WEKIVA RIVER SPRINGSWATCH MONITORING SUMMARY

January- December 2023

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

Howard T. Odum
FLORIDA SPRINGS INSTITUTE

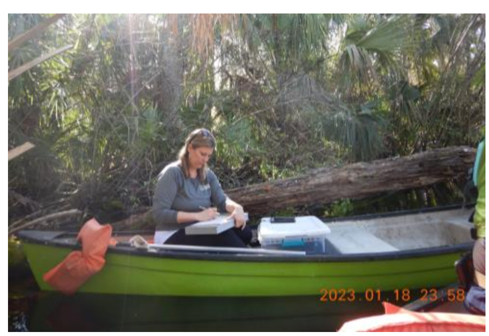
Photo by Michelle Jamesson

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 07012340.

Our Wekiva River SpringsWatch program would not be possible without the hard work of team leaders, Chris Newport and Michelle Jamesson, and their team of volunteers: Lori Patterson, Mark Patterson, Joy Bonin, Sean Cliburn, James Kutzner, Mike Cliburn, Steph Shelley, Shannon Letcher, Ashley Konon, Michelle Jamesson, Wyatt Letcher-Whitfield, Wren Letcher-Whitfield, John Whitfield, Willabelle Letcher-Whitfield, Daniel Bryant, Avery Smith, Yeraldine, Rob Quinlan, Andrea Ledezma, Tamia Dorsey, Ana Jamesson, Katie Durham, Ana Jamesson, Natalia Rodriguez, Luna Rodriguez, Willow Rodriguez, Katie Durham, Judy Lathrop, Zyriah Huges, Gerardo Milan, Johana Horet, Karol Landaeta, Santiago Troconis, Rosemary Cliburn, Gina del Pizzo, Christopher Brink, Alysha Rocca, Yvette Witherell, Chris Castillo, Jace Castillo, Frank Weaver, Frank Bagdah, Em Gerety, Valerie Koppen, Matt Koppen, Gabi Koppen, Rebekah Martin, Lander Martin, Laila Martin, Nelido Agven, Lucos Agven, Adrian Agven, Kani Hale, and Val Hahn. Together they put in 244 volunteer hours over twelve monitoring sessions in 2023. We would like to thank Isaac Szabo for his underwater fish photography utilized in this report.

We would like to thank FSI's SpringsWatch Coordinators, Emanuela Torres-Marquis, Shannon Letcher, and Jill Lingard and Environmental Scientist Bill Hawthorne, and Associate Director Haley Moody for their contributions to this report; all of whom worked under the guidance of Executive Director Dr. Emily Taylor. We also acknowledge the ongoing guidance from former Executive Director Dr. Robert Knight.



Section 1.0 Introduction

Located 17 miles north of Orlando, the Wekiva River is a major tributary to the St. Johns River, receiving over half of its flow from more than 30 artesian springs. The Wekiva River begins its flow at Wekiwa Spring, a second magnitude spring discharging over 43 million gallons per day. The Wekiva River is also fed by input from Rock Spring Run, which flows roughly 8.5 miles before meeting with the Wekiva River. Because of its natural beauty and cool waters, the Wekiva River is a popular place for recreation such as kayaking, canoeing, paddle boarding, swimming, and other water-related activities.

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

This report was prepared by the Howard T. Odum Florida Springs Institute and is focused on the ecological monitoring of the Wekiva River and springs conducted by SpringsWatch volunteers in 2023.

1.1 Monitoring Stations

Figure 1 shows the eight SpringsWatch monitoring stations along the Wekiva River. These stations included the Wekiwa Head Spring (WEK-HS), 6 stations along the Wekiva River (WEK-2 through WEK-7), and its confluence with Rock Spring Run (RS-1).

Figure 1. Wekiva SpringsWatch monitoring stations.

Section 2.0 Methods

Ecological monitoring was conducted on the Wekiva River from January 2023 to December 2023. Data collection included water quality field parameters, light measurements, and vegetation.

2.1 Sampling Events

Table 1 summarizes the sampling events along the Wekiva River. With assistance from FSI, SpringsWatch volunteers conducted six sampling sessions in 2023.

Table 1. Wekiva SpringsWatch sampling events (January–December 2023).

