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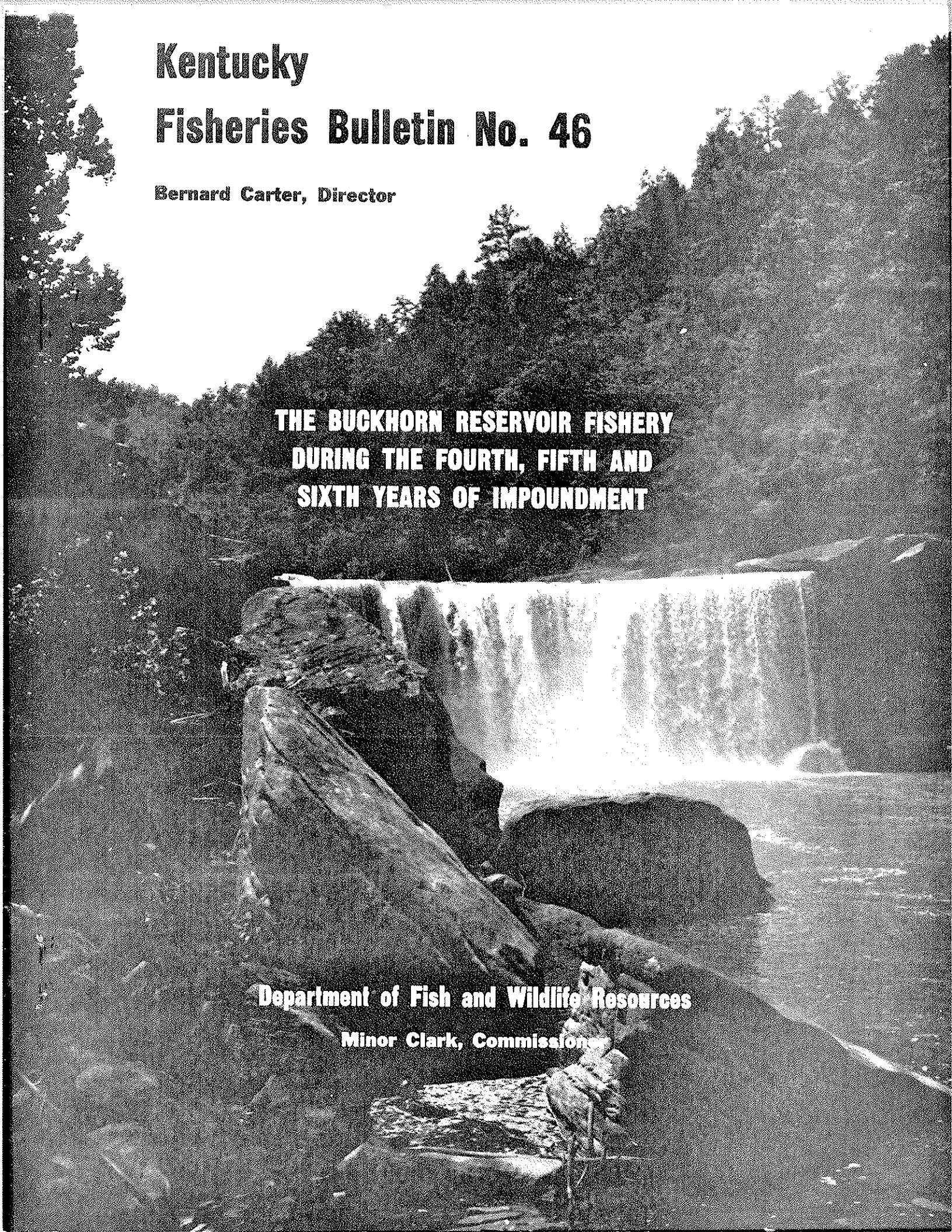
Bernard Carter, Director



THE BUCKHORN RESERVOIR FISHERY DURING THE FOURTH, FIFTH AND SIXTH YEARS OF IMPOUNDMENT

Department of Fish and Wildlife Resources

Minor Clark, Commissioner

THE BUCKHORN RESERVOIR FISHERY DURING THE FOURTH, FIFTH, AND SIXTH YEARS OF IMPOUNDMENT

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ABSTRACT

The standing fish crop in Buckhorn Reservoir during 1964 and 1965, the fourth and fifth years of impoundment, averaged between 62 and 63 pounds per acre. Carrying capacity was apparently reached during the second year of impoundment, when an 89-pound per acre biomass was recorded, and was duplicated the following year. The percentage of the biomass composed of harvestable-size fish appears to have stabilized between 56 and 59%, considerably higher than any previous A_t value. The much sought-after game fishes were more abundant (310 vs. 288, per acre) in 1965 than in the previous year. Concurrently, their biomass also increased from 10 to 18 pounds, per acre. Game fishes of harvestable-size numbered 5 per acre in 1964; their number had risen to 9 per acre by 1965. The continued scarcity of forage fishes (0.6 to 0.7 pound per acre), accentuated by the unique absence of gizzard shad in this reservoir, was the chief factor responsible for the low productivity.

The Cumberland Lake strain of threadfin shad, possibly more winter-hardy than other strains, was introduced into Buckhorn Reservoir in the spring of 1964 and re-introduced in the spring of 1966. Spot-sampling in the fall of 1964 disclosed the presence of a tremendous spawn, indicating that this species had been very successful in saturating an uncontested niche, consequently no restocking was done in 1965. The unforeseen absence of threadfin in 1965, discovered during routine population sampling, was attributed to migration from the reservoir during the fall drawdown, rather than to winter-kill, no instances of the latter having been observed. Inexplicably, the adult threadfin shad stocked in 1966 failed to reproduce.

Fishing pressure at Buckhorn Reservoir between April 1 and October 31, 1964 amounted to 64,275 man-hours, or 51 man-hours per acre. The following year, over the same 7-month period, the pressure was 58,828 man-hours, or 47 man-hours per acre. The survey in 1966 was expanded to include March, and during that 8-month period the fishing pressure was 49,965 man-hours, or 40 man-hours per acre. The yield or harvest in 1964 was 72 fish and 18 pounds, per acre. In 1965 it was 68 fish and 21 pounds, per acre. In 1966 the harvest was 62 fish and 23 pounds, per acre. The annual average catch rate for the 3 years was 1.4, 1.5, and 1.5 fish per man-hour. Fish caught at Buckhorn annually averaged 0.25, 0.31, and 0.37 pound. Fisherman success was high: 78% of all anglers caught fish in 1964, 68% were successful in 1965, and again 78% were successful in 1966. Other characteristics of the fishery (composition of the catch, fisherman intent, etc.) are described and evaluated in the report.

Water quality determinations (temperature, dissolved oxygen, and total alkalinity) normally were made once each month at three widely separated stations until isothermic conditions prevailed. Temperatures found in relation to the various strata (at 5-foot intervals) are described and are shown in tabular form. Dissolved oxygen was abundant, or at least adequate for the normal needs of fishes, seldom being absent even near the bottom. The total alkalinity of this mountain reservoir, reflecting the nature of the drainage basin parent material, was relatively low, ranging from the high teens to the low twenties (ppm, as $CaCO_3$).

INTRODUCTION

Buckhorn Reservoir, created in late 1960 by a U. S. Army Corps of Engineers dam on the Middle Fork of the Kentucky River, is in southeastern Kentucky. The reservoir lies in Perry and Leslie Counties, deriving its name from the town of Buckhorn, located one-half mile downstream from the dam. The reservoir when held at seasonal pool level (elevation 782) from April 1 through Labor Day extends about 21 miles upstream to a point 3 miles above Hyden and impounds 1250 acres. At minimum pool level (elevation 757) from December 1 to April 1 the reservoir is 13 miles long and covers only 550 acres. The Buckhorn Reservoir was constructed primarily for flood control (it controls the run-off from a drainage area of 409 square miles) and for downstream water quality improvement (low flow augmentation). As a flood control project, the reservoir is operated as a unit in the general reservoir plan for the Ohio River Basin to effect reduction in flood stages at all points downstream from the reservoir (U. S. Army Corps of Engineers, 1963).

The Fisheries Division of the Kentucky Department of Fish and Wildlife Resources has had a vital interest in Buckhorn Reservoir, even before impoundment, for several reasons. Other than Dewey Reservoir, some 75 tortuous road miles away, Buckhorn has been the only sizeable body of impounded water in the entire eastern third of the state available to the fishing public. Another reason is the fact that Buckhorn is unique among Kentucky reservoirs in being devoid of that ubiquitous species, the gizzard shad. A continuing scarcity of so-called forage fishes, accentuated by the absence of gizzard shad, is believed to be the chief factor responsible for the relatively low productivity. Despite erratic reproductive success of repeated introductions of the exotic threadfin shad, fisherman success and fishing quality at Buckhorn has remained at a surprisingly high level, compared to other more productive reservoirs in the state.

