2024 Kennebago Lake Water Quality Report

Rangeley Lakes Heritage Trust
CONSERVE | RESTORE | STEWARD

Survey History:

There are two sample stations on Kennebago Lake that represent the deepest holes on the water. Station 1 reaches 116ft., while station 2 reaches 93ft. (Figure1). Station 1 has been monitored since 1981, while monitoring began on station 2 in 2002. Monitoring these stations provides 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 Kennebago Lake and its watershed, but also how it has been changing in recent years with rising temperatures, shorter winters, and increased development and runoff.

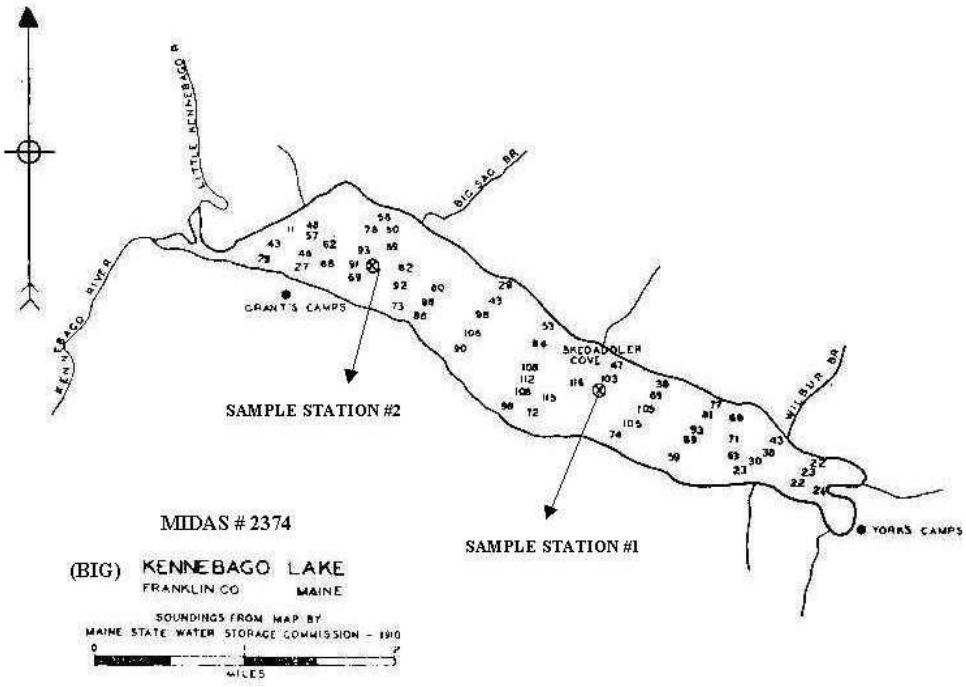

Figure 1: Map of the sample stations on Kennebago Lake. Via Lake Stewards of Maine

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 all being observed on Kennebago Lake.

At each location, annual readings of dissolved oxygen, secchi, and temperature have been recorded, as well as periodic phosphorus samples. This has historically been a task for volunteers who live on Kennebago Lake and have a way to access the station twice a month during the summer. However, some years in the past had a lack of volunteers or the resources to monitor the lake biweekly as suggested by the state and Lake Stewards of Maine. Therefore, the data is not entirely complete and has some gaps which could account for minor inconsistencies in the data.

Current Trends:

While observing the trends on Kennebago Lake a general pattern became clear. It appears that all the historic data from the lake collected from 1981-2002 were taken at station 1, while more current data from 2002-2018 were taking at station 2. There are no trends available more up to date than 2018. When observing this report and the data please note than the stations have been monitored at different periods of time, but can also assist in giving a long-term image of the whole lake.

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 has shown different trends at each station on the Lake. From 1981-2002 the secchi depth was decreasing on Kennebago Lake at station 1 (Figure 2). However, from 2002-2018 at station 2 this trend began to stabilize and has shown little change (Figure 3). These trends (and the record low recorded in 1992 of 3.8m) suggest that the water transparency on the lake was likely experiencing increased runoff or pollution in the 90’s causing a decline in transparency. In 2002 the transparency stabilized around 5.5m in visibility and has since not dropped significantly. This likely suggests that the excessive runoff is no longer occurring on Kennebago Lake. Water clarity on the lake is remaining at healthy levels which suggests healthy water quality in terms of turbidity and pollution.

