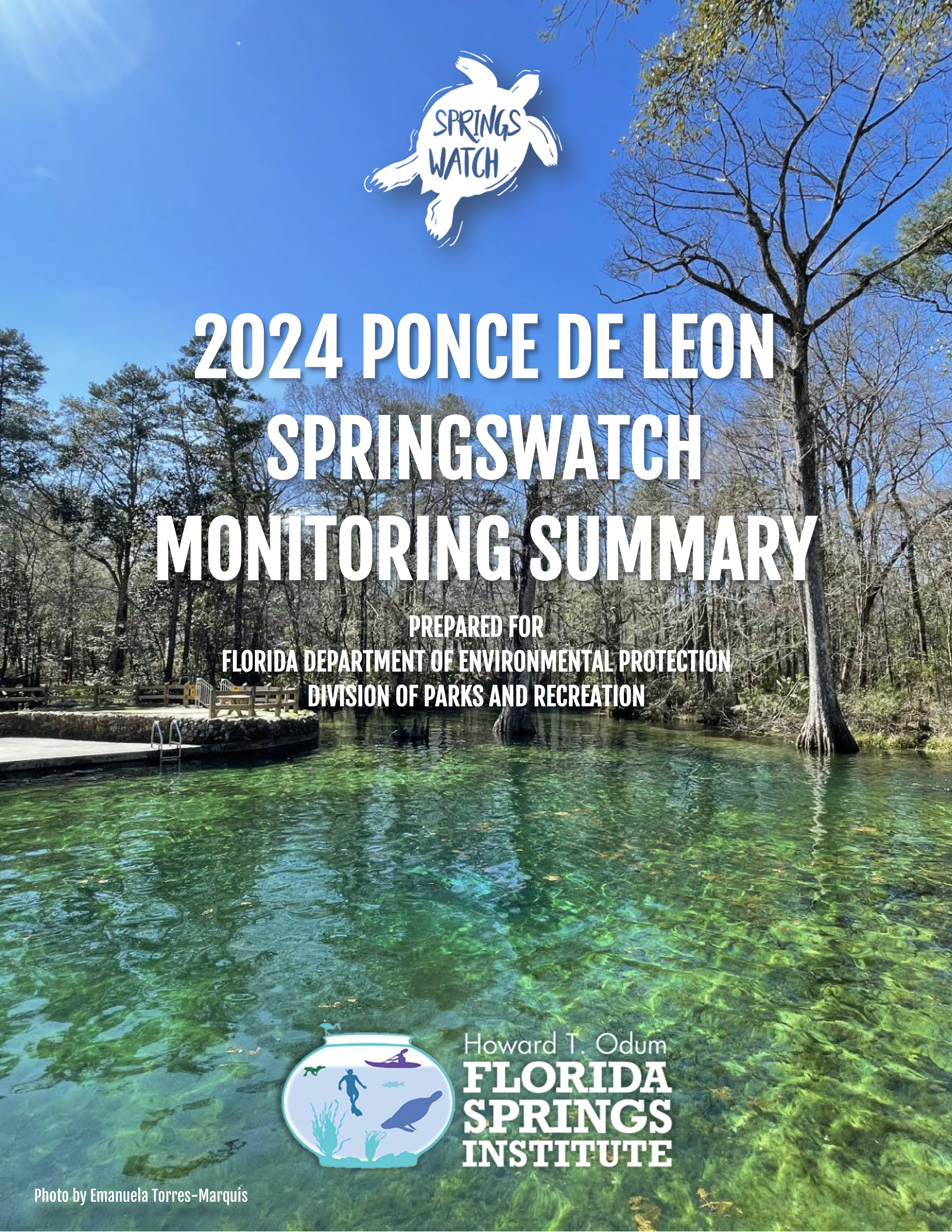


2024 PONCE DE LEON SPRINGSWATCH MONITORING SUMMARY

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

Howard T. Odum
FLORIDA SPRINGS INSTITUTE

Photo by Emanuela Torres-Marquis

Volunteer and Staff Acknowledgments

This report was prepared by the Howard T. Odum Florida Springs Institute (FSI). Ecological monitoring was conducted by FSI staff and the Florida SpringsWatch volunteers under the Florida Department of Environmental Protection (FDEP) Division of Recreation and Parks Research/Collection Permit Number 07012340 and 09132401.

