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A SURVEY OF THE COMMERCIAL FISHERY ON FOUR OKLAHOMA RESERVOIRS

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ABSTRACT

The commercial fishery on four Oklahoma lakes (Eufaula, Gibson, Grand and Texoma) from which approximately 85 percent of the total state commercial harvest is landed was studied from July 1967 through June 1968. Thirty to forty-eight fishermen fished gill and trammel nets throughout the study period. Legal restrictions limited gear to 3 inch and larger bar mesh. The amount of fishing effort expended by mesh size and lakes was studied. Approximately 70 percent of the total effort was fished with 3 and 3½ inch bar-mesh nets. On the lakes studied, approximately 50 percent of the effort was fished on Lake Texoma. Monthly and yearly percent catch composition was determined and the average lengths, weights and condition factors for the fish harvested were computed. The catch was primarily composed of buffalo, flathead catfish, and carp with average weights of individual fish landed being 5.3, 5.0, and 7.5 pounds, respectively. During some months in various lakes a noticeable portion of the catch was carpsucker, paddlefish and channel catfish. The latter species could not legally be harvested. The best estimate of the harvest during the sampling year was 1,360,650 pounds on the lakes studies and 1,625,637 pounds for the total Oklahoma fishery. The average catch per 24 hours for 100 feet of net fished was 4.4 pounds. Lakes in northern Oklahoma yielded approximately 3 pounds per acre and Lake Texoma in southern Oklahoma yielded approximately 9 pounds per acre which was six percent of the standing crop other than clupeids.

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2 Common names correspond to those in—,. A list of common and scientific names of fishes

INTRODUCTION

The commercial fishery in Oklahoma is a gill and trammel net fishery on large impoundments. Fishermen are required by state regulations to submit reports of their effort and catch. Previous studies by Houser (1957), Jones (1961), and Elkin (1959) were based primarily on fishermen reports, although Houser did conduct experimental netting during his study on Lake Texoma.

Information on the commercial fishery is necessary for sound planning of the management of Oklahoma reservoirs. To obtain such information, an intensive study of commercial fishing on four major reservoirs, which support approximately 85 percent of the state's commercial fishing, was conducted from July 1967 through June 1968. In this paper, estimates of the catch were made using sampling methods as well as fishermen reports.

Estimates made on a monthly basis of the total harvest, species composition of the catch, and average sizes of the fish caught are given. The amount of effort expended by fishermen and the type of gear used are presented.

DESCRIPTION OF THE FISHERY

Oklahoma's commercial fishery consisted in recent years of approximately 80 fishermen who fish singly or in pairs from small boats using gill and trammel nets. During legal fishing periods the nets are kept continuously in the water, except when removed for repairs or cleaning or are shifted to other areas. They are fished by raising them out of the water, removing the fish, and dropping the nets back into the water.

Nets must be 3-inch bar mesh or larger, must be located 4 feet below the water's surface and must be at least 100 yards from the bank. Nets must be removed each Friday and kept out until Monday from June 1 to September 7, so that no nets can be in the water through the weekend. This results in a 4 day fishing week in the summer. In addition, the spring season on some lakes has sometimes been closed to commercial fishing upon action by the Oklahoma Legislature. For example in 1965 all lakes except Texoma were closed to commercial fishing from March 21 through May 21. In the spring of 1968, Grand Lake was closed during April.

Oklahoma supports a buffalo [2] sps., flathead catfish, carp, freshwater drum, river carpsucker and gar sps. fishery. Buffalo and flathead catfish contribute most towards the fishermen's income with other species being of secondary importance. Although a large portion of the harvest is carp, this species contributes very little to the income of the fishermen.

Commercial fishermen in Oklahoma are required to purchase a yearly license which cost $50.00 in 1967 and 1968. On the application for the license the fisherman is required to state the specific lake or lakes that he desires to fish. In 1967 there were 82 fishermen fishing 13 lakes. In 1968 these figures were 82 and 8, respectively. Fifty percent of the fishermen fished on Lake Texoma. Lakes Grand, Eufaula, and Gibson accounted for 33 percent. These four lakes were the ones selected for this study because of the concentration of fishermen and logistical convenience. Characteristics of the lakes are presented in Table 1.

