

Aquatic Environmental
SERVICES, INC.



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Education in the School of Fish

Electrofishing Report

Swan Lake

Fishery Goals: Balanced; Quality Bass and Crappie Fishing



Survey Date: 03/25/2025

Report Date: 04/11/2025

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Water Quality: Pages 6 - 8

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Dam and Outlet Assessment: Pages 44 - 45

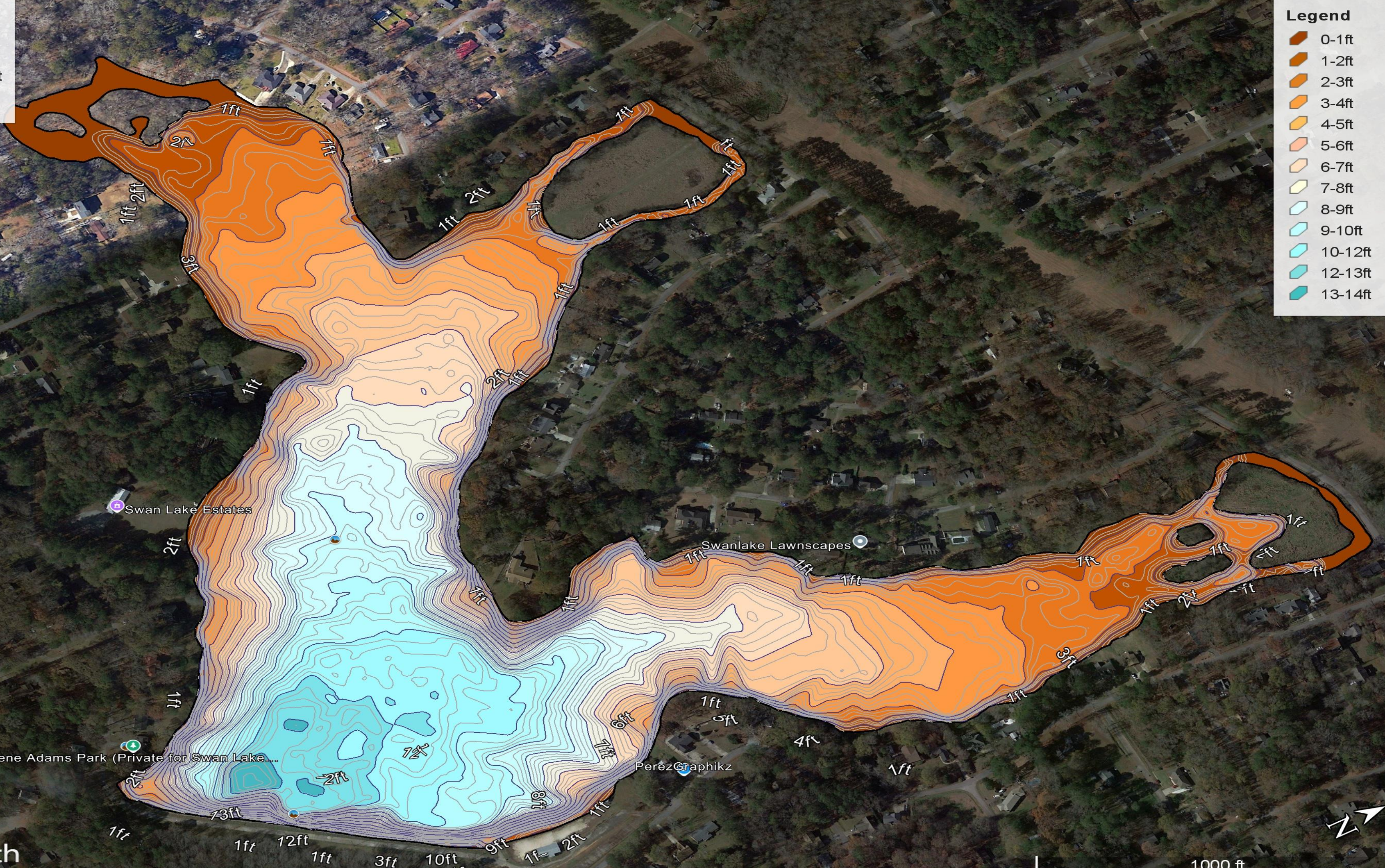
Lake Morphology / Characteristics

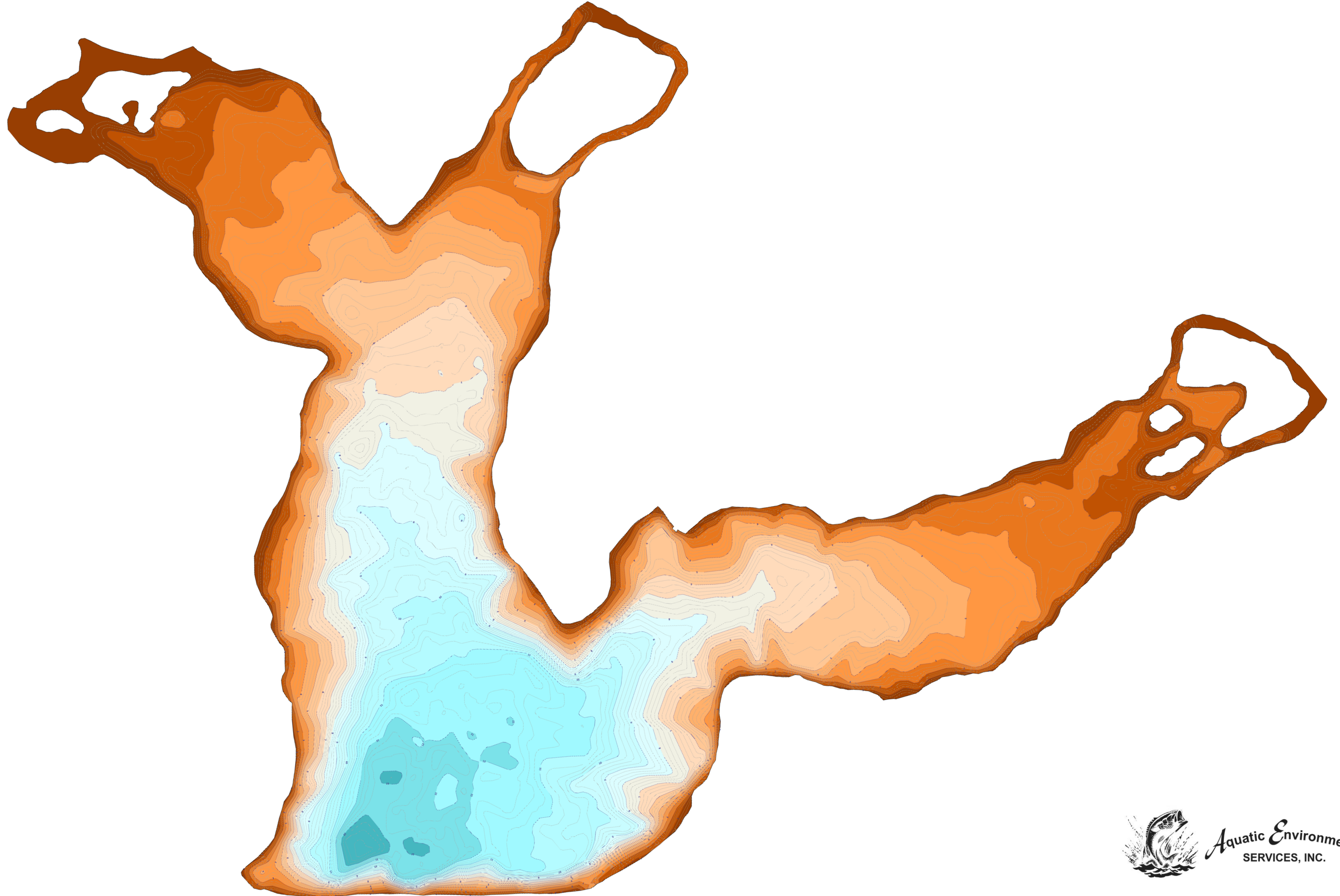
Item	Result	Evaluation
Lake Surface Acreage	81.8	-
Perimeter Length (ft.)	15,134	-
Average Depth (ft.)	5.7	-
Maximum Depth (ft.)	13.9	-
Total Acre-Feet	425.1	-
Watershed Acreage	4,165	The watershed consists mainly of residential development and forested land.
Watershed Ratio	51:1	Overall, the watershed is suitable for the pond's surface area (20:1 – 40:1 desirable) and should allow the pond to maintain full pool throughout the year; however, the pond may still fluctuate during periods of limited rainfall.
Drainage System	Two Siphon Systems and Concrete Spillway	Keep dam mowed at least two times a year, remove small trees growing on the dam with a <6" diameter.
Habitat Assessment	Fair dense habitat for forage refuge in the form of vegetation; limited fishing habitat for predators to utilize as ambush/orientation points.	Install natural laydowns/brush to improve fish structure and provide habitat apart from vegetation. Vegetation can recede in cold months, leaving bluegill with limited refuge areas and bass with limited ambush habitat (see page 26).