This bulletin is, in essence, the continuation of a Dingle-Johnson research project begun on the Middle Fork of the Kentucky River in 1957, 4 years prior to actual impoundment, and continued for 3 years following impoundment. [The results of that initial project, under the leadership of William R. Turner, former staff biologist, will be published in 1967 under the title, *A Pre- and Post-Impoundment Survey of Middle Fork of the Kentucky River.*] The period covered by the present investigation (Dingle-Johnson Project F-22-R) was from April 1, 1964 through November 30, 1966 and was under my leadership. The current status of the sport fishery at Buckhorn was documented annually by population studies and spot-sampling, and by creel surveys. Water quality determinations were made monthly. Fish stocking records are listed and subsequent success or failure of the introduced species was determined.

ACKNOWLEDGEMENTS

Much credit for all aspects of the project work, both indoors and out, must be given to my former full-time Fishery Aide, Charles Gorham. Summer Aide Robert Rash contributed materially to the summer field work. I am especially grateful to Elvin Witt, Conservation Officer of Leslie County, for the competent and conscientious manner in which he performed the creel survey duties assigned him. He was a handy man to have around during the population studies, too. Corps of Engineer personnel stationed at Buckhorn Dam were always cordial and cooperative.

METHODS AND MATERIALS USED

Fish Fauna Studies

Fish population studies were conducted in cove areas at Buckhorn Reservoir during the summers of 1964 and 1965. Spot-sampling with dilute rotenone emulsions to determine reproductive success of spring-stocked threadfin shad

was done in September of 1964 and again in October of 1966. The fish toxicants used in the population studies were emulsifiable rotenone and powdered cubé.

Fish population sampling methods were reviewed by the Director of Fisheries and the staff fishery biologists early in 1964. Standard methods to be used in cove sampling, described in the following annotated list, were adopted. These methods were used by F-22-R personnel throughout all population studies.

1. Coves selected for fish population sampling will be at least one acre in size; two-acre areas are preferable. (Smaller areas are less likely to contain representative fish populations.)

2. Coves will be measured by accepted surveying methods, not by visual estimation. Soundings will be made to determine the average depth.

3. A net that effectively blocks the cove mouth from shore to shore and from surface to bottom will be used. (The most widely-used net was 300 feet long, 20 feet deep, with 3/4-inch bar-measure mesh.)

4. All population studies will begin between the hours of 7:00 and 9:00 a.m., the earlier hour being preferable. (The block net was positioned before other activities relevant to the study were begun.)

5. Population studies will not be conducted in water having a surface temperature less than 75° F.

6. Liquid fish toxicants will be mixed with water at a 1:10 ratio and applied through the propeller wash via a venturi-type boat bailer. In deep coves, the mud-ball method (powdered cubé) will be used for better penetration of the thermocline. (Noxfish, a specially formulated emulsifiable toxicant containing 5% rotenone, was used at a concentration of 1.0 ppm, or 0.05 ppm actual rotenone.)

7. Fish within the study area will be picked up for three days (50-60 hours). Freshly-killed fish will not be counted the second and third days. (Sanitary and esthetical considerations required disposal of floating extra-territorial fish before leaving the lake.)

8. Fish will be sorted according to species, measured in inch-groups, (0 to 1.4" = 1 inch, 1.5" to 2.4" = 2 inch, etc.), and weighed to the nearest 0.01 pound. (Small species, as well as questionable larger specimens, were preserved in formalin for later identification.)

9. Appropriate field notes will be kept and the resulting data will be reported according to recommendations of the Southern Division's Reservoir Committee. (Standardized field forms, designed to complement the Kentucky-version of the standard method of reporting fish population data, were used in recording measurable data.)

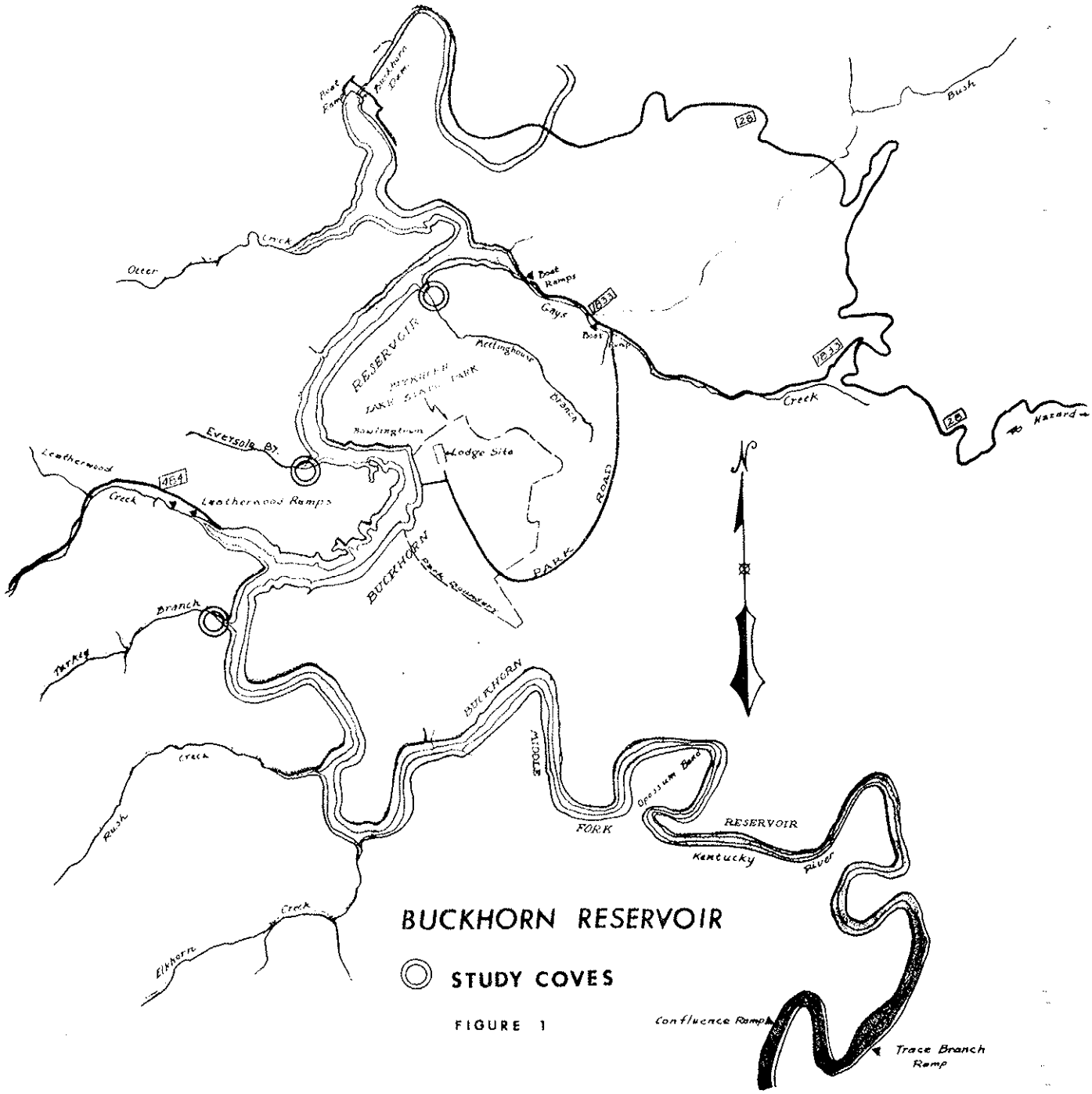
10. Fish nomenclature, both scientific and common, will comply with recommendations of the American Fisheries Society.

The fish population of this mountain multiple-purpose reservoir was sampled at differing locations three times during 1964 and four times during 1965, the fourth and fifth years of impoundment (Figure 1). Eversole Branch Cove and Meeting House Branch Cove have been sampled annually since impoundment, but Turkey Branch Cove was sampled in 1964 for the first time and Langdon Branch Cove was first sampled during 1965. The combined acreage of the three 1964 study coves was 7.35 acres. The four study areas used in 1965 amounted to 8.85 acres.