SAMPLING PROCEDURES

In order to estimate the catch on each of the lakes in this study, an appropriate sampling scheme was required. Monthly estimates appeared desirable in order to follow seasonal trends. All fishermen on the lists of commercial fishing license holders on each lake were contacted each month to determine those planning to fish the following month. Samples

2 Common names correspond to these in—,. A list of common and scientific names of fishes from the United States and Canada. Spec. Publ. No. 2. 1960, Am. Fish. Soc. Washington Bldg. Suite 1040, 15th and N. Y. Ave. N. W. Washington, D. C.

for each lake were selected from the list of fishermen fishing the following month by use of a random number table. the fishermen in the sample were then contacted and the sampler and fishermen decided which days would be convenient for them to go out together.

Occasionally a fisherman would say he would be fishing and not fish, or one would say that he would not fishing in a given month and would fish. Sometimes the fisherman and sampler would agree upon a sampling date but the fisherman, due to illness, personal reasons, or bad weather, would not show up. In this case the sampler tried to find another fisherman going out that day or returned without sampling. The sample schedules actually used (not the ones drawn) for the different lakes and months are shown in Table II.

In order to estimate the catch from the sample, it was necessary to obtain a measure or measures of the units of effort which could be used to expand the samples to the monthly totals. Two such measures were used.

One measure, referred to as a net night, was 100 feet of net fished for 24 hours. This measure reduced differences between fishermen with regard to length of net and the number of days fished to a standard measure. The second measure, a raise or fishermen raise referred to the total amount of a net a fisherman removes fish from during a fishing trip. The length of net and period the net was fished were therefore confounded with raises in this measure.

The estimates of yearly totals and variances were obtained by summing the monthly estimates separately for each lake. A total of four estimating procedures was utilized and a description of each procedure follows:

The first estimate was made by expanding the ratio of total estimated pounds caught to net nights fished by the fishermen sampled, by the total net nights fished by all fishermen on the strata. The form of the estimator followed Cochran (1963) and Raj (1968).

Estimate II used a ratio estimator expanding the estimated mean catch per net night by the number of net nights fished that month. Although fishermen catch differences were confounded in this estimate, this was probably the better of the two ratio estimates because it was based on the unit that was actually measured, i. e., fishermen raises.

The third estimate used was a simple expansion estimator as given by Cochran (1963). The estimated total catch for a month then was the average catch per raise computed from samples times the total number of raises in that month.

Although length of net and the hours the net was fished were not accounted for in this estimate, the estimate was valuable because the reported effort, i. e., fishermen raises, was a more reliable figure than the reported net nights.

Estimate IV was a questionnaire census based on the required fishermen catch reports. During the year the study was conducted, the samplers contacted the fishermen personally every month to gather this information. As a result of the constant contact, this estimate, based on fishermen reports, was believed to be accurate for the saleable species. However, the fishermen did not keep an accurate record of their game-fish because they released these after removing them from the net.

FISHING EFFORT

The total amount of fishing effort was determined by interviewing all fishermen each month and asking the amount of yards of each mesh size that they fished that month, the number of days the nets were in the water, and the number of times the nets were raised. Observations by fishery personnel corroborated the interview data.

The numbers of fishermen actively fishing on each lake by months are presented in Table III. Bad weather conditions caused a greater length

of time between lifts in the winter, and the possibility of spoilage made daily checks necessary in the summer. The average time between net lifts is given by months for Lake Texoma (the only lake with complete data) in Table IV.

Table V presents the statistics concerning fishing effort. Fishermen fished 9 million net nights on Lake Texoma. Lake Eufaula fishermen expended 5 million net nights, followed by those in Lake Grand who fished 2 million net nights. Most of the effort was expended in the fall and spring quarters.

Both gill and trammel nets were used in these fisheries but the proportion differed markedly from lake to lake (Table V.) Trammel nets were most frequently used on Lake Eufaula, which was also the lake with the most intensive flathead catfish fishery although there is not necessarily a correlation between the two. Most of the fishing was done with 3 to 3½-inch mesh nets. The greatest use of the larger mesh size occurred in the spring. On Lakes Grand and Gibson fishermen used larger mesh to catch paddlefish.

On Lake Eufaula the 4-inch mesh net was the most commonly used, and noticeable amounts of the 5-inch mesh were also fished.

ESTIMATED YEARLY HARVEST

Annual Estimates

Estimates of annual catch and standard deviation computed by the four different methods are given for each lake in Table VI. The percentage contribution of each lake to the total catch of all four lakes is given in Table VII.

