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## SUMMARY OF FISHERY MANAGEMENT ACTIVITIES ON LAKES EUCHA AND SPAVINAW, OKLAHOMA

1951-1964

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### ABSTRACT

The City of Tulsa, Oklahoma has long been a proponent of the multiple-use concept of its water resources; including approximately 5,000 surface acres of impounded water. These waters are: Lake Eucha (2,880 surface acres), also known as Upper Spavinaw, Delaware County, Oklahoma, Spavinaw Lake (1,637 surface acres), Mayes County, Oklahoma, and Lake Yahola (425 surface acres) Tulsa County, Oklahoma (Jackson, 1957).

The fishery management program on the Spavinaw Lakes was initiated by A. D. "Bob" Aldrich in 1949 and has been expanded and continuous for a period of sixteen years. Although progress may have appeared slow at times during this period, the trend has been toward improved fishing and an improved fishable fish population.

The rough fish removal program was initiated in 1949. 436,513

fish weighing 163,265 pounds have been removed from Spavinaw Lake during the past fourteen years (1951-1964). 59,670 fish weighing 47,904 pounds have been removed from Lake Eucha during the past twelve years (1953-1964).

Age and growth studies were initiated on the Spavinaw Lakes in 1952. Growth trends indicate improvement in the growth of the more desirable species over the management period.

Creel survey studies began in 1954 and trends indicate fishing has generally improved during the management period. 90,000 fishermen spent 331,350 hours harvesting 322,250 fish on Spavinaw Lake at an average annual harvest rate of 19.7 fish weighing 23.7 pounds per surface acre over the ten year period 1955-1964. 216,700 fishermen spent 1,075,600 hours harvesting 1,068,950 fish on Lake Eucha during the 10-year period 1955-1964 at an average annual harvest rate of 37.1 fish weighing 43.3 pounds per surface acre.

Other management practices employed on the two lakes include: tagging studies on largemouth bass, establishment of fish concentration stations, identifying prominent landmarks, coves and hollows with signs, providing maps for fishermen, the construction of loading ramps and bank fishing piers.

## INTRODUCTION

The City of Tulsa, Oklahoma has long been a proponent of the multiple-use concept on its municipal water reservoirs. Since 1924, when Spavinaw Lake was impounded, the City has allowed fishing on its reservoirs. Even though municipalities in Northeastern United States long held their water reservoirs inviolate (some relaxation during recent years), the sports-minded city fathers of Tulsa recognized fishing in its water reservoirs as another service to the well-being of its citizens.

The City of Tulsa owns and operates two water supply reservoirs in Northeastern Oklahoma, approximately seventy miles from its using source. The drainage and description of Lake Eucha, the upper lake (2,880 surface acres at spillway level; impounded in 1952), and Spavinaw Lake, the lower lake (1,637 surface acres at spillway level; impounded in 1924), have been described by Jackson, 1957. Both lakes are located on Spavinaw Creek, a tributary to Grand River in Northeastern Oklahoma.

A. D. "Bob" Aldrich, one of the nation's outstanding fish and game administrators and an early advocate of fishery management as a means of maintaining a continual, sustained sports fishery, initiated the fishery management concept on Tulsa municipal reservoirs in 1949. First emphasis was placed on a rough fish removal program. The original management program has been expanded to include water fluctuation, annual age and growth studies, creel surveys, brush shelter inductions and maintenance, tagging studies, installation of boat ramps and bank fishing piers, publishing maps and pamphlets, placing designation signs at prominent points around the lake, and sending a weekly fishing report to sixteen news media in a 150-mile radius of the lakes.

## MATERIALS AND METHODS

### *Fish Removal*

Rough fish removal is generally accepted as a fishery management tool. Experience has indicated control of rough fish must be substantial and persistent if it is to be effective, otherwise, recovery to their original abundance is apt to be rapid (Eschmeyer, 1936, 1955; Hulsey, 1958; Lambou and Stern, 1958; Rose and Moen, 1952; White and Jaco, 1961; and others). Although it is recognized the equipment now employed on the Spavinaw Lakes is less efficient than newer types being developed, a continual effort still applies pressures to the species not utilized by the average hook and line fisherman. The fish removal program is planned to be continual and expanded as newer types of equipment become available.

The rough fish removal program, initiated on Spavinaw Lake in 1949 with one 300-foot, 1½-inch and one 300-foot, 2-inch standard linen

gill nets, has been expanded and continuous for sixteen years. Equipment now in use in the fish removal program includes: 3,000 feet of standard, 1-1/2-inch No. 139 square mesh nylon gill netting, 3,600 feet of standard, 2-inch No. 139 square mesh nylon netting, 4,200 feet of standard, 3-inch No. 208 square mesh nylon gill netting and 1,800 feet of standard, 4-inch No. 208 square mesh nylon gill netting. All gill nets are hung on a 1/2-basis with both lead and cork lines and are approximately six feet in depth. One 300-foot, 3/4-inch square mesh nylon seine, 8 feet deep, and one 100-foot, 1-inch square mesh nylon seine, 8 feet deep, are utilized in the taking of shad and carp. One 363-foot experimental gill net 3/4-in to 2 1/2-inch square mesh (each section 17 2/7-yards of length and 6-feet in depth) is used in collection of fish for age and growth studies.

Daily catch record forms are maintained on all catches by species.

Data are recorded on:

- a. The lake fished
- b. The location of the set
- c. The net size and length of net used
- d. Water temperature
- e. Air temperature
- f. Date
- g. Direction of wind
- h. Wind velocity
- i. Depth of set
- j. Weather conditions at time net is raised
- k. Precipitation
- l. Number, species, weights (in pounds and tenths of pounds)
- m. The disposal of the fish. Records of disposal by species, numbers and weights.

These daily netting records are summerized at the end of each month and posted to the rough fish removal ledger.

Regular netting stations have been established on both lakes (Jackson, 1957) and standard procedures followed in setting and raising nets. The nets are set perpendicular to the bank in the evening, fished for approximately twelve hours and raised the following morning, during most of the netting season (January-May, October-December). When concentrating on "sucker" and carp runs, nets are in the water for twenty-four hours. One net is pulled the first thing in the morning and another set in its place.

One area in Spavinaw Lake, Tag Hollow, lends itself to removal of concentrations of gizzard shad during the winter months. A spring at the extreme end of the arm emits warmer water than lake water and, in the presence of an ice cover, large concentrations of gizzard shad gather near the spring. An area approximately three acres in extent lends itself to the use of the 300-foot, 3/4-inch square mesh seine. When shad concentrations are observed in this area (January and February), the seine is set behind the main concentration, blocking off and trapping the shad. As time permits, the seine is closed manually to a working area not to exceed 3/4 acre. The shad are then removed from this area with a regular 20-foot common sense seine. The shad are placed in No. 2 washtubs (regular samples being counted and weighed) and carried to waiting vehicles, usually pickup trucks. Sample counts indicate approximately 1,680 shad weighing 404 pounds fill a 55-gallon drum, the standard measure used in this area. The shad are sold to local bait dealers, who prepare them for catfish bait, and monies are placed in the fishing and hunting fund.

### *Creel Survey*

The creel survey was initiated on Lakes Spavinaw and Eucha in September, 1954 and has been continuous since that time. A permit system on the City's reservoirs allows for a continual check to be made on fisherman utilization. The creel survey is an estimate of the fisherman utilization and contains recognized inherent biases. The method of taking has been the same since its instigation, therefore the trends presented are considered valid for our purposes even though

the estimations may be exaggerated above or below the actual harvest. All information presented in the creel survey analysis is, therefore, a function of the number of fishermen utilizing the lakes.

A permit is required of every fisherman over 16 years of age utilizing the lake. Permits are of three types: Daily, monthly and annual. In determining the total numbers of fishermen trips from permit sales, one trip was assigned to the daily; eight trips assigned to the monthly and twenty trips assigned to the annual. These assignments were made on a cost basis of the monthly and annual permits and the number of trips a fisherman would have to make, to make it economical to purchase the permit of longest duration. The survey takers are the lake patrolmen who are on the lake every day, covering both lakes at least twice a day, and the methods are the same as reported by Jackson, 1957. The patrolmen contact every fifth group of fishermen, whether bank or boat, on their rounds of the lake. A creel survey form and "De-Lier" type spring scale and measure are standard equipment in the patrol boats. The creel survey form (Jackson, 1958) contains the standard information required in most creel surveys. The data are collected and analyzed on a monthly basis and are adjusted annually to coincide with expanded permit sales. Over the 10-year period the sample has been found to be approximately five percent of expanded permit sales on both lakes. Creel survey analysis is considered an important part of the fishery management program as a measure of the fisherman utilization and success on the two reservoirs. In this summary, the four months information taken in 1954 has been deleted for purposes of presentation.

#### *Age and Growth*

Annual age and growth studies were initiated in 1951 and have continued since then with the exception of the periods 1959-1962, when unqualified personnel were employed. Fish are collected during the period from December 15 to February 15, by use of an experimental gill net, and data taken from individual fish by standard methods used in Oklahoma (Jenkins, 1953). Age and growth determinations are made from these data by using the O intercept-direct proportion method (Weese, 1951; Jenkins, 1953; and others), standard practices in Oklahoma. The scales are analyzed on a standard scale projection machine at the Tulsa District Corps of Engineers, Tulsa, Oklahoma, and spines are analyzed at the Oklahoma Fishery Research Laboratory in Norman, Oklahoma. These data are compared with previous information to determine the annual condition of the fish and to provide another check on effect of management practices. Ecological changes are also noted to determine effect, if any, on fish growth.

