

SEGMENT REPORT

FILE

State of TEXAS

Project No. F7R5

Name: Fisheries Investigations and Surveys of the Waters of Region 1-B.

Job No. E-2

Title: Experimental Control of Undesirable Fish Species in Lake Diversion.

Period Covered:

June 1, 1957 through May 31, 1958

ABSTRACT:

An estimated minimum of 185 tons of fish, mostly shad and drum, was removed from Lake Diversion by an experimental selective-kill treatment in March 1957. Inventory was made by nets and seines before and after treatment in order to compile comparative data which may indicate possible effects of the treatment.

A total of 3,004 fishes was collected 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.

The most significant changes in the fish population following the treatment are: (1) increase in "K" factors for all species; (2) reduction of the shad population; (3) increase in the relative abundance of carpsucker and buffalo, and (4) increase in average weight of all species except shortnose gar and carp.

OBJECTIVES:

To determine the practical application and effectiveness of methods developed under Job E-1 (Experimental Control of Undesirable Fish Species). Specifically, objectives of the work covered by this report were to determine effects of the selective-kill treatment in March 1957.

TECHNIQUES:

Field work on this job began in June 1957. Collections were spaced one month apart so that data collected would be comparable to that of the previous segment. Approximately 1200 feet of gill net, ranging in size from one inch to three inches square mesh, was 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, along with ripe ovaries and pathological tissues. Samples of forage fishes were obtained with small-mesh minnow seines, and the complete collections preserved in formalin. Formalin-preserved materials were identified and examined in the laboratory and the data recorded.

Physical data, including air temperature, water-surface temperature and turbidity were recorded at the lake. Samples of lake water were saved and the pH and dissolved solids present were determined.

FINDINGS:

An estimated minimum of 185 tons of fish, mostly gizzard shad and drum, was removed from Lake Diversion by an experimental selective-kill treatment in March 1957. Inventory had been taken by gill nets and seines for ten months prior to the treatment in order to compile data which would be comparative to that collected following treatment. Details of the work done during that period are discussed in the report F7R4, Job E-1. This report presents data collected during 12 consecutive months following treatment, which may indicate resulting effects of reducing of shad and drum populations.

FISH COLLECTIONS

A total of 1,716 fishes was collected from Lake Diversion during the segment 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 is given in Tables 1 and 2 respectively. The total weight of all species collected by gill nets is 3,580 pounds. 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 comparison between the number and percent of the total number of fishes taken in Lake Diversion during the 1956 - 1957 and 1957 - 1958 segments is given in Table 5.

A total of 1,964 forage fishes was collected during the segment with small-mesh minnow seines. This information, with a break-down of species, is given in Table 6. The total number of fishes taken by both gill nets and seines is given in Table 7. Table 8 presents monthly totals of species collected by gill nets during the segment covered by this report.

WATER QUALITY

A complete chemical analysis of the lake water is given in Table 9. There was a considerable decrease in total salts during the 1957 - 1958 segment as compared to the previous segment. This decrease in total salts is most probably caused by the increase in the amount of precipitation during the 1957 - 1958 segment.

PHYSICAL CHARACTERISTICS

The surface of the open water reached temperatures as high as 85 degrees F. in summer and as low as 45 degrees F. in winter. During some cold snaps, a layer of ice formed in shallow areas along the shore and in the river above the lake. The water was relatively clear, and readings on the Jackson turbidimeter were always less than 25 (clear). The secchi disc readings were not considered as valid because of variations in light and difference in vision of persons taking the readings. The same person always read the Jackson turbidimeter. Physical conditions of Lake Diversion water are given in Table 10.

FOOD HABITS

Food remains were found in stomachs of 81 specimens; 22 channel cat, 2 flathead catfish, 5 black bass, 27 white bass, 2 black bullhead catfish and 23 crappie. Tables 11 through 13 present results of analysis made on food remains found in stomachs of all predacious species that contained food. The bulk of food items identified were fish, fresh-water shrimp and insects, in that order. Gizzard shad was the fish most often present, with sunfish next.

White bass fed almost entirely on fish, mostly shad. Freshwater shrimp were found on two occasions. The only insects were taken in June when remains of a few damsel fly larva were identified in one stomach.

