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To: Big Kandiyohi Lake Association
Attn: Jerry Brustuen

From: Tom Langer, Wenck Associates, Inc.
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Date: November 16, 2018

Subject: Big Kandiyohi Lake Carp Assessment

Wenck Associates was contracted by the Big Kandiyohi Lake Association to perform a common carp (*Cyprinus carpio)* population assessment on Big Kandiyohi on 9/28/2018. This is the first common carp population assessment conducted on Big Kandiyohi. The 9/28/2018 survey effort was intended to better inform lake managers of the abundance and density of carp within the system. The timing of the survey was later than typical summer time assessments, as the water temperatures had cooled form summer highs back into the mid-50s. Cooling waters change the behavior of fish and may impact the catchability of certain species of fish. However, the common carp catch rate may not have been significantly impacted by the cooler temperatures as carp were sampled and observed at all three of the shoreline transects during the 9/28/2018 assessment. This technical memo summarizes the methods and results of the 9/28/2018 assessment and provides management recommendations.

Methods

Biologists and scientists from Wenck Associates conducted a common carp population assessment on Big Kandiyohi using standard research methods described in (Bajer and Sorensen 2012). Boat electrofishing was implemented to sample three shoreline transects for approximately 20 minutes each under MnDNR permit (#24213) approval (Figure 1).

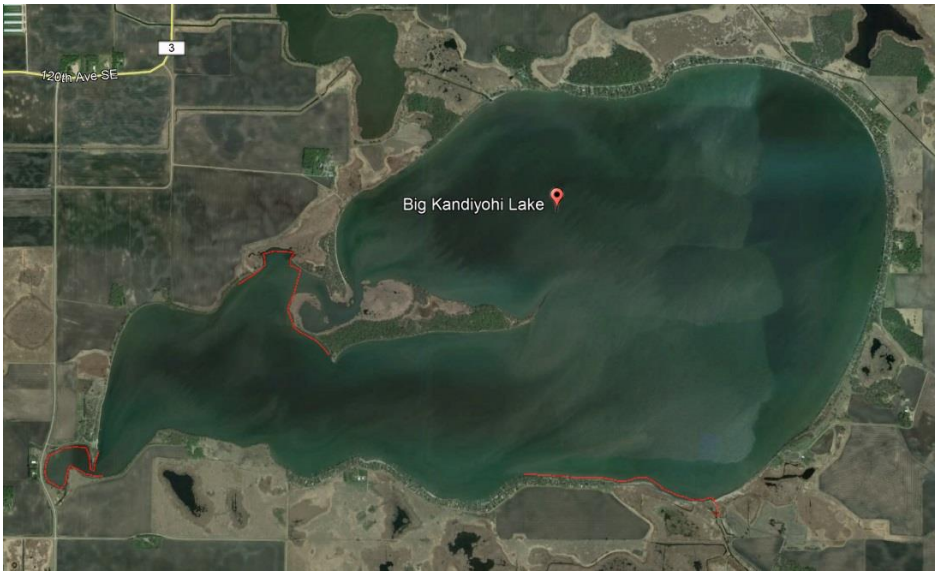

Figure 1: Sampling transects (red lines) from the 9/28/2018 carp assessment.

All common carp were netted (some carp are inevitability missed), counted and measured for total length (weight was extrapolated from length using a regression model) prior to being released. This information, along with the amount of time spent electrofishing, were used in linear regression models developed by (Bajer and Sorensen 2012) to estimate the current population size and density within Big Kandiyohi Lake.

Results

A total of 31 common carp were captured during the 9/28/2018 assessment. The average total length was 71.7 cm (28.2 inches) and weight was 5.41 kg (11.9 pounds). Carp were captured in all three transect. Using results of this assessment and the regression equation described above, it is estimated that the lake has a common carp density of ~149 carp/ha (~60 carp/acre) and a biomass density of 806 kg/ha (718 lbs/acre). Extrapolating this density across the entire basin suggests that there are ~162,000 individual carp within the lake. Using this population estimate and the average weight of the fish capture suggests that there are currently ~2,000,000 pounds of carp in Big Kandiyohi Lake. Table 1 provides a summary of the 9/28/2018 common carp survey results for the main-lake.

Table 1: Summary of Big Kandiyohi 9/28/2018 common carp assessment.

Lake	Carp Collected	Shock Time (hour)	Average Length (cm)	Average Weight (kg)	Biomass Mean (kg/ha)	Estimated Population Size
Big Kandiyohi	31	1.0	71.7	5.4	**806**	**161,834**

Big Kandiyohi is a very large lake with a large open area with shorelines exposed to high wave energy and residential development. These areas are typically never completely void of carp, but it is likely that carp densities are not as high as other areas of the lake. Therefore, in order to provide a more conservative estimate, we re-ran the model under a hypothetical scenario assuming that we electrofished three additional transects (increasing our sampling time to 2.0 hours) and did not capture any additional carp. Using this population estimate and the average weight of the fish captured suggests that ~1,000,000 pounds of carp currently exist in Big Kandiyohi Lake (Table 2).

Table 2: Summary of hypothetical scenario on Big Kandiyohi.