Creel Surveys

A non-uniform (unequal) probability creel survey was conducted at Buckhorn Reservoir for the first time between April 1 and October 31, 1965, and was used again during the same period in 1966. A completely different type of creel survey — the systematic stratified — had been used in 1964. The systematic stratified was also used to survey the sport fishing during March of 1966 since prior creel data for this particular month, requisite for the design of a non-uniform probability survey, were lacking.

The non-uniform probability survey was designed, and the resulting data expanded, according to recommendations of Dr. Don W. Hayne of the Southeastern Cooperative Fish and Game Statistics Project (North Carolina State University: Institute of Statistics). Pfeiffer, who employed the same type of creel survey on a small Kentucky state-owned lake in 1965, has published (1966) a report that details the methodology used in setting up a survey of this type. The only difference in our methods was that of the basic time interval: he divided the 12-hour fishing day (7:00 a.m. to 7:00 p.m.) into 2-hour intervals because his lake was small; I used 4-hour time periods because more time was required for the creel clerk to make fisherman counts and conduct interviews on the larger reservoir.



BUCKHORN RESERVOIR

STUDY COVES

FIGURE 1

The methods involved in the systematic stratified survey were fully described in a previous report (Charles, 1965). The local conservation officer, Elvin Witt, acted as creel clerk all three years.

Fish Stocking

Threadfin shad, *Dorosoma petenense* (Günther), were procured from the Beaver Creek area of Cumberland Lake (Kentucky) for introduction into Buckhorn Reservoir in the spring of 1964, since it is believed that this strain may be more winter-hardy. The same strain was used again in the spring of 1966.

Tagged largemouth bass brood fish were stocked in Buckhorn Reservoir at the request of a local Junior Chamber of Commerce which sponsored a fishing derby and offered prizes for these fish

Water Quality Determinations

Water-quality sampling stations were established at three locations in Buckhorn Reservoir because of its length. Water temperatures were taken at 5-foot intervals, from surface to bottom, with an electronic thermometer calibrated in Fahrenheit. A Kemmerer-type sampler was used to procure water samples at 10-foot intervals for chemical determinations. Water samples and temperatures frequently were taken at in-between depths to more precisely locate various strata.

Dissolved oxygen concentrations (ppm) were determined in 1964 by a modification of the Winkler method that substituted "powder pillows" (Hach Chemical Company) for some of the liquid reagents. Conventional reagents were used in 1965. Total alkalinity values (ppm) were determined by titration with 0.02N sulfuric acid, using a mixed indicator (brom cresol green and methyl red). The mixed indicator was very superior to other single indicators tested, since the waters under study were all of relatively low alkalinity. No water quality determinations were made after 1965.

THE SPORT FISHERY

Population Sampling

Twenty-six different species of fishes were recovered from the seven population studies of 1964 and 1965 (Table 1). While Turner (1967) found 61 species native to the Middle Fork of the Kentucky River prior to creation of Buckhorn Reservoir, and an additional 6 species after impoundment, he stated that the number of species inhabiting the reservoir by 1963 had decreased to 24. Only one species, *Pimephales promelas* Rafinesque (fathead minnow), not collected prior to the present investigation, was added to the Buckhorn check-list. Live-bait anglers, with their well-known propensity for dumping minnow buckets when through fishing, are probably responsible for this addition to the fauna.

The fish population of the reservoir reached carrying capacity in 1962, during the second summer of impoundment (Table 2). Comparison of the annual average standing crops (biomass) the first 5 years suggests that the population has stabilized at 62 to 63 lb/A (fishery topics require the repeated usage of "pounds per acre" and "fish per acre" — hence the abbreviations lb/A and f/A for these terms). The biomass averaged 76 lb/A in 1961, increased to 89 lb/A the following 2 years, and leveled off at 62 and 63 lb/A in 1964 and 1965. Meeting House Branch Cove, located nearest to the dam and the only cove sampled that contained remnants of standing timber, was the most productive during this investigation. Langdon Branch Cove, nearest to the headwaters, was the least productive in 1965, the only year it was sampled (Table 2).

The A_{tl} value (the "legal A_t", modified to conform with legal size limits imposed on certain game fish species), or percent of the total weight composed of harvestable-size* fishes, showed moderate variation between 1964 and 1965.

* See Figure A-1 (Appendix) for species and size classifications.

While the Langdon Branch A_{ti} value was aberrant at 27, the other coves registered values between 49 and 66 both years. During the first 3 years of impoundment, while the structure of the fish population was expanding and shifting, the A_{ti} values for the reservoir as a whole ranged from 32 to 44.

The game fish group (white bass, largemouth bass, spotted bass, and white crappie) comprised nearly 17% (10 lb/A) of the 1964 biomass (Table 3). A significant increase was noted the following year, when this group comprised nearly 28% (18 lb/A) of the standing crop (Table 4). Most of the increase occurred in the intermediate size class, particularly that of white crappie. Relative abundance of the game fishes was fairly stable both years. Two hundred eighty-eight (21%) of the 1350-f/A population in 1964, and 310 (18%) of the 1685-f/A population in 1965, were game fishes. Only one other fish group, panfishes, was more abundant either year. Harvestable-size game fishes available for angler exploitation numbered 5 per acre in 1964 and 9 per acre in 1965. Creel survey data show unquestionably that "harvestable-size" means one thing to fishery biologists, but that it means quite another to Buckhorn Reservoir fishermen. The harvest of white crappie alone in 1964 was estimated to have been 43,423 fish, or some 35 crappie per acre. To this figure must be added 3 white and 3 black basses per acre -- combined, some 41 game fish per acre.

The food fish group (channel and flathead catfishes), poorly represented in the sampled population, showed little change between years. They contributed 7%, or 5 lb/A, to the 1964 biomass, and 4%, or 2 lb/A, to the 1965 biomass. The 14 food fishes per acre recovered the first year represented 1% of the population; the 9 per acre recovered the next year was less than 1%.

The only member of the predatory fish group recovered from the sampled coves was longnose gar. The intermediate-sized specimens were relatively scarce both years. Their contribution to the biomass was negligible.

Less fluctuation occurred in the relative abundance and size composition of the panfish group between 1964 and 1965 than compared to previous years. Bluegill and longear sunfish were the principal species; rock bass and green sunfish were poorly represented in the population. The group, at 18 lb/A in 1964, accounted for 28% of the biomass. The following year, at 14 lb/A, it comprised 21% of the standing crop. Nearly 70% of the sampled population in 1964 was sunfishes, by far the dominant group in the reservoir. The next year the group was even more abundant, accounting for 73% of all fish recovered.

The commercial fish group, represented by various redhorses, yellow bullhead, and quillback, dominated the standing crop both years. Some 46% of the biomass each year was derived from this group. Comparison of species, size class, and relative percentages reveals almost identical values between years across the board. Three to 4% of the population was composed of commercial fishes.

The forage fish group, usually the most abundant single group in a large reservoir, was very weakly represented in the Buckhorn fish population. One reason for the paucity of forage fishes is that Buckhorn is unique among large Kentucky reservoirs by being devoid of gizzard shad. Although threadfin shad were stocked in the spring of 1964, and literally exploded numerically by fall, very few were recovered inside the boundaries of the summer-sampled cove areas. Many threadfin (more, in fact, than had been stocked earlier in the year) were observed dead along the shoreline outside of the study areas, but could not in good conscience be included in the sample data. Threadfin shad were not recovered from the 1965 studies. Apparently they had migrated from the reservoir during the 1964 fall drawdown.

The forage fishes contributed 0.7 lb/A, or 1%, to the 1964 biomass. The next year, 0.6 lb/A, again 1% of the biomass, came from this group.

Table 1. List of fishes collected from Buckhorn Reservoir during the course of routine population studies conducted in 1964 and 1965.

