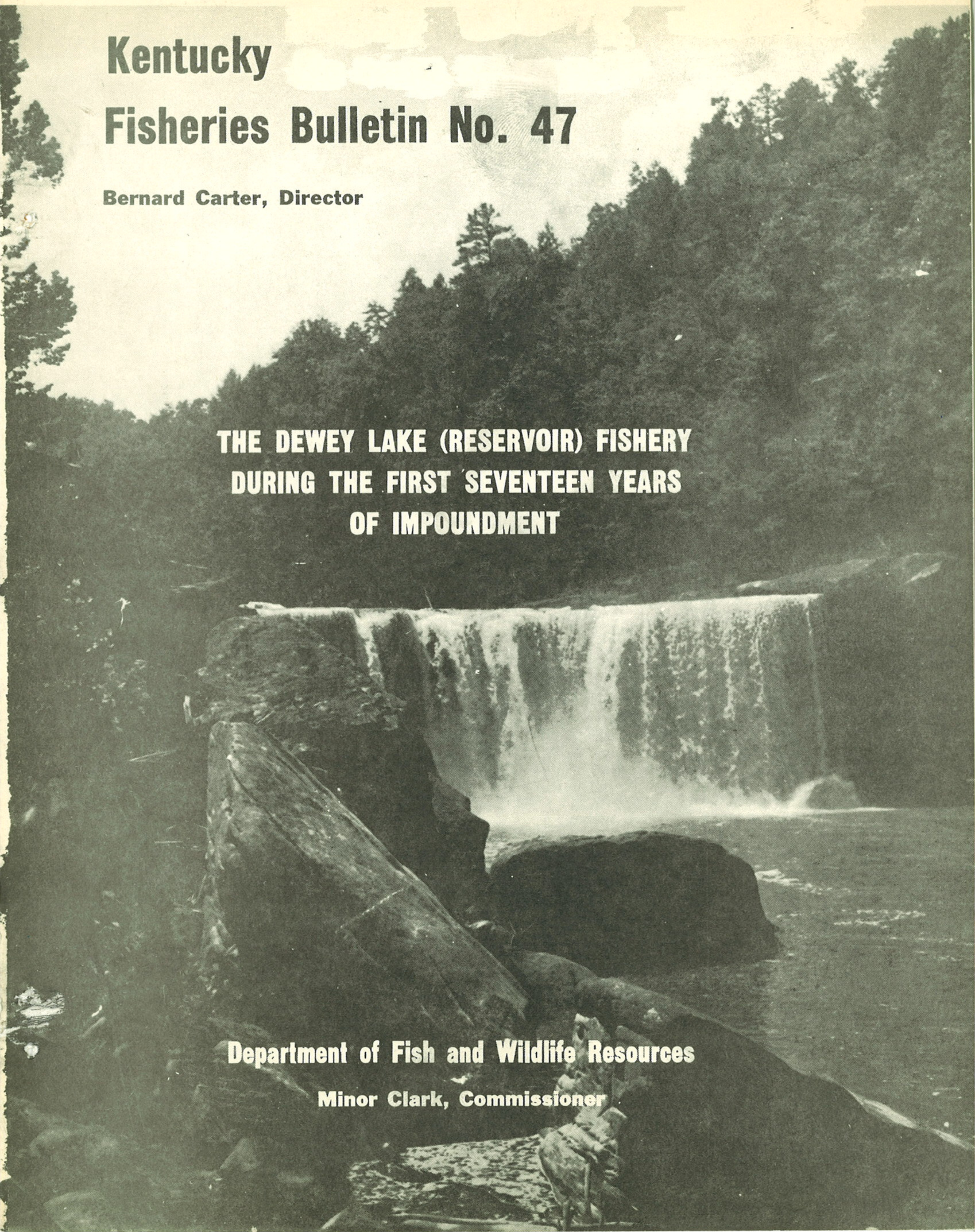

Kentucky Fisheries Bulletin No. 47

Bernard Carter, Director

THE DEWEY LAKE (RESERVOIR) FISHERY DURING THE FIRST SEVENTEEN YEARS OF IMPOUNDMENT

Department of Fish and Wildlife Resources

Minor Clark, Commissioner

THE DEWEY LAKE (RESERVOIR) FISHERY

DURING THE FIRST SEVENTEEN YEARS OF IMPOUNDMENT

By

James R. Charles

Principal Fishery Biologist

This project was financed partially with

Federal Aid in Fish Restoration Funds

Kentucky Project F-22-R

1967

CONTENTS

ABSTRACT

The sport fishery of Dewey Lake (Reservoir), an 1100-acre flood control reservoir in eastern Kentucky, has been under continuous observation and management by the Fisheries Division of the Kentucky Department of Fish and Wildlife Resources since impoundment in mid-1949. Major research and management activities conducted prior to 1964 are reviewed and summarized. The latest investigation at Dewey, reported on in detail in this bulletin, began in the spring of 1964 and continued through 1966.