Lake	Carp Collected	Shock Time (hour)	Average Length (cm)	Average Weight (kg)	Biomass Mean (kg/ha)	Estimated Population Size
Big Kandiyohi	31	**2.0**	71.7	5.4	**411**	**82,567**

Discussion

Common carp (*Cyprinus carpio)* are among the most widespread aquatic invasive species in North America. Common Carp can rapidly colonize a waterbody and significantly alter habitat, water quality conditions and nutrient dynamics within a lake. High densities of common carp can have specific impacts within a system, including reduced vegetation

coverage, lower water fowl populations and increased water turbidity. Research suggests that these impacts begin to occur at densities of ~100 kg of carp biomass/hectare (89 lbs/acre) (Bajer *et al.* 2009). Populations observed at or above this density threshold would benefit from population reductions below 100 kg/ha as a strategy to improve water quality and restore a healthy functioning ecosystem.

Results of the 9/28/2018 common carp assessments indicate that Big Kandiyohi currently has carp biomass densities more than eight times (4x in hypothetical scenario) the impairment threshold. These results suggest common carp are a contributing factor to water quality impairments and habitat degradation within Big Kandiyohi Lake. To achieve density levels right at the 100 kg/ha threshold would require the removal of ~141,753 carp or ~766,433 kg (1,690,000 lbs); (hypothetical scenario would be approximately half these values) of carp from the system. We recommend establishing removal goals below the 100 kg/ha threshold to account for potential growth of individuals that are removed from the system.

Recommendations

- It is our understanding that a fish barrier will be installed at the outlet of the lake in the fall of 2018 and a fish barrier was recently installed at the major inlet ditch/channel on the north side of the lake. These barriers should limit movement of carp into and out of the system. Once barriers are in place it is our recommendation to begin carp removals and periodically update population assessments.

- Once removal efforts begin, we recommend conducting carp population assessments each summer after large scale commercial removals. Assessments will provide updated density models and removal goals.

- An additional management consideration should be implanting carp with radio tags and periodic telemetry tracking. Implanting carp with radio tags can assist with understanding timing, movement and habitat preference of carp, but more importantly, it can greatly increase capture and removal efficiency of carp from the lake.

- Carp aging and recruitment dynamic assessments can provide great insight to how to manage carp. With the new barriers that are being constructed, it is assumed carp immigration and emigration will be stopped and therefore, what aging and recruitment dynamics learned from these assessments is not needed to guide the next management steps. Aging and recruitment assessments can be discussed but are not critical at this stage in management of carp on Big Kandiyohi Lake.

References

Bajer, P.G, G. Sullivan, and P.W. Sorensen. 2009. Effects of a rapidly increasing population of common carp on vegetative cover and waterfowl in a recently restored Midwestern shallow lake. Hydrobiologia 632: 235-245.

Bajer, P.G. and P.W. Sorensen. 2012. Using Boat Electrofishing to Estimate the Abundance of Invasive Common Carp in Small Midwestern Lakes. North American Journal of Fisheries Management 32: 817-822.

Photos

Photo 1: Common carp.

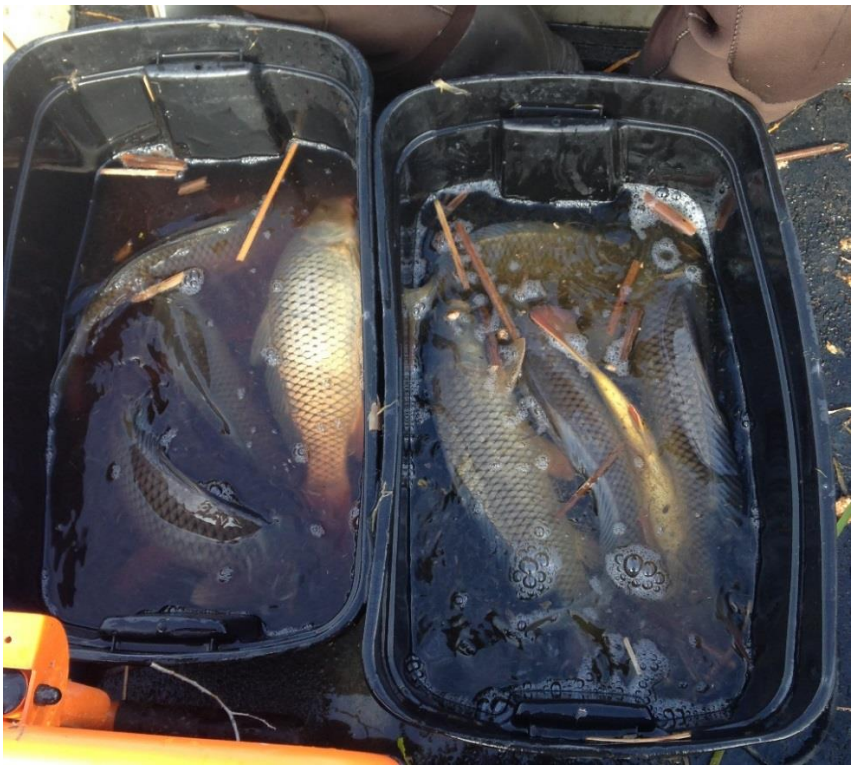

Photo 2: Holding tanks filled with common carp during the assessment.