LEPISOSTEIDAE	
Lepisosteus osseus (Linnaeus)	Longnose gar
CLUPEIDAE	
****Dorosoma petenense* (Günther)	Threadfin shad
CYPRINIDAE	
Notropis atherinoides Rafinesque	Emerald shiner
**Notropis whipplei* (Girard)	Steelcolor shiner
Pimephales notatus (Rafinesque)	Bluntnose minnow
******Pimephales promelas* Rafinesque	Fathead minnow
CATOSTOMIDAE	
Carpiodes cyprinus (LeSueur)	Quillback
Moxostoma anisurum (Rafinesque)	Silver redhorse
Moxostoma carinatum (Cope)	River redhorse
Moxostoma duquesnei (LeSueur)	Black redhorse
Moxostoma erythrurum (Rafinesque)	Golden redhorse
ICTALURIDAE	
Ictalurus natalis (LeSueur)	Yellow bullhead
Ictalurus punctatus (Rafinesque)	Channel catfish
Pylodictis olivaris (Rafinesque)	Flathead catfish
SERRANIDAE	
Roccus chrysops (Rafinesque)	White bass
CENTRARCHIDAE	
Ambloplites rupestris (Rafinesque)	Rock bass
****Lepomis cyanellus* Rafinesque	Green sunfish
Lepomis macrochirus Rafinesque	Bluegill
Lepomis megalotis (Rafinesque)	Longear sunfish
Micropterus punctulatus (Rafinesque)	Spotted bass
Micropterus salmoides (Lacepede)	Largemouth bass
Pomoxis annularis Rafinesque	White crappie
PERCIDAE	
Etheostoma blennioides Rafinesque	Greenside darter
Percina caprodes (Rafinesque)	Logperch
SCIAENIDAE	
Aplodinotus grunniens Rafinesque	Freshwater drum
ATHERINIDAE	
Labidesthes sicculus (Cope)	Brook silverside

* Not taken in 1964.
** Not taken in 1965.
***Not taken prior to 1964.

Table 2. Annual standing crop values, derived from cove sampling with rotenone, at Buckhorn Reservoir since impoundment.

Cove	Surface area	Standing fish crop										A_{tl}**				
		Number per acre					Pounds per acre									
(*)	(acres)	1961	1962	1963	1964	1965	1961	1962	1963	1964	1965	1961	1962	1963	1964	1965
M	2.30	2275	1906	1587	1553	2176	81	89	82	76	78	48.7	31.5	41.5	58.7	49.0
E	1.75	1258	5949	1327	1165	3060	64	82	74	53	62	23.2	29.3	48.4	50.3	63.8
S	0.50	-	3556	1652	-	-	-	112	172	-	-	-	33.5	42.0	-	-
T	3.30	-	-	-	1307	1234	-	-	-	58	65	-	-	-	51.6	66.0
L	1.50	-	-	-	-	317	-	-	-	-	38	-	-	-	-	27.0
	M_c	1957	3882	1499	1350	1685	76	89	89	62	63	40.8	31.8	43.8	58.5	56.2

* M = Meeting House Branch; E = Eversole Branch; S = Spring Branch; T = Turkey Branch; L = Langdon Branch.

** = Legal A_t (a legal size limit of 12 inches was imposed on black basses beginning in 1962).

Table 3. Species composition, relative abundance, and biomass composition of the fish population at Buckhorn Reservoir during 1964, the fourth year of impoundment. Values were derived from sampling 3 coves (7.35 acres) with rotenone.

Group	Fingerling size		Intermediate size		Harvestable size		Group total		Percent of total population	
	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number	Biomass
GAME FISHES										
White bass	3	0.1	2	0.3	1	0.2			0.4	0.9
Largemouth bass	32	0.1	10	2.2	1	1.5			3.2	6.0
Spotted bass	91	0.4	8	1.2	-	-			7.3	2.7
White crappie	105	1.4	31	2.3	3	0.5			10.4	6.8
Total	232	2.1	51	6.0	5	2.2	288	10.3	21.3	16.5
FOOD FISHES										
Channel catfish	3	0.1	3	0.3	1	2.0			0.5	3.8
Flathead catfish	5	t	1	0.1	1	2.1			0.4	3.6
Total	8	0.1	4	0.4	2	4.1	14	4.6	1.0	7.4
PREDATORY FISHES										
Longnose gar	t	t	1	0.2	-	-			0.1	0.3
Total	t	t	1	0.2	-	-	1	0.2	0.1	0.3
PANFISHES										
Rock bass	-	-	1	0.1	1	0.2			0.2	0.4
Bluegill	534	1.3	260	7.8	45	6.2			62.1	24.5
Green sunfish	-	-	t	t	-	-			t	t
Longear sunfish	24	0.2	75	1.8	t	0.1			7.3	3.3
Total	557	1.4	336	9.7	46	6.5	939	17.6	69.6	28.2

Table 3. (continued)

Group	Fingerling size		Intermediate size		Harvestable size		Group total		Percent of total population	
	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number	Biomass
COMMERCIAL FISHES										
Quillback	-	-	-	-	1	0.9			t	1.5
Redhorses	-	-	5	2.1	19	20.4			1.7	36.0
Yellow bullhead	2	t	1	0.1	t	0.1			0.2	0.4
Drum	1	t	19	3.1	5	2.3			1.8	8.7
Total	3	t	25	5.4	24	23.7	52	29.1	3.8	46.6
					Above forage size					
FORAGE FISHES										
Threadfin shad	1	t	16	0.3	-	-			1.3	0.5
Shiners	1	t	-	-	-	-			0.1	t
Other cyprinids	10	t	-	-	-	-			0.7	0.1
Darters	11	0.1	9	0.3	-	-			1.5	0.5
Brook silverside	8	t	t	t	-	-			0.6	t
Total	31	0.1	26	0.6	-	-	57	0.7	4.2	1.1
GRAND TOTAL	831	3.7	442	22.2	77	36.5	1350	62.4	100.0	100.0

Standing crop: 1350 fish per acre; 62 pounds per acre. A_{tl} = 58.5

Table 4. Species composition, relative abundance, and biomass composition of the fish population at Buckhorn Reservoir during 1965, the fifth year of impoundment. Values were derived from sampling 4 coves (8.85 acres) with rotenone.

Group	Fingerling size		Intermediate size		Harvestable size		Group total		Percent of total population	
	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number	Biomass
GAME FISHES										
White bass	2	t	2	0.2	1	0.8			0.4	1.9
Largemouth bass	114	1.0	17	2.6	2	2.5			7.9	9.9
Spotted bass	39	0.2	7	1.2	t	t			2.8	2.5
White crappie	40	0.4	78	6.8	6	1.1			7.4	13.4
Total	196	1.7	105	11.0	9	4.7	310	17.5	18.4	27.6
FOOD FISHES										
Channel catfish	2	t	1	0.1	2	1.7			0.3	3.0
Flathead catfish	3	t	1	t	1	0.4			0.2	0.9
Total	5	t	1	0.1	3	2.2	9	2.4	0.5	3.9
PREDATORY FISHES										
Longnose gar	t	t	1	t	-	-			0.1	0.1
Total	t	t	1	t	-	-	1	t	0.1	0.1
PANFISHES										
Rock bass	-	-	t	t	t	t			t	0.1
Bluegill	958	2.3	191	4.9	29	4.8			70.0	19.2
Longear sunfish	7	t	42	1.3	t	t			3.0	2.2
Total	966	2.3	234	6.3	29	4.9	1299	13.6	72.9	21.4

Table 4. (continued)

Group	Fingerling size		Intermediate size		Harvestable size		Group total		Percent of total population	
	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number per acre	Pounds per acre	Number	Biomass
COMMERCIAL FISHES										
Quillback	-	-	1	0.1	-	-			t	0.3
Redhorses	t	t	9	2.3	17	21.2			1.5	37.1
Yellow bullhead	3	t	1	t	t	t			0.2	0.2
Drum	t	t	13	2.8	5	2.4			1.1	8.3
Total	3	t	23	5.4	22	23.7	48	29.1	2.9	46.0
					Above forage size					
FORAGE FISHES										
Shiners	1	t	t	t	-	-			t	t
Other cyprinids	62	0.1	t	t	-	-			3.7	0.3
Darters	6	t	16	0.3	-	-			1.3	0.6
Brook silverside	2	t	-	-	-	-			0.1	t
Total	70	0.2	17	0.3	-	-	87	0.5	5.2	0.9
GRAND TOTAL	1240	4.4	382	23.4	63	35.6	1685	63.4	100.0	100.0

Standing crop: 1685 fish per acre; 63 pounds per acre. A_{tl} = 56.2

Their relative abundance was equally low: 4% (57 f/A) in 1964 and 5% (87 f/A) in 1965 of the aggregate samples.

Creel Surveys

Sport fishing quality during 1965 and 1966 continued to be quite satisfactory, considering the low standing crop available for angler exploitation (1964 creel survey statistics were fully described and discussed in a previous report: Charles, 1965). Based on interviews with 447 fishermen during the 7-month period in 1965, the average angler enjoyed a catch rate of 1.5 fish per hour. The average fish caught by the interviewed anglers, 68% of whom were successful, weighed 0.31 pound

Total fishing pressure at Buckhorn during the 1965 survey period amounted to 58,828 man-hours, or 47 man-hours per acre. This was a reduction of 5447 man-hours, or 4.3 man-hours per acre, compared to 1964. Fishing pressure was greatest by far during the month of May. Less fishing was done in July than in any other month.

