Electrofishing Study Results & Fishery Analysis

PROPERTY NAME: Miromar Lakes CDD and Esplanade Lake Club CDD (North Lake 5/6)
SUBMITTED TO: Bruce Bernard
SAMPLING DATE: 3/21/2022
Report DATE 5/2/2022
SUBMITTED BY: David Beasley, Peyton Woods and Alex Johnson

The electrofishing report is designed to provide an in-depth representation and analysis of the current state of the fishery. The results allow our biologists to make educated and precise decisions on any improvements that may be needed to meet your goals. The findings and their significance are followed by a discussion including management recommendations.

Goals

Establish and maintain a healthy fishery with good water visibility as well as minimal midge populations.

Methods (Approach)

A Midwest Lake Electrofishing System was used to collect all fish that were observed. Information was gathered on all fish collected during two sampling events. Length, weight, and abundance data were recorded and logged into a database. Relative weights were calculated for Largemouth Bass and Redear Sunfish. During sampling, all fish over three inches were collected to determine species relative abundance and size classes to evaluate the health of the fishery.

Relative Weights

Relative Weight (Wr) is the ratio of the actual weight of a fish to what a healthy fish of the same length should weigh, called standard weight. Fish with high relative weights are fat while those with low relative weights are thin. Comparing Wr is a preferred method of biologists to understand how a fishery is responding to management practices. Proper attention to Wr in relation to the time of year is important when drawing conclusions regarding a fishery. Relative weights of bass below 90 could be an indication of a lack of food resources or difficulty obtaining prey. A relative weight of 100 would indicate a bass of "normal weight" relative to its length and would be desired for a balanced fishery. Those desiring a trophy bass fishery should aim to maintain relative weights of 110 and above.

$$Wr = \frac{\text{Actual Weight of Captured Fish}}{\text{Standard Weight of Fish at Same Length}} \times 100$$

Relative Weight Reference

Wr	Condition of Fish
90	Healthy
100	Quality
110	Trophy

Results & Discussion

Relative Abundance

- We collected nine species of fish: Bluegill (10), Largemouth Bass (70), Redear Sunfish (24), Blue Tilapia (8), Florida Gar (12), Threadfin Shad (2), Pleco/armored catfish (2), Bowfin (1), and Mayan Cichlid (2).
- We removed all stunted Largemouth Bass, Florida Gar, Bowfin, Tilapia, and Vermiculated Sailfin Catfish. All Bluegill, Redear Sunfish, and Threadfin Shad were released. See the appendix at the end of this document for all fish descriptions.
- The survey was conducted at night due to the lake's clear water.
- Catch rates were impacted by water clarity and a lack of cover.
- The predator to prey ratio is 'poor' with more predator fish collected than prey.
- Very few minnow species such as Golden Shiner or Threadfin Shad were observed during sampling.

- Based on the goals of the fishery, young-of-the-year Bluegill counts were 'rare' and adult numbers were 'absent'.
- The Catch per Unit Effort (CPUE) for Largemouth Bass over 8 inches was 67 fish/ hour, for Bluegill it was 15.6 fish/hour, and for Redear Sunfish it was 37.4 fish per hour. The CPUE for all bass was 109.5 fish/hour.

Size Structure

- Largemouth Bass ranged in size from 4.5 to 15.0 inches and averaged 9.4. We collected 52 stock-size Largemouth Bass (over 8 inches) and their length distribution is indicative of a small stunted population of fish with no bass greater than 14 inches collected (Figure 1).
- Only ten Bluegill were collected during sampling, and the Bluegill ranged in size from 2.8 to 5.4 inches with an average of 3.6. Based on the collected fish, the population is small in both size and quantity. (Figure 2).
- Redear Sunfish ranged in size from 3.1 to 11.0 inches, and averaged 8.2 inches. The population consists mainly of adult fish, although multiple size classes of fish were present.
- Florida Gar ranged in size from 16 to 20 inches.

