Journal of the Arkansas Academy of Science

Volume 31 Article 24

1977

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Attraction of Aerial Insects as a Fish Food Supplement*

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ABSTRACT

Insect populations over a 1.2 hectare southeast Arkansas livestock pond were sampled to consider the possibility of their use as a fish food supplement. A commercial insect attraction unit was suspended above the pond, and attracted insects were collected. Insect populations were sampled 3-4 nights each month, January-December, 1976. Insects collected were identified and analyses were performed to determine nutritional composition and pesticide content.

Insect samples were variable, however, 62% of the insects identified were in the Order Diptera and 97% of these were in the Family Chironomidae. Nutritional analyses revealed insects were more than 60% crude protein. Pesticide analysis indicated 0.98 ppm toxaphene was present in the insects.

INTRODUCTION

Insects have been shown to constitute a part of the natural diet of channel catfish, *Ictalurus punctatus* Rafinesque (Bailey and Harrison, 1945; Perry, 1966; and Mathur, 1970). The portion of the natural diet consisting of insects was reported by Mathur (1970) to be 2.16% of the organic food material. Although the amount of the diet consisting of insects was not overwhelming, it should be noted these insects were naturally occurring organisms not made available to the fish by any particular means. The degree to which channel catfish feed on insects appears to be related to insect availability as Bonneau et al. (1972) reported with channel catfish fry. If this were shown to be true, insect availability could become an important tool in pond management. A potential value of insects appears to be in recycling their protein (i.e. through fish) for human consumption (DeFoliart, 1975).

Insect populations were sampled above a southeast Arkansas pond on a monthly basis during 1976. Insects were collected in conjunction with an experiment in which they were attracted to supplement the diet of channel catfish.

MATERIALS AND METHODS

This study was conducted on a 1.2 ha pond located on the University of Arkansas at Pine Bluff Experiment Station, Jefferson Co., Ark. The pond was surrounded by pasture and the water level was maintained solely by drainage from a small watershed. Cattle and swine had access to the pond throughout the study. The sampling station was placed 10 m offshore, in an area of the pond where emerging aquatic and terrestrial aerial insects could be attracted from nearby shallow water and surrounding terrestrial environments.

Insects were collected 3 or 4 nights each month beneath a commercial insect attraction unit. The unit consisted of a 15-watt ultraviolet bulb (BLB) surrounded by a ½-inch mesh wire cylinder which electrocuted attracted insects. The unit was suspended 30 cm above the pond surface and centered over a collection box measuring 81 cm by 81 cm. A timer turned the unit on daily at 1900 hrs. and off at 0700 hrs. The collection box was transported to the laboratory where insects were removed, dried, weighed, and frozen. Later, insects were identified by Mr. Phil Rouse. Nutritional and pesticide analyses were performed by Woodson-Tenant and the Arkansas State Health Department Laboratories.

RESULTS

Average weights of insects collected per night are listed in Table 1. As expected, insect activity during the year was greatest from May through September. During this period, the average dry weight of insects collected each night was 29 g with peak collections obtained in June and August. Samples collected during the months of February, March, April, and October were considerably smaller, averaging only a little over 1 g per night. No insects were collected during the months of November, December, or January.

Identification was difficult because insects were usually damaged by the attraction unit or during collecting and processing. However, all were identified to order and most to family. Samples varied; some consisted of as many as fifteen families while others consisted of as few as two families. Sample identifications revealed that 62% (dry weight) of the insects were in the Order Diptera and 97% of these were in the Family Chironomidae (Figure 1).

Nutritional analyses revealed insects were more than 60% crude protein (Table II). Pesticide analysis of insects collected during 1976 indicated 0.98 ppm toxaphene was present.

DISCUSSION

During April through October, when catfish in Arkansas feed best, insect abundance was also highest. However, in a related study with channel catfish fingerlings, attraction units did not significantly increase fish production in cages (Newton and Merkowsky, 1976). Fore (1969) reported that lights did increase the carrying capacity of ponds in Illinois by adding aerial insects to the fish's food supply. Heidinger (1971a) found that a 15-watt (BLB) insect attraction unit supported 11.4 kg of bluegill, *Lepomis macrochirus* Rafinesque, in a cage floated in a 0.1 ha pond in southern Illinois. He further reported that 60% of the organisms attracted to the unit were flying insects, while the balance was aquatic insect forms attracted into the cage by the light. Heidinger (1971b) also reported insects became more important and zooplankton less important as bluegill increased in size. This increase in dependence on insects was correlated in our study by a relative increase in insects of the Order Diptera during August, September, and October. Walburg (1975) in Nebraska found that insects in the Order Diptera occurred with greater frequency in channel catfish stomachs as the fish increased from 15-19 mm to 35-40 mm total length.

