



## **2007 Range Ponds Water Quality Report**

**Prepared by Scott Williams, Aquatic Biologist**

**Lake & Watershed Resource Management Associates**

The Range Ponds Environmental Association continued to monitor the health of Upper, Middle and Lower Range Ponds in 2007. 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 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 2007 monitoring season was characterized by below average precipitation during the winter, spring and early 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:**

2007 was a slightly above average year for Upper Range Pond. Water clarity averaged 6.5 meters, compared to 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, so the lake was overall slightly clearer than average in 2007, 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 conditions discussed above. It is

likely that Upper Range would have been shown to be even clearer in 2007 if more data for the summer had been available, as it was for Middle and Lower Range Ponds.

The concentration of phosphorus (the nutrient that is responsible for the growth of algae in lakes) averaged 6 parts per billion (ppb) in 2007, compared to 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.

Chlorophyll-a (CHL) is a pigment that is measured to determine the concentration of algae in lake water. The 2007 average concentration measured 2.9 ppb, compared to 4.0 ppb in 2006, 3.5 ppb in 2005, and the historical average of 4.5 ppb. All three of the primary water quality indicators were better than the historical average for Upper Range in 2007.

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, but they were not as low as in August, 2006. A phosphorus sample taken near the bottom of the deepest point in the lake in August measured substantially higher than the concentration near the surface, 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.

Natural water color levels were slightly higher than average in 2007, and pH and total alkalinity were within the normal range of historical values for the lake.

### **Middle Range Pond:**

Middle Range Pond experienced a much better than average year in 2007. In fact, 2007 was the clearest year on record for Middle Range Pond! The lake was much clearer than average in 2007, averaging 7.1 meters for the summer, compared to 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 improved slightly in 2007.

Phosphorus levels were lower than average (good) for 2007, averaging 7 ppb, compared to the historical average of 8 ppb, as well as 8 ppb in 2006, and 9 ppb in 2005. 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 2007, measuring 3.6 ppb, compared to 5.2 ppb in 2006, and the historical average of 4.4 ppb. CHL was considerably lower than in 2006. This suggests that overall biological productivity and algal growth decreased somewhat in 2007, compared to recent years, most probably due to the weather influences mentioned above. 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 low, but not depleted, as has been the case in some previous years. 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 2007.

#### **Lower Range Pond:**

Overall, Lower Range Pond experienced a slightly above average year in 2007. The lake was clearer than average in 2007, averaging 7.0 meters for the monitoring season, compared to 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 nearly as clear as Middle Range in 2007, whereas in 2006, Lower Range was the clearest of the Range Ponds by a substantial margin.

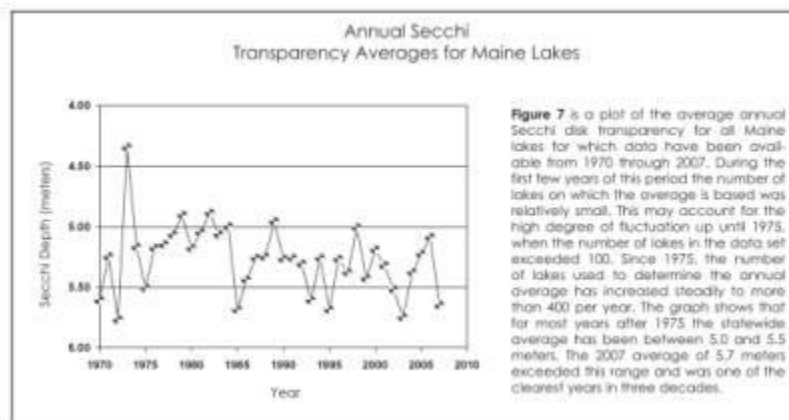
The average total phosphorus concentration in Lower Range Pond last summer was 7 ppb, compared to 8 ppb in 2006, 9 ppb in 2005, 6 ppb in 2004, and the historical average of 8 ppb. A phosphorus sample taken near the bottom of the lake in August (due to very low oxygen levels at that time) measured 15 ppb, possibly suggesting that phosphorus was being released from the sediments at that time. The low oxygen loss, 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 3.6 ppb in 2007, compared to 4.3 ppb in 2006, 4.4 ppb in 2005 and the historical average of 3.6 ppb. The 2007 average represented an improvement over the two previous years, as well as being below the historical average for the lake.

August, 2007 dissolved oxygen levels were critically low in the deepest area of the lake. By August 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. As indicated above, a phosphorus sample taken near the bottom of the deepest point in the lake on August 13 showed elevated concentrations of total phosphorus in the water, compared to a sample taken near the surface.

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 2007.

To put into perspective the significance of the 2007 water clarity findings, consider that out of 404 Maine lakes that were assessed last year, about 62% (including The Range Ponds) were clearer than their historical averages, and about 30 % were less clear than their historical averages. This represents a significant change from 2006, when substantially fewer than half of Maine lakes assessed were clearer than their historical average. The improvement in lakes statewide resulted in a higher overall water clarity average for Maine lakes, increasing to 5.65 meters, the fourth clearest year for Maine lakes since the mid 1970's!



**Percentage of Maine Lakes that were clearer, less clear, and the same as their Historical Average in 2007 (Source:Maine Volunteer Lake Monitoring Program)**

It is likely that the improvement in many Maine lakes last summer was the result of reduced precipitation during the winter, spring and early summer, during which snow and rainfall

amounts were somewhat below average for Maine, even though frequent spring and early summer showers resulted in the perception that precipitation was above average for the period. Spring runoff from melting snow and rain typically carries a high percentage of the annual phosphorus load to lakes from their watersheds.

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 clearer overall during relatively dry years because stormwater runoff from rainfall carries phosphorus and other pollutants from the watershed to the lake.

Comparison of 2007 water clarity of Maine lakes to their long term clarity.



Source: Maine Volunteer Lake Monitoring Program 2007 Annual Report

**Source: Maine Volunteer Lake Monitoring Program 2007 Annual 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. But 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.

This graph shows that a number of similar dramatic 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. 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.

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, 2007 was a 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 likely that the drier than average weather during the first six months of the year had a positive bearing on the quality of the Range Ponds last summer. Stormwater runoff from watershed precipitation is the means by which phosphorus, sediment and other pollutants travel downstream to lakes.

It is important to note that while the Range Ponds were very clear in 2007, 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 the volunteer lake monitors who collected water clarity data for the Range Ponds in 2007. Their efforts added substantially to the value of the data used to create this report!