



2014 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 2014. 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 October, 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.

2014 Weather Influences :

Weather conditions during the 2014 lake monitoring season were less extreme than in 2012, but similar to the spring and early summer of 2013, in that the period was characterized by frequent rain events. Stormwater runoff to lakes from winter snowmelt and rainfall during the spring and early summer period typically contributes a significant percentage of the annual phosphorus load to lakes from their watersheds.

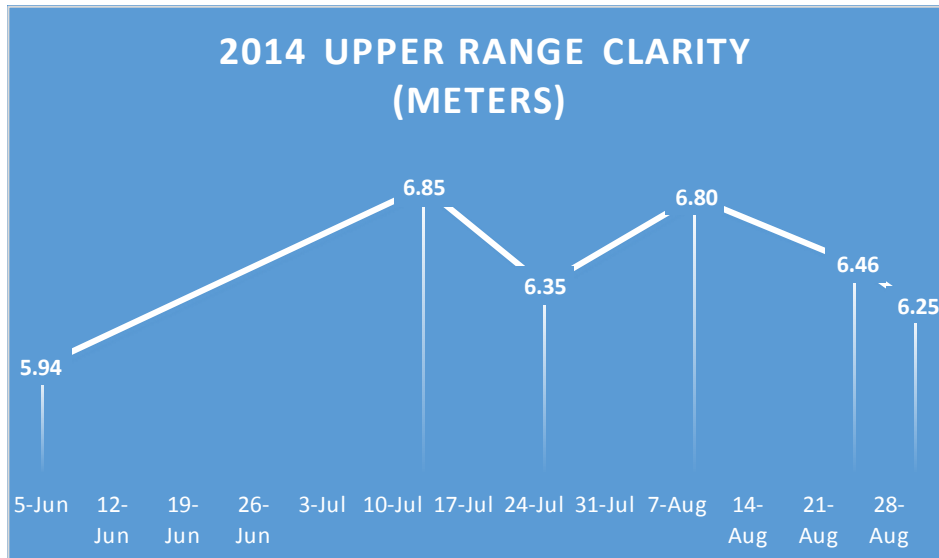
The following is a summary of findings for the three Range Ponds in 2014. Water clarity data are based on readings taken in August 9, 2014, as well as water clarity data provided by certified volunteer lake monitors for each of the Range Ponds. All other summary data were obtained by LWRMA staff in August, at a time consistent with the historical gathering of “baseline” data for the Range Ponds.

Upper Range Pond:

Upper Range Pond was average, to slightly above average in 2014, compared to historical information for the lake. Water clarity was the exact historical average, but a single phosphorus sample taken in August was slightly lower (better) than the average for the lake, and an August

chlorophyll (algae) sample was also lower (better) than the historical average for these critical indicators of lake water quality. The August dissolved oxygen profile showed some oxygen loss in the deepest area of the pond, no worse than conditions documented for previous years.

Water clarity averaged 6.4 meters in 2014, based on a reading from the August sampling, and from readings taken by certified VLMP lake monitor Matthew Brettler in June, July and August. The historical average for the lake is also 6.4 meters (21 feet). Readings taken in 2014 ranged from 5.9-6.9 meters. The following graphic illustrates the changes in water clarity during the period:



The concentration of phosphorus (the nutrient that is responsible for the growth of algae in lakes) measured 6 parts per billion (ppb) in the single sample taken on August 9, 2014. The historical average for Upper Range is 8 ppb. Total phosphorus concentrations in Upper Range Pond have ranged from 5-16 ppb since 1979, when phosphorus samples were first measured on this body of water. It is very important to note that the 2014 “average” was based on only a single sample taken in August. It is quite likely that the concentration of phosphorus in the pond varied during the course of the summer.

Chlorophyll-a (CHL) is a pigment that is measured to determine the concentration of algae in lake water. The August 2014 sample measured 4.1 parts per billion (ppb). The historical average for Upper Range is 4.2 ppb. Annual CHL averages in Upper Range have varied from 2.4 ppb to 9.9 ppb. In many cases, the “average” is based on a single sample taken during the summer, as was the case, in 2014. A single sample taken in late summer often, but not always, represents the period when lakes are most biologically “productive”, and algae concentrations in the water are highest for the monitoring period.

