ANGLING SUCCESS AND RECREATIONAL USE ON TWELVE STATE-OWNED LAKES IN OKLAHOMA[1]

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ABSTRACT

Twelve state-owned lakes in Oklahoma were surveyed in 1965 to obtain data on sport fishing and recreational use. The lakes were virtually unmanaged and ranged in size from 26 to 180 surface acres. This project was designed to provide a basis for future management.

Data was calculated on an I.B.M. 7040 computer. Average harvest in pounds per acre ranged from 22 to 107, with fishing pressure ranging from 138 to 622 hours per acre. The catch consisted mainly of largemouth bass, crappie, channel catfish, bullheads, redear sunfish and bluegill sunfish. Most of the fishing effort was expended from April through October.

Other recreational use consisted mainly of sight-seeing, camping and picnicking. This usage rivaled fishing in number of participants on most lakes.

INTRODUCTION

This report is the culmination of twelve concurrent creel surveys conducted from December 1964 to December 1965. The project was designed to determine fisherman harvest for small unmanaged lakes in Oklahoma and provide background information for future research projects. It was accomplished through the use of Federal Aid to Fish Restoration funds.

The Oklahoma Department of Wildlife Conservation began construction of the first state-owned lake in 1953. Since that time a total of seventeen lakes have been built. Federal aid to fish restoration (D-J) provided funds for the construction of most of these lakes. Sites were selected to provide fishable waters in areas of the state where none existed. They were designed and constructed solely for sport fishing and recreational use. Swimming, skiing and trotlining are outlawed on all lakes to provide a more suitable environment for the sport fisherman. Waterfowl hunting is encouraged on fourteen of the lakes with Lake Etling managed as a waterfowl refuge six months of the year. No fees are charged to users on any of the lakes.

Department ownership provides the fisheries division a twofold opportunity. First, to provide quality fishing in areas of distinct shortage through proper management, and secondly, to experiment with new techniques for developing better management tools for use in Oklahoma waters. Manpower and funds, to date, have not been available to initiate a planned program of management on any of the lakes. This creel survey is intended to provide a basis by which accurate evaluation of the effects of fishery management on fisherman success and recreational use can be determined. Future creel surveys will be conducted for a quantitative measurement of these indices. Data from this project will also be used to determine needs for expanded recreational facilities on most of the lakes.

Lake Descriptions

This creel survey was conducted on twelve of the lakes ranging in size from 26 to 180 acres and totaling 1,006 acres. Five of the lakes are either still under construction or were unsuitable for a creel survey at the time of the project. The twelve lakes sampled are located in virtually every physiographic region in the state and vary greatly in

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water chemistry, productivity, and surrounding terrain. The lakes in the western portion of the state are located in short and mixed grass prairie biomes and the eastern lakes are surrounded by pine, postoak-blackjack oak forest. No attempt will be made to describe the lakes in detail except in cases where unusual features have an effect on data collected. Figure 1 shows the location of each lake and the population density of the area.

Statistical Design and Analysis

The design for this creel survey was developed by Victor Lambou, then of the Oklahoma Fishery Research Laboratory. A stratified random design was used. Weekday and weekend sampling periods were considered separate strata. Within these strata the following factors were considered; access points, days and periods (mornings and afternoons).

The number of access points varied from one to three at different lakes. For each stratum a block was established containing all possible combinations of days-access points. All of these combinations were then sampled in an order determined from a random number table separately for morning and afternoon periods. Creel checkers were instructed to arrive in morning sampling periods early enough to check all fishermen leaving the lake and quit exactly at noon. In afternoon periods the creel checker began at noon and stayed long enough to check all fishermen leaving in the evening. The fishermen were interviewed as they left the lake in all cases except two (Nanih Waiya and Carl Etling). In the latter a roving survey was established where the checker completely circled the lake every hour. For these lakes the blocks were established as if there were two access points; one corresponding to counts made on the hour and the other to interviews on the half hour. One morning and one afternoon were sampled each week and each weekend.

The interview information was punched on I.B.M. cards and the data for the estimates were calculated using an I.B.M. 7040 computer at the Oklahoma State University computing center. An attempt was made to follow the reporting outline described by Lambou, (1966) for reporting creel surveys to the Southern Division of the American Fisheries Society. It was impossible to extract information on fishing pressure by class of fish. Creel checkers frequently misinterpreted information received in the interview. Often if a party was fishing for crappie and caught bass, hours were entered in the bass column. A class was provided for fishermen fishing for anything but this was not used by the creel checkers.

