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Culver Lake 2006 Status Report – Executive Summary

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This Summary Status Report presents and discusses data collected during 2006 and compares it to data from previous years to identify trends. The data analysis is in a PowerPoint file, with numbered slides corresponding to each of the summary sections below. Observations are also noted directly on the slides to make pointing out specific aspects easy.

Physical Stratification Structure (Slides 1,2,3)

Temperature and Relative Thermal Resistance to Mixing (RTRM) quantifies thermal stratification in Culver Lake. The highest RTRM values identify the thermocline. The lake exhibited strong thermal stratification by early June. A very steep temperature/RTRM gradient persisted at 4-6 meters, with low RTRM values between 7-11 m deep (a result of layer aeration of that depth range). A weaker thermocline was again identified 11-13m. That tends to isolate the deepest strata.

Dissolved oxygen persisted throughout the water column until early August. 2006 was a hot/calm summer, one of the warmest in many years. Several extended heat waves were experienced. As a result of summer weather and downtime for one of the layer aerators, dissolved oxygen was consumed more rapidly than during recent years. A moderate degree of anoxia developed below 11m in August, ascending to approximately 10 m deep. Adequate temperature and dissolved oxygen concentration was observed at the epilimnetic-metalimnetic interface for suitable zooplankton refuge and cool water fish habitat (however a “stressed condition” was observed in August – Slide 12). The summer of 2006 was “hot, dry, and calm.” Many lakes exhibited strong stratification and higher than normal oxygen demand and bluegreen algae blooms in 2006.

Summer stratification extended well into September at Culver Lake during 2006. The lake did not completely circulate (“turnover”) until October. 2004. An abrupt die off of bluegreen algae resulted in a late Fall algal scum that collected in near-shore areas, and was more intense than during 2005.

Water Clarity – Transparency (Slides 4, 5)

Secchi disk transparency measures how deep into the lake you can view an 8-inch diameter disk. It is a simple measure of water clarity (aesthetic quality) as well as an important lake parameter. Secchi disk transparency approximates the depth to which rooted vegetation could establish and become a nuisance. Approximately 2-2.5 times the

Secchi disk transparency estimates the depth to which adequate light penetrates for plants (including algae) to produce oxygen via photosynthesis in excess of their respiration needs (boundary of “net photosynthetic oxygen production, “compensation depth”). Transparency was approximately 7-8 ft during the Spring phytoplankton maximum (diatoms and bluegreens) and increased to over 10 ft during the May-June “clear water phase”. Transparency remained between 7-8 ft through the summer, but declined during Fall overturn (called “purging” locally), and the dying algae caused significant floating scum in some locations around the perimeter in October. Overall, transparency was quite good, and met the goals established a number of years ago.

Phytoplankton (Slides 6, 7, and 8)

Although transparency was good and algae densities were not as high as during past years, the phytoplankton community continues to be dominated by Cyanobacteria (bluegreen algae). When the phytoplankton population “crashed” at the end of an extended summer season, an algal scum developed. Surface water dissolved oxygen was consistently near 100%, indicating no intense bloom condition. Although bluegreen genera continue to be dominant, the number of genera appears to have increased (higher diversity, generally a “good thing”).

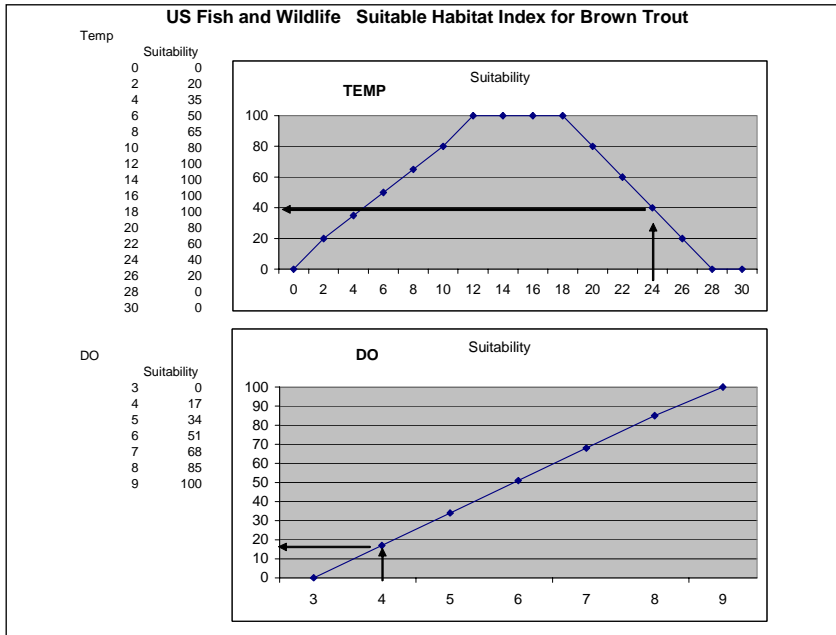
Zooplankton (Slides 9, 10, 11)

