Report of Fisheries Investigations

Resurvey of Waters of Region 1-B

by

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Dingell-Johnson Project F-7-R-8, Job B-14
January 1, 1960 - December 31, 1960

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A B S T R A C T

Buffalo Springs Lake near Lubbock was resurveyed on several occasions to determine condition and growth rate of species stocked following a total kill treatment during the previous segment with rotenone. Satisfactory growth was evident during the resurvey in August, and the opening date of fishing was set for October 10, 1960.

Periodic surveys were conducted at Buffalo Lake at Umbarger to determine condition and growth rate of species stocked following a total-kill treatment with toxaphene in April, 1959. During the survey in April 1960, all species were in excellent condition but too small in size to interest most anglers. Since the small sizes were due to the short growing seasons of the Panhandle climate rather than to over-stocking, the project leader recommended to lake officials that fishing be postponed until sufficient growth was achieved. Contrary to this recommendation, however, the lake was opened to fishing on May 1, 1960, as originally planned.

Rita Blanca Lake at Dalhart was resurveyed on two occasions to determine effects of experimental management practices initiated during the previous segment. Results of this work are given in the report, F-7-R-8, Job B-16.

Lake McClellan was surveyed to locate desirable seining beaches and to determine the feasibility of reducing an over-abundant white crappie population by seining. In July 1960, approximately 65,000 crappie were seined from Lake McClellan and restocked in other Panhandle and High Plains Lakes.

During the resurvey of Lake Kemp from June 6-10, 1960, 1,442 fish were taken. Only 213 or 14.77 percent of the total gill net collection were game fish species. The total weight of fish netted was 1,557.19 pounds. Carpsuckers comprised over one-half or 56.52 percent of the total weight. All other rough fish comprised 32.43 percent, and game fish species comprised 11.05 percent of the total weight. Young-of-the-year gizzard shad were the most abundant species taken in seine collections. Two new species were taken during the resurvey that were not taken during the year-long original survey. These were the spotted sunfish and the smallmouth buffalo.

Comparison of average coefficients of condition of species collected from Lake Kemp during this resurvey with those taken during the previous survey showed significant increases for carpsucker and carp, and a significant decrease for white bass. With the exception of white bass, smallmouth buffalo and flathead catfish, "K" factors of Lake Kemp species were quite the same as those in Lake Diversion. Seine collections indicated a very successful spawn of white bass this year. Most of the channel catfish taken had not spawned, but there were indications of a good spawn during the previous year, 1959. Although some of the female crappie collected were spent, no young-of-the-year crappie were taken. Both crappie and largemouth bass were probably nesting at the time of the survey.

None of the experimentally introduced redfish and speckled sea trout, nor their progeny, were taken during this survey of Lake Kemp.

The first resurvey of Lake Kickapoo since the original basic survey and inventory in 1953 and 1954 was conducted in March, 1960. Basically the relative abundance of species is quite the same as it was during the original inventory. Rough fish have increased slightly, but Lake Kickapoo still supports an unusually high percentage of game fish (57.14 percent). Crappie was the most abundant species present, comprising

42.85 percent of the total gill net collection. Shortnose gar have become established, and shad and buffalo show a small increase. Game species were dominant in both weight and numbers. The most apparent change in the game fish population since 1954 is the increase in mean weight for all game species.

Both crappie and channel catfish are reproducing very successfully. No indications of reproduction of largemouth bass and white bass for the previous year (1959) were found. However, most of white bass taken were heavily laden with eggs and milt, and with favorable conditions, they should spawn successfully in 1960.

With the exception of carp, the general condition of all species was good. The "K" factors of all game fish were exceptionally high.

In order to compare the effectiveness of our conventional sampling equipment with the equipment used by commercial fishermen, and to obtain an explanation for the difference in results of the two methods, Lake Kickapoo was surveyed simultaneously with both types of nets. Results of both methods are compared and discussed briefly.

Recommendations for improving the fishing of Lake Kickapoo include a selective-kill treatment for the control of shad and drum, and increased commercial fishing for the reduction of buffalo, carp and carpsucker.

Segment Completion Report

State of Texas

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

Job No. B-14 Title: Resurvey of Waters of Region 1-B.

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

OBJECTIVES

To resurvey waters in Region 1-B that have been previously surveyed so that possible changes in any aspect of the previous survey can be detected and recorded.

