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Report of Fisheries Investigations
Evaluation of Selective Shad Control Work at Fincastle Lake

by

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Dingell-Johnson Project F-4-R-7, Job E-7
April 1, 1960 - October 31, 1960

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A B S T R A C T

The total kill of the fish population in Fincastle Lake was undertaken as a means of evaluating the results of an attempted shad control on May 20-21, 1958. This control was the result of survey work under Jobs B-17, Project F-4-R-4 and B-26, Project F-4-R-6. Other survey work as well as the shad control attempt were reported under Job E-6, Project F-4-R-5.

Net checks revealed that before the selective treatment, gizzard shad comprised 69.1 percent of the catch, while following the selective kill shad were reduced to 1.5 percent. The three shad taken during the check netting, that followed the treatment, were all large females. Each was gravid, but the physical condition of the eggs indicated that none of them would spawn during the summer or fall of 1958.

There is no indication that any shad spawn occurred until June 1959 when the good fishing, that had prevailed since the selective treatment, ended. This condition appeared to coincide with the appearance of schools of small shad in the lake and poor fishing became the rule. A net check in January 1960 revealed that shad made up 46 percent of the nettable population. This was raised to 55.25 percent by the net check made in April 1960.

The return of the gizzard shad to position of dominance in the population led to a total kill attempt. This was done by the use of 2.5 percent synergized rotenone liquid applied at the rate of 0.50 parts-per-million in two applications at 18-hour interval. The application was made by gravity flow treatment drums in open water and pressure pump spray in vegetation along the shoreline.

Attempts at estimating the number and weights of each species killed were not successful as vegetation, wind, and fish eating mammals, birds, and reptiles were present. These combined with people, who picked up many of the more desirable fish made reasonably accurate estimates almost impossible. A diligent search was made to locate and pick up all the shad whose size indicated that they might have escaped the selective kill of 1958. A total of five large shad were found. They ranged in size from 2.06 to 3.12 pounds. Each of the three females were gravid and the two males appeared to be in condition to spawn within 30 to 60 days. The remainder of the gizzard shad population was divided into three size groups. The larger size group ranged from 10 to 11 inches and appeared to be ready to spawn. The other groups were 8 to 10 and 5 to 7 inches respectively. It would appear that the 1959 gizzard shad production consisted of three separate spawns that covered the period from June to October or November.

Continued

A B S T R A C T

That the rise and fall of the shad population has a marked effect on the growth of the game species is quite evident in the data presented in the tables. The average weight of game fish dropped when the shad population was drastically reduced, but rose sharply when the 1959 spawns became available.

The information gained from the work on Fincastle Lake indicates that the benefits from shad control work will not last more than two years unless the entire shad population is removed. The removal of the entire shad population will require the sacrifice of a fairly large percentage of the game fish population, but the gain is believed to justify the cost.



Job Completion Report

State of TEXAS

Project No. F-4-R-7

Name: Fisheries Investigations and Surveys
of the Waters of Region 4-B

Job No. E-7

Title: Evaluation of Selective Shad Control
Work at Fincastle Lake

Period Covered:

April 1, 1960 - October 31, 1960

OBJECTIVES

To evaluate selective shad control work at Fincastle Lake by chemically killing the existing fish population to determine its species composition by numbers and weights.

HISTORY

Fincastle Lake is a privately owned lake on the headwaters of Catfish Creek in Henderson County, Texas. This lake is located on the Trinity River watershed and is a slightly acid lake. A survey was made of this lake under Jobs B-17, Project F-4-R-4, and B-26, Project F-4-R-6. Other surveys and experimental gizzard shad control work were accomplished and reported under Job E-6, Project F-4-R-5.

