Pocasset Lake

WATER QUALITY REPORT

2023

30 Mile River Watershed Association
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2023 Pocasset Lake Water Quality Report

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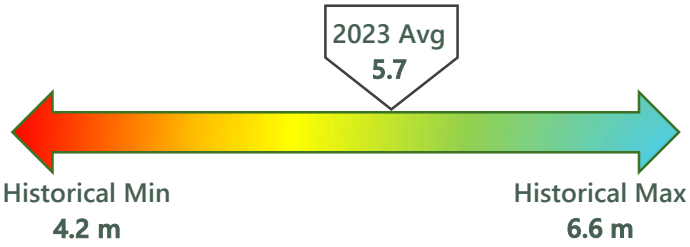
2023 Water Quality Summary[1]

Monitoring on Pocasset Lake occurred on nine (9) dates between June and September 2023 by Whitney Baker and Silas Mohlar of 30 Mile River Watershed Association (30 Mile) and volunteers from the Pocasset Lake Association (PLA).

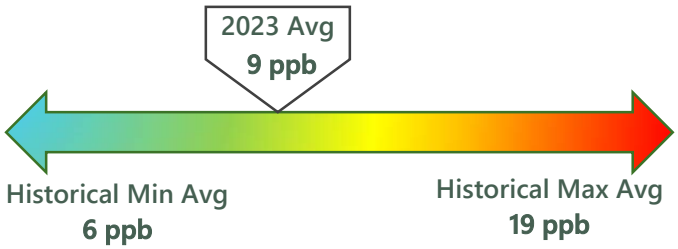
Water clarity readings in 2023 ranged from 5.3 meters to 6.4 meters with an annual average of 5.7 meters. 12 readings were collected in 2023 in total.

Water Clarity (m)	
2023 Water Clarity Average	5.7
Historical SDT Average	5.7
Maine Lakes SDT Average	4.8



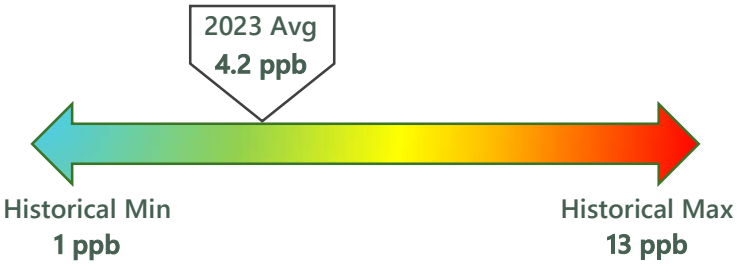
Four (5) samples were collected and analyzed for **Total Phosphorus**. Laboratory results ranged from 7 ppb (parts per billion) to 13 ppb with an annual average of 9 ppb.

Total Phosphorus (ppb)	
2023 TP Average	9
Historical TP Average	9
Maine Lakes TP Average	12



Chlorophyll was measured four (5) times in 2022. Results ranged from 1 ppb to 6 ppb with an annual average of 4.2 ppb.

Chlorophyll-a (ppb)	
2023 Chl-a Average	4.2
2023 Peak Chl-a	6
Historical Chl-a Average	3.7
Maine Lakes Chl-a Average	5.4



Nine (9) **Dissolved Oxygen (DO)** and Temperature profiles were collected in 2023. Anoxia (DO <2 ppm) was documented in the lake in 2023 at 6m on 7/13/23, 7/26/23, and 8/10/23. Low DO (DO <5 ppm) was documented in 6 meters on 8/10/23 and 8/24/23, 5 meters and deeper on 7/13/23, and 4m and deeper on 7/2/23.

[1] Scale bars illustrate the range of data collected for each parameter over the historical monitoring record for general comparison with the 2023 monitoring results. The blue end represents the historical minimum (best), and the red end represents the historical maximum (worst) of all monitoring data collected.

Overview

Pocasset Lake is located in the town of Wayne in Kennebec County and has a direct watershed area of approximately 4 square miles. Its indirect, upstream watershed is very large (53 square miles) and includes the upstream drainages of Hales Pond, Pickerel Pond, Lovejoy Pond, Echo Lake, Taylor Pond, Minnehonk Lake, David Pond, Parker Pond, Flying Pond, and several other smaller ponds and tributaries flowing into each of the above. Pocasset Lake drains to a single outlet located at the south end of the lake that flows south to Androscoggin Lake in Wayne.

