FISH POPULATION OF THE STILLING BASIN BELOW CANTON RESERVOIR

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For the past five years, Canton Reservoir has been the site of intensive reservoir biology studies conducted by the Oklahoma Department of Wildlife Conservation at the Oklahoma Fishery Research Laboratory. One phase of these studies is a yearly creel survey of the entire reservoir sport fishery. We have learned that while the stilling basin below the dam comprises only 0.03% of the fishable area of the reservoir, it may support up to 37% of the annual fishing pressure. It also appears that the popularity of the stilling basin fishery has been increasing recently. The area is especially popular with walleye, white bass, and crappie fishermen, but is also frequented by many catfish and carp anglers. It is used heavily during all months, but the heaviest pressure occurs during spring and fall. While we have no creel data from other stilling basin and tailrace fisheries around the state other than the Illinois River trout fishery, we do know that they are popular fishing sites.

Very little is known about fish populations in stilling basins. The only published information, by Hall (1), is on the population of the basin below Wister Reservoir. When it was learned that the U. S. Army Corps of Engineers was planning to drain the stilling basin below Canton for periodic inspection and maintenance, we saw an opportunity to expand our knowledge of fish populations in Oklahoma waters and perhaps to learn reasons why stilling basins are such popular and productive fishing sites.

DESCRIPTION OF THE STILLING BASIN

The concrete stilling basin is 780 ft. long ıd, when filled, extends 140 ft. between the ım and downstream sill for an area of 9,200 sq. ft. (2.3 acres). All sides except e downstream side slope in gradually, giv- g the bottom of the basin a slightly smaller ea. The downstream sill consists of two ps each 2½ ft. deep and one step which extends 5 ft. to the bottom for a total basin depth of 10 ft. Two rows of concrete baffles, one 10 ft. high and one 5 ft. high, alternate down the center of the basin. The basin is a fairly efficient selfcleaning structure containing surprisingly little silt. Since Canton is both a flood control reservoir and supplemental water supply for Oklahoma City, the volume of water released into the basin each year is variable, depending primarily upon flood conditions and the water needs of Oklahoma City. At least one early spring release of flood water and one or two water supply releases to Oklahoma City can be expected each year. During 1969, flood waters were released almost continuously from January through June, and two summer releases were made to Oklahoma City. The last of these was completed the week before the dewatering operation began. During releases the water is channeled through a portion of the large boulder riprapping piled up along the entire length of the downstream sill. These boulders rise two to three feet above the sill and only during a very large release does water pass over the rocks instead of through them. This arrangement would appear to be an effective barrier to the upstream passage of most species into the basin. Seepage around the several gates in the dam keeps the basin filled to maximum capacity at all times.

METHODS AND MATERIALS

Available information indicated that an extremely large fish population existed in the basin, and a large scale operation was deemed necessary to remove and process all fish in the basin within the designated time. All field personnel in the Fisheries Division of the Department, except those needed to operate the hatcheries, participated. In all, 29 Department personnel plus a Corps of Engineers crane operator assisted.

The Corps began drawdown operations

at 0800 on September 29, using two large oil field pumps with a combined pumping rate of 150 barrels (6,240 gal) per min. Pumping proceeded much faster than expected, and, in order to coordinate with our program, the pumps were shut down between 0100 and 0400 on September 30. The water was down to 3.5 ft. at this time. Pumping was then resumed at the full rate until noon on September 30, when the smaller pump was removed and pumping continued at 80 barrels (3,300 gal.) per min. until the water was down to 18 inches at 1600 on September 30.

Fish removal operations began at 0700 on September 30. The removal procedures for the first day consisted of a combination of shocking and herding. One electric shocking unit with hand-held electrodes was placed on each side of the two rows of baffles. The fish were herded the entire length of the basin to the removal point, using the electrical field supplemented by a line of men who also collected shocked fish with dip nets. The concentrated fish were loaded into large trap-door baskets similar to those described by Clemens (2) and lifted up to a work area. By the end of the day, most of the larger fish of all species, representing about half of the total poundage, had been harvested.

Operations resumed again at 0700 on October 1, when 4 gal. of 2.5% emulsifiable rotenone were applied to the basin. This was more than adequate to ensure a complete kill. The second day rotenone pickup was completed by noon of the following day. Two persons remained to make a third day count of any remaining fish, but an unexpected demand for more water by Oklahoma City required the Corps to refill the basin on the afternoon of October 2. After filling, numerous fish which floated up were counted, by species. The estimated weight of this final count was 200 lb.

