

sport fishery. The commercial fishing on Lake Bistineau is directed primarily toward buffalo fishes. Small buffalo fishes are not of much value commercially. Mesh sizes of 3.0 inch square mesh and larger would catch buffalo fishes mainly of a size desired by the market.

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THE SELECTIVITY AND EFFECTIVENESS OF BAIT AND SNAG LINES FISHED IN THE TVA LAKES OF ALABAMA

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1961

ABSTRACT

A study of bait and snag lines was conducted in the TVA lakes of Alabama from December, 1958, through December, 1959, to determine species composition of the catch, the effectiveness of bait and snag lines for taking fish and the effectiveness of various types of bait used on baited lines. Data were obtained by accompanying the fisherman as he removed the fish from his lines. Bait line catches were, by weight, 92 percent catfish and 4 percent buffalo and carp. Grasshoppers were the most effective bait used while threadfin shad were used on 47 percent of the baited hooks. Snag line catches were, by weight, 77 percent catfish and 21 percent buffalo and carp. Both bait and snag lines were selected for the taking of catfish; but they were considered ineffective for the taking of carp, buffalo and other non-game forage fish.

INTRODUCTION

An investigation to determine the selectiveness and effectiveness of bait and snag lines were made from December, 1958, through December, 1959, in the TVA lakes of Alabama which have a surface area of 182,000 acres. The objectives of the study were to determine the species composi-

tion of the catches, the effectiveness of bait and snag lines for taking fish and the effectiveness of various types of baits used on bait lines.

Several investigators have reported information on certain types of nets. Starrett and Barnickol (1955) reported on the efficiency and selectivity of nets in the Mississippi River. They indicated that 2-inch bar mesh trammel nets were efficient and selective for the taking of commercial species. Heard (1959) reported that hobbled gill nets fished in Lake Blackwell, Oklahoma, were effective for the taking of flathead catfish. His data also indicated that 3-inch bar mesh hobbled gill nets efficiently and selectively caught commercial species such as carp and carpsucker. Davis and Posey (1959) discussed the relative selectivity of trammel, gill and hoop nets along with wire and wood baskets fished in the fresh waters of Louisiana. They found that 2.5-inch bar mesh and larger nets were selective and most efficient for the taking of commercial species.

This project completed a study of freshwater commercial fishing gear used in Alabama. Byrd reported the catches made with hoop nets fished in TVA lakes of Alabama¹ and catches made with trammel nets in the tidal streams of Alabama (1955). The selectivity and effectiveness of trammel, riprap and gill nets were reported by White (1955 and 1959).

Little information was found in the literature concerning bait and snag lines and the fishing of this gear in freshwater. Bait lines were fished in the Tennessee River before the inception of the TVA program and are probably the oldest type of commercial fishing gear used. Snag lines were first used in the Tennessee Valley in 1941. From November, 1942, through September, 1943, 77 percent of the catch by weight on snag lines in the TVA lakes was paddlefish while 20 percent by weight was catfish (Tarzwell and Bryan, 1945).

MATERIALS AND METHODS

Bait and snag lines used by most commercial fishermen in the TVA lakes of Alabama from December, 1958, through December, 1959, were constructed of nylon seine twine. To simplify the description of bait and snag lines the following terms will be used hereafter. The *main line* was the heavy twine (No. 18 to 24 nylon seine twine) to which the floats, anchors and hooks were tied with twine of appropriate length. *Tugs* were the twine (No. 9 to 18 nylon seine twine) used to attach hooks to the main line. *Floats* were bottles, cans, sticks or other flotation materials. *Anchors* were rocks, scrap metal or other heavy material used to anchor the lines. A complete bait or snag line, called a *set*, included the main line, tugs, hooks, floats and anchors.

When smaller twine was used for tugs the twine was usually doubled with the ends tied together at the main line. The loop formed was pushed through the eye of the hook, passed over the shank, twisted once and passed again over the shank of the hook. Tugs varied from 10 to 14 inches in length on bait sets and were spaced 3 to 5 feet apart on the main line. Tugs on snag sets varied from 8 to 10 inches in length and were placed at 8 to 10-inch intervals on the main line. In general, the hook size was 2/0.

Bait lines were usually constructed with 100 hooks per set. The number of hooks on bait sets checked during this study varied from 50 to 125.

Snag lines normally had 500 or 1,000 hooks per set. For the purpose of evaluating the data in this report 1,000 hooks were accepted as a standard since most of the snag sets checked had 1,000 hooks.