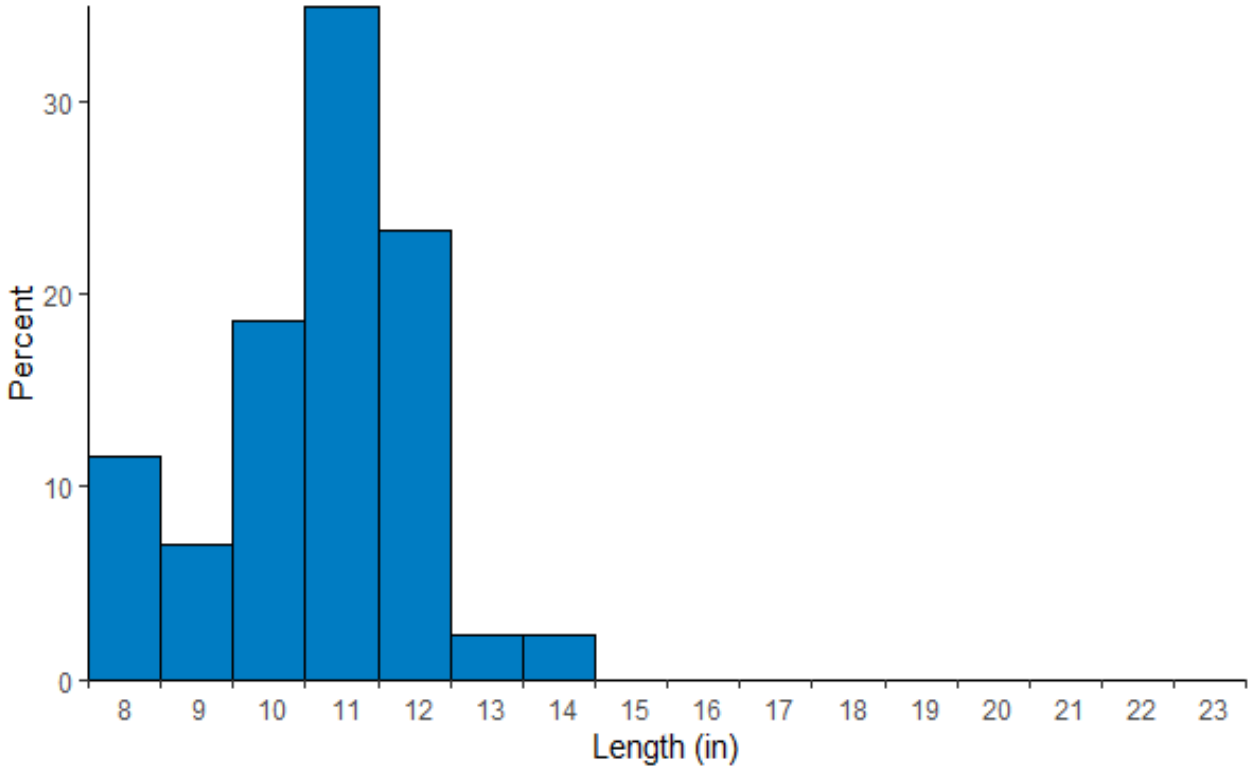


Figure 1 – Largemouth Bass size distribution.

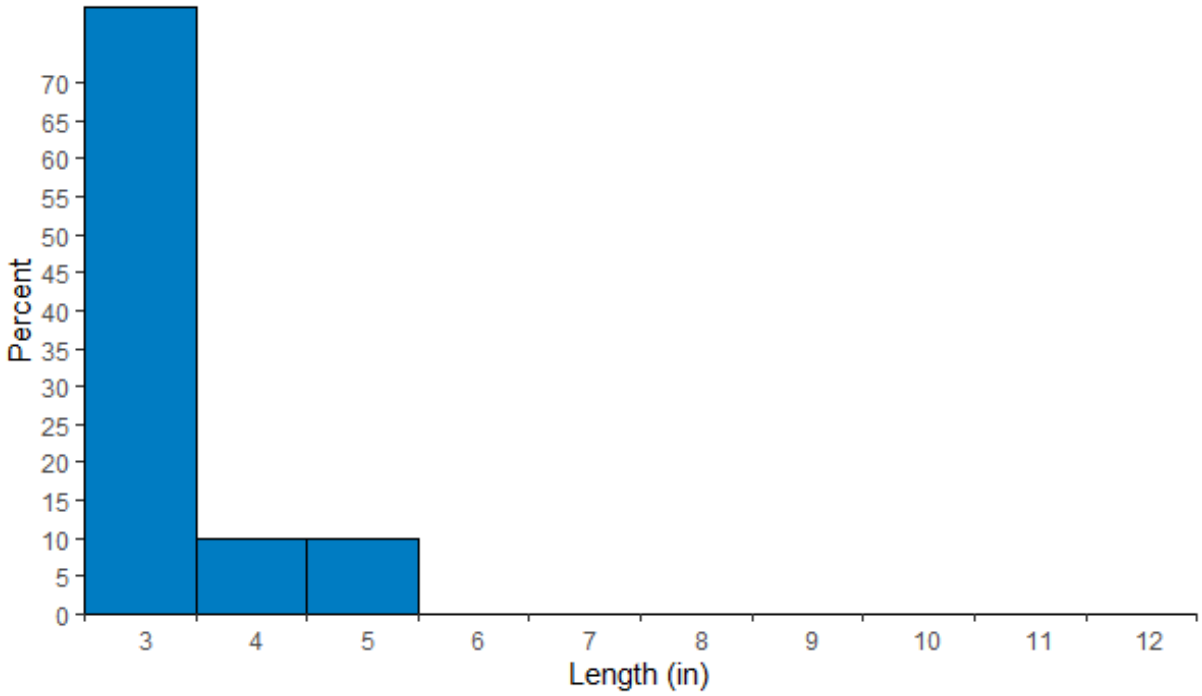


Figure 2 – Bluegill size distribution.

