2020 Normandale Lake Report

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Summary

This report summarizes the carp management work completed in Normandale Lake by Carp Solutions for Nine Mile Creek Watershed District (NMCWD) in 2020. In order to create a long-term carp management plan in Normandale Lake, an ageing analysis was to be conducted to determine the recruitment frequency. This analysis began in April/ May of 2020 with the collection of carp through boat electrofishing. During these electrofishing surveys in the spring, thousands of juvenile (~100mm) carp were observed. Due to the size of recruitment in 2019, it was determined that the use of regular box-net traps would not be feasible. Therefore, the carp removal and refined population estimate using mark-recapture method via baited box-net traps were postponed until further net design could be established. In order to test one such net design, box nets with reduced mesh size were ordered, and box netting commenced in late August. Box netting was conducted without the marking of fish via electrofishing due to the netting getting pushed into the fall. In total 5,037 mostly small (~300 mm) carp were captured by box netting in the fall of 2020. A trap netting survey to examine the native fish population was carried out in late September. It found large numbers but a small average size of many native fish, especially bluegill. A post box net removal electrofishing survey was conducted in mid-October, resulting in a carp population estimate of 6,702 and a biomass density estimate of 220 kg/ha. However, this estimate likely underrepresents the actual abundance and biomass of carp in the lake.

Spring Electrofishing to Collect Carp for Ageing Analyses

Two electrofishing surveys were completed on April 23 and May 1, 2020. The areas of the lake covered in these surveys were not selected randomly, but were selected to maximize catch to collect enough carp for ageing analyses. During these surveys thousands of small (80-150 mm) carp were seen. These juvenile carp were all assumed to be recruits from the spring of 2019,

and to verify that, a sample of 10 of those fish were taken for ageing. In addition, 54 adult carp (all carp we captured) were collected for ageing analysis. The length and catch data from these surveys were also documented. The length distribution of all carp collected during these surveys can be seen in Figure 1.

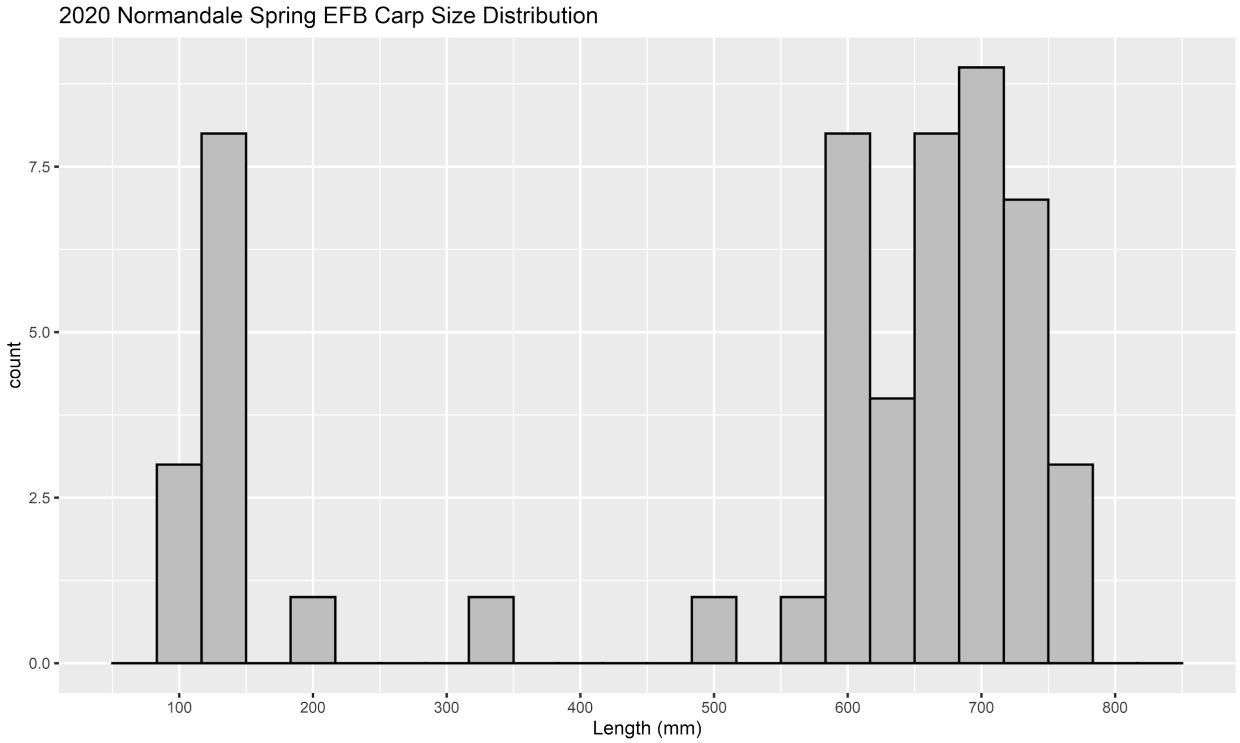

Figure 1: Length distribution of carp captured during spring electrofishing.

