



Worcester Fish Survey

Analysis of Fish Survey Data and Trends at Worcester Lakes





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Worcester, MA

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1.0 INTRODUCTION

ESS Group, Inc. (ESS) was contracted by the City of Worcester (City) to complete a summary of fishery trends over time from available fish survey data obtained from several of Worcester’s lakes. The City provided ESS with results from an angler survey conducted by the Indian Lake Watershed Association along with fish survey results provided to ESS from the Massachusetts Division of Fisheries and Wildlife (MassWildlife) so the results could be summarized. The angler survey was run by local students at the Worcester Polytechnic Institute during the spring months of 2020. About 250 people answered the survey which asked a multitude of questions such as which lakes they fish at, what species they catch, and what changes would they like to see at fishing areas, specifically Indian Lake, Coes Reservoir, Bell Pond, and Lake Quinsigamond (Table 1). Using data from the four target lakes, (Lake Quinsigamond, Indian Lake, Bell Pond, and Coes Reservoir) we have provided the City with an assessment of fisheries trends and recommendations for the type of fish community each system should be able to sustain under ideal conditions.

We intend to provide insight to the City on how the fish population has changed over time in the four waterbodies: Lake Quinsigamond, Indian Lake, Bell Pond, and Coes Reservoir. We also aim to offer management techniques to help benefit the fish communities present in each lake and alter each waterbody to improve the fish habitat.

Table 1: Fish Species Present in Lake Quinsigamond, Indian Lake, Bell Pond, and Coes Reservoir from 2020 Angler Survey

| Diet* | Species | Lake Quinsigamond | Indian Lake | Bell Pond | Coes Reservoir |
|--|-------------------|-------------------|-------------|-----------|----------------|
| Zooplankton | Golden Shiner | x | | | x |
| Shifts diet to or from Zooplankton | Black Crappie | x | x | x | x |
| | Bluegill | x | x | x | x |
| | Common Carp | x | x | x | x |
| | Rainbow Smelt | x | | | x |
| | Smallmouth Bass | x | x | x | x |
| | White Perch | x | x | x | x |
| | Yellow Perch | x | x | x | x |
| Algae and Invertebrates | White Sucker | x | | | x |
| Insects, Mollusks, Crustaceans, Etc. | Banded Killifish | x | | x | |
| | Pumpkinseed | x | x | x | x |
| | Rainbow Trout | x | x | x | x |
| | Tiger Trout | x | | | |
| Shifts from macroinvertebrates to small fish- no zooplankton | Brown Bullhead | x | x | x | x |
| | Brown Trout | x | | | |
| | Largemouth Bass | x | x | x | x |
| | Northern Pike | x | x | | x |
| | Rock Bass | x | x | x | x |
| Carnivores | Chain Pickerel | x | x | x | x |
| | Tiger Muskellunge | x | | | x |
| | Yellow Bullhead | x | x | x | x |

*Source: Smith, C. (1985). *The Inland Fishes of New York State*. Albany, NY: Sponsored and Published by the New York State Dept. of Environmental Conservation.

2.0 LAKE QUINSIGAMOND

Lake Quinsigamond is the biggest of the four lakes studied at about 800 acres. The northern portion of the lake is narrow but deep with steep side slopes and wave-exposed shorelines, although a few shallow coves provide shelter for aquatic plant growth. The deepest point in this part of the lake is around 90 feet with depths averaging at between 20-30 feet. The southern portion of Lake Quinsigamond, including the area typically referred to as Flint Pond, is much shallower and hosts numerous islands, coves, and other sheltered areas. As a result, aquatic plant beds are extensive but open deepwater habitat is limited. The large area of Lake Quinsigamond and its' habitat variability make it hospitable for a wide variety of fish species.