This design was best adapted to obtain yearly totals. For the lakes with a stationary creel survey; each access point was considered to completely sample the area involved and an expansion factor was developed as the ratio between the number of days sampled and the number of possible sample days. There were two known exceptions to the assumption that the creel checker sampled every party. There were parties for which the interview forms were incomplete and had to be voided. In addition some persons were not interviewed for reasons such as refusing to stop. The number of such parties were known. These complications caused difficulties in setting reasonable confidence limits. To accomplish this goal the following approximate procedures were utilized. All parties counted included rejects and refusals were expanded to a total for each access X weekday or weekend strata. The means and 95% confidence limits of the means were computed for party size, number of fish caught per party, weight caught per party and hours fished by parties. These values were multiplied by the estimated number of parties and then summed over all areas to get weekday and weekend totals. The latter were combined to obtain grand totals. Confidence limits calculated in this manner are only approximate; however, it is felt they are useful as indicators of precision.

The yearly breakdown of species groups was estimated without correcting for missed parties. However, the values established by expanding the sampling ratio fell within the limits established by the previously described procedure.

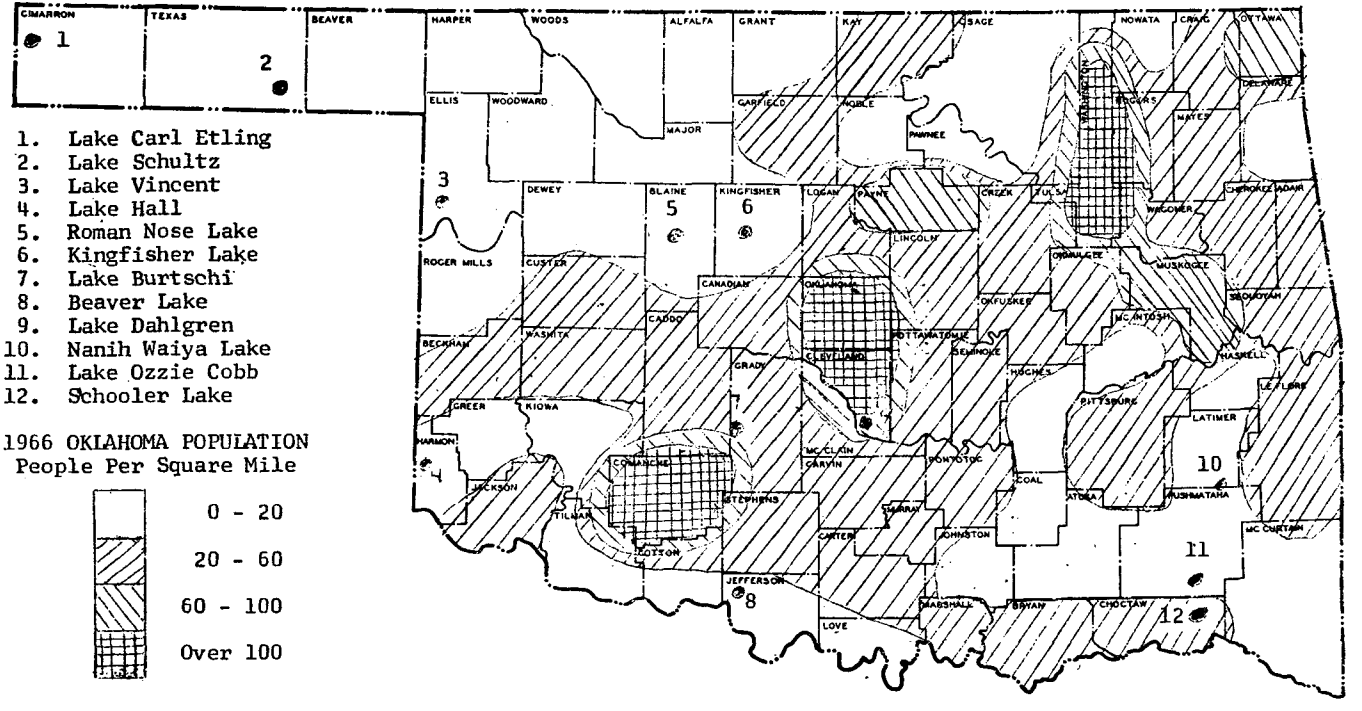

FIGURE 1. Lake locations and population density of the area of twelve department owned lakes.