Pocasset Lake is quite shallow with a maximum depth of just over 6 m (20 ft), an average depth of 4m (13 ft), and a surface area covering approximately 600 acres. Pocasset Lake does not have a public boat launch.

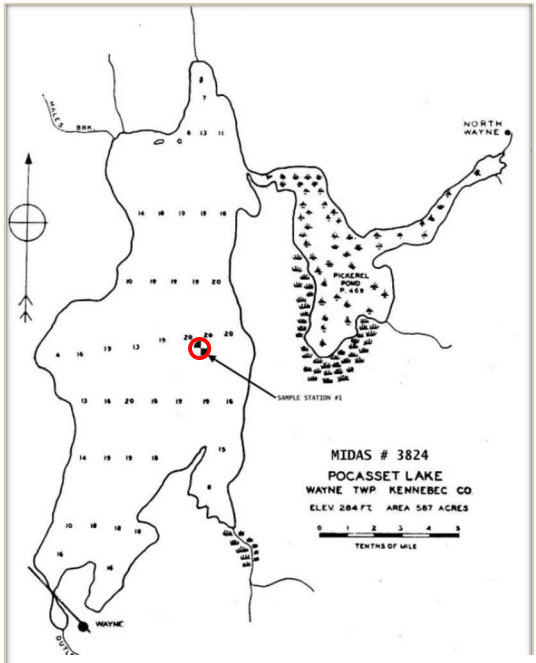


Figure 1. Pocasset Lake Monitoring Station, Maine DEP.

Water Quality Monitoring in 2023

Bluebird September morning on Pocasset Lake

Water quality monitoring on Pocasset Lake takes place at the deepest spot in the lake (Maine DEP Station 1), also known as the "deep spot", located off the eastern shore near Richardson's Beach. Station 1 is just over 6 meters (20 ft) deep (Figure 1). Monitoring in 2023 was completed by Whitney Baker and Silas Mohlar of 30 Mile River Watershed Association (30 Mile) and volunteers from the Pocasset Lake Association (PLA). A special thanks to the 2023 volunteers: Will Jennings, and Deb & Fred Duplisea.

Water quality data was collected on nine dates between June and September. Parameters include Secchi disk transparency, dissolved oxygen and temperature, phosphorus, chlorophyll, and advanced chemistry parameters (pH, Alkalinity, Color, and Conductivity).

Secchi Disk Transparency (Water Clarity)

Secchi disk transparency (SDT) is an indicator of water clarity. To measure water clarity, a black and white disk is lowered into the water and the reading is taken at the depth at which it is no longer visible. Factors that affect water clarity include algal growth, zooplankton densities, natural water color, and suspended silt or sediment particles.

Water Clarity (m)	
2023 Water Clarity Average	5.7
Historical SDT Average	5.7
Maine Lakes SDT Average	4.8

Water clarity readings in 2023 ranged from 5.3 meters (9/21/23) to 6.4 meters (10/5/23) with an annual average of 5.7 meters. 12 readings were collected in 2023 in total over nine monitoring days in 2023 (Figure 2).

