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Feeding Habits of Juvenile Largemouth Bass Micropterus Salmoides (Lacepede)

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THE CARL AND WINIFRED LEE HONORS COLLEGE

CERTIFICATE OF ORAL EXAMINATION

Thomas Goodwill, having been admitted to the Carl and Winifred Lee Honors College in 1991, successfully presented the Lee Honors College Thesis on July 8, 1996.

The title of the paper is:

"Feeding Habits of Juvenile Largemouth Bass Micropterus salmoides (Lacepede)"

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7260 S. Stony Lake Road
Jackson, Michigan 49201
December 15, 1996

Dr. Joseph Reish
Lee Honors College
Western Michigan University
Kalamazoo, Michigan 49008

Dear Dr. Reish:

Enclosed is the final version of my Honors College thesis. My defense sheet has been on file with the Honors College for some time now, but I have included another copy of it, just in case the first one was misplaced. Currently, my thesis is being considered for publication in the Gulf Reports, for 1997, and is being edited by Dr. Richard Heard.

Everything is going well with me. I am enjoying my job as a program instructor for outdoor environmental education. Well, I should get going now. Take care and have a good holiday season.

Sincerely,

Thomas R. Goodwill

Thomas R. Goodwill
(517)536-8607 ext. 53

Feeding Habits of Juvenile Largemouth Bass, *Micropterus salmoides* (Lacepede) in a Brackish Tidal River

by
Thomas R. Goodwill
with help from
Dr. Richard Heard
Dr. Joseph Engemann
Kathy VanderKooy
Dr. Chet Rakocinski

December 1996

Abstract

The stomachs of 110 juvenile largemouth bass, Micropterus salmoides (Lacepede) were examined to learn the early feeding habits of bass in a brackish environment (Davis Bayou, Ocean Springs, Mississippi). Bass were found to have five primary food sources: Taphromysis bowmani, Cloeon sp., Gammarus mucronatus, Micropterus salmoides, and Lepidophthalmus louisianum. Three feeding trends were observed during the course of the study. First, bass seemed to display prey selection. Second, bass length increased as prey size increased. Third, the types of prey eaten by the bass changed as the bass increased in size.

Introduction

Many studies have been done on the feeding habits of largemouth bass in freshwater (Hickley et al. 1994, Rogers 1967, McDowall 1968, Clady 1974, Lewis et al. 1974, Applegate and Mullen 1967). However, there is little literature about the feeding habits of bass in brackish environments. Even less has been written about the specific feeding habits of juvenile largemouth bass in brackish environments. The only two known studies on Micropterus salmoides (Lacepede) in brackish environments are two unpublished papers (Coleman 1974 , McMiller 1993). One was a graduate thesis (Coleman 1974) that looked at all ages of bass and identified prey by groups only. The other was a summer class paper (McMiller 1993) that looked at juvenile largemouth bass in Davis Bayou (Ocean Springs, MS), and identified some prey to genus and species, but most by groups. However, this is the first known study to focus on the feeding habits of juvenile largemouth bass in a brackish environment, attempting to identify all prey by genus and species.

Materials and Methods

Specimens used during this project were a by-catch, except two collections (July and August 1995), from the collections taken by Kathy VanderKooy (graduate thesis on Lepomis). Bass were gathered from two different sites located in Davis Bayou (Ocean Springs, MS). Specimens were collected twice a month by Felder, from March 1994 to February 1995, except two collections made by the Gulf Coast Research Laboratory class, Fauna and Faunistic Ecology, in July and August 1995. A total of 20 collections (110 fish) of specimens were used for the project. Because, no bass were collected in some months by VanderKooy and other months only one collection contained bass.

Specimens were gathered using cast and kick nets both from skiffs and the water's edge. The nets were used in areas of vegetation containing submerged Ruppia maritima and Vallisneria americana. Gathered specimens were immediately placed in vials (10% formalin) for preservation. Specimens were weighed and various measurements taken and recorded (total length, standard length, head length, gape width). Bass were then switched to 70% alcohol and dissected within three days.

Micropterus salmoides were dissected by using scissors to remove the head and tail. The head was removed just anterior to the gill slits, while the tail was removed just posterior to the anal opening. Scissors were used to cut just beneath the ribs of both lateral lines to expose the stomach and intestines. The stomach and intestines were taken out of the body, separated from one another, using forceps, and placed into two petri dishes. Petri dishes contained water.