Fishermen on Lake Texoma contributed the most to the catch, Lake Eufaula second, Lake Grand next, and Lake Gibson the least. These lakes contributed 83.7 percent of the total reported commercial catch of Oklahoma in the months of this survey.

If the questionnaire census is considered to be close to the parameter, then estimates I and II were overestimates in all lakes, and estimate III was close to the parameter but was a slight underestimate. However, no samples were taken on Lake Texoma during January and, according to the questionnaire census, 234,122 pounds were harvested during January on Lake Texoma. If this is added to estimate III, the total estimated harvest by the method becomes 1,360,650 pounds which was very close to the 1,246,458 pounds reported in the questionnaire census, although the corrected estimate III did slightly tend to be an overestimate. However, the overestimate may be explained by considering that 4.2 percent of the catch was released on site of capture so that a portion of these fish may not have been reported. The questionnaire census would then have been a slight underestimate and estimate III may have been the most accurate.

Annual harvest rates are given in Table VIII. Harvest rate or catch-per-unit effort was measured in two ways. First, the pounds caught per 100 feet of net per 24 hours fished were computed for the harvest taken on each sample and secondly the pounds caught per raise of the net on each sample were calculated.

The averages over all lakes given in Table VIII were obtained by weighting the average for each lake by the pounds harvested on that lake.

The annual percent compositions (Table IX) were obtained by estimating the pounds caught of each species by the simple expansion estimate based on average catch per raise (estimate III) and finding the percent of the total that each species contributed to the catch.

The data in Table IX shows that the fishermen on the northeastern lakes (Eufaula, Grand, and Gibson) depended upon flathead catfish much more than fishermen on Lake Texoma. A very large percentage of the Lake Texoma catch was buffalo, but carp, carpsucker, and gar did make up an important portion of the catch. Catch compositions on Lakes

Grand, and Ft. Gibson were similar with buffalo making of the largest portion, followed by carp, then flathead catfish, with paddlefish and channel catfish making a noticeable contribution. Lake Eufaula was unique in that a very large portion of the catch was flathead catfish. Lakes Eufaula and Gibson were similar in that channel catfish, a game species which had to be released, made up a significant percentage of the catch.

Commercial harvests in pounds caught per acre of lake are given in Table X. Lake Texoma which had 59 percent of the fishermen surveyed yielded more commercial harvest-per-acre than the other lakes studied. Lake Texoma is also possibly more productive because of a longer growing season due to its more southerly location. On the average, Oklahoma waters may be said to yield 5.4 pounds per acre, but consideration must be given to the location of the lake in question if the figures are to be used specifically. The eastern Oklahoma lakes yielded approximately 3 pounds per acre while Texoma yielded approximately 9 pounds per acre during the period of this study.

SEASONAL FLUCTUATIONS

Total Catch

The monthly distribution of the total catch as estimated by estimate III, the simple expansion estimate based on average catch per raise, for all lakes combined is shown in Table XI. The peak harvest period occurred during March through May, although February and June were also important months. There was a lesser peak from September through November. Harvest in mid-summer and mid-winter was very low. The spring fishing season, February through June, accounted for 68 percent of the catch and the fall season of September, October, and November accounted for 22 percent of the catch.

Catch Rates

Catch rates also varied drastically from month to month as shown in Table XII. Catch rates were highest in the spring, moderate in the fall, and low in the summer and winter. Catch rates on Lake Eufaula were very low throughout the year, but they did follow the same general trends as the other lakes. Catch per 24 hours per 100 feet of net ranged from 0.7 pounds during August on Lake Eufaula to 8.7 pounds during June on Lake Texoma. Harvest per raise ranged from 23.9 pounds on Lake Eufaula during July to 643.3 pounds on Grand Lake during March.

AVERAGE SIZE OF FISH CAUGHT

The average length in tenths of inches and weight in tenths of pounds of the various species were computed separately for each lake for each quarter to compare seasonal trends in sizes captured.

