# 2024 Mooselookmeguntic Water Quality Report

**Survey History:**

There are four sample stations on Mooselookmeguntic that represent the deepest areas on the lake. These stations have been sampled periodically dating back to 1981 and provide us with important information on water temperature, dissolved oxygen, water clarity, and water chemistry parameters including phosphorus. Collecting and observing this data helps us understand not only the current state of Mooselook, but also how it has been changing in recent years with rising temperatures, shorter winters, and increased development and runoff.

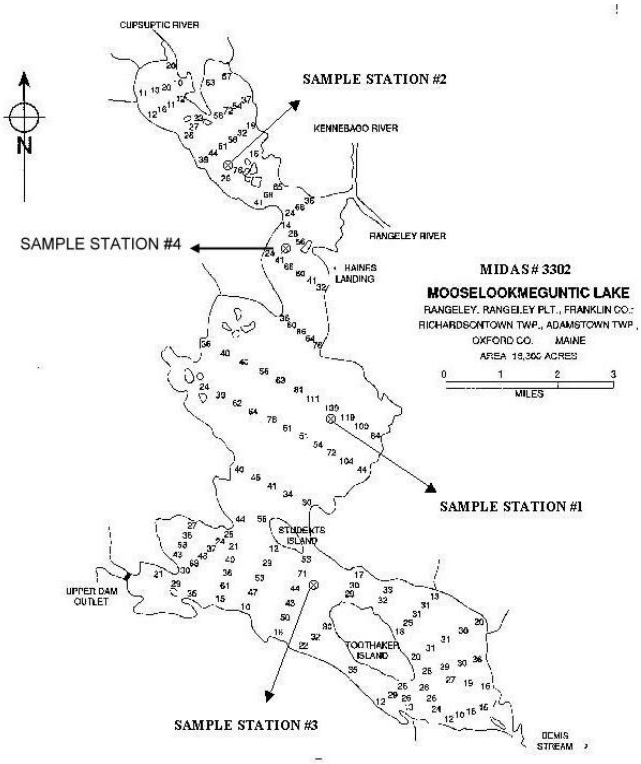


*Figure 1: Map of the four sample stations across Mooselookmeguntic Lake. Via Lake Stewards of Maine*

A common trend occurring in ponds and lakes is a tendency to become warmer and more polluted due to climate change and lakefront development. Warmer waters are not able to hold as much oxygen as colder waters. When oxygen levels drop too low, lakes are not able to support fish, plants, and other aquatic life. Increased pollution due to runoff of fertilizers, herbicides, human and pet waste, and other man-made materials can cause increased algae, decreased oxygen, and decreased water transparency. Although these are all common trends statewide, they are not being observed in Mooselookmeguntic Lake.

At each location, annual readings of DO and Secchi have been recorded, as well as periodic phosphorus samples. This has historically been a task for volunteers who live on the lake and have a way to access the stations on the lake twice a month. However, in recent years we have not had volunteers or the resources to regularly monitor all four stations twice a month as suggested by the state and Lake Stewards of Maine. Therefore, our data is not ideally up to date, or robust enough to make strong inferences about water quality on Mooselookmeguntic Lake.

**Current Trends:**

Mooselook is currently experiencing different trends depending on which station is observed. Factors that affect each station include proximity to streams and rivers, development of the surrounding shoreline, and inconsistencies with the data that has been collected. While some of the stations have been monitored for over 40 years, others are new to monitoring and only have data for around 20 years.

*Water Transparency:*

Water transparency readings are taken with a secchi disk to determine the depth at which light can penetrate through the water. This tells us how clear or turbid the water is at any given time. Transparency also represents how abundant pollutants could be in the water. Murkier or turbid water typically has more runoff, while clearer water is less polluted. However, natural factors like rain, seasonal changes, and proximity to the shore can also cause secchi readings to be lower due to increased sediments in the water. A higher Secchi reading is preferable as it suggests that water is clear, unpolluted, and contains less runoff. Lower secchi readings suggest increased pollution and runoff.

Water transparency levels have remained relatively stable on some stations on Mooselook while others are seeing slight shifts. Station 1 and station 3 have both experienced increases in water transparency, however station 1's increase is very slight and weakly correlated (Figures 2 and 4). Station 2 and station 4 are both experiencing decreasing water transparency, however station 2's is very slight and weakly coorelated (Figure 3 and 5). Station 2 and 4 are both located on the northern end of the lake and could be experiencing decreased transparency due to increased runoff from the shore surrounding the stations. Station 1 and 3 are located on the southern end of the lake and are further from the shore than the northern stations. Since they are distanced from the shore they could be experiencing less impacts from shore runoff. Increasing transparency is ideal as it suggests a healthier lake with less polluted water. Stations 1and 3 are showing positive trends, while station 2 is showing non-concerning trends due to such a minor decrease. These positive trends are likely due to the intact forested buffer surrounding the entire West shore of Mooselookmeguntic Lake. Station 4 however is showing some concerning trends with decreasing water transparency. This station is the shallowest and the closest to the shore. It is possible that this station is the most exposed to lakefront runoff from homes and properties around the lake. There are some actions that can be taken to help reduce lakefront runoff as discussed in the last section.

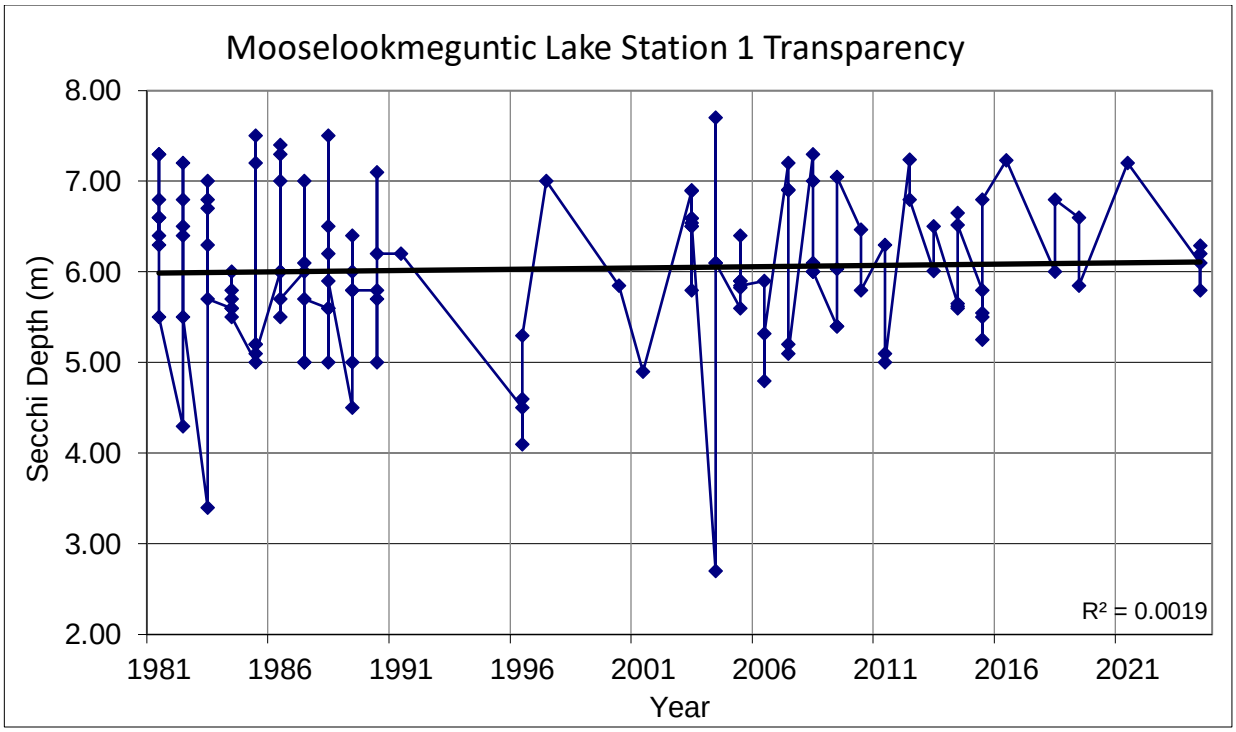


*Figure 2: Water transparency on Mooselookmeguntic Lake station 1 with a weak correlation showing a very slight increase in over 40 years.*

