CONCLUSION

A satisfactory all-plant feed for pond-fed catfish can be formulated which is economical and will produce fish of uniform and desirable size; however, the protein level in such a feed must be considerably higher, than when fish meal constitutes a part of the formula. In this study, increasing protein percentage in an all-plant diet from 29 to 43 produced statistically significant and economical weight increases.

Results from this study indicate, that under the described stocking and feeding conditions in non-flowing ponds, a 36% protein feed containing 8.8% fish meal (and 1,200 kcal of metabolizable energy) is more practical for feeding channel catfish than 29 or 43% protein diets containing either less or more fish meal protein. With this feed, yields approaching 3,000 lbs/acre were attainable when 1/10-acre ponds are stocked at rates of 3,000, 4- to 5-inch fingerlings per acre and fed for 198 days at daily allowances not exceeding 40 pounds of feed per acre.

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PUPAE OF FACE FLY AS FOOD FOR CHANNEL CATFISH[1]

by

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ABSTRACT

Pupae of face fly (*Musca autumnalis* De Geer) were offered to channel catfish fingerlings fed outdoors in plastic pools. Other channel catfish fingerlings received rations of equal parts of face fly pupae and Purina Catfish Cage Chow® (pellets) or pellets only. After 9 weeks of feeding, catfish from each pool were counted and weighed. Survival rates were 94, 97, and 93% and ratios of dry weight of food to increase in live weight of fish were 1.62, 1.77, and 2.29 for fish receiving pupae, pupae and pellets mixed, and pellets only, respectively. There were no statistically significant differences between these values (P=.05).

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INTRODUCTION

In recent years fish meal, the principal source of animal protein in fish feed, has become increasingly scarce and expensive. Although Hastings (1974) determined that diets lacking animal protein were satisfactory at 23.9° C, at higher temperatures greater amounts of protein were necessary to produce maximum growth (Hastings, 1973). An increased demand for protein in the diet may require inclusion of animal protein, and a form of animal protein, more readily available and less expensive than fish meal, is needed.

Insects in various developmental stages have been used to feed fishes. Pieces of rotting meat suspended over trout raceways served as "maggot factories" in the early days of trout culture in the United States (Bowen 1970). Silk worm pupae have been an important component of the diet of carp in Japan and China (Hickling 1962). Aerial insects attracted to light traps suspended over cages stocked with bluegill fell from the light into the cages, providing food that significantly increased the production of bluegill (Heidinger 1971). Aquatic insects or bottom arthropods were the primary food of channel catfish 100-mm TL (total length) (Bailey and Harrison 1948), and mayflies were most important in food of channel catfish 241-546 mm TL in one study and caddisflies in another (Carlander 1969).

Pupae of the face fly, *Musca autumnalis* De Geer, may be a satisfactory substitute for fish meal in fish feed. The face fly oviposits in fresh cattle manure and, after hatching, the larvae feed on the manure, then leave it to burrow in soil before pupating (Hair 1964). Pupae approximate rice grains in size, vary from light tan to dark brown in color and average 25.8% dry matter (E. W. King. unpublished data. Department of Entomology and Economic Zoology, Clemson University), of which 51.7% is crude protein. The amino-acid profile (D. E. Turk. unpublished data. Department of Poultry Science, Clemson University) includes all those considered essential for channel catfish growth (Dupree and Halver 1970). Availability of cattle manure and improved culture techniques for face fly (Discussions with E. W. King. 1974.) make the pupa of this insect a candidate for a component in catfish feed.

Objectives of this study were to determine (1) if channel catfish fingerlings would accept face fly pupae as food and (2) the effect of this food on survival and growth of the fish.

I am indebted to Dr. E. W. King for his advice and especially for supplying pupae for this experiment.

MATERIALS AND METHODS

Each of 15 plastic pools, 305 cm in diameter and partially filled with tap water to a depth of about 66 cm, was stocked on 27 May 1974 with 20 fingerling channel catfish trained to feed at the surface. Total wt of fish per pool was 415 g (mean). Five pools were assigned randomly to each of three diets: Diet 1, frozen face fly pupae only; Diet 2, equal portions of frozen pupae and Purina Catfish Cage Chow® (pellets); and Diet 3, pellets only.

The daily ration was 3% of the mean total wt of fish per pool. The fish were fed in late afternoon 6 days per week for 9 wk. Assuming a conversion rate of 1.5, the daily ration was increased at weekly intervals. A total of 810 g of food was offered to fish in each pool; however, total dry wt of food was 211, 575, and 729 g in pools receiving Diets 1, 2, and 3, respectively. (Purina Catfish Cage Chow is approximately 90% dry wt).