Crappie fed exclusively on small fish, mostly shad. Only one stomach contained remains of insects, a water beetle.

Channel cat fed almost exclusively on mayflies throughout June and July. Thereafter, fish comprised the main part of their diet, along with a few bugs, beetles, freshwater shrimp and plant remains.

The five black bass stomachs examined contained 1 white bass (3"), 1 sunfish (5½"), 1 shad (2½"), and 3 unidentifiable fish remains.

Two flathead catfish stomachs contained 5 shad (2" to 3"), 1 unidentifiable fish remains, and cattail or bullrush fiber.

Two black bullhead stomachs contained one sunfish, 6 unidentifiable fish remains, 4 earthworms and plant fiber.

SEXUAL DEVELOPMENT AND SPAWNING SUCCESS

All fishes captured in gill nets were opened in the field, 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 and measured and counted. In addition, notes were made of schools of fry seen, young fishes found in stomachs of predacious fishes, etc.

Except for beginning a little later, spawning habits of fishes in Lake Diversion during this segment were quite similar to those of the previous segment. The smallmouth buffalo was the only fish to show any appreciable change. Spawning of this species usually begins in late March or early April, and continues through June. This year, however, no spent males or females were taken until April, at which time only two spent females were taken. All of the rest were ripe, except for a few immature specimens. In May, only two spent males were taken, no spent females, with all others being either ripe or immature.

PATHOLOGICAL CONDITIONS

Three white bass captured in gill nets were blind in one eye. This may have affected the health of two of these individuals because their "K" factors were somewhat below average (2.40 as compared to an overall average of 2.98). One white bass was found to have one hardened and one normal ovary. One carp-sucker possessed only one ovary.

COEFFICIENT OF CONDITION

"K" factors were worked out for all of the larger fishes collected in gill nets. A comparison of the distribution and yearly averages of "K" factors for fishes in Lake Diversion between the 1956 - 1957 and 1957 - 1958 segments is shown in Table 14. The "K" factors of all species increased, to some extent, over the preceding segment (1956-1957). The selective-kill treatment was given about 2 months before the 1957 - 1958 segment began; therefore, it is most probable that the increase in "K" is the result of the reduction of shad and drum populations.

DISCUSSION:

The most significant changes in the fish populations following the treatment are: (1) increase in "K" factors for all species, including shad; (2) reduction of the shad population; (3) increase in average weight of all species except shortnose gar and carp.

"K" factors for male shad increased from an average of 1.86 to 2.17. Female shad increased from an average of 1.85 to 2.32. Along with an increase in "K" factors, in shad, was a marked increase in their average weight. Average weight of shad collected during the 1957 - 1958 period was more than twice as much as for the preceding period. Increase in average size may be due to the possibility that more small than large shad were killed and young of the year were mostly too small to be taken in gill nets. If this is the case, then, naturally, the average weight would be greater.

The shad population was greatly reduced by the selective-kill treatment. During the 1956 - 1957 period, shad comprised 36.6 percent of the total number of fish taken, whereas during the present segment, shad made up only 6.8 percent. This constitutes a drop of 29.8 percent. While there was a decrease in the numbers of shad, there was an increase in carpsucker and smallmouth buffalo. Carpsucker increased from 28.6 percent to 36.1 percent, and buffalo from 13.6 percent to 26.6 percent, (almost doubled).

Discrepancies in the methods of sampling fish populations for drum were emphasized again during this segment. According to gill netting results prior to the treatment, the drum population was 0.7 percent of the total. During the treatment, an estimated 400,000 drum weighing 99.8 tons were killed. According to gill netting results following the treatment, the drum population was still 0.6 percent of the total. The method of sampling fish populations by gill nets failed to indicate either the great over-population of drum before the treatment or the decrease in drum population following the treatment. It is a proven fact that the drum population was much smaller during this segment than it was during the preceding segment, however, gill netting failed to show this reduction.

Increase in "K" factors for all species, as well as increase in average weight for most species, can probably be explained by the fact that the fishes present after the treatment no longer need to compete for food and space with the over-abundant shad and drum populations, as in the past. Therefore, there is more food and space available for fewer fishes, and as a result, the betterment of condition for those remaining.