Age Structure Analysis

To determine the most cost effective carp management strategy in Normandale Lake, it is important to evaluate carp recruitment patterns (production of young carp). An ageing analysis can be used to identify successful year classes of carp. To conduct this analysis, we removed otoliths from the 54 carp collected during spring electrofishing. The otoliths were embedded in epoxy, sectioned using a high precision saw and aged under a microscope. The distribution of ages can be seen in the graph in Figure 2. We did verify that the juvenile carp, whose large numbers were observed during electrofishing were age-1 (2019 year class). In addition, we documented many additional older year classes, especially in ages 9-30 in the population (Figure 2). Our ageing data suggests that carp have recruited frequently into the population over the last 30 years. However, only two strong year classes occurred in the last 10 years - the 2019 and 2011 year classes. Overall, processes that regulate carp recruitment within the system, including the abundance of native fishes such as bluegill need to continue. For example, severe annual fluctuations in water level, winter kills, or other processes that could negatively impact bluegill populations need to be examined.

Further, frequent recruitment is not necessarily problematic as long as the overall number of carp that recruit is low (e.g. many small year classes can be easily managed via occasional removal, but many strong year classes would be difficult to manage). At this point we do not have good carp population estimates for Normandale Lake because mark-recapture analyses were not practical in 2020 due to the extremely abundant age-1 year class. We propose conducting formal mark-recapture estimates in 2021 to determine not only how often carp recruit but also the relative strength (number of carp) in each age class.

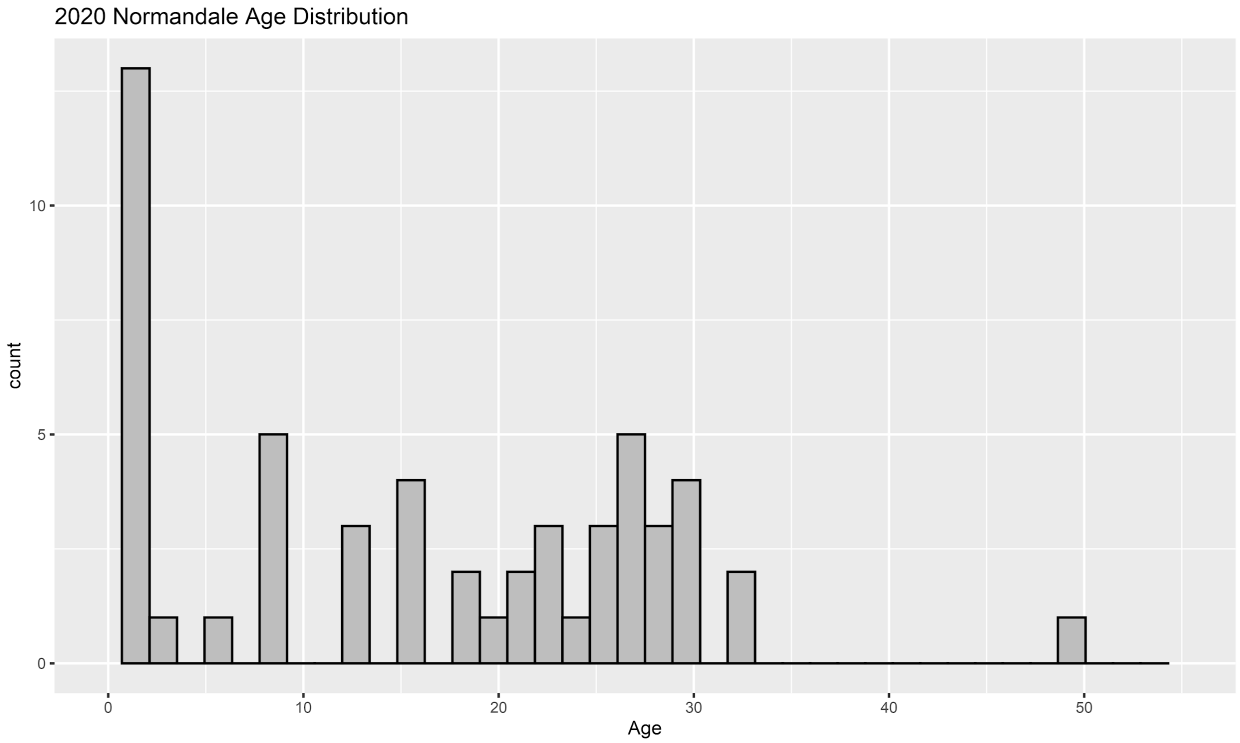

Figure 2. Age distribution graph containing 54 carp collected in the Spring of 2020.