Historical and Recent Fish Data

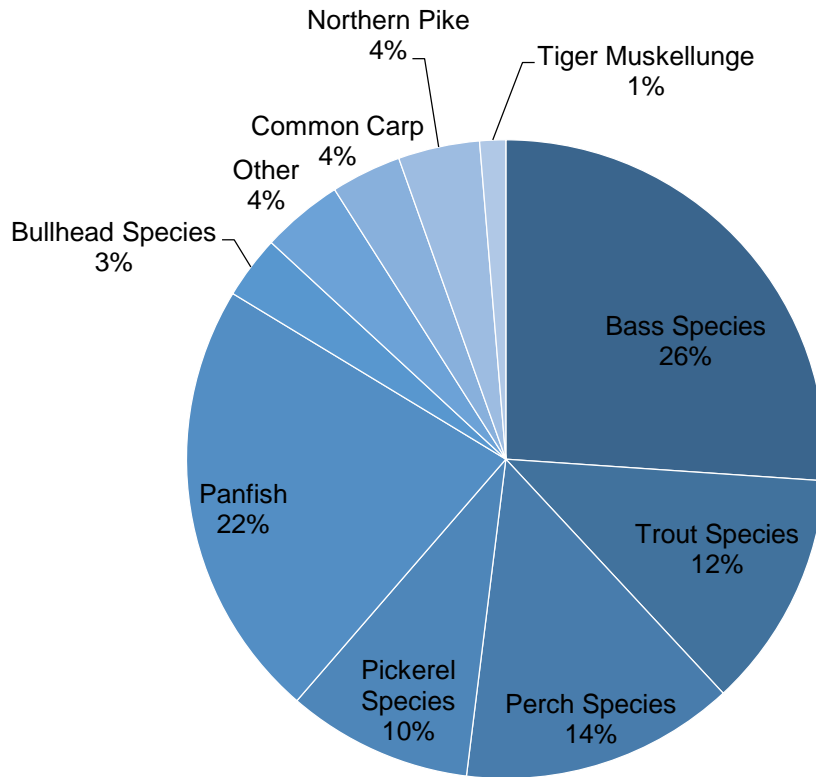
Lake Quinsigamond has been regularly stocked by MassWildlife with multiple species of fish throughout the years. From 2003 to 2006 tiger muskellunge were stocked in the Lake, as well as northern pike in various years from 2002 to present. Lake Quinsigamond has also been stocked with trout, usually rainbow, both in spring and fall up until as recently as 2020.

MassWildlife provided data from two fish surveys in their records, the first of which took place in 2015 and only targeted northern pike, which were not found. The next survey took place in 2018, where bluegill were the most abundant species.

The 2020 angler survey suggests that rainbow trout and largemouth bass are the most prominent species caught in Lake Quinsigamond. (Table 2). Because of the depth in the Lake, the species present include both cold and warm water fish species. Cold water fish can survive harsher temperatures and deeper water; they tend to be larger and have more fat than warm water fish in order to have greater protection against the water. Warm water fish can include species such as large and smallmouth bass and other sunfish, while cold-water fish are mainly trout.

According to the Sport Fishing Award data kept by MassWildlife, fish size is generally similar to past years. Trout are caught at about 20 inches or less, recorded as early as 2001 all the way until 2020 with that same size range. Carp are also frequently caught around 30 inches as of MassWildlife fishing data from 2020.

Table 2: Fish Species Present in Lake Quinsigamond from 2020 Angler Survey



3.0 INDIAN LAKE

Indian Lake is a shallow lake with an average depth of 8-feet and a maximum depth of 19-feet. In having frequent algal blooms and low clarity, a yearly drawdown of the Lake is conducted during winter to reduce plant growth. Indian Lake has multiple locations for recreational fishing, including three parks and a boat ramp. Multiple game fish can be found within Indian Lake, mainly warm water fish as the Lake's depth is relatively shallow.

