Algae and Aquatic Vegetation in White Lake

During the time that David Frey was working at White Lake (late 1940s-early 1950s), there were three issues that generated much interest among various stakeholders:

- Low lake levels (boaters)
- Abundant mats of bottom algae and vegetation that were considered a nuisance, as they were dislodged by boating activity and washed ashore to decompose, particularly on the western side of the lake (residents and swimmers)
- Improving the recreational fishery (Wildlife Resources Commission)

Extending the length of piers was offered as a solution to reduce the effects of boating on the lake bottom and algae, as was reducing or eliminating power boating. Several ideas were promoted to rid the lake of the bottom algae, including the algicide copper sulfate, and herbivorous (plant/algae-eating) carp, and these "solutions" were requested repeatedly over the years.

The following reports and letters mention the types of algae and vegetation found:

- D. Frey report 7-25-50: Noted a "recent bloom of algae", identified *Mougeotia, Ulothrix, Zygnema,* and *Spirogyra.* He mentioned that the abundance was greatest in the western side of the lake, around the lake outlet. He also suggested that the state hire a student to test whether copper sulfate would be effective, and whether it would be safe to use in a lake with low alkalinity (the copper could be toxic to fish)

- Letter from T.C. Ellis, Senior Park Ranger 7-10-50: "the attendance at White Lake has not been what I believe that it would have if the rumor had not gotten out that White Lake had become polluted"

- Letter from J.H. Cornell, Chief, Fish Division, Wildlife Resources Commission, 7-17-50: he made a brief visit to the lake, and found "at the end of the lake near the swamp, members of the Zygnematales present were principally *Zygnema* and *Spirogyra* in moderate quantities, of the Ulotrichales, very considerable growths of *Ulothrix* were collected, at the opposite end of the lake, near the beaches, the Ulotrichales were predominant, with some *Ulothrix* present, but principally *Cladophora* and *Rhizoclonium.* In in the central part of the lake were several floating mats of the bladderwort *Utricularia"*

- In the late 1950s, the dominant genera (in order of abundance) were: *Sagittaria* (arrowhead), the filamentous green alga *Spirogyra, Cabomba* (fanwort), *Utricularia* (bladderwort) and *Eleocharis* (spikerush) (Tebo 1961)

- Survey work in 1978-79 indicated that densities of vegetation varied noticeably in different regions of the lake, with the primary species being the bladderwort Utricularia and the spikerush Eleocharis, both of which are low growing (1 to 8 inches in height) (Nichols, 1979)