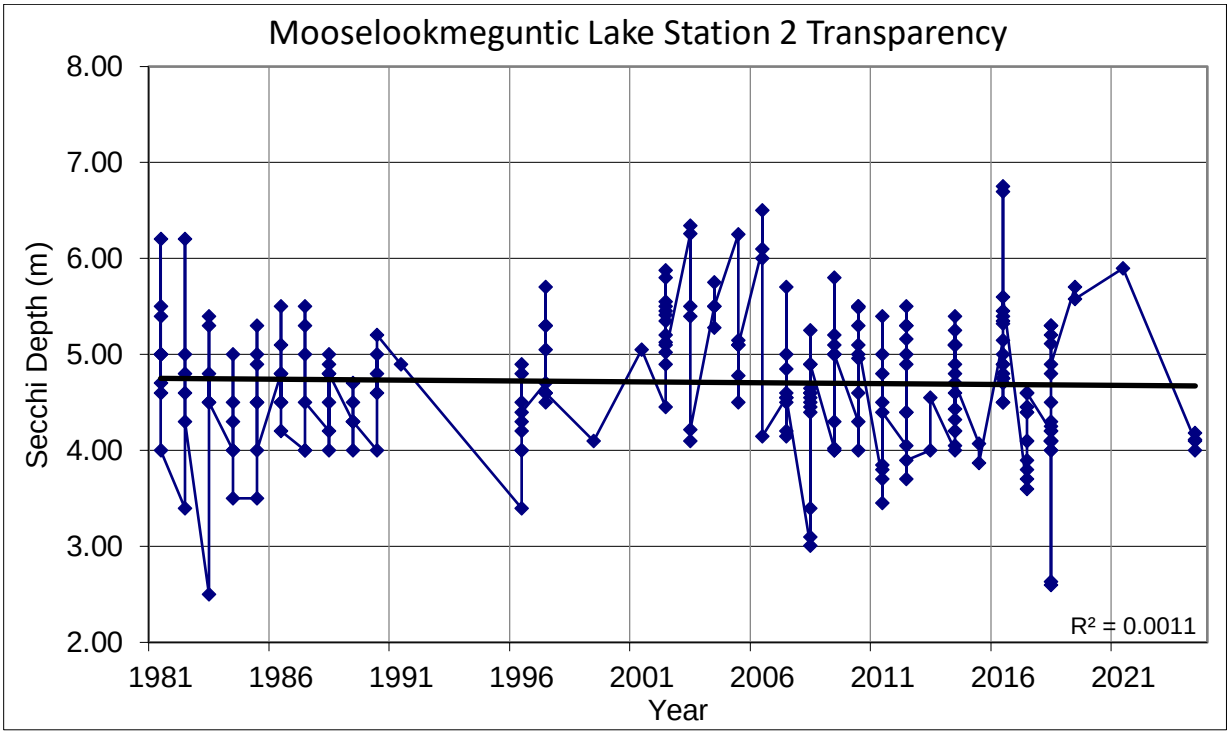


*Figure 3: Water transparency on Mooselookmeguntic Lake station 2 with a weak correlation showing relatively no change in over 40 years.*

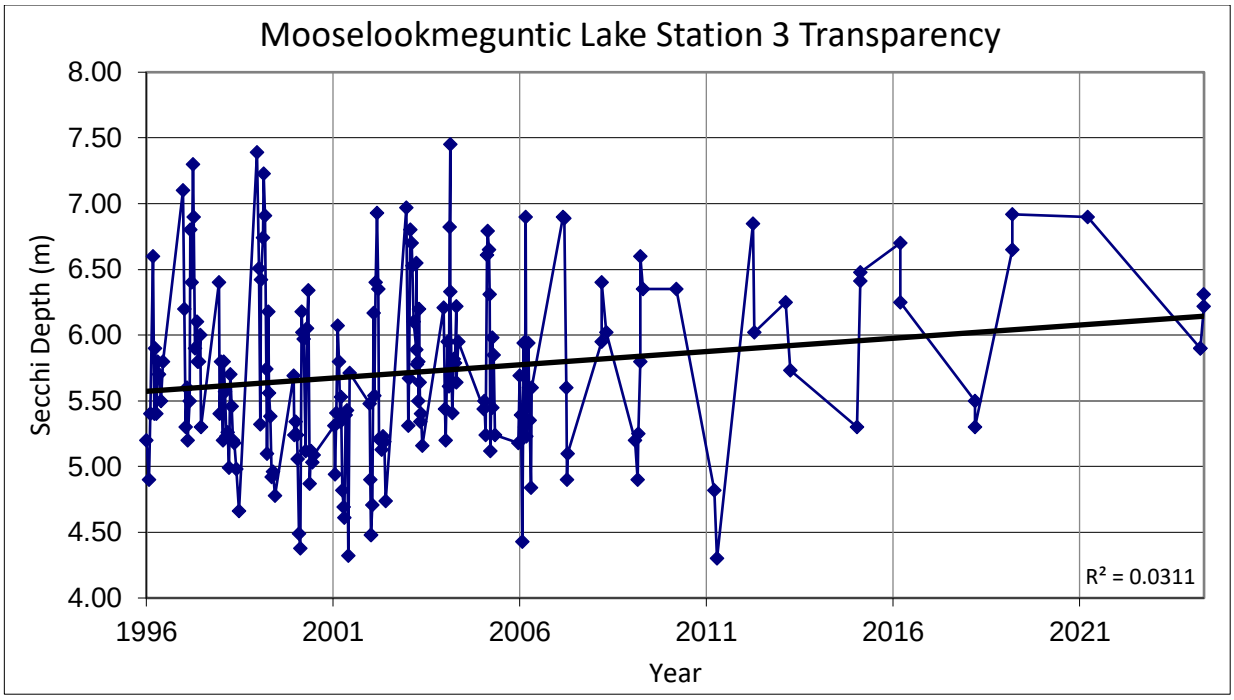


*Figure 4: Water transparency on Mooselookmeguntic Lake station 3 with a weak correlation showing an increase of approximately .5m in over 20 years.*

