Investigation on the Eutrophication status of the Silver Lake

English Summary
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Summary

Since years, the residents in the Silver Lake area have noticed the increase of aquatic plants in the lake, which is the evident sign of premature aging of the lake. The investigation on the eutrophic status of the lake was investigated by the Éco-Guide Environnement. Water samples in lake were collected in 30 June 2003 and analyzed for parameters such as dissolved oxygen, pH, temperature, chlorophylle-a and total phosphorous etc. Based on the Carlson eutrophication index of 41, the Silver Lake is in the transition stage from oligotrophic to eutrophic. Some suggestions were made to prevent the eutrophication of the lake for a long run.

1. Results and discussions

Oxygen and Temperature

Oxygen level is an important parameter for lake water quality. Like other lakes the Silver Lake is thermally stratified into three layers, epilimnion, thermocline and hypolimnion. In summer 2003 (June 2003), water temperature ranged from about 4 °C at the bed (15m) to about 24 °C at the surface. Oxygen is partially depleted in hypolimnion (bottom layer), demonstrating a high biochemical oxygen demand (BOD) in the sediments. This situation can become worse in August when the dissolved oxygen level decreases due to the higher BOD in the sediment than in June.

The impact of oxygen depletion in the hypolimion on cool water fish will be the mortality of fish due to various diseases or to the lack of oxygen. The depletion of oxygen in the water and sediment interface will promote the release of phosphorous and hydrogen sulfide from the sediments. This will cause the proliferation of algae and other aquatic plants, making the water inappropriate for consumption and smelly.

Low water quality can also cause many socio-economic problems, such as the lost of fish, the vacationers may not be able to use the lake for recreational purpose, and the property values around the lake will decrease.

pH

A lake becomes acid when its pH reaches 5.5. For a transitional lake, its pH varies between 5.5 and 6.0. An appropriate pH is critical for organism survival.
The pH of surface water in the lake during June 2003 is 8.5, which is quite high and may be due to the increase in the photosynthetic activities of aquatic plants and/or phytoplankton (algae) of the lake.

Impact on the organisms at depth

Due to lack of oxygen, it is predicted that the amount of benthic fauna and flora will decrease; the result of this is that the sedimentation rate will be higher than that of decomposition. The result is the depth of the lake will decrease more and more rapidly in the following years due to the rapid accumulation of sediments that are not completely decomposed.

Chlorophylle-a, total phosphorous and water transparency

Eutrophication index is a parameter designed to evaluate the significance of eutrophication of a lake. It can be used to quantify the change of the lake after the implementation of some practical protection measures. This index used in this study is the one developed by Robert Carlson in 1977, which is especially used for lakes situated in northern hemisphere.

The average Carlson eutrophication index (the average of three parameters - total phosphorous (53), chlorophylle-a (36) and transparence (34)) for Silver Lake is 41, which falls into the category of mesotrophic. It means that the lake is in a transitional stage from oligotrophic to eutrophic. However, if we take other water quality indicators such as dissolved oxygen in hypolimnion during summer season, certain types of aquatic plants and their volumes in certain bays, this lake should be characterized as advanced mesotrophic. If we use total phosphorous (the highest among the three parameters) as the indicator of eutrophication, the Silver Lake should be classified as eutrophic.

2. Recommendations

In terms of lake management, in the long term, the corrective management scheme will be reduced by the continuous input of silt, organic matter and nutrients- this input is the product of the entire watershed. Hence, a restoration scheme must start at the scale of the watershed in order to improve the situation in the lake. The following measures are recommended in order to maintain or improve the water quality in the lake.

1. Analyses of fecal Coli-form to assure the beach is safe all the time and try to determine if certain tributaries are important sources of coliforms. It is strongly recommended not use lake water as the source of drinking water without appropriate treatment.
2. Inspection of septic tanks at residential and municipal levels around the lake,
3. Independent verification of conformity of septic tank installation,
4. Lake bank protection, ensuring that the riparian vegetation is left intact everywhere (minimum of 10 m)
5. Ecological landscape installation (trees, shrubs and herbaceous plants) for septic tank installation,
6. Eliminate fertilizers around the lake,
7. Using vegetation for low-supporting walls,

8. Destroy the dams created by beavers, and
9. Tributary restoration.

3. Conclusion

This study shows that the Silver Lake has reached an alarming stage in its ageing level. However it is still possible to improve the water quality in the lake by eliminating the potential sources of pollution. The suggestions for reducing the sources of pollution include better management in septic tank installation, protection the bank erosion, elimination of fertilizer application in the catchment basin.

The lake managers should be patient because the apparent results can take years to show. For this reason it is suggested to continue the follow-up programme to ensure that the lake is under good observation and thus to direct you well through this process.