#### *Fish Shelter Program*

Introduction of brush as fish concentration points was first practiced in Spavinaw Lake in 1950 when ten sites were established. In 1951, while Lake Eucha Dam was being constructed and clearing of the area taking place, sites were chosen on the lake floor where trees were to be left standing. Twenty-five sites were chosen at various elevations (12' - 35' below spillway level) around the lake to provide concentration points when the lake was impounded. Two trees at each site were marked and the clearing crew piled additional trees between the two marked trees. This material was secured to the ground by cables anchored across the "brush-piles."

The program has been expanded to thirty sites on Spavinaw Lake and forty-four sites on Lake Eucha. These sites are marked with barrels attached to cable and anchored by weights. The shelter sites are "recharged" on a staggered biennial schedule; Spavinaw Lake one year, Lake Eucha the next.

"Recharge" material consists of one or more cedar trees (6-14 inches butt diameter and up to 30 feet in length) which are cut, hauled to loading zones, placed on a barge and transported to the site. Sonar depth indicators (Fish-Lo-K-Tor) are used to locate the old site if

barrel is missing. The new material is placed adjacent to old material (as near as possible). Barrels, standard 55-gallon drums, are painted and stencilled with the word "shelter" to mark the sites. Rings are welded to each end of the barrel for fishermen to tie their boats. Barrels are replaced as the need arises. If the barrel is missing when the shelter station is recharged, the anchor weight (300 pounds of concrete) is attached to the cedar tree with appropriate length of cable; the other end being fastened to the barrel; all attachments secured with cable clamps. Three to six feet of slack is allowed for water fluctuation. Permanent records are kept on shelters and approximate location of shelter material in relation to barrel markers. This information is made available to the fishermen.

#### *Experimental Station*

The City maintains an experimental station of 14 ponds comprising approximately 6¼ acres of water contained in eleven ponds at Spavinaw, Oklahoma. These ponds range from ¼ acre to 1¼ acre in size. Largemouth bass are maintained in a "wild" state and fish in excess of 10 inches are harvested periodically, tagged and released in the two lakes. One hundred eighty-four largemouth bass, ten to twenty inches, total-length, were tagged and released in Spavinaw Lake in 1957 and two hundred eighty-four tagged and released in Lake Eucha. Standard, self-piercing jaw tags (National Band and Tag Company, No. 3) were attached to the upper jaw. Prizes were offered by local merchants for return of tags as an added incentive for getting tag-return information.

#### *Miscellaneous*

Four bank piers have been constructed by Lakes Division personnel on Lake Eucha and four on Spavinaw Lake near the permit office areas. Piles of brush are secured directly below these piers to affect fish concentrations.

Concrete loading ramps have been constructed on both lakes to facilitate the loading and unloading of boats.

Printed maps, available at each permit office, indicate shelter locations, ground configuration of lakes and points of interest as an added service to fishermen.

### RESULTS

#### *Fish Removal*

During thirteen years of rough fish removal (all methods combined) on Spavinaw Lake (Table 1), only 3.5 percent by number and 5.7 percent by weight have been game species. Many of these fish have either been returned to the lake, if in an uninjured condition, or utilized for age and growth data. During eleven years of rough fish removal (all methods combined) in Lake Eucha (Table 2), 9.6 percent by number and 8.4 percent by weight game fish have been captured. Many of the larger, uninjured game fish have been released and others were utilized for age and growth data. Rotenone samples in 1953 and 1957 contributed substantially to the number of game fish reflected in the total fish taken in both lakes.

An effort was made to arrive at a factor which would compensate for the variation, from year to year, of the amount of netting used in relation to the number of fish harvested. A factor of fish/net-foot was used, primarily to determine what months of the year would yield the highest catch per unit effort. Netting operations are now concentrated in these months. It was determined, for most rough fish species, the best netting months were February through April and October through December. This was convenient as netting operations cease during increased fisherman utilization.

Factors derived from netting data on Spavinaw Lake indicated the spotted sucker declined from the period 1951-1960 while concentrated effort was being applied. However, effort was reduced through the period 1959-1963 and an increase in catch per unit was indicated (Graph 1).

Table 1. 14-Year Summary of Fish Removal from Spavinaw Lake, Oklahoma, 1951-1964. (All Methods Included.)

Species	1951-1954		1955		1956		1957		1958		1959	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Gizzard Shad	6111	1939.2	840	267.3	3223	714.4	31208	4834.3	185	40.2	869	193.0
Carp	3163	8091.9	484	449.4	906	799.5	2169	4866.2	432	842.4	331	796.9
River Carpsucker	1	1.0					5	25.4	2	3.6		
White Sucker	2	2.3	2	3.2								
Hogsucker	18	16.7	3	5.6	5	4.9	127	86.2	14	17.1	21	33.3
Buffalo												
Spotted Sucker	10014	9997.4	3523	3119.8	1130	1119.6	1734	1452.4	652	587.1	2741	2738.5
River Redhorse												
Golden Redhorse	138	301.3	42	91.2	51	93.8	281	287.6	230	349.2	239	485.9
Black Bullhead					1	0.3	87	63.2	13	12.4		
Yellow Bullhead					1	0.5			13	5.5	20	15.3
Channel Catfish	711	684.9	97	154.0	204	388.5	148	298.7	172	389.6	311	552.4
Flathead Catfish	156	1024.2	2	4.3	10	88.2	31	206.4	24	308.5	23	174.0
White Bass	804	688.7	1239	1362.0	1534	1610.0	1945	1549.7	1081	936.5	1188	1039.8
Rock Bass												
Warmouth			1	0.2					19	3.8	7	2.4
Green Sunfish									4	1.4		
Bluegill			7	1.8					1611	209.9	536	67.5
Longear Sunfish												
Redear Sunfish			1	0.3					223	17.9	18	2.4
Smallmouth Bass	1	1.8										
Spotted Bass	4	3.9	16	12.2	45	28.4	42	17.9	50	26.5	20	16.6
Largemouth Bass	86	72.1	34	44.9	100	38.6	208	165.8	54	39.0	79	85.6
White Crappie	970	473.6	317	179.0	949	441.0	1062	436.3	1792	449.2	921	389.8
Black Crappie	2	1.1	4	3.2	28	8.2	887	66.1	288	84.5	94	36.9
Drum	2250	1429.0	185	76.6	316	140.8	4044	847.2	126	60.8	238	128.3
Misc. Sunfish	306	60.1	93	24.0	1116	129.4	2381	339.7	299	37.1	59	8.5
Other	1	8.1	1	0.7	235	1.0	370	9.0				
Total	24738	24797.3	6891	5799.7	9854	5607.1	46732	15602.1	7284	4422.2	7755	6767.1

Table 1. Continued. 14-Year Summary of Fish Removal from Spavinaw Lake, Oklahoma, 1951-1964. (All Methods Included.)

Species	1960		1961		1962		1963		1964		Total	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.		
Gizzard Shad	120	38.9	280	105.9	25140	6096.0	226218	55427.9	60094	15179.6	354288	84886.7
Carp	104	477.5	166	673.0	306	1221.0	109	240.9	85	253.2	8255	18711.9
River Carpsucker					1	3.0			1	3.4	10	36.4
White Sucker			1	2.1					2	2.4	4	5.5
Hogsucker											191	168.3
Buffalo												
Spotted Sucker	518	510.5	1581	1701.7	1911	2113.9	522	603.6	1629	1579.0	25958	25523.5
River Redhorse												
Golden Redhorse	37	75.9	102	168.5	116	217.1	39	63.4	332	313.9	1657	2447.8
Black Bullhead			3	1.7					2	2.0	101	75.9
Yellow Bullhead	55	78.5	250	305.4	579	777.5	84	120.6	160	238.3	2771	3988.4
Channel Catfish	9	33.5	31	130.1	10	48.8	1	1.5	3	14.5	300	2034.0
Flathead Catfish												
White Bass	286	341.3	1218	1408.2	2152	2534.9	789	811.4	3744	3969.0	15980	16251.5
Rock Bass												
Warmouth											27	6.4
Green Sunfish									2	0.4	6	1.8
Bluegill	129	26.0					45	2.8	54	13.6	2382	321.6
Longear Sunfish							3	0.3			3	0.3
Redear Sunfish											242	20.6
Smallmouth Bass									1	1.0	2	2.8
Spotted Bass	4	3.9	1	0.8			9	5.2	2	2.0	193	117.4
Largemouth Bass	7	12.3	13	12.1	22	39.4	2	0.2	18	25.3	623	535.3
White Crappie	315	123.7	806	465.3	656	400.1	199	127.8	265	109.4	8252	3595.2
Black Crappie	16	6.3	25	12.8	22	14.3	2	1.1	10	7.9	1378	242.4
Drum	64	35.8	402	201.0	611	373.9						
Misc. Sunfish			189	51.2	47	14.9	74	28.0			4564	692.9
Other											607	18.8
Total	1664	1764.1	5068	5239.8	31573	13854.8	228425	57620.4	66529	21790.1	436518	163264.7

Graph 1 GRAPHIC ANALYSIS OF REDUCTION OF SPOTTED SUCKER POPULATION IN SPAVINAW LAKE FROM 1952 - 63 AND SUBSEQUENT EXPANSION OF POPULATION WHEN PROGRAM RELAXED — (BASED ON FACTOR OF FISH CAPTURED PER UNIT EFFORT OF NET FOOT USED)