Historical and Recent Fish Data

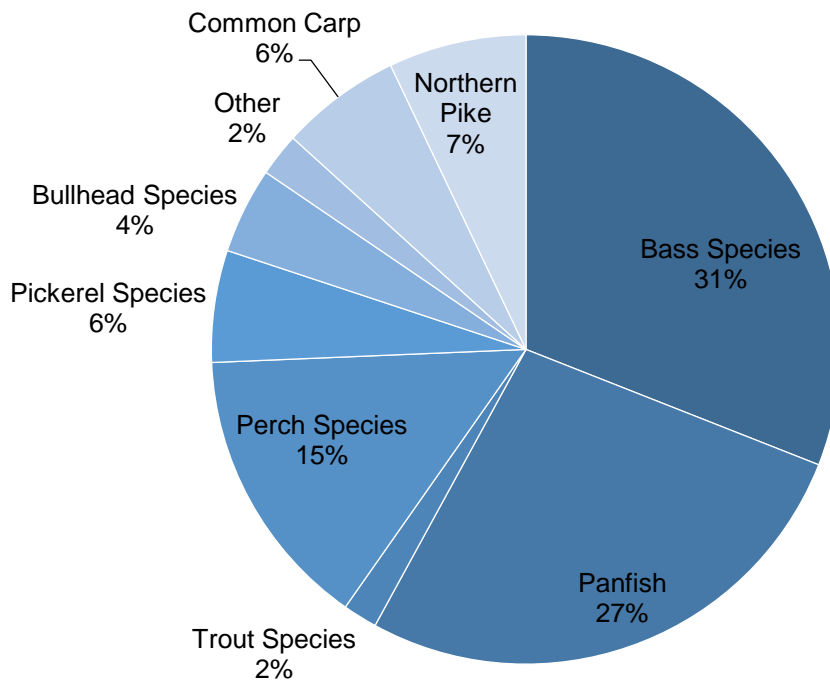
Indian Lake is the only one of the four lakes that is not stocked with trout. No other records of stocking were provided from MassWildlife for any species of fish.

There are MassWildlife records of fish surveys in 2011 and 2017. From the 2011 survey, yellow perch, white sucker, common carp, and largemouth bass were the dominant species caught using electroshocking from the boat. A second selective fish survey was completed in 2011 for Large Mouth Bass, where 25 fish were caught through electrofishing. In the 2017 survey, another total pickup survey was completed, with around 500 fish caught in total. Yellow perch continued to be a dominant species caught throughout the survey.

From the recent angler survey, the leading species caught is largemouth bass, with the addition of bluegill and smallmouth bass, making it great for anglers looking for game fish (Table 3).

Fish size seems to be about the same as previous years, according to the Sport Fishing Award data kept by MassWildlife. There are records of black crappies being caught at 14 inches in 2009 and between 13 and 14 inches in 2019. A multitude of carp were noted in the shallow and muddy areas of Indian Lake in the 2017 electroshocking visit. It is also known that there are aquarium releases in this Lake according to the Indian Lake Watershed Association, but we are not aware of any of the fish colonizing.

Table 3: Fish Species Present in Indian Lake from 2020 Angler Survey



4.0 BELL POND

Bell Pond, formerly Bladder Pond, was Worcester’s first water supply in 1845. The Pond is about 11 acres and is around 17 feet deep. It is surrounded by crowded neighborhoods and a large apartment building and attracts many people with its beach and park.

Historical and Recent Fish Data

MassWildlife has stocked trout in Bell Pond for multiple years, most recently in the spring of 2020. Because of the 17 feet depth in Bell Pond, cold water fish such as trout may not survive the warmer months of summer if the thermal stratification is not enough to keep the water cool. By stocking trout, anglers can have a period of fishing for these popular game fish before the temperatures get too high for the trout in the summer.

