REEL Results

SOUTHERN POND PROFESSIONALS

Why Should I Fertilize?

Predator vs. Prey

Is your pond in balance?

TOPWATER TECHNIQUES

Improve Your Harvest and Fishing Experience

Southern Pond Professionals, LLC

Data provided in this management plan was collected on March 22, 2018 and March 27, 2018 at Highland Lake in Highland Lake, Alabama by biologist Mason Grimes. Questions regarding this report and recommendations made can be addressed via email at mason@southernpond.pro or phone at 205-569-1895.

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Introduction

Southern Pond Professionals derives our management techniques from the studies of Dr. H.S. Swingle and Auburn University. We blend Auburn University's fundamental philosophies with unique, innovative techniques to provide our clients the most comprehensive lake management available. SPP can achieve any lake owner's desired goals by evaluating and manipulating lake fertility, aquatic weeds, and fish populations. Southern Pond Professionals focuses on developing a one-on-one relationship between a lake owner and their biologist to cater to specific lake needs and aspirations.

On March 22 and 27, 2018 a comprehensive electrofishing survey was conducted at Highland Lake. During this survey we assessed fish population dynamics, visual and chemical water quality, and any aquatic plants present. To best evaluate the lake, it was divided into five 43-acre sections. These sections were divided equally, taking into consideration depth, spawning area, and forage zones- pelagic vs littoral. A sample was extracted using electrofishing methods to show the state of equilibrium between predators and prey present. Water samples were collected and analyzed for alkalinity, hardness, and pH using LaMotte water test kit. Visual evaluation of physical attributes was used to identify potentially undesirable plant species. In conjunction with customer comments and goals, the analysis of these test results provides the foundation for which this management plan is conducted.

The objective of this management plan is to establish and maintain a population of fish with a balanced predator prey relationship to potentially grow trophy bass and black crappie in Highland Lake. The subsequent report and management plan explicates and describes our recommendations with the following goals in consideration:

- Generate conditions favorable to growing and reproducing **quality size** and **trophy size** bass (Table 1.)
- Generate conditions favorable to growing and reproducing **quality size** and **trophy size** black crappie (Table 1.)
- Generate conditions favorable to growing and reproducing **quality size** bluegill (BG) (Table 1.)
- Influence factors advantageous to maximizing water quality in terms of fertility.
- Maintain fishability and an aesthetically pleasing environment in terms of aquatic weeds

Table 1	**Bass**	**BG**	**Black Crappie**
Quality Size	≥ 12 inches total length	≥ 6 inches total length	≥ 8 inches total length
Trophy Size	≥ 20 inches total length	≥ 10 inches total length	≥ 12 inches total length

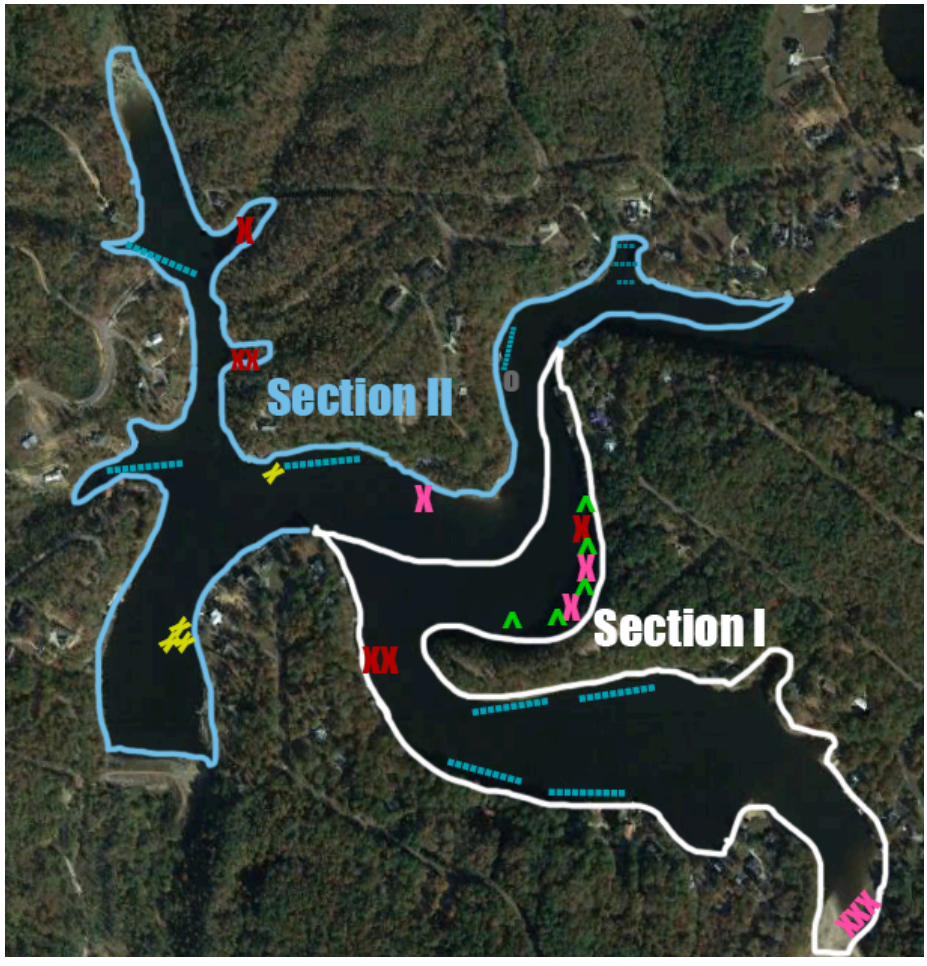
Introduction

Southern Pond Professionals generates our plans and recommendations based upon the goals mention above by the client. By developing a one on one relationship with our clients we can encourage them through consultation to select the best fit for them in terms of management. We rely on our electrofishing survey as a basis to show where management attention is necessary. Our biologists strive to make our reports as comprehensive and technically accurate as possible but still explain them in way that is easily comprehendible.

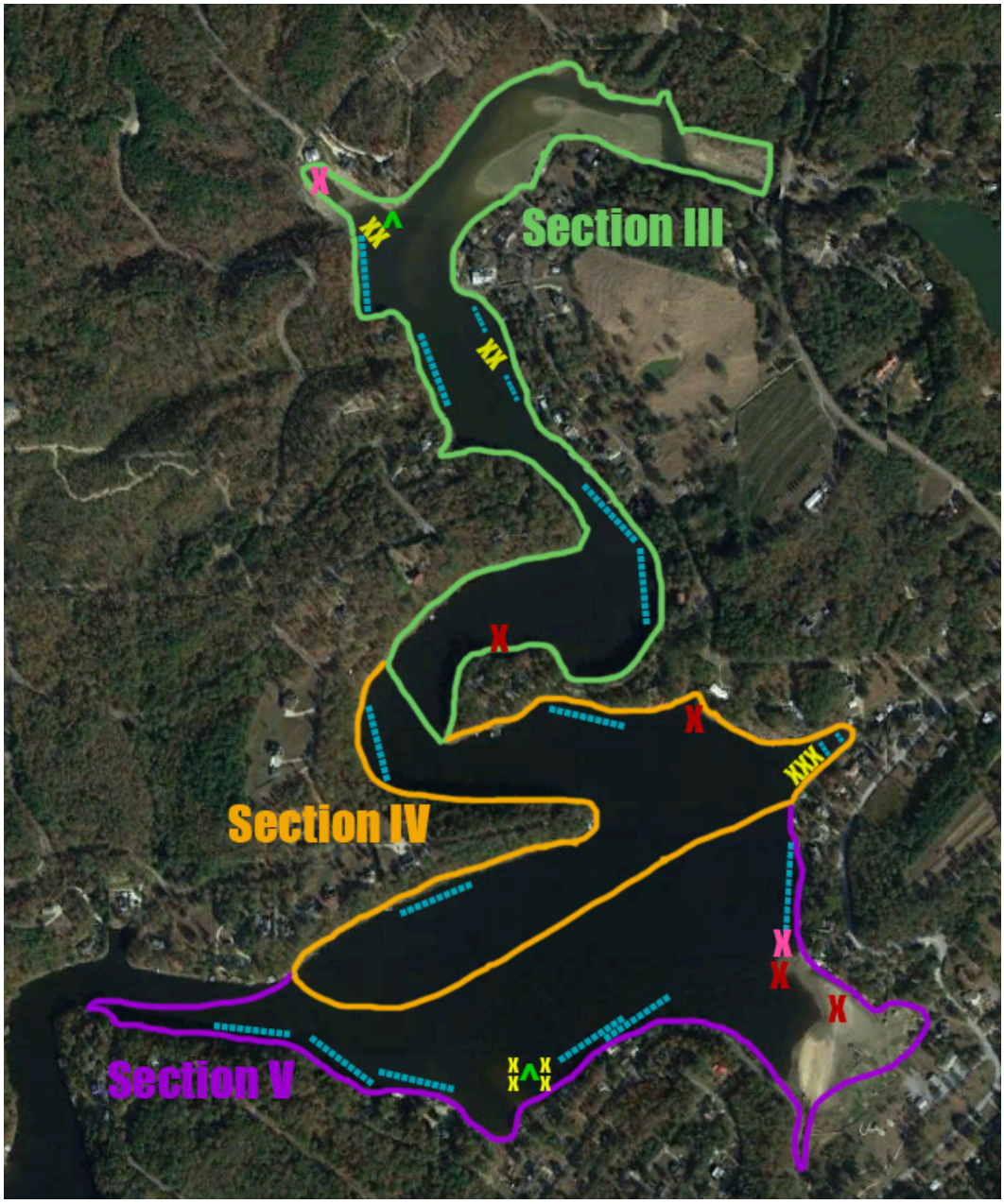
Please keep in mind that improvements in your overall fishing experience will not happen immediately. Our management techniques are intended to be an ongoing effort to maximize your lakes potential and not a one-time fix. Each management action is recommended individually but bear in mind that the management program could potentially suffer if all actions are not employed. Please call, text, or email if you have any questions concerning this report or its recommendations.

Physical Assessment

Highland Lake is a 215 acre impoundment (per Google Earth) located in Blount County, Alabama. Initial construction of the lake was completed in 1952. The concrete spillway is adequate for regulating the lake's water level and overflow discharge. The lake is nestled into the rolling hills of the Appalachian Plateau. These hills are forested with stands of deciduous trees and southern pines. Soils in this region are usually associated with low fertility and high acidity but as you can see in the water quality section of this report alkalinity, hardness, and pH are slightly above desired levels. The initial stocking rates and species is unknown. Gizzard shad and threadfin shad were stocked in 2007. Fish harvest has been limited only by state laws and regulations. Aquatic weeds observed included spadder dock (*Nuphar Luteum*), water willow (*Justicia americana)*, and small bands of filamentous algae. Also, there was a multitude of notable points of interest in terms of structure observed, large fish, and high densities of fish. Highland Lake is functioning as a predator crowded system, but still has some notable growth rates. Consistent management of a body of water with this much potential will take this lake from notable to memorable.



Physical Assessment



Highland Lake Map Key

x - largemouth bass of significant size

x - black crappie of significant size

x - spotted bass of significant size

o - large rock

^ - treetop

..... - high density of fish

Water Quality

When it comes to lake management, water quality is the most important aspect to consider. The condition of the water effects a fish's ability to breathe, feed, grow, excrete waste, and reproduce. To a certain degree, water determines the success or failure of a large impoundment. The objective for a productive lake is to influence factors favorable to maximizing fertility and sustainability. These factors include the water's pH, alkalinity, and hardness. To assess these conditions, we use an array of LaMotte water testing kits. The evaluation of these tests will determine what actions can be recommended to improve your system's water quality.

pH is an index of the hydrogen ion concentration, or more simply, whether the water is acidic or basic. This is important because it is impossible to sustain life without a stable and relatively neutral pH. Fish have an average blood pH of 7.4, so water with a pH close to this is optimal. 0 to 6.9 is considered acidic water. 7.0 is neutral and 7.1 to 14 are referred to as basic. Systems with an acidity less than 4.5 or a basicity greater than 9.5 are considered unsuitable pH values for most aquatic organisms. We want a pH range of 6.6-9 for best fertility and growth. The pH for Highland Lake is 6.9.

Water Quality

Alkalinity and hardness are important to creating a fertile environment for fertilizer to be most beneficial to a plankton bloom. Fish growth and reproduction are also affected by them. ***Alkalinity*** is the total concentration of titratable bases in the water (bicarbonates, carbonates, and-in rare cases-hydroxide). Bases neutralize acids by bonding with hydrogen ions to buffer changes in pH. If a body of water is too acidic then it will have a negative effect on algae blooms, fish development, and breeding. ***Hardness*** is a measure of calcium and magnesium ions. A lack of hardness can cause muddiness and low phytoplankton production. For optimal fish production and growth, an alkalinity and hardness of 20ppm (parts per million) is essential. Highland Lake has an alkalinity (test =mg/L determines ppm) of 20 ppm and a hardness of 21 ppm. This determines whether or not the lake needs lime.

As a result of the above testing, I recommend that no application of crushed limestone be applied.

Fish Assessment

A sampled was attained at Highland Lake using a boat mounted electrofishing system. Our collective catch consisted of 734 fish. The species witnessed in the sample were largemouth bass, spotted bass, hybrid stripe bass, yellow perch, black crappie, bluegill, shellcracker, threadfin shad, gizzard shad, and channel catfish. The primary predators in this system are largemouth bass, spotted bass, black crappie, hybrid stripe, yellow perch, and channel catfish. Prey species include bluegill, shellcracker, threadfin shad, and gizzard shad.

Largemouth and spotted bass were collected in high abundance. The total length of each bass ranged from **4 to 24 inches** (expressed in Figure 1 and 2.) There were several fish of quality length (measuring 12 inches or more) or larger observed. The largest largemouth of quality length sampled weighed **8.3lbs**. In addition, the largest spotted bass sampled weighed **4.7lbs**. Moving forward, largemouth and spotted bass measuring **15 inches or less**, should be harvested at a rate of **25lbs per acre per year**.

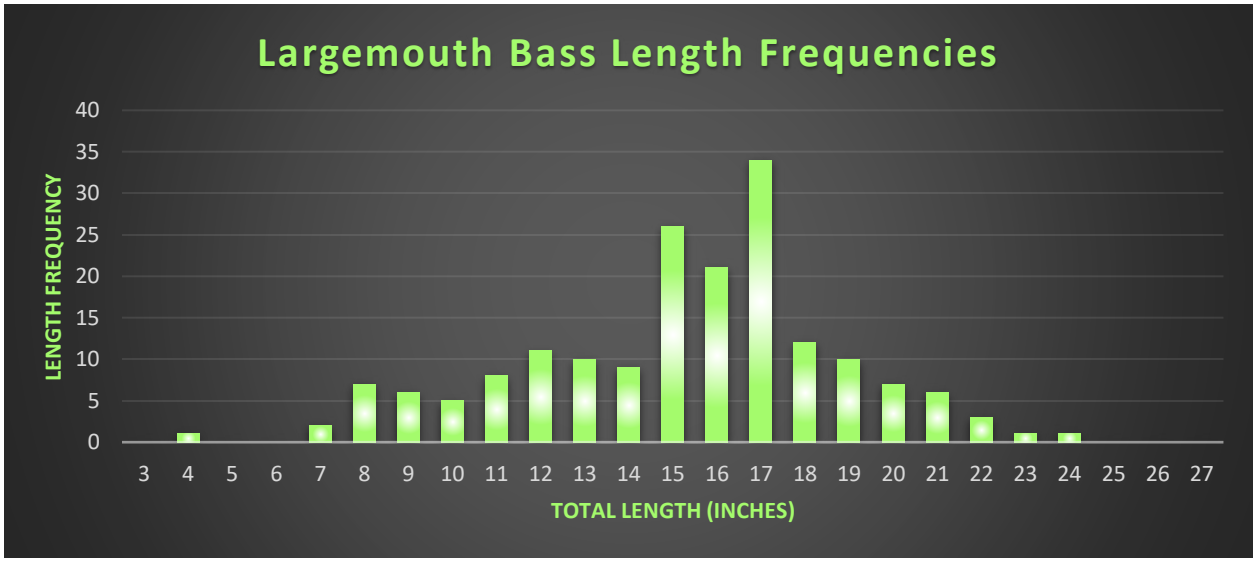


Figure 1: Length frequencies of Largemouth Bass collected from Highland Lake March 22 and 27, 2018.

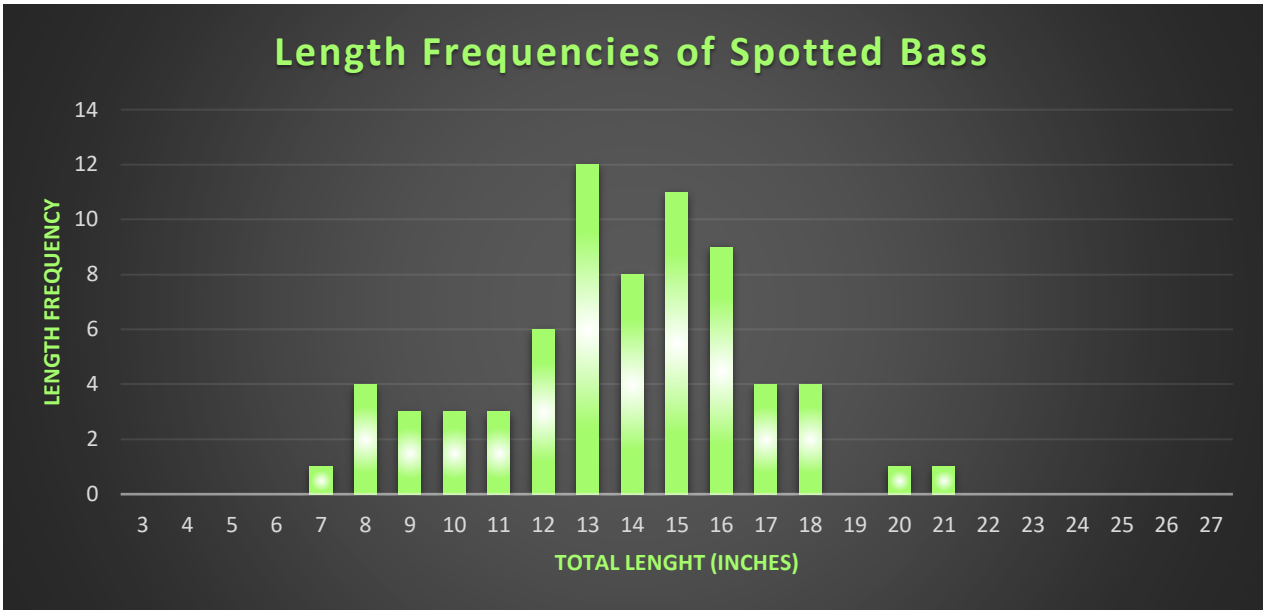


Figure 2: Length frequencies of spotted bass collected from Highland Lake March 22 and 27, 2018.

Black crappie were also collected in high abundance. Total length of each Crappie ranged from **9 to 15 inches**. Every fish observed was above quality length (measuring 8 inches or more). The largest crappie sampled weighed **2.2lbs.** Looking ahead there will be no target harvest set on Crappie due to the "boom or bust" spawning nature. Since we cannot accurately account for their recruitment then we cannot safely set a removal rate. As a result, maintaining the health and balance of prey populations is essential to the success of both bass and crappie.

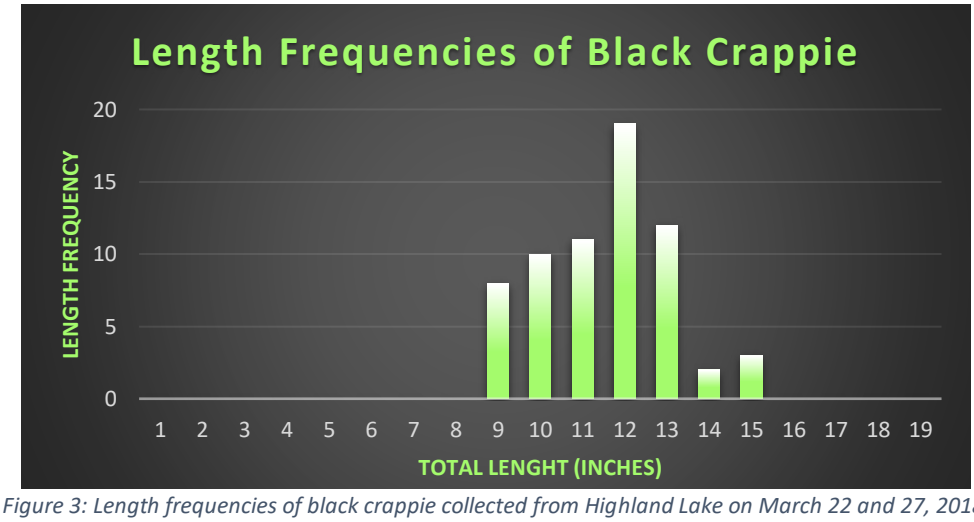


Figure 3: Length frequencies of black crappie collected from Highland Lake on March 22 and 27, 2018.

Bluegill and shellcracker were caught ranging in total length from 1 to 10 inches. Figures 4 and 5 shows size distribution of Bluegill and Shellcracker. Notably, these figures show a desirable range for bluegill but the range for shellcracker is lacking. In comparison to the 3 to 5 inch size range, mature adult shellcracker were sampled in much higher abundance. This is probably due to heavy predation and the shellcracker's ability to only spawn once a year. Because Bluegill and shellcracker live in the littoral zone (shallow areas) in close proximity to predators and are the main food source for these predators special attention in terms of management must be taken.

