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A STUDY OF THE FOOD HABITS OF LARGE-MOUTH BLACK BASS FINGERLINGS (Huro salmoides) IN REARING PONDS

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Introduction

Although studies have been made on the feeding-habits of bass-fingerlings in northern and eastern parts of the United States, no studies seem to have been published in the Southwest. Differences, both qualitative and quantitative, have been found between the plankters produced in the Southwest and in northern waters; and it is to be expected that these differences are reflected in the diet of fingerling fish.

With this in mind, studies were begun (June, 1941) at the city fish hatchery of Dallas on fingerling bass, *Huro salmoides,* to determine by stomach analysis (1) the food of fingerlings; (2) transition in diet during the growth period; (3) correlation between available and consumed planktonic food; and (4) food-selection by fingerlings of specific plankters.

The Dallas hatchery, located at the southwest end of White Rock lake, has twenty-six ponds, twelve of which were used for bass-rearing in 1941. These ponds vary in size from 3/5 to 1 1/5 acres, with depths ranging from 4.5 to 7 feet. They are fed from White Rock lake with water of about 8.3 pH. Marginal zones have been practically denuded of vegetation, most of that remaining being of short grass, with some sedge encroaching upon the water.

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Technique

Plankton samples for each pond were taken at an eighteen-inch level with a Foerst two-liter sampler and a 20-mesh plankton net. Samples were always taken at the same station in each pond and were concentrated to one cc. per liter in 2% aqueous formaldehyde. Counts for each bottle covered five units of a Sedgwick-Rafter counting-cell. With the plankton samples were taken from ten to twenty-five bass, either by seining or by random sampling when the ponds were drained. The belly of each was opened, and the fish immediately placed in 4% formaldehyde solution. The total length of each fish was measured before the stomach contents were removed in the laboratory; the contents of each stomach were placed in formalin and centrifuged for one minute. Supernatant liquid was decanted to 1 cc., and this, with its contained stomach debris, was counted in toto on a Sedgwick-Rafter cell.

In my studies, particularly as concerned the length of the fish, it was convenient to sort them into the following length-classes: 0-3.8 cm.; 3.9-5.1 cm.; 5.2-6.4 cm; 6.5-7.6 cm.; 7.7-8.9 cm.

Results

The following table and plates present results of stomach-analyses and plankton counts:

TABLE 1.—Relationship between length and type of food consumed

Length of fish (cm.)	Plankton	Insects
0 - 3.8	99.6%	.4%
3.9 - 5.1	98.5%	1.5%
5.2 - 6.4	76.0%	24.0%
6.5 - 7.6	52.3%	47.7%
7.7 - 8.9	3.8%	96.2%

Cooper (1936) in Michigan waters found Cladocera dominant in the diet of bass-fingerlings. Tester (1932) found that in Ontario, Cladocera dominated at one time, and copepods at other times, in the stomachs of small-mouth bass-fingerlings. Pearse (1921) and Moore (1922) also found Cladocera dominant in the consumed plankton.

Figure 2 shows that nauplii of copepods are usually nearly equal in numbers with adult *Cyclops* and that there are comparatively few *Diaptomus* compared with *Cyclops*.

A number of the ponds showed greater abundance of Cladocera than of copepods.

Table 2 shows *Cyclops* dominating the planktonic food in all fingerling stages studied. Possibly this shows selection on the part of the bass, but one cannot be certain of it. No correlation between available planktonic food and consumed plankton is apparent from my data.