Net checks made during the Trinity River watershed survey showed Fincastle Lake to have a nettable fish population made up of 51.6 percent gizzard shad. Net collections made prior to the selective shad kill in 1958 indicated the shad population to be 69.1 percent of the net catch. Rough fish species composed 75.4 percent of all fish netted. An experimental attempt to control the shad population was made on May 20-21, 1958. This was accomplished by applying 2.5 percent synergized rotenone liquid by gravity flow drum at the rate of 0.065 parts-per-million followed after 18 hours with another application of the same concentration. It was found that the split application provided a sustained toxicity which resulted in a good shad kill with little harm to game species. The presence of a south wind caused the dead fish to drift to the north shore where they could be estimated. The shad kill from this treatment was estimated at 36,960 fish weighing 16,592 pounds. Net checks subsequent to the selective kill produced only three shad in six net runs with 500 feet of gill net set overnight. These nets were the same mesh size as those used before the treatment and were set in the same locations.

The three shad collected during the first year following the selective shad treatment were all large, adult females. The first was taken in June and one was taken in both July and August. These fish were gravid but gave no indication that they would spawn. The eggs appeared to be drying up in the first specimen taken and the ovaries were in the process of becoming atrophied in the specimens taken in August. There is evidence to support the belief that no spawn of shad was obtained in 1958, but such was not the case in 1959.

The fishing improved for both crappie and bass following the treatment and remained good until June 1959. There were indications that a large spawn of shad occurred at this time and fishing became poor. The lack of fishing success continued and in January 1960 a net check was made. The results of this check showed the nettable population of the lake to consist of 46 percent shad while further net checks in April showed an increase in shad to 55.25 percent of the catch. The shad netted during the 1960 survey were of two sizes and it was believed that they represented the 1959 spawn of a relatively few large shad who were able to survive the selective shad kill of 1958.

Since there is a definite size differential between the shad that escaped the selective treatment in 1958 and their yearling offspring, it was believed that a total kill of the species present would reveal the approximate number of brood shad that remained in the lake.

PROCEDURE

Fincastle Lake covers 54 acres and contains 382 acre-feet of water with a maximum depth of 15 feet. A total of 130 gallons of 2.5 percent emulsifiable rotenone liquid was applied to the lake in two applications of 0.50 parts-per-million each, separated by an 18-hour interval. The applications were made with gravity flow drums in the open lake and pressure pump-sprayer in the vegetation around the shore line. The first application was begun at 2:00 p. m. April 25, 1960, and the second was begun at 8:00 a. m. April 26, 1960.

All efforts to estimate the total numbers and weights of the various species killed were hampered by the people who picked up the more desirable fish as soon as the treatment was concluded. Many small shad were taken to be frozen for use as trotline bait. The relative abundance of the various species was noted and is recorded on Table 1.

The data collected after this treatment has been compared with that previously collected, both before the selective kill and during the interval between the two treatments. A very diligent search was made to recover all the large shad that were believed to have survived the selective kill. These specimens formed the brood stock that were able to repopulate the lake.

RESULTS

The treatment, as previously stated, was begun at 2:00 p. m. April 25, 1960. Two boats equipped with gravity flow treatment drums and one with a John Bean No. 44K pressure sprayer started operations simultaneously. The first fish were noted in distress within 30 minutes. These fish were shad but soon largemouth bass, sunfishes, crappie, bullheads, spotted suckers, channel catfish, and spotted gars were noted. Largemouth bass weighing as much as $7\frac{1}{2}$ pounds were taken before dark. No bass was observed weighing less than 12 ounces.

Treatment was resumed at 8:00 a. m., on April 26, with the procedure exactly as that followed the previous day. Many species appeared after this application that were not noted on the first day. Bowfins, grass pickerels, smallmouth buffalo, and carp were the most important of this group. A complete list of species

identified from this lake is given in Table 1, together with symbols indicating the frequency of their appearance. A total of 24 species representing 16 genera and 10 families were observed.

Specimens of two amphibians were observed among the dead fish and were included in the checklist. They were the western dwarf siren and the spotted salamander.