All fish, except crappie, sunfishes, and gar other than longnose gar, were sorted according to species and then weighed. To determine the size and weight distribution for each species in the population, much more detailed data were taken from every fifth basket. All fish, except the shortnose and spotted gar, were sorted to species, then to inch-class, and the number in each inch-class was counted and weighed. On the first day, 4 of the 18 loads brought up were processed in detail.

Procedures on the second day were similar, but since the size and species composition of all 9 baskets of fish appeared quite similar, only one large load was given a detailed examination.

Operations during the third day proceeded on the assumption that the remaining fish were similar in size and weight distributions to those found on the second day. All fish were weighed by species, and about a third were counted and weighed to obtain an average weight.

The total population of each species was estimated from the daily average weight of the species, as determined from detailed data, and each day's total poundage for the species. The total weight and estimated number of each species were then broken down by inch-class, using composition of the catch data from the detailed workup. Detailed data from the first day were applied only to the first day harvest, but second day data were applied to both second and third day poundages, as well as to the final count.

Data have been tabulated according to the recommendations of Surber (3) with three minor exceptions. Channel catfish here are considered as predatory game fish, instead of predatory food fish, since they are considered game fish by Oklahoma law. No attempt was made to separate spotted and shortnose gar because they were not a significant part of the population, and no mention is made of minnows or other small forage fish in this report for the same reason. We saw no more than a dozen minnows throughout the operation and those that were missed or pulled through the pumps could not have amounted to more than 2 or 3 lbs.

RESULTS AND DISCUSSION

A total of 93,135 fish with a total weight of 12,857.3 lb. was removed from the stilling basin during this operation (Tables 1-4).

TABLE 1. *Composition of the population of fingerling-size fishes removed from the stilling basin below Canton Dam, 30 Sept. - 2 Oct., 1969. Percentages indicative relative contribution of this size-group to total number and pounds of each species.*

	Inch class	Number	Percentage by number	Weight (lb)	Percentage by weight
Predatory game fish		418	1.7	11.1	0.2
Largemouth Bass	0-4	4	2.7	0.1	0.1
White Bass	0-4	39	5.6	0.7	0.2
White Crappie	0-4	113	8.0	2.7	1.2
Black Crappie	0-4	128	4.8	6.8	2.4
Walleye	0-4	—	—	—	—
Channel Catfish	0-4	134	0.7	0.8	0.3
Non-predatory game fish		—	—	—	—
Bluegill	0-2	—	—	—	—
Longear Sunfish	0-2	—	—	—	—
Green Sunfish	0-2	—	—	—	—
Orangespotted Sunfish	0-1	—	—	—	—
Non-predatory food fish		233	4.3	7.5	0.2
Carp	0-6	59	3.8	5.1	0.3
Smallmouth Buffalo	0-4	—	—	—	—
River Carpsucker	0-4	—	—	—	—
Black Bullhead	0-4	—	—	—	—
Freshwater Drum	0-4	174	14.3	2.4	0.4
Predatory food fish		—	—	—	—
Flathead Catfish	0-4	—	—	—	—
Longnose Gar	0-6	—	—	—	—
Shortnose + Spotted Gar	0-6	—	—	—	—
Forage fish		15,866	25.7	112.6	3.4
Gizzard shad	0-3	15,866	25.7	112.6	3.4
TOTAL		16,517	17.4	131.2	1.0

TABLE 2. *Composition of the population of intermediate-size fishes removed from the stilling basin below Canton Dam, 30 Sept. - 2 Oct., 1969. Percentages indicative relative contribution of this size-group to total number and pounds of each species.*

