Report of Fisheries Investigations

Inventory of Fish Species Present in Buffalo Lake (Continued from F7R4).

by

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Dingell-Johnson Project F-7-R-5, Job B-9
June 1, 1957 - May 31, 1958

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SEGMENT COMPLETION REPORT

Investigations Projects

State of TEXAS

Project No. F7R5 Name: Fisheries Investigations and Surveys of the Waters of Region 1-B.

Job No. B-9 Title: Inventory of Fish Species Present in Buffalo Lake (Continued from F7R4).

Period Covered: June 1, 1957 through May 31, 1958

ABSTRACT:

An estimated 200 tons of fish, mostly gizzard shad and carp, was removed from Buffalo Lake from May 1956 through June 1957. Inventory was made during one year prior to this period through one year following, in order to compile comparative data which may indicate possible effects of this fish removal.

A total of 2,207 fishes was collected during this segment by gill nets from which data concerning food habits, sexual development, spawning success, coefficient of condition and pathological conditions was recorded, and as far as possible, reduced to tabular form.

Work done at Buffalo Lake has failed to serve as an adequate check on selective-kill methods. The lake has been reduced to abnormally low levels, resulting in conditions that would have been a detriment to the fishery of any body of water. This job will be discontinued in order to devote more time to natural history studies of rough fish species in an effort to obtain information that may assist in the control of their populations.

Buffalo Lake will be checked periodically on a re-survey job to determine any possible benefits derived from the work in the past.

OBJECTIVES:

To determine the fish species present and their relative abundance, as well as to determine the ecological factors influencing their distribution. To discover both the immediate and progressive changes which may occur in the fish population as the result of experimental selective-kill treatments under Job E-1.

TECHNIQUES:

Field work on this job began in June 1957, and terminated in April 1958. The month of May 1958, was devoted to final compilation and tabulation of data and report writing. Collections were spaced approximately one month apart so that data collected

would be comparable to that of previous segments. Approximately 1200 feet of gill net, ranging in size from 1 inch to 3 inch (square mesh) were set on each visit. Each fish taken in these nets was measured, weighed, and the stage of gonadal development recorded. Filled stomachs of predacious species were saved in formalin, as well as ripe ovaries, pathological tissues and parasites. Samples of forage fishes were obtained with the use of small-mesh seines, and the complete collections preserved in formalin. In the laboratory, formalin-preserved materials were identified, examined and the data recorded.

In addition to collections made with gill nets and minnow seines, supplemental data was obtained by the use of 1200 foot drag seine. In order to efficiently operate this seine, it was necessary to clear several large areas of stumps, rocks, trotline stakes and other obstructions. As a result, operation of the seine was much easier than during previous segments, additional information was obtained, and considerable quantities of undesirable fish were removed.

Physical data, including air temperature, water-surface temperature and turbidity (Secchi disc) was recorded at the lake. Samples of lake water were saved and the pH and dissolved solids present were determined. Also, a gallon of water was saved each time to determine turbidity with the Jackson turbidimeter.

FINDINGS:

An estimated minimum of 200 tons of fish, mostly gizzard shad and carp, was removed from Buffalo Lake by experimental selective-kill and spot treatments, seining and gill netting, from May 1956 through June 1957. Inventory had been taken by gill nets and seines for 11 months prior to the first treatment in order to compile data which would be comparative to that collected following experimental treatments. Details of the work done at Buffalo Lake prior to this study period are discussed in the reports F7R3, Job B-9; F7R3, Job B-4; F7R4, Job B-9; and F7R4, Job E-1. This report presents data collected during 11 consecutive months following the last spot chemical treatment in June 1957.

FISH COLLECTIONS

A total of 2,207 fishes was collected by gill nets from Buffalo Lake during the segment period from June 1, 1957 to May 31, 1958. Percentage composition, sex ratios, and average weights by sex of fishes collected by gill nets during the 1956 - 1957 segment as compared to the 1957- 1958 segment are given in Tables 1 and 2 respectively. Percentage composition by weight and mean weights of fishes collected by gill nets during the 1956 - 1957 segment as compared to the 1957 - 1958 segment is given in Tables 3 and 4 respectively.