After dissection of the stomach and intestines, their contents were examined under a dissecting microscope and identified. All identifications were recorded, on data sheets, with unknown/uncertain specimens being saved for future reference.

Results

The stomach contents of 110 largemouth bass were examined. Thirty-four (30.91 %) of the bass stomachs were empty. A total of 381 organisms were found in the stomachs. Counts were not noted from intestines, since organisms found in intestines cannot be accurately counted. Information from intestines was used to give general information on the feeding habits of bass.

Table 1 indicates that eighteen different types of prey were eaten by juvenile bass. Taphromysis bowmani was found in the most stomachs (32.73 %) and comprised the highest numerical percentage of prey found in bass stomachs (52.49%). Gammarus mucronatus were found to be second highest (21.82%) in the frequency of occurrence, but third highest (10.76 %) for numerical percentage of prey found in stomachs. Cloeon sp. was third highest (10.91 %) in the frequency of occurrence and second highest (12.34 %) for numerical percentage of prey found in stomachs. Remaining 15 prey types were found in significantly less amounts in both frequency of occurrence in which prey was found and in numerical percentage of prey found in the stomachs.

Figure 1 displays the trend that as the length of bass increases so does the size of the prey that it eats. Size class 1 fish (0-50 mm) had the highest percentage of prey eaten for the prey size range of 1-5 mm, and did not eat any prey larger than 15 mm in length. Size class 2 fish (50-80 mm) ate prey of all sizes, but ate the most prey in the range of 4.3-6 mm. Size class 3 fish (>80 mm) ate prey of all sizes, but ate prey that were mostly 6 mm or greater in length.

Table 2 indicates that for size class 1 (bass length 0-50 mm) that Cloeon sp. (5 mm). had the highest frequency of occurrence (27.27%) of prey found in stomachs. Taphromysis bowmani (6 mm) was second at 24.85 %. For size class 2 (bass length 50-80 mm) Taphromysis bowmani (6 mm) was highest (84.0 %) with Gammarus mucronatus (4 mm) second (8.67 %). In size class 3 (bass length >80 mm) Taphromysis bowmani (6 mm) was first at 50.0 % with Lepidophthalmus louisianum (10 mm) second (25.76 %).

Figure 2 displays the frequency of occurrence of the top three prey items ingested by Micropterus salmoides versus the standard length of the bass: T. bowmani, Cloeon sp., and G. mucronatus. T. bowmani was eaten by all sizes of bass, but is most frequent in fish that are >55 mm in length. Cloeon sp. was found in a wide range of fish sizes, but was most frequent in the range between 47.1-54.2 mm. Frequency of occurrence for G. mucronatus remained steady in all sizes of juvenile largemouth bass.

Discussion

Juvenile largemouth bass are known to eat a wide variety of prey, and this study is no exception. Eighteen different types of prey were eaten by the bass in this study. However, three types of prey made up over 75% of the total prey eaten by all of the bass. The three items are Taphromysis bowmani, Cloeon sp., and Gammarus mucronatus. It is important to note that of the 75% of the total prey eaten, T. bowmani represents 52.49%, making it the most frequently eaten prey.

The results suggest that juvenile bass exhibit prey selection when feeding. The problem is being able to discern whether the bass are showing preference or eating the most abundant prey. Unfortunately, the abundance of prey available in Davis Bayou for the time of this study is not known. Hickley et al.(1993) in their 5 year study observed the same types of prey being eaten year after year, which suggests the possibility that fish show prey selection. It should be noted that most of the literature done on bass usually covers one to two years of observations. This makes it hard to establish enough data to show prey selection, especially since the abundance of prey can vary every year (Lewis et al 1974). The length of time for observations of the feeding habits of juvenile largemouth bass in Davis Bayou is one year and four months of combined time, including McMiller's study (1993). From the observations made, there is quite a lot of agreement in the groups of prey being eaten the most by the bass (see Table 3). There is not, however, enough data to specifically show what prey is preferred the most by M. salmoides, especially when mysids were eaten the most in this study and barely eaten in McMiller's. Therefore, one cannot prove that juvenile largemouth bass are showing prey selection, but such selection may possibly be indicated with further observations.