There are indications that a direct relationship exists between shad and carp-sucker, buffalo and carp. Experiments on other large bodies of water have shown that when shad populations decrease, carpsucker and buffalo, or carp populations greatly increase. An attempt to discover explanations for this, as well as many other unknown factors, will be made during future segments when natural history studies will be conducted on these rough fish species.

The opening of flood gates at Lake Kemp, which empties into Lake Diversion, has long been considered as a source of contamination by rough fish for Lake Diversion. An effort was made to confirm or deny this possibility in May 1958, when the flood gates were opened from a closed position to 30 and 80 inches. Many dead drum and only a few dead crappie and sunfishes were observed floating down the river immediately below the gates. It is presumed that these fish were killed by the sudden change in pressure from the bottom of Lake Kemp to the atmosphere in the river below. Since none of the other rough fish species were observed, it can be concluded that either (1) they are not being released through the gates; (2) they are not floating after death until much farther down the river than observations were made, or (3) they are surviving the pressure change and are entering Lake Diversion. Studies will be continued during future segment periods to determine condition of all species released through the gates from Lake Kemp.

Time has not permitted creel census or collection of detailed reports of fishing success from Lake Diversion sportsmen. However, a meeting was attended with the Lake Diversion Cabin Owners Association, at which time a talk was given concerning the fisheries improvement work and a request was made for the sportsmen present to render their opinion as to effects of the selective-kill treatment. Without exception, those who expressed an opinion reported increases in fishing success and were in favor of the work performed.

Additional time, continuous study, and surveys of fishing success of sportsmen are necessary before the feasibility and benefits of the selective-kill treatment can be ascertained. Authorization has been approved to continue this work until at least May 31, 1959.

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

Species	Number Taken	% of Total	% Males	Avg. Male Weight	% Females	Avg. Female Weight
Lepisosteus osseus	37	2.9	54.0	2.9	46.0	6.4
Lepisosteus platostomus	4	.3	25.0	2.8	75.0	3.7
Lepisosteus productus	0	.00		0		0
Dorosoma cepedianum	472	36.6	42.6	.65	57.4	.75
Ictiobus bubalus	175	13.6	64.0	2.22	36.0	3.54
Carpionodes carpio	369	28.6	54.2	1.27	45.8	1.33
Cyprinus carpio	31	2.40	48.4	3.82	51.6	4.47
Ictalurus punctatus	38	3.0	55.3	1.58	44.7	1.68
Roccus chrysops	76	5.90	47.4	.72	52.6	.72
Micropterus salmoides	7	.5	28.6	.74	71.4	1.80
Pomoxis annularis	68	5.3	47.0	.34	53.0	.53
Aplodinotus grunniens	9	.7	55.5	.80	44.5	.92
Pylodictus olivaris	2	.2	0		100.0	1.40
Total	1288	100.0				

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

Species	Number Taken	% of Total	% Males	Avg. Male Weight	% Female	Avg. Female Weight
Lepisosteus osseus	133	6.6	51.4	4.19	48.6	7.97
Lepisosteus platostomus	6	0.3	0.0	-	100.0	1.54
Dorosoma cepedianum	116	6.8	40.0	1.16	60.0	1.63
Ictiobus bubalus	456	26.6	54.8	2.86	45.2	3.38
Carpionodes carpio	620	36.1	45.3	1.35	54.7	1.39
Cyprinus carpio	44	2.6	43.9	3.12	56.1	4.30
Ictalurus punctatus	95	5.5	26.3	1.86	73.7	2.11
Ictalurus melas	3	0.2	0.0		100.0	1.19
Roccus chrysops	121	7.1	34.7	1.07	65.3	1.36
Micropterus salmoides	18	1.0	33.3	1.88	66.7	2.29
Pomoxis annularis	110	6.4	43.6	0.56	56.4	0.73
Aplodinotus grunniens	11	0.6	63.6	0.74	36.4	1.35
Pylodictus olivaris	3	0.2	0.0	-	100.0	4.10
Total	1716	100.0				