Swan Lake

Area: 81.8 acres
Perimeter: 15,134 ft
Volume: 425.1 acre-ft
Avg. Depth: 5.7 ft
Max Depth: 13.9 ft

Legend	
	0-1ft
	1-2ft
	2-3ft
	3-4ft
	4-5ft
	5-6ft
	6-7ft
	7-8ft
	8-9ft
	9-10ft
	10-12ft
	12-13ft
	13-14ft





Aquatic Vegetation

Image of Nitella



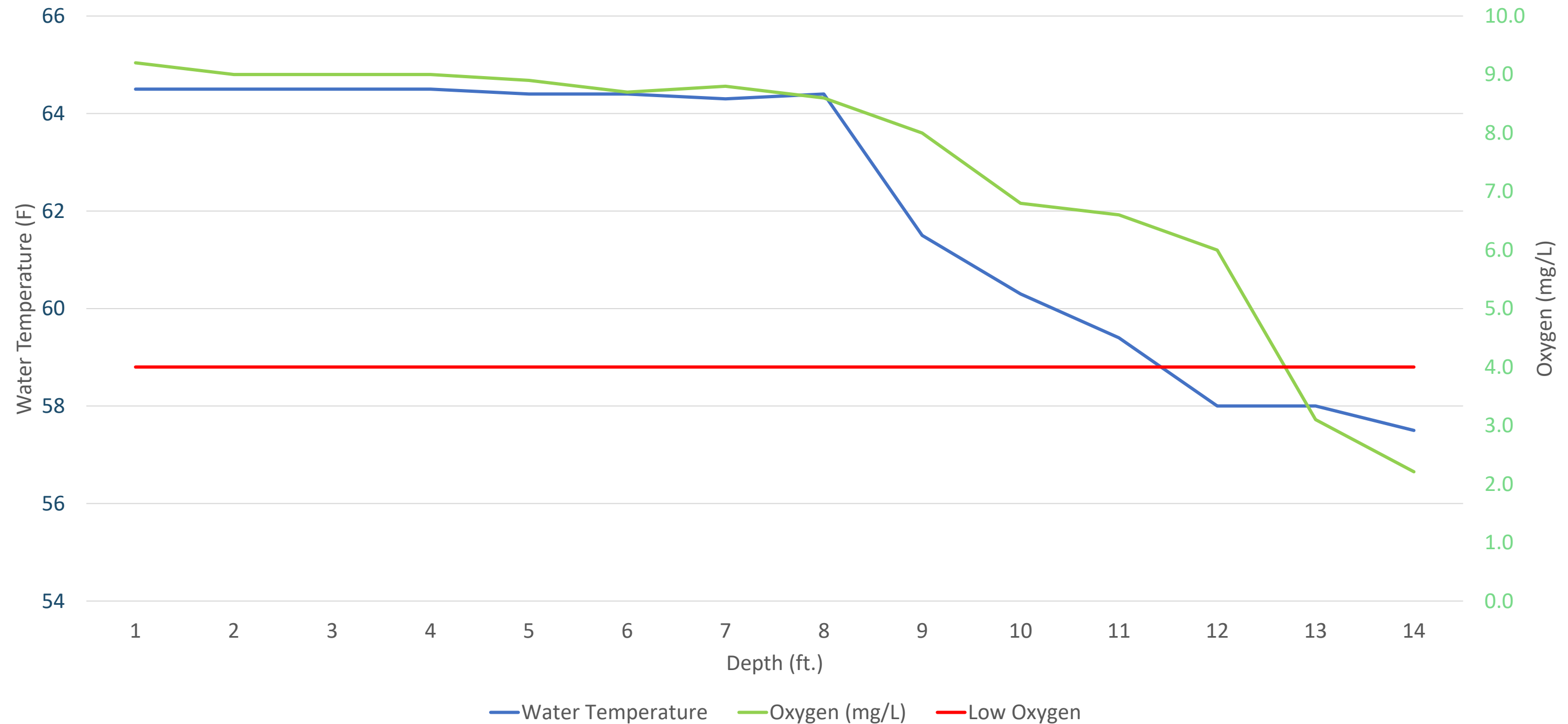
Aquatic Vegetation Species Observed	Growth Status	Recommendations
Nitella	Heavy	These species of vegetation can provide beneficial fish habitat at low – moderate densities. However, with the heavy growth observed, it was deemed to be growing at densities harmful to the health of the fishery and recreational use of the lake. Stocking grass carp is recommended to aid in control alongside an herbicide treatment plan this year.
Variable Leaf Pondweed	Moderate	
Waterweed	Slight	

Water Quality

Parameter	Result
Surface Water Temperature (°F)	52.3
Surface Dissolved Oxygen (mg/L)	<p>Stressful Suitable</p> <p>0 2 4 6 8 10 12</p>
pH	<p>Low High</p> <p>4 5 6 7 8 9 10</p>
Alkalinity (mg/L CaCO ₃)	<p>Needs Lime Suitable for Fertilization</p> <p>0 10 20 30 40 50 60 70 80 90 100</p>
Visibility (inches)	<p>Too Turbid Poor Plankton Growth</p> <p>6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60</p>
Total Nitrogen (mg/L) <i>*TBD, will be sent once results are received*</i>	<p>Low Too High</p> <p>0 0.5 1 1.5 2 2.5 3 3.5 4</p>
Total Phosphorous (mg/L) <i>*TBD, will be sent once results are received*</i>	<p>Low Too High</p> <p>0 0.025 0.05 0.075 0.1 0.125 0.15 0.175 0.2</p>
Nitrogen : Phosphorous Ratio ((X:1) <i>*TBD, will be sent once results are received*</i>	<p>Cyanobacteria Risk Healthy Plankton</p> <p>0 10 20 30</p>

Water Quality

Dissolved Oxygen & Temperature Profile



Evaluation

Dissolved Oxygen Profile: The lake has adequate oxygen down to depth of 13 feet. Available oxygen depths will likely decrease as the water warms, causing fish to be limited to where they can access in the summer months. In smaller systems, aeration is installed to de-stratify the lake and allow fish to utilize the entire water column; however, on a lake this size, it would be unfeasible (see page 25 to read more on this concept).

Plankton Analysis

Classification	Count (cells/ml)	Percentage of Plankton Community	Evaluation
Cyanobacteria (Toxin and Non-Toxin Producers)			*TBD, results will be sent once they are received*
Toxin Producing Cyanobacteria			
Green Phytoplankton			
Dinoflagellates			
Euglena			
Golden Algae			
Diatoms			
TOTAL			

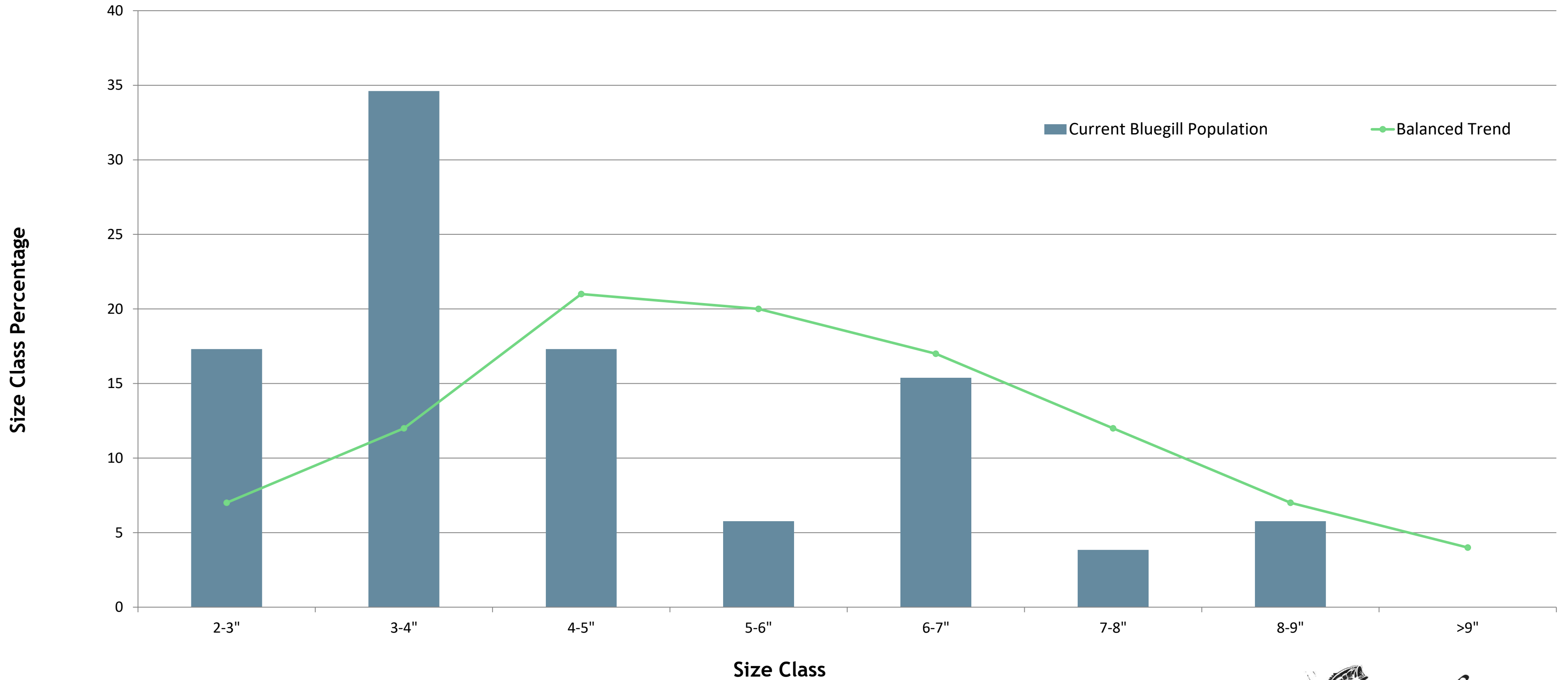
Fish Sampled

Species	Size Class (in.)	Quantity	CPUE (number/hour)	% of Total Sampled
Bluegill	Reproduction	Moderate	-	-
	2-3	9	6	17
	3-4	18	13	35
	4-5	9	6	17
	5-6	3	2	6
	6-7	8	6	15
	7-8	2	1	4
	8-9	3	2	6
	>9	0	0	0
	Total	-	52	36
Redear Sunfish	Reproduction	Limited	-	-
	2-6	5	3	9
	6-9	37	26	65
	>9	15	10	26
Total	-	57	40	100

Species	Size Class (in.)	Quantity	CPUE (number/hour)	% of Total Sampled	Avg. Relative Weight/Size Class
Largemouth Bass	Reproduction	Limited	-	-	-
	2-4	1	1	1	-
	4-6	10	5	5	-
	6-8	19	10	10	-
	8-10	18	9	10	-
	10-12	37	19	20	83
	12-14	55	28	29	81
	14-16	32	17	17	81
	16-18	10	5	5	84
	18-20	2	1	1	86
	>20	4	2	2	41
	Total	-	188	97	100
Additional Species					
Black Crappie	12-16	35	18	-	-
Yellow Perch	4-10	14	7	-	-
Warmouth	-	1	1	-	-