Mean length of buffalo captured ranged from 18 to 22 inches. The larger fish (20-22 inches in average lengths) were from Lake Texoma. Buffalo mean lengths were 19 inches on other lakes. The larger size flathead catfish (mean lengths 24-26 inches) were captured in lakes Texoma and Eufaula. The fish from Lakes Grand and Gibson had mean lengths of from 22 to 23 inches. The average sizes in the other lakes were 19 to 20 inches. Blue catfish in Lake Texoma ranged between 25 and 29 inches in average length with average weights from 6.8 to 14.9 pounds. Gar ranged from 28 to 42 inches and from 3 to 15 pounds in average size. Paddlefish averaged between 46 to 59 inches in length and from 14 to 29 pounds in weight. The overall average size was 56 inches and 26 pounds. White bass were smallest (13.2 inches and 0.8 pounds average) in Lake Texoma. The sizes on Lakes Grand and Gibson (15.0 and 15.6 inches and 2.2 and 2.1 pounds) were very similar. Average size of channel catfish was slightly greater in Lake Eufaula than in the other lakes (mean length 23.8 inches; mean weight 6.6 pounds.

DISCUSSION AND CONCLUSIONS

The freshwater commercial fishery in most other states in mid-America differs from that in Oklahoma in two ways. First is the wider range of gear and second is the extensive use of river fisheries in other states (Lyles, 1968). Renaker and Carter (1967) reported that in Kentucky such diverse gear as hoop, wing, trammel and gill nets, drag and bait lines, seines, cast nets, shad dippers and even rods and reels are used. Basket traps are utilized in the Illinois portion of Mississippi River (Starrett and Barnickol, 1955) and haul seines in the Iowa sections (Carlander, 1954).

Louisiana allows seines and hoop nets of 1 inch bar mesh to be used in the commercial fishery (Lambou, 1965). Both North Dakota (Hill, 1968) and South Dakota (Sullivan and Warnick, 1968) have hoop net fisheries. These differences in gear must be kept in mind when comparing Oklahoma's commercial fisheries with those in other states. Even where a gill and trammel net fishery is operating, comparisons are difficult because of the differences in mesh size.

Byrd (1956) reported that tidal streams in Alabama were fished with trammel nets with 1¼- and 1⅝-inch bar mesh. North Dakota (Hill, 1968) laws are even more restrictive than in Oklahoma as the minimum bar mesh size is 3¼ inches. Of the studies reviewed from the literature, only Lambou (1965) in a description of the Atchafalaya Basin fishery in Louisiana reported similar gear types and mesh size to that in Oklahoma.

The estimated total commercial harvest and standard deviation on the Oklahoma lakes studied (Texoma, Grand, Gibson, and Eufaula) from July 1967 to July 1968, was 1,360,659 ± 292,820 pounds by a simple expansion estimate (including the January questionnaire value for Lake Texoma) and 1,246,458 pounds by the questionnaire census. Of the total Oklahoma harvest 83.7 percent was taken from the lakes sampled as determined from the questionnaire census. After expanding on this basis, the total Oklahoma harvest for the project year was 1,625,638 pounds by the simple expansion estimate, and 1,489,197 pounds by the questionnaire census.

According to the commercial fishermen reports the commercial fisheries catch in Oklahoma has increased since 1958 although the number of fishermen has remained relatively constant. This situation could be due to increasing accuracy of the fishermen reports. It is probable that increasing personal contact with the fishermen over these years by the Wildlife Conservation Department biologists has resulted in greater accuracy in these reports.

Oklahoma ranks low in total harvest as compared to other states in the Mississippi River drainage fisheries. Lyles (1968) reported the 1966 Wisconsin catch as 12 million pounds, the Illinois and Arkansas catch as 5 million pounds each, and the Louisiana and Tennessee harvest each being 4 million pounds. The 1967-68 Oklahoma catch compared closely with the 1966 Texas catch of 1,376,000 pounds (Lyles, 1968).

The yield on the lakes in this study was 5.4 pounds per acre. This figure was weighted for reservoir size by the surface acreage. According to Elkin's (1959) data the per acre yield in 1957 for Lakes Gibson, Grand, and Texoma was 3.1 pounds. (Lake Eufaula was not completed at that time). Based on the catch figures given by Jones (1961) the per acre harvest in 1958 and 1959 was 1.4 and 2.7 pounds per acre for these lakes, respectively. The difference in yield between the past figures and the present may in part be due to better rapport with the fishermen resulting in improved accuracy of fishermen reports.

The Oklahoma figure of 5.4 pounds per acre was slightly below the average weighted mean from 46 reservoirs of 7.0 pounds per acre given by Jenkins (1967). It was far below the 21.7 pounds per surface acre reported by Bryan and White (1959) for T. V. A. lakes in Alabama.

