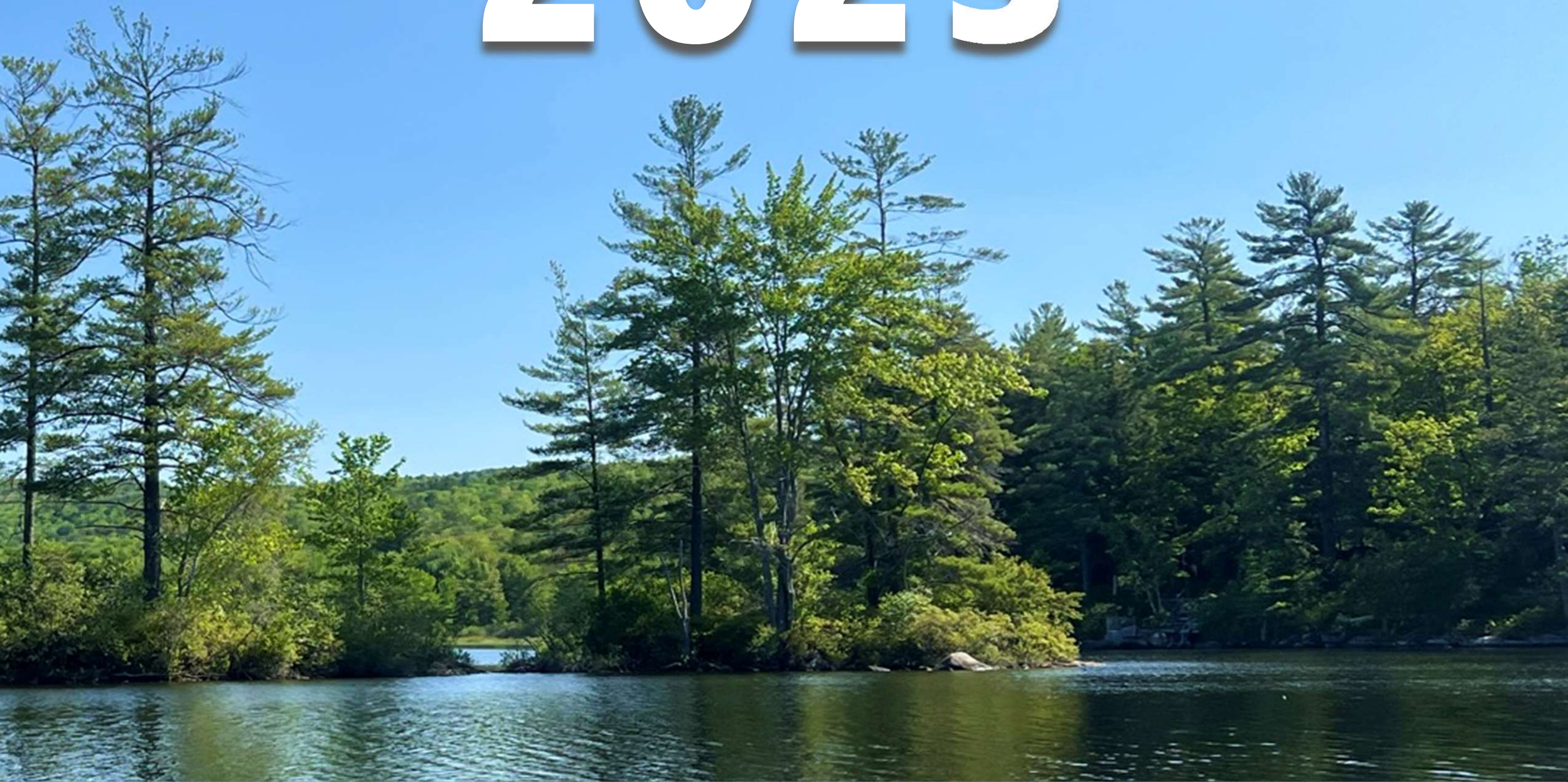
# Parker Pond

## WATER QUALITY REPORT

# 2023



30 Mile River Watershed Association
P.O. Box 132
Mount Vernon, ME 04352
www.30mileriver.org

# 2023 Parker Pond Water Quality Report

## TABLE OF CONTENTS



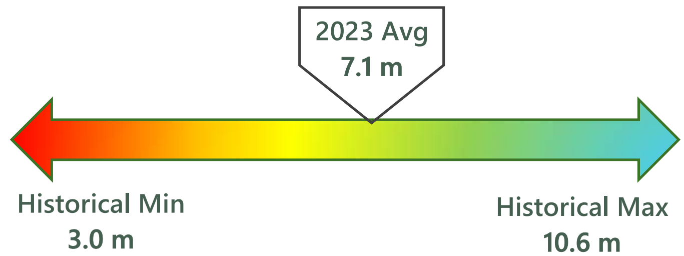
## TABLE OF FIGURES

## 2023 Water Quality Summary[1]

Monitoring on Parker Pond occurred on eleven dates between May and October in 2023 by Whitney Baker and Silas Mohlar of the 30 Mile River Watershed Association (30 Mile) and volunteers from the Parker Pond Association (PPA).