INTRODUCTION

Basic surveys and inventories of fish species have been conducted on seven streams and nine lakes in Region 1-B within the past six years. It is logically expected that certain changes will naturally occur in these waters that may alter fish populations as well as chemical and physical factors. These waters were resurveyed as time permitted in the same manner as in the previous surveys, except on a much smaller scale, so that changes in the concerned waters could be detected and recorded.

On the larger lake resurveys, such as those conducted on Lakes Kemp and Kickapoo, considerably more time and effort was expended than on smaller lakes which received only "spot checks". Therefore, detailed, separate reports were written on the resurvey of Lakes Kemp and Kickapoo immediately following the field work and are presented in this report in their original form.

Buffalo Springs Lake

On September 27 and 28, 1959, Buffalo Springs Lake at Lubbock and a part of its watershed was treated for a total eradication of fish species with rotenone compounds. An account of this work is given in the Report, F-14-D-4, Job 18a-10.

Periodic resurveys were conducted during this segment to determine growth rate and condition of the species stocked after the treatment.

In August 1960, Buffalo Springs Lake received the final survey prior to resumption of fishing. Satisfactory growth was evident at this time, and the opening date of fishing was set for October 10, 1960.

Buffalo Lake

On April 15 and 16, 1959, Buffalo Lake near Umbarger was resurveyed to determine results of the freeze-kills during January and February of the same year. Results of this survey disclosed that the game fish populations had been depleted to the extent

that a total eradication of the remaining population was justifiable. The lake was treated on April 29 and 30 with toxaphene and restocked after the toxicant had sufficiently dissipated.

Periodic resurveys were donducted during this period of study to determine growth rate and condition of the species stocked after the treatment. In April, 1960, a cooperative study was conducted at Buffalo Lake with the regional biologist of the U. S. Fish and Wildlife Service.

Although all species collected at this time were in excellent condition, they were too small in size to interest the average fisherman. Since the small sizes were due to the short growing seasons of the Panhandle climate rather than to over-stocking, the project leader recommended to officials in charge of the lake that fishing be postponed until sufficient growth was achieved. Contrary to this recommendation, however, the lake was opened to fishing on May 1, 1960 as originally planned.

Rita Blanca Lake

Previous investigations at Rita Blanca Lake near Dalhart revealed excessive populations of bullhead catfish and golden shiners, as well as threatening populations of carp and goldfish. As a result of this work, an experimental management project was initiated to control excessive populations of undesirable species.

Rita Blanca was completely resurveyed on two occasions during this period of study (May and October) in an effort to determine effects of these experimental management procedures. In order to prevent lengthy repetition, the reader is referred to the report, F-7-R-8, Job B-16 for details of these surveys.

Lake McClellan

Previous surveys of Lake McClellan revealed an over-abundance of crappie, and recommendations were made for their reduction. The lake was check-seined during this period of study to locate desirable seining beaches and to determine the feasibility of reducing the crappie population by seining.

In July 1960, approximately 65,000 crappie were seined from Lake McClellan and restocked in other Panhandle and High Plains Lakes, including Rita Blanca Lake, Buffalo Lake, Buffalo Springs Lake, Clapp City Park Lake and Reese Air Force Lake.

Lake Kemp

Objectives To resurvey Lake Kemp to determine species present, changes in relative abundance of species, and in conjunction with Job F-1, to determine the status of experimentally introduced redfish (Sciaenops ocellata), and speckled sea trout (Cynosicion nebulosus).

Procedure Due to the large size of Lake Kemp, lack of equipment, and the tremendous amount of work involved, netting could not be extended to cover the entire area of the lake in one night. Therefore, for expediency, the lake was divided into three sections, and each section was netted separately for three consecutive nights during the period from June 6 through June 10, 1960. Two boats were used to raise the nets, to reset the nets in a different section of the lake, and to bring the catch to

a central location for processing. One crew of two men remained at the field headquarters to work fish, record data and collect game fish stomachs.

Nets were fairly evenly distributed throughout the lake in water depths ranging from 3 to 50 feet deep. Various mesh sizes were used, and some nets were set at the surface while others were set on the lake bottom. The total footage of gill net used during the three nights of netting was approximately 9,500 feet.

All fish, regardless of size, were measured, weighed, and sexed. The contents of game fish stomachs were noted, as well as diseases, injuries, and other abnormal conditions. Seine samples were collected with twenty foot minnow seines and preserved for later identification and counting.

Findings Lake Kemp was constructed on the Big Wichita River in 1923 for purposes of flood control, irrigation, and recreation. It is a large lake (22,000 acres) with very clear water suitable for irrigation, but due to high chloride content is unfit for human consumption. With exception of black willow and salt cedar, rooted vegetation in Kemp is lacking. This is mostly because of the great fluctuation in water level caused by inflow from rains and release of water for irrigation.

