FOOD HABITS OF WHITE AMUR, LARGEMOUTH BASS, BLUEGILL, AND REDEAR SUNFISH RECEIVING SUPPLEMENTAL FEED

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ABSTRACT

White amur effectively controlled dense growths of *Mougeotia, Zygnema,* and *Eleocharis,* when introduced into a pond containing a supplementally fed largemouth bass-bluegill-redear population. Analysis of stomach contents showed that white amur preferred plant foods (88% by volume), and probably ingested a few insects and crustaceans while "grazing" on plant materials. Largemouth bass preferred fish and other animals (64%), but also ate some supplemental feed (32%). Bluegill stomachs contained more supplemental feed (44%) than any other item, followed by insects and animal parts (28%), and plant parts (17%). Redears seemed to prefer insect larvae (42%), but also ate plant material (38%). White amur apparently did not compete with the sunfishes for either natural or supplementary food items.

INTRODUCTION

The effects of supplemental feeding on largemouth bass-bluegill populations were investigated by Schmittou (1969). Fed populations yielded 60 percent higher fishing success and a standing crop of 768 lb/acre more than control populations. The conversion rate was 4.0 lb of feed per one lb increase in weight of standing crop. Excessive growth of noxious aquatic vegetation can result when high rates of feeding are employed. Uneaten and partially digested feed can produce over-fertility in a pond. In April, 1970, this problem occurred during a study similar to Schmittou's previous experiment. Clumps of filamentous algae, mainly *Mougeotia* and *Zygnema,* were observed floating in an experimental pond. Dense growths of *Elocharis* covered much of the pond bottom. The pond was to be opened to the public for fee-fishing during the fall, but the presence of extensive vegetation would have made fishing very difficult.

The use of white amur, *Ctenopharyngodon idellus* Valenciennes, as a weed control agent has been demonstrated by Avault (1965), Avault et al. (1968), Kilgen and Smitherman (1971), and Stevenson (1965). Accordingly, they were stocked in this pond to control the vegetation so as to make fishing possible. Observations were made on their effectiveness in controlling vegetation. In an effort to determine if competetion for natural food and supplemental feed would occur, their food habits were compared with those of the other species in the pond.

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MATERIALS AND METHODS

The study was conducted in a 3.5 acre pond (S-9) at the Fisheries Research Unit, Auburn University Agricultural Research Station, Auburn, Alabama. The pond had been stocked with 7,000 fingerling-size bluegill, *Lepomis macrochirus* Rafinesque, and 3,500 fingerling-size redear, *L. microlophus* (Gunther), on 5 February 1968; 10,500 fathead minnows, *Pimephales promelas* Rafinesque, 8 February 1968; and 14 brood-size (0.7 lb) largemouth bass, *Micropterus salmoides* (Lacepede), on 19 February 1968. The fishes were fed Auburn No. 2 sinking pellets from August to November, 1968, and from March to October, 1969. The pond was opened to public fishing on 21 June 1969 and closed on 20 September 1969. Feeding was resumed on 13 April 1970, using Purina Floating Catfish Chow. The pond was fertilized five times between February and May, 1970, using 61 lb of triple superphosphate per application.

Dense filamentous algae and *Eleocharis* populations were discovered during routine monthly seine samples in April and May, 1970. In an attempt to control the vegetation in a short period of time, 490 white amur averaging 130 g were stocked on 2 June 1970 (140/acre). All species except fathead minnow were collected either by angling or by seining from June to October, 1970. Stomachs were removed immediately and preserved in 5% formalin for analysis of contents. Before the stomachs were dissected, an estimate was made as to their "degree of fullness" (Bogorov, 1934), whereby a number was assigned to each stomach according to the following scale:

5 = distended stomach (95-100% full)
4 = full (80-94%)
3 = moderately full (40-79%)
2 = not very full (6-39%)
1 = empty (0-5%).

Condition coefficients for each fish were determined, according to Carlander (1969):

$$K = W \times 10^5 / L^3,$$

where W = weight (g), and L = total length (mm). Relative condition coefficients,

$$Kn = W / W,$$

where W = the observed weight (g) of a particular fish, and W = the computed weight (g) for a fish of the same length, were calculated using tables compiled by Swingle and Shell (1971).

RESULTS AND DISCUSSION

Table 1 includes data on lengths, weights, condition coefficients, and stomach fullness, collected at approximate monthly intervals, although samples were collected more frequently. Since fishes were collected randomly by either hook and line or by seining, no conclusions will be drawn from the obvious fluctuations in average lengths and weights. These values, along with K_{TL} values, are presented merely for reference. As a rule, when using an exponential factor of 3.0 in calculating K_{TL} values, they will tend to be higher for the older and longer individuals.

Swingle and Shell (1971) observed that Kn values for bluegill populations receiving supplemental feed were higher than those for either fertilized or natural populations. With only two exceptions, Kn values for all species in the present study were greater than 1.0. This indicates that they were in "good" condition, compared to fish populations in either fertilized ponds or natural waters. It was difficult to detect a trend in differences of Kn values for any species before and after the introduction of white amur. The dramatic increase in Kn for largemouth bass between 2 June and 26 June (0.97-1.96) might be attributable to the availability of many small and intermediate size bluegills, which probably became more vulnerable to predation due to a decrease in vegetative cover after the white amur were stocked. If competition for food existed, it was not evident in analysis of the Kn values.