The primary objectives of the present study, Dingell-Johnson Project No. F-22-R, were to determine (or accomplish):

- *A. Fish population dynamics, by cove rotenone sampling.*
- *B. Fish stocking success, by spot-sampling.*
- *C. Sport fishing quality, by creel surveying.*
- *D. Fish habitat enhancement, by artificial cover emplacement.*
- *E. Fish population thinning, by lake drawdown.*
- *F. Water quality, by physico-chemical determinations.*

Fish population studies have been conducted at Dewey every summer since 1951 - 15 consecutive years of sampling. Wide fluctuation in the fish population has occurred from year to year, in response to various population manipulation efforts, not only in relative abundance and biomass, but in the size-class structure as well. Most of the research and management activities have been directed toward suppression of a single species: gizzard shad.

Sport fishing quality between 1964 and 1966 was judged to have been both satisfactory and unsatisfactory depending upon the parameters used: the annual average catch rate ranged between 0.70 and 0.93 fish per man-hour, considered moderately good; fisherman success during the same 3-year period ranged from 34% to 43% successful anglers, considered rather poor.

The lakebed at Dewey Lake was clear-cut prior to impoundment; consequently, to enhance the habitat for both the fish and the fisherman, 4 used automobile bodies were clumped at each of 50 sites in the lower half of the lake in 1963. An additional 250 used car bodies were placed at 25 of the better locations in 1965. Each site was marked by a numbered, wooden float cabled to the center body in the cluster.

Attempting to thin out the gizzard shad and white crappie populations in Dewey Lake, the lake level in October, 1962 was lowered rapidly from 650 feet to 625 feet. Results of the rapid drawdown, evaluated by population sampling the following summer, were quite satisfactory. A second drawdown was accomplished in November, 1964, when the lake was lowered 25 feet in 5-foot decrements. The 5-stage drawdown did not achieve the desired results; in fact, gizzard shad were nearly as abundant the following year as they had been before the drawdown.

Water quality determinations at three widely separated stations, made for the first time on a monthly, year-round basis in 1964 and 1965, documented physical and chemical characteristics well within expected ranges. Thermal stratification was typical and well defined during the warmer months.

INTRODUCTION

Dewey Reservoir, named after a post office and a school once located near the dam site and more commonly known in Kentucky as Dewey Lake, was created in mid-1949 by a U. S. Army Corps of Engineers dam across Johns Creek in Floyd County near Prestonsburg. Johns Creek enters Levisa Fork of the Big Sandy River 5.4 miles downstream from the dam. Nearly 47 miles downstream from the mouth of Johns Creek, at Louisa, Kentucky, the Levisa Fork combines with the Tug Fork to form the Big Sandy River, the latter two streams forming the boundary between Kentucky and West Virginia. In addition to its primary function of controlling run-off from a drainage basin of 207 square miles and providing flood control in this part of the Big Sandy River Basin, Dewey Lake is one unit in the coordinated system of reservoirs designed to reduce floods on the Ohio and lower Mississippi Rivers.

Completed July 22, 1949, the water level behind the rolled earthfill dam first reached the then normal summer conservation pool elevation of 645.0 feet on June 14, 1950. During the ensuing 11 years, or until Buckhorn Reservoir on the Middle Fork of the Kentucky River was completed in late 1960, Dewey Lake was the only large body of impounded water in the state east of a north-south line bisecting Lexington, between Cincinnati, Ohio and the Tennessee border. Despite the mountainous terrain and other forbidding aspects of the watershed, the Dewey Lake basin and adjacent environs are densely populated, compared to other areas in eastern Kentucky. Quite naturally the local fishermen looked forward to and expected good fishing close at hand, now that they no longer had to travel great distances to reach impounded fishing waters. Their high hopes and great expectations were never fully realized — or at best, short-lived.