There were three exceptions to the yearly surveys conducted on most lakes. Lake Carl Etling is a waterfowl refuge and is closed to the public seven months of the year. The creel survey was conducted during the five-month period the lake is open. Administrators encountered considerable difficulty in locating suitable creel checkers on lakes Kingfisher and Schultz. These lakes were sampled six and eight months, respectively.

Although this survey was not specifically designed to obtain estimates on a monthly basis it was possible to gain an indication of seasonal trends. This was done by treating each month as a separate sample and using an expansion value of the ratio of the number of days sampled each month (separately for each area and by weekday and weekend) to the total possible days. This resulted in small sample size for certain months in some areas. However, this did not mask seasonal patterns.

In the two lakes with the roving creel survey each count was considered to represent an instantaneous count. These were then raised by the number of hours in the survey day X number of days in the season or year to obtain an estimate of the total hours fished. These totals were then divided by the mean time spent fishing by completed parties to arrive at an estimate of the total number of parties. The party means with 95% confidence limits for the desired statistics were then applied to the estimated number of parties to obtain the final values used with approximate confidence limits. No confidence limits were placed on the number of hours fished. The percentage breakdown of species caught was applied to the total estimated number of pounds of fish caught for appropriate strata.

The estimates of recreational use other than fishing are minimum estimates in the sense that no adjustments were made for persons not interviewed. The totals of other recreational use were determined by using the same expansion factor described in the previous paragraphs.

RESULTS

Average harvest and fisherman use is presented in Table I. Total pounds of fish of all species harvested ranged from 22 to 107 per acre, with most lakes 40 to 60 pounds per acre. The number of fish per acre varied from 68 to 242. Apparently, there was no correlation between fishing pressure and catch rate. Also, population density around the lakes did not influence fishing pressure, e.g. Lake Vincent is located in a remote area and still received heavy fishing pressure.

Table II presents composition of catch data from the twelve lakes. Bass and catfish comprise the largest portion of the catch in most lakes. The average weight of bass ranges from 0.65 to 2.10 pounds and catfish average 0.57 to 1.90 pounds. The remainder of the catch was crappie and sunfish with crappie being the least important. Average weight of sunfish ranged from 0.17 to 0.50 pounds. Crappie were somewhat larger and averaged less than 0.5 pounds.

Virtually all bass weighed were largemouth bass (*Micropterus salmoides*) with both black bullheads (*Ictalurus melas*) and cannel catfish (*Ictalurus punctatus*) being represented in the catfish class. In only one lake (Carl Etling) were bullheads more numerous than channel catfish. The sunfish harvested were bluegill (*Lepomis macrochirus*), redear (*Lepomis microlophus*) and green (*Lepomis cyanellus*). Both white crappie (*Pomoxis annularis*) and black crappie (*Pomoxis nigromaculatus*) were represented in the harvest.

Oklahoma fishermen, when fishing state owned lakes, usually went fishing in parties of two or three and fished approximately three hours (Table III). In all but two lakes, fishermen were predominately residents of Oklahoma and two-thirds were males. On lakes Vincent and Hall, located near the Texas border, approximately one-half of the fishermen were non-residents.

Figure II shows the seasonal distribution of total harvest and fishing pressure by class of fish. The majority of both occurred from April through October. Crappie harvest was highest in May and poor through the summer. Bass harvest was large throughout the summer months