Pools were drained and catfish were counted and weighed on 22 July 1974. Data were subjected to analysis of variance and Duncan's multiple range techique.

RESULTS

Channel catfish fed actively on face fly pupae floating on the surface, and did not show a preference for pupae or pellets in pools receiving the mixed ration. Survival rates were 94, 97, and 93% and increases in weight were 33.8, 80.0, and 91.8% for fish receiving Diets 1, 2, and 3, respectively. The food conversion rate, dry wt of food offered divided by the increase in live wt (g) of fish, was 1.62, 1.77, and 2.29 for the three diets, respectively. Survival rate, percent of wt increase, dry wt of food offered and food conversion rate for each pool are shown in Table 1.

Table 1. Survival, weight increase, dry wt of food offered, and food conversion (dry wt of food increase in wt of fish) of channel catfish fed face fly pupae (Diet 1), equal portions of pupae and Purina Catfish Cage Chow® (Diet 2), and Cage Chow only (Diet 3).

	Survival (%)	Increase in weight (%)	Dry wt of food (g)	Dry wt of food (g) / Increase in weight (g)
Diet 1	90	33	211	1.5
	90	23	211	2.3
	100	33	211	1.5
	90	34	211	1.6
	100	46	211	1.1
Mean	94	33.8		1.62
Diet 2	90	72	575	2.0
	100	81	575	1.7
	95	68	575	1.9
	100	77	575	1.9
	100	102	575	1.3
Mean	97	80.0		1.77
Diet 3	90	73	729	2.5
	95	117	729	1.7
	90	109	729	1.6
	100	119	729	1.4
	90	41	729	4.3
Mean	93	91.8		2.29

There was no significant difference among treatments with respect to survival or food conversion rates ($P=.05$), but the difference in percent of wt increase was significant ($P=.01$) between Diet 1 and Diets 2 and 3. The correlation coefficient between percent of wt increase and dry wt of food offered was .79 ($P=.01$).

DISCUSSION

Survival and growth of channel catfish fingerlings offered face fly pupae indicate this insect may provide an excellent source of animal protein for catfish diets. When dry wt of the three diets is considered all fish in the experiment performed equally well relative to feed conversion, although actual wt increases were different between Diet 1 and Diets 2 and 3. Dry weight of food was not used to calculate daily rations, because offering equal volumes and total weights of food to fish in all pools was considered desirable.

Further investigation of face fly pupae as food for channel catfish should include substituting dried, ground pupae for fish meal, soybean meal, or both in standard pelleted catfish feed.

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COMPARISONS OF ALBINO AND NORMAL CHANNEL CATFISH GROWN IN CAGES IN A POND

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ABSTRACT

Albino and normal channel catfish, *Ictalurus punctatus* (Rafinesque), were stocked in suspended cages in a pond at densities of *11.1, 13.9 and 16.7 fish per ft*^{3}*, respectively, with two replications of each. There were no apparent growth or survival differences* between the albino and normal channel catfish. Mean gain/fish and mean gain/cage/day were significantly different (P 0.01) between the two higher stocking densities with both types of fish. These data indicate that a standing crop of about 15 lb per ft^3 of cage is the maximum which can be grown in still water ponds.

INTRODUCTION

Cage culture of channel catfish, *Ictalurus punctatus* (Rafinesque), has been investigated by a number of researchers in this country in recent years. Schmittou (1969) listed several advantages of cage culture in certain situations and demonstrated that standing crops in excess of 400 lb per m^3 could be produced. Collins (1970) compared the growth of channel and blue catfish, *Ictalurus furcatus* (LeSeuer) when cultured as single and mixed populations in cages. One purpose given by Hatcher (1971) for the use of cages was to rear catfish to be stocked into existing populations of fish to a large enough size that predation by large bass would not be a problem.

Prather (1961) compared the production of albino and normal color (gray) channel catfish in production ponds. The higher mortality experienced by the albino fish in his study was attributed to their susceptibility to predators and was considered to be a distinct disadvantage. Some fish farmers who operate fee fishing ponds attribute additional value to albino catfish as a novelty for their customers.

It was the purpose of this study to determine differences in performance of albino and gray channel catfish when grown in cages at three high stocking densities.

METHODS AND MATERIALS

The 12 cages utilized in this study were constructed of 2 inch X 2 inch creosote treated pine for frames with tar treated 1/2 inch nylon netting insets with a volume of 36 ft^3. Styrofoam billets 3 ft X 1 ft X 2 inches thick were attached to each end of a cage for flotation. The cages were arranged in two batteries with six cages each separated