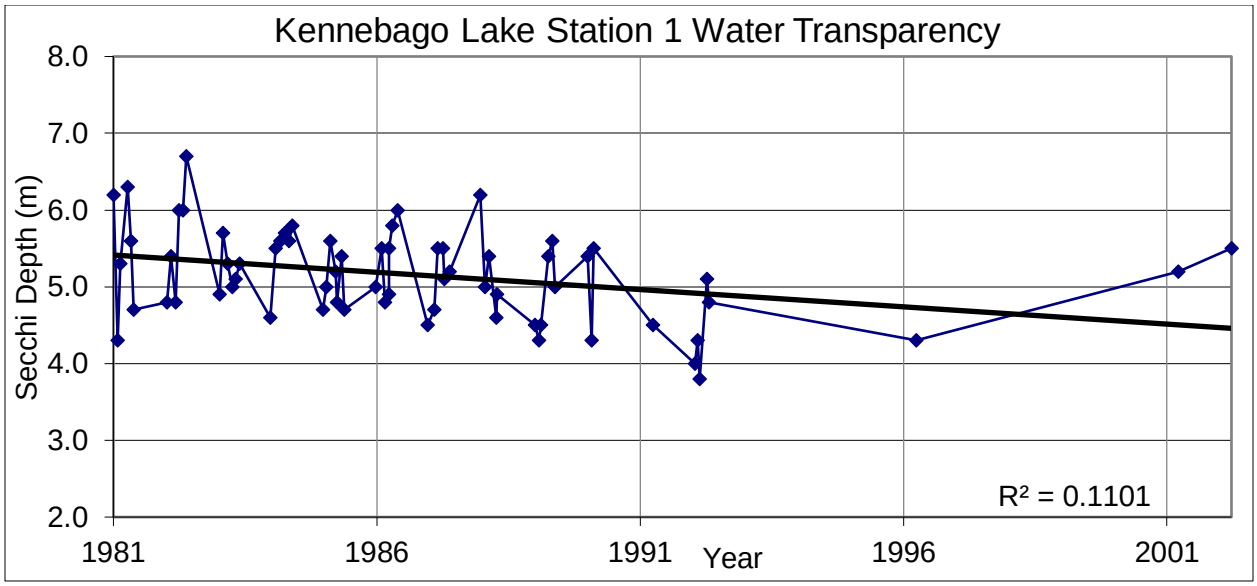

Figure 2: Water transparency on Kennebago Lake station 1 with a weak correlation showing a decrease of less than 1m in over 20 years.