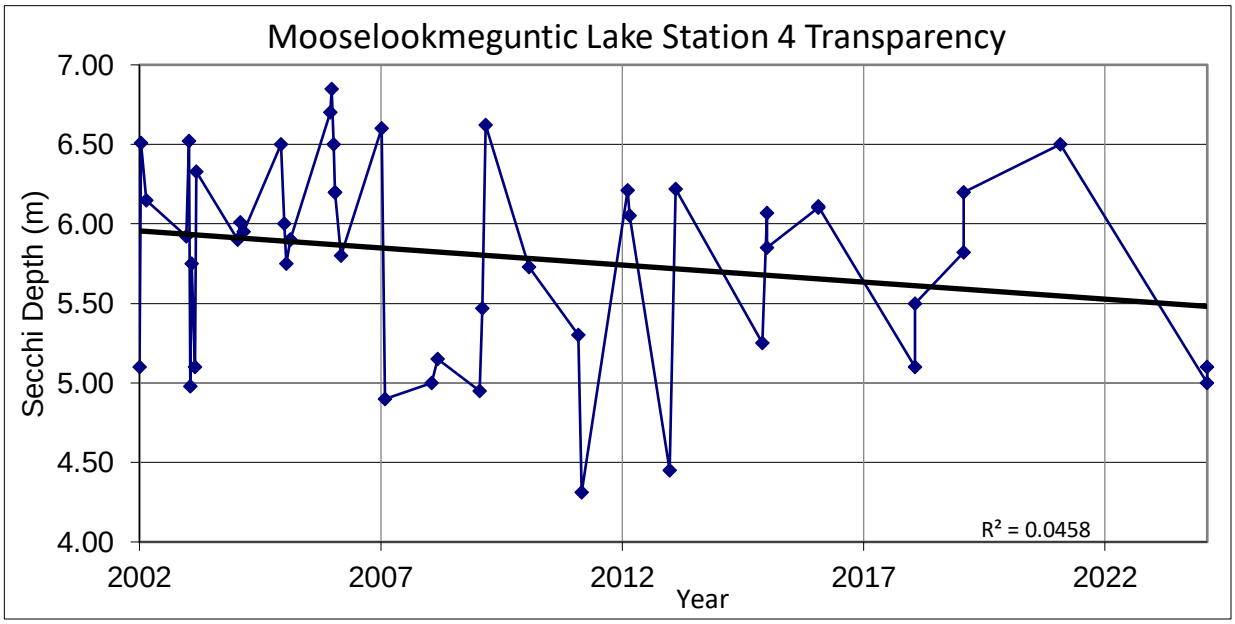


*Figure 5: Water transparency on Mooselookmeguntic Lake station 4 with a weak correlation showing a slight decrease of less than .5m in over 20 years.*

*Dissolved Oxygen:*

Dissolved Oxygen (DO) readings are taken with a meter that is slowly lowered from the surface to the bottom of the lake in 1m increments. DO levels will fluctuate from the surface to the bottom for a host of reasons including water temperatures, decomposing matter, light penetration, and photosynthesis abilities. In the summer, it is expected that DO will be lower at the bottom of a body of water. If DO levels are too low throughout the entire column for

long periods of time aquatic life will not be able to survive. According to the US EPA when dissolved oxygen levels drop below 5mg/L the waters become stressful to fish and aquatic life. When levels drop below 3mg/L they can no longer support fish, and below 1mg/L is considered a hypoxic dead zone where nothing can survive. When excess nutrients such as phosphorus and nitrogen enter the water or temperatures rise, DO levels will decrease.

DO levels have been decreasing at stations 1, 2, and 3, however station 3's trend is weakly correlated and very slight (Figures 6, 7, and 8). DO levels often decrease due to increasing temperatures. It is likely that station 1 and 3 are experiencing increasing temperatures which are causing the DO to decrease. However, station 2 is experiencing decreasing temperatures so this increase must be caused by separate factors which could include increased runoff or pollution. It is important to note that, although all these stations are experiencing declines, none have reached the stressful threshold.

Station 4 is showing signs of increased DO (Figure 9). This is a positive trend that suggests that more oxygen is in the water allowing aquatic life to thrive. However, this trend is not common as the station is also experiencing increasing temperatures which usually results in lowered dissolved oxygen. This station has also been monitored for the least amount of time, which could also suggest that in more recent year's DO has been increasing.

These trends, suggests that across the majority of Mooselook, DO levels have been increasing. However, in recent years these readings have leveled out which suggests that they are not decreasing dramatically. It is also important that these levels are not low enough to cause stress for aquatic life.

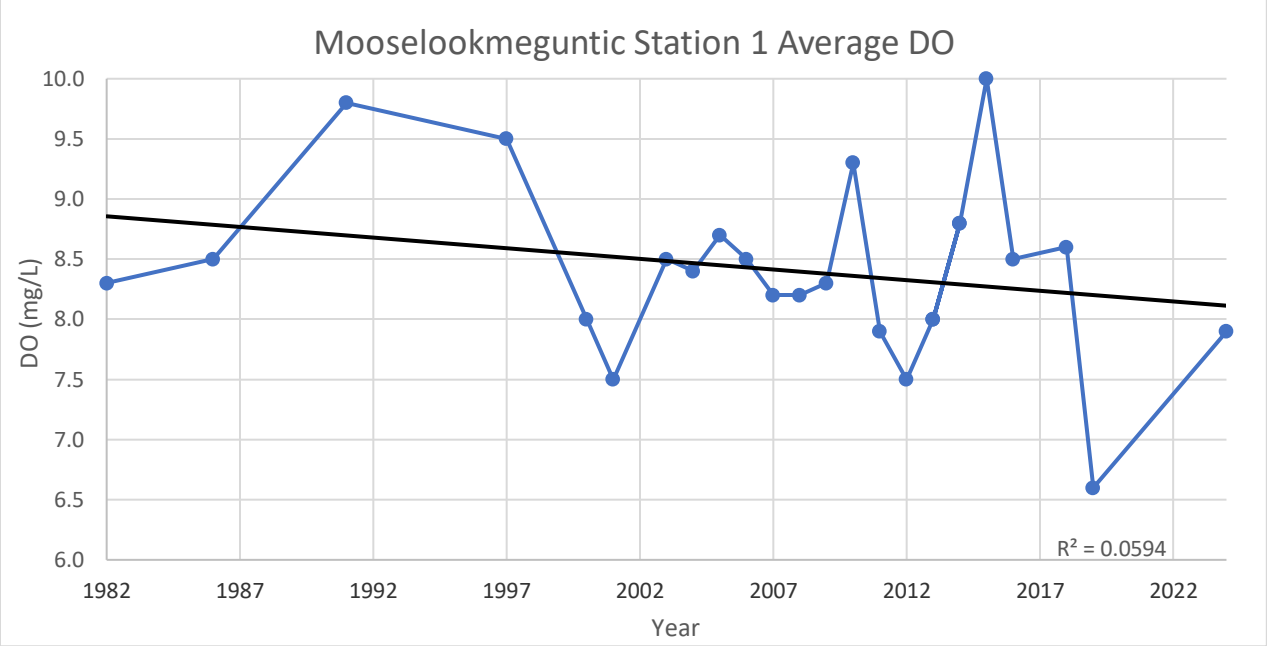


*Figure 6: Average DO on Mooselookmeguntic Lake station 1 from 1982-2024 with a weak correlation showing a decrease of less than 1mg/L in over 35 years.*

