Kezar Lake Water Quality Report

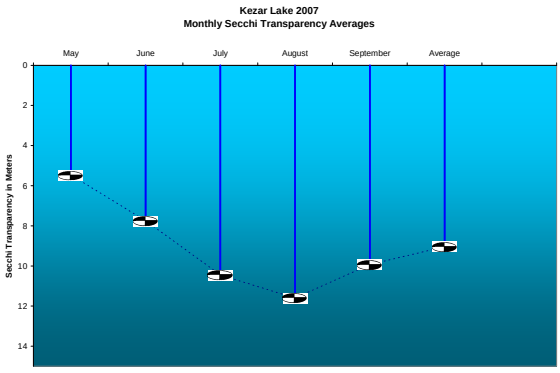
2007

Baseline water quality monitoring was conducted on the two main basins of Kezar Lake from May through September, 2007. A number of indicators of lake water quality were measured and sampled, using methods and protocol for lake assessment established by the Maine Department of Environmental Protection and the Maine Volunteer Lake Monitoring Program.

Overall, Kezar Lake experienced a *substantially above average* year, in the north (North Bay) basin of the lake, while conditions were closer to the historical average for the south basin (South Bay). Differences between the two areas of the lake are, at least partially due to natural differences in the physical characteristics of the two basins. The north basin is relatively deep (~155 feet maximum depth, 34 feet average), whereas the south basin is shallow (~15 feet maximum depth, 8-10 feet average). These differences, combined with the fact that water entering the north basin comes directly from a relatively undeveloped watershed, whereas water in the south basin passes not only through the north and middle area of the lake, but receives drainage from several smaller ponds in the watershed, generally cause the south basin to be more turbid, and to have higher concentrations of nutrients and algae.

User perception surveys that have been conducted in Maine, and throughout the U.S., have consistently shown that the characteristic of lakes that is most highly valued by the public is “clear water”. Water clarity, also referred to as “Secchi transparency”, is the distance that one can see down into a lake from the surface. It is one of several key indicators used to assess the quality of Kezar, and other Maine lakes.

The 2007 water clarity average for the north basin (monitoring station 01) was 9.04 meters (nearly 30 feet), compared to 8.7 meters in 2006, 8.2 meters in 2005, and the historical average of 7.7 meters (25 feet). Thus, water clarity averaged 1.3 meters (approximately 4 feet) clearer in 2007 than the average for Kezar Lake during the period from 1970-2005)! The lowest reading of the summer was 5.47 meters, recorded on May 15, while the highest (best) reading was 11.60 meters, recorded on August 16.



Secchi Transparency (water clarity) Readings for Station 01 (North Basin)

The water clarity average for the south basin (station 03) was 3.1 meters, compared to 3.4 meters in 2006, 3.5 meters in 2005, and the historical average of 3.1 meters at this station. However, as has been noted in previous reports, the shallow nature of the south basin limits water clarity. In other words, water clarity is underestimated for the south basin because the device that is used to measure this indicator reaches the bottom of the basin before it disappears from view. All of the 2007 water clarity readings in the south basin hit bottom before the Secchi disk disappeared. For this reason, greater emphasis is placed on other water quality indicators in the south basin, as discussed below.

2006 SECCHI GRAPHIC HERE, SHOWING ANNUAL HISTORICAL DATA

To put into perspective the significance of the overall excellent water clarity of Kezar Lake, consider that out of ___ Maine lakes that were assessed in 2007, _____% were clearer than their historical averages, _____ % were less clear, and ____% were the same as their historical averages. The average lake water clarity for all Maine lakes _____ last year, and for the second year, the number of Maine lakes that were clearer than their historical average declined to fewer than 50%. *However, overall, Kezar Lake was substantially clearer than its historical average.*

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Number of Maine lakes that were less clear, unchanged, or clearer than their historical Average in 2007. (Maine Volunteer Lake Monitoring Program and Maine Department of

Environmental Protection)

Water clarity is one of three primary indicators of the overall biological productivity of lake ecosystems, in addition to the nutrient phosphorus (TP) and chlorophyll a (CHL), a pigment that is used to measure the concentration of algae in lake water. The three indicators, along with the concentration of oxygen dissolved in the water, are the key measures of the water quality, and overall health of Maine lakes.