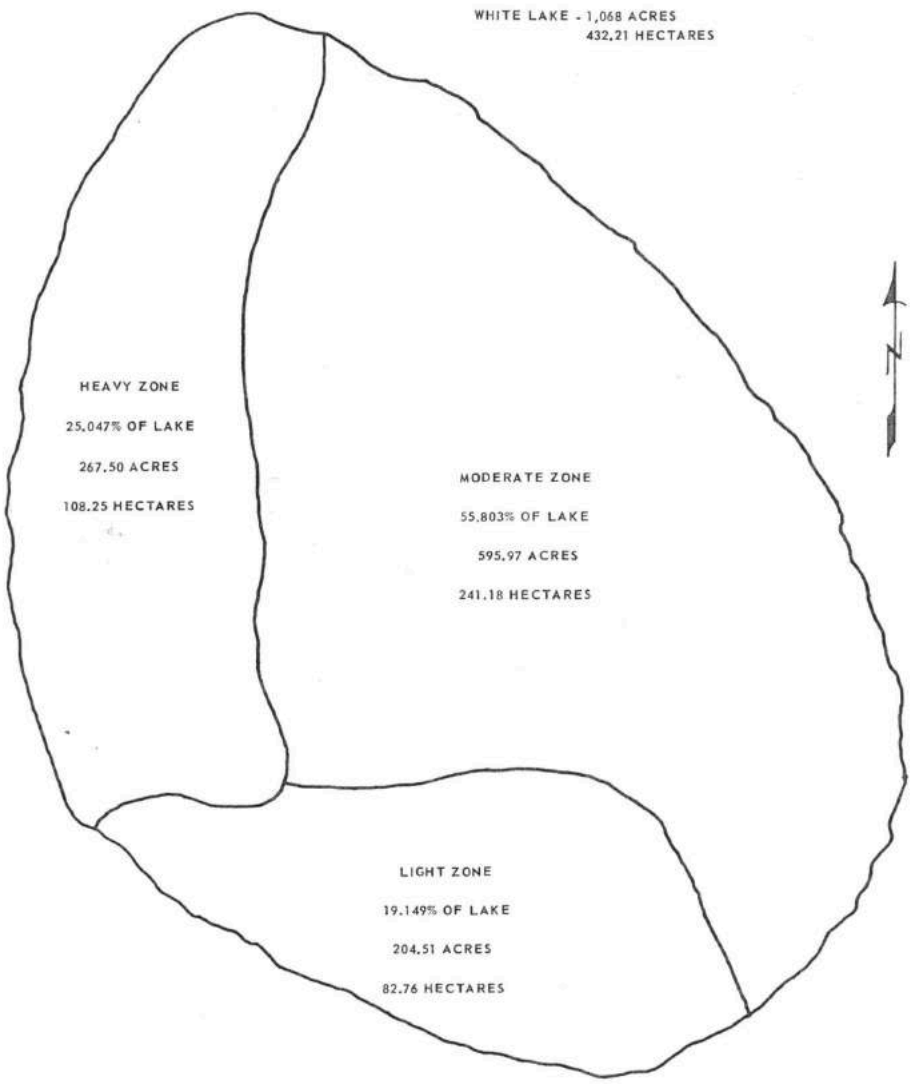


Figure 2. Estimated area affected by vegetation.

Figure 1. Relative abundance zones for aquatic vegetation in White Lake, from Nichols 1979 Wildlife Resources Commission Report on White Lake.

A survey was conducted by NC Division of Water Quality in 2001:

Division of Water Quality

June15, 2001

MEMORANDUM

To: Paul Rawls

Through: Jay Sauber

From: Ed Williams EW

Subject: White Lake Algae/Aquatic Weed Survey
(Cape Fear River Basin)

Because of historic seasonal algal blooms, on June 12, 2001, staff from the Intensive Survey Group (ISG) accompanied by Hughie White of the Fayetteville Regional Office (FRO), performed an algae/aquatic weed survey of White Lake in Bladen County. For many years, White Lake has experienced problems with the seasonal growth and subsequent die-off of filamentous algae and macrophytes. In the summer months, large mats of algae washing up on the shore and rotting have caused noxious odors.

Our survey consisted of three east/west cross sections on the northern, middle, and southern portions of the lake, and a cruise of the lake's perimeter in the shallow zone (≈ 5 feet). Samples of filamentous algae had one dominant taxon, *Zygnema*, and a few other taxa, *Spirogyra* and *Oedogonium* mixed in but not more than 3% of the sample. The macrophytes sampled were identified as bryophyte, commonly referred to as moss. The cruise of the lake's perimeter revealed scattered patches of *Zygnema* at around a depth of 5 feet. Bryophyte dominated the northwest sector of the lake.

At the time of the survey, the filamentous algae *Zygnema* was not found in a great abundance. It was mostly formed in scattered patches in the shallower zones of the lake (≈ 5 feet). It may increase in density as the season progresses. There is potential for *Spirogyra* to outcompete *Zygnema*, as these two species have expressed dominance in different years. Based on staff observations in June of 2000; it is believed that the algae was much denser last year than this year.

If you have any questions concerning this survey or other White Lake data, please contact me at 919/733-6510.

*see attached map for station locations

Northern cross section

Station 1 - Dense mats of bryophytes (moss) were taken from the bottom at a depth of 6 feet. No filamentous algae were present.

Station 2 – No aquatic weeds or filamentous algae was present at this site. Some bryophyte roots were present in the sediment at a depth of 9 feet.