Some bait and snag sets were fished near the surface, some were fished on or near the bottom and others were fished with part of the set near the bottom and part of the set near the surface. The main line was placed in the water in a straight line with anchors tied to each end or with one end tied at the bank and the other end anchored. The depth at which the set was fished was determined by float and anchor lines of varied lengths tied at intervals along the main line. When sets were fished at the surface, the float lines were from 1.5 to 3 feet long so the main line would not be cut by boat propellers. When sets were fished

¹ Byrd, I. B. (1953). Commercial fishing studies in TVA lakes during March, April, and May, 1954. Unpublished report to the Director of the Department of Conservation, Montgomery, Alabama.

near the bottom, some were allowed to lie on the bottom while others, equipped with floats, had anchor lines long enough to allow the tugs and hooks to dangle slightly above the bottom of the lake. Other sets were fished with floats and anchors alternately tied to the main line allowing part of the set to be near the bottom and part of the set to be near the surface.

Bait sets were placed in the water by two methods. The first method was one in which the main line without tugs, hooks or floats was stretched and anchors were tied to each end. The fishermen then traveled along the main line tying tugs with hooks attached to the main line at 3 to 5-foot intervals. Sets placed in the water by this method were called *set lines* and when raised, fish were removed and hooks were baited from a boat without changing the location of the set.

The second method of placing a bait set in the water was as follows: the set was arranged in an especially designed box called a *jump box* which had notches around its lip to hold the tugs in an orderly manner. The hooks attached to the tugs were baited and allowed to hang outside the box. The set was stretched by placing the box on the transom of a boat, anchoring one end of the set and allowing the main line, baited hooks, floats and anchors to feed out of the box as the boat was propelled by the motor. The set was raised the following morning, the fish were removed and the set was stored in an empty jump box to be transported back to the bank. During the day, the set was rearranged and baited in the jump box from which it was again placed in the water during the evening. When the set was made in this manner, it was referred to as a *jump line*.

Hooks on bait sets were baited with dead threadfin shad, *Dorosoma petenense* (Gunther); cut gizzard shad, *Dorosoma cepedianum* (LeSueur); cut skipjack herring, *Alosa chrysochloris* (Rafinesque); cut buffalo, *Ictiobus* sp.; chicken hearts; live crayfish; live goldfish, *Carassius auratus* (Linnaeus); grasshoppers; soap and ravelled tugs. Ravelled tugs may be described as follows: the end of the tug to which the hook was tied extended approximately one inch beyond the knot. The extended twine was unraveled and acted similar to the flyfisherman's streamer.

Snag line sets were usually fished with floats and anchors alternately tied to the main line allowing part of the set to be near the bottom and part of the set to be near the surface. They were usually put into the water in a manner similar to baited set lines except that tugs with hooks attached were tied on the main line before the set was placed in the water. The hooks were kept in an orderly manner by arranging them around the edge of a small tub or by hooking them into a split cane. In the case of the tub, the main line and tugs were stored inside the tub while in the case of the cane the tugs and main line were allowed to dangle from the hooks hooked into the split cane.

Hooks on snag sets were not baited. Fish were captured when some part of their body came in contact with the closely spaced hooks.

During the investigation, data were obtained by accompanying fishermen to remove the fish from their lines. On the morning of the visit, the investigator traveled upstream or downstream by boat from a selected landing and stopped to interview line fishermen as they were sighted. Each fisherman was accompanied until all his sets had been raised and the fish removed. All fish except game fish were returned to the landing, counted and weighed by species. Game fish were weighed, recorded and released at the point of capture.

RESULTS

The catch on bait line sets fished for 760.5 set-days (one set-day was 100 baited hooks fished for 24 hours) was 3,077 fish weighing 4,362 pounds. The common and scientific names of the fish taken are listed in Table 1. Blue, channel and flathead catfish made up 92 percent of the catch by weight from bait lines while buffalo and carp constituted 4 percent of the catch by weight (Table 2). Catfish were caught most effectively in June at which time an average of 15 pounds were taken per set-day. However, less fishermen were checked during June. The average catch of catfish during the other eleven months ranged from 5 to 8 pounds per set-day during February, April, May, July and November, 1959, and from 0.5 to 5 pounds per set-day during December, 1958; January, March, September, October and December, 1959 (Table 3).

TABLE 1.
FISH TAKEN FROM TVA LAKES OF ALABAMA WITH BAIT AND SNAG LINES
FROM DECEMBER, 1958, THROUGH DECEMBER, 1959.