As early as 1954, the fifth year of impoundment, a fishery biologist was assigned to work full time at Dewey Lake to investigate the reasons for the declining fishing quality. Fish population samples and creel surveys, the former taken every year since 1951 and the latter first made in 1954, indicated a decline in game fish numbers and weight. As will be documented throughout this bulletin, the Fisheries Division has subsequently expended more time and effort attempting to improve the fishing quality at Dewey Lake than at any other impoundment in the state (Table 1).

Although I have reviewed and summarized the major research and management activities carried on at Dewey Lake during its first 17 years, only during the latter 3 years (1964 through 1966) were those activities under my leadership. [Detailed analysis and evaluation of data obtained prior to 1964 is beyond the scope of this publication; available reports and the years covered are listed under DEWEY LAKE BIBLIOGRAPHY.] Dewey Lake was one of several impoundments under study by Dingell-Johnson Project No. F-22-R (Reservoir Research and Management), of which I was project leader. The objectives of this project were to determine (or accomplish):

A. Fish population dynamics, by cove rotenone sampling.
B. Fish stocking success, by spot-sampling.
C. Sport fishing quality, by creel surveying.
D. Fish habitat enhancement, by artificial cover emplacement.
E. Fish population thinning, by lake drawdown.
F. Water quality, by physico-chemical determinations.

ACKNOWLEDGEMENTS

Much credit for all aspects of the project work, both indoors and out, is due to my former full-time Fishery Aide, Charles Gorham. Summer Aide Robert Rash contributed materially to the summer field work. I am particularly grateful to Raymond Copley, former conservation officer of Floyd County, for the competent manner in which he performed the creel survey duties assigned him. The Corps of Engineers was always helpful and cooperative in our joint ventures. Dean Murray, Corps reservoir manager, was especially helpful and accommodating. Last, but not necessarily least, is my appreciation of

Table 1. Research and management activities at Dewey Lake since impoundment.

Year	Cove population studies	Fish stocked	Creel surveys	Experimental netting	Selective shad poisoning	Water quality analyses	Experimental drawdowns	Fish attractor emplacement	Principal investigator (*)
1950 [Lake filling — no activity]									---
1951	x								BTC
1952	x								BTC
1953	x	x							BTC
1954	x	x	x	Apr.-Oct.					ERC
1955	x	x	x	Apr.-Sept.	March September				ERC
1956	x	x			October				BTC
1957	x	x			October				BTC
1958	x	x	x		October	May-Oct.			WAS
1959	x	x	x		September	May-Sept.			WAS
1960	x	x	x						EWW
1961	x	x	x						EWW
1962	x	x	x	Mar.-May Nov.-Dec.			Nov.-Feb.		EWW
1963	x	x	x	March				April	JKA
1964	x	x	x			May-Dec.	Nov.-Dec.		JRC
1965	x	x	x			Mar.-Nov.		November	JRC
1966		x	x						JRC

(*) Identified in "Acknowledgements" section.

cooperation extended by personnel of Jenny Wiley State Park, notably that of Mark Lovely, former dock manager.

Listed below are the principal investigators who have been assigned to Dewey Lake since its impoundment, their tenure, and the Dingell-Johnson projects of which they were project leaders. The publications resulting from their work at Dewey Lake are listed under DEWEY LAKE BIBLIOGRAPHY, in the back of this bulletin. For brevity and clarity (three different Carters have published on Dewey Lake), references to their publications are indicated by their initials; e.g., (ERC, 1954). Literature citations with the conventional surname and year will be found under OTHER LITERATURE CITED.

1950	Lake filling — no investigation
1951	Bernard T. Carter (State sponsored)
1952	Bernard T. Carter (State sponsored)
1953	Bernard T. Carter (State sponsored)
1954	Ellis R. Carter F-8-R (1)
1955	Ellis R. Carter F-8-R (2)
1956	Bernard T. Carter (State sponsored)
1957	Bernard T. Carter (State sponsored)
1958	William A. Smith F-11-R (3)
1959	William A. Smith F-11-R (4)
1960	Eugene W. Whitney F-11-R (5)
1961	Eugene W. Whitney F-19-R (1)
1962	Eugene W. Whitney F-19-R (2)
1963	Jon K. Anderson F-19-R (3)
1964	James R. Charles F-22-R (1)
1965	James R. Charles F-22-R (2)
1966	James R. Charles F-22-R (2, extended)

METHODS AND MATERIALS USED

Fish Fauna Studies

Fish population studies were conducted in cove areas at Dewey Lake 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 July of both 1965 and 1966.