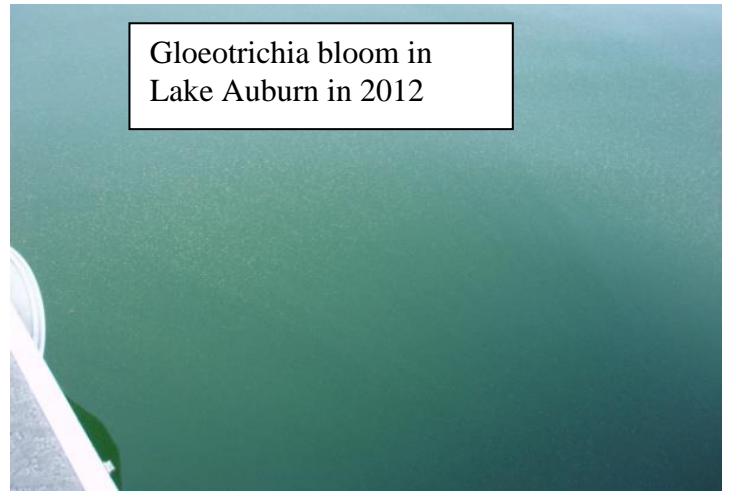
A temperature and dissolved oxygen profile taken on August 9 indicated that Upper Range was strongly thermally stratified, with water temperatures ranging from 25.1C at the surface to 8.9 C at 11 meters depth, approximately one half meter from the bottom of the sample station at the

deepest point in the lake. Dissolved oxygen levels ranged from 8.4 parts per million (ppm) at the surface to a low level of 2.3 ppm at 11 meters depth. Late summer dissolved oxygen loss in Upper Range Pond has been minimal in past years, and conditions encountered in 2014 were somewhat typical for this lake.

Specific Conductance/Conductivity is a measure of the extent to which water is able to pass an electrical current, which is an indication of the concentration of ions in the water. An increase in conductivity over time may correlate with watershed development. A conductivity sample taken in August, 2014 measured 60.5 microsiemens/centimeter. The historical average for Upper Range is 49 ms/cm.

Other water quality indicators that are measured to help support the primary data (pH, Total Alkalinity and Color) were within the normal range of historical values for Upper Range in 2014.

The bluegreen alga/cyanobacteria, (*Gloeotrichia echinulata*) that is a current focus of research in New England Lakes, was not observed in Upper Range on the August 2014 site visit, nor was it detected in Middle Range. Gloeo was observed in Lower Range at a relatively low concentration (0.5 on the VLMP/DEP “Gloeo” scale). “Gloeo” appears to have been on the increase in some Maine lakes in recent years. The implications of this increase are not well understood, however, recent research has suggested that this alga may have the potential to play a role in changing lake water quality. The adjacent photo was taken at the surface of Lake Auburn in 2012 during the peak of a *Gloeotrichia* bloom. Gloeo

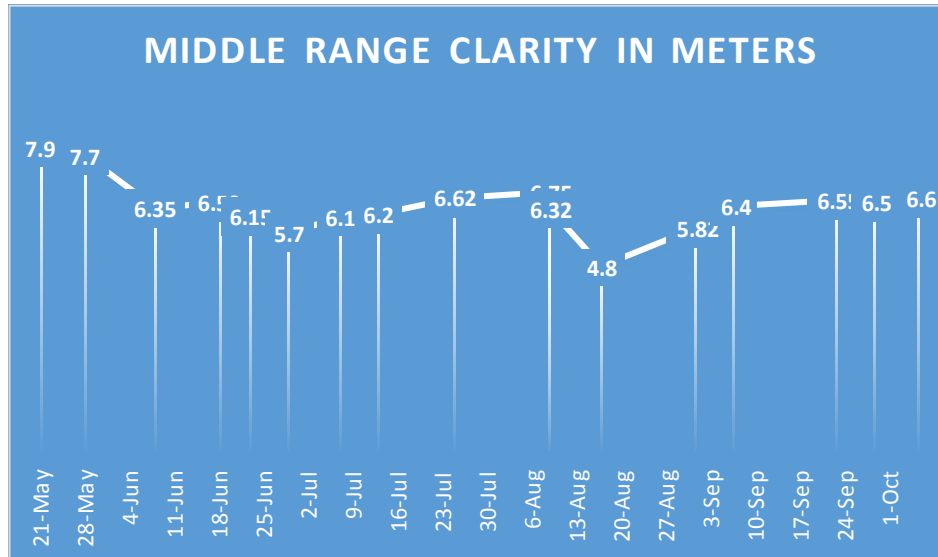


observations took place at the boat launch area and at the deep monitoring station for each of the three lakes.

