

Segment Completion Report

Leo D. Lewis, Project Leader  
Walter W. Dalquest, Assistant Project Leader

TITLE

Laboratory and Statistical Analyses of Materials and Data Collected in the Field.

OBJECTIVES

1. To determine the following from laboratory examination of field-collected specimens and data:
  - a. Food Habits.
  - b. Sexual development and spawning success.
  - c. Comparative physical condition (Coefficient of Condition).
2. To determine population estimates and trends from field data.

TECHNIQUES

Data for item 1, above, was obtained by field collections, field notes, and laboratory studies. Techniques are explained in full detail in the following pages.

Population estimates and trends (Item 2, above) were determined in the field with the aid of gill-nets, seines and rotenone collections. This information for the concerned waters, Buffalo Lake and the Little Wichita River, has been reported elsewhere (Completion Reports, Job B-9, and Jobs A-3 and B-8, combined, respectively).

BACKGROUND

This is the third segment completion report on this job. The first (F7R1) covered data obtained from Lake Diversion, Lake Kemp and Lake Kickapoo. The second (F7R2) included Lake Wichita and the Big Wichita River. With the inclusion of Buffalo Lake and the Little Wichita River in the present report, the volume of data, all collected in similar fashion and strictly comparable, becomes especially valuable.

FOOD HABITS

Stomachs of predacious fishes were examined in the field by opening the body wall and squeezing the stomach between thumb and forefinger. Bulk of the stomach alone did not prove the presence of food, because some fishes, especially catfishes, swallow water when captured and their stomachs may be greatly distended although free of food. If solid materials are felt through the wall of the stomach, a thread is tied tightly around the base of the esophagus and another is tied around the duodenum, and the stomach cut free. A label is tied to the stomach, stating locality and date of capture, species of fish, sex, length and weight. A few small holes are punched in the stomach wall, and the organ is dropped into a container of formalin solution, to be opened in the laboratory at a later date.

In the laboratory, the stomach to be opened is first soaked in water for several hours. Then the label is removed and the label data written at the top of a sheet of paper. The stomach is slit completely open and the contents washed into a small, white enamel pan. The contents are examined, identified and noted on the proper sheet of paper. Materials were not recorded unless identification was reasonably certain. Statements such as "unidentifiable fish remains" are meaningless, because all predacious fishes are presumed to eat other fishes. Because the aquatic fauna, both vertebrate and invertebrate, of Buffalo Lake and the Little Wichita River are different, food habits of fishes from each area are discussed separately.

Hiodon alosoides - Goldeye. Seven specimens containing food were taken, all from the Little Wichita River. These stomachs contained remains of insects only. This is rather surprising on two counts. First, the fishes managed to find considerable insect food even in the winter months, when supposedly few insects were present. Second, the goldeye does eat fishes on occasion because many are taken by fishermen using minnows for bait. Perhaps the goldeyes attack fishes only when the latter are injured.

A goldeye taken July 28, 1955, contained only a large shorthorn grasshopper. Five specimens taken November 23, 1955, contained food as follows: (1) finely-divided insect remains, including a large grasshopper, 2 blue-bottle flies, 1 robber fly, 1 carabid beetle, and 1 stinkbug; (2) considerable finely-divided and unidentifiable insect remains and 1 large tiger beetle, 2 lady beetles, 4 or 5 chrysomelid beetles and a stinkbug; (3) crammed with insect remains, not as finely chewed as numbers 1 and 2, including 1 large yellow-jacket, 1 large assassin bug (wheelbug), 3 or 5 small phalaenid moths and a grasshopper; (4) 1 grasshopper, 2 phalaenid moths, 1 house fly, 1 mayfly larva and several tiny insects too digested to identify; (5) crammed to bulging with 55 phalaenid moths, all of the same species and the same as contained in numbers 3 and 4 above.

A fish taken March 29, 1956, contained only two species of insects but was filled to bulging. The catch included 11 carabid beetles and 9 tiger beetles.

Ictalurus punctatus - Channel Catfish. Arthropods and fishes were the principal food eaten by channel catfish in both Buffalo Lake and the Little Wichita River. In general, smaller fishes fed more extensively on insects and larger individuals ate more fishes. Details are shown in the following two tables.

Table 1. Food of Channel Catfish in the Little Wichita River.