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, (0.4 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.)

* None of the coves sampled in 1964 or 1965 were actually measured, the surface acreage of these coves having been determined and accepted for many years. Stadia surveying subsequent to preparation of this manuscript showed two of the three coves are larger than listed.

9. Appropriate field notes will be kept and the resulting data will be reported according to recommendations of the Reservoir Committee, Southern Division, American Fisheries Society.

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

Although the sampling methods used by the earlier investigators did not meet all the above criteria (for example, block nets were first used at Dewey late in 1959, by Smith), the evolution of sampling methodology has been so gradual that it permits valid comparison of annual population statistics, particularly trends in the fish population.

Fish Stocking

Threadfin shad, *Dorosoma petenense* (Gunther), were procured from the Beaver Creek area of Cumberland Lake (Kentucky) for introduction into Dewey Lake, since it is believed that this strain may be more winter-hardy. Preponderantly-ripe specimens of this strain were stocked each spring all three years (1964 - 1966). The desirability of threadfin shad as a forage species and as a competitor/suppressor of gizzard shad, *Dorosoma cepedianum* (LeSueur), is well documented (Henley, 1967). Unfortunately, eastern Kentucky winters have proven too severe for threadfin survival; annual spring stocking of this species is now a standard management procedure.

Largemouth bass, *Micropterus salmoides* (Lacepede), were stocked in Dewey Lake during January 1965, following the drastic 1964 winter drawdown, to augment and supplement this most-important game/predator species.

Creel Surveys

Two distinctly different types of creel surveys were used at Dewey Lake to determine sport fishing quality and related statistics. A systematic, stratified creel survey was conducted from April 1 through October 31, 1964.

Total fishing pressure was determined by the mean count method (Lambou, 1961) whereby:

$$f = C\bar{x}$$

where f = number of man-hours of fishing
C = number of fishing hours available between April 1 and October 31
$\bar{x}$ = mean number of fishermen observed per count.

In the first survey the creel clerk made total fisherman counts, and interviewed anglers, between the hours of 7:00 a.m. and 7:00 p.m., arbitrarily defined as a fishing day. The 12-hour fishing day was divided for survey purposes into three 4-hour time periods. Each day of the week was equally represented in the survey schedule; each was sampled on 9 different dates during the 1964 creel survey. However, since only 1 of the 3 available 4-hour time periods was used on any scheduled survey day (e.g., Wednesday: 7-11 a.m.), complete coverage of any 12-hour fishing day required 3 separate dates on the creel survey schedule. Therefore, each day of the week was completely surveyed 3 times during the 214-day period.

Because total fisherman counts could be made at Dewey Lake in less than an hour, the counts were considered as being instantaneous. Half of the counts was made at the beginning of the survey periods prior to the fisherman interviews; half was made after the interviews were completed, but before the end of the 4-hour time period. The creel clerk interviewed as many fishermen as possible during the scheduled periods. Three holidays (Memorial Day, Independence Day, and Labor Day) were treated as Sundays for creel survey purposes, and were deducted from the appropriate week-day fishing pressure estimates.

A non-uniform (unequal) probability creel survey was conducted at Dewey Lake for the first time between April 1 and October 31, 1965, and was used again during the same period in 1966. The systematic-stratified type was used to survey the sport fishing during March of 1966 since prior creel data for that 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 state-owned Kentucky lake in 1965, has published (1966) a report that details the methodology used in designing a survey of this type. The only difference in our methods was that of the basic time interval: he divided the basic 12-hour fishing day 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 1100-acre reservoir.

Fish Attractors

The lakebed at Dewey Lake was completely cleared of timber prior to impoundment. Also, the lake basin contained almost no rock outcroppings or other kinds of cover. In an attempt to create areas of fish concentration, 4 used automobile bodies were clumped at 50 sites in the lower half of the lake during April of 1963. While only 5% of the interviewed anglers fished over these so-called fish attractors that summer, they caught 14% of all fish taken by the interviewees (JKA, 1964). This encouraged us to emplace additional car bodies in the lake.