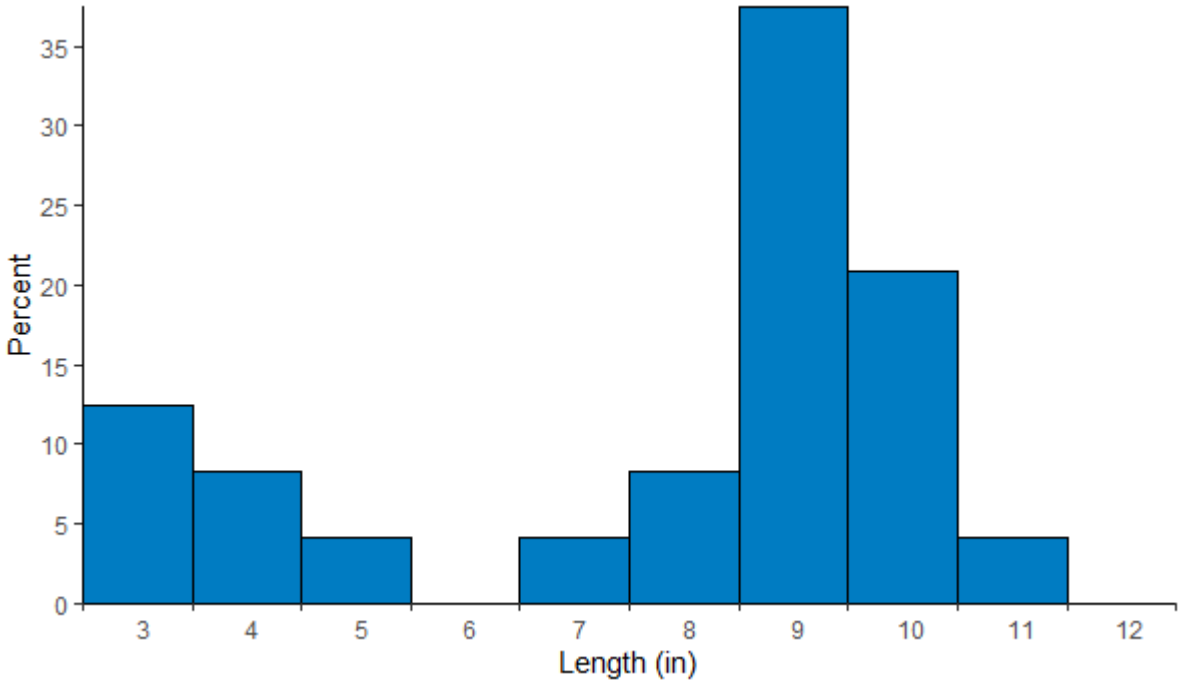


Figure 3- Redear Sunfish size distribution.

Relative Weight

Relative weights (Wr) of Largemouth Bass were 'poor' based on the goals set for the fishery. Wr ranges from 61.8 – 113.8 and averaged 81.2 (Figure 4). Figure 4 provides a visual of the undersized Largemouth Bass present in the lake, with a lack of bass weighing greater than one pound. There is a steep decreasing trend present between relative weight and length of Largemouth Bass (Figure 5). As length increases, the relative weight decreases, suggesting that suitable forage is absent for larger bass.

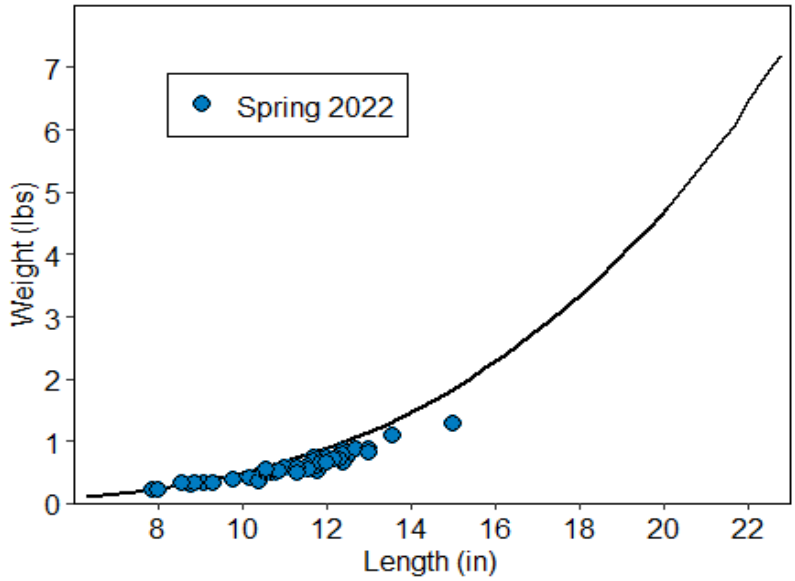


Figure 4 – Largemouth Bass relative weights. The black line represents the relative weight of 100.

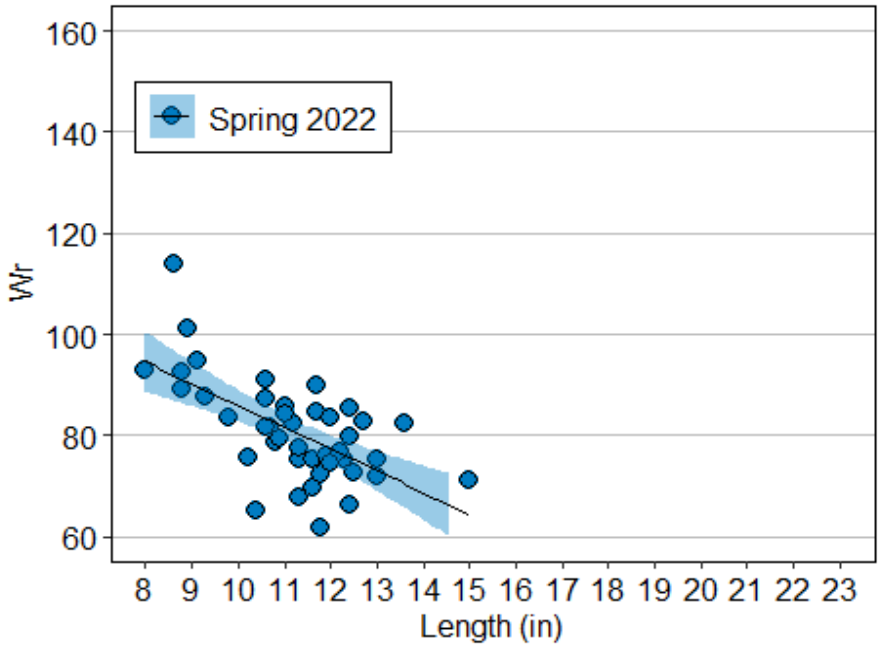


Figure 5 - Largemouth Bass relative weights versus length.

Only one of the ten Bluegill collected was large enough to measure its relative weight. As a result no graph was created. There were 24 Redear Sunfish collected during the survey and 19 were large enough to measure for relative weights. The relative weights for the Redear Sunfish ranged from 70.6-118.8, with an average of 103.1 (Figure 6).

