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An Investigation of the Stomach Contents of Micropterus Dolomieu

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AN INVESTIGATION OF THE STOMACH CONTENTS OF MICROPTERUS DOLOMIEU (LACEPEDE)

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CHAPTER I

THE PROBLEM

During the last eight to ten years there has been an awakening of interest in conservation. With this interest has come the application of scientific methods to conservation methods to replace the former replacement technique of hatcheries and game farms.

I. THE PROBLEM

Statement of the problem. It was the purpose of this study to scientifically analyze the stomach contents of Micropterus dolomieu. The study was based upon 168 stomachs taken from various sized fish caught by hook and line from the streams of Northern Illinois.

Importance of the study. This investigation is but a step in the complete survey of the streams and lakes of Illinois. According to the present scientific methods of fish conservation, the food of these fish must be determined before an accurate and successful method of stream and lake planting can be determined. The small fish thus planted must be assured of an available supply of their select foods if the maxium of satisfactory results is to be obtained. Due to legal restrictions the size group herein studied has been only those mature fish ten inches or more in length. The study of the food of these fish is essential in order that a rapid rate of growth may be maintained. That an increased supply of food correspondingly increases rate of

growth was shown by an unpublished study of Tonto and Horton Creeks near Payson, Arizona.[1] The investigations which necessarily must follow this type of work are: (1) the determination of the food of the size groups less than ten inches in length; (2) collection of scale samples to determine the age and rate of growth of the various size and age groups; (3) the complete analysis of the available food from each stream and lake surveyed; (4) the determination of methods of improvement of conditions for protection of the young as well as the adult fish; (5) the determination of methods of increasing certain types of foods considered as select as based upon stomach analyses; (6) the determination of the migrations of the fish following plantings to establish factually the numerical distribution and final fate of each fish.

Statement of organization into chapters. In Chapter II the reader will find a statement of the method of procedure and sources of data. Chapter III gives a complete report of the stomach contents of the fish studied. Chapter IV is a summary chapter of findings, conclusions and recommendations.

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[1] United States Forest Service Stream and Lake Survey; June 1937

Review of literature. The literature treating this subject was found to be lacking except for general opinions based on observation. Forbes[2] states that his colleagues have examined, "but three specimens," and found their food consisted, "wholly of fishes and crawfishes, approximately a third of the first and two thirds of the second. Among the fishes were a stonecat(Noturus flavus) and a log-perch (Percina caprodes)."

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[2] Forbes Stephen A., The Fishes of Illinois. (Springfield; Natural History Survey of Illinois, Vol. III, 1920), p. 265

CHAPTER II

METHOD OF PROCEDURE AND SOURCES OF DATA

The stomach specimens were collected by means of hook and line fishing in the streams and lakes of Winnebago, Boone, Ogle, and Stephenson counties in northern Illinois. The stomach of each fish was removed immediately after being caught and placed in a two ounce bottle of four percent formalin. The stomachs were opened in the laboratory and the complete volume and weight of contents recorded. A complete macroscopic examination followed which sufficed to separate readily identifiable portions. All unidentified portions along with debris obtained by filtration were placed in small vials. The contents of these vials were then examined microscopically and as complete identification as possible obtained. The remaining debris consisted mostly of portions of viscera of fish and slightly decomposed stomach wall.

CHAPTER III

REPORT OF STOMACH ANALYSES

In this chapter will be found a complete report of the stomach analyses discussed according to the following food groups: (1) Cambarus, (2) Fishes, (3) Rana, (4) Locustidae, (5) Other insects, (6) Worms.

An investigation of the contents of 168 stomachs of Micropterus dolomeiu can not be taken to be conclusive evidence of the complete food habits of this fish. The stomachs analyzed were all from specimens ten inches or more in length, determined to be mature by dissection.

The total volume of the Cambarus found in the stomachs included parts as well as whole animals. From this standpoint the total volume of the Cambarus eaten by the fish may far exceed that represented in the findings. In view of the fact that the calcium carbonate of the exo-skeleton of the Cambarus is less rapidly digested than the fish, insects, or worms the volume actually found probably represented a reliable ratio to other food groups. In eighteen stomachs chelipeds or legs were the only parts found.

The sizes of the Cambarus varied greatly from 10.7 cubic centimeter specimen from stomach number 135 to .7 cubic centimeter specimen in stomach number 164. The variation in the sizes of the Cambarus gives no indication of selection according to size on the part of Micropterus dolomeiu. The selection of Cambarus by fish of all sizes collected indicated that this animal serveddaas the principal food for all size groups ten inches or more in length.

According to the coefficient of expectancy for Cambarus (.929) approximately one crayfish can be expected to be found in each stomach. The average volume of this specimen will be 2.738 cubic centimeters.[3]

Of the three genera of fish found in the stomachs analyzed, little evidence can be seen of any selection of Micropterus dolomeiu within this food group. The fishes varied in size from that of a Notropis fry .3 cubic centimeters in stomach number 29 to an Etheostoma 12.2 cubic centimeters in stomach number 68.[4] The average size of the Etheostoma and Ameiurus found in the stomachs was much greater than the average size of the Notropis that were found. Though the total volumes represented by the fishes found in the stomachs were approximately similar, the coefficient of frequency per stomach for all three groups was .643 cubic centimeters.[5]

Although frogs are common along the banks of most of the Illinois streams, only four stomachs contained samples of Rana. Frogs, for the most part, are beyond the reach of feeding bass, tending to remain in extremely shallow water or in dense vegetation in the streams; the frogs are not so available to fish as they would seem to be by casual observation.

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[3] Averages and Totals of Data on Fish, Table III, p.17 of this Study .

[4] Stomach Analyses, Table II, pps. 12,13,14,15,16, of this study.

[5] Averages and Totals of Data on Fish, Table III, p.17 of this study.

The average volume of the frogs found in the stomachs was eight cubic centimeters, however, they appeared in only four stomachs of the 168 analyzed. The average volume expectancy per stomach was found to be .192 cubic centimeters.