The November 1965 fish attractor emplacement operation was completed in 10 days and required 460 man-hours of labor. An additional 250 used car bodies were placed in the lake at 25 of the 50 original attractor sites. Since there were already 4 car bodies at all the original sites, there is now a cluster of 14 car bodies at 25 of the better locations. The car bodies were sunk to a depth of at least 10 feet below the surface at summer pool stage (650 msl), but not so far from shore as to be located in the oxygen-depleted hypolimnion. Each attractor site was marked by a styrofoam-floated wooden buoy cabled to the center body in the cluster. The buoys have numbered yellow signs stating "Fish Attractor". An eye bolt is placed on each side of the buoy. It was hoped that provision of boat-anchoring facilities would encourage greater utilization of the sites by the angling public. The first attractor signs used were mounted on steel stakes driven into the bank and were equipped with arrows pointing to the location of the car bodies. These signs were removed because they did not accurately depict the site and because of vandalism.

In the summer of 1966, at the request of local fish and game club members, a moderate number of trees growing along the banks of certain coves in the upper half of the lake were felled into the water to create brush fish shelter attractors. Project personnel that summer selected and marked each tree, primarily oak and beech. Club members felled the trees and cabled each trunk to its stump to fulfill Corps of Engineers' requirements.

The car-body fish attractors were evaluated by creel surveys and limited SCUBA diving observations. The findings are discussed in the section entitled Creel Surveys: 1964 - 1966. The brush shelter attractors were not evaluated.

Experimental Drawdowns

In October, 1962 in an attempt to thin out the gizzard shad and the white crappie populations in Dewey Lake, the lake level was rapidly lowered from 650 feet to 625 feet and held at this level until March, 1963. This drawdown reduced the surface acreage from 1100 acres to 220 acres. Experimental rough fish removal by netting was then practiced until the first week in December, after which an ice cover prevented netting until March, (JPC, 1963). Results of the rapid drawdown were gratifying; gizzard shad abundance decreased from 2045 fish per acre in 1962, to 689 per acre in 1963. Shad biomass decreased from 124 pounds per acre in 1962, to 35 pounds in 1963, among the lowest values ever recorded at Dewey Lake (JKA, 1963).

A second drawdown was indicated after the 1964 population study data were tabulated: gizzard shad were more abundant (4049 per acre) and their biomass greater (227 pounds per acre) than at any time in the history of the lake (JRC, 1965). Consequently, the lake was lowered beginning October 31, 1964 in 5-foot decrements according to the following timetable:

Stage	Elevation	Gates opened	Gates closed (next day)	Hours required
First	650' to 645'	Oct. 31 (Sat.) 6:00 a.m.	1:00 p.m.	31
Second	645' to 640'	Nov. 10 (Tues.) 6:00 a.m.	7:00 a.m.	25
Third	640' to 635'	Nov. 17 (Tues.) 6:00 p.m.	3:00 p.m.	21
Fourth	635' to 630'	Nov. 24 (Tues.) 8:00 p.m.	3:00 p.m.	19
Fifth	630' to 625'	Dec. 1 (Tues.) 8:00 p.m.	12:00 noon	16

The reservoir was then held at 625 feet during the month of December to permit installation of a water line between Jenny Wiley State Park Lodge and the Park swimming beach.

Adjacent to the tailrace below Dewey Dam, separated by a concrete wall that forms one of the sides, is the emergency spillway. The spillway "chamber" (much like a small navigation lock chamber) is 140 feet long, 46 feet wide (0.15 acre), and during periods of normal discharge averages 8 feet deep (1.20 acre feet). A concrete sill across the downstream end of the chamber provided an excellent base for a block net. During normal discharge, the water below the dam eddied only several inches deep across the top of the sill, connecting the tailrace and spillway chamber. Several feet of water covered the sill, however, during each of the five drawdown discharges. Many of the fish that spilled through the dam sought the quiet water of the spillway chamber by swimming around the end of the concrete wall that deflected the roaring tailrace discharge water away from the chamber mouth. Prior investigation had shown that the spillway chamber was the logical site for the drawdown evaluation studies.

Sodium cyanide in briquette form was the fish toxicant used throughout the drawdown population sampling. Water temperatures that ranged between 44° and 58° ruled out rotenone. The briquettes were weighed out into dip nets which were then hung over the side of a moving boat. Fish usually became distressed before the NaCn had completely dissolved. From 6 to 10 pounds of NaCn were used for each study.