Date	Temperature	Dissolved Oxygen	Specific Conductance	PAR	Nitrate+Nitrite	Vegetation	Birds
1/19/2023	X	X		X		X	X
2/16/2023	X	X		X		X	X
3/16/2023	X	X		X		X	X
4/20/2023	X	X	X	X		X	X
5/18/2023	X	X	X	X		X	X
6/15/2023	X	X	X	X		X	X
7/20/2023	X	X	X	X		X	X
8/17/2023	X	X		X		X	X
9/21/2023	X		X	X		X	X
10/19/2023	X	X	X	X		X	X
12/21/2023	X	X	X	X		X	X
12/26/2023					X		

2.2 Water Quality

SpringsWatch volunteers used handheld YSI ProODO and YSI EcoSense EC300A meters at each of the eight monitoring stations along the Wekiva River to collect measurements of dissolved oxygen, temperature, and specific conductance. The team leader maintained water quality meters according to factory instructions and calibrated them before and after each sampling event.

2.2.1. Nitrate-Nitrite (NOx-N)

FSI staff collected nitrogen as nitrate + nitrite (NOx-N) samples at stations WEK-HS (Figure 1). Water samples were sent to a state-accredited laboratory (McGlynn Laboratories Inc.) for NOx-N analysis. Preparation, storage, and analysis all followed FDEP Standard Operating Procedures. Samples were hand collected from approximately 0.1m depth. Sample bottles were re-capped and sealed before being acidified with approximately 0.25mL of 50% sulfuric acid (H_2SO_4) and then stored on ice prior to transport. Water sampled were held in a refrigerator for <21days before being sent to a state-accredited laboratory (McGlynn Laboratories Inc.) for NOx-N analysis. All analyses were conducted within a standard holding time of 28 days from sample collection.

2.3 Light Measurements

Photosynthetically Active Radiation (PAR) underwater light transmission and attenuation coefficients were measured monthly at the eight monitoring stations. Volunteers used a LI-COR brand LI-192 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-192 photometer

2.4 Vegetation

Submerged aquatic vegetation (SAV) was monitored monthly at each of the eight Wekiva SpringsWatch stations. Volunteers took two underwater photographs at each station in two different locations, which they sent to FSI for analysis.

2.5 Bird Survey

Wekiva SpringsWatch volunteers recorded visual monthly observations of birds between stations WEK-HS and WEK-7.

Section 3.0 Results

This section summarizes field data along the Wekiva River and springs collected from January to December 2023 by SpringsWatch volunteers.

3.1 Water Quality

3.1.1. Dissolved Oxygen, Water Temperature, and Specific Conductance

Figure 3 through Figure 6 present water quality results collected by Wekiva SpringsWatch volunteers in 2022. Figure 3 shows dissolved oxygen results measured in percent saturation (DO%) at each river station. Figure 4 shows DO results measured in milligrams per liter (mg/L), or parts per million, at each river station.

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.

The lowest DO results were found at the Wekiwa headspring station (WEK-HS) with DO concentrations increasing downstream from the spring. DO increases as the water accumulates more free oxygen from the atmosphere as well as photosynthesizing submerged aquatic vegetation. Rock Spring run (RS-1) flows 8.5 miles before meeting with the Wekiva River and exhibits a much higher DO concentration. Input from RS-1 increased the overall DO concentration of the Wekiva River from WEK-4 to WEK-7.

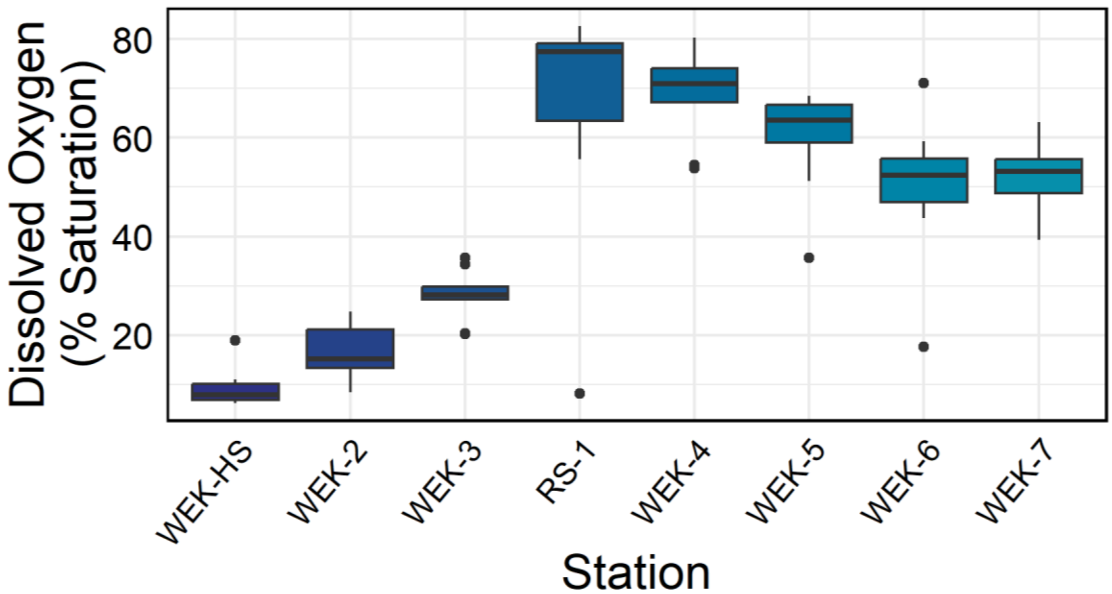


Figure 3. Dissolved oxygen percent saturation (DO%) by Wekiva SpringsWatch station (January-December 2023).

