2009 Range Ponds Water Quality Report

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The Range Ponds Environmental Association continued to monitor the health of Upper, Middle and Lower Range Ponds in 2009. 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 2009 monitoring season was similar, or worse than it was in 2008, characterized by extreme periods of precipitation throughout much of the summer. It may have been the wettest summer on record, as was the case in Portland. 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 average to slightly below average year for Upper Range Pond, because while the clarity of the water was the same as the historical average, both phosphorus and chlorophyll (algae) levels measured in June were higher than average**.

Water clarity averaged 6.4 meters (21 feet) for the summer monitoring season, compared to 7.1 meters (23 feet) in 2008, 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 also 6.4 meters (21 feet). Upper

Range was noticeably less clear in 2009 than in 2008, but considering the extreme snowmelt and rainfall during the spring, summer and early fall, the lake held its own!

The concentration of phosphorus (the nutrient that is responsible for the growth of algae in lakes) measured 16 parts per billion (ppb) in the single sample taken in June, 2009, compared to 5 ppb in 2008, 6 ppb average in 2007, 9 ppb in 2006, 8 ppb in 2005, and the historical average of 8 ppb. The single sample taken in June was the highest single phosphorus sample level on record for the pond, in stark contrast to the 2008 average, which was one of the lowest on record. It is important to note that the 2009 phosphorus average was based on a single sample taken in June, whereas for many of the previous years, early and late summer samples were used to create the average. Total phosphorus concentrations in Upper Range Pond have ranged from 5-16 ppb since 1979, when phosphorus sampling began on this body of water.

Chlorophyll-a (CHL) is a pigment that is measured to determine the concentration of algae in lake water. The 2009 sample, taken in June when the phosphorus level in the lake was high, measured 5.8 ppb, compared to the 2008 average concentration of 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 4.4 ppb. The 2009 average was one of the highest on record for Upper Range, compared to the 2008 average, which was one of the lowest. However, the 2009 average was based on a single reading taken in June, whereas many of the annual averages in past years have been based on two samples, collected in early and late summer.

Because the 2009 baseline sampling was limited to a visit to the pond in June, no late summer dissolved oxygen data are available for the year. A temperature/dissolved oxygen profile taken on June 23 showed relatively high concentrations of oxygen from the surface to the bottom of the deepest point in the pond. However, past historical data have consistently shown a significant depletion of oxygen in Upper Range Pond during the late summer

Natural water color levels were slightly higher than average in 2009, possibly as a result of extreme rain and flushing of the lake. A late summer sample might have brought the average for the year closer to the historical average for the 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 average to above average year in 2009, in that the lake was clearer than average, there was less algae in the water, and phosphorus levels were equal to the historical average for the lake. The average water clarity in 2009 (based on five months of volunteer data, in addition to the reading that we took in late June) was 7.1 meters (23+ feet), compared to the 2008 average of 6.7 meters (22 feet), 7.1 meters in 2007, 6.3 meters in 2006, 6.7 meters in 2005, and the historical average of 6.1 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 three years!

The phosphorus level measured in June was the same as the historical average for the lake (8 ppb), compared to the average of 6 ppb in 2008, 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 lower (better) than the historical average for the lake, measuring 3.7 ppb in June, compared to the 2008 average of 3.0 ppb, 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.

Because the 2009 baseline sampling was limited to a visit to the pond in June, no late summer dissolved oxygen data are available for the year. A temperature/dissolved oxygen profile taken on June 23 showed relatively high concentrations of oxygen from the surface to the bottom of the deepest point in the pond. However, past historical data have consistently shown a significant loss of oxygen in Middle Range Pond during the late summer.

Other water quality indicators that are measured to help support the primary data were within the normal range of historical values for Middle Range in 2009.

Lower Range Pond:

Overall, Lower Range Pond experienced an above average year in 2009, in that the lake was significantly clearer than its historical average, and phosphorus and chlorophyll (algae) levels were lower than their historical averages**. The lake was clearer than average in 2009, averaging 7.3 meters (24 feet), based on a full summer of readings taken by volunteer lake monitors, and our reading in late June. In 2008 the average was 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 6.9 meters, which has recently increased slightly as a result of several very clear years for the lake. Lower Range was the clearest of the Range Ponds in 2009.

The total phosphorus concentration in Lower Range Pond last summer, based on the single June sample, was 6 ppb compared to 7 ppb in 2008 and 2007, 8 ppb in 2006, 9 ppb in 2005, 6 ppb in 2004, and the historical average of 8 ppb.

Chlorophyll-a (measuring algal growth in the water) measured 3.5 ppb in June, compared to the 2008 average of 3.0 ppb, 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, but the single 2009 sample was also relatively low for Lower Range.

Because the 2009 baseline sampling was limited to a visit to the pond in June, no late summer dissolved oxygen data are available for the year. A temperature/dissolved oxygen profile taken on June 23 showed relatively high concentrations of oxygen from the surface to the bottom of the deepest point in the pond. However, past historical data have consistently shown a significant loss of oxygen in Middle Range Pond during the late summer. Additional supporting indicators of water quality were within the normal range of the historical data for Lower Range Pond in 2009.

