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General Notes

EFFECT OF STOCKING DENSITY ON CHANNEL CATFISH GROWTH, SURVIVAL AND FOOD CONVERSION EFFICIENCY IN CAGES*

Rearing of channel catfish (*Ictalurus punctatus*) in cages has developed past the experimental phases of maintaining and growing them. Present research interests are directed toward maximizing yields and profits from each production unit. Therefore, a study was conducted to update the effects of stocking density on catfish growth, survival, and food conversion efficiency in cages due to the marked improvement in ration quality within the past decade (Newton, 1980).

Lewis and Konikoff (1974) noted that at stocking densities of less than 80 catfish/m² fighting occurred when fish reached a size of 0.22 kg. Previous nutritional research in Arkansas and Oklahoma (Newton and Merkowsky, 1977; Collins, 1975) utilized stocking densities of 200-250 catfish/m². Fish stocked at these densities had favorable growth and survival. In addition, at these higher densities no behavioral problems were encountered and fish obtained a marketable size of 0.45 kg during one growing season (100 days). Schmittou (1970) reported that catfish stocked at 500 fish/m² could reach 0.34 kg in one growing season. Newton and Robison (1980) reared catfish in cages at three densities (200, 350, 500 fish/m²) and noted that fish stocked at 350 fish/m² gave the best economic return. Catfish stocked at 500 fish/m² had lower growth rates, food conversion efficiencies, and survival rates.

The purpose of this study was to determine an optimum stocking density for catfish survival, food conversion, and growth. Catfish were reared in twelve 1 m² cages constructed with 5 x 5 cm pine and 1.2 cm plastic netting. Cages were floated in a 1.6 ha farm pond located at the University of Arkansas at Pine Bluff Research Center. Catfish fingerlings ranging in size from 12.7 to 22.8 cm were stocked at the rates of 200 and 300 fish/m² in April, 1981. Each treatment rate was replicated six times. Catfish were fed a 32% protein floating ration five days per week. All fish were fed three to five percent of their estimated body weight according to a schedule adjusted every ten feeding days based upon a 1.5:1 feed conversion ratio. Catfish were harvested in October after 140 feeding days. At harvest a ten percent sample was used to determine dress-out percentages and body fat. Dress-out weight (%) is the fish portion available for market sale after skinning and evisceration. Percentage body fat was determined by weighing the mesenteric fat removed from individual fish.

Analysis of variance (Steele and Torrie, 1960) was used to test for significant differences among average weight gain, food conversion efficiency (FCE), survival, percentage mesenteric fat, and dress-out weight. Statistical tests were performed at the 0.05 significance level.

Catfish reared at 200 fish/m² had a significantly higher survival rate than catfish reared at 300 fish/m² (97% and 92%, respectively). Additionally, catfish reared at the higher stocking density suffered more bacterial problems. Bacterial infections occurred in four of the six cages at the higher density and in only one of the cages at the lower density. Mortality from bacterial losses was the major cause for the significant difference in survival.

Food conversion efficiency was directly related to stocking density. Data indicated (Table) that as density increases individual food efficiency utilization significantly decreases. Fish reared at 200/m² had an average of 13% better FCE than fish reared at 300 fish/m² (1.9 and 2.2 respectively).

There was a significant decrease in average individual size from the lower to higher stocking density. Fish reared at 200 and 300 fish per cage averaged 328 and 255 g, respectively. Net total production of catfish was higher in the cages stocked at 300 fish/m² (72 kg) than at the lower density (60 kg).

Fish at the lower stocking density had a significantly higher percentage of mesenteric fat than fish reared at the higher density (2.2% and 1.6%, respectively). Parker (1982) noted that catfish muscle lipid deposits were positively correlated with mesenteric fat deposits. He stated that increased muscle lipid deposits may have a beneficial influence on the quality of fish flesh. This suggests that the fish at the lower stocking density may also have greater consumer acceptance in addition to higher food conversions and growth rates. There was no significant difference in the percentage dressout weights between the two densities.

In this study, individual caged reared catfish growth was reduced by increasing the density from 200 to 300 fish/m² (Table). This finding concurs with results of other caged catfish investigations. Previous research by Newton and Robison (1980) and Schmittou (1970) indicated that as stocking densities increase, individual fish growth decreases. Food conversion efficiency and survival also decrease as stocking density increases. In the past, growth comparisons among various caged catfish studies have not been significantly different up to densities of 500 fish/m² (Collins, 1971; Schmittou, 1970). However, in the present study there were significant differences among survival, FCE and individual growth. The significant difference between survival rates was attributable to recurrent bacterial infections at the higher stocking density.