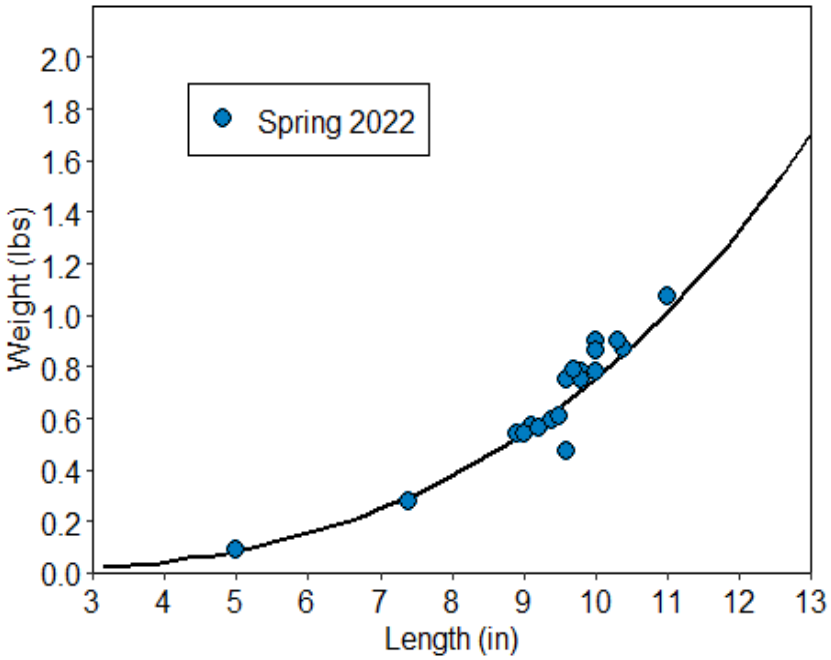


Figure 6 - Redear Sunfish relative weight.

Fish Habitat

Shoreline rip-rap as well as minor amounts of submerged aquatic vegetation are present, but are not providing adequate refuge for forage fish. Following years of minimal vegetation growth throughout the lake as a result of Grass Carp consuming it, aquatic vegetation is starting to reestablish itself in areas throughout the lake. This is likely a result of a diminishing Grass Carp population.

Dense cover required by forage fish needs to be improved through the addition of beneficial aquatic vegetation and artificial structures. The lakes bottom substrate is composed mainly of sandy material, and is an excellent fish spawning material. The overall fish habitat is rated as 'poor'.

Fishery Assessment

The predator fish population is overcrowded relative to the current population of forage fish. Bluegill are an important forage fish species within the food chain and their population is low. A healthy population of Bluegill and Redear Sunfish play's a key role in the process of controlling aquatic insects, including midge larvae.

Fisheries managers compute relative weight to assess fish condition, and our results indicate that Largemouth Bass relative weights are well below optimal. This data is supported by the lack of small and intermediate sized forage fish (Bluegill, Redear Sunfish, Threadfin Shad, Tilapia). Largemouth Bass will remain undersized and underweight until the forage base improves. During this time as the bass are overpopulated relative to the forage base, it will be difficult to establish a thriving population of forage fish.

Although the current population of small and intermediate size forage fish are being suppressed by predator fish, observations as well as data indicate that the forage population is in poor shape due to insufficient cover as well as a lack of available food. To improve the population of forage fish the availability of cover as well as a reliable food source must be improved.

Conclusions & Recommendations

The forage base will need to be supported through improving the fish habitat, improving their food source as well as reducing the number of predator fish. A dense population of phytoplankton and zooplankton would solve the forage bases food source issues, but it would conflict with the goal of good water clarity. Based on the goals, the best approach to improving the food source for forage fish, as well as improving the amount of cover for forage fish will be to promote the growth of aquatic vegetation species throughout the lake. To do this successfully while minimizing the risk of vegetation growing on the beach areas and in front of waterfront homes, it would be best to install aquatic vegetation species that can coexist with a moderate population of Grass Carp (i.e. carp do not eat them). If done correctly the lake can have 5-10 percent coverage or greater of aquatic vegetation while still utilizing Grass Carp to cost effectively suppress many species of vegetation throughout the lake where plants are undesired. Determining the actual areas where vegetation will be installed/tolerated will require further discussion.

A strategy of this nature is an ideal approach to striking a balance between all goals while also helping to limit the future budget/effort required to control aquatic vegetation using herbicides.

A summary of our recommendations:

Habitat

- Add artificial manmade cover to protect smaller fish.
- Promote the growth of fragrant White Water Lily's in water depths up to 10 feet deep, as well as emergent vegetation species (Pickerelweed, Duck Potato, Soft Rush) along the shoreline in water depths less than three feet deep. Based on initial observations, there are over 30,000 linear feet of areas that vegetation will likely be tolerated by the communities. It is likely that a portion of the vegetation will need to be protected using exclosures. These exclosures would be constructed of 3-4 foot tall black pvc coated galvanized steel fence material. Exclosures would be installed during the seasonally low water levels in the spring and would most likely stay in place for 18 months.

Fish Stocking

- Stock adult Bluegill and Redear Sunfish greater than 5.5 inches to establish a population of adult forage fish.

Management

- Harvest intermediate size Largemouth Bass as well as Gar via electrofishing and angling to improve the existing population of forage fish as well as reduce predation on any forage fish being stocked.
- Control submersed aquatic vegetation using Grass Carp once species such as Pickerelweed, Duck Potato, Soft Rush and White Water Lily's have been successfully established.