A total of 7,426 forage fishes was collected during the segment with small mesh minnow seines. This information, with a break-down of species, is given in Table 5. The total number of fishes taken by both gill nets and small-mesh seines during the 1956 - 1957 and 1957 - 1958 segments is compared in Table 6. Table 7 presents the number of fishes collected with the 1200 foot and 300 foot drag seine.

WATER QUALITY

Chemical analysis of Buffalo Lake water is given in Table 8. The quality of water in Buffalo Lake during this study period is appreciably the same as during previous segments.

PHYSICAL CHARACTERISTICS

Physical conditions of Buffalo Lake water, at times when the fish population was sampled, are given in Table 9. Air temperature ranged from 86 degrees to 36 degrees, and water surface temperature ranged from 79 degrees to 34 degrees. During the January survey, the lake was covered with at least one inch of ice which hindered gill netting operations. The water was commonly quite turbid during the survey due to fertility of the water, low water levels caused by drought, almost constant wave action which keeps the bottom mud in suspension, and an abundant rough fish population.

FOOD HABITS

Food remains were found in stomachs of 69 specimens; 15 channel catfish, 3 flathead catfish, 5 black bullhead catfish, 38 crappie and 8 black bass. Table 10 presents results of the analysis made on food remains found in stomachs of all predacious species that contained food.

Shad was by far the most frequently identified food item. A total of 98 shad was found in 49 of the 69 stomachs examined. Flathead catfish, black bullhead catfish, crappie and black bass fed almost exclusively on fish, with the exception on one crayfish in the stomach of a black bass and plant remains in 3 crappie stomachs. Channel catfish stomachs contained a wide variety of food items, including shad, crayfish, freshwater shrimp, fish eggs, plant remains, grasshoppers and blister bugs.

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 instances where a fish was captured shortly after spawning, it was called "spent".

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

According to condition of gonads observed throughout the year, sexual development of all species was quite similar to that of the preceding segment. Actual spawning, however, appeared to be somewhat different. During June and July, 1957, shad, carp and goldfish were observed spawning in the shallows on cockel burr stalks, tumbleweeds and large rocks. Apparently, these species will utilize any object upon which their eggs will adhere, including rusty beer cans and trotline stakes. Seining collections during the summer months also indicated that these species were successful in their spawning, in spite of limited spawning areas caused

by receding water levels. Except for channel catfish, which probably spawned in the rocks near the dam, spawning of game species was somewhat limited. Channel catfish young-of-the-year were commonly found in spawning areas of the rough fish species.

In the spring of 1958, the water level had been reduced to a very low level, depriving the bottom nesting game species of most of their natural spawning conditions, except down near the dam. Although the usual large scale spawning activities of shad, carp and goldfish were not observed, seine collections indicated that they were spawning as before in spite of adverse conditions. Oddly enough, freshly spawned channel catfish were collected in the latter part of April.

Conditions that are conducive to the spawning of white bass have not been afforded in Buffalo Lake, and up to the latter part of April, there are no indications that any of the 1420 white bass stocked during this segment have reproduced.

COEFFICIENT OF CONDITION

"K" factors were worked out for all of the larger fishes taken in gill nets. Distribution of "K" factors for fishes in Buffalo Lake during the 1957 - 1958 segment, as compared to those of 1956 - 1957, is given in Table 11. All of the fishes taken are not listed in Table 11 because immature animals less than 50 mm. were rejected, and a few were recorded erroneously, resulting in ridiculous "K" factors.

Interesting to note is the substantial increase in "K" for both sexes of black bass and crappie. Coefficients of condition for most species increased slightly with the exception of shad and female goldfish, black bullhead, carpsucker and channel catfish. "K" factors for the males of the 4 latter species increased to some extent.

