CONTRIBUTION OF STRIPED BASS TO THE FISHERY OF LAKE OF THE OZARKS, MISSOURI

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ABSTRACT

Lake of the Ozarks, a 60,000 acre reservoir built in 1931 by the Union Electric Company in west-central Missouri, was chosen for an introduction of striped bass since it offered the best chance for establishing a naturally perpetuating fishery in Missouri. Fingerling striped bass were reared and stocked each year from 1967 to 1974 with the exception of 1972. The effects of these introductions upon the existing fishery were monitored by a creel census conducted from March to November, 1967-1973.

Fishing pressure in the two census areas of the lake ranged from 35.5 to 63.7 hours per acre in the Niangua Arm and from 10.4 to 25.9 hours per acre in the Osage Arm. The average number of fishing trips per acre per year was 18.5 for the Niangua Arm and 5.4 for the Osage Arm. Fish harvest and catch rate were estimated and ranged from 42,000 (0.61 fish per hour) to 138,000 (1.11 fish per hour) fishes caught in the Niangua Arm and from 15,600 (0.40 fish per hour) to 164,000 (1.69 fish per hour) fishes caught in the Osage Arm. White crappies, white bass, channel catfish, and bluegills made up about 90% of the catch from both arms.

Striped bass were first observed in the creel in 1971. Most of the 41 stripers reported or observed were taken from the clearest water areas of the lake and from the tailwater. Fishing success, in general, was positively correlated with water clarity; the clearer water provided a better catch. Stocking densities were considered too low to adequately evaluate the introduction of striped bass. Those that were stocked apparently did not adversely affect the harvest of other fishes.

The completion of Harry S. Truman Dam above Lake of the Ozarks will undoubtedly preclude the establishment of a self-perpetuating striped bass fishery since the river characteristics needed for spawning will be permanently altered.

INTRODUCTION

Striped bass, *Morone saxatilis,* were stocked in Lake of the Ozarks, Missouri from 1967 through 1974 in an attempt to better utilize an abundant gizzard shad population and to improve the quality of the angling experience by adding an additional species to the fishery. Additionally, the Osage River—Lake of the Ozarks complex was chosen for the introduction since there appeared to be enough suitable spawning habitat available in the river above the reservoir to establish a naturally perpetuating striped bass fishery. The objective of this study was to determine the effect of the stocked striped bass upon the fishery of Lake of the Ozarks. Parameters measured included: fishing pressure, rate of success, and hook-and-line yield.

MATERIALS AND METHODS

Lake of the Ozarks, a 60,000 acre reservoir in west central-Missouri impounding the Osage River, is owned and operated by Union Electric Company. The lake was created by the completion of Bagnell Dam, in October, 1931. Covering an area of 93 square miles in seven counties, the 14,000 square miles of watershed reaches into Kansas. Nearly 80 miles long with a 1,300 mile shoreline, the reservoir has an average depth of 34.4 feet at 660 m.s.l. (normal pool). Maximum depth is 110 feet. Eigh 21,500 kilowatt generators produce 440,000,000 kilowatt hours of electricity annually. Flood waters are controlled by 12 spillway gates. The average annual river flow is 5,015 c.f.s. (U. S. Geological Survey, 1972).

A creel census was conducted on two areas (Figure 1) to evaluate the striped bass stockings. The Niangua Arm area (1,949 acres) was chosen because the water in this arm tends to be clearer than for the other arms and therefore, was considered to be better striped bass habitat. Hahatonka, a large spring (64 c.f.s.; Vineyard and Feder, 1974), is located in the upper reaches of this arm. It was considered likely to provide further good habitat, especially in winter. The census area on the Osage Arm (3,759 acres) was picked because it is the main-stem arm of the reservoir, and striped bass moving through its length could be expected to appear in the creel. The two census areas made up about 10% of the reservoir area.