Several species were observed among the fish killed that had not been taken in nets. A total of five smallmouth buffalo weighing from 22 to $45\frac{1}{2}$ pounds were noted. There were no small buffalo which was true of the carp where only two specimens were found. Bowfins and grass pickerels were known to be in the lake, but had never been taken by nets. Channel catfish were present, but rare and none had been netted. The warmouth was rather common among the dead fish, but rarely taken by nets. Green sunfish, orangespotted sunfish, and yellowbelly sunfish were much more numerous than the netting indicated, but were so small that the nets were not likely to take them often.

The large number of vultures, crows, racoons, skunks, turtles, and other fish eaters consumed many fish and further complicated the task of estimating the number and weight of the various species killed. The margin of the lake was heavily vegetated with shrubs and aquatic plants extending several yards from shore on all sides of the lake except the dam and a short section near the boat house and owners residence. Constantly changing winds prevented the formation of large drifts of fish and many trips around the entire lake were made to determine the results of the treatment.

A total of 39 bass, whose weights were estimated at from 2 to 6 pounds, were counted and added to the 18 bass, weighing from 2 to $7\frac{1}{2}$ pounds, that were picked up on the first day of treatment. This made a total of 57 bass weighing 2 pounds or more.

Black and white crappie were seen in good numbers and many were picked up, but the tendency of this species to remain on the bottom resulted in many being punctured by turtles and not floating.

Fish continued to rise to the surface for four days following the last application of rotenone, which made the possibility of an accurate estimate of the kill rather remote. Many fish that floated on April 25 were badly decomposed and were broken up by wave action before April 29 or were eaten by birds, mammals, or turtles.

A very careful check was made to determine the make up of the shad population. Many of the smaller shad were threadfin shad that could have come up stream from Pharris Lake which is less than five miles below Fincastle and on the same tributary to Catfish Creek. Pharris Lake was stocked with threadfin shad, shortly after the selective kill on Fincastle Lake in 1958, and a recent copper sulphate treatment revealed that the stocking was very successful. The bulk of the shad population was made up of gizzard shad in four general size groups. The largest shad weighed 3.12 pounds followed by four others weighing 2.50, 2.19, 2.12, and 2.06 pounds respectively. The three larger specimens were females. This, when combined with the three specimens taken in nets following the first treatment, gives a total of 6 females and two males that survived the selective kill in 1958. It is believed

that the 5 large shad formed the brood stock that failed to spawn in 1958, but produced three spawns in 1959. The smaller gizzard shad were in three general size groups. One group measured from 10 to 11 inches, total length, while the other two groups were from 8 to 10 and from 5 to 7 inches long, respectively. Whether each of these size groups represent the spawn of a single female or a partial spawn of more than one female is a question that cannot be answered. The smaller size group of gizzard shad and the threadfin shad were too small to be taken in the gill nets which have a $1\frac{1}{2}$ -inch square mesh. There is little doubt that the gizzard shad population was well on the way to regain the dominance it had held before the control attempt in 1958. Each of the three large females was gravid and the condition of the eggs indicated that a spawn could be expected by early June. The 10 to 11 inch size group were also in breeding condition, with both males and females appearing to be less than 60 days from spawning.

The effect of the selective kill on the mettable fish population in Fincastle Lake can be seen in Tables 2 and 3. Before the selective kill, the net catch was dominated by gizzard shad to the extent that 69.1 percent of the number and 60.7 percent of the weight were this species. This is rather interesting when one considers that several species are present that attain a much larger size than do the shad. Following the shad control attempt, this species made up only 1.5 percent of the net catch by number and 2.9 percent by weight. Netting done just prior to the total kill showed that the shad had recovered to the extent that 50.6 percent of the number and 31.5 percent of the weight were of this species. The smaller size of the individual shad may be attributed to the fact that none of them appeared to be more than one year of age.