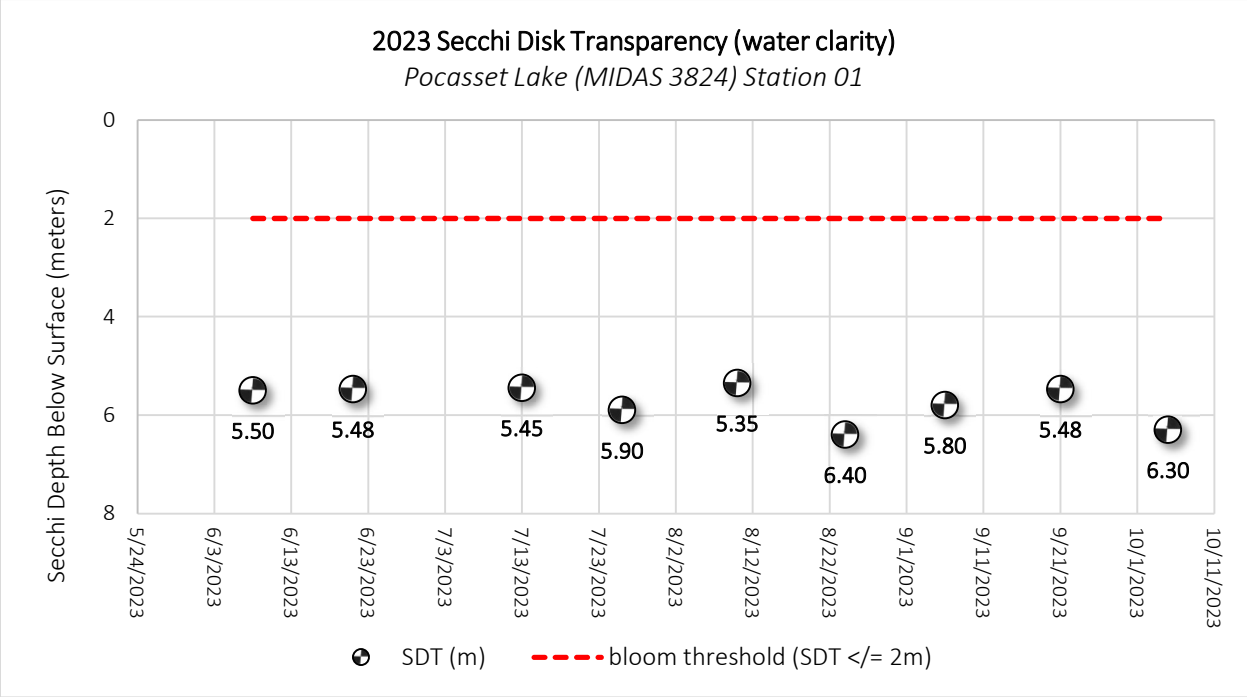


Figure 11. 2023 Secchi Disk Transparency (water clarity), Station 1

SDT data has been collected during 41 years throughout the historical monitoring period spanning the past 47 years. SDT readings in Pocasset Lake have ranged from 4.2 m (1976) to 6.6 m (2021) with an average annual reading 5.7 m (Figure 3). It is important to note that water clarity readings in Pocasset Lake can sometimes be physically restricted by the depth of the lake. Ocassionally, the Secchi disk will touch the bottom of the lake while still visible. The secchi disk hit bottom once during 2023 on October 5th.

