



2008 Range Ponds Water Quality Report

The Range Ponds Environmental Association continued to monitor the health of Upper, Middle and Lower Range Ponds in 2008. Water quality monitoring was a combined effort of certified volunteer lake monitors and LWRMA biologists. Monitoring and sampling of the lakes took place from early May through September, during the time of year when lakes and ponds are the most biologically productive, water quality problems are most evident, and “worst case scenario” conditions may exist.

The weather that occurs during and preceding lake monitoring can have a strong influence on indicators of lake water quality, and is likely responsible for some of the variability that is measured within individual seasons and from one year to the next. National Weather Service data indicate that the weather during the 2008 monitoring season was characterized by extreme periods of precipitation throughout much of the summer. This period is critical for the Range Ponds and other lakes, because much of annual runoff from the watershed that carries phosphorus, sediment and other pollutants into the ponds occurs during this time.

The following is a summary of findings for the three lakes.

Upper Range Pond:

2008 was an *above average* year for Upper Range Pond. Water clarity averaged 7.1 meters (23 feet), compared to 6.5 meters in 2007, 5.7 meters in 2006, 5.7 meters also in 2005, and 6.7 meters in 2004. The historical average for the lake is 6.4 meters (21 feet), so the lake was significantly clearer than average in 2008, and considerably clearer than it was in both 2005 and 2006. This improvement in the clarity of the lake was very likely influenced by the weather and other factors.

The concentration of phosphorus (the nutrient that is responsible for the growth of algae in lakes) averaged 5 parts per billion (ppb) in 2008, compared to 6 ppb in 2007, 9 ppb in 2006, 8 ppb in 2005, and the historical average of 8 ppb. Total phosphorus concentrations in Upper Range Pond have ranged from 5-11 ppb since 1979, when phosphorus sampling began on this body of water. The 2008 average annual average (based on two samples) was one of the lowest (best) on record for Upper Range.

Chlorophyll-a (CHL) is a pigment that is measured to determine the concentration of algae in lake water. The 2008 average concentration measured 2.7 ppb, compared to 2.9 ppb in 2007,

4.0 ppb in 2006, 3.5 ppb in 2005, and the historical average of 4.3 ppb. All three of the primary water quality indicators were better than the historical average for Upper Range in 2008.

Late summer dissolved oxygen levels were very low in the deepest region of the lake, as has been the case for a number of years. A phosphorus sample taken near the bottom of the deepest point in the lake in early September measured substantially higher (12 ppb) than the concentration near the surface (5 ppb), indicating that low oxygen in the water could have been causing phosphorus to be released from the bottom sediments at that time. Low concentrations of late summer dissolved oxygen serve as a warning that the lake is sensitive and vulnerable to a decline in water quality. *It is for this reason that Upper Range Pond is considered at moderate risk for experiencing a nuisance algal bloom*, even though the lake at this time exhibits signs of very good water quality.

Natural water color levels were slightly lower than average in 2008, probably as a result of extreme rain and flushing of the lake. Lake water color is influenced by the concentration of natural humic acids from vegetation in the watershed. High levels of color may influence the relationship between water clarity, and phosphorus and chlorophyll-a levels.

Middle Range Pond:

Middle Range Pond also experienced an above average year in 2008, and while not as clear as it was in record-breaking 2007, the lake in 2008 was still significantly clearer than it has been historically. The average water clarity in 2008 measured 6.7 meters (22 feet), compared to 7.1 meters in 2007, 6.3 meters in 2006, 6.7 meters in 2005, and the historical average of 6.0 meters. Water clarity in Middle Range has improved to the point where the long-term historical average for the lake has improved slightly during the past two years!

Phosphorus levels were lower than average (good) in 2008, averaging 6 ppb, compared to 7 ppb, in 2007, 8 ppb in 2006, ppb in 2005, and the historical average of 8 ppb. Historical phosphorus levels in Middle Range Pond have varied from 5-12 ppb since samples have been collected starting in 1985.