Another interesting observation may be made when the data, in Tables 2 and 3, are examined. The removal of the majority of the shad resulted in an increase in the numbers of all species taken in gill nets except the chubsucker. This increase was also noted in the total weight of each species in the net catch. The net catches just before the total kill in 1960 showed a marked increase from 1.5 percent to 50.6 percent in the number and 2.9 percent to 31.5 percent in the weight. Spotted gar, chubsucker, largemouth bass, and black crappie were the other species to show an increase in both numbers and weight.

The data in Table 4 presents the comparison of the game and rough species in the net catch with relation to the selective shad kill of 1958. This table compares the catch in 1957, which was before the shad kill, with the catch in 1958 which was immediately after the selective treatment. The 1959 netting was done during the period when the first shad spawns were appearing while the 1960 netting reflects the effect of the increase in shad production.

The total number of fish taken in gill nets is quite similar in 1957 and 1960 as in both cases the large number of shad can be considered responsible. The shad catch in 1958 and 1959 was very low since almost all of them were killed in May 1958 and apparently no spawn was obtained from the survivors until June 1959.

The average weight of rough fish taken rose sharply in 1958 and lowered only slightly in 1959. This was due to the fact that the shad were not present in the catch to reduce the average. The average weight of game fish dropped from 0.40 pounds in 1957 to 0.37 pounds in 1958. This is believed to be due to the fact that the removal of the entire population of small shad reduced the available food and

slowed the growth of game species. This appears to be substantiated by the fact that the average weight of game species remained at 0.37 pounds in 1959, but increased to 0.48 pounds in 1960, when the shad spawns of the previous summer and fall became a part of the diet of the game species.

A comparison of the data in Table 5 with that in Table 6 discloses some facts that appear significant. Both tables contain information from net runs in the months of January and April, Table 5 presents data from 1959 and Table 6 presents data from 1960. Table 5 data was collected by 15 net sets while 22 net sets were made in the 1960 netting. The absence of shad from the 1959 netting is responsible, to a great extent, for the difference in both numbers of fish taken and the percentage of the catch represented by the various species.

The most significant comparison is in the number of fish per 100 feet of net and the number of pounds per 100 feet of net. There is little difference in the average number of fish or pounds of fish taken during the two netting periods except with regard to the shad which are not present in the 1959 netting, but are rather abundant in the 1960 samples. If the number and weight of the shad taken, per 100 feet of gill net, in 1960 are subtracted from the total number and weight of all species taken one arrives at a figure rather close to that of the 1959 netting.

CONCLUSIONS

The results obtained by following the selective shad kill of 1958 with a complete kill in 1960 indicate that the benefits from a selective kill may be very short in duration. The failure of the shad, that escaped the selective treatment, to spawn during the 1958 season added about one year to the duration of the good fishing. This condition was changed with the three spawns obtained in 1959. The abundant crop of young shad was divided into three size groups that were able to provide suitable forage for almost all sizes of game fish from June until late fall or winter.

The question most often brought up in connection with the selective control of shad concerns the percentage of shad that must be removed to effectuate a control of reasonable duration. The opinion held by some workers in this field was that a removal of 85 to 95 percent of the shad would provide a control of 3 to 5 years duration. The results of the Fincastle Lake treatment indicate that the reproductive potential of the gizzard shad is such that the removal of all the shad is the only control that can hope to last more than one or two spawning seasons in the warm water areas.

The removal of the entire shad population will entail the sacrifice of a portion of the game fish crop, but it is believed that this is a justifiable expenditure.