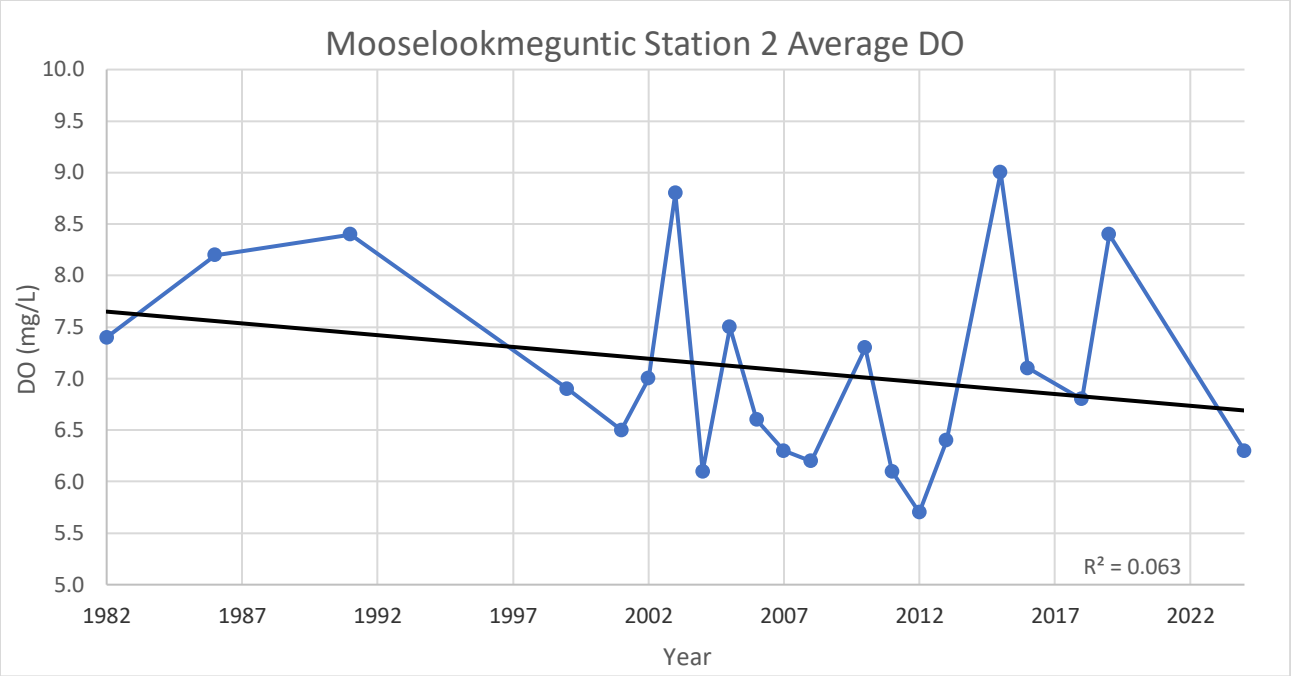


*Figure 7: Average DO on Mooselookmeguntic Lake station 2 from 1982-2024 with a weak correlation showing a decrease of approximately 1mg/L in over 35 years.*

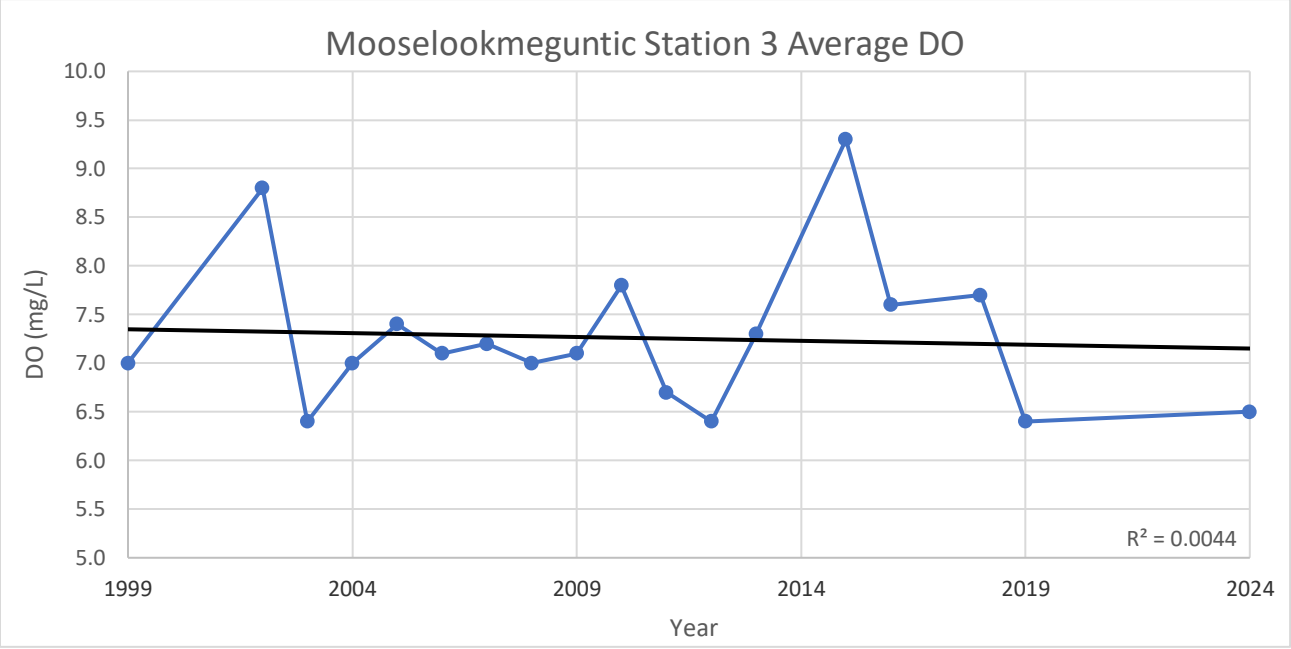


*Figure 8: Average DO on Mooselookmeguntic Lake station 3 with a weak correlation showing a slight decrease in 25 years.*

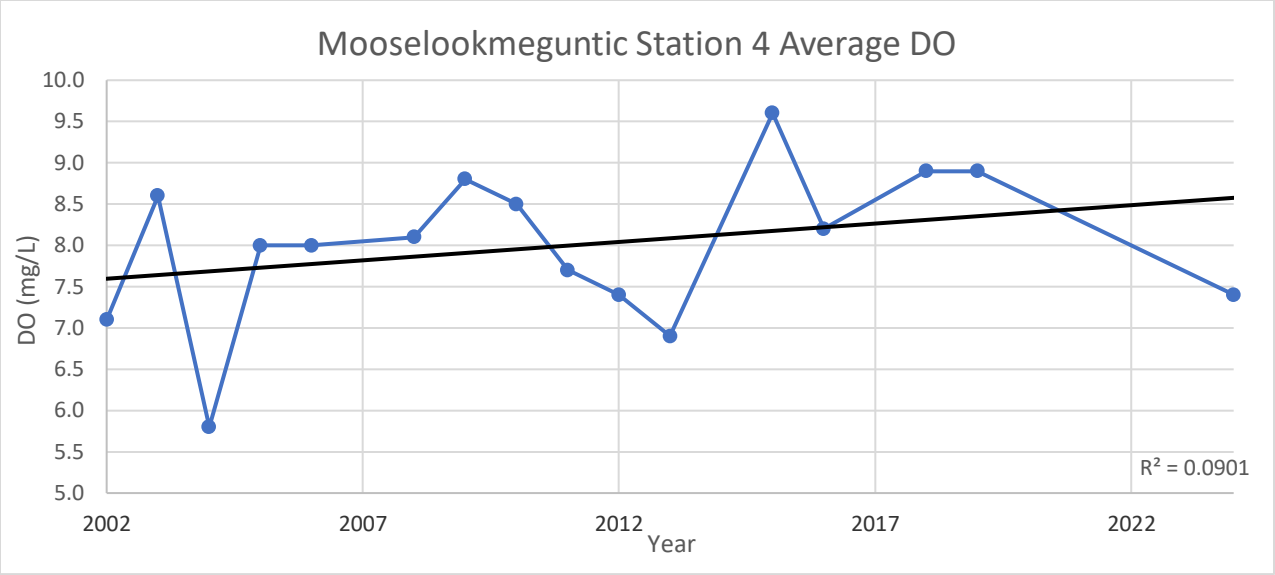


*Figure 9: Average DO on Mooselookmeguntic Lake station 4 with a weak correlation showing an increase of approximately 1mg/L in over 20 years.*

*Temperature:*

Temperature readings are taken with the same meter as DO and are measured in 1m increments from the surface to the bottom of the lake. In the summer, temperatures will typically be higher at the surface and cooler at the bottom. Rising temperatures in a lake can directly impact fish and other aquatic wildlife, increase the production of algal blooms, decrease DO levels, and in extreme cases lead to dead zones where no life can survive. Lake temperatures have been increasing across New England for decades, and Mooselookmeguntic Lake is no exception.