The concentration of chlorophyll-a (algal concentration in the pond) was also lower than the historical average for the pond in 2008, measuring 3.0 ppb, compared to 3.6 ppb in 2007, 5.2 ppb in 2006, and the historical average of 4.2 ppb. CHL was considerably lower than in 2007 and 2006, resulting in a lowering (improvement) of the historical average for the lake. This suggests that overall biological productivity and algal growth has decreased somewhat in recent years, most probably due to the weather influences mentioned above and below. *However, weather influences aside, the overall clarity of Middle Range Pond has improved measurably in the past decade.*

Late summer oxygen levels near the bottom of the lake were very low, but not depleted, as has been the case in some previous years. A phosphorus sample taken near the bottom of the deepest point in the lake basin was significantly higher than a sample taken near the surface on

the same day. Oxygen loss during the critical summer months can precipitate the release of phosphorus from bottom sediments, and under certain conditions, can cause relatively rapid negative changes in water quality. Efforts to protect the lake from phosphorus pollution and excess algal growth can help to minimize this risk.

Other water quality indicators that are measured to help support the primary data (color, pH, and total alkalinity) were within the normal range of historical values for Middle Range in 2008.

Lower Range Pond:

Overall, Lower Range Pond experienced an above average year in 2008. The lake was clearer than average in 2008, averaging 7.2 meters (23.5 feet), compared to 7.0 meters in 2007, 7.1 meters in 2006, 6.9 meters in 2005, 7.8 meters in 2004 and the historical average of 6.8 meters. Lower Range was clearer than both Middle and Upper Range Ponds in 2008!

The average total phosphorus concentration in Lower Range Pond last summer was 7 ppb, compared to 7 ppb in 2007, 8 ppb in 2006, 9 ppb in 2005, 6 ppb in 2004, and the historical average of 8 ppb. A phosphorus sample taken near the bottom of the lake in early September (due to very low oxygen levels at that time) measured 12 ppb, which may suggest that phosphorus was being released from the sediments at that time. Even though Lower Range currently exhibits indications of very good water quality, loss of dissolved oxygen in the deepest area of the pond in late summer/early fall, combined with present phosphorus levels in the lake puts Lower Range Pond at moderate risk to experience a nuisance algal bloom. Efforts taken to reduce phosphorus export to the lake from developed areas of the watershed can help to reduce this risk.

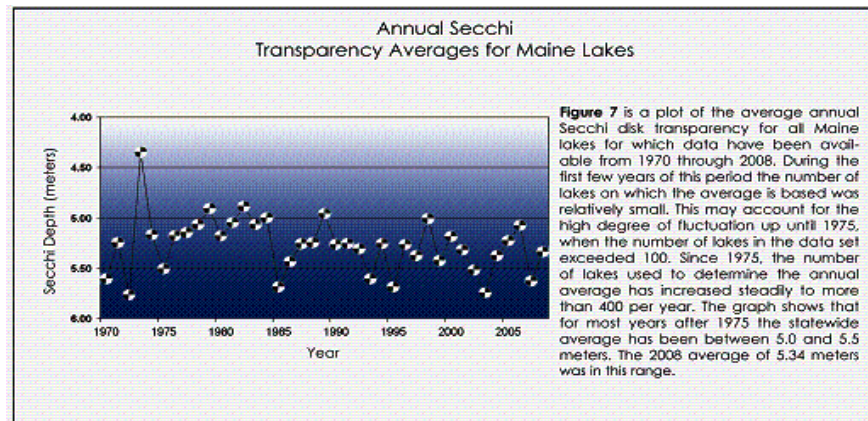
Chlorophyll-a (algal growth in the water) averaged 3.0 ppb in 2008, compared to 3.6 ppb in 2007, 4.3 ppb in 2006, 4.4 ppb in 2005 and the historical average of 3.6 ppb. The 2008 average was one of the lowest (best) on record for the pond, and was well-below the historical average.

