Segment Completion Report

Investigations Projects

State of TEXAS

Project No. F-7-R-8 Name: Fisheries Investigations and Surveys of the Waters of Region 1-B.

Job No. B-15 Title: Notes on the Natural History of Problematical Fish Species.

Period covered: January 1, 1960 - December 31, 1960

OBJECTIVES

To conduct laboratory and field studies on the anatomy, food and feeding habits, distribution, movements, and reproductive habits of problematical species. This work is to be preparatory to more detailed studies of each species at a future time, with special emphasis on such features of natural histories that may aid in population controls.

TECHNIQUES

The techniques employed this segment were basically the same as during the last segment. Gill net collections were made at regular netting stations with experimental gill nets and with 3-inch mesh gill nets. Additional 3-inch webbing was used in an attempt to catch specimens of larger carp and buffalo which could not be taken in the smaller mesh sizes. Data concerning food habits, distribution, and movements of the larger specimens of these two species are lacking because sufficient amounts of large mesh sizes have not been used in the past. In order to further alleviate this problem next segment, $3\frac{1}{2}$-inch and possibly 4-inch mesh nets will be used.

Through an inter-agency contract between the Game and Fish Commission and Midwestern University, Midwestern University is conducting studies on the anatomy, food habits, and reproductive habits of problematical fish species including gizzard shad, European carp, river carpsucker, and smallmouth buffalo. The inter-agency contract allows the use of trained personnel and laboratory facilities which are necessary for the work, and which are not immediately available to personnel of the Inland Fisheries Division.

Digestive tracts to be used at Midwestern University for food habits study were removed from netted specimens and placed in cloth bags. These bags have a water-proof tag attached to them on which pertinent data were recorded. Bags containing tracts were then immersed in jars of 10 percent formalin for preservation of tissue. Plankton and bottom samples were collected, preserved, and delivered along with the digestive tracts. The plankton was collected with a standard size net which was weighted to drag at depths from 10 to 20 feet. The bottom samples were collected with an Eckman dredge.

Seine samples were collected in shallow areas throughout the lake. Both 20-foot, ¼-inch mesh seines and 100- and 200-foot ½-inch mesh seines were used. Night seining wa done, and the results were compared with daylight seining.

Several attempts to collect fish with gill nets in the river above Lake Diversion were unsuccessful due to fast currents and floating debris. An attempt to use a 200-foot seine in the river was also unsuccessful. Work on the river, therefore, was limited to seining with 20-foot minnow seines which provided distribution data for small fish only. Plans have been made to construct short lengths of gill nets to be used in eddies and tributaries. Hoop nets will be used if tests show them to be effective.

Shallow areas of the lake were scouted for spawning activity and notes were taken when spawning fish or concentrations of fish were found.

Length measurements were made on the young of some species of fish taken in seine collections. From an analysis of the measurements, early growth rates have been noted.

The stages of gonadal development of rough fish were recorded and sex ratios were determined.

FINDINGS

Fish Collections

A total of 2,616 fish was collected by gill nets from the regular netting stations. Data from these collections were used in making distribution charts. Additional data were collected during spot checks and random netting. Gizzard shad were the most abundant species taken and comprised 28.48 percent of the total. River carpsuckers were next most abundant (23.32 percent) followed by smallmouth buffalos (14.67 percent). Game fish accounted for 17.47 percent of the catch. The remainder were longnose gars, shortnose gars, bigmouth buffalos, carp, black bullheads, and freshwater drum. Only one bullhead, two bigmouth buffalos, and six flathead catfish were taken. Table 1 gives the percentage composition of fish taken by gill nets from the regular netting stations. The relatively large percentage of drum (6.39 percent) was due mostly to the July 8, and October 21 collections which produced 76 and 58 drum respectively. These were unusual numbers of drum and were taken from only two nets on both occasions. On July 8, the "Fence Line" set took 54 drum and the "Hackberry" set took 20. On October 21, the "Fence Line" set took 32 drum and the "Sandy Beach" sinking set took 20 drum. All three of these sets are located in the extreme upper end of the lake, in or near the old river channel. It is believed that movements by this species, due to increased water release from Lake Kemp, caused the abnormally big catches on these dates. That drum are not easily taken by gill nets has been realized for some time, and examination of station records shows that four drum was the greatest number taken at any station during any other single collection during this segment.

