

PHASE II:
2019 CARP AND PIKE
MOVEMENT STUDY AND
PURSUANCE OF CARP
BIOMASS REMOVAL -
FISH LAKE, RICE LAKE

Maple Grove, Minnesota

Mary Newman
mnewman@wsbeng.com

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1. Introduction

This document provides information on the Fish Lake and Rice Lake Common Carp population. This report summarizes the data collected on carp in Phase I: 2018 and Phase II: 2019-2021 and provides next steps in sustainably managing carp to improve the ecological integrity of these lakes. Not only can the management of common carp help to address internal loading of nutrients, but it can help to improve habitat for native fish species as well as waterfowl.

1.1 Background

Fish Lake and Rice Lakes were added to the MPCA's impaired waters 303(d) list in 2012 and 2010, respectively. This designation was given to both lakes due to excess nutrients, impacting aquatic recreation. Both lakes are described in the Elm Creek TMDL as having both internal and external nutrient loading sources that would need to be addressed. Common carp are present in both basins, but the impact they may be having on lake water quality was unknown.

In 2018, The Fish Lake Area Residents Association (FLARA) and Rice Lake Area Association (RLAA) contracted for a carp population estimate to assess the relative impact these fish may be having on the internal loading of nutrients to the lake. Results of that survey estimated that Fish Lake and Rice Lake had a carp biomass abundance 2.5 times the 89.9 lbs/acre threshold value where carp are known to be damaging to water quality and ecological integrity. These numbers suggest that carp management was warranted, and a Phase II of carp management was initiated in 2019. The aim of Phase II was to identify carp and northern pike movement patterns and aggregation sites, assess the feasibility of carp removal via commercial seine netting, and refine carp population estimates.

The 2018 study included a trap net study to assess carp young of the year and bluegill relative abundance. This survey found no young of the year carp and bluegill catch per unit effort that was in the upper end of the MN DNR normal range for this species in both basins. This is important to note because a healthy population of bluegill can help to effectively control the recruitment of carp as they are known to predate on carp eggs and larvae. Rice Lake operates an aeration unit to continue to promote a healthy bluegill population.

Drawdowns are conducted periodically in Rice Lake to control curly leaf pondweed. In the late summer to fall of 2022, a fish survey was conducted on Rice Lake by Bluewater Science. This survey was a part of a drawdown study but is helping to answer questions about carp recruitment in the system. In 2022 young of the year and estimated age 1-2 year old carp were captured in the survey. This information can be coupled with the length distribution collected on carp in Fish Lake and Rice Lake in 2018 that indicated a recruitment event was likely in 2013-2014 and again in 2020-2021, and again in 2022.

Although no ageing data has been collected on carp in these basins, the length distribution and most frequent capture in 2022 of small carp indicates that recruitment is not infrequent in Rice Lake or its connected wetlands. It is unknown what the exact impact this occurrence is on the carp in Fish Lake.

1.2 Project Area

The project area comprises Fish Lake and Rice Lake and interconnected waterbodies located in Maple Grove, Minnesota (Figure 1). This type of system is typical in Minnesota where deep lakes are interconnected with shallow basins. In this type of system, migratory species such as native northern pike and invasive common carp can thrive. These species rely on the Minnesota winters to occasionally freeze out shallow basins, making them devoid of other fish species. They then exploit those areas by spawning young fish who are able to grow and return to the deeper more stable basin/deep lake. This return migration to the basin where the parents originated is a behavior known as homing.

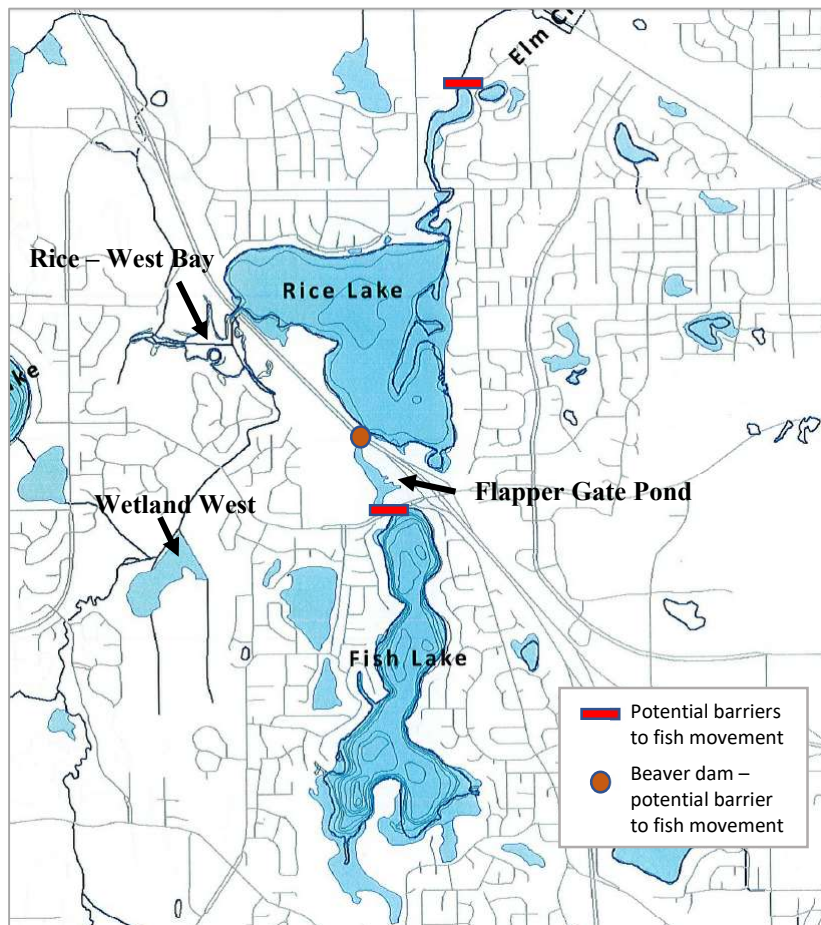


Figure 1 Map of Project area.