Contrary to the previous segment, monthly variations of "K" factor distribution for shad did not follow the pattern of increasing during the summer and decreasing during the winter. Instead, there was a slight, but gradual, decrease of the average "K" throughout the segment with a slight increase in April, 1958. Average monthly weights and lengths also followed this pattern. One possible explanation for this decrease in "K" is the increase in the shad population, causing over-crowded conditions in the lake which is decreasing in size. During the last four months of the segment, the number of shad taken by gill nets was twice that of previous months.

PATHOLOGICAL CONDITIONS

All fishes taken during the study were examined for evidence of disease, parasites, or other abnormalities.

Two crappie were found to be infected with the hard, encrusted type fungus. Infected areas were confined to their tails.

Gonads of several goldfish were greatly enlarged and filled with water. It appeared to be an enormous hydrocele which gave the entire fish a round appearance. This condition greatly increased the "K" factor in the infected fish.

Two black bass were found to be blind in one eye, which, apparently, had no effect on their condition.

Blindness in large shad was common, but it had no apparent effect on their health. Eyes and part of the head of infected fishes were covered with what appeared to be ossified mucous. One shad had a crooked body, probably resulting from an injury occurring early in life.

A carpsucker was taken with a short, stunted body, resulting in a "K" factor much higher than average.

The only other abnormality noticed was the possession of 3 ovaries by a carp.

DISCUSSION:

An estimated 200 tons of fish, mostly gizzard shad and carp, was removed from Buffalo Lake from May, 1956 through June 1957. Netting and seining operations during routine fisheries surveys since that time have removed an additional 1,813 pounds of shad and 8,133 pounds of carp. In spite of this population reduction, shad and carp have replenished themselves in sufficient numbers to constitute a major problem to the fishery of Buffalo Lake.

According to gill netting results during the three years of study, the rough fish population has increased from 55.1 percent to 82.1 percent. Shad increased from 40.9 percent to 45.7 percent, carp from 11.1 percent to 23.6 percent, carpsucker from 1.1 percent to 2.7 percent and goldfish from 0.7 percent to 2.7 percent. The crappie population decreased from 37.4 percent to 10.6 percent, whereas all other species have remained about the same, percentage-wise.

This great increase in percentages of rough fish species is partly explained by a change in techniques following the first period of study at Buffalo Lake. During the first survey, crappie, especially small individuals, were excessively abundant. They were taken in great numbers in the one inch mesh sections of experimental type gill nets, and were worked into the data with all other fishes taken. As a result, this over-abundant population of small crappie was considered a major problem, and recommendations were made in the report F7R3, Job B-9, for a reduction of their numbers. During the last two periods of study, however, the decision was made to reject all crappie under 50 mm. long in order to obtain more reliable "K" factor data for this species. This resulted in a great reduction in the number of crappie recorded during the last two segments, which increased the ratio of rough fish to game fish. This is only a partial explanation, however, because crappie are apparently not as abundant in Buffalo Lake as they were during the first segment. This may be partly due to adverse spawning conditions caused by receding water levels and partly to the effects of the experimental selective-kill treatment. Nevertheless, this reduction has been beneficial to the crappie population because both the average size and coefficient of condition of crappie has increased during the present segment.

Judging from the great numbers of rough fish removed and the excessive population of rough fish still present, the selective-kill treatments have not produced the beneficial effects that were expected. Immediately following the treatments, turbidity decreased considerably and there was a considerable decrease in the number of shad and carp taken in gill nets. However, they replenished themselves in a very short time.

Shad apparently had a very productive spawn following the last treatment because their numbers have doubled during the last four months of this segment period.

As stated before, the excessive relative-abundance of rough fish in Buffalo Lake is possibly due to some extent, to the low water levels for the past two years. Most of the natural nesting and breeding sites of black bass, crappie and sunfishes are no longer under water, making it more difficult for these species to reproduce in the mud and silt-laden bottom. Whereas, the rough fish species were able to produce successful spawns on wind-deposited tumbleweeds, larger rocks and other objects above the silt.