LAKE	ACRES	NUMBERS	POUNDS	NUMBER PER ACRE	POUNDS PER ACRE	HOURS	HOURS PER ACRE	NUMBER PER HOUR	POUNDS PER HOUR
Beaver	42.9	3,301 ± 1,746	2,047 ±1,380	79 ± 39	49 ± 31	11,284 ± 2,170	263 ± 50	.59	.37
Burtschi	180.0	43,499 ±13,485	19,268 ±6,046	242 ± 82	107 ± 34	112,044 ±22,568	622 ±125	.40	.20
Dahlgren	26.4	2,430 ± 816	1,157 ± 410	92 ± 24	43 ± 12	16,302 ± 2,540	617 ± 96	.15	.07
Hall	36.2	8,628 ± 5,286	810 ± 320	238 ±146	22 ± 9	20,351 ± 5,779	562 ±159	.40	.04
Nanih Waiya	117.4	17,946 ± 3,883	6,919 ±1,400	149 ± 37	59 ± 13	34,827	296	.52	.20
Ozzie Cobb	69.4	10,726 ± 2,848	3,927 ± 868	154 ± 42	57 ± 13	19,954 ± 2,808	287 ± 40	.54	.20
Roman Nose	60.0	4,093 ± 1,659	1,862 ± 725	68 ± 28	31 ± 12	26,165 ±16,071	434 ±102	.39	.27
Schooler	28.5	2,441 ± 2,238	674 ± 543	86 ±112	24 ± 19	3,924 ± 1,435	138 ± 50	.60	.20
Vincent	169.0	17,424 ± 6,134	8,472 ±2,951	174 ± 62	85 ± 30	62,227 ±12,024	622 ±120	.28	.14
*Etling	161.5	6,948 ± 3,360	2,869 ±1,141	43 ± 21	18 ± 7	53,111	329	.13	.54
**Kingfisher	58.0	1,286 ± 1,321	475 ±1,111	22 ± 23	23 ± 19	10,635 ± 2,872	183 ± 49	.10	.10
***Schultz	56.8	4,641 ± 1,807	3,751 ±1,382	81 ± 32	66 ± 24	17,194 ± 5,530	302 ± 98	.27	.22

* 5 month survey
** 6 month survey
*** 8 month survey

Table I. Harvest and fisherman use at twelve department owned public lakes from December 1964 to December 1965 with 95% confidence intervals.

Lake	BASS			CRAPPIE			CATFISH			SUNFISH			TROUT		
	No.	Lbs.	Avg. Wt.	No.	Lbs.	Avg. Wt.	No.	Lbs.	Avg. Wt.	No.	Lbs.	Avg. Wt.	No.	Lbs.	Avg. Wt.
Beaver	318	278	.90	1374	636	.46	558	731	1.31	580	163	.28	--	--	--
Burtschi	3574	3627	1.00	6346	3229	.51	1238	2302	1.90	25052	5016	.20	--	--	--
Dahlgren	220	392	1.78	560	159	.28	860	492	.57	794	104	.13	--	--	--
Hall	801	1718	2.10	436	124	.30	448	654	1.50	1092	319	.30	--	---	--
Nanih Waiya	4576	2993	.65	5873	1606	.27	1237	1354	1.09	5056	849	.17	--	--	--
Ozzie Cobb	798	717	.90	3950	1036	.26	1856	1394	.75	3452	644	.19	--	--	--
Roman Nose	416	291	.70	66	26	.40	180	347	1.90	1400	214	.15	--	--	--
Schooler	50	104	2.10	83	33	.40	--	--	--	2130	480	.20	--	---	--
Vincent	2243	1691	.75	452	367	.80	4122	3882	.94	10978	1824	.17	--	--	--
*Etling	8	8	1.05	--	--	--	6374	2238	.35	70	9	.12	419	572	1.36
**Kingfisher	111	13	1.20	--	--	--	1146	1194	1.00	146	67	.50	--	--	--
***Schultz	2132	2163	1.00	--	--	--	2024	1592	.90	--	--	--	--	--	--

TABLE II. Sport fishing harvest by class of fish on twelve department owned fishing lakes.

LAKE	NUMBER OF PARTIES	AVERAGE PARTY SIZE	NUMBER OF FISHERMEN	AVERAGE TIME SPENT FISHING	RESIDENT PERCENT	NON-RESIDENT PERCENT	MALE PERCENT	FEMALE PERCENT
Beaver	1,722	2.4	4,070 ± 540	2.8	91.7	8.3	76.0	24.0
Burtschi	14,273	3.6	30,805 ± 2,585	2.2	95.9	4.1	74.2	25.8
Dahlgren	1,680	2.7	4,540 ± 302	3.6	97.4	2.6	69.3	30.7
Hall	2,745	2.1	5,734 ± 906	3.6	58.1	41.9	73.5	26.5
Nanih Waiya	4,596	2.6	11,933 ± 370	2.9	97.4	2.6	64.5	35.5
Ozzie Cobb	2,040	2.9	5,914 ± 766	3.4	87.7	10.3	65.3	34.7
Roman Nose	2,581	2.8	7,123 ± 515	3.7	95.4	4.6	64.9	35.1
Schooler	794	2.1	1,684 ± 472	2.3	100.0	0	69.8	30.2
Vincent	4,199	2.72	11,425 ± 1,121	5.4	40.0	60.0	65.0	35.0
*Etling	3,761	2.9	11,024 ± 1,387	4.8	86.3	13.7	66.1	33.9
**Kingfisher	2,268	1.7	3,925 ± 626	2.7	98.9	1.1	68.9	31.1
***Schultz	1,726	2.2	3,867 ± 486	4.5	78.6	21.4	74.5	25.5

* 5 month survey
** 6 month survey
*** 8 month survey

TABLE III. A summary of fishing party characteristics on twelve department owned lakes.