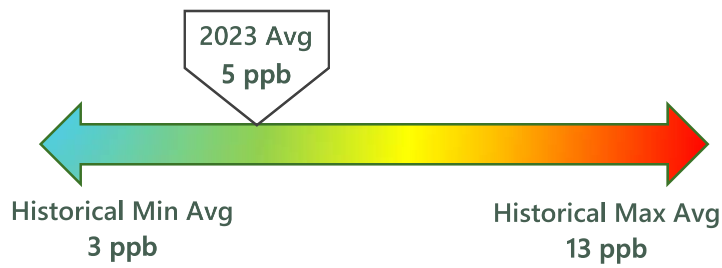
Water clarity readings in 2023 ranged from 5.70 meters to 7.75 meters with an annual average of 7.1 meters. 13 total readings were collected in 2023.

| Water Clarity (m) | |
|---|---|
| 2023 Water Clarity Average | 7.1 |
| Historical SDT Average | 7.4 |
| Maine Lakes SDT Average | 4.8 |



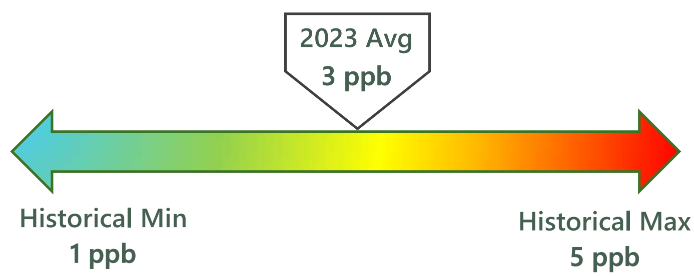

Six (6) samples were collected and analyzed for Total Phosphorus. Laboratory results ranged from 3 ppb (parts per billion) to 6 ppb with an average of 5 ppb.

| Total Phosphorus (ppb) | |
|---|---|
| 2023 TP Average | 5 |
| Historical TP Average | 7 |
| Maine Lakes TP Average | 12 |




Chlorophyll was also measured Six (6) times in 2023. Results ranged from 1 ppb to 4ppb with an annual average of 2.8 ppb.

| Chlorophyll-a (ppb) | |
|---|---|
| 2023 Chl-a Average | 3.0 |
| 2023 Peak Chl-a | 4.0 |
| Historical Chl-a Average | 2.6 |
| Maine Lakes Chl-a Average | 5.4 |




Eleven (11) Dissolved Oxygen (DO) profiles were collected in 2023. Anoxia (DO <2 ppm) was first encountered in deep waters at a depth of 19 meters in August and this zone of anoxia grew larger to include waters 10 meters and deeper by September. This pattern of oxygen loss is typical of Parker Pond in late August and September.

[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

Parker Pond is located in the towns of Mount Vernon, Fayette, Vienna, and Chesterville, located in the upper west branch of the 30 Mile River watershed. Parker Pond has a watershed drainage area of approximately 13 square miles, which includes the indirect, upstream drainages (6 sq. mi.) of Tilton, Basin, David, and Whittier Ponds. Parker Pond has a single outlet located on the southeastern shore that flows south to Taylor Pond and Echo Lake in Mount Vernon.

Parker Pond is moderately deep with a maximum depth of 20 m (65 ft) and an average depth of 8 m (27 ft). The pond has a relatively large surface area covering over 1,500 acres (2.4 sq. mi.) and can be accessed via a public boat launch located on the north end of the lake on Tower Road in Vienna.