Food conversion efficiency was significantly lower in this study than reported by other investigators possibly because of greater fingerling weight variation at stocking. In previous related studies, Collins (1971) and Schmittou (1970) used fingerlings of uniform weights for stocking cages. Lewis and Konikoff (1974) used a wide range of size variation and fed the fish to satiation. Fish in this study were not fed to satiation, but fed a scheduled percentage (5-3%) of estimated body weight. This may have allowed the larger fish to consume a greater portion of the ration thus inhibiting growth of smaller fish.

Table. Comparison of channel catfish reared in cages at two stocking densities fed a 32% protein floating catfish ration.

Stocking density	Percent survival	Food conversion efficiency	Average final harvest weight (g)	Percent mesenteric fat	Percent dress-out weight
*200	97 a/	1.9 a	328 a	2.2 a	54.4 a
*300	92 b	2.2 b	255 b	1.6 b	53.3 a

* Results are based upon averaging the data of six cages for each treatment.

a/ Means followed by different letters are significantly different at the 0.05 level.

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Food conversion efficiency was also lower because larger fish consumed a greater percentage of the ration, utilizing the excess energy for fat deposition. On the average, fish greater than 350 g had 7% more body fat than smaller fish. Presently, it is assumed that this behavioral problem does not occur as dramatically with uniformly stocked fish.

*Published with the approval of the Director of the Arkansas Agriculture Experiment Station.

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NEW RECORDS FOR TROGLOBITIC ASELLIDS FROM NORTHWEST ARKANSAS

Little effort has been made to document the presence and location of the troglobitic Asellidae (Crustacea: Isopoda) occurring in northwest Arkansas. Previous records include: *Caecidotea ancyla* from Brewer Cave in Boone County (Fleming, Proc. Biol. Soc. Wash., 84:489-500, 1972; McDaniel and Smith, Proc. Ark. Acad. Sci., 30:57-60, 1976); and *C. stiladactyla* from a spring in Newton County, from seeps in Newton and Boone counties (Mackin and Hubricht, Trans. Amer. Micros. Soc., 59:383-397, 1940), and from Big Spring at Bella Vista, and Cave Springs Cave in Benton County (Fleming, Int. J. Speleol., 4:221-256, 1972; McDaniel and Smith, Proc. Ark. Acad. Sci., 30:57-60, 1976). No other localities in northwest Arkansas are known to harbor troglobitic asellids. The purpose of this paper is to report on the troglobitic asellid fauna of northwest Arkansas.

Hypogean and epigean environments were visited from March 1978 to December 1979. Collections were preserved in 70% ethanol and transported to the laboratory for identification. Type specimens were borrowed from the United States National Museum to compare and confirm identifications. All collections are in the possession of the author.

Twenty-one new locality records were recorded (Figure), and include the following species: *Caecidotea ancyla*, *C. antricola*, *C. steevesi*, and *C. stiladactyla*. This is the first Arkansas record for *C. steevesi*. Locality data for each species and other troglobitic fauna encountered are given in the following account.

Caecidotea ancyla (Fleming). Madison Co.: Denny Cave, War Eagle Cave; Washington Co.: Greasy Valley Cave. Specimens of *C. steevesi* and *Stygobromus ozarkensis* (Amphipoda: Crangonyctidae) were taken from War Eagle Cave.

Caecidotea antricola Creaser. Benton Co.: Civil War Cave, Logan Cave; Newton Co.: Earls Cave (collected by W. C. Welbourn). *Amblyopsis rosae* (Teleostomi: Amblyopsidae) was observed in Logan Cave.

Caecidotea steevesi (Fleming). Madison Co.: War Eagle Cave; Washington Co.: Well on the property of O. A. Lastering (collected by E. H. Schmitz).

Caecidotea stiladactyla Mackin and Hubricht. Benton Co.: Dickerson Cave, War Eagle Caverns; Carroll Co.: spring at Hogscald Hollow, White River below Beaver Dam; Madison Co.: Cal Cave, Laningham's Cave. Specimens of *Stygobromus ozarkensis* were taken from Dickerson Cave and from the White River below Beaver Dam.

Caecidotea sp. Collections consisting of female and immature specimens only. Benton Co.: small pool near Spanish Treasure Cave, spring at Sulphur Springs; Madison Co.: unnamed cave at McIlroy Refuge; Marion Co.: Coon Cave; Newton Co.: Copperhead Cave, John Eddings Cave, unnamed cave near Diamond Cave, seep at Running Creek. Collections from Coon Cave, John Eddings Cave, and seep at Running Creek by W. C. Welbourn.

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