	Inch class	Number	Percentage by number	Weight (lb)	Percentage by weight
Predatory game fish		17,614	70.6	1,596.2	36.1
Largemouth Bass	5-8	10	7.4	1.5	1.0
White Bass	5-6	53	7.5	3.0	0.9
White Crappie	5-6	725	51.1	46.2	21.4
Black Crappie	5-6	1,933	71.9	158.3	57.4
Walleye	5-11	282	36.4	81.9	9.4
Channel Catfish	5-9	14,611	76.0	1,305.3	50.5
Non-predatory game fish		1,585	56.5	73.9	38.2
Bluegill	3-4	565	38.7	23.3	20.2
Longear Sunfish	3-4	986	78.6	49.4	69.6
Green Sunfish	3-4	16	21.5	0.8	11.0
Orangespotted Sunfish	2 & up	18	100.0	0.4	100.0
Non-predatory food fish		3,046	56.7	1,490.2	34.2
Carp	7-13	882	57.5	648.2	37.4
Smallmouth Buffalo	5-15	89	37.3	111.4	14.3
River Carpsucker	5-11	1,665	70.3	670.7	52.0
Black Bullhead	5-6	—	—	—	—
Freshwater Drum	5-9	410	33.7	59.9	10.7
Predatory food fish		151	50.2	129.9	24.8
Flathead Catfish	5-9	25	33.3	4.9	15.8
Longnose Gar	7-25	122	57.3	118.8	25.7
Shortnose + Spotted Gar	7-23	4	25.0	6.2	19.5
Forage fish		33,707	54.6	1,418.6	42.3
Gizzard Shad	4-7	33,707	54.6	1,418.6	42.3
TOTAL		56,103	59.0	119.6	61.8

TABLE 3. *Composition of the population of available-size fishes removed from the stilling basin below Canton Dam, 30 Sept. - 2 Oct., 1969. Percentages indicative relative contribution of this size-group to total number and pounds of each species.*

	Inch class and up	Number	Percentage by number	Weight (lb)	Percentage by weight
Predatory game fish		6,916	27.7	2,814.6	63.6
Largemouth Bass	9	116	89.9	150.5	98.9
White Bass	7	612	86.9	313.3	98.8
White Crappie	7	581	40.9	167.6	77.4
Black Crappie	7	626	23.3	110.5	40.1
Walleye	12	491	63.6	792.6	90.6
Channel Catfish	10	4,490	23.3	1,280.1	49.5
Non-predatory game fish		1,221	43.5	119.6	61.8
Bluegill	5	895	61.3	91.8	79.7
Longear Sunfish	5	269	21.4	21.6	30.4
Green Sunfish	5	57	78.5	6.2	89.0
Orangespotted Sunfish	—	—	—	—	—
Non-predatory food fish		2,095	39.0	2,865.6	65.7
Carp	14	593	38.6	1,081.0	62.3
Smallmouth Buffalo	16	150	62.7	666.8	85.7
River Carpsucker	12	702	29.7	618.4	48.0
Black Bullhead	7	19	100.0	3.6	100.0
Freshwater Drum	10	631	52.1	495.8	88.8
Predatory food fish		150	49.8	394.0	75.2
Flathead Catfish	10	49	66.7	26.0	84.2
Longnose Gar	26	91	42.6	342.5	74.2
Shortnose + Spotted Gar	24	10	75.0	25.5	80.5
Forage Fish		12,133	19.7	1,823.5	54.4
Gizzard Shad	8	12,133	19.7	1,823.5	54.4
TOTAL		22,515	23.7	8,017.3	62.4

TABLE 4. *Standing crop of the stilling basin below Canton Dam, 30 Sept. - 2 Oct., 1969. Percentages indicate contribution of each species to total standing crop.*

	Number	Percentage standing crop	Weight (lb)	Percentage standing crop
Predatory game fish	24,948	26.2	4,421.9	34.4
Largemouth Bass	130	0.1	152.1	1.2
White Bass	704	0.7	317.0	2.5
White Crappie	1,419	1.5	216.5	1.7
Black Crappie	2,687	2.8	275.6	2.1
Walleye	773	0.8	874.5	6.8
Channel Catfish	19,235	20.2	2,586.2	20.1
Non-predatory game fish	2,806	3.0	193.5	1.5
Bluegill	1,460	1.5	115.1	0.9
Longear Sunfish	1,255	1.3	71.0	0.6
Green Sunfish	73	0.1	7.0	Tr
Orangespotted Sunfish	18	Tr	0.4	Tr
Non-predatory food fish	5,374	5.6	4,363.3	33.9
Carp	1,534	1.6	1,734.3	13.5
Smallmouth Buffalo	239	0.2	778.2	6.1
River Carpsucker	2,367	2.5	1,289.1	10.0
Black Bullhead	19	Tr	3.6	Tr
Freshwater Drum	1,215	1.3	558.1	4.3
Predatory food fish	301	0.3	523.9	4.1
Flathead Catfish	74	0.1	30.9	0.2
Longnose Gar	213	0.2	461.3	3.6
Shortnose + Spotted Gar	14	Tr	31.7	0.3
Forage Fish	61,706	64.9	3,354.7	26.1
Gizzard Shad	61,706	64.9	3,354.7	26.1
TOTAL	95,135		12,857.3	