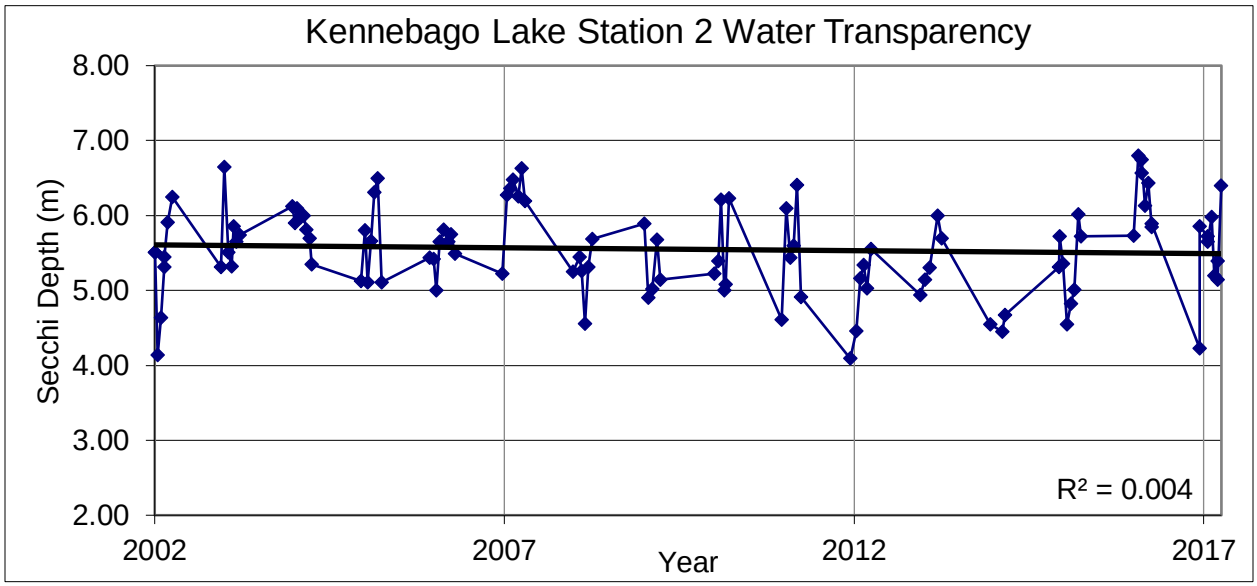

Figure 3: Water Transparency on Kennebago Lake station 2 with a weak correlation showing relatively no change in over 15 years.

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. DO levels are highly dependent on temperature. If

temperatures rise or excess nutrients such as phosphorus or nitrogen enter the water, DO levels with typically decrease.

Kennebago Lake is experiencing a decrease in DO. From 1982-2001 at station 1 DO levels decreased by over 1mg/L (Figure 4). However, it is important to note that only 5 years of data are available for a 19-year period which is typically not a sufficient amount of data to provide significant results. At station 2 from 2002-2018 DO levels decreased by slightly less than 1.5mg/L (Figure 5). Overall, it appears that DO levels have been and are continuing to decrease across the lake. It is likely that these declining DO trends are due to the warming temperatures that the lake is experiencing as discussed below. While these levels have not yet reached the stressful threshold of 5mg/L it is important to continue monitoring to observe if the levels continue to decrease to concerning levels.

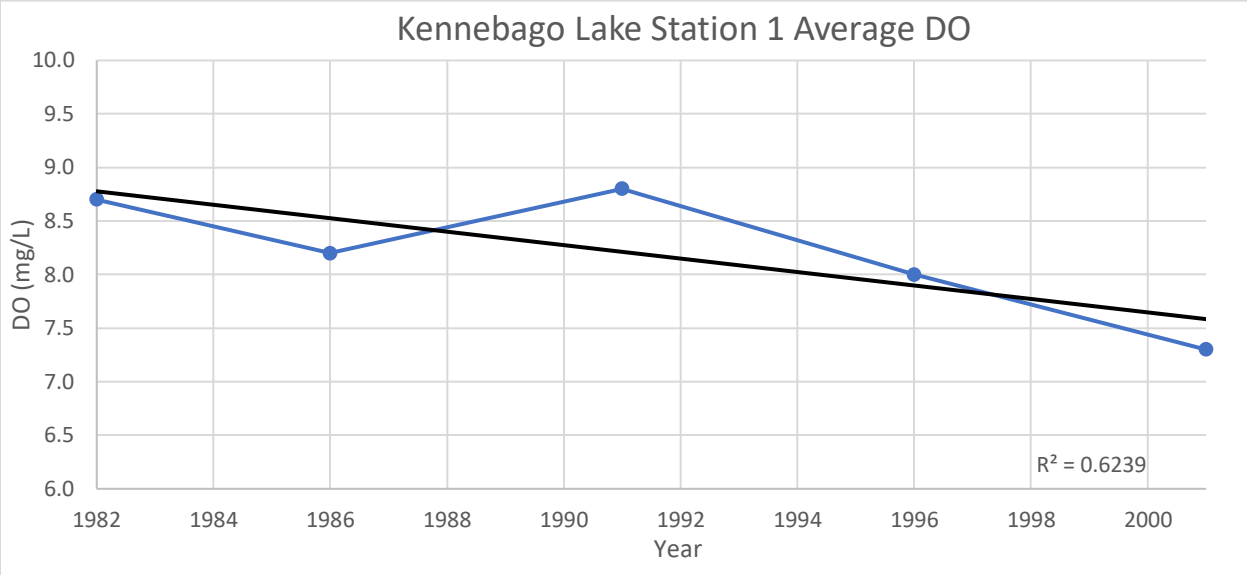

Figure 4: Average summer DO levels on Kennebago Lake station 1 with a moderate correlation showing a decrease of over 1mg/L over 15 years.