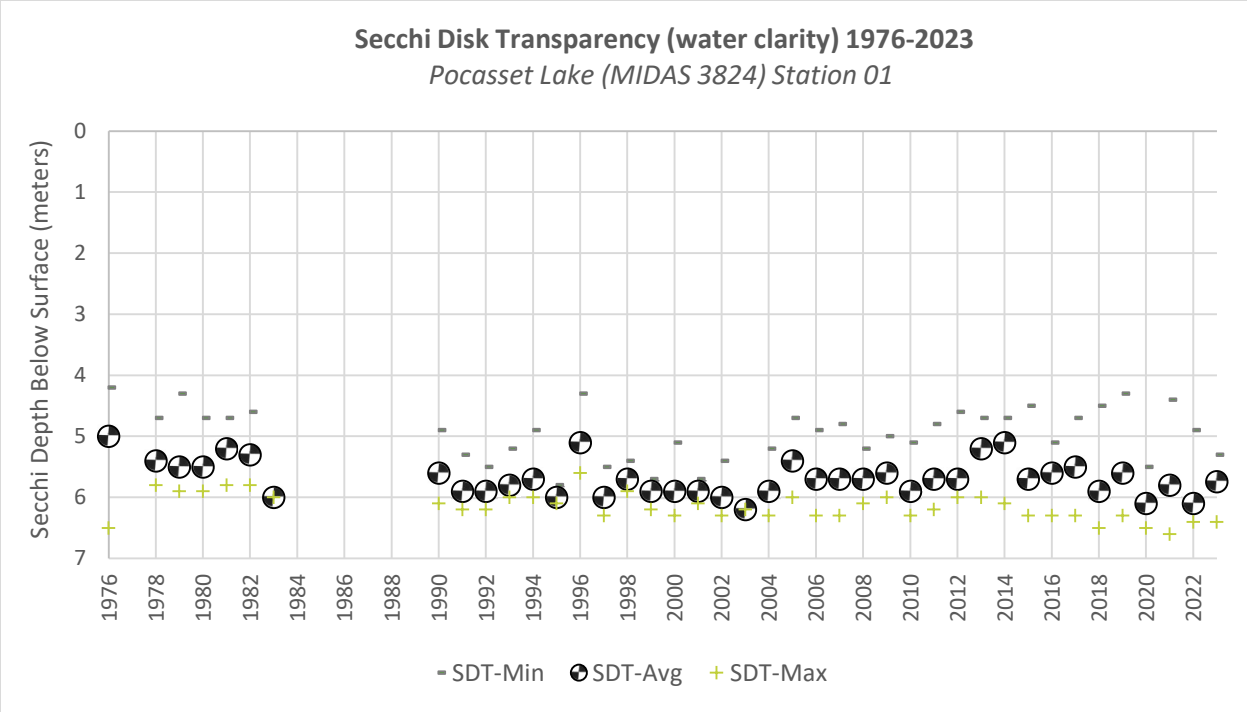


Figure 19. Historical Secchi Disk Transparency (water clarity), Station 01

Dissolved Oxygen and Temperature

Dissolved oxygen (DO) is a critical indicator of the health of the lake system. DO is produced through photosynthesis, consumed during respiration and decomposition, and is influenced by wind, wave action, weather events, and lake productivity. A good supply of oxygen is essential for fish and other aquatic species, with most fish species requiring a DO concentration of 5 mg/L or more. *Anoxia* can occur when DO drops below 2 mg/L. As lake water is warmed during the summer, deep lakes will form three distinct temperature layers. There is a warm layer at the surface (epilimnion), a thin transitional layer (metalimnion or thermocline), and a deep cold layer (hypolimnion). The change in water temperature and density at the metalimnion acts as a physical barrier that prevents mixing of the upper and lower layers for several months during the warm summer months.

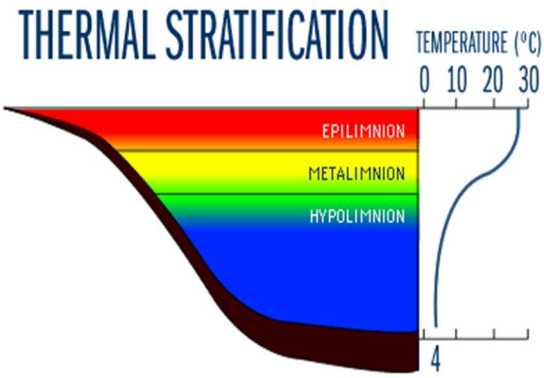


Figure 39. Thermal Stratification in a deep lake. Image source: www.watertheweb.org.

As lakes become more biologically productive in the summer, oxygen can decline as decomposition occurs in deep areas of the lake. While oxygen loss at the bottom of a deep lake is common in the summer months, excessive loss of oxygen may indicate a stressed and changing ecosystem with some lakes at more of a risk than others depending on sediment

chemistry[2]. Shallow lakes, like Pocasset Lake, may experience brief or periodic occurrences of thermal stratification throughout the open water season, but most often shallow lakes are homothermous, with consistent temperature and dissolved oxygen levels from the lake surface to the lake bottom. Lovejoy Pond is considered a homothermous lake, which is typical of lakes of similar depth as wind events can facilitate water mixing and easily disrupt thermal stratification. Pocasset Lake does occasionally stratify in the summer, and low levels of DO have been documented in the bottom meter of the pond.

In 2023, DO <5 ppm was documented in 4 of the 9 total profiles collected, in water 6 m and deeper, reaching waters 4m and deeper on July 26th. For the first time since 2019, anoxia (DO <2 ppm) was documented in Pocasset Lake at 6m on 7/13/23, 7/26/23, and 8/10/23 (Figure 4).

Water surface temperatures through the monitoring season ranged from 16.4 C (61.5 F) to 27.2 C (81.0 F) with an average surface water temperature of 22.9 C (73.3 F) between June and September. Continued collection of bi-weekly DO and temperature profiles will identify trends and