Fish Collections: The total catch for three nights of netting was 1,442 fish of which only 213 (14.77%) were game fish. Over one-half of the game fish were channel catfish. Eleven largemouth bass, 39 crappie, 33 white bass and nine flathead catfish were taken. Species of rough fish taken were shortnose gar, gizzard shad, smallmouth buffalo, carpsucker, carp and drum. The carpsucker, by far the most abundant fish taken, comprised 49.10 percent of the total catch. Shad and carp each comprised about 15 percent of the total while shortnose gar and drum together accounted for an additional 5.61 percent. One smallmouth buffalo was taken, disproving the popular claim that Kemp has no buffalo (Table 1).

Significant sex ratios were noted in carpsucker and shortnose gar (Table 1). Almost 65 percent of the 708 carpsuckers taken were males. In view of this large number of river carpsucker taken, a deviation of 15 percent from a normal 50:50 ratio suggests either selectivity of nets, which from past experience is unlikely, or else suggests increased activity of males, possibly related to spawning. Since spawning was underway at the time of the survey, the latter reason is more plausible. The only discernible factor which could have caused the 23 percent deviation in shortnose gar is that there was a considerable difference in average weights of males and females of this species. The smaller male gar (average wt. 1.21) passed through the nets, whereas the larger female gar (average wt. 2.47) became entangled more easily.

The total weight of netted fish was 1,557.19 pounds (Table 1). Carpsuckers comprised over one-half of this total. Game fish weighed 172.00 pounds, carp 291.53 pounds, and shortnose gar 134.00 pounds. In percent of total weight, carpsucker comprised 56.52 percent, other rough fish 32.43 percent, and game fish 11.05 percent.

Seining with 20 foot minnow seines produced 674 fish (Table 2). Due to rocky shorelines and clarity of water which allowed the fish to see the seiners and to escape, there was difficulty in getting a seine sample which was representative of the entire lake. Young-of-the-year shad were the most abundant fish taken by seine, and were found mostly in shallow, turbid headwaters.

Ten or less individuals were taken of nine of the fourteen species. The most common species were Notropis lutrensis, Hybognathus placita, and fingerling Dorosoma cepedianum.

Table 3 is a check list of species taken from Lake Kemp during this survey and during the original basic survey (see Job B-1, Project F-7-R-1). Two new species were added to the Kemp checklist of fishes.* These were the spotted sunfish (Lepomis punctatus), and smallmouth buffalo (Ictiobus bubalus). Although rare at present, the smallmouth buffalo may become more abundant in the future and perhaps will be a competitor to the less desirable river carpsucker, carp, and gizzard shad.

Food habits: Game fish were examined for identifiable stomach contents. Surprisingly, while a very few crappie and white bass had unidentifiable contents in their stomachs, most contained nothing at all (Table 4). In channel catfish, the most common food items were aquatic insect larvae and fish. Insects were third in importance and grain and plant matter each were found twice. Other items included crayfish, mussels, and mammal remains. Only one of the nine flathead catfish contained food. It had eaten a small fish. Three largemouth bass had eaten fish and insects.

Condition factors: Comparison of average "K" factor data collected on this survey with data collected in 1953 and 1954 showed significant increases for carpsucker and carp, and a significant decrease for white bass (Table 5). No explanation for these changes were noted.

In comparing "K" factors from this survey with those of fish from Lake Diversion, some differences were noted. Lake Diversion "K" factors that were collected prior to the rotenone treatment of Diversion were used because the 1957 selective-kill treatment resulted in considerable changes in average "K" factors. Post-treatment data, therefore, would be unsuitable for comparison with data from Lake Kemp, which has not been treated and where fish have not been affected by unnatural population changes such as were brought about at Diversion. Except for white bass, smallmouth buffalo, and flathead catfish, "K" factors were fairly near the same (Table 5). White bass from Kemp had lower "K" factors than those from Lake Diversion. Both sexes from Lake Kemp averaged 2.1 as compared to males - 2.4 and females 2.6 from Diversion. Kemp flathead catfish averaged 1.9 which is considerably higher than the 1.5 average from Diversion. However, all the flathead catfish from Kemp were gravid females which might account for the difference. The one smallmouth buffalo from Kemp had a "K" factor of 3.3 which indicates that buffalo in Kemp are doing well and may be expected to increase. Table 6 gives the "K" factor range and average "K" for fish taken from Kemp during this survey.