Station 3 – Patches of the filamentous algae *Zygnema* were observed at a depth of 5 feet. No aquatic weeds were present.

Middle cross section

Station 4 – Patches of *Zygnema* with some bryophytes mixed in were observed at a depth of 4.5 feet.

Station 5 – Dense mats of bryophytes were observed at a depth of 9 feet. No *Zygnema* was found at this site.

Station 6 – Patches of *Zygnema* were observed at a depth of 5 feet.

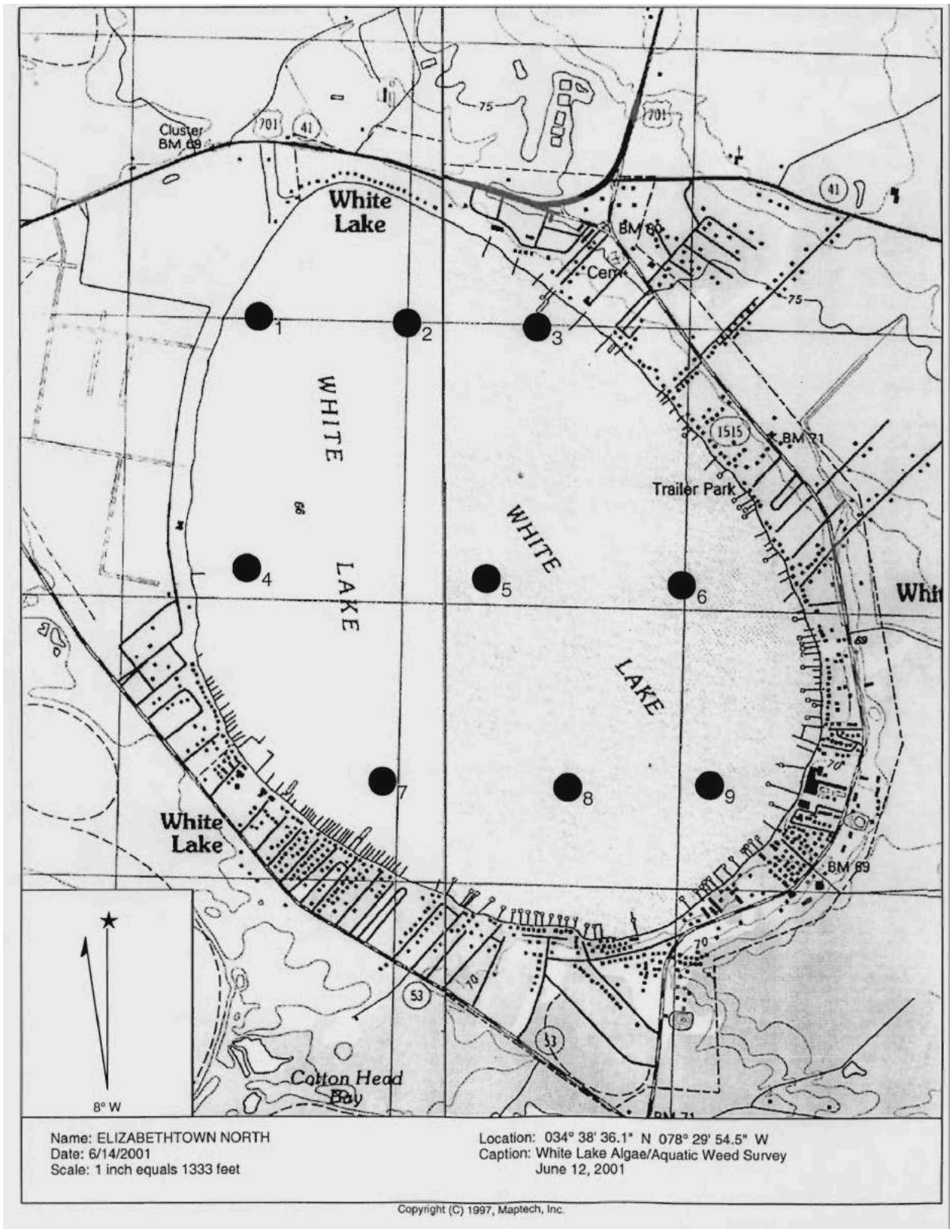
Southern cross section

Station 7 – Patches of *Zygnema* were observed at a depth of 5 feet.

