

**EVALUATION OF GROWTH AND COSTS WITH USE
OF HIGHER PROTEIN FISH FOOD DIETS ON
BLUEGILL (*LEPOMIS MACROCHIRUS*).**

Greg Grimes

Introduction

- With the private pond owner in mind, we decided to conduct a small scale experiment comparing several different fish food formulations to determine growth rates of bluegill and costs associated to achieve this growth.

Methods

- The pond used in the study is located in Ball Ground, Georgia 34.324514°, -84.422242°. It is 1/20 acres that averages four feet of depth and is creek fed. This pond has high flow and low fertility with little natural food outside the pellet feed. The eight cages were built with dimensions of 32" X 32" X 56" with 33 ft³ of cage and approximately 27 ft³ of cage under the water. Each cage was comprised of 10 ft of 3/4 inch PVC pipe and a 3' X 15' sheet of plastic 1/2 inch square mesh. The mesh was held into place by eight zip ties, approximately 150 per cage. Holes were drilled into the top and bottom of the cages so they were able to stay submerged in the pond.
- The fish were stocked at a 4-5" in size; at a rate of 150 per cage. A subsample of 20 bluegill were measured by lengths in inches and weights in grams before starting the first phase. Average weight was calculated at the end of each phase in order to calculate growth rates. Numbers of the fish in the cage were adjusted per mortalities and escapees, mostly after doing phase measurements. Mortalities and water temperature were recorded per feeding along with bluegill activity, time, and date.



Methods

- The following food types used in the study were:

Food Type	Percent Protein	Percent Fat	Pellet Size (in.)
Purina AquaMax 500	41	12	3/16
Purina Gamechow	32	3	Multiple Sizes
Cargill 45-12	45	12	1/16
Cargill 40-10	40	10	1/16

- There were two cages per feed formulation. The cages were placed so they were not beside a cage with the same food type. The amount of food given to the fish at the beginning of phase one was 30 grams per day and increased weekly by 5 grams until we reached 50 grams. We observed feeding habits and determined 35 grams per day would be the best amount for the fish to reach satiation. The first phase of the study began in May and extended into October, having 5 complete phases to the study (approximately one month per phase). For the first three phases of the study there were issues with mortalities and food escaping from the mesh of the cages and drifting other cages, so another layer of mesh was attached to the top of the cage to prevent food from floating into another cage. Because of this, the last data from the last two phases was used for our calculations and presentation.

Methods

- Weight change was noted between phases in order to calculate the feed conversion ratio. The total feed added was calculated by multiplying (food added per day X number of days fed) The feed conversion ratio was then found by dividing pounds of food fed/pounds of weight gained.

Purina Aquamax 500	Cargill Aquafeed 40-10
Cargill Aquafeed 45-12	Purina Gamechow
Purina Gamechow	Cargill Aquafeed 45-12
Cargill Aquafeed 40-10	Purina Aquamax 500

Table 1: Each square represents a cage and its corresponding food type in the same arrangement as in the pond.

Results

Food Type	Total Weight Gain of Cage (lbs.)	Feed Conversion	Weight Gained (lbs.) From One Pound of Food	Weight Gained (lbs.) From One bag of Food (50 lb. bag)
Purina AquaMax 500	2.24	1.86:1	0.54	26.96
Cargill 40-10	2.00	2.08:1	0.48	24.05
Cargill 45-12	1.92	2.18:1	0.46	23.11
Purina Game Chow	1.27	3.27:1	0.31	15.27

- Purina AquaMax 500 produced the greatest weight increase. Cargill 40-10 was a close second and surprisingly out-performed the Cargill 45-12. The Purina Gamechow produced the lowest weight gain which was to be expected considering the lower quality of this particular fish food compared to the other three.

Results

Food Type	Cost per lb.	Cost of 50 lb. Bag	Cost of Food Needed To Gain One Pound of Weight
Purina AquaMax 500	\$0.74	\$37.00	\$1.37
Cargill 40-10	\$0.64	\$32.00	\$1.33
Cargill 45-12	\$0.70	\$35.00	\$1.53
Purina Game Chow	\$0.52	\$26.00	\$1.70

- From a cost stand point, it is more cost effective to use Cargill 40-10 to achieve the most weight gain. It only takes \$1.33 to produce one pound of weight of the bluegill. Purina AquaMax was a close second at \$1.37 to achieve one pound of growth though it had the best feed conversion.
- The main issue that stands out from the data is that the Purina Gamechow is the most expensive to use in order to produce one pound of growth though it is overall the cheapest food per pound. Looking from a pond owners perspective, this is very important since a majority of pond owners feel that cheaper food will suffice. Though cheaper food is better than nothing, it is actually cheaper to use a higher quality and more expensive food to achieve more pounds of growth.

