WAKULLA SPRINGSWATCH MONITORING SUMMARY

January –December 2022

PREPARED FOR
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION,
DIVISION OF RECREATION AND PARKS

Howard T. Odum
FLORIDA SPRINGS INSTITUTE

Photo by Jill Lingard

Volunteer and Staff Acknowledgments

This report was prepared by the Howard T. Odum Florida Springs Institute (FSI). Ecological monitoring was conducted by Florida SpringsWatch volunteers and FSI staff under the Florida Department of Environmental Protection Division of Recreation and Parks Research/Collection Permit Number 06212220.

Our Wakulla SpringsWatch program would not be possible without the hard work of our team leader, Sean McGlynn, Edward Ball Wakulla Springs State Park boat captains, and a dedicated team of volunteers: Ken Biati, Miranda Capps, Kaden Gould, Cal Jamison; Brian Lupiani, Julia McGlynn, David Shepard, Linda Shepard, Lauren Thornberg, Joanna Walker, Barbara Washington, Maria Wilhelmy, and Dana Wilson. Together they put in 91 volunteer hours over 12 monitoring sessions in 2022.

We would also like to thank FSI's SpringsWatch Coordinator Jill Lingard and Environmental Scientist Bill Hawthorne for their contributions to this report, as well as the ongoing guidance of Executive Director Dr. Bob Knight. We also acknowledge the data entry efforts from our diligent FSI science interns.





Section 1.0 Introduction

Located 16 miles south of Tallahassee, Wakulla Spring is one of the largest first-magnitude artesian springs in Florida and the United States. Wakulla Spring lies within the Edward Ball Wakulla Springs State Park, which is listed on the Natural Register of Historic Places and is designated a National Natural Landmark. Wakulla Spring forms the headwaters of the Wakulla River, which flows for nearly 11 miles before merging with the St. Marks River in the town of St. Marks. Wakulla Springs is renowned for is natural beauty and has been a favorite recreational site, as well as potable water source, for residents of Leon, Wakulla, and surrounding counties. However, the river and springs have not been immune to human impacts, demonstrating reductions/reversals in flow, elevated nitrate nitrogen, increased dark-water days, and increased growth of invasive hydrilla and filamentous algae.

FSI's SpringsWatch volunteer citizen-science program has provided enhanced monitoring of the Wakulla River and springs ecological health since 2019. The resulting data are provided in annual reports and via the SpringsWatch website (floridaspringsinstitute.org/springswatch) to inform the state's environmental agencies and educate the public about the springs and river health.

This report was prepared by the Howard T. Odum Florida Springs Institute and is focused on 2022 ecological monitoring along the Wakulla River and springs conducted by SpringsWatch volunteers.

1.1 Monitoring Stations

Figure 1 shows the nine SpringsWatch monitoring stations along the Wakulla River. WAK-HS represents the head spring; WAK-1 through WAK-8 denote river stations. For the first half of 2022, SpringsWatch volunteers conducted monthly sampling sessions at six of stations: WAK-HS, WAK-1, WAK-2, WAK-3, WAK-4, and WAK-7. The state park's pontoon boat couldn't access stations WAK-5, WAK-6, and WAK-8 during lower water levels.

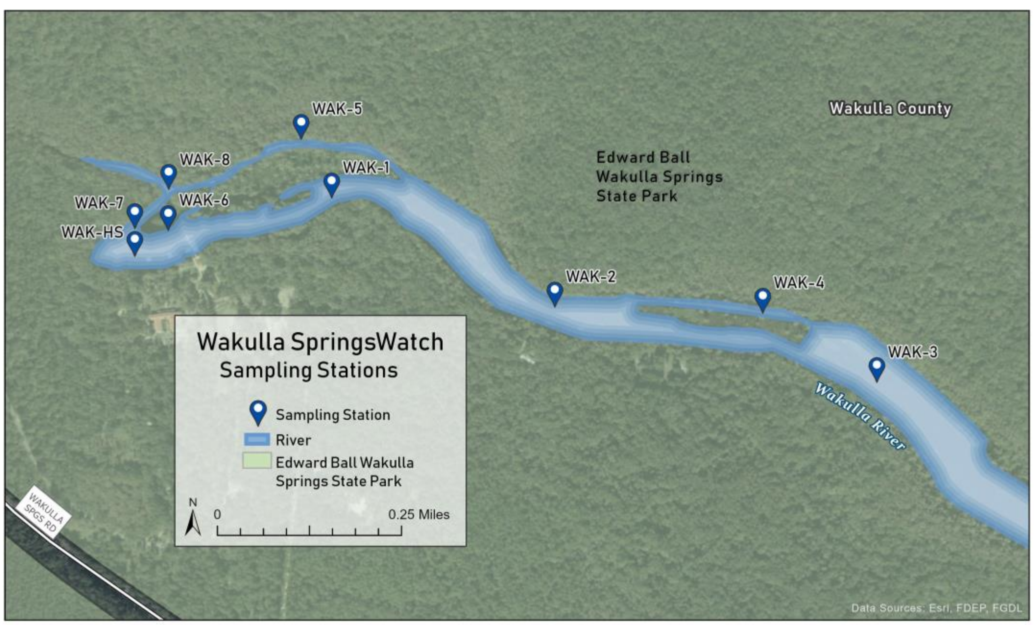


Figure 1. Wakulla SpringsWatch monitoring stations.