The 2007 average total phosphorus (TP) concentration for the north basin was 4 parts per billion (ppb), compared to the historical average of 6 ppb. Over the years, annual TP concentrations in north Kezar have ranged from as low as 4 ppb, to as high as 11 ppb (an unusual year). Lakes are particularly sensitive to phosphorus, which strongly influences the growth of algae in the water, which, in turn, influences water clarity. Maine's cleanest, clearest lakes typically have TP concentrations in the 3-4 ppb range, while lakes with TP levels as low as 12-15 ppb may experience nuisance algal blooms.

The average total phosphorus concentration in the south basin was 8 ppb in 2007, compared to the historical average of 9 ppb for this area of the lake. Part of the reason that TP is higher in this area of the lake is linked to the shallow nature of the basin. Strong winds cause bottom sediments to become suspended in the water, elevating the concentration of phosphorus. The south basin of Kezar is considered to be somewhat more naturally biologically productive than the northern area due, in part, to this phenomenon.

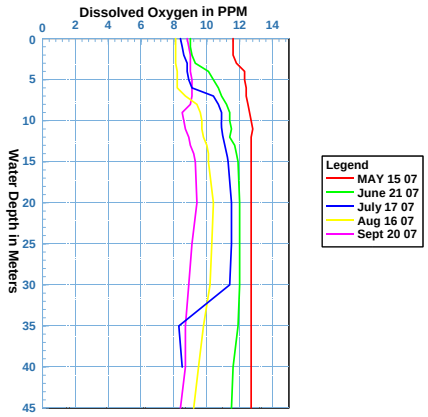
The 2007 chlorophyll-a (CHL) average was 1.8 ppb (very good) in the north end of the lake, compared to the historical average of 2.8 ppb at this station. This finding is consistent with the excellent water clarity and low phosphorus in the north basin. CHL is a direct measure of the amount of algae growing in the lake. Algae are at the base of the lake ecosystem food web, and thus play an important role in the biological productivity and overall health of the lake. However, excess algae growth reduces water clarity and may result in the loss of dissolved oxygen in the water, especially during warm summer months. This, in turn, may stress coldwater fish (trout and salmon).

The 2007 average CHL concentration in the south basin was 2.5 ppb, compared to the historical average of 2.4 ppb. Although higher than levels in the north basin, CHL levels in the southern region of the lake are also relatively low (good). Low CHL levels in the south basin indicate that the moderate TP concentration is, in part, linked to suspended sediment in the water, because generally lakes that have moderate TP levels, as documented in this area of the lake, would be expected to experience greater algal growth, measured by CHL.

Dissolved oxygen profiles taken throughout the summer, from the surface of the lake to the bottom of the deepest area in the north basin, revealed similar excellent results to previous years. Many Maine lakes experience moderate to severe dissolved oxygen loss in deep areas during late summer (August and September). Oxygen loss is linked to

biological productivity, specifically, to algal levels in the lake over time. Kezar Lake retains high (healthy) levels of dissolved oxygen, even in the deepest area of the lake throughout the summer and early fall monitoring period. This is perhaps the most significant indicator of Kezar Lake's excellent water quality. It is also a major factor in Kezar's ability to support coldwater fish species.

Temperature and dissolved oxygen profiles taken monthly during the 2007 monitoring period showed high concentrations of oxygen throughout the lake. There is no apparent trend in oxygen levels in Kezar, over the three decade monitoring period, nor is there any apparent negative trend for any of the key indicators of water quality for Kezar Lake.



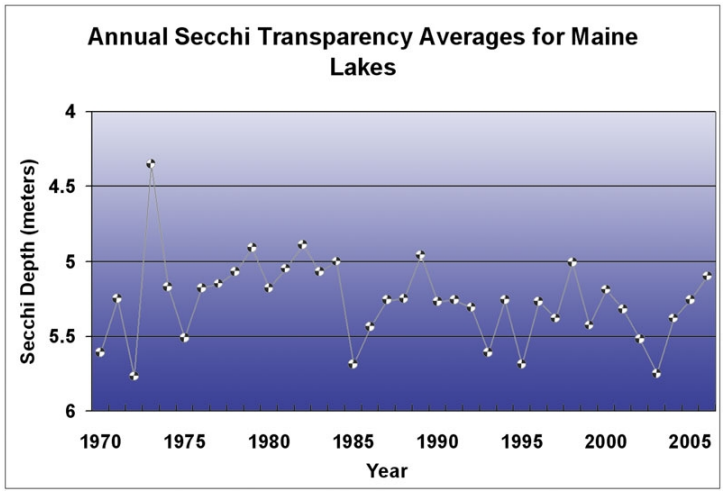
Dissolved Oxygen Profiles, Station 01 (North Basin)