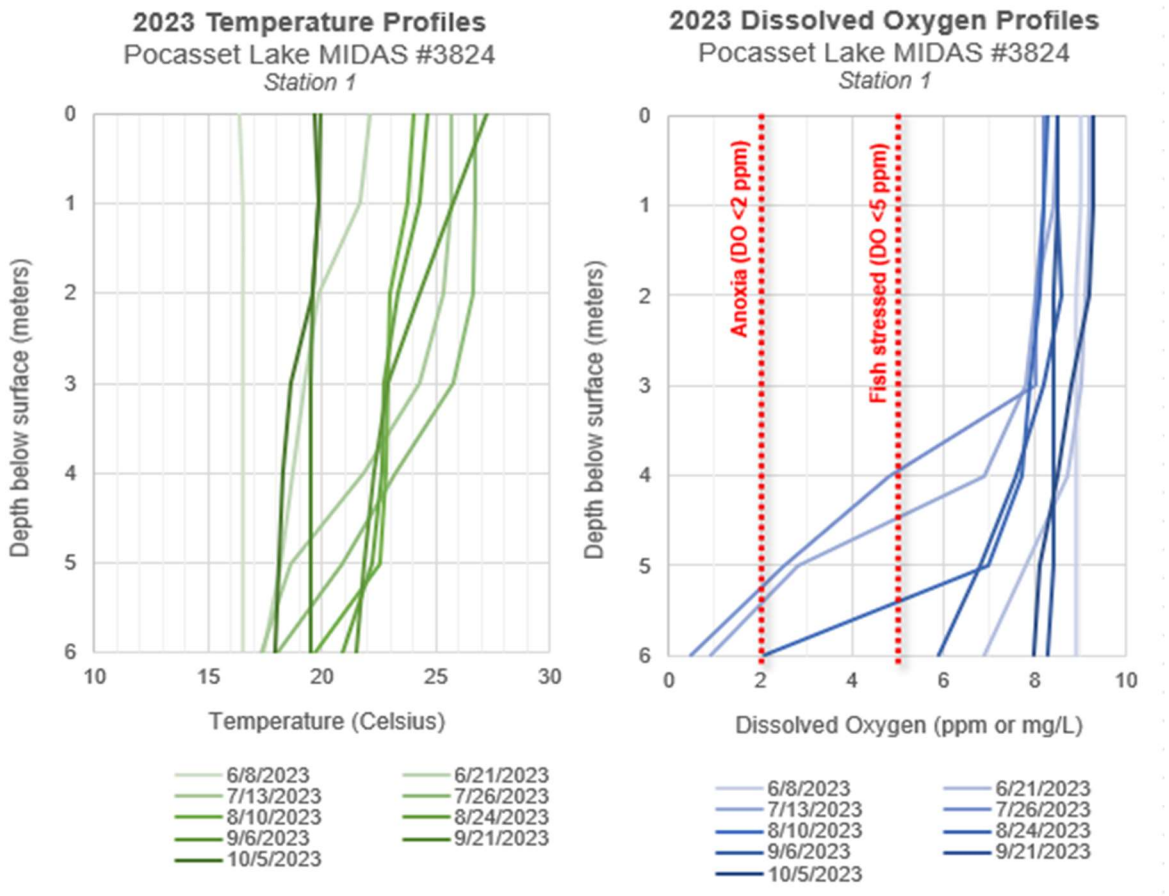


Figure 5. 2023 Dissolved Oxygen and Temperature Profiles, Station 1

[2]Some lakes in Maine may be more vulnerable than others to internal phosphorus loading, a phenomenon that can occur when deep waters become anoxic (DO loss <2 ppm) resulting in phosphorus release from the bottom sediments exposed to anoxic waters.

changes occurring in Pocasset Lake in order to better understand variations in thermal stratification and the extent and severity of the low DO and anoxia throughout the monitoring season.

Total Phosphorus (TP)

Total Phosphorus (ppb)	
2023 TP Average	9
Historical TP Average	9
Maine Lakes TP Average	12

Phosphorus is the nutrient that most influences the growth of algae in lakes. Because its natural occurrence in lakes is very small, phosphorus "limits" the growth of algae in lake ecosystems. Small increases in phosphorus in lake water can cause substantial increases in algal growth, hindering lake health as well as the economic, recreational, and aesthetic value of the lake. Tracking in-lake phosphorus levels over time is another way of monitoring change in lake water quality trends.

Five (5) samples were collected from the surface of Pocasset Lake in 2023 using an integrated core sampler (referred to as "epilimnetic core samples") and analyzed for Total Phosphorus (TP). Samples were collected monthly between June and October. Laboratory results for epilimnetic core samples collected in 2023 ranged from 7 ppb to 13 ppb with an annual average of 9 ppb. Generally speaking, in-lake phosphorus concentrations (epilimnetic samples) less than 10-12 ppb are ideal. Lakes with in-lake phosphorus concentrations of 13 ppb or more are able to sustain algal blooms, and blooms become frequent as in-lake average concentrations approach 20 ppb. TP data has been collected from Pocasset Lake during 15 years since 1976. Historically, the annual average