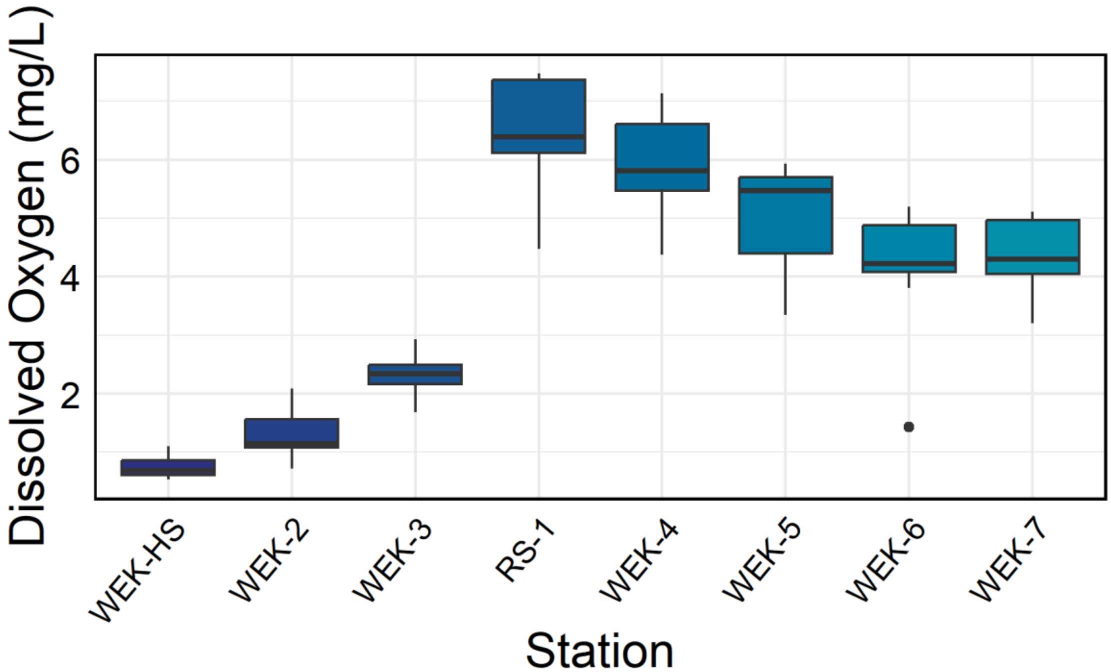


Figure 4. Dissolved oxygen (mg/L) by Wekiva SpringsWatch station (January-December 2023).

Figure 5 presents data for water temperature (°C) field measurements by each station.

Water temperature in the Wekiva River ranged from 15.9-26.5°C. Water emerging from Wekiwa Spring averages about 24°C, typical of the springs in the Central Florida region. From WEK-HS to WEK-3, temperature remains relatively constant (~24°C) until cooler water from RS-1 mixes with the spring water from Wekiwa Spring. As the water moves downstream (WEK-4 to WEK-7), the two different water sources blend, resulting in an average temperature of about 22.7°C.