**It is important to note that our baseline sampling of the lake in 2009 was limited to the month of June, whereas much of the historical data for the three Range Ponds is based on early and late summer (August) sampling, or in some cases, just for the month of August. This change in the sampling schedule may have influenced the 2009 average readings for some of the indicators that were monitored, as well as our ability to measure the extent to which dissolved oxygen was lost in the deepest areas of the lake in late summer. However, volunteer lake monitors on the three lakes provided additional water clarity (Secchi transparency) readings for the full summer monitoring season.

It is important to keep this change in the sampling schedule in mind when considering the 2009 monitoring results.

2009 Water Clarity Perspective for Maine Lakes

To put into perspective the 2009 lake monitoring season, consider the fact that out of 457 Maine lakes that were assessed last year, only 39.2% were clearer, 50.1 % were less clear, and 10.7% were unchanged, compared to their historical average (Figure 2). The clarity of Maine's lakes has declined significantly during the past two years, compared to 2007 a much drier year, when a much higher percentage of lakes were clearer than they had been historically.

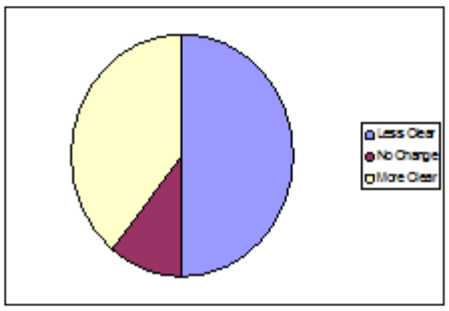

Figure 1: Percentage of 457 Maine Lakes that were clearer, less clear, or unchanged, compared to their historical average in 2009 (Source: MDEP and VLMP)

It is likely that the further decline in the number of lakes that were clearer than average in 2009 was the result of heavy snow melt during the spring, and moderate to severe rainfall throughout much of Maine during the summer period.

Spring runoff from melting snow and rain typically carries a high percentage of the annual phosphorus load to lakes from their watersheds. The annual phosphorus load to a lake from it's watershed has a strong bearing on water clarity throughout the summer monitoring period.

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, denoted by the small dot on the solid line. Note that this average has, for a majority of the years since this information has been tracked, fallen between 5.0-5.5 meters. Although weather influences have a strong bearing on the overall clarity of Maine lakes, the natural rate of flushing, the extent of watershed development and other influences play an equally important role for individual lakes and ponds.

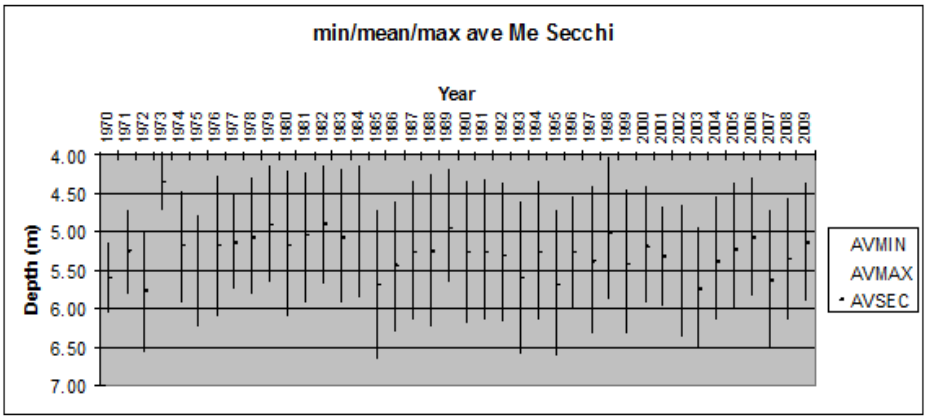

Figure 2: Average, Maximum and Minimum Clarity for Maine Lakes

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 relatively little precipitation throughout the state during the winter, spring and early summer months. But in 2008 and 2009, along with a reduction in the percentage of lakes that were as clear as they were in 2007, the overall water clarity for Maine lakes declined, as shown in figure 3 above. Note that the average maximum and minimum lake water clarity for 2009 also dropped, compared to 2008 and 2007.

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 concentration of the nutrient phosphorus (TP), the concentration of chlorophyll a (CHL), a plant pigment used to measure of the concentration of algae in lake water, and dissolved oxygen levels in deep areas of the lake during the summer months. The combined information obtained from these critical indicators provide a general picture of the health of individual lakes.

Summary:

Overall, 2009 was a good year for the Range Ponds, in that all three of the ponds were as clear as, or significantly clearer than they have been historically. Considering the fact that so many lakes and ponds in Maine were less clear than their historical averages last year, the Range Ponds did very well! Concentrations of total phosphorus and algae in the three ponds were also generally average, or better, during the summer**. Lake water clarity is highly valued by the public, often ranking first in terms of desirable attributes in user-perception surveys.

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 three Range Ponds in 2009. Their efforts added substantially to the value of the data used to create this report!

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