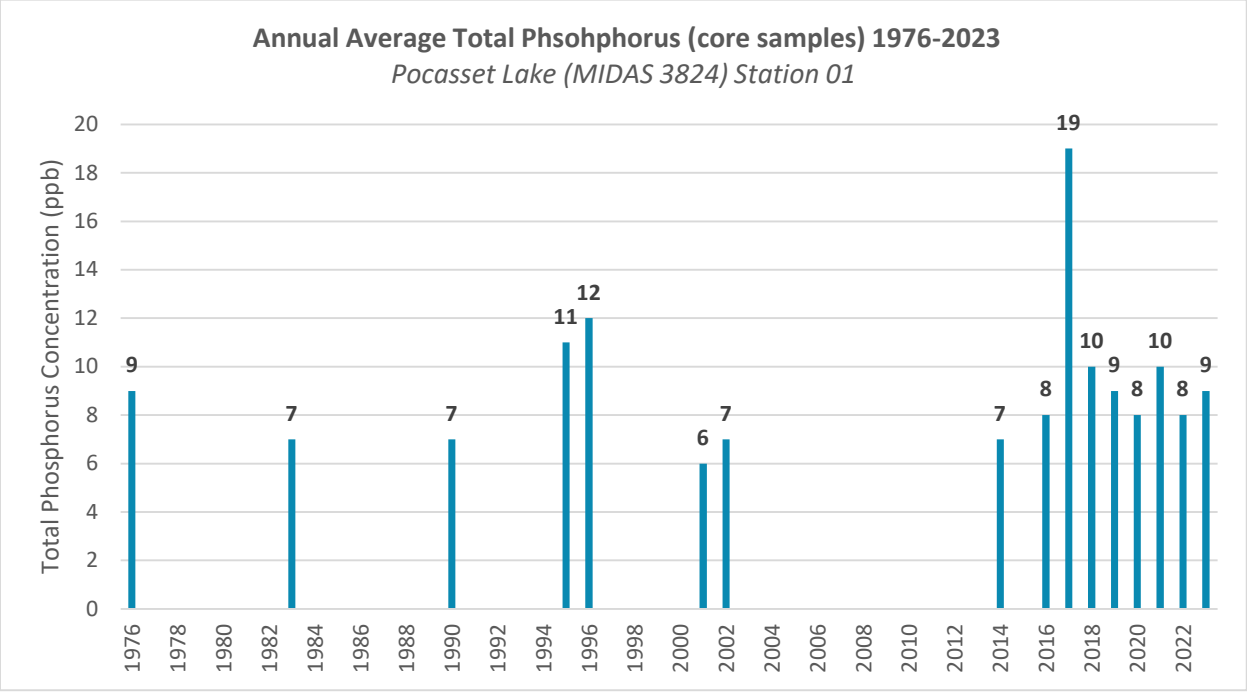


Figure 6. Annual Average Total Phosphorus data (epilimnetic core samples) collected 1976-2023, Station 1.

in-lake phosphorus concentration in Pocasset Lake ranges from 6 ppb (2001) to 19 ppb (2017) with a historical average of 9.3 ppb (Figure 5).

In 2023, two (2) TP samples were collected from the bottom of Pocasset Lake using a Kemmerer grab sampler; this type of sample is known as a "bottom grab". Bottom grabs are collected when anoxia is encountered anywhere in the dissolved oxygen profile and help us determine if there is active phosphorus release from bottom sediments exposed to anoxic conditions. Lab results for the three bottom grab samples collected in 2023 were 8 ppb (July 13th) and 10 ppb (August 10th) (Figure 6).