Approximately 1,000 preserved and labeled digestive tracts were delivered to Midwestern University during this segment. If possible, four specimens each of gizzard shad, smallmouth buffalos, river carpsucker, and carp from each netting station were prepared for delivery to the college each month. Many times, however, less than four specimens of each species were taken at some of the stations.

Distribution

Distribution studies were continued in an effort to locate major spawning areas of the rough fish. Data collected at the regular netting stations were tabulated and put on charts of the type described in Job Completion Report F-7-R-7, Job B-15. A study of these charts has given some indications of the areas preferred by the various rough fish species. A study of sex ratios has shown that at times males and females of some species segregate. Smallmouth buffalo, for example, were located in a headwater tributary on April 13. At this time, 26 were collected with a gill net and 23 of these were males. On April 12, a concentration of fish was noted in Cottonwood Creek. A net was set across the mouth of the creek and fish were "boogered". Thirty-one smallmouth buffalo were caught of which 29 were ripe males. This occurrence was noted last year, but since no eggs or fry were found, one could only guess at the reason. The time at which this occurred suggests that spawning must be involved. It is believed that the spawning urge strikes males early in the spring, and they move into shallow areas to await the arrival of ripe females. A similar situation was noted with river carpsuckers. On May 11, 19 and 17 carpsuckers were taken at Cottonwood Creek and Red Bluff respectively. At Cottonwood 18 were ripe males and at Red Bluff 17 were ripe males.

This segregation of sexes has not been noted in carp or gizzard shad.

The distribution of young carpsuckers, as determined from seine samples, has strengthened our belief that a big part of the carpsuckers spawn in the river. An analysis of seine samples shows that 57 percent of the young carpsuckers which were collected during the past summer were taken at points located along the river above Fulda Bridge. This is significant because a great majority of the seining was done below this point. Therefore, during the spawning season, we should expect to find a large part of the adult carpsucker population in the river. As mentioned before, we have not been able to prove this because swift currents and floating debris curtailed our netting of the river.

It is believed that the river may not be too important to other rough fish, but that it is important to the successful spawning of river carpsuckers. The very name, river carpsucker, indicates that this species was originally a river fish, accustomed to living and breeding in flowing streams. It is very probable that they utilize the river for spawning and a study of their activities in the river will be an important phase of our work in the future, however, we must first find effective collecting techniques.

During this segment the biggest catches of gizzard shad were taken at the stations along the river channel in the upper end of the lake, and at the "Gravel Beach" station. These stations are similar in that water depth and bottom types are much the same. Water depth at these stations ranges from 13- to about 20-feet deep. "Gravel Beach" produced the most shad during August, September, and October. The other netting stations produced shad fairly consistently throughout the year.

The number of carp (65) taken during this segment was not enough to give sufficient distribution data. The greatest number of carp was taken in August when 21 were taken at 9 stations. The Cottonwood Creek station produced nine of these, which was the greatest number taken at any single station during any month.

Spawning

Smallmouth buffalo exhibited a prolonged spawning period this year. Spawning began in April and extended through July. Table 2 gives the number of females taken, the number that were spent, and the water temperature on collection dates. Although we were unable to find them actually spawning, concentrations of adults and fry were found. Hackberry, Boggy Bay, and Duck Bay were checked for spawning activity several times. Cottonwood Creek was also checked and on two occasions large numbers of males were found. On April 12 and 13, many males were there but no eggs or fry were found. On May 12 the adults were gone, but fry were found.

The first spent river carpsuckers to be taken were collected in May. They began spawning in early May (water temperature - 73° F.), but the biggest spawn occurred in late June or early July (water temperatures - 79 to 85° F.). The first young-of-the-year carpsuckers were taken on June 21 in the river. The shallows of the river produced many young carpsuckers during the following months. Table 3 gives the number of females taken, the number of spent females, and water temperatures.