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

Species	Weight (lbs)	% of Total Weight	Mean Weight
Lepisosteus osseus	166.1	9.4	4.5
Lepisosteus platostomus	13.8	.8	3.45
Lepisosteus productus	0	0	0
Dorosoma cepedianum	335.4	19.0	.71
Ictiobus bubalus	472.0	26.8	2.7
Carpionodes carpio	479.5	27.2	1.3
Cyprinus carpio	128.7	7.3	4.15
Ictalurus punctatus	61.7	3.5	1.6
Roccus chrysops	54.5	3.1	.72
Micropterus salmoides	10.5	.6	1.50
Pomoxis annularis	30.0	1.7	.44
Aplodinotus grunniens	7.7	.4	.85
Pylodictus olivaris	2.8	.2	1.4
Total	1,763.2	100.0	-

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

Species	Weight (lbs)	% of Total Weight	Mean Weight
Lepisosteus osseus	645.4	18.0	6.03
Lepisosteus platostomus	7.7	0.2	1.54
Dorosoma cepedianum	149.8	4.2	1.43
Ictiobus bubalus	1,406.1	39.3	3.10
Carpionodes carpio	728.1	20.3	1.37
Cyprinus carpio	159.4	4.5	3.80
Ictalurus punctatus	194.2	5.4	2.04
Ictalurus melas	3.6	0.1	1.19
Roccus chrysops	152.1	4.2	1.26
Micropterus salmoides	38.8	1.1	2.16
Pomoxis annularis	72.4	2.0	0.66
Aplodinotus grunniens	10.6	0.3	0.96
Pylodictus olivaris	12.3	0.3	4.10
Total	3,580.5	99.9	-

TABLE NO. 5 COMPARISON OF THE NUMBER AND PERCENT OF TOTAL OF FISH TAKEN IN GILL NETS IN LAKE DIVERSION DURING THE 1956 - 1957 and 1957 - 1958 SEGMENTS

Species	1956 - 1957		1957 - 1958	
	Number Taken	% of Total	Number Taken	% of Total
<i>Lepisosteus osseus</i>	37	2.9	113	6.6
<i>Lepisosteus platostomus</i>	4	0.3	6	0.3
<i>Dorosoma cepedianum</i>	472	36.6	116	6.8
<i>Ictiobus bubalus</i>	175	13.6	456	26.6
<i>Carpiodes carpio</i>	369	28.6	620	36.1
<i>Cyprinus carpio</i>	31	2.4	44	2.6
<i>Ictalurus punctatus</i>	38	3.0	95	5.5
<i>Ictalurus melas</i>	0	0.0	3	0.2
<i>Roccus chrysops</i>	76	5.9	121	7.1
<i>Micropterus salmoides</i>	7	0.5	18	1.0
<i>Pomoxis annularis</i>	68	5.3	110	6.4
<i>Aplodinotus</i>	9	0.7	11	0.6
<i>Pylodictus olivaris</i>	2	0.2	3	0.2
Total	1288	100.0	1716	100.0

TABLE NO. 6 TOTAL NUMBER OF FORAGE FISHES TAKEN FROM LAKE
DIVERSION, 1957 - 1958

Species	Number Taken
<i>Lepisosteus osseus</i>	2
<i>Dorosoma cepedianum</i>	98
<i>Carpionodes carpio</i>	78
<i>Cyprinus carpio</i>	14
<i>Phenacobius mirabilis</i>	10
<i>Notropis percobromus</i>	129
<i>Notropis bairdi</i>	21
<i>Notropis lutrensis</i>	739
<i>Notropis deliciosus</i>	13
<i>Hybognathus placita</i>	5
<i>Pimephales vigilax</i>	395
<i>Ictalurus punctatus</i>	11*
<i>Pylodictus olivaris</i>	1**
<i>Gambusia affinis</i>	19
<i>Roccus chrysops</i>	5***
<i>Micropterus salmoides</i>	135****
<i>Lepomis cyanellus</i>	56
<i>Lepomis microlophus</i>	7
<i>Lepomis macrochirus</i>	138
<i>Lepomis humilis</i>	58
<i>Pomoxis annularis</i>	17*****
<i>Percina caprodes</i>	3
<i>Aplodinotus grunniens</i>	10
Total	1,964

- * 9 channel cat returned to lake.
 ** 1 flathead returned to lake.
 *** 3 white bass returned to lake.
 **** 93 black bass returned to lake.
 ***** 1 crappie returned to lake.