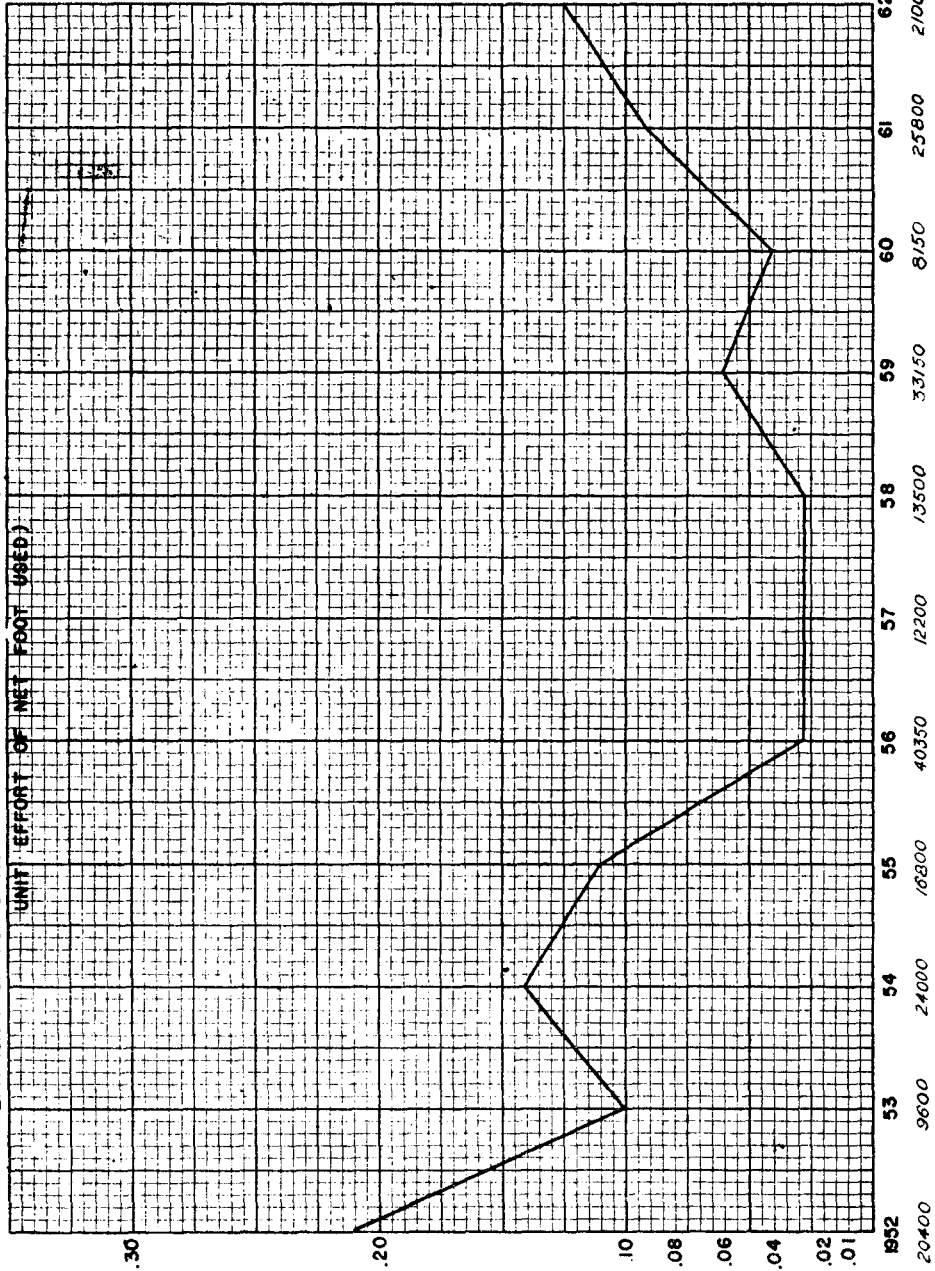


Table 2 is a summary of fish removal (by all methods) from Lake Eucha from 1953 through 1964. A total of 59,670 fish weighing 47,903.8 pounds was harvested. Effort was reduced through the periods of 1959-1963 because of inexperienced personnel. Shad, carp and spotted sucker constituted the bulk of the harvest as more effort was directed toward these species.



Table 2. 12-Year Summary of Fish Removal From Lake Eucha, Oklahoma, 1953-1964 (All Methods Included)

Species	1953-1954		1955		1956		1957		1958		1959	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Gizzard Shad	1441	496.7	5603	1714.5	839	263.1	175	78.4	196	66.3	175	68.3
Carp	42	95.1	127	571.6	856	2999.0	1521	3367.3	695	1629.9	314	894.0
River Carpsucker					3	3.0	1	2.0	7	25.5	1	4.1
White Sucker	8	13.8	12	24.3	45	114.0	15	26.8	18	27.5	22	38.1
Hogsucker			10	11.0	94	142.4	11	17.6	6	8.0	18	30.5
Buffalo												
Spotted Sucker	90	94.8	79	113.6	869	1024.0	2032	2247.6	915	1251.3	1501	1899.8
River Redhorse	70	103.8	320	626.3	562	1248.4	244	422.1	491	920.0	431	888.9
Golden Redhorse												
Black Bullhead	1620	868.8	524	301.2	1725	1022.0	1959	1413.4	1019	1151.3	599	749.1
Yellow Bullhead	2	1.0	44	1.8					4	3.1	5	4.4
Channel Catfish	5	20.2	5	8.4	37	85.6	37	54.4	31	51.6	35	32.8
Flathead Catfish	1	9.0	1	0.3	6	18.1	9	10.9	5	15.4	7	15.5
White Bass												
Rock Bass									2	0.5		
Warmouth			215	3.9					48	8.5	29	8.3
Green Sunfish			1702	51.3					12	2.7	8	2.2
Bluegill			4392	135.3					937	124.8	905	115.3
Longear Sunfish												
Redear Sunfish	67	20.4	79	26.9	2	2.7			4	0.8	3	0.6
Smallmouth Bass	1	1.0	1	0.8	1	0.5			7	2.5	4	4.6
Spotted Bass												
Largemouth Bass	101	58.4	1122	112.0	110	158.9	54	137.1	103	127.9	134	168.1
White Crappie	69	15.9	55	16.6	450	139.9	290	164.1	324	219.6	293	167.5
Black Crappie	86	18.4	116	54.3	169	97.6	116	55.2	120	62.6	117	46.4
Drum												
Misc. Sunfish	1045	44.6	2140	69.4	331	68.5	349	89.4	12	1.0	80	6.4
Other												
Total	4761	1864.3	16687	3844.4	6129	7392.6	6815	8093.2	4957	5702.1	4681	5124.9

Table 2 Continued. 12-Year Summary of Fish Removal From Lake Eucha, Oklahoma, 1953-1964 (All Methods Included)

Species	1960		1961		1962		1963		1964		12-Year Totals	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Gizzard Shad	97	37.2	3	1.5	46	21.3	3808	502.7	874	233.3	13257	3483.3
Carp	141	427.1	36	153.2	30	93.9	178	199.5	1113	5879.9	5053	16300.5
River Carpsucker											12	34.6
White Sucker	6	8.7	1	2.5			2	3.9	1	1.1	128	256.8
Hogsucker	2	2.5							3	3.3	146	219.2
Buffalo												
Spotted Sucker	672	726.2	37	42.5	514	653.3	1041	1152.5	1010	951.3	8760	10146.9
River Redhorse	34	68.2	12	22.0	39	61.8	216	346.0	227	356.1	2646	5063.6
Golden Redhorse									9	7.6	9	7.6
Black Bullhead	12	14.0					1	0.5			7486	5520.3
Yellow Bullhead	12	12.4			2	1.5	1	1.8			70	26.0
Channel Catfish	66	117.5			28	58.8	32	53.3	87	256.6	363	739.2
Flathead Catfish	18	58.1			2	8.8	2	4.1	34	228.6	85	368.8
White Bass	1	1.5	1	0.5	19	11.5	425	447.0	981	1027.7	*1427	1488.2
Rock Bass											2	0.5
Warmouth							147	16.4	1	0.4	440	37.5
Green Sunfish							423	39.7	3	1.0	2148	96.9
Bluegill							175	10.7	262	51.7	6671	437.8
Longear Sunfish							780	41.7	1	T	781	41.7
Redear Sunfish									7	4.6	14	6.0
Smallmouth Bass	4	4.7							2	2.0	165	63.8
Spotted Bass									1	0.9	4	3.2
Largemouth Bass	4	5.8			3	8.8	35	31.0	147	627.0	1813	1435.0
White Crappie	179	91.3	9	5.9	80	43.3	358	207.9	442	312.6	2549	1384.6
Black Crappie	53	21.6	1	0.9	10	7.1	4	3.0	20	13.7	812	380.8
Drum												
Misc. Sunfish	52	15.9	1	0.3	36	11.0	524	38.1			4570	344.6
Other											259	16.4
Total	1353	1612.7	101	229.3	809	981.1	8152	3099.8	5225	9959.4	59670	47903.8

\* White bass introduced in 1960.

436,513 fish weighing 163,264 pounds were removed from Spavinaw Lake from 1951 through 1964 (Table 1). Gizzard shad harvest has increased from 1962 as a result of the shad removal program. 25,000 shad weighing 6,100 pounds were removed in 1962 using gill nets and a 100-foot, 1-inch nylon seine. A 300-foot,  $\frac{3}{4}$ -inch mesh nylon seine was first employed in 1963 when two concentrations of shad were observed and harvested. 226,000 shad weighing 55,400 pounds were harvested during these two operations. Only one operation was conducted in 1964 and yielded a harvest of 60,000 shad weighing 15,000 pounds. In the first operation (with gill nets and 100-foot seine), crappie and white bass were mixed in the shad and complicated the operation. Considerable numbers of white bass were encountered in 1963, but only 500 were found mixed with the shad in 1964.