Gizzard shad began spawning in Lake Diversion between May 11 and May 25, (water temperatures - 73 to 76°F.). On May 11, 60 females were taken, none were spent, while on May 25 three females were taken and two were spent. By July 27, all of the females taken were spent. Spawning areas of shad appear to be widespread throughout the lake and river. Around the middle of June, shad fry were abundant all over the lake in shallow areas, and in the river. Table 4 gives the number of females, spent females, and water temperatures.

Carp appear to have the longest spawning period of any rough fish. They began shortly after May 11 and continued through August (water temperatures - 76 to 86° F.). Unlike shad, which seem to spawn continuously during a short period, carp were more sporadic in their spawning. They must spawn as the urge strikes, and some may not spawn until early fall. Table 5 gives the number of females, spent females and water temperatures.

We had an opportunity to observe the spawning of longnose gar during this period of study. On May 26, (water temperatures - 78° F.) a rocky beach was approached and found to be covered with thousands of gar eggs. The area was about 100-yards long and was located on the southwest side of Little Brushy Bay. The gar eggs were deposited on large slabs of limestone in water one inch to about eighteen inches deep. There was no spawning activity going on at the time we were there on the 26th. The following day when we returned to the same place to see if we could find the gar spawning, there were again none in that area. However, along the north side of "High Point", longnose gar were found spawning. We approached the area and watched from the boat. The gar were moving slowly along the shore towards the east (upwind) in groups of three to fifteen fish. The smaller females were accompanied by one to three males who "guided" her along. Two of the males stationed themselves beside the female and with their bills against her head guided her slowly along. Occasionally, the gar would get into water so shallow that they would be almost entirely exposed. The larger females often had as many as ten or more smaller males attending her. Two or more males guided her along while others swam along by her side or behind. One large female was captured and found to be slightly spent. The gar were not wary and we watched their actions from a distance of about 10 feet, until the last of them had passed by. It was interesting to note that all of the gars came from the same direction, passed by slowly going

upwind, and did not linger in the area. The male fish were always smaller and darker in color than the females they were with. Some of the smaller rocks with eggs on them were taken to the lab and kept in areated five gallon jars. Approximately 300 eggs were collected and all but a few of them hatched within three days. After hatching, the young gar attached themselves to the sides of the jar by their yolk sacs or noses (both appeared to have a sticky mucous covering) for about two days. They then became active and swam about in the jar. They grew quite rapidly. When hatched, they were 3/8-inch long and within four days all of the yolk sac had been absorbed. The mouth, gill arches, and fins were developed and they had increased to 7/8-inch in length. The young gar began to feed on about the fifth day. They had good appetites and readily ate minnow fry. Older gar, about three weeks old, eagerly ate the freshly hatched gar.

Growth Rates

A considerable number of gizzard shad, river carpsuckers, white bass, and largemouth bass were measured to determine growth rates. Largemouth and white bass both were bigger than shad and carpsucker, and could have fed on them. Average sizes of fish taken on September 29, were as follows: gizzard shad - 70 mm., river carpsuckers - 79 mm., white bass - 89 mm., and largemouth bass - 82 mm. Measurement of one year old carpsuckers taken on June 13 indicates a growth rate of about 3.6 inches in one year. This same growth rate for carpsuckers in Lake Texoma was calculated by Bass and Riggs.[1] It was hoped that age of carpsuckers could be determined from their length; however, a study of the length frequency distribution of 708 carpsuckers taken from Lake Kemp (Table 7) in June, 1959, showed that this will not be possible. The length ranges of different age groups must overlap to the extent that peaks cannot be determined. Table 7 which gives the length frequency ratios of the carpsuckers from Kemp possibly exhibits a peak at the 190-199 mm. interval which would be the two year old group. Other peaks which should occur at approximately 240, 300, 365, and 380 mm. are not evident. Age determination from scale annuli was not attempted. Table 6 gives the average sizes of fish taken in June, July and September. Average lengths (standard) were taken from a sample of 25 fish of each species if our seine samples included that many.

Movements

Night seining showed that less young shad were taken from the shallows at night than during the day, indicating that they seek the protection of shallow water during the daylight hours, but venture out into deeper water at night to feed.

Many schools of small shad were seen in the shallows of the lake during June and July, and on one occasion when the lake was dead calm, small shad were schooling over the entire lake in open water. They traveled so close to the surface that they made small ripples which were visible for a long distance. They did not appear to be feeding out in this open water.