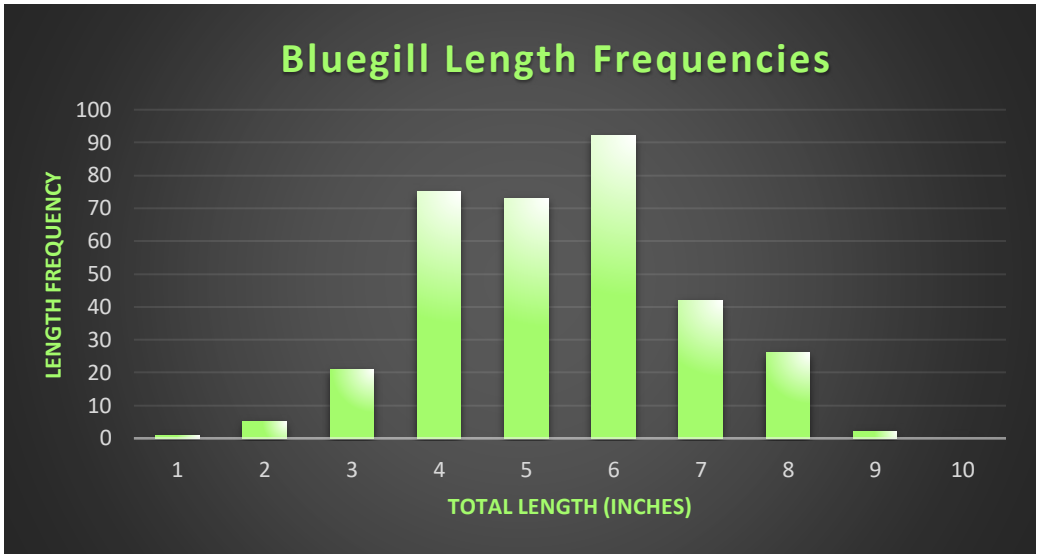


Figure 4: Length frequencies of Bluegill collected from Highland Lake March 22 and 27, 2018.

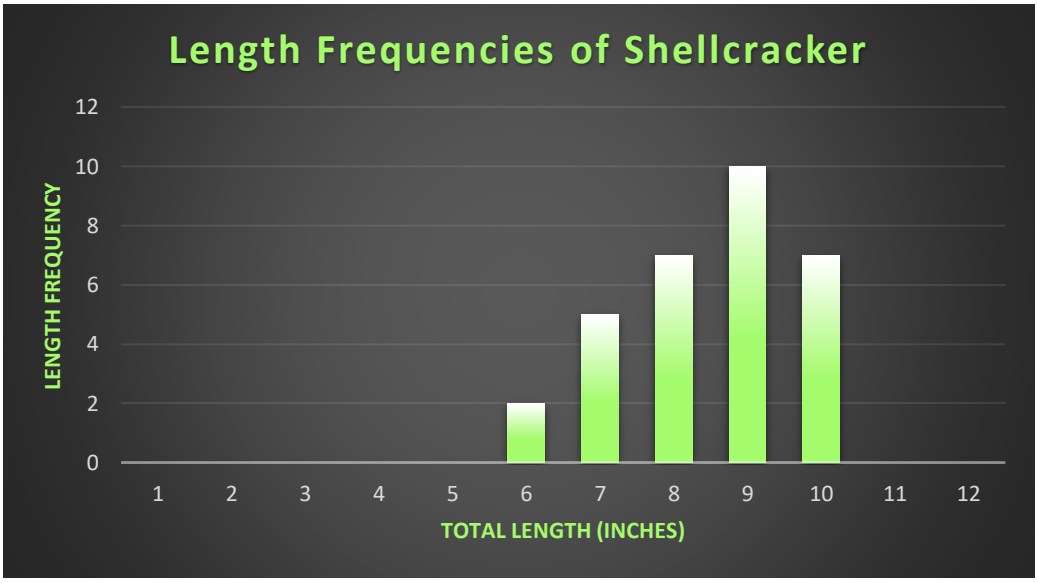


Figure 5: Length frequencies of Shellcracker collected from Highland Lake March 22 and 27, 2018.

The two types of shad collected during sampling were gizzard and threadfin shad. Gizzard shad were caught ranging in size from 5-12 inches and threadfin were attained in sizes from 3-5 inches. When it comes to threadfins it is important to remember that they are consumable by predators throughout all stages of their life. As a result a large population of breeding adults is desirable, which is what is portrayed in figure 6. In comparison, once gizzard shad reach a certain length (8+ inches) they are only consumable by a small portion of large predators. This is key to be mindful of because if gizzard shad become over populated they will consume the majority of planktonic resources vital for growth and development of juvenile fish. Figure 7 does show desirable amounts and lengths for gizzard shad population.

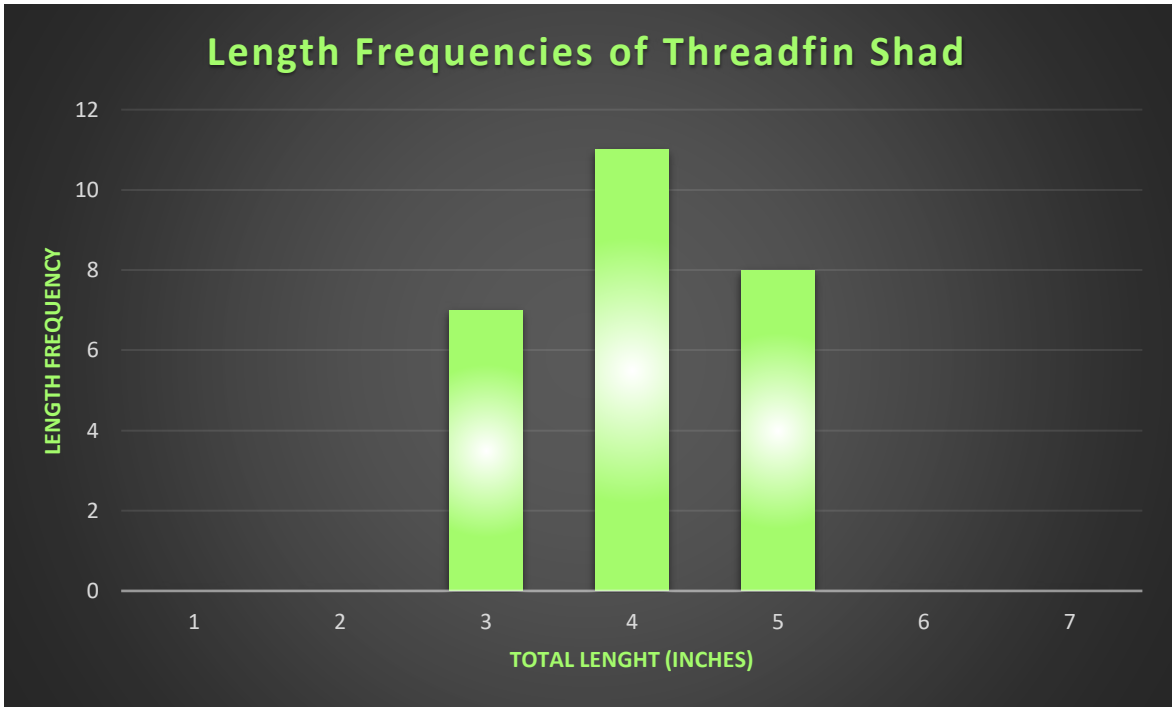


Figure 6: Length frequencies of threadfin shad collected from Highland Lake March 22 and 27, 2018.

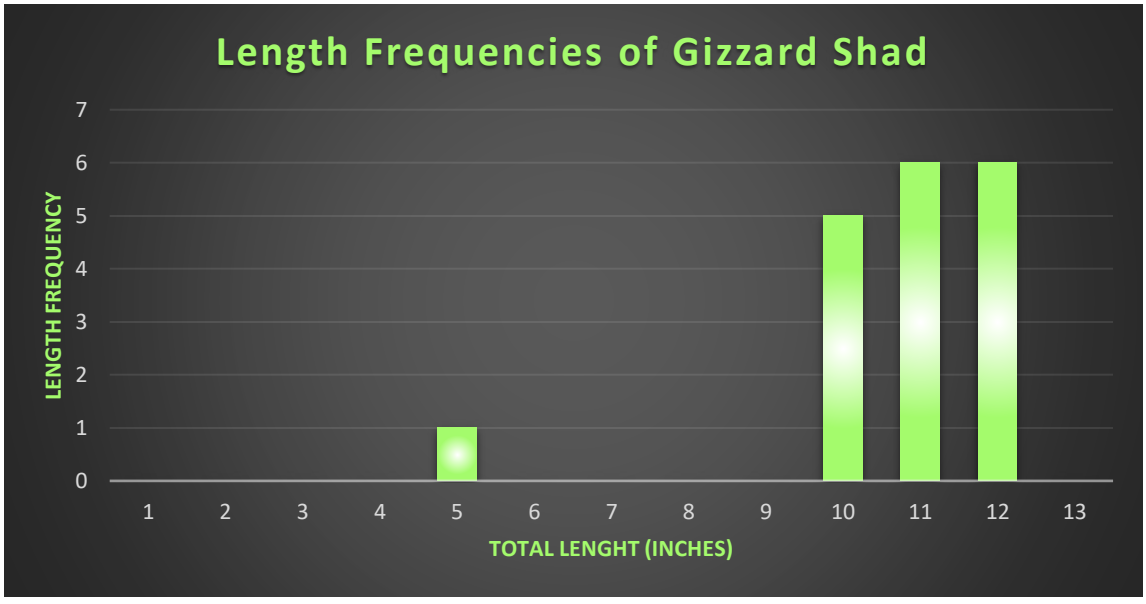


Figure 7: Length frequencies of gizzard shad collected from Highland Lake March 22 and 27, 2018.

Relative weight is one way of measuring the health or plumpness of a fish. It is the ratio of the actual weight of a fish to what a rapidly growing healthy fish of the same length should weigh. The **average relative weight** (Wr) of largemouth bass for Highland Lake was **90.88%** (Figure 8). The **Wr** of spotted bass for Highland Lake was **90.73%** (Figure 9). This means on average Largemouth Bass in this system are 9.12%, and spotted bass are 9.27% below a perfect health rating. In other words, the majority of adult bass in the lake are in relatively good to excellent condition. We want to see the relative weight averaging from **85-100%** (85-90% considered good, 90-100% is excellent). Black Crappie attained in the sample had an **Wr** of **90.85%.** Even though this is a desirable Wr, it should be taken into account that a high number of larger crappie have low Wr's (Figure 10). This is revealing the high competition between the three predator species being managed. This can be corrected by harvesting of competing bass and supplemental stocking of prey species present and new additional species.

The bluegill in the sample had an **Wr** of **86.25%** (Figure 11). In comparison to the bass, the majority of fish in the system are in relatively good health. Supplemental feeding of a high protein feed like **Triton** will result in a large increase in the overall health of your bluegill. Also, if these fish do not have to expend as much energy trying to find food they will allocate these extra resources towards breeding. This will, in turn, create more food for the bass and crappie.

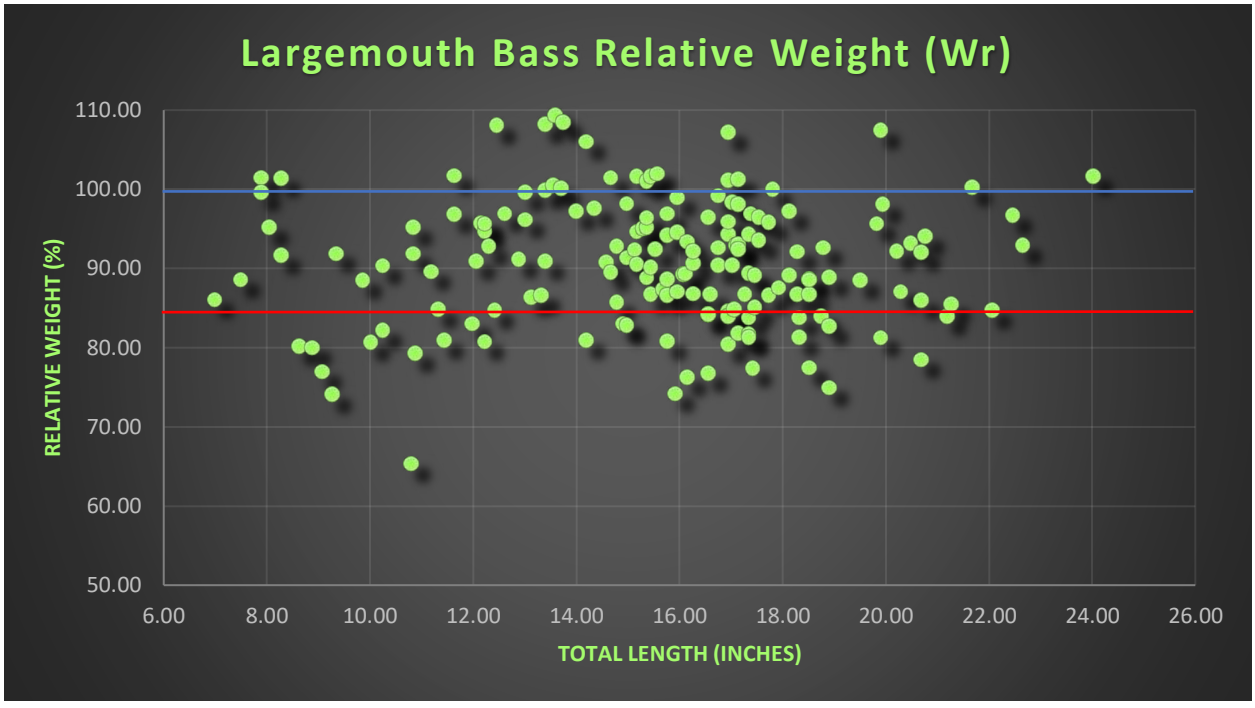


Figure 8: Wr's of adult largemouth bass collected from Highland Lake March 22 and 27, 2018.

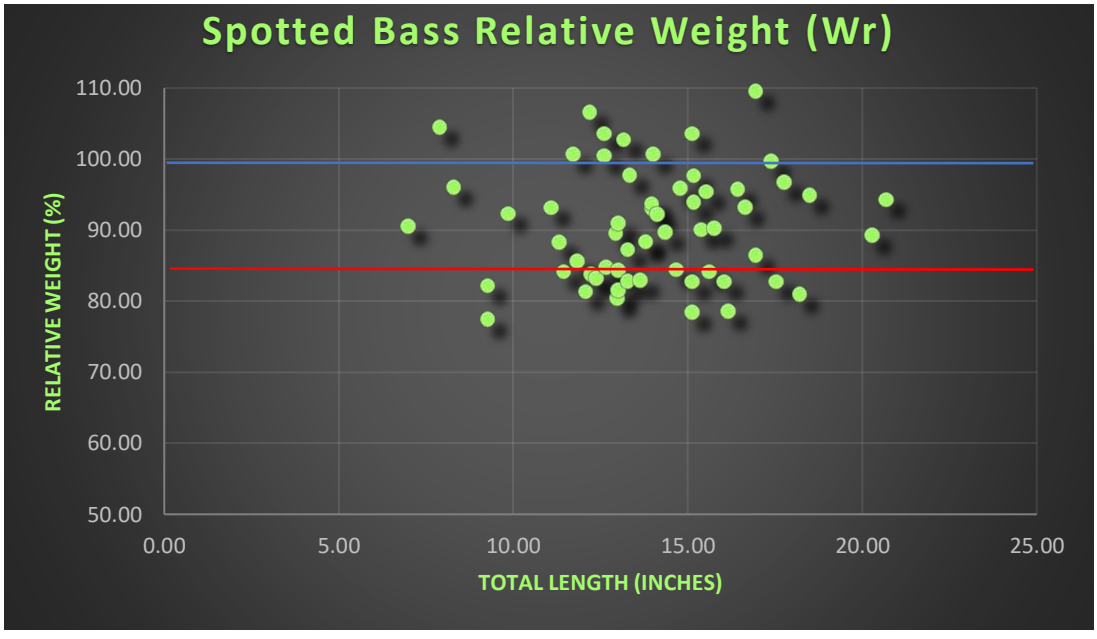


Figure 9: Wr's of adult spotted bass collected from Highland Lake March 22 and 27, 2018.

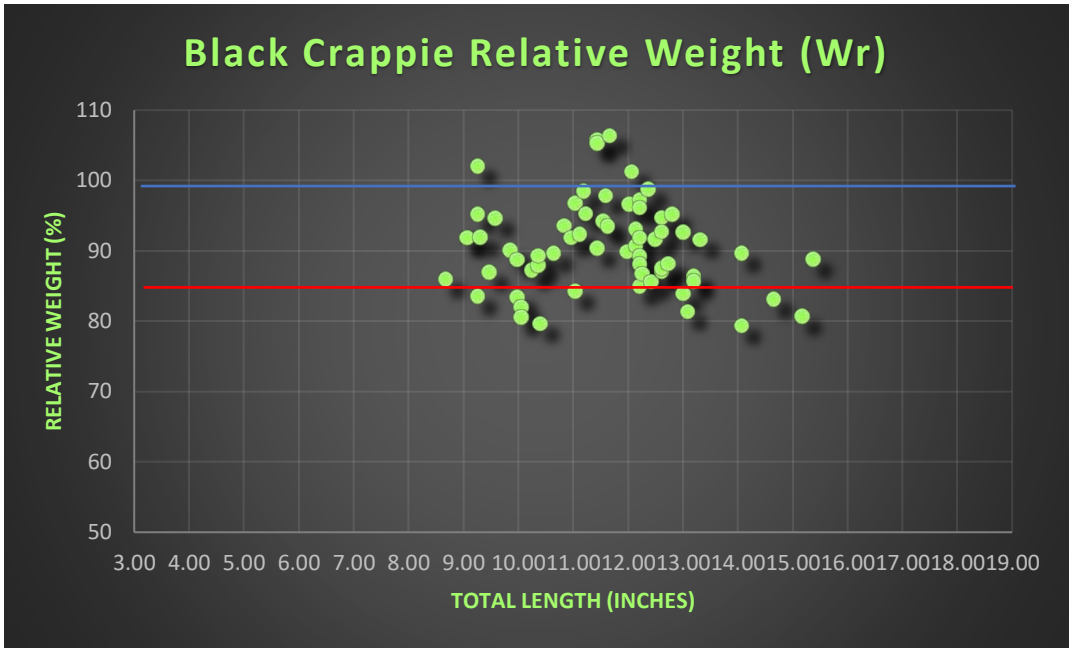


Figure 10: Wr's of adult black crappie collected form Highland Lake March 22 and 27, 2018.

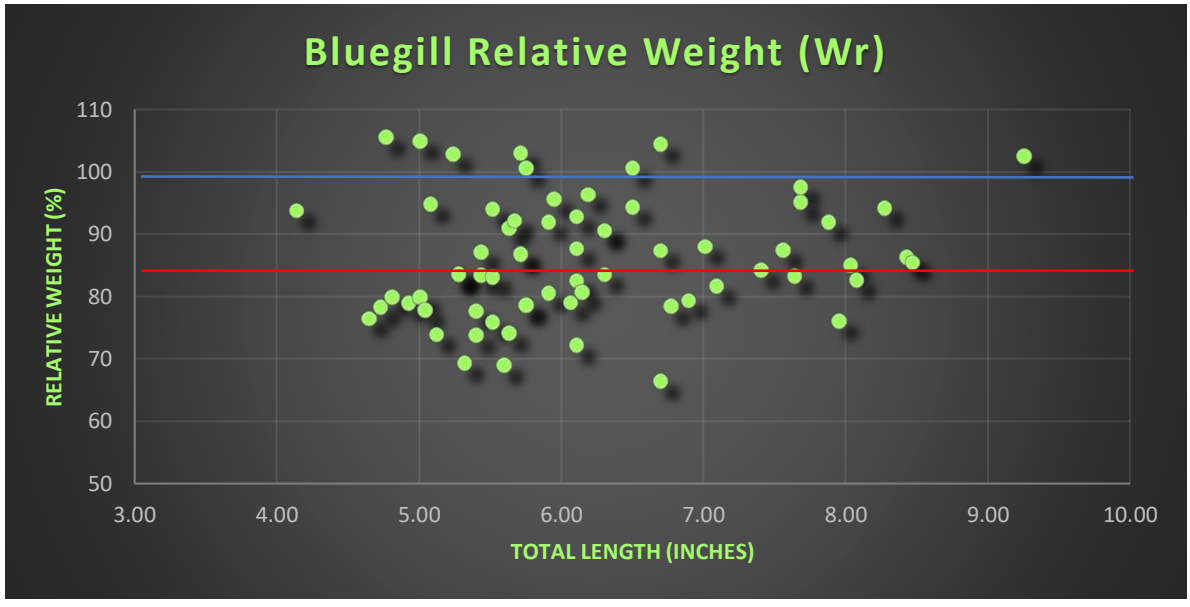


Figure 11: Wr's of adult bluegill collected from Highland Lake March 22 and 27, 2018.

Fish Assessment

Proportional Size Distribution (PSD) is another calculation we use to measure the balance of fish populations in a lake. This compares, in terms of total length in inches, the number of quality fish sampled to the total number of adult fish sampled. The PSD for Largemouth in Highland Lake was 82% and spotted bass was 77%. This means that out of the adult Bass sampled 82% and 77% of them were over quality length (Largemouth and spots measuring 12 inches or more in total length). A target PSD for bass in a lake is between 40-70%, this expresses Highland Lake's bass population's PSD is in excellent condition.