Thank you,
SOLitude Lake Management
Fisheries Biologists
David Beasley, Peyton Woods and Alex Johnson

Projected Budget

Year	Month	Details - North Lake 5/6	Cost	Notes
2022	May/June	Vegetation test areas (without fencing)	$18,870	Test areas to see if vegetation can be installed successfully without using fencing exclosures
2022	May/June	Install artificial fish cover in select locations throughout the lake	$30,300	Artificial mossback fish cover
2022	August/September	Vegetation test areas (without fencing)	$40,780	This assumes the initial test areas work and exclosures are not needed. If exclosures are needed, this task would move to 2023 to coincide with seasonally low water levels. Artificial cover scheduled for 2023 would be completed in 2022 instead of this vegetation installation
2023	January/February	Install artificial fish cover in select locations throughout the lake	$62,100	Artificial mossback fish cover
2023	TBD	Vegetation Installation (including fencing if needed)	$135,900	If exclosures to protect plants are not needed, then funds will be reallocated to install more plants
2023	December	Harvest gar and bass and any undesired species over multiple electrofishing events	$28,900	Make observations on forage fish and aquatic vegetation, modify stocking strategy accordingly
2024	February/March	Harvest gar and bass via electrofishing	$56,700	Improve the forage base population by electrofishing to reduce the population of predator fish, tag female bass to better understand population size
2024	March	Stock 6,500 pounds of Bluegill greater than 5.5 inches	$103,000	Price accounts for the likely price increase that may occur (actual price will depend on fair market value at the time of the sale)
2024	November	Stock Grass Carp	$8,000	If needed (the number of carp will depend on the amount of undesired submersed aquatic vegetation present). This assumes the desired vegetation species have established and are maturing

2025	February/March	Harvest gar and bass and any undesired species over multiple electrofishing events	$27,650	Improve the forage base population by electrofishing to reduce the population of predator fish, tag female bass to better understand population size
2025	March	Stock 3,250 pounds of Bluegill greater than 5.5 inches	$54,000	Price accounts for the likely price increase that may occur (actual price will depend on fair market value at the time of the sale). Space stocking out further if the relative weights of the stocked Bluegill are lower than desired
2024	November	Stock Grass Carp	$4,100	If needed (the number of carp will depend on the amount of undesired submersed aquatic vegetation present)
2026	February/March	Harvest gar and bass and any undesired species over multiple electrofishing events	$29,000	Improve the forage base population by electrofishing to reduce the population of predator fish, tag female bass to better understand population size
2026	April	Stock Grass Carp	$8,600	If needed (the number of carp will depend on the amount of undesired submersed aquatic vegetation present)
		Projected Budget		
		2022	$89,950	
		2023	$226,900	
		2024	$167,700	
		2025	$85,750	
		2026	$37,600	
		Total	**$607,900**	

Artificial Fish Cover Recommendations

The units below are recommended based on the large amount of surface area they provide for periphyton to grow on. Due to the lack of plankton in the water, all fish cover installed should maximize periphyton growth as well as protect smaller fish.

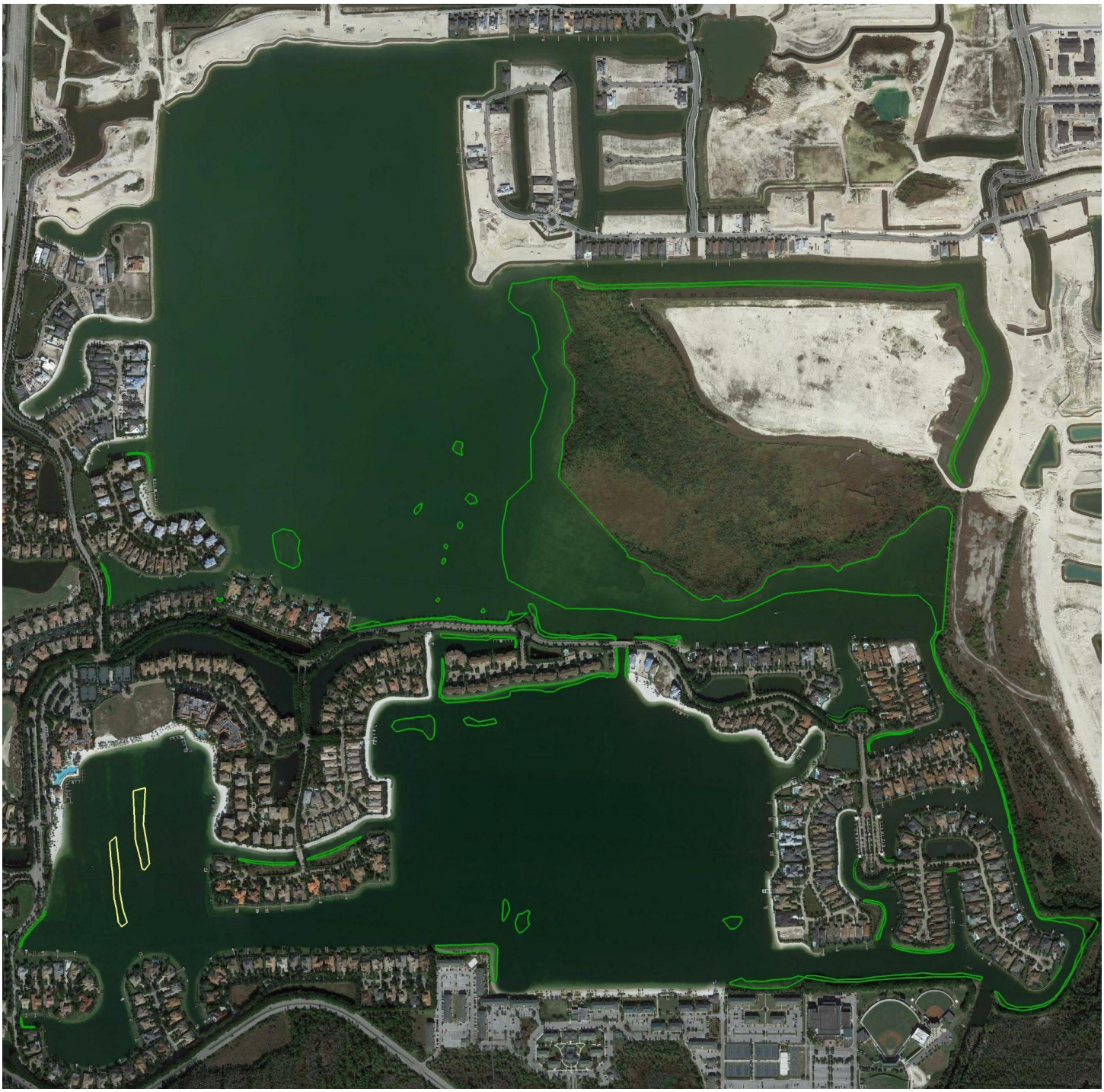
MossBack Safe Haven Kit
(3) 40-inch Trophy Tree Trunks
43 inches tall including base
(54) 46" Limbs