Our Panhandle SpringsWatch program would not be possible without the hard work of our group leaders, Makena Mungania and Zac Zawahry, and their dedicated team of volunteers: Heather Zawahry, Moses Mungania, Anthony Hinson, Amani Mungania, Imani Mungania, Joseph Mungania, Makena Mungania, Patricia Mungania, Linda Sheffer, Nora Zawahry, and Zac Zawahry. Together, Ponce de Leon volunteers contributed 32 hours over 10 monitoring sessions in 2024. We also acknowledge the data entry efforts from our Fall 2024 diligent science interns: Avery Rust, Avah Lena, and Renee Hartless. We would like to thank Isaac Szabo for his underwater fish photography utilized in this report.

We would also like to recognize FSI's SpringsWatch Coordinator, Emanuela Torres-Marquis, and Environmental Scientists Bill Hawthorne, Thomas "TJ" Comer, and Sky Notestein for their support, working under the direction of FSI Director Haley Moody. Finally, we acknowledge the ongoing guidance and vision of FSI founder, Dr. Robert Knight.

Section 1.0 Introduction

1.1 Site Overview

The Panhandle SpringsWatch group is currently monitoring the health of Ponce De Leon Springs located within Ponce De Leon Springs State Park. This spring discharges more than 14 million gallons of groundwater per day and is a favorite swimming hole for local residents. This state park spring is bisected by Sandy Creek, a blackwater creek that runs through the park.

FSI's SpringsWatch volunteer citizen science program has provided enhanced monitoring of springs across Florida. 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 springs and bay health.

This report is focused on the monthly ecological monitoring at Ponce de Leon Spring conducted by SpringsWatch volunteers in 2024.

1.2 Monitoring Stations

Data was collected by SpringsWatch volunteers at a total of three stations (Figure 1). Station WPH-1 is in the Ponce De Leon headspring. Stations WPH-2 and WPH -3 are located in the spring run. A summary of all sampling sites, their station names, latitude, and longitude used within the Ponce De Leon SpringsWatch groups can be viewed in Table 1.

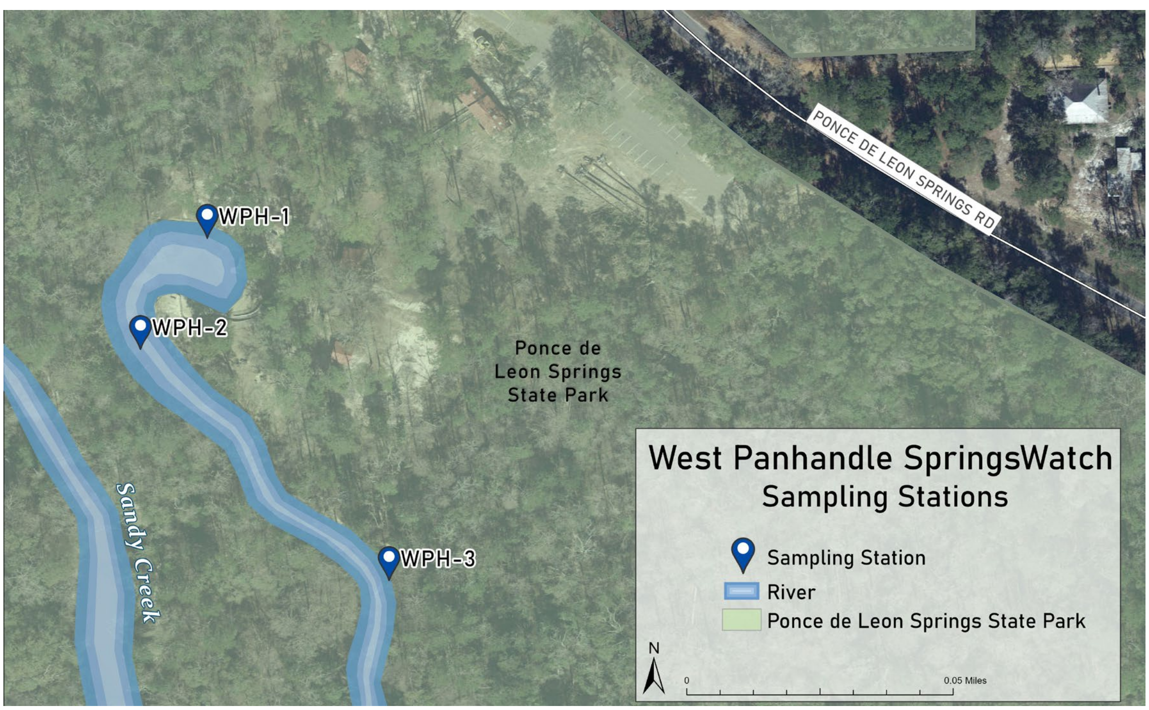


Figure 1. Stations within the Panhandle SpringsWatch study area.