### *Age and Growth*

Age and growth information on the two lakes has been compiled annually from 1951-1963, except for the period 1959-1962 when studies were not conducted because of unqualified personnel.

The experimental gill net was employed for collecting most samples. Growth rates have generally declined in Lake Eucha since impoundment, but are still above average when compared to state averages (Houser and Bross, 1963). (Tables 3 and 4.)

Calculated growths from annual collections are illustrated for seventeen species from Lake Eucha and sixteen species from Spavinaw Lake (Tables 4 and 5).

Table 5 is a summary of growth rates in Spavinaw Lake. Growth patterns in the lower lake have generally shown some improvement since management practices have been in operation (Table 5).

Table 6 is a comparison of eleven of the more important species of fish from the two Spavinaw Lakes. Growth rates in the upper lake generally exceed the growth rates of the lower lake. This is assumed to be the influence of "new lake" conditions still existing in the upper lake due to periodic late summer and fall draw downs.

Table 3 is a comparison of the average growth rates of four primary sport species from the two Spavinaw Lakes with the fastest, slowest and average growth rates of these species on a statewide basis (Houser & Bross, 1963). In each case, the four species from the Spavinaw Lakes compared, exceeded the state's average growth rates. The fishes from Spavinaw Lakes became an average size acceptable to the fishermen by the end of the second year of life.

### *Creel Survey*

Creel survey analysis has been used as a measure of utilization on Spavinaw Lake since 1954. Graphs 2 and 3 depict the average monthly trends of fishing on the two reservoirs. Crappie (black and white combined) are the most important sport-fish in both lakes. Largemouth bass (and spotted) represents a higher percentage of the harvest in the upper lake.

The trends presented from annual harvest estimates (Graphs 4 and 5) indicate a general increase in utilization on both lakes. Harvest estimates of the various species of fish have fluctuated from year to year but have reflected a general improvement over the 10-year period.

An estimated 216,702 fishermen have harvested an estimated 1,068,943 fish from Lake Eucha during 1,075,608 hours of fishing during the ten-year period. The average fisherman day (trip) was determined to be 7.3 hours.

Crappie have remained the dominant species since 1956, reflecting 62.6 percent of the estimated total catch. Largemouth bass were the second most important species, reflecting 24.2 percent of the total catch. Miscellaneous sunfish comprised 5.2 percent of the total harvest and channel catfish 2.4 percent. White bass, although present in Lake Eucha since 1961, reflected 3.2 percent of the total estimated harvest. (Table 11.)

Peak harvest of largemouth bass in Lake Eucha is reached during June (Graph 4). The high yield of largemouth bass after the spawning

Table 3. Comparison of State Averages (Highest, Lowest and Average) with Principal Game Fishes from Lake Eucha and Spavinaw Lake.

	1	2	3	4	5	6	7	8	9
Calculated average total length (in inches) at end of year of life									
Largemouth Bass									
State Fastest Rate of Growth	11.2	15.4	20.1	21.8	22.8	21.9	22.8	23.8	23.5
State Slowest Rate of Growth	2.5	4.9	6.7	10.4	12.9	14.0	16.0	16.7	20.9
State Average Rate of Growth	5.5	9.7	12.5	14.9	17.1	18.6	19.9	20.9	22.6
Lake Eucha	6.4	11.9	15.2	16.7	18.9	20.0	21.5	22.6	
Spavinaw Lake	6.1	11.6	14.0	16.4	19.5	20.8	21.4	22.1	22.6
White Crappie									
State Fastest Rate of Growth	10.1	12.9	14.2	13.9	15.2	15.8	16.0		
State Slowest Rate of Growth	1.2	2.7	4.0	5.2	6.5	8.7	12.6		
State Average Rate of Growth	2.9	5.9	7.8	9.8	11.9	13.2	14.3		
Lake Eucha	5.0	9.8	12.1	13.3	14.2				
Spavinaw Lake	4.7	8.9	11.9	13.4	14.4	15.4	16.2*		
Black Crappie									
State Fastest Rate of Growth	8.5	11.9	13.2	14.8	15.7	16.2			
State Slowest Rate of Growth	1.5	3.8	5.9	7.1	8.3	12.1			
State Average Rate of Growth	3.1	6.3	8.2	9.9	11.6	13.5			
Lake Eucha	3.4	8.7	11.7	15.2	16.0				
Spavinaw Lake	3.7	8.4	11.7	13.2	14.8	16.2*			
White Bass									
State Fastest Rate of Growth	12.0	15.3	17.0	18.2	18.9	18.3			
State Slowest Rate of Growth	3.8	6.6	10.4	11.7	15.7	17.2			
State Average Rate of Growth	7.5	12.2	14.4	16.1	17.1	17.8			
Lake Eucha	8.8	14.1	16.3	18.2					
Spavinaw Lake	8.2	12.8	12.8	16.5	18.1	20.5			

\* Denotes growth equal to or exceeding state's fastest average growth recorded.

Table 4. LAKE EUCHA  
 Comparison of Age and Growth (weighted average of total collection to date) of 17 Species of Fishes from 1957 to 1964, Incl.

Species	No. of Fish in Sample	No. of Year		Ave. Calculated Total Length (Inches) at End of Year of Life	1	2	3	4	5	6	7	8	9	10
		Classes Represented	Year of Collection Represented											
Gizzard Shad	714	11	1964	5.5	9.0	10.6	12.0	13.1						
	77	5	1957	4.6	10.4	11.2	13.7							
Carp	104	9	1964	11.2	16.7	19.3	21.1	22.6	25.5	27.4				
	19	4	1957	12.6	17.9	23.1	24.3							
Hogsucker	8	2	1964	4.3	8.7	12.8	14.8							
	—	—	1957											
Spotted Sucker	591	11	1964	5.8	10.9	13.3	14.8	16.1						
	119	6	1957	7.1	10.4	15.7	17.1							
Golden Redhorse	89	7	1964	5.7	11.9	15.4	17.1	19.3						
Black Redhorse	71	5	1964	5.0	11.2	14.9	16.4	17.8						
	38	7	1957	4.2	11.9	15.4	17.5	21.2						
White Sucker	16	5	1964	5.5	12.2	15.4	16.9							
	3	1	1957	6.0	13.2	15.8								
River Carpsucker*	7	2	1964	4.5	11.6	16.1								
	3	1	1957	3.5	12.1	15.1								
Black Bullhead**	—	—	—											
Flathead Catfish	164	5	1957	7.0	10.0	12.4								
	10	5	1964	5.7	10.2	15.5								
	6	2	1957	8.4	14.1									

\* River Carpsucker — only 12 specimens collected in 12 years.

\*\* Black Bullhead — none collected since 1957.

Table 4 Continued. LAKE EUCHA  
 Comparison of Age and Growth (weighted average of total collection to date) of 17 Species of Fishes from 1957 to 1964, Incl.

Species	No. of Fish in Sample	No. of Year Classes Represented	Year of Collection Represented	One Calculated Total Length (Inches) at End of Year of Life														
				1	2	3	4	5	6	7	8	9	10					
Channel Catfish	88	11	1964	5.4	10.8	14.4	17.1	18.8	20.9									
	30	7	1957	6.2	11.6	15.5	18.0	18.7	20.7									
White Bass*	390	4	1964	8.5	14.0	15.8	18.3											
	—	—	1957															
Largemouth Bass	272	13	1964	6.5	12.0	15.2	17.5	19.2	20.5	21.9	23.0	24.1						
	185	6	1957	6.4	11.5	15.1	17.9	20.9	21.6	22.3								
Smallmouth Bass	12	7	1964	4.1	9.1	12.0	14.8											
	5	3	1957	3.6	8.3	11.8	14.4											
White Crappie	760	11	1964	4.8	9.4	11.9	13.2	14.2	15.8									
	129	5	1957	4.4	9.9	12.5												
Black Crappie	118	8	1964	3.1	8.7	11.6	14.1	16.0										
	72	6	1957	3.6	8.8	11.6	15.2	16.0										
Bluegill	1186	11	1964	2.2	4.0	5.5	6.7	7.5										
	23	5	1957	2.6	5.0	6.6	7.3											

\* White Bass — Introduced in 1960-1961.

Table 5. SPAVINAW LAKE  
 Comparison of Age and Growth (weighted average of total collection to date) of 16 Species of Fishes from 1957 to 1964 Incl.

Species	No. of Fish in Sample	No. of Year Classes Represented	Year of Collection Represented	Ave. Calculated Total Length (Inches) at End of Year of Life														
				1	2	3	4	5	6	7	8	9	10					
Gizzard Shad	999	10	1964	5.6	8.4	9.8	11.5	12.5										
	90	7	1957	5.2	7.9	9.3	11.1	12.3										
Carp	70	12	1964	9.2	13.7	15.9	17.9	19.8	21.3	22.9	26.4							
	49	5	1957	9.5	14.1	16.0	18.0	19.4										
Hogsucker	15	4	1964	4.6	10.7	13.8	14.0											
	12	2	1957	4.9	11.1	13.9												
Spotted Sucker	571	12	1964	5.9	10.7	12.9	13.8	14.7										
	91	6	1957	5.6	10.6	12.7	13.9	14.6										
Golden Redhorse	138	9	1964	4.8	11.6	13.9	16.5	21.9										
	24	6	1957	4.7	12.1	15.9	18.3	19.8										
River Carpsucker	2	2	1964	3.3	12.6	16.3	17.7											
	1	1	1957	3.3	12.4	16.4	18.3											
Flathead Cat.	18	12	1964	5.3	8.9	11.9	15.9	19.3										
	11	6	1957	4.9	8.3	11.7	15.3	19.3										
Channel Cat.	195	16	1964	5.0	9.9	12.6	15.3	17.8	20.1	22.0	25.5	27.3						
	111	11	1957	5.1	9.4	12.8	15.3	17.7	20.4	23.0	25.7	27.3						
White Bass	1587	12	1964	8.1	12.8	14.8	16.4	17.8	19.8									
	510	7	1957	8.6	10.4	12.9	14.2	16.7										

Table 5 Continued. SPAVINAW LAKE  
 Comparison of Age and Growth (weighted average of total collection to date) of 16 Species of Fishes from 1957 to 1964 Incl.