Common name	Scientific name
Non-game fish:	
Buffalo: bigmouth	<i>Ictiobus cyprinellus</i> (Valenciennes)
black	<i>Ictiobus niger</i> (Rafinesque)
smallmouth	<i>Ictiobus bubalus</i> (Rafinesque)
Bullhead: black	<i>Ictalurus melas</i> (Rafinesque)
Carp	<i>Cyprinus carpio</i> (Linnaeus)
Carp sucker	<i>Carpiodes</i> sp.
Catfish: blue	<i>Ictalurus furcatus</i> (LeSueur)
channel	<i>Ictalurus punctatus</i> (Rafinesque)
flathead	<i>Pylodictis olivaris</i> (Rafinesque)
Freshwater drum	<i>Aplodinotus grunniens</i> (Rafinesque)
Gar: spotted	<i>Lepisosteus oculatus</i> (Winchell)
Paddlefish	<i>Polyodon spathula</i> (Walbaum)
Skipjack herring	<i>Alosa chrysochloris</i> (Rafinesque)
Sucker: golden redborse	<i>Moxostoma erythrurum</i> (Rafinesque)
Game fish:	
Bass: white	<i>Roccus chrysops</i> (Rafinesque)
yellow	<i>Roccus mississippiensis</i> (Jordan and Eigenmann)
Crappie: white	<i>Pomoxis annularis</i> (Rafinesque)

Ten different baits (buffalo, chicken hearts, crayfish, gizzard shad, goldfish, grasshoppers, ravelled tugs, skipjack herring, soap and threadfin shad) were used on baited lines from December, 1958, through December, 1959. The number of hooks used with each bait was not equal, therefore, a good comparison of the effectiveness of the various types of bait was impossible. The number of hooks per bait as given in Table 2 indicated the preference of fishermen for certain types of baits. The three major baits used were threadfin shad, crayfish and chicken hearts which were fished on 47, 13 and 13 percent of the hooks, respectively.

Comparative effectiveness was determined by randomly selecting subsamples of catches made on about 5,000 hooks with each of five baits (chicken hearts, crayfish, grasshoppers, skipjack herring and threadfin shad). These subsamples indicated that grasshoppers took an average of 10 pounds of fish per set-day and were the most effective bait used followed by crayfish, chicken hearts, threadfin shad and skipjack herring in descending order of effectiveness (Table 4). Crayfish, which were second in total effectiveness, were the most effective bait for taking buffalo and carp.

Snag line sets fished for 55.5 set-days (one set-day was 1,000 hooks fished for 24 hours) caught 639 fish which weighed 1,178 pounds (Table 5). Blue, channel and flathead catfish made up 76 percent of the catch by weight on snag lines while buffalo and carp constituted 21 percent of the catch by weight. No paddlefish were taken on snag line sets during this period. Snag line sets were fished throughout the sample period; however, data were limited to the period from February, 1959, through May, 1959, because of the random sampling method. This type of set was fished primarily for flathead catfish, blue catfish and buffalo. Snag line sets were most effective in May when an average of 49 pounds of fish was taken per set-day. Buffalo were taken most effectively in February when an average of 11 pounds was taken per set-day.

CONCLUSIONS

Snag lines were more effective per set-day than were bait lines during the period of February, 1959, through May, 1959. However, the average catch per hook was greater on baited hooks than on snag hooks. Bait line and snag line catches during this study were 92 and 76 percent catfish (channel, blue and flathead) by weight while buffalo and carp represented only 4 and 21 percent of the catch by weight, respectively.

The selectivity of bait and snag lines for taking catfish may not be advantageous to fishery biologists who are trying to maintain balanced

TABLE 2.
 PERCENTAGE OF THE WEIGHT COMPRISED BY EACH SPECIES OF FISH TAKEN WITH VARIOUS TYPES OF BAIT FROM THE TVA
 LAKES OF ALABAMA FROM DECEMBER, 1958, THROUGH DECEMBER, 1959.