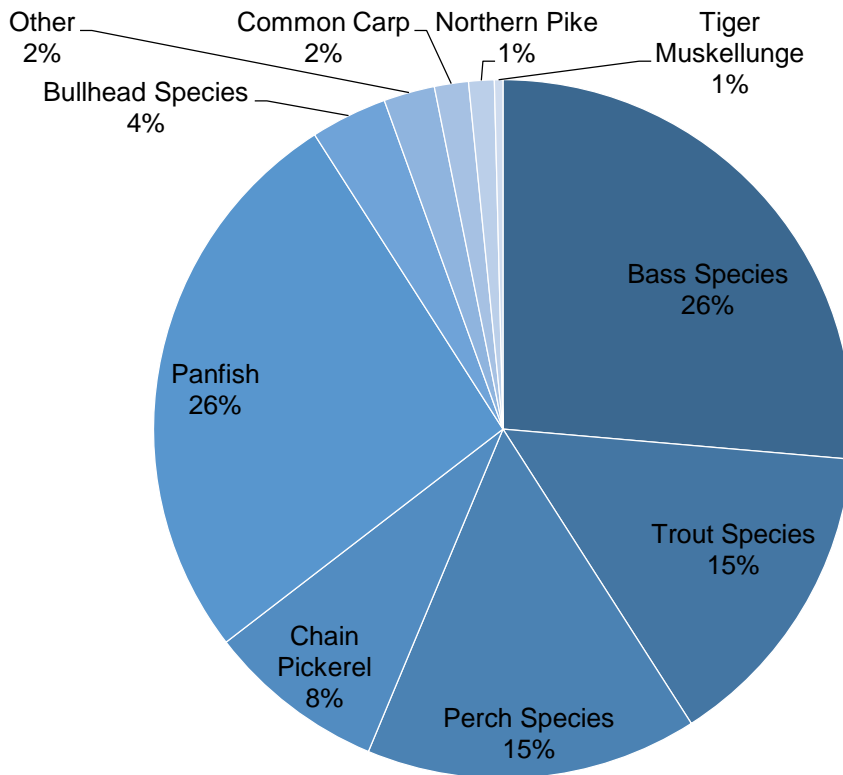
MassWildlife provided records of a fish survey done at Bell Pond in 1994. This survey used various techniques such as gill nets, angling, and seine fishing to target the full fish community. Many species

recorded during this fish study are still present in Bell Pond today, such as pumpkinseeds, bluegill, chain pickerel, largemouth bass, and yellow perch.

From the 2020 Angler Survey, results show similar species being in Bell Pond but in different quantities as the study done in 1994, with bowfin being the only species not recorded as being present in 2020. The species most present recently are largemouth bass, rainbow trout, and bluegill, making the pond better for anglers or anyone looking for game fish (Table 4). A multitude of banded killifish were recorded in the 1994 survey (66 fish reported), while only one person submitted they caught that species of fish in the Angler Survey.

MassWildlife did not provide Sport Fishing data from Bell Pond and size data does not seem to have been recorded in the 1994 survey; so, fish size over time is unable to be reported.

Table 4: Fish Species Present in Bell Pond from 2020 Angler Survey



5.0 COES RESERVOIR

Coes Reservoir is around 90 acres and has multiple areas that can be accessed for swimming, fishing, kayaking and other recreational activities. It is one of the beginning points of the Blackstone River, which flows into Rhode Island. Coes Reservoir also deals with frequent algal blooms during the summer months and is monitored by ESS.

Historical and Recent Fish Data

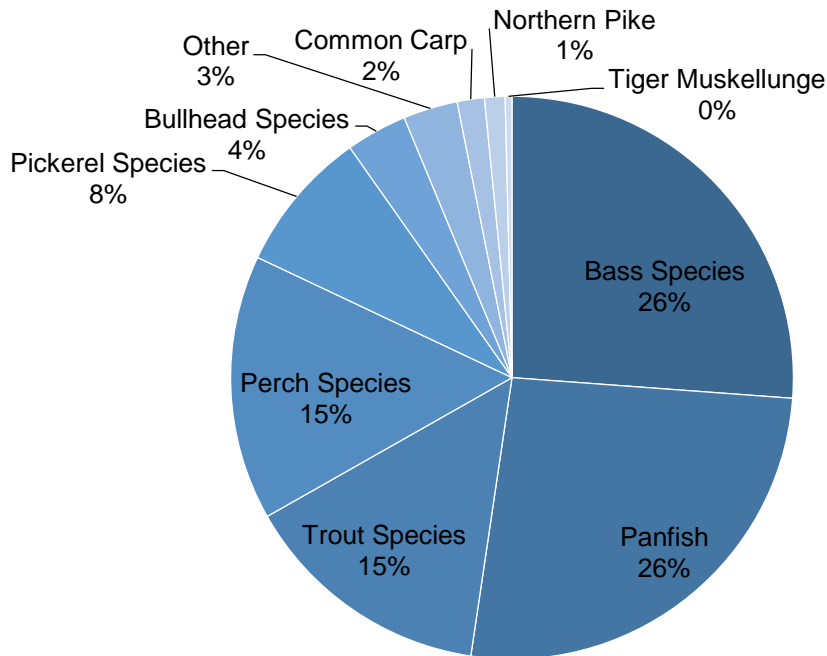
Coes Reservoir has stocked trout for multiple years, most recently in the spring of 2020. The year MassWildlife started stocking trout was not provided, but no trout were caught in the earlier surveys taken before 1982.