A small-mesh block net was tautly stretched across the chamber sill after each stage of the drawdown and was anchored in place with large rocks. The net was positioned while the water was still receding. Very few fish escaped from the chamber after the net was in place.

Water Quality Determinations

Water-quality sampling stations were established at three locations (headwater, mid-lake, and dam) in Dewey Lake. Physico-chemical determinations were made once each month, weather (ice cover) permitting, during 1964 and 1965. No determinations were made after 1965. Water temperatures were taken at 5-foot intervals, from surface to bottom, with an electrical-resistance thermometer calibrated in Fahrenheit. Current water-level elevation was obtained by reading the gauge, or from the dam operator. 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. Free carbon dioxide content was monitored only during the 1964 winter drawdown.

DESCRIPTION OF DEWEY LAKE AND WATERSHED

Being primarily a flood control reservoir, Dewey Lake normally fluctuates 5 feet between summer conservation pool level and winter flood storage pool level. During the first 5 years of impoundment the summer pool at Dewey Lake was maintained at 645 feet above mean sea level. At this elevation the lake was 16.8 miles long and contained 880 surface acres. Various interests prevailed upon the Corps of Engineers for a larger summer pool; beginning in 1955, the summer pool was raised 5 feet to 650 feet during the summer and fall seasons. This increased the size of Dewey Lake to 18.5 miles long and 1100 acres. From April 1 to November 1 the lake contains 17,200 acre-feet of water at an average depth of 15.6 feet (ERC, 1956). Total capacity at elevation 686 (spillway crest) is 93,300 acre-feet, of which 81,000 acre-feet above elevation 645 is reserved for flood control. Maximum depth is 56 feet. During the experimental drawdowns of 1962 and 1964, described in another section of this bulletin, the lake level was reduced 25 feet. At elevation 625 the lake was only 220 acres in size and contained 1560 acre-feet.

Johns Creek originates in Pike County, Kentucky, approximately 7 miles from the West Virginia border. It flows northwestward through Pike and Floyd Counties and joins the Levisa Fork of the Big Sandy River near Auxier, Kentucky, on the Floyd-Johnson County boundary (EWW, 1962).

The Dewey Lake watershed is steep and mountainous and lies entirely in the Eastern Coal Field physiographic region of the state. The watershed is forested with second and third growth mixed mesophytic hardwoods interspersed with pines in the open areas and hemlock on the north-facing slopes and narrow stream valleys. Most of the valleys are under cultivation to garden crops, tobacco, and corn, or in pasture. Nearly all of the larger valleys are occupied, because these land areas are the only ones available or suitable for construction of houses and buildings.

The human population of the area is exceptionally high considering the terrain and occupational opportunities: the combined population of Floyd and Pike Counties in 1960 was 109,906. I can only echo Whitney's statement (EWW, 1962) that Dewey Lake has been the only impounded water in the immediate area and is an extremely valuable recreation area.

THE SPORT FISHERY

Cove Population Studies: 1951 - 1963

The first cove population sampling at Dewey Lake was done in 1951, the second year of impoundment. Population studies were then conducted every summer until 1966 — 15 consecutive years of sampling. The combined surface acreage of the sampled coves has varied from a maximum of 8.2 acres in 1960, to a minimum of 1.5 acres in 1957. Wide fluctuation, in response to population manipulation efforts (see Table 1), occurred annually not only in relative abundance and biomass, but in the size-class structure as well. Following the first selective shad poisoning operations in 1955, the 1956 population numbered only 637 f/A — the lowest ever recorded at Dewey Lake (fishery topics require the repeated usage of "fish per acre" and "pounds per acre" — hence the abbreviations f/A and lb/A for these terms). The 1964 population, following a year wherein no manipulation attempts were made, numbered 5235 f/A — the highest ever recorded. The lowest biomass recorded was 60 lb/A in 1952, prior to any management practices. The highest biomass recorded was 311 lb/A in 1964, the same year that relative abundance was greatest. Annual standing fish crop values since impoundment are shown in Table 2. Singled out in this table are the values pertaining to the dominant species in Dewey Lake: gizzard shad. Most of the research and management activities at Dewey have been directed toward suppression of this single species.