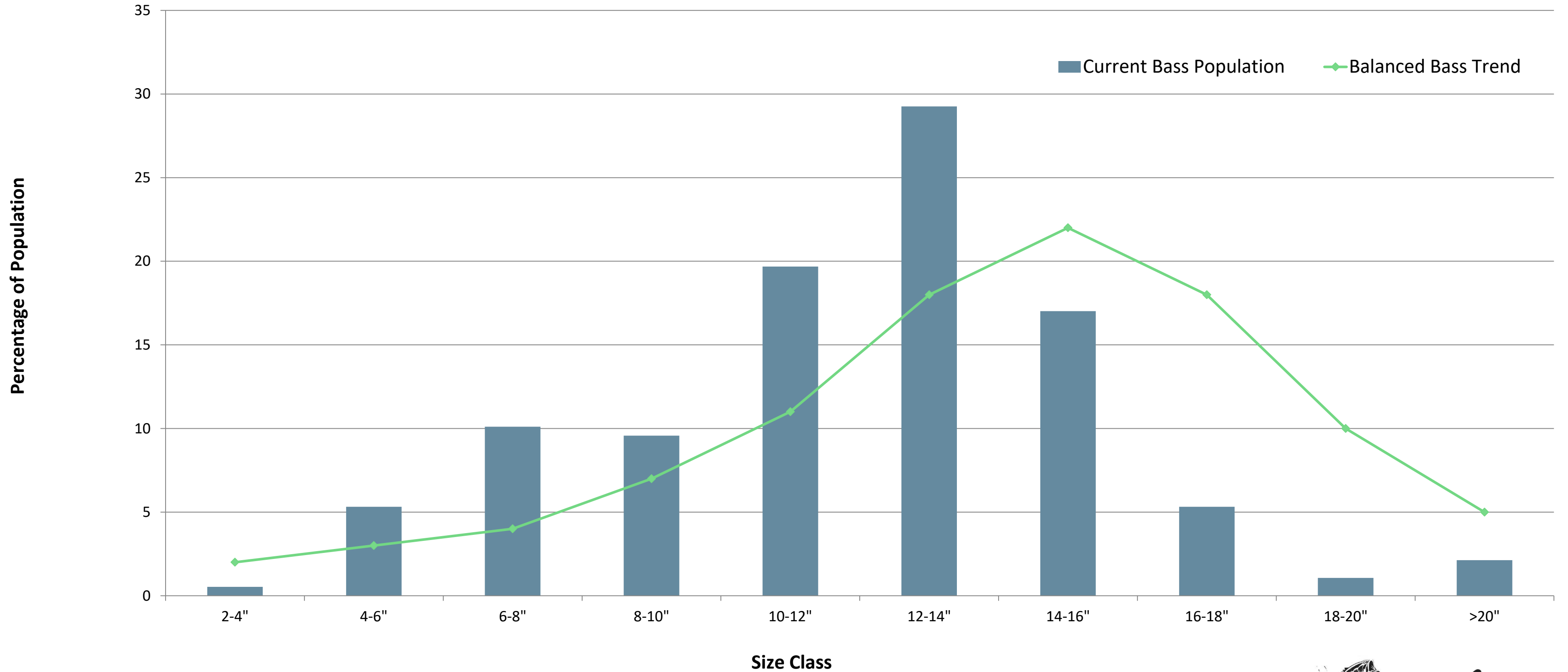
Bluegill Results

Size Class Distribution of Bluegill



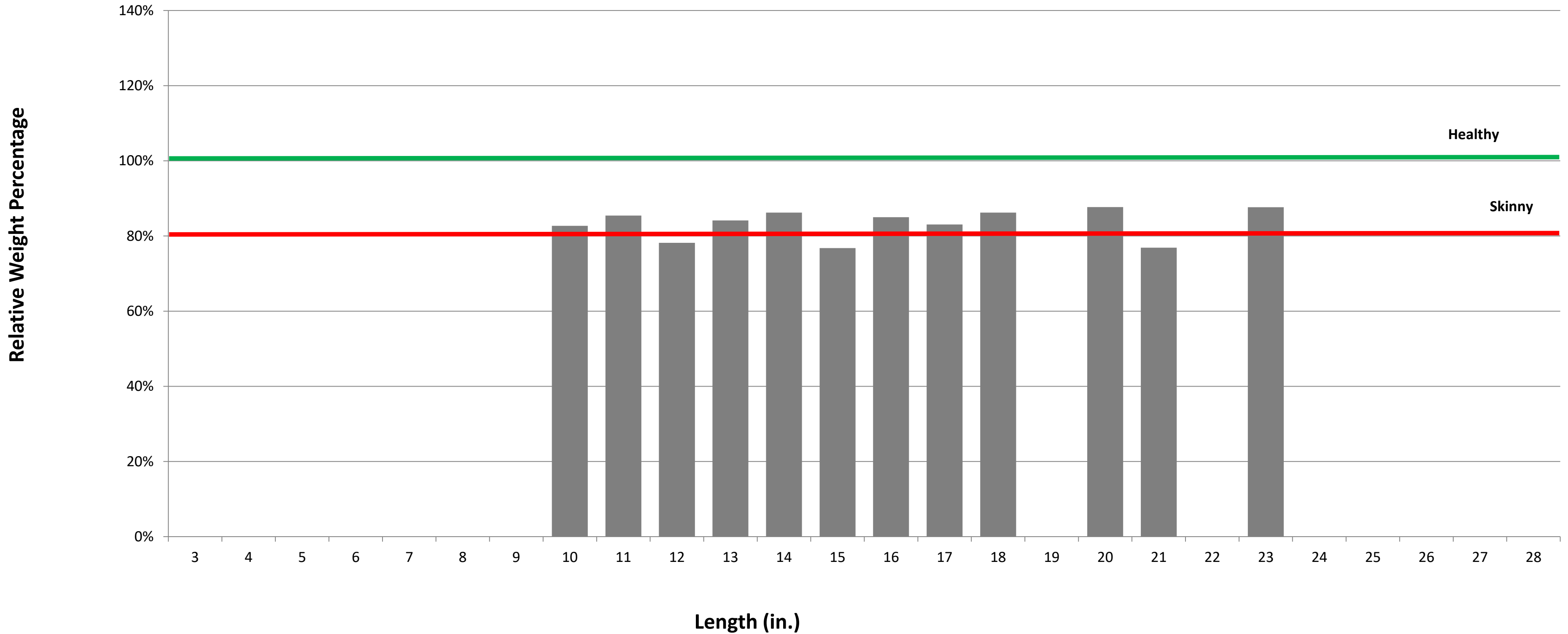
Largemouth Bass Results

Size Class Distribution of Largemouth Bass



Largemouth Bass Results

Largemouth Bass Average Relative Weight By Length Class



Largemouth Bass Age Analysis

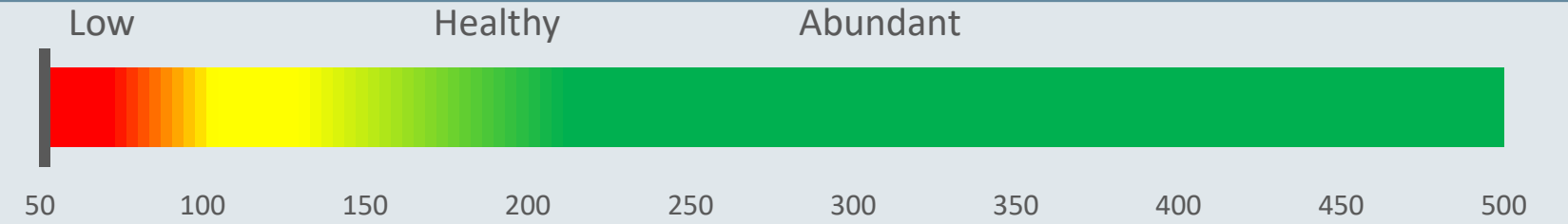
Fish Number	Length (in.)	Weight (lbs.)	Relative Weight (%)	Age (years)	Growth Status
1	13.0	1.0	89.6		*TBD, results will be sent once they are received*
2	13.5	1.1	90.8		
3	14.3	1.3	77.6		
4	15.0	1.4	78.4		
5	16.0	1.8	78.9		
6	16.3	1.9	82.2		
7	17.8	2.5	80.9		
8	21.0	4.1	76.9		

Fishery Results

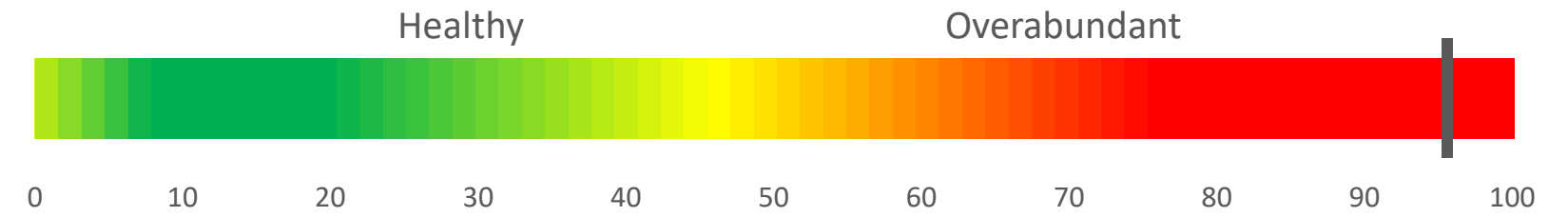
Item

Result

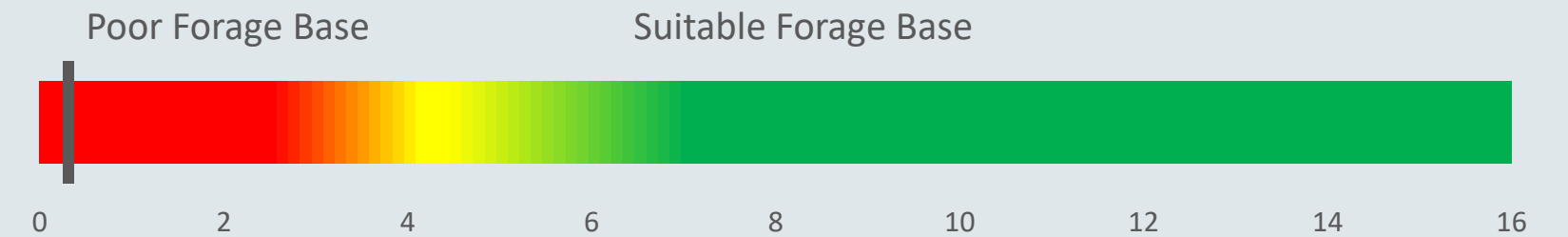
Bluegill CPUE (fish/hour)