Survey data indicate that 85,462 fish weighing 26,772 pounds were taken from Buckhorn between April 1 and October 31, 1965. This was a yield or harvest of 68 fish and 21 pounds, respectively, per acre. The harvest in 1964 was 72 fish and 18 pounds, per acre.

The composition of the 1965 catch each month is shown in Table 5. Since more fishing was done in May, it is reasonable to expect that more fish were caught that month than in any other. While this happens to be true, it is not true that the least number were caught in July, the month when the least fishing occurred. In fact, fewer fish were caught in both August and September than in July. Nearly 51% of the harvest was provided by crappies. The sunfishes were the next most often caught group, accounting for nearly 39% of the harvest. The white and black basses each contributed 4+% to the catch. The corresponding weight values are also shown in Table 5.

Table 5. Sport fishing harvest at Buckhorn Reservoir between April 1 and October 31, 1965. Values were derived from expansion of data resulting from fisherman counts and from creel survey interviews with 447 anglers during the 7-month period.

Month	Man-hours fished	White bass	Black basses	Crappies	Channel cat	Flathead cat	Rock bass	Sunfishes	Suckers	Drum	Total
					Fish						
April	7,981	1,783	563	12,075	286	-	-	3,080	114	-	17,901
May	16,083	196	525	6,703	82	46	-	10,340	-	150	18,042
June	9,119	99	591	4,115	34	34	-	7,359	34	-	12,266
July	4,798	115	76	2,987	-	20	-	5,684	-	121	9,003
August	6,968	484	895	1,364	64	-	-	3,318	-	96	6,221
September	6,585	471	556	2,993	32	32	-	2,107	-	32	6,223
October	7,294	420	728	13,186	-	-	175	1,297	-	-	15,806
Total	58,828	3,568	3,934	43,423	498	132	175	33,185	148	399	85,462
Percent of total catch		4.2	4.6	50.8	0.6	0.2	0.2	38.8	0.2	0.5	100.0
					Pounds						
April		1,916	487	3,631	571	-	-	228	114	-	6,947
May		133	710	1,820	257	285	-	1,282	-	102	4,589
June		83	661	1,105	68	4	-	1,099	21	-	3,041
July		114	139	593	-	t	-	880	-	118	1,844
August		416	1,226	257	7	-	-	480	-	18	2,444
September		316	719	826	91	78	-	362	-	38	2,430
October		284	1,177	3,755	-	-	39	222	-	-	5,477
Total		3,662	5,159	11,987	994	367	39	4,553	135	276	26,772
Percent of total catch		12.2	19.3	44.8	3.7	1.4	0.1	17.0	0.5	1.0	100.0
Average weight		1.03	1.31	0.28	2.00	2.78	0.22	0.14	0.91	0.69	0.31

Unfortunately, the average weight of the more than 43,000 crappies caught during 1965 was calculated to have been only 0.26 pound, an 8- to 9-inch fish in Buckhorn. The sunfishes averaged 0.14 pound each, a 6-inch fish. White bass averaged about a pound apiece, while black basses weighed nearly one and one-third pound each.

One interesting characteristic of the Buckhorn fishery investigated in 1965 for the second time was that of the angler intent or preference. Interviewed fishermen were again asked to specify which particular species they sought, or at least hoped to catch. Approximately one third of the fishermen was seeking crappies and another third was after sunfishes. Not quite a fourth of the anglers specified black basses as their choice. About 6% declared they were after "anything", meaning any species that would bite that day.

Success in catching the species specified varied widely, as did overall fishing success. The angler preference data in Table 6 show that fishermen intent on catching sunfishes were 94% successful in doing so. Crappie anglers were the next most successful in catching the species they were fishing for, some 90% did catch crappies. While only one angler stated that he was fishing for flathead catfish, he had the dubious distinction of having the poorest success of all: he caught neither flatheads nor any other species. White bass and black bass anglers were 45% and 56% successful.

Table 6 also shows overall fishing success, which includes other fish caught in addition to the preferred species. Crappie anglers accounted for 51% of all fish caught by the interviewed anglers. Sunfish fishermen creeled about 38% of the total catch. White bass and black bass anglers took 2% and 7% of all fish caught. The "anything" group caught less than 2% of all fish landed.

Table 6. Angler preference (intent), overall fishing success, and specific success* of 447 fishermen interviewed at Buckhorn Reservoir between April 1 and October 31, 1965.

Species sought	Percent of anglers seeking	Overall success (percent of total catch) Number (*)	Weight	Overall catch rate (fish per hour)
White bass	2.5	1.7 (45.4)	4.9	0.6
Black basses	23.6	7.3 (55.6)	25.2	0.4
Crappies	32.7	50.6 (90.3)	45.6	1.9
Channel cats	0.9	0.4 (42.9)	2.9	0.5
Flathead cats	0.2	- (-)	-	-
Sunfishes	34.2	37.7 (94.3)	19.1	1.6
Suckers	0.2	0.1 (50.0)	0.3	1.0
Drum	0.4	0.4 (42.9)	0.5	0.5
"Anything"	5.6	1.9 (24.0)	1.5	0.4
Total	100.0	100.0	100.0	M_C 1.3

* Specific success: percent of their catch composed of the species sought.

The total, or overall, hourly catch rate of the various fisherman groups varied widely. Those anglers intent on catching crappies enjoyed the highest overall catch rate of all: nearly 1.9 fish per hour. The sunfish seekers caught 1.6 fish per hour. White bass anglers averaged nearly 0.6 fish per hour, while those after black basses caught only 0.4 fish per hour.

The sex ratio of the anglers during 1965 was 86 males to 14 females. Nearly 93% of the fishermen were Kentucky residents. Still fishing was the method most often used (77%), followed by casting (15%), then trolling (6%), and lastly fly fishing (2%).

The 1966 creel survey at Buckhorn Reservoir was conducted between March 1 and October 31. March was added to the schedule for the first time at the suggestion of Elvin Witt, the local conservation officer, who maintained that a great deal of fishing was done in this month. He was right, as the survey data ultimately showed. Interviews with 552 anglers during the 8-month period indicated an average catch rate in 1966 of 1.5 fish per hour, identical to the rate the previous year. The catch rate in March, however, was 2.4

fish per hour. The average fish from Buckhorn in 1966 weighed 0.37 pound, a slight improvement over the previous year. More anglers were successful in 1966 than in 1965 (78% vs. 68%).

Total fishing pressure continued to slump, amounting to 49,965 man-hours (45,337 man-hours if March is excluded), or 40 man-hours per acre. As in the previous year, fishing pressure was heaviest in May; however, the lightest pressure was recorded in October, rather than in July.

The 8-month harvest was estimated to have been 76,979 fish, or 62 fish per acre, and 28,564 pounds, or 23 pounds per acre. Fewer fish were removed from Buckhorn in 1966, but they were slightly larger and this resulted in a per acre harvest increase of 2 pounds.

The composition of the 1966 catch is detailed in Table 7. More fish were caught in September, rather than in May, which ranked second. That poorest of fishing months, July, did produce the least number of fish in 1966. Considerable shifting was noted in the species composition of the catch. Crappies failed to dominate the harvest in 1966, ranking second instead by comprising 39% of the catch. Sunfishes were the most often caught group, accounting for 42% of the creeled fish. More than twice as many white bass were creeled in 1966 than were caught in 1965. The black bass catch was improved, but very slightly.

The average crappie caught continued to be an 8- to 9-inch specimen and weighed 0.27 pound. The average sunfish was a little heavier in 1966, weighing 0.18 pound. White bass averaged 0.8 pound each, less than the pound apiece they weighed in 1965. The average black bass, however, went from 1.3 to 1.6 pound.

Some shifting was noted in angler preference during 1966 (Table 8). More fishermen were seeking crappies (42% of the interviewees), fewer were after

Table 7. Sport fishing harvest at Buckhorn Reservoir between March 1 and October 31, 1966. Values were derived from expansion of data resulting from fishermen counts and from creel survey interviews with 552 anglers during the 8-month period.