Box Netting

Carp Solutions uses box netting to trap and remove carp. The purpose of this work was to determine feasibility of box netting in Lake Normandale. A box net trap consists of a rectangular net with sides placed on the bottom of the lake at a selected site. The net remains on the bottom of the lake while the carp are trained to aggregate in the net through the use of cracked corn as bait. While the consumption rates rise, the net is set by raising counter weights. When the carp are actively feeding at night, the counter weights are dropped and the sides of the net raised to trap the carp inside. Any bycatch can be sorted out and the carp removed at this point. Box-netting is an efficient and very selective method to remove carp.

Before the 2020 season, it was planned to use 5 standard mesh baited box net traps spread around the lake to remove adult carp. During the spring electrofishing surveys, large numbers of small carp were observed. Because these small carp have a high mortality rate and in

addition would be able to pass through the normal mesh size (2 inch), it was proposed to wait one year to box net. However, it was later decided to go ahead with box netting, but to use two experimental smaller mesh (<½ inch) box nets that were expected to capture the small carp along with the larger ones. Two such nets that were 30 foot long by 30 foot wide were installed between 8/21 and 8/24 at the locations shown in Figure 3. Both nets were pulled 4 times between 8/27 and 10/12. The catch totals and average length by date are shown in Table 1. On the first two occasions, 8/27 and 9/17, nets were tripped in the early morning, just before dawn. These pulls were largely unsuccessful, despite high corn consumption at each site, with a total of 143 carp being caught between the two pulls. Encouragingly, the catches were mostly made up of the small carp, proving that the small mesh nets worked. We suspected that the carp consumed the bait earlier in the night and no bait was left by the morning when the nets were pulled. Subsequently, it was decided to try tripping the nets at night, around 11 pm, instead of morning. This tactic was significantly more successful, with 4,894 carp being caught between the next two pulls on 9/21 and 10/12. The catch was fairly evenly distributed between the two sites, with Net 2 by the bandshell capturing about 500 more carp. The catch data broken down by net is shown in Table 2. As shown by the histogram of a sample of 198 lengths in Figure 4, the captured carp were predominantly small, between 200-400 mm. A small sample of these small carp (n=10) were kept for aging. All of the sampled carp were one year old fish (2019 age class). Therefore, it can be assumed that the bulk of the fish caught in the box nets were the same juvenile year class (age-1) that we were also seeing during spring boat electrofishing. However, their mean length increased from ~150 mm to ~ 300 mm between the spring and the fall.

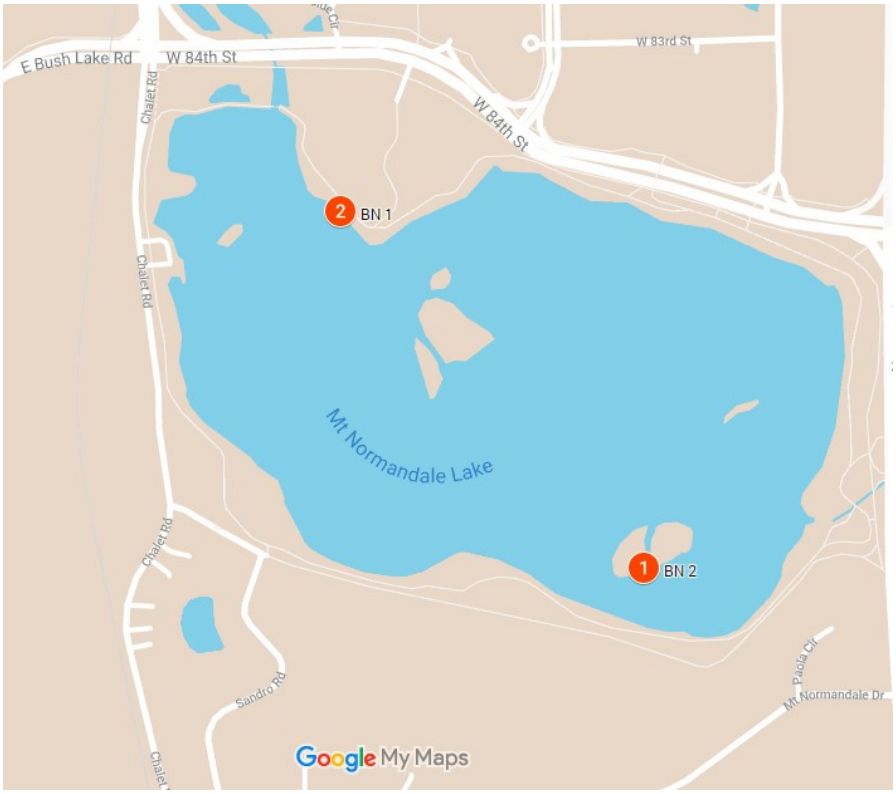

Figure 3: Map of box net locations in 2020

Table 1: Number and average length of carp captured in box nets by date.

Date	Catch	Average Length (mm)
8/27/2020	48	275
9/17/2020	95	397
9/21/2020	1770	300
10/12/2020	3124	300

Table 2: Number of carp captured in box nets divided by date and net site (corresponding the map in Figure 3).

Site	Totals by date				
	8/27/2020	9/17/2020	9/21/2020	10/12/2020	Total
1	44	0	1021	1224	2289
2	4	95	749	1900	2748
Total:	48	95	1770	3124	5037

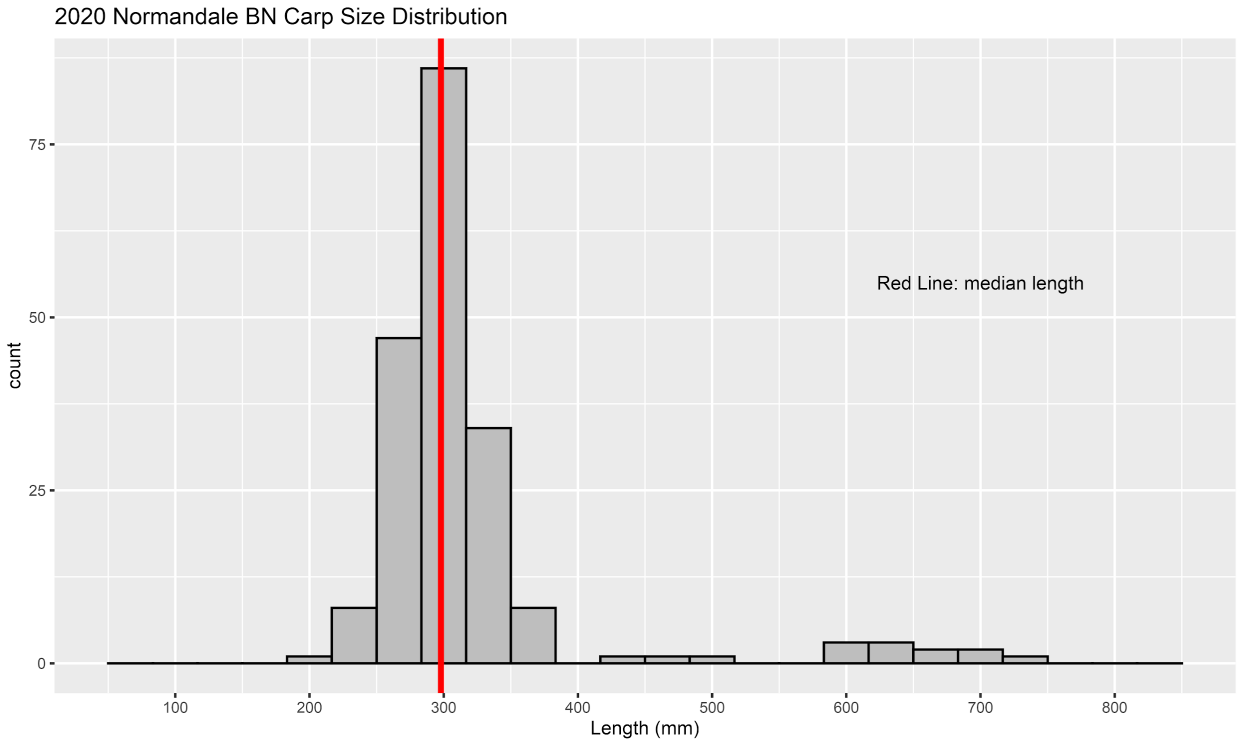

Figure 4: Length distribution of a sample of 198 carp captured in box nets in 2020.

