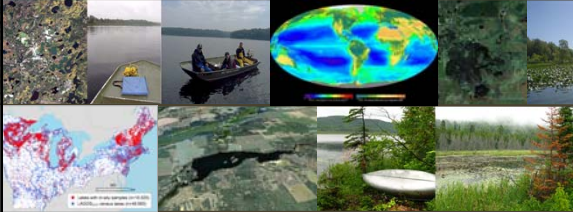



Lessons from LAGOS: Creating & using big data to understand lakes at broad scales of space & time



Kendra Spence Cheruvellil
Dept. Fisheries & Wildlife
Lyman Briggs College
Michigan State University
September 2020

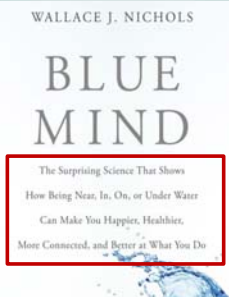
 www.lagoslakes.org

1

WALLACE J. NICHOLS

BLUE MIND

The Surprising Science That Shows
How Being Near, In, On, or Under Water
Can Make You Happier, Healthier,
More Connected, and Better at What You Do



2

Questions 1 & 2

1) Not counting the Great Lakes, what is the deepest lake in the northeastern U.S.?

2) And... what is the largest?

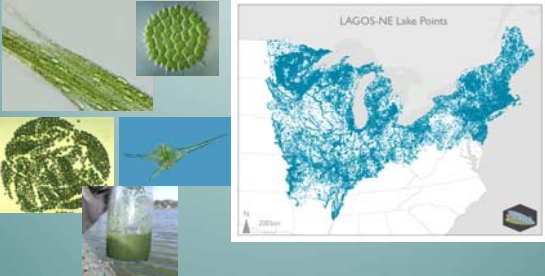


3

Question 3

Which state in the northeastern U.S. has the lowest levels of algae in its lakes?

ME, NH, VT, NY, MA, CT, RI, NJ, PA, OH, IN, IL, MI, WI, MN, IA, MO



4

Question 4

What group(s) or organization(s) or institution(s) is/are responsible for monitoring **lake water quality** in the U.S.?

5

Why do these facts & statistics matter?

People care



Images ©Kendra Cheruvellil

6

Why do these facts & statistics matter?

Scientists need this type of information



Image ©Patricia Soranno

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Why do these facts & statistics matter?

Policymakers need this type of information



Image: <https://www.gettyimages.com/detail/stock-photo/236148613/236148613-2019-07-12-2019-07-12-detroit-michigan-12000-px>

8

Analogy: Human health is to lake health...



An individual person is understood & treated by a doctor



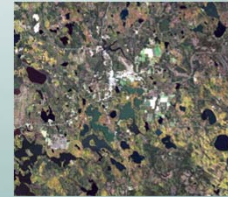
A population of people is understood & legislated by those who study & make decisions about public health

9

Analogy: Human health is to lake health...



An individual lake is understood & managed by lake users/owners & managers



A population of lakes is understood & legislated by those who study & make decisions about lake health

10

Analogy: Human health is to lake health...



Recover from sickness vs. increase public health by minimizing poverty, education disparities, unequal access to medical care...



Recover from sickness vs. increase lake health by minimizing riparian disturbances, climate change effects, spread of exotics in a region...


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Lessons learned:

- (1) We need to study lakes individually AND at the population level so that we can continue to enjoy, understand, and manage lakes, as well as make sound decisions about lakes (i.e., set good policies).

12

How do we study lakes at the population level?
10yrs ago, we couldn't answer most quiz bowl questions...



And, many scientists study individual lakes, one at a time



13

10yrs ago, we couldn't answer most quiz bowl questions...



So, where did my information come from?