Effects on the fish population of the various management techniques practiced at Dewey over the years may be seen by comparing Tables 1 and 2. From 1955 through 1959, the lake was treated annually with dilute rotenone concentrations. The biomass decreased from 181 lb/A prior to treatment, to annual values the next 4 years in the range of 73 to 94 lb/A. Gizzard shad biomass dropped from 102 lb/A, to an annual range of 32 to 54 lb/A during the same period. Inexplicably, both shad and total biomass, respectively, surged to 132 and 208 lb/A in 1959 and to 55 and 150 lb/A in 1960, despite continuing treatment. Following no management attempts in 1960 or 1961, the biomass increased to 240 lb/A, of which 131 pounds were gizzard shad. The rapid drawdown in the winter of 1962 resulted in a much reduced fish population the following summer. Total biomass went down to 81 lb/A and the 35 lb/A standing crop of gizzard shad was the second-lowest in the history of the lake. However, the shad remaining in the lake literally underwent a population explosion during the summer of 1964, my first year at Dewey Lake. Relative abundance and biomass values, both total and for gizzard shad, exceeded by a wide margin all values derived prior to 1964.

Cove Population Studies: 1964 - 1965

The fish population was sampled three times at differing locations during 1964, the fifteenth year of impoundment. The combined acreage of the 3 study coves was 4.9 acres. Production was 141 lb/A in June (No. 36 Cove), 416 lb/A in August (Clark's Branch Cove) and 422 lb/A in July (McGuire Branch Cove). The mean standing crop of the aggregate samples was 311 lb/A, compared to 81

Table 2. Annual standing fish crop values, derived from cove sampling with rotenone, at Dewey Lake since impoundment. Parenthesized values refer to a single species: gizzard shad.

Year	Acres sampled	Number per acre		Pounds per acre		A_T*	A_T^H*	A_T^N*
1951	2.0	1778	(726)	95	(71)	75.9	7.0	(68.9)
1952	5.0	976	(331)	60	(41)	61.0	9.1	(51.9)
1953	3.5	1644	(646)	99	(55)	44.6	17.1	(27.5)
1954	6.6	3470	(1277)	181	(102)	29.9	14.8	(15.1)
1955	6.6	1976	(542)	73	(32)	48.7	30.0	(18.7)
1956	2.5	637	(365)	89	(38)	72.0	45.9	(26.1)
1957	1.5	1079	(488)	95	(46)	65.2	24.3	(40.9)
1958	4.1	3731	(2720)	94	(54)	24.0	9.4	(14.6)
1959	6.8	4317	(2720)	208	(132)	27.0	12.3	(14.7)
1960	8.2	2996	(2009)	150	(55)	24.0	16.0	(8.0)
1961	7.0	3516	(2422)	240	(131)	35.8	30.0	(5.8)
1962	4.0	3419	(2045)	191	(124)	32.4	22.7	(9.7)
1963	5.3	1772	(689)	81	(35)	70.5	34.0	(36.5)
1964	4.9	5235	(4049)	311	(227)	26.6	16.7	(9.9)
1965	4.9	5110	(3929)	277	(203)	21.8	17.5	(4.3)

* The A_T of Swingle ("total availability value") is the percentage of the biomass comprised by all fish of harvestable size; the A_T^H represents only that portion of the A_T value comprised by species that are normally harvested; and the A_T^N is that portion of the A_T value comprised by species not normally harvested - at Dewey Lake, gizzard shad.

lb/A recorded during 1963 (JKA, 1964). The A_T value decreased to 27; the previous year, 71% of the biomass was composed of harvestable-size fish. The rising dominance of the gizzard shad was responsible for the drastic changes in the population structure. Nearly 4000 of the 5235 f/A standing fish crop and nearly 200 pounds of the 311 lb/A biomass were intermediate-size (4" - 7") gizzard shad.* Following the rapid drawdown of 1962, this size class during the summer of 1963 comprised only 25 f/A and 0.39 lb/A of the total standing crop.

The fish population composition of the three combined samples is summarized in Appendix Table 2. The game fish group (five species) showed some improvement during 1964. Little change occurred in the fingerling size class, but the intermediate and harvestable size classes were either more abundant or contributed more weight to the biomass than they did in 1963. While the game fishes made up only 7% of the biomass, this percentage was equivalent to 20 lb/A, compared to only 12 lb/A in 1963. Intermediate-size white crappie outnumbered and outweighed the combined size classes of any other species in the group.

The food fish group, made up of channel and flathead catfishes, continued to occupