Proceedings of the Iowa Academy of Science

Volume 79 | Number Article 5

1972

Feeding of Black Bullheads Ictalurus melas (Rafinesque) in Experimental Cages

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Feeding of Black Bullheads *Ictalurus melas (Rafinesque)* in Experimental Cages[1]

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HILL, KAY R. Feeding of Black Bullhead, *Ictalurus Melas (Rafinesque)* in experimental cages. *Proc. Iowa Acad. Sci.*, 79(1):10-11, 1972.

SYNOPSIS: Black Bullheads, *Ictalurus Melas (Rafinesque),* were grown experimentally in two cage sizes from 25 July through 16 October, 1969. Little difference in fish growth between the two cage sizes was observed. Over 75% of total gain occurred while water temperatures were between 23 and 24° C. Better food conversion ratios were obtained when water temperature was above 23°C than when water temperature was below 23°C. Little difference in fish condition between the two cage sizes was observed. Fish were produced slightly more economically in the larger cages ($1.01/kg.) than in smaller cages ($1.05/kg.).

The majority of small ponds in Eastern South Dakota are reasonably fertile and are conducive to high fish production, but many ponds winterkill, thus harvesting of the fish is essential. The present project involved feeding black bullheads, *Ictalurus Melas (Rafinesque),* in small cages suspended in a pond because of the harvesting ease. Many species of fish have been reared in the United States specifically for food, Albaugh (1969), Swingle (1954) and (1956). Obectives of the study were to determine if black bullheads in South Dakota could be grown economically in cages and to determine differences in growth, mortality and cost of growing fish in two different size cages.

The pond in this study was located one-half mile north of Brookings, South Dakota. It has a maximum width of 62.2 m, maximum length of 121.9 m, and a surface area of .67 hectares. The bottom consisted of sand and gravel grading to silt covered clay. The principal water source is College Creek which drains approximately 24,605 hectares to the location of the pond.

MATERIALS AND METHODS

Ten cages, with redwood frames were suspended in the pond, to confine the fish during an experimental feeding study. Galvanized hardware cloth (6.4 mm mesh) was stapled to the sides and ends. Bottoms were covered with galvanized window screen (1.6 mm mesh). The five larger cages had inner measurements of 2.48 m x 1.67 m and were 1.21 m in depth. The five smaller cages had inner measurements of 1.72 m x 1.67 m and were 1.21 m in depth. A styrofoam billet was attached to each upper corner so that approximately 25.4 cm of each cage remained above the water surface.

Black bullheads were collected from Lake Poinsett and placed in all cages at a rate of 17.50 kg fish/m^3 of water. The average lengths and weights of the fish in large cages were 199 mm and 120 g with a range of 108 to 288 mm and 60 to 310 g. The small cages received fish with average lengths and weights of 202 mm and 128 g ranging between 112 and 295 mm and 72 to 324 g, respectively. Feeding rates from 3-4% of the body weight/day were changed to achieve a high rate of gain and obtain a desirable food conversion factor.

One large cage and one small cage were chosen at random every 14 days (25 July to 16 October). One hundred bullheads from each cage were measured and weighed to the nearest mm and g.

Data collected included length and weights of fish, fish mortality, water temperature, and amount of food fed. Growth differences, mortality differences, and condition factor differences of fish between cage size were tested statistically. Feed conversion rates were also calculated.

RESULTS AND DISCUSSION

The fish in the large cages each grew approximately 33 mm (119 to 232 mm) and gained 85 g (120 to 232 g), while the fish in small cages each grew approximately 26

TABLE 1. MEAN WATER TEMPERATURES OF STUDY POND, WEIGHT GAINS, FEEDING RATES, FOOD CONVERSIONS, MORTALITY, FACTOR K, OF BLACK BULLHEADS FROM 25 JULY TO 16 OCTOBER.