14

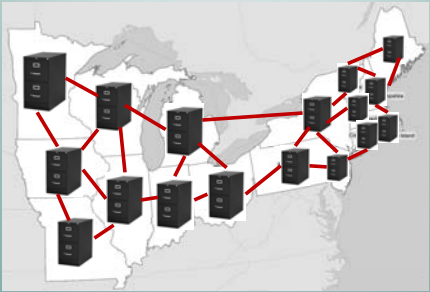


Kendra S. Cheruvellil & Patricia A. Soranno
Co-directors of the Data-Intensive
Landscape Limnology Lab

Our idea: Build a database with the needed information to better understand **lake water quality at the population level**

15

Our idea...




16

Data sources for lake water quality

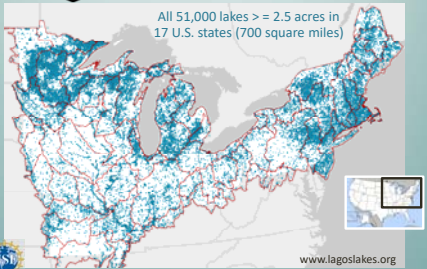
- State natural resource agencies
- Tribal natural resource agencies
- Federal agencies
- Citizen science programs
- University research programs

17



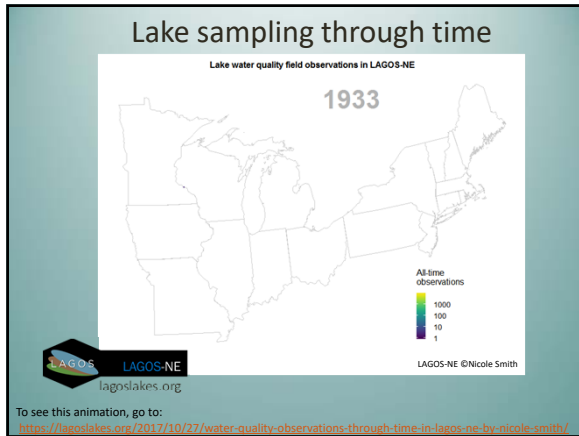
LAGOS LAke multi-scaled GeOSpatial and temporal database

All 51,000 lakes >= 2.5 acres in 17 U.S. states (700 square miles)

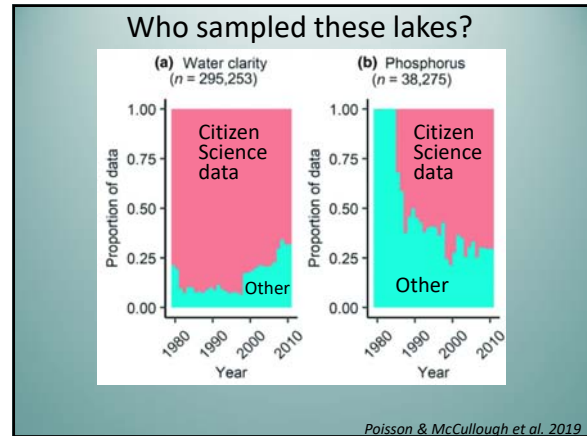


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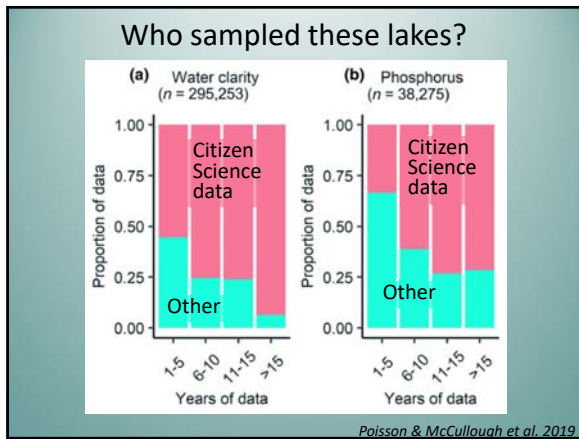
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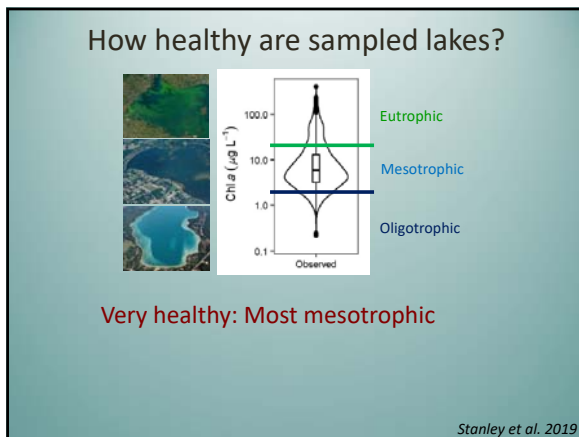