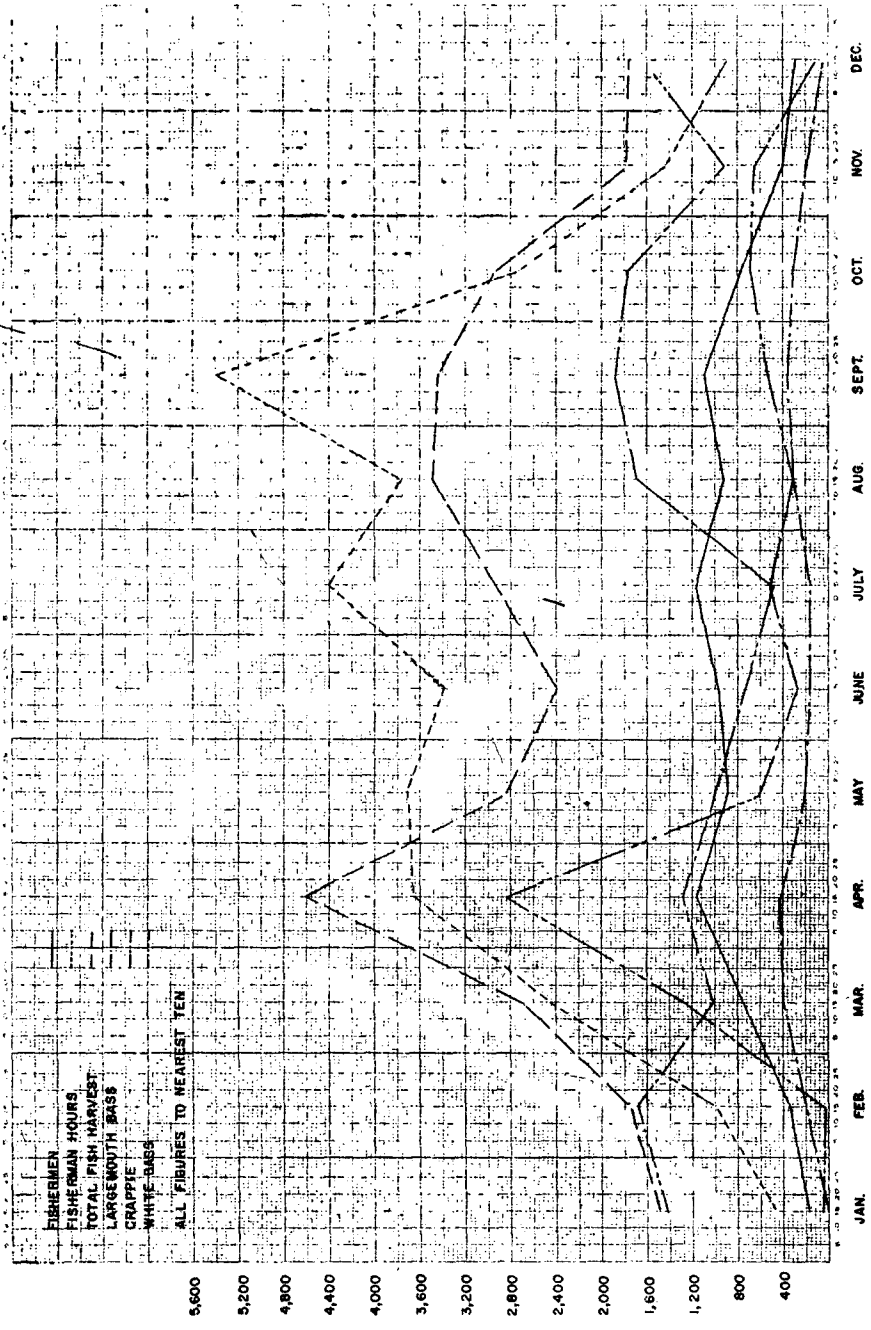
Species	No. of Fish in Sample	No. of Year Classes Represented	Year of Collection Represented	Ave. Calculated Total Length (Inches) at End of Year of Life									
				1	2	3	4	5	6	7	8	9	10
Largemouth Bass	52	9	1964	5.8	11.3	13.9	16.7	19.0	20.9	21.6	22.1	22.6	
	42	9	1957	6.1	10.4	14.2	17.2	19.2	20.3	21.3	22.2	22.8	
Spotted Bass	64	9	1964	5.1	9.6	12.0	13.9						
	50	6	1957	4.9	9.1	11.6	13.9						
White Crappie	1646	12	1964	5.1	9.0	11.9	13.3	14.3	15.2	16.2			
	645	8	1957	4.7	7.6	9.7	11.6	13.5	14.3				
Black Crappie	70	9	1964	3.6	8.4	11.6	13.2	14.8	16.2				
	61	6	1957	3.7	7.9	10.8	12.9						
Redear Sunfish	16	4	1964	2.8	5.4	7.1	7.8	8.8					
	7	3	1957	2.7	5.2	7.1	7.8	9.1					
Bluegill	130	10	1964	2.7	4.8	6.2	6.9	7.7					
	58	7	1957	2.7	4.8	6.1	6.9	7.3					
Drum	104	10	1964	5.3	8.9	10.8	12.2	13.8					
	32	7	1957	5.1	8.7	10.8	12.3	14.8					



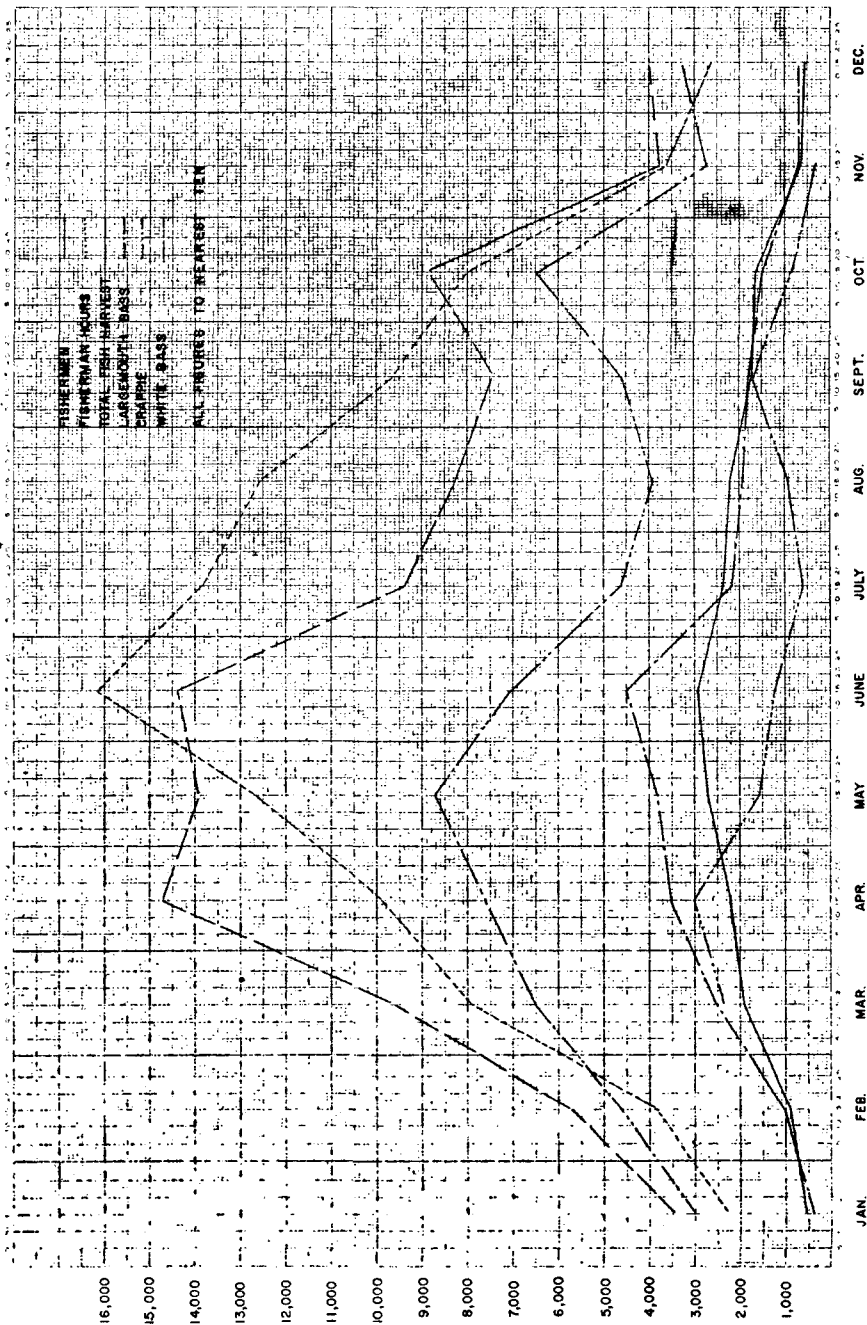
Table 6. Comparison of Age and Growth Analysis of Eleven Species of Fish from Lake Eucha and Spavinaw Lake.