A daytime creel census was conducted on a March 1 to November 30 basis each year from 1967 to 1973. Past studies in Missouri have revealed less than 5% of the angling occurs during the winter months in Missouri reservoirs. A creel clerk censused each of the two areas about 7 days each month. The census was stratified so that one-half the weekend days, in which most of the fishing took place, were sampled. Holidays were treated as weekend days.

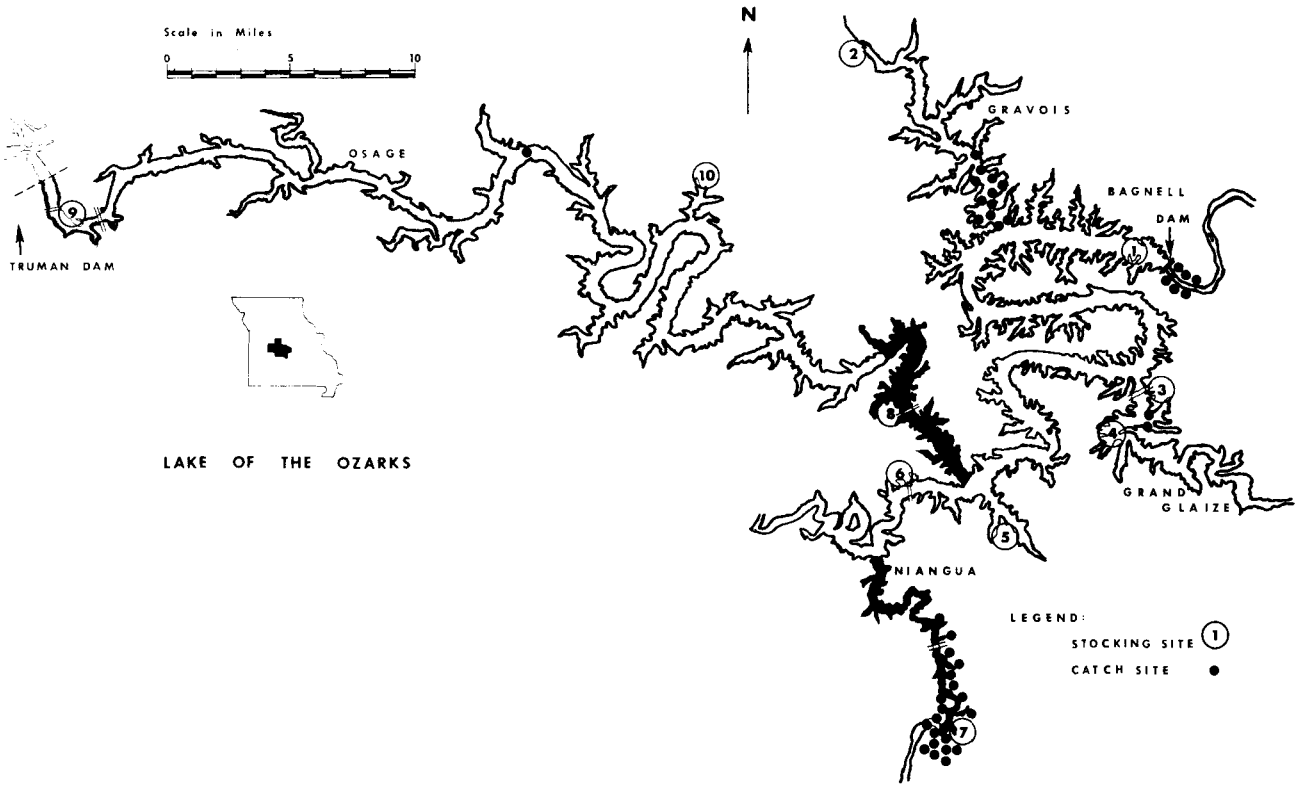

Figure 1. Lake of the Ozarks, Missouri showing stocking and catch sites of striped bass. Creel census areas are shaded in black.

On a typical census day, the clerk made two, 1 hour fishermen counts and then spent the remaining 6 hours interviewing individual anglers. The fisherman counts were randomly scheduled during the three, 3-month seasonal periods so that all possible daylight hours were sampled. The clerk also measured water transparency with a Secchi disk each day he worked.