Section 2.0 Methods

SpringsWatch volunteers conducted ecological monitoring on the Wakulla River from January to December 2022. Data collection included water quality field parameters, light attenuation measurements, and aquatic vegetation surveys.

2.1 Sampling Events

Table 1 summarizes the 12 sampling events that occurred in 2022 along the Wakulla River. Monitoring was conducted by SpringsWatch volunteers with assistance from FSI staff.

Table 1. 2021 Sampling Events for Wakulla SpringsWatch

Sampling Date	DO	Temperature	Specific Conductance	Water Clarity	Light Attenuation	Vegetation
1/26/2022	X	X	X	X	X	X
2/24/2022	X	X	X	X	X	X
3/25/2022	X	X	X	X	X	X
4/28/2022	X	X	X	X	X	X
5/26/2022	X	X	X	X	X	X
7/1/2022	X	X	X	X	X	X
7/28/2022	X	X	X	X	X	X
8/26/2022	X	X	X	X	X	X
9/28/2022	X	X	X	X	X	X
10/27/2022	X	X	X	X	X	X
11/23/2022	X	X	X	X	X	X
12/29/2022	X	X	X	X	X	X

2.2 Water Quality

SpringsWatch volunteers used handheld YSI ProODO and EcoSense EC300A meters at each of the six Wakulla River monitoring stations to collect dissolved oxygen, temperature, and specific conductance measurements. Volunteers maintained the meters according to factory instructions and calibrated them prior to and after each sampling event.

2.3 Light Measurements

Photosynthetically Active Radiation (PAR) underwater light transmission and attenuation coefficients were measured monthly at the 15 monitoring sites. Volunteers used a LI-COR brand LI-250A underwater quantum photometer to measure PAR energy reaching the water surface and at depth intervals of one foot and two feet. Figure 2 provides an image of the LI-COR photometer.

Figure 2. LI-COR LI-250A Photometer

2.4 Secchi Disk Visibility

SpringsWatch volunteers took monthly vertical Secchi disk measurements at Wakulla head spring, station WAK-HS, throughout the sampling period.

The Secchi disk (Figure 3) is a tool for measuring water clarity in aquatic ecosystems. It is a disk with alternating black and white quadrants that is lowered into the water until it is no longer visible. The depth at which the disk disappears is known as the Secchi depth and is used as an indicator of water quality. Secchi length can be used to monitor changes in water clarity over time and can be used to identify problems such as algal blooms or pollution.

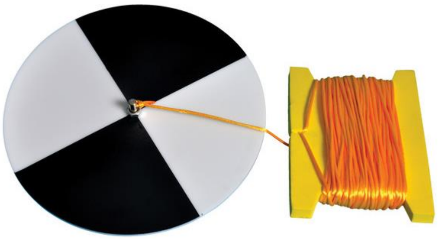


Figure 3. Secchi disk.

2.5 Vegetation

Submerged aquatic vegetation (SAV) was monitored monthly at each station. SpringsWatch volunteers took two photographs at each station in two different locations, which they sent to FSI for analysis. The photographs will be used to provide the overall average percent plant coverage at each station.

Section 3.0 Results

This section summarizes field data along the Wakulla River and springs collected from January to December 2022 by SpringsWatch volunteers.

3.1 Water Quality

3.1.1. Dissolved Oxygen, Water Temperature, and Specific Conductance

Figure 4 through Figure 12 present water quality results collected from Wakulla SpringsWatch stations from January to December 2022. Figures 4 and 5 show dissolved oxygen results measured in percent saturation (DO%). Figures 6 and 7 present DO data measured in milligrams per liter (mg/L), or parts per million (ppm).

DO levels fluctuated between spring and river stations primarily due to groundwater vs. surface water influence. Spring stations tend to exhibit lower DO values than river stations since emerging groundwater typically contains less free oxygen depending on the duration of time the water has been underground before reaching a spring vent.

Stations WAK-HS and WAK-7 are closest to the Wakulla Spring vent (Figure1) and exhibited the lowest DO concentrations. As water moves downstream, its potential to receive oxygen from atmospheric diffusion and from photosynthesizing SAV and algae increases, resulting in higher DO concentrations.