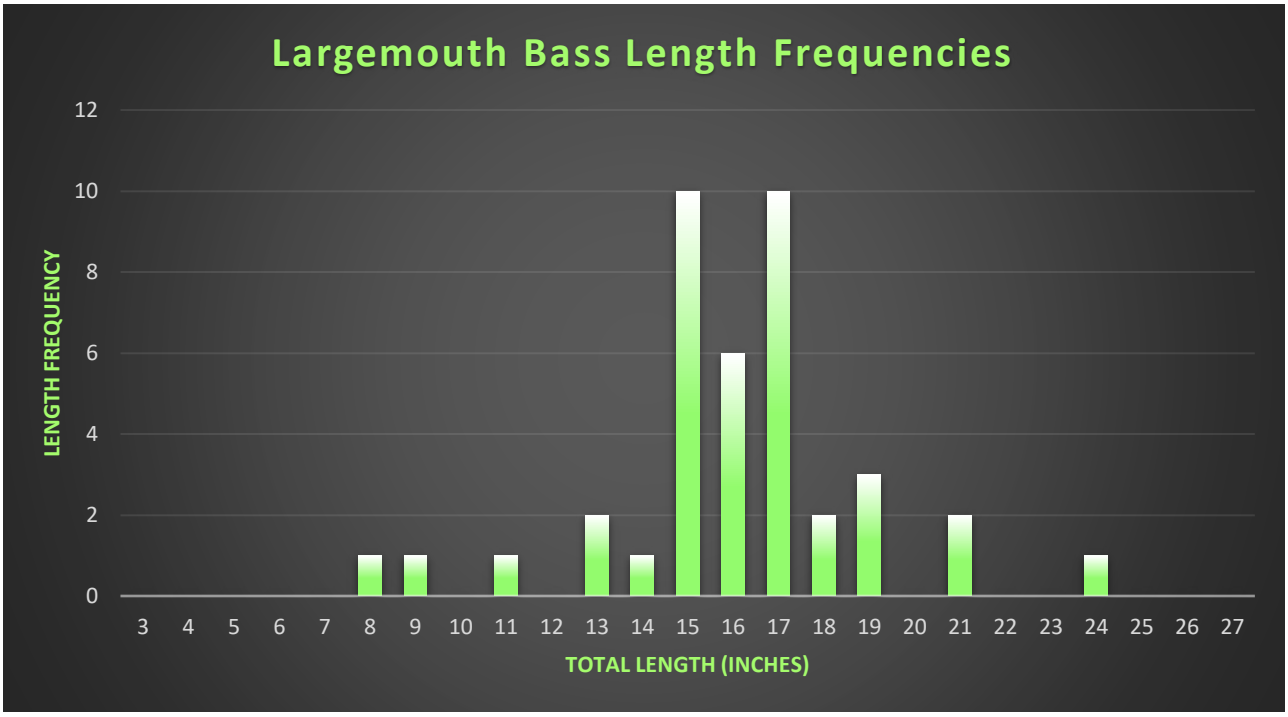
PSD for black crappie in Highland Lake was remarkable. 100% of the fish sampled were above quality length (Black crappie measuring 8 inches or more). Since we are managing for bass and crappie alike they both have a target PSD of 40-70%. There were 65 crappie total in the sample, once again showing how extraordinary this PSD is.

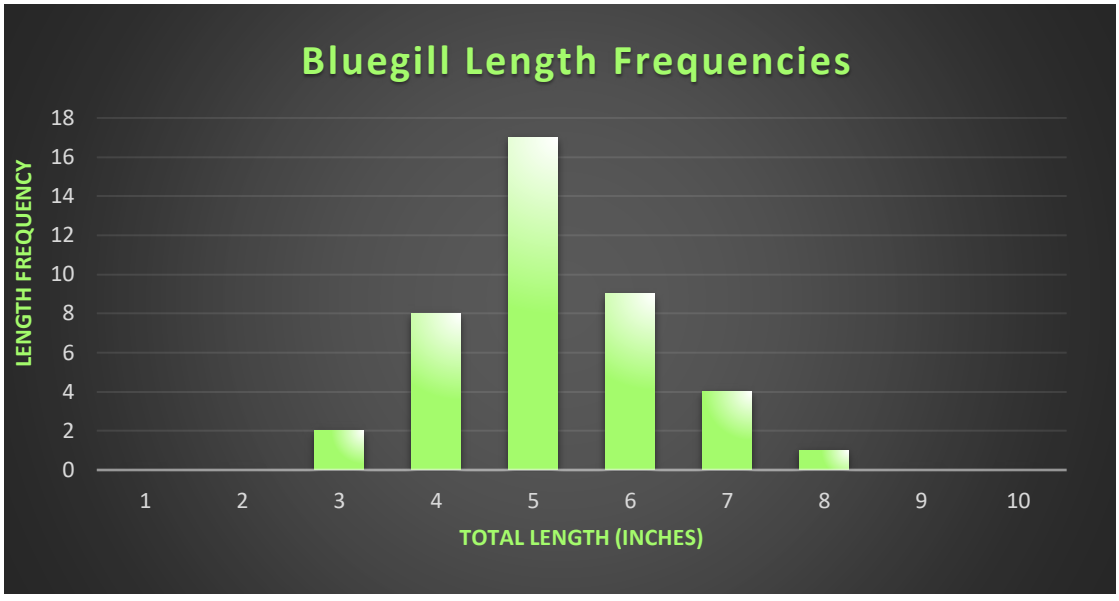
The PSD for bluegill in Highland Lake was 44%. This is a desirable PSD. Remember that quality length in bluegill is any fish measuring 6 inches or more in total length. The reason we want a PSD of 20-40% is because we want the other 60-80% of the bluegill population to be 1-5 inches in total length. These are fish predominately preyed upon by the predators in the system.

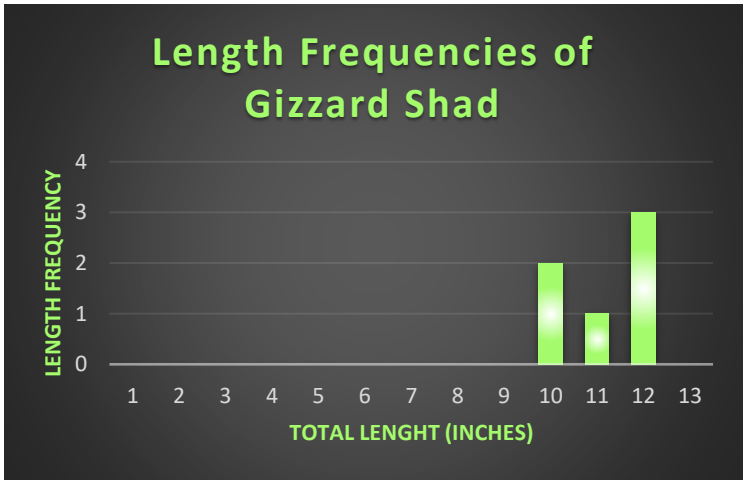
Cumulative comparisons of the following graphs were used to generate the conclusions mentioned above. Management actions such as stocking locations and fish removals will be decided by comparing these quadrants individually.

PMD By Quadrant

	Large Mouth Bass	Spotted Bass	Bluegill	Black Crappie
Quadrant One	93	83	24	100
Quadrant Two	72	78	74	100
Quadrant Three	83	95	44	100
Quadrant Four	84	50	32	100
Quadrant Five	86	78	67	100




Bluegill Length Frequencies
LENGTH FREQUENCY
0
2
4
6
8
10
12
14
16
18
1
2
3
4
5
6
7
8
9
10
TOTAL LENGTH (INCHES)


Length Frequencies of Gizzard Shad
LENGTH FREQUENCY
0
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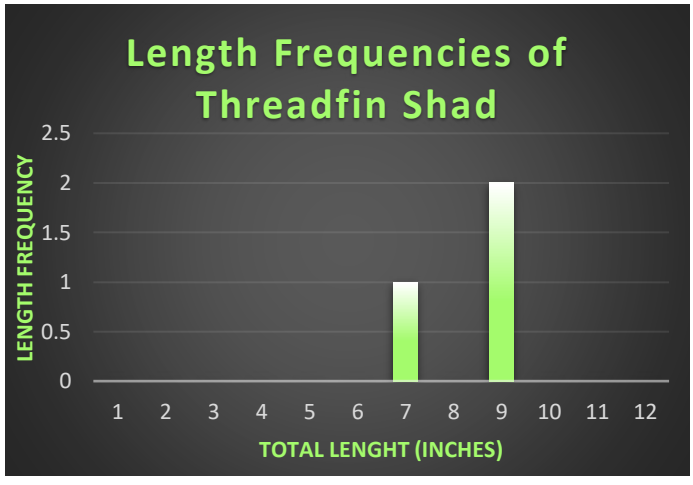
4
1
2
3
4
5
6
7
8
9
10
11
12
13
TOTAL LENGHT (INCHES)


Length Frequencies of Threadfin Shad
LENGTH FREQUENCY
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0.5
1
1.5
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2.5
1
2
3
4
5
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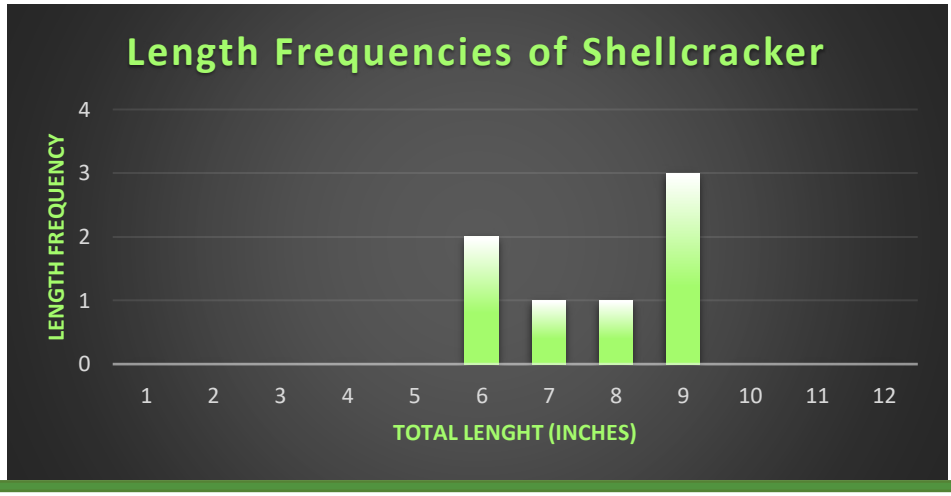
7
8
9
10
11
12
TOTAL LENGHT (INCHES)


Length Frequencies of Shellcracker
LENGTH FREQUENCY
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1
2
3
4
5
6
7
8
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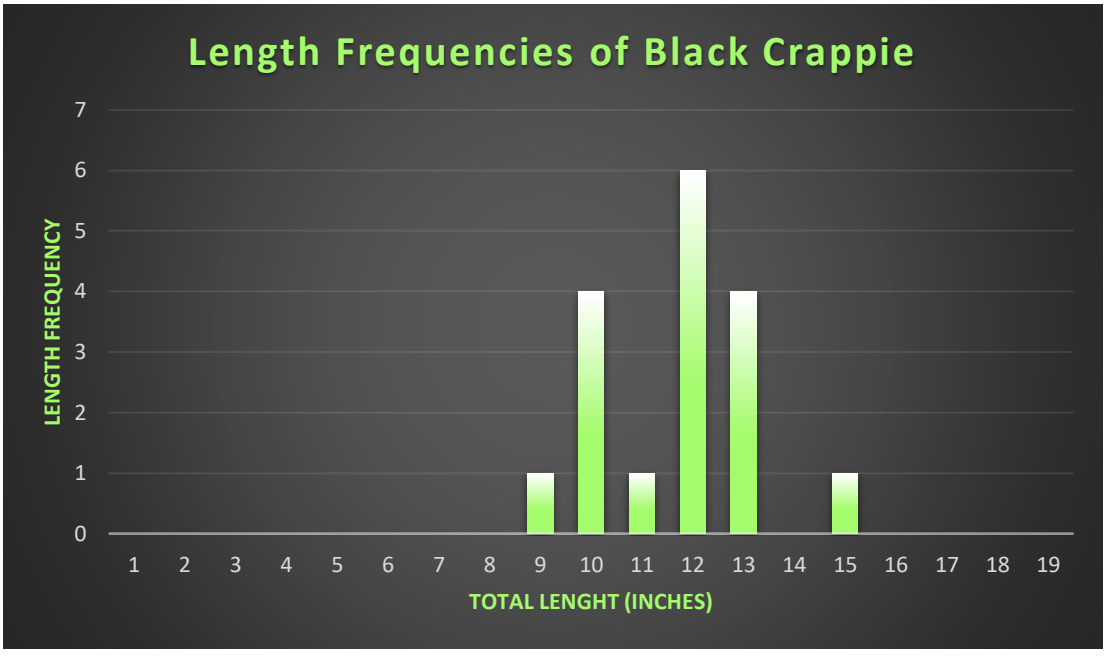
11
12
TOTAL LENGHT (INCHES)


Length Frequencies of Black Crappie
LENGTH FREQUENCY
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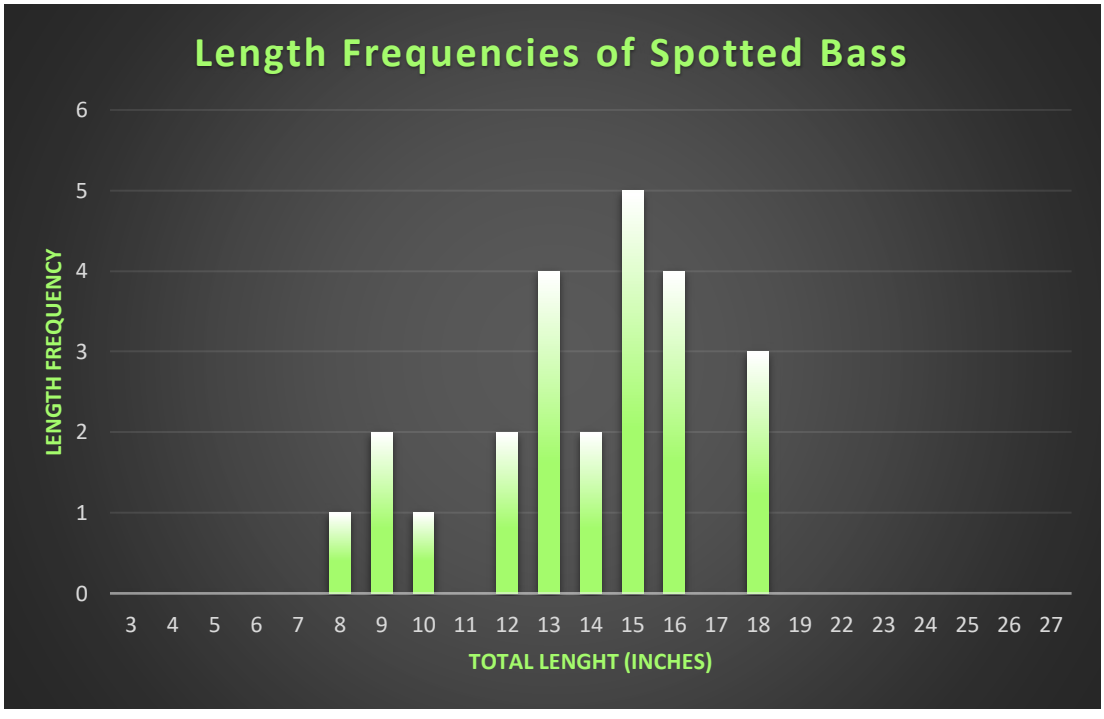
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
TOTAL LENGHT (INCHES)