Station 8 - Mats of bryophytes were observed at a depth of 9 feet. No *Zygnema* was found at this site.

Station 9 - Patches of *Zygnema* were observed at a depth of 5 feet.

Cc: Ernie Seneca
Carol Tingley
Keith Ashley
Jimmie Overton
Hughie White
Don Register
Dave DeMont
Marshall Ellis



Name: ELIZABETHTOWN NORTH
Date: 6/14/2001
Scale: 1 inch equals 1333 feet

Location: 034° 38' 36.1" N 078° 29' 54.5" W
Caption: White Lake Algae/Aquatic Weed Survey
June 12, 2001

The 2001 memo indicated that in 2000 levels of algae had been higher, and this Bladen Journal article and photo from July 2000 shows what the decaying algae looked like in some places:

FRIDAY, JULY 21, 2000

BLADEN JOURNAL

Volume 92, No. 58

5

Dr. Lawson is finalist for job in Pitt County

BY DAVID BRAY
Staff Writer

Dr. Byron Lawson, superintendent of Bladen County Schools, has been selected as one of five finalist for the position of Superintendent of Pitt County Schools. The Pitt County Board of Education released the names of four of the candidates on Friday, July 14th.

Contacted at his office at Bladen County Schools, Dr. Lawson said, "This is not a position that I was seeking in any way. The opportunity presented itself, and I believe the fairest thing to do, professionally and personally, is to examine all aspects of the situation."

The Pitt County school system is considerably larger than the Bladen County system. Pitt has 34 schools serving 21,000 students, compared to Bladen which has 5,800 students enrolled at 14 schools.

According to Ginger Livingston reporting in *The Daily Reflector*, the Pitt County Board of Education will start interviewing candidates for the position on Monday, July 24.

In addition to Lawson, other candidates for the superintendent position include two educators from the Pitt County school system: Brenda K. Jones, associate superintendent for human resources, and Del Burns, a former assistant superintendent for curriculum and instruction.

Michael Priddy, associate superintendent of auxiliary services for Guilford County Schools, and Dr. Lawson complete the list of named

SEE LAWSON page 9A

Staff photo by Jack McDuffie

It's only decaying algae

The thick and smelly black material that is collecting at a few localized spots mostly along the south side of White Lake is a naturally occurring algae that grows at the bottom of the lake and floats to the surface where it decays causing an offensive odor. In photo, town Director of Public Works Tim Frush lifts a pitchfork of the matted material from a cove along the south shore.

Constru new hig on OK

BY MICHAEL SIMMONS
Journal Editor/GM

Construction on Bladen County' two new high schools may be run ning a little behind schedule, bu not so far behind that there is nee for concern at this point that the will not be ready for students o the appointed time of fall, 2001

So said Robbie Ferris of the ar chitect firm Shuller, Ferris, Lind strom and Associates to the count school board Monday night.

Contractors on both the east an west sites have asked for exten sions on when the projects must b complete, but both seem to b working within the windows c time they have been given, Ferri told the board. Neither extensio request has yet been granted by hi firm, Ferris said.

"There are ways to speed up con struction work," Ferris said, an added that the contracting firm o the eastern site had been behind hi planned schedule by a self described 60 days a short time ago.

"Now," he said, "the project i behind the contractor's schedule by only 25 days."

The western site, though it look to most observers to be well behin the eastern site, is actually ahead o its tentative schedule, Ferris said He added, though, that Cook Brothers Company, the genera contractor on the western schoo project, still has not provided the architect firm with its finalized schedule.