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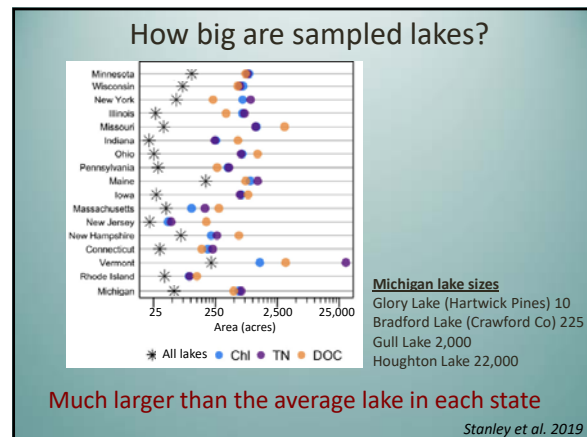
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- (3) Citizen-collected data make up a VERY HIGH proportion of available water quality data AND long-term data.

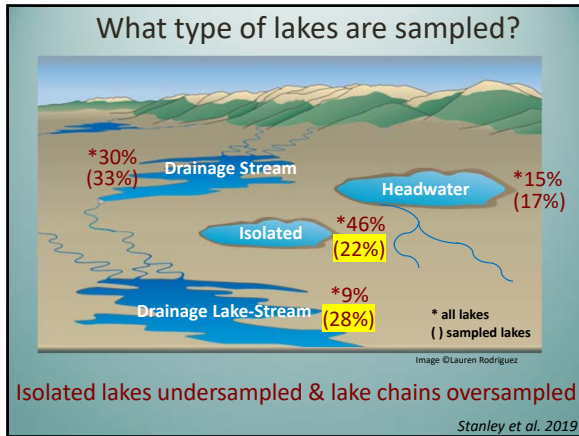
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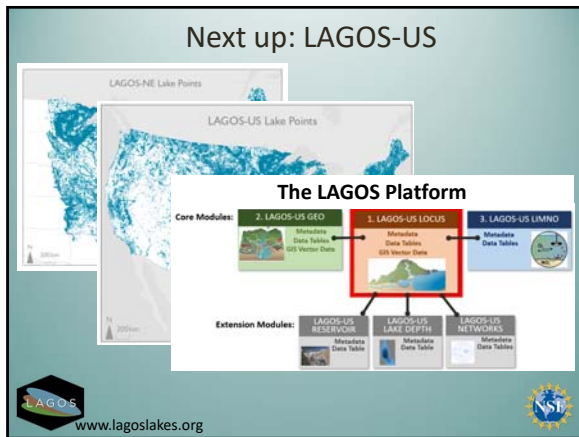


25

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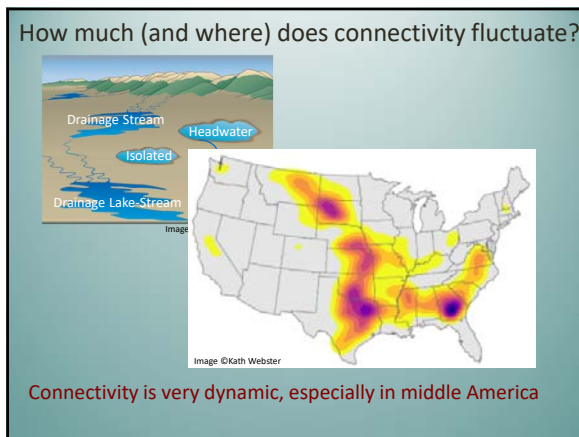
26