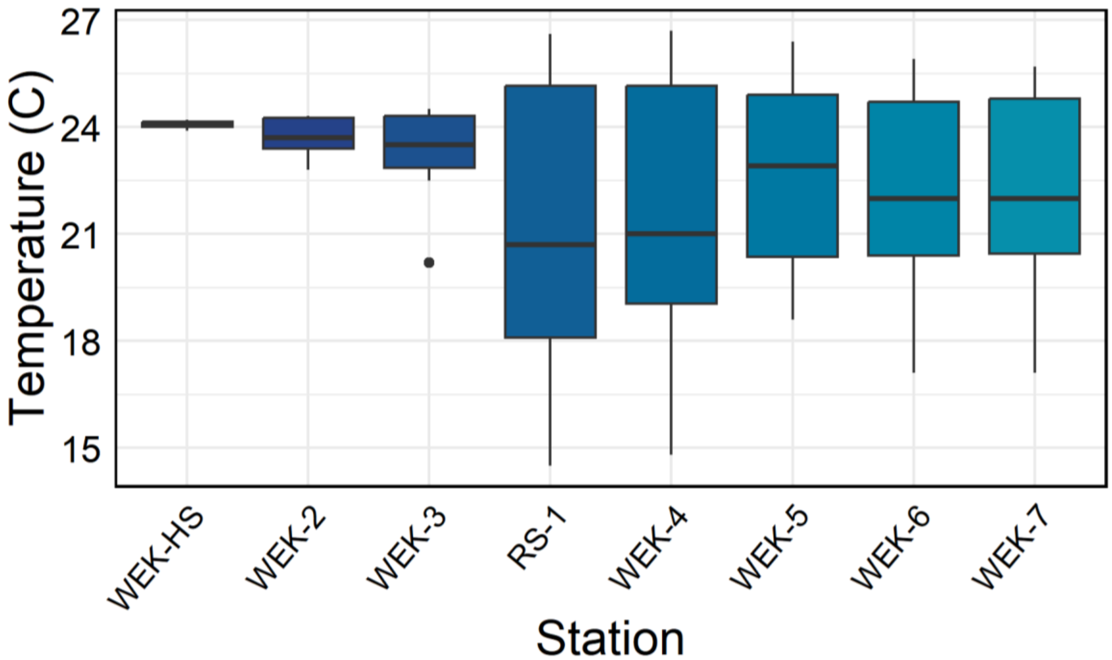


Figure 5. Water temperature (°C) by Wekiva SpringsWatch station (January-December 2023).

Figure 6 shows the results for specific conductance (uS/cm) field measurements along the Wekiva River by station. 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. Specific conductance levels are highest from WEK-HS to WEK-3, dropping significantly after input from RS-1 (Figure 6). These data indicate that Rock Springs receives groundwater with less dissolved ions than Wekiwa Spring.

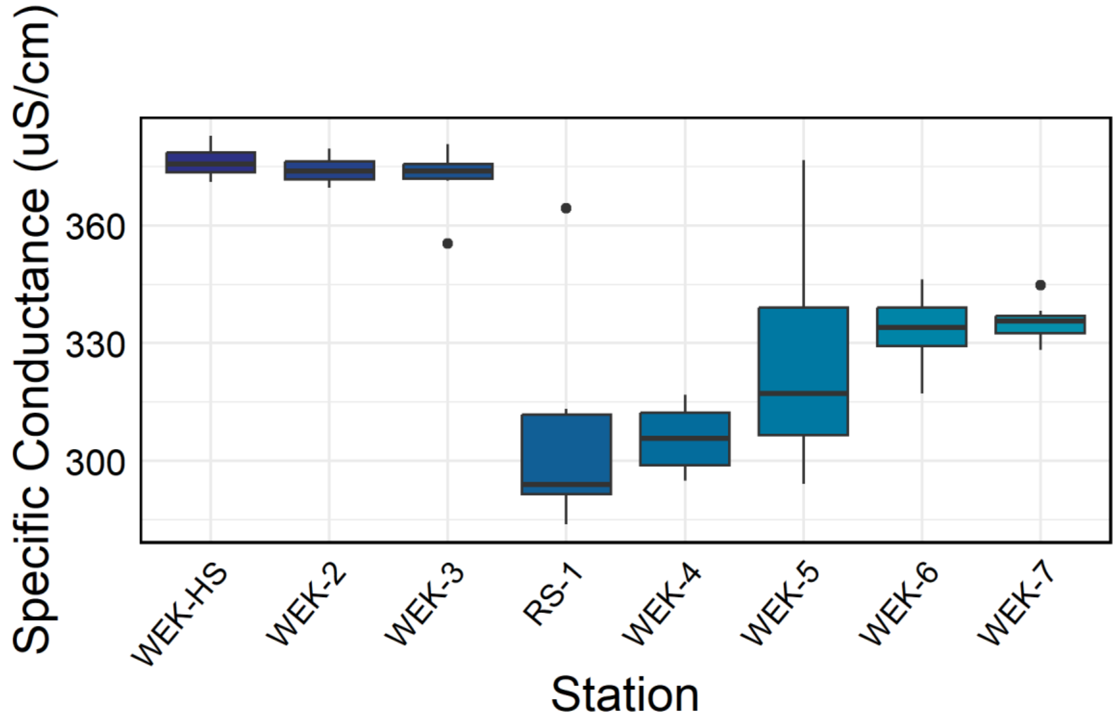


Figure 6. Specific conductance (uS/cm) by Wekiva SpringsWatch station (January-December 2023).