TABLE NO. 7 TOTAL NUMBER OF FISHES TAKEN FROM
LAKE DIVERSION, 1957 - 1958

Species	Number Taken
<i>Lepisosteus osseus</i>	115
<i>Lepisosteus platostomus</i>	6
<i>Dorosoma cepedianum</i>	214
<i>Ictiobus bubalus</i>	456
<i>Carpionodes carpio</i>	698
<i>Cyprinus carpio</i>	58
<i>Phenacobius mirabilis</i>	10
<i>Notropis percobromus</i>	129
<i>Notropis bairdi</i>	21
<i>Notropis lutrensis</i>	739
<i>Notropis deliciosus</i>	13
<i>Hybognathus placita</i>	5
<i>Pimephales vigilax</i>	395
<i>Ictalurus punctatus</i>	106
<i>Ictalurus melas</i>	3
<i>Pylodictus olivaris</i>	4
<i>Gambusia affinis</i>	19
<i>Roccus chrysops</i>	126
<i>Micropterus salmoides</i>	153
<i>Lepomis cyanellus</i>	56
<i>Lepomis microlophus</i>	7
<i>Lepomis macrochirus</i>	138
<i>Lepomis humilis</i>	58
<i>Pomoxis annularis</i>	127
<i>Percina caprodes</i>	3
<i>Aplodinotus grunniens</i>	21
Total	3,680

Species	June		July		August		September		October		November		December	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Longnose gar	8	2.7	8	6.3	4	5.1	7	4.5	3	1.8	4	3.0	1	1.1
Shortnose gar	1	0.3	0	-	1	1.3	3	1.9	1	0.6	0	-	0	-
Gizzard shad	16	5.4	6	4.7	5	6.3	8	5.2	8	4.8	6	4.5	2	2.3
Smallmouth buffalo	74	25.0	26	20.3	47	59.5	44	28.4	79	47.6	33	24.8	13	14.8
River carpsucker	155	52.4	59	46.1	8	10.1	49	31.6	37	22.3	39	29.3	36	40.9
Carp	12	4.1	7	5.5	6	7.6	3	1.9	9	5.4	2	1.5	1	1.1
Channel cat	15	5.1	5	3.9	2	2.5	2	1.3	7	4.2	29	21.8	8	9.1
Black Bullhead	0	-	0	-	0	-	0	-	0	-	1	0.8	1	1.1
White Bass	1	0.3	8	6.3	0	-	8	5.2	11	6.6	12	9.0	14	15.9
Black Bass	1	0.3	1	0.8	1	1.3	0	-	2	1.2	0	-	2	2.3
White Crappie	10	3.4	7	5.5	5	6.3	27	17.4	9	5.4	7	5.3	9	10.2
Drum	0	-	1	0.8	0	-	4	2.6	0	-	0	-	1	1.1
Flathead Catfish	3	1.0	0	-	0	-	0	-	0	-	0	-	0	-
Totals	296	100.0	128	100.2	79	100.0	155	100.0	166	99.9	133	100.0	88	99.9

TABLE NO. 9 CHEMICAL NATURE OF THE WATER AT LAKE DIVERSION, 1957 - 1958

Date	ca	na	cl	So4	Co3	HCo3	Total	pH
6/24/57	210	330	497	448	6	84	1,575	8.12
8/6/57	210	237	511	211	0	127	1,296	
9/3/57	224	340	536	451	0	91	1,642	
10/7/57	232	336	563	418	0	98	1,647	
11/7/57	172	221	338	336	0	99	1,166	
12/3/57	136	261	408	365	0	132	1,340	8.0
1/2/58	134	261	401	303	6	150	1,273	8.0
2/3/58	176	270	415	331	3	132	1,335	8.0

TABLE NO. 10 PHYSICAL CONDITIONS OF LAKE DIVERSION WATER, 1957 - 1958

Date	Air	Water	Turbidity	
			Secchi Disc	Jackson Turbidimeter
6/24/57	88	83	570	-
7/9/57	94	85	1000 plus	-
8/7/57	93	83	800	-
9/4/57	(lost)	(lost)	-	clear (less than 25 ppm)
10/7/57	81	70	520	clear (less than 25 ppm)
11/7/57	51	55	720	clear (less than 25 ppm)
12/4/57	48	46	750	clear (less than 25 ppm)
1/3/58	40	45	870	clear (less than 25 ppm)
2/3/58	58	46	580	clear (less than 25 ppm)
3/5/58	52	47	530	clear (less than 25 ppm)
4/14/58	58	54	710	clear (less than 25 ppm)
5/6/58	71	64	1000 plus	clear (less than 25 ppm)