Low water levels and reduction in the size of the lake is also a probable factor in the increase of rough fish captured in gill nets. In order to keep the data comparable, net sets were maintained in the same locations as far as possible. As water levels receded, the nets were moved farther into the lake from the same location, resulting in most of the nets being set in shallow, muddy water. Since most of the self-respecting game fishes may have retreated to the more desirable deep water at the lower end of the lake, the nets in the middle and upper end captured relatively greater numbers of rough fish species. Also, with a smaller volume of water, an increase in the capture of the very active shad and carp can be expected.

Although physical conditions of the fishes in Buffalo Lake did not change appreciably during this segment, "K" factors and the average lengths and weights have increased considerably since the first period of study in 1955 - 1956. Although netting results indicate that the relative abundance of game species has decreased, their condition and average size have definitely increased.

The selective-kill treatments may have produced greater selectivity on male shad than females, because 80 percent of the shad taken in gill nets, following the treatments, were females. This is an increase of 25 percent females over the 1955 - 1956 segment period.

Regrettably, the work done at Buffalo Lake has failed to serve as an adequate check on selective-kill methods. Rains that have occurred in practically all other parts of Texas failed to occur on the watershed of Buffalo Lake, and the lake has been reduced to an abnormally low level. Conditions have resulted that would have been a detriment to the fishery of any body of water. For that reason, this job (B-9) will be discontinued in order to devote more time to the natural history studies of rough fish species, in an effort to obtain information that may assist in the control of their populations. Buffalo Lake will be checked periodically on a re-survey job to determine any possible benefits derived from the work in the past.

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TABLE NO. 1 PERCENTAGE COMPOSITION, SEX RATIOS AND AVERAGE WEIGHTS BY SEX OF FISH COLLECTED BY GILL NETS FROM BUFFALO LAKE 1956 - 1957.

Species	Number Taken	% of Total	% Males	Avg. Male Weight	% Females	Avg. Female Weight
Dorosoma cepedianum	844	40.0	24.2	.56	75.8	.74
Carpiodes carpio	82	3.9	57.3	3.1	42.7	2.77
Cyprinus carpio	428	20.3	61.9	1.38	38.1	1.70
Carassius auritus	26	1.2	57.7	1.00	42.3	1.67
Carassius-Cyprinus Cross	58	2.8	72.4	.58	27.6	1.36
Ictalurus punctatus	98	4.7	39.8	1.0	60.2	1.10
Ictalurus melas	5	.2	40.0	.21	60.0	.21
Pylodictus olivaris	4	.2	0	0	100.0	6.25
Roccus chrysops	0	0	0	0	0	0
Micropterus salmoides	41	1.9	24.4	2.5	75.6	3.82
Pomoxis annularis	522	24.8	41.6	.2	58.4	.17
Total	2108	100.0				

TABLE NO. 2 PERCENTAGE COMPOSITION, SEX RATIOS AND AVERAGE WEIGHTS BY SEX OF FISH COLLECTED BY GILL NETS FROM BUFFALO LAKE, 1957 - 1958.

Species	Number Taken	% of Total	% Males	Avg. Male Weight (lbs.)	% Females	Avg. Female Weight (lbs.)
Dorosoma cepedianum	1009	45.74	20.0	0.58	80.0	0.79
Carpiodes carpio	160	7.25	46.9	2.45	53.1	2.86
Cyprinus carpio	522	23.64	55.2	1.48	44.8	1.50
Carassius auritus	61	2.76	23.0	1.00	77.0	1.51
Carassius-Cyprinus Cross	60	2.72	36.8	1.37	63.2	1.72
Ictalurus punctatus	99	4.48	20.2	1.31	79.8	0.95
Pylodictus olivaris	5	0.23	0.0	-	100.0	8.14
Ictalurus melas	24	1.09	16.7	0.45	83.3	0.35
Roccus chrysops	1	0.04	0.0	-	100.0	2.59
Micropterus salmoides	32	1.45	34.4	3.34	65.6	4.08
Pomoxis annularis	234	10.60	37.6	0.48	62.4	0.41
Total	2207	100.0				

TABLE NO. 3 PERCENTAGE COMPOSITION BY WEIGHT AND MEAN WEIGHTS OF FISHES COLLECTED BY GILL NETS FROM BUFFALO LAKE, 1956 - 1957.