Type of bait	Buffalo hearts	Chicken gizzards	Crayfish	Goldfish	Grass-hopper	Ravelled tugs	Skipjack herring	Soap	Thread	Total	
Number of hooks	650	10,000	10,100	1,400	2,400	5,400	1,200	9,000	500	35,400	76,050
Non-game fish:											
Buffalo	5.8	6.3	...	...	...	...	2.4	...	...	2.1	2.9
Bullhead	...	0.4	...	...	...	...	0.4	...	...	...	0.1
Carp	0.7	3.3	...	...	1.0	...	...	...	...	1.6	1.5
Catfish, blue	14.3	1.7	60.1	0.2	33.7	100.0	24.8	100.0	...	29.5	22.8
channel	96.7	80.6	23.1	2.2	61.5	...	71.0	...	...	61.4	63.1
flathead	8.9	1.5	4.5	92.1	3.5	...	0.5	...	...	1.8	6.2
Freshwater drum	tr ¹	5.7	8.4	3.0	0.3	...	0.6	...	...	2.5	2.6
Gar	...	...	3.9	...	...	...	...	...	...	...	0.1
Paddlefish	...	...	0.5	...	...	...	...	...	...	0.2	0.2
Skipjack herring	...	...	...	...	...	...	...	...	...	0.1	0.1
Sucker	...	...	...	2.5	...	...	...	...	...	0.3	0.2
Subtotal	96.7	100.0	100.0	100.0	100.0	100.0	99.7	100.0	99.7	99.7	99.8
Game fish:											
Bass, white	...	...	tr	...	...	...	...	0.3	...	0.2	0.1
yellow	...	...	...	...	...	...	...	...	...	tr	tr
Crappie, white	3.3	...	tr	...	...	...	...	...	...	0.1	0.1
Subtotal	3.3	0.0	...	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total number of fish	34	325	596	71	47	377	72	132	18	1,404	3,077
Total pounds of fish	66.5	458.4	905.3	88.8	170.5	522.8	66.0	188.1	15.1	1,880.7	4,362.2

¹ Less than 0.05 percent.

TABLE 3.

AVERAGE POUNDS OF FISH TAKEN PER 100 HOOKS PER DAY WITH BAITED LINES FROM TVA LAKES OF ALABAMA FROM DECEMBER, 1958, THROUGH DECEMBER, 1959.

	December 1958		January 1959		February 1959		March 1959		April 1959		May 1959		June 1959		July 1959		September 1959		October 1959		November 1959		December 1959		Total
	1,300	1,750	8,400	19,700	14,700	9,600	1,100	9,700	3,100	2,100	3,900	1,400	76,000												
Number of hooks	1,300	1,750	8,400	19,700	14,700	9,600	1,100	9,700	3,100	2,100	3,900	1,400	76,000												
Non-game fish:																									
Buffalo	0.25	...	0.05	...	0.64	0.14	...	...	...	0.21	0.20	...	0.17									
Bullhead	...	...	...	...	0.03	...	...	...	...	...	...	...	0.01	
Carp	...	...	...	...	0.33	0.11	...	0.05	0.10	...	...	...	0.09					
Catfish, blue channel	0.35	...	1.96	0.70	0.42	0.84	6.69	3.26	1.97	1.05	1.21	1.93	1.30												
flathead	0.55	0.49	3.32	1.44	6.99	5.03	7.88	4.69	0.85	0.45	1.61	2.62	3.61												
Freshwater drum	...	...	0.01	0.09	0.01	0.08	...	0.43	1.21	0.06	4.09	...	0.35										
Gar	...	...	0.01	0.08	0.23	...	...	0.24	0.09	0.23	0.84	...	0.15								
Paddlefish	...	...	...	...	0.06	...	...	0.04	...	...	...	...	0.01		
Skipjack herring	...	...	...	...	...	...	...	...	...	...	...	...	0.33
Sucker	0.18	...	...	...	...	...	...	...	...	...	0.11	0.22	0.01			
Subtotal	1.33	0.49	5.35	2.31	8.71	6.19	14.57	8.71	4.22	2.00	8.06	5.10	5.72												
Game fish:																									
White bass	...	...	...	...	tr ¹	...	...	...	...	...	...	...	0.28	
White crappie	...	...	...	...	tr	0.04	...	...	...	...	...	...	0.01		
Yellow bass	...	...	...	...	...	...	...	tr	...	...	...	...	tr	
Subtotal	0.00	0.00	0.00	0.00	tr	0.04	0.00	tr	0.00	0.00	0.00	0.00	0.28												
Total	1.33	0.49	5.35	2.31	8.71	6.23	14.57	8.71	4.22	2.00	8.06	5.38	5.74												

¹ Less than 0.005 pounds.

TABLE 4.
POUNDS OF FISH TAKEN PER SET-DAY AND PERCENTAGE OF THE WEIGHT COMPRISED BY EACH SPECIES TAKEN WITH FIVE BAITS BASED ON A SUBSAMPLE OF DATA COLLECTED ON THE TVA LAKES OF ALABAMA FROM DECEMBER, 1958, THROUGH DECEMBER, 1959.