Spawning success: Seine sample data shows a good spawn of white bass this year. Most of the channel catfish taken had not spawned, but the number of small channel catfish taken in gill nets indicates a good spawn in 1959. While some of the female white crappie were spent, no young-of-the-year crappie were taken. Probably both crappie and largemouth bass were nesting at the time this survey was conducted.

Discussion The fish population of Lake Kemp consists of about 85 percent rough fish according to our gill net collections. The most abundant species is the river carpsucker, which comprised 49.10 percent of our catch. From past experience, the relative abundance of freshwater drum cannot be accurately determined with gill nets, but is almost certain to be much higher than the percentage our data shows (1.25%).

The percentage of shad on our catch was 15.40 percent. This is somewhat lower than was expected and compares favorably with the percentage of shad in Lake Diversion, which is about twice as high. This relatively lower percentage of shad may be attributed to the more abundant carpsucker, the reduction of which would probably result in an increase in shad. These two species, the least desirable we have, are similar in some respects. Food habits for example are very similar, and they probably compete for both food and space. Therefore, the control of only one of these two fish may benefit the other insofar as space and food are concerned.

The game fish species in Kemp include channel catfish, flathead catfish, white bass, black bass, crappie and spotted black bass. Of these, the channel catfish appears to be the most abundant. Crappie fishing in Lake Kemp is usually good, especially during the months of February through April, when fishermen often catch limits of crappie from around brush piles. Flathead catfish appear to be increasing and white bass are abundant.

It is interesting to note that as yet longnose gar have not become established in Kemp. It is thought by many people that this is a desirable situation, but in view of the fact that most of our lakes are lacking in predator fishes, the absence of this species may be a disadvantage.

Smallmouth buffalo are present in very small numbers. Only one adult specimen was captured.

Redfish and Speckled Sea Trout: The results of our efforts to determine the status of experimentally introduced marine species were negative. Although a total of almost 10,000 feet of gill net were used, we did not catch a single specimen of either species in the nets, nor did we find young of either species by seining. It was not expected that one of the transplanted fish would be taken, however, because even if all have survived, there would be an average of only one per each seven surface acres. The odds of catching one under these conditions would be almost nil. If these fish have reproduced, it is possible that one or more offspring could have been caught. Due to lack of time, our seining effort was not as great as it could have been, and future seining, in an effort to learn the status of these fish, may prove to be more successful.

Table 1. Results of gill netting, Lake Kemp, June 6-10, 1960.

Species	Fish collected		Weights of fish collected			Male fish collected				Female fish collected			
						Numbers		Weights		Numbers		Weights	
	Number	Percent of total	Weights in pounds	Percent of total weight	Mean weight in pounds	Fish	Percent males	Pounds	Average in pounds	Fish	Percent females	Pounds	Average in pounds
Shortnose gar	63	4.36	134.00	8.60	2.13	17	26.98	20.60	1.21	46	73.02	113.40	2.47
Gizzard shad	222	15.40	70.76	4.54	0.32	102	45.95	31.80	0.31	120	54.05	38.96	0.32
Smallmouth buffalo	1	0.07	2.04	0.14	2.04	1	100.00	2.04	2.04	-	-	-	-
Carpsucker	708	49.10	880.24	56.52	1.24	457	64.55	567.96	1.24	251	35.45	312.28	1.24
Carp	217	15.05	291.53	18.72	1.34	116	53.46	132.64	1.14	101	46.54	158.89	1.57
Channel catfish	121	8.39	96.05	6.17	0.79	50	41.32	42.91	0.86	71	58.68	53.14	0.75
Flathead catfish	9	0.62	32.09	2.06	3.57	-	-	-	-	9	100.00	32.09	3.57
White bass	33	2.29	15.18	0.98	0.46	20	60.61	8.86	0.44	13	39.39	6.32	0.49
Largemouth bass	11	0.76	16.29	1.04	1.48	6	54.55	8.81	1.47	5	45.45	7.48	1.50
White crappie	39	2.71	12.39	0.80	0.32	14	35.90	3.49	0.25	25	64.10	8.90	0.36
Freshwater drum	18	1.25	6.62	0.43	0.37	11	61.11	1.56	0.14	7	38.89	5.06	0.72
Totals	1,442	100.00	1,557.19	100.00		794		820.67		648		736.52	

Table 2. Results of seining, Lake Kemp, June 6-10, 1960.