Food Item	Frequency of Occurrence	Total Number Identified
Gizzard Shad ( <u>Dorosoma</u> )	2	2
Carp sucker ( <u>Carpiodes</u> )	2	2
Crappie ( <u>Pomoxis</u> )	1	1
Grasshopper ( <u>Orthoptera</u> )	1	5
Dragonfly ( <u>Odonata</u> )	1	1
Cicada ( <u>Homoptera</u> )	1	1
Crayfish ( <u>Procambrus</u> )	3	3
Grass Shrimp ( <u>Palemanotes</u> )	1	2

Note: In addition to the above materials, the following was found: two catfish had swallowed a number of large scales of individual fishes far too large to have been prey of the catfishes. The catfish that had eaten the dragonfly larva also held a large wad of algae that might have been swallowed inadvertently along with the larva.

Table 2. Food of Channel Catfish in Buffalo Lake.

Food Item	Frequency of occurrence	Total Number Identified
Lizard ( <u>Holbrookia</u> )	1	1
Gizzard Shad ( <u>Dorosoma</u> )	5	5
Carp sucker ( <u>Carpiodes</u> )	1	1
Carp ( <u>Cyprinus</u> )	1	1
Goldfish ( <u>Carassius</u> )	2	2
Shiner ( <u>Notropis</u> )	1	1
Bullhead ( <u>Ameiurus</u> )	1	1
Damselfly ( <u>Odonata</u> )	1	1
Grasshopper ( <u>Orthoptera</u> )	7	31
Cricket ( <u>Orthoptera</u> )	1	1
Stinkbug ( <u>Hemiptera</u> )	1	1
Carabid Beetle ( <u>Coleoptera</u> )	1	1
Blister Beetle ( <u>Coleoptera</u> )	2	3
House Fly ( <u>Diptera</u> )	1	1
Honey Bee ( <u>Hymenoptera</u> )	1	1

Note: In addition to the above, the following trash was found: fish scales in 6 stomachs, an old, dried pectoral fin of a fish in 1, and algae in 3.

Pilodictus olivaris - Flathead Catfish. One specimen from the Little Wichita River contained two small Dorosoma cepedianum and many scales that seemed to be from a carpsucker. A second individual contained a complete crappie (Pomoxis) about six inches in length. Our only full stomach from Buffalo Lake held two small gizzard shad and a small crawling water beetle. The insect may have been swallowed by accident, because all our other data indicates that the flathead catfish feeds exclusively on fishes.

Ameiurus melas - Black Bullhead. Two specimens from the Little Wichita River contained food. One held a small carpsucker, about two and one-half inches long, and the other held a freshly-swallowed grasshopper.

Morone chrysops - White Bass. The only specimen with food in its stomach came from the Little Wichita River. It contained a single silvery plains minnow (Hybognathus) that may have been a bait minnow.

Micropterus salmoides - Largemouth Black Bass. Large specimens of the black bass are usually piscivorous. Two specimens from the Little Wichita River held fish in their stomachs: one, an orange-spotted sunfish (Lepomis Humilis) and the other, a small bullhead, probably Ameiurus melas. We obtained nine filled stomachs in Buffalo Lake that contained identifiable fish remains: eight held one gizzard shad (Dorosoma), one held a small goldfish in addition to a shad, and one held a small white bass (Morone chrysops).

Pomoxis annularis - White Crappie. Many crappie with filled stomachs were taken, but in many instances the food present could not be identified beyond the obvious fact that it was fish remains. In the Little Wichita River, seven stomachs contained a total of 11 gizzard shad (Dorosoma); one contained a small sunfish with a deep body, probably Lepomis megalotis; two contained a total of three grass shrimp (Palaemonetes); one contained four tiny insects, possibly mosquitos.

Food items found in crappie from Buffalo Lake are shown in the following table.

Table 3. Food of White Crappie from Buffalo Lake

Food Item	Frequency of Occurrence	Total Number Identified
Gizzard Shad ( <u>Dorosoma</u> )	19	24
Goldfish ( <u>Carassius</u> )	1	1
Shiner ( <u>Notropis</u> )	5	11
Sunfish ( <u>Lepomis</u> )	1	1
Crappie ( <u>Pomoxis</u> )	1	1
Grasshopper ( <u>Orthoptera</u> )	1	2
Backswimmer ( <u>Hemiptera</u> )	1	1

Note: One large crappie contained the pectoral fin of another large crappie, freshly severed with a knife and obviously scrap from a fisherman's catch.