Dissolved oxygen levels at the deepest point in Lower Range were critically low in both July and early September. By September 13, there was virtually no oxygen in the water below 7.0 meters depth (~24 feet). The maximum depth of Lower Range Pond is approximately 13 meters. Consistently depleted levels of dissolved oxygen in the deepest area of Lower Range Pond in late summer is a significant warning of the vulnerability of this body of water to experience a negative change in water quality – even though conditions at the surface currently look very good at this time.

Additional supporting indicators of water quality (pH, total alkalinity and color) were within the normal range of the historical data for Lower Range Pond in 2008.

Statewide Perspective on 2008 Lake Water Clarity:

To put into perspective the significance of the 2008 water clarity findings, consider that out of 418 Maine lakes that were assessed last year, about 46% were clearer than their historical averages, and about 41 % were less clear than their average. *This represents a significant change from 2007, when a much higher percentage of Maine lakes were clearer than they had been historically.*



Percentage of Maine Lakes that were clearer, less clear, and the same as their Historical Average in 2008

(Source: Maine Volunteer Lake Monitoring Program; 2008 Maine Lakes Report)

It is likely that the reduction in the number of lakes that were clearer than average in 2008 was the result of heavy snow and runoff in the spring and moderate to severe rain throughout much of Maine during the mid to late summer period. Spring runoff from melting snow and rain typically carries a high percentage of the annual phosphorus load to lakes from their watersheds. Information obtained from the National Weather service indicated that Portland, Maine experienced the wettest summer period in 138 years.

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 dissolved oxygen, are considered to be key measures of the water quality, and overall health of Maine lakes.

The chart below shows the extent to which water clarity (Secchi transparency) has varied for Maine lakes over time. The chart shows the average water clarity for all Maine lakes monitored in a given year. Note that this average 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 relatively clearer during dry years because stormwater runoff from rainfall carries phosphorus and other pollutants from the watershed to the lake.

Source: Maine Volunteer Lake Monitoring Program 2008 Maine Lakes Report

The illustration above shows that for the period from 2004-2006, the “average” clarity of Maine lakes dropped substantially. This may have been due to the fact that much of the state experienced above average precipitation during the period. In 2007, Maine lakes as a whole were significantly clearer, most probably due to reduced precipitation during the winter, spring and early summer months, when a high percentage of watershed phosphorus loading typically occurs for lakes. But in 2008, along with a lower percentage of lakes being as clear as they were in 2007, the overall water clarity for Maine lakes dropped to 5.35 meters, as the graph above illustrates.

The graph shows that a number of similar changes have occurred historically. Some of the “clearest” years have been those during which drought has recently occurred, such as 1985 and 2002 and 2003, which followed the severe statewide drought of 2001.

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. That is because of the wide range of physical, chemical and biological characteristics of each lake basin and its watershed. Most lakes and ponds experience moderate levels of natural annual variability.

Water clarity (Secchi transparency) is one of four primary indicators of the biological productivity of lake ecosystems, in addition to the nutrient phosphorus (TP), chlorophyll a (CHL), a plant pigment used to measure of the concentration of algae in lake water, and the concentration of dissolved oxygen in deep areas of the lake during the summer months.

Summary:

Overall, 2008 was a very good year for the Range Ponds, in that all three of the ponds were clearer than their individual historical averages! Concentrations of total phosphorus and algae in the three ponds were also below average during the summer. Lake water clarity is highly valued by the public, often ranking first in terms of desirable attributes in user-perception surveys.

It is important to note that while the Range Ponds continued to look very good, in most respects, in 2008, each experienced low levels of dissolved oxygen during the late summer. This risk factor suggests that the overall vulnerability of the Range Ponds to a decline in water quality over time is real and measurable. Through the efforts of the Range Ponds Environmental Association, the excellent conservation work that has taken place in the watershed during recent years will help to offset this change. But the challenges of ongoing watershed development, as well as existing threats to the lakes, must continue to be addressed if good water quality is to be maintained for the future.

Special thanks are due to several volunteer lake monitors who collected water clarity data for the Range Ponds in 2008. Their efforts added substantially to the value of the data used to create this report!

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