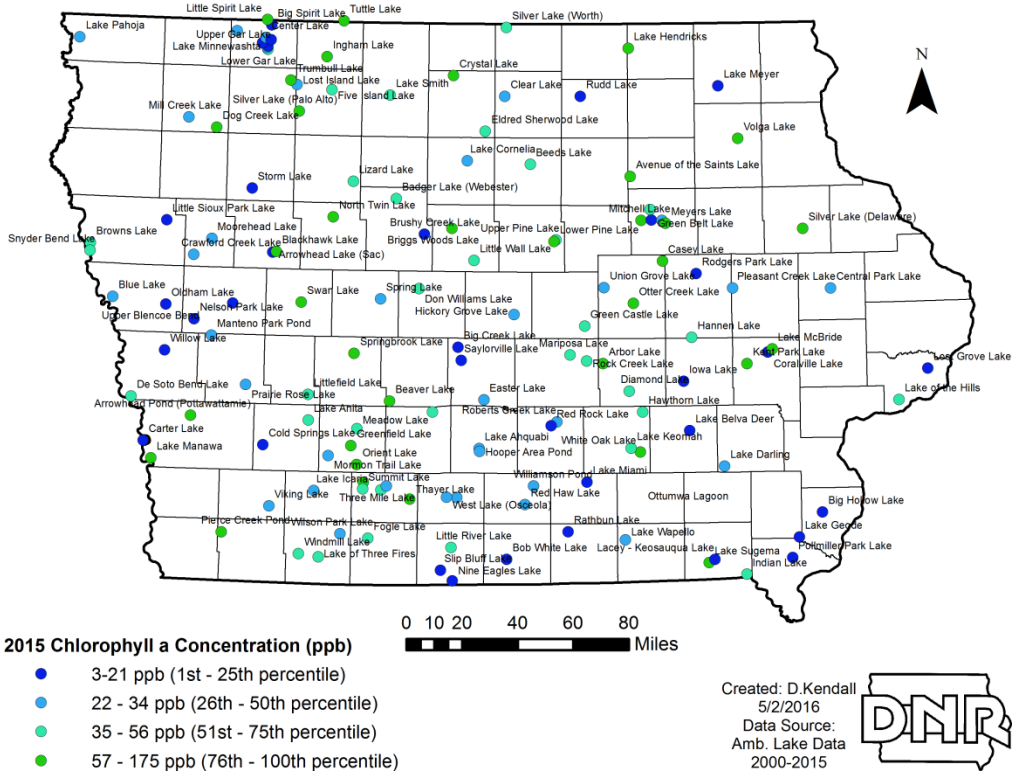


**Figure 4. Average concentrations of chlorophyll a (an estimate of algae production) in Iowa lakes.**

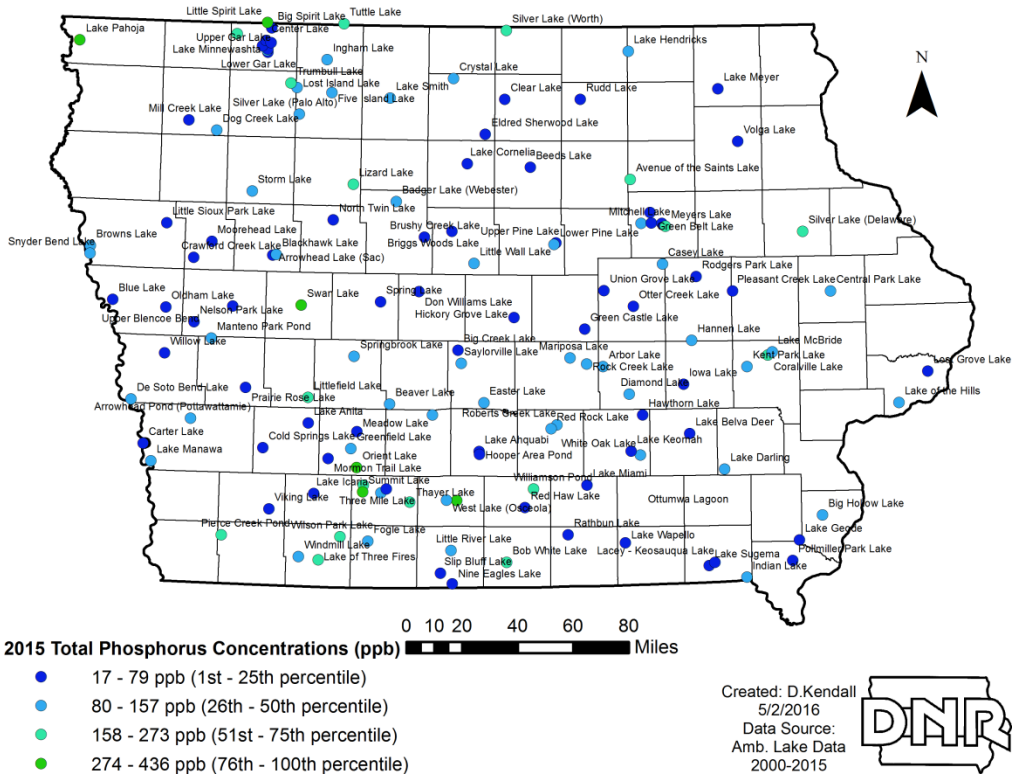


**Figure 5. Average 2015 total phosphorus concentrations for Iowa lakes.**

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