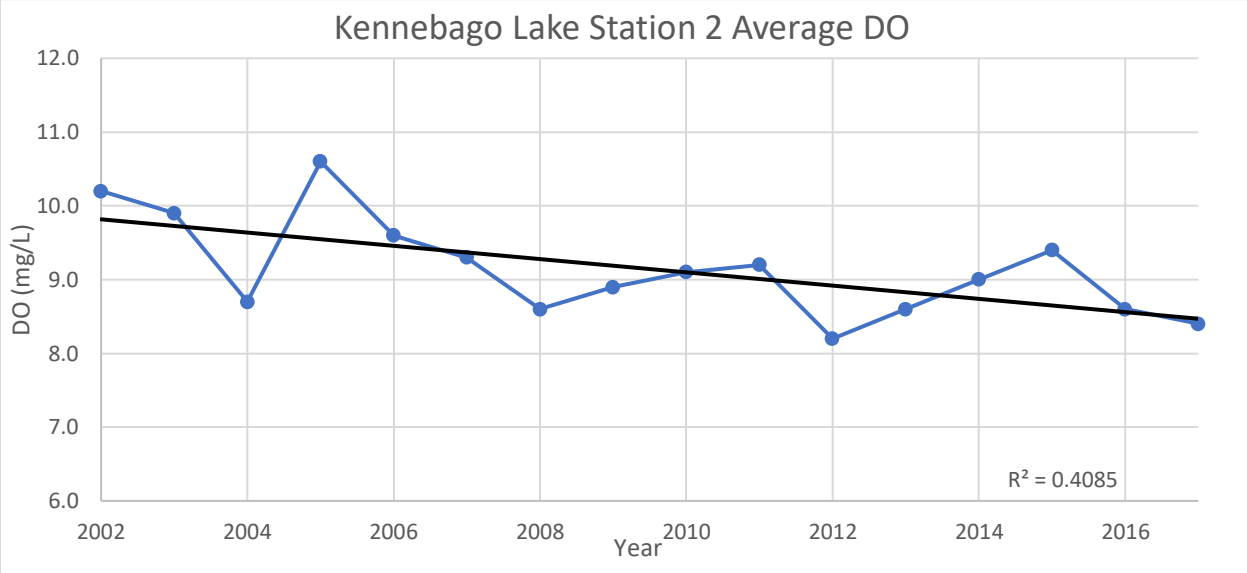

Figure 5: Average summer DO levels on Kennebago Lake station 2 with a moderate correlation showing a decrease of approximately 1.5mg/L in 15 years.

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 Kennebago Lake is experiencing similar trends.

Kennebago Lake is experiencing increasing temperatures in recent years. From 1982-2001 temperatures increased rapidly then decreased at station 1 (Figure 6). However, it is important to note that only 5 years of data are available for a 19-year period which is typically not a sufficient amount of data to provide significant results. The overall trends from this period do show a slight decrease in temperature, but this is likely due to insufficient data. From 2002-2017 temperatures have increased by approximately 7°F at station 2 (Figure 7). This trend is confirmed by several years of data, a moderately strong correlation, and a similarity with most other trends in the region. This is likely causing the decreasing DO levels that are also being observed. These rising temperatures could lead to continuously decreasing DO, stressful environments for aquatic life, and dead zones. While it is difficult to control air and water temperatures, there are a few steps that can be taken to help reduce the impact of warming waters on the lakes health which are discussed in the suggestions section.