#### SEXUAL DEVELOPMENT AND SPAWNING SUCCESS

Larger fishes were opened in the field and their gonads examined and the stage of development recorded. If the gonads were of medium-size or smaller, and were poorly-developed, they were recorded as "immature." If they were large and well-developed, obviously approaching spawning condition, they were termed "ripe." In those few instances where a fish was captured shortly after spawning, it was called "spent." The latter condition is difficult to determine in males but easier in females.

Immature individuals of the larger fishes were taken in seine drags and measured and counted. In addition, notes were made of schools of fry seen, young fishes found in the stomachs of predacious fishes, etc.

When ovaries contained large eggs, nearly ready to be spawned, the two ovaries of such a fish were carefully removed, labeled and preserved in formalin. In the laboratory, the ovaries were carefully cleaned of excess tissues and weighed to the nearest one-tenth of a gram. Then a small quantity, roughly a gram, was snipped from one ovary and weighed on a chemical balance to the nearest one-one hundredth of a gram. The eggs in the small portion were then counted and the total number of eggs present in the two ovaries estimated (number of eggs counted times weight of both ovaries divided by the weight of the small section).

Lepisosteus osseus - Longnosed Gar. Females of large size from the Little Wichita River were listed as "ripe" from February through September. The main spawning season comes in early June and growth of the young is rapid. In July, they are scarcely larger in diameter than a lead pencil, but in August, they range from 9 to 11 inches in length. A seven-inch specimen as thick as a man's thumb was taken June 25.

Lepisosteus platostomus - Shortnosed Gar. Little information was gained on this species this year. A female taken May 15, was recorded as "spent," but this might have been an error. A large female taken October 16, was "ripe." No fry or young were taken in seine drags.

Dorosoma cepedianum - Gizzard Shad. Shad become "ripe" as early as mid-May but the major spawning season is mid-June. The young-of-the-year are common in May and June and become abundant in July. There are usually a few off-season spawns that sometimes are quite successful.

Hiodon alosoides - Goldeye. Most adult female goldeyes were ripe from January to May in the lower Little Wichita River. Not only were the eggs large, but even a moderately-firm squeeze would force separated eggs from the cloaca. There was every evidence of spawning, and a few fish were even recorded as "spent." Nevertheless, we did not actually find goldeyes spawning, and much seining failed to take goldeye fry.

Ictiobus bubalus - Smallmouth Buffalo. A few ripe females were taken in May, but no fry or young were captured in the past project year.

Ictiobus cyprinellus - Bigmouth Buffalo. Three females, one taken in November, one in December and one in January, were all recorded as "ripe." No other information about the spawning of the species was obtained this year.

Carpiodes carpio - River Carpsucker. The principal spawn of this fish occurs in May, June and sometimes early July. A fair number of individuals are in spawning condition at almost every time of the year. Young carpsuckers also are found every month of the year.

Cyprinus carpio - European Carp. The carp usually become ripe in May, but actual spawning seems to be deferred until the spring rains raise the water level. The spawning season of this species is quite uniform in our area.

Carassius auratus - Goldfish. There is some overlap in the spawning seasons of the carp and the goldfish, but in Buffalo Lake, most of the carp have completed spawning before the goldfish begin.

Carassius x Cyprinus - Carp-Goldfish Hybrid. A very few ripe female hybrids were taken in Buffalo Lake in late May.

Ictalurus punctatus - Channel Catfish. The main spawn of this species occurs in late June in our waters, and sometimes later. Some young channel catfish, only an inch or so long, are taken as late as August.

Ameiurus melas - Black Bullhead Catfish. No ripe females were taken during the project year, but fry were found in late May. In August, the young were about one and one-half inches long at Kickapoo Station; in September, two inches long; in October three inches long. These were not found on later visits to the same locality.

Pilodictus olivaris - Flathead Catfish. Spent females were taken at Lake Kickapoo on May 15. Ripe females were taken at Buffalo Lake in August. Young flatheads, two to three inches long, were taken at Henrietta Station in September.

Morone chrysops - White Bass. The major white bass spawn came in mid-May this past year. We found no out-of-season spawners this year.

Micropterus salmoides - Largemouth Black Bass. Large black bass were almost all ripe in late May of the project year. Spawning probably did not occur until well into June.

Pomoxis annularis - White Crappie. In the past project year, the main crappie spawn came in mid-April, and only an occasional ripe female was found after that date.