These creel census methods were originally described by Kathrein (1953) and later modified and updated by Fry (1962) and Hanson (1973).

Estimated total fishing hours were calculated as the product of the average daily angler count times the average length of the day censused times the number of days in the period. The angler counting interval was short enough so that an instantaneous count was assumed.

The estimated total catch was calculated by multiplying total hours fished times the catch rate. Emperical data were used to compute the catch rate. Only the length of completed trips was used to arrive at a figure for estimated total trips. Data from weekdays and weekend days were treated separately and then combined for total figures. Measurements of total length of some fishes were made so that average lengths of each species were available for calculating yield by weight to the fishery for each species of fish.

Striped bass fingerlings hatched from eggs obtained from out-of-state sources, mainly South Carolina, and reared in our hatcheries were released in several locations in Lake of the Ozarks from 1967 through 1974 (Figure 1). Early attempts to rear fingerlings encountered a variety of problems. These were solved, and later attempts were much more successful (Table 1). In 1973, 10,000 fingerlings were purchased from Marine Protein, a private source in Florida.

The striped bass were not protected by any special regulations after stocking although there was a fairly large population of white bass, *Morone chrysops*, in the lake. A leaflet was distributed to dock and resort operators in the Lake of the Ozarks area to enable anglers to distinguish between the two species. In addition, posters were displayed at docks, restaurants, and assorted stores. Both leaflets and posters encouraged anglers to return small stripers to the water.

Table 1. Striped bass stocked in Lake of the Ozarks, 1967-1974.

Year	*Hatchery*	*Number*	*Avg. Size (inches)*	*Release sites*
1967 Aug	Glaize	110	5.5	3
Sept	Glaize	1,932	5.5	3
1968 July	Glaize	30,043	3.0	3
Sept	Glaize	29,765	5.0	1,2,3,4,6,8
1969 July	Glaize	55,695	2.0	4,5
Sept	Glaize, Hunnewell	71,096	3.0	2,4,6,8
1970 July	Glaize	32,755	2.5	2,4,6,8,
Oct	Glaize	34,642	3.8	2,4,5,6,8
1971 July	Glaize	3,771	4.0	4
Aug	Glaize	4,283	3.3	4
1972		None		
1973 July	Glaize	56,540	2.4	2,4,6,8
Sept	Marine protein	10,000	3.1	9
Sept	Glaize	78,053	3.7	2,4,6,8
Sept	Blind Pony	54,892	4.0	9
Mar, 1974 (1973 Year-class)				
	Glaize	185	8.0	3
	Blind Pony	390	—	10
1974 Sept	Glaize	201,511	3.3	2,3,4,6,7,8
Sept	Blind Pony	153,402	3.6	9

* 1—Lower Osage
2—Gravois Mills
3—Glaize Hatchery Cove
4—Grand Glaize
5—Linn Creek
6—Niangua Arm
7—Hahatonka
8—Hurricane Deck
9—Warsaw
10—Proctor Creek

RESULTS

Fishing pressure

On the Niangua Arm census area, the estimated hours fished ranged from 35.5 per acre to 63.7 per acre. Average hours fished per acre per year was 49.8. There were approximately 18.5 trips per acre per year (Table 2).

The estimated hours fished on the Osage Arm census area ranged from 10.4 per acre to 25.9. Average hours fished per acre per year was about 16.6. There were approximately 5.4 fishing trips per acre per year.

Table 2. The estimated number of fishing trips and hours fished on two creel census areas on Lake of the Ozarks, Missouri, 1967-1973.