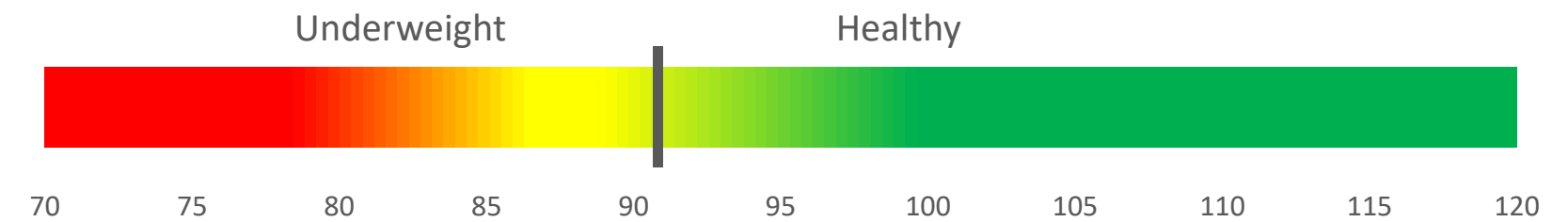
Largemouth Bass CPUE (fish/hour)



Bluegill : Largemouth Bass CPUE Ratio (X:1)



Average Relative Weight of Largemouth Bass (%)



Average Length of Largemouth Bass (in.)

14.7

Average Weight of Largemouth Bass (lbs.)

1.6

Forage Species Sampled

Bluegill, Redear Sunfish, Yellow Perch, Warmouth

Predator Species Sampled

Largemouth Bass and Black Crappie

Status (Balance) of Fishery

Out of Balance with Limited Productivity and Competitive Species

Fishery Results

Limiting Management Factors

- Poor Water Quality (Alkalinity)
- Low Density Of Desired Plankton Bloom
- Cyanobacteria Dominant
- Poor Dense Habitat (Protective Cover)
- Poor Fishing/Predator Habitat
- Excessive Vegetation Growth
- Limited Fish Food (No Feeders/Poor Feed)
- Incorrect Forage Size
- Low Forage Abundance
- Low Forage Base Diversity
- Presence of Competitive Species
- Limited Harvest of Predators

Summary

Overall, the pond is consisting of an abundant bass population and other predators (crappie) competing for a limited forage base (e.g. bluegill). This competition— along with a lack of structured, dense, bluegill refuge habitat and limited plankton productivity (due to a low alkalinity and dense vegetation growth)— has resulted in poor bluegill availability and a slow growing bass population. AES recommends the following to improve the current fishery to experience healthier, more quality bass and crappie growth:

- ◆ Harvest small, underweight largemouth bass and crappie to decrease predator numbers and free up more forage to go around
- ◆ Install fish feeders to boost bluegill growth and production
- ◆ Install natural habitat (laydowns, brush piles, Christmas trees, etc.) to provide dense protective habitat for bluegill, and give bass areas to orient/ambush from
- ◆ Stock supplemental forage items (e.g. crawfish and threadfin shad) to add diversity, more sources of protein for the bass, and allow for predation pressure to be taken off the bluegill so they can recover their abundances
- ◆ Stock grass carp to reduce vegetation densities, allowing for improved recreational use and increasing predator foraging efficiency
- ◆ Sign a Lake Management Contract with AES to provide routine servicing and care for your pond's needs. These contracts can include pond vegetation/algae treatments, water quality management, product maintenance (fish feeders, aeration systems, etc.), and annual fish population surveys (electrofishing).

Recommendations

Recommendation	Cost	Timeframe
Harvesting Recommendations	<p>AES harvested 60 lbs. of bass during the survey. Encourage residents to harvest any bass <16". For perspective in a lake this size, removing 3,280 lbs. of bass this year would be the goal, so overharvest is not a concern.</p> <p>May harvest any crappie caught. May harvest any yellow perch >8" caught.</p> <p>It is recommended to limit bluegill harvest to a bag limit of 10 bluegill/other sunfish per angler per day to allow their population to recover.</p>	
Installation of Natural Brush to Improve Bluegill Refuge Habitat and Bass/Crappie Ambush Locations (Christmas Trees, Brush Piles, Laydowns, Etc.)	<p>N/A</p> <p>*Sink as much as possible; Christmas tree drives around the holidays are a good way to collect from residents. AES can help sink habitat with our barge if-desired*</p>	2025
Implement an AES Vegetation Management Contract to Help Manage Growth this Season	<p>TBD</p> <p>*Can discuss details once report is gone over*</p>	2025
Stocking of 500 (10-12") Grass Carp	\$4,725.00 Delivered	Spring 2025
Stocking of 5 Loads of Threadfin Shad	\$8,500.00 Delivered	Spring 2025
Stocking of 1,000 lbs. of Crawfish	\$3,750.00 Delivered	May 2025 (Stock Annually)
Installation of 1 Texas Hunter LM175 Fish Feeders (Includes Solar Panel, Battery, Control Panel, Dock Leg Kit)	\$1,168.00/Feeder + Tax + Shipping + Install (If-Desired)	2025

Recommendations are listed in priority from highest to lowest.

The recommendations listed above (and more importantly the timeline) are designed to improve the fishery as quickly as possible. The recommendations can be implemented over a longer period if needed for budgetary concerns. For example, the artificial habitats can be installed over a period of three years.

All pricing and products quoted are valid for 30 days of the report date. After 30 days pricing is subject to change and may have to be requested.

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Appendix of Fact Sheets

Electrofishing

Electrofishing is the most scientifically advanced method of analyzing fish populations in freshwater ponds and lakes in the Southeastern United States. Electrofishing provides a fisheries biologist with a representative sample of all fish in the lake.

An electrofishing boat is designed to transmit an electrical current from a generator through a control box to a set of electrodes, which are hanging at the front of the boat and into the lake. An electrical field is formed around the area of the electrodes. The field reaches up to ten feet in front of the boat and to a depth of approximately 6-8 feet. This allows AES to sample all habitat types found within the lake. Fish within this field are stunned and float to the water surface. No harm is done to the fish and the fish will recover completely within five minutes. Electrofishing is less stressful on the fish compared to catching fish with hook and line.

Relative Weight (W_r) is a coefficient used to compare the standard weight of a bass at a given length to the actual weight of the collected bass at the same length. It is the ratio of the actual fish weight to the standard fish weight. A W_r of over 90% is desired in a balanced fishery and 100% or greater for a quality bass fishery.

Catch Per Unit Effort (CPUE) is the total number of fish captured with a defined unit of sampling effort. CPUE can be used as an index of population density and provides valuable information when tracked from year to year. Changes in CPUE will indicate corresponding changes (increases or decreases) in species abundance.



Largemouth Bass Aging

The average lifespan of a largemouth bass is ten years. Typically, in a well-balanced established fishery, we expect largemouth bass in the Southeast to be within the following size classes based off their age:

One Year Old = 6-8"
Two-Year-Old = 8-10"
Three-Year-Old = 10-13"
Four-Year-Old = 14-16"
Five-Year-Old = 16-18"
Six-Year-Old = 18-20"
Seven-Year-Old = 20-22"
Eight-Year-Old = >22"

Fish Aging is done by removing the sagittal otoliths from the fish. The otoliths are then processed at AES facilities for age determination. In order to age the fish, the otoliths are sanded down and polished to make the annuli (rings) visible with a compound microscope. Throughout the year, fish lay down layers called circuli on the otolith. Because fish grow at different rates during different seasons, otoliths can be analyzed to determine the age of a fish. During the winter (slow growth period), the circuli bunch closely together to form dark bands called annuli. Age is determined by counting the annuli growth (rings) present on the otoliths (similar to aging a tree). One annuli equals one year of growth.



Fishery Status

AES often refers to a fishery as a balanced fishery or an out of balance fishery. The balance of a fishery is determined by several factors such as size structure of the fishery, relative weights, and predator to prey ratio. Balance will differ from lake to lake depending on goals and what species are defined as prey and predators. In most cases, the prey species will consist of bluegill, redear sunfish, threadfin shad, etc. The predator base often consists of largemouth bass, catfish, crappie, etc.

Balanced Fishery: A fishery is in balance when there is an adequate predator population and adequate prey (forage base) permitting good growth and reproduction of all fish species. A balanced fishery will have a large distribution of predator and prey species ranging over several age and size classes. In a balanced fishery, the average relative weights of the largemouth bass will be 90% or greater.

Out of Balance Fishery: Out of balance often occurs when the predators become over abundant which allows them to limit their forage base. In an out of balance fishery, the predators will "stunt" or stop growing because they do not have the forage they need to continue growing. Stunting is often indicated when one size class of predators becomes over abundant, and one size class of prey becomes limited. In a typical out of balance fishery with largemouth bass as the top end predator and bluegill as the primary prey species, the fishery will consist primarily of underweight 10-14" bass with few larger bass. The bluegill population will consist primarily of larger bluegill with few preferred, smaller 3-5" bluegill. In an out of balance fishery, the average relative weights of the largemouth bass will be less than 90%.

Quality Bass Fishery: Is a fishery that has an abundant and diverse forage base consisting of species such as bluegill, redear sunfish, threadfin shad, crawfish, etc. Along with a strong forage base, the bass population will usually be maintained under carrying capacity through an aggressive harvesting program. By maintaining a smaller bass population, the bass will have higher growth rates producing numbers of 5-6 lb. bass and will provide the environment to allow them to potentially grow 10+ pounds. In a quality bass fishery, the average relative weights of the bass will be well over 100%.

Low Productivity Lake: A low productivity lake, or oligotrophic lake, can also be referred as a lake that has limited fertility. In such lakes, the lakes are "clear" lakes with little to no phytoplankton or zooplankton production. As a result, the lake cannot produce and sustain large fish populations and may only average 40-60 pounds of fish per acre of water. A low productivity lake will produce a fishery where all species of fish display slow growth rates, and often leads to an out of balance fishery.