Samples of Locustidae were comparatively numerous in the stomachs analyzed. Parts of eighty-three specimens were found, however these made up a total volume of only 24.8 cubic centimeters due to the fact that only small portions of the Locustidae are not readily digestible.[6] Undoubtedly, this food group is of the floating type having fallen onto the surface of the water. The fact that the year 1937 witnessed a peak in the cycle of abundance of Locustidae in the Middle West must be taken into consideration. For the latter reason the average expectancy per stomach is .148 cubic centimeters.[7] It is well to mention again the fact that these soft-bodied insects are rapidly digested. This fact, together with their frequency, is indicative of a greater volume of food than is actually represented.

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6 Table II, op. cit., pps. 12,13,14,15,16 of this study.

7 Table III, op. cit., p.17 of this study.

Insects other than Locustidae included: Damsel flies (Agrionidae), Dragon flies (Libellulidae), May flies (Ephemeridae), Mosquitoes (Culex), Bot fly (Oestridae), and Beetles (Coleoptera). Of these, Coleoptera were the most numerous, 19 samples having been found. The Agrionidae, Libellulidae, and Ephemeridae were nymphs, while the Culex, Oestridae and Coleoptera were adults. This entire food group represented two percent by volume of the entire stomach contents.[9] By weight, the group represented 1.46 percent of the total weight of the stomach contents.[10] The insects exclusive of Locustidae had an average expectancy per stomach of .078 cubic centimeters.

Three types of worms were found, Hirudinea, fresh-water Oligochaeta, and Nematoda. Of these, the Hirudinea were the most numerous, twenty-two having been found. The combined volume of these worms represents only .7 percent of the total volume of the stomach contents.[11] It is highly probable that the Nematoda were parasitic on Locustidae which had been eaten and subsequently digested. The undigested condition of these threadlike Nematoda among advanced digested portions is an indication of their resistance to digestive process. The Hirudinea was well represented in frequency in the stomachs analyzed.

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[9] Percent of Stomach Contents by Weight, Figure II, p.19, in this study.

[10] Percent of Stomach Contents by Weight, Figure II, p.19, of this study.

The frequency coefficient was ,131 as compared to .018 each for the Oligochaeta and the Nematoda. The worms had an average expectancy of .021 cubic centimeters per stomach.

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[11] Percent of Stomach Contents by Volume, Figure I, p. 18 of this study.

The frequency coefficient was .153 as compared to .019 each for the Oligochaeta and the Nematoda. The worms had an average expectancy of .001 cubic centimeters per stomach.

Percent of Stomach Contents by Volume, Figure X, p. 18 of this study.