Table 1. Table of sampling sites used within the Ponce de Leon SpringsWatch group.

Station Code	Station Name	Latitude	Longitude
WPH-1	Ponce De Leon Spring WPH-1	30.721164	-85.930703
WPH-2	Ponce De Leon Spring WPH-2	30.720844	-85.930895
WPH-3	Ponce De Leon Spring WPH-3	30.720179	-85.93018

Section 2.0 Methods

Ecological monitoring was conducted on Ponce de Leon Spring and spring run from January to December 2024. Data collection included water quality field parameters, light measurements, and submerged aquatic vegetation (SAV) photography.

2.1 Sampling Events

Table 2 summarizes the sampling events conducted during 2024 by the Florida SpringsWatch Program with assistance from FSI staff.

Panhandle SpringsWatch monitoring events included the following:

- Water quality field parameters (temperature, dissolved oxygen, specific conductivity, and nitrate-nitrite)
- Vertical light attenuation (PAR)
- Submerged aquatic vegetation (SAV) photography
- Visual fish surveys

Table 2. Summary of 2024 Panhandle SpringsWatch sampling events

Date	Temperature	Dissolved Oxygen	Specific Conductance	PAR	Vegetation	Secchi
2/3/2024	X	X	X	X	X	X
2/24/2024	X	X	X	X	X	
3/15/2024	X	X	X	X		
4/27/2024	X	X	X	X	X	
5/29/2024	X	X	X	X	X	
6/28/2024	X	X	X	X	X	
7/28/2024	X	X	X	X		
10/27/2024	X	X	X	X		
11/30/2024	X	X	X	X		
12/21/2024	X	X	X	X		

2.2 Water Quality

2.2.1 Dissolved Oxygen and Temperature

SpringsWatch volunteers used a handheld YSI ProODO meter at each of the monitoring stations in the Ponce De Leon Springs System to collect monthly measurements of water temperature and dissolved oxygen. Team leaders calibrated and maintained water quality meters according to manufacturer instructions and Florida Department of Environmental Protection Standard Operating Procedures (FDEP, 2017).

2.2.2 Specific Conductance

SpringsWatch volunteers used a handheld YSI EcoSense EC300A meter at each of the monitoring stations in the Ponce De Leon Springs System to collect monthly specific conductivity readings at each of the monitoring stations. Team leaders calibrated and maintained water quality meters according to manufacturer instructions and Florida Department of Environmental Protection Standard Operating Procedures (FDEP, 2017). If either the initial or post-sampling calibration failed, the associated data were excluded from this report and subsequent analyses.

2.3 Water Clarity

2.3.1 Diffuse Attenuation Coefficient (k) and Percent Transmittance

Photosynthetically Active Radiation (PAR) underwater light transmission and attenuation coefficients were measured at the monitoring sites during ecological assessments. Volunteers used an Apogee brand MQ-200 underwater quantum sensor to measure PAR energy reaching the water surface and at depth intervals of one foot and two feet. Figures and results are from collections where percent transmittance is greater than 10% and less than 100% due to near-zero or above 100 values; all other values were flagged and omitted from this report and analyses. Figure 2 provides an image of the Apogee PAR meter. Light extinction (attenuation) coefficients will be calculated from these data using the Lambert-Beer equation (Wetzel 2001):

Iz = Io(e-kz)

Where:

Iz = PAR at depth z

Io = PAR at the water surface

k = diffuse attenuation coefficient, m-1

z = water depth, m

Figure 2. Apogee MQ-200 PAR meter.

2.3.2. Secchi Disk

SpringsWatch volunteers took periodic horizontal Secchi disk measurements in the Ponce de Leon headspring (WPH-1) throughout the sampling period. Cold temperatures prevented consistent sampling effort.

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. The longer the Secchi depth, the clearer the water is. As Florida springs are often clearer than they are deep, we measure Secchi horizontally. 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.