Fish Lake is a deep lake basin with an area of 230 acres and a maximum depth of nearly 50 feet. The fishery is managed by the MN DNR primarily for northern pike and largemouth bass while the lake association funds supplemental walleye fingerling stocking in odd numbered years. This lake was listed on the MPCA's list of impaired waters in 2012, however, this designation has been lifted after a successful alum treatment and it is expected to be removed from the list in 2024. Invasive species listed in Fish Lake include Eurasian water milfoil (1995) and most recently Zebra Mussels (2022).

Rice Lake is a shallow, 365-acre basin with a maximum depth of 11.5 feet. The fishery is not actively managed by the MN DNR. The last fisheries survey was completed in 1994 where bluegill and black crappies were found in above average numbers. Black bullhead seem to have a boom and bust cycle in this lake and although undocumented, it is likely carp have the same cycle in this shallow and interconnected basin. The Rice Lake Area Residents Association has operated an aerator in the northwest quadrant of the lake since 2003. Water levels are periodically manipulated to control Curly Leaf Pondweed. Eurasian watermilfoil is listed as an invasive in Rice Lake.

Fish Lake and Rice Lake are connected via a small pond and waterway on the north end of Fish Lake (Figure 1). Water typically flows north to downstream Rice Lake which also receives water from Elm Creek. Elm creek flows into Rice Lake from the northwest and outlets to the northeast. Periodically, given Rice Lake's larger drainage area, its water elevation can exceed Fish Lake's elevation and cause backwater flow. Under these conditions, a manual gate valve ("flapper gate") is temporarily closed to prevent backflow into Fish Lake until Rice Lake drains. Rice Lake's water level is controlled via a water control structure (low head dam) located along the outlet channel that was constructed to inundate Rice Lake for water retention. Elm Creek is mostly unimpeded upstream and connects to several waterbodies and wetlands including an unnamed waterbody that shown in Figure 1 and is referred to as "Wetland West" in this document.

Fish movement is mostly unimpeded between Rice Lake and Fish Lake, however, the flapper gate system is in place on a culvert at the inlet to Rice Lake and is operated by the City of Maple Grove. This gate system is designed to prevent backflow from Rice Lake into Fish Lake during high water conditions as described above but can also prevent fish movement between the basins. The water control structure, or dam, on the outlet channel of Rice Lake is suspected to prohibit movement into the lake from downstream waterbodies. Upstream Elm Creek connects to several wetland areas where fish movement is unimpeded.

2. Methods and Results

The following section describes the tasks and objectives that were pursued in Phase II of carp management in Fish Lake and Rice Lake in 2019-2021.

2.1 Radio-telemetry study

Movement data from tagged individuals can be used to describe aggregation areas or migration routes, both behaviors that can be targeted for management action. Radiotelemetry is used to track animal movements with the use of a tag that is attached or implanted on the animal; location data is collected, in the case of this study, using manual survey techniques.

In 2019-2020, ten (10) carp and seven (7) northern pike were tagged with high-frequency radiotags in Rice Lake and ten (10) carp and two (2) northern pike were tagged in Fish Lake. Attempts were made to capture five additional pike in Fish Lake to implant with tags, but these efforts were unsuccessful. Both the Rice Lake Area Association and the Fish Lake Area Residents Association purchased high-frequency radio-receivers to participate in conducting telemetry surveys throughout the project period. WSB staff also conducted regular telemetry surveys.

2.1.1 Identify common carp movement patterns and aggregation sites that may be targeted for management action

A number of shoreline tracking locations were established, and telemetry surveys began in October 2019, soon after the first radiotags were implanted on both lakes. Beginning in January 2020, telemetry surveys showed that aggregation sites in both lakes were beginning to form. Location data from the 2019-20 and 2020-21 show that carp used two preferred under-ice aggregation sites in Fish Lake and three preferred under-ice aggregation sites in Rice Lake (Figure 2, 3). These sites were assessed for feasibility of large scale commercial harvest via seine netting.

The bathymetry ideal for seine netting is one with a gradual slope and an area near shore of ~4 feet where the net can be landed without gaps between the lead line of the net and the lake bottom. Based on this, the only aggregation the commercial crews could feasibly target in Fish Lake was the aggregation labeled #1 in Figure 2. The area labeled #2 posed constraints to seine netting due to the steep drop off from shore that would cause a net to hang above the bottom, allowing a space for fish to escape. Tight aggregations at site #1 began to form in early January and persisted through mid-February. This aggregation was targeted for seine netting in 2021, this event is described in section 2.2.1 of this document.