That they must do so within the

Lake phenomenon said to be natural

BY JACK McDUFFIE
Staff Writer

The smelly black material that has accumulated at some locations along the shore of White Lake, primarily on the south end, is nothing but decaying algae, according to Paul Rawls of the North Carolina Division of Water Quality District Office in Fayetteville.

Though the material looks and smells somewhat like sludge in some localized areas, mostly in coves, it is harmless to animal life, Rawls said.

"It's more of a nuisance than a water quality problem," Rawls pointed out. "It is a natural process that has occurred for many years. We (DWQ) have been involved in monitoring the occurrence of the problem since the 1950's and it is a regularly occurring phenomenon."

Rawls says that his department just finished the latest tests on the lake and no indication of contamination was found in the samples taken.

"The material is the same type that has been there many times before," Rawls explained. "It is filamentous green algae of the spirogyra species that grows on the lake floor. The fact that the lake water is clear allows more light to get to the bottom of the lake which enhances the growth of the algae."

Rawls says algae, in the right proportions, is necessary and very beneficial. However, it becomes a nuisance when the amount gets out of balance.

"The samples we just collected and tested confirmed that this is spirogyra," Rawls said.

"Several factors contribute to the collection of the decaying algae in certain areas," Rawls said. "The natural current and wave action of the water along with the boat traffic on the lake probably contribute to the algae breaking loose from the bottom of the lake and floating to the top where it decays and turns black. The fact that the lake is pretty shallow probably contributes to the algae breaking loose. The decaying algae is what causes the smell that people object to.

"Based on previous studies of the lake, there has been no degradation of water quality," Rawls added. "DWQ will continue to monitor the lake to determine if conditions change. Periodically we do a thorough investigation of the lake and we've found no evidence to indicate that the situation presents a health problem."

"Periodically we do a thorough investigation of the lake, and we've found no evidence to indicate that the situation presents a health problem."

Paul Rawls, District DWQ official

Rawls said his agency is going to meet with town officials at a later date to look at some alternatives to try to lessen the nuisance created by the algae accumulation.

David Coburn, park superintendent at Singletary Lake and the individual charged with monitoring three state-owned lakes in the county—White Lake, Bay Tree

SEE WHITE LAKE, page 4A

The next surveys were more intensive; a 2014 survey of the lake conducted by personnel from NC State University was initiated after an infestation of the aquatic weed *Hydrilla verticillata* was found in Lake Waccamaw. No hydrilla was found that year, but vegetation was found at most of the stations sampled (89%). The same type of whole-lake annual survey has been conducted from 2017 to the present. Hydrilla was found in most of White Lake in 2017 but has been found very sparsely since that time. These annual surveys give a good indication of the natural variability in the presence of bottom algae and vegetation in the lake.

Recent Data on Aquatic Vegetation/Algae from NCSU Surveys (reported in the 2021 White Lake Monitoring Report):

The 2021 White Lake vegetation survey conducted by NCSU Extension personnel found a decrease in the percentage occurrence of aquatic vegetation/filamentous algae compared to 2020, with 64% of the sample sites having aquatic vegetation (Table 5). The lake elevation at the time of the 2021 survey was 64.1 feet above sea level (NAVD 88), and the Secchi depth was 1.0 m. Lake elevation at the time of the 2020 survey was 64.55 feet (due to high rainfall that year) and Secchi depth was 1.0 m, while the lake level was much lower at the time of the 2019 survey (63.68 feet) and the Secchi depth was 1.6 m. The 2018 survey was conducted about five weeks after Hurricane Florence, and floodwaters had subsided quickly; the Secchi depth was 1.25 m. In September 2017, White Lake Secchi depths were less than 1 m due to the cyanobacterial bloom (NC DEQ 2018).

Table 5. Aquatic vegetation found in annual whole-lake surveys of White Lake. Percentage occurrence is determined as the number of survey points in which each vegetation species is found divided by the total number of survey points (202) sampled (Table from 2021 NCSU White Lake Aquatic Vegetation Survey Report). Green indicates an increase from the previous year, and red indicates a decrease.