Lambou (1965) reported 12.2 pounds per surface on the Atchafalaya Basin of Louisiana while 19.2 pounds per surface was reported harvested on the Mobile Delta (Spencer, Swingle, and Scott, 1966). The Oklahoma figure was, however, larger than the 1.4 pounds per acre reported for Oahe Reservoir in South Dakota (Sullivan and Warnick, 1968). Oklahoma waters are perhaps less productive than the southeastern reservoirs but more productive than those in more northern climes.

Average catch rates were 4.4 pounds per 24 hours per 100 feet of net and 193 pounds per fisherman trip on the lakes studies in Oklahoma. These catch rates are larger than the 61 pounds per fishermen trip reported for Oklahoma in 1957 by Elkin (1959) and the 56 pounds per fishermen trip reported for Oahe Reservoir in South Dakota (Sullivan and Warnick, 1968).

During the project year buffalo, flathead catfish, and carp accounted for the bulk of the commercial catch in Oklahoma. Elkin (1959) found that the same species dominate in 1957 in his study of commercial fishermen reports in Oklahoma. Houser (1957) and Jones (1961) also found that the major portion of the catch in Oklahoma was composed of buffalo, flathead catfish and carp. Unpublished commercial fishermen reports in the files of the Oklahoma Department of Wildlife Conservation for the years since 1959 support these conclusions. Apparently, the catch composition has remained relatively stable since 1952.

Lyles (1968) reported that other states of the Mississippi River fisheries have a similar commercial catch composition as regards to species. The Kentucky harvest is made up of catfish, gizzard shad, buffalo, and carp in order of importance (Renaker and Carter, 1967). Buffalo, carp, and catfish also support the Mississippi River fishery proper according to Barnickol and Starrett (1951). In South Dakota, Sullivan and Warnick (1968) found that buffalo, carp, and goldeye compose the bulk of the catch. In Louisiana most of the catch is composed of catfish, buffalo, and drum (Lambou, 1965). It is important to note that most of the states in the Mississippi drainage allow the commercial harvest of all catfish including flathead catfish while Oklahoma allows only flathead catfish to be harvested commercially. Tarzwell and Bryan (1944) reported that an extensive snagline paddlefish fishery existed on the lower Tennessee River, with 740,000 pounds harvested between November 1942 through September 1943. Bryan and White (1959) found paddlefish to make up approximately 5 percent of the catch in T. V. A. lakes and in North Dakota this species contributes as much as 10 percent of the catch on certain lakes (Hill, 1968). In Oklahoma paddlefish made up 5 percent of the total harvest and 42 percent of the Grand Lake harvest in February.

Only a small percent (3.95) of the total annual harvest on the four study lakes, as estimated by the simple expansion estimate, was gamefish. Of this 3.6 percent was channel catfish, 0.03 percent was blue catfish, and 0.3 percent was crappie spp. White and Jaco (1961) reported that 1.5 percent of the commercial catch on Guntersville Lake was gamefish and White (1956) found that 1.2 percent of commercial catch on T. V. A. lakes was gamefish. If channel catfish were a commercial species, as it is in other states such as Alabama, Kentucky, and Louisiana, only 0.34 percent of the harvest would have been gamefish so that the percent of the catch made up of gamefish compares closely with T. V. A. lakes. Although in Oklahoma white bass is a commercial fish, only 0.28 percent of the catch was made up of this species. If the value for white bass is combined with that for gamefish, excepting channel catfish, a figure of 0.6 percent results.

In general the average weights (Table XIII) of commercial species in Oklahoma are larger than those reported elsewhere. During the project year the average weight of buffalo on the Oklahoma lakes studied was 5.3 pounds while average weight of these fish on T. V. A. lakes has been reported to be 3.9 pounds (White, 1956), and in the