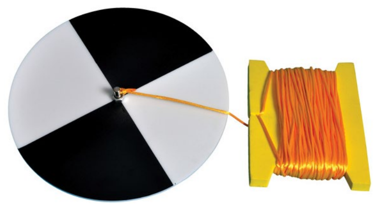


Figure 3. Secchi disk.

2.4 Vegetation

Submerged aquatic vegetation (SAV) was monitored monthly at all 3 stations. SpringsWatch volunteers took two photographs at each station in two different locations, which they sent to FSI for analysis. Analysis of vegetative cover was not complete for this report, so photos of typical spring run vegetation are provided instead.

Section 3.0 Results

This section summarizes field data collected as part of the ecosystem monitoring conducted at the Ponce de Leon spring and run in 2024. Data collected by Florida SpringsWatch volunteers included water quality field parameters, light measurements, and SAV photography. This data presents an ongoing record of conditions in the river and spring and will be useful for comparison to future evaluations of the ecological health of the Ponce de Leon Springs system.

3.1 Water Quality

Figure 4 through 7 present water quality field parameter results collected from the three stations along the Ponce de Leon spring and run in 2024, arranged graphically in upstream to downstream order.

3.1.1 Dissolved Oxygen

Figure 4 presents dissolved oxygen (DO) data measured in percent saturation (%), and Figure 5 presents DO results measured in milligrams per liter (mg/L) or parts per million (ppm). DO levels fluctuated between spring and river stations primarily due to ground 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 WPH-1 and WPH-2 were closest to the Ponce de Leon vent (Figure 1) 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.

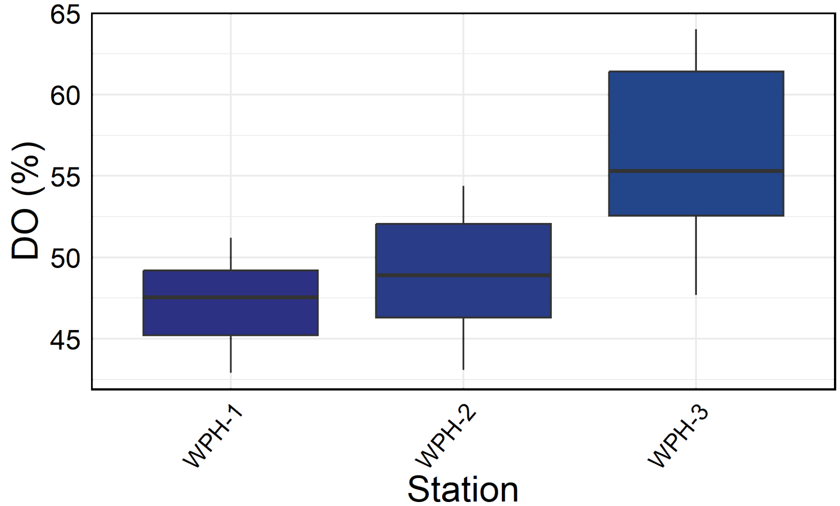


Figure 4. Dissolved oxygen percent saturation (DO%) for Panhandle SpringsWatch stations (January-December 2024).

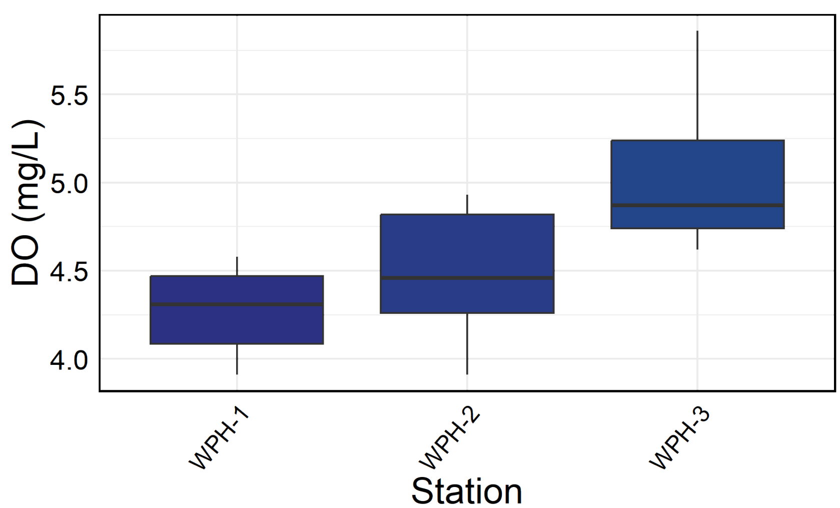


Figure 5. Average dissolved oxygen measurements (mg/L) by Panhandle SpringsWatch stations (January-December 2024).