Table 4. Reproductive Potential

Length of Fish	Weight of Fish	Total Number of Eggs
<u>DOROSOMA CEPEDIANUM</u>		
296	381	109,760
294	401	34,425
290	410	44,886
295	410	121,375
295	456	68,266
309	480	201,119
<u>HIODON ALOSOIDES</u>		
290	248	189,321
295	432	152,240
300	466	141,566
298	598	212,596
<u>CARPIODES CARPIO</u>		
345	1,280	300,955
367	1,460	359,068
382	2,000	377,509
436	3,025	551,045
<u>CYPRINUS CARPIO</u>		
284	575	122,553
310	670	82,861
308	680	576,627
305	700	348,135
300	715	122,040
320	760	377,696
330	890	82,408
330	925	100,016
345	1,050	137,101
475	2,230	275,401
<u>CARASSIUS AURATUS</u>		
280	727	74,887

Table 4. (Continued)

Length of Fish	Weight of Fish	Total Number of Eggs.
<u>ICTALURUS PUNCTATUS</u>		
305	475	4,470
308	500	7,576
295	525	6,518
312	560	7,738
310	575	5,937
295	590	6,820
330	700	8,717
340	705	6,338
340	710	9,657
348	745	8,728
345	750	6,802
345	800	9,834
360	810	7,055
359	1,003	12,186
365	1,110	24,810
385	1,245	11,234
370	1,260	8,127
540	3,710	26,160
520	3,900	23,762
<u>PILODICTUS OLIVARIS</u>		
400	1,400	5,501
852	15,207	33,765
<u>MICROPTERUS SALMOIDES</u>		
273	600	29,114
300	655	55,497
326	1,060	64,425
328	1,070	82,023
330	1,095	55,496
323	1,103	81,079
340	1,125	96,361
335	1,174	116,229
350	1,175	115,073
335	1,205	52,480
393	1,240	62,580
346	1,250	105,709
359	1,425	99,977
350	1,440	44,523
375	1,500	25,689
355	1,550	114,595
370	1,660	112,778
372	1,660	60,155
380	1,790	176,000

Table 4. (Continued)

Length of Fish	Weight of Fish	Total Number of Eggs
<u>MICROPTERUS SALMOIDES</u>		
398	1,820	75,029
385	1,825	129,200
390	1,850	116,867
395	1,960	55,200
460	2,030	145,780
400	2,100	85,843
398	2,355	209,664
425	2,500	86,708
405	2,900	122,937
420	2,900	152,880
<u>POMOXIS ANNULARIS</u>		
203	208	36,080
190	219	47,440
196	251	43,887
194	263	80,422
195	272	36,300
198	278	26,000
196	280	43,371
205	280	79,239
200	300	145,800
202	315	37,787
197	317	63,196
203	351	175,950
216	407	45,819
228	442	84,920
228	445	27,026
228	450	211,641
274	645	82,588
226	650	20,436
282	875	167,760

COEFFICIENT OF CONDITION

"K" factors were worked out for all of the larger fishes taken in Buffalo Lake and the Little Wichita River. Not all of the fishes taken are listed in the following tables, because some immature animals are rejected and approximately one fish out of each hundred was recorded erroneously, resulting in ridiculous "K" factors.

Some striking differences are noted in the comparison of the factors of fishes from Buffalo Lake and the Little Wichita River. The carpsuckers from the Panhandle lake are extremely large and have large "K" factors, far greater than those from the Little Wichita River. On the other hand, gizzard shad and European carp from the lake are in poor condition as compared with fish from the river.

Table 5. Distribution of "K" Factors for the Little Wichita River.

Lepisosteus osseus

factor	.3	.4	.5
males	4	42	18
females	-	10	6

Lepisosteus productus

factor	.5	.6	.7	.8	.9
males	1	3	6	1	1
females	-	2	1	1	1

Dorosoma cepedianum

factor	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8
males	1	4	5	10	12	25	13	13	10	6	4	1	2	1
females	3	9	5	13	19	29	23	27	18	20	15	9	5	-

Hiodon alosoides

factor	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
males	-	-	22	35	18	8	1	-
females	1	4	8	12	15	7	2	2

Ictiobus bubalus

factor	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0
males	1	2	3	1	5	6	3	9	1	-	3	-	1
females	-	-	2	2	2	-	1	2	1	1	1	-	-

Ictiobus cyprinellus

factor	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6
males	-	2	-	1	2	1	-	1
females	1	-	-	-	1	-	-	1

Table 5. Distribution of "K" Factors for the Little Wichita River.