Species	Number collected	Percent of total collected
Gizzard shad	379	56.23
Carpsucker	9	1.33
Sharpnose shiner	9	1.33
Red River shiner	9	1.34
Redhorse shiner	132	19.58
Ghost shiner	25	3.71
Plains minnow	60	8.90
Parrot minnow	10	1.49
White bass	27	4.01
Largemouth bass	1	0.14
Green sunfish	1	0.15
Spotted sunfish	5	0.74
Bluegill	4	0.60
Freshwater Drum	3	0.45
Totals	674	100.00

Table 3. Checklist of fishes, Lake Kemp.

Species	Scientific name	Numbers collected June 6-10, 1960	Not collected in June 1960, but known to occur in lake	Added to checklist June, 1960
Shortnose gar[1]	Lepisosteus platostomus	63		
Spotted gar[1]	L. productus		*	
Gizzard shad	Dorosoma cepedianum	601		
Smallmouth buffalo	Ictiobus bubalus	1		*
Carpsucker	Carpiodes carpio	717		
Carp	Cyprinus carpio	217		
Speckled chub	Hybopsis aestivalis		*	
Red River shiner	Notropis bairdi	9		
Sharpnose shiner	N. oxyrhynchus	9		
Redhorse shiner	N. lutrensis	132		
Ghost shiner	N. buchanani	25		
Plains minnow	Hybognathus placita	60		
Parrot minnow	Pimephales vigilas	10		
Channel catfish	Ictalurus punctatus	121		
Blue catfish	I. furcatus		*	
Flathead catfish	Pylodictus olivaris	9		
Plains killifish	Fundulus kansae		*	
Red River pupfish	Cyprinodon rubrofluviatilis		*	
White bass	Roccus chrysops	60		
Spotted bass	Micropterus punctulatus		*	
Largemouth bass	M. Salmoides	12		
Green sunfish	Lepomis cyanellus	1		
Spotted sunfish	L. punctatus	5		*
Bluegill	L. macrochirus	4		
Orangespotted sunfish	L. humilis		*	
Longear sunfish	L. megalotis		*	
White crappie	Pomoxis annularis	39		
Freshwater drum	Aplodinotus grunniens	21		
Totals		2116		

[1]Shortnose and spotted gar not differentiated during June 1960 survey.

Table 4. Food of game fish, Lake Kemp, June 6-10, 1960.

Species	Number of stomachs examined	Food Items	Frequency of occurrence	Number identified
Channel catfish	24	Aquatic insect larvae	11	many
		Crawfish	1	1
		plant matter	2	-
		grain	2	-
		insects	6	many
		fish remains	9	-
		mammal remains	1	1
		mussels	1	3
Largemouth bass	3	gizzard shad	1	
		fish remains	3	
		grass hopper	1	
Flathead catfish	1	fish remains	1	

Table 5. Comparison of average "K" factors from Lake Kemp and Lake Diversion.

Species	Lake Kemp		Lake Diversion
	1953-54	1960	1956
Shortnose gar			
male	.7	.6	.4
female	.6	.6	.4
Shad			
male	1.8	1.8	1.9
female	1.8	1.8	1.9
Smallmouth buffalo			
male	-	3.3	3.1
female	-	-	3.1
River carpsucker			
male	2.4	2.7	2.6
female	2.4	2.8	2.7
Carp			
male	2.3	2.5	2.5
female	2.4	2.6	2.6
Channel catfish			
male	1.6	1.6	1.7
female	1.6	1.7	1.6
Flathead catfish			
male	-	-	-
female	-	1.9	1.5
White bass			
male	2.6	2.1	2.4
female	2.5	2.1	2.6
Largemouth bass			
male	2.9	2.4	2.4
female	2.9	2.6	2.4
Crappie			
male	2.7	2.7	2.5
female	2.6	2.6	2.5
Freshwater drum			
male	2.3	2.4	2.2
female	-	2.3	2.2

Table 6. Lake Kemp fish species "K" factors, June 1960.