FSI staff collected Nitrate-nitrite (NOx-N) samples at Wekiwa headspring during their December 2023 sampling session. The springs impairment level set by the Florida Department of Environmental Protection is 0.35mg/L. NOx-N at Wekiwa headspring was 1.00 mg/L, which is 3 times greater than the FDEP threshold.

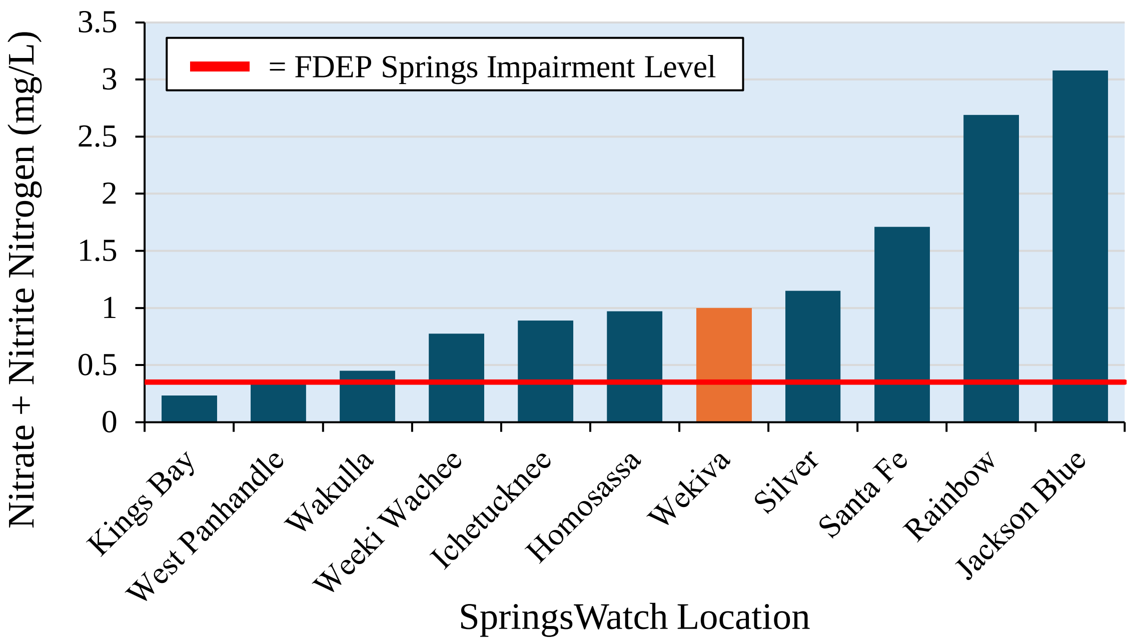


Figure 7. Nitrate-nitrite (NOx-N) levels at SpringsWatch samples sites in 2023. Taken in December 2023, Wekiva is denoted by the orange bar.

3.2 Light Measurements

Figure 7 present the percent transmittance estimates collected by Wekiva SpringsWatch volunteers from January through December 2023. Figure 9 presents the calculated k (diffuse light coefficient) by station from January to December 2023.

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. Figure 9 presents the k (diffuse light attenuation) calculated average per Santa SpringsWatch monitoring session (January to November 2023). The diffuse attenuation coefficient (k) is the calculated via the Lambert-Beer equation (Wetzel 2001) to measure how readily light dissipates throughout the water column. Higher attenuation values correspond to less water clarity. Higher values of percent transmittance tend to correspond with lower values of coefficient k. Higher k values, or 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.

In aquatic ecosystems, the diffusion attenuation coefficient can have a significant impact on the biota that inhabit the water. For example, in shallow, clear water with a low diffusion attenuation coefficient and high percent transmittance, light can easily reach the bottom of the water column, enabling the growth of aquatic plants and phytoplankton. This, in turn, can support the entire food web, from primary producers to top predators. On the other hand, in deep, turbid water with a high diffusion attenuation coefficient and low percent transmittance, light is unable to penetrate as far, limiting the growth of aquatic plants and phytoplankton. This can have cascading effects on the entire ecosystem, potentially reducing the population size and diversity of biota that depend on these primary producers. Thus, the diffusion attenuation coefficient is an important factor to consider when evaluating the health and productivity of aquatic ecosystems.

in dissolved substances such as tannins (color) and suspended solids (turbidity) in the water.

Percent transmittance is higher at Wekiwa Spring (WEK-HS) with decreasing water clarity moving downstream. Clarity picks up a little with the blending of spring water from Rock Springs Run at station RS-1. Station WEK-5 exhibited the lowest percent transmittance. Moving away from Wekiwa spring and Rock Springs Run, the water darkens due to tannins from leaf litter and increased surface runoff input, decreasing water clarity.