Species	2014	2017	2018	2019	2020	2021
Hydrilla	0%	84%	0.50%	1.50%	0%	0.5%
Tuckerman's Pondweed	0%	0%	0%	0%	13%	9%
Variable Pondweed	0%	0%	0%	0%	0%	<1%
Spikerush	40%	9%	56%	68%	45%	3%
Bladderwort	14%	0%	0%	0%	0%	4%
Dwarf Milfoil	0%	15%	20%	34%	20%	14%
Low Milfoil	54%	0%	0.50%	0%	0%	0%
Filamentous Algae	0%	0%	0%	0%	24%	28%
Macroalgae	29%	66%	0%	0%	6%	27%
Aquatic Moss	43%	63%	32%	6%	8%	0%
No Vegetation	11%	6%	36%	16%	25%	36%
Vegetation	89%	93%	65%	84%	75%	64%

Many of the sample points on the western side of the lake had two or more kinds of vegetation found (Fig. 13). A single occurrence of the invasive weed hydrilla was found in the same general areas where it was found in 2018 and 2019 (Fig. 14).

The 2018 survey of White Lake found the biomass of aquatic vegetation was much lower than in 2017; this was best illustrated by comparison photos included with the survey report that year:

2017

2018

While the presence of different kinds of vegetation can vary from year to year, there can also be variability over the course of the summer season. Mid-year monitoring events were

Attachment 10 (continued).

conducted in June and August of 2020 for hydrilla detection, with results indicating a trend of more vegetation present in early summer, particularly for spikerush and macroalgae *Chara/Nitella* (both have been found in the lake and are very similar in appearance) (Figure 16; NCSU 2020).

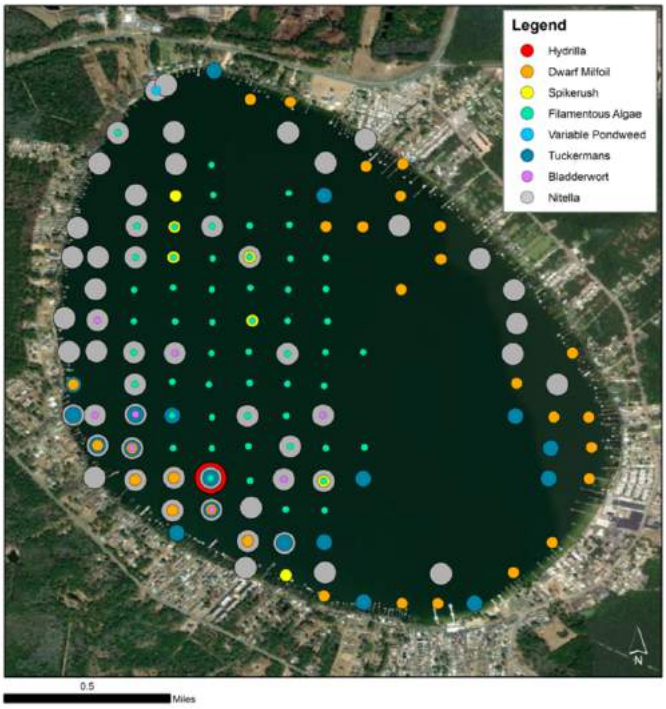


Figure 13. Sample locations where aquatic vegetation/algae was found in 2021 (NCSU 2021).