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[1] Bass, J. Carl and Carl D. Riggs. (1959) Age and Growth of the River Carpsucker, Carpiodes carpio, of Lake Texoma. Proc. of the Oklahoma Academy of Science, Vol. 39, 50-69.

Feeding schools of shad move with remarkable precision. They go up and down, twist and turn in almost perfect unison. When frightened they dart below and scatter They will soon regroup after scattering and resume their restless movements. The motion of an individual shad within a school is an up and down movement. They go up to the surface and immediately turn and go down to a depth of six inches then back up again, but all the time they remain with the group as it shifts around, turns and drifts. In still water young shad are very sensitive to noise and vibration. They will frantically scatter and flee at the sound of a loud shout or at the vibration caused by lightly bumping the bottom of a boat. In clear water, quick motions will also cause instant flight. This acute sensitivity and alertness to sounds and quick motions probably gives them a great degree of protection from attacks by predators. Frightened shad are capable of great speed and were very difficult to dip up with fry dips. A quick swipe with a dip net through a school of several hundred shad very seldom caught more than a few individuals, and often none at all. Most schools of young shad were seen in fairly shallow, slightly turbid water, (except for the one occasion when the lake was dead calm and they were surfacing all over the lake).

Carpsucker fry were observed in the shallows along the river. In contrast to the shad, they did not move constantly -- in schools -- but rather moved slowly, often stopping completely and remaining motionless on the bottom. When frightened they darted from place to place, finally concealing themselves under something. Their actions in this respect closely resemble pupfish. Apparently, the young carpsucker feed on or very near the bottom as they were never seen near the surface.

Carp and buffalo young were not located where their actions and movements could be observed.

The total number of fishes taken by seining is given in Table 8.

DISCUSSION

Most of the work done during this segment was devoted to collecting material for the food habits study being conducted by Midwestern University, to collecting distribution data, and to check-seining with twenty foot minnow seines. Approximately one thousand preserved digestive tracts were delivered. Plankton samples, bottom samples, and live specimens were collected periodically.

Three-inch mesh nets were added to increase the catch of larger carp and buffalo. These nets were added during the last part of the segment and the resulting increase in the catches was considerable. Three and one-half inch webbing has been ordered for use during the next segment, and this should supply better samples of the larger fish.

Growth rate studies were started and will be continued in the future.

Distribution studies have shown certain areas are preferred by different species, and that sexual segregation of river carpsucker and smallmouth buffalo occurs during the early summer months. Insufficient numbers of carp were taken to provide good distribution data. The distribution of shad indicates a preference for the upper end of the lake, probably due to the available food supply.

Seining results suggests that shad spawn over a large portion of the lake. Buffa[illegible]

and carp spawn in weedy or grassy areas, and carpsucker spawn in the river and upper portions of the lake.

With the termination of other jobs, more time will be spent on Job B-15. Considerably more time will be spent in organizing and carrying out studies of the fish activity in the river above Lake Diversion. Considerable time has been spent in evaluating our data and in planning and organizing future field work.

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Date May 1, 1961

Table 1. Results of gill netting, Lake Diversion, 1960.

Species	Numbers of fish collected	Percent of total netted fish
Longnose gar	158	6.03
Shortnose gar	27	1.04
Gizzard shad	745	28.48
Smallmouth buffalo	384	14.67
Bigmouth buffalo	2	0.08
River carpsucker	610	23.32
Carp	65	2.48
Channel catfish	97	3.71
Black bullhead	1	0.04
Flathead catfish	5	0.19
White bass	183	7.00
Largemouth bass	18	0.68
White crappie	154	5.89
Freshwater drum	167	6.39
Totals	2,616	100.00

Table 2. Smallmouth buffalo females collected from Lake Diversion, 1960.

Collection period	Water temperature (°F.)	Females collected	Spent females	
			Number	Percent of monthly total
March	54	11	0	0.00
April	72	30	10	33.33
May	73	36	19	52.78
June	86	7	6	85.71
July	79	14	13	92.86

Table 3. River carpsucker females collected from Lake Diversion, 1960.