MossBack Trophy Tree Kit
(3) 40-inch Trophy Tree Trunks
43 inches tall including base
(27) 46" Limbs

MossBack Trophy Tree
40-inch Trophy Tree Trunk
(9) 46 inch Limbs

MossBack Root Wad Kit
(3) 20-inch Trophy Tree Trunks
23 inches tall including base
(9) 46 inch Limbs

Draft Map of Vegetation Installation areas (primarily areas without homes)



Appendix: Fish Pictures and Life History

Largemouth Bass
Micropterus salmoides

Management Notes: Largemouth Bass are the most popular warm water sport fish in North America. However, more fish in a pond does not mean more big bass. They have a tendency to become overpopulated and often require active harvest or removal of intermediate sized fish to prevent size classes from becoming stunted. Under trophy management Largemouth Bass can exceed 12 pounds.

Habitat and Biology: Largemouth Bass occupy almost all aquatic habitats. They thrive in lakes, ponds, and reservoirs where they are more tolerant of turbidity and slack water current and are found in the weedy parts of the body of water. Spawning occurs in spring, when water temperatures reach the mid- 60's and takes place in deeper water than other sunfishes, usually1 to 4 feet. Males build and defend a nest. After spawning, the female leaves the nest although she, or another female, may return to spawn later. The eggs hatch in 3 to 4 days. Females produce 2000 to 7000 eggs per pound of body weight. Until they are 2 inches long, largemouth fry feed on plankton, insects and other invertebrates. Adult Largemouth Bass prey upon Bluegill and Redear Sunfish in stocked ponds and upon shad, minnows, smaller sunfishes, crayfishes, and amphibians in natural habitats. Average life span is from 10 to 12 years, although growth rates are extremely variable depending on the water body.

Characteristics: The back of the fish is olive green to brown, and the greenish sides are marked with a broad black band composed of somewhat oval blotches connected by shorter blotches. The belly is white, and between it and the lateral stripe are several rows of scales with darkened centers, giving the fish a striped appearance. The dorsal, caudal, and pectoral fins are varying shades of green and the pelvic and anal fins are clear to white. They typically grow 12 to 30 inches in length.

Bluegill
Lepomis macrochirus

Management Notes: Bluegill are the number one food source for Largemouth Bass. A healthy population with abundant small individuals is critical for ponds being managed as successful Largemouth Bass fisheries. They readily accept pelletized feed, which makes it very straightforward to grow large Bluegill for angling and lots of small fish to feed bass. Bluegill are not only stocked in ponds and lakes as the primary food source for Largemouth Bass, but are also a fun and easy sportfish for kids to catch. In addition to their catchability, they also help bring balance to the ecosystem by feeding on insect larvae, including mosquito larvae.

Habitat and Biology: Bluegill are warm water species that are well suited for the habitat found in ponds and lakes. Bluegill are colony nesters and begin spawning when the water temperatures reach 60°F. They have a protracted spawning season lasting from April to September. The long spawning season of Bluegill gives them tremendous reproductive potential. Bluegill nest in colonies and prefer sites with firm substrates such as gravel within water 1 to 3 feet deep with little to no vegetation or debris. They typically reach maturity at age 1 or 2. Bluegill feed during the day and most actively in the morning and afternoon. They eat a wide variety of organisms including significant amounts of plant material and insect larvae. Young Bluegill feed on plankton while larger individuals eat insects and other fish. They feed throughout the water column. Bluegill live for 5 to 6 years and grow 6 to 10 inches in length.

Identification Characteristics: The mouth on a Bluegill is small with the upper jaw not extending to the front of the eye. The flexible ear flap is always black and is small in juveniles while longer in adults. Juveniles and non-breeding adults are light olive to gray on the back and sides with several evenly spaced, darker vertical bands. The venter varies from pale yellow to white. All but small individuals have a distinct black spot toward the rear of the soft dorsal fin. Breeding males darken, with the black and sides becoming purple.

Redear Sunfish (Shellcracker)
Lepomis microlophus

Management Notes: Due to their preferred diet of snails and clams, Redear Sunfish play a vital role in reducing fish parasites such as black and yellow grub in a pond, which require a mollusk host to complete their life cycle. Redear are usually stocked into small ponds and lakes with Bluegill and Largemouth Bass. They grow quite well in these environments, and because of their diet, do not compete with Bluegill. Their reproduction is limited, however, and a supplemental stocking is recommended every few years to support their population.