Trap Netting

In order to examine the population of native fishes that could limit carp reproduction through predation on carp eggs, larvae, and juveniles, a trap-netting survey was conducted in late September. Five small mesh trap nets were placed around the lake on 9/29. The locations of these nets are shown in the map in Figure 5. The nets were checked 24 hours later on 9/30. All fish were identified to species, counted, up to 20 fish of each species were measured, and released. The data from the trap net catches is shown in Table 3. No carp were caught in these surveys, somewhat surprisingly. Eight species of native fish were captured in the trap nets (Table 3). The catch was dominated by bluegills sunfish - mean catch 64.6 per net. The mean catch of bluegills per net was similar to that documented by Riley Purgatory Bluff Creek in 2018 (57 bluegills/net) and 2019 (69.4 bluegills/net). Although the catch-per-unit-effort (CPUE) numbers for sunfish, especially bluegill, were fairly high, the size of those fish was quite small. Bluegill ranged from 60-150 mm (2.4-5.9 inches), with an average of 88 mm (3.5 inches) (Figure 6). Other most common species sampled in trap nets in 2020 included pumpkinseed and black crappie (Table 3).

Abundance of bluegills in the lake is desired as bluegills play an important role in controlling the recruitment of carp by foraging on carp eggs and larvae (Bajer et al. 2015; Poole and Bajer 2019). Overall, the abundance of bluegills in 2018, 2019 and 2020 should have been sufficient for controlling the recruitment of carp, thus it is not clear why so many carp recruited into the population in 2019. In the fall of 2018, Normandale Lake was drawn down to control invasive plants (https://www.ninemilecreek.org/whats-happening/current-projects/normandale/). The lake was refilled with water in March 2019. Sudden increase in shallow, vegetated areas in the spring of 2019, shortly before carp spawning season, might have allowed carp to find new spawning habitats where the abundance of bluegills or other native predators might have been low.

Table 3: Data from trap netting on 9/29-9/30/20, broken down by trap net number (corresponding to the map in Figure 5) and count of each species of fish caught. Catch-per-unit-effort (CPUE), in units of fish caught per net (total/number of trap nets set), and average length of those species in millimeters is also given.

Trap Net #	Black Bullhead	Black Crappie	Bluegill	Green Sunfish	Hybrid Sunfish	Largemouth Bass	Pumpkinseed	Yellow Bullhead	Total
1	2	8	21	11	2	0	15	1	60
2	0	3	12	2	5	0	17	0	39
3	0	2	69	3	1	1	9	1	86
4	0	0	59	0	1	0	10	1	71
5	1	19	162	2	3	0	13	1	201
Total	3	32	323	18	12	1	64	4	457
CPUE	0.6	6.4	64.6	3.6	2.4	0.2	12.8	0.8	
Avg. Length (mm)	104	99	88	88	98	167	104	132	