Length Frequencies of Spotted Bass
LENGTH FREQUENCY
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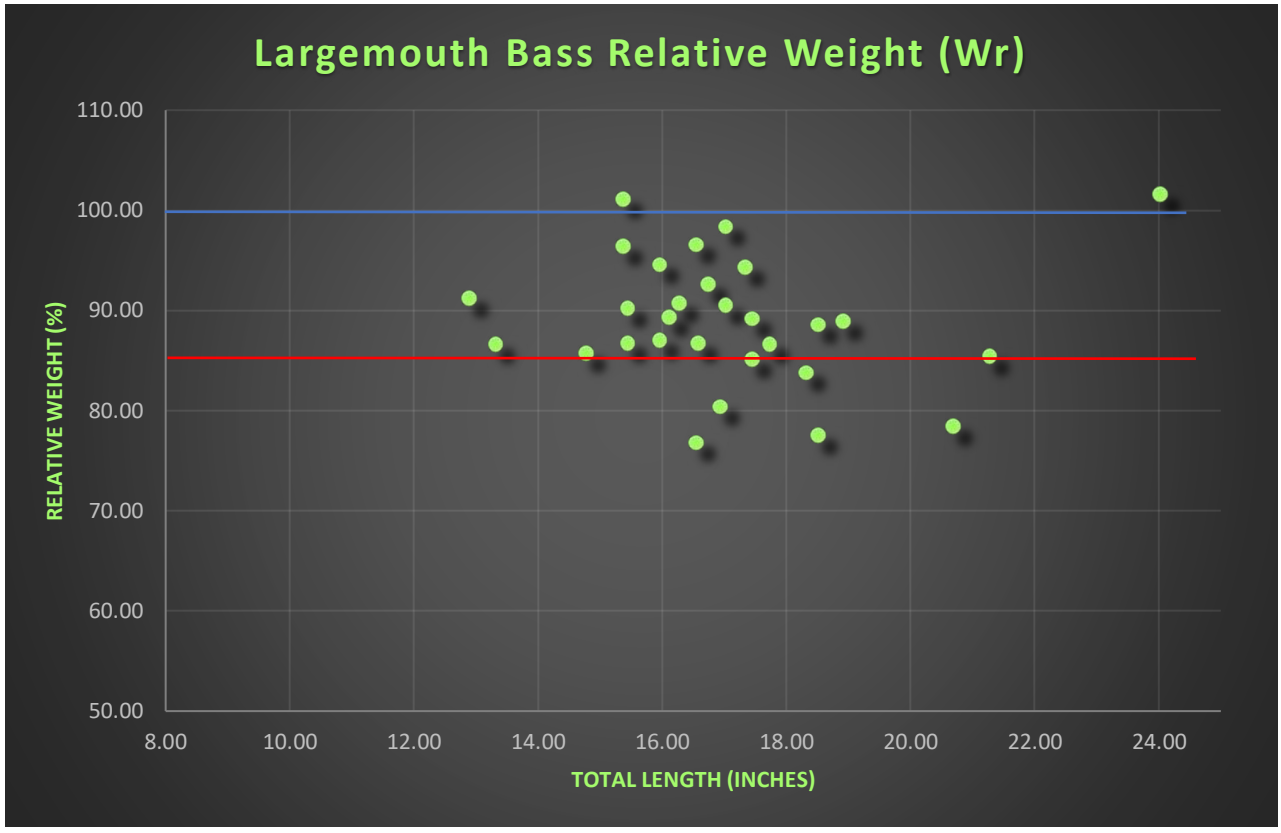
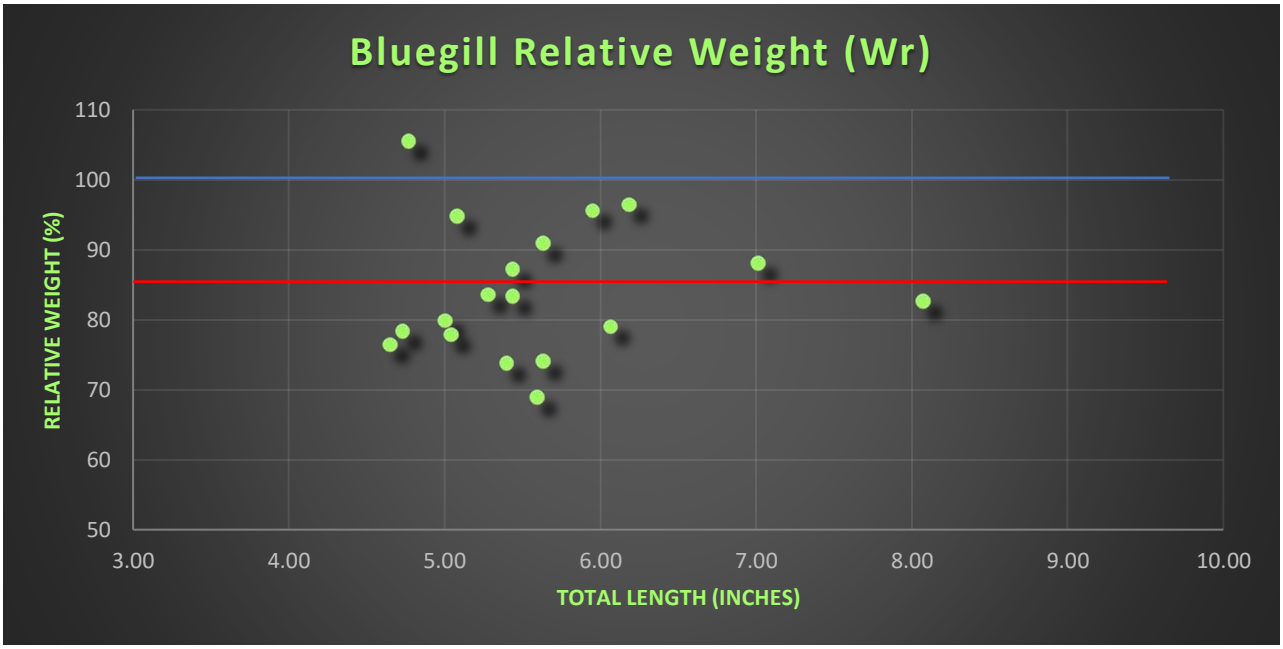
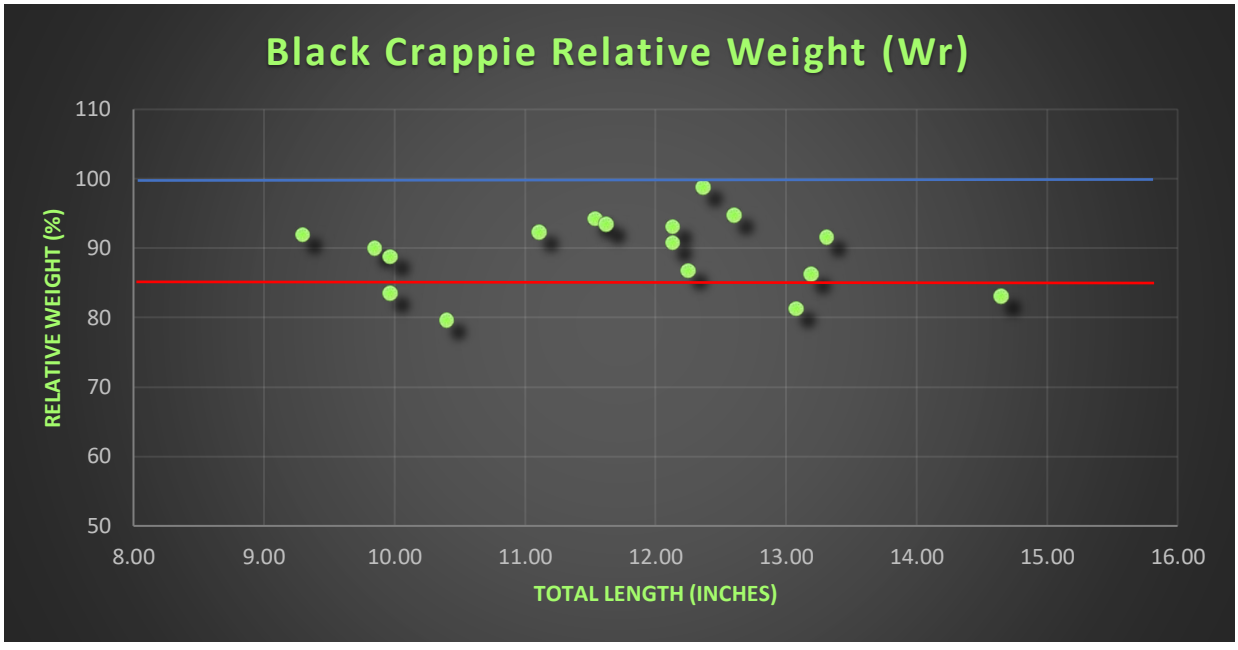
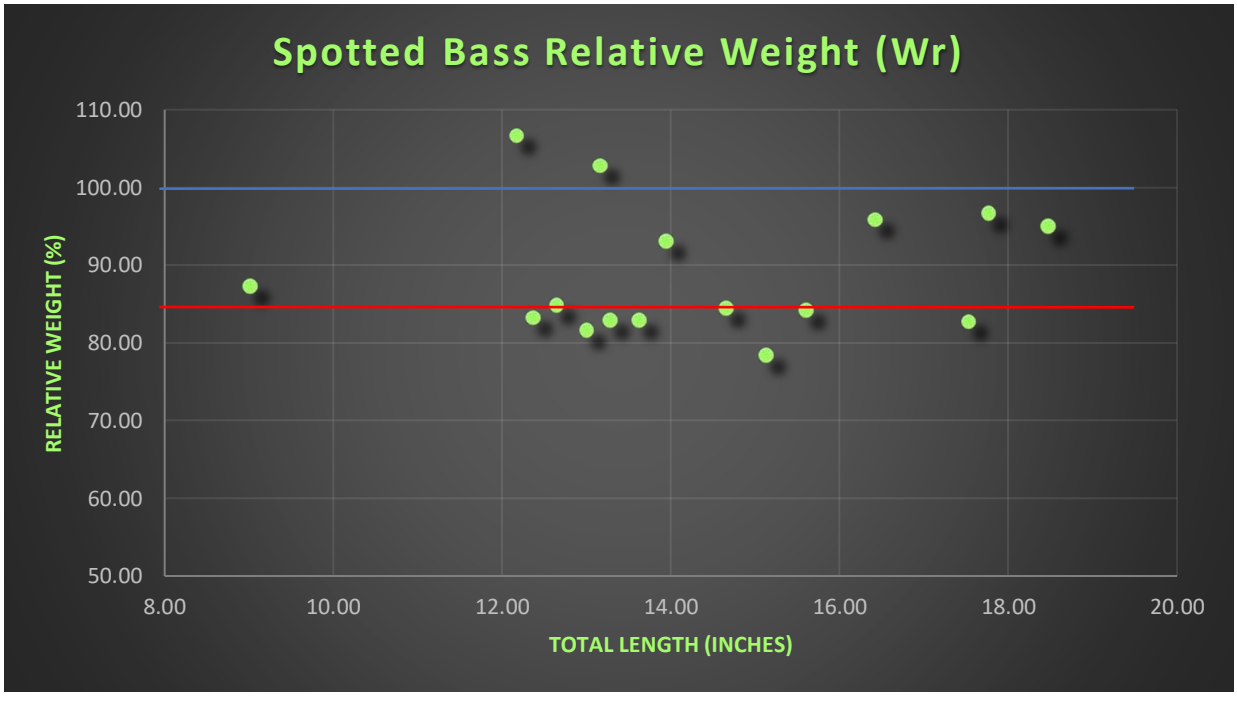
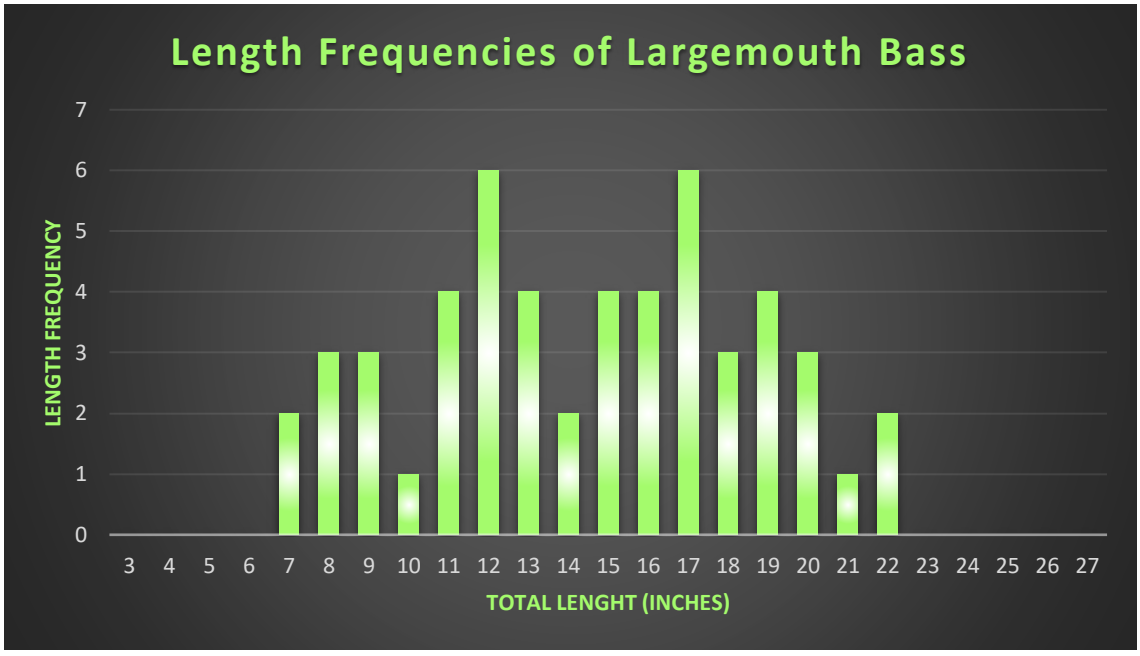
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 22 23 24 25 26 27
TOTAL LENGHT (INCHES)

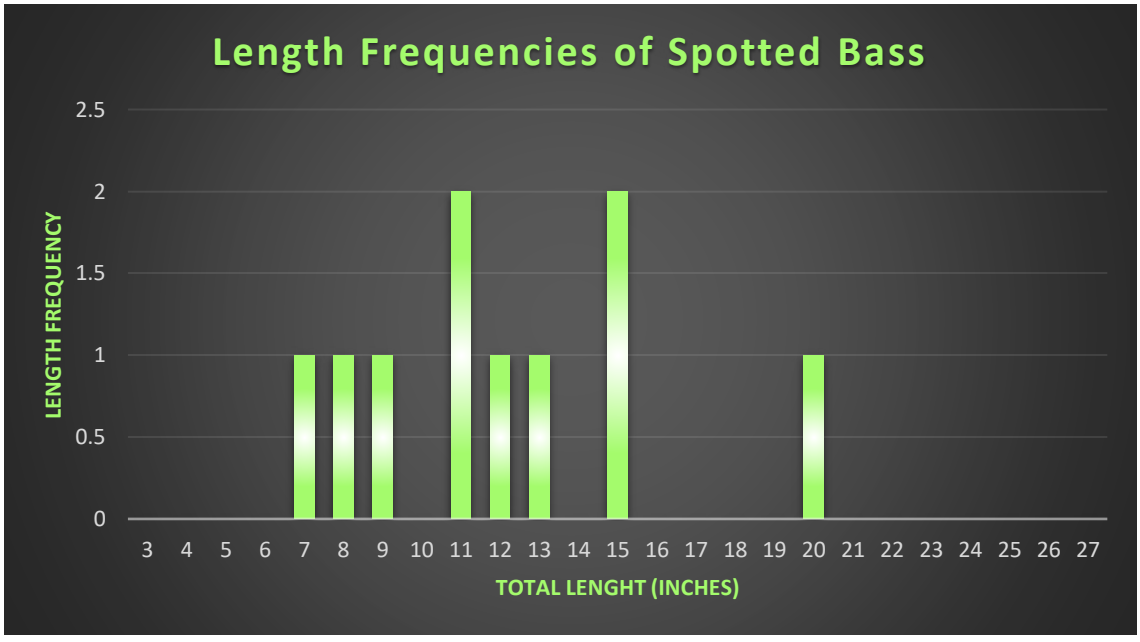

Largemouth Bass Relative Weight (Wr)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
RELATIVE WEIGHT (%)
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
TOTAL LENGTH (INCHES)

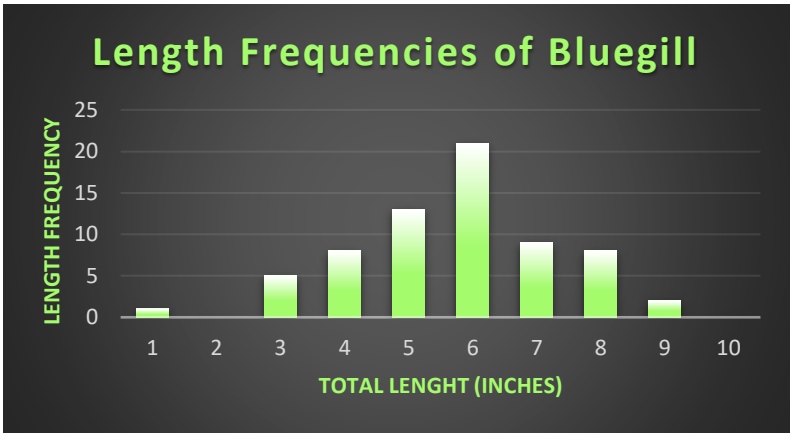

Bluegill Relative Weight (Wr)
110
100
90
80
70
60
50
RELATIVE WEIGHT (%)
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
TOTAL LENGTH (INCHES)

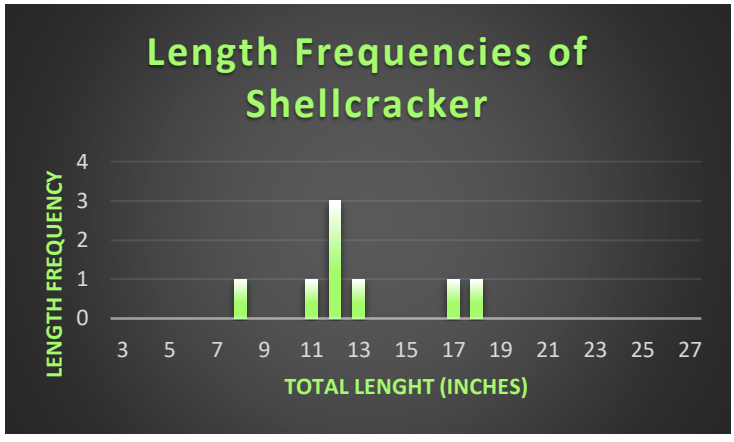

Black Crappie Relative Weight (Wr)
RELATIVE WEIGHT (%)
110
100
90
80
70
60
50
8.00
9.00
10.00
11.00
12.00
13.00
14.00
15.00
16.00
TOTAL LENGTH (INCHES)

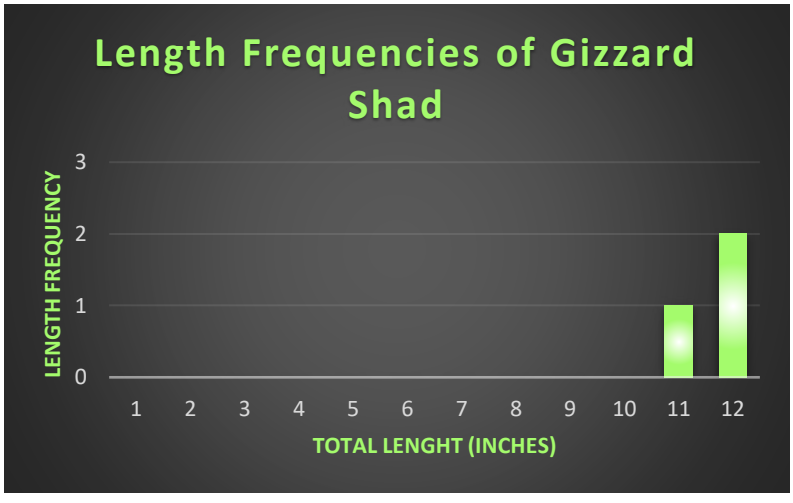

Spotted Bass Relative Weight (Wr)
RELATIVE WEIGHT (%)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
TOTAL LENGTH (INCHES)

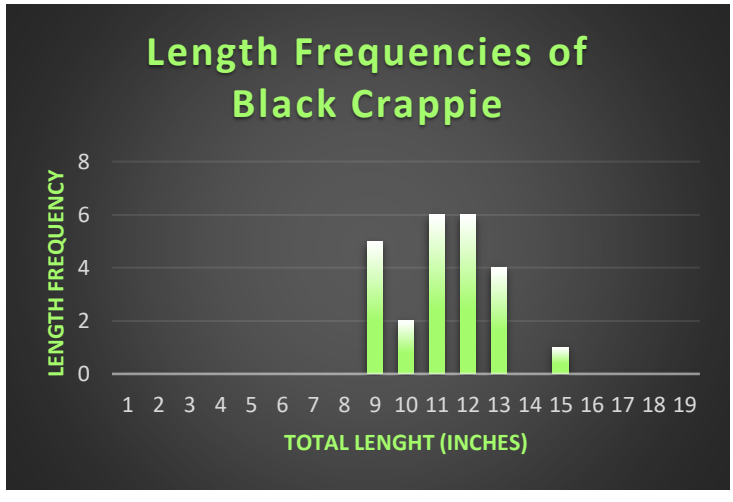

Length Frequencies of Largemouth Bass
LENGTH FREQUENCY
0
1
2
3
4
5
6
7
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGHT (INCHES)

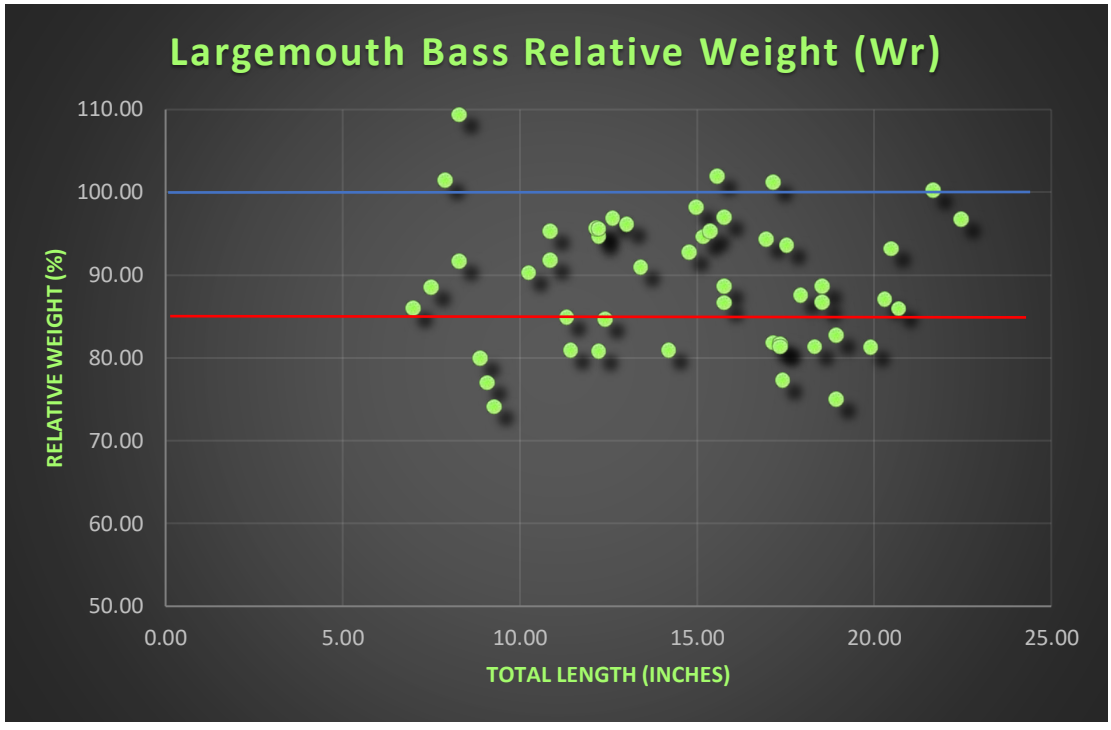

Length Frequencies of Spotted Bass
LENGTH FREQUENCY
0
0.5
1
1.5
2
2.5
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGHT (INCHES)

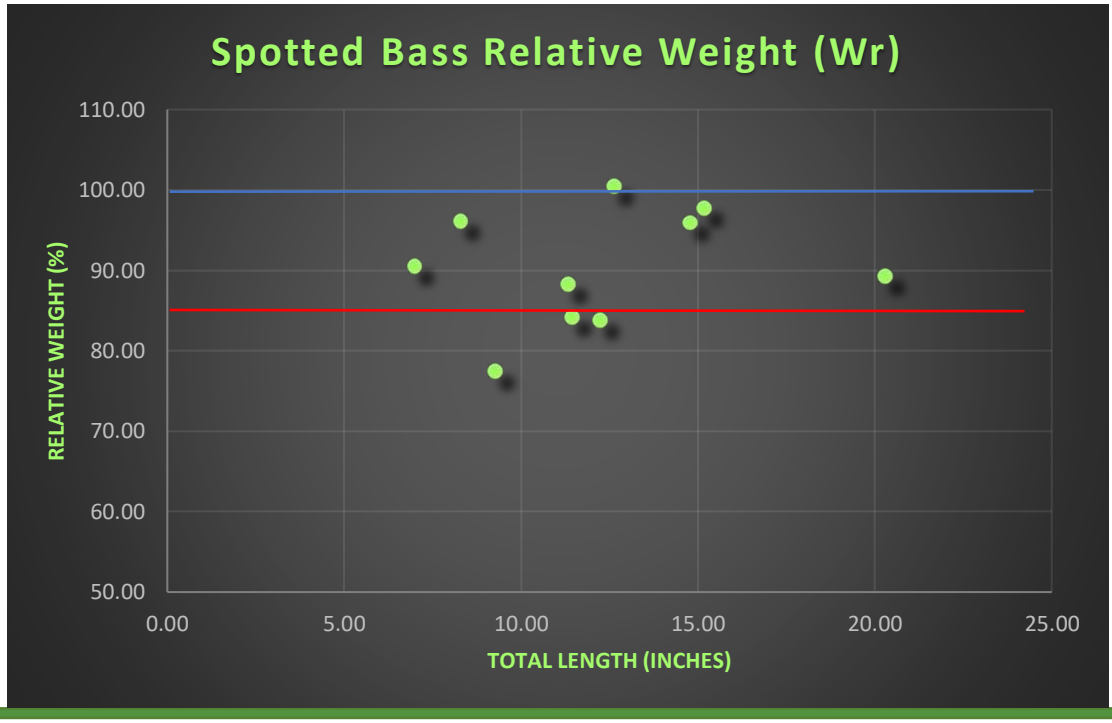

Length Frequencies of Bluegill
LENGTH FREQUENCY
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10
TOTAL LENGHT (INCHES)


Length Frequencies of Shellcracker
LENGTH FREQUENCY
4
3
2
1
0
3 5 7 9 11 13 15 17 19 21 23 25 27
TOTAL LENGHT (INCHES)