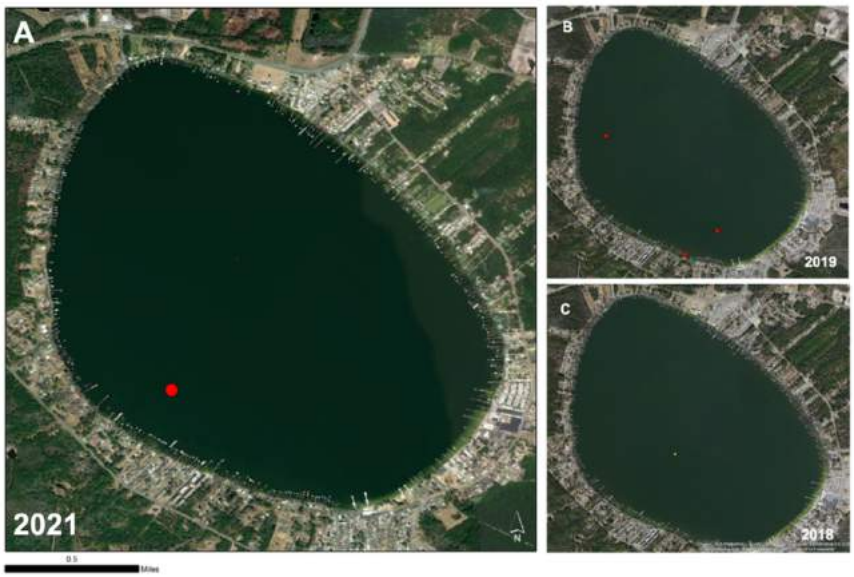


Figure 14. Locations where the aquatic weed *Hydrilla verticillata* was found, A) in 2021; B) in 2019; and C) in 2018 (NCSU 2021).

Attachment 10 (continued).

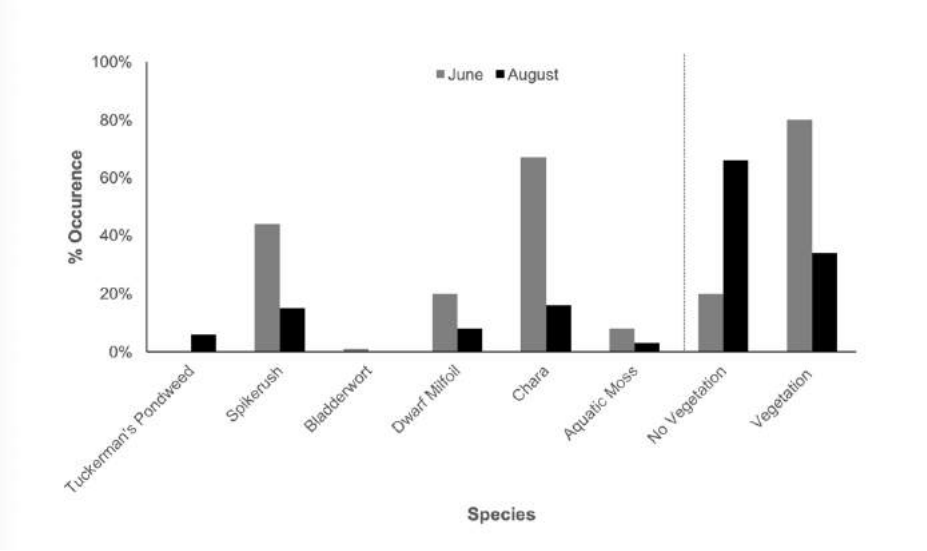


Figure 16. White Lake % occurrence of submerged aquatic vegetation in June and August 2020 (NCSU 2020).

Tuckerman's pondweed (*Potamogeton confervoides*, also known as algal pondweed) was first found in White Lake in 2020, and it was the only species that was classified as "dense" in the 2021 survey (Fig. 17).

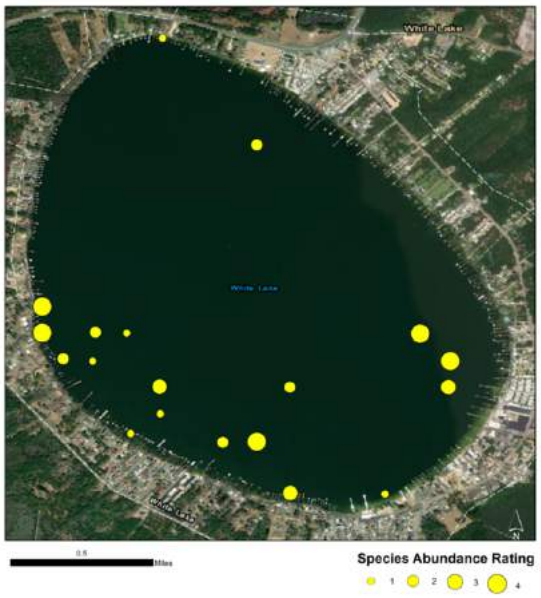


Figure 17. Relative abundance of Tuckerman's pondweed (*Potamogeton confer*voides) in White Lake in October 2021 (NCSU 2021).