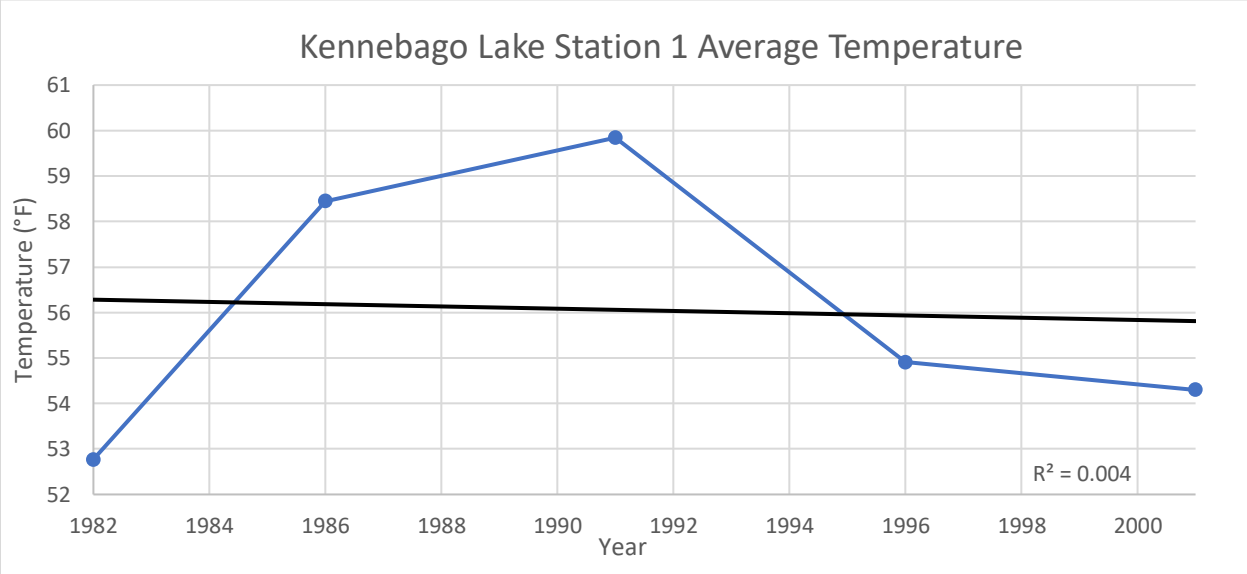

Figure 6: Average summer temperature on Kennebago Lake station 1 with a weak correlation showing a slight decrease of less than .5°F in over 15 years.

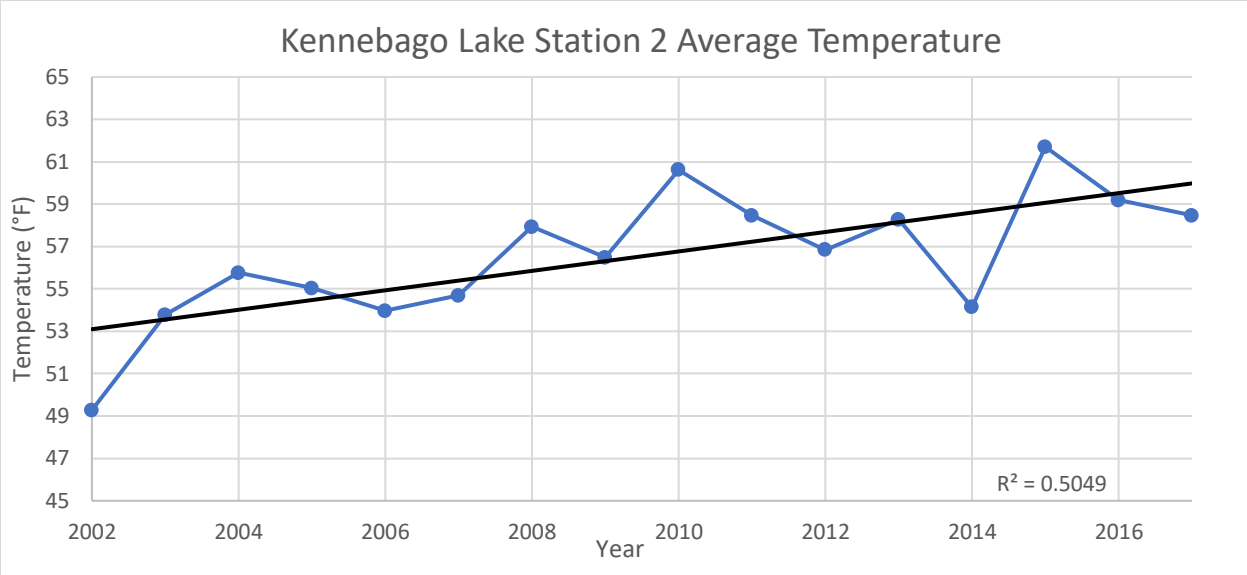

Figure 7: Average summer temperature on Kennebago Lake station 2 with a moderate correlation showing an increase of over 7°F in 15 years.

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 and sewage which can easily flow from lakefront gardens, yards, or faulty septic's 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 0.03mg/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.