Month	Man-hours fished	White bass	Black basses	Crappies	Channel cat	Flathead cat	Rock bass	Sunfishes	Suckers	Drum	Total
					Fish						
March	4,628	83	204	5,913	15	-	-	4,978	7	-	11,200
April	4,789	4,129	80	5,108	45	141	-	1,099	85	24	10,711
May	10,116	154	1,080	7,426	-	-	54	4,910	-	40	13,664
June	6,670	468	418	1,237	61	-	-	5,467	-	134	7,785
July	5,609	184	502	871	1,174	29	-	2,986	-	-	5,746
August	7,448	197	1,397	1,507	-	45	-	3,547	-	-	6,693
September	6,195	2,222	366	5,067	77	-	-	6,141	-	-	13,873
October	4,510	369	360	3,124	79	-	-	3,319	-	56	7,307
Total	49,965	7,806	4,407	30,253	1,451	215	54	32,447	92	254	76,979
Percent of total catch		10.1	5.7	39.3	1.9	0.3	0.1	42.2	0.1	0.3	100.0
					Pounds						
March		69	492	1,484	28	-	-	881	8	-	2,962
April		3,579	73	1,313	81	191	-	153	85	69	5,544
May		171	1,802	2,170	-	-	15	884	-	23	5,065
June		472	609	345	225	-	-	1,126	-	93	2,870
July		52	758	155	44	29	-	615	-	-	1,653
August		111	1,807	330	-	98	-	545	-	-	2,891
September		1,420	565	1,440	200	-	-	1,094	-	-	4,719
October		296	916	859	94	-	-	533	-	162	2,860
Total		6,170	7,022	8,096	672	318	15	5,831	93	347	28,564
Percent of total weight		21.6	24.6	28.3	2.4	1.1	0.1	20.4	0.3	1.2	100.0
Average weight		0.79	1.59	0.27	0.46	1.48	0.28	0.18	1.01	1.37	0.37

Table 8. Angler preference (intent), overall fishing success, and specific success* of 552 fishermen interviewed at Buckhorn Reservoir between March 1 and October 31, 1966.

Species sought	Percent of anglers seeking	Overall success (percent of total catch) Number (*)	Weight	Overall catch rate (fish per hour)
White bass	3.4	3.4 (70.5)	8.4	1.6
Black basses	22.1	6.6 (59.1)	25.2	0.5
Crappies	42.0	58.5 (76.1)	45.8	2.2
Channel cats	0.5	0.2 (37.5)	0.8	0.4
Flathead cats	0.2	0.1 (100.0)	0.6	1.0
Sunfishes	27.7	29.2 (94.6)	16.1	2.2
Drum	0.2	t (100.0)	0.2	0.3
"Anything"	3.8	2.0 (42.9)	2.8	0.9
Total	100.0	100.0	100.0	M_C 1.7

* Specific success: percent of their catch composed of the species sought.

sunfishes (28%), and also fewer were those intent on catching black basses (22%). Less than 4% professed to be after "anything" when asked their preference.

Those anglers seeking flathead catfish and those after drum enjoyed complete success. Although in the minority, since less than 0.2% specified each of these 2 species, they were 100% successful. Sunfish anglers were 95% successful in catching sunfishes. Crappie fishermen were less successful in 1966; only 76% of them caught crappies. White bass anglers were much more successful than they were the previous year; 71% of their number caught white bass. The success of black bass anglers remained about the same at the 59% level.

Overall fishing success, which includes other fish caught in addition to the preferred species, was comparable to that recorded in 1965. The crappie anglers accounted for even more of the total catch (59 vs. 51%) and the sunfish fishermen creeled less (29 vs. 38%). The other categories showed little change (Table 8).

The overall hourly catch rate showed improvement in most all categories. Those anglers preferring crappie had an overall catch rate of 2.2 fish per hour, as did the sunfish anglers. Even those anglers who expressed no preference as to species caught fish at the rate of 0.9 per hour.

The fisherman sex ratio during 1966 was 90 males to 10 females. Exactly 92% of the interviewed fishermen were Kentucky residents. Still fishing was not practiced by as great a percentage of anglers (70 vs. 77%), and casting had more adherents (20 vs. 15%). Again 6% of the anglers preferred trolling, and 4% were fly fishermen.

Fish Stocking

Threadfin shad were first introduced into this reservoir in June 1962, the second year of impoundment, to supplement the meager supply of forage fishes. Buckhorn then was almost, and now is, unique among Kentucky reservoirs in being free of the ubiquitous gizzard shad. The initial stocking of 305 adult threadfin shad, obtained from the tailwater of Tennessee's Fort Loudon Reservoir, proved highly successful according to Turner (1967). But, since he found no threadfin shad in his 1963 population study samples, he was justified in believing that winter-kill had extirpated the species. Attempts by departmental personnel to procure threadfin shad in 1963 for stocking purposes were unsuccessful.

In April and May of 1964, 312 threadfin shad from Cumberland Lake were introduced into Buckhorn Reservoir (to prevent accidental contamination with gizzard shad, these fish were sorted and counted individually). Routine population sampling during the ensuing summer revealed that some threadfin shad from the 1962 stocking had survived through two winters, even though none were found in Turner's 1963 studies, because many more *adult* threadfin than had been stocked earlier in the year were either recovered inside or observed dead outside the 1964 study areas.

Five widely-separated coves in Buckhorn were spot-sampled with dilute rotenone emulsions in September of 1964. A tremendous spawn of threadfin shad, considering that so many adults had been killed during the summer population studies, was observed in four of the five coves. Literally thousands of threadfin, ranging from 0.5 to 3 inches in length and falling into 3 distinct size groups, were seen in distress as school after school moved into the rotenone-treated areas. Each school was sharply segregated into one of the three size classes, with little or no overlapping of sizes. Brook silverside were also extremely abundant in the spot-sampled areas.

Because of the foregoing information, I recommended that Buckhorn Reservoir not be stocked with threadfin shad in the spring of 1965, thereby making more of these sometimes hard-to-obtain fish available for distribution elsewhere. The 1965 population studies in Buckhorn proved this to be a mistake, for not a single threadfin shad was found in the reservoir that year. Since none of the vast population that had existed the previous fall was observed dead or dying during the subsequent winter, as had been observed during the winter of 1962-3, it must be concluded that the threadfin left the reservoir during the fall drawdown.

Consequently, 388 gravid threadfin shad were re-introduced into Buckhorn in May 1966 (Table 9). These fish hauled extremely well with no mortality (51% of the first load in 1964 and 32% of the second load died in transit; this was during the time that threadfin transporting techniques were being perfected). Yet, spot-sampling in October 1966 disclosed only a few (26 + 1) young-of-the-year threadfin in two coves and none in two other coves. The 1966 threadfin shad stocking was inexplicably a dismal failure.

Table 9. Fish stocking summary, Buckhorn Reservoir, 1964 - 1966.

Date	Species	Number	Size (inches)	Site	Source
April 2, 1964	Threadfin shad	111	2-4	Confluence Ramp	Cumberland Lake
May 6, 1964	Threadfin shad	201	3-4	Dam	Cumberland Lake
June 1, 1964	Largemouth bass	39	Brood stock	Confluence Ramp	Gatliff Hatchery
June 8, 1964	Largemouth bass	96	Brood stock	Confluence Ramp	Gatliff Hatchery
May 5, 1966	Threadfin shad	388	4-5	Confluence Ramp	Cumberland Lake

WATER QUALITY

Pronounced thermal stratification was evident when the first temperatures were taken on May 13, 1964 (Table 10). On this date, surface temperatures varied from 75° at Station I (headwaters at Confluence), to 72° at Station II (Elkhorn Creek, mid-lake), to 74° at Station III (dam area). The maixmum surface temperature recorded during the 8-month (May-December) period in 1964 was 88° on June 22 at Station I. The minimum surface temperature during the period was 41° at both Stations I and II on November 23. Only a thin thermocline existed in the lower lake as early as September 15, isothermic conditions already prevailing in the headwaters and at mid-lake. By October 20, the entire reservoir was essentially isothermal.

A well-developed thermocline was found during the summer months in 1964 at all three stations. The epilimnetic layer varied greatly in thickness between months and stations. It reached its greatest thickness in August at Station III, when it extended downward between 15 and 20 feet. Concurrently at this station, two thermoclines were found, separated by a 10-foot layer that could not qualify as part of the thermocline, according to the standard definition. This thermoclinal disruption was probably due to the adclaustral zone effect" described by Fish (1961). To preclude the possibility of errant values in 1965, Station III was changed in location from the dam area uplake to the Otter Creek area.

A typical stratification pattern was recorded at Buckhorn during 1965 (Table 11). Maximum surface temperatures of 84° were reached in July, later but more moderate than recorded the previous year. An isothermal condition was reached by October 12. No disruption of the thermocline was noted during the sampling period which ran from April through October.