Three out of the four stations on Mooselook are experiencing an increase in water temperature (Figures 10, 12, and 13). Increased water temperature is common across the region with increased air temperatures. Increased water temperatures are likely contributing to decreased DO at stations 1 and 3 as discussed in the previous section. However, station 2 is experiencing a slight decrease in water temperature (Figure 11). This station is between the Cupsuptic River, Kennebago River, and Toothaker Brook. It is possible that these three lotic systems are depositing cold water into the lake and contributing to the decrease in water temperature.

In addition to the temperature readings from the meter, there are also three hobo temperature loggers that record temperature data year-round on Mooselook (Figures 14, 15, and 16). These loggers are placed in water less than 10 feet deep and were launched for the first time in the summer of 2023. We hope to gather long-term year-round data with these loggers. These loggers were all successful in collecting temperature data, however the logger located at Upper Dam had been removed from the water before we were able to collect its data. Therefore, it is missing approximately a month's worth of data in June 2024. This logger has been moved to a new location in hopes that it will remain untouched.

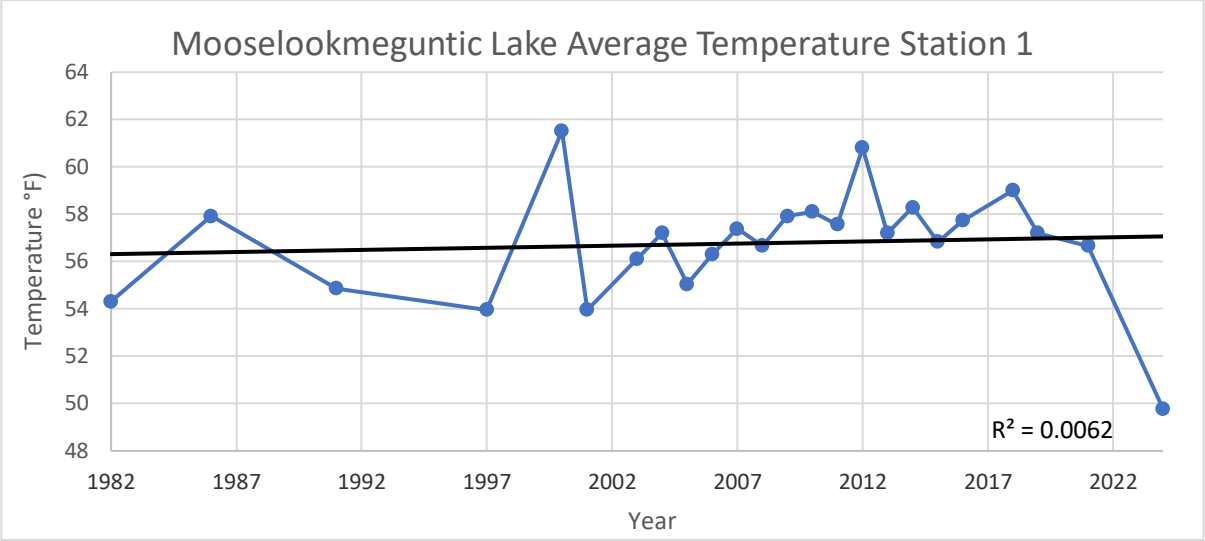


*Figure 10: Average summer temperature on Mooselookmeguntic Lake station 1with a weak correlation showing a slight increase in temperature in over 40 years.*

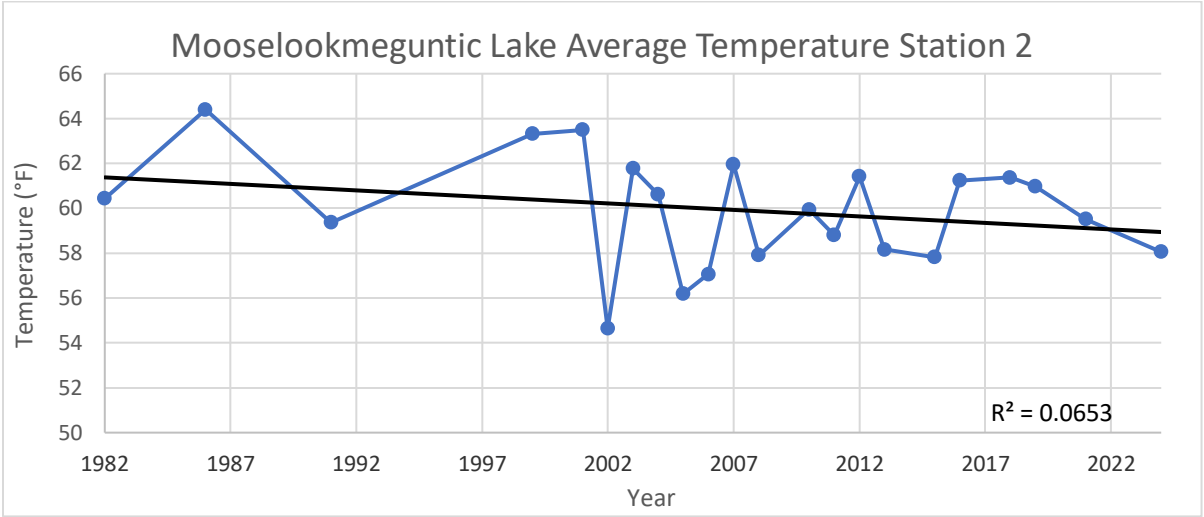


*Figure 11: Average summer temperature on Mooselookmeguntic Lake station 2 with a weak correlation showing a slight decrease in temperature in over 40 years.*

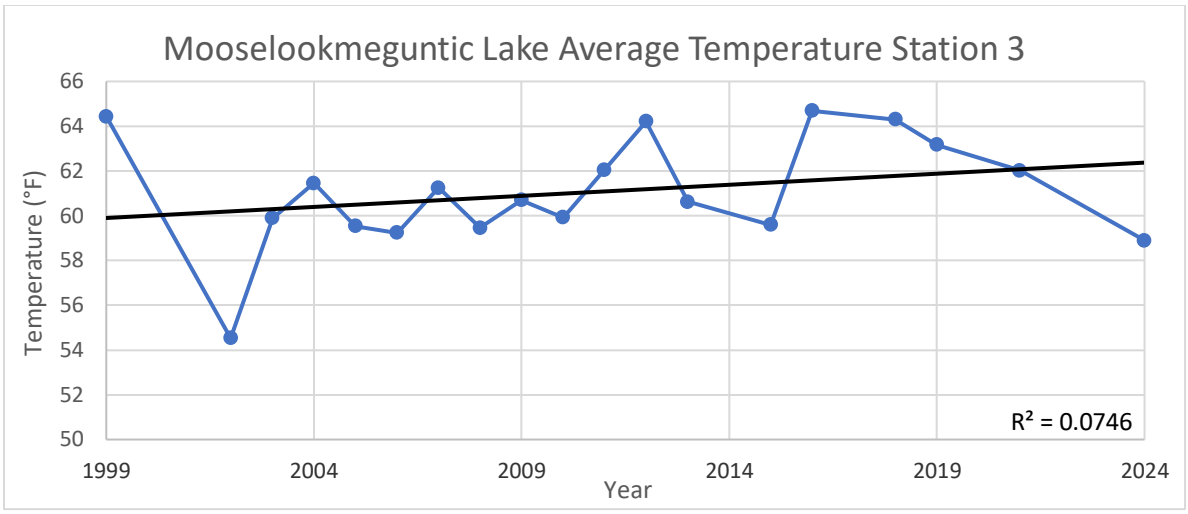


*Figure 12: Average summer temperature on Mooselookmeguntic Lake station 3 with a weak correlation showing an increase in temperature of over 2°F in 25 years.*