Total phosphorus levels on Kennebago lake are showing healthy trends. From 1982-2006 there was relatively no change in phosphorus as station 1 (Figure 8). From 2002-2016 there was a slight decrease of approximately .001mg/L at station 2 (Figure 9). It is common for phosphorus levels to decrease over time naturally as is being observed in recent years on Kennebago Lake. Phosphorus typically will not fluctuate unless there is a heavy introduction of the nutrient. These stable and slightly decreasing trends that are seen suggest there is no phosphorus pollution occurring. The levels have remained within the healthy range which further confirm that there are no phosphorus related issues on the lake.

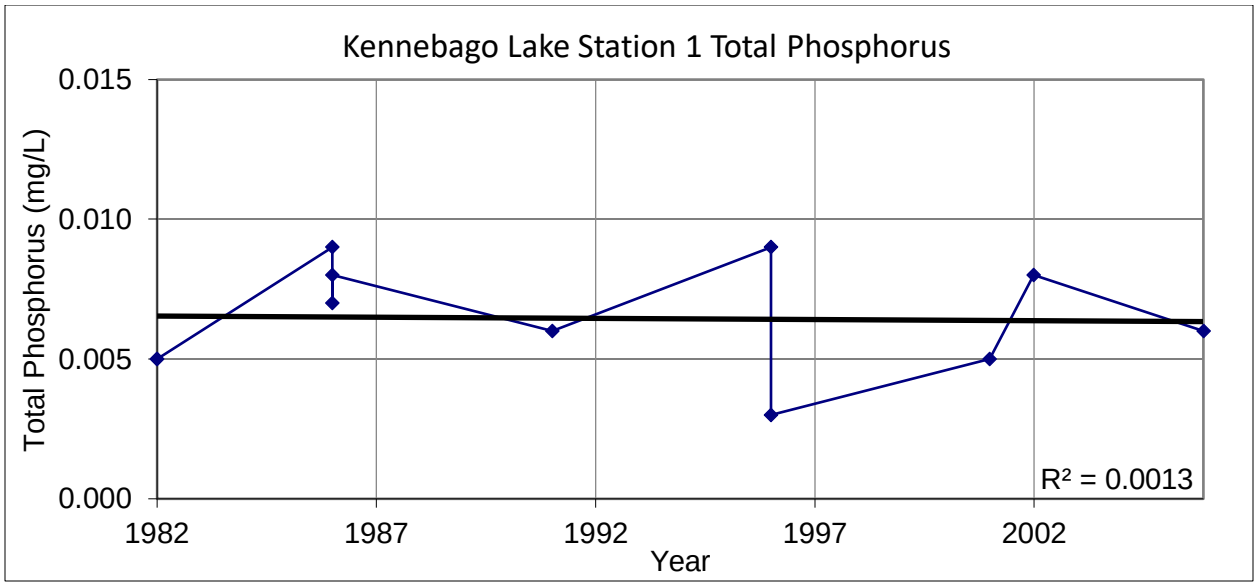

Figure 8: Total Phosphorus on Kennebago Lake station 1 with a weak correlation showing relatively no change in over 20 years.