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Approved by Marion Toole
Director Inland Fisheries Division

Date September 1, 1960

Table 1. - A checklist of species killed in Fincastle Lake, April 25-26, 1960, showing their relative abundance in the kill

Scientific Name	Common Name	Frequency*
<u>Lepisosteus productus</u>	Spotted gar	F
<u>Amia calva</u>	Bowfin	O
<u>Dorosoma petenense</u>	Threadfin shad	O
<u>Dorosoma cepedianum</u>	Gizzard shad	A
<u>Esox americanus</u>	Grass pickerel	O
<u>Ictiobus bubalus</u>	Smallmouth buffalo	R
<u>Erimyzon sucetta</u>	Lake chubsucker	C
<u>Cyprinus carpio</u>	European carp	R
<u>Opsopoeodus emiliae</u>	Pugnose minnow	O
<u>Ictalurus punctatus</u>	Channel catfish	R
<u>Ictalurus melas</u>	Black bullhead	F
<u>Ictalurus natalis</u>	Yellow bullhead	C
<u>Schilbeodes gyrinus</u>	Tadpole madtom	O
<u>Fundulus notti</u>	Starhead minnow	O
<u>Gambusia affinis</u>	Common mosquitofish	A
<u>Micropterus salmoides</u>	Largemouth bass	C
<u>Chaenobryttus gulosus</u>	Warmouth	C
<u>Lepomis cyanellus</u>	Green sunfish	C
<u>Lepomis microlophus</u>	Redear sunfish	A
<u>Lepomis macrochirus</u>	Bluegill sunfish	A
<u>Lepomis humilis</u>	Orangespotted sunfish	O
<u>Lepomis auritus</u>	Yellowbelly sunfish	O
<u>Pomoxis annularis</u>	White crappie	F
<u>Pomoxis nigromaculatus</u>	Black crappie	A
<u>Siren intermedia</u>	Western dwarf siren	O
<u>Ambistoma tigrinum</u>	Spotted salamander	O

* Note: A=abundant, C=common, F=frequent, O=occasional and R=rare

Table 2. - Netting results from Fincastle Lake before and after the selective kill in 1958 and before the total kill in 1960

Species	1958 before the selective kill		1958 after the selective kill		1960 before the total kill		Totals	
	number	percent	number	percent	number	percent	number	percent
Alligator gar	----	----	1	0.5	----	----	1	0.1
Spotted gar	14	3.1	23	11.6	65	14.2	102	9.1
Gizzard shad	317	69.1	3	1.5	231	50.6	551	49.4
Chubsucker	8	1.7	5	2.5	21	4.6	34	3.1
Black bullhead	1	0.2	2	1.0	----	----	3	0.3
Yellow bullhead	6	1.3	19	9.5	20	4.4	45	4.0
Largemouth bass	1	0.2	2	1.0	18	3.9	21	1.9
Warmouth	----	----	1	0.5	1	0.2	2	0.2
Redear sunfish	53	11.5	62	31.2	33	7.2	148	13.3
Bluegill sunfish	39	8.5	49	24.6	44	9.6	132	11.8
White crappie	20	4.4	31	15.6	5	1.1	56	5.0
Black crappie	----	----	1	0.5	19	4.2	20	1.8
Totals	459	100.0	199	100.0	457	100.0	1,115	100.0

Table 3. - Comparison of weights of fish netted in Fincastle Lake before and after the selective shad kill, in 1958, and before the total kill, in 1960

Species	1958 before the selective kill		1958 after the selective kill		1960 before the total kill		Totals	
	weight in pounds	percent of weight	weight in pounds	percent of weight	weight in pounds	percent of weight	weight in pounds	percent of weight
Alligator gar	----	----	8.00	5.9	----	----	8.00	1.3
Spotted gar	35.87	15.1	48.31	35.7	96.48	36.6	180.66	28.4
Gizzard shad	144.03	60.7	4.00	2.9	83.03	31.5	231.06	36.3
Chubsucker	6.71	2.8	4.11	3.0	13.82	5.2	24.64	3.9
Black bullhead	1.75	0.8	2.94	2.2	----	----	4.69	0.7
Yellow bullhead	3.16	1.3	13.90	10.3	12.90	4.9	29.96	4.7
Largemouth bass	8.68	3.7	9.12	6.7	18.70	7.1	36.50	5.8
Warmouth	----	----	0.50	0.4	0.32	0.1	0.82	0.1
Redear sunfish	15.83	6.7	18.79	13.9	10.64	4.0	45.26	7.1
Bluegill sunfish	12.88	5.4	11.04	8.2	9.88	3.8	33.80	5.3
White crappie	8.25	3.5	13.97	10.3	5.18	1.9	27.40	4.3
Black crappie	----	----	0.67	0.5	12.94	4.9	13.61	2.1
Totals	237.16	100.0	135.35	100.0	263.89	100.0	636.40	100.0