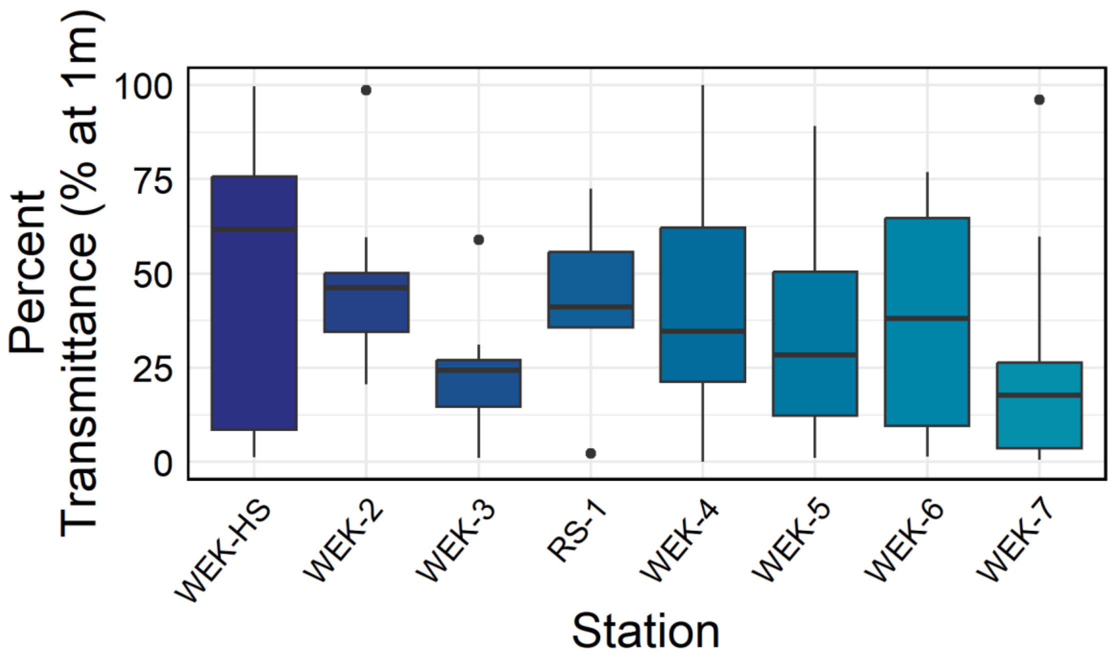


Figure 8. Percent transmittance (@ 1m) for Wekiva SpringsWatch by station (January–December 2023).