Habitat and Ecology: This species occurs in moderate to large streams, rivers, reservoirs, lakes, swamps, and other standing-water habitats. Spawning occurs during May, June and July when water temperatures reach 70°F. They prefer water three to four feet deep, and a firm, shelly bottom, often near a dropoff. Nesting sites are often near aquatic vegetation such as water lilies, cattails, lizard's tail, and maidencane. Breeding behavior is similar to other sunfish, with the males doing the nest building and guarding the young. A female may lay between 15,000 to 30,000 eggs during a spawn. Redear Sunfish have extensive molar surfaces on the pharyngeal arches and associated musculature that enables the fish to crack mollusk shells, hence the local name of shellcracker. Individuals live for six years and grow 8 - 11 inches in length.

Characteristics: The back of this species is light green to brown with scattered dark spots. The sides are light gray to silver. Lower surfaces of the head and venter are light yellow to white. Sides of the head are mottled with brown to dark orange spots. The dorsal fin is light gray while the anal fin is light yellow to white. The pectoral fin is long and pointed, its end reaching past the nostril when bent forward. The common name of this species is derived from the characteristic red or orange spot at the rear of the opercular flap.

Golden Shiner
Notemigonus crysoleucas

Management Notes: Golden Shiners are a great supplemental forage fish for Largemouth Bass ponds. They reproduce several times a season, and routine stocking helps reduce the predation pressure on the Bluegill population. Golden Shiners compete with young Bluegill for food and are therefore best stocked in the fall.

Habitat and Biology: The Golden Shiner is a slow-water fish that thrives in ponds. It usually occurs where there is abundant vegetation and clear water and commonly avoids silty areas. Spawning occurs several times from April to July when water temperatures exceed 68° F. Females lay adhesive eggs in shallow water over vegetation, including filamentous algae and rooted aquatic plants. The eggs are usually broadcast with no nesting or parental care but some Golden Shiners have been reported to spawn over the nests of both Bluegills and Largemouth Bass. Growth is typically rapid and maturity is usually reached at age 2, although fast growing fish may spawn during their second summer. Zooplankton forms a large part of their diet. They are also known to feed on algae, insect larvae, and the eggs of other fish species.

Characteristics: The body of the Golden Shiner is deeply and laterally compressed, with a lateral line that curves toward the venter on the anterior part of the body. The venter has a sharp, fleshly keel extending from between the pelvic fins to the sickle-shaped anal fin. The head is small, with a small, upturned mouth. The back is light greenish olive to light orange; the sides are silvery, the venter white. They grow 2 to 9 inches in length.

Threadfin Shad
Dorosoma petenense

Management Notes: The Threadfin Shad is a favorite food for many game fishes including Largemouth Bass, Hybrid Striped Bass, Smallmouth Bass, and catfish. It is a warm water fish that requires annual spring stocking. This fish is widely introduced throughout the U.S. as a forage fish for game fish.

Habitat and Biology: This pelagic, plankton-feeding species occurs in large, often single-size schools and with Gizzard Shad. The greatest numbers occur in rivers, reservoirs, and large streams, where they can be seen rippling the surface at dawn and dusk. Spawning typically occurs from dawn to sunrise, when water temperatures reach 70°F. The eggs adhere to submerged and floating objects. Females lay from 2,000 to 24,000 eggs. The young and adults feed on a variety of planktonic organisms and organic debris. This fish is very sensitive to changes in temperature and dissolved oxygen, and die offs are frequent in fall and late summer especially when water temperature reaches 42 °F. Threadfin Shad sometimes grow larger than their prey when this happens they tend to take up a large number of the biomass and a method of reduction is required. Life expectancy seldom exceeds 2 to 3 years and they grow 5 to 7 inches in length.

Characteristics: Like the Gizzard Shad, the Threadfin Shad has an elongated posterior dorsal ray, but its mouth is terminal and the lower margin of its upper jaw is not notched. The back is bluish gray with a persistent black or purple shoulder spot. The venter is silver to creamy white. The caudal fin is distinctly yellow (hence the local name "yellowtails). Other fins may be light yellow, dusky, or clear.

Blue Tilapia
Oreochromis aureus

Management Notes: Due to their rapid reproduction, Blue Tilapia can be stocked as a supplemental food source in ponds managed for Largemouth Bass. They can also be placed in ponds for algae control where legal. They are a warm water fish and will die each fall when water cools to about 50° F. Whether stocked for algae control or as a food source, it is important to remember they are not native to the United States and should never be moved from pond to pond. Tilapia should only be stocked by professional biologists who possess a permit and are certified by each state.

Habitat and Biology: Tilapia are tropical fish species that resemble our native sunfish and can control certain aquatic vegetation. Blue Tilapia commonly stocked in the United States are native to the Middle East and northern Africa. They feed on algae (both planktonic and filamentous) and detritus and do not readily consume submerged vascular plants. Because Blue Tilapia are tropical fish, they cannot survive normal winter water temperatures in most of the U.S. In the mid-Atlantic, annual restocking is generally necessary unless a warm water supply (such as thermal spring or power plant cooling reservoir) is available as a refuge where the fish can overwinter. Tilapia are stocked in the spring and reproduce often, providing a steady supply of food for predators. They have demonstrated control of algae in ponds in approximately one month. They are an excellent food fish and can be eaten if caught. The high rate of reproduction, coupled with high fry survival and fast growth, make Blue Tilapia an excellent supplemental forage for largemouth bass.

Characteristics: Blue Tilapia are large cichlids resembling a two-pound Bluegill with rounded fins when fully grown. They are bluish-gray in color with a white underside. They average about 8 inches but can reach up to 20 inches and 8 pounds.