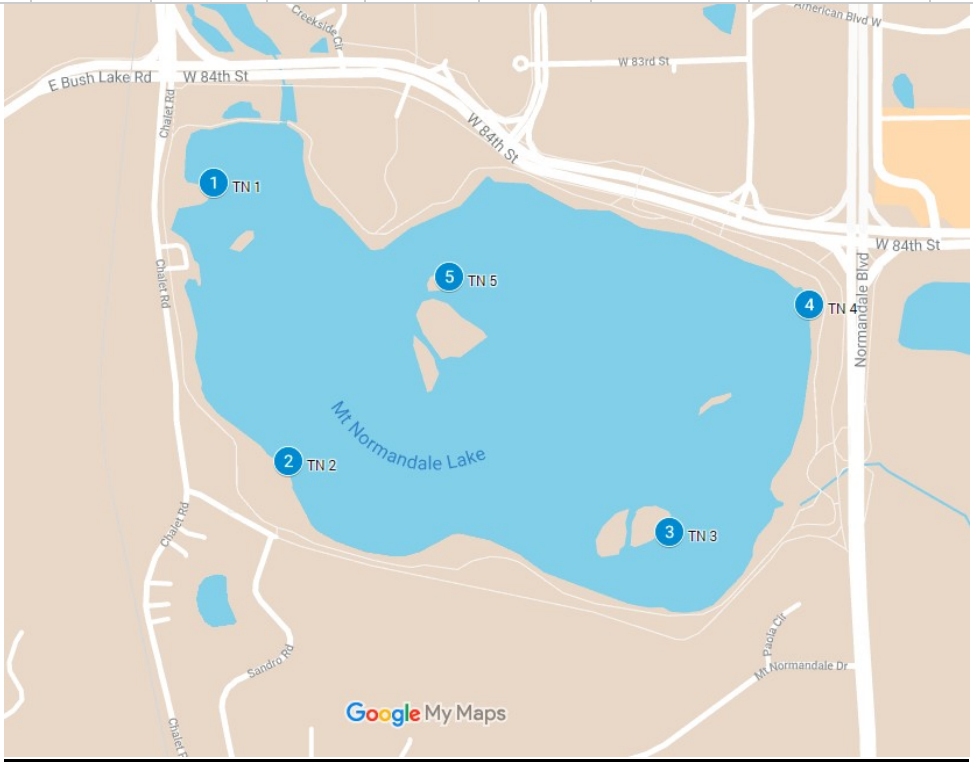

Figure 5: Map of locations and site ID numbers where trap nets were placed on 9/29 and checked on 9/30/20

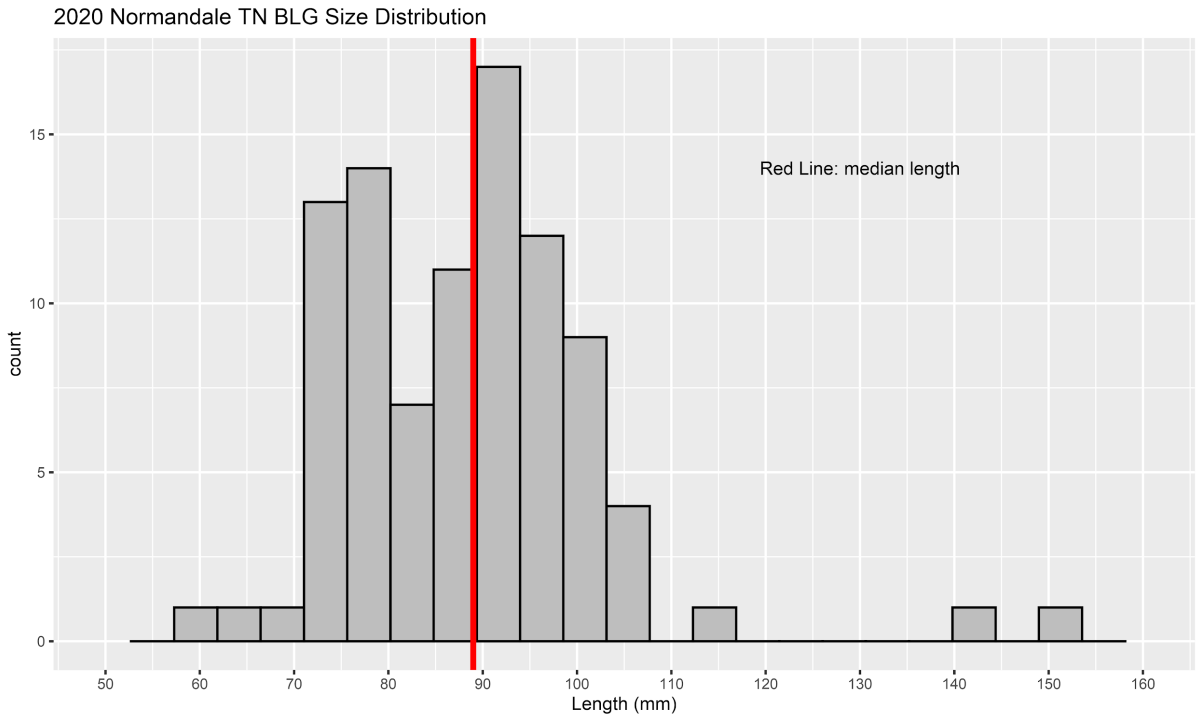

Figure 6: Length distribution of the sample of bluegill captured in trap net surveys on 9/29 - 9/30/20

Fall Electrofishing

A fall electrofishing survey was conducted to assess carp length structure and estimate carp population abundance and biomass post box net removals. These can be calculated using the catch-per-unit-effort (CPUE), in carp caught per hour of shocking time. The survey was completed on October 14, 2020. During this survey, 41 carp were captured. Using the CPUE, the abundance was estimated to be 6,702 carp in the lake. The corresponding biomass density was 220 kilograms per hectare of lake. This biomass density estimate exceeded the determined ecologically damaging threshold of 100 kg/ha (Bajer et al. 2009). This estimate, however, should be considered preliminary because it was based on a single electrofishing survey.