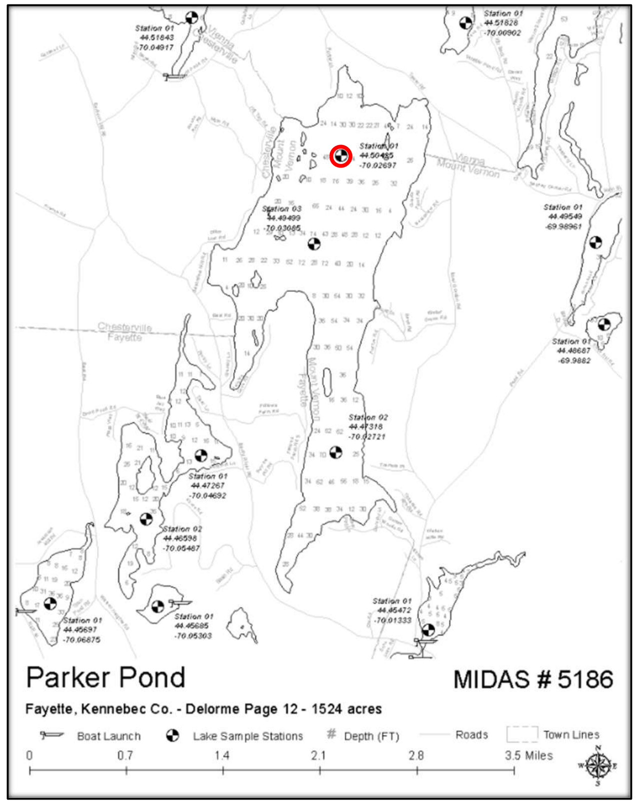



*Figure 1. Parker Pond Monitoring Stations, Maine DEP.*

## Water Quality Monitoring in 2023

*30 Mile WQM Program Manager, Whitney Baker, collects a water sample using a Kemmerer on Parker Pond in August.*

Water quality monitoring on Parker Pond takes place at the deepest spot in the lake (Maine DEP Station 1), located in the north end of the lake (Figure 1). Monitoring in 2023 was completed by Whitney Baker and Silas Mohlar of the 30 Mile River Watershed Association (30 Mile) and volunteers from the Parker Pond Association (PPA). A special thanks to the 2023 volunteers: Bob Weimont and Ken Tillman.

In 2023, water quality monitors collected data on 11 dates between late May and October. Parameters collected include Secchi disk transparency, dissolved oxygen and temperature, phosphorus, chlorophyll-a, 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 | 7.1 |
| Historical SDT Average | 7.4 |
| Maine Lakes SDT Average | 4.8 |

Water clarity readings in 2023 ranged from 5.70 meters (5/31/23) to 7.75 meters (9/5/23) with an annual average of 7.1 meters. 13 total readings were collected during eleven monitoring days in 2023 (Figure 2).

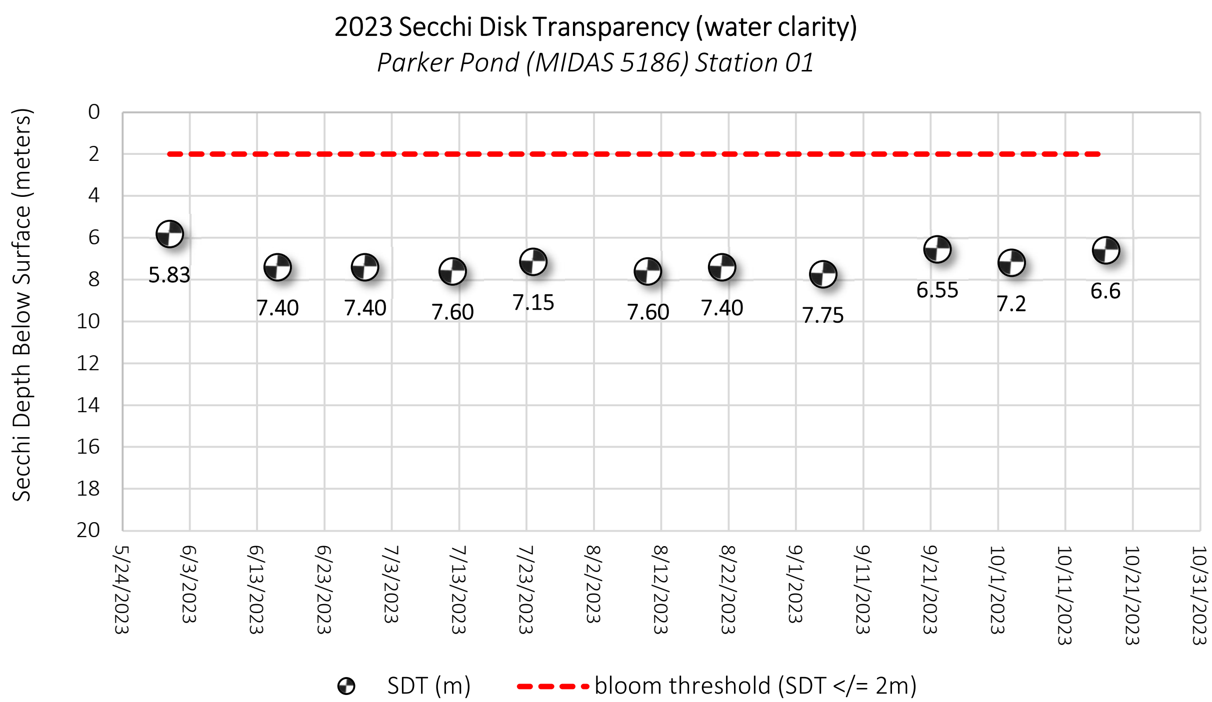



*Figure 2. Historical Secchi disk transparency (water clarity) data 1976-2023, Station 01.*

Historically, SDT data was collected on Parker Pond during 41 of the past 47 years. Readings ranged from 3.0 m (1989) to 10.6 m (1995) with an average annual reading of 7.4 m (Figure 3).