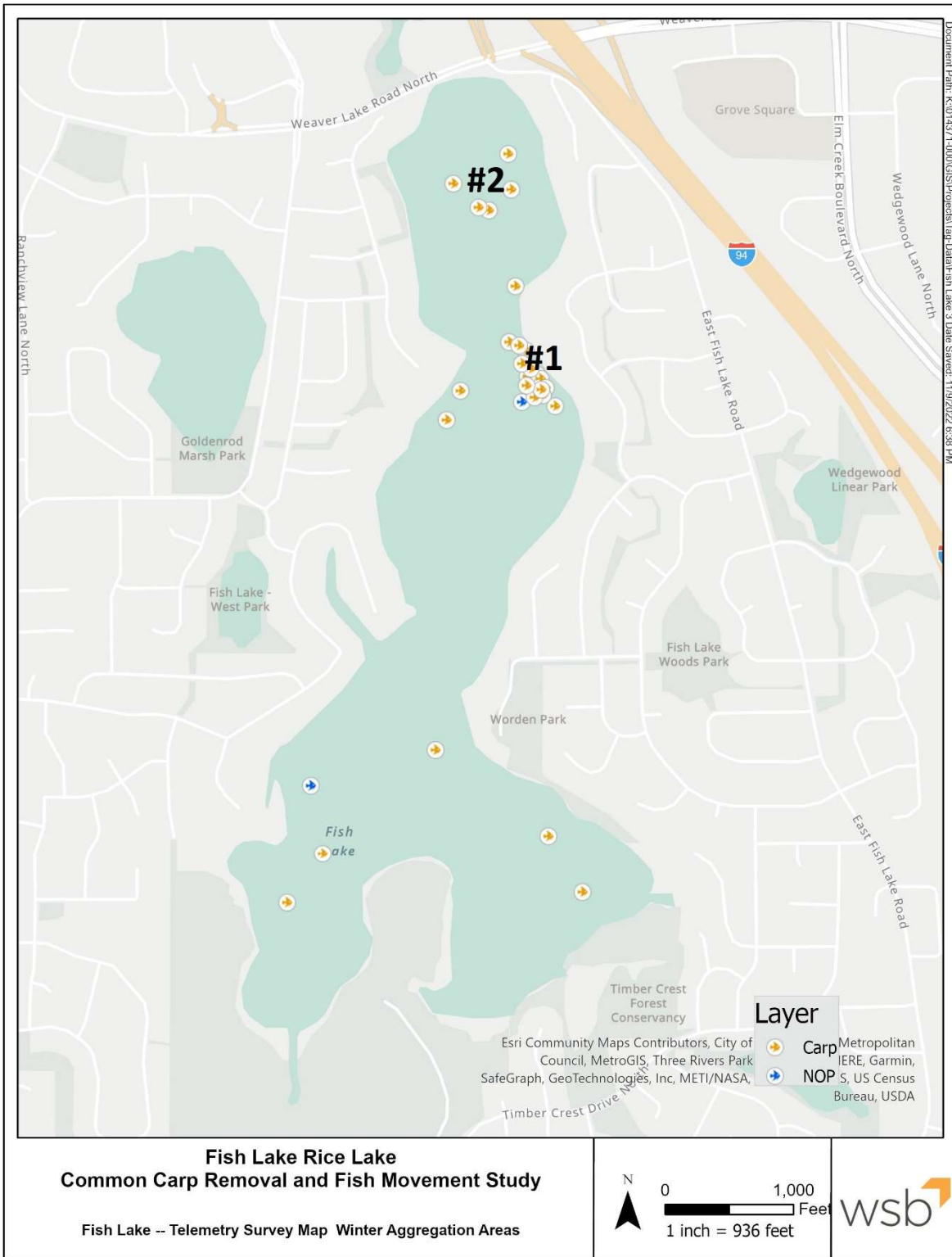


Figure 2 Fish Lake winter aggregation areas.

The three aggregation sites on Rice Lake provided for good conditions as they relate to bathymetry (Figure 3). However, Rice Lake was considered an ephemeral wetland before the dam was constructed at its outflow (Figure 4). The shallow nature of this historic wetland left obstructions such as a historic riverbed, tree stumps, and hummocky substrate that are still present and cause the commercial crews to be hesitant on where they pull a net through, especially under-ice. The preferred netting location on Rice Lake are labeled #1 and #3. Seine netting attempts in these locations on Rice Lake are described in Section 2.2.3.