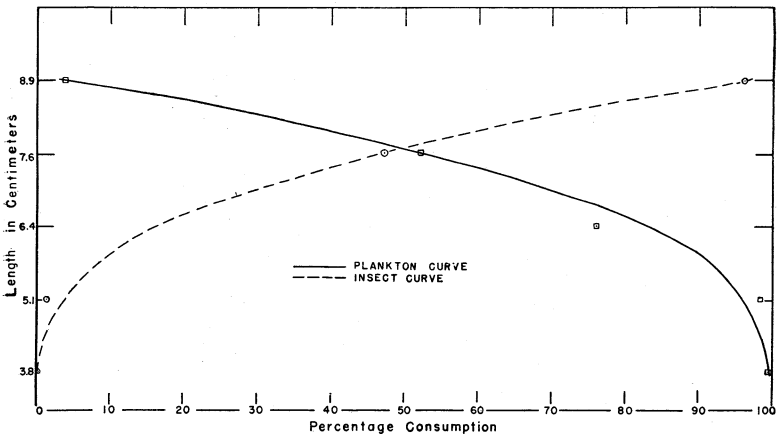

Figure 1.—Analysis of plankton-insect consumption in bass fingerlings.

Comparison of our findings with those obtained in the North again emphasizes limnological differences of the Southwest from those conditions existing in other parts of the country.

TABLE 2.—Percentage of fish food based on stomach analysis

	0-3.8*	3.9-5.1	5.2-6.4	6.5-7.6	7.7-8.9
Cyclops	75	58	51	31	90
Copepod Eggs	20	29	10	10	10
Cladocera	2	10	11	2	
Diaptomus			9	15	
Cladocera Remains			6	15	
Copepod Remains			10	14	
Ostracods	3			13	
Others		3	3	10	
Culicid Larvae	100	100	82	55	12
Corixidae			18	38	28
Dragonfly Nymphs			6	6	8
Insect Remains				1	52

*Size of fish in cm.

Table 2 shows culicid larvae dominant in the lower size ranges (0-6.5 cm.) and corixids and dragonfly nymphs dominant in ranges beyond 6.5 cm. There was a striking correlation between the size of the fingerlings and the size of insects eaten.

		ZOOPLANKTON																					
		PROTOZOA			ROTIFERA									COPEPODA			CLADOCERA						
POND	DATE	CERATIUM	DINOBRYON	DIFFLUGIA	CILIATAE	ASPLANCHNA	FILINIA	KERATELLA	TRICHOCERCA	BRACHIONUS	CONTRACTED ROTIFERS	FREE EGGS	DIAPTOMUS	CYCLOPS	NAUPLII	EGGS	DAPHNIA	CERIODAPHNIA	BOSMINA	DIAPHNOSOMA	EGGS	OSTRACODS	TOTAL ZOOPLANKTON
4	6-16-41	330		520	200			270	10	32	111	81	23	40	42	208		172	220		20		3279
6	6-28-41	172		178				620	132		68	45		50	73	60	20	41	40				1499
13	6-24-41	600		1310	11	42	30	331	62	160	51			35	33	70			116				2851
14	6-23-41	192		1021				662	428	21	6	108	308	420	526	325		1440	553		320	50	6340
17	6-21-41	321		124			50	92	206	23	412	30		222	221	30	200	3944			601	5	6481
20	6-20-41	680						324	12	20	10		1	382	431	110		102	20				2092
21	6-19-41	320		432	20	44	32	300	80	21	70	30		70	335	190		350	1839		162		4295
22	6-19-41	18	2	92	32				38	10	22	16	4	14	62	2	116	44	520	12	50	22	1076
23	6-21-41	75		762	32			871		39	36	52	42	68	72	69			58				2176
24	6-19-41	86		820	624	7	57	1126	40	143	300	84	88	37	474	103	3		214	37			4243
25	6-17-41			332	372			72		248	84	108	4	200	272	6	20	8	2904		236	32	14898
26	6-18-41	301			22			426		31		81	62	103	208	326		150	48		29		1787

QUANTITIES ARE ORGANISMS per LITER

Figure 2.—Zooplankton counts for the various ponds.

It has been known for some years that many fish pick out each separate food organism, instead of feeding on them *en masse*. Thus, Ricker (1937) found that sockeye salmon took each plankter individually; and Battle and others (1936) found the same condition in the herring. The present study shows the average length of *Cyclops* eaten by bass fingerlings to be 1.1 mm., as compared with an average size of *Cyclops* in the pond of 0.8 mm.—probably an example of food selection. W. L. Tressler informed the writer that in his work on bass of Irondequoit Bay he found stomachs of several fish of a bright orange hue, owing to numerous consumed *Diaptomus* with orange-colored fat droplets.