<u>Carpionodes carpio</u>																
factor	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6
males	1	2	5	17	18	29	25	15	25	22	7	5	9	5	5	-
females	2	-	1	4	9	12	17	16	26	18	18	6	11	6	1	5

  

<u>Cyprinus carpio</u>												
factor	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	
males	1	-	4	5	8	6	6	2	1	1	2	
females	1	-	4	7	5	8	2	4	2	2	-	

  

<u>Ictalurus punctatus</u>										
factor	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	
males	-	1	1	4	4	2	1	1	-	
females	1	-	1	7	5	3	1	3	2	

  

<u>Ameiurus melas</u>															
factor	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
males	2	4	7	3	3	1	1	-	-	-	-	1	1	-	1
females	1	-	4	-	1	2	-	2	-	-	-	-	-	-	1

  

<u>Pilodictus olivaris</u>								
factor	1.3	1.4	1.5	1.6	1.7	1.8	1.9	
females	1	-	-	-	1	-	2	

  

<u>Morone chrysops</u>													
factor	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	
males	1	-	1	1	1	5	4	7	8	10	5	3	
females	-	-	-	1	-	-	3	4	8	9	1	1	

Table 5. (Continued)

Micropterus salmoides

Factor	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3
males	1	-	-	-	-	1	-	1	-	-
females	1	1	-	1	1	-	1	-	1	1

Note: Black bass weighing less than 350 grams had "K" factors of less than 2.5; bass with "K" factors higher than 2.6 weighed more than 1,000 grams.

Pomoxis annularis

factor	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8
males	2	2	2	5	6	4	1	4	11	7	5	5	1	-	-
females	1	3	4	3	10	8	8	9	6	4	6	9	2	1	2

Aplodinotus grunniens

factor	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8
males	1	-	-	-	-	-	-	1
females	-	1	2	1	1	1	-	-

Table 6. Distribution of "K" Factors for Buffalo Lake.

		<u>Dorosoma cepedianum</u>														
factor	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
males	3	22	56	108	117	125	90	35	12	9	8	3	7	1	2	
females	4	10	69	110	156	174	126	64	22	10	1	-	2	4	1	
		<u>Carpionodes carpio</u>														
factor	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8			
males	2	3	7	4	5	2	2	4	1	-	-	-	-			
females	-	-	-	1	1	1	1	2	3	-	4	1	5			
		<u>Cyprinus carpio</u>														
factor	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	
males	4	12	20	31	45	31	13	3	4	1	-	-	-	-	-	
females	6	12	19	30	28	26	12	6	7	4	4	6	4	3	1	
		<u>Carassius auratus</u>														
factor	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	
males	2	-	-	-	1	2	1	1	-	-	1	-	1	-	1	
females	-	1	-	-	-	1	-	1	1	-	1	2	1	2	-	
		<u>Cyprinus x Carassius</u>														
factor	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6								
males	1	1	5	2	3	1	1	2								
females	-	1	1	5	1	-	-	-								
		<u>Ictalurus punctatus</u>														
factor	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1				
males	1	-	1	1	4	15	15	12	11	6	2	-				
females	-	-	2	1	6	13	11	16	11	8	2	2				

Table 6. Distribution of "K" Factors for Buffalo Lake. (Continued)

		<u>Ameiurus melas</u>														
factor	2.0	2.1	2.2	2.3	2.4	2.5	2.6									
males	1	-	-	2	-	1	1									
females	2	-	1	-	1	1	1									
		<u>Pilodictus olivaris</u>														
factor	1.8	1.9	2.0	2.1	2.2	2.3										
males	1	-	-	-	-	1										
females	2	-	2	1	2	-										
		<u>Morone chrysops</u>														
factor	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5					
males	1	-	-	-	-	2	-	-	-	-	1					
females	-	-	-	2	-	2	-	2	1	1	3					
		<u>Micropterus salmoides</u>														
factor	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	
males	1	2	2	2	1	4	4	1	2	3	1	2	1	2	1	
females	1	1	2	1	5	1	4	4	7	7	5	2	1	3	1	
		<u>Pomoxis annularis</u>														
factor	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	
males	27	45	63	89	99	91	47	43	29	19	11	13	13	7	5	
females	19	43	52	94	89	102	39	40	27	22	11	11	8	5	5	

## SUMMARY

The food habits, spawning success and comparative physical condition of larger fishes which were taken in Buffalo Lake and the Little Wichita River are described, and, insofar as possible, reduced to tabular form.

