**Preliminary 2024 Hess Lake Carp Management Report**
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Prepared for: Progressive AE
Attn.: Tony Groves

Prepared by:
Carp Solutions LLC
www.CarpSolutionsMN.com

## Background

In the summer of 2022, Carp Solutions conducted a pilot project to assess the carp population and test baited box nets as a removal technique in Hess Lake. Three boat electrofishing surveys were conducted that yielded 129 individuals, as well as two recaptured carp. A total of 127 carp were tagged with Passive Integrated Transponder (PIT) tags, fin-clipped, and released. The high catch rates from boat electrofishing surveys produced a population estimate of 32,480 carp and a biomass density estimate of 253 kg/ha. Later in the season, three box nets were installed in the lake to capture carp with two separate pulls in August and September. The box netting removals resulted in 396 carp being collected and removed from the lake. One of these carp had been tagged with a PIT tag earlier in the summer.

During the fall of 2023, boat electrofishing was used to collect 50 carp for aging and 20 carp to implant with radio tags to track their movements during the winter of 2023 - 2024. The ages of the 50 carp captured for aging ranged from 10 - 29 years, with an average of 23.2 years, and 64% were 24 or 25 years old (i.e., born in 1998 - 1999). Two outings were conducted to track the locations of radio-tagged carp, one in late fall of 2023 and another in early spring 2024. In the fall of 2023, all 20 radio-tagged carp were located and there was no apparent aggregation of carp. All but two of the carp were in shallow areas near the shoreline. In the spring of 2024, all 20 carp were precisely located again. In contrast to the fall survey, an aggregation of 11 radio-tagged carp was located in the southeast area of the lake off of the mouth of Wheeler Drain.

## Management Efforts in 2024

In 2024, four box nets were installed in Hess Lake (Fig. 1) and three rounds of baiting and removal were conducted (Table 1). During each round, nets were baited with cracked corn in mesh bags placed in the center of each net inside PIT antennas that monitored the presence of pit-tagged carp. The bait bags were checked each day and more corn was added as needed. Nets were tripped (i.e., sides pulled up) at night and the carp were removed, anesthetized, euthanized, counted, measured, weighed, and

disposed of the following day. In addition, one boat electrofishing survey and one radio tag survey were conducted before Round 3 removals.


Figure 1. Map of Hess Lake showing the locations of the four box nets.

Overall, 752 carp were captured in the box nets, including 12 tagged individuals (Table 1). The mean length was 579 mm (22.8 inches) (Fig. 2). The mean weight was 2.57 kg (5.7 lbs) (Fig. 3). During each round of box netting, bait consumption was high (50 - 100 lbs of corn per net per day), but we suspect that channel catfish might have accounted for most of it as over 1,000 catfish were captured in each round (the majority of them were juveniles approximately 6 - 10 inches in length) (Table 1). We routinely found catfish with extended abdomens, presumably full of bait, inside our bait bags.

Table 1. Summary of common carp removal and assessment in 2024

| Round | Date | Method | Carp Captured | Tagged Carp Recaptured | Catfish Captured |
|---|---|---|---|---|---|
| 1 | 7/16/24 | Box net | 399 | 7 | 1,054 |
| 2 | 7/30/24 | Box Net | 244 | 4 | 1,940 |
| 3 | 8/13/24 | Box net | 99 | 0 | 1,937 |
| | 8/9/24 | Electrofishing | 10 | 1 | *NA* |
| | Total | | 752 | 12 | 4,931 |

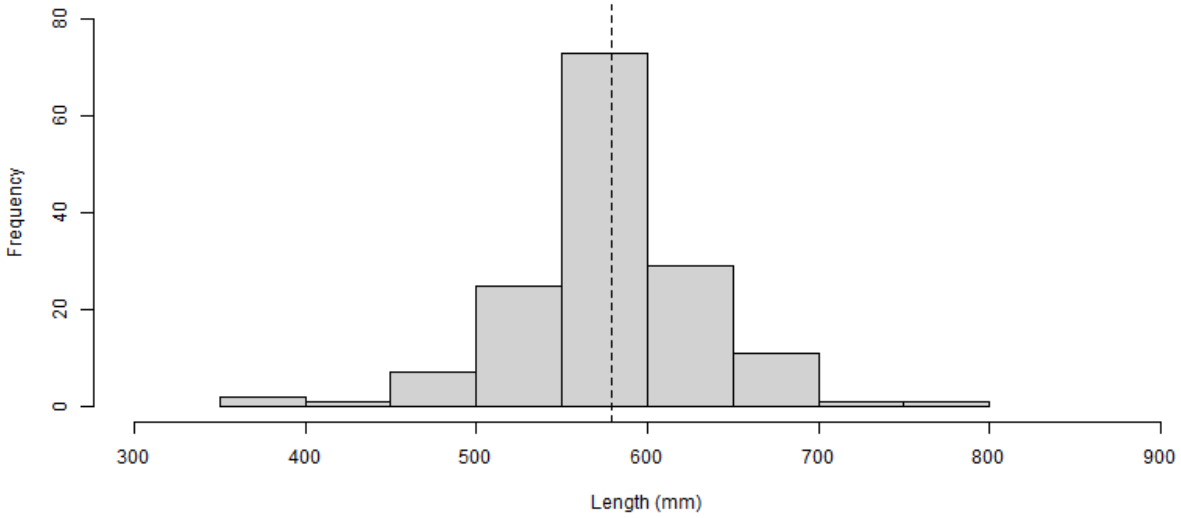


Figure 2. Histogram of the lengths of carp captured in Hess Lake in 2024. The vertical dashed line indicates the mean length (579 mm).