TABLE I

DATA ON FISH

Specimen number	Length	Date	Time of day	Where collected	Lure	Air temperature	Condition of fish	Condition of stomach
1	10"	8/14/37	4 P.M.	1	Fly	80°F.	Fair	c
2	10"	7/9/37	5 P.M.	2	Fly	85°F.	Good	b
3	10"	7/13/37	11 A.M.	1	Fly	90°F.	Good	b
4	10"	7/2/37	2 P.M.	1	Fly	95°F.	Good	c
5	10"	8/9/37	5 P.M.	5	Fly	80°F.	Good	b
6	10"	8/1/37	6:45 P.M.	3	Fly	85°F.	Good	b
7	10"	7/24/37	6:15 P.M.	4	Fly	80°F.	Fair	c
8	10"	7/27/37	4 P.M.	2	Fly	85°F.	Good	c
9	10"	6/29/37	3 P.M.	3	Fly	90°F.	Fair	c
10	10"	8/3/37	12Noon.	3	Worm	90°F.	Good	b
11	10"	8/11/37	5:30 P.M.	3	Fly	85°F.	Good	b
12	10"	8/9/37	6:15 P.M.	1	Fly	85°F.	Good	b
13	10"	8/5/37	6:30 P.M.	2	Fly	75°F.	Good	b
14	10"	7/17/37	4 P.M.	4	Fly	85°F.	Good	b
15	10"	7/16/37	12 Noon.	6	Spinner	95°F.	Good	b
16	10.5"	7/3/37	2:30 P.M.	1	Fly	90°F.	Fair	d
17	10.5"	7/30/37	4:30 P.M.	2	Fly	90°F.	Good	c
18	10.5"	8/1/37	7 P.M.	4	Fly	80°F.	Good	c
19	10.5"	6/29/37	5 P.M.	4	Fly	85°F.	Fair	b
20	10.5"	7/2/37	4:45 P.M.	5	Fly	90°F.	Fair	b
21	10.5"	8/3/37	4:30 P.M.	3	Fly	80°F.	Good	c
22	10.5"	6/23/37	11:30 A.M.	1	Fly	85°F.	Good	c
23	10.5"	7/16/37	7:30 P.M.	3	Fly	75°F.	Good	b
24	10.5"	7/15/37	5 P.M.	4	Fly	85°F.	Good	c
25	10.5"	7/29/37	5P. M.	3	Fly	80°F.	Good	b
26	10.5"	7/26/37	4 P.M.	3	Fly	85°F.	Fair	b
27	10.5"	7/14/37	2 1 P.M.	2	Crayfish	90°F.	Fair	c
28	10.5"	8/9/37	2:30P.M.	1	Fly	90°F.	Good	c
29	10.5"	7/29/37	5:15 P.M.	3	Fly	80°F.	Good	b
30	10.5"	6/29/37	5 P.M.	10	Fly	85°F.	Good	c
31	10.5"	8/14/37	4:30 P.M.	1	Fly	85°F.	Good	c
32	10.5"	8/4/37	3 P.M.	3	Fly	85°F.	Good	c
33	10.5"	8/28/37	12 Noon :	3	Fly	90°F.	Fair	b
34	10.5"	6/30/37	5 P.M.	4	Fly	90°F.	Fair	c
35	10.5"	7/31/37	4 P.M.	2	Fly	85°F.	Good	b
36	10.5"	8/1/37	4 P.M.	5	Fly	86°F.	Good	c
37	10.5"	8/12/37	5:30 P.M.	4	Fly	85°F.	Fair	e
38	10.5"	9/4/37	5 P.M.	2	Fly	80°F.	Fair	c
39	10.5"	8/12/37	3:45 P.M.	2	Fly	85°F.	Good	b
40	10.5"	8/11/37	5 P.M.	2	Spinner	85°F.	Good	b
41	10.5"	8/12/37	5:30 P.M.	4	Fly	80°F.	Good	b
42	10.5"	7/22/37	5 P.M.	1	Fly	85°F.	Good	b
43	10.5"	8/4/37	5:30 P.M.	1	Fly	85°F.	Good	c
44	10.5"	7/2/37	4:15 P.M.	4	Fly	90°F.	Good	c
45	10.5"	10/24/37	12 Noon.	3	Fly	50°F.	Good	c
46	10.5"	8/9/37	5 P.M.	3	Fly	90°F.	Good	b
47	10.5"	8/7/37	1 P.M.	5	Fly	90°F.	Fair	b
48	10.5"	8/13/37	5:30 P.M.	7	Fly	85°F.	Good	b
49	11"	8/4/37	1 P.M.	1	Fly	90°F.	Good	c
50	11"	7/31/37	6 P.M.	9	Fly	80°F.	Fair	c
51	11"	6/ 29/37	4 PM .	2	Fly	90°F.	Fair	b
52	11"	7/9/37	10 A.M.	1	Spinner	90°F.	Good	b
53	11"	7/24/37	4 P.M.	3	Fly	80°F.	VeryGood	b
54	11"	7/10/37	3:30 P.M.	3	Fly	90°F.	Good	b
55	11"	8/10/37	5:30 P.M.	5	Fly	85°F.	Good	b
56	11"	8/7/37	6:30 P.M.	4	Fly	80°F.	Good	b
57	11"	7/29/37	4 P.M.	3	Fly	85°F.	Good	c
58	11"	9/5/37	6:30 P.M.	4	Fly	80°F.	Good	a
59	11"	6/ 25/37	5:30 P.M.	3	Fly	85°F.	Fair	b
60	11"	8/11/37	5 P.M.	3	Fly	85°F.	Good	b
61	11"	8/ 12/37	4:30 P.M.	4	Fly	80°F.	Good	a
62	11"	7/13/37	4 P.M.	5	Fly	85°F.	VeryGood	c
63	11"	7/30/37	5 P.M.	1	Fly	90°F.	Good	c
64	11"	7/6/37	5:30 P.M.	1	Fly	85°F.	Good	b
65	11"	7/24/37	2:00 P.M.	3	Fly	88°F.	Good	a
66	11"	7/5/37	6:45 P.M.	3	Fly	85°F.	Good	b
67	11"	6/28/37	1 P.M.	2	Fly	90°F.	Fair	b
68	11"	8/6/37	4 P.M.	2	Fly	90°F.	Good	c
69	11"	6/20/37	6 P.M.	8	Worm	80°F.	Good	c
70	11"	7/19/37	5 P.M.	6	Fly	85°F.	Fair	a
71	11"	7/26/37	4:45 P.M.	1	Fly	85°F.	Good	b
72	11"	6/27/37	2 P.M.	5	Fly	90°F.	Good	b
73	11"	7/5/37	1:30 P.M.	2	Fly	74°F.	Fair	c
74	11"	8/14/37	5:15 P.M.	2	Fly	85°F.	Fair	c
75	11"	7/11/37	7 P.M.	1	Fly	85°F.	Good	a
76	11"	8/7/37	5:30 P.M.	3	Fly	85°F.	Good	b
77	11"	7/28/337	10:30 A.M.	4	Fly	90°F.	Good	c
78	11"	8/15/37	2 P.M.	3	Fly	95°F.	Good	c
79	11"	7/14/37	4 P.M.	3	Fly	95°F.	Good	c
80	11"	7/15/37	5:30 P.M.	7	Fly	85°F.	VeryGood	b
81	11"	8/12/37	4 P.M.	4	Fly	80°F.	Good	b
82	11"	7/7/37	5 P.M.	1	Fly	90°F.	Good	a
83	11"	7/19/37	4:30 P.M.	3	Fly	90°F.	Fair	b
84	11"	6/27/37	5:15 P.M.	3	Fly	85°F.	Good	c
85	11"	8/2/37	6 P.M.	1	Fly	75°F.	Good	b
86	11"	7/22/37	5 P.M.	1	Fly	85°F.	Good	b
87	11	8/4/37	6 P.M.	3	Fly	85°F.	Good	c
88	11"	8/5/37	4 P.M.	3	Fly	90°F.	Good	c

TABLE I (continued)