There are records of multiple fish studies being done at Coes Reservoir throughout the years. MassWildlife shows there were surveys conducted in 1951, 1956, and 1982. Many different techniques were used to capture the fish, including gill nets, fyke nets, chemicals (not recorded what types), and electrofishing. In the more recent studies, a total pickup was used to study all the fish caught, while in the 1951 and 1956 surveys, it is not recorded if they studied all the fish caught or selectively chosen species.

The following fish species were found throughout these three surveys that are still present in Coes Lake today according to the 2020 Angler Survey: black crappie, smallmouth bass, white sucker, yellow bullhead, brown bullhead, pumpkinseed, bluegill, chain pickerel, largemouth bass, yellow perch, golden shiner, and white perch (Table 5). In the 1982 study, tessellated darter were also recorded which has not been recorded again since then. According to the Angler Survey, the most common species caught were rainbow trout and largemouth bass, which were both caught by over half of the people that responded to that question. (Table 5). At that time bluegill, white and yellow perch dominated the pond, while in more recent years a bigger presence of largemouth bass, rainbow trout, and smallmouth bass have been noticed, according to the 2020 angler survey (Table 5).

According to Sport Fishing Award data kept by MassWildlife, the size of fish has generally stayed the same in Coes Reservoir, with the largemouth bass being around 25 inches and carp being caught at around 31 inches.

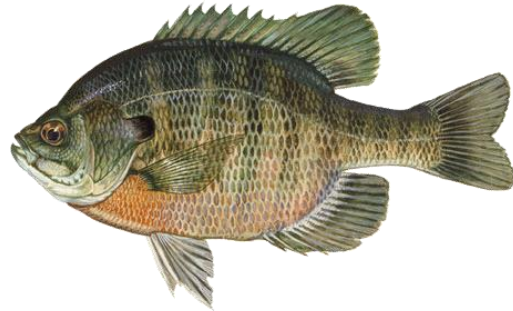
Table 5: Fish Species Present in Coes Reservoir from 2020 Angler Survey



6.0 POPULAR FISH SPECIES IN YOUR LAKES

Bluegill Sunfish (*Lepomis macrochirus*)

Though not native to the area, bluegill is often introduced or stocked into pond systems. The bluegill sunfish is a greenish olive color that softens to a lighter shade on the stomach. Bluegills have a distinctive spot on the soft dorsal fin if they are greater than an inch in length. There are usually traces of six to eight double, vertical dark bars that stretch along their body. Adult sizes usually range between 4-6 inches and they can reach 11 years of age (Smith, 1985).