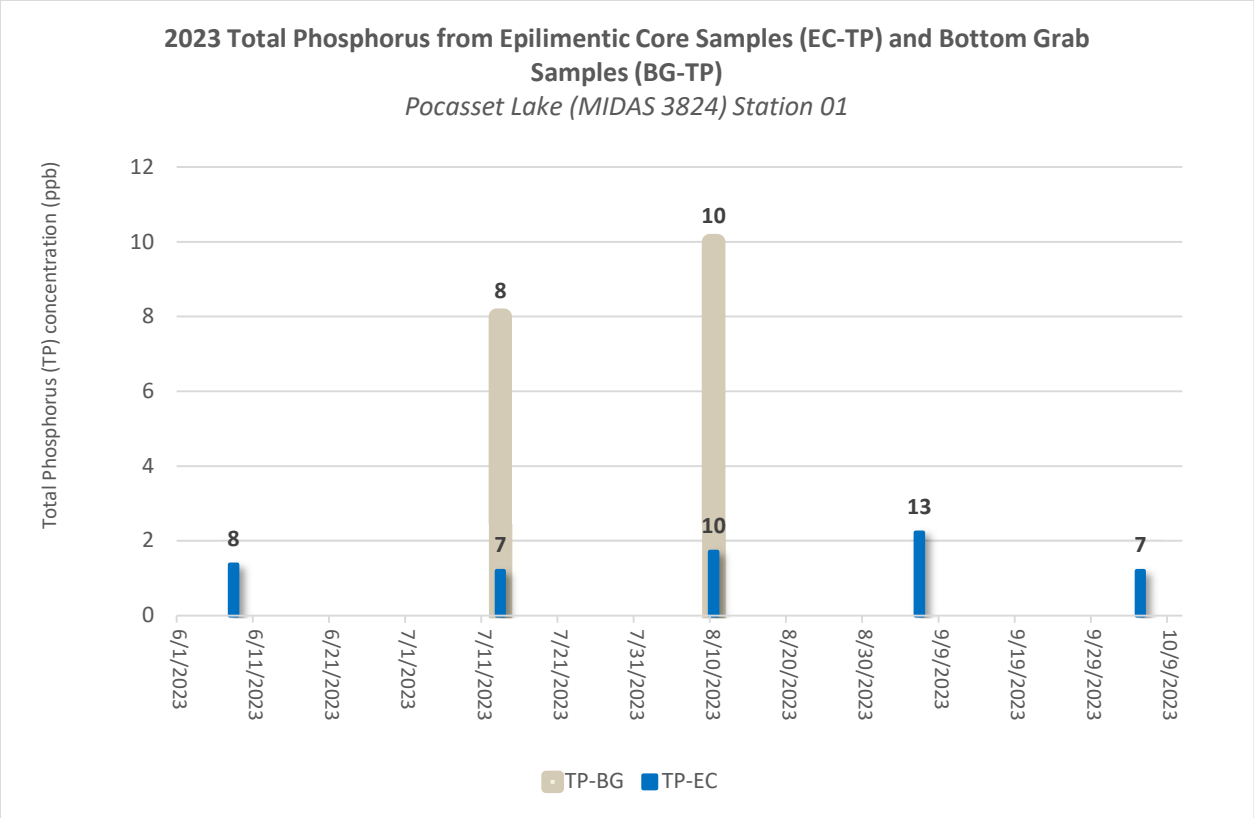


Figure 7. 2023 Total Phosphorus (epilimnetic core samples), Station 01

Chlorophyll (Chl-a)

Chlorophyll is found in plants (including algae) and is used to convert sunlight into energy. Measuring the concentration of Chlorophyll in lake water helps us estimate the algae population in the lake.

Chl-a (ppb)	
2023 Chl-a Average	4.2
2023 Peak Chl-a	6.0
Historical Chl-a Average	3.7
Maine Lakes Chl-a Average	5.4

Chlorophyll was measured five (5) times in 2023. Results ranged from 1 ppb to 6 ppb, with a 2023 annual average of 4.2 ppb. Historical monitoring data collected during 13 years between 1976-2023 ranged from 1 ppb (2023) to 12.8 ppb (1977) with a historical annual average of 3.7 ppb.

pH

pH	
2023 pH	7.2
Historical pH Average	7.2
Maine Lakes Average	6.44

pH helps determine which plant and animal species can live in the lake, and it governs biochemical processes that take place. The pH scale ranges from 0-14, with 7 being neutral. Water is increasingly acidic below 7, and increasingly alkaline above 7. A one unit change in pH represents a tenfold change in acidity or alkalinity. The pH scale is the inverse log of the hydrogen ion concentration.

One sample taken on August 10th was analyzed for pH and had a result of 7.1. Historically, pH has only been analyzed 12 other years (1980, 1981, 1982, 1983, 1990, 2001, 2008, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023), with a historical annual average of 7.2.

True Color

Color (PCU)	
2023 Color	19
Historical Color Average	14
Maine Lakes Color Average	20.7

Water color refers to the concentration of natural dissolved organic acids. This includes natural tannins and lignins dissolved in the water, often resulting in "tea" or "root beer" colored water. “True Color” is measured in Platinum Cobalt Units (PCU) after all particulates (including algae cells) have been filtered out of the sample. Colored lakes (>25 PCU) can have reduced transparency readings and increased phosphorus values. However, this does not mean the lakes produce more algae. The color simply reduces the transparency such that the reading is not a good measure of algal biomass. Chlorophyll-a (Chl-a) is the best indicator of algal productivity in colored lakes and should be used if possible.