DATA ON FISH

Specimen number	Length	Date	Time of day	Where collected	Lure	Air temperature	Condition of fish	Condition of stomach
89	11"	8/12/37	2:30 P.M.	1*	Fly	75°F.	Fair	c**
90	11"	7/23/37	4 P.M.	2	Crayfish	90°F.	Good	a
91	11"	6/24/37	3:30 P.M.	4	Fly	90°F.	Good	b
92	11.5"	7/13/37	1:30 P.M.	5	Fly	95°F.	Good	d
93	11.5"	7/18/37	4:15 P.M.	4	Fly	88°F.	Good	c
94	11.5"	9/5/37	11 A.M.	9	Fly	90°F.	Fair	b
95	11.5"	7/11/37	2 P.M.	2	Fly	90°F.	Good	b
96	11.5"	6/25/37	5 P.M.	1	Fly	85°F.	Good	b
97	11.5"	7/29/37	4:30 P.M.	4	Fly	85°F.	Good	d
98	11.5"	9/21/37	4 P.M.	4	Fly	80°F.	Good	c
99	11.5"	9/18/37	5:30 P.M.	1	Fly	85°F.	Fair	d
100	11.5"	7/13/37	6:15 P.M.	5	Fly	80°F.	Good	b
101	12"	8/2/37	5 P.M.	1	Fly	85°F.	Good	b
102	12"	8/1/37	4:30 P.M.	10	Fly	90°F.	VeryGood	c
103	12"	8/11/37	5:30 P.M.	1	Fly	85°F.	Good	c
104	12"	8/14/37	4 P.M.	3	Fly	85°F.	Good	b
105	12"	8/12/37	5 P.M.	1	Fly	85°F.	Fair	c
106	12"	8/8/37	5 P.M.	1	Fly	90°F.	Good	b
107	12"	7/25/37	4:15 P.M.	3	Fly	90°F.	Fair	b
108	12"	8/11/37	2:30 P.M.	3	Fly	90°F.	Good	c
109	12"	7/4/37	4 P.M.	1	Spinner	90°F.	Good	c
110	12"	8/4/37	5 P.M.	2	Fly	90°F.	Good	b
112	12"	7/21/37	5 P.M.	6	Worm	90°F.	Fair	a
113	12"	8/12/37	6:30 P.M.	7	Fly	85°F.	Good	d
114	12"	6/26/37	11:30 A.M.	8	Minnow	76°F.	Good	c
115	12"	7/3/37	12 Noon.	9	Fly	95°F.	Good	b
116	12"	7/15/37	4 P.M.	3	Fly	90°F.	Good	d
117	12"	8/11/37	5:30 P.M.	3	Fly	75°F.	VeryGood	c
118	12"	8/4/37	7 P.M.	1	Fly	80°F.	Good	a
119	12"	8/10/37	4:30 P.M.	2	Fly	90°F.	Good	b
120	12"	9/2/37	5 P.M.	1	Fly	85°F.	Fair	c
121	12"	7/12/37	4:30 P.M.	4	Fly	75°F.	Excellent	c
122	12"	7/22/37	5 P.M.	3	Fly	85°F.	Good	b
123	12"	8/12/37	4:30 P.M.	3	Fly	90°F.	Fair	b
124	12"	6/30/37	4:15 P.M.	6	Fly	85°F.	VeryGood	b
125	12"	7/12/37	4:45 P.M.	4	Fly	75°F.	Fair	d
126	12"	7/4/37	3:45 P.M.	8	Spinner	95°F.	Good	c
127	12"	7/19/37	5:30 P.M.	10	Fly	90°F.	Good	b
128	12"	8/8/37	6:30 P.M.	2	Fly	80°F.	VeryGood	a
129	12"	8/4/37	4 P.M.	1	Fly	90°F.	Good	b
130	12"	8/7/37	3:30 P.M.	1	Fly	90°F.	Good	b
131	12"	6/21/37	4 P.M.	8	Minnows	90°F.	Fair	c
132	12.5"	7/25/37	5:15 P.M.	3	Minnows	85°F.	Good	d
133	12.5"	8/2/37	3 P.M.	1	Minnows	88°F.	Good	c
134	12.5"	7/13/37	5:45 P.M.	9	Minnows	85°F.	Good	b
135	12.5"	8/2/37	3 P.M.	4	Crayfish	90°F.	VeryGood	a
136	12.5"	8/16/37	4 P.M.	1	Fly	90°F.	Good	b
137	13"	7/26/37	6 P.M.	1	Fly	80°F.	Good	b
138	13"	6/27/37	5:45 P.M.	3	Spinner	85°F.	Fair	b
139	13"	7/1/37	6 P.M.	3	Fly	85°F.	Good	c
140	13"	7/10/37	5:15 P.M.	5	Fly	85°F.	Good	c
141	13"	7/16/37	5 P.M.	7	Fly	75°F.	Excellent	b
142	13"	7/12/37	4 P.M.	8	Fly	85°F.	Good	b
143	13.5"	8/1/37	5:30 P.M.	1	Fly	80°F.	Good	d
144	13.5"	6/30/37	3:30 P.M.	3	Fly	88°F.	VeryGood	c
145	14"	6/22/37	12 Noon.	6	Fly	90°F.	Good	b
146	14"	7/11/37	5 P.M.	2	Fly	85°F.	Good	a
147	14"	7/8/37	4 P.M.	5	Fly	85°F.	Good	b
148	14.5"	7/2/37	3:45 P.M.	1	Crayfish	90°F.	VeryGood	c
149	15"	8/9/37	4 P.M.	2	Fly	80°F.	Good	c
150	15"	8/14/37	5 P.M.	4	Fly	85°F.	VeryGood	c
151	15"	8/1/37	4 P.M.	3	Worm	85°F.	VeryGood	b
152	15"	7/25/37	5:30 P.M.	3	Worm	90°F.	Excellent	b
153	15"	8/9/37	4:30 P.M.	2	Worm	80°F.	Good	c
154	15"	8/4/37	3P.M.	2	Worm	90°F.	VeryGood	c
155	15"	8/3/37	5 P.M.	1	Worm	85°F.	VeryGood	b
156	15.5"	7/31/37	6 P.M.	1	Spinner	80°F.	Excellent	c
157	15.5"	7/24/37	4 P.M.	3	Fly	85°F.	Excellent	a
158	16"	7/21/37	4:30 P.M.	5	Fly	90°F.	VeryGood	b
159	16"	7/20/37	5 P.M.	7	Spinner	90°F.	Good	d
160	16"	7/1/37	4:30 P.M.	9	Fly	90°F.	VeryGood	c
161	16"	7/24/37	3:30 P.M.	3	Fly	85°F.	Excellent	b
162	16"	7/16/37	4:30 P.M.	4	Fly	88°F.	VeryGood	c
163	16"	8/10/37	6 P.M.	2	Spinner	80°F.	Excellent	c
164	16.5"	9/17/37	5:15 P.M.	1	Fly	80°F.	VeryGood	b
165	17"	8/5/37	5 P.M.	10	Spinner	80°F.	Excellent	c
166	17"	8/4/37	1 P.M.	3	Fly	90°F.	Good	b
167	18"	7/6/37	5:30 P.M.	1	Minnows	85°F.	Good	d
168	18.5"	8/5/37	4:30 P.M.	8	Minnows	90°F.	Excellent	a

KEY

*1. North Kishwaukee
2. South Kishwaukee
3. Piscasaw
4. Beaver
5. Coon
6. Saint Croix
7. Michigan
8. Long Lake
9. Keyle
10. Nippersink

**a. Undigested
b. Partly digested
c. Advanced digestion
d. Empty
e. Wholly digested

TABLE 1 (continued)