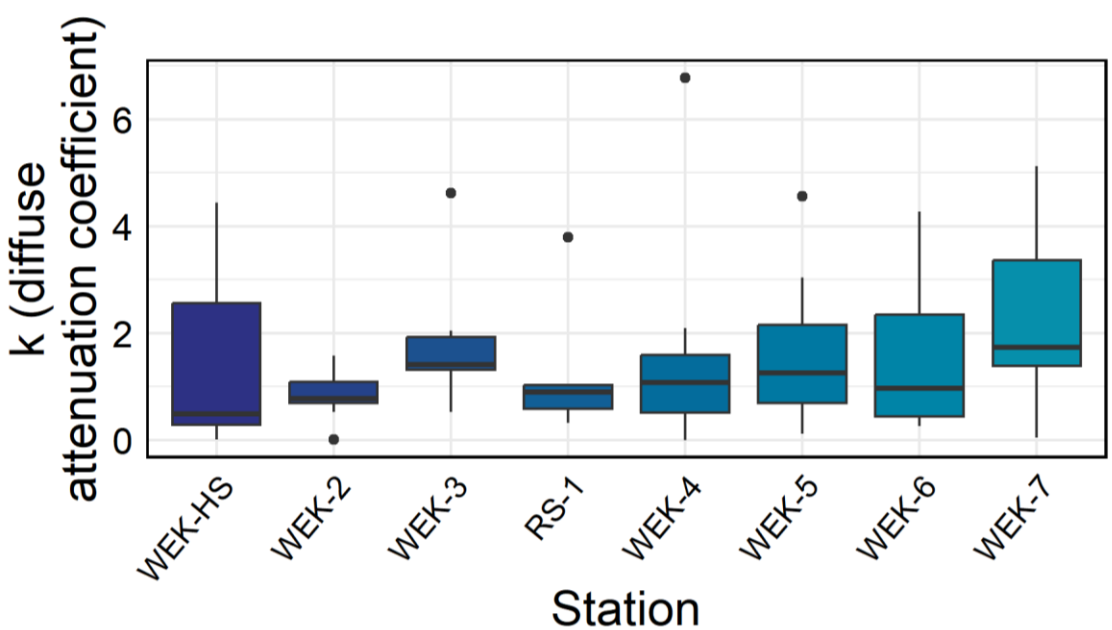


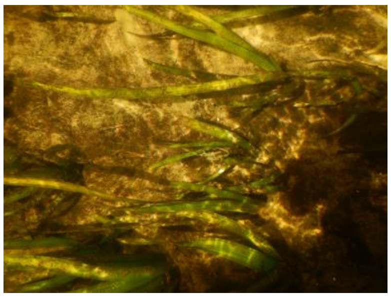
Figure 9. k (diffuse attenuation coefficient) for Wekiva SpringsWatch by station (January - December 2023)

3.3 Aquatic Vegetation Survey

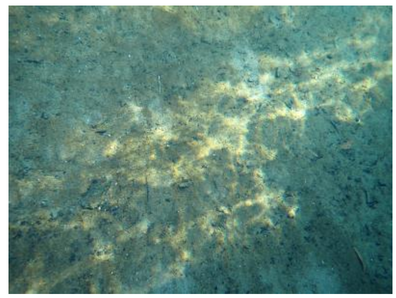
Submerged aquatic vegetation plays an important ecological role within a springs system. It provides habitat and food for fish and other wildlife, increases water clarity, affects nutrient cycles, and stabilizes shorelines and sediments.

The river bottom nearest Wekiwa Spring (WEK-HS) is mostly bare sand covered with patches of algae. As SpringsWatch volunteers paddled downstream, they surveyed mostly Spatterdock and algae, with small patches of Strap-leaf Sagittaria.

Pictured below are river bottom photos taken by SpringsWatch volunteers in 2023 which feature the SAV of the Wekiva River and springs.



Vallisneria, detritus, and sand



Sand

Spatterdock and detritus

Detritus and spatterdock

Sand and algae

Sand

3.4 Bird Survey

Between January and December 2023, twelve bird counts occurred within Wekiva. Table 2 shows the average number of each species observed during bird counts in 2023. Overall, 35 species were observed. White Ibis were the most commonly observed bird.

Table 2. A table of bird species recorded by Wekiva SpringsWatch over 2023 and the average number counted per survey.

Common Name	Scientific Name	Average # Counted Per Survey
Anhinga	*Anhinga anhinga*	2
Barred Owl	*Strix varia*	1
Belted Kingfisher	*Megaceryle alcyon*	2
Black Crowned Night Heron	*Nycticorax nycticorax*	2
Black Vulture	*Coragyps atratus*	3
Blue Gray Gnatcatcher	*Polioptila caerulea*	2
Brown Creeper	*Certhia americana*	1
Cardinal	*Cardinalis cardinalis*	2
Carolina Wren	*Thryothorus ludovicianus*	2
Catbird	*Dumetella carolinensis*	2
Cedar Waxwing	*Bombycilla cedrorum*	1
Common Moorhen	*Gallinula chloropus*	1
Crow	*Corvus* sp.	3
Downy Woodpecker	*Dryobates*	1
Eastern Phoebe	*Sayornis phoebe*	2
Fish Crow	*Corvus ossifragus*	1
Great Blue Heron	*Ardea herodias*	2
Great Egret	*Ardea alba*	5
Green Heron	*Butorides virenscens*	5
Limpkin	*Aramus guarauna*	1
Little Blue Heron	*Egretta caerulea*	4
Northern Mockingbird	*Mimus polyglottos*	1
Northern Parula	*American redstarts*	2
Pied Billed Grebe	*Podilymbus podiceps*	1
Pileated Woodpecker	*Dryocopus pileatus*	2
Purple Gallinule	*Porphyrio martinicus*	3
Red Bellied Woodpecker	*Melanerpes carolinus*	2
Red Shouldered Hawk	*Buteo lineatus*	2
Swallow Tailed Kite	*Elanoides forficatus*	1
Tricolored Heron	*Egretta tricolo*	1
Tufted Titmouse	*Baeolophus bicolor*	2
White Eyed Vireo	*Vireo griseus*	1
White Ibis	*Eudocimus albus*	16
Wood Duck	*Aix sponsa*	2
Yellow-Crowned Night Heron	*Nyctanassa violacea*	3
Yellow-Rumped Warbler	*Setophaga coronata*	3

Section 4.0 References

Florida Springs Institute (FSI). (2015), *Florida Springs Baseline Ecological Assessment: Standard Operating Procedures.* Howard T. Odum Florida Springs Institute, High Springs, Florida. Unpublished manuscript.