Results

- The majority of pond owners we encounter want to grow quality sized largemouth bass. Considering it takes 8-10 pounds of forage for a bass to gain one pound, stocking forage to be eaten appears to be much more costly.
- Lets say we want to produce enough forage for 10 pounds of weight gain for largemouth bass in an established fishery:
 - Option 1 (Stock Fathead Minnows): In order to produce 10 pounds of weight gain for largemouth bass, you would need to stock 100 pounds of fathead minnows (33,000 minnows). This would be an estimated cost of \$1,320.00
 - Option 2 (Stock 3-4" Golden Shiners): You would need to stock 100 pounds or 5,000 shiners with an estimated cost of \$930.00.
 - Option 3 (Stock 5-6" Bluegill): You would need to stock 100 pounds and considering they weight 80 lbs. per 1,000, this would be 1,250 bluegill for an estimated cost of \$1,312.50.
 - Option 4 (Begin a supplemental feeding program): In order to produce 100 pounds of bluegill growth, you would need the following pounds of fish food:
 - Purina AquaMax 500: 186 pounds, \$137.64
 - Cargill 40-10: 208 pounds, \$133.12
 - Cargill 45-12: 218 pounds, \$152.60
 - Purina Gamechow: 327 pounds, \$170.04
- This is a simplified example and many environmental factors will influence the growth rates of all of these options for increasing bass growth. However, it does show that supplemental feeding program is a cost effective option for increasing bass growth.

Results



Discussion

- At the beginning of the study, 150 fish were added per cage. However, there were significant amounts of mortalities early in the study. Overcrowding resulted in the mortalities. Also, if bluegills are overcrowded this will limit their food supply and cause them to quit crowding before they reach sized that most fishermen prefer (Goodwin et al., 2000). Knowing the correct amount of fish per cage to allow healthy growth is needed to be able keep a steady amount of fish per cage. The last two phases of the study held a stagnant 50 fish per cage. The bluegill may have reached a level of homeostasis at this number (Heidinger, 1971).
- Some issues occurred during the study that could have affected the results. During Phase I, the colder temperatures that occurred early in the study could have affected bluegill feeding activity (Bettinger, 1979). For the first three phases of the study there were issues with food escaping from the mesh of the cages and drifting other cages, so another layer of mesh was attached to the top of the cage to prevent food from floating into another cage. We only used results from phase 4 and 5 once we secured all food staying in the cage.

Discussion

- One issue with this experiment was fish mortality. Mortalities were tracked at the end of the phase. Initially mortalities were not figured into the analysis of the data. To include mortality, we determined the mortalities of each cage and figured these fish perished by the midway point of each phase. Though are results changed, the changes were minimal.

Food Type	Total Weight Gain of Cage (lbs.)	Feed Conversion	Weight Gained (lbs.) From One Pound of Food	Weight Gained (lbs.) From One bag of Food (50 lb. bag)
Purina AquaMax 500	2.27	1.83:1	0.55	27.30
Cargill 40-10	2.12	1.96:1	0.51	25.53
Cargill 45-12	2.03	2.08:1	0.49	24.37
Purina Game Chow	1.34	3.11:1	0.32	16.07

Discussion

- For this particular study we were primarily interested in the protein and fat levels in the fish food. However, vitamin levels are important as well and play an important role in the overall quality of the fish food as well.
- The sources of the protein, fat, etc. play a major role in the effectiveness of the fish food. What are raw ingredients chicken feathers or better products? Knowing this is key when selecting the correct fish food for your particular situation. Though Purina Gamechow has only 32% protein derived it has higher percentage of fish meal and it may be more beneficial than a 36% protein fish food containing little to no fish meal.
- From our results, it is apparent that fish foods comprised of fish meal are more beneficial to the fish due to the quality of the food and the palatability of the food. Fish fed the Purina Aquamax 500, which is derived from fish meal, had reoccurring fast reaction times of bluegill activity during feeding. We had video of each cage and the reaction was superior on this product.
- Using these Fed conversions a pond owner can calculate their own cost based on actual cost of produce to grow bluegill with different feeds. I feel 32% catfish food would perform at best at 3.5:1 and probably more in the 4:1 range.

Conclusion

- In conclusion, this study demonstrated higher protein fat content fish food not only results in better growth but is actually more cost effective. Overall, there is reason to believe that both Purina Aquamax 500 and Cargill Aquafeed 40-10 and 45-12 are food types that would qualify as efficient in weight gain and cost. For clients wanting to maximize growth to reach trophy bluegill status it is critical to use this better food during the entire life span.

Acknowledgements

- Caroline Folsom was an intern summer of 2013 for AES. She worked on construction of the cages and worked through this issues we had. She weighed out fish food and tracked data.
- Caleb LeWellen and Matthew Morgan helped feed the fish and Matthew help with data analysis.
- A big thanks to Purina and Cargill for providing these fish feeds for this study.