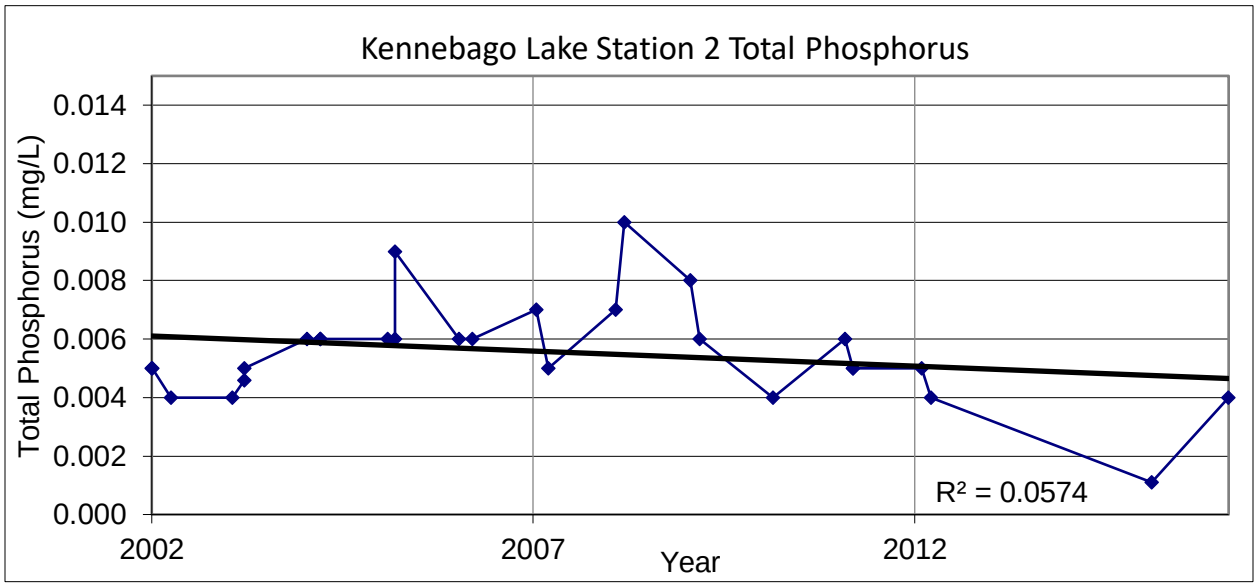

Figure 9: Total phosphorus on Kennebago Lake station 2 with a weak correlation showing a slight decrease of approximately .001mg/L in over 10 years.

Suggestions:

The trends discussed suggest that Kennebago Lake is experiencing possibly harmful warming temperatures, but no notable runoff or pollution events. Stable water transparency and total phosphorus levels suggests healthy waters with little pollution. However, rising temperatures and decreasing DO levels suggest warming waters. This is a common trend which is caused by warming air temperatures and shorter winters which are being experienced across the region. While these are difficult factors to control there are a few steps that can be taken to help reduce the impact of rising temperatures on lakes. There are also a few actions to take that can attempt to lighten the impact of decreasing DO.

Possibly actions to decrease lake temperatures:

Actions	Benefit	Location
Implement rain gardens and infiltration steps	-Allows stormwater to enter underground aquifers to cool instead of entering directly into the lake -Reduces the risk of erosion	Lakefront homes and properties
Maintain a native vegetative buffer at the shoreline	-Reduces the flow of stormwater directly into the lake -Reduces the risk of erosion	-Lakefront homes and properties -Shoreline around the entire lake
Plant mature trees along lake edge	-Directly shades and cools shallow waters along the lake -Helps reduce the flow of stormwater into the lake	-Lakefront homes and properties -Shoreline around the entire lake
Maintain narrow, shaded roadways	-Shades and cools the land around lake	Large and small roads surrounding the lake
Continuous monitoring of potential invasive plants	-Reduces the possibility of invasive plants entering the water body, disrupting the ecosystem, and contributing to warming temperatures.	-Boat Launches -Littoral zone surrounding the lake
Maintain healthy and shaded tributaries	-Deposits cold water directly into lake -Improves fish habitat and movement	-Kennebago River -Small surrounding brooks and streams

Possibly actions to limit decreasing DO:

Actions	Benefits	Locations
Maintain a vegetative buffer and native forests surrounding the lake	-Intercepts stormwater and prevents large amounts of runoff from entering the lake -Reduces soil erosion	Lakefront homes and properties
Implement highly permeable soils	-Sandy and permeable soils increase filtration of stormwater before entering the lake	-Lakefront gardens -Lakefront lawns
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 -Nearby farms
Maintain driveways and roads with less impervious surfaces	-Minimizes road chemicals entering the lake directly	-Lakefront homes and properties -Roads surrounding the lake
Consider becoming LakeSmart certified	-Allows waterfront properties to be individually analyzed -Provides feedback on how to improve your home lake impact	Lakefront homes

While any of these actions could be beneficial to the health of Kennebago lake, there is no way for us to understand our impact without continued monitoring. It is extremely important to continue monitoring to determine if DO levels reach stressful levels. For more information or any other questions, please reach out to headwaters@rlht.org.

Sources:

Lakes Environmental Association

United States Environmental Protection Agency-Climate Change Workbook

United States Environmental Protection Agency-Dissolved Oxygen

USGS-EPA Phosphorus levels

Maine Lakes

Lake Stewards of Maine