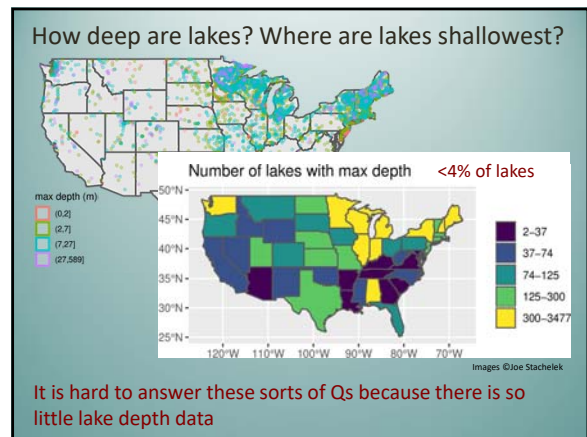
27



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29



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How many lakes are being protected, and where?

= 10% lakes
a) Strict (28,704 lakes)

A small proportion of lakes are being protected, mainly in the mountainous western U.S.

McCullough et al. 2019

31

How does fire affect lakes? And, where?

In this long exposure photograph, flames consumes both sides of a segment of Lake Berryessa during the Hennessy fire in the Spanish Flat area of Napa, California on August 18, 2020.
JOHN EDELSON/AFP via Getty Images

Fire is increasingly affecting lake watersheds across the U.S.

McCullough et al. 2019

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YOU too can use our data!

LAGOS-NE: A multi-scaled geospatial and temporal database of lake ecological context and water quality for thousands of U.S. lakes

Patricia A. Soranno, Linda C. Bacon, Michael Beauchene, Karen E. Bednar, Edward G. Bittell, Claire K. Boudreau, Marvin G. Boyer, Mary T. Bremigan, Stephen R. Carpenter, Jamie W. Carr, Keriha S. Cheruvellil, Samuel T. Christel, Matt Claucherty, Sarah M. Collins, Joseph D. Conroy, John A. Downing, Jrd Dukett, C. Emil Fergin, Christopher T. Filstrup, Clara Funk, Maria J. Gonzalez, Linda T. Green, Caroline Guis, John D. Halfman, Stephen R. Hamilton, Paul C. Hanson, Emily M. Henry, Elizabeth M. Henson, Celeste Hockings, James R. Jackson, Karl Jacobson-Hedus, Lorena L. Janusi, William W. Jones, John R. Jones, Caroline M. Keeson, Katelyn B.S. King, Scott A. Kibbalaugh, Jean-Francois Lapierre, Barbara Lathrop, Jo A. Latimore, Yushin Lee, Noah R. Lottig, Jason A. Lynch, Leslie J. Matthews, William H. McDowell, Karen E. B. Moore, Brian P. Rerill, Sarah J. Ribson, Samantha K. Oliver, Michael L. Pace, Donald C. Pierson, Katherine C. Pielonski, Anissa I. Pofford, David M. Ford, Paul D. Rayes, Donald O. Rosenberry, Karen M. Roy, Lars G. Rudstam, Orlando Sarmelle, Nancy J. Schults, Caren E. Scott, Nicholas K. Skaff, Nicole J. Smith, Nick R. Spinelli, Joseph J. Stachelski, Emily H. Stanley, John L. Stoddard, Scott B. Stopyrak, Craig A. Stow, Jason M. Tallant, Pang Ning Tan, Anthony P. Thorpe, Michael J. Vanni, Tyler Wagner, Catherine Walkers, Kathleen C. Weathers, Katherine E. Webber, Jeffrey D. White, Nancy A. Willms, Shuai Yuan

GigaScience, gix101, <https://doi.org/10.1093/gigascience/gix101>
Published: 19 October 2017

www.lagoslakes.org Data access package (R) = LAGOSNE

34

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Together, we are all in the fight to understand and protect our waters for future generations.

ksc@msu.edu

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