Adequate dissolved oxygen to meet the normal needs of fishes was found usually to depths of 35 feet during 1964 and to 30 feet during 1965 (Tables 12 and 13). Dissolved oxygen was seldom absent, even near the bottom, either year.

The total alkalinity of this mountain reservoir, reflecting the nature of the parent material found in the drainage basin, was relatively low (Tables 12 and 13). The vertical series of determinations at the three sampling stations conformed generally to the normal pattern: (1) a gradual increase in total alkalinity from the surface downward, usually accompanied by an abrupt increase in concentration on or near the reservoir bottom; (2) lower than average values following a sudden influx of runoff water (dilution), and higher than average values during periods of low runoff (concentration); and (3) diminishing surface alkalinity from the headwaters in the direction of the dam (precipitation). Bicarbonates alone were responsible for the alkalinity values and are expressed as ppm $CaCO_3$. Total alkalinity generally ranged between the high teens and low twenties.

No water quality determinations were made during 1966.

Table 10. Water temperature of Buckhorn Reservoir, 1964. Temperatures (Fahrenheit) were taken once each month at Stations I (Confluence), II (Elkhorn Creek), and III (Dam). Existing lake elevations (msl) are shown in parentheses. Normal summer pool elevation was 782 feet.

Depth	May 13 (782')			June 22 (782')			July 20 (780')			Aug. 10 (782')			Sept. 15 (778')			Oct. 20 (770')			Nov. 23 (760')			Dec. 28 (775')		
(feet)	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
0	75	72	74	88	86	85	84	83	85	83	83	84	74	77	81	56	57	57	41	41	52	48	48	48
5	74	71		82	84	85	76	83	84	78	83	84	74	77	77	56	57	57	41	41	52	48	48	48
10	73	71	73		83	82	69	81	81	75	83	84	74	76	77		57	57		41	52	48	48	48
15	69				76	76		80	78	74	83	84	74	76	77		56	56			51		48	48
20	64	66	65		71	72		76	74		79	79		76	76		56	56			51			48
25					67	68		74	70		77	76		75	76			56			51			48
30		62	61		64	65			67		75	75			76			56			51			48
35						63			62			74			75			56			51			48
40		54	59			60			60			71			74			55						48
45						59			57			66						55						
50			53						54			61												
55			52						54			57												

Table 11. Water temperature of Buckhorn Reservoir, 1965. Temperatures (Fahrenheit) were taken once each month at Stations I (Confluence), II (Elkhorn Creek), and III (Otter Creek). Existing lake elevations (msl) are shown in parentheses. Normal summer pool elevation was 782 feet.

Depth (feet)	April 28 (781')			May 12 (782')			June 16 (782')			July 15 (782')			Aug. 11 (781')			Sept. 9 (780')			Oct. 12 (773')		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
0	63	65	64	72	73	74	75	78	77	84	83	84	83	82	83	81	83	82	69	69	70
5	63	65	64	72	73	73	75	78	77	84	83	84	80	82	83	78	82	82	64	68	70
10	62	65	64	72	71	70	75	78	77	83	83	84	78	81	82	76	80	81	62	68	69
15		65	62		67	67		78	77		81	82		81	82		80	80		67	69
20		63	61		65	65		72	72		77	78		81	80		79	79			69
25		61	60		62	62		69	68		74	76		80	79		78	79			69
30		60	60		62	61			66		73	72		76	76		78	76			
35			58			60			63		71	70		75	74			76			
40			58																		

Table 12. Dissolved oxygen content (ppm) and total alkalinity (ppm) of Buck horn Reservoir, 1964. Determinations were made once each month at Stations I (Confluence), II (Elkhorn Creek), and III (Dam). Existing lake elevations (msl) are shown in parentheses. Normal summer pool elevation was 782 feet.

Depth (feet)	May 13 (782')			June 22 (782')			July 20 (780')			Aug. 10 (782')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	8.2 31	9.0 22	8.6 20	7.8 47	9.6 24	8.2 16	8.2 58	8.8 24	8.4 17	8.6 33	7.6 29	8.7 18
10	9.4 32	9.2 22	8.6 21	6.6 46	9.0 23	8.1 19	2.4 48	9.0 24	8.8 18	7.0 28	7.9 30	8.8 18
20	5.8 30	9.4 22	9.0 22		8.0 35	8.4 18		6.2 35	8.3 21		5.2 37	8.6 17
30		7.2 25	7.6 22		1.5 35	6.4 20			7.0 20		5.0 26	1.4 34
40		4.8 32	7.8 24			3.4 22			1.3 25			0.6 30
50			7.2 19						0.4 44			
55									0.2 28			0.0 47

Depth (feet)	Sept. 15 (778')			Oct. 20 (770')			Nov. 23 (760')			Dec. 28 (775')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	8.2 48	7.8 30	7.2 31	8.2 19	9.0 9	7.8 5	12.8 19	12.6 20	9.6 38	11.2 13	10.6 16	10.8 17
10	7.4 48	8.4 31	6.6 26		9.2 13	7.6 16		12.2 19	9.3 38		11.2 18	11.0 22
20		7.6 32	6.8 24		9.0 16	6.8 17			9.7 35			10.2 16
30			7.0 24			7.6 21			9.8 36			11.0 17
40			2.2 29			7.6 12						10.6 16

Table 13. Dissolved oxygen content (ppm) and total alkalinity (ppm) of Buckhorn Reservoir, 1965. Determinations were made once each month at Stations I (Confluence), II (Elkhorn Creek), and III (Otter Creek). Existing lake elevations (msl) are shown in parentheses. Normal summer pool elevation was 782 feet.

Depth (feet)	April 28 (781')			May 12 (782')			June 16 (782')			July 15 (782')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	8.6	9.6	9.8	7.8	8.8	8.6	6.8	8.0	8.4	7.2	8.6	8.4
	12	14	13	23	15	14	47	21	16	17	22	19
10	8.4	9.4	9.2	7.6	9.0	9.2	6.6	8.2	8.4	4.2	8.6	8.2
	12	14	13	31	15	14	47	21	16	16	23	19
20		8.0	8.2		8.4	9.4		6.4	8.6		5.2	6.0
		13	13		15	13		24	17		34	17
30		8.1	8.2		6.4	7.6		2.1	8.2		4.4	1.8
		14	14		12	14		26	16		34	21
40			8.4						6.8			
			13						15			

Depth (feet)	Aug. 11 (781')			Sept. 9 (780')			Oct. 12 (773')		
	I	II	III	I	II	III	I	II	III
0	7.4	7.8	8.0	8.0	8.1	8.1	9.2	7.7	8.0
	48	29	22	79	32	27	55	40	28
10	4.8	8.0	7.6	7.8	8.3	7.9	8.2	8.1	7.4
	50	28	21	80	31	27	49	45	30
20		1.4	7.6		7.6	6.0			7.6
		35	20		36	29			29
30			1.0		4.4	4.0			
			28		42	28			

RECOMMENDATIONS

Gravid threadfin shad, preferably the Cumberland Lake strain, should be stocked early each spring in Buckhorn Reservoir to supplement the very low forage fish population that has existed there since impoundment. Extreme care should be exercised (each threadfin should be identified by qualified personnel) to prevent accidental inclusion of gizzard or hybridized shad among the specimens introduced. I believe that the very satisfactory sport fishing success enjoyed at Buckhorn ever since impoundment has been due in large measure to the continuing absence of gizzard shad.

Future creel surveys should be of the non-uniform probability type since experience has shown this type to be much more efficient in time and effort expended by the creel clerk, and, the statisticians assure us, less subject to bias. Creel surveys produce a much better index to sport fishing quality than does fish population sampling. Consequently, creel surveys should be employed whenever and wherever such information is deemed desirable. Future surveys should differentiate between the individual fish species, especially the game fishes, and should not lump them into groups such as "black basses", "sunfishes", etc.

SUMMARY

1. The sport fishery of Buckhorn Reservoir, a 1250-acre multi-purpose reservoir in southeastern Kentucky, has been under continuous observation by the Fisheries Division of the Kentucky Department of Fish and Wildlife Resources since impoundment in late 1960. The present investigation reported on in this bulletin began in early 1964 and continued through 1966.

2. The primary objectives of the study, Dingell-Johnson Project No. F-22-R, were to determine:

A. Fish population dynamics, by sampling.
B. Sport fishing quality, by creel surveys.
C. Fish stocking success, by spot sampling.
D. Water quality, by physico-chemical determinations.