TABLE II

STOMACH ANALYSES

Specimen number	Cambarus		Notropis		Etheostoma		Ameiurus		Rana		Locustidae		Libellulidae		Agrionidae		Culex		Oestridae		Coleoptera		Ephemeridae		Hirudinea		Nematoda		Fresh-water Oligochaeta	
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume
1	3	6.6	1	1.1							1	.1			1	.5														
2	1	4.7									1	.4																		
3			1	.8																									1	.3
4	1	3.									1	.8																		
5	1	1.8									1	.1																		
6											1	.4																		
7	1	9.1													1	.3														
8	1	3.									1	1.1																		
9	1	9.6																												
10	1	1.8	1	1.4																	1	.1			1	.1				
11	1	4.9											1	.3																
12			1	.1							2	.2																		
13																	1	.1												
14	5	10.3							1	7.7																				
15	3	3.4									2	.4																		
16																														
17	1	1.2																					1	.1						
18			1	6.5																										

TABLE II

SPONGE ANALYSIS

Specimen number	Cephalaspongia		Hetrospongia		Rhizospongia		Axinyssa		Reniera		Isodictya
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number
1	3	6.6	1	11.1			1	5			1
2	1	4.7									1
3			1	.8							
4	1	2.									1
5	1	1.8									1
6											1
7	1	8.1									
8	1	3.									1
9	1	8.8									
10	1	1.8	1	1.4							
11	1	4.8									
12			1	.1							2
13											
14	8	10.3							1	7.7	
15	3	3.4									2
16											
17	1	1.2									
18			1	8.8							

TABLE II (continued)

STOMACH ANALYSES

Specimen number	Cambarus		Notropis		Etheostoma		Ameiurus		Rana		Locustidae		Libellulidae		Agrionidae		Culex		Oestridae		Coleoptera		Ephemeridae		Hirudinea		Nematoda		Fresh-water Oligochaeta	
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume
19	1	1.6																	1	.2										
20			1	.2																					1	.1				
21	1	3.									1	.2									1	.2								
22	1	2 .3																							1	.1				
23			1	.2																										
24	5	1.6									1	.3							1	.2										
25	1	2.																												
26	1	2.9																												
27							1	6.9																						
28	1	7.6																			1	.1								
29			1	.3																										
30	1	.4											1	.5																
31											1	.1																		
32	1	9.	1	1.1																										
33			1	.3							2	.6							1	.2										
34	1	1.									3	.7													1	.1				
35	2	6.3																												
36	1	.1																					1	.2						
37	1	.8									1	1.1													2	.2				
38	2	9.6	1	.7																										
39											1	.4																		
40	1	1.2																							1	.1				
41	5	6.2																												
42																														
43	1	3 .																			1	.3								
44																														
45	1	3.									3	.4																		
46	2	20.8																												
47			1	.3																										
48	2	3.9																							1	.1				
49	1	.3	1	.7																										
50																					1	.1			1	.1				
51											1	.1																		
52	1	.1									2	.6																		
53	1	5.3																			1	.8								
54																														
55	1	3.1	1	1.1							1	.3															1	.1		

TABLE II (continued)

SOIL ANALYSES

TABLE II (continued)

STOMACH ANALYSES

Specimen number	Cambarus		Notropis		Etheostoma		Ameiurus		Rana		Locustidae		Libellulidae		Agrionidae		Culex		Oestridae		Coleoptera		Ephemeridae		Hirudinea		Nematoda		Fresh-water Oligochaeta	
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume
56	1	8.4									3	.4																		
57	5	3.9							1	8.	3	.8									1	.2								
58			1	1.5																										
59	1	1.2																												
60	1	3.1									1	..3									1	1.			1	.1				
61																														
62	1	5.6									1	.4							1	.3										
63	2	6.																			1	.6								
64	1	1.6									1	.7																		
65	1	.9																												
66	1	1.3	1	1.2																										
67	2	4.5									1	.3													1	.1				
68					1	22.2																								
69	1	4.9																												
70	1	1.1																												
71	1	.4									1	.5													1	.1				
72	1	1.1																			1	.3								
73											1	.4																		
74	2	9.3	1	1.1											1	.5														
75	3	3.8																									1	.1		
76	2	6.2																												
77			2	1.2							1	.5																		
78	5	20.2																			1	.2								
79	1	7.4											1	.1																
80			1	.8																										
81	1	1 0.									2	.8																		
82											1	1.																		
83	1	10.2																												
84			1	1.6							2	.6																		
85	1	9.1																												
86	1	1.1																							1	.1				
87											1	.1	1	.5																
88	1	5.2															1	.1												
89	1	1.																												
90			1	1.4																										
91	5	9.6							1	9.4																				
92																														
93			1	1.1																										
94	1	3.1									2	.3											1	.2						

TABLE II (continued)

Stomach Analyses

Specimen number	Cambarus		Notropis		Etheostoma		Ameiurus		Rana		Libellulidae		Agrionidae		Culex		Oestridae		Coleoptera		Ephemeridae		Hirudinea		Nematoda		Locustidae		Fresh-water Oligochaeta	
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume
95			1	.5															1	.2										
96	1	5.1																												
97																														
98	1	8.9																									2	.3		
99																														
100			2	2.7																			1	.1						
101	2	3.4																												
102																											1	.1		
103	1	.7																			1	.3								
104			1	.6																										
105					1	9.2																								
106																							1	.1						
107			1	.7																										
108																											3	.7		
109	1	3.																					1	.1			1	.2		
110	1	3.8																												
111	1	1.1																									1	.6		
112	2	20.8																												
113																														
114	2	6.5																					1	.1			1	1.1		
115	1	5.2	1	1.5					1	6.9																				
116	2	4.6																									2	.5		
117											1	.6							1	.4	1	.2					3	.4		
118			1	1.7																										
119																			2	.7										
120																														
121	2	7.6									1	.5	1	.3																
122											1	.3																		
123	3	4.	1	.6																										
124	1	3.2																												
125																														
126																														
127	1	3.1																									1	.6		
128			1	1.1																										
129																							1	.2						
130																			1	.2										
131	5	3.													1	.1					1	.2								
132																														
133	1	.1																												

TABLE II (continued)