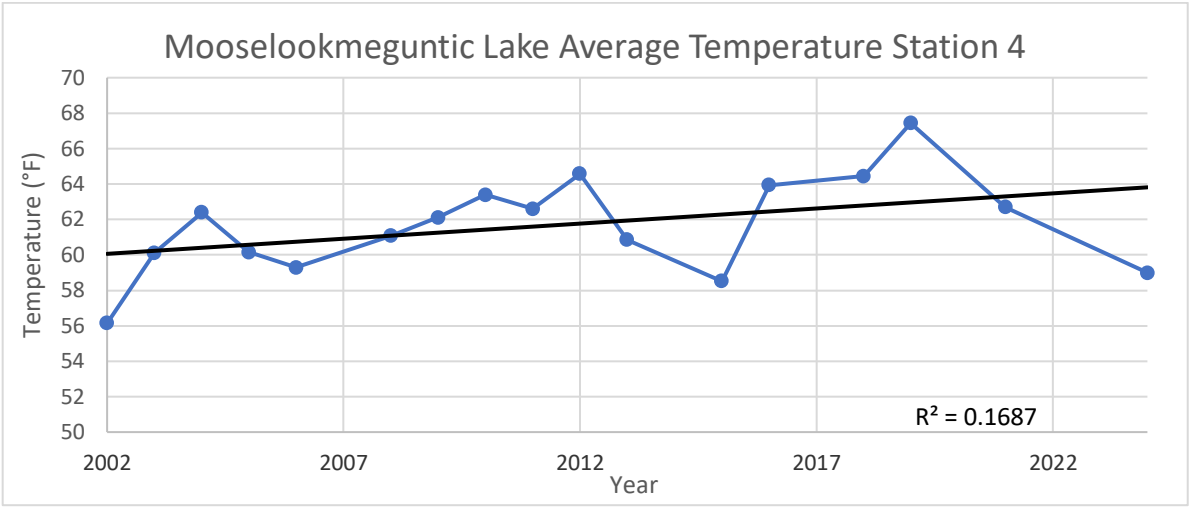


*Figure 13: Average summer temperature on Mooselookmeguntic Lake station 4 with a weak correlation showing an increase in temperature of approximately 4°F in over 20 years.*

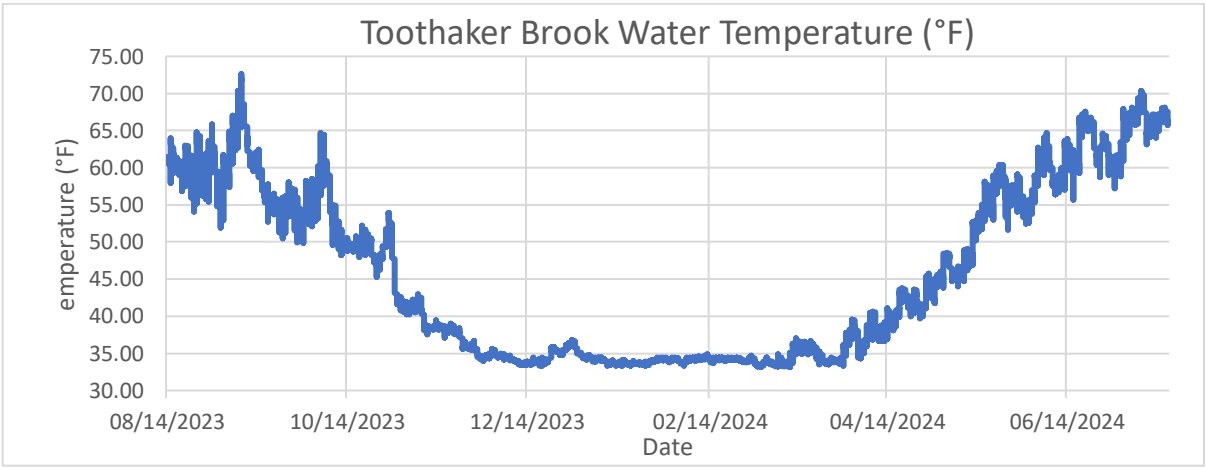


*Figure 14: Year-round temperature data from the hobo logger stationed at the inlet of Toothaker Brook into Cupsuptic.*

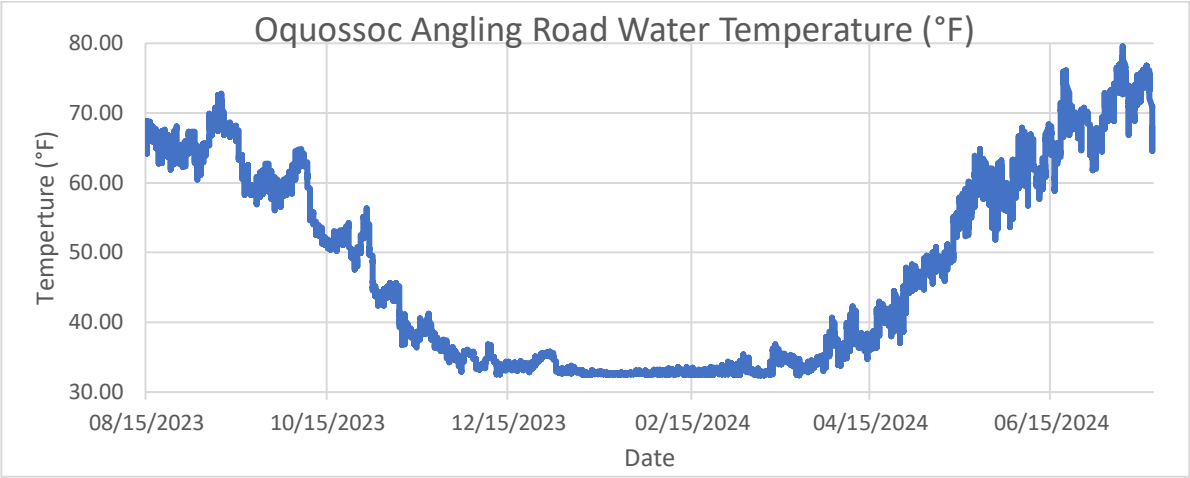


*Figure 15: Year-round temperature data from the hobo logger stationed off of Heaton Robertson's dock on Oquossoc Angling rd.*

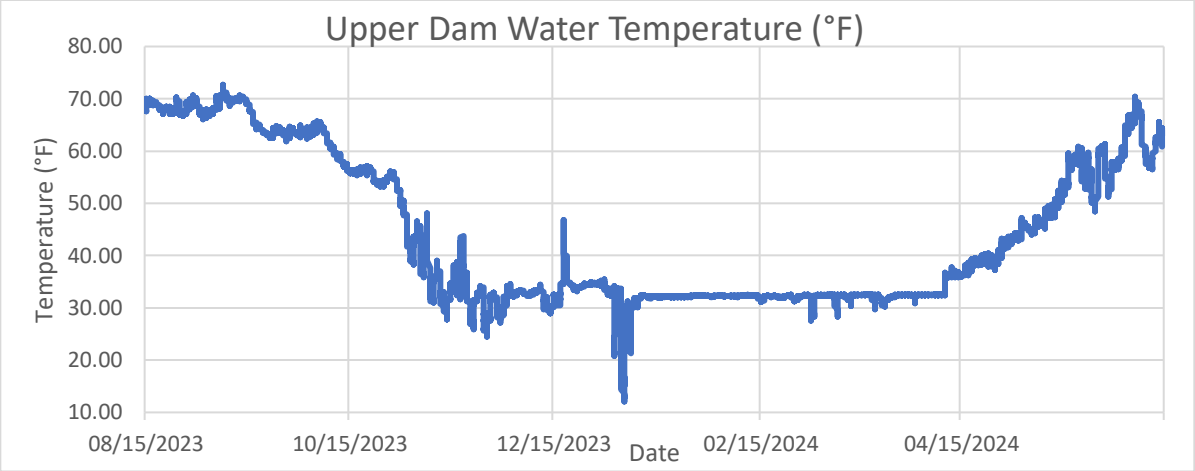


*Figure 16: Year-round temperature data from the hobo logger stationed near Upper Dam.*