The population of large-bodied Cladocera (the most efficient herbivores) was very healthy during 2004 and 2005 (that contributed to the improved water clarity). The long-term data suggests that the zooplankton has “recovered” from the years when large-bodied Cladocera were essentially “locally extinct”. Large-bodied cladocera were abundant during early summer, but declined later in the year. It is very important to track the persistence of large-bodied zooplankton. It is also desirable to keep track of the alewife population and predator-prey interactions. We suggest initiating a simple annual gill net census using only small mesh size to monitor the relative abundance and age-class distribution of the alewife population. That could be implemented cost-effectively by several Normanoch volunteers.

Large-bodied Cladocera (which are desirable herbivorous zooplankton) have increased and have become more persistent at Culver Lake since 1999.

Fish Habitat (Slide 12)

A habitat assessment approach was developed several years ago for Culver Lake, in order



to track habitat suitability for cold water fish (and also habitat for zooplankton refuge). The “Habitat Factor” essentially computes the “percent of optimum” for habitat conditions (temperature and oxygen) using brown trout as an indicator organism (USFWS HSI criteria).

Cool water habitat was relatively good during most of 2006, but a relatively “severe stress condition” was observed for approximately 3 weeks in early August (until the surface layer decreased to below 25 degrees C).

ECS, Inc. is currently doing research and development on a new aerator technology which may be very beneficial for maintaining habitat (and further reducing bluegreen algae abundance) at Culver Lake.

Total phosphorus (TP) was relatively low in the surface and mid-depth aerated layer during 2005. TP did accumulate in the deepest waters. Increases in the concentration of ammonia-N, iron, and manganese concentrations were only observed in the deepest water samples. Deep accumulation during summer stratification had very little influence on surface TP when the lake circulated in the Fall (perhaps due to re-precipitation with iron which reached 2.5 mg/L in the deep strata).

Surface water TP concentrations have decreased to nearly half those observed during the early 1990’s, and have been more stable at 10-15 ppb for the past 5 years.

Water Chemistry and Nutrient Levels (Slides 13-17)

Total phosphorus concentrations have remained relatively low, especially in the surface and aerated mid-depth layer. Nutrient concentrations have decreased over the

years, and (perhaps more importantly) concentrations have been more consistent, less variable, during the year.

Summary:

Culver Lake exhibited good water quality conditions during 2006. Secchi disk transparency usually exceeded 7ft and often reached 10 ft. Large-bodied Cladocera were observed at significant abundance and were observed during all samplings. Diatoms were less abundant and bluegreens were more dominant.

Surface water total phosphorus was relatively low and deep accumulations did not have a major impact on surface water TP at overturn.

Culver Lake continues to exhibit more stable water quality conditions. Bluegreen algae will not disappear – but blooms should be less frequent and less severe. Lake management needs to continue and other aspects need to become a focus. For example, as clarity improves, more light reaches the bottom in deeper areas and rooted aquatic macrophytes (a.k.a. “weeds”) will become more abundant. This is actually “good for the lake ecosystem.” However, the nuisance that the “weeds” pose to lake users needs to be managed in the areas where the “nuisance” exists (not all “weeds” should be eliminated).

Ongoing management efforts should focus on:

- Maintaining improvements in resource quality (not losing ground, not creating a “perturbation” via another activity).
- Continuing to implement macrophyte management strategies that alleviate the nuisance condition caused by dense weeds in certain areas, while avoiding potential impacts.
- Further improvements in sustaining cool water habitat through the “critical period” July 15 – September 1.

During 2007 we recommend:

Conducting a winter sampling (depending on the continuation of “unusual winter weather” we have experienced so far).

Initiating a routine annual selective gill net alewife census by volunteers.

Continuation of operation and monitoring programs.

Sincerely,

Robert (Bob) Kortmann, Ph.D.



(Data figures attached)