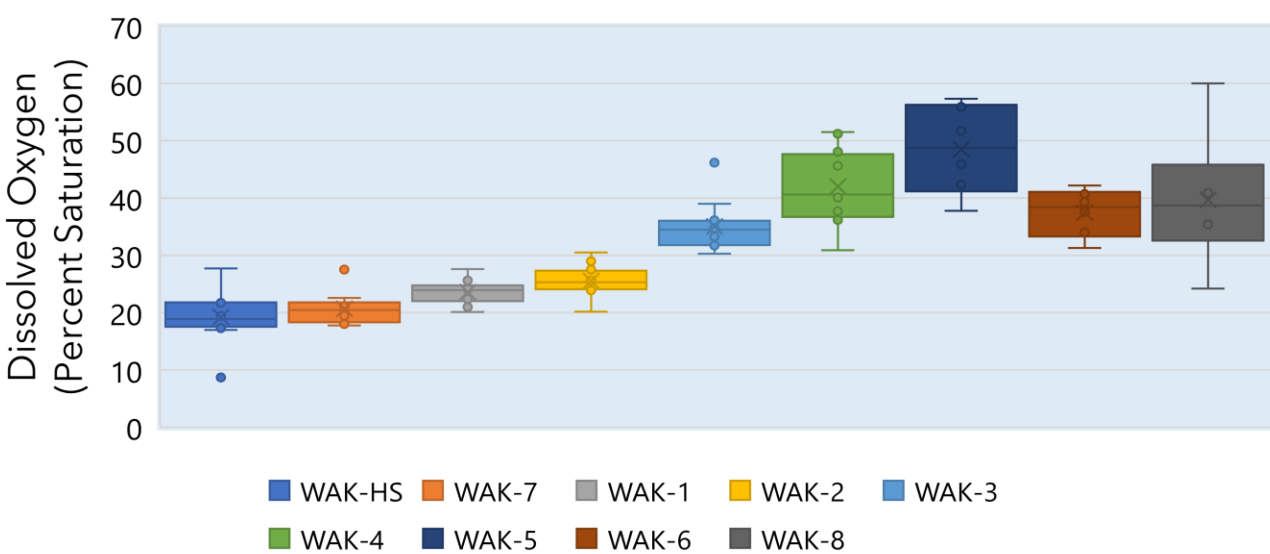


Figure 4. Dissolved oxygen percent saturation (DO%) by Wakulla SpringsWatch station (January-December 2022).

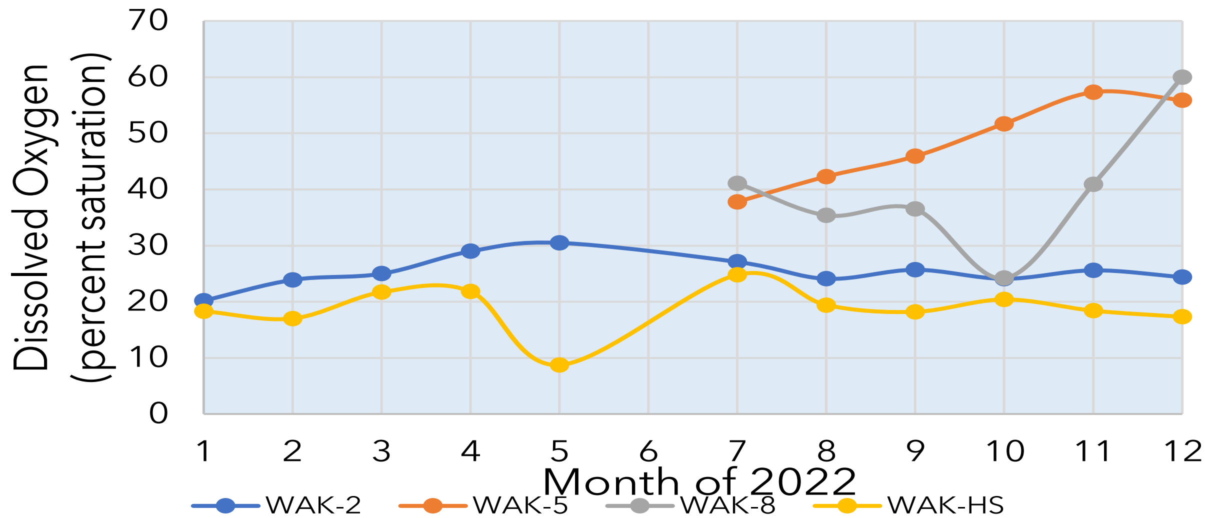


Figure 5. Dissolved oxygen percent saturation (DO%) by month for Wakulla SpringsWatch (January-December 2022).