Mississippi River fisheries, 1.7 pounds (Barnickol and Starrett, 1951). Byrd (1956) however, reported that the average weight of buffalo in the fishery of tidal streams of Alabama was 8.9 pounds. The average weight of carp taken on the lakes studied was 5.0 pounds so that Oklahoma carp were larger than the 2.6 pounds fish caught in the Mississippi River fishery (Barnickol and Starrett, 1951) and the 4.5 pounds fish on the T. V. A. lakes in Alabama (White, 1956). Barnickol and Starrett (1951) reported that the average weight of flathead catfish in the Mississippi River fishery was 3.1 pounds, and White (1956) reported the average weight of catfish of all species taken in the T. V. A. lakes to be 3.8 pounds as compared to the average weight of flathead catfish caught in the lakes in the present study of 7.5 pounds. Paddlefish also followed this trend. The average weight of paddlefish harvested on the study lakes was 26.4 pounds as compared to the Mississippi River fishery where the average weight was 2.2 pounds (Barnickol and Starrett, 1951) and the T. V. A. lakes where the average weight was 10.0 pounds (White, 1956). Some of the difference may be due to gear and mesh size differences as the larger size gill and trammel nets would be expected to be selective for larger fish.

The size composition of the catch on Lake Texoma has evidently changed since 1953. Houser (1957) reported the average weight of buffalo, carp, and flathead catfish to be 9.8, 3.4, and 15.7 pounds respectively. The average weights of buffalo and flathead catfish, the two most important commercial species have decreased noticeably in the commercial fishery on Lake Texoma while the average weight of carp, which was worth less on the commercial market, has increased almost twofold. This may be a reflection of an increased harvest of buffalo and flathead. However, average weights of fish harvested in the Oklahoma fishery as a whole have not changed noticeably since 1957 as Elkin (1959) reported the average weight of buffalo, carp, paddlefish, and flathead to be 5.0, 4.6, 7.7, and 22.6 pounds, respectively.

There were 80 fishermen during the project year in the total Oklahoma fishery. Houser (1957) reported over 300 commercial fishing licenses sold in Oklahoma in the 1951-1952 fiscal year. Jones (1961) reported that there were 84 licensed fishermen in 1958 and 56 licensed commercial fishermen in 1959 so that the number of commercial fishermen in the state has not changed drastically between 1959 and 1967. The laws prior to 1959 were less restrictive so that a number of rivers were fished at that time. Of the 80 commercial fishermen in the Oklahoma fishery, approximately 6 to 12 of these were full time fishermen who depended upon the industry for their total incomes. Thus, in general, few people are employed in the Oklahoma fishery.

Bryan and White (1959) reported that on T. V. A. lakes in Alabama there were 372 licensed commercial fishermen. Seventy percent of these depended on commercial fishing for 50 to 100 percent of their income and 169 of these 372 depended entirely on the commercial fishing industry. Lambou (1953) reported that in the Atchafalaya Basin fishery in Louisiana, 602 persons were involved in the fishing operation, 349 of these were licensed commercial fishermen and 220 depended on commercial fishing as a main source of income. He found that 2,128 persons depended on that fishery as a source of income to a greater or lesser extent. Renaker and Carter (1967) reported that there were 3,015 licensed commercial fishermen in Kentucky in 1965, and Carlander (1954) reported 5,807 fishermen working the upper Mississippi River in 1949. The number of Oklahoma commercial fishermen was quite small when compared to the number of fishermen in other states fisheries in the Mississippi River drainage.

It is doubtful that the commercial harvest had a noticeable impact on the standing crop of fishes on the lakes studied. Jenkins (1967) reported that the standing crops of fisheries other than clupeids on Lake Grand, Gibson, and Texoma were 236, 124, and 145 pounds per acre respectively. The commercial harvest on those lakes, as found by

the simple expansion estimate, was 2, 3, and 9 pounds per acre, respectively, so that at most approximately 6 percent of the standing crop (excluding clupeids) was harvested commercially.

ACKNOWLEDGMENTS

The project was supported by a U. S. Bureau of Commercial Fisheries grant under Public Law 88-309 to the Oklahoma Department of Wildlife Conservation through Project 4-25-D Commercial Fisheries Statistics. Additional details can be found in the Final Report of that Project. Dr. R. C. Summerfelt contributed advice to this study.