A trend that has been displayed is that as the length of the bass increase, so does the size and type of prey ingested. Figure 1 exhibited the fact that fish that were 50 mm or less in length ate prey mostly in the range of 1-5 mm and that fish that were >80 mm ate prey mostly 6 mm or greater in length. The trend indicated by Figure 1 would be even more convincing if 58.82% of the fish stomachs in class 3 (> 80 mm in length) were not empty (see Figure 1). Research by J. M. Lawrence (1956) supports the observed trend of bass eating larger prey as the fish grows larger. Lawrence found that Micropterus salmoides eats prey whose width is slightly less than the gape width of the fish eating the prey, if the prey is available (Lawrence 1956).

The trend from Figure 1 is important, but what is more important to understanding the feeding habits of bass is what the bass are eating over time. Unfortunately, the collections used for this project are not consistent enough to be able to do that accurately. For example, no fish were collected in the month of May, while 36 fish were collected in June (averaged 8.46 fish/month). What can be done, however, is to look at what the bass are eating as they grow in size.

Table 2 and Figure 2 indicate that Cloeon sp. (5 mm in length) is the most commonly eaten prey for class 1 fish (bass length: 0-50 mm) and fish around the size of class 1. The table and figure show that Taphromysis bowmani (6 mm in length) is eaten the most frequently by fish that are in class 2 (bass length: 50-80 mm) and class 3 (bass length: >80 mm). However, it should be noted that if over half of the bass in class 3 were not empty, then T. bowmani probably would not have been the most eaten item in class 3. Something like M. salmoides (length 25.6 mm) or L. Louisianum (length 10 mm) probably would have been the top prey item, especially since the two prey represent over 40% of the prey eaten by bass in class 3. Table 2 and Figure 2 also display that G. mucronatus (4.3 mm in length) is an important food source for bass of sizes 1 and 2, with a slight tendency to be eaten by juveniles that are in class size 2 (bass length: 50-80 mm). Therefore, Cloeon sp., Taphromysis bowmani, M. salmoides, L. Louisianum, and G. mucronatus seem to represent the primary foods eaten by juvenile bass in Davis Bayou.

It is apparent from the observations made during the course of this project, that a lot more research needs to be done to learn the feeding habits of juvenile largemouth bass in a brackish environment. First, juvenile largemouth bass in a brackish environment need to be studied on a long term basis. Second, collections used for the project need to be consistent enough to allow for a more accurate look at the feeding habits of the bass over time. Third, the abundance of prey in the brackish environment (i. e., Davis Bayou) needs to be known to better be able to judge whether bass feed more opportunistically or show preference for certain prey types.

The information presented in the study is only surface of what can be known about the feeding habits of juvenile largemouth bass in a brackish environment. The study is meant to be a stimulus for others to seek out the knowledge of how juvenile Micropterus salmoides, feeding in a brackish environment, effects the overall ecology of a bayou.