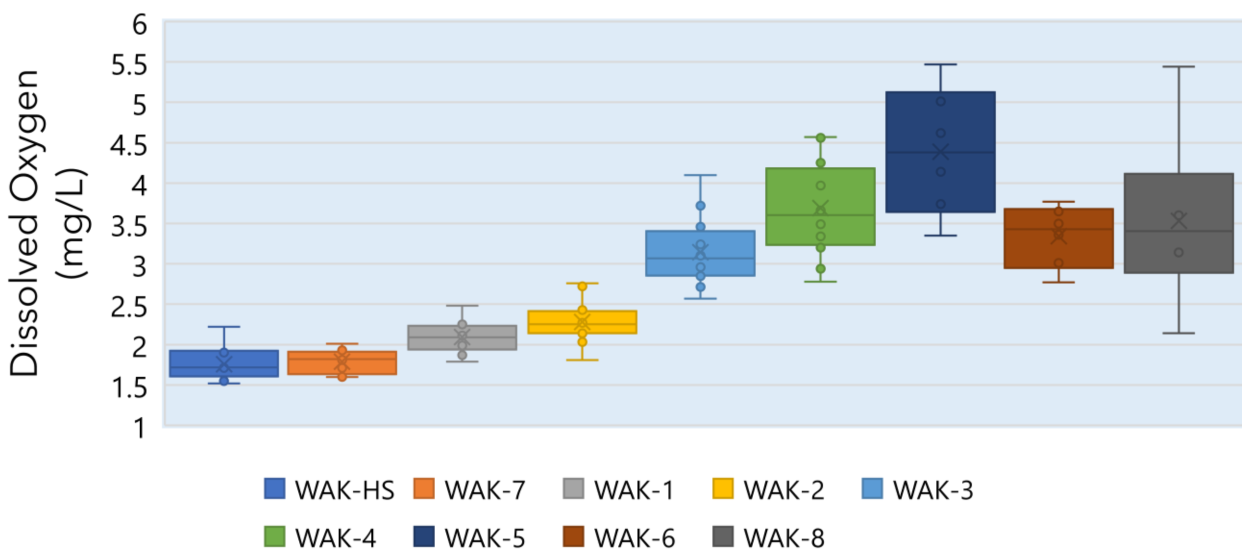


Figure 6. Dissolved oxygen (mg/L) by Wakulla SpringsWatch station (January-December 2022).

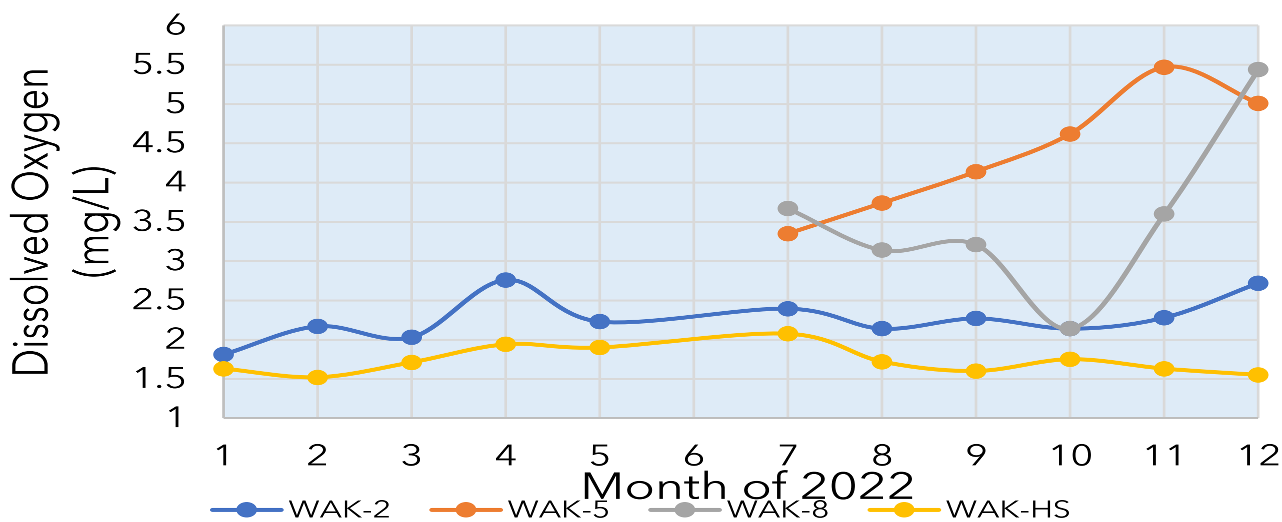


Figure 7. Dissolved oxygen (mg/L) by month for Wakulla SpringsWatch (January-December 2022).

Figure 8 and 9 present data for water temperature (°C) field measurements by station and by month. Water temperature in the Wakulla River ranged from 20.0-21.8°C, remaining relatively constant throughout the year due to its groundwater sources (typically 22°C).