*Phosphorus:*

Phosphorus tests are taken during the summer at the surface of the lake. A small sample of water is collected and sent to the Maine Health and Environmental Testing Laboratory. Phosphorus is a nutrient that occurs naturally in soils and sediments and is vital for plant growth. However, too much phosphorus can lead to excessive bacteria and algae growth commonly known as algal blooms. These blooms can decrease water clarity and even produce harmful toxins for humans and animals. Phosphorus is very commonly found in fertilizers which can easily flow from lakefront gardens or yards and into a body of water. The USEPA suggests that in order to maintain healthy lake levels phosphorus should remain below 0.05mg/L, however other sources suggest maintaining levels below 3mg/L is best. We test for this nutrient in the water to understand how much runoff is entering the lake and if there is any potential for harmful algal blooms and decreased lake health.

Phosphorus levels on Mooselook are staying relatively stable. Stations 1 and 3 are experiencing very slight increases in phosphorus (Figures 17 and 19), while stations 2 and 4 are experiencing relatively no change (Figures 18 and 20). These trends suggests that phosphorus

levels are remaining at healthy levels and that the lake is not experiencing large runoff of fertilizers or phosphorus containing chemicals. These are healthy and positive trends.

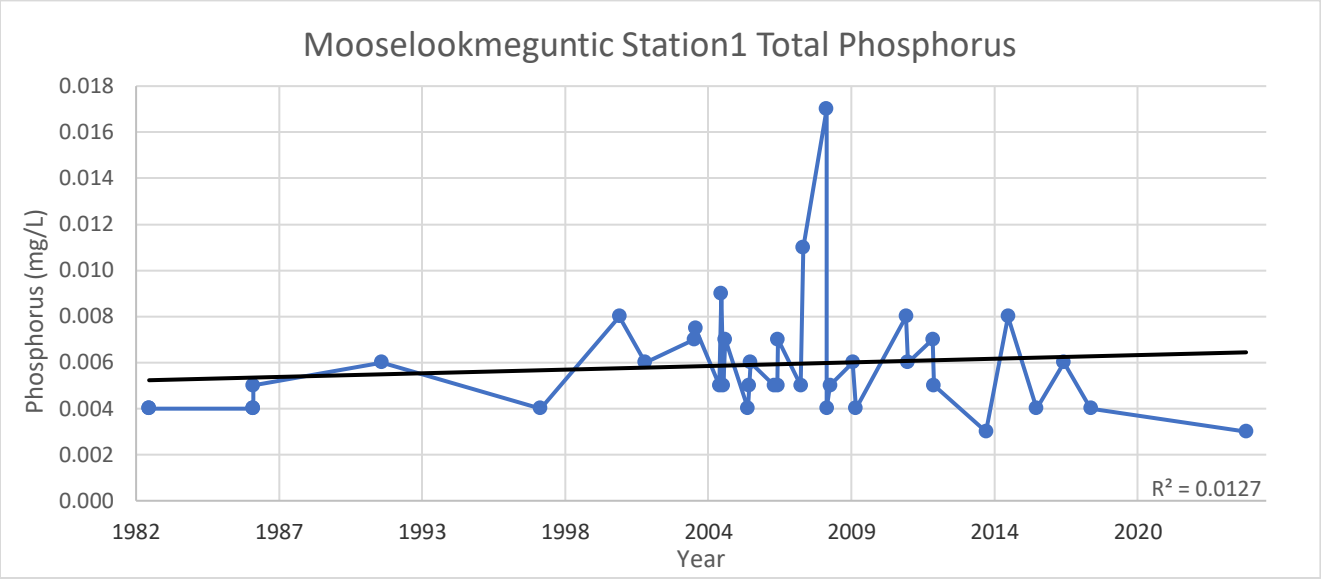


*Figure 17: Total phosphorus levels on Mooselookmeguntic Lake station 1 with a weak correlation showing a slight increase of approximately .001mg/L in over 40 years.*

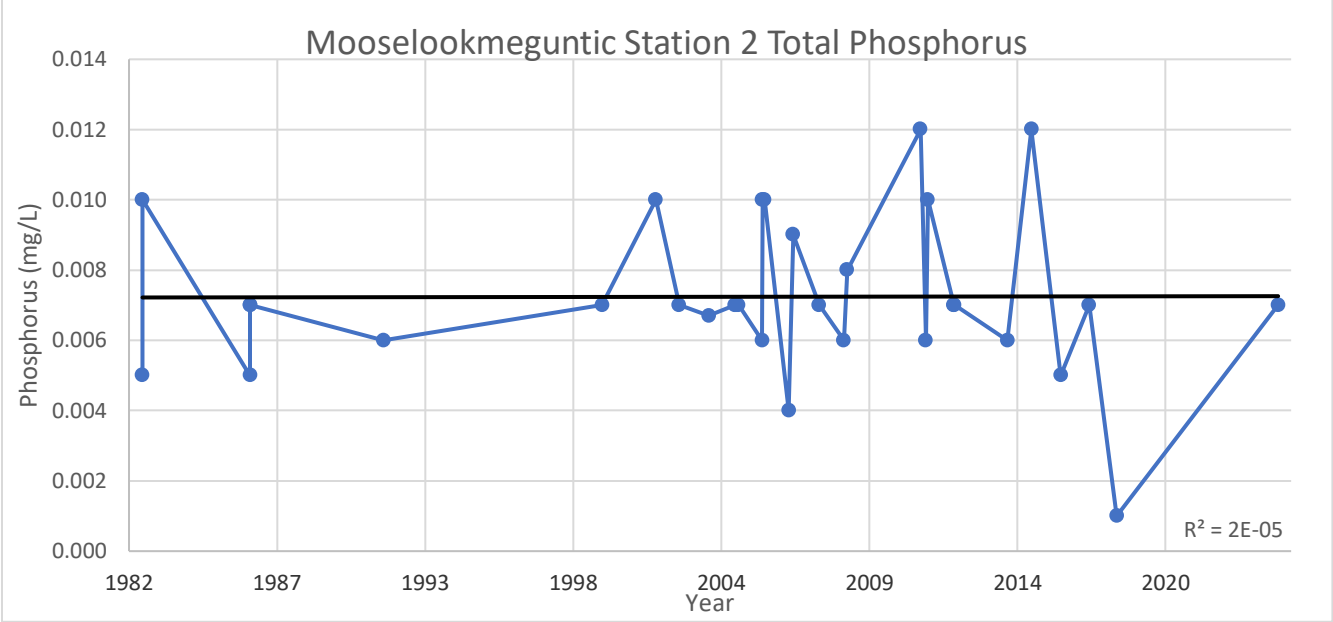


*Figure 18: Total Phosphorus on Mooselookmeguntic lake station2 with a weak correlation showing relatively no change in over 40 years.*