Table 4. - A comparison of game and rough fish species caught in gill nets from Fincastle Lake before and after the selective shad kill on May 20-21, 1958, and before the total kill on April 25-26, 1960

	1957	1958	1959	1960
Total number of specimens caught	459.00	199.00	148.00	457.00
Total weight of specimens in pounds	237.16	135.35	113.11	263.89
Average weight per specimen in pounds	0.52	0.68	0.76	0.58
Total weight of rough fish in pounds	191.52	81.16	83.89	206.23
Total weight of game fish in pounds	45.64	54.19	29.22	57.66
Total number of rough fish	346.00	53.00	78.00	337.00
Total number of game fish	113.00	146.00	70.00	120.00
Average weight per rough fish in pounds	0.55	1.53	1.07	0.61
Average weight per game fish in pounds	0.40	0.37	0.37	0.48
Percent of rough fish by weight in total catch	81.00%	60.00%	74.00%	78.00%
Percent of game fish by weight in total catch	19.00%	40.00%	26.00%	22.00%
Percent of rough fish by number in total catch	75.00%	27.00%	53.00%	74.00%
Percent of game fish by number in total catch	25.00%	73.00%	47.00%	26.00%

Table 5. - Length, weight, coefficient of condition, and catch per 100 feet of gill net data for fish taken from Fincastle Lake in January and April, 1959

Species	Total number	Percent of number	Total pounds weight	Percent of weight	Average length millimeters	Average weight grams	Number per 100' of net	Pounds per 100' of net	"K" average
Spotted gar	18	12.16	39.50	34.92	524	1,494	1.20	2.63	0.59
Chubsucker	47	31.75	31.79	28.10	274	307	3.13	2.12	2.50
Black bullhead	3	2.03	5.80	5.13	307	879	0.20	0.38	3.03
Yellow bullhead	10	6.76	6.80	6.01	220	308	0.67	0.46	2.86
Largemouth bass	4	2.70	7.30	6.46	295	831	0.26	0.48	2.14
Warmouth	1	0.68	0.30	0.26	170	155	0.07	0.02	3.20
Redear sunfish	18	12.16	5.24	4.63	162	128	1.20	0.35	3.10
Bluegill sunfish	29	19.59	7.06	6.25	140	117	1.93	0.47	3.95
White crappie	7	4.73	5.32	4.70	172	114	0.47	0.36	2.15
Black crappie	11	7.44	4.00	3.54	180	164	0.73	0.27	2.70
Totals	148	100.00	113.11	100.00			9.86	7.54	

Table 6. - Length, weight, coefficient of condition and catch per 100 feet of gill net data for fish taken from Fincastle Lake in January and April, 1960

Species	Total number	Percent of number	Total pounds weight	Percent of weight	Average length millimeters	Average weight grams	Number per 100' of net	Pounds per 100' of net	"K" average
Spotted gar	65	14.2	96.48	36.56	475	673	2.95	4.38	0.62
Gizzard shad	231	50.6	83.03	31.46	199	162	10.50	3.77	2.01
Chubsucker	21	4.6	13.82	5.24	226	298	0.95	0.63	2.59
Yellow bullhead	20	4.4	12.90	4.88	230	292	0.91	0.59	2.39
Largemouth bass	18	3.9	18.70	7.09	254	471	0.82	0.85	2.31
Warmouth	1	0.2	0.32	0.12	160	145	0.05	0.01	3.50
Redear sunfish	33	7.2	10.64	4.03	161	146	1.50	0.49	3.58
Bluegill sunfish	44	9.6	9.88	3.75	135	101	2.00	0.45	4.05
White crappie	5	1.1	5.18	1.96	235	446	0.22	0.23	3.25
Black crappie	19	4.2	12.94	4.91	203	309	0.87	0.59	3.19
Totals	457	100.0	263.89	100.00			20.77	11.99	