Species	Average Wt. Largest Fish		No. of Fish in Sample	Average Length of Largest Fish														
	Upper	Lower		1	2	3	4	5	6	7	8	9						
Gizzard Shad	10.0 oz.		674	5.5	8.9	10.6	11.8											
Gizzard Shad	10.2 oz.		553	6.0	8.8	10.3	11.7	12.5										
Carp	159.5 oz.		64	10.5	16.3	19.0	20.9	22.2	25.5	27.4								
Carp	60.0 oz.		51	9.4	13.9	15.8	17.7	18.9	19.5	21.5								
Spotted Sucker	27.7 oz.		515	5.9	11.1	13.4	14.8	16.1										
Spotted Sucker	20.6 oz.		485	5.8	10.7	12.9	13.8	14.7										
Channel Catfish	42.0 oz.		30	6.2	11.8	16.9	19.5											
Channel Catfish	168.0 oz.		120	5.0	9.4	12.8	15.5	18.0	20.7	22.7	25.5	27.5						
Flathead Catfish	198.1 oz.		7	5.8	10.1	15.8	23.7	29.7										
Flathead Catfish	151.0 oz.		14	5.1	8.4	11.8	14.2	16.7	20.2	20.5	25.1	25.4						
White Bass	54.0 oz.		332	8.8	14.1	16.3	18.2											
White Bass	76.5 oz.		1349	8.2	12.8	14.7	16.5	18.1	20.5									
Largemouth Bass	124.0 oz.		223	6.4	11.9	15.2	16.7	18.9	20.0	21.5	22.6							
Largemouth Bass	120.9 oz.		39	6.1	11.6	14.0	16.4	19.5	20.8	21.4	22.1	22.6						
Spotted Bass	23.0 oz.		2	7.7	12.4	14.1	14.0											
Spotted Bass	28.8 oz.		61	4.3	8.0	11.4												
White Crappie	24.5 oz.		703	5.0	9.8	12.1	13.3	14.2										
White Crappie	41.0 oz.		1380	4.7	8.9	11.9	13.4	14.4	15.4	16.2								
Black Crappie	32.0 oz.		112	3.4	8.7	11.7	15.2	16.0										
Black Crappie	28.0 oz.		60	3.7	8.4	11.7	13.2	14.8	16.2									
Bluegill	4.8 oz.		1167	2.2	4.0	5.4	6.7	7.5										
Bluegill	4.1 oz.		127	2.7	4.8	6.2	6.8	7.7										

10-YEAR AVERAGE, BY MONTHS, OF TOTAL FISHERMEN, TOTAL FISHERMAN HOURS, TOTAL FISH HARVEST AND TOTAL NUMBER OF LARGE MOUTH BASS, CRAPPIE AND WHITE BASS AS INDICATOR SPECIES FROM SPAVINAW LAKE, OKLAHOMA, 1955-1964.

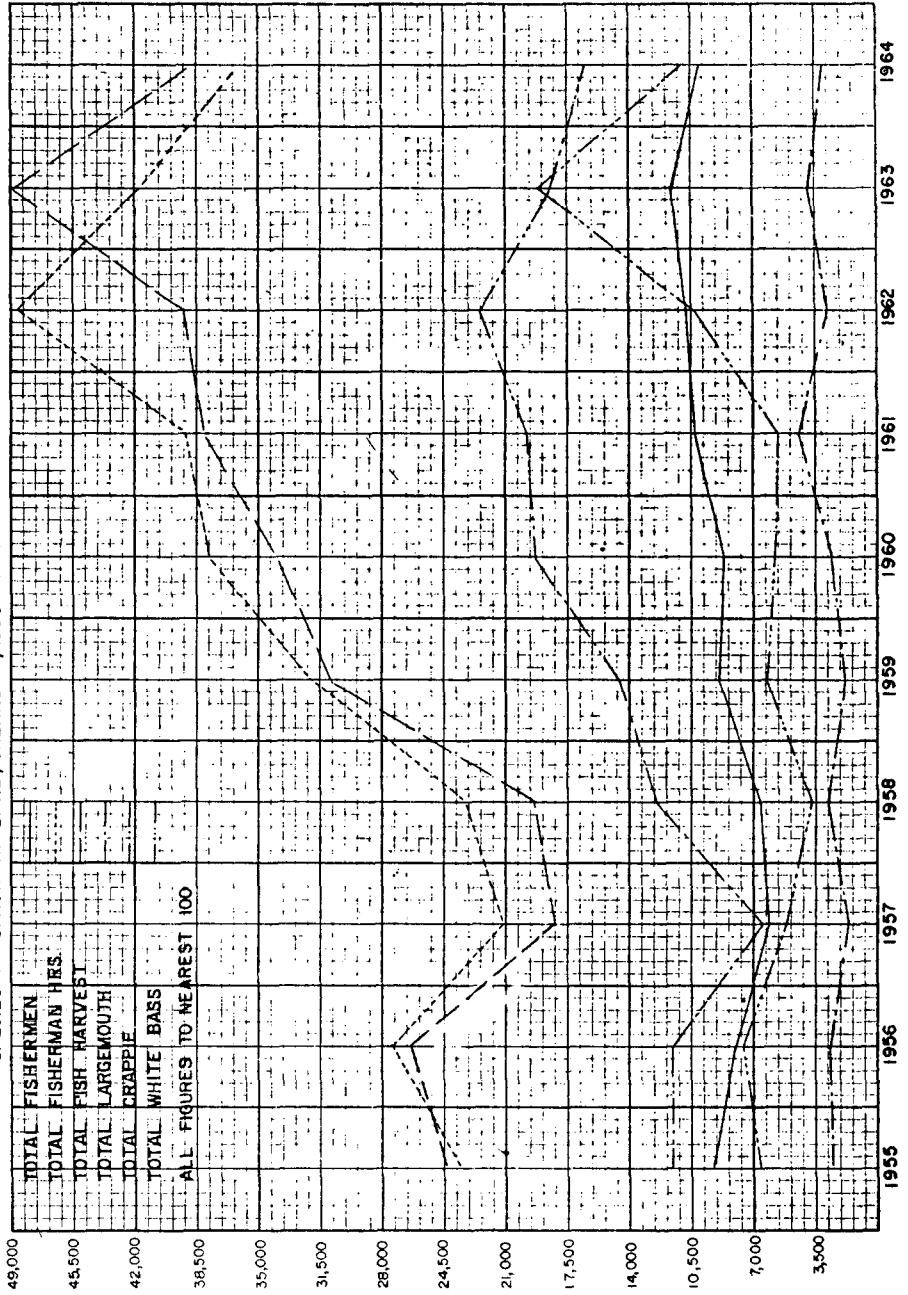


10-YEAR AVERAGE, BY MONTHS, OF TOTAL FISHERMEN, TOTAL FISHERMAN HOURS,  
 TOTAL FISH HARVEST AND TOTAL NUMBERS OF LARGE MOUTH BASS, CRAPPIE AND WHITE BASS  
 AS INDICATOR SPECIES FROM LAKE EUCHA, OKLAHOMA, 1955-1964