Type of bait	Chicken hearts		Crayfish		Grasshoppers		Skipjack herring		Threadfin Shad		Total
	Pounds per set-day ¹	E ²	Pounds per set-day	E	Pounds per set-day	E	Pounds per set-day	E	Pounds per set-day	E	
Number of hooks	5,200		5,300		5,400		5,000		5,500		26,400
Buffalo	0.42	6.7	0.57	6.6							3.5
Bullhead			0.02	0.2			0.01	1.3			0.01
Carp			0.07	0.8	0.10	1.0			0.06	2.3	0.05
Catfish, blue channel	0.28	4.3	0.08	0.9	3.26	33.7	0.10	9.1	0.36	14.0	0.83
flathead	5.62	88.4	7.46	85.2	5.95	61.5	0.97	89.6	2.17	83.7	77.7
Freshwater drum	0.04	0.6	0.26	3.0	0.34	3.5					2.3
			0.29	3.3	0.03	0.3					0.06
Total	6.36	100.0	8.75	100.0	9.68	100.0	1.08	100.0	2.59	100.0	5.73
Total number of fish	182		368		377		37		97		1,061
Total pounds of fish	330.5		463.7		522.8		54.0		142.8		1,513.8

¹ 100 hooks fished for 24 hours.

² Percentage of the total weight comprised by each species.

TABLE 5.
AVERAGE POUNDS OF FISH TAKEN PER SET-DAY AND PERCENTAGES OF THE WEIGHT COMPRISED BY EACH SPECIES TAKEN FROM TVA LAKES OF ALABAMA WITH SNAG LINES FROM FEBRUARY, 1959, THROUGH MAY, 1959.

	February 1959	March 1959	April 1959	May 1959	Total					
Number of hooks	10,000	20,500	18,000	7,000	55,500					
	Pounds per set-day ¹	Pounds per set-day	Pounds per set-day	Pounds per set-day	Pounds per set-day					
	E ²	E	E	E	E					
Non-game fish:										
Buffalo	10.59	57.9	4.68	35.6	1.41	6.7	0.57	1.2	4.17	19.6
Carp	.....	.....	0.15	1.1	.....	.....	2.00	4.0	0.25	1.2
Carp sucker	.....	.....	2.77	21.9	6.62	31.5	30.57	61.8	0.05	0.3
Catfish, blue channel	2.14	11.7	1.03	7.9	12.91	61.3	10.64	21.5	7.42	34.8
flathead	5.55	30.4	3.22	24.5	.....	.....	5.67	11.5	6.91	32.6
Freshwater drum	.....	.....	0.29	2.2	0.07	0.3	.....	.....	1.90	9.0
Sucker	.....	.....	1.02	7.7	.....	.....	.....	.....	0.13	0.6
Subtotal	18.28	100.0	13.16	100.0	21.01	99.8	49.45	100.0	21.21	99.9
Game fish:										
White crappie	.....	.....	.....	.....	0.04	0.2	.....	.....	0.01	0.1
Subtotal	0.00	0.0	0.00	0.0	0.04	0.2	0.00	0.0	0.01	0.1
Total	18.28	100.0	13.16	100.0	21.05	100.0	49.45	100.0	21.22	100.0
Total number of fish	.....	51	.....	69	.....	288	.....	231	.....	639
Total pounds of fish	.....	182.8	.....	269.8	.....	378.9	.....	346.2	.....	1,177.7

¹ 1,000 hooks fished for 24 hours.

² Percentage of the total weight comprised by each species.

populations of carnivorous and forage fish in large reservoirs. Catfish above 16 inches in length are considered to be predators and as such they play an important part in the control of the numbers of fish (including rough fish) present in reservoirs (Swingle, 1954). A unilateral harvest of predatory species by commercial line fishermen fishing for catfish and sport fishermen fishing for bass, crappie, sauger, and catfish without legalized commercial net fishing to control carp, buffalo and other forage species could bring about a reduction in the poundage of predatory game species in large reservoirs. The long-term result could be fewer harvestable sized game fish and the possibility of an unbalanced fish population causing poor sport fishing.

It is recommended, therefore, that the commercial net fishing program allowing the use of trammel and gill nets with a minimum bar-mesh of 3 inches be continued in the TVA lakes and other public waters in Alabama where large populations of non-game fish are present and not adequately harvested.

ACKNOWLEDGMENT

The assistance given by Paul Bryan, Fish and Game Branch, Tennessee Valley Authority, Decatur, Alabama, in collecting the data for this report is gratefully acknowledged.

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HOW MANY OUT-OF-STATE FISHERMEN PURCHASE MORE THAN ONE LICENSE IN KENTUCKY, AND WHERE AND WHEN DO THEY FISH?

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ABSTRACT

Since the distribution of Federal Dingell-Johnson funds to the several states is determined in part by the number of out-of-state licensees fishing in a state, the Federal Government requested that Kentucky check its license sales to determine the number of duplicate purchases in order that the funds might be administered properly. To comply with