Date	Mean Water Temp. C°	Weight Gain (Kg.) Lg.Cage	Sm.Cage	Feeding Rate	Food Conversion Lg.Cage	Sm.Cage	Mortality Lg.Cage	Sm.Cage	Factor K Lg.Cage	Sm.Cage
July 25-Aug. 7	23.5	60.57	45.40	3.0	2.371	2.279	127	109	1.522	1.552
Aug. 8-Aug. 21	24.0	65.12	43.32	4.0	3.395	3.591	12	10	1.759	1.820
Aug. 22-Sept. 4	23.2	31.13	19.78	4.0	8.389	9.040	15	8	1.857	1.806
Sept. 5-Sept. 18	20.5	21.47	8.95	3.5	11.376	18.604	9	8	1.835	1.824
Sept. 19-Oct. 2	15.8	14.29	8.95	3.5	17.864	19.010	3	1	1.773	1.773
Oct. 3-Oct. 16	10.5	11.89	7.15	3.0	18.947	20.929	4	3	1.732	1.770
Total		204.48	133.55				170	139		

[1] This paper is a condensed form of a thesis submitted for the degree of Master of Science at South Dakota State University.

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mm (202 to 228 mm) and gained 100 g (128 to 228 g).

A Least Significant Difference test revealed no significant difference (P 0.05) of fish growth between cage sizes. The absence of significant growth difference between bullheads from large and small cages is probably because all cages were stocked at equal densities and fish were fed at the same rate.

Water temperatures appeared to influence rate of fish gain and food conversion because there was a direct relationship between rapid gain in both sizes and higher water temperatures. Food conversion values of fish in both cage sizes greatly increased from 4 September to 18 October, when water temperatures decreased to 20.5°C (Table 1). Shrable, et al. (1969) found the optimum temperature range for most rapid rate of digestion by channel catfish was 26.6° C to 29.4° C but was only slightly less at 21.1° C to 23.9° C. Tiemeier (1962) suggested, with respect to his catfish feeding, the fish be removed in September to obtain a desirable conversion value.

Results of this study follow those of Tiemeier's. Conversion values obtained in all cages averaged 2.31 during the first two weeks and increased to 3.40 from 8 August to 21 August. Food conversion values increased to an average of 8.7 on 4 September.

Known mortality during the study was 309 fish or 6.6% (Table 2). Seventy-eight per cent of the deaths occurred within the first two weeks. The high initial mortality was probably due to injuries the fish received while being captured, transported, and placed in cages. Tiemeier (1962), when feeding channel catfish in ponds, observed mortality rates from 6.4% to 10.5% with a total average mortality of 8.4%.

TABLE 2. KNOWN MORTALITY OF BLACK BULLHEAD POPULATION IN LARGE AND SMALL CAGES FROM 25 JULY TO 16 OCTOBER

DATE	DEAD		ALIVE
	Total Number	% of Total Population	Total Number
July 25	0	0	4775
Aug. 7	236	4.946	4539
Aug. 21	22	.484	4517
Sept. 4	23	.509	4494
Sept. 18	17	.378	4477
Oct. 2	4	.089	4473
Oct. 16	7	.156	4466
Totals	309	6.562%	

The Chi-Square test results indicate that there is no significant difference (P 0.05) in mortality between cage sizes for each date. This could have been expected as there were no large differences in density, feeding rates or handling.

No significant difference was revealed by the Chi-Square test for the condition (Factor K) of fish between the two cage sizes. This test did reveal a significant difference (P 0.05) between fish condition (1.53) on 25 July and fish condition (1.67) of 16 October. The better fish condition on 16 October could possibly be explained by the increased food consumption by fish when food is abundant.

Black bullheads in large cages appear to gain slightly more economically than those in small cages (Table 3). Fish in larger cages produced a total gain of 204.4 Kg at a cost of $1.01/Kg; and fish in smaller cages produced gains for $1.05/Kg.

TABLE 3. FOOD COST, AND PRODUCTION COSTS OF BLACK BULLHEADS IN CAGES

Cage Size	Total Cost of Food Fed	Gain Cost
Large	$208.28	$1.01/Kg
Small	$142.55	$1.05/Kg

Swingle (1954) produced speckled bullheads at a cost of $1.05/Kg, but pointed out that elimination of feeding during the winter while water temperatures were below 60° F should result in more economical production. If the cage-grown bullheads of this study had not been fed at water temperatures below 60° F, then feeding would have ceased 8 September, 1969. The fish would have gained 295.7 Kg at a cost of 78¢/Kg.

ACKNOWLEDGMENTS

The author is grateful to James K. Mayhew, Dr. John G. Nickum and Allan Swanson for their help in this project. Mr. Mayhew and Dr. Nickum reviewed the manuscript and Mr. Swanson assisted with sampling.

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