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

Section 5.0 Appendix

Table A.1. Average data collected during Wekiva River SpringsWatch monitoring sessions (January to December 2023)

Station Name	Parameter Name	Average	Number of Samples	Maximum	Minimum	Standard Deviation
WEK-HS	k (diffuse attenuation coefficient)	1.4	11	4.4	0.0	1.6
	Temperature (°C)	24.1	11	24.2	23.9	0.1
	Dissolved Oxygen (%)	9.3	10	19.0	6.3	3.8
	Dissolved Oxygen (mg/L)	0.7	8	1.1	0.5	0.2
	Specific Conductance (µS/cm)	376.2	7	382.8	371.0	4.1
	Nitrate+Nitrite (mg/L)	1.0	1	1.0	1.0	NA
	Percent Transmittance (% at 1 meter)	48.8	11	99.6	1.2	36.4
WEK-2	k (diffuse attenuation coefficient)	0.9	12	1.6	0.0	0.5
	Temperature (°C)	23.7	11	24.3	22.8	0.5
	Dissolved Oxygen (%)	16.6	10	24.8	8.5	5.7
	Dissolved Oxygen (mg/L)	1.3	8	2.1	0.7	0.5
	Specific Conductance (µS/cm)	374.2	7	379.6	369.6	3.5
	Percent Transmittance (% at 1 meter)	45.5	12	98.7	20.6	21.1
WEK-3	k (diffuse attenuation coefficient)	2.0	11	4.6	0.5	1.4
	Temperature (°C)	23.3	11	24.5	20.2	1.3
	Dissolved Oxygen (%)	28.1	10	35.7	20.2	5.0
	Dissolved Oxygen (mg/L)	2.3	8	2.9	1.7	0.4
	Specific Conductance (µS/cm)	372.1	7	380.7	355.4	8.0
	Percent Transmittance (% at 1 meter)	22.2	11	59.0	1.0	15.9
WEK-4	k (diffuse attenuation coefficient)	1.6	8	6.8	0.0	2.2
	Temperature (°C)	21.8	11	26.7	14.8	3.9
	Dissolved Oxygen (%)	68.8	10	80.3	53.8	8.6
	Dissolved Oxygen (mg/L)	5.9	8	7.1	4.4	0.9
	Specific Conductance (µS/cm)	305.7	7	316.8	295.0	8.3
	Percent Transmittance (% at 1 meter)	44.0	8	100.0	0.1	36.4
WEK-5	k (diffuse attenuation coefficient)	1.6	11	4.6	0.1	1.3
	Temperature (°C)	22.7	11	26.4	18.6	2.9
	Dissolved Oxygen (%)	60.3	10	68.4	35.7	10.1
	Dissolved Oxygen (mg/L)	5.0	8	5.9	3.4	0.9
	Specific Conductance (µS/cm)	325.6	7	376.6	294.2	28.2
	Percent Transmittance (% at 1 meter)	32.9	11	89.1	1.0	26.7
WEK-6	k (diffuse attenuation coefficient)	1.4	12	4.3	0.3	1.3
	Temperature (°C)	22.4	11	25.9	17.1	2.8
	Dissolved Oxygen (%)	50.4	10	71.0	17.7	13.8
	Dissolved Oxygen (mg/L)	4.1	8	5.2	1.4	1.2
	Specific Conductance (µS/cm)	333.4	7	346.3	317.2	9.5
	Percent Transmittance (% at 1 meter)	40.1	12	76.9	1.4	28.7

Table A.1. Continued

WEK-7	k (diffuse attenuation coefficient)	2.2	12	5.1	0.0	1.6
	Temperature (°C)	22.4	11	25.7	17.1	2.8
	Dissolved Oxygen (%)	52.0	10	63.2	39.3	7.2
	Dissolved Oxygen (mg/L)	4.4	8	5.1	3.2	0.7
	Specific Conductance (µS/cm)	335.3	7	344.7	328.3	5.3
	Percent Transmittance (% at 1 meter)	24.5	12	96.1	0.6	28.7
RS-1	k (diffuse attenuation coefficient)	1.1	8	3.8	0.3	1.1
	Temperature (°C)	21.4	11	26.6	14.5	4.3
	Dissolved Oxygen (%)	67.1	10	82.6	8.2	22.5
	Dissolved Oxygen (mg/L)	6.5	8	7.5	4.5	1.0
	Specific Conductance (µS/cm)	307.0	7	364.4	283.9	27.5
	Percent Transmittance (% at 1 meter)	42.9	8	72.4	2.3	21.0