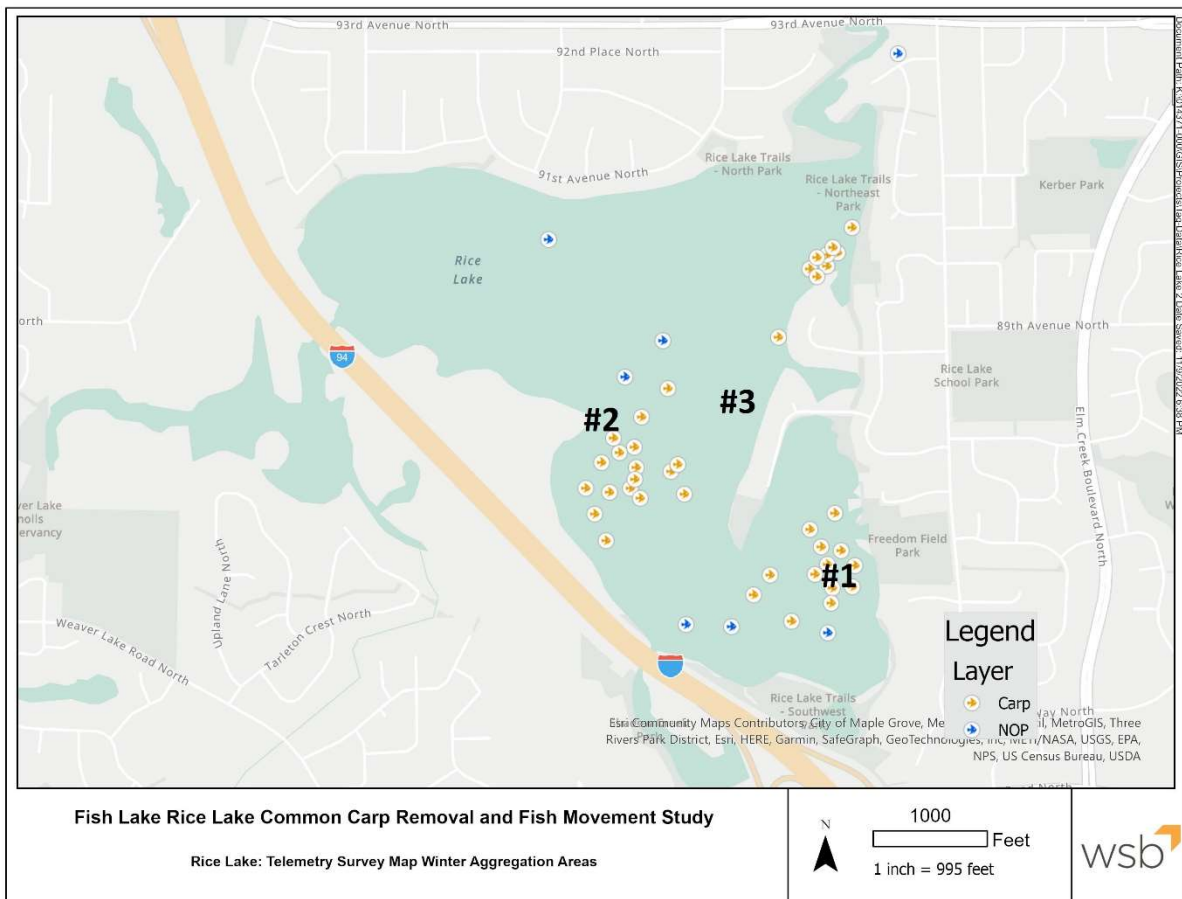


Figure 3 Rice Lake winter aggregation areas.



Figure 4 Historical aerial photographs of Rice Lake showing presence of stream bed and trees: 1940 and 1957.

Beyond identifying winter aggregations, this study was designed to detect seasonal movement of carp. Carp are known to move en masse in the springtime to spawning grounds and this movement can be targeted for removal or simply blocking access to prime spawning grounds to reduce reproductive success. Anecdotal evidence had suggested that this movement occurred from Fish Lake into Rice Lake, but the extent was unknown.

In 2020, carp were found to move from Fish Lake to Rice Lake and then back to Fish Lake (Table 1). Of the ten (10) carp that were radiotagged in Fish Lake, three (3) moved in the spring of 2020 to Rice Lake. Of these three carp, one was found to have moved back to Fish Lake by January of 2021. The exact timing of movement is unknown, although 2 of the 3 fish moved in a small window of time between 3/27/2020 and 4/7/2020 which coincided with observed spawning behavior in Rice Lake.

Table 1 Carp tagged originally in Fish Lake where movement to Rice Lake was captured in the radiotelemetry study.

Species	Tag Number	Lake tracked	Date
Carp	150.234	Fish	3/27/2020
		Rice	4/7/2020
	150.134	Fish	4/16/2020
		Rice	10/21/2020
	150.493	Fish	3/27/2020
		Rice	4/16/2020
Fish		1/25/2021	