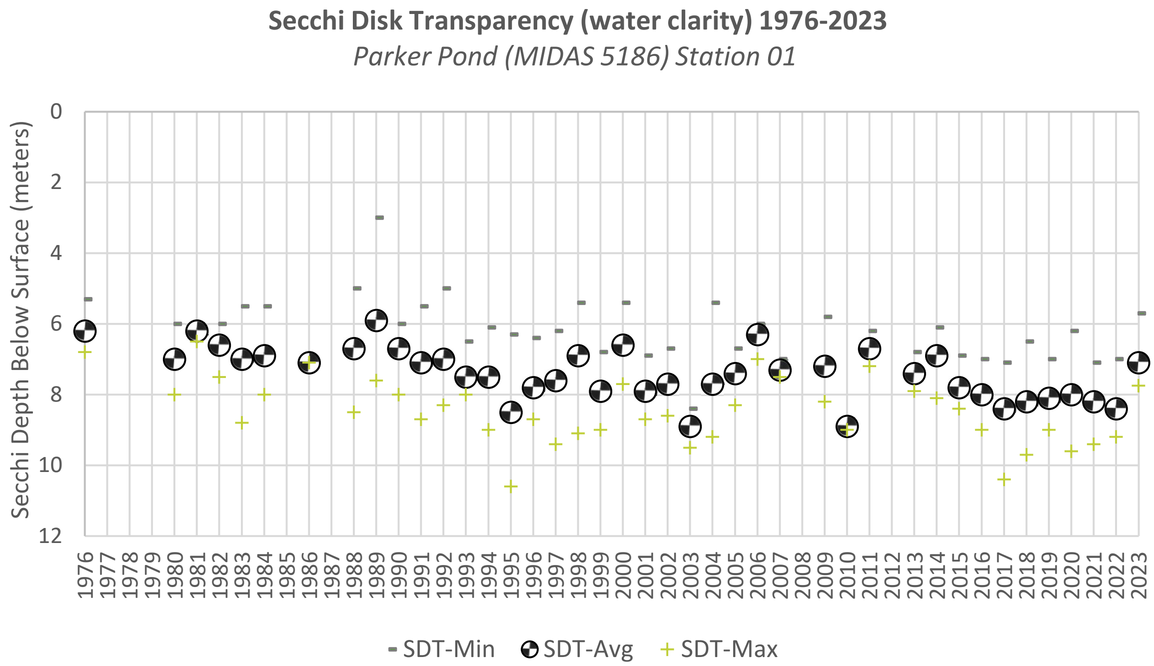



*Figure 3. 2023 Secchi disk transparency (water clarity) data, Station 01.*

## 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.

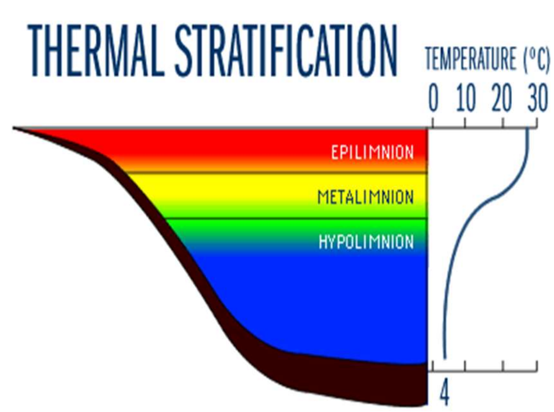



*Figure 4. Thermal stratification in a deep lake. Image source: www.waterontheweb.org.*

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. Monitoring the pattern and extent of oxygen loss in deep areas of Parker Pond is important to understanding changes between the years and throughout a single season and is particularly important for Parker Pond because it may be more vulnerable for internal phosphorus loading due to its unique sediment chemistry[2].

Eleven (11) DO and temperature profiles were collected in 2023 (Figure 5). Anoxia (DO <2 mg/L) was first encountered in deep waters of the hypolimnion in waters 19 meters and deeper in August, but this zone of anoxic water grew to include all waters 10 meters and deeper by September and persisted in waters 11-12 meters and deeper through October. Low DO (<5 mg/L) was documented in every profile collected in 2023 starting in mid-July in waters 13 meters and deeper, and growing to includes all waters 9 meters and deeper through October.