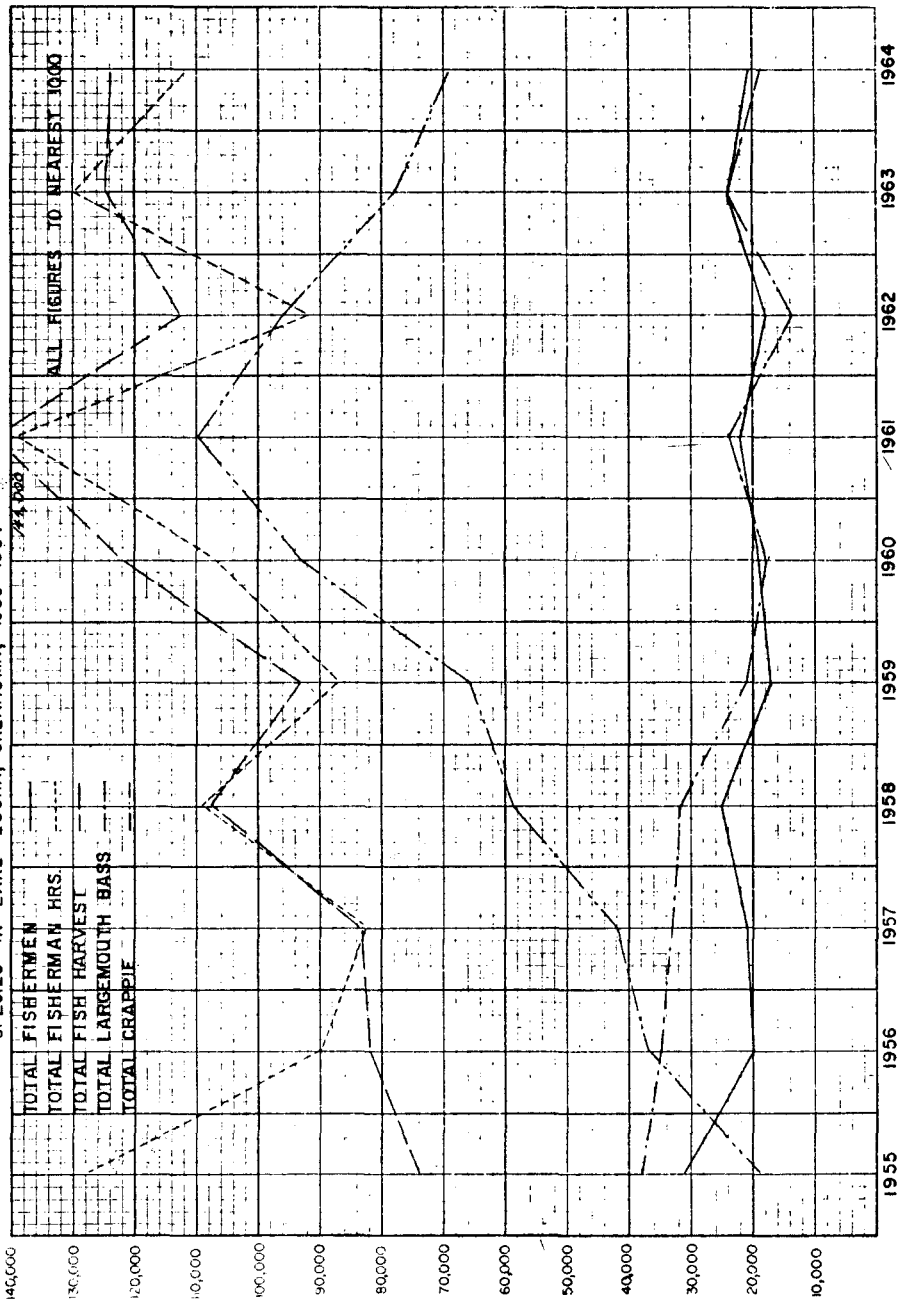
Graph 4

10-YEAR TREND IN NUMBER OF ESTIMATED FISHERMEN, FISHERMAN HOURS, TOTAL FISH HARVESTED AND LARGEMOUTH, CRAPPIE AND WHITE BASS AS INDICATOR SPECIES IN SPAVINAW LAKE, OKLAHOMA, 1955-1964



Graph 5

10-YEAR TREND IN NUMBER OF ESTIMATED FISHERMEN, FISHERMAN HOURS  
 TOTAL FISH HARVESTED AND LARGEMOUTH BASS AND CRAPPIE AS INDICATOR  
 SPECIES IN LAKE EUGHA, OKLAHOMA, 1955-1964



season is partially explained by the numbers taken by night fishermen. Crappie are harvested in greatest numbers in the spring months of April and May.

Harvest from sport fishing resulted in an average removal of 37.1 fish weighing 43.3 pounds per acre in Lake Eucha over the 10-year period. Sport fish harvest on Lake Eucha (all species) continued to increase from 1954 through 1961 with a gradual decline through 1964 (Graph 5). (Table 7, 9 and 11.)

Percent of successful fishermen (Table 7) for Lake Eucha, as reflected by the creel survey, has reflected an increase from 68.6 percent in 1954 to 78.3 percent in 1964. The average percent reflected for the 10-year period was 72.1 percent. The 10-year average of fish per hour was 1.0, varying from 0.6 to 1.2 and the average weight was 1.1 pounds per hour, varying from 0.7 - 1.4.

An estimated 90,016 fishermen harvested an estimated 322,237 fish from Spavinaw Lake during the 10-year period. The 10-year average of 4.1 fish weighing 4.8 pounds were harvested during the average fisherman trip of 4.2 hours. (Table 8.)

Crappie have remained the dominant species appearing in the creel, reflecting an average 47.6 percent number and 29.6 percent by weight of the total estimated catch (Tables 8-12). White bass comprised 25.1 percent by number and 28.0 percent by weight of the total catch. Channel catfish comprised 9.2 percent by number and 22.4 percent by weight while largemouth bass was the fourth prominent fish, 8.5 percent by number and 16.1 percent by weight. Sunfish, 8.2 percent by number, 2.4 percent by weight and drum, flathead and other species comprised the rest of the hook and line harvest in Spavinaw Lake.

Peak harvest of all species in Spavinaw Lake occurred in April (Graph 5). Crappie harvest was best during April-May, September-October and December-January. White bass, during their spawning runs in March and April, contributed substantially to the harvest for this period. Largemouth bass harvest was greatest in March-April and September-October.

Sport fish harvest on Spavinaw Lake has shown a general improvement through 1963 with a slight decline in 1964 (Graph 5). The percent of successful fishermen (Table 8-10-12) for Spavinaw Lake, as reflected by the creel survey, indicates a general improvement from 55.5 percent in 1954 to 61.7 percent in 1964. The average percent of successful fishermen in Spavinaw Lake for the 10-year period was 63.2 percent, fluctuating from a low of 55.5 percent in 1955 and a high of 71.5 percent in 1959. The 10-year average of fish per hour was 0.98 (varying from 0.8 to 1.2), weighing 1.05 pounds per hour (varying from 0.8-1.4). Yields averaged 19.7 fish per acre, varying from 11.1 in 1957 to 30.0 in 1963.

## TAGGING

Results from tagging 184 largemouth bass in Spavinaw Lake in 1957 indicated a return of 54 fish or 29.6 percent of total released. Results from tagging 284 largemouth bass in Lake Eucha in 1957 indicated a return of 91 fish or 32.2 percent of total released. Adequate data were not kept during 1960-1963 because of inexperienced personnel so information from tagging projects is lacking during this period.

Most of the tagged returns were made within an area of 1/2 mile from the point of release. On Spavinaw Lake the greatest movement was 4.4 miles in forty-eight hours. The fish was released in front of the permit house on the lower lake and was captured two days later in the creek channel at the eastern end of the lake.

## SUMMARY

The fishery management program initiated in 1949 by A. D. "Bob" Aldrich has been expanded and continuous for a period of sixteen years. Although progress may have appeared slow at times during this period, the trend has been toward an improved fishery and greater utilization.

Age and growth studies initiated in 1952 indicated growth of the primary species in Spavinaw Lake has improved over the management

Table 7. 10-Year Summary of Annual Creel Census Data From Lake Eucha, Oklahoma, 1955 - 1964

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	10-Year Totals
Total Estimated No. Fishermen	30,845	20,101	20,697	24,574	16,815	18,510	22,332	18,404	23,690	20,734	216,702
Percent Male	81.2	76.5	77.8	80.9	82.5	81.3	84.0	84.9	80.3	80.8	81.0
Percent Female	18.8	23.5	22.2	19.1	17.5	18.7	16.0	15.1	19.7	19.2	19.0
Fishermen From :											
Tulsa (%)	63.6	64.6	62.4	44.4					59.2	50.4	55.8
In-State (%)	95.5	97.8	91.1	86.3					91.6	91.7	92.3
Out-State (%)	4.5	2.2	8.9	13.7					8.4	8.3	7.7
Total Fisherman Hours	127,581	89,645	82,671	108,539	87,354	106,874	138,794	92,172	130,269	111,709	1,075,608
Average Fisherman Day	4.4	5.5	5.5	5.5	6.5	6.9	6.8	6.4	6.2	6.7	6.04
Total Estimated No. Fish Harvest	74,065	82,343	82,967	107,880	93,432	122,103	113,363	113,410	124,909	124,271	1,068,943
Total Estimated											
Wt. (Lbs.) Fish Harvest				82,717.8	89,247.4	107,729.4	189,222.3	112,291.1	155,294.3	127,202.5	873,704.8*
Estimated Harvest No. Fish/Acre	25.7	28.6	28.8	37.4	32.5	42.4	49.9	39.4	45.4	43.2	37.1
Estimated Harvest											
Wt. (Lbs.) Fish/Acre				28.7	31.0	37.4	65.7	39.0	57.4	54.2	43.3*
Average Harvest No. Fish/Hour	0.6	0.9	1.0	1.0	1.1	1.1	1.0	1.2	1.0	1.1	1.0
Average Harvest											
Wt. (Lbs.) Fish/Hour				0.7	1.1	1.2	1.4	1.2	1.3	1.1	1.1*
Average Harvest											
No. Fish/Fisherman Day	2.6	5.0	5.5	5.5	7.2	7.6	6.8	7.7	6.2	7.4	6.2
Average Harvest											
Wt. (Lbs.) Fish/Fisherman Day				4.0	7.3	7.7	9.6	7.7	8.0	7.4	7.3*
Successful Fishermen (Percent)	68.6	68.0	73.8	64.0	75.9	73.5	71.3	69.0	78.4	78.3	72.1

\* Wt. on 7 - year total.

Table 7. 10-year Summary, Lake Eucha, Page 2.