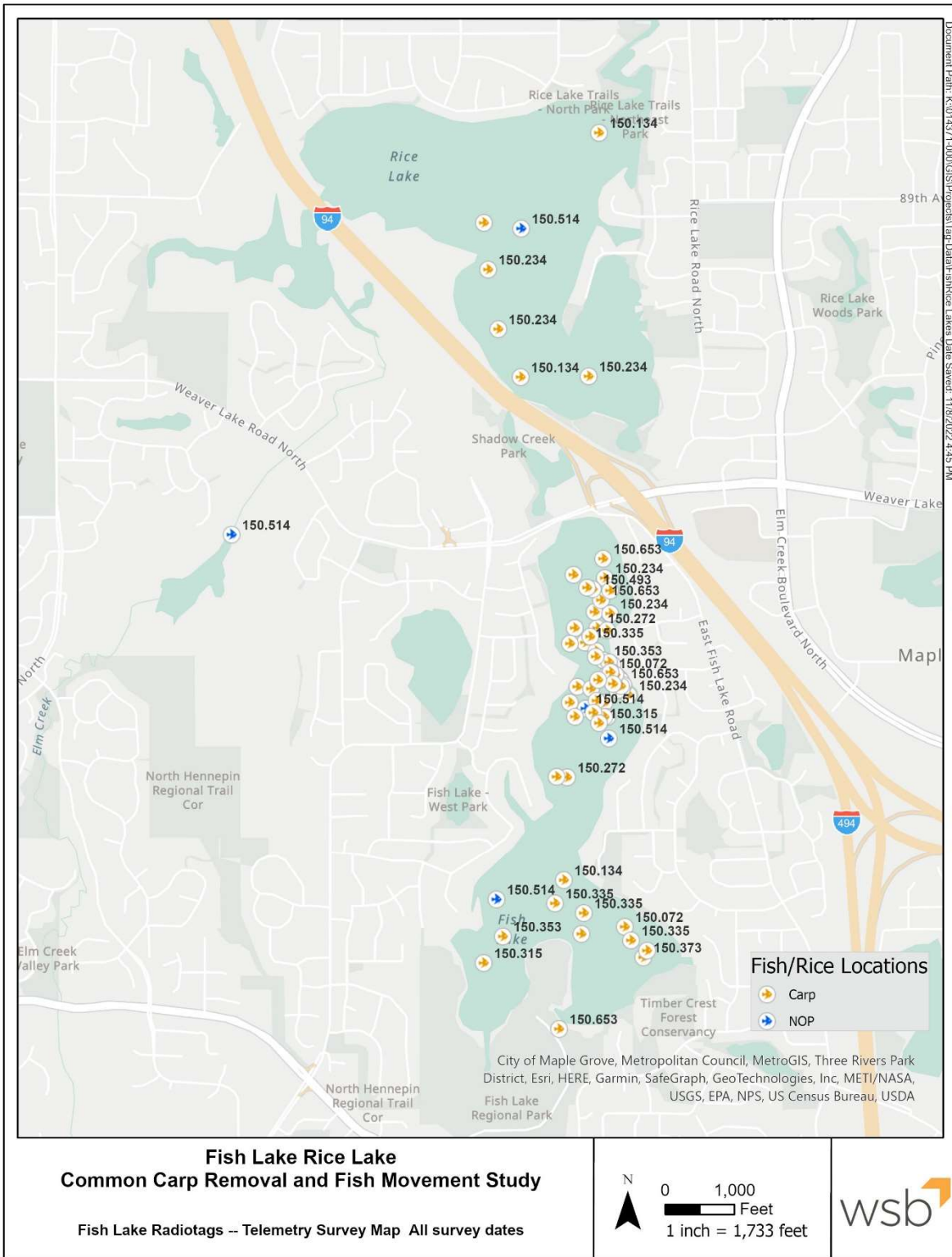


Figure 5 Tag locations 2019-2021 of fish originally tagged in Fish Lake.

Three (3) out of the ten (10) carp tagged in Rice Lake did exhibit movement into the west bay of Rice Lake (located west of Hwy 94). Movement into this bay of Rice Lake seemed to happen freely as this movement was back and forth to the main basin into late June. Notably, one of these carp moved further up Elm Creek and into “Wetland West” in between the dates of April 7 and April 9, 2020 (Table 2). Because carp have been shown to exhibit natal homing behavior, this movement suggests that upstream wetland areas may be serving as carp nurseries that serve Rice and Fish Lakes.

Carp originally tagged in Rice Lake were not found to migrate into Fish Lake during any time period. However, northern pike tagged in Rice Lake were tracked in Fish Lake.

Table 2 Carp tagged originally in Rice Lake where movement outside the main basin was captured in the radiotelemetry study.

Species	Tag Number	Lake tracked	Date
Carp	151.453	Rice	4/7/2020
		West Bay – Rice	4/9/2020
		Rice	4/16/2020
	153.573	Rice	4/7/2020
		West Bay – Rice	4/9/2020
		West Bay – Rice	4/16/2020
		West Bay – Rice	6/20/2020
		Rice	9/23/2020
	150.093	Rice	3/27/2020
		West Bay – Rice	4/7/2020
		Wetland West	4/9/2020
		Rice	4/16/2020
		West Bay – Rice	6/20/2020
		Rice	9/23/2020