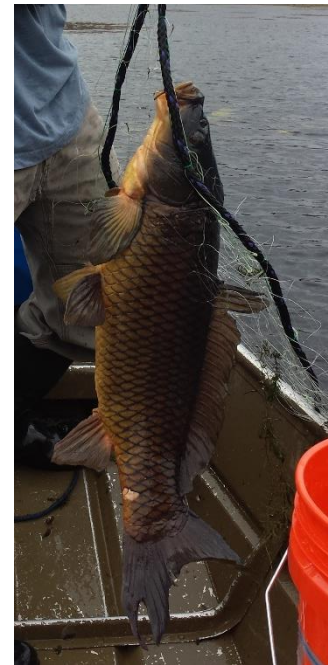


Typical bluegill habitats occur in standing or slow-moving water where there is vegetation or other shelter available. Bluegills require extensive littoral areas, or areas of shallow depths near the shoreline. Excessive aquatic vegetation (comprising greater than 30% of the littoral zone) can interfere with bluegill feeding or cause stunted growth by reducing predation (NJ DEP, 2020). The optimal depth for bluegill growth is 3-10 feet, though deeper waters are needed for overwintering (NJ DEP, 2020). Bluegill prefer sites with firm sand or mud with some debris but limited vegetation in 1-3 feet of water for spawning (NJ DEP, 2020).

Common Carp (*Cyprinus carpio*)

Common Carp are nonnative invasive fish species. Originally from Europe and central Asia, common carp have been introduced to a wide variety of habitats worldwide. Carp are undesirable because they increase turbidity and degrade habitat quality for other species. Carp have a pair of distinguishable barbels extruding from each corner of their mouth. They have small eyes and thick lips. In the wild, carp are usually olive green, bronze or silver colored with a paler underside. Carp exhibit a forked tail and have large, thick scales. Though historically regarded as undesirable by most anglers, carp reach large sizes and put up a fight when hooked.

Carp prefer still or slow-moving waters but can live in a variety of habitats which is why they are such a successful invader. They can thrive in highly degraded areas, with low oxygen levels and turbid waters. Areas with abundant aquatic vegetation are attractive to carp. They can grow to be very large; commonly 24 inches in length, with some specimens reaching 48 inches (OARS, 2020). Carp produce sticky eggs when breeding so it is likely that they adhere to the abundant aquatic vegetation in the ponds.



The main components of a carp diet include mollusks, crustaceans, insect worms, aquatic plants, and algae (OARS, 2020a). When feeding, carp suck up mouthfuls of bottom sediments, along with food items, from the pond bottom and filter the material using their gill rakers. This feeding process increases water turbidity, which can negatively impact native fish populations. During winter, carp typically congregate near the mouths of streams or within streams or slow moving rivers. Carp are not an ideal sport fish, although there are some fishermen that actively seek out carp due to their size and fight. Carp eggs are a favorite forage item for bluegill and other panfish and these species have been shown to control carp abundance if the habitat can support a high density of these panfish species.

Largemouth Bass (*Micropterus salmoides*)

Largemouth bass may arguably be the most popular game fish in the United States. Due to extensive stocking of this species throughout the country over 100 years ago, the only state in which largemouth bass are not currently present is Alaska (Smith, 1985). Largemouth bass is a favorite among anglers because of its willingness to strike at a lure or bait with explosive force (IGFA, 2020). Largemouth bass are dark green with a pronounced black stripe. Largemouth bass routinely reach lengths 10 to 16 inches and larger individuals (some reaching ≥24 inches) are fairly common (OARS, 2020b).



This species prefers slow-moving rivers and lakes, with mud or sand bottoms and abundant aquatic vegetation (OARS 2020b). Largemouth bass are generally found in shallow areas and rarely swim into waters deeper than 8 feet, except when overwintering. Largemouth bass are visual predators and prefer clear water habitats. Spawning occurs in water depths ranging from 1-4 feet, once water temperatures reach approximately 60°F (Smith, 1985). Largemouth bass prefer to spawn on sandy or fine gravel substrates but will use a variety of inorganic and organic substrates (Stuber et al., 1982).

Smallmouth Bass (*Micropterus dolomieu*)

The smallmouth bass is among the most desirable for anglers, for many of the same reasons as the largemouth bass. Smallmouth bass are greenish bronze to brown in color with lighter sides and an off-white stomach. This species usually has faint vertical bars on the body, and dark bars radiating out from the eyes. Smallmouth bass are smaller than largemouth bass, typically reaching lengths of around 12 inches, and rarely exceeding 20 inches (Wickstrom, 1994).