TABLE NO. 11 STOMACH ANALYSIS OF WHITE BASS COLLECTED FROM LAKE DIVERSION, 1957 - 1958

Food Item	Frequency of Occurrence	Total Number Identified
Shad (Dorosoma)	13	23
Black Bass (Micropterus)	1	3
Crappie (Pomoxis)	2	3
Sunfish (Lepomis)	5	12
Fish remains (Unidentifiable)	9	20
Freshwater shrimp	2	51 /
Damsel fly larva	1	1 /
Drum (Aplodinotus)	1	2

TABLE NO. 12 STOMACH ANALYSIS OF CRAPPIE COLLECTED FROM LAKE DIVERSION, 1957 - 1958

Food Item	Frequency of Occurrence	Total Number Identified
Shad (Dorosoma)	12	15
Drum (Aplodinotus)	2	2
Crappie (Pomoxis)	2	2
Sunfish (Lepomis)	2	3
Fish remains (Unidentifiable)	9	15
Freshwater shrimp	2	10
Water beetle	1	1

TABLE NO. 13 STOMACH ANALYSIS OF CHANNEL CAT COLLECTED FROM LAKE
DIVERSION, 1957 - 1958

Food Item	Frequency of Occurrence	Total Number Identified
Shad (Dorosoma)	3	10
Sunfish (Lepomis)	4	20
Channel Cat (Ictalurus)	2	2
Drum (Aplodinotus)	3	4
Fish remains (Unidentifiable)	7	19
Fish scales	1	1
Crayfish	3	3
Freshwater shrimp remains	4	20 f
Mayflies	6	30 f
Stink bug (Pentatomidae)	1	2
Scavenger water beetle (Hydrophilidae)	1	1
Vespid Wasp (Vespidae)	1	1
Caterpillar (Noctuidae)	1	1
Grasshopper	1	1
Bird leg (Mudhen)	1	1
Plant remains	4	4
Plant seeds	1	1
Bullhead catfish	1	1
Insect larva	1	1

TABLE NO. 14 DISTRIBUTION OF "K" FACTORS FOR LAKE DIVISION FOR 1957 - 1958 AS COMPARED TO 1956 - 1957

		Average "K"	
Factor			
Males	4	15	0.38
Females	3	13	0.39

Lepisosteus osseus
1956 - 1957

1957 - 1958

		Average "K"	
Factor			
Males	5	47	7
Females	5	35	12
		Average "K"	
		0.41	

Lepisosteus platostomus
1956 - 1957

1957 - 1958

		Average "K"	
Factor			
Males	1	2	0.50
Females	1	2	0.57
		Average "K"	
		0.60	

Dorosoma cepedianum
1956 - 1957

Factor	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	Average "K"	
Males	2	-	1	2	17	30	38	52	40	13	5	-	1	1.86	1.85
Females	-	1	-	10	22	47	55	59	42	19	12	2	1		

1957 - 1958

Factor	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	3.7	Average "K"	
Males	2	1				1	3	2	4	5	7	8	9	3	4	2	2	1	1	2.17	2.32
Females							1	5	7	7	4	5	6	8	4	4	2	2			

Garrulus 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	Average "K"	
Males	2	1	5	13	17	31	34	27	35	15	9	6	5	1	2	2.64	2.68
Females	-	-	5	7	23	25	21	23	20	16	14	7	5	1			

1957 - 1958

Factor	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	Average "K"	
Males	1	-	-	1	2	4	6	22	32	38	49	42	21	17	4	2	2	2	-	1	1	2.71	2.74
Females	-	1	-	1	-	1	7	12	32	42	60	45	38	33	6	9	2	1	-	-	1		