Species	Weight Taken (lbs.)	% of Total Weight	Mean Weight
Dorosoma cepedianum	589.0	30.6	.69 lbs.
Carpiodes carpio	242.5	12.6	2.96
Cyprinus carpio	642.1	33.4	1.50
Carassius auritus	34.1	1.8	1.31
Carassius-Cyprinus Cross	46.1	2.4	.79
Ictalurus punctatus	105.6	5.5	1.07
Ictalurus melas	1.1	.1	.21
Pylodictus olivaris	25.2	1.3	6.25
Roccus chrysops	0	0	-
Micropterus salmoides	143.6	7.5	3.50
Pomoxis annularis	93.3	4.8	1.78
Total	1922.6	100.0	

TABLE NO. 4 PERCENTAGE COMPOSITION BY WEIGHT AND MEAN WEIGHTS OF FISHES COLLECTED BY GILL NETS FROM BUFFALO LAKE, 1957 - 1958

Species	Weight Taken (lbs.)	% of Total Weight	Mean Weight
Dorosoma cepedianum	751.4	30.0	0.74
Carpiodes carpio	427.3	17.1	2.67
Cyprinus carpio	772.7	30.9	1.49
Carassius auritus	86.7	3.5	1.40
Carassius-Cyprinus Cross	94.1	3.8	1.59
Ictalurus punctatus	90.9	3.6	1.02
Pylodictus olivaris	40.7	1.6	8.14
Ictalurus melas	8.8	0.4	0.37
Roccus chrysops	2.6	0.1	2.60
Micropterus salmoides	122.4	4.9	3.83
Pomoxis annularis	102.9	4.1	0.44
Total	2500.5	100.0	

TABLE NO. 5 TOTAL NUMBER OF FORAGE FISHES TAKEN FROM BUFFALO LAKE, 1957 - 1958

Species	Total
Dorosoma cepedianum	723
Carpiodes carpio	10
Cyprinus carpio	144
Carassius auritus	5
Cyprinus-Carassius Cross	10
Notemigonus crysoleucas	1
Phenacobius mirabilis	3
Notropis bairdi	21
Notropis lutrensis	3261
Hybognathus	24
Pimephales vigilax	853
Pimephales promelas	1960
Ictalurus punctatus	35
Ictalurus melas	13
Fundulus kansae	19
Gambusia affinis	22
Micropterus salmoides	16
Lepomis cyanellus	9
Lepomis microlophus	2
Lepomis macrochirus	77
Lepomis humilis	201
Lepomis megalotis	1
Pomoxis annularis	16
Total	7426

Note: The Brook Stickleback (Eucalia inconstano) was observed being sold as bait by the Buffalo Lake concessionaire and the species may be present in the lake. They were part of a shipment of bait minnows from Wisconsin to Buffalo Lake.