3.1.2 Temperature

Water temperature is relatively constant in Florida springs. However, heavy rain, runoff from land, river flooding, and spring reversals (when surface water flows back into the spring) can disrupt this stability and cause the temperature to fluctuate along the spring run. In Florida, the average temperature from the spring vent is determined by the annual average air temperature and depth of the groundwater source.

Temperature directly affects how much dissolved oxygen the water can hold and how fast plants and animals use energy, their metabolism (Stevens et al., 2002; Hawkins, 1995; Gillooly et al., 2001; Short et al., 2016). The purpose of monitoring water temperature is to indicate any significant changes that may have large effects on other biological and chemical processes in the spring system.

Figure 6 presents data for water temperature (°C) field measurements. Temperature in the Ponce De Leon Springs run ranged from 19-21°C in January through December.

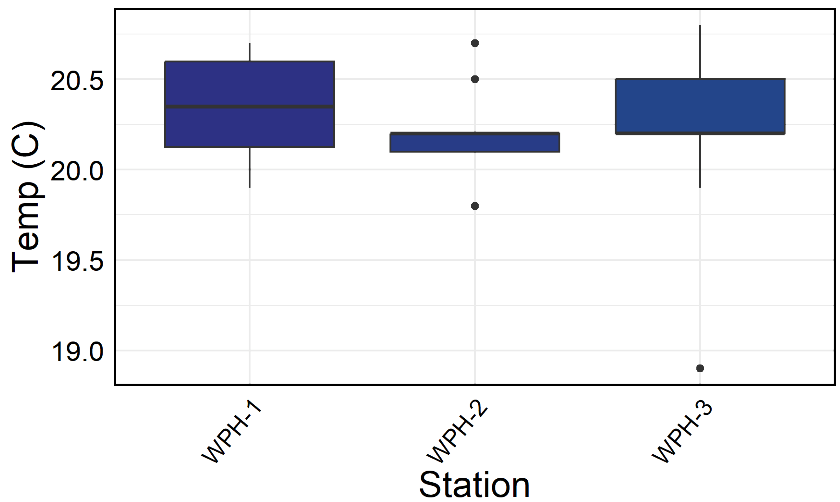


Figure 6. Water temperature (°C) by Panhandle SpringsWatch stations (January-December 2024).

3.1.3. Specific Conductivity

Specific conductance levels in spring water can be influenced by naturally occurring ions as well as by ions introduced from elevated levels of nitrate/nitrite, saltwater intrusion, and other compounds. Higher specific conductance values indicate a greater concentration of these dissolved ions in the water. Figure 10 shows specific conductance for the Ponce de Leon SpringsWatch stations.

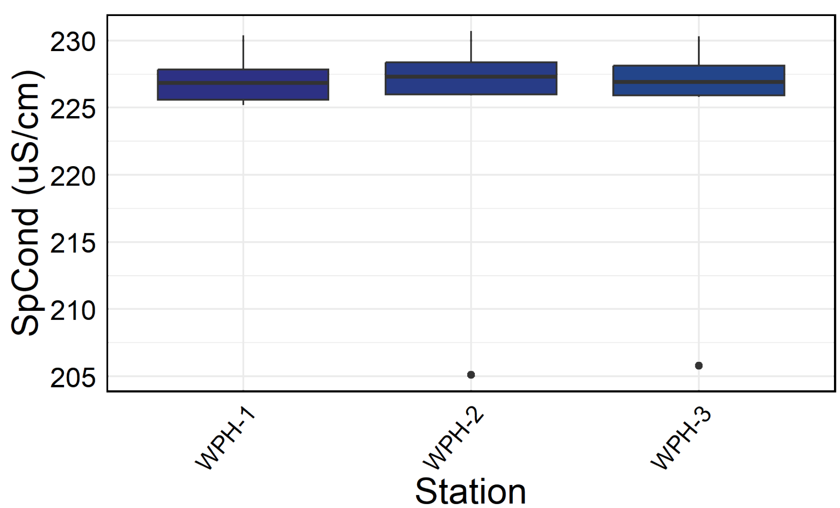


Figure 7. Specific conductance (uS/cm) for Panhandle SpringsWatch stations (January-December 2024).