Interestingly, carp collected during fall electrofishing ranged between 200 and 800 mm with the lengths being relatively uniformly distributed (Figure 7). This is in contrast to box netting where carp catches were heavily dominated by the small carp < 300 mm (Figure 8). The reason for this discrepancy is unclear. It is possible that box nets targeted disproportionally more small carp or that the single boat electrofishing survey in the fall was not representative of the entire population.

We speculate, however, that the population and biomass density estimates obtained from the electrofishing survey are likely underestimating the actual carp abundance and biomass in the lake, because it is unlikely that the relatively small scale box netting efforts removed nearly half

of the carp population from the lake (5,037 carp captured in box nets; post removal electrofishing estimate 6,702).

Notably, no age-0 (young-of-year) carp were collected in fall electrofishing survey, corroborating the results of trapnet surveys. Apparently, there was not a detectable carp recruitment in 2020.

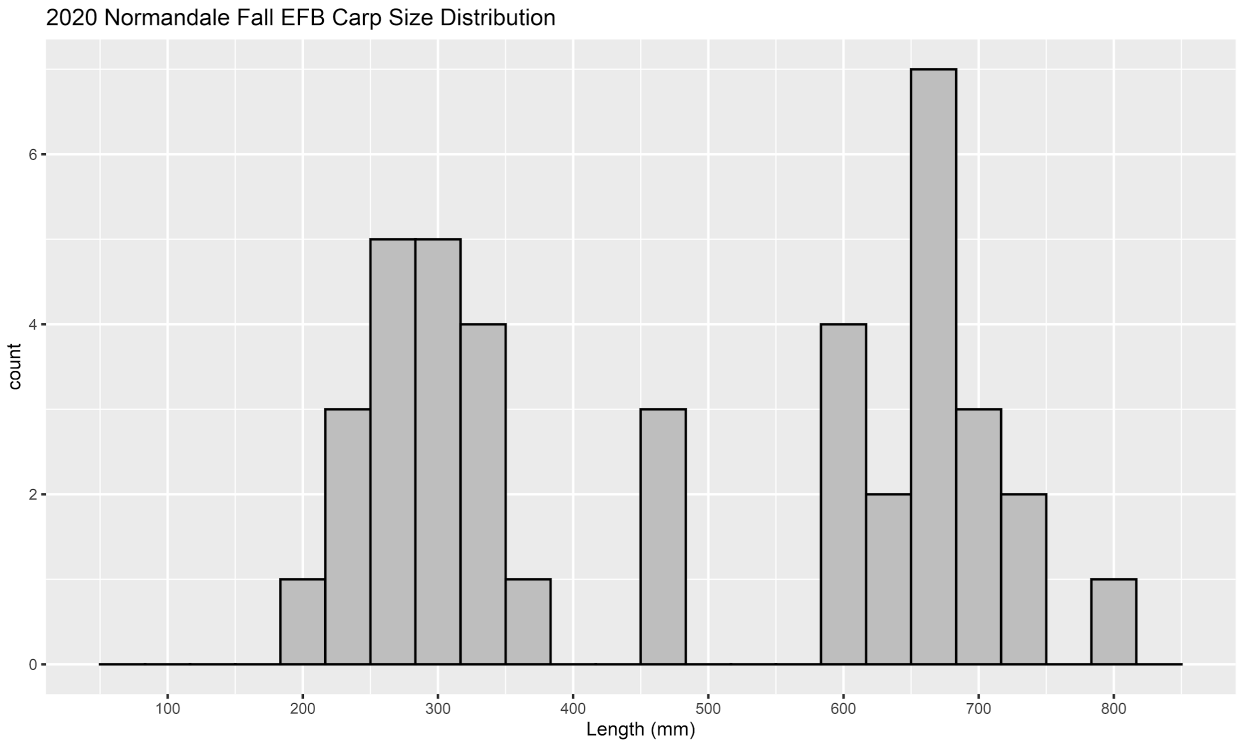

Figure 7: Length distribution of the 41 carp captured by boat electrofishing on 10/14. This was the only randomized electrofishing survey conducted in 2020.