Florida Gar
Lepisosteus platyrhincus

Management Notes: Although native to Florida, gars may be undesirable in a system being actively managed for Largemouth Bass as they compete for the same forage fish.

Characteristics: Florida Gar have irregular round, black spots on the top of the head and over the entire body including the anal fin. It has a shorter, broad snout with a single row of irregularly spaced sharp teeth on the upper and lower jaws. No bony scales are on the throat. Their color is olive-brown on the back and upper sides, with a white to yellow belly. The young may have dark stripes on the back and sides.

Habitat and Biology: The Florida Gar is found throughout peninsular Florida and north into Georgia. It can often be found in medium to large lowland streams such as the Ochlockonee River, lakes and canals with sandy or muddy bottoms and ample vegetation. They inhabit shallow to medium-depth waters and prefer to ambush prey rather than chase them down. Adult gar feed primarily on fish, though they are known to eat crayfish and shrimp as well. They are capable of surviving in poorly oxygenated water due to their ability to gulp air at the surface utilizing their specialized gas bladder. Spawning occurs in late winter and early spring in shallow weedy areas.

Bowfin
Amia calva

Characteristics: The Bowfin has been given other vernacular names such as grindle, grinnel, mudfish, and dogfish. The Bowfin is a long, cylindrical fish with a prominent backbone that flexes upward into a rounded tail. Body color is mottled olive green to light brown on the back, grading to light green to cream on the venter. It has a prominent black spot, which is surrounded by a yellow or orange ring and located near the base of the caudal fin on young Bowfins and adult males. The adult Bowfin's large mouth possesses many sharp, canine teeth.

Habitat and Biology: Bowfins prefer quiet, clear, backwater areas, lingering along the margins of aquatic vegetation, in undercut banks, and around branches and other submerged structures. Bowfins are spring spawners, nesting from May to early June when temperatures are 60° to 66°F. The nests are usually in quiet bays or inlets with abundant water plants and shelter such as stumps or fallen logs. The male Bowfin exhibits extensive parental care. The male clears an area in the mud for the female to lay eggs in, and then fertilizes them. He hovers nearby and aggressively protects the eggs and the fry after they emerge. Hatching typically occurs after 8 to 10 days. Small Bowfin typically form dense schools and remain in or near aquatic vegetation until they reach 4 to 5 inches. Bowfins are able to breathe air, using their swim bladder as a primitive lung, and can be seen coming to the surface and gulping air even in well oxygenated water. This air-breathing ability allows them to utilize shoreline habitats that are not accessible to other predator fish. The Bowfin is an indiscriminate predator that readily preys on a broad variety of arthropod and vertebrate prey, from insects and crawfish to other fish and frogs. They can live 30 years or more and reach lengths from 15 to 24 inches.

Vermiculated Sailfin Catfish
Pterygoplichthys disjunctivus

Characteristics: Vermiculated Sailfin Catfish have worm-like markings all along their body, and have 9-14 dorsal fin rays. They a benthic forager, using its suctorial mouth to attach to surfaces and to consume detritus and algae. They were most likely introduced through fish farm escapes or releases, although aquarium releases cannot be ruled out.

Habitat and Biology: Sailfin Catfish live in nearly any type of slow moving streams, canals, ponds, and lakes; and are normally most abundant along the shore and in shallower waters. They are known to create spawning burrows along shorelines, sometimes undermining canal banks and lake shorelines. Little is known about the vermiculated sailfin's specific habitat preferences. Male and females start maturing when they reach 13 and 11 inches long respectively. Male members of the genus Pterygoplichthys dig out banks to create burrows in which an attracted female will lay her eggs. Females will lay about 2,000 eggs in shoreline burrows, holes, or crevices generally between April and September. The nests are guarded by the female until the eggs hatch. In large numbers, this burrowing behavior by *Pterygoplichthys* contributes to problems with siltation and can potentially destabilize the banks, leading to an increased rate of erosion.

They primarily feed on detritus, algae, sand, small freshwater bivalves, water fleas, and decaying matter. They are most active around dusk, when they root around the bottom sediments looking for worms and insect larvae. They have a sucker-like mouth that is used to scrape algae from stones and other surfaces with their spoon shaped teeth.

Mayan Cichlid

Cichlasoma urophthalmus

Characteristics: Adult and juvenile *C. urophthalmus* have a yellow to olive-brown body, with five to seven distinct vertical bars and a prominent dark ocellus ringed by blue at the base of the caudal fin. Their body color varies greatly in intensity; sometimes with bright red on the chin, throat, and breast. Adult *C. urophthalmus* have a slightly protrusible mouth with three rows of unicuspid teeth in both the upper and lower jaws. The first row of teeth is more pronounced than the other two, and includes teeth differentiated as canines (two or three on each side). The pharyngeal bone is occupied by flattened, crushing-type teeth in the center, surrounded by smaller, fine teeth. The flat, short gill rakers generally range in number from 9 to 11.

Habitat and Characteristics: Mayan Cichlids are very adaptable and live well in a wide variety of habitats including canals, rivers, lakes and marshes. They can tolerate a wide range of salinities. Nest building primarily occurs in April, followed by peak spawning in May and June. Mayan cichlids are biparental substrate spawners, and produce adhesive eggs. When the young hatch, they will immediately swim toward the bottom, where they attach with adhesive head glands. The young begin free-swimming after about five to six days, but continue to be guarded by the parents for days thereafter. They will generally only spawn once per year. Mayan Cichlids are generalist predators, consuming grass shrimp, small fish, snails, and insects along with some incidental detritus and vegetative matter.