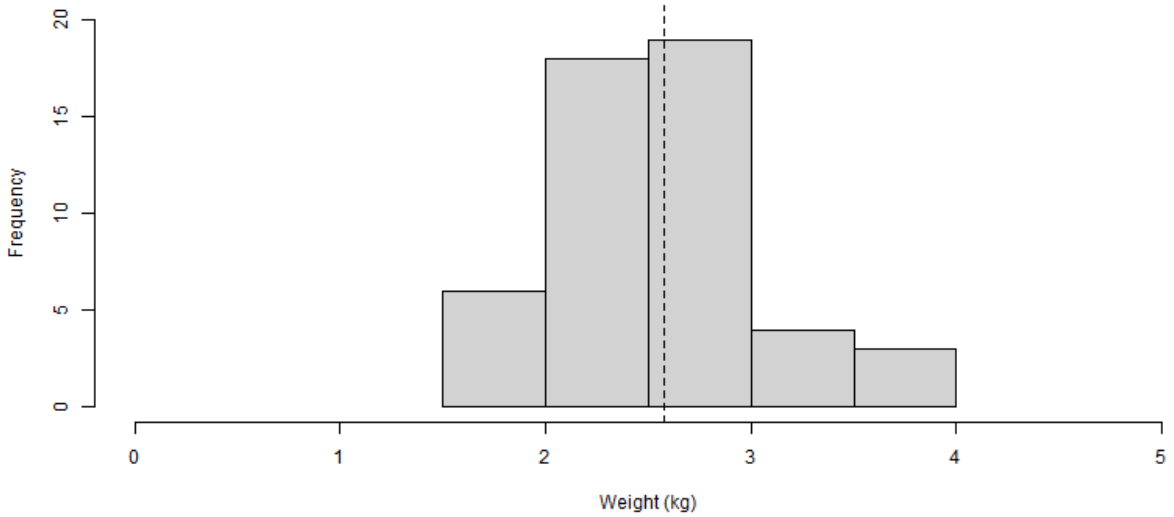


Figure 3. Histogram of the weights of carp captured in Hess Lake in 2024. The vertical dashed line indicates the mean weight (2.57 kg).

On August 9, 2024, before removals were conducted in Round 3, a boat electrofishing survey was conducted which involved three transects, each about 28 minutes in length with a total shock time of 86.2 minutes. The three transects were enough to cover the entire shoreline of the lake. A total of 10 carp were captured, including one pit-tagged individual. With such a small sample size, a population estimate would not be reliable, but this catch rate is much lower than that of the electrofishing surveys in 2022.

On August 11, 2024, a quick, informal, radio-tracking survey was conducted. The goal was to determine if radio-tagged carp were still in the lake and not to locate all tags precisely. Six sites were selected around the lake where tags were listened for. Thirteen of the 20 tagged carp were heard at least once. Four of those tags were heard in the direction of Brooks Lake so another quick radio-tracking survey was conducted in that lake to determine if radio-tagged carp had traveled there, but no radio tags were detected in Brooks Lake.

**Abundance and Biomass Estimates Using Mark and Recapture**

Combined data from 2022 and 2024 allow for revised carp abundance and biomass estimates using mark and recapture methodology, which is generally more robust than boat electrofishing. In this analysis, the overall number of carp tagged and released in 2022 (M = 127), the overall number of carp captured and examined for marks in 2022 and 2024 (C = 396 + 752 = 1,148) and the overall number of tagged carp recaptured in 2022 and 2024 (R = 1 + 12 = 13) are used to calculate the carp population using the following formula:

$$N = \frac{(M+1)(C+1)}{(R+1)} - 1$$

Mark and recapture analysis suggests that at the time of tagging, Hess Lake was inhabited by approximately 10,504 carp, of which we removed 1,138 (the ten collected with boat electrofishing in 2024 were released). This suggests that the post-removal carp population is approximately 9,367 carp.

Given the mean weight of the carp (2.57 kg) and the surface area of the lake (305 ha), the post-removal (i.e., current) carp biomass in the lake is estimated at 78.9 kg/ha. This estimate is below the management threshold of 100 kg/ha and much less than our initial estimates generated via boat electrofishing in 2022 (population of 32,480 carp and biomass of 253 kg/ha).