Middle Range Pond:

The water clarity of Middle Range Pond was once again very clear in 2014, compared to its historical average. The concentration of phosphorus in the water was slightly below the average, as was the concentration of algae in the lake in early August (based on a single sample). Overall, conditions were above average for Middle Range.

The average water clarity in 2014, based on 6 months of data provided by VLMP certified lake monitor, Barry Kutzen (in addition to our August reading) was 6.5 meters (~ 21feet) The historical average for Middle Range is 6.1 meters. Water clarity ranged from an unusually low reading of 4.8 meters on August 17, to a high reading of 7.9 meters on May 21. The following graphic illustrates the changes in water clarity for Range Pond during the 6 month monitoring period:



The phosphorus concentration measured at the deep sampling station in August measured 6 parts per billion (ppb), compared to the historical average for the lake 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 (algae concentration in the pond) was lower than the historical average for the lake, measuring 3.6 ppb in August, compared to the historical average of 4.2 ppb. Based on the clarity of the water, the concentration of phosphorus, and algae in the water, conditions in 2014 were improved, compared to both the most recent two years and the historical average for the lake.

A temperature and dissolved oxygen profile taken on August 9 indicated that Middle Range was strongly stratified, with water temperatures ranging from 25.1 degrees C at the surface to 6.1 C at 19 meters depth, near the bottom of the sample station at the deepest point in the lake. Dissolved oxygen levels ranged from 8.3 ppm at the surface to a low level of 2.6 ppm at 19 meters depth. Late summer oxygen levels in Middle Range are low, but are not yet critically so. Efforts to protect the water quality of Middle Range may help prevent DO levels from declining further in the future.

The concentration of the bluegreen algae, *Gloeotrichia echinulata* (see above) measured 0 on the Maine VLMP/DEP “Gloeo” scale on August 9 at the deep monitoring station. In August, 2012, the concentration recorded was 1.0, and in August, 2013, 0.5. The scale for monitoring *Gloeotrichia* density runs from 0-6.0. Many Maine lakes have experienced late summer *Gloeo* concentrations in the 0.5 range.

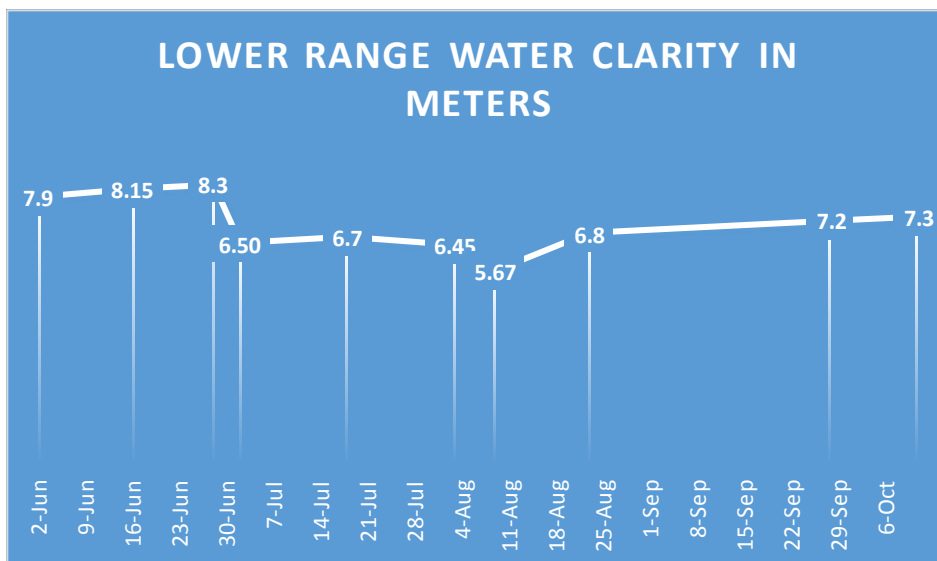
A sample for Specific Conductance (see above) measured 69 ms/cm, compared to the historical average for Middle Range of 50 ms/cm.