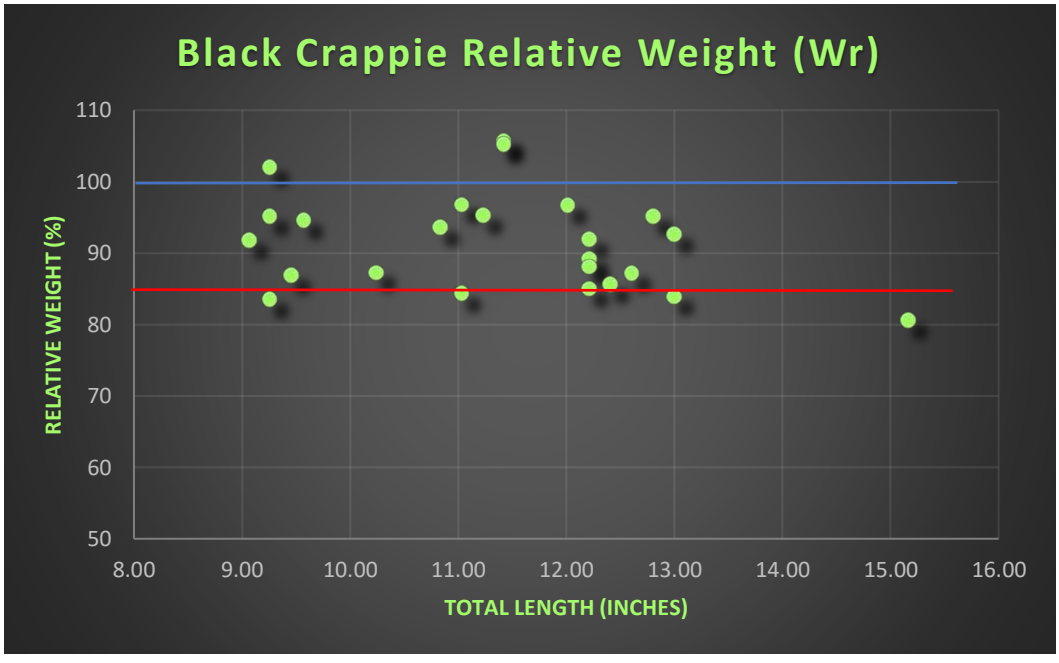

Length Frequencies of Gizzard Shad
LENGTH FREQUENCY
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12
TOTAL LENGHT (INCHES)

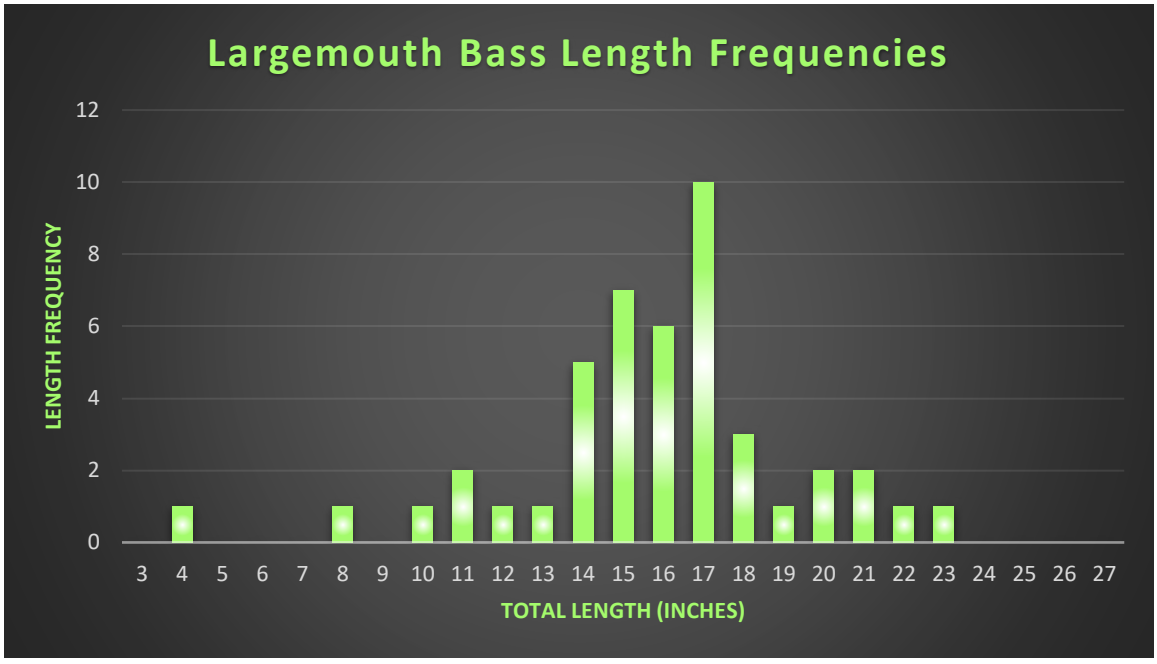

Length Frequencies of Black Crappie
LENGTH FREQUENCY
8
6
4
2
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
TOTAL LENGHT (INCHES)

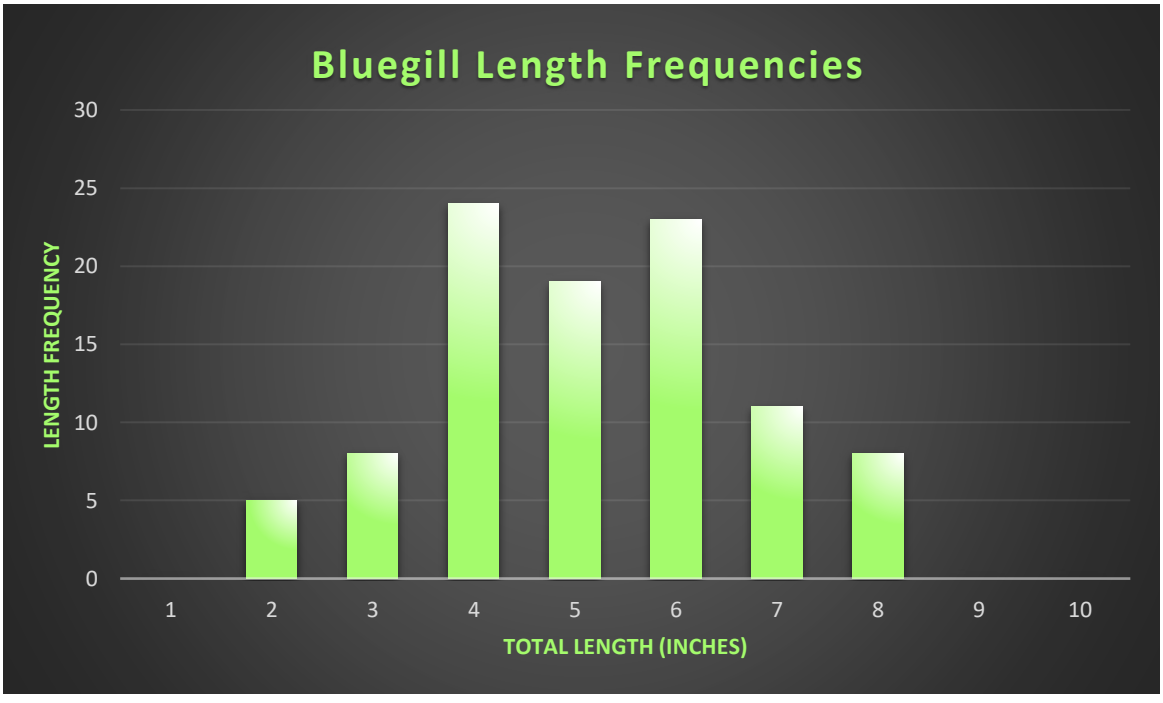

Largemouth Bass Relative Weight (Wr)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
RELATIVE WEIGHT (%)
0.00
5.00
10.00
15.00
20.00
25.00
TOTAL LENGTH (INCHES)

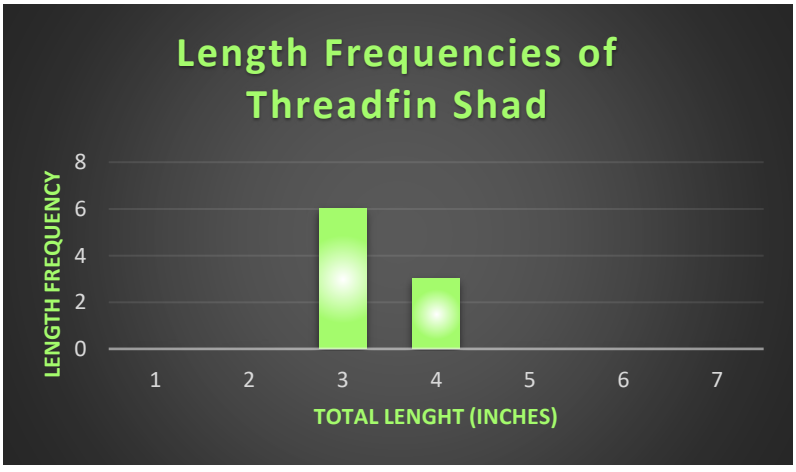

Spotted Bass Relative Weight (Wr)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
RELATIVE WEIGHT (%)
0.00
5.00
10.00
15.00
20.00
25.00
TOTAL LENGTH (INCHES)

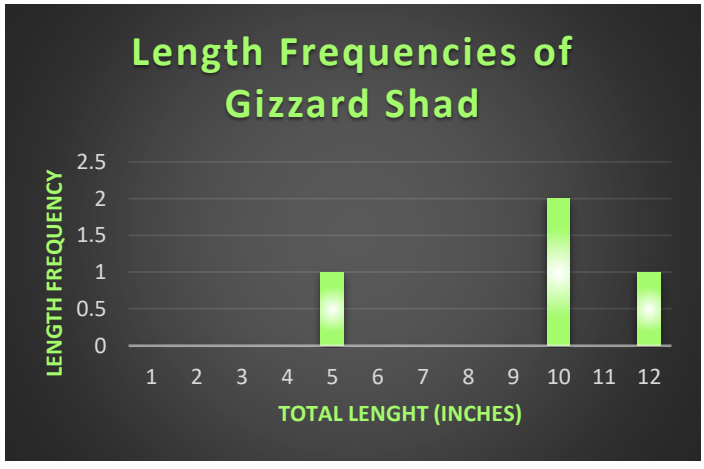

Bluegill Relative Weight (Wr)
RELATIVE WEIGHT (%)
110
100
90
80
70
60
50
5.00
5.50
6.00
6.50
7.00
7.50
8.00
8.50
9.00
9.50
TOTAL LENGTH (INCHES)

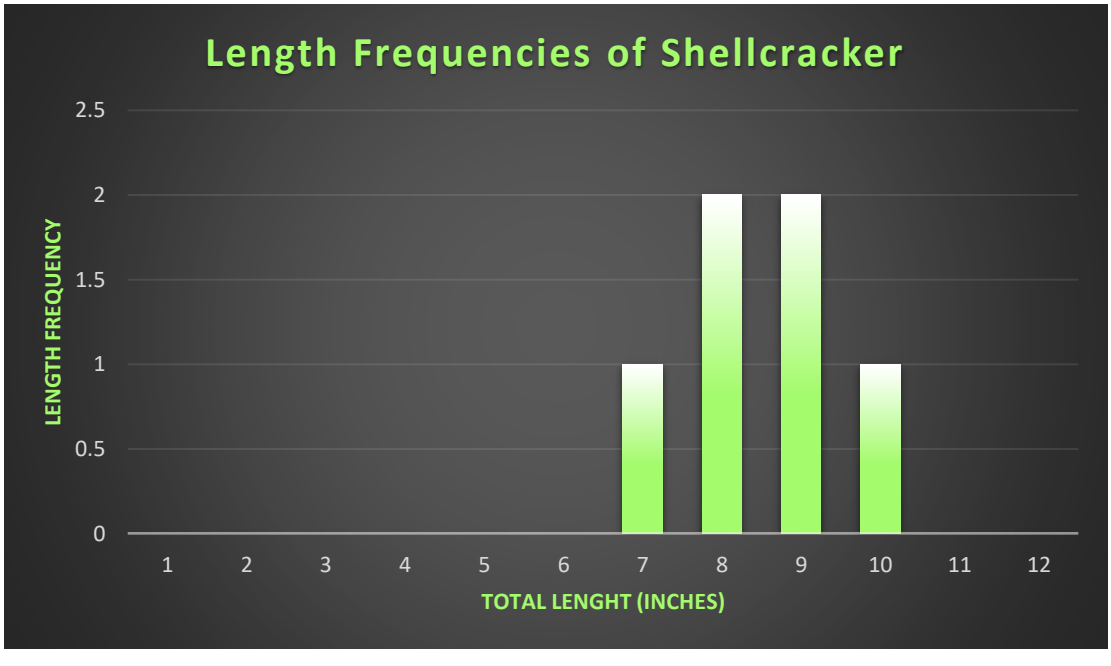

Black Crappie Relative Weight (Wr)
RELATIVE WEIGHT (%)
110
100
90
80
70
60
50
8.00
9.00
10.00
11.00
12.00
13.00
14.00
15.00
16.00
TOTAL LENGTH (INCHES)

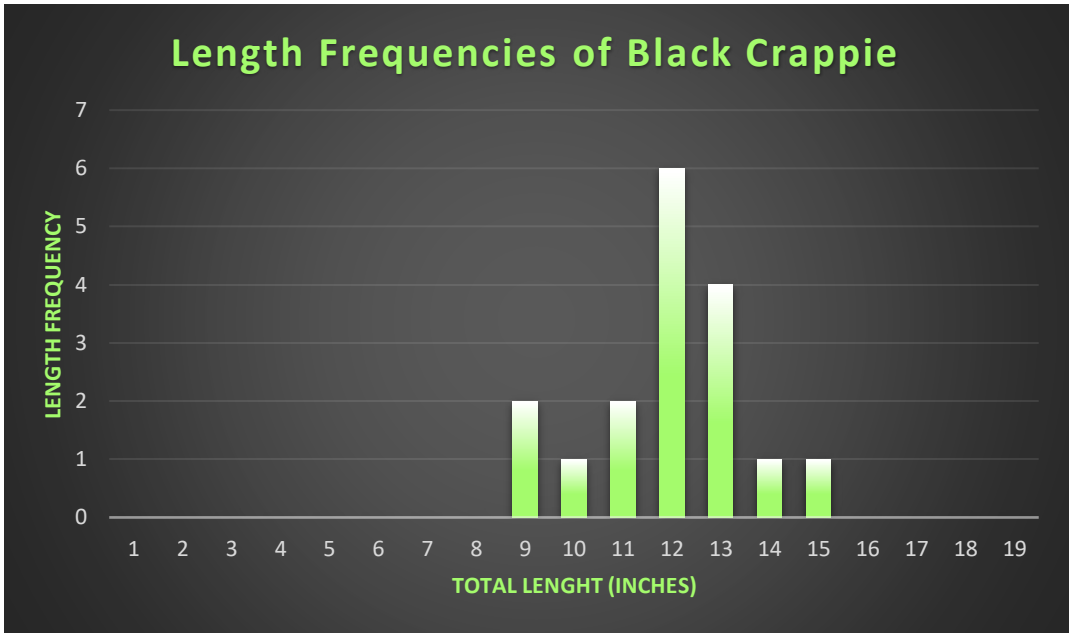

Largemouth Bass Length Frequencies
LENGTH FREQUENCY
0
2
4
6
8
10
12
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGTH (INCHES)

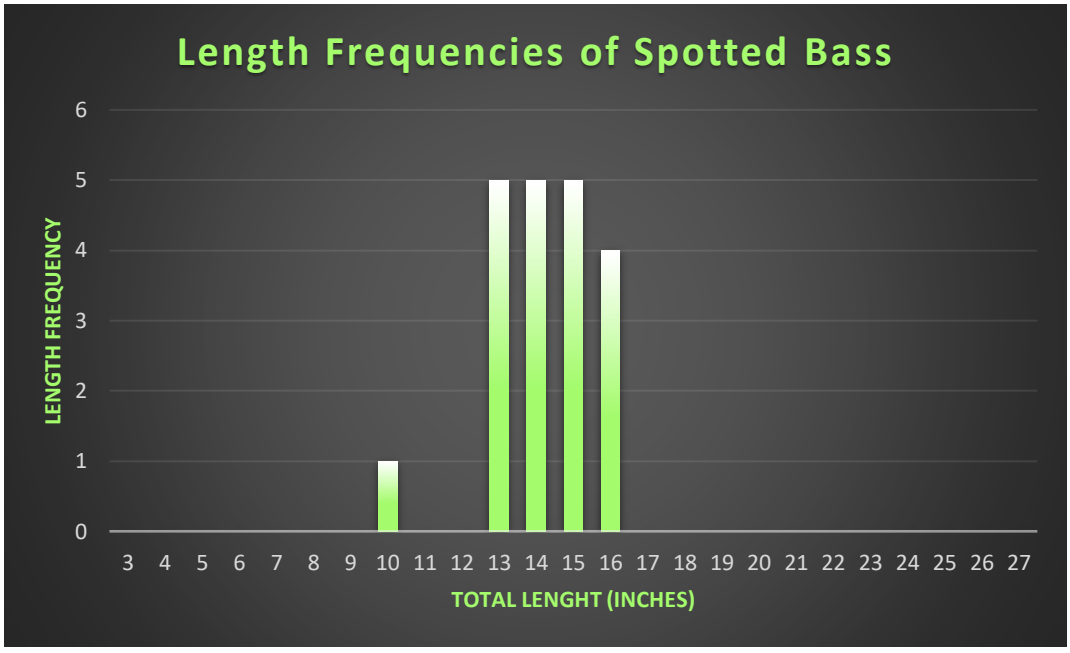

Bluegill Length Frequencies
LENGTH FREQUENCY
0
5
10
15
20
25
30
1 2 3 4 5 6 7 8 9 10
TOTAL LENGTH (INCHES)

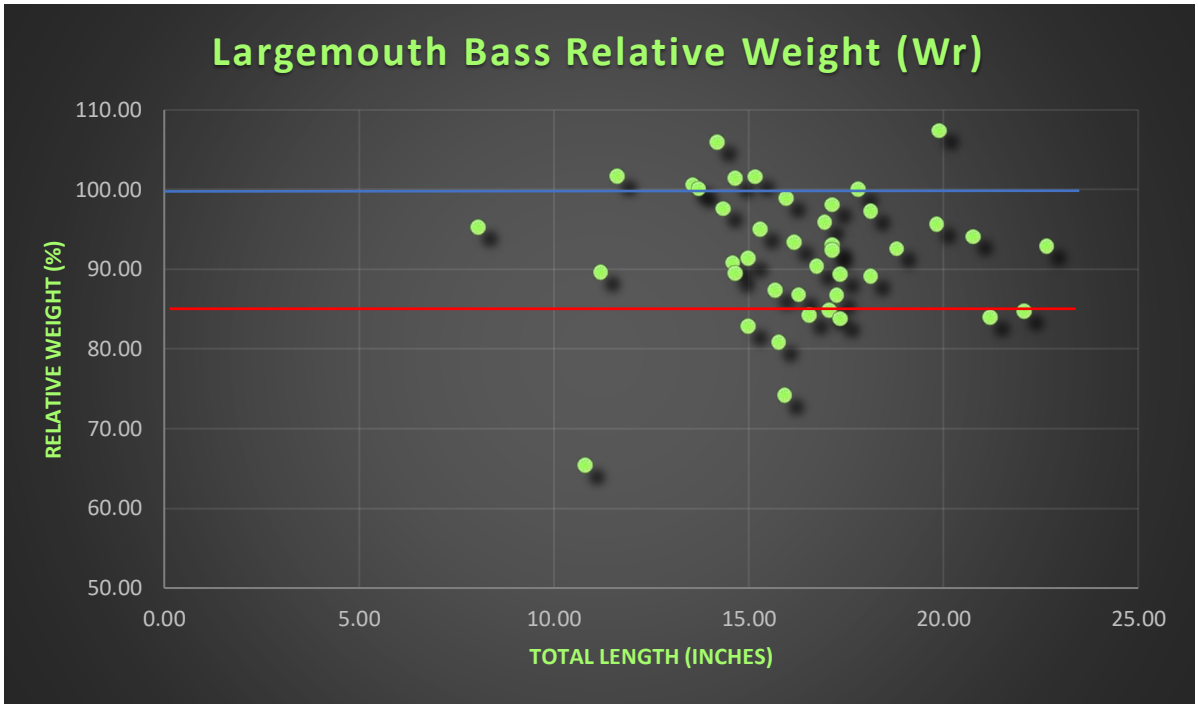

Length Frequencies of Threadfin Shad
LENGTH FREQUENCY
8
6
4
2
0
1
2
3
4
5
6
7
TOTAL LENGHT (INCHES)

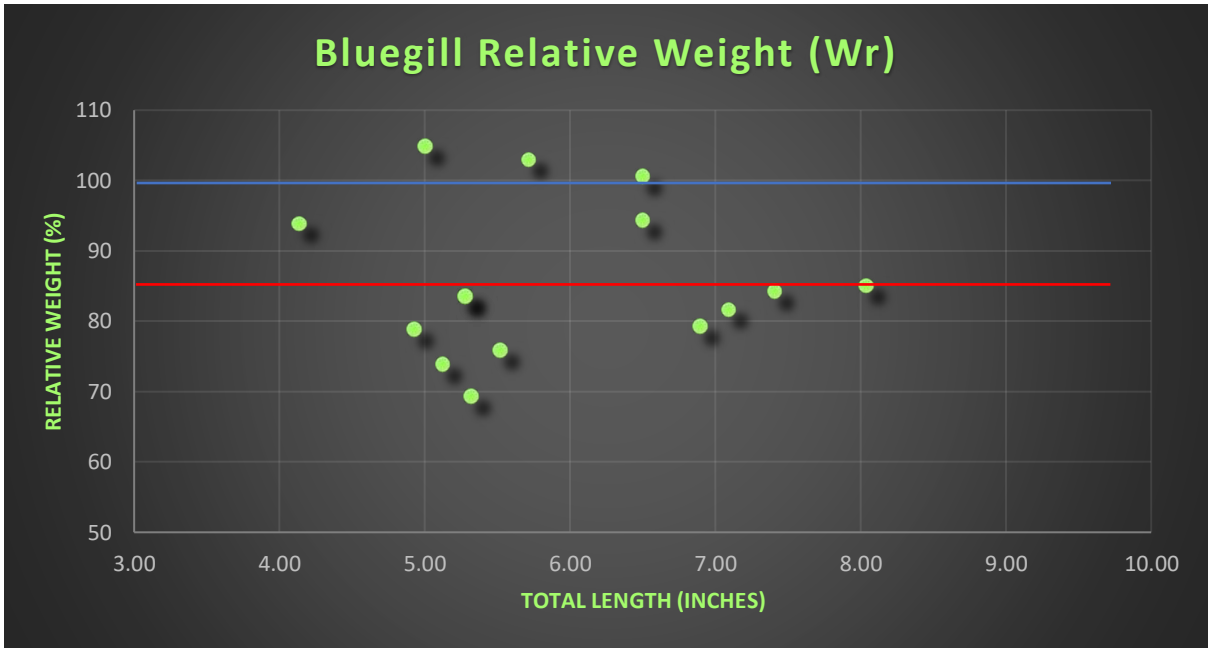

Length Frequencies of Gizzard Shad
LENGTH FREQUENCY
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
10
11
12
TOTAL LENGHT (INCHES)

