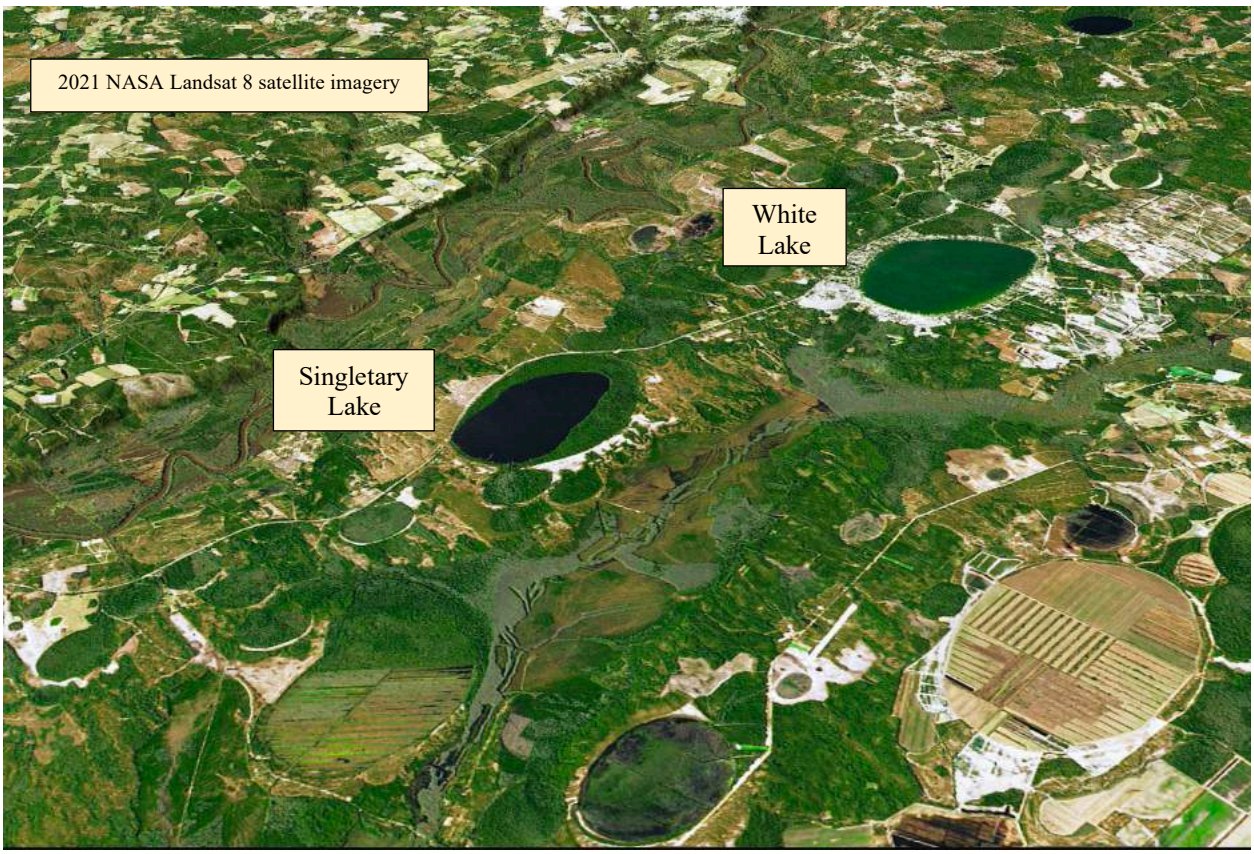
The Value of Lake Monitoring Data

Comparisons of lake data over time, and comparisons between White Lake and other Bay lakes provides a means to identify drivers of lake changes. LIMNOSCIENCES has been collecting monitoring data at White Lake since May 2018 and sampled nearby Singletary Lake three times a year (February, June, September) in 2021, 2022, and 2023 as an acidic reference lake with an undeveloped lakeshore.



Singletary Lake is a blackwater lake that has no inlet, and the outlet was dredged, and a spillway dam created "160 yards from the original shoreline in the region of the sand rim", by the Resettlement Administration. At 569 acres, Singletary Lake occupies 56% of its bay (the remaining portion is wetlands), while White Lake, at 1,067 acres, occupies 71% of its bay (Frey 1949).

White Lake Comparisons Over Time: The following table includes 1974 data from Weiss and Kuenzler (1976), with a single asterisk noting that a different methodology was used for chlorophyll a (the data is reported as Turner units) and the double asterisk noting that turbidity was reported as JTU. The 1998-2017 data was collected and analyzed by NC DEQ, and 2018-2023 data is from LIMNOSCIENCES. Chlorophyll means in parenthesis are from measurements taken in the field with a handheld fluorometer.