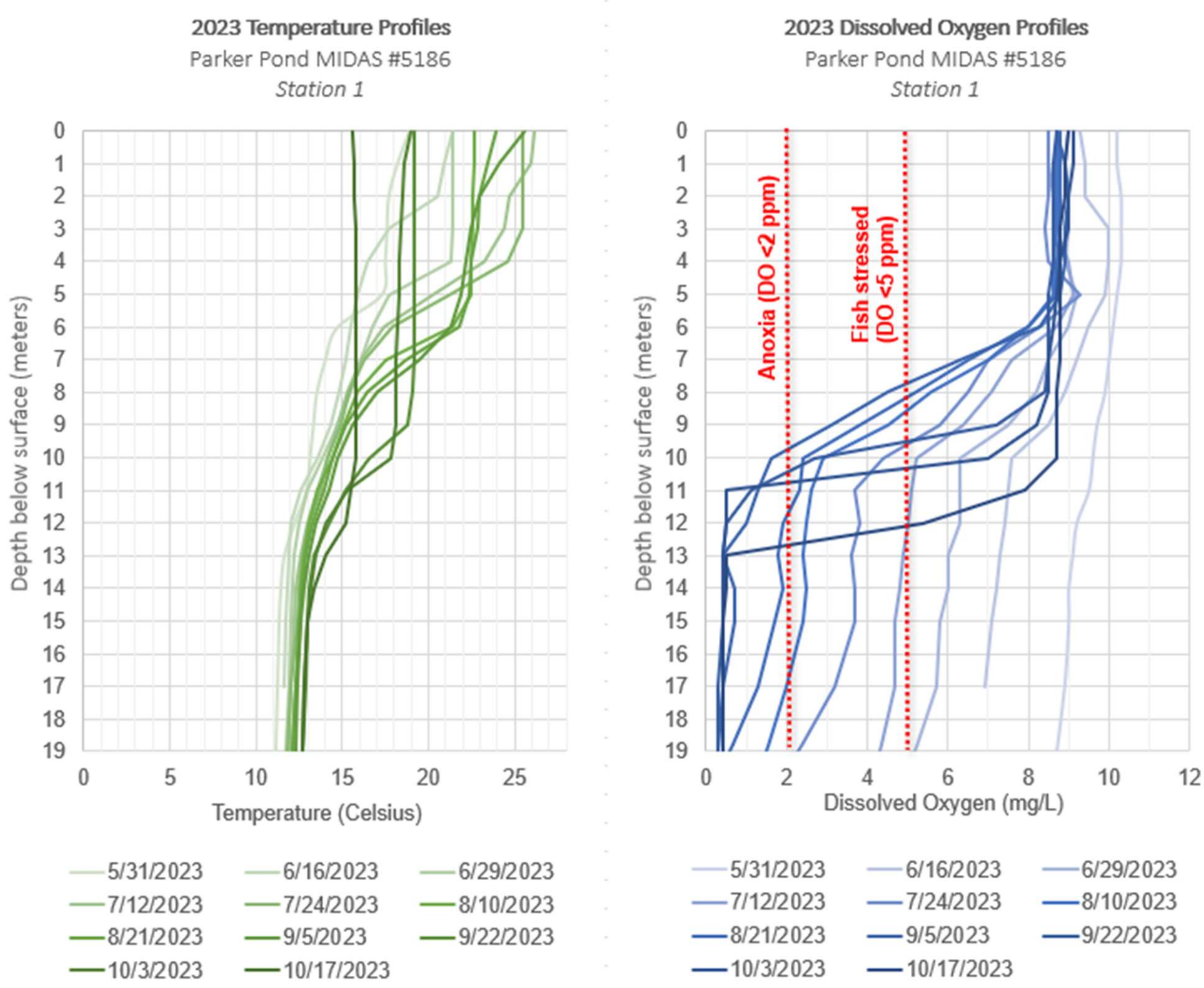



*Figure 5. 2023 dissolved oxygen and temperature profiles, Station 01.*

---

[2] Parker Pond appears on Maine DEP's list of "Threatened Lakes" on the NPS Priority Watersheds List (https://www.maine.gov/dep/land/watershed/nps_priority_list/NPS%20Priority%20List%20-%20Lakes20.pdf) due to its sediment chemistry. Sediment results suggest that the lake is more vulnerable to internal phosphorus loading, a phenomenon that can occur when deep waters become anoxic (DO loss <2 mg/L) resulting in phosphorus release from the bottom sediments exposed to anoxic waters.

The shallowest documented depth of anoxia in Parker Pond is 9 meters and was documented in just two years in September of 2009 and 2013. Anoxia in waters 10 meters and deeper has only been documented during four (4) other years (1998, 2000, 2004, and 2006). Aside from this, the extent of anoxia documented in the pond has remained relatively consistent throughout the historical monitoring period beginning in 1983.

Water surface temperatures ranged from 15.6 C (60.1 F) to 26.1 C (79.0 F) with an average surface water temperature of 21.8 C (71.2 F). Continued collection of bi-weekly DO and temperature profiles will identify trends and changes occurring in Parker Pond in order to better understand variations in stratification and the area of seasonal anoxia in deep waters.

## Total Phosphorus (TP)

| Total Phosphorus (ppb) | |
|---|---|
| 2023 TP Average | 5 |
| Historical TP Average | 7 |
| 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.

Nine (9) samples were collected by 30 Mile staff this year and analyzed for Total Phosphorus (TP). Samples were collected monthly between May and October. Six (6) of these were collected from the top layer of the pond using an integrated core sampler and are referred to as "epilimentic core

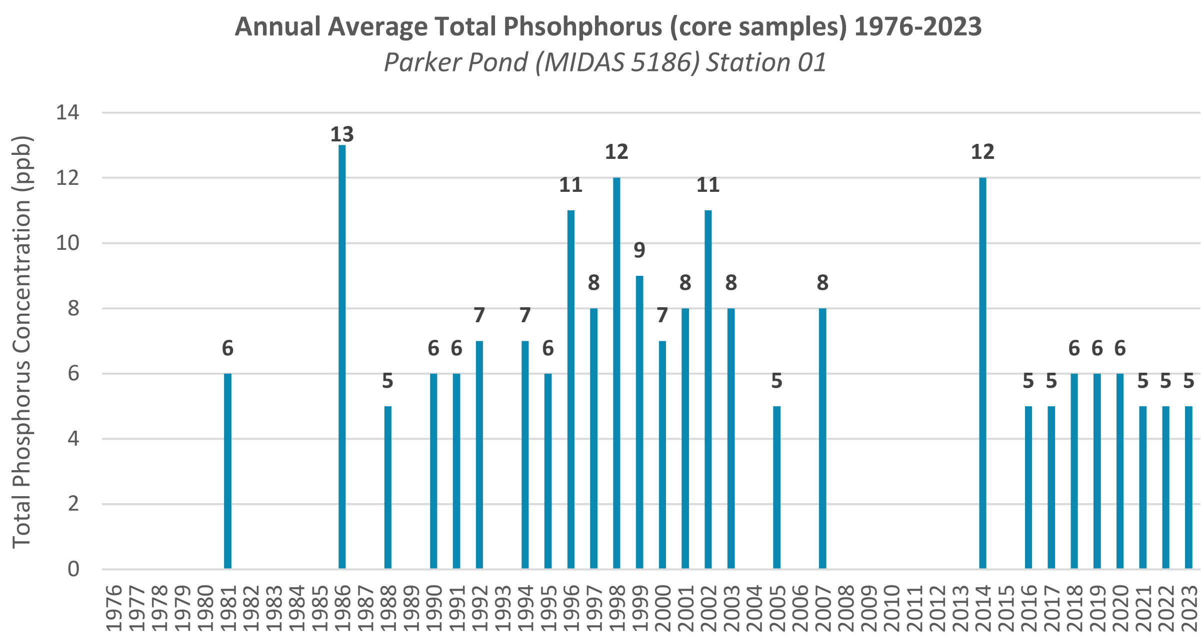



*Figure 6. Annual average phosphorus concentration (epilimnetic core) 1976-2023, Station 01.*

samples". Laboratory results for epilimnetic core samples collected in 2023 ranged from 3 ppb to 6 ppb with an average of 5 ppb.

Generally speaking, in-lake phosphorus concentrations (epilimnetic core samples) less than 10 ppb are ideal. Lakes with in-lake phosphorus concentrations of ~13 ppb or more are known to sustain algal blooms, and blooms become frequent as in-lake average concentrations approach 20 ppb. Historically, annual average in-lake phosphorus concentrations in Parker Pond have ranged from 5 ppb (2023, 2022, 2021, 2017, 2016, 2005, and 1988) to 13 ppb (1986) with a historical average of 7 ppb (Figures 6 and 7).

Three (3) samples were collected from the bottom of Parker Pond 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 to determine if there is active phosphorus release from bottom sediments exposed to anoxic conditions. TP laboratory results for the three bottom grabs collected in 2023 were 10 ppb (8/20/23), 15 ppb (9/22/23), and 34 ppb (10/17/23) with an annual average of 19.7 ppb, indicating that a small internal P load from bottom sediments likely occurred this summer during periods of anoxia (Figure 7). Continued monitoring later into the season, such as the sampling done this year (late October), is needed to better document this trend.