Nutritional analyses revealed that insects compare favorably with commercial fish rations; which usually consist of approximately 25-36% protein, 4% fat, and 7% fiber. It is not known if aerial insects alone would constitute a complete diet for fish, but some growth benefits should be derived from them. We calculated that an average of 17 g of protein (aerial insects) was attracted each night during the fish growing season (May-September) of 1976. At this rate, the insect protein was valued at approximately $5.00 per kilogram, which includes unit and operational expenses. A unit cost $130.00 (depreciated over 10 years) and the electrical expense was about 1 cent per 12 hr. period. Protein derived from a 25% commercial fish ration was only 79 cents per kilogram during 1976. Therefore, insect attraction units such as these are currently not economical investments for increasing fish production, especially channel catfish (Newton and Merkowsky, 1976). However, as commercial feed prices increase, insect attraction units may become practical in some instances.

In agricultural areas the residual level of toxaphene in insects may prove to be a problem as it may be biologically magnified in fish. Additional studies are warranted on this topic if light units are to be used in fish production for human consumption.

*Published with the approval of the Director of the Arkansas Agricultural Experiment Station

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ACKNOWLEDGEMENTS

This project was supported with funds provided by the United States Department of Agriculture, Cooperative State Research Service grant number PL 89-109, 416-15-72 for the University of Arkansas at Pine Bluff fisheries facility, Department of Agriculture. The authors appreciate the assistance of Mr. Phil Rouse, University of Arkansas at Fayetteville, for identification of insects.

LITERATURE CITED

BAILEY, R.M. and H.M. HARRISON, JR. 1945. Food habits of the Southern Channel Catfish *(Ictalurus lacustris punctatus)* in the Des Moines River, Iowa. Trans. Am. Fish. Soc. 75:110-138.

BONNEAU, D.L., J.W. MCGUIRE, O.W. TIEMEIER and C.W. DEYOE. 1972. Food habits and growth of Channel Catfish Fry, *Ictalurus punctatus*. Trans. Am. Fish. Soc. 101(4):613-619.

DEFOLIART, G.R. 1975. Insects as a source of protein. Bul. Entomol. Soc. Am. 21(3):161-163.

FORE, P.L. 1969. Response of fish to light. Ph.D. Dissertation, Southern Illinois University, 85pp.

HEIDINGER, R.C. 1971a. Feeding fish with light. The Am. Fish. Farm. Dec:12-13.

HEIDINGER, R.C. 1971b. Use of ultraviolet light to increase the availability of aerial insects to caged bluegill sunfish. Prog. Fish Cult. 33(4):187-192.

MATHUR, PHILIP. 1970. Food habits and feeding chronology of Channel Catfish, *Ictalurus punctatus* (Rafinesque) in Conowingo Reservoir. Proc. Southeast. Assoc. Game and Fish Comm. 24:377-386.

NEWTON, S.H. and A.J. MERKOWSKY. 1976. Using lights to attract insects for caged catfish. Ark. Farm Res. J. 25(3):8.

PERRY, W.G. 1966. Distribution and relative abundance of Blue Catfish, *Ictalurus furcatus* and Channel Catfish, *Ictalurus punctatus* with relation to salinity. M.S. Thesis. Louisiana State University, Baton Rouge, Louisiana.

WALBURG, C.H. 1975. Food of young-of-year Channel Catfish in Lewis and Clark Lake, a Missouri River Reservoir. The Am. Mid. Nat. 93(1):218-221.

Table 1. Average nightly dry weight of aerial insects collected monthly during 1976 over a southeast Arkansas pond.

Month	Weight (g) Insects/Night
January	None
February	0.8
March	0.9
April	3.0
May	16.5
June	41.1
July	15.6
August	49.1
September	23.7
October	0.8
November	None
December	None

Table II. Nutritional analyses of insects collected on 2 and 3 July and 7 and 8 October, 1976, over a southeast Arkansas pond.

	July	October
Protein	63.12%	60.18%
Carbohydrates	16.52%	22.31%
Fat	8.56%	5.86%
Crude Fiber	6.93%	4.86%
Ash	4.50%	4.84%

Figure 1. Percentage (dry weight) of insect samples belonging to Order Diptera and Family Chironomidae. Samples were collected over a southeast Arkansas pond during 1976.