Fish Harvesting

For harvesting of bluegill and redear sunfish (i.e., bream), there is no need to harvest a certain amount if managing for largemouth bass. It is not detrimental to take out bluegill on occasion, but the bluegill are the backbone forage species for largemouth bass. The more bluegill you harvest, the more food you are taking away from the largemouth bass. In a balanced fishery, AES recommends harvesting no more than 10 bream per day, keeping in mind not to over harvest. AES does not want fishermen harvesting bluegill every day. In severely out of balance fisheries, it is often best to suspend bream harvesting until the fishery is back in balance.

As a guideline, for fisheries that are out of balance with an overabundant bass population, harvesting up to 25-45 pounds of bass per acre per year may be needed to get the fishery back in balance. Typically, in an out of balance fishery, the most abundant size classes of bass must be harvested to thin them out. For fisheries that are in balance, 10-15 pounds of bass must be harvested to maintain a balanced fishery. One of the most effective methods for harvesting bass is to harvest the selected fish based off their relative weight. This method helps you remove the underweight bass while keeping the more superior bass in the lake. If the relative weight of a bass you catch is below 90%, harvest the fish no matter the size of the bass. If the relative weight is over 90%, release the bass no matter what the size of the bass is. Status and goals of a fishery will determine the exact number of pounds of fish to harvest.

Black crappie will easily overpopulate a lake and it is crucial to harvest crappie aggressively. For harvesting black crappie, a good rule of thumb is to harvest all crappie measuring less than 10". With severely overpopulated crappie populations, all crappie have to be harvested to thin out the population. Goals and status of the crappie population will determine how aggressive to harvest the crappie. But often, it is best to harvest all crappie when caught.

Channel catfish will have limited to no reproduction with largemouth bass present. For those that have catfish, it is best to manage them as a "put and take" fishery. Stock a known amount, enjoy them, and harvest them over a few years and once the population becomes limited, re-stock 8-11" catfish to start the process over again. As a rule of thumb, harvest all catfish measuring two pounds or larger. Once catfish reach two pounds, their gape size is large enough to compete with largemouth bass for forage.

For species such as bullhead catfish, gar, bowfin, chain pickerel, green sunfish, and warmouth, harvest all that are caught. These species are considered trash fish by most, do not provide any benefit to the fishery, and will limit the success of bluegill and largemouth bass populations (i.e., preferred species).



Plankton Analysis

There are hundreds and hundreds of species of plankton found in freshwater systems. When lakes are fertilized to improve the fertility and productivity of the lake, the goal is to grow green phytoplankton. Green phytoplankton (which there are hundreds of species of) are the base of the food chain in a water body. In lakes that have a strong plankton bloom, the water will have a dark green color to it. Clear water indicates very little plankton growth. Green phytoplankton provides a food source for zooplankton, which are a microscopic organism that all species of fish will consume shortly after hatching. With a strong phytoplankton and zooplankton population, recruitment of newly hatched fish will increase, which increases the poundage of fish a lake can produce and support.

Unfortunately, there are some plankton species that are not beneficial to the fishery and can be harmful to humans and pets. Just because a lake has a green color to the water, does not mean it is helping the fishery. Cyanobacteria is a plankton species that is not beneficial to the fishery. Though it is microscopic, the majority of cyanobacteria are too large for zooplankton to consume. As a result, the cyanobacteria are not being grazed upon and not entering the food chain in the lake. So, it is not benefiting the fishery in terms of providing food for newly hatched fish. Since cyanobacteria are not being grazed upon by zooplankton, the population can easily become too dense which often results in pea soup green water. This can easily result in a fish kill due to low oxygen levels.

Another issue with cyanobacteria is that there are some species that produce toxins that are harmful to humans and pets. Known toxins produced by different species of cyanobacteria include Hepatotoxins, Neurotoxins, Dermatotoxins and Endotoxins. These toxins can result in mild to severe health issues, including death in severe cases depending on concentrations and sensitivity to those coming into contact with the water.

Aggressive research is taking place around the world on cyanobacteria as it is becoming more and more common. Cyanobacteria can be treated with an array of algicides and implementing bottom diffused aeration. In lakes that receive a lot of phosphorus runoff, preventing this runoff at the point source is often the best approach if applicable. In most cases, it is best to avoid contact with the water and let the cyanobacteria run its course. Unfortunately, all cases are different and there is not one specific solution that works for all cases.



Cyanobacteria Concentrations	Hazard Status	Recommended Action
<20,000 cell/ml	Low	Continue Monitoring, Advise Lake Users
20,000 – 100,000 cells/ml	Moderate	Restrict Swimming (Humans/Pets)
>100,000 cells/ml	High	Prohibit Swimming (Humans/Pets) and All Other Water Contact Activities

Water Quality

AES uses an Oxygen Meter (YSI model 55) for determining the dissolved oxygen (D.O.) and temperature for a water body. Alkalinity is determined using a portable Hatch® digital titrator. A secchi disk is used to determine visibility and a portable pH/conductivity meter is used to determine pH/conductivity.

Dissolved Oxygen (D.O.) is a measure of the amount of oxygen available to aquatic organisms and is reported as mg/l or percent saturation. Percent saturation is a representation of how much oxygen is dissolved in the water relative to the amount of oxygen that can be held at a specific temperature. Colder water can hold more oxygen than warm water. Dissolved oxygen fluctuates daily with it being at its lowest levels in the early morning hours. D.O. does not pose a problem for most fish until levels fall below 4 mg/l.

pH measures the concentration of the hydrogen ions present in the water and is usually thought of as the measurement of acidic or alkaline conditions. A pH of 7 is neutral with lower values being acidic and higher values being alkaline. Most organisms in a lake prosper when the pH is maintained between 6.5 and 9. The pH cycles daily due to a complex interaction of alkalinity, hardness, carbon dioxide, and photosynthesis and respiration. The lake is more acidic in the mornings and will also vary according to depth. When pH levels are out of the desired range for long periods, detrimental effects may occur.

Visibility is measured with the use of a secchi disc. The white/black disc (20 cm in diameter) is lowered vertically through the water until it can no longer be seen. Suspended particles reduce the visibility level. Therefore, in the absence of turbidity from silt or mud, the secchi disc serves as an international standard to indicate phytoplankton. We recommend keeping a phytoplankton bloom with a visibility between 24-36 inches via fertilization depending on the goals and time of year.

Alkalinity is the buffering capacity of the water and helps buffer sudden pH changes in the water. The main reason we are concerned about the alkalinity is because higher alkalinity levels allow fertilization to be more effective by making the phosphorus in the fertilizer more readily available for phytoplankton growth. If you were to try and fertilize a lake with low alkalinity, the phosphorus would just bind up with metals in the soil at the bottom of the lake.

Conductivity is not a major concern when managing a fishery. However, it is particularly important when electrofishing a body of water. Conductivity is a measure of the ability of water to pass an electrical current. The higher the conductivity, the larger the electric field generated by the electrofishing boat. The lower the conductivity, the smaller the electric field generated by the electrofishing boat.

Water Quality

Nitrogen and Phosphorus Ratio (N:P Ratio): Nitrogen and phosphorus— in general— are the two main nutrients in a lake that affect plankton growth. In most lakes, phosphorus is the limiting nutrient and is why most lake fertilizers are high in phosphorus. Current research is showing that adding additional phosphorus to a lake may or may not be the best approach to growing green phytoplankton. In lakes where cyanobacteria are present, they can out compete green phytoplankton for sunlight and nutrients. One way to combat cyanobacteria growth is to manipulate the nitrogen and phosphorus levels. Increasing the N:P ratio to a 20:1 or higher ratio, provides a more ideal environment for green plankton growth allowing them to dominate over cyanobacteria. This is more beneficial to the food chain and fish in the lake.

Nitrogen levels are typically less than 1.0 mg/L. Levels higher than 1.0 mg/L can be potentially harmful.

Phosphorus levels less than 0.012 mg/L indicate an Oligotrophic lake. Oligotrophic lakes have limited nutrient levels (nitrogen and phosphorus) and are often clear lakes with little to no plankton growth. As a result, Oligotrophic lakes have small fish populations due to the inability of the lake to produce and support many pounds of fish.

Phosphorus levels between 0.012 – 0.024 mg/L indicate a Mesotrophic lake. Mesotrophic lakes are considered to have a medium or moderate amount of nutrients that are often clear lakes with some plankton and plant growth. Fish populations are often limited in a Mesotrophic lake.

Phosphorus levels between 0.025 – 0.096 mg/L indicate a Eutrophic lake. Eutrophic lakes are rich in nutrients and considered fertile lakes. Eutrophic lakes produce and support high densities of fish, plankton, and a diversity of aquatic plants. Eutrophic lakes can be prone to oxygen issues.

Phosphorus levels greater than 0.25 mg/L indicate a Hyper-Eutrophic lake. Hyper-Eutrophic lakes are overly rich in nutrients and often have severe algae blooms. Hyper-Eutrophic lakes can support very large fisheries, but fisheries can often be severely limited due to frequent fish kills.

Dissolved Oxygen Profile

The Dissolved Oxygen Profile shows how stratification affects D.O. levels as depth changes. Stratification occurs in all lakes during the summer months. As the air temperature increases during the spring, the temperature of the upper water column increases as well. The lower water column (i.e., deeper water), does not warm up because it receives little sunlight, and it is not in contact with the atmosphere. Since this deeper water is colder and denser, it sinks to the bottom of the lake. The warmer, upper water column floats on top of this colder, denser, and deeper water because this upper warmer water is not as dense. The upper water column is in contact with the atmosphere so gas exchange can occur, and it is also receiving sunlight which allows for the growth of oxygen producers (aquatic plants and phytoplankton). The deeper water is not receiving sunlight and is not in contact with the atmosphere which is resulting in little to no oxygen production. Because of this, the fish are restricted to the upper water column because there is not enough oxygen to support the fish in deeper depths.