SPECIES	"K" FACTOR FREQUENCIES																																						Average "K" factors
	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	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	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9				
Shortnose gar																																							
males	8	5	3																																				0.6
females	9	23	9	5																																			0.6
Gizzard shad																																							
males								1	1	2	8	14	19	19	14	11	4	5	2	1	0	1																		1.8
females								1	1	1	9	21	24	17	19	12	8	3	1	0	1	2																		1.8
Smallmouth buffalo																																							
males																													1											3.3
females																													0											-
Carpsuckers																																							
males														1	1	2	6	7	27	30	46	61	65	63	48	26	30	24	7	8	4	1	0		0				2.7
females														0	1	2	1	5	17	18	14	23	29	43	25	26	12	14	6	6	4	0	1		1				2.8
Carp																																							
males														2		1	10	4	17	27	13	21	7	4	3	2	2	3	0		0				0				2.5
females														0		2	8	4	11	13	13	16	11	5	6	6	2	0	2		1				1				2.6
Channel catfish																																							
males							1	0	1	5	11	13	9	1	4	3	2	0	0																					1.6
females							0	1	1	5	16	14	13	12	3	2	2	1	1																					1.7
Flathead catfish																																							
males													0	0		0	0			0																				-
females													2	3		1	2			1																				1.9
White bass																																							
males												1	1	2	3	2	3	3	2	1	1	0	1																	2.1
females												0	1	0	2	3	4	0	1	2	0	0																	2.1
Largemouth bass																																							
males																		1	2	1	0	1	1	0	1															2.4
females																		0	1	1	1	0	0	1	1															2.6
White crappie																																							
males																	0	1	2	2	2	2	1		1	0	1	1				1							2.7
females																	1	2	2	4	2	4	4		1	4	1	0				0							2.6
Freshwater drum																																							
males														1			1	2	1		2		2	1	1															2.4
females														1			1	2	0		1		1	1	0															2.3

Lake Kickapoo

Objectives To resurvey Lake Kickapoo so that possible changes in any aspect of the previous survey can be detected and recorded.

Procedure Approximately 2,450 feet of various sized gill nets were set at 14 locations around Lake Kickapoo for two consecutive nights, March 29 and 30, 1960. Netting stations were selected at sites considered most suitable to sample the varied ecological niches present. All fish collected were identified, measured, weighed, and sexed. Contents of game fish stomachs were noted, as well as stages of gonadal development, diseases, injuries, and other abnormal conditions. Seine samples were collected with 20 foot minnow seines and preserved for later identification and counting.

Findings Lake Kickapoo, which is the water supply for the city of Wichita Falls, has a surface area of 6,200 acres and a volume of 105,000 acre-feet. Increased water demands from the rapidly increasing population of Wichita Falls causes the lake to become very low by the end of each summer. Fall and spring rains usually restore the water level sufficiently. Due to this fluctuation, rooted vegetation is scarce in the lake and will probably never become well established. Water quality is very good. It is slightly alkaline with a pH of 8.1, low in chlorides with 22 p.p.m., and low in dissolved solids with 251 p.p.m. Turbidity is always high, especially so after high winds.

A total of twelve species of fish was collected by gill net, and only five species were collected by seining. The only new species taken were the shortnose gar, Lepisosteus platostomus, the Red River shiner, Notropis bairdi. The redhorse shiner, Notropis lutrensis, was the most abundant minnow taken, and the fathead minnow, Pimephales vigilax, was common.

Gill netting results showed a population consisting of 57.14 percent game fish. White crappie were most abundant and comprised 42.85 percent of the catch (Table 1). Some of the rough fish species have apparently increased since 1954. Shortnose gar became established and gizzard shad and buffalos showed a slight increase. Table 1 gives the percentage composition, sex ratios, weights and average weights by sex of gill-netted fish.

The most apparent change in the game fish population since 1954 is the increase in mean weight of all game fish species. The increases are as follows:

	1954	1960
White crappie	0.27	0.86
Channel catfish	1.16	3.08
Flathead catfish	3.97	5.81
White bass	0.81	1.59

Netting and seining results indicate that crappie and channel catfish are reproducing very well (Tables 1 and 5). There was no indication that black bass or white bass reproduced very well last year, however. Many of the white bass taken were heavily laden with milt or eggs, and there should be a good spawn of white bass this year.

The principal food of white bass and crappie was small shad (Table 2). Although

none were taken by seine, they are very abundant and are easily available to the larger game fish. Channel catfish were found to feed mostly on algae, fish and insect larvae (Table 2). No black bass were taken, and as flathead catfish were saved for brood stock for the state fish hatchery, neither species was examined for stomach contents.

With the exception of carp, the general condition of all species was good (Table 3). The "K" factors of game fish and shortnose gar were exceptionally high. This was partially due to the fact that most fish were heavily laden with eggs or milt.

Due to the turbidity of Lake Kickapoo, fishermen using artificial lures have very limited success. Live bait fishing is more popular and more rewarding. Kickapoo fishermen should catch many more crappie and white bass than they do, however, and it is believed that the relatively small amount of success is due to the abundance of shad, drum, and small crappie. The young of these species supply an abundant and easily available source of food for the larger crappie and white bass. Control of these forage fishes would be desirable.