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TABLE 1. Characteristics of Selected Oklahoma Reservoirs

Lake	Age in 1967	Surface acres	Miles shore line	Location	Vol. in acre ft.	Rivers dammed
Eufaula	2	102500	600	E. Central	2378000	Deepfork, Canadian, Little
Gibson	14	19100	225	N. E. Okla.	365000	Neosho
Grand	26	46400	1300	N. E. Okla.	1643000	Neosho
Texoma	23	93080	580	S. Central	3024900	Red, Washita

TABLE II. Number of Fishermen Raises Sampled

Month	Lake			
	Eufaula	Gibson	Grand	Texoma
January	2	4	4	0[1]
February	5	2	2	8
March	6	7	5	9
April	6	4	0[2]	12
May	4	6	5	16
June	5	1	5	10
July	5	4	5	12
August	6	3	6	12
September	7	5	8	14
October	7	9	9	8
November	6	4	7	6
December	4	3	5	8

TABLE III. Number of Active Commercial Fishermen by Lake and Months

Month	Year	Lake Texoma	Lake Grand	Lake Gibson	Lake Eufaula
July	1967	17	4	3	6
August	"	16	4	3	9
September	"	19	5	3	11
October	"	17	5	3	11
November	"	21	5	3	10
December	"	22	5	4	10
January	1968	22	4	3	10
February	"	27	4	4	10
March	"	30	4	4	10
April	"	29		3	10
May	"	28	3	4	13
June	"	24	4	4	12

[1] Illness of sampled resulted in lack of samples.
[2] Closed to fishing by law.

TABLE IV. Average Days Between Net Lifts for Lake Texoma

Month	Year	Average Days Between Lifts
July	1967	1.1
August	"	1.1
September	"	1.2
October	"	1.7
November	"	1.8
December	"	2.2
January	1968	2.2
February	"	2.1
March	"	2.1
April	"	1.5
May	"	1.4
June	"	1.2

TABLE V. Percent of Fishing Effort and Net Type

Lake	Mesh in Size in Inches 3	3.25	3.50	4.00	4.50	5.00	5.50	6.00	% Gill Net	% Trammel Nets	Total Effort[1]
Eufaula	24.6	11.5	25.5	27.3	6.1	4.3	0.3	..	57.2	42.7	5,222,484
Gibson	63.8	2.9	21.6	9.5	..	2.0	..	..	69.1	30.8	976,698
Grand	53.8	4.7	27.7	...	9.1	3.7	..	0.7	95.2	4.7	2,378,622
Texoma	24.4	9.0	50.0	4.1	2.0	9.5	..	0.5	98.7	1.2	9,129,300

[1] Expressed in 100 yards of net nights fished.

TABLE VI. Estimated Annual Catch in Pounds and Standard Deviations by the Four Different Estimation Methods

Lake	Methods I	II	III	IV
Eufaula	347,000± 80,426	336,397± 34,523	141,258± 58,446	173,484
Gibson	95,025± 8,566	86,689± 7,666	55,468± 5,158	64,003
Grand	216,253± 4,323	207,217± 16,870	94,895± 25,319	172,504
Texoma	1,687,418±375,602[1]	1,304,405±202,608[1]	834,915±203,906[1]	836,467
	2,345,696±468,917	1,934,698±261,667	1,126,536±292,829	1,246,458

[1] No estimate was made for January by methods I, II, and III for Lake Texoma. See text for explanation.

TABLE VII. Percent of Total Catch for Each Lake in the Survey as Estimated by Four Different Methods

Lake	Methods I	II	III	IV
Eufaula	14.8	17.4	12.5	13.9
Gibson	4.1	4.5	4.1	6.2
Grand	9.2	10.7	8.4	13.8
Texoma	71.9	67.4	74.1	66.1

TABLE VIII. Annual Harvest Rates

Lake	Average catch per raise	Average catch per 24 hrs. per 100 feet of net
Eufaula	96 lbs.	3.57 lbs.
Gibson	157 lbs.	2.14 lbs.
Grand	225 lbs.	3.14 lbs.
Texoma	208 lbs.	5.03 lbs.
Weighted average	193 lbs.	4.42 lbs.

TABLE IX. Percent Species Composition of the Catch

Species	Total	Texoma	Lake Grand	Eufaula	Gibson
Buffalo	55.9	65.3	36.8	24.9	38.3
Flathead catfish	10.4	2.4	13.3	51.0	13.9
Carp	15.8	17.9	15.9	3.6	16.1
Drum	1.4	0.8	5.8	0.9	2.5
Carpsucker	5.4	6.8	2.4	0.6	2.6
Gar	5.4	5.8	5.4	4.0	2.9
Paddlefish	1.4	. . .	12.6	. . .	4.1
White bass	0.3	0.2	1.1	0.1	0.7
Shad **	0.1	0.2	+0.0	+0.0	+0.0
Others **	0.1	. . .	0.3	. . .	0.2
Blue catfish *	0.1	0.1	. . .	. . .	. . .
Channel catfish *	3.6	0.3	5.7	14.6	18.1
Crappie *	0.3	0.3	0.5	0.1	0.5

+ = Less than 1.
* = classified as gamefish (illegal to sell).
** = not marketable.