Attachment 10 (continued).

Plant biovolume was estimated by using BioSonics equipment and software. The map generated (Fig. 18)) shows that submerged aquatic vegetation biovolume was relatively low (mean biovolume from stations with vegetation was 9.8%) with plant heights less than 12 inches, with few observations of emergent vegetation (NCSU 2021).

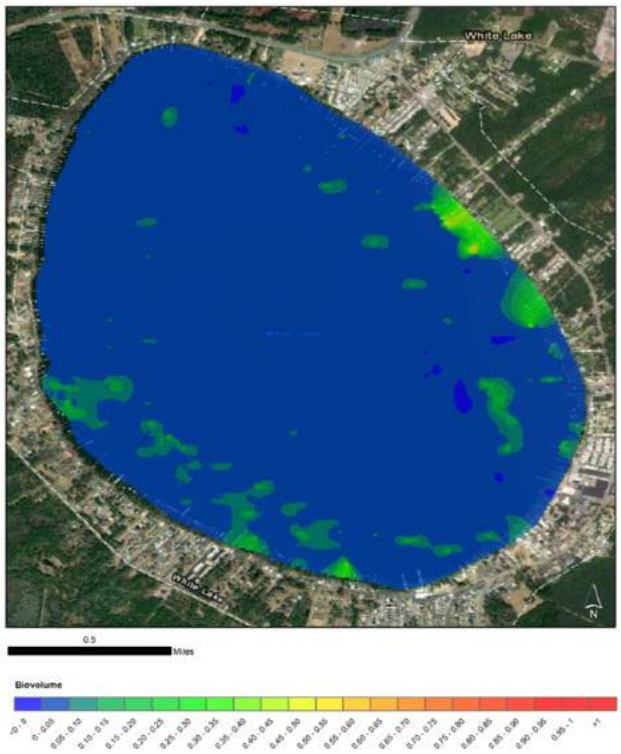


Figure 18. White Lake submerged aquatic vegetation biovolume in October 2021 (NCSU 2021).

Filamentous bottom algae (Mougiotia sp.) observed during 2019 lake monitoring:

This green alga was found by Frey in 1950

The recent presence of healthy green mats in shallow areas of the lake was at a time when the clarity of the water was very good

Attachment 10 (continued).

This type of bladderwort does not have roots, and is typically found floating on the lake surface

It is a carnivorous aquatic plant that is characteristic of low nutrient conditions, and has been found in the lake since 1950

Utricularia floating on the lake surface, April 20, 2022

Summary Observations on Bottom Algae and Vegetation in White Lake:

- The diversity in filamentous green algae found in the lake in 1950 is indicative of a healthy community rather than one influenced by nutrient pollution from septic systems (which was suggested at the time)
- The same types of mat-forming green algae are still found in the lake and their abundance varies from year to year
- There have been no reports of filamentous cyanobacterial mats, as have been found at Lake Waccamaw
- According to residents, large windrows of aquatic moss have collected along the lakeshore in times past, and recent vegetation surveys indicate that it is still found in the lake, although its abundance is quite variable
- Much of the material which has and continues to collect around sea walls is decomposing algae mats, and residents in the same locations (along the western and southern shore) report the same situation year after year
- The submerged vegetation found in White Lake is for the most part characteristic of acidic and/or low-nutrient conditions
- There are only two native taxa common to both White Lake and Lake Waccamaw: macroalgae (*Chara* and *Nitella*), and spikerush
- The invasive aquatic weed *Hydrilla verticillata,* found throughout most of the lake in 2017, is not thriving under present lake conditions, and no tuber bank has been found in lake sediments