Phenol Analyses

Specimen number	Centrum		Notopodium		Rhizoneura		Aeolosoma		Nematoda		Bibliography
	Number	Volume mm	Number	Volume mm	Number per mm	Volume mm	Number per mm	Volume mm	Number per mm	Volume mm	
95			1	1.8							
96	1	8.1									
97											
98	1	8.8									
99											
100			2	3.7							
101	2	3.4									
102											
103	1	8.7	1								
104			1	.6							
105					1	8.3					
106											
107			1	.7							
108											
109	1	3.									
110	1	3.8									
111	1	1.1									
112	2	20.8									
113											
114	2	8.5									
115	1	8.2	1	1.8					1	6.9	
116	2	4.5									
117			1		1						1
118											
119			1	1.7							
120											
121	2	7.8									1
122											
123	2	4.	1	.8							
124	1	3.3									
125											
126											
127	1	3.1									
128			1	1.1							
129					1						
130											
131	2	3.									
132											
133	1	.1									

TABLE II(continued)
STOMACH ANALYSES

Specimen number	Cambarus		Notropis		Etheostoma		Ameiurus		Rana		Locustidae		Libellulidae		Agrionidae		Culex		Oestridae		Coleoptera		Ephemeridae		Hirudinea		Nematoda		Fresh-water Oligochaeta	
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume
134	1	..3									1	.4															1	.2		
135	1	10.7																												
136	1	1.8									1	.2																		
137	1	3.9									1	.8																		
138																					1	.1								
139	1	.2																							1	.1				
140															1	.3														
141	2	10.																												
142	1	.6									3	.4																		
143																													1	.3
144	1	3.	1	.4																										
145											2	.2																		
146											1	.4																		
147	1	1.2			1	8.9					2	.3			1	.2														
148	1	3.																							1	.2				
149			1	3.1																										
150							1	7.3																						
151	2	8.1																												
152	1	6.8									1	.3													1	.1				
153	1	1.1																												
154	1	1.7	1	3.5																										
155	1	6.9									2	.5																		
156	2	5.8																			1	.1								
157			1	.7							1	.4																		
158			1	1.2															1	.1										
159																														
160	1	5.3									1	.4																		
161							1	8.2			1	.1																		
162			2	1.9																					1	.1				
163	5	19.9																												
164	1	.7									2	.3																		
165	1	.4	1	1.1																									1	.3
166			1	1.5																										
167																														
168											1	.3																		
TOTALS	1156	451.5	40	38.4	4	36.8	3	32.4	4	32.	83	24.8	7	2.8	6	2.1	3	.3	4	.8	19	5.8	6	1.2	22	2.4	3	.3	3	.9

TABLE III

AVERAGES AND TOTAL OF DATA ON FISH

Specimen	Number found	Volume	Coefficient of frequency	Average volume per specimen	Average expectancy per stomach in cubic centimeters
Cambarus	156	451.5	.929	2.84 c.c.	2.738 c.c.
Notropis	40	38.4	.238	.96 c.c.	.228 c.c.
Ethiostoma	4	38.8	.024	9.2 c.c.	.221 c.c.
Ameirus	3	32.4	.018	10.8 c.c.	.194 c.c.
Rana	4	32.0	.024	8.0 c.c.	.192 c.c.
Locustidae	83	24.8	.494	.3 c.c.	.148 c.c.
Agrionidae	6	2.1	.036	.35 c.c.	.013 c.c.
Culex	3	.3	.018	.1 c.c.	.002 c.c.
Oestridae	4	.8	.024	.2 c.c.	.005 c.c.
Coleoptera	19	5.8	.113	.31 c.c.	.035 c.c.
Ephemeridae	6	1.2	.036	.2 c.c.	.007 c.c.
Libellulidae	7	2.8	.04	.4 c.c.	.016 c.c.
Hirudinea	22	2.4	.131	.11 c.c.	.014 c.c.
Oligochaeta	3	.9	.018	.3 c.c.	.005 c.c.
Nematoda	3	.3	.018	.1 c.c.	.002 c.c.
TOTALS	363	632.5	2.16	1.75 c.c.	3.820 c.c.