During the fall as the air temperature decreases, the temperature of the upper water column begins to decrease as well. As this temperature decreases, its density begins to equalize with the density of the colder, deeper water. As the densities of these two layers of water equalize, they will begin to mix which is referred to as a fall turnover. Typically, a fall turnover is rarely noticed by a lake owner. However, if these two layers of water mix too quickly-- during a severe cold front for example-- it can result in a sharp decrease in the oxygen levels and cause a fish kill. You can also have turnovers occur during the summer months if a severe rain event sets in for several days. A large influx of cold rainwater can cool off the upper water column causing a turnover.

Habitat Improvements Using Natural Material

Nearly any material can be used to create fish habitat. The key is to use the correct size and style of material to achieve the goals of improving the specific habitat your pond needs. For example, dense material such as Christmas Trees work great to provide complex habitat in shallower water depths to protect smaller forage fish. Whereas wooden pallets work well in deeper water to provide orientation/ambush points for largemouth bass. Typically, most lakes lack dense protective habitat in shallower depths, and it is critical to have ample dense habitat throughout the lake to protect forage fish. When improving dense habitat using natural material, AES recommends using Christmas Trees, dense treetops, and/or falling brush and trees growing along the shoreline and letting it fall into the lake. Rock or busted concrete is also great when it can be easily added.

For adding habitat in deeper water, 10-15' trees can be cut be used. These trees can be dragged out into the lake where cinder blocks are placed on the tree trunk. This will sink the tree trunk first allowing the tree to stand up through the water column providing excellent habitat for fish.

If a lake owner has easy access to natural material (like trees/brush), AES recommends utilizing this resource. With using natural material, it's important to remember it will decompose over time and will need to be replenished every two – three years. AES has vast experience in installation of habitat and can provide the labor necessary for deploying the material with our barge.



Supplemental Fish Feeding

One of the best means of increasing the enjoyment of a pond is the addition of a fish feeding program. Feeders will directly feed bluegill, trout, hybrid striped bass, channel catfish, and feed trained largemouth bass. In many ponds, you are feeding your bluegill population to indirectly feed the bass. Feeding bluegill a supplemental fish food creates healthier fish that reproduce at higher rates, therefore increasing the population. In addition, feeding bluegill increases its weight, which subsequently increases the weight of the bass. Feeding can occur year-round in some areas, but generally begins in March and continues into December in much of the Southeast.

Feeding by hand is acceptable but will not compare to using an automatic fish feeder which feeds multiple times a day. Having feeders on the lake provides a great food source on a continuous basis. Bluegill have a short intestinal tract and benefit from multiple feedings during the day. An automatic fish feeder is one of the best investments a lake owner can make. It will concentrate fish for easier fishing and grow the largest bluegill in the lake. It is also a great place for kids to learn to fish, because the action is always fast.

Bluegill will not travel far to consume food. To maximize bluegill growth and production, setup multiple feeders on lakes greater than 1/2 acre. All lakes are shaped differently, but typically a minimum of one feeder per acre is necessary to feed a majority of the bluegill population in smaller lakes. For lakes greater than 10 acres one feeder/three acres is sufficient.

For bluegill, we recommend using Purina AquaMax MVP, 500 or 600 fish food. The AquaMax 500 and 600 contain 41% protein and 12% fat and are both a floating fish food. The AquaMax 500 is 3/16" (4.8 mm) in size and the AquaMax 600 is 9/32" (7.1 mm) in size, while MVP is a mix of nine sizes of feed and contains 43% protein and 12% fat and is a floating fish food as well. For most applications where bluegill are the targeted species, we recommend the AquaMax MVP.

A research project was conducted comparing the growth of bluegill with several formulations of fish food. In short, with a higher quality fish food, less pounds of food is needed to achieve faster and higher growth rates. Though a higher quality food is more expensive per pound, it is cheaper to use because less pounds of the higher quality food is needed. The bluegill growth research project showed a feed conversion of 1.86 for AquaMax 500 and 3.3 for a 32% protein fish food. With these conversions we compared cost: cheaper feed is \$1.75/lb. of weight gain compared to Purina AquaMax \$1.42/lb. of weight gain. This is a huge cost savings over the course of a year, and you will have much larger fish to catch as a result.

Supplemental Fish Feeding

Feeding bluegill and catfish will occur from March – November and the feeder will need to be filled once a month on average (i.e., two bags per month). This is a total of 18 bags needed for the year and with using Purina AquaMax fish food, the yearly cost of fish food for one feeder is approximately \$1,200 though this can change depending how aggressively the feeders are adjusted.

How much should you feed? Generally, only cast enough feed so the fish will eat most of the food in 5 to 10 minutes. The total amount of food consumed will vary due to surface water temperature, fish species and water quality.

Bluegill experience their most rapid growth in the spring and fall. To maximize growth, feed four times daily in the spring and early summer. During the heat of the summer, feed only in the early morning and late afternoon. As the water begins to cool in the fall, feed four times daily. In early spring and winter, feed only once at the hottest part of the day. Below is a feeding guide for bluegill based on the water surface temperature:

Water temperature below 55°F: Feed only one time per day, during the warmest part of the day. Set the automatic feeder for one second. If fish are not feeding, discontinue feeding until water temperature increases above 55-60°F.

Water temperature between 65°F and 80°F: Feed four times per day. Temperatures between 65-80°F are ideal for maximize fish growth and production. Bluegill will feed aggressively at these water temperatures. Separating the feedings by a few hours allows digestion of the food prior to next feeding.

Water Temperature between 80°F and 90°F: Feed two times per day during the cooler parts of the day, typically at sunrise and sunset. The amount of food used may need to be decreased as temperatures continue to rise. Discontinue feeding when water temperature increases above 90°F and start back up when it drops to 85°F or less.

Texas Hunter Fish Feeders

AES recommends the Texas Hunter Product line of fish feeders. Texas Hunter Products have developed the best fish feeder on the market today. From excellent customer service to ease of use, these feeders were built with the lake owner in mind. We offer price breaks for quantity purchases.

Texas Hunter Fish Feeder Advantages:

- Patented, powerful centrifugal air blower engineered to eliminate the need for solenoids, gates, and augers, reducing the number of parts and possible breakdowns
- The corners of the lids are formed and welded before being powder-coated, providing a better seal and avoiding possible cuts from the sharp edges of the lid
- A quick-release side panel with a Clear-View Funnel so you can immediately detect a clog from debris, without having to take the feeder apart. Should a clog occur, you can clean out the entire blower system and you are up and running again in less than five minutes. On most feeders on the market today, the lower half of the feeder has to be disassembled just to access the motors.
- Texas Hunter's powerful 2-watt solar charger can be mounted to any side of the unit. This maximizes the sun's energy – no matter where the feeder is placed around the lake.
- Designed to feed fish pellets (up to 7mm)
- Wedge-shaped feed pattern 45' x 20'
- Large welded footpads for extra stability
- Legs & footpads are powder-coated for rust prevention
- Powerful 2-watt Solar Panel
- Different models to choose from: LM135 (70 lb. capacity), LM175 (100 lb. capacity), LM335 (175 lb. capacity) and LM435 (250 lb. capacity)
- Your choice: Adjustable legs for easy leveling or Straight legs for piers & docks
- EZ Set digital timer - no fuses - no 'timer' battery required - 5-year warranty
- 12v rechargeable heavy duty 7amp battery included
- Built-in 'nut-inserts' make leg installation a breeze



Vegetation Management

Aquatic vegetation not only decreases the aesthetic appeal of the lake and interferes with fishing efforts and boating, but it also utilizes available nutrients. In severe infestations, aquatic vegetation utilizes all the available nutrients within the lake preventing the growth of phytoplankton. This limits the productivity of the lake. Not all aquatic vegetation in a lake is detrimental to the fishery. Some species of vegetation are encouraged in order to provide fish habitat. In larger bodies of water, aquatic vegetation coverage up to 20% can be sustained without detrimental effects to the productivity of the lake.

Aquatic vegetation needs three essential elements to grow: sunlight, nutrients, and temperature. There is nothing we can do to control temperature and there is little we can do to control nutrients in most scenarios. However, we can manipulate the sunlight penetration through the water column. If sunlight can penetrate through the water column to the lake bottom, aquatic vegetation is very likely to grow. This typically occurs in water depths of three feet or less. In lakes with “gin clear” water, weeds will grow in deeper depths due to increased sunlight penetration. Lake dyes can be used to shade out the sunlight which will help deter aquatic vegetation growth. However, for those concerned with producing a quality fishery, lake dye is not recommended because it will also shade out sunlight for phytoplankton growth. An option for growing phytoplankton and deterring vegetation growth is implementing a proper fertilization program. By establishing a phytoplankton bloom early in the spring via a fertilization program, the phytoplankton bloom will minimize sunlight penetration which will help deter submersed aquatic vegetation growth. Once vegetation is established it becomes more difficult to fertilize.

For lakes with severe vegetation growth, implementing an Aquatic Vegetation Control Program that includes a multi-pronged attack to keep aquatic vegetation under control is recommended (i.e., herbicide applications, grass carp stocking, dredging shallow areas, and aeration).

For many submerged vegetation species, the best method to control aquatic vegetation is the stocking of the proper number of grass carp. They provide the most economical long-term control of submersed vegetation.

For some select species where grass carp have limited success, use an EPA approved aquatic labeled herbicide. Aquatic herbicides will often provide the quickest results for controlling aquatic vegetation. Aquatic herbicides are not harmful to fish when used properly. When treating aquatic vegetation with herbicides, the vegetation may need to be treated with multiple applications over a period of time. With severe infestations, if the entire biomass of vegetation is killed all at once, it can degrade the water quality as the vegetation decomposes potentially resulting in a fish kill.

Annual Lake Management Contract

Among many pond owners, there is a strong desire to have a top-notch fishery and superior lake; but often, these owners do not have the time or expertise to manage such a lake and would like a professional, like AES, to take over the responsibility of management necessary for meeting their goals. We have modified our programs over the years to maximize the recreational value of clients' lakes and we now have clients all over the state, with our team working out of our north Georgia and middle Georgia offices to save on travel costs. Our services can be easily modified and customized to meet your pond goals and budget. Some of the services performed on yearly management contract include:

- Lake Inspections
- Aquatic Weed/Algae Examination and Treatment
- Cyanobacteria Control
- Nutrient Remediation Treatments
- Water Quality Analysis
- Fish Population Analysis /Fish Harvesting
- Fish Feeder Maintenance
- Fertilization Programs
- Customer Services

Lake Inspections occur on a biweekly, monthly, or quarterly basis from March through November and every visit will include a visual inspection of the dam and outlet system. Aquatic Weed/Algae examinations are made during visits and after each visit you will receive a report on current lake conditions and actions taken, as well as corrective actions recommended for the future.