Collection period	Water temperature (°F.)	Females collected	Spent females	
			Number	Percent of monthly total
March	54	16	0	-
April	72	13	0	-
May	73	46	8	17.39
June	86	42	3	7.14
July 8	79	20	10	50.00
July 27	85	9	9	100.00

Table 4. Gizzard shad females collected from Lake Diversion, 1960.

Collection period	Water temperature (°F.)	Females collected	Spent females	
			Number	Percent of monthly total
March	54	33	0	0.00
April	72	24	0	0.00
May 11	73	60	0	0.00
May 25	76	3	2	66.66
June	86	34	32	94.12
July 8	79	24	17	70.83
July 27	85	29	29	100.00

Table 5. Carp females collected from Lake Diversion, 1960.

Collection period	Water temperature (°F.)	Females collected	Spent females	
			Number	Percent of monthly total
March	54	7	0	0.00
April	72	5	0	0.00
May 11	73	4	0	0.00
May 25	76	24	6	25.00
June 15	86	4	0	0.00
June 29	80	4	1	25.00
July	79	5	2	40.00
August	85	12	5	41.67

Table 6. Average lengths of netted fish, Lake Diversion, June, July and September, 1960.

Species	One-year old fish							Young-of-the-year						
	June 13	July 4	July 11	July 18	July 25	Sept. 17	Sept. 29	June 13	July 4	July 11	July 18	July 25	Sept. 17	Sept. 29
Gizzard shad						142 mm		30 mm		49 mm	47 mm	43 mm	67 mm	70 mm
Smallmouth buffalo	95 mm										49 mm	43 mm		
River carpsucker	93 mm	119 mm		112 mm		127 mm			45 mm	41 mm	47 mm	44 mm	75 mm	79 mm
White bass						129 mm		35 mm		44 mm		44 mm	66 mm	89 mm
Largemouth bass								44 mm				71 mm	81 mm	82 mm

Table 7. Length frequency distribution for river carpsuckers, Lake Kemp, June 1960.

Length interval (mm)	Number of fish
180-189	4
190-199	8
200-209	4
210-219	11
220-229	8
230-239	10
240-249	32
250-259	90
260-269	149
270-279	100
280-289	98
290-299	71
300-309	54
310-319	37
320-329	17
330-339	6
340-349	7
350-359	1
360-369	0
370-379	1
Totals	708

Table 8. Results of seining, Lake Diversion, 1960.

Species	Scientific name	Number collected
Shortnose gar	Lepisosteus platostomus	4
Longnose gar	L. osseus	6
Gizzard shad	Dorosoma cepedianum	6,448
Smallmouth buffalo	Ictiobus bubalus	65
River carpsucker	Carpiodes carpio	273
Carp	Cyprinus carpio	18
Golden shiner	Notemigonus crysoleucas	3
Suckermouth minnow	Phenacobius mirabilis	122
Plains shiner	Notropis percobromus	223
Sharpnose shiner	N. oxyrhynchus	110
Red River shiner	N. bairdi	189
Arkansas River shiner	N. girardi	56
Red shiner	N. lutrensis	4,026
Sand shiner	N. stramineus	271
Mimic shiner	N. volucellus	42
Ghost shiner	N. buchanani	7
Silvery minnow	Hybognathus nuchalis	1
Plains minnow	H. placita	53
Bullhead minnow	Pimephales vigilax	1,871
Channel catfish	Ictalurus punctatus	50
Black bullhead	Ictalurus melas	30
Plains killifish	Fundulus kansae	10
Red River pupfish	Cyprinodon rubrofluviatilis	244
Mosquitofish	Gambusia affinis	2,616
White bass	Roccus chrysops	532
Largemouth bass	Micropterus salmoides	97
Green sunfish	Lepomis cyanellus	23
Spotted sunfish	L. punctatus	471
Redear sunfish	L. microlophus	91
Bluegill sunfish	L. macrochirus	1,654
Orangespotted sunfish	L. humilis	166
Longear sunfish	L. megalotis	33
White crappie	Pomoxis annularis	237
Logperch	Percina caprodes	89
Freshwater drum	Aplodinotus grunniens	267
Totals		20,398