3.2 Clarity and Light Measurements

3.2.1 Light Measurements

Percent transmittance refers to the amount of light that is able to pass through the water column to a depth of 1 foot below the surface. The diffuse attenuation coefficient (k) is 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 inhabits 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.

Figure 8 presents the percent transmittance estimates collected by SpringsWatch volunteers for stations WPH-1, WPH-2, and WPH-3 in Ponce de Leon headspring and run. Figure 9 presents average k (diffuse attenuation coefficient) for stations WPH-1, WPH-2, and WPH-3.

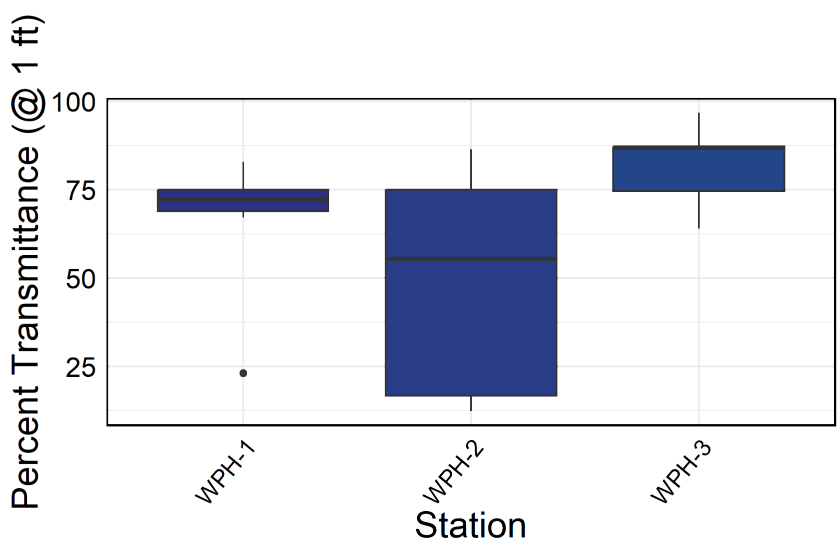


Figure 8. Percent transmittance (1ft) at Panhandle SpringsWatch stations (January-December 2024)

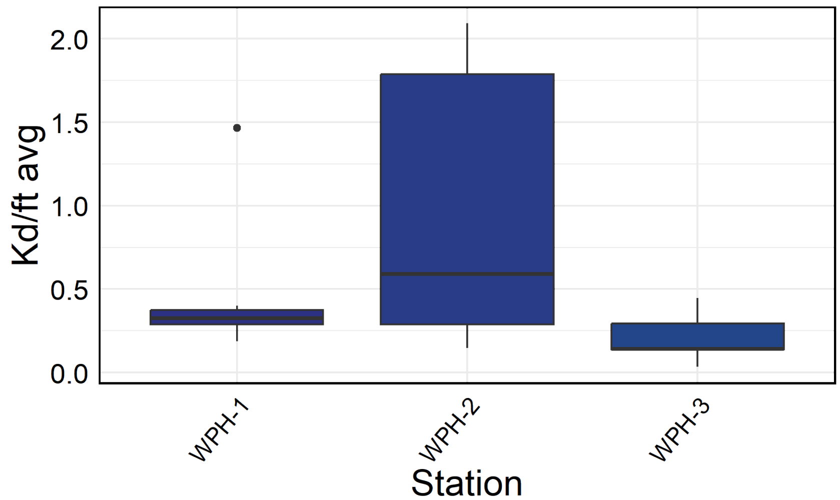


Figure 9. Average k (diffuse attenuation coefficient) Ponce De Leon Springs SpringsWatch (January–December 2024).

Section 4.0 Vegetation

4.2 Vegetation

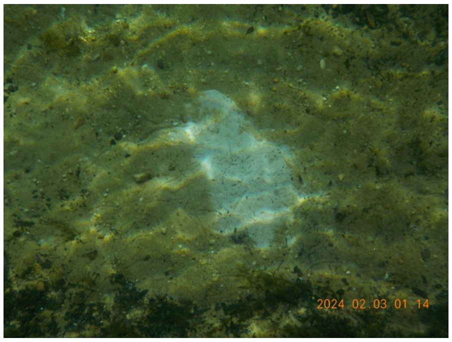
Submerged aquatic vegetation plays an important ecological role within a springs system. It provides habitat and food for fish and other wildlife, increases water clarity, affects nutrient cycles, and stabilizes shorelines and sediments.