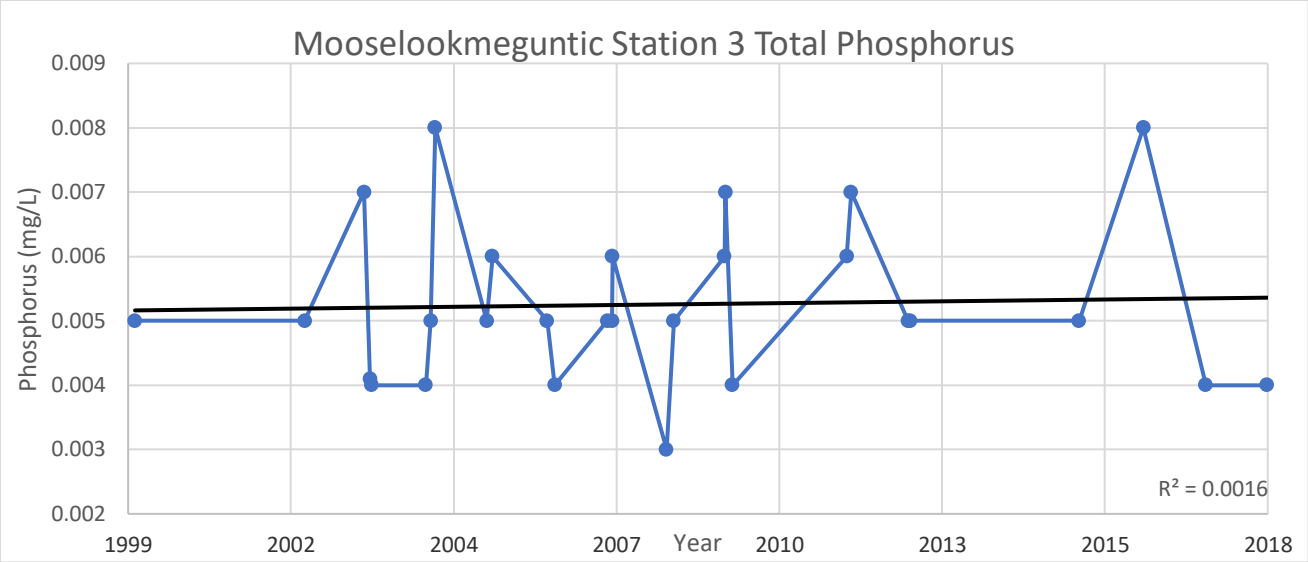


*Figure 19: Total Phosphorus on Mooselookmeguntic Lake station 3 with a weak correlation showing a very slight increase in approximately 20 years.*

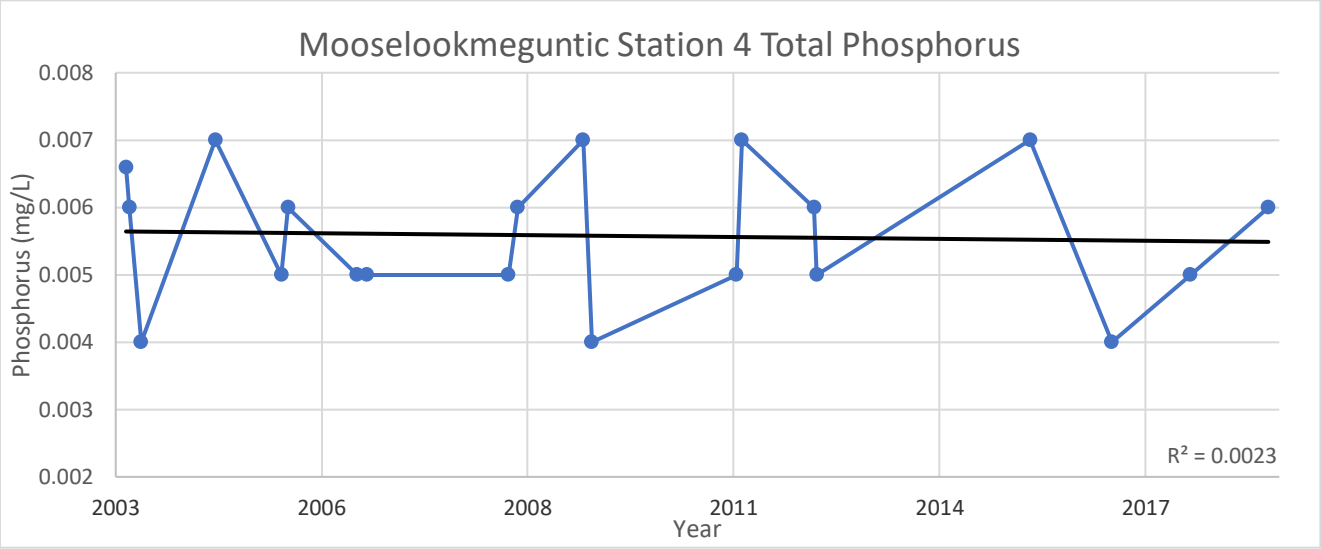


*Figure 20: Total phosphorus on Mooselookmeguntic Lake station 4 with a weak correlation showing a very slight decrease in 15 years.*

**Suggestions:**

The overall water quality on Mooselook is healthy and not concerning. The increased water temperature leading to decreased DO is the only factor observed that is not ideal. Water temperature is not something that is easily controlled, as it is dependent on ambient air temperatures which are rising. However, there are still opportunities to reduce water temperatures by continued river restoration efforts, maintaining intact forested buffers that shade lake shorelines, and improving stormwater ground infiltration.

The water transparency and phosphorus levels suggest that there is not a harmful number of pollutants entering the lake. It is important to continue any runoff resisting practices that are being used on the lake. There are also additional steps that can help keep chemicals on land and

out of the water including implementing vegetative buffers, maintaining land utilities, and limiting the use of harmful chemicals near the lake.

Possible actions to decrease lake temperatures

| Actions | Benefit | Location |
|---|---|---|
| Continued river restoration | -Deposits cold water directly into lakes<br>-Improves fish habitat and movement | -Kennebago River<br>-Cupsuptic River<br>-Bemis Stream |
| Plant mature trees along lakes edge | -Directly shades and cools shallow waters along the lake | Lakefront homes and properties |
| Implement rain gardens and infiltration steps | -Allows stormwater to enter underground aquifers to cool instead of entering directly into the lake | Lakefront homes and properties |
| Maintain narrow roadways | -Shades and cools the land around lakes | Roads surrounding the lake |

Possible actions to continue limiting runoff and pollution

| Actions | Benefits | Locations |
|---|---|---|
| Maintain a vegetative buffer and forests | -Intercepts stormwater and prevents large amounts of runoff from entering the lake<br>-Reduces soil erosion | Lakefront homes and properties |
| Care for septic systems | -Reduces the risk of chemicals, bacteria, and viruses from entering the water | Lakefront homes and properties |
| Limit use of herbicides, pesticides, and fertilizers | -Prevents toxic chemicals from getting the chance to enter the water | -Lakefront homes and properties<br>-Nearby farms |
| Maintain driveways and roads with less impervious surfaces | -Minimizes road chemicals entering lakes directly | -Lakefront homes and properties<br>-Roads surrounding the lake |
| Consider becoming LakeSmart certified | -Allows lakefront properties to be individually analyzed<br>-Provides feedback on how to improve your home lake impact | Lakefront homes |

While any of these actions could be beneficial to the health of Mooselookmeguntic Lake, there is no way for us to understand our impact without continued monitoring. The volunteer water quality monitoring program needs volunteers to continue taking annual readings at the sampling stations. Individuals can become certified to take Secchi and DO readings through Lake Stewards of Maine. With the information gathered, we can observe current trends and take immediate action if concerning trends are observed. For more information on joining the volunteer effort, or with any other questions, please reach out to headwaters@rlht.org.

**Sources:**

Lakes Environmental Association

United States Environmental Protection Agency

Maine Lakes

Lake Stewards of Maine