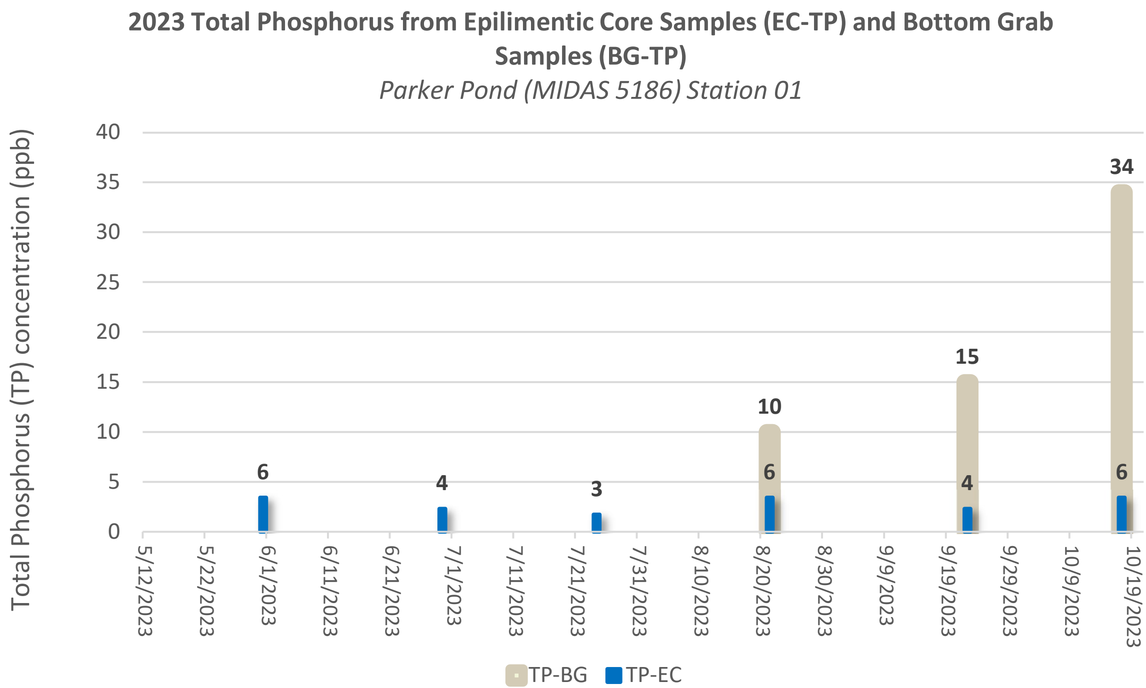



*Figure 7. 2023 TP core sample and bottom grab sample results from Parker Pond.*

Historically, bottom grab phosphorus samples have been collected during 23 years, starting in 1981. Average annual bottom phosphorus concentrations have ranged from 7 ppb (1983) to 21 ppb (1997 and 2017) with 2023 documenting the third highest average on the historical record (19.7 ppb).

## Chlorophyll (Chl-a)

| Chl-a (ppb) | |
|---|---|
| 2023 Chl-a Average | 2.8 |
| 2023 Peak Chl-a | 4.0 |
| Historical Chl-a Average | 2.6 |
| Maine Lakes Chl-a Average | 5.4 |

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. Chlorophyll was measured Six (6) times in 2023.

Results ranged from 1 ppb (10/17/23) to 4 ppb (8/21 & 9/22) with an annual average of 2.8 ppb. Historical monitoring data collected between 1976-2023 has ranged from 1 ppb (2017, 2019, and 2023) to 5 ppb (2021) with a historical annual average of 2.6 ppb (Figure 6).

## pH

| pH | |
|---|---|
| 2023 pH | 7.2 |
| Historical pH Average | 7.0 |
| Maine Lakes Average | 6.4 |

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 21st was analyzed for pH and had a result of 7.2. Historically, pH has been analyzed during thirteen other years (1983, 1986, 1988, 1989, 1991, 1992, 1994, 2005, 2014, 2017, 2018, 2022, 2023) with a historical annual average of 7.0.

## True Color

| Color (PCU) | |
|---|---|
| 2023 Color | 10 |
| Historical Color Average | 8 |
| 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 (>30 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 21st was analyzed for true color and had a result of 10 PCU. Historically, true color has been analyzed six (6) other years (2005, 2014, 2017, 2018, 2022, and 2023) and results range from 5 PCU (2022 and 2017) to 12 PCU (2014) with a historical average annual result of 8 PCU. The second highest true color result documented in Parker Pond was collected in 2023.

## Conductivity

| Conductivity (µMHOS/cm) | |
|---|---|
| 2023 Conductivity | 48 |
| Historical Conductivity Average | 37 |
| 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 (µMHOS/cm).

One sample taken on August 21st was analyzed for conductivity and had a result of 48 µMHOS/cm. Historically, conductivity has been analyzed during just 10 years (1986, 1991, 1996, 2000, 2005, 2014, 2017, 2018, 2022, and 2023) since 1986 and results range between 9 µMHOS/cm (1996) and 50 µMHOS/cm (2022) with a historical annual average of 37 µMHOS/cm. The second highest conductivity result since was observed in 2023.