Pictured below are river bottom photos taken by Panhandle SpringsWatch volunteers in 2024 which feature the SAV (or lack thereof) of the river and its springs. These data suggest that there is very little SAV at Ponce de Leon. The headspring and spring run exhibit mainly bare ground, detritus, algae, and some water moss. This data presents an ongoing record of conditions in the river and spring and will be useful for comparison to future evaluations of the ecological health of the Ponce de Leon system.

Understanding the distribution, abundance, and dynamics of SAV in springs is essential for understanding the overall health of these ecosystems and identifying any potential problems or issues that may need to be addressed. SAV provides shelter and breeding grounds for fish, amphibians, and invertebrates, and it is an important source of food for waterfowl and other animals. SAV also helps to stabilize sediments and improve water quality by absorbing excess nutrients and reducing erosion. In addition, SAV can have a positive effect on the surrounding environment by increasing oxygen levels and providing shade, which can help to regulate water temperature.

Overall, the presence of SAV in Florida Springs is essential for the health and functioning of these ecosystems, and its protection and conservation is crucial for the long-term sustainability of these natural resources. SAV also has economic value, as it plays important role in the recreational and tourism industries in Florida. People visit Florida springs from all over the world to enjoy activities such as swimming, boating, and fishing in the clear, pristine waters, and the presence of SAV adds to the beauty and enjoyment of these activities.

Station WPH-1:



Sand and detritus

Sand and detritus

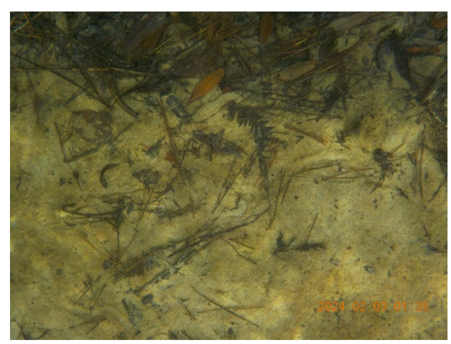
Station WPH-2:

Sand and detritus

Sand and detritus

Station WPH-3:

Ludwigia



Sand and detritus

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Section 6.0 Appendix A:

Table A.1. Data collected from Ponce de Leon SpringsWatch Group January to December 2024

Station	Parameter Name	Average	Number of Samples	Maximum	Minimum	Standard Deviation
WPH-1	Dissolved Oxygen (%)	47.3	8	51.2	42.9	2.9
	Dissolved Oxygen (mg/L)	4.3	8	4.6	3.9	0.3
	Secchi	6.5	2	8.8	4.1	3.4
	Specific Conductance (µS/cm)	227.0	8	230.4	225.2	1.8
	Temperature (°C)	20.3	10	20.7	19.9	0.3
	k (diffuse attenuation coefficient)	0.5	7	1.5	0.2	0.4
	Percent Transmittance (@ 1 ft)	66.6	7	82.8	23.1	19.8
WPH-2	Dissolved Oxygen (%)	49.0	7	54.4	43.1	4.1
	Dissolved Oxygen (mg/L)	4.5	9	4.9	3.9	0.3
	Specific Conductance (µS/cm)	224.9	8	230.7	205.1	8.2
	Temperature (°C)	20.2	9	20.7	19.8	0.3
	k (diffuse attenuation coefficient)	1.0	7	2.1	0.1	0.9
	Percent Transmittance (@ 1 ft)	48.2	7	86.4	12.3	32.2
WPH-3	Dissolved Oxygen (%)	56.4	7	64.0	47.7	6.1
	Dissolved Oxygen (mg/L)	5.0	7	5.9	4.6	0.5
	Specific Conductance (µS/cm)	224.4	7	230.3	205.8	8.4
	Temperature (°C)	20.2	9	20.8	18.9	0.5
	k (diffuse attenuation coefficient)	0.2	5	0.4	0.0	0.2
	Percent Transmittance (@ 1 ft)	81.9	5	96.7	64.0	12.7