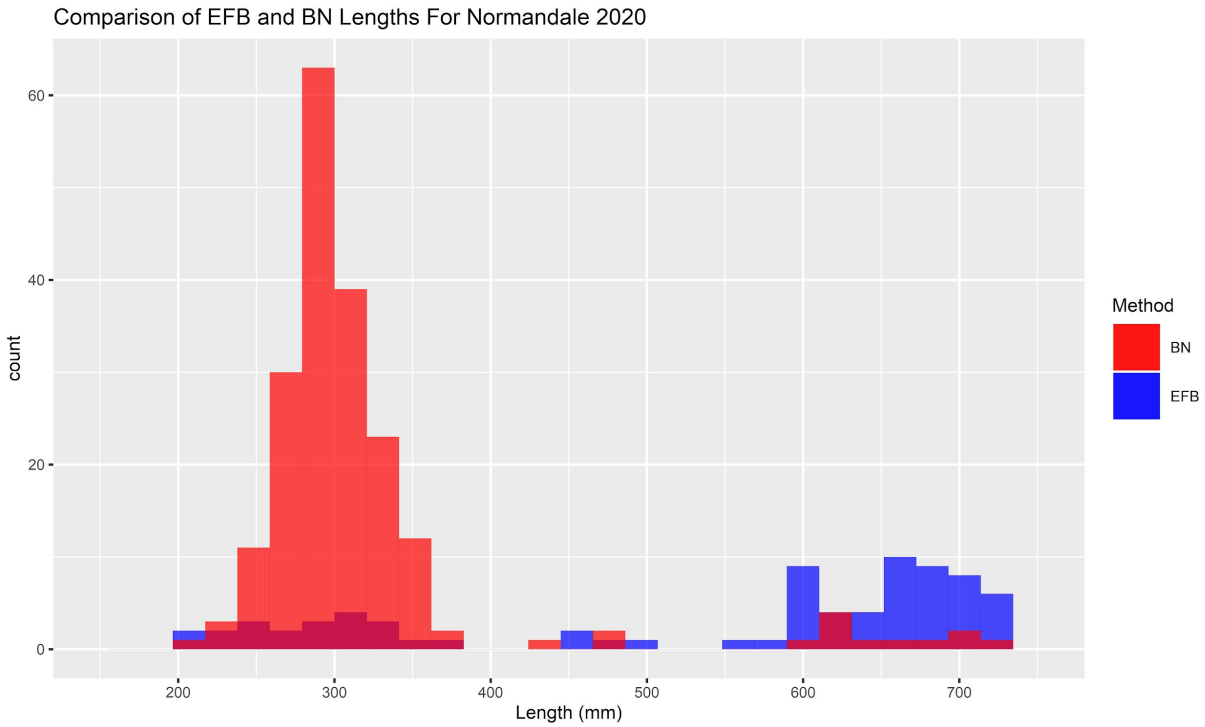

Figure 8: Comparison of all carp captured by electrofishing (blue), both spring and fall, and those captured by box netting (red). Clearly, a larger proportion of small carp were captured by box netting as compared to electrofishing

Conclusions and Management Recommendations

The results from carp management efforts in 2020 show that carp population likely exceeds the ecologically damaging threshold of 100 kg/ha. The ageing analysis indicated that the population is dominated by age-1 year class (spawned in 2019). However, many additional year classes were detected. Notably, in the last decade, another strong recruitment occurred in 2011. Other abundant year classes occurred more than 10 years ago. Box netting proved to be relatively effective with over 5,000 carp removed from the lake with just two relatively small nets. Trapnet surveys suggest that native fish community is currently strong enough to control carp recruitment.

For 2021, we recommend the following management actions:

1. A robust population estimate based on mark-recapture is needed to determine carp biomass and management thresholds (how many carp need to be removed). We recommend catching carp through boat electrofishing and marking at least 100 carp in the spring 2021. In addition to marking the carp with a fin clip, a Passive Integrated Transponder (PIT) tag could be implanted to track individual fish and also to monitor possible spawning migrations with an antenna placed upstream of Normandale Lake (see below). In order to ensure that a representative sample of carp are marked, we recommend that at least three separate electrofishing surveys are carried out. To complete the mark-recapture analyses, we recommend that carp are recaptured in the summed during carp removal efforts with baited box nets.

2. We recommend that carp removal with baited nets is scaled up. We suggest using four nets, all with smaller mesh, installed throughout the lake. These nets would be operated in the same fashion as the nets from 2020 and should be pulled at least 3 times.
3. In addition to carp recruiting in Normandale Lake itself, it is likely that some carp are moving upstream to spawn. One likely close spawning and nursery location is Josten's Pond just upstream of Normandale Lake across E Bush Lake Road. Two radio tagged carp were tracked there on May 28, 2019, during the spawning season. Further assessment of the movement of carp could be tracked by placing a PIT antenna at the walking bridge on the Northwest end of Normandale Lake between it and Josten's Pond. Such a system could monitor carp passage with a minimum amount of labor. If heavy movement is observed, barriers could be considered in the future to restrict access to this spawning area.

References

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