Predatory game fish comprised 26.2% of the total number and 34.4% of the total population weight. Substantial populations of harvestable fish were found for nearly all game species. The largemouth bass population was larger than had been expected, consisting of an estimated 130 fish averaging nearly 1.2 lb. We also took an estimated 773 walleye weighing 874.5 lb. Of these, 63% were of available size, averaging 1.6 lb. There were large populations of small black crappie and channel catfish, with over 70% of the individuals and 50% of the weight of both species falling into the intermediate size-group. Hall (1) found this same situation existing for catfish in the stilling basin below Wister Reservoir. Only 20% of the Wister catfish were of available size as compared with 23.3% in Canton.

Non-predatory game fish were an insignificant part of the total stilling basin population, contributing only 3.0% of the total number and 1.5% of the weight. Bluegill and longear sunfish were by far the most abundant, whereas we estimated that the stilling basin contained only 73 green sunfish and 18 orange-spotted sunfish.

Non-predatory food fish were not exceptionally abundant, but they accounted for one-third of the total weight of the population. River carpsuckers were the most abundant fish in this group, but most were smaller, intermediate-size fish. Carp averaging 1.1 lb. were the next most abundant species, and freshwater drum were third. Although they were far less abundant, smallmouth buffalo had an average weight of 3.3 lb. and, therefore, made a significant contribution to the total weight. Black bullheads were almost absent from the basin, with an estimate of only 19.

Predatory food fish were an extremely small part of the numbers, but they accounted for 4.1% of the weight. Most of this weight can be attributed to large longnose gar. These gar were one of the most surprising finds in the basin. Over 93% of the gar were longnose gar and in 4 years of sampling in the reservoir proper, we have seen no more than four longnose gar. This part of the basin population undoubtedly came from the stream below. A surprisingly small population of flathead catfish was found. The flathead catfish population at the time of the 1956 dewatering was, apparently, much more impressive according to several Canton residents.

The forage fish group is composed entirely of gizzard shad, more than half of which were in the intermediate size-group.

The population structure of the stilling basin below Canton Dam does not appear to vary appreciably from what we have found in several cove rotenone samples of the reservoir. Results of these cove samples vary greatly, but when their species composition is compared with the stilling basin sample, the two are quite similar (Table 5).

TABLE 5. *Comparison of fish populations in Canton Reservoir*[1] *and Canton Stilling Basin.*

	Percentage of Standing Crop				
	Reservoir				Stilling Basin
	1965	1966	1967	1968	1969
Predatory game fish	9.9	29.5	10.6	40.1	34.4
Non-predatory game fish	1.5	6.9	4.7	4.5	1.5
Non-predatory food fish	63.5	39.6	52.1	32.9	33.9
Predatory food fish	0.8	1.0	0.5	0.4	4.1
Forage fish	24.4	23.0	32.1	21.3	26.1
Available game fish	5.7	27.4	6.4	25.0	22.8
Available food fish	44.5	29.3	37.3	28.4	25.4
Total Game fish	11.3	36.4	15.3	45.3	35.9
Total food fish	64.2	40.6	52.6	33.6	38.0
Total predatory fish	10.6	30.5	11.1	41.2	38.5
Total non-predatory fish	89.4	69.5	88.9	58.8	61.5
	Standing Crop (pounds-per-acre)				
	270.8	169.6	201.8	374.5	5,590.1

[1]Findings of cove rotenone samples

The stilling basin populations of predatory game fish and predatory food fish are perhaps slightly larger than those in the reservoir. However, this may not be a valid observation since sampling with other gear has shown the number of walleye and shortnose and spotted gar to be much higher in the reservoir than our cove samples indicate. It also appears that the stilling basin contains fewer non-predatory game fish and non-predatory food fish.

The marked similarities between the two populations suggest that the stilling basin population is influenced more by the reservoir population than by the river population. The large population of longnose gar is the only real inconsistency.

Probably the principal reason for the popularity of the stilling basin is that it is a concentrator of fish, thus making them more available to fishermen. The stilling basin, at the time we sampled, had a standing crop of 5,590 lb per acre. This crop is several times greater than the 374 lb and 525 lb per acre found in the reservoir in 1968 and 1969, respectively.

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