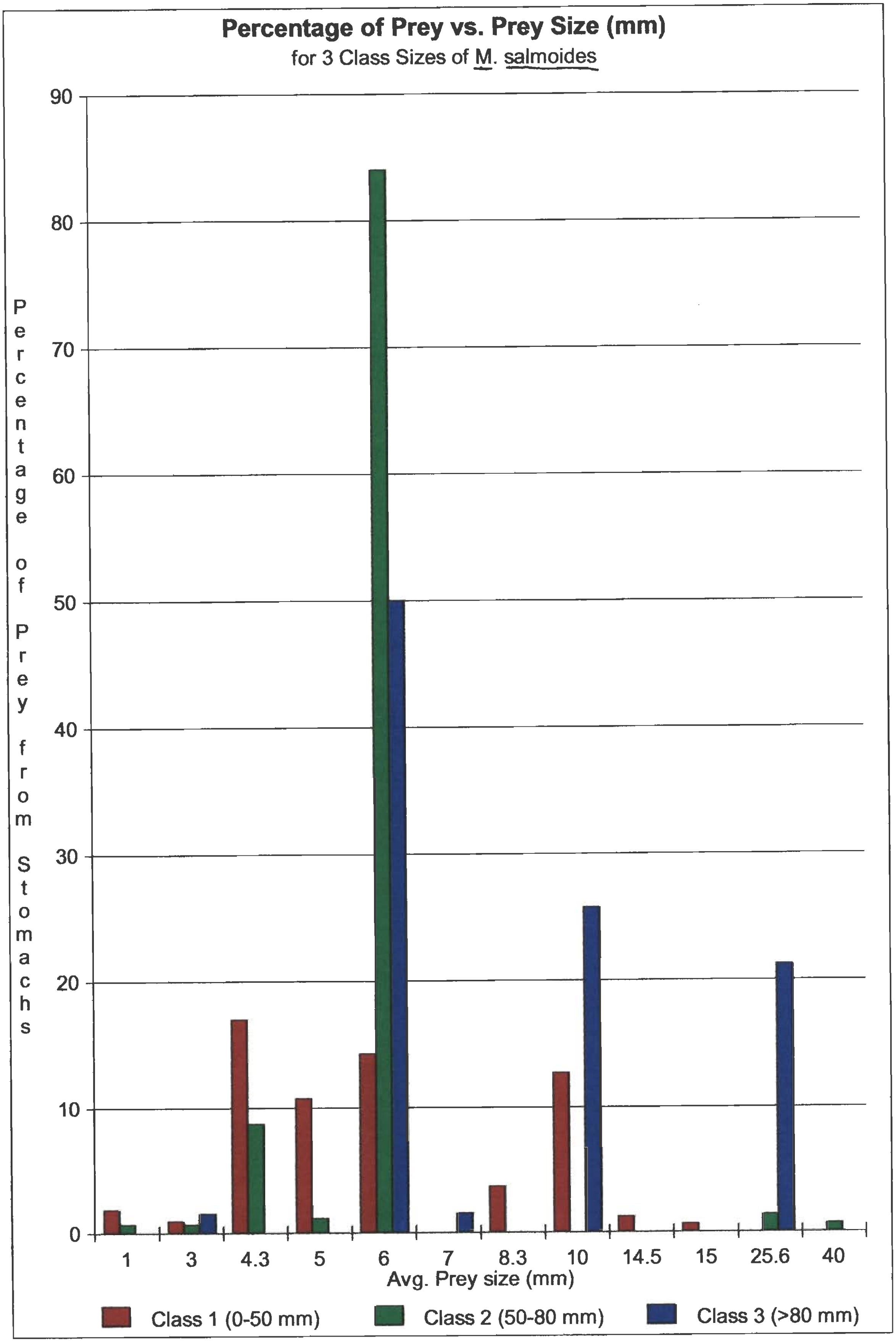
Table 1

Percentage of Stomachs Prey were found and Percentage of Prey found in Stomachs of *M. salmoides*

Prey	Percentage of stomachs prey was found in	Percentage of prey found in stomachs
Insects:		
Ischnura sp.	1.82	0.52
Gerris sp.	2.73	0.79
Family Baetidae	2.73	1.57
Caenis sp.	3.64	1.57
Cloeon sp.	10.91	12.34
Family Corixidae	2.73	1.57
Family Ceratopogonidae	2.73	1.05
Family Chironomidae	1.82	0.26
Dragonfly larvae	0.91	0.52
Amphipods:		
Gammarus mucronatus	21.82	10.76
Grandidierella bonnieroides	2.73	1.31
Decapods:		
Palaemonetes pugio	0.91	0.26
Palaemonetes paludosus	0.91	0.26
Palaemonetes sp.	0.91	0.26
Lepidophthalmus louisiana	1.82	9.97
Mysids:		
Taphromysis bowmani	32.73	52.49
Fish:		
Fundulas pulvereus	0.45	0.26
Micropterus salmoides	5.45	4.20

Prey total: 381
Total number of Stomachs: 110

Figure 1



Percentage of Prey vs. Prey Size (mm)
for 3 Class Sizes of M. salmoides
90
80
70
60
50
40
30
20
10
0
Percentage of Prey from Stomachs
1
3
4.3
5
6
7
8.3
10
14.5
15
25.6
40
Avg. Prey size (mm)
Class 1 (0-50 mm)
Class 2 (50-80 mm)
Class 3 (>80 mm)