TABLE NO. 6 TOTAL NUMBER OF FISHES TAKEN FROM BUFFALO LAKE, 1957 - 1958 AS COMPARED WITH 1956 - 1957

Species	Number Taken 1956 - 1957	Number Taken 1957 - 1958
Dorosoma cepedianum	854	1732
Carpiodes carpio	82	170
Cyprinus carpio	431	666
Carassius auritus	26	66
Cyprinus-Carassius Cross	59	70
Notemigonus crysoleucas	0	1
Phenacobius mirabilis	0	3
Notropis percobromus	2	0
Notropis bairdi	5	21
Notropis girardi	3	0
Notropis lutrensis	689	3261
Hybognathus	203	24
Pimephales vigilax	4	853
Pimephales promelas	147	1960
Ictalurus punctatus	99	134
Ictalurus melas	5	37
Pylodictus olivaris	4	5
Fundulus kansae	16	19
Gambusia affinis	4	22
Roccus chrysops	0	1
Micropterus salmoides	73	48
Lepomis cyanellus	0	9
Lepomis microlophus	0	2
Lepomis macrochirus	12	77
Lepomis humilis	107	201
Lepomis auritus	4	0
Lepomis megalotis	2	1
Pomoxis annularis	527	250
Totals	3358	9633

TABLE NO. 7 RESULTS OF 1200 FOOT AND 300 FOOT SEINE DRAGS IN BUFFALO LAKE

Date	Seine	Species	1st Drag	2nd Drag	3rd Drag	4th Drag	Total
7/22/57	1200'	Shad	11	159			170
2 drags		Carp	39	149			188
		Goldfish	29	63			92
		Carpsucker	5	-			5
		Channel Cat	2	6			8
		Crappie	22	23			45
		Bullhead	-	7			7
		Total	108	407			515
7/23/57	1200'	Shad	68	24	51		143
3 drags		Carp	1878	414	928		3220
		Goldfish	329	122	341		792
		Channel Cat	44	17	51		112
		Bullhead	3	2	2		7
		Black Bass	1	-	1		2
		Crappie	19	6	88		113
		White Bass	-	-	1		1
		Carpsucker	-	-	3		3
		Total	2342	585	1466		4393
7/24/57	1200'	Shad	11	380			391
2 drags		Carp	85	279			364
		Goldfish	38	110			148
		Channel Cat	32	64			96
		Bullhead	7	7			14
		Black Bass	1	2			3
		Crappie	54	133			187
		Total	228	975			1203
8/26/57	300'	Crappie	17	39	36	33	125
4 drags		Shad	8	4	1	29	42
		Carp	7	10	45	19	81
		Goldfish	1	3	2	-	6
		Carp-Goldfish Cross	1	-	1	-	2
		Bullhead	1	1	8	2	12
		Channel Cat	-	1	3	38	42
		Black Bass	-	1	-	-	1
		Carpsucker	-	3	5	-	8
		Total	35	62	101	121	319
1/15/58	1200'	Shad	689	49			738
2 drags		Carp	42	1030			1072
		Goldfish	55	5			60
		Black Bass	5	2			7
		Crappie	88	8			96
		White Bass	1	-			1
		Channel Cat	21	-			21
		Carpsucker	1	-			1
		Total	902	1094			1996

TABLE NO. 8 CHEMICAL NATURE OF THE WATER AT BUFFALO LAKE, 1957 - 1958

Date	ca	na	cl	So4	Co3	HCo3	Total	pH
6/27/57	88	132	63	84	18	366	751	8.40
7/23/57	97	281	70	384	18	390	1240	
8/26/57	88	173	96	125	90	216	788	
9/17/57	94	173	95	132	72	268	834	
10/22/57	97	172	95	102	18	415	899	
11/18/57	96	188	83	154	15	415	951	
12/16/57	28	174	78	58	3	546	930	8.5
1/16/58	58	195	92	211	27	372	987	8.5

TABLE NO. 9 BUFFALO LAKE PHYSICAL DATA

Date	Air	Water	Turbidity	
			Secchi Disc	Jackson Turbidimeter
June 28, 1957	86	79	230	
July 23, 1957	69	76	220	
August 27, 1957	77	69	110	
September 17, 1957	59	61	120	
October 22, 1957	60	53	110	191 ppm.
November 19, 1957	43	46	122	228 ppm.
December 17, 1957	63	39	75	315 ppm.
January 16, 1958	36	36	115	243 ppm.
February 18, 1958	39	34	120	232 ppm.
March 25, 1958	54	43	70	243 ppm.
April 24, 1958	50	57		