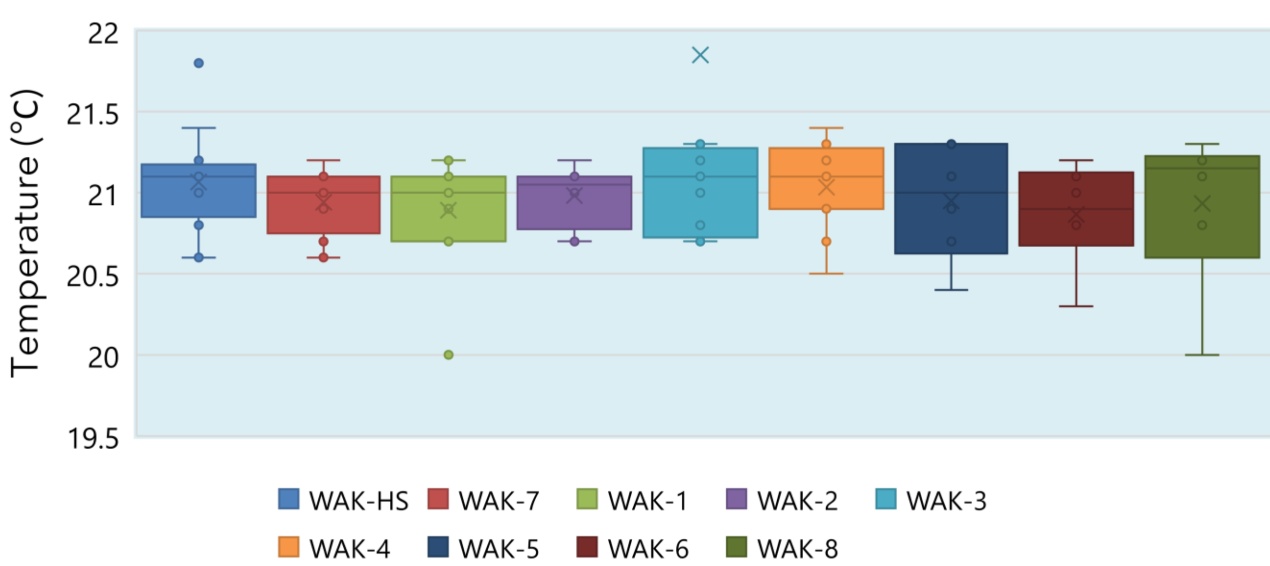


Figure 8. Water temperature (°C) by Wakulla River station (January-December 2022).

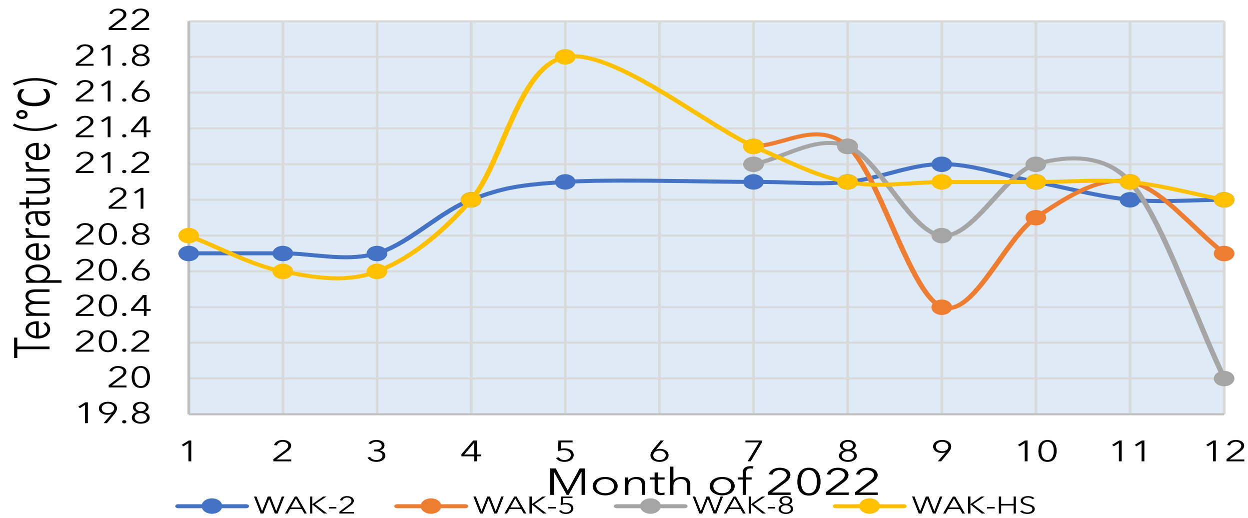


Figure 9. Water temperature (°C) by month for Wakulla SpringsWatch (January-December 2022).

Figures 10 and 11 show the results for specific conductance (uS/cm) field measurements. Figure 10 shows specific conductance by river station; Figure 11 presents by them month.

Specific conductance levels can be influenced by naturally occurring ions present in spring water but also from ions present due to higher levels of nitrate/nitrite, saltwater, and other compounds. Higher specific conductance values suggest a higher concentration of these ions in the water.

All of the Wakulla stations exhibited periodic elevated specific conductance readings. These readings may be due to backflow of saltwater inland from Springs Creek Springs. Lower concentrations of specific conductance are a possible indicator of swallet inlets on the edge of the Apalachicola National Forest feeding surface water with elevated tannic color to Wakulla Springs. Evidence for these phenomena is provided in FSI's Wakulla Springs Restoration Plan (FSI 2012).