In general, smallmouth bass typically prefer streams with slow to moderate current or standing waters with areas of rocky shoreline and considerable shelter. They are able to tolerate a wide range of environmental conditions however they are usually found in cooler, clearer water than the largemouth bass. Much like the largemouth, they are voracious predators that feed on many types of aquatic life. Their diet includes zooplankton, tadpoles, frogs, insects, crayfish, and fish. Spawning begins once water temperatures reach 62-65°F. Smallmouth bass prefer to have gravel shorelines in depths of 2-20 feet (average 3 feet) for spawning (Smith, 1985).

7.0 RECOMMENDATIONS

Table 6: Suggestions by Anglers from the Worcester Angler Survey*

| Waterbody | Fish Variety, Size, and Health Concerns | Improvement Recommendations |
|-------------------|--|------------------------------------|
| Lake Quinsigamond | "smaller fish and skinnier fish/bass" | "aquatic weed control" |
| | "some fish have spots and holes in the fins and gills" | "more shoreline fishing access" |
| Indian Lake | "less fish caught" | "ban jetskis"/ "reduce motor size" |

| | | |
|----------------|--|------------------------|
| | | |
| Bell Pond | request for "bigger trout" | "cleanup trash" |
| | "stocked always looks good" | |
| Coes Reservoir | "the fish are smaller and more scarce" | "cleanup trash" |
| | "fish are much more healthy-looking" | "stock bass and trout" |

*Not Professional Recommendations

7.1 Overall Management Recommendations

7.1.1 Improve Dissolved Oxygen

Oxygen levels that are low will result in stunting of the fish populations over time and can cause fish kills or elimination of entire species when conditions worsen. By increasing the dissolved oxygen in lakes, a better habitat can be provided for game fish such as trout and bass which are desirable compared to invaders like carp, who can survive in low oxygen and turbid waters. There are multiple ways to improve the dissolved oxygen, and with regular monitoring you can decrease fish kills and improve the health of fish communities. Ways to increase oxygen include the following:

1. Installation of an aeration system: Artificial aeration is costly for larger systems but may be economical for Bell Pond. This would help reduce algal blooms and thus improve oxygen levels.
2. Reducing nutrients in the water column that fuel algae blooms which ultimately reduce oxygen levels: Reduction of nutrients is best achieved through watershed management actions to reduce fertilizer use, pick up pet waster, and infiltrate stormwater runoff before it reaches a waterbody. In larger more developed watersheds such as with Indian Lake and Quinsigamond, the opportunities for improvement to be made are extensive and the effort will be costly and take significant amounts of time to implement. Simple education of watershed residents would be a great start, but other solutions for reducing nutrients such as the alum dosing station currently being planned for Indian Lake are another alternative approach.
3. Removal of excessive aquatic weed growth: Weeds die and decay. This results in consumption of available oxygen from the water column. Managing weed growth to be between 24% and 50% of the bottom cover in a waterbody will achieve a great balance for fish habitat and oxygen levels. This is a goal for many of the coves in Quinsigamond and the southern cove of Indian Lake.

7.1.2 Reduce Algal Blooms

Reducing blooms in the lakes can be done by reducing nutrient levels and routine monitoring and active management of the algae levels, especially during summer months. Regular monitoring can help tell if other steps should be taken such as algaecide treatments. If large algae blooms continue to happen, they can result in fish kills or other negative consequences such as closure of a waterbody to swimming due to toxins released by some algae.

7.1.3 Restore Open Water Areas

Multiple species of fish spawn in areas with less vegetation and more open sunlight, so preventing excessive vegetation from growing in shallower areas can help sunfish and other desirable species survive. Restoring the pond reduces the oxygen demand which can stunt fish populations in some situations.