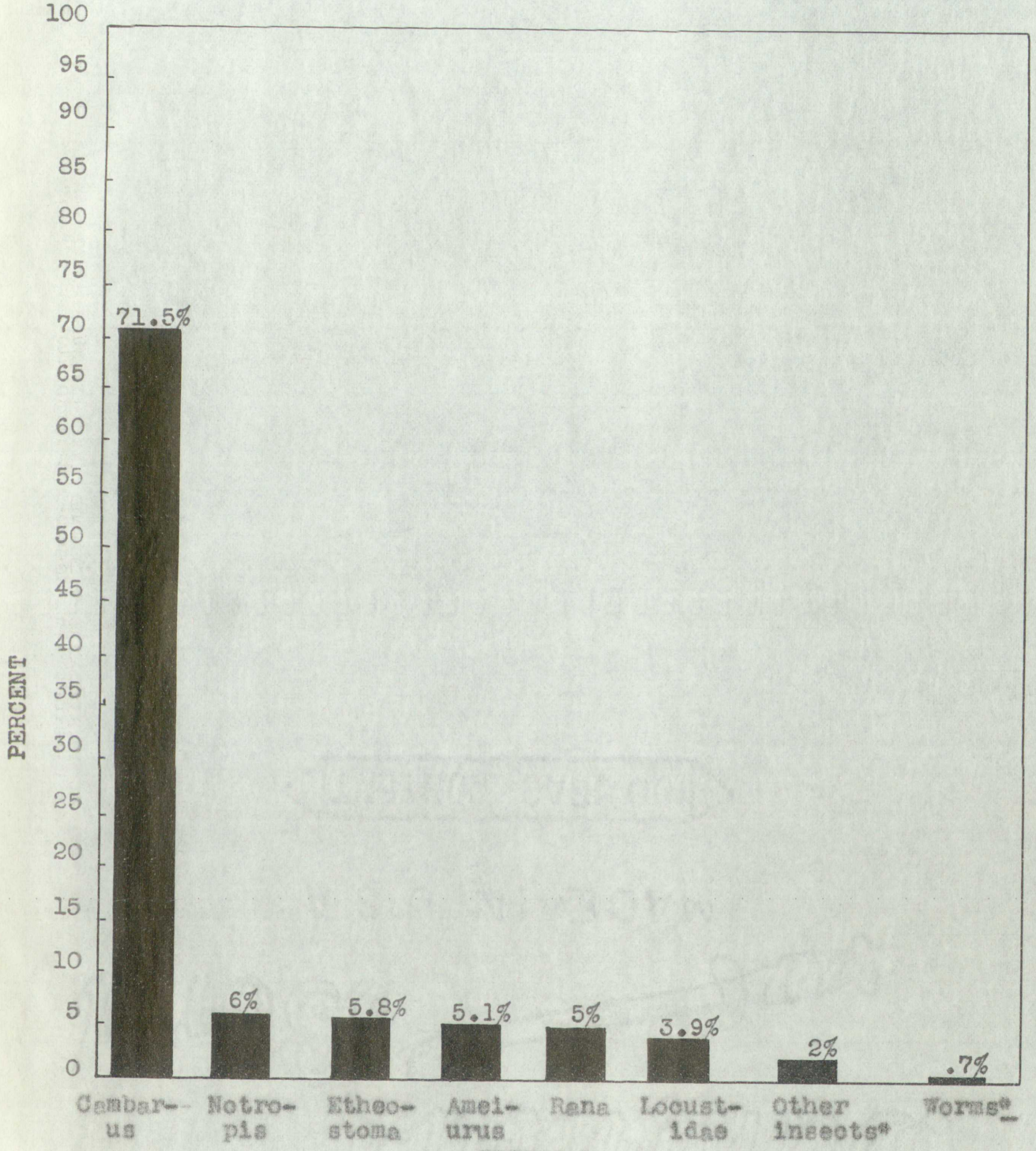


FIGURE I

PERCENT OF STOMACH CONTENTS BY VOLUME

* Includes Odonata, Ephemerida, Diptera, and Coleoptera
** Includes Hirudinea, Fresh-water Oligochaeta, and Nematoda