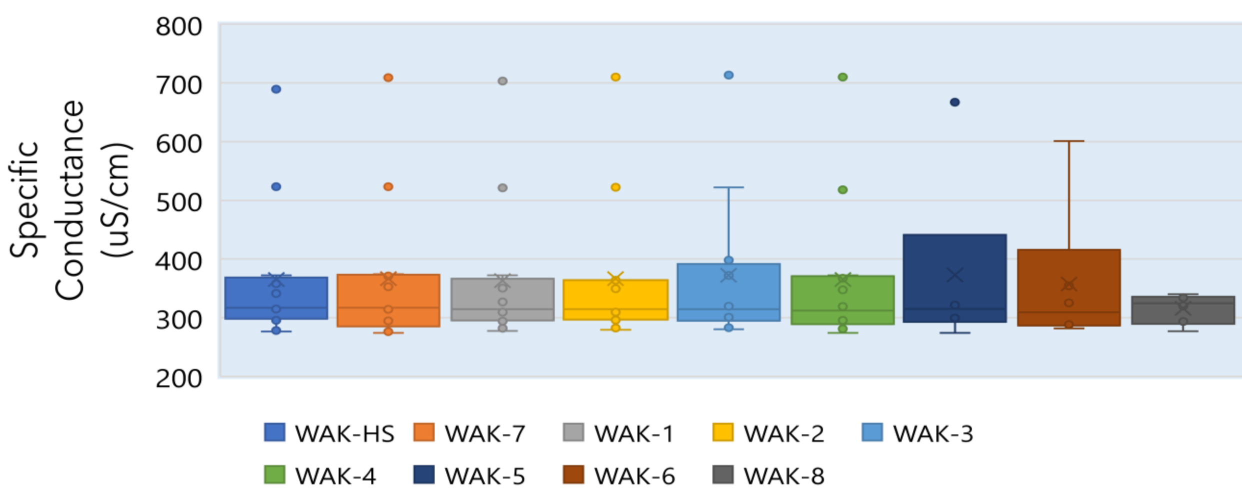


Figure 10. Specific conductance (uS/cm) by Wakulla SpringsWatch station (January-December 2022).

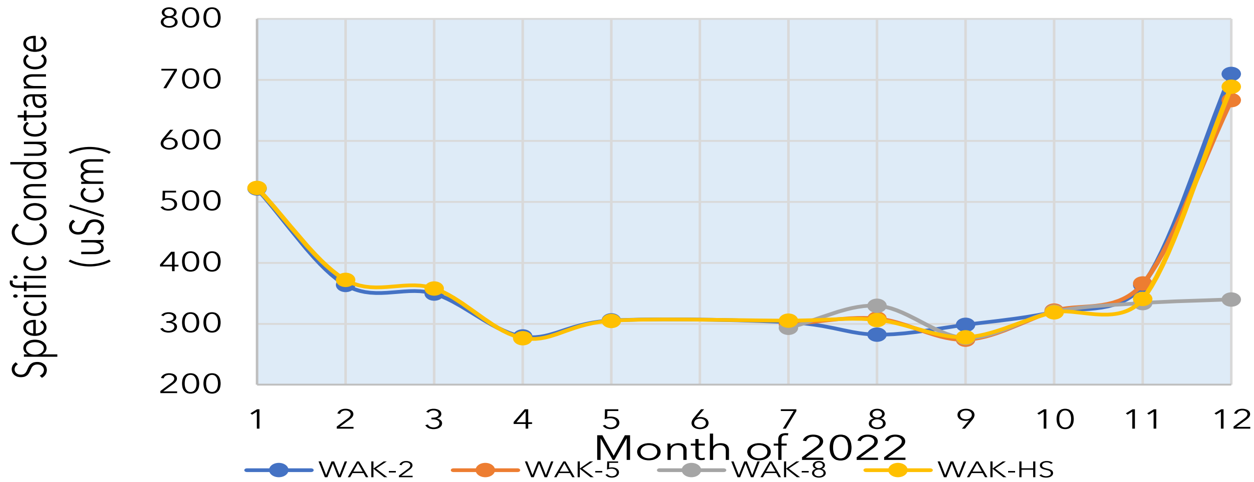


Figure 11. Specific conductance (uS/cm) by month for Wakulla SpringsWatch (January-December 2022).

SpringsWatch volunteers collected Nitrate-nitrite (NOX-n) samples at Wakulla head spring in June 2022. Figure 12 summarizes 2022 NOX-n data for all 11 SpringsWatch groups; the orange bar highlights the result for Wakulla. The horizontal red line denotes the 0.35mg/L springs impairment level set by the Florida Department of Environmental Protection. NOX-n at station WW-1 was 0.52 mg/L, which is 1.5 times greater than the FDEP threshold.

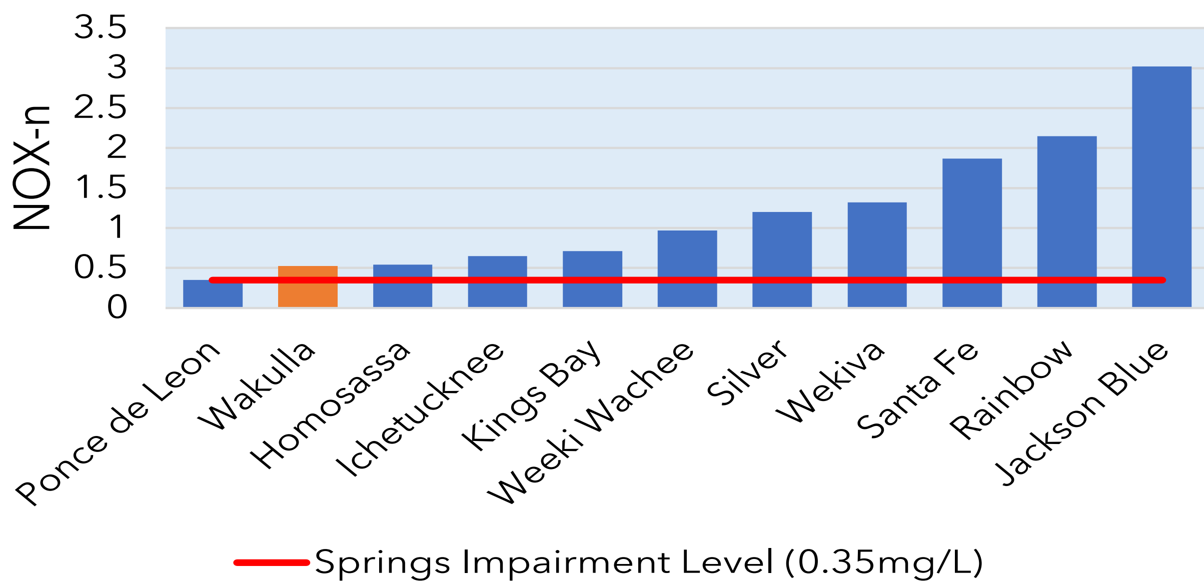


Figure 12. Nitrate-nitrite (NOX-n) levels by SpringsWatch group in 2022. Taken in June, Wakulla is denoted by the orange bar.