Water Quality Analysis includes ambient temperature, water temperature, visibility (secchi disc), hardness, alkalinity, pH, and dissolved oxygen. When low alkalinities are recorded, we will take a second sample from the pond soils for analysis. This is the best method to determine lime requirements for proper fertilization schedule. The pond will be fertilized during each visit if needed and dependent on specific pond goals. Visibility is checked and fertilizer is applied to maintain healthy plankton growth which creates an environment that produces many more pounds of fish. Anticipated rain events will be considered when timing fertilizer applications.

An electrofishing survey may also be included in the lake management contract, which will include a comprehensive analysis of the fishery and management report. The report details recommendations for fish harvest, fish stocking, and habitat enhancements to achieve our clients desired fishing goals. Additional electrofishing surveys will be geared towards bass harvest if it is deemed necessary based on goals and electrofishing survey results.

Fish Feeder Maintenance is also included in the yearly management contract. Feeders are filled and feeding times adjusted periodically to maximize fish growth and minimize waste. If the fish feeders need replacement motors, batteries, timers, etc., AES will identify and remedy any faulty parts while on site to limit down time for problematic feeders.

Also included in a yearly lake management contract is always having a biologist familiar with your lake available to answer any questions you have.



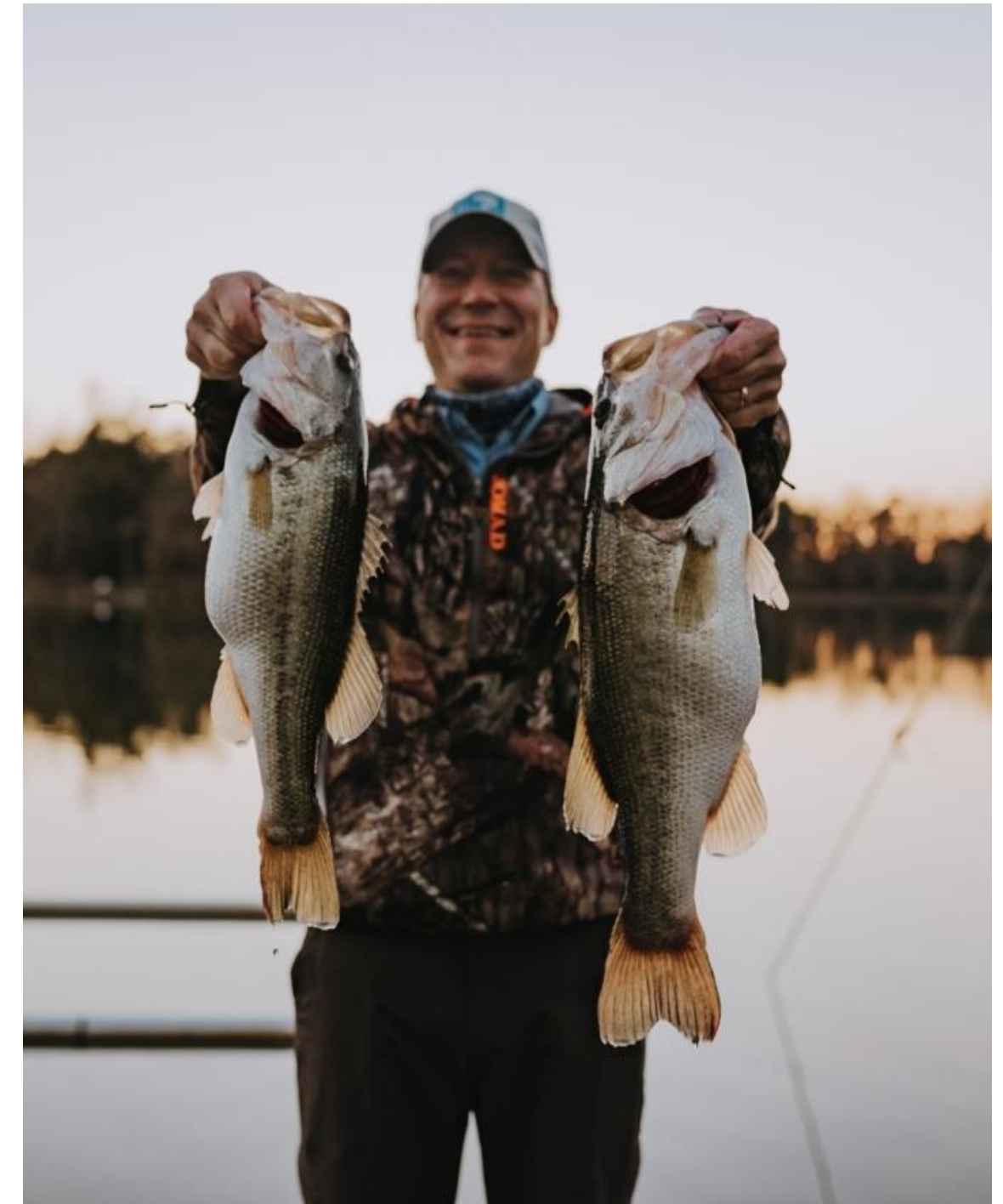
Largemouth Bass

Largemouth Bass (*Micropterus salmoides*) are the preferred game fish in the U.S. providing exciting fishing for anglers. They will eat just about anything that they can fit into their mouths making largemouth bass the top end predator in most lakes. Largemouth bass begin to spawn when the water temperature reaches 63-68°F, and normally once a year in the early spring before bluegill begin to spawn. The average lifespan of largemouth bass is ten years.

There are two known subspecies, Florida and Northern Largemouth Bass. Florida bass are known to grow quite large, but some research has shown them to be less aggressive when adults, making them harder to catch. Northern bass are more aggressive but do not have the top end potential of Florida bass. There is also the F1, which is a pure cross (50% Florida and 50% Northern) between the two having the best characteristics of both subspecies (aggressive and grows big in size). You can also have Fx bass that are a mix of genetics of both subspecies and are most common in older lakes.

For stocking bass in existing fisheries, Florida Bass, Northern Bass, and/or F1 Bass can be stocked. Depending on goals, 10-20 largemouth bass should be stocked in existing fisheries. The key here is to not stock too many so that the fishery becomes out of balance. If wanting to introduce fresh genetics to the fishery, ten bass can be stocked per acre; and for those wanting to increase catch rates, upwards of twenty bass per acre can be stocked.

One option that we have had great success with is creating a feed trained fishery by stocking feed trained Pure Northern Bass. This is a great option for smaller ponds. For stocking feed trained bass to create a feed trained bass fishery, Pure Northern Bass that are a pound in size and have been raised on fish food are stocked. In order to have a feed trained bass fishery, the bass will have to be stocked at a high rate of 50 bass per acre in order to maintain a high rate of competition among the bass for forage which keeps the bass on the fish food. Along with this, an aggressive supplemental feeding program needs to be in place using high quality fish food. Feed trained bass may grow upwards of 5-7lbs. when on the correct feeding program.



Bluegill

Bluegill (*Lepomis macrochirus*) (AKA “Bream”) are the backbone of the forage base for largemouth bass. Average lifespan of bluegill is 6-8 years and bluegill are very prolific, reproducing multiple times a season (3-5 times/year). This provides largemouth bass with a large quantity of food while still allowing themselves to sustain a healthy thriving population. To produce quality largemouth bass, the lake must have an abundant and healthy bluegill population. Bluegill spawn in large colonies in 1-5 feet in depth over sandy and gravel substrates. Spawning occurs when water temperatures reach 67-70°F.

There are two subspecies, native (also called Mississippi) and coppernose. The coppernose are better suited for warm climates and are more aggressive when feeding on supplemental fish food compared to the Mississippi bluegill resulting in great growth rates.

For supplemental stocking of bluegill in an existing fishery, we recommend stocking 3-5” bluegill. These fish are sexually mature at this size and will reproduce actively during the growing season. To supplement an existing bluegill population, stock 500-1000 (3-5”) bluegill per acre. Keep in mind you can never have too many bluegill if wanting better bass growth, so you may consider stocking more to speed up the improvements of the fishery.



Redear Sunfish

Redear Sunfish (*Lepomis microlophus*) (Another species that may be labeled “bream” and/or shellcracker) occupy a different ecological niche than bluegill, improving the utilization of the lake’s natural productivity. The teeth in the throat of redear sunfish are adapted for crushing shells of snails and other mollusks giving them the name shellcracker. By consuming snails along with other invertebrates present in the lake, redear sunfish can help to reduce the incidence of some fish parasites (i.e., grubs, flatworms) that use a snail as an intermediate host.

Similar to other bream species, shellcracker are a favorite prey fish for bass. They can grow larger than bluegill, but they are not as prolific, since they reproduce only once per year. Redear sunfish can be distinguished from bluegill by the presence of a red or orange “ear tab”.

Redear sunfish spawn in the spring and spawn in colonies like bluegill. Redear sunfish typically build their nest next to aquatic vegetation. Typical life expectancy is six years.



Golden Shiners

Golden Shiner (*Notemigonus crysoleucas*) provide great forage for largemouth bass. Golden shiners can reach sizes of 10-12", meaning that they can grow larger than threadfin shad but not as large as gizzard shad. This makes the golden shiners a great in-between forage item for largemouth bass. Golden shiners are slender in shape and do not have any hard spines in their fins making them an easy forage item for bass to consume.

Golden shiners feed on small aquatic organisms as well as filamentous algae. Spawning occurs once the water temperature reaches 68 degrees and ceases once the water temperature reaches 80 degrees. Adhesive eggs are laid on aquatic plants and algae and the eggs are not guarded. Typical lifespan of golden shiners is 4-7 years.



Threadfin Shad

Threadfin Shad (*Dorosoma petenense*) occupy an additional niche in the ecosystem. Threadfin shad provide a rich and abundant source of protein for largemouth bass and are an open water species that feed on phytoplankton, performing best when a fertilization program is in place.