Ninety-five per cent of the consumed *Cyclops* in my study bore reddish-orange fat droplets, whereas only three per cent of the total plankton catch of *Cyclops* possessed

these droplets. Color-bearing *Cyclops* may have been more conspicuous, this condition thus causing selection as food. This supposition is based only on meagre information.

Cannibalism was not observed in the bass-fingerlings studied, a condition that perhaps is owing largely to the adequate food supply of the hatchery ponds and the uniform growth of the bass in each pond.

Conclusions

1. The diet of fingerlings from 6.4 to 8.9 cm. in length shows an abrupt transition from plankters to insects as chief food items.
2. There is no evidence of correlation between available planktonic food and consumed planktonic food.
3. *Cyclops* dominated the consumed planktonic food.
4. There is positive correlation between the size of fingerlings and the size of insects consumed.
5. Since the average size of consumed *Cyclops* was larger than the average size of *Cyclops* in the pond, selection of food is demonstrated in these fingerlings.
6. They appear also to have shown selection of *Cyclops* with enclosed orange-colored fat droplets.
7. No cannibalism was noted.

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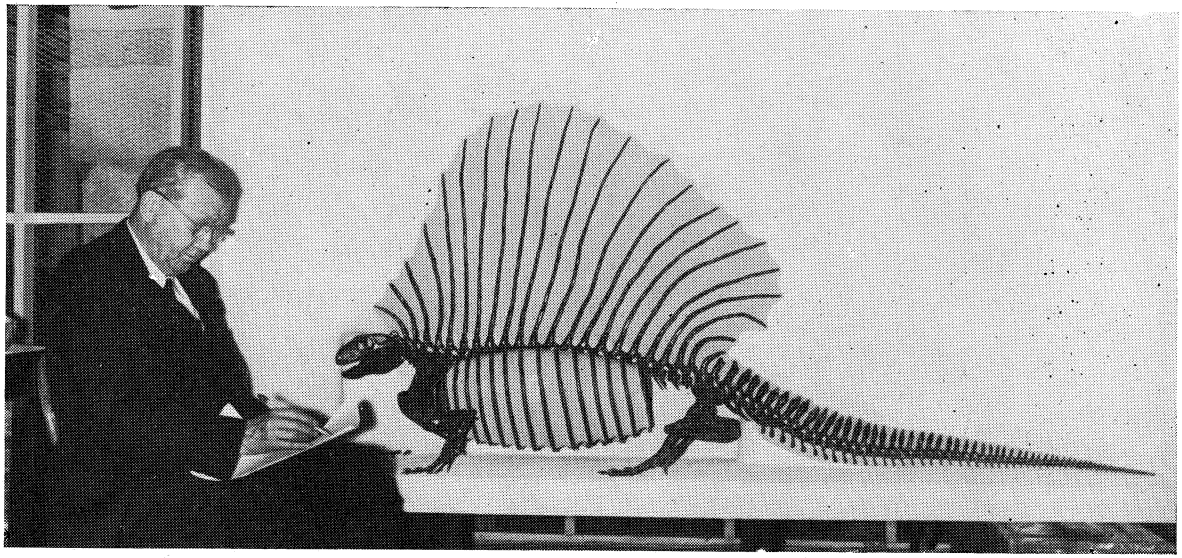

Friends have presented the Geological Museum of Southern Methodist University with a fine specimen of the Permian fin-backed lizard, *Edaphosaurus boanerges* Romer. It was collected at Geraldine in Archer County, Texas, about twenty-three miles southwest of Wichita Falls. The specimen comes from the Admiral formation of the Wichita group. It is 6 feet 10 inches in length and the spines have a length of about 24 inches above the vertebrae. The Edaphosaurs were herbivorous but closely resembled their relatives, the better-known carnivorous fin-backed Dimetrodons.