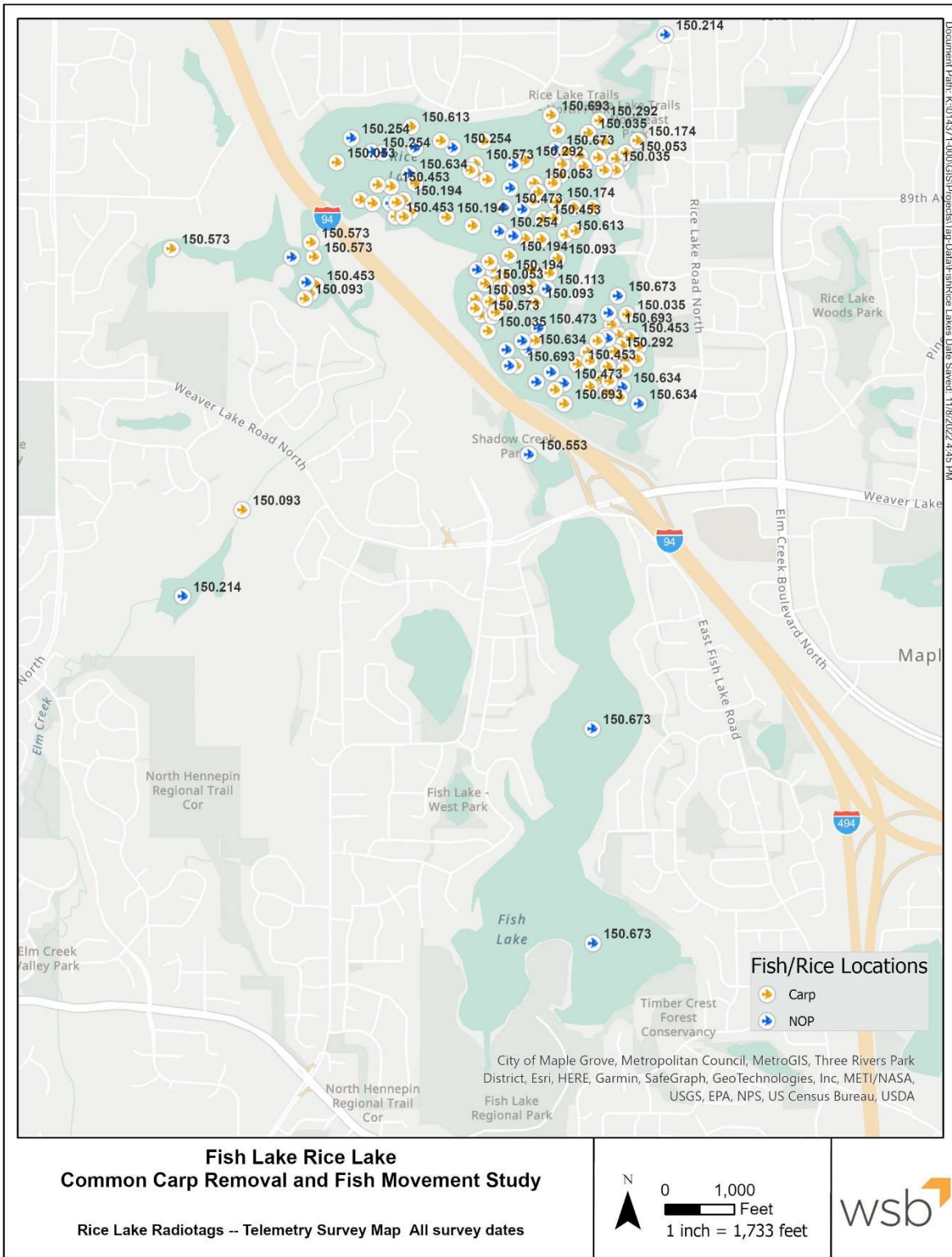


Figure 6 Tag locations 2019-2021 of fish originally tagged in Rice Lake

2.1.2 Identify northern pike migration patterns to inform future carp management actions (i.e. barriers) to minimize impacts on native species

The second objective of the fish movement study was to begin understanding northern pike and common carp migration patterns within and between Fish Lake and Rice Lake and connected waterbodies. This information was collected to guide future data collection and management actions to control common carp without adversely impacting this important game fish species.

One (1) of the two (2) northern pike that was originally tagged in Fish Lake was found to move to Rice Lake and further upstream to “Wetland West”, during the springtime spawning period (Table 3). This movement was detected between the survey dates of March 27 and April 9, 2020. This northern pike had returned to Rice Lake by April 16, 2020 and was not tracked back in Fish Lake by the time the tag life had expired in the summer of 2022.

Table 3 Northern Pike originally tagged in Fish Lake, movement detected

Species	Tag Number	Lake tracked	Date
Northern Pike	150.514	Fish	3/27/2020
		“Wetland West”	4/9/2020
		Rice	4/16/2020

One (1) northern pike of the seven (7) originally tagged in January of 2020 in Rice Lake had moved to Fish Lake in the springtime of 2020 (Table X). This movement occurred between the date of implant on January 29 and April 16 and had moved back to Rice Lake by late June 2020.

In total, five (5) out of the seven (7) northern pike migrated from the main basin of Rice Lake during the survey period. One (1) of these tags moved from Rice Lake further up Elm Creek into “Wetland West” while four (4) of the seven moved to the West Bay of Rice Lake in April of 2020 and eventually back to the main basin.

Table 4 Northern Pike originally tagged in Rice Lake, movement detected,

Species	Tag Number	Lake tracked	Date
Northern Pike	150.673	Rice	1/29/2020
		Fish	4/16/2020
		Rice	6/20/2020
	150.214	Rice	1/29/2020
		“Wetland West”	4/9/2020

		“Wetland West”	4/16/2020
		Rice	1/9/2021
	151.254	Rice	3/27/2020
		West Bay-Rice	4/7/2020
		Rice	4/9/2020
	153.473	Rice	3/27/2020
		West Bay-Rice	4/16/2020
		Rice	6/20/2020
	150.553	Rice	1/29/2020
		West Bay-Rice	4/9/2020
		Rice	4/16/2020

Over an 11 day period in March – April of 2020, both carp and northern pike movement was detected out of Fish Lake to Rice Lake. This observation that timing and routes seem to overlap between these two species is important for management planning. If barriers are considered, it will be important to employ one that allows for selective passage as to not disrupt pike reproductive success while limiting carp. Barrier placement may be considered not only between Rice and Fish Lakes but also between Rice Lake and upstream shallow basin habitats where carp and pike have been documented to move, suggesting they are productive nursery habitats.

2.2 Pursue Removal of Carp Biomass

2.2.1 Coordinate with area commercial fishing crew to conduct seine netting events targeting aggregations of radio-tagged carp

In Fish Lake, the radiotelemetry study confirmed that carp tend to aggregate in the northern portion of the lake as depicted in Figure 2 in the location labeled #1. Anecdotally, this aggregation site has been preferred for many years and this is indicated by thin ice. In fact, in one year, a tree maintenance truck fell through the ice in this area and it is now suspected the ice had been thinned by a carp aggregation that had been stirring the water underneath. In early 2020 and again in 2021, a large scale under-ice commercial seine was attempted to target this aggregation.

The aggregation in Fish Lake was easily spooked in 2020 as attempts were made to target this group with under-ice seine netting gear. Radiotelemetry captured movement from a portion of the group to across the lake to the west and/or slightly to the north each time fishermen began to prep the area for a seine haul. These alternative sites were analyzed for seine netting

feasibility, but steep drop offs and presence of bottom structure, such as rocks, prevented attempts. During the project period, the one aggregation area (#1) on fish lake remained the focus for under-ice seining and finally, on March 2, 2021 a seine net was deployed here by Reidemann Commercial Fishing.

In the seine event on March 2, 2021 on Fish Lake, 228 carp were captured and removed from the lake and at an average weight of 5 lbs. That equates to approximately 1,140 lbs or 4.8 lbs/acre. Out of 6 radiotags that were being targeted in this event, zero were captured. Radiotags were being tracked during the entirety of the event and it was clear that they escaped as the net pull was nearly complete.

The net pull had been running smoothly and the crew was working quickly as they knew the propensity of the fish to escape the area. As the pull was nearly complete, a snag occur, slowing the pull considerably and causing the net to rip. As the net came out of the water it was clear that the snag was caused, at least in part, by a large chunk of metal and an old rusty lawnmower. The site was also surveyed in open water by the fishermen who identified a depression in the substrate near the takeout hole that may have allowed a portion of the fish to escape under the net during the delay.