White Lake Monitoring Data Collected in June, From 1974 to 2023

	1974	2003	2013	2017	2018	2019	2020	2021	2022	2023
Mean Temperature (°C)	26.1	27.6	27.5	28.6	30.2	29.0	27.5	28	29.6	28.3
Mean Secchi Depth (m)	>3.0	2.6	2.8	1.2	1.75	>3.0	1.25	1.25	1.25	1.6
Turbidity (NTU)	3**			4.3			2.3	2.6	2.6	2.3
Mean Chlorophyll a (µg/L)	13*	5	2.5	10.7	8	5.5	6.4	9.4 (7.5)	3.4 (6.2)	8.3(13)
Mean Biovolume (mm_3/m_3)	156				18,318	12,128	23,360	5,316	657	6,769
pH Range (std. units)	4.6	4.2	6.0-6.8	6.5-7.4	6.6-7.3	6.2-6.7	7.1-7.3	6.8-7.0	6.7-6.9	6.7-7.2
Mean Dissolved Oxygen (mg/L)	8.6	8.0	7.0	7.3	7.6	7.9	8.6	7.8	8.1	8.8
Mean Total Nitrogen (mg/L)	0.211	0.11	0.39	0.68	0.50	0.481	0.757	0.870	0.745	0.768
Mean NO_3-NO_2 (mg/L)	0.011			<0.02	<0.02	<0.010	0.013	<0.010	<0.010	<0.010
Mean NH3-NH4 (mg/L)	0.038			<0.02			0.006	0.014	0.010	<0.010
Mean Total Phosphorus (mg/L)	0.017	<0.02	<0.02	0.02	0.02	0.014	0.025	0.031	0.029	0.023
Mean SRP (mg/L)	0.016					<0.001	<0.001	<0.001	<0.001	0.003
TN/TP (mass)	12.4			34	25	34.4	30.3	28.1	26.0	33.4
# of Samples		3	3	7	7	6	6	6	6	6

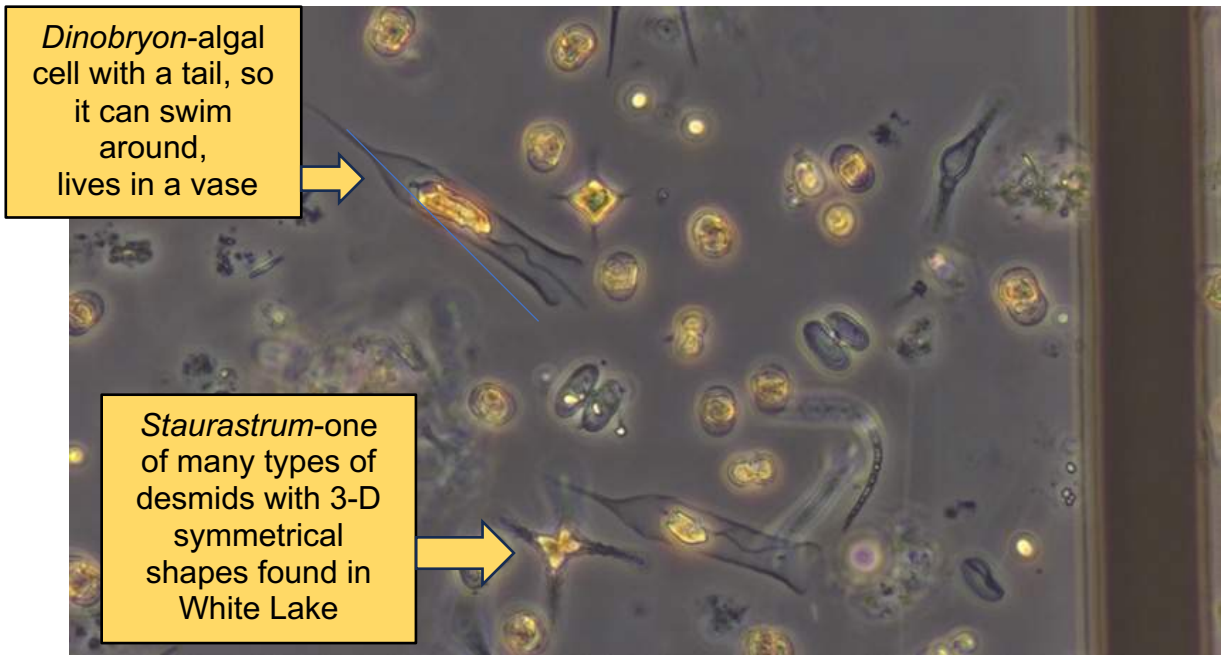
White Lake experienced a filamentous cyanobacteria (*Planktolyngbya limnetica*) bloom from September 2017 to May 2018 (green line), and a low dosage alum treatment was applied 5/3 to 5/16/18. The June 2018 data is 6 weeks post-treatment.

Singletary Lake Comparisons Over Time: The following table includes 1974 data for Singletary Lake from Weiss and Kuenzler (1976) (turbidity data with 2 asterisks was reported as JTU; chlorophyll a data with a single asterisk was reported as Turner units); 2003-2018 data from NC DEQ; 2021-2023 data from LIMNOSCIENCES, and chlorophyll data in the table includes both lab measurements and field measurement with a handheld fluorometer (field data in parenthesis).