Table 2

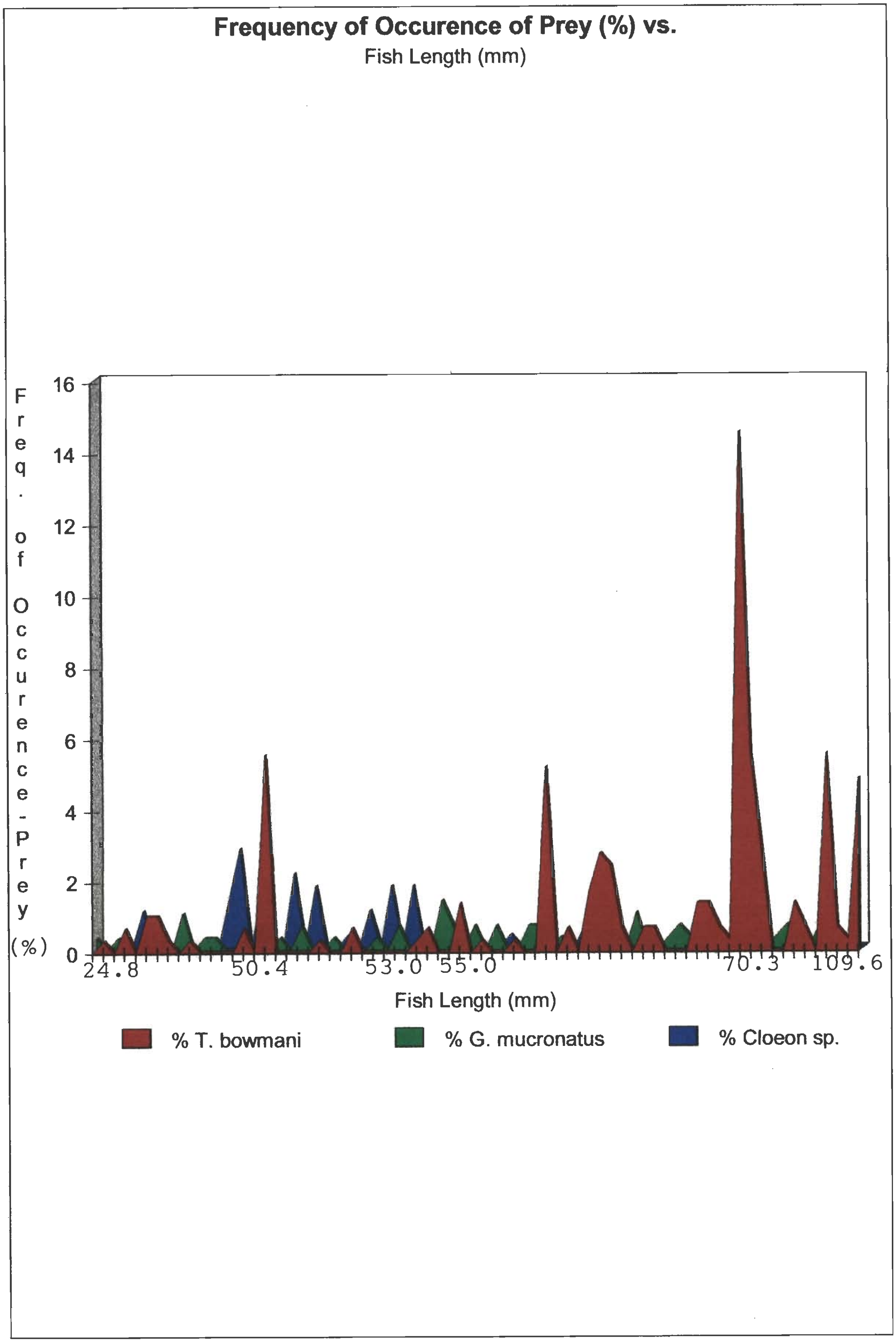
Average Size and Percentage of Prey found in 110 Stomachs of Three Class Sizes of *Micropterus salmoides*