Five (5) carp were captured in this event that had a left pelvic fin clip that that was applied during the 2018 project period. This helped to refine the population estimate using a mark-recapture model of estimation that is described in the Section 2.2.2.

2.2.2 Refine population estimate using mark-recapture model of estimation in the event large scale carp capture occurs to track progress towards biomass reduction goals

Established electrofishing Catch Per Unit Effort (CPUE) estimates are used by WSB scientists to give managers rough estimate to the carp population. The estimate can be refined by completing a mark-recapture estimate of population. To complete this task, carp that were captured in the 2018 surveys were marked with a unique fin clip that could be used to complete this method of estimation in the case of a large-scale re-capture event.

The seine event on Fish Lake that captured 228 carp and allowed us to complete a mark-recapture model of population estimate. With only five (5) carp recaptured and a total of 125 carp marked in 2019-2020, this estimate is not robust, however it does give some additional confidence as we move forward with carp management in this basin.

Results of the mark-recapture estimate of population in Fish Lake return a value of 100 +/- 20 lbs/acre. This can be compared to the CPUE estimate that was run in 2018 that estimated a biomass of 286 +/- 146 lbs/acre (Figure 7). The lower end of the CPUE estimate (140 lbs/acre) and the upper end of the mark-recapture estimate (120 lbs/acre) do not intersect but are close to one another. It is likely these numbers fluctuate with the given evidence of carp movement between Fish and Rice lakes but it is evident that the population in Fish Lake is elevated above slightly above the threshold value of 89.9 lbs/acre.

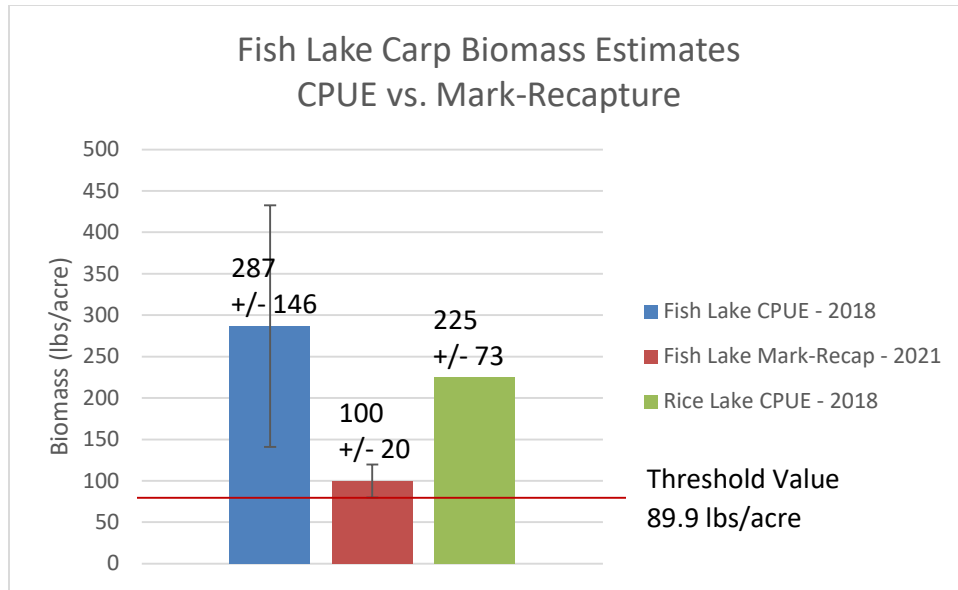


Figure 7 Graphical comparison of Fish Lake 2018 CPUE estimate and 2021 mark-recapture estimate of the population.

Monitoring of carp marked with a fin clip during the 2018 electrofishing surveys was also used to monitor movement between basins. The only way to do this of course, is to recapture these carp and that was accomplished in a seine event on Fish Lake where five carp were recaptured with a fin clip. All five of the recaptured carp were marked with a left fin clip, an indication that they were originally marked in Fish Lake. This fin-clip recapture event did not detect movement from Rice Lake.

The population estimate for Rice Lake was not refined with a mark-recapture estimate as a large scale capture event did not occur. The 2018 estimate of 225 +/- 73 is being used to describe the population in Rice Lake.

2.2.3 Assess the feasibility of access to Rice Lake by commercial fishing crews

Commercial fishing crews have been hesitant in the past to commit to a seine event on Rice Lake due to limited access for heavy equipment. Rice Lake does have a private boat ramp located in a small bay on the east side of the lake, however, the narrow channel from the bay to the main basin of the lake is seen as a hazardous location. This is due to possible movement of water through the small channel making ice conditions unsafe for multiple trips with heavy equipment back and forth and thus limiting ability to transport fish through the area for loading out of the lake onto semi-trucks.

The proposed action at the beginning of the project period was to assess the feasibility of access to Rice Lake for potential under-ice removal operations. This was done with collaboration between the City of Maple Grove and the commercial fishing crews and access was obtained through a city parcel on the eastern side of Rice Lake along Glacier Ln N, to the

south of the existing boat ramp. This site allowed access onto the main basin of Rice Lake with fishing crew and heavy equipment.

Beyond access to rice lake, reconnaissance of possible seining locations was completed. Before the dam was constructed in the outlet channel of Rice Lake, the lake was an ephemeral wetland and features such as tree stumps, rocks, and sunken islands remain underwater. As aggregation sites were identified in the winter of 2020 these sites were explored by the commercial crew to assess the feasibility of seining in these locations. It was determined that the south-east bay (#1) and the central bay along the eastern shoreline (#3) were feasible to attempt seine netting (Figure 3).