Area	*1967*	*1968*	*1969*	*1970*	*1971*	*1972*	*1973*	*Grand Totals or average*
Niangua Arm:								
Fishing trips	46,127	25,787	19,982	22,962	31,742	52,406	52,790	251,796
Total hours	96,158	98,155	94,873	69,257	88,009	124,225	108,361	679,038
Hours per acre	49.3	50.4	48.7	35.5	45.2	63.7	55.6	49.8
Osage Arm:								
Fishing trips	25,670	9,256	8,710	13,196	24,010	36,385	25,200	142,427
Total hours	58,300	59,902	53,235	39,152	70,054	97,316	58,020	435,979
Hours per acre	15.5	15.9	14.2	10.4	18.7	25.9	15.4	16.6

Table 3. The estimated number of fish caught, pounds per acre, and rate of catch on two creel census areas on Lake of the Ozarks, Missouri, 1967-1973.

Area	*1967*	*1968*	*1969*	*1970*	*1971*	*1972*	*1973*	*Grand Totals or average*
Niangua Arm:								
Number of fish	83,801	70,795	63,454	41,995	92,757	138,061	109,486	600,349
Pounds per acre	15.4	25.8	15.5	10.1	19.4	31.1	20.4	19.7
Fish per hour	0.88	0.72	0.67	0.61	1.05	1.11	1.01	0.88
Osage Arm:								
Number of fish	48,961	30,406	25,313	15,604	66,979	164,049	97,675	448,987
Pounds per acre	4.4	3.9	3.5	2.2	5.6	18.1	7.7	6.5
Fish per hour	0.84	0.51	0.48	0.40	0.96	1.69	1.68	1.03

Fish harvest

The estimated catch of fish on the Niangua Arm census area ranged from about 42,000 to 138,000 (Table 3). The average catch was about 2.4 fish per trip. An average catch rate of 0.88 fish per hour provided a harvest of 44 fish, or 19.7 pounds per acre per year. An average of 45% of the anglers were successful in catching at least one fish. Catch rates ranged from 0.61 to 1.11 fish per hour. White crappies made up 54%, white bass 23%, bluegill 9%, and channel catfish 5% of the catch.

The estimated catch of fish on the Osage Arm census area ranged from about 15,600 to 164,000 (Table 3). The average was about 3.2 fish per trip. An average catch rate of 1.03 fish per hour provided an average harvest of 17.1 fish, or about 6.5 pounds per acre per year. About 47% of the anglers were successful. Eighty percent of the catch was white crappies. Bluegill, channel catfish, and white bass comprised about 11%.

Striped bass fishery

Striped bass were first observed during the census on the Niangua Arm in 1971, but the clerk did not observe any while censusing the area on the Osage Arm. Records of individual catches of stripers from various additional sources were kept when specific information could be obtained. Most catches were from two areas; the Gravois Creek Arm, the clearest water area, and the upper Big Niangua Arm, the next clearest water area (Figure 1). Several stripers were also caught in the tailwater creel census area below the dam. A total of 41 striped bass were either observed in the creel or authenticated catches reported by reliable sources. In addition, it was known that numbers of small stripers were included in catches of white bass, and the difference went undetected by the anglers. Almost all authenticated stripers were reported by Missouri Department of Conservation personnel.

Thirty-two striped bass scale samples became available from various sources; mainly from our Conservation Agents. Growth-rates were back-calculated from these scales assuming a zero intercept. Growth was found to have been good the second and third years following stocking (Table 4). Their growth compared favorably with sea-run stripers off the California coast (Calhoun, 1952). Five-year-old stripers there averaged about 21 inches in length while the one, 5-year-old striper from Lake of the Ozarks was 25 inches long.

Table 4. The average calculated lengths in inches of striped bass at the end of each year of life for each age group caught in Lake of the Ozarks, 1967-1973.

		Calculated length at end of year of life				
Age group	*No. fish*	*1*	*2*	*3*	*4*	*5*
I	4	7.1				
II	16	6.4	13.4			
III	11	5.5	13.3	19.3		
IV	—	—	—	—		
V	1	8.0	17.7	19.8	23.0	25.0
	32					
Grand average		6.2	13.5	19.3	23.0	25.0
Average increment		6.2	7.3	5.8	3.7	2.0
No. of fish		32	28	12	1	1

Water transparency

Water transparencies in different areas of the lake varied quite widely during this study. For example, the Gravois Arm would be quite clear while the middle and upper Osage Arm were quite turbid. The differences, of course, are mainly related to watershed types and characteristics of the various arms of this large reservoir.