3. The standing crop (biomass) during 1964 and 1965 averaged 62 and 63 pounds per acre, respectively. The percentage of the biomass composed of harvestable-size fish appeared to have stabilized between 56 and 59%, considerably higher than any previous A_t value.

4. The game fishes (white, largemouth, and spotted basses, and white crappie) increased slightly in relative abundance, going from 21% of the 1350-fish per acre population in 1964, to 18% of the 1685-fish per acre population in 1965. The group's biomass, however, registered a significant increase between years, going from 17% (10 pounds per acre) in 1964, to 28% (18 pounds per acre) in 1965. Harvestable-size game fishes numbered 5 per acre in 1964 and 9 per acre in 1965.

5. Food fishes (channel and flathead catfishes) were poorly represented in the sampled population. They contributed between 2 and 5 pounds per acre to the annual biomass.

6. The only member of the predatory fish group recovered from the sampled coves was intermediate-sized specimens of longnose gar. Gar were relatively scarce both years and their contribution to the biomass was negligible.

7. Bluegill and longear sunfish were the major and rock bass and green sunfish the minor components of the panfish group. The panfishes were by far the dominant group in the reservoir both years (70% in 1964 and 73% in 1965).

8. The commercial fish group (redhorses, yellow bullhead, and quillback) dominated the standing crop by accounting for 46% of the biomass both years. That

these were large specimens is revealed by the fact that the group comprised only 3 to 4% of the sampled population.

9. The forage fishes, usually the most abundant single group in a large reservoir, were very weakly represented. Only 1% of the biomass came from this group.

10. Sport fishing quality, particularly fisherman success, was judged very satisfactory, considering the low standing crop available for angler exploitation. The annual average catch rate in 1964, 1965, and 1966 was 1.4, 1.5, and 1.5 fish per man-hour. During the same period, the percentages of successful anglers were 78, 68, and 78%.

11. Fishing pressure between April 1 and October 31, 1964 amounted to 51 man-hours per acre. The following year, over the same 7-month period, the pressure dropped to 47 man-hours per acre. March was included in the 1966 creel survey; fishing pressure that year was 40 man-hours per acre.

12. Interviewed anglers were asked to specify which particular species they sought; their success in catching the species specified, as well as other species, was determined and evaluated. Some shifting in angler preference was noted from year to year, but the species most often mentioned was sunfish. From 4 to 6% of the anglers each year stated they had no preference and were after "anything".

13. Anglers intent on catching crappie increased from 21% of all interviewees during 1964, to 33% in 1965, to 42% in 1966. Their overall catch rate, which included all species caught while fishing for crappie, was higher each year than that of anglers seeking some other species. Crappie anglers creeled fish in 1964 at the rate of 1.8 fish per man-hour; in 1965 the rate was 1.9; and in 1966 the rate rose to 2.2 fish per man-hour.

14. Less than one fourth of the interviewees each year was fishing primarily for black basses. The catch rate these anglers enjoyed varied from 0.4 to 0.5 fish per man-hour, among the lowest catch rates posted.

15. Sunfish anglers enjoyed the second-highest catch rate each year: 1.7, 1.6, and 2.2 fish per man-hour. They were among the most successful in catching the species specified; 86% of the fish they creeled in 1964 was sunfishes, the following year 94% was sunfishes, and in 1966 nearly 95% of their catch was the sought-after species.

16. The size of the average fish caught in Buckhorn showed a steady increase from 0.25 pound in 1964, to 0.31 pound in 1965, to 0.37 pound in 1966.

17. Threadfin shad, first introduced into this reservoir in June 1962 to supplement the meager forage fish population, were re-introduced in 1964 and again in 1966. The initial stocking was almost completely decimated by winterkill. The 1964-stocked threadfin, very successful in bringing off at least three distinct spawns that summer, apparently all migrated from the reservoir during the fall drawdown. The 1966-stocked threadfin failed to spawn successfully.

18. Water quality determinations at three widely separated stations documented physical and chemical characteristics well within expected ranges. Thermal stratification was typical and well defined during the warmer months. Dissolved oxygen, even near the bottom, was found in adequate amounts to meet the normal needs of fishes. Total alkalinity, reflecting the nature of the parent material in the drainage basin, ranged from the high teens to the low twenties (as ppm $CaCO_3$).

19. Annual spring stocking of gravid threadfin shad, carefully identified to prevent accidental contamination of this reservoir with gizzard shad, was recommended.

20. It was recommended that future creel surveys be of the non-uniform probability type since experience has shown them to be more efficient and less subject to bias. Separation of individual species, rather than lumping several species into a single category (e.g., "black basses") on the creel cards was also recommended for the creel clerks.

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A P P E N D I X

Figure A-1

Figure A-1. Kentucky's Standard Form for reporting fish population study data. The A_{tl} or "legal A_t" applies to only those species having a legal size limit.

GROUP (species)	FINGERLING SIZE			INTERMEDIATE SIZE			HARVESTABLE SIZE		
	Range	Number per acre	Pounds per acre	Range	Number per acre	Pounds per acre	Min. inch group	Number per acre	Pounds per acre
GAME FISH GROUP									
Rainbow trout	0-4			5-7			8		
Ohio muskellunge	0-4			5-29			30 (A_{tl})		
Chain pickerel	0-4			5-11			12		
Grass pickerel	0-4			5-9			10		
White bass	0-4			5-8			9		
Yellow bass	0-4			5-6			7		
Sauger	0-4			5-11			12		
Walleye	0-4			5-14			15 (A_{tl})		
Largemouth bass	0-4			5-11			12 (A_{tl})		
Smallmouth bass	0-4			5-11			12 (A_{tl})		
Spotted bass	0-4			5-11			12 (A_{tl})		
Black crappie	0-4			5-7			8		
White crappie	0-4			5-7			8		
FOOD FISH GROUP									
Blue catfish	0-4			5-9			10		
Channel catfish	0-4			5-9			10		
Flathead catfish	0-4			5-9			10		
PREDATORY FISH GROUP									
Skipjack herring	0-4			5-9			10		
Goldeye	0-4			5-9			10		
Mooneye	0-4			5-9			10		
Longnose gar	0-4			5-23			24		
Shortnose gar	0-4			5-23			24		

Figure A-1. (continued)

GROUP (species)	FINGERLING SIZE Range	FINGERLING SIZE Number per acre	FINGERLING SIZE Pounds per acre	INTERMEDIATE SIZE Range	INTERMEDIATE SIZE Number per acre	INTERMEDIATE SIZE Pounds per acre	HARVESTABLE SIZE Min. inch group	HARVESTABLE SIZE Number per acre	HARVESTABLE SIZE Pounds per acre
PREDATORY FISH GROUP (continued)									
Spotted gar	0-4			5-23			24		
Bowfin	0-4			5-13			14		
American eel				8-15			16		
PANFISH GROUP									
Rock bass	0-2			3-5			6		
Bluegill	0-2			3-5			6		
Green sunfish	0-2			3-5			6		
Hybrid sunfish	0-2			3-5			6		
Longear sunfish	0-2			3-5			6		
Redear sunfish	0-2			3-5			6		
Warmouth	0-2			3-5			6		
COMMERCIAL FISH GROUP									
Sturgeons	0-7			8-23			24		
Paddlefish	0-7			8-23			24		
Buffalofishes	0-4			5-11			12		
Carpsuckers	0-4			5-11			12		
Hogsucker	0-4			5-11			12		
Redhorses	0-4			5-11			12		
White sucker	0-4			5-11			12		
Spotted sucker	0-4			5-11			12		
Carp	0-4			5-11			12		
Bullheads	0-4			5-8			9		
Drum	0-4			5-9			10		

Figure A-1. (continued)

GROUP (species)	FINGERLING SIZE			INTERMEDIATE SIZE			ABOVE FORAGE SIZE		
	Range	Number per acre	Pounds per acre	Range	Number per acre	Pounds per acre	Min. inch group	Number per acre	Pounds per acre
FORAGE FISH GROUP									
Lampreys	0-3			4-7			8		
Gizzard shad	0-3			4-7			8		
Threadfin shad	0-3			4-7			8		
Shiners	0-3			4-7			8		
Misc. cyprinids	0-3			4-7			8		
Madtoms	0-3			4-7			8		
Topminnows	0-3			4-7			8		
Darters	0-3			4-7			8		
Orangespotted sunfish	0-3			4-7			8		
Brook silverside	0-3			4-7			8		
Sculpins	0-3			4-7			8		