How many lakes are (really) in Wisconsin?

Cory McDonald, *Research Scientist*
Wisconsin Department of Natural Resources

Introduction

It is often claimed that the state of Wisconsin contains 15,000 lakes, though it is not clear where that figure originated. A Google search for "Wisconsin 15,000 lakes" returns 7.1 million hits, whereas a search for "Minnesota 10,000 lakes" returns 6.2 million hits. The number of named lakes, ponds, and reservoirs is approximately 6,000 (*WDNR 24K Hydro Geodatabase*). The relatively recent availability of high-resolution hydrographic data has allowed an estimate of national and global lake abundance to be made with unprecedented accuracy (*McDonald et al. 2012*); these same data are utilized here to accurately characterize the abundance and size distribution of lakes in Wisconsin.

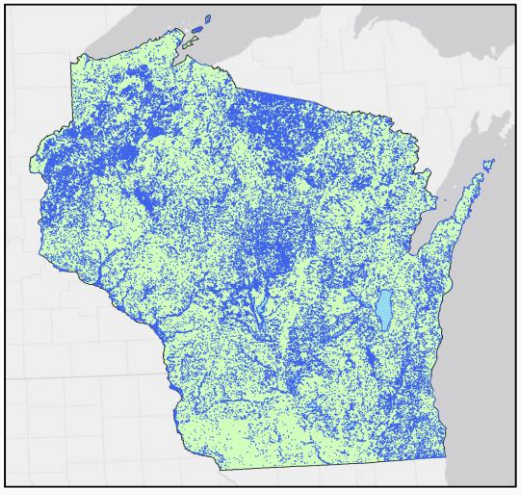

Figure 1. All non-riverine water bodies (lakes, ponds, reservoirs, etc.) in Wisconsin (*National Hydrography Dataset).*

Methods

There are two sources of high-resolution (1:24,000 scale) hydrographic data for Wisconsin: the *WDNR 24K Hydro Geodatabase* and the *National Hydrography Dataset (NHD)*. These two datasets contain approximately the same number of waterbodies for the state, but the WDNR dataset contains considerably more accurate metadata. Nonetheless, in order to remain consistent with the methodology of *McDonald et al. 2012* and to facilitate inter-state comparisons, this analysis relies primarily on the NHD. The main drawback of this dataset it its inability to distinguish between natural and artificial waterbodies, which were combined here. The Great Lakes were excluded. Data for WI and MN were projected and areas calculated using ArcGIS, and post-processing was done using R.

There is no universally-agreed upon definition of a lake, but most definitions involve setting a lower bound on surface area. This is problematic, however, because the size distribution of lakes in the landscape approximates a power-law function (*Downing et al. 2006*), meaning that the choice of this lower bound greatly influences how many "lakes" there are. Large-scale estimates of lake abundance typically choose 1000 m² (0.1 ha) as the lower limit, which coincides with the resolution limit of currently available hydrographic data. However, criteria of 1,2,5,8, and 40 ha, and others, have been used.

Results

Table 1. Abundance and surface area of WI lakes/ponds/reservoirs, corresponding to various surface-area based definitions of "lakes".

Size cutoff (ha)	Number of lakes	Total surface area (km²)	Mean size (ha)
0.1	56,600	4,200	7.5
0.93	**15,000**	4,100	27.4
1	14,300	4,100	28.7
2	9,400	4,000	43.0
5	5,300	3,900	73.2
8	3,900	3,800	97.6

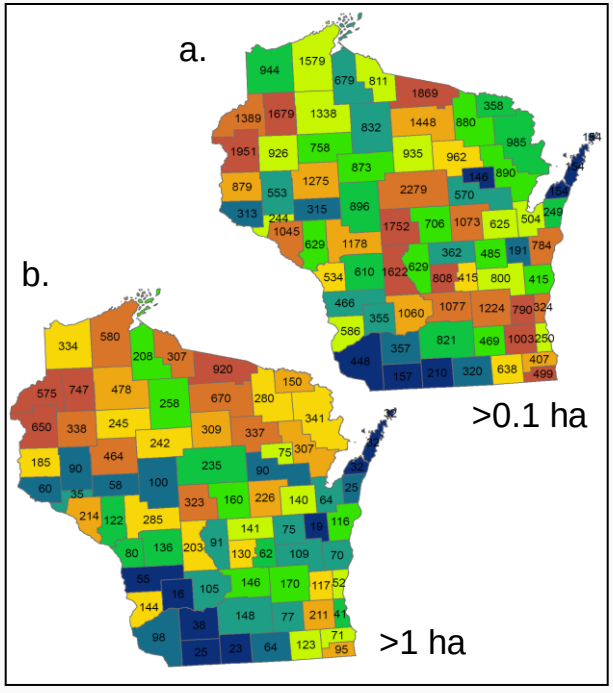

Figure 2. Abundance of lakes by county using a size cutoff of (a) 0.1 ha and (b) 1 ha. Color scale is abundance normalized to county size (i.e., lake density), with hotter colors corresponding to higher values.

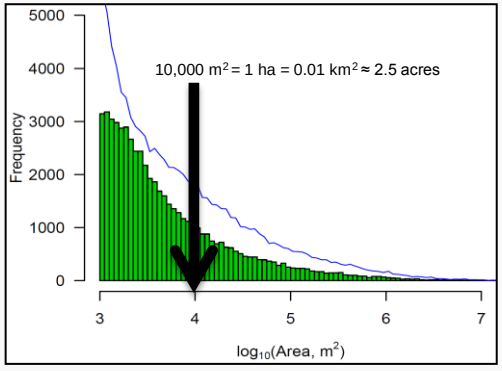

Figure 3. Size distribution of water bodies in WI (green histogram) and MN (blue line, drawn using same bins).

Discussion

Depending on the definition of what size of water body constitutes a lake is used, the number of lakes in Wisconsin ranges from less than 4,000 to over 50,000 (Table 1). Because the number of small ponds <0.1 ha has been shown to be nearly equal to the number of water bodies >0.1 ha in some cases (*McDonald et al. 2012*) the actual number of lakes, ponds, and reservoirs in the state may even approach 100,000. While the statement that Wisconsin contains 15,000 lakes is conditionally true, it requires invoking a somewhat nonconventional definition of a lake as a water body greater than 0.93 ha (2.2 acres, or approximately 100,000 ft²) in area.

If all water bodies >0.1 ha are considered, many of the counties with the greatest density of lakes are in the central and southeastern portions of the state (Fig. 2a), presumably owing to the greater abundance of small impoundments and farm ponds in that region. When a 1 ha cutoff is applied, however, the distribution clearly shifts to the north (Fig. 2b).

In comparison with Minnesota, Wisconsin clearly contains fewer lakes, regardless of size criteria applied (Fig. 3). However, the total area of Minnesota is also greater, so that the lake density is more similar (0.08 lakes/km² WI vs. 0.13 lakes/km² MN). Wisconsin also contains considerably more (~2x) total water area when the Great Lakes are considered.

References

WDNR 24K Hydrography Geodatabase. Available at *http://dnr.wi.gov/maps/gis/datahydro.html*
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McDonald, C.P., J.A. Rover, E.G. Stets, and R.G. Striegl. 2012. The regional abundance and size distribution of lakes and reservoirs in the United States and implications for estimates of global lake extent. *Limnol. Oceanogr.* 57(2):597-606
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