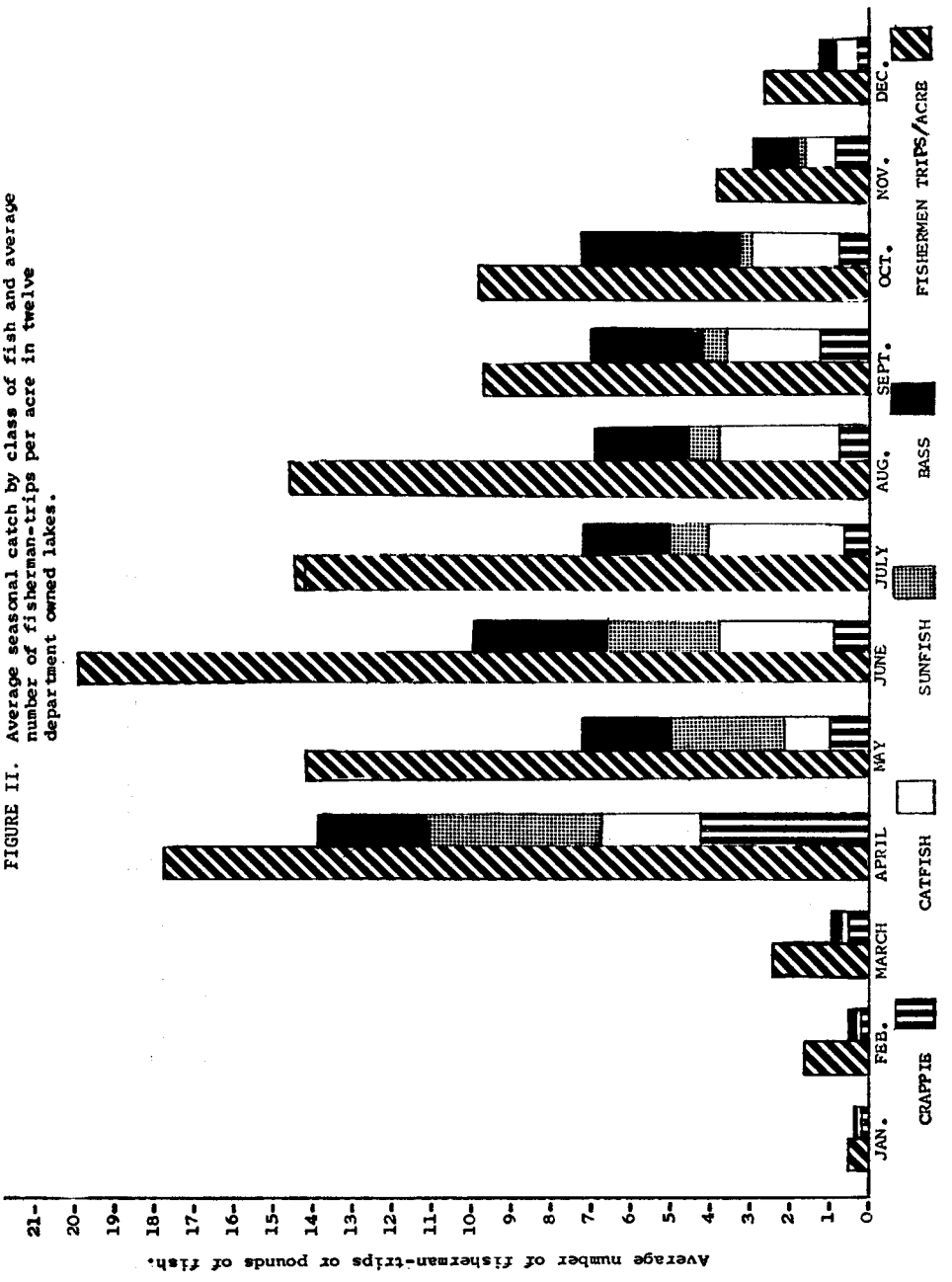

FIGURE II. Average seasonal catch by class of fish and average number of fisherman-trips per acre in twelve department owned lakes.

and small from December through March. Most catfish were harvested through the summer and early fall while sunfish harvest was heavy in the spring and early summer.