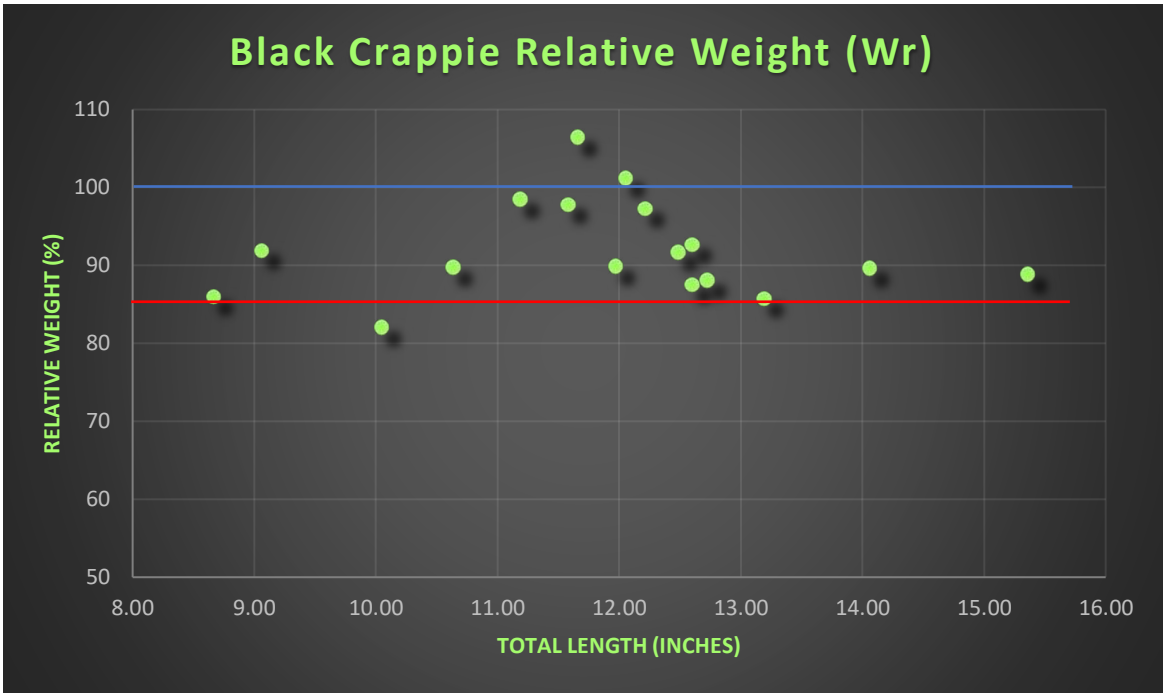

Length Frequencies of Shellcracker
LENGTH FREQUENCY
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
10
11
12
TOTAL LENGHT (INCHES)

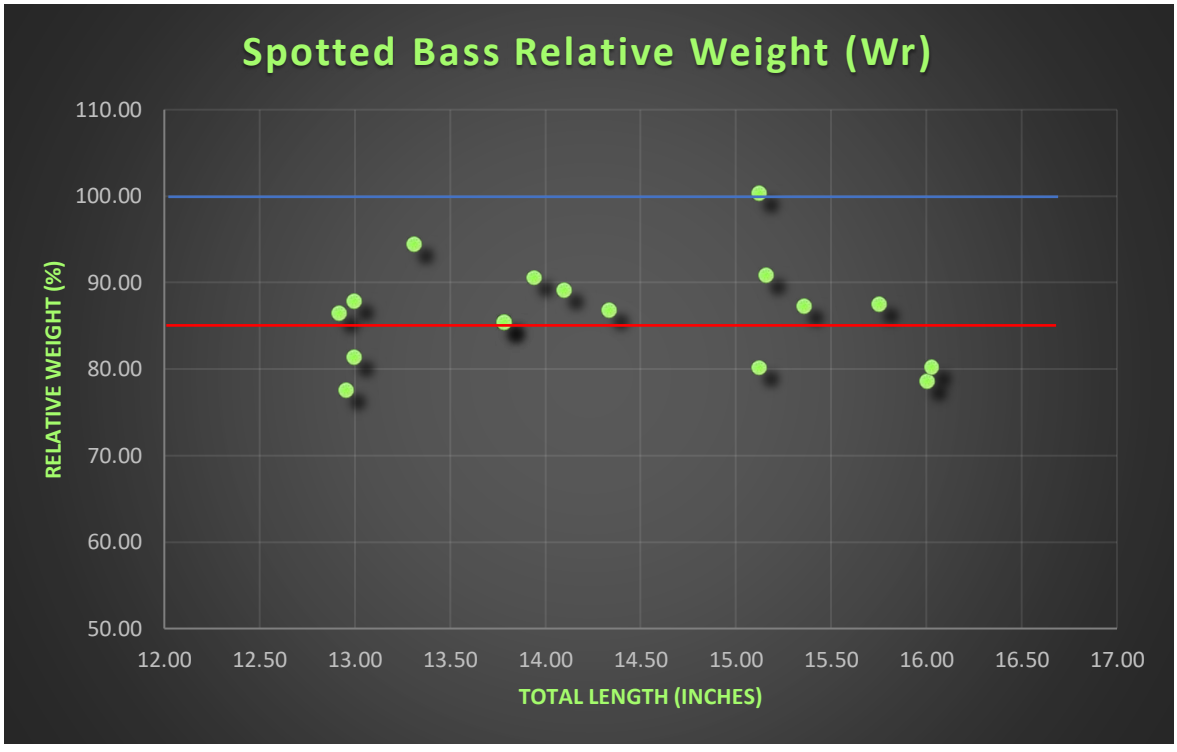

Length Frequencies of Black Crappie
LENGTH FREQUENCY
0
1
2
3
4
5
6
7
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
TOTAL LENGHT (INCHES)

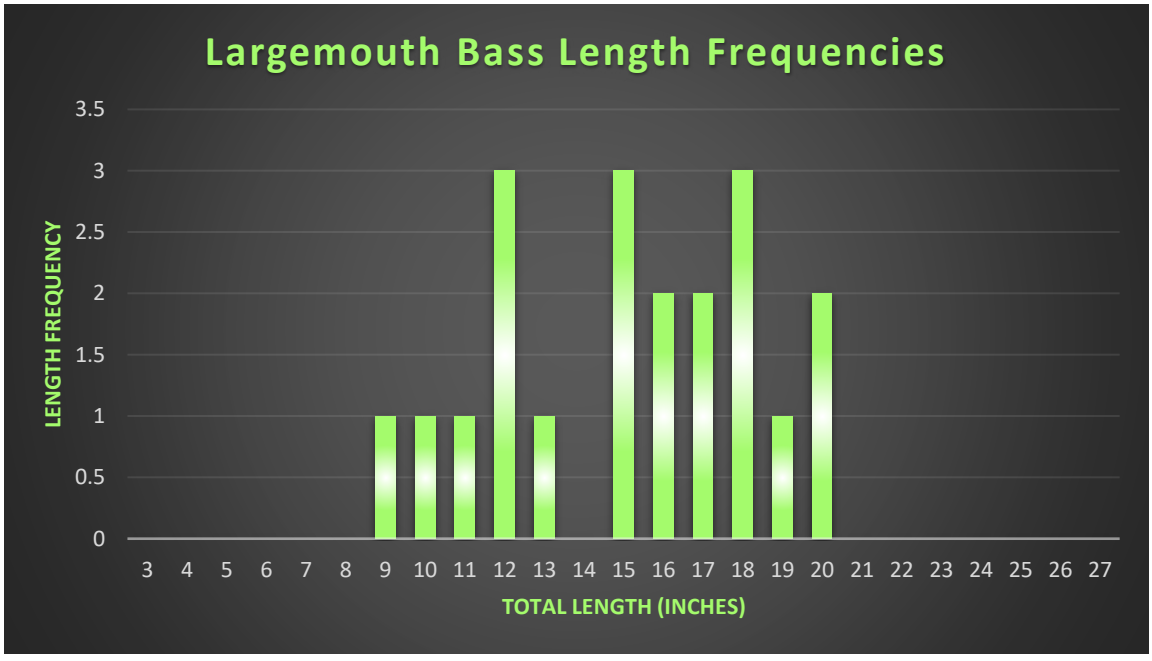

Length Frequencies of Spotted Bass
LENGTH FREQUENCY
0
1
2
3
4
5
6
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGHT (INCHES)

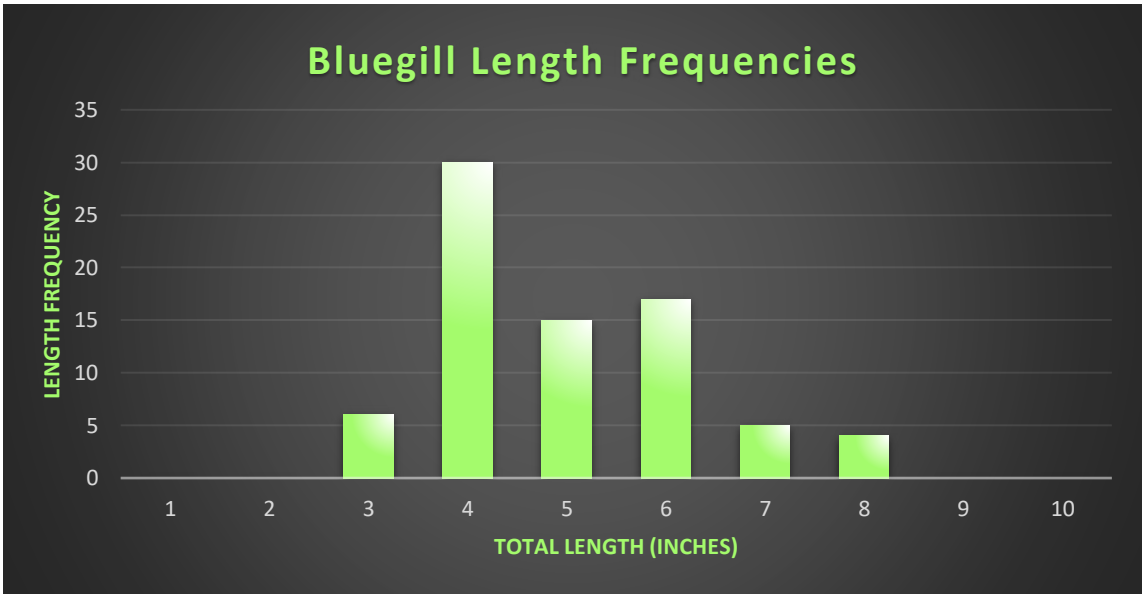

Largemouth Bass Relative Weight (Wr)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
RELATIVE WEIGHT (%)
0.00
5.00
10.00
15.00
20.00
25.00
TOTAL LENGTH (INCHES)

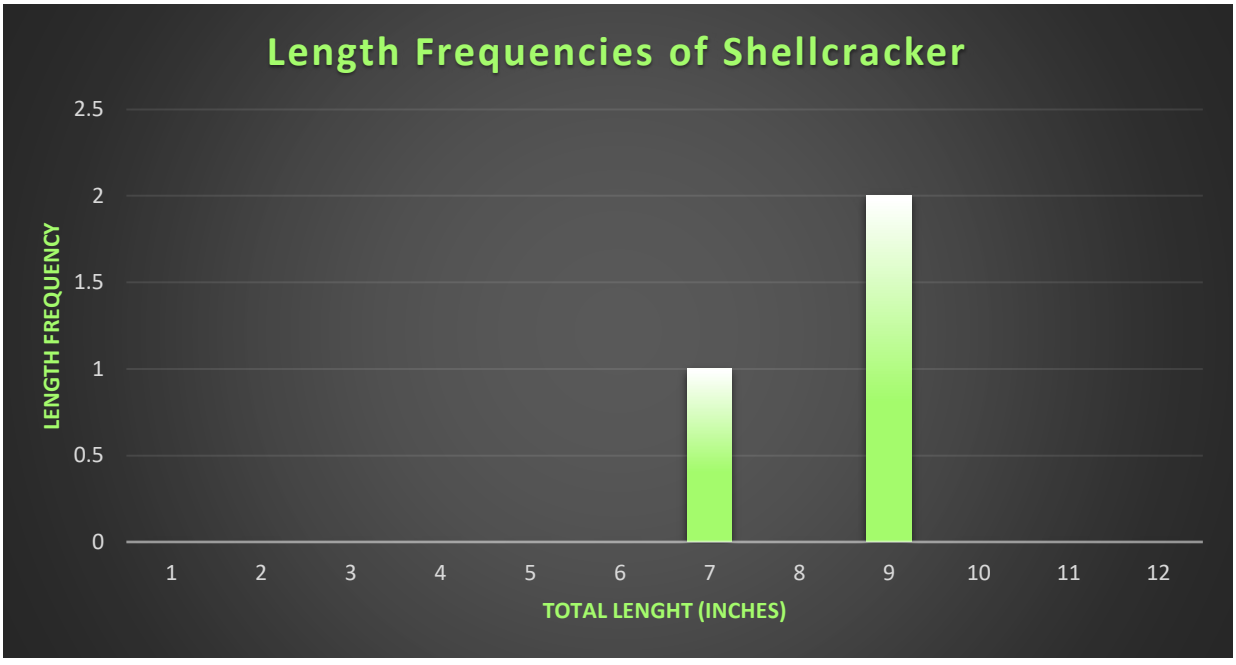

Bluegill Relative Weight (Wr)
110
100
90
80
70
60
50
RELATIVE WEIGHT (%)
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
TOTAL LENGTH (INCHES)

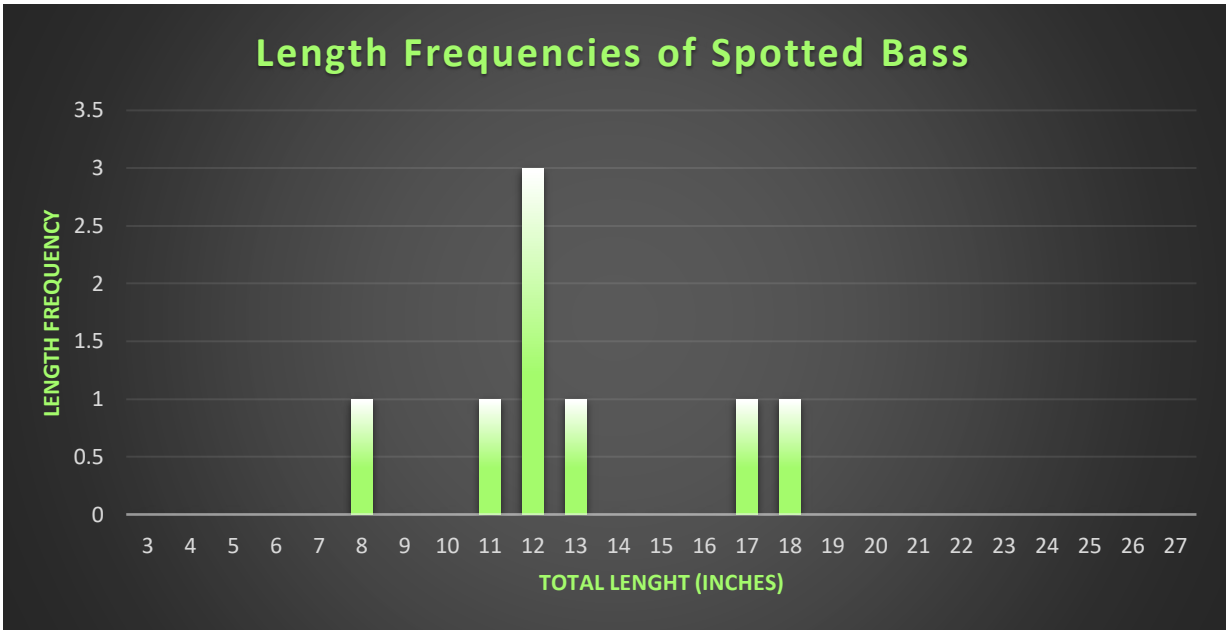

Black Crappie Relative Weight (Wr)
RELATIVE WEIGHT (%)
110
100
90
80
70
60
50
8.00
9.00
10.00
11.00
12.00
13.00
14.00
15.00
16.00
TOTAL LENGTH (INCHES)

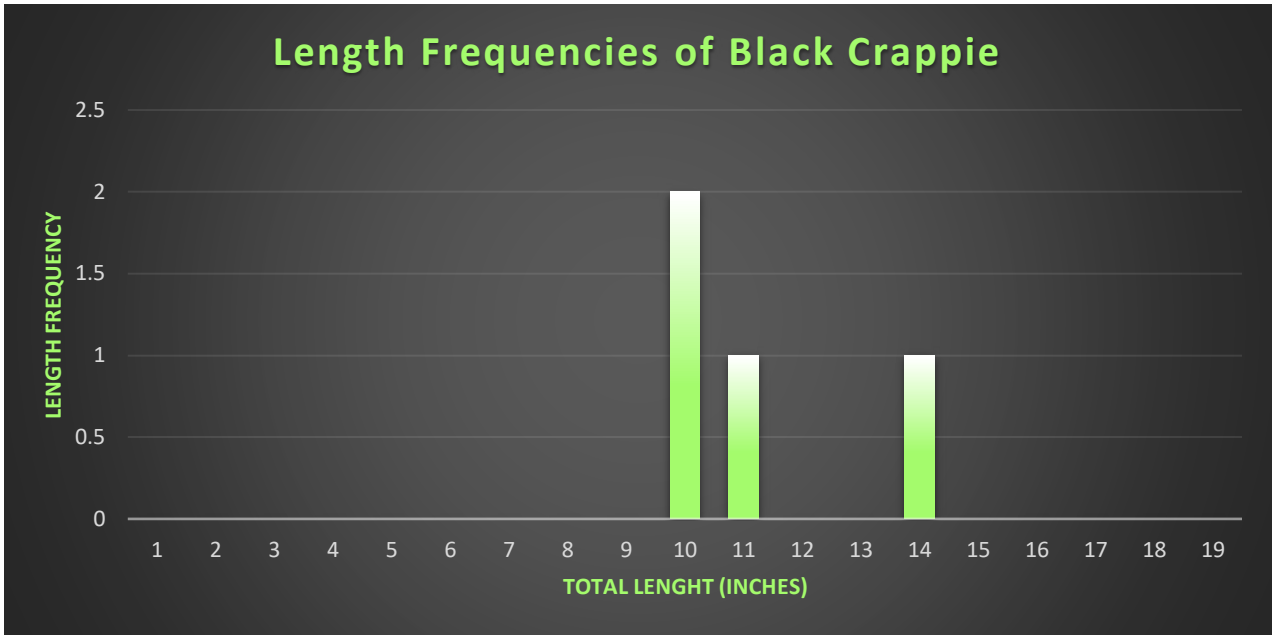

Spotted Bass Relative Weight (Wr)
RELATIVE WEIGHT (%)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
12.00
12.50
13.00
13.50
14.00
14.50
15.00
15.50
16.00
16.50
17.00
TOTAL LENGTH (INCHES)

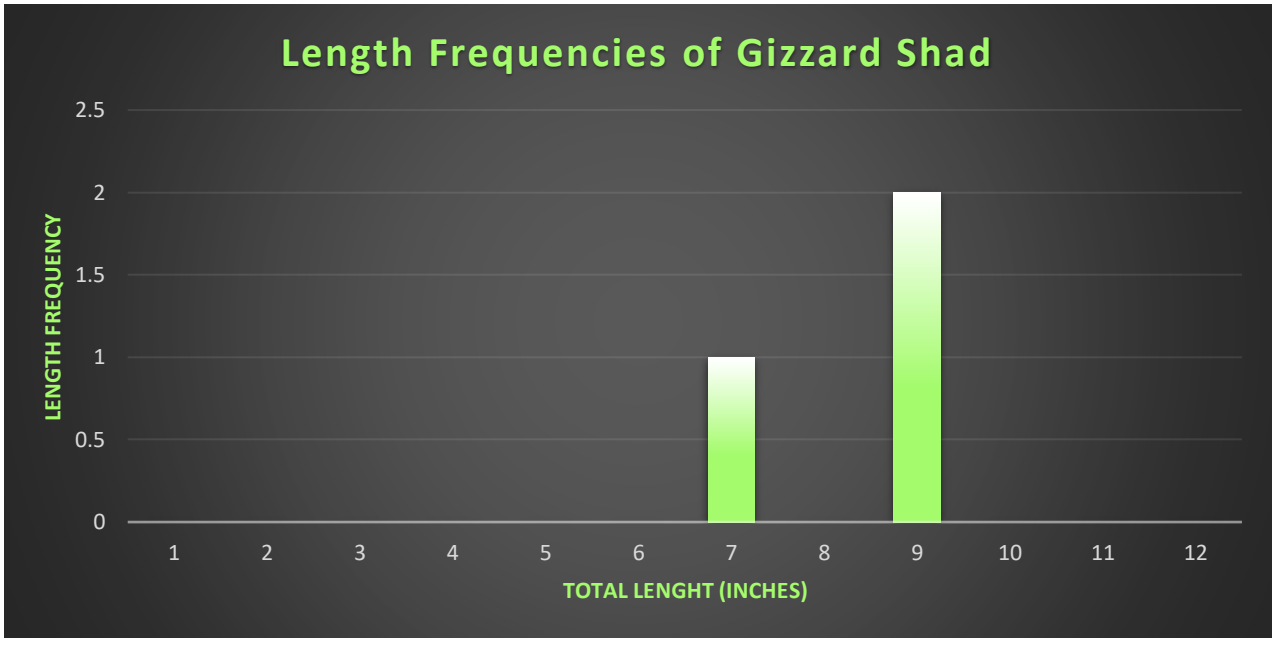

Largemouth Bass Length Frequencies
LENGTH FREQUENCY
3.5
3
2.5
2
1.5
1
0.5
0
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGTH (INCHES)

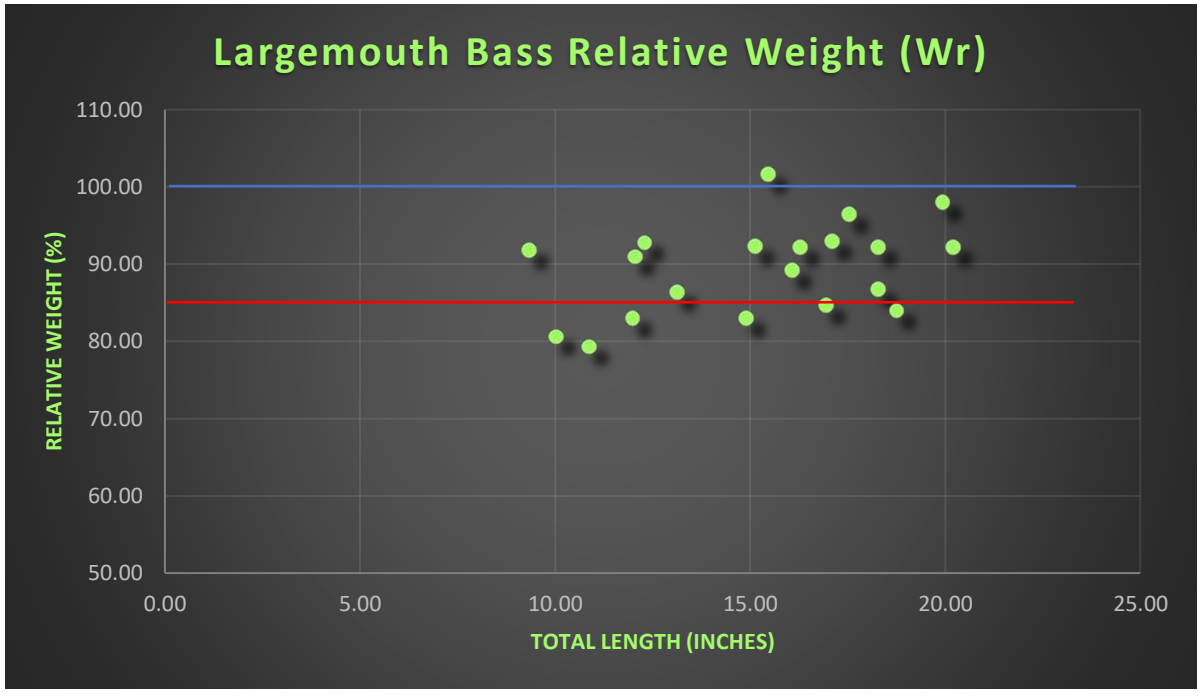

Bluegill Length Frequencies
LENGTH FREQUENCY
35
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10
TOTAL LENGTH (INCHES)


Length Frequencies of Shellcracker
LENGTH FREQUENCY
2.5
2
1.5
1
0.5
0
1 2 3 4 5 6 7 8 9 10 11 12
TOTAL LENGHT (INCHES)

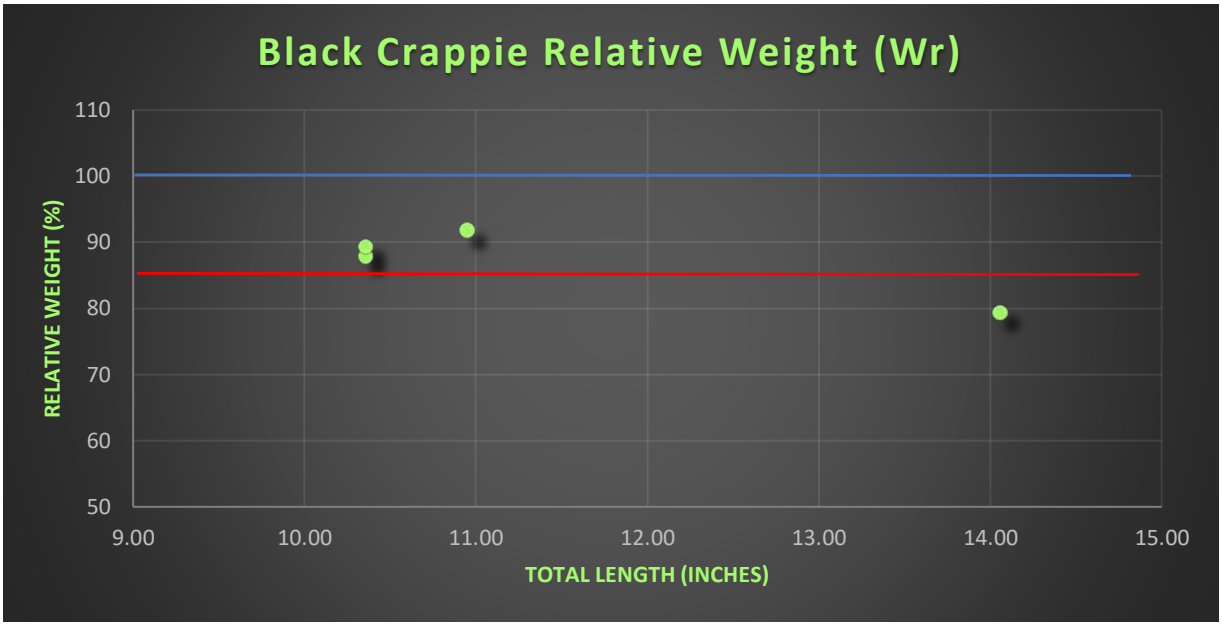

Length Frequencies of Spotted Bass
LENGTH FREQUENCY
3.5
3
2.5
2
1.5
1
0.5
0
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGHT (INCHES)

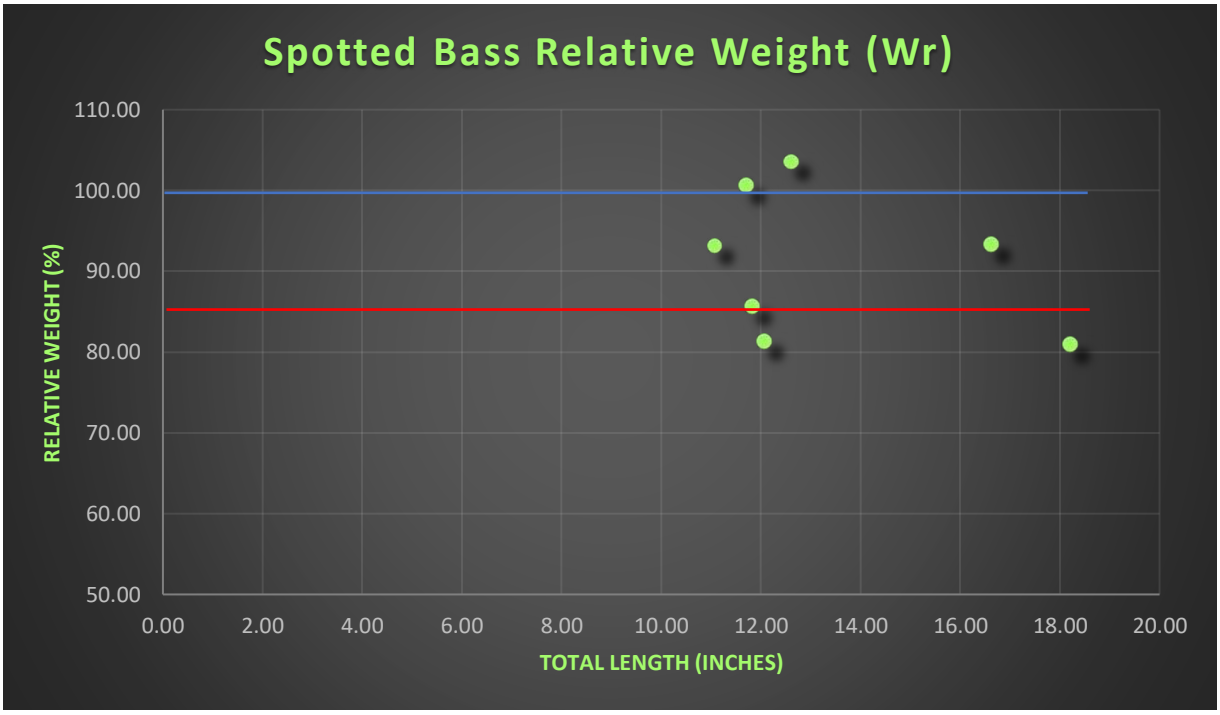

Length Frequencies of Black Crappie
LENGTH FREQUENCY
2.5
2
1.5
1
0.5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
TOTAL LENGHT (INCHES)

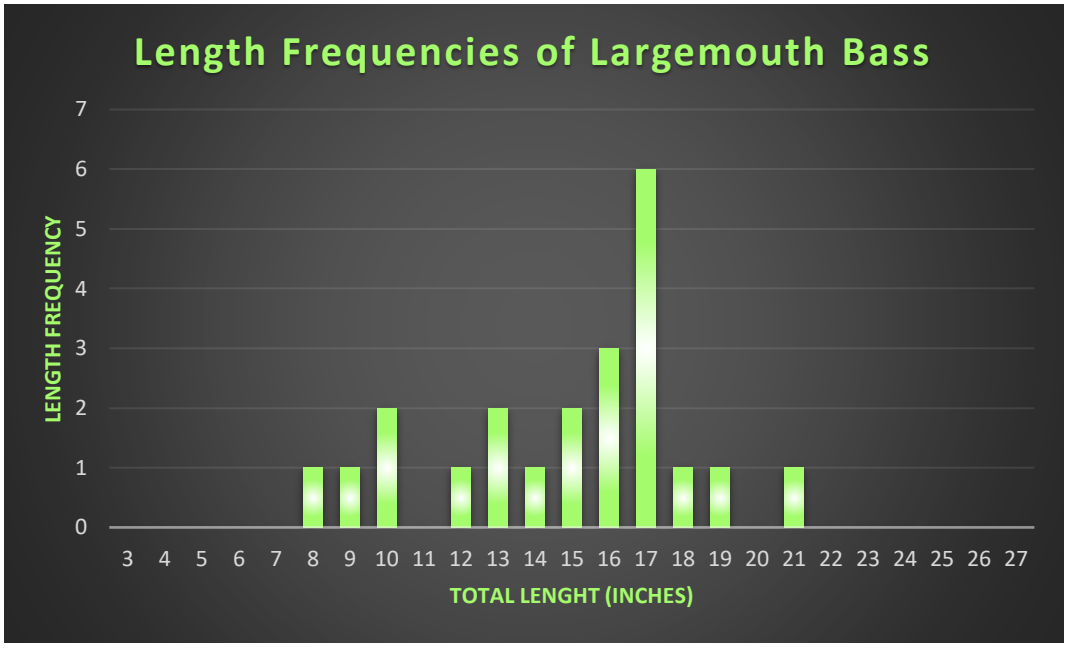

Length Frequencies of Gizzard Shad
LENGTH FREQUENCY
2.5
2
1.5
1
0.5
0
1 2 3 4 5 6 7 8 9 10 11 12
TOTAL LENGHT (INCHES)

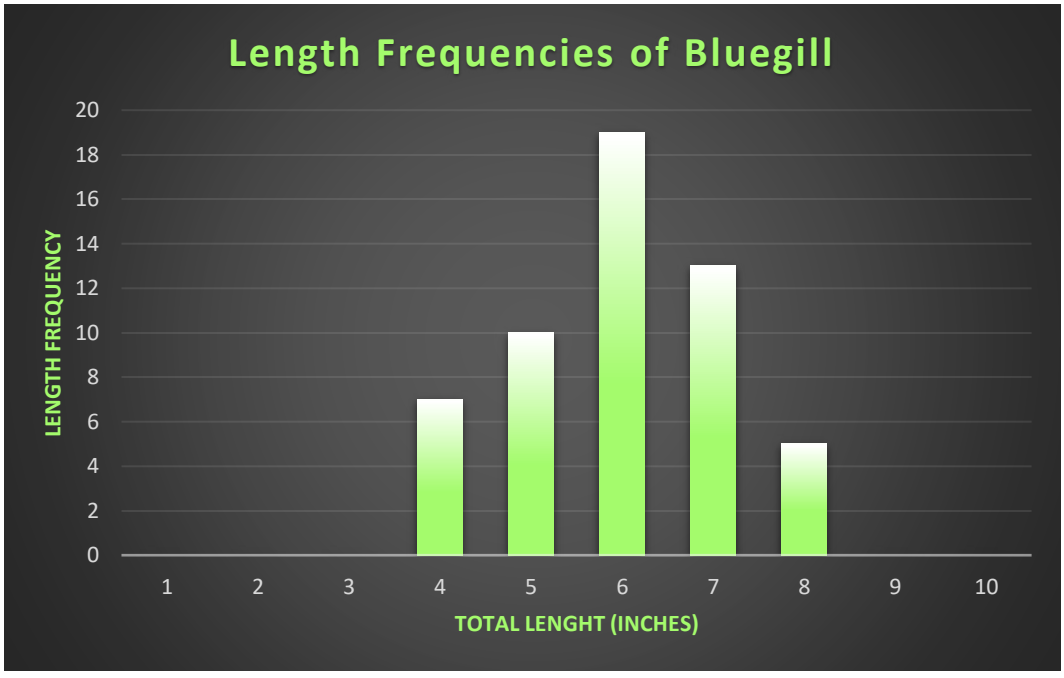

Largemouth Bass Relative Weight (Wr)
RELATIVE WEIGHT (%)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
0.00
5.00
10.00
15.00
20.00
25.00
TOTAL LENGTH (INCHES)

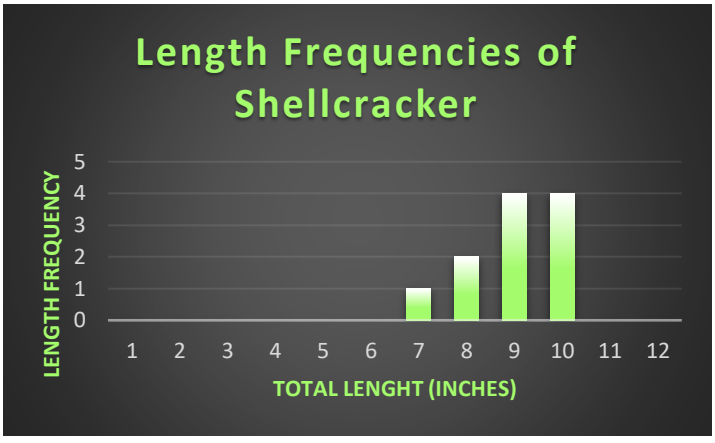

Bluegill Relative Weight (Wr)
RELATIVE WEIGHT (%)
110
100
90
80
70
60
50
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
TOTAL LENGTH (INCHES)

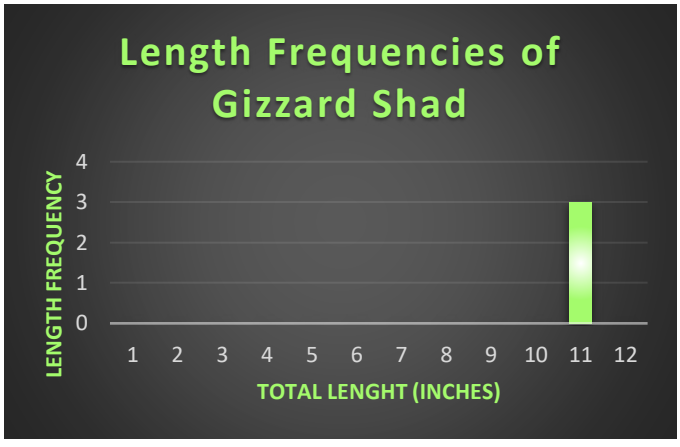

Black Crappie Relative Weight (Wr)
RELATIVE WEIGHT (%)
110
100
90
80
70
60
50
9.00
10.00
11.00
12.00
13.00
14.00
15.00
TOTAL LENGTH (INCHES)

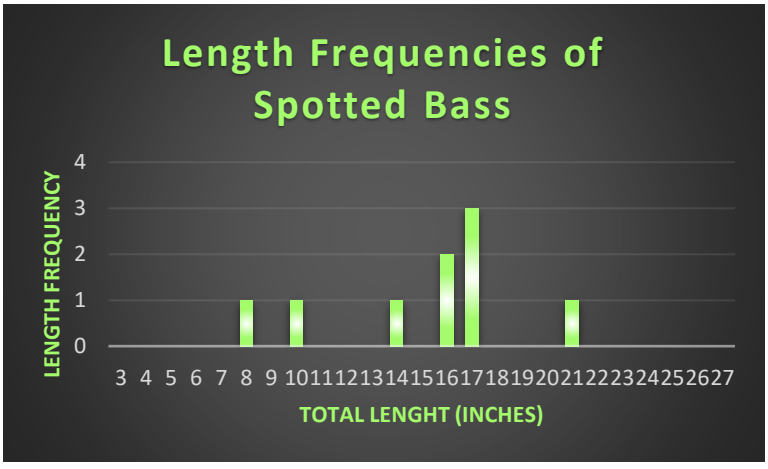

Spotted Bass Relative Weight (Wr)
RELATIVE WEIGHT (%)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
TOTAL LENGTH (INCHES)

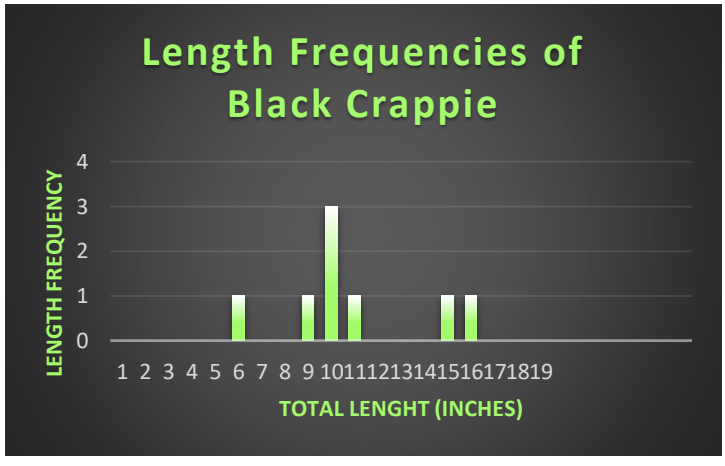

Length Frequencies of Largemouth Bass
LENGTH FREQUENCY
0 1 2 3 4 5 6 7
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGHT (INCHES)

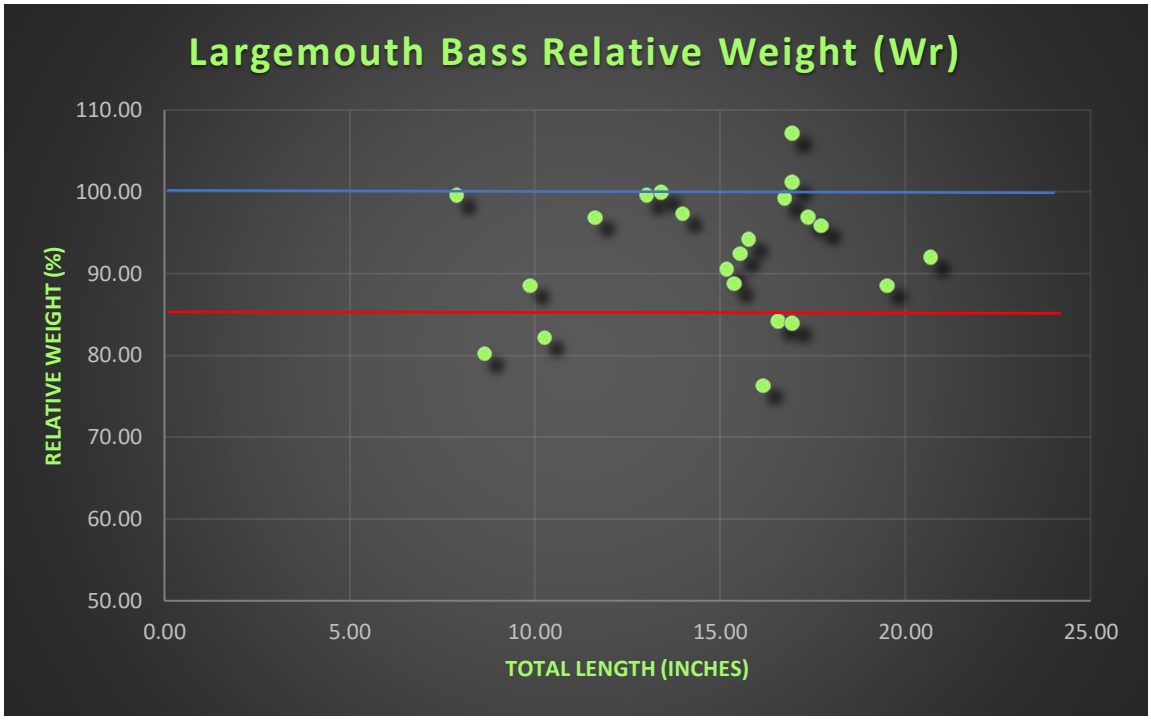

Length Frequencies of Bluegill
LENGTH FREQUENCY
0 2 4 6 8 10 12 14 16 18 20
1 2 3 4 5 6 7 8 9 10
TOTAL LENGHT (INCHES)


Length Frequencies of Shellcracker
LENGTH FREQUENCY
0 1 2 3 4 5
1 2 3 4 5 6 7 8 9 10 11 12
TOTAL LENGHT (INCHES)

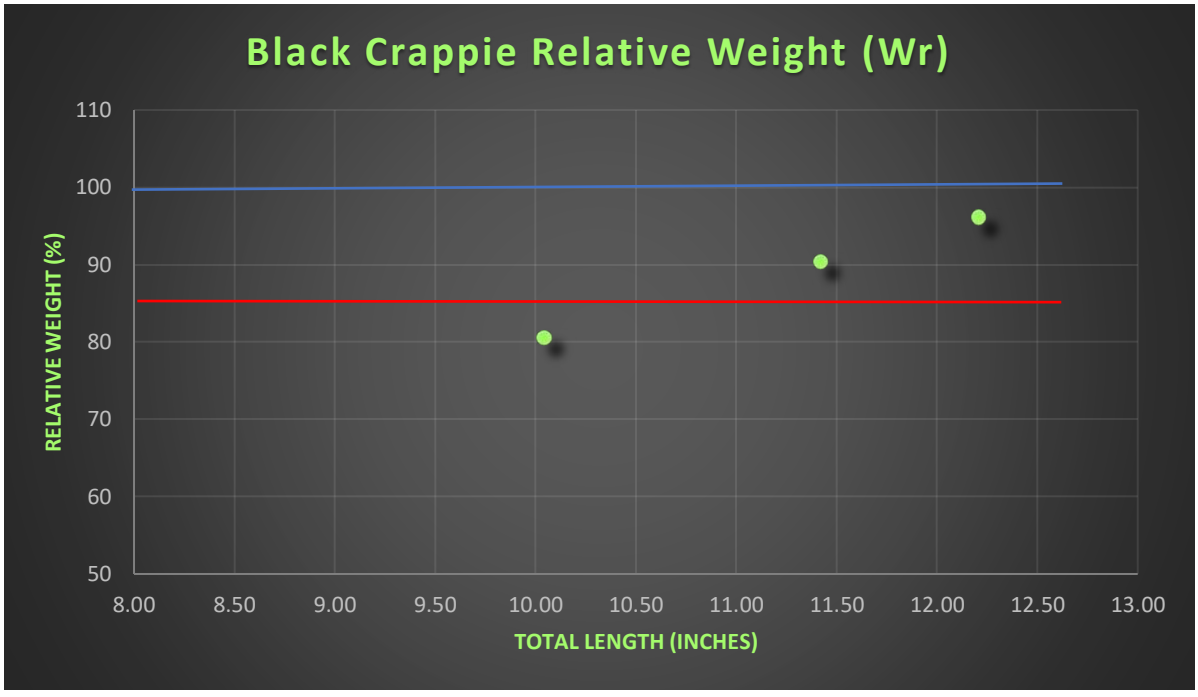

Length Frequencies of Gizzard Shad
LENGTH FREQUENCY
0 1 2 3 4
1 2 3 4 5 6 7 8 9 10 11 12
TOTAL LENGHT (INCHES)

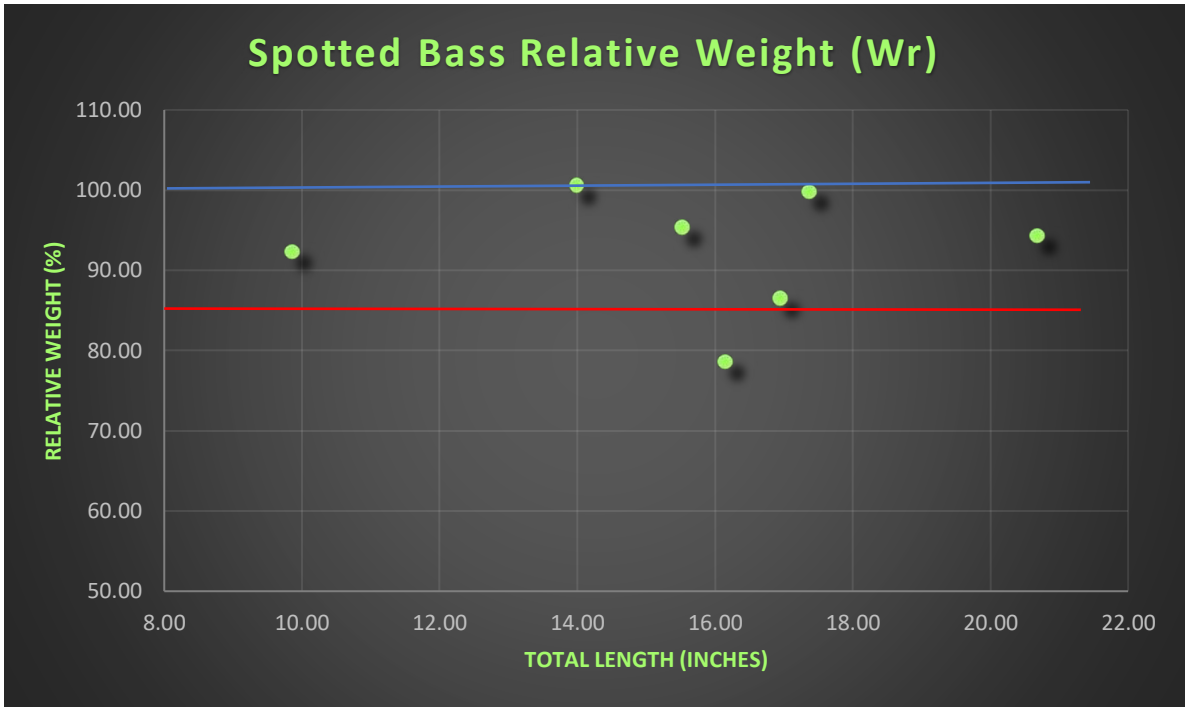

Length Frequencies of Spotted Bass
LENGTH FREQUENCY
0 1 2 3 4
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TOTAL LENGHT (INCHES)


Length Frequencies of Black Crappie
LENGTH FREQUENCY
0 1 2 3 4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
TOTAL LENGHT (INCHES)


Largemouth Bass Relative Weight (Wr)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
RELATIVE WEIGHT (%)
0.00
5.00
10.00
15.00
20.00
25.00
TOTAL LENGTH (INCHES)


Bluegill Relative Weight (Wr)
110
100
90
80
70
60
50
RELATIVE WEIGHT (%)
4.00
4.50
5.00
5.50
6.00
6.50
7.00
7.50
8.00
8.50
9.00
TOTAL LENGTH (INCHES)


Black Crappie Relative Weight (Wr)
RELATIVE WEIGHT (%)
110
100
90
80
70
60
50
8.00
8.50
9.00
9.50
10.00
10.50
11.00
11.50
12.00
12.50
13.00
TOTAL LENGTH (INCHES)


Spotted Bass Relative Weight (Wr)
RELATIVE WEIGHT (%)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
TOTAL LENGTH (INCHES)

Recommendations

Highland Lake is functioning as a predator crowded system with a moderate level of fertility. As per the fish assessment section of this report (pages 9-39), bass and black crappie growth has been slightly limited by high competition of predators for forage species. Alkalinity, hardness, and pH were above desired levels, and moderate visibility in the water indicated moderate phytoplankton production. Management actions moving forward will focus on reducing competition of predator species, introducing new supplement forage species, and enriching an environment favorable to growth and reproduction of forage fish.

Harvest

Harvest is the most important management practice for growing large fish. By keeping our predator prey relationship in balance, we can provide our bass and crappie with an abundance of prey necessary for high growth rates. I recommend that bass 15 inches or less in total length be harvested out of Highland Lake at a rate of 25lbs per acre per year. As a result of the measurements made per Google Earth, that is a total target harvest of 5,375lbs of bass per year. This can be accomplished through an electrofishing harvest or hook and line methods. If you would like I can provide data sheets for hook and line harvest at no cost, so you can easily track your progress. If you prefer to have an electrofishing harvest performed, I would suggest one hour of harvest per quadrant three times during the course of a year. It is important to note that 242lbs of bass were removed during this evaluation, so approximately 5,000lbs of harvest remain to meet this year's target harvest. This is a large amount to meet every year, but 3 removals should amount to roughly 1000lbs a year of fish removed. Over time this will result in desired results. Annual electrofishing evaluations will aid in determining when target harvest length should be adjusted.

Supplemental Feeding

Supplemental feeding of a high protein feed not only increases growth rate of your forage species but will also contribute to them being more prolific. Simply put, the bigger the female, the more eggs she can carry, and the more small fish for your bass to eat. You can accomplish this by hand feeding or we offer a full line of Texas Avenger automatic fish feeders. These feeders can be set to go off multiple times during the day or night. They have a self-charging solar panel for the

battery and come fully assemble. Our biologists can install them on dock or bank and can consult with you about how and when to set your feeding times. I recommend feeding Triton by Cargill, but any high protein fish feed will do. It is in my opinion that Triton has better science behind its development than its competitors. It also has the most crude protein at 45% than any other high protein fish feed on the market. The results speak for themselves in high growth rates and increased reproduction.

Structure

Structure in a lake is beneficial to fish and fisherman alike in many different aspects. Most importantly, structure provides a place for juvenile fish to hide from predators and develop. If the bluegill and shellcracker have nowhere to go, then the majority of them will be eaten before they grow large enough to be beneficial to larger bass. Structure will also create reliable feeding areas for bass where they know they can consistently find food. This in turn creates hot spots for fisherman because where there is bait the predators will follow. The best and most affordable structures are tree tops. From Christmas trees to hardwoods, they not only provide shelter but many bugs and other organisms feed on the wood providing food for small fish. If tree tops sticking out of you lake are not aesthetically pleasing to you, then we also offer Mossback fish attractors. Most fish attractors on the market today are plastic- and in my opinion-very cumbersome to build and install. They also do not provide any food for smaller fish causing them to have to leave the safety of the structure to find food. Mossback are far superior to their competitors due to the limbs being made of a composite material that promotes algae growth which benthic insects and other organisms feed upon. This means that bait fish can feed in the safety of cover. If the prey fish are spending more time in cover then so will bigger fish preying on them. In turn, if the bass spend more time eating and less time swimming then they will have higher growth rates. The final result gives the fisherman a higher probability of higher catch rates and larger fish. Structure in Highland Lake is adequate, but it might be beneficial to put structure in marked locations. This will enhance the fishing experience for residents and paying fishermen alike. Placing structure next to feeders is also suitable as it allows bluegill to feed and immediately return to safety.

Recommendations

Supplemental Stocking

Finally, supplemental stocking of new forage species such as coppernose bluegill and golden shiners. First, I recommend we stock 3-5 inch coppernose bluegill at a rate of 1,000 bluegill per quadrant. The bluegill present in Highland Lake are of the northern genetic strain. The benefits of stocking the coppernose are they grow larger, produce more eggs, and are more aggressive. They will spawn with the northern bluegill present giving you the genetic benefits throughout the lake. 3-5 inch sized bluegill are the most preyed upon because they can be easily eaten by a wide size range of predators. 12 to 17 inch predators are the most abundant and efficient in the system. Bass especially feed upon 3-5 inch bluegill to make the size jump from a 1-3 pound fish range to the 4-6 pound fish range. Once a bluegill reaches 7 inches in length it is impossible for a 10-12 inch bass or crappie to eat them due to the gape limitations of their mouth. Bluegill also reach sexual maturity at approximately 3 inches and begin spawning once water temperatures reach 65 degrees Fahrenheit at the time of each full moon. In addition to providing food, they will also put more fish back into the system through reproduction. In combination with the bluegill, I recommend we stock large adult golden shiners at a rate of 5,000 per quadrant. In a perfect world we would recommend a stocking rate of 3,000 per acre but in a lake, this size a strategic stocking at the rate mention above should give us a good probability of establishment. Golden shiners spawn annually and are adhesive breeders meaning they adhere their eggs to structure instead of laying them in beds. The major benefit to stocking shiners is they will grow as big as bluegill but still easily fit down a bass gullet. Stocking shiners will aide in taking the feeding pressure off the bluegill allowing them to become more prolific. Other species to consider stocking are crawfish and tilapia. We consider these to be third tier supplemental, meaning they will die off annually due to predation or a lack of ability to survive Alabama winters. While on bed, female bass become extremely depleted due to lack of feeding while protecting their eggs. Crawfish are usually stocked in late April to provide females coming off bed with a high calorie meal. Tilapia are usually stocked throughout the spring and summer. They breed every 21 days creating an abundance of food for your bass. Tilapia are also mouth breeders meaning they lay eggs and fry in their mouths. By protecting their fry this way, they allow for their offspring to grow big enough to be most beneficial to smaller bass. They also aid in weed control by consuming algae.

The Management actions recommended above have been listed on the following page. We have created a schedule for the next twelve months with a color code system to show the priority in which these actions need to be implemented. If you have any questions regarding this report or the recommendations made please do not hesitate to text, call, or email your biologist.

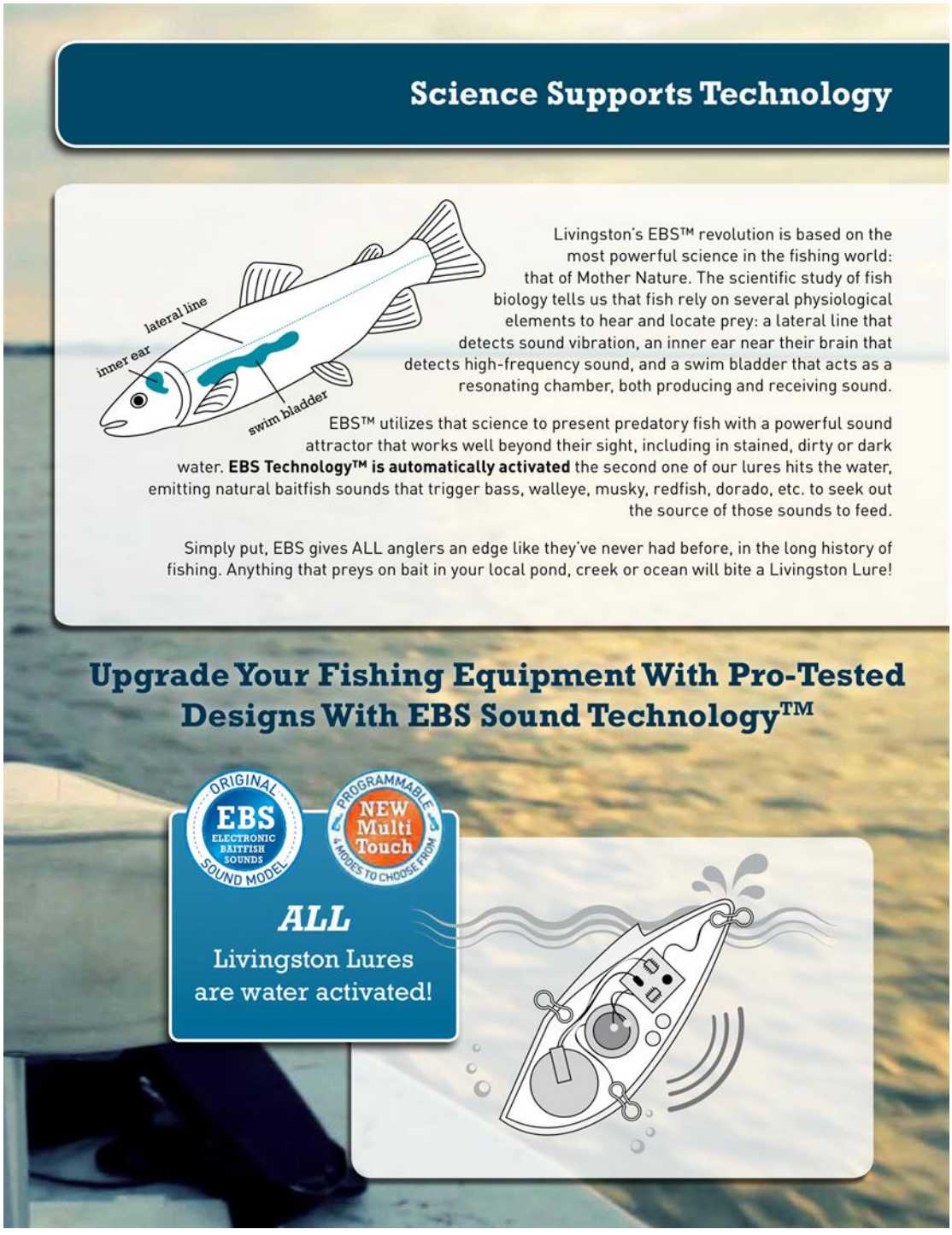
Recommendations Schedule

Priority I	One Hour Electrofishing Harvest Per Quadrant Three Times Per Year	Spring, Summer, Fall 2018	$300.00/hour
Priority I	Supplemental Stocking-1000 Bluegill Per Quadrant	Spring 2018	$2,750 + mileage
Priority I	Supplemental Stocking-5000 Golden Shiners Per Quadrant	Spring 2018	Price Varies Seasonally
Priority I	Automatic Feeder and High Protein Feed	Spring 2018	Texas Avenger Automatic Feeder 100lb capacity-$900.00 | Triton Feed: $44.00/50lb bag
Priority II	Aquatic Weed Control	Year Round	Recommendations of control and price vary per infestation.
Priority II	Structure Additions	Spring 2018	Discuss best options with biologist.
Priority III	Supplemental Stocking-200lbs Crawfish Per Quadrant	Spring 2018	$3,000.00 + mileage
Priority III	Supplemental Stocking-100lbs Tilapia Per Quadrant	Spring 2018	$4,000 + mileage
Priority I: Management actions necessary to reach pond goals. These actions are listed in sequential order in terms of urgency.		* Delivery Mileage: $1.00/mile as the crow flies, from location of product aquired to property.	
Priority II: Management actions of significance, but less urgent than Priority I.			
Priority III: Management actions to additionally enhance Priorities I & II.			

Improve Fishing With Topwater Techniques

Topwater fishing is one of the most successful and exciting ways to catch more and bigger fish. Topwater baits on the market today use some form of water disturbance to entice strikes. Predatory fish have a system of tactile sensory organs known as the lateral line. This lateral line is used to detect erratic vibrations in the water made by baitfish in distress. By disturbing the water these topwater baits are imitating an injured fish. This, in turn, stimulates the lateral line, triggering a bass' instinct to capitalize on an easy meal.

Personally, my favorite topwater bait is the Walking Boss II designed by Livingston Lure. This lure has three different actions, and emits Livingston Lure's patented Electronic Baitfish Sound (explained in detail on the following page), making it in my opinion the most versatile topwater bait on the market. You can pop it, walk it, or just slow reel it in displaying a thrashing swimming action. To make it most effective, allow for a few pauses during the retrieve giving time for the fish to hear and feel the distress sounds emitted by the bait. You can usually expect explosive topwater strikes during these pauses. I like to use a 7'0" medium heavy Glory Rod, paired with a 7.5:1 Lew's reel that is spooled with 10-12 lb. monofilament line. The 7'0" medium heavy rod gives you long casts with just enough give to have good treble hook penetration. The high-speed reel ratio (7.5:1) allows for fast slack recovery after casting. This is important since strikes frequently occur within the first five to six feet of presentation. Monofilament line is vital to topwater fishing since it floats allowing for maximum bait action. Finally, the Walking Boss II is best fished around cover or in open, calm water during the early morning or late afternoon. We offer Livingston Lure's full line of baits and colors. I hope this improves your fishing experience at your lake.We would love to see your catches, so please send them to us via Facebook or email!


Science Supports Technology
lateral line
inner ear
swim bladder
Livingston's EBS™ revolution is based on the most powerful science in the fishing world: that of Mother Nature. The scientific study of fish biology tells us that fish rely on several physiological elements to hear and locate prey: a lateral line that detects sound vibration, an inner ear near their brain that detects high-frequency sound, and a swim bladder that acts as a resonating chamber, both producing and receiving sound.
EBS™ utilizes that science to present predatory fish with a powerful sound attractor that works well beyond their sight, including in stained, dirty or dark water. EBS Technology™ is automatically activated the second one of our lures hits the water, emitting natural baitfish sounds that trigger bass, walleye, musky, redfish, dorado, etc. to seek out the source of those sounds to feed.
Simply put, EBS gives ALL anglers an edge like they've never had before, in the long history of fishing. Anything that preys on bait in your local pond, creek or ocean will bite a Livingston Lure!
Upgrade Your Fishing Equipment With Pro-Tested Designs With EBS Sound Technology™
ORIGINAL
EBS
ELECTRONIC BAITFISH SOUNDS
SOUND MODEL
PROGRAMMABLE
NEW Multi Touch
4 MODES TO CHOOSE FROM
ALL
Livingston Lures
are water activated!

Fish Attractors

GAMEKEEPER™ MOSSBACK

Fish and Game Feeders

ULTRAMATIC FEEDERS

Aeration and Fountains

Kasco®

Custom Fishing Rods