3.2 Clarity and Light Measurements

3.2.1 Secchi Disk Visibility

Figure 13 presents vertical Secchi disk measurements in meters at the Wakulla headspring (station WAK-HS) during the sampling period. Secchi data provides additional information concerning water clarity and the light attenuation properties of the spring. Secchi distances ranged from 4.57 to 22 meters throughout 2022. Lower Secchi measurements indicate reduced water clarity, possibly due to recreational activity and resuspension of algae growing attached to surfaces in the stream channel.

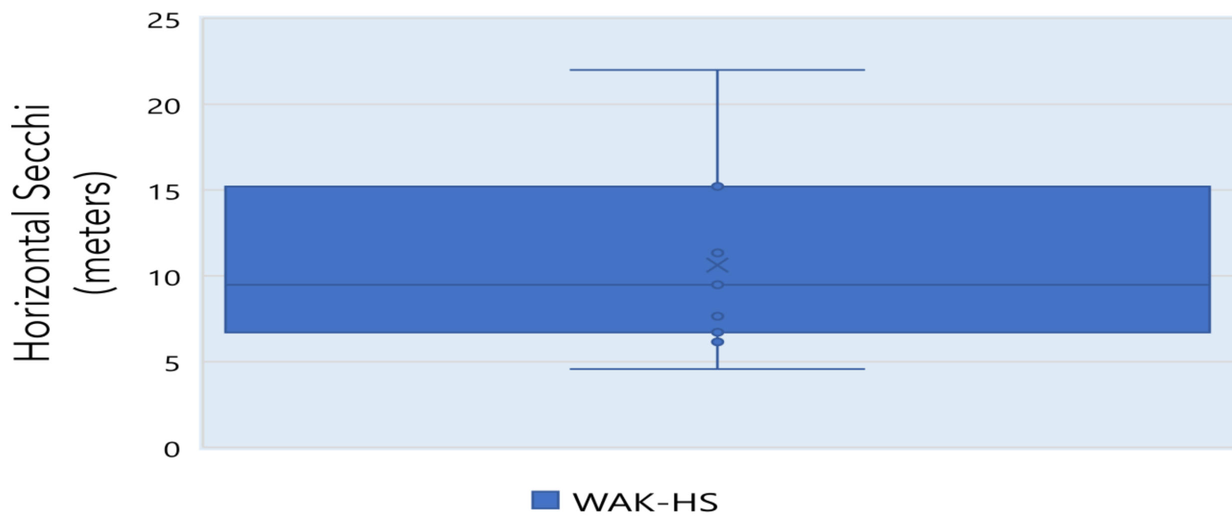


Figure 13. Vertical Secchi disk measurements (m) at Wakulla Spring (Station WAK-HS) (January-December 2022)

3.2.2 Light Measurements

Table 2 and Figure 14 present the percent transmittance estimates collected by Wakulla SpringsWatch volunteers from January through December 2022.

Percent transmittance refers to the amount of light that is able to pass through the water column to a depth of 1 meter below the surface. A higher value indicates greater water clarity. Lower percent transmittance values can indicate poor water clarity since light cannot pass as easily through the water column, often due to increases in dissolved substances such as tannins (color) and suspended solids (turbidity) in the water.

All of the stations had average percent transmittance between about 30-46%, low values for water clarity in blue-water springs. Combined with the Secchi depth data described above, the continuing impairment of water clarity in Wakulla Spring is confirmed. As described in FSI (2012), reduced aquifer pressures in Leon and Wakulla counties due to large groundwater extractions by Tallahassee and in south Georgia have altered the historic movement of groundwaters in the Floridan Aquifer. Wakulla Spring is receiving an increased share of tannic groundwaters from the Apalachicola National Forest that in the past flowed south to Springs Creek. Increased tannic water is presumed to be the cause of reduced water clarity in Wakulla Spring.

Table 2. Percent transmittance (@ 1m) for Wakulla SpringsWatch (January–December 2022).