TABLE NO. 14 (CONTINUED) DISTRIBUTION OF "K" FACTORS FOR LAKE DIVERSION FOR 1957 - 1958 AS COMPARED TO 1956 - 1957

<u>Ictalurus punctatus</u>																		
1956 - 1957																		
Factor	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	Average "K"						
Males	-	-	1	3	2	6	3	3	2	-	-	1.67						
Females	1	-	-	-	-	-	-	-	-	-	-	1.56						
1957 - 1958																		
Factor	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	Average "K"						
Males	-	-	-	5	7	4	5	1	3	2	-	1.80						
Females	1	1	9	11	12	11	12	5	5	4	5	1.78						
<u>Pomoxis annularis</u>																		
1956 - 1957																		
Factor	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	Average "K"
Males	1	-	-	-	-	3	2	4	3	4	4	5	4	5	4	4	5	2.52
Females	-	-	-	-	-	-	-	-	3	2	3	4	4	5	4	4	5	2.48
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	3.4	3.5	3.6	3.7	Average "K"
Males	1	1	1	1	1	1	1	3	4	5	2	5	4	7	4	1	1	3.00
Females	-	1	1	1	4	2	8	7	9	9	9	4	4	2	7	-	-	2.91
<u>Roccus chrysops</u>																		
1956 - 1957																		
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	3.1	3.2	3.3	3.4	Average "K"	
Males	1	1	-	1	1	1	7	8	7	11	6	4	2	-	1	1	2.37	
Females	1	-	1	1	1	6	11	3	4	5	3	1	-	-	-	-	2.56	
1957 - 1958																		
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	3.8	4.1	Average "K"
Males	-	1	-	-	1	1	10	4	7	7	5	3	3	-	-	-	-	3.04
Females	2	-	4	4	4	7	8	9	9	7	7	5	7	4	1	1	1	2.98
<u>Macropodus salmoides</u>																		
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	3.8	4.1	Average "K"
Males	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2.35
Females	1	1	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	2.42
1957 - 1958																		
Factor	1.5	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	Average "K"					
Males	1	-	-	-	-	-	2	-	1	2	-	-	2.72					
Females	-	1	1	2	1	1	3	-	1	1	1	-	2.73					

TABLE NO. 14 (CONTINUED) DISTRIBUTION OF "K" FACTORS FOR LAKE DIVERSION FOR 1957 - 1958 AS COMPARED TO 1956 - 1957

Factor	2.9	3.0	3.5	Average "K"
Males	-	-	-	-
Females	1	1	1	3.13

Ictalurus nebulosus
1957 - 1958

Aplodinotus grunniens
1956 - 1957

Factor	2.0	2.1	2.2	2.3	2.4	2.5	Average "K"					
Males	1	-	2	1	1	-	2.22					
Females	1	-	2	1	1	-	2.23					
1957 - 1958												
Factor	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	Average "K"
Males	1	-	-	-	2	2	1	-	-	1	-	2.77
Females	-	1	-	-	-	-	-	-	1	-	1	2.93

Pylodictus olivaris
1956 - 1957

Factor	1.4	1.5	1.6	Average "K"
Males	-	-	-	-
Females	1	-	1	1.50
Factor	1.7	1.8	1.9	Average "K"
Males	-	-	-	-
Females	1	1	1	1.80

1957 - 1958

Ictiobus bubalus
1956 - 1957

Factor	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	4.2	Average "K"
Males	1	3	8	12	14	13	18	14	10	11	4	3	-	-	-	-	-	3.07
Females	-	-	8	9	3	8	10	6	4	8	2	3	1	-	-	-	1	3.09
1957 - 1958																		
Factor	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	Average "K"		
Males	-	3	11	12	23	29	36	44	28	34	14	5	4	3	2	3.17		
Females	1	2	3	15	20	22	26	41	25	23	11	6	6	3	2	3.18		

Cyprinus carpio
1956 - 1957

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	3.1	Average "K"
Males	-	-	1	2	1	1	1	4	3	2	-	1	1	2.45
Females	1	-	-	-	-	-	1	3	1	4	1	4	1	2.57
1957 - 1958														
Factor	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	Average "K"		
Males	1	-	2	1	4	2	2	1	3	2	-	2.62		
Females	-	1	-	-	5	5	5	3	3	1	-	2.67		