Recreational use, other than fishing, was quite heavy on Lake Burtschi (Table IV) with all other lakes having less than one-third as many recreationists. Percent of non-resident recreationists was somewhat

higher than for fishing possibly due to the cost of a non-resident fishing license. Also, the percent of female recreationists was higher than for fishing.

LAKE	TOTAL RECREATIONIST	PERCENT RESIDENT	PERCENT NON-RESIDENT	PERCENT MALES	PERCENT FEMALES
Beaver	3,849	79.6	20.4	62.6	37.4
Burtschi	59,197	88.2	11.8	49.8	50.2
Dahlgren	2,284	99.4	0.6	68.7	31.3
Nanih Waiya	1,036	93.3	6.7	54.2	45.8
Ozzie Cobb	3,203	87.9	12.1	53.8	46.2
Roman Nose	9.943	86.8	13.2	51.3	48.7
Schooler	8,602	80.4	19.6	51.8	48.2
Vincent	612	52.3	47.7	53.9	46.1
*Etling	5,184	56.5	43.5	53.5	46.5
**Kingfisher	2,286	90.6	9.4	55.4	44.6
***Schultz	3,684	57.2	42.8	51.5	48.5

* 5 month survey
** 6 month survey
*** 8 month survey

TABLE IV. Sociological characteristics of recreationists on twelve department owned lakes.

Major uses, other than fishing (Table V) were sightseeing, camping, and picnicking. Boating was well represented on most lakes even though outboard motors are limited to ten horsepower or less. Swimming is prohibited on all lakes but represented one-third of the recreational use

	HOURS	AVG. TIME AT LAKE	PERCENT SIGHT-SIGHT-SEEING	PERCENT CAMPING	PERCENT PICNICKING	PERCENT BOATING	PERCENT BIRD WATCHING	PERCENT HUNTING	PERCENT SWIMMING +	PERCENT OTHER ++
Beaver	5889	1.3	32.8	2.5	57.0	0.5	0.9	2.7	3.1	0.1
Burtschi	173580	1.2	15.3	37.5	27.8	0.1	--	2.8	--	16.6
Dahlgren	7896	3.5	17.2	70.3	6.5	0.6	0.8	4.2	0.4	--
Nanih Waiya	6773	6.5	6.7	13.5	23.7	7.8	--	0.2	5.5	42.7
Ozzie Cobb	26286	8.2	9.0	63.3	11.5	4.7	--	--	4.2	5.0
Roman Nose	53432	5.4	7.0	85.1	6.2	1.5	--	--	---	0.2
Schooler	71725	8.3	2.7	45.8	9.2	1.7	--	--	31.2	9.1
Vincent	278	.5	90.5	--	9.5	--	--	--	---	--
*Etling	36152	7.0	5.9	88.8	2.5	0.4	0.4	--	--	2.0
**Kingfisher	1220	.4	63.5	--	36.5	--	--	--	--	--
***Schultz	15775	.4	3.5	39.9	55.0	1.3	--	--	--	--

* 6 month survey
** 6 month survey
*** 8 month survey

\+ Not allowed.
\++ Frogging, photography, Commercial fishing, Baptismal services, Easter egg hunts and school picnicks.

TABLE V. A summary of recreational use by class of use.

on Schooler Lake and was represented in the data on four other lakes. Lake Nanih Waiya receives almost half of its recreational use other than fishing in unusual fashion. Large crowds attended several baptismal services during the year. Normal time spent at the lake for this was about one-half day. At the same lake, a community Easter egg hunt also enlarged the percentage of other uses.

Variation in surrounding facilities and lake location accounted for differences in percent of use among different lakes. Lakes Burtschi and Nanih Waiya have good picnicking facilities so this use was high on these lakes. Lakes Etling and Roman Nose have good camping facilities, therefore, camping hours were high. A large portion of the campers also fished while at the lake and the breakdown of hours between the two uses was not always accurate, particularly on Ozzie Cobb and Schooler. Two lakes (Vincent and Kingfisher) exhibited high percentages of sightseeing. Both of these lakes are located near western Oklahoma towns with virtually no other public water or natural attractions located in the area.