Prey	Avg. size (mm) of prey	% of Prey in Fish Size 1 (0-50mm) n=38	% of Prey in Fish Size 2 (50-80mm) n=35	% of Prey in Fish Size 3(>80 mm) n=37
Insects:				
Ischnura sp.	14.5	1.21	0.00	0.00
Gerris sp.	3	0.61	0.67	1.52
Family Baetidae	5	3.03	0.67	0.00
Caenis sp.	6	3.64	0.00	0.00
Cloeon sp.	5	27.27	1.33	0.00
Family Corixidae	8.3	3.64	0.00	0.00
Family Ceratopogonidae	1	1.82	0.67	0.00
Family Chironomidae	3	1.21	0.00	0.00
Dragonfly larvae	-	0.61	0.00	0.00
Amphipods:				
Gammarus mucronatus	4.3	16.97	8.67	0.00
Grandidierella bonnieroides	5	1.82	1.33	0.00
Decapods:				
Palaemonetes pugio	7	0.00	0.00	1.52
Palaemonetes paludosus	15	0.61	0.00	0.00
Palaemonetes sp.	-	0.00	0.67	0.00
Lepidophthalmus louisiana	10	12.73	0.00	25.76
Mysids:				
Taphromysis bowmani	6	24.85	84.0	50.00
Fish:				
Fudulas pulvereus	40	0.00	0.67	0.00
Micropterus salmoides	25.6	0.00	1.33	21.21

Total number of prey items per size class: 165 150 66

Prey total: 381

Figure 2



Frequency of Occurence of Prey (%) vs.
Fish Length (mm)
Freq. of Occurence-Prey (%)
16
14
12
10
8
6
4
2
0
24.8
50.4
53.0
55.0
70.3
109.6
Fish Length (mm)
% T. bowmani
% G. mucronatus
% Cloeon sp.

Table 3

Comparison of the Percentages of Prey Numbers from Two Studies of *Micropterus salmoides* in Davis Bayou*

Prey	# of prey found in stomachs (McMiller)	% of prey found in stomachs (McMiller)	# of prey found in stomachs (Goodwill)	% of prey found in stomachs (Goodwill)
Order Hemiptera	5	2.45	9	2.36
Order Ephemeroptera	24	11.76	59	15.49
Order Odonata	25	12.25	3	0.79
Order Diptera	2	0.98	6	1.57
Order Mysidacea	3	1.47	200	52.49
Order Amphipoda	28	13.72	46	12.07
Order Decapoda	18	8.82	41	10.76
Fish	23	11.27	17	4.46

Total prey (McMiller): 204
Total prey used in table: 128

Total prey (Goodwill): 381
Total prey used in table: 381

*Compatible groups compared only

Prey Taxa Found in the largemouth bass, Micropterus salmoides

- Phylum Arthropoda
  - Subphylum Hexopoda (Insecta)
    - Order Hemiptera
      - Family Gerridae
        - Gerris sp.
      - Family Corixidae
        - unident. sp. A
    - Order Ephemeroptera
      - Family Baetidae
        - Caenis sp.
        - Cloeon sp.
    - Order Odonata
      - Suborder Zygoptera (Damselflies)
        - Family Coenagrionidae (Narrowwinged damselflies)
          - Ischnura sp.
      - Suborder Anisoptera (Dragonflies)
        - unident. dragonfly larva
    - Order Tricoptera
      - Family Leptoceridae
        - unident. sp. A
    - Order Diptera
      - Family Ceratogonidae
        - unident. sp. A
      - Family Chironomidae
        - unident. spp.
  - Subphylum Crustacea
    - Order Mysidacea
      - Family Mysidae
        - Taphromysis cf. bowmani Bacescu, 1961
    - Order Amphipoda
      - Family Gammaridae
        - Gammarus cf. mucronatus Say, 1818
      - Family Aoridae
        - Grandidierella bonnieroides Stephensen, 1948
    - Order Decapoda
      - Family Palaemonidae
        - Palaemonetes paludosus (Gibbes, 1850)
      - Family Callianassidae
        - Lepidophthalmus louisiana (Schmitt, 1935)

Phylum Chordata
Class Osteichthyes
Order Perciformes
Family Centrachiidae
Micropterus salmoides (Lacepede, 1819)
Family Cyprinodontideae
Fundulus pulvereus (Evermann, 1892)

Parasites Observed

Phylum Platyhelminthes
Class Digenea
Family Heterphyidae
Phagicola nana (Ransom, 1920)
Phylum Acanthocephala
Order Echinorhynchidea
Family Echinorhynchidae
Leptohynchoides thecatus (Linton, 1891)

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