Figure 1. - Margin of Fincastle Lake with dead fish in foreground and heavy vegetation in background.



Figure 2. - Game and Fish Commission personnel pulling through aquatic brush to pick up large shad.

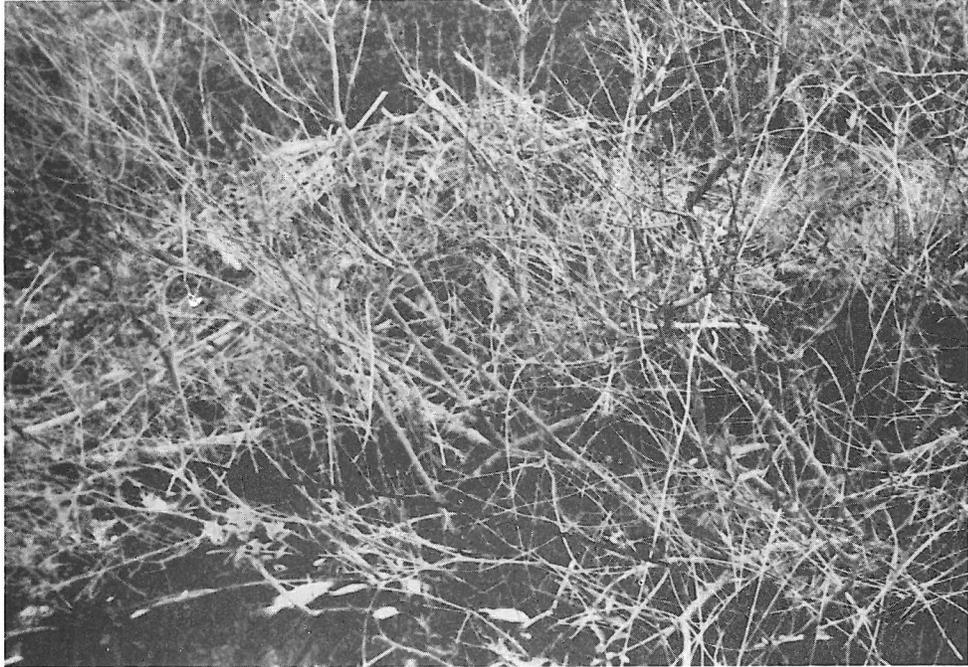


Figure 3. - Dead fish floating in brush near beaver lodge in
in Fincastle Lake



Figure 4. - Dead fish in Fincastle Lake three days after
treatment. Bloated fish in center is largemouth bass.