Composition of Estimated Catch:	1955		1956		1957		1958		1959		1960		1961		1962		1963		1964		
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	
Largemouth Bass (and Spotted)	38,422	34,657	33,368	40,066.5	20,920	41,520.2	18,161	34,419.5	23,904	76,750.8	14,326	37,559.9	23,967	52,546.6	18,743	32,295.0					
Crapple (White & Black)	19,036	37,439	42,153	58,538	32,736.6	66,378	36,066.9	93,420	49,201.5	109,843	61,848.2	95,597	60,080.5	77,964	55,169.9	69,306	47,743.9				
White Bass																					
Channel Catfish	177	134	443	1,096	2,684.0	2,567	9,830.4	4,813	10,968.4	4,813	19,222.6	1,050	4,387.1	6,698	20,903.1	5,390	12,063.5				
Misc. Sunfish	9,424	7,936	6,413	13,203	3,563.0	3,045	741.8	5,787	1,458.8	1,612	541.4	488	121.8	3,886	1,103.0	4,168	1,177.0				
Drum																					
Flathead Catfish	19		13	20	91.7	230	795.3	1,617	11,265.8	3,224	30,703.5	1,246	9,865.1	3,103	27,768.0	1,172	7,457.4				
Carp	175		9																		
Bullhead Catfish	4,594	1,868	216	2,814	3,421.7	292	292.8	308	415.4					50	126.3	45	45.2				
Smallmouth Bass	2,218	309	352	172	204.3																
Other																					
10-Year Totals:		No.		Wt.		No.		Wt.		No.		Wt.		No.		Wt.		No.		Wt.	
Largemouth Bass (and Spotted)		258,505		315,158.5		36.1%		Drum													
Crapple (White & Black)		669,674		342,847.5		39.2%		Flathead Catfish		10,644		1.0%									
White Bass		35,162*		33,973.6		3.9%		Carp		206		T									
Channel Catfish		25,178		80,009.1		9.2%		Bullhead Catfish		10,187		1.0%									
Misc. Sunfish		55,912		8,706.8		1.0%		Smallmouth Bass		3,475		0.3%									
								Other													

\* 4-Year Total



Table 8. 10 - Year Summary of Annual Creel Census Data from Spavinaw Lake, Oklahoma, 1955 - 1964

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	10-Year Totals
Total Estimated No. Fishermen	9,166	7,992	6,152	6,509	8,930	8,631	10,270	10,685	11,672	10,009	90,016
Percent Male	80.2	84.0	84.8	77.2	69.0	78.1	78.0	70.8	76.6	75.1	77.4
Percent Female	19.8	16.0	15.2	22.8	31.0	21.9	22.0	29.2	23.4	24.9	22.6
Fishermen From:											
Tulsa (%)	78.0	69.0	60.2	65.7					53.3	51.8	63.0
In-State (%)	98.5	95.5	98.8	99.2					93.2	95.4	96.8
Out-State (%)	1.5	4.5	1.2	0.8					6.8	4.6	3.2
Total Fisherman Hours	23,637	27,852	21,091	23,257	32,076	37,813	39,247	48,790	41,769	36,202	331,334
Average Fisherman Day	2.4	4.1	4.0	3.8	4.5	4.7	4.4	5.0	4.4	4.5	4.2
Total Estimated No. Fish Harvest	24,394	26,526	18,158	22,918	30,864	34,014	37,998	39,406	49,050	38,909	322,237
Total Estimated											
Wt. (Lbs.) Fish Harvest	14.9	16.2	11.1	14.0	18.9	20.8	23.2	24.1	30.0	23.8	19.7
Estimated Harvest No. Fish/Acre				18,018.0	26,364.6	34,891.0	54,301.1	47,515.9	53,002.1	36,022.3	272,115.0 *
Estimated Harvest											
Wt. (Lbs.) Fish/Acre				11.0	16.1	21.3	33.2	29.0	32.4	23.2	23.7
Average Harvest No. Fish/Hour	1.0	1.0	0.9	0.9	1.0	0.9	1.0	0.8	1.2	1.1	0.98
Average Harvest											
Wt. (Lbs.) Fish/Hour				0.3	0.8	0.9	1.4	1.0	1.3	1.1	1.05
Average Harvest											
No. Fish/Fisherman Day	2.4	4.1	3.6	3.3	4.5	4.2	4.4	4.0	5.3	5.0	4.1
Average Harvest											
Wt. (Lbs.) Fish/Fisherman Day				3.0	3.6	4.2	6.2	5.0	6.5	5.0	4.8
Successful Fishermen (Percent)	55.5	64.2	53.7	68.5	71.5	71.2	58.4	62.7	59.6	61.7	63.2

\* Wt. on 7 - year total.



Table 9. 10-Year Averages of Yield Per Acre and Percent Composition of Creel Survey on Spavinaw Lake, Oklahoma, 1955 - 1965

	Yield per Acre		Percent Composition	
	Number	Pounds	Number	Pounds
Largemouth Bass*	1.7	3.8	8.5	16.0
Crappie**	9.4	7.0	47.6	29.6
White Bass	4.9	6.7	25.1	28.3
Channel Catfish	1.8	5.3	9.2	22.4
Sunfish***	1.6	0.6	8.2	2.4
Other	.3	0.3	1.3	1.3
Total	19.7	23.7		

\* Largemouth bass and spotted bass

\*\* White crappie and black crappie

\*\*\* All sunfish

Table 10. 10-Year Averages of Yield Per Acre and Percent Composition of Creel Survey on Lake Eucha, Oklahoma, 1955 - 1964

	Yield per Acre		Percent Composition	
	Number	Pounds	Number	Pounds
Largemouth Bass*	9.0	15.6	24.2	36.0
Crappie**	23.3	17.0	62.6	39.3
White Bass	1.2	2.9	3.2	6.7
Channel Catfish	0.9	4.0	2.4	9.2
Sunfish***	1.9	0.4	5.2	0.9
Other	.8	3.4	2.4	7.9
Total	37.1	43.3		

\* Largemouth bass and spotted bass

\*\* White crappie and black crappie

\*\*\* All sunfish

Table 11. 10-Year Averages of Creel Composition of Creel Survey on Lake Eucha, Oklahoma, 1955 - 1964.

	Pounds Per Fisherman Hour	Number Per Fisherman Hour	Average Weight	Percent of Successful Fishermen	Percent Fisherman Creel Limit	Fisherman Hours of Fishing per Acre	Mean Time Spent Fishing
Total	1.16	1.0	—	72.1	—	373.5	7.3 hrs.
Largemouth Bass*	.41	.23	1.7 lbs.	—	—	—	—
Crappie**	.45	.60	0.7	—	—	—	—
White Bass	.08	.08	0.97	—	—	—	—
Channel Cat	.10	.02	4.5	—	—	—	—
Sunfish***	.01	.05	0.22	—	—	—	—
Other	.11	.02	3.8	—	—	—	—

\* Largemouth bass and spotted bass

\*\* White crappie and black crappie

\*\*\* All sunfish

Table 12. 10-Year Averages of Creel Composition of  
Creel Survey on Spavinaw Lake, Oklahoma, 1955 - 1964.

	Pounds Per Fisherman Hour	Number Per Fisherman Hour	Average Weight	Percent of Successful Fishermen	Percent Fisherman Creel Limit	Fisherman Hours of Fishing per Acre	Mean Time Spent Fishing
Total	1.05	0.98	—	63.2	—	202.4	4.2 hrs.
Largemouth Bass*	.17	.08	2.27 lbs.	—	—	—	—
Crappie**	.31	.46	0.75	—	—	—	—
White Bass	.29	.24	0.87	—	—	—	—
Channel Catfish	.23	.09	2.70	—	—	—	—
Sunfish***	.02	.08	0.3	—	—	—	—
Other	.03	.03	1.6	—	—	—	—

\* Largemouth bass and spotted bass

\*\* White crappie and black crappie

\*\*\* All sunfish

period. Growth rates in Lake Eucha have generally declined, but remain above the state average and Spavinaw.

59,670 fish weighing 47,903.8 pounds were taken (all methods — gill nets, traps, seines and rotenone) during twelve years of fish removal from 1953 to 1964. This amounted to an average annual harvest through fish removal projects of two fish per acre weighing 1.7 pounds per acre.

436,513 fish weighing 163,264.7 pounds were removed (all methods) from Spavinaw Lake during 14 years of fish removal, 1951-1964. This amounted to an annual average of 26.7 fish per acre weighing 10.0 pounds per acre. Over a three-year period, 1962-1964, 311,000 gizzard shad, weighing 76,500 pounds were removed from winter concentrations of this species. Observations on the influence of removal of shad will be of major importance during future operations.

The creel survey was established on the two Spavinaw Lakes in September, 1954 and has been continuous for a period of ten years. Estimations of harvest on Lake Eucha indicate a general upward trend with fluctuations from year to year. The creel survey indicated 216,702 fisherman days (trips) yielded 1,068,943 fish over the 12-year period or an average of 37.1 fish per acre per year. Estimated weights of fish harvested were included from 1958 (seven years) and indicated an average annual harvest of 43.3 pounds per acre. The estimated weight per acre varied from 23.7 in 1958 to 65.7 in 1961.

Estimation of harvest on Spavinaw Lake indicates a general improvement trend with fluctuations throughout the 10-year period. The creel survey indicated 90,016 fishermen trips yielded a harvest of 322,237 fish over this period, or an average annual harvest of 19.7 fish per acre. Estimated harvest per acre varied from 11.1 in 1957 to 30.0 in 1963. Estimated weights of fish harvested were included from 1958 (seven years) and indicated an average annual harvest of 23.7 pounds per acre, varying from 11.0 pounds per acre in 1958 to 33.2 pounds per acre in 1961.

Total harvest, by anglers and the fish removal program, averaged 474 fish per acre weighing 26.6 pounds per acre per year for the 10-year period in Spavinaw Lake. Total harvest, by anglers and the fish removal program, average 39.1 fish weighing 45 pounds per acre in Lake Eucha.

Influence of water fluctuation on the Spavinaw Lakes was evaluated by Jackson, 1957. Fluctuation has been both controlled and uncontrolled on these two reservoirs during the 10-year period.

Fish shelters or brush pile induction has been practiced on both

lakes over the past 10 years and serve well as fish concentration points. With the exception of the spring inshore crappie fishing, better than 90 percent of the crappie harvest is around the marked shelters. Bank fishing piers installed on both lakes provide fishing for those fishermen not wanting to go out in a boat.

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## AGING AND GROWTH OF LARGEMOUTH BASS, BLUEGILL, AND REDEAR SUNFISH FROM LOUISIANA PONDS OF KNOWN STOCKING HISTORY <sup>1</sup>

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### ABSTRACT

Scales of largemouth bass taken from two ponds at Baton Rouge, Louisiana over a three-year period agreed closely with the known past stocking history on these fish. Largemouth bass scales from a 50-acre pond at Clinton, Louisiana indicated agreement with the six years fish

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