Comparisons between water transparencies and angler use and success were made and tested statistically. When comparing Secchi disk readings with catch rates, positive correlations to the 5% level on the Niangua and to the 1% level on the Osage census areas were obtained. Clearer water was associated with better catch rates. When Secchi disk readings were compared with numbers of anglers interviewed, positive correlations to the 1% level were obtained on both census areas. The clearer the water, the more anglers were present and subject to interview. A similar relationship was measured on Thomas Hill Reservoir, Missouri (Hanson, 1973).

Water clarity also was compared with non-angling recreational boating activity. The clerk counted "pleasure" craft while making angler counts. Positive correlations to the 1% level on the Niangua and to the 5% level on the Osage were obtained. Clearer water also meant increased pleasure boating activity.

DISCUSSION

Fishing success ranged from good to outstanding on the Niangua Arm and from fair to outstanding on the Osage Arm census areas. During this time, however, few striped bass were checked in the creel census. The fact that numbers stocked were quite low from 1967 to 1972 and the fact that the areas censused only comprised about 10% of the reservoir lowered the probability that the clerks

would see one in the creel. Many of the stripers caught were from the Gravois Creek Arm which was not being censused further lowering the probability. Poor survival of stocked fingerlings may have also lessened chances of seeing a striper in the creel, although survival was not measured. Stocking densities were higher the last year of the census, 1973, and again in 1974. If survival is good and migration out of the reservoir is minimal, stripers should be caught in increasing numbers in the future.

During the course of this study, the presence of striped bass did not appear to adversely affect the harvest of other fishes. The catch for the other species, particularly white crappie and white bass, remained quite good. Occasional periods of lower catch rates were most likely influenced by turbid water conditions. Water clarity was found to be an important factor regarding catch rates, number of anglers out fishing, and the amount of other recreational boating. More stripers were reported caught in clearer waters. This knowledge may well suggest potential management problems or goals on yet to be built reservoirs in watersheds that will likely have chronically turbid run-off water.

The blocking of the only potentially successful striped bass spawning sites on the Osage River above Lake of the Ozarks by Truman Dam, currently under construction, makes recommendations regarding continued striped bass stocking difficult. If this fishery continues to develop successfully in scope and in popularity, it may prove desirable to make future releases of hatchery reared fingerlings. In view of their longevity, only periodic releases at wider intervals may be necessary. Possibly, mature spawners may become available in the tailwater below Truman Dam and we could take our own striper eggs. The situation now dictates that we wait to see what happens with this fishery and to the angling public's attitude and desires toward this recently introduced fish.

LITERATURE CITED

Calhoun, A. J. 1952. Striped bass fishing map, State of California, Dept. of Fish and Game, Sacramento, Calif.

Fry, James P. 1962. Harvest of fish from tailwaters of three large impoundments in Missouri. Proc. Ann. Conf. S. E. Game and Fish. Comm. 16:405-411.

Hanson, Willis D. 1973. The fishery of a Missouri reservoir receiving thermal effluent. Proc. Ann. Conf. S. E. Game and Fish. Comm. 27:722-734.

Kathrein, Joseph W. 1953. An intensive creel census on Clearwater Lake, Missouri, during its first four years of impoundment, 1949-1952. Trans. 18th N. A. Wildl. Conf.:282-295.

U. S. Geological Survey. 1972. Water Resources Data for Missouri. Pub. by U. S. Dept. of the Interior, Geological Survey, 387 pp.

Vineyard, Jerry D. and Gerald L. Feder. 1974. Springs of Missouri: Mo. Geol. Survey and Water Resources, WR 29, 272 pp., 49 figs., 26 tbls.

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