Summary of 2022 PAR (percent transmittance) data

Site	Average	N	Max	Min	StDev
WAK-1	42.47	11	68.33	7.28	16.00
WAK-2	40.17	11	99.45	1.61	30.64
WAK-3	34.62	12	91.71	0.90	29.26
WAK-4	42.63	12	97.28	0.51	34.17
WAK-5	42.16	5	71.30	22.18	18.10
WAK-6	40.55	6	74.23	19.30	22.90
WAK-7	38.09	12	61.58	0.96	15.55
WAK-8	46.61	4	89.02	0.69	36.95
WAK-HS	30.78	10	70.30	1.23	24.16

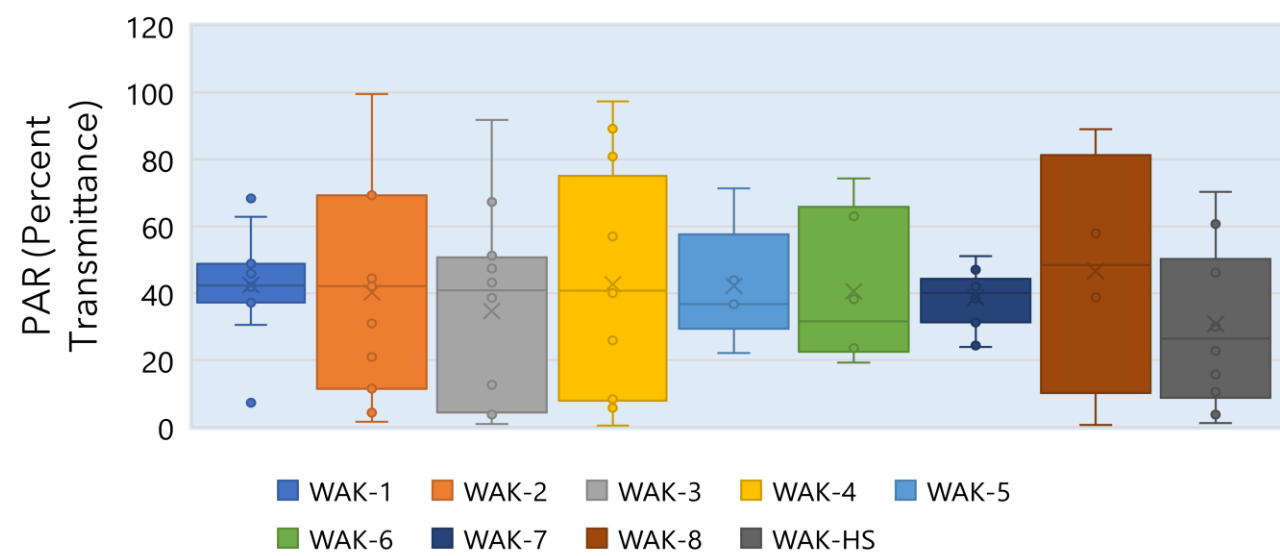
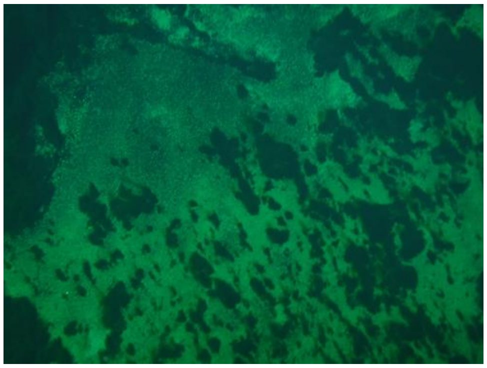


Figure 14. Percent transmittance (@ 1m) for Wakulla SpringsWatch (January–December 2022).

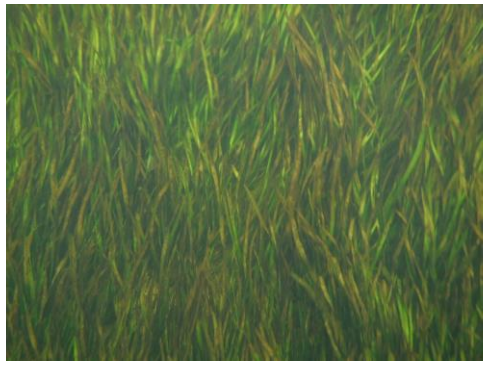
3.3 Aquatic Vegetation Survey

Submerged aquatic vegetation plays an important ecological role within a springs system. It provides habitat and food for fish and other wildlife, increases water clarity, affects nutrient cycles, and stabilizes shorelines and sediments.

Pictured below are river bottom photos taken by SpringsWatch volunteers in 2022 which feature the SAV of the Wakulla River and springs.

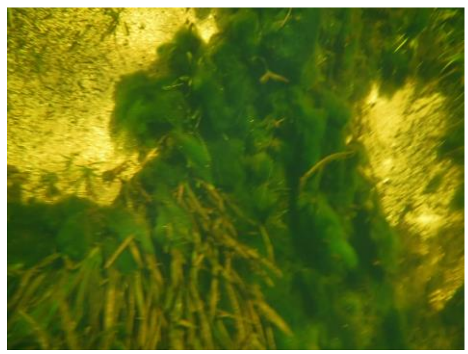


Algae and bare ground at head spring



Strap-leaf Sagittaria

Bare ground and algae



Vallisneria, algae, and bare ground

Hydrilla and algae

Algae and bare ground

Section 4.0 References

Howard T. Odum Florida Springs Institute (FSI) 2014. *Wakulla Spring Restoration Plan.* Prepared for the Wakulla Springs Alliance and the Friends of Wakulla Springs.

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Wetzel, R. G. (2001). Limnology: Lake and River Ecosystems. Third Edition. San Diego, CA, CA: Academic Press.