TABLE NO. 10 STOMACH ANALYSIS OF FISHES TAKEN IN GILL NETS FROM BUFFALO LAKE, 1957 - 1958

Food Item	Frequency of Occurrence	Total Number Identified
Channel Cat		
Shad	7	30
Sunfish	1	1
Fish remains (unidentifiable)	4	12
Minnow remains (unidentifiable)	1	1
Crayfish	3	3
Freshwater shrimp	1	1
Carp and Goldfish eggs	1	1 /
Fish scales	1	1
Carp tooth	1	1
Otolith bone	1	1
External plate of turtle	1	1
Algae	3	3
Plant remains	1	1
Grasshopper remains (acridae)	1	25
Blister bugs (Meloidae)	1	2
Flathead Catfish		
Shad	3	8 /
Crappie	1	1
Fish remains	1	1
Black Bullhead		
Shad	4	9
Fish remains	1	1
Crappie		
Shad	31	43
Fish remains	12	12
Plant seeds	2	3
Plant fibers	1	1
Nearly digested food (unidentifiable)	2	2
Black Bass		
Shad	4	8
Crappie	1	2
Carp	1	1
Fish remains	3	3
Minnow remains	1	1
Crayfish	1	1

TABLE NO. 11 DISTRIBUTION OF "K" FACTORS FROM BUFFALO LAKE, 1957 - 1958 AS COMPARED TO 1956 - 1957

Cyprinus carpio

1956 - 1957

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	3.5	3.6	Avg. "K"
Males	4	11	31	46	48	42	28	27	9	2	4	4	3	2	-	-	-	2.46
Females	4	6	9	18	16	29	14	18	18	13	5	5	2	1	1	-	1	2.58

1957 - 1958

Factor	1.6	1.7	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	5.0	Avg. "K"
Males	-	-	3	5	5	13	38	54	66	47	26	18	3	4	1	-	2	1	1	2.60
Females	1	1	1	-	1	10	32	34	50	40	36	15	5	4	-	1	1	1	-	2.63

Capriodes carpio

1956 - 1957

Factor	2.4	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	Avg. "K"
Males	-	1	1	1	5	6	11	4	5	5	4	2	0	1	-	-	-	1	-	3.20
Females	1	1	-	1	-	3	4	2	3	6	3	5	1	2	-	1	-	1	1	3.38

1957 - 1958

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	3.9	4.0	4.1	4.2	4.5	4.6	Avg. "K"
Males	1	3	6	9	11	12	10	10	4	5	2	-	-	1	-	-	-	-	-	3.12
Females	-	1	1	7	5	7	16	13	12	8	4	2	4	1	1	-	1	1	1	3.34

Dorosoma cepedianum

1956 - 1957

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	2.8	2.9	Avg. "K"
Males	-	-	2	1	3	7	33	59	46	19	12	9	4	3	1	2	3	2.08
Females	-	-	3	3	5	10	26	119	205	136	71	34	16	10	9	1	1	2.15

1957 - 1958

Factor	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	Avg. "K"
Males	-	-	1	9	20	47	48	41	16	15	3	2	-	-	-	-	-	-	2.01
Females	1	-	4	8	29	74	174	238	170	74	27	5	3	-	-	-	-	1	2.10

TABLE NO. 11 (CONTINUED) DISTRIBUTION OF "K" FACTORS FROM BUFFALO LAKE, 1957 - 1958 AS COMPARED TO 1956 - 1957

Ictalurus punctatus
1956 - 1957

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	2.2	2.3	2.4	2.5	Avg. "K"
Males	-	-	-	1	1	2	6	6	10	5	3	1	2	-	2	-	1.80
Females	-	-	-	-	2	2	3	7	15	12	5	4	2	2	3	1	1.89

1957 - 1958

Factor	0.9	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	Avg. "K"
Males	-	2	2	3	3	2	2	2	1	-	1	-	-	1.85
Females	1	5	4	16	14	14	11	2	1	2	-	-	1	1.75