DISCUSSION

Oklahoma has virtually no creel data on small unmanaged lakes. Published data on fisherman harvest in Oklahoma waters are from lakes that range in size from 1,638 acres, Spavinaw Lake (Jackson, 1958) to 19,100 acres, Ft. Gibson (Houser and Heard, 1958) the sport fishing harvest in pounds per acre ranged from 9.5 at Spavinaw Lake to 46 at Ft. Gibson Reservoir. Only four state lakes exhibited a lower harvest per acre than Ft. Gibson Reservoir.

Data for small lakes (under 500 acres) in other southeastern states (Bureau of Sport Fisheries and Wildlife, 1963) can be compared to Oklahoma lakes. In Florida, the catch rate ranges from 1.0 to 9.0 fish per hour. In Kentucky, where eight lakes were sampled, the catch rate ranges from 0.4 to 4.4. Maryland and Texas sampled one lake apiece and report 0.09 and 1.9 fish per hour, respectively. Virginia sampled seven lakes with catch rates ranging from 0.3 to 0.9 fish per hour. Oklahoma's twelve state owned lakes ranged from 0.1 to 0.6 fish per hour.

Byrd (1959) reported creel survey results from twelve state owned lakes in Alabama. These lakes were managed for a bass-bluegill combination and were heavily fertilized. The average catch per acre was 591 fish weighing 174.2 pounds. The nine lakes in Oklahoma with a full year survey averaged 142 fish weighing 53.0 pounds per acre. Average weight of fish caught in Alabama is 0.29 pounds compared to Oklahoma's 0.37 average weight. This is probably due to the larger percentage of bass and fatfish harvested from Oklahoma waters. The harvest by number of sunfish in Alabama was 91.54% of the total compared to Oklahoma's 48.6 percent.

Seasonal fishing pressure in Alabama is quite similar to that found in Oklahoma. The state owned lakes in Alabama receive somewhat more fishing pressure than Oklahoma lakes during the peak fishing months of May, June, and July. Alabama also receives more pressure during the winter months of January, February and March probably due to the milder winters in that state.

Fisherman harvest in Oklahoma is greatly different than in Alabama. Sunfish species comprise the major portion of Alabama's harvest in both numbers and weights. In Oklahoma, the harvest of bass and catfish are each equal in weight to that of sunfish. Crappie constitute a larger portion of the fisherman's creel than reported from Alabama.

CONCLUSION

Oklahoma's state owned lakes are at this time relatively unmanaged. They have a more varied fishery, although the harvest is only approximately one-third as great as that of managed lakes in other states.

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TURBIDITY CONTROL AND FISH POPULATION RENOVATION ON BLUE MOUNTAIN LAKE, ARKANSAS*

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ABSTRACT

Blue Mountain Dam, a flood control project on the Petit Jean River in west central Arkansas, was completed in 1947 impounding a 2,900 acre reservoir.

The reservoir is relatively shallow, receives strong wind action and has a watershed to lake area ratio of over 100:1.

Since four to five years after impoundment, the lake has been plagued with heavy concentrations of colloidal turbidity and a fish population dominated by non-foragable sizes of buffalo, carp, drum and gizzard shad.

Combinations of fall-winter drawdowns, commercial fishing for non-game species, a selective shad kill and the planting of rye grass in the exposed lake bed produced beneficial results in reducing colloidal turbidity and improving the fish population. However, these results were shortlived.

A continuation of these efforts in a more intensive and drastic form was initiated in June, 1965. The lake was dewatered to expose 1,500 to 2,000 acres of lake bed. This area was seeded by airplane with approximately 10 tons of a mixture of Tracy sorghum, *Sorghum sorghum* var. *Tracy,* sweet sudan grass, *Sorghum sorghum* var. *sudanensis,* and a sorghum-sudan grass hybrid. Four months later, almost the entire lake bed was a dense growth of sorghum-type plants six to eight feet tall.

The drawn down lake remained open to both sport and commercial fishing throughout the summer.

In October of the same year, over 95% of the total fish population by weight was removed by treating the lake with 6,000 pounds of 7.6% powdered rotenone.

Restocking, primarily with yearling fish, in the winter of 1965-66, totaled over one and one-third million fish.

Since refilling, the lake has remained relatively clear (visibility 14 to 18 inches) except during high water, and the fish population shows

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