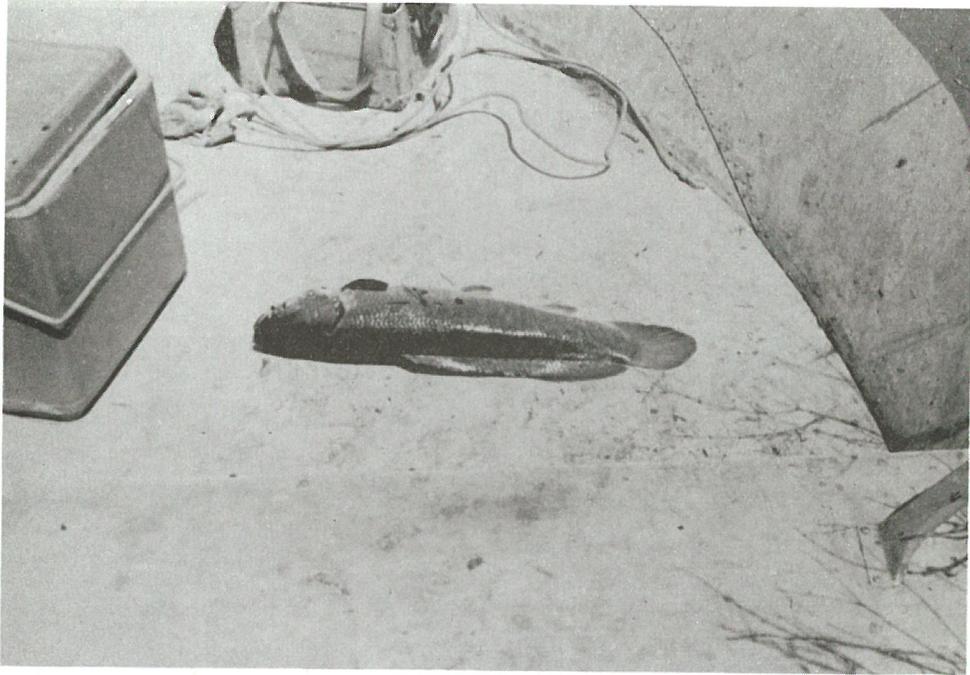


Figure 5. - Bowfin 24 inches in length from Fincastle Lake

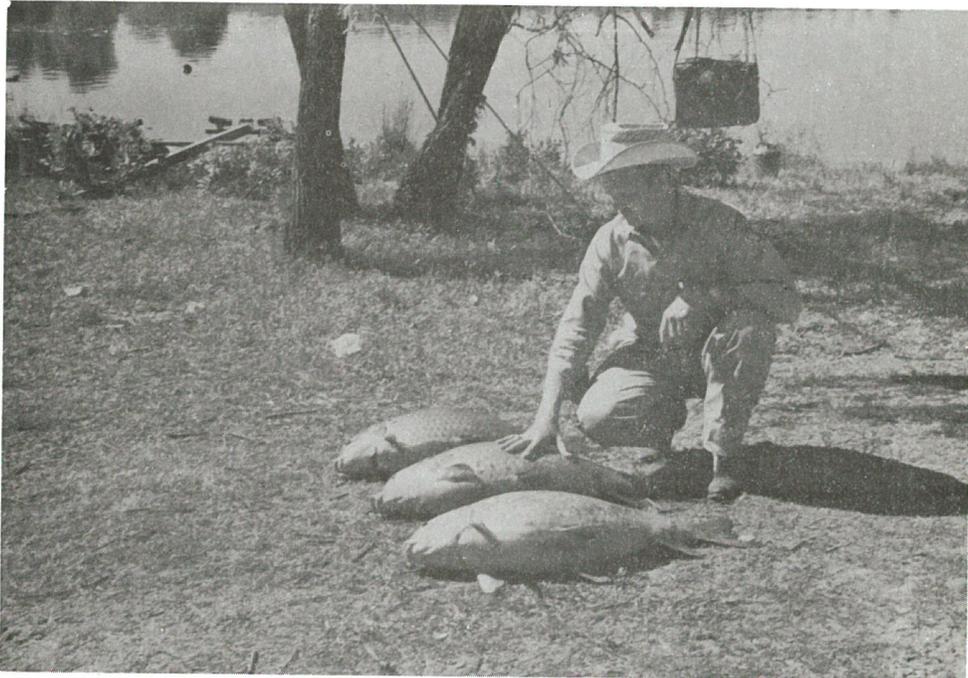


Figure 6. - Three of the five smallmouth buffalo killed in Fincastle Lake. These ranged in weight from 22 to $45\frac{1}{2}$ pounds.