PERCENT
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

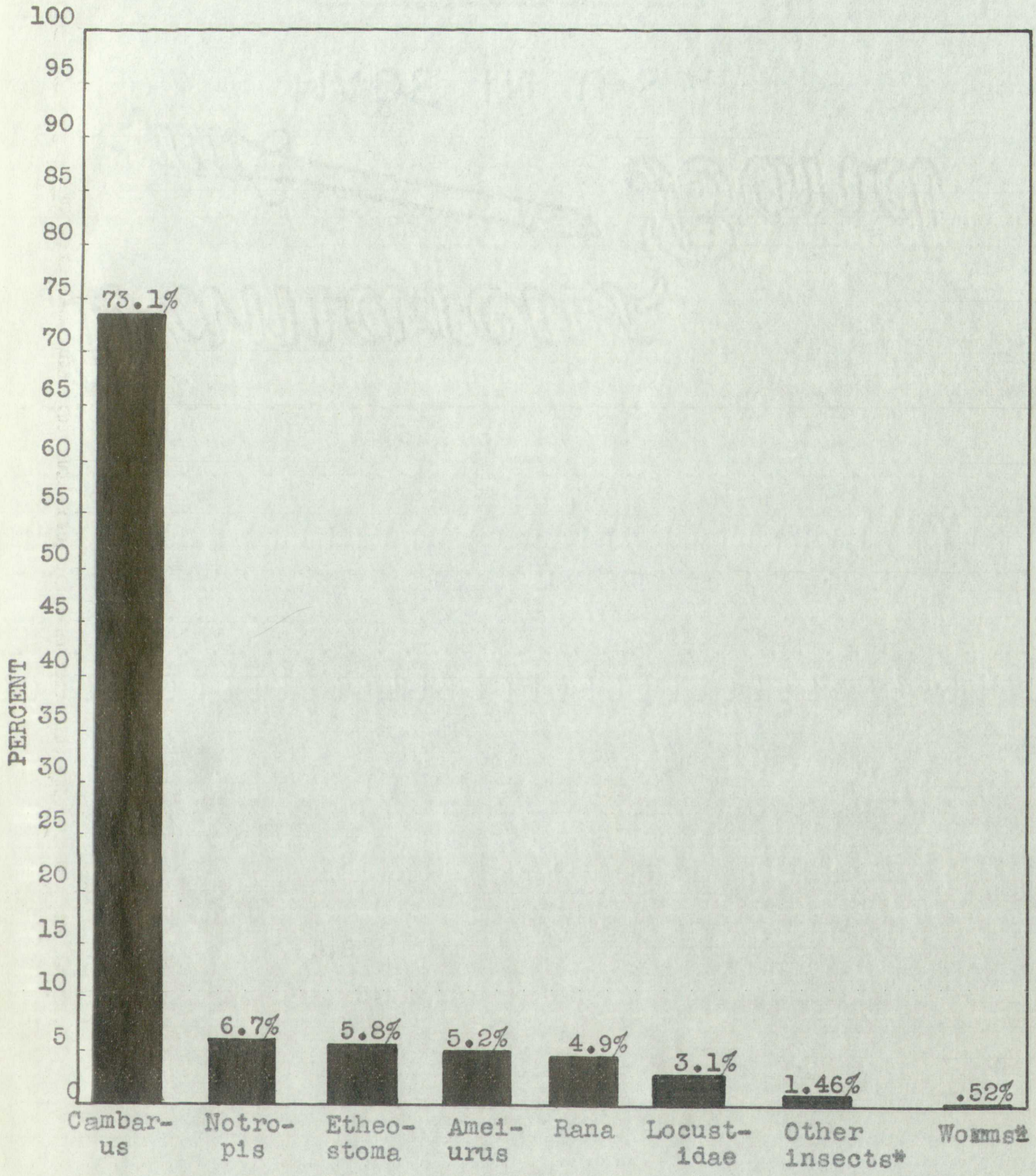


FIGURE II

PERCENT OF STOMACH CONTENTS BY WEIGHT

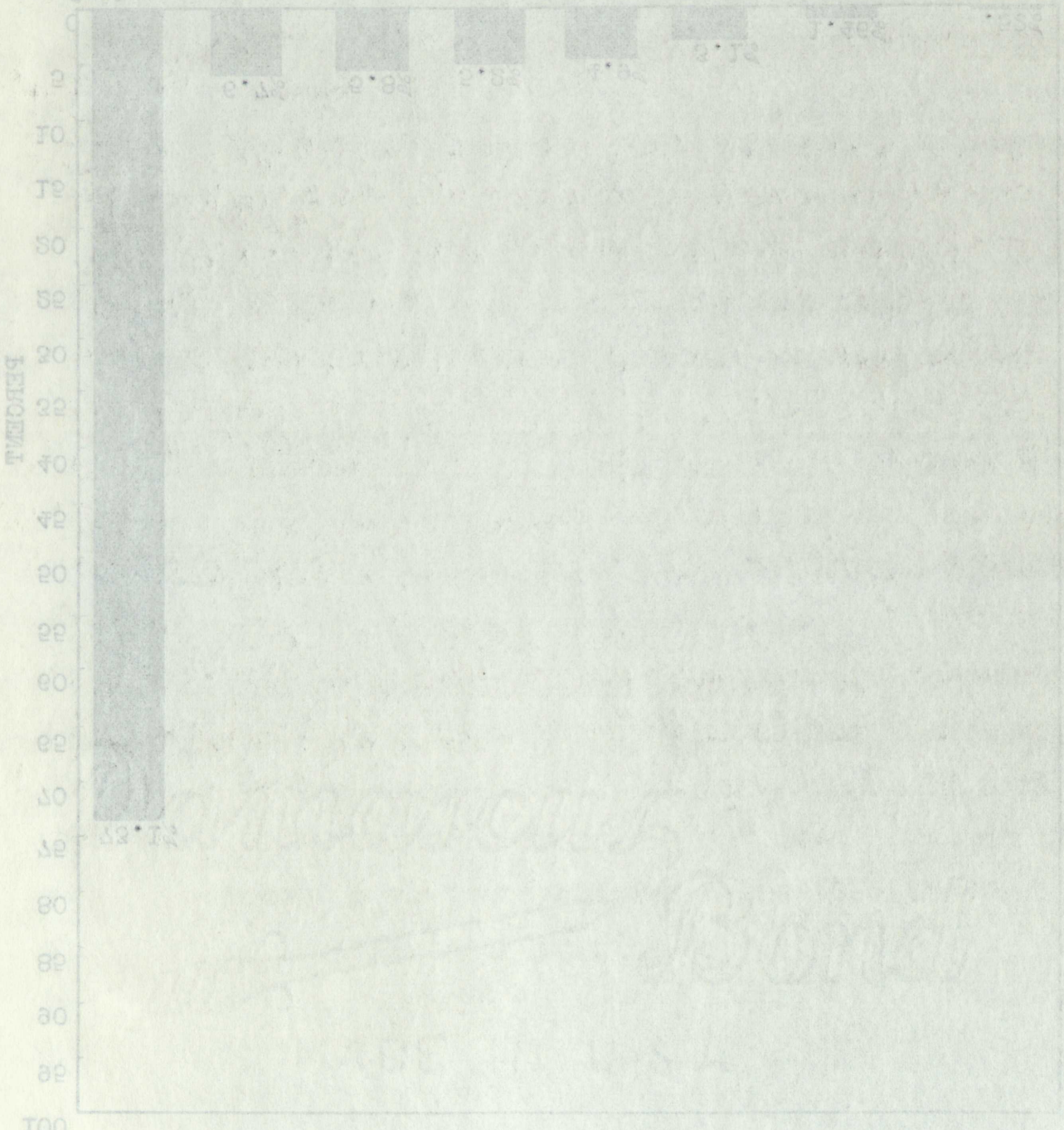
* Includes Odonata, Ephemerida, Diptera, and Coleoptera
* Includes Hirudinea, Fresh-water Oligochaeta, and Nematoda

* Includes Nitrogen, Free-water Oil-soluble, and Ammonia

* Includes Sediment, Entrained Water, and Carbonate

PERCENT OF AMMONIA COMPOUNDS BY WEIGHT

FIGURE II



CHAPTER IV

SUMMARY OF FINDINGS

According to the data collected, mature Micropterus dolomeiu fed principally on crayfish of the Genus Cambarus. The combined fishes on which Micropterus dolomeiu fed made up only one-sixth of the total food eaten. All other food groups were comparatively unimportant, representing approximately one-tenth of the total volume and weight of the contents.[12]

The varied character of the food of Micropterus dolomeiu indicated little selection except within food groups. The combined Cambarus and fishes represented ninety percent of the total weight of the food.[13]

The mature Micropterus dolomeiu were collected entirely by hook and line fishing.[14] This fact is important since the fish taken in this manner were definitely feeding. In contrast to this type of study an investigation should be made of similar size groups that were not feeding. This could be accomplished only through the use of seines.

The fish that were collected represented all normalsize groups over ten inches. The collections were attempted at different times during the day, but the late afternoon and early evening fishing produced over eighty percent of the fish

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[12] Figure I and II, pps. 18,19, in this study.

[13] Table II, pps. 12, 13, 14, 15, 16 in this study.

[14] Table I, pps. 10, 11 in this study.

collected.[15]

This type of investigation in itself is of little practical value if it is not subsequently followed by other investigations similar to the one just completed. This would increase the scope of the food study of Micropterus dolomeiu to include more varied local and climatic conditions.

Further studies should be made of the food of the smaller size groups of the Micropterus dolomeiu. Availability of food in the streams should be investigated. Recommendations should be made wherever necessary to modify the streams or lakes so as to produce or restock them with the essential food of Micropterus dolomeiu. The enemies of these fish including turtles, kingfishers, and herons should be reduced to a minimum. Illegitimate seining should be eliminated by more complete supervision by authorities.

If the small-mouthed black bass, Micropterus dolomeiu, is to be successfully propogated in its natural habitat, it must be assured of a readily available supply of food for all size groups.

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[15] Table I, pps. 10, 11 of this study

BIBLIOGRAPHY

Forbes, Stephen A., The Fishes of Illinois. Illinois State Journal Company, Springfield, 1920. Natural History Survey of Illinois, Vol. III, p.265.