Singletary Lake Monitoring Data for June, 1974 to 2023

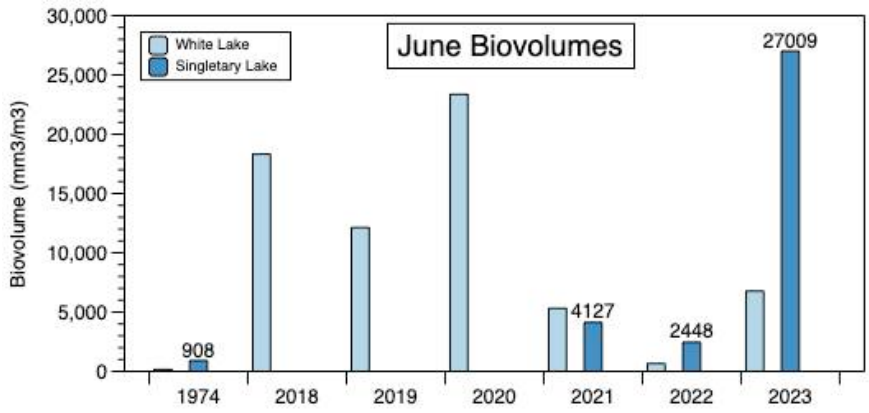
	1974	2003	2013	2018	2021	2022	2023
Mean Temperature (°C)	25.6	30.3	27.8	30.7	29.1	29.2	31.4
Mean Secchi Depth (m)	0.9	1.0	0.7	0.4	0.25	0.5	0.6
Mean Turbidity (NTU)	8**				2.6	3.9	4.4
Mean Chlorophyll a (µg/L)	34*	12	6.2	12.2	11 (14)	11 (10)	12(11)
Mean Biovolume (mm_3/m_3)	908				4,127	2,448	27,009
pH Range (std. units)	4.2	3.6-3.7	5.4-5.6	4.1-4.2	4.3	4.26	4.20
Mean Dissolved Oxygen (mg/L)	8.5	7.6	8.7	6.6	7.3	6.36	8.19
Mean Total Nitrogen (mg/L)	0.306	0.340	0.43	0.730	0.881	0.625	0.641
NO_3-NO_2 (mg/L)	0.031	<0.02	<0.02	0.12	0.101	<0.010	0.015
NH_3-NH_4 (mg/L)	0.02	<0.02	0.02	0.02	0.036	0.059	<0.010
Mean Total Phosphorus (mg/L)	0.022	0.023	0.023	0.04	0.038	0.030	0.036
Mean SRP (mg/L)					0.030	0.022	0.017
TN/TP (mass)	13.9	14.8	18.7	18.25	23.2	20.8	17.8

June Biovolume Comparisons Between White Lake and Singletary Lake: Biovolume is determined by measuring the sizes of algae and cyanobacteria, and applying these measurements to the counts that are done by Dr. Linda Ehrlich, the taxonomist who has been working on White Lake samples since 2018. It is tedious work that is done by using an inverted microscope and is the best way to truly understand phytoplankton communities in lakes and how they change over time. The photograph below shows the magnified view of a sample that has been concentrated (phytoplankton are not that dense in an unconcentrated sample unless there is a large bloom).



Photograph provided by Dr. Ehrlich

High phytoplankton biovolumes reduce lake clarity, although there are non-living constituents (like muddy sediments) that can also impact clarity. In June 2022, phytoplankton biovolume in White Lake was very low, but measures of clarity (Secchi depth and turbidity) were similar to June 2020 levels (when biovolume was relatively high) and June 2021 levels.



There has been a long-standing opinion that White Lake was clear because it was acidic, and if it were acidic again, algae and cyanobacteria would disappear. ***Scientists collect data before making such statements.*** The data collected at acidic Singletary Lake does not support this opinion—quite the contrary, as was seen in June 2023, with Singletary having a biovolume peak that was higher than what has been seen at White Lake in June from 2018-2023. The phytoplankton species dominating the biovolume at Singletary was a desmid (like the one in the photo above), and similar desmids are often dominant in summer months at White Lake. There are many more phytoplankton species found in White Lake compared to Singletary, and this diversity is beneficial.

Data Sources:

A NC Water Resources Research Institute 1976 report on the Trophic Status of North Carolina Lakes by Dr. C. Weiss and Dr. E. Kuenzler includes data collected in 1974 (this is the first nutrient data reported for the Bay lakes), while NC DEQ conducts lake monitoring every five years for the summer period (May-September). LIMNOSCIENCES has been collecting monitoring data at White Lake since May 2018 and sampled nearby Singletary Lake three times a year (February, June, September) in 2021, 2022, and 2023 as an acidic reference lake with an undeveloped lakeshore.

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