Cyprinus-Carassius Cross
1956 - 1957

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	Avg. "K"
Males	1	-	-	-	-	3	6	6	7	6	6	4	2	-	1	3.12
Females	-	-	-	2	-	2	4	2	4	2	-	-	-	-	-	2.95

1957 - 1958

Factor	2.6	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	Avg. "K"
Males	1	3	-	4	11	1	1	-	-	-	-	-	-	-	-	3.12
Females	1	1	2	6	9	5	6	2	1	-	1	-	1	1	1	3.31
Sterile	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	3.10

Carassius auritus
1956 - 1957

Factor	3.6	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.6	6.7	6.9	7.0	8.4	Avg. "K"
Males	2	3	1	4	-	2	1	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4.05
Females	-	-	-	-	1	-	-	-	-	1	-	1	3	-	-	1	-	-	-	1	-	1	-	-	-	1	1	-	5.41

1957 - 1958

Factor	3.1	3.4	3.9	4.0	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.6	6.7	6.8	7.5	8.4	Avg. "K"
Males	-	1	1	1	2	-	3	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.42
Females	1	-	-	-	1	2	3	2	7	4	4	1	3	1	4	2	1	1	1	2	1	1	1	1	1	1	1	1	5.13

TABLE NO. 11 (CONTINUED) DISTRIBUTION OF "K" FACTORS FROM BUFFALO LAKE, 1957 - 1958 AS COMPARED TO 1956 - 1957

Micropterus salmoides

1956 - 1957

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	Avg. "K"
Males	-	-	-	-	1	-	2	1	1	-	2	1	-	-	-	2.98
Females	-	2	1	-	2	-	1	4	3	7	3	4	2	1	-	3.01

1957 - 1958

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	4.0	4.2	4.4	Avg. "K"
Males	-	1	-	-	1	-	3	3	1	1	1	-	-	-	-	3.25
Females	2	-	1	2	1	5	3	-	3	1	1	1	-	-	1	3.20

Pomoxis annularis

1956 - 1957

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	3.7	3.8	3.9	4.0	4.1	4.5	Avg. "K"
Males	1	1	-	4	9	19	25	44	42	23	21	7	9	3	1	2	2	-	-	-	1	2	2.90
Females	-	1	3	9	33	45	41	34	48	16	34	20	11	6	3	1	-	-	-	1	-	-	2.83

1957 - 1958

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	3.5	3.6	3.7	3.8	3.9	4.0	4.1	Avg. "K"
Males	-	1	-	-	-	-	2	-	2	4	5	5	11	6	11	6	10	5	9	1	-	1	3.36
Females	-	-	-	-	3	1	5	11	8	14	12	12	18	15	14	9	11	7	2	2	1	1	3.18

Pylodictus olivaris

1956 - 1957

Factor	1.8	1.9	2.0	2.1	2.2	2.3	2.4	Avg. "K"
Males	-	-	-	-	-	-	-	-
Females	-	-	-	3	1	-	-	2.13

1957 - 1958

Factor	2.0	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	Avg. "K"
Males	-	-	-	-	-	-	-	-	-	-	-	-
Females	1	1	-	1	-	2	-	-	-	-	-	2.36

TABLE NO. 11 (CONTINUED) DISTRIBUTION OF "K" FACTORS FROM BUFFALO LAKE, 1957 - 1958 AS COMPARED TO 1956 - 1957

Ictalurus melas

1956 - 1957

Factor	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	Avg. "K"
Males	-	-	-	-	-	1	-	-	-	1	2.70
Females	-	-	-	-	1	-	2	-	-	-	2.53

1957 - 1958

Factor	2.0	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	Avg. "K"
Males	-	-	-	-	1	-	-	-	1	2	-	-	-	2.85
Females	3	3	3	1	2	-	3	1	-	1	1	1	1	2.52

Roccus chrysops

1957 - 1958

Factor	3.0	3.1	3.2
Males	-	-	-
Females	-	1	-