TABLE X. Commercial Harvest in Pounds Caught per Acre of Lake

Lake	I	II	III	IV
Eufaula	7.21	6.99	2.93	3.61
Gibson	4.97	4.53	2.90	3.35
Grand	4.65	4.45	2.74	3.71
Texoma	18.12	14.01	8.96	8.99
Total	11.34	9.35	5.44	6.03

TABLE XI. Monthly Distribution of Commercial Harvest as Estimated by the Simple Expansion Estimate

Month and Year	Estimated harvest in pounds	Standard error	Percent of Total Estimated Harvest
July, 1967	25,036	9206	2.2
August, 1967	31,568	6398	2.8
September, 1967	93,508	18244	8.3
October, 1967	73,039	25783	6.5
November, 1967	81,060	23291	7.2
December, 1967	52,581	16049	4.7
January, 1968	11,203	3075	1.0
February, 1968	90,833	32220	8.1
March, 1968	167,385	40548	14.9
April, 1968	203,329	37005	18.9
May, 1968	212,562	52474	18.9
June, 1968	84,432	28536	7.5
Total	1,126,536	292829	100.1

TABLE XII. Monthly Catch Rates by Lakes

Month	Eufaula Catch raise	Eufaula Net night	Gibson Catch raise	Gibson Net night	Grand Catch raise	Grand Net night	Texoma Catch raise	Texoma Net night
July	23.9	1.1	144.7	3.1	145.6	4.2	84.0	2.7
August	38.5	0.7	115.9	3.5	179.7	3.7	66.1	2.1
September	57.8	0.8	146.3	2.5	190.1	3.5	170.8	5.0
October	202.9	2.6	145.6	2.5	142.1	3.1	98.4	4.0
November	119.5	2.1	90.1	1.9	111.6	1.9	208.6	6.3
December	55.1	1.2	174.6	1.4	152.4	2.0	157.8	2.8
January	42.6	1.2	76.4	2.1	204.5	1.0	...	...
February	122.0	2.2	160.0	3.6	137.8	4.8	238.3	2.5
March	116.1	2.1	245.1	1.9	643.3	3.2	447.2	7.0
April	165.9	2.8	222.0	4.3	....	..	333.9	6.9
May	115.1	5.1	179.3	6.6	461.9	7.7	284.7	7.3
June	82.2	3.5	210.0	4.2	108.2	4.1	192.3	8.7

TABLE XIII. Average Weights with 95 Percent Confidence Limits of Fish Caught in the Oklahoma Commercial Fishery

Species	Lake Grand	Lake Gibson	Lake Eufaula	Lake Texoma
Buffalo	4.3±0.1	3.9±0.1	4.0±0.4	7.0±0.2
Flathead catfish	6.7±0.8	6.6±0.5	8.3±0.4	9.2±1.1
Carp	4.3±0.2	3.8±0.2	2.8±0.6	6.7±0.2
Carpsucker	2.6±0.1	2.8±0.1	3.0±0.2	3.1±0.1
Paddlefish	.....	26.4±1.3	.....	.....

A GROWTH STUDY OF REDBREAST, Lepomis auritus (Gunther), AND BLUEGILL, Lepomis machrochirus (Rafinesque), POPULATIONS IN A THERMALLY INFLUENCED LAKE

By ROBERT STEPHEN O'REAR *

B.S., The University of Georgia, 1968

ABSTRACT

Bluegill and redbreast populations were sampled by electric shocking techniques from two normal areas and an area affected by the heated discharge of a power generation plant at Lake Sinclair, Georgia. Growth of the fish was derived by the Lea method from measurements of the distance between the last formed annulus to the edge of the scale. By comparison of the study areas, temperature was found not to be the controlling factor of bluegill and redbreast growth in the discharge area.

INTRODUCTION

The purpose of this study was to determine whether thermal increases caused by discharges from a power generation plant affects growth

* A thesis submitted to the graduate faculty of the University of Georgia in partial fulfillment of the requirements for the degree of Master of Science in Forestry, Athens, Georgia, 1970.