In our experience, it is uncommon for the two methods (boat electrofishing vs mark and recapture) to generate such different results. Mark and recapture analyses are generally considered more robust and accurate, especially if conducted using two different gear types (e.g., marking with boat electrofishing and recapturing with baited box nets). Therefore, we expect the mark and recapture estimate to represent the carp population in Hess Lake more accurately than the initial boat electrofishing surveys. Furthermore, carp catches in all box net attempts were relatively uniform and modest (approximately 100 - 300 per round), which is typical for lakes with moderate carp biomass (< 100 kg/ha). For example, in nearby Lake Allegan, MI, where identical baited box nets were used, carp catches were approximately 600 per net when their biomass was high (450 kg/ha) but dropped to approximately 30 per net when the biomass declined to 90 kg/ha. We have observed similar results in other lakes as well. As carp densities decline, they are less interested in the bait as more other food resources are available in the lake.

Had there been much larger numbers of carp feeding at the bait (as suggested by high bait consumption), it is unlikely that we would have missed them during each of the five rounds of removal (two rounds in 2022 and three rounds in 2024). Furthermore, data from the PIT antennas used in Hess Lake suggested that only a handful of tagged carp visited baited sites during each round of removal (Fig. 4). A total of 11 unique tags visited the nets in 2024. Seven unique tags visited the nets in Round 1, four in Round 2, and two in Round 3. This aligns with the numbers of tagged carp we caught in the nets, showing that relatively few carp aggregated at the bait. Catfish likely drove most of the bait consumption.

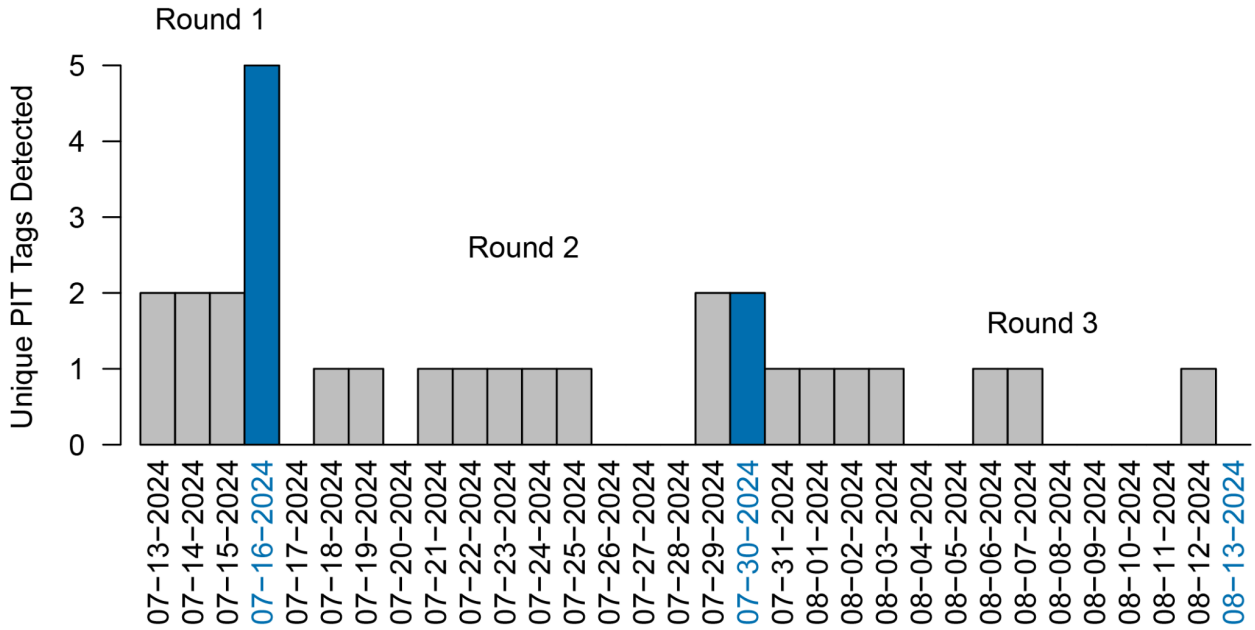


Figure 4. Number of unique PIT tags detected in the box nets each day. The dates when the carp were removed from box nets are in blue.

## Management Recommendations

Carp biomass is below the management threshold, so the impact of carp on water quality and aquatic habitat may be minimal. Given the age structure of the carp population, it appears that carp are unable to produce viable offspring most years. A single adult female can produce hundreds of thousands of eggs in a single spring, so it will be important to keep track of the population size through time as it could increase quickly. The PIT tags implanted in 2022 should last indefinitely and can be used for such estimates in years to come. Hess Lake is not isolated, so it may be beneficial to investigate migration pathways and the feasibility of barriers to migration, especially during the spring spawning season. If the location of spawning grounds can be located, barriers and/or targeted removals could help keep the carp population small. The high numbers of channel catfish caught are concerning, and they may be causing a larger problem in the lake than carp. At the very least, a study of the catfish population in Hess Lake may be beneficial.