Additional water quality indicators monitored in 2007 (pH, total alkalinity, water color) were within normal limits for Kezar Lake, and generally supported the indicators of water quality discussed above. Natural color is an indicator that measures the concentration of humic acids in lake water. The color concentration was average for the lake in 2007, measuring 11 standard platinum-cobalt units (SPU). Color concentration is largely due to the leaching of organic acids from wetland vegetation in the lake watershed. Moderately high concentrations of color can alter the dynamics of lake ecosystems somewhat, by, among others, reducing water clarity. However, historical and present color levels in Kezar Lake have always been relatively low. Summer pH readings were all very close to the historical average for the lake, as was the average total alkalinity, which is a measure of the stability of pH in water. However, the average alkalinity of Kezar Lake (4.7 mg/l) is quite low, indicating that the pH is vulnerable to change. Given the thin upland soils of much of the Kezar Lake watershed, it is conceivable (but unknown) that significant downward shifts in pH (more acidic) may occur during periods of winter and spring runoff, and that this phenomenon could be linked to negative changes in the lake biota.

TO BE REVISED: The chart below shows the extent to which water clarity (Secchi transparency) varies for Maine lakes over time. The chart shows the average water clarity

for all Maine lakes monitored in a given year. Note that the average for all Maine lakes has, for most years since this information has been tracked, fallen between 5.0-5.5 meters. Variation from one year to the next is influenced by many factors, not the least of which is weather. Maine lakes may be clearer overall during relatively dry years because stormwater runoff from rainfall carries phosphorus and other pollutants from the watershed to the lake.

PLEASE NOTE: THIS GRAPHIC AND NARRATIVE WILL BE UPDATED IN APRIL, 2008



Source: Maine Volunteer Lake Monitoring Program

The illustration above shows that for the past three years, the "average" clarity of Maine lakes has been dropping. This may be related to the fact that much of the state has experienced above average precipitation during the period. Or, it may be related to other natural forces that are not known or easily measurable. It can be seen from this illustration, however, that similar declines have occurred historically, sometimes followed by dramatic recoveries. Some of the "clearest" years have been those during which drought has recently occurred, such as 1985 and 2002 and 2003 (possible delayed effects of the severe 2001-2002 drought).

Each lake and pond responds in a unique way to the influences of weather, changes in land use in the watershed, and other forces upon the ecosystem. This is because of the wide range of physical, chemical and biological characteristics of each lake basin and its watershed. Most lakes and ponds experience a moderate amount of natural annual variability.

Kezar is one of Maine's clearest and cleanest lakes. The north basin of the lake was much clearer than the historical average in 2007. In fact, the lake was the clearest that is has been since 2000. While this message is, without question, positive, it is important to note that Kezar is also sensitive and vulnerable to change, which is why, in 2005 the Maine DEP added Kezar Lake to Maine's list of *Priority Waterbodies.*

Questions have been raised concerning other aspects of Kezar Lake's health, including anecdotal reports of a decline in the fishery, as well as other forms of aquatic life that are critical to the health of the lake ecosystem. There is also widespread speculation regarding the impact of global climate change on Maine lakes. Extreme summer weather in recent years undoubtedly influences many of the indicators used to assess lake health. Could improvements in the clarity of the lake in recent years be linked to this phenomenon? What might be the implications of such change over time? Despite a great deal of historical information for Kezar Lake, the future holds many unknowns as we ponder the influence of climate change, and the Kezar Lake watershed continues to develop.

Throughout its history, KLWA has played a major role in the protection of Kezar Lake. The challenges of maintaining the outstanding conditions that we have all come to expect from this lake continue to grow. KLWA's forward-thinking decision to establish a comprehensive water quality monitoring and data management program not just for Kezar, but for the small ponds that drain to Kezar Lake as well, will very likely play an important role in answering these complex questions, and meeting the challenges of ensuring a healthy lake environment for the future.

Prepared by Scott Williams, Aquatic Biologist