One sample taken on August 10th was analyzed for true color and had a result of 19 PCU. Historically, true color has been analyzed seven (7) other years (2002, 2008 ,2014, 2017, 2018, 2022, and 2023), with a result with a historical average annual result of 14 PCU.

Conductivity

Conductivity (uMHOS/cm)	
2023 Conductivity	66.4
Historical Conductivity Average	58
Maine Lakes Conductivity Average	51.1

Conductivity measures the ability of water to carry electrical current and is directly related to the dissolved ions (charged particles) present in the water. Fishery biologists can use conductivity values to calculate fish yield estimates because

conductivity will generally increase if there is an increase of pollutants entering the lake or pond. Stormwater runoff from developed areas and roadways is the most common pollutant in Maine lakes that can raise conductivity values. Conductivity is measured in micromhos per centimeter (uMHOS/cm).

One sample taken on August 10th was analyzed for conductivity and had a result of 66.4 uMHOS/cm. Historically, conductivity has been analyzed during 10 (1980, 1990, 2001, 2002, 2008, 2014, 2017, 2018, 2022, 2023) of the 47-year monitoring period, with a historical annual average of 58 uMHOS/cm.

Alkalinity

Alkalinity (mg/L)	
2023 Alkalinity	14
Historical Alkalinity Average	14
Maine Lakes Alkalinity Average	11.7

Alkalinity is also referred to as "buffering capacity." It is a measure primarily of naturally available bicarbonate, carbonate, and hydroxide ions in the water and is measured in milligrams per liter (mg/L). Measuring alkalinity is important to determining a lake's ability to neutralize acidic pollution from rainfall or snowmelt. Lakes with alkalinity values >20 mg/L are considered well buffered against pH changes over time. Lakes with low or zero alkalinity may have more variation in pH levels that can sometimes result in damage to aquatic life.

One sample taken on August 10th was analyzed for alkalinity and had a result of 14 mg/L. Historically, alkalinity has been analyzed during 12 (1980, 1983, 1990, 1995, 1996, 2001, 2002, 2008, 2014, 2017, 2022, 2023) of the 47-year monitoring period, with a historical annual average of 14 mg/L.

Discussion

Data presented in this report includes all monitoring data collected through 2022, submitted by volunteer monitors, 30 Mile staff, and state agencies, that has undergone a thorough QA/QC process at Maine DEP. 2023 data included in this report is data collected by 30 Mile only.

2023 marked 30 Mile's eighth year of monitoring Pocasset Lake and a particularly wet season, with an unprecedented rainstorm in early May delivering a large amount of polluted stormwater runoff into the lake. This likely increased the mass of algae in the lake this year, which resulted in more biological productivity and decomposition – processes that consume oxygen in the water. This is likely why anoxia (DO <2 ppm) was documented for the first time since 2019 and the annual chl-a concentration average was the highest since 1996 (4.7 ppb). This makes it difficult to compare this

year's data to that collected years prior, which saw a lot less precipitation and emphasizes the importance to continue monitoring Pocasset Lake consistently every year.

Five years of consecutive data collection for any given parameter will provide the baseline condition for water quality. 10 years of consecutive data collection is needed to meet the minimum data thresholds for determining trends over time. 30 Mile's monitoring program will continue to develop a robust dataset that can help our community identify and address water quality concerns in Pocasset Lake.

Near real-time data for Pocasset Lake's clarity (Secchi depth), and dissolved oxygen and temperature profiles can be found online at https://30mileriver.org/pocasset-lake/, along with a link to the historical dataset and depth map.

Next Steps

1. Continue **bi-weekly baseline monitoring** between May and October each year to monitor seasonal and annual variability across all parameters, and better document changes and trends over time.

2. Develop a **LakeSmart team** on Pocasset Lake, providing education to shorefront property owners about polluted stormwater runoff, phosphorus, and the affects that watershed development can have on lake water quality.

3. This September, we completed a **watershed survey** of the Pocasset Lake watershed! Over the winter, we will be compiling the survey results and writing a report. Once the report has been finished, we will begin to build a watershed-based management plan to help protect and improve the Pocasset Lake watershed for the future years to come!