## Alkalinity

| Alkalinity (mg/L) | |
|---|---|
| 2023 Alkalinity | 9 |
| Historical Alkalinity Average | 8 |
| 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 21st was analyzed for alkalinity and had a result of 9 mg/L. Historically, alkalinity has been analyzed during 14 years since 1983 and results range between 4 mg/L (1996) and 11 (2017) with a historical annual average of 8 mg/L.

## Gloeotrichia echinulata (Gloeo)

*Gloeotrichia echinulate* – a.k.a. “Gloeo” (pronounced “glee-oh”) is a type of cyanobacteria (blue-green algae) that lives suspended in lake water during the summer, sinks to the lakebed in a state of dormancy over the winter, then rises back up into the water column when the water warms in the spring. Unlike other bloom-forming cyanobacteria species that rely on nutrients in the water to fuel growth (like the bloom in Androscoggin Lake), Gloeo rely on lakebed sediments for their nutrient source. For this reason, reports of Gloeo blooms in pristine, low-nutrient lakes in the northeastern US, such as Parker Pond, have been on the rise in recent years.

New research has suggested that Gloeo may be an early indication of declining water quality of otherwise healthy lakes and that Gloeo may be increasing nutrient levels and algae growth within these lakes by moving phosphorus from the sediments at the lake bottom up into the water column, where it can be used by other algae. Anecdotal data indicates an overall increase in Gloeo abundance in recent decades, with the effects of climate change potentially accelerating growth.

During each monitoring session, the abundance of Gloeo in Parker Pond is noted. In 2023, Gloeo abundances ranged from 1 – 4 (refer to the *Abundance Estimation Scale* right) and was present during 7 of the 11 monitoring dates. Historically Gloeo has been present in Parker Pond and in 2022, Gloeo was present during 3 of the 9 monitoring dates, with abundances ranging from 1-3. 30 Mile will continue to monitor Gloeo abundance to help build a robust dataset to help identify Gloeo patterns and trends in Parker Pond.

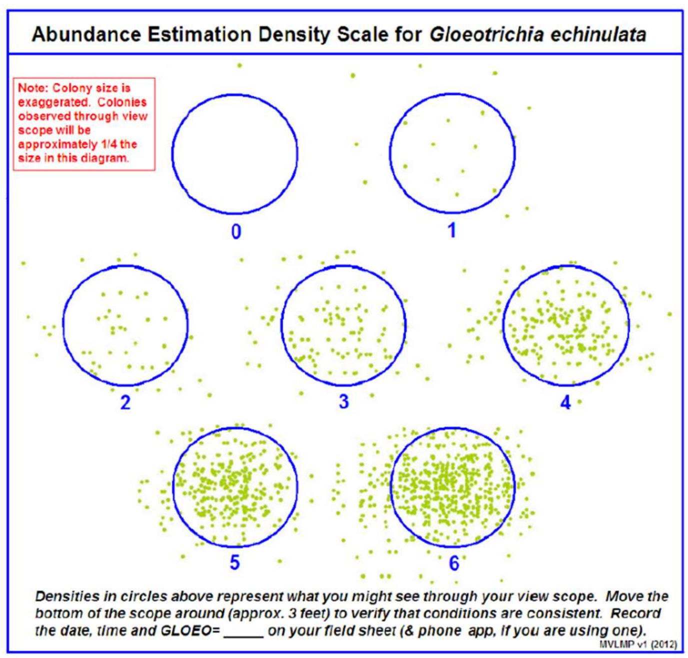



*Figure 8. Abundance Estimation Scale used for assessing Gloeotrichia echinulata. Source: Lake Stewards of Maine.*

## 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 was 30 Mile's eighth year of monitoring Parker Pond and saw the lowest average Secchi reading since 2009, and the lowest reading recorded (5.9 meters on May 31st), since 2004. The trend of lower averages and readings is something many of the lakes and ponds across the 30 Mile River Watershed experienced in 2023 along with larger and more intense anoxic zones, like in we also observed in Parker Pond this season.

The 2023 season was a particularly wet one, with an unprecedented rainstorm in early May delivering a large amount of polluted stormwater runoff into the lake. Decreased water clarity was likely due to the increase in watershed loading of dissolved organic matter and nutrients which resulted in more biological productivity (respiration) and resulting decomposition – processes that consume oxygen in the water.

Five years of consecutive data collection for any given parameter will provide the baseline condition of the Pond. 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 Parker Pond.

Near real-time data for Parker Pond's clarity (Secchi depth), and dissolved oxygen and temperature profiles can be found online at https://30mileriver.org/parker-pond/, 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 document changes and trends over time.

2. Continue to deliver and expand LakeSmart programming on Parker Pond, providing education to shorefront property owners about polluted stormwater runoff, phosphorus, and the effects that watershed development can have on lake water quality.