Report to White Lake Town Board
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LIMNOSCIENCES

Data—What Does it Mean?

  I have often emphasized the value of data collection for understanding complex systems such as White Lake. However, the value is only realized with a great deal of time spent on analysis, compilation, and synthesis, building a body of evidence in the same way that a trial lawyer would. This year's annual monitoring report is over 30 pages, and it is not complete yet, but the intent is to provide as comprehensive overview of the scientific evidence we now have about what is changing at White Lake and why those changes are occurring. The following is offered as an example of what is in the draft report; as it is technical, I would like to draw your attention to the items circled in red: they are multiple lines of evidence related to the same issue.
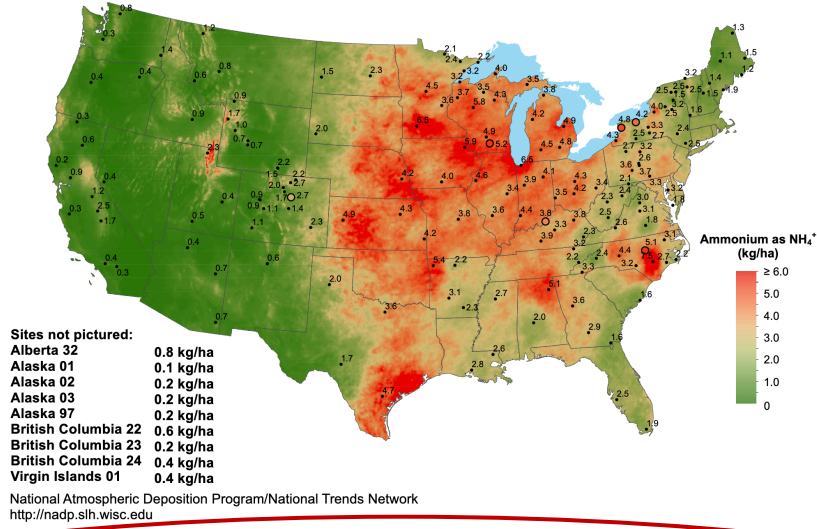
Table 2. White Lake 2020-2021 rainfall sampling, with rainfall event amounts in inches and nutrient concentrations (Total Phosphorus [TP], Total Nitrogen [TN], $NH_3 – NH_4$, $NO_3 - NO_2$) in mg/L. Dissolved Inorganic Nitrogen (DIN) equals $NH_3 – NH_4 + NO_3 - NO_2$.

White Lake Rainfall Nutrients 2020-2021

| DATE	RAIN (inches)	TP (mg/mL)	TN (mg/mL)	NH3-NH4	NO3-NO2	DIN % TN	RAIN TN/TP	LAKE NH3-NH4	LAKE TN/TP
2/13/20	0.25	0.017	0.586	0.159	0.082	41%	34.5	0.044	27.9
3/5/20	1.25	0.012	0.302	0.123	0.049	57%	25.2	0.050	22.6
4/23/20	0.25	0.008	0.190	0.107	0.068	92%	23.8	0.033	26.3
5/29/20	3.3	0.045	1.35	0.410	0.328	55%	30	0.037	40.3
9/17/20	2.5	0.007	0.385	0.176			55		40.4
11/12/20	2.75	<0.002	0.202	0.018	0.011	14%			
8/18/21	0.75	<0.002	0.190	0.029	0.059	46%		<0.010	30.5

This form of nitrogen, found in the rain, is also being found in the lake—it can be utilized very quickly by algae

Ammonium ion wet deposition, 2020

Sites not pictured:

Alberta 32	0.8 kg/ha
Alaska 01	0.1 kg/ha
Alaska 02	0.2 kg/ha
Alaska 03	0.2 kg/ha
Alaska 97	0.2 kg/ha
British Columbia 22	0.6 kg/ha
British Columbia 23	0.2 kg/ha
British Columbia 24	0.4 kg/ha
Virgin Islands 01	0.4 kg/ha

National Atmospheric Deposition Program/National Trends Network
http://nadp.slh.wisc.edu

Long-term monitoring of rainfall is finding that this form of nitrogen is increasing sharply in this region of NC— the annual average is very high

Figure 3. Mean annual wet deposition of ammonium, in kg/ha, in 2020. The mean at the Clinton, NC, monitoring station, 7.5 kg/ha, was the highest among the national monitoring locations, while the mean at Raleigh, at 5.1 kg/ha, was also high. U.S. EPA Clean Air Status and Trends Network: https://www.epa.gov/castnet (Accessed 1/4/22)
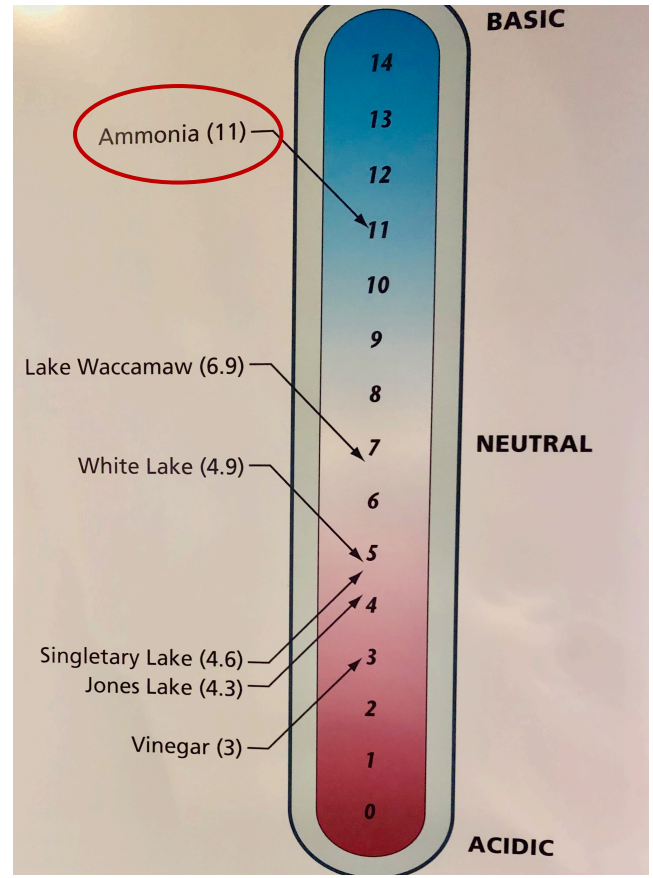
This photo was taken at Jones Lake SP Visitor's Center—it shows ammonia as an example of a strong base

When ammonia mixes with water in the atmosphere, it forms ammonium—and this reaction increases the pH of rainwater

So, ammonia emissions in this region of NC are making rain less acidic and more basic, and are also providing a source of fuel for lake algae

Atmospheric deposition is a large-scale process, which means that effects can be distributed widely. It is also a "hidden" process, unless and until data is collected to assess its relative importance. It is very important at White Lake, as the evidence indicates, and the focus now will be to share what we have learned with a larger audience, so opinions are replaced with reality, and ideally, understanding.