Comparison of the catches of conventional sampling gear and commercial fishing gear Five thousand feet of commercial gill nets were set at the same time as our regular gill nets were set. Thirty-eight hundred feet of the net were $3\frac{1}{2}$-inch mesh and the remainder were 4-inch mesh. Previously, results of surveys did not accurately show the population of larger rough fish such as bigmouth buffalo.

A comparison of the two catches shows that they are not at all similar in percentage composition (Table 4). Shad and carpsucker did not appear in the catch taken with commercial fishing gear. The catches of drum, carp, and longnose gar were nearly the same, but the catches of buffalos and other species were greatly different. Using our sampling methods, the total catch of buffalos, both species, was 10.55 percent of the total catch, whereas the catch of both species of buffalo, using the other gear, was 69.58 percent of the total catch. This is a very significant difference, and reflects the selectivity of different netting techniques.

The factors influencing the differences in the two catches were probably mesh size, twine size, location of nets, and manner in which the nets are hung.

Recommendations Shad and drum should be controlled. It is recommended that Lake Kickapoo be given a selective rotenone treatment to reduce these species. Such a treatment should be effective for about three years and would undoubtly improve fishing. The present crappie population is very near the point at which the lake would not produce large crappie, but would produce many stunted ones. Proper harvesting will reduce their numbers, and allow the remaining fish to become larger, thus making them more desirable to catch and to eat.

A fall treatment is recommended for the removal of shad and drum. In addition, insect larvae, which supply a considerable amount of the winter food for crappie and white bass, would also be removed. Without small shad, drum and insect larvae to feed upon, game fish would have to search for other food, and fishermen could more properly harvest them. A spring treatment would probably be less desirable than a fall treatment for the following reasons:

1. Some shad and drum would survive and spawn, thus providing forage for the following winter.

2. Aquatic larvae may be killed, but during the following summer months adult insects from nearby water areas would lay their eggs in the lake. A fall treatment would be done after the insect breeding season had passed.

Lake Kickapoo should also be fished commercially for the removal of buffalo, carp, and carpsucker.

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Date April 3, 1961

Table 1. Results of gill netting, Lake Kickapoo, March 29-30, 1960.

Species	Fish collected		Weights of fish collected			Male fish collected				Female fish collected			
						Numbers		Weights		Numbers		Weights	
	Number	Percent of total	Weights in pounds	Percent of total weight	Mean weight in pounds	Fish	Percent males	Pounds	Average in pounds	Fish	Percent females	Pounds	Average in pounds
Longnose gar	1	0.29	3.06	0.50	3.06	1	100.00	3.06	3.06	0	0	0	0
Shortnose gar	14	4.11	43.93	7.17	3.14	5	35.71	5.28	1.06	9	64.29	38.11	4.23
Gizzard shad	27	7.92	5.91	0.97	0.22	11	40.74	1.62	0.15	16	59.26	4.29	0.27
Smallmouth buffalo	24	7.03	79.33	12.97	3.31	17	70.83	49.91	2.94	7	29.17	29.42	4.20
Bigmouth buffalo	12	3.52	58.82	9.61	4.90	9	75.00	31.06	3.45	3	25.00	27.76	9.25
Carpsucker	48	14.08	33.99	5.55	0.71	23	47.92	16.13	0.70	25	52.08	18.86	0.75
Carp	14	4.10	43.74	7.15	3.12	3	21.43	5.50	1.83	11	78.57	38.24	3.48
Channel catfish	36	10.56	110.89	18.12	3.08	14	38.89	40.83	2.92	22	61.11	70.06	3.18
Flathead catfish	14	4.11	81.28	13.29	5.81	*	*	*	*	*	*	*	*
White bass	33	9.67	52.33	8.55	1.59	15	45.45	11.73	0.78	18	54.55	40.60	2.26
White crappie	111	32.85	96.42	15.76	0.87	53	47.74	30.34	0.57	58	52.26	66.08	1.14
Freshwater drum	6	1.76	2.19	0.36	0.37	3	50.00	0.40	0.13	3	50.00	1.79	0.60
Totals	340	100.00	611.89	100.00									

*Flathead catfish were saved for hatchery brood stock and their sex was not determined.

Table 2. Food of game fish, Lake Kickapoo, March 29-30, 1960.