Threadfin shad will help reduce predation pressure on bluegill which will help improve the bluegill population. Threadfin shad are sold by the load and a load consists of 3,500-5,000 adult fish ready to spawn, which are stocked in April and May. Spawning occurs from dawn to shortly after sunrise in shallow water where the adhesive eggs adhere to submerged objects.

Threadfin shad are cold tolerant and can die off in extreme cold winters when the water temperatures reaches 45 degrees or colder. If a pond or lake ices-over in the winter, the shad will likely winter kill. Their average lifespan is three years.



Crawfish

Crawfish: Provide a high protein forage item for largemouth bass at a fraction of the cost of other supplemental forage. The benefits of stocking crawfish are quick and catch rates have been known to increase after crawfish are stocked. Bass love crawfish and studies have shown that they prefer them over bluegill nine times to one, which means your bluegill survival rates will increase during this time.

Stocking rates vary from 40-100 lbs. per acre. Though crawfish will have some establishment, in most cases, their populations will be limited in size and AES prefers to stock crawfish each spring for providing a boost of forage for the largemouth bass. Considering that crawfish are stocked later in the spring, stocking them each year helps largemouth bass recover weight loss from spawning season.



Grass Carp

Grass Carp (*Ctenopharyngodon idella*) The best long-term control of many species of aquatic vegetation is the stocking of grass carp. They can eat up to five times their body weight in one day and are required to be triploid (i.e., sterile) in most states including Georgia.

When stocking a new pond, AES proposes stocking a few per acre initially. If stocking an existing pond with an abundance of submersed weeds, AES often recommends stocking ten per acre. For ponds less than an acre, AES recommends stocking at a rate of twenty per acre and for very large lakes, stocking rates may be as low as three grass carp per acre. Stocking rates can also be determined on total acres of water containing vegetation growth.

Grass carp will only consume submersed aquatic vegetation. If it is a vegetation species that you can crunch in your hand, then grass carp will consume it. Grass carp have pharyngeal teeth and have to be able to chew their food. Grass carp may consume some filamentous algae without the presence of a more preferred food item, but they will not control filamentous algae.

Though grass carp can live up to twenty years, they only provide 4-5 years of good vegetation control. As grass carp get older and larger in size, their metabolism slows, and they do not consume as much compared to younger grass carp. Because of this, it is wise to stock additional grass carp every 4-5 years to maintain good submersed vegetation control.



Black Crappie

Black Crappie (*Pomoxis nigromaculatus*) are a desirable species for many fishermen; however, they can have a negative impact on a fishery. Black crappie can live up to 15 years and spawning occurs when the water temperature reaches 62-65°F. This allows the crappie to get a head start on other species in the lake giving them a large recruitment class (i.e., small fish survive to reach a larger size). This results in the crappie fingerlings growing too big to serve as food for young of the year bass and they compete with and predate small largemouth bass. This often leads to a rapidly expanding crappie population in smaller lakes.

As the crappie population grows, so does the competition between crappie and bass resulting in decreased growth in both species.

Threadfin shad and golden shiners provide ideal forage for crappie. However, crappie are similar to largemouth bass in forage selection, as they will consume anything that will fit in their mouth.



Warmouth

Warmouth (*Lepomis gulosus*) belong in the sunfish family and closely resemble bluegill, except they have a larger mouth. They are aggressive predators, and their large mouth enables them to eat small minnows and other aquatic organisms. Warmouth will compete with desirable species and can even prey upon smaller bluegill which will take away possible forage from largemouth bass.

Typically found in sluggish streams and swamps, warmouth will inhabit lakes that have an inflow stream allowing the warmouth to access the lake. In general, warmouth populations are very small in lakes since they do not reproduce at high rates like bluegill which allows the bluegill population to out compete the warmouth.



Largemouth Relative Weight Index (Grams)

Weight of Bass Caught (Grams)

Length (in.)	110%	100% (Standard Weight)	95%	90%	85%	80%	75%
10	250	227	215	204	193	181	170
10.5	304	276	262	249	235	221	207
11	339	308	293	278	262	247	231
11.5	389	354	336	318	301	283	265
12	449	408	388	367	347	327	306
12.5	509	463	440	416	393	370	347
13	579	526	500	474	447	421	395
13.5	653	594	565	535	505	475	446
14	734	667	633	600	567	533	500
14.5	818	744	707	670	632	595	558
15	913	830	789	747	706	664	623
15.5	1013	921	875	829	783	737	691
16	1123	1021	970	919	868	816	765
16.5	1238	1125	1069	1012	956	900	844
17	1362	1238	1176	1114	1053	991	929
17.5	1497	1361	1293	1225	1157	1089	1021
18	1637	1488	1413	1339	1265	1190	1116
18.5	1786	1624	1543	1461	1380	1299	1218
19	1942	1765	1676	1588	1500	1412	1323
19.5	2112	1920	1824	1728	1632	1536	1440
20	2290	2082	1978	1874	1770	1666	1562
20.5	2475	2250	2137	2025	1912	1800	1687
21	2674	2431	2310	2188	2067	1945	1823
21.5	2884	2622	2491	2360	2229	2097	1966
22	3103	2821	2680	2539	2398	2257	2116
22.5	3333	3030	2879	2727	2576	2424	2273
23	3577	3252	3090	2927	2764	2602	2439
23.5	3827	3479	3305	3131	2957	2783	2609
24	4096	3724	3538	3352	3165	2979	2793
24.5	4376	3978	3779	3580	3381	3182	2984

Measure fish from tip of nose with mouth closed to the end of the tail (make sure to “pinch” the tail). Weigh the bass in grams and measure in inches to nearest 1/4 inch; then using the table, look up the relative weight of the bass for its current length and weight. For example: a bass was caught measuring 16” and weighed 940 grams. Looking at the chart, this particular bass has a relative weight of approximately 92%. To get the exact relative weight of a bass, use the standard weight column from the table above to find the standard weight of the bass caught. Divide the actual weight of the bass caught by the standard weight and multiply by 100. This will give you the relative weight of the bass caught.

Example: a 20.5” bass was caught weighing 2100 grams. Looking at the table above, The standard weight for a 20.5” is 2250 grams. $2100/2250 = 0.933 * 100 = 93\%$.

1 pound = 454 grams
 1 ounce = 28.35 grams
 1 ounce = .0625 lbs



Largemouth Relative Weight Index (Pounds)

Weight of Bass Caught (Pounds)

Length (in.)	110%	100% (Standard Weight)	95%	90%	85%	80%	75%
10	0.55	0.50	0.47	0.45	0.43	0.40	0.37
10.5	0.67	0.61	0.58	0.55	0.52	0.49	0.46
11	0.75	0.68	0.65	0.61	0.58	0.54	0.51
11.5	0.86	0.78	0.74	0.70	0.66	0.62	0.58
12	0.99	0.90	0.85	0.81	0.76	0.72	0.67
12.5	1.12	1.02	0.97	0.92	0.87	0.81	0.76
13	1.28	1.16	1.10	1.04	0.98	0.93	0.87
13.5	1.44	1.31	1.24	1.18	1.11	1.05	0.98
14	1.62	1.47	1.39	1.32	1.25	1.17	1.10
14.5	1.80	1.64	1.56	1.48	1.39	1.31	1.23
15	2.01	1.83	1.74	1.65	1.56	1.46	1.37
15.5	2.23	2.03	1.93	1.83	1.72	1.62	1.52
16	2.47	2.25	2.14	2.02	1.91	1.80	1.69
16.5	2.73	2.48	2.35	2.23	2.11	1.98	1.86
17	3.00	2.73	2.59	2.45	2.32	2.18	2.05
17.5	3.30	3.00	2.85	2.70	2.55	2.40	2.25
18	3.61	3.28	3.11	2.95	2.79	2.62	2.46
18.5	3.93	3.58	3.40	3.22	3.04	2.86	2.68
19	4.28	3.89	3.69	3.50	3.30	3.11	2.91
19.5	4.65	4.22	4.00	3.79	3.59	3.38	3.17
20	5.04	4.59	4.36	4.13	3.90	3.67	3.44
20.5	5.45	4.96	4.71	4.46	4.21	3.96	3.72
21	5.89	5.35	5.09	4.82	4.55	4.28	4.02
21.5	6.35	5.78	5.49	5.20	4.91	4.62	4.33
22	6.83	6.21	5.90	5.59	5.28	4.97	4.66
22.5	7.34	6.67	6.34	6.01	5.67	5.34	5.01
23	7.88	7.16	6.81	6.45	6.09	5.73	5.37
23.5	8.43	7.66	7.28	6.90	6.51	6.13	5.75
24	9.02	8.20	7.79	7.38	6.97	6.56	6.15
24.5	9.64	8.76	8.32	7.89	7.45	7.01	6.57

Measure fish from tip of nose with mouth closed to the end of the tail (make sure to “pinch” the tail). Weigh the bass in lbs. and measure in inches to nearest 1/4 inch; then using the table, look up the relative weight of the bass for its current length and weight. For example: a bass was caught measuring 16” and weighed 2.10 lbs. Looking at the chart this particular bass has a relative weight of approximately 93%.

To get the exact relative weight of a bass, use the standard weight column from the table above to find the standard weight of the bass caught. Divide the actual weight of the bass caught by the standard weight and multiply by 100. This will give you the relative weight of the bass caught.

Example: a 20.5” bass was caught weighing 4.5 lbs. Looking at the table, The standard weight for a 20.5” is 4.96 lbs. $4.5/4.96 = 0.907 * 100 = 90.7\%$.

- 1 pound = 454 grams
- 1 ounce = 28.35 grams
- 1 ounce = .0625 lbs.



Dam and Outlet Assessment

The spillway was in fair shape. It contained lots of rip-rap which is good for protecting the dam against erosion. Ensure a clear path to the outlet creek is clear to prevent water from diverting and cutting into the dam elsewhere.



Dam and Outlet Assessment

There was some wet spots observed behind the dam toe (left image) and active seepage as well. This area is trickling water out in a steady stream and is definitely an area to be monitored. If this worsens, dam rehab work will be necessary.