Other water quality indicators that are measured to help support the primary data (pH, Total Alkalinity and Color) were within the normal range of historical values for Middle Range Pond in 2014.

Lower Range Pond:

Overall, Lower Range Pond experienced another above average year in 2014, in that the lake was clearer than its historical water clarity average, the concentration of phosphorus was slightly lower (better) than the average for Lower Range, and the baseline chlorophyll (algae) concentration in August was also below the historical average, based on a single sample taken on August 9.

The lake was clearer than average in 2014, averaging 7.1 meters (~23 feet), compared to 7.5 meters in 2013 and 6.8 meters (~22 feet) in 2012. The 2014 average was based on our August reading, plus 5 months of readings by Maine VLMP certified lake monitors John and Poppy Connor Crouch. The historical average for Lower Range is 6.9 meters, which has recently increased slightly as a result of several very clear years for the lake. Water clarity readings in 2014 ranged from a low reading of 5.7 meters on August 9 to a high reading of 8.3 meters on June 30 (~27 feet) on May 28. The low reading coincided with the time that an unusually low reading was recorded on Middle Range Pond in August. The graphic below illustrates the changes in Secchi disk transparency during the course of the 2014 monitoring season. Readings are in meters.



The total phosphorus concentration in Lower Range Pond last summer, based on the single August sample, was 5 ppb, compared to 6 ppb in 2013, 8 ppb in 2012, and the historical average of 7 ppb. Phosphorus levels have ranged from 6- 15 ppb in Lower Range since 1981. The very high 15 ppb sample was taken in 1981, and none of the samples taken since have approached this level.

Chlorophyll-a (measuring algal growth in the water) measured 3.6 parts per billion in August, 2014, compared to 3.7 ppb in 2013, 5.1 ppb in August 2012, and the historical average of 3.7 ppb. CHL levels in Lower Range have ranged from 2.9-6.5 ppb, the highest reading having been measured in 1993. The 2014 reading/concentration was consistent with the excellent water clarity and relatively low concentration of total phosphorus in 2014.

A temperature and dissolved oxygen profile taken on August 3 indicated that Lower Range was strongly stratified, with water temperatures ranging from 25.5 degrees C at the surface to 8.0 degrees C at 14 meters depth, near the bottom of the sample station at the deepest point in the lake. Dissolved oxygen levels ranged from 8.3 ppm at the surface to a low level of 0.0 ppm, beginning at 12 meters, and extending to the bottom at 14.5 meters depth. Late summer dissolved oxygen levels in Lower Range have been consistently depleted in the deepest area of the lake. A second phosphorus sample taken near the bottom of the deepest point in the pond measured 10 ppb – twice the concentration near the surface. This may suggest that oxygen depletion is causing phosphorus to be released from the bottom sediments, a phenomenon that has the potential to negatively impact the overall health of the lake over time. Aggressive measures to protect water quality through the identification and mitigation of sources of phosphorus in the watershed may help to stabilize or improve late summer DO loss in Lower Range.

Low density colonies of *Gloeotrichia echinulate* were observed in the water column on August 9. Many Maine lakes experience low density “Gloeo” growth in the late summer/early fall.

A sample taken to measure Specific Conductance (see above) measured 64 microsiemens/centimeter, compared to the historical average of 56 ms/cm for Lower Range.

Additional supporting indicators of water quality were within the normal range of the historical data for Lower Range Pond in 2014

It is important to note that our baseline sampling of the lake in 2014 was limited to the month of August, whereas much of the historical data for the three Range Ponds is based on both mid and late summer sampling. This change in the sampling schedule may have influenced the 2014 averages for some of the indicators that were monitored, relative to historical levels for some indicators. However, volunteer lake monitors on the three lakes provided additional substantial water clarity (Secchi transparency) readings for the full summer monitoring season. It is important to keep the change in sampling frequency in mind when considering these results.

The Range Ponds Association has been a steadfast steward for the three Range Ponds and their watersheds for several decades. In addition to supporting comprehensive annual water quality monitoring of the ponds, the association has conducted surveys of the watersheds to identify and remediate soil erosion problems, and has produced a Watershed Management Plan to provide landowners, community planners and others with guidance for the long-term protection of the Range Ponds.

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