Species	Number of stomachs examined	Food items	Frequency of occurrence	Number identified
Channel catfish	22	Mayfly nymphs	3	22
		Fish remains	3	3
		White crappie	3	4
		Freshwater drum	3	5
		Grain	1	-
		Insects	1	1
		Bait shrimp	1	3
		Grass	1	-
		Algae	10	-
White bass	10	Gizzard shad	5	6
		Fish remains	6	6
White crappie	33	Gizzard shad	22	27
		Sunfish	1	1
		Fish remains	11	11
		White crappie	1	1
		Freshwater drum	1	1
		Mayfly nymphs	1	3

Table 3. Lake Kickapoo fish species "K" factors, March 1960.

Species	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2
Longnose gar																		
males	1																	
females	-																	
Shortnose gar																		
males		2	2	1	-	-												
females		-	2	4	2	1												
Gizzard shad																		
males												1	4	3	2	-	1	-
females												-	-	4	4	1	1	1
Smallmouth buffalo																		
males																		
females																		
Bigmouth buffalo																		
males																		
females																		
Carpsucker																		
males																1		
females																-		
Carp																		
males																		
females																		
Channel catfish																		
males										1	1	1	3	-	3	3	-	-
females										2	-	4	3	2	1	3	3	1
Flathead catfish																		
males																		
females													3	4	3	1		1
White bass																		
males																		
females																		
White crappie																		
males																	2	2
females																	-	-
Freshwater drum																		
males																		3
females																		1

Species	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	3.8	3.9	4.0	4.1	4.2	4.3	4.6	Average "K" factor
Longnose gar																							
males																							0.5
females																							-
Shortnose gar																							
males																							0.7
females																							0.8
Gizzard shad																							
males	-	-																					1.8
females	3	2																					2.1
Smallmouth buffalo																							
males								1	2	2	-	2	4	2	2	1		-	-	1			3.5
females								-	-	1	1	-	1	-	-	-		2	1	1			3.8
Bigmouth buffalo																							
males						1			1	1		2	1	1	1	1			-				3.4
females						-			-	-		1	-	-	-	1			1				3.8
Carpsucker																							
males	2	1	2	3	-	10	3	-	-														2.5
females	1	-	2	3	5	2	9	1	3														2.9
Carp																							
males		1	-	1	1	-	-																2.6
females		3	2	1	1	3	1																2.6
Channel catfish																							
males	1	-	1	-																			1.9
females	-	1	1	1																			1.9
Flathead catfish																							
males																							
females	1		1																				1.9
White bass																							
males				1	1	3	4	5	1	-	-	-	-	-				-					2.9
females				-	1	1	-	1	2	5	2	3	1	1				1					3.3
White crappie																							
males	2	1	2	-	2	5	11	4	3	6	1	4	1	3	-	1	1	-		1		1	3.0
females	-	1	1	1	2	6	8	2	4	4	1	6	2	3	1	7	-	5		3		1	3.3
Freshwater drum																							
males																							2.2
females	1					1																	2.4

Table 4. Comparison of catches of conventional sampling gear and commercial fishing gear

Species	Conventional gear*		Commercial gear**	
	Fish caught in two days fishing	Percent of total	Fish caught in two days fishing	Percent of total
Longnose gar	1	0.29	1	0.46
Shortnose gar	14	4.11	2	0.92
Gizzard shad	27	7.92	-	
Smallmouth buffalo	24	7.03	41	18.89
Bigmouth buffalo	12	3.52	110	50.69
Carpsucker	48	14.08	-	
Carp	14	4.10	6	2.77
Channel catfish	36	10.56	13	5.99
Flathead catfish	14	4.11	17	7.83
White bass	33	9.67	3	1.39
White crappie	111	32.85	21	9.67
Freshwater drum	6	1.76	3	1.39
Totals	340	100.00	217	100.00

*825 feet of 3-inch mesh and 1,500 feet of experimental gill nets (300 feet each of 1-, 1½-, 2-, 2½-, and 3-inch meshes)

**3,800 feet of 3½-inch mesh and 1,200 feet of 4-inch mesh.

Table 5. Results of seining, Lake Kickapoo, March 30, 1960.

Species	Scientific name	Number collected	Percent of total collected
Red River shiner	Notropis bairdi	14	4.93
Redhorse shiner	N. lutrensis	242	85.21
Parrot minnow	Pimephales vigilax	20	7.04
Gambusia	Gambusia affinis	7	2.46
Bluegill	Lepomis macrochirus	1	0.36
	Totals	284	100.00