As the crew would mobilize to prepare for a seine event the carp on Rice Lake responded similarly to the carp on Fish Lake in 2020 and were easily spooked by this increase in activity. On 1/21/2020 carp on Rice Lake were found to be aggregating in the southeast basin of Rice Lake (#1) but pre-seine activity caused carp to move overnight to the west and north.

Finally, on January 29, 2020, a plan was set and a seine net was deployed in Rice Lake in attempt to capture an aggregation identified to the north of location #3 (Figure 3). Historic aerial photos of Rice Lake show an old riverbed surrounded by high ground in this area so an attempt was made to move the aggregation south into area #3 (Figure 3). In this event, sound was generated north and west of the aggregation to move them into the seine net set to the south.

The aggregation did move to the south but stayed in the northeast bay along the southern shoreline where more undulation of the substrate and tree stumps are known to exist. Even when a speaker system was placed within the new aggregation site, the fish did not move. The seine net was pulled out of the water after attempting to move the aggregation into the area for more than two hours. Zero (0) carp were captured in this event; however, four (4) adult northern pike were captured in the netting material and radiotags were implanted into these fish.

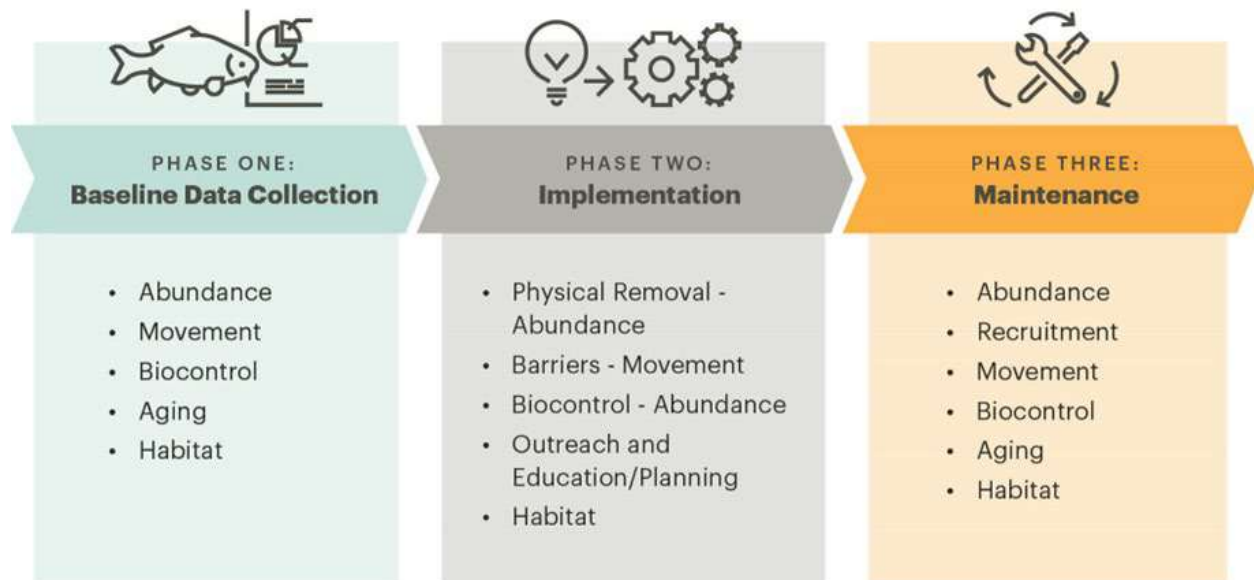
3. Recommendations

Carp biomass reduction would benefit both Fish Lake and Rice Lake but would not be sustainable unless a holistic approach is taken due to the movement of carp between the basins. To implement a holistic and long term management plan, it would be advantageous to create an integrated pest management plan for common carp. WSB has assisted water managers to create this type of document to guide carp management.

An IPM plan is designed as a living document that can be developed with current knowledge of a system and updated as action items are accomplished. We approach this plan in three phases:

1) Data Collection 2) Implementation 3) Maintenance

Carp Integrated Pest Management BMP's



In the Fish/Rice system, data collected in 2018 to date can be used as guiding principles for next steps in both further data collection and implementation of carp management actions. Data collection and management action in the next phase of carp management could include:

Data Collection:

- Refined movement data
 - o To guide removal strategies
 - o To further guide barrier placement and timing
- Study feasibility of barrier to carp movement
 - o Type: electric or physical
 - o Operation: timing to coincide with carp movement
 - o Location(s): Rice/Fish, Rice/Upstream basins
- Refine removal strategies on both Fish Lake and Rice Lake

Implementation

- Carp biomass reduction in Fish Lake (seine, box-net, remove migrating carp)
- Block carp movement into Fish Lake from Rice Lake
- Carp biomass reduction in Rice Lake once barriers to carp movement have proven effective

Maintenance

- Monitor carp abundance and recruitment
- Monitor barrier effectiveness
- Support robust diversity in fish assemblage, especially bluegill

Data suggests that Rice Lake is an important migration route or destination for spawning northern pike. The form and function of Rice Creek puts limitation on the type of management activities pursued here. The placement of barriers to carp movement must take into account the movement of this desirable native fish species.

Rice Lake poses challenges to a carp management plan because of the shallow nature of the basin and its interconnection to Elm Creek and other shallow basins. The shallow nature Rice Lake makes it suitable for carp reproductive success in-lake in the same way as the connected basins due to a frequency of winterkill events. Since carp may not rely on migration to and from the basin to complete their life cycle, reducing the carp biomass here is not likely to provide long-term solutions unless coupled with selective barriers, a robust biomass reduction plan, and additional in-lake measures to reduce the occurrence of winter-kill events.