No meaningful differences were detected in stomach fullness for any species during the study period.

Food items found in fish stomachs (Figure 1) were classified as plant parts; crustacea (Cladocera Copepoda, Ostrocoda); insect larvae; animal parts; fish or fish eggs; silt and sand; and other, mainly supplemental feed. Values expressed are a volumetric percentage of the total stomach contents. Although food items were identified to species in some cases, they were lumped together in broad groups, e.g., "plant parts" includes *Mougeotia, Oscillatoria, Zygnema, Eleocharis,* and several unidentifiable plants.

It is evident that white amur rarely ate anything except plant materials (88%), and therefore probably did not interfere with food items preferred by the bass and other sunfishes. The small numbers of crustaceans and insect larvae (1%), and "other" materials (5%) may have been inadvertently ingested when the fish were "grazing" on plants.

Largemouth bass seemed to prefer fish and other animals (64%) combined, but also ate some supplemental feed (32%).

Bluegills preferred the supplemental feed (44%), but also had some insects and animal parts (28%), and plant parts (17%) in their stomachs. The latter may have been ingested during the process of obtaining feed pellets and insects.

When compared to the other fishes, redear stomachs contained the highest amount (42%) of insect larvae, but also contained a relatively high amount (38%) of plant material. The small number of individuals sampled (7) makes it difficult to draw any valid conclusion on food preference.

Within 30 days after introduction of 140 white amur per acre into the pond, the amounts of algae and rooted vegetation had substantially decreased. Some vegetation remained at the time of draining on 19 November 1970, but fishing was much easier because of the relative absence of floating algae clumps and rooted vegetation.

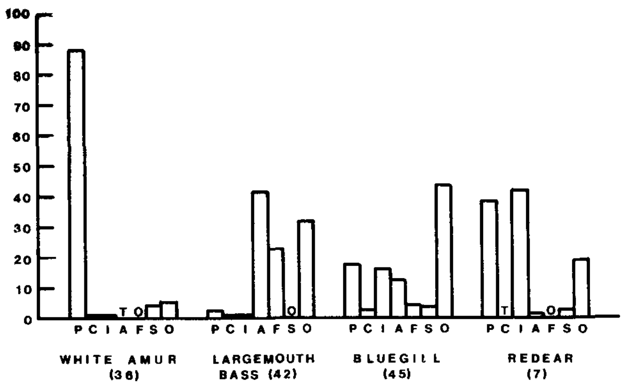

Figure 1. Stomach contents (percent volume) of fishes in pond S-9 (June-October, 1970). Key to symbols: P = plant parts; C = Crustacea (Cladocera, Copepoda, Ostracoda); I = insect larvae (Trichoptera, *Chaoborus*, Chironomidae); A = animal parts (adult insects, Nematoda); F = fish or fish eggs; S = silt and sand; O = other, mainly supplemental feed; T = trace; ( ) = number of stomachs examined.

Table 1. Number, average lengths, weights, K , Kn, and degree of fullness of fishes receiving supplemental feed, pond S-9, Auburn, Alabama (June - October, 1970)

Species, by date	Number of Fish	Average Total Length (mm)	Average Weight (g)	Average K TL	Average Kn	Average Degree of Fullness
White amur						
6/26	3	334	701	1.75	--	5.0
8/4	5	356	644	1.40	--	4.8
9/9	8	407	856	1.25	--	5.0
10/2	9	415	892	1.23	--	3.8
Largemouth bass						
6/2	6	259	229	1.29	0.97	--
6/26	15	181	155	1.25	1.96	1.9
8/4	5	234	219	1.28	1.26	2.4
9/9	6	251	248	1.34	1.15	2.2
10/2	10	215	184	1.64	1.37	1.8
Bluegill						
6/2	8	136	76	1.78	1.64	--
6/26	19	141	77	1.74	1.50	2.9
8/4	5	200	187	2.30	1.24	2.2
9/9	6	205	208	2.38	1.28	2.7
10/2	12	189	156	2.10	1.22	3.6
Redear						
6/2	8	152	91	1.65	1.48	--
6/26	22	133	43	1.51	1.04	4.0
8/4	3	162	69	1.62	0.93	2.7
9/9	1	213	194	2.01	1.16	3.0
9/25*	12	145	56	1.80	1.05	--

*Data for 10/2 not available.

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SURVIVAL, GROWTH, AND FEED CONVERSION OF CHANNEL CATFISH AFTER ELECTRONARCOSIS

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ABSTRACT

Electrically narcotized and untreated lots of two-year-old channel catfish (*Ictalurus punctatus*) were held in divided cages in a pond to determine the effects of narcosis on their survival, growth, and feed conversion. Fish were narcotized by exposure to 1.5 votls/cm for 60 seconds duration with either 60 hertz alternating current, continuous direct current, or pulsed direct current of 15, 20, or 25 pulses/sec.

There was no significant difference in survival, growth, or feed conversion between the treated and untreated lots at the 0.01 probability level.

INTRODUCTION

The use of electricity in fisheries is a recognized research and management tool. The possibility of exposure to electrical parameters that affect the morphology and physiology of fish is of major concern to investigators in management, harvesting, and grading studies. Maxfield, et al. (1971) found that pulsed direct electrical current had no effect on the survival, growth, and fecun-