7.1.4 Restore Spawning Areas

Some species of fish, such as bass, perch and sunfish require coarse silt-free sediment for successful nesting and spawning. In ponds that have filled in over time with fine silt and sediment, there may be a need to enhance spawning habitat in select areas through the addition of coarse sand, gravel, or other substrates that would be attractive to bass and other species for nesting. This can be achieved by layering the clean material over the silt, or preferably removing the silt and fines to expose the underlying coarse material. Selecting areas that are naturally exposed to wind and waves will help maintain these areas.

7.2 Lake Quinsigamond Recommendations

Lake Quinsigamond's fish community is overall good, with a wide variety of game fish, sun fish, and other species. There are reports of stunted fish according to the angler survey, which could be caused by the excessive plant growth, especially in the southern end of the lake.

7.2.1 Continue with Invasive Plant Management

Various Anglers reported wanting to see less vegetation, specifically milfoil, in the way while they are fishing in Lake Quinsigamond. By preventing the excess vegetation, other sunfish species can thrive with more open space. Having more open space can also help with improving the dissolved oxygen levels and keep fish populations from being stunted, since another comment from the angler survey was the small fish size. It is recommended to continue with the existing plant management program on a more consistent basis, to keep the habitat consistent for fish communities.

7.3 Indian Lake Recommendations

Indian Lake has had issues with both algal blooms and excessive plant growth, which could stunt the fish population. The lake has great deep and shallow water areas to support a wide variety of fish species with the lake in the best conditions.

7.3.1 Reduce Algal Blooms

Indian Lake has a history of algae blooms leading to decreased water quality, possibly affecting the fish population in the lake. This solution will hopefully be tested as plans for the alum dosing station on Shore Drive continue to move forward. Until then, monitoring during summer months and alum treatments should continue to keep nutrient levels at an appropriate level for fish.

7.3.2 Stocking Trout

Although Indian Lake's shallow water level is not ideal for long term communities of cold water species such as trout, stocking trout in the spring can be nice to encourage anglers to use the lake.

7.3.3 Carp Control

Recent fish surveys had noted the excessive amount of carp in the water at Indian Lake. These carp can stir up the sediment at the bottom of the lake, decreasing the quality of the water, especially with how shallow the lake is. Carp removal can be done in a variety of methods, including contracting a company to use netting or electrofishing to eliminate as many as possible. Other less direct methods can be done like introducing more of a competing species, such as bluegills, which can feed on carp eggs.

7.4 Bell Pond Recommendations

Bell Pond is a smaller pond area with deep and shallow water present to support their wide variety of fish species. There are reports of well stocked trout and other game fish in the pond, which show that the fish community is overall reasonably good. Additional monitoring of water quality, including a dissolved oxygen profile, could give a better idea of the condition of the lake in regards to stratification and weed management.

7.4.1 Maintain Trout Stocking

Many people commented on the abundance of fish including rainbow trout and largemouth bass. Bell Pond is stocked with trout in the spring, so it is in their best interest to continue stocking at the same rate to maintain the fishing habitat.

7.5 Coes Reservoir Recommendations

Coes Reservoir is known to have frequent algal blooms in summer months, which could affect the fish population. The fish population will continue to succeed as long as the weed growth stays under control and the algae monitoring programs keep watch for cyanobacteria cell counts.

7.5.1 Monitor Bluegill- Stock Largemouth Bass

Coes Reservoir has an abundance of bluegill noted by anglers on the survey. These fish could contribute to algal blooms because of their tendency to eat zooplankton as adults. By monitoring the population size, and possibly removing or stocking a competing species, water quality could improve with fewer algae blooms. A common monitoring technique is to stock more largemouth bass, which can outcompete the extensive bluegill population. Largemouth bass are already present in Coes Reservoir and anglers have commented on wanting more game fish. By stocking largemouth bass, the fish population can be improved by adding more game fish and lowering the number of bluegills.

7.5.2 Stock Trout in Spring and Fall

Currently there are records of trout being stocked in the spring, but multiple responses from the angler survey mentioned wanted more trout and bass. By stocking in the spring and fall there will be an increase in game fish, helping both anglers and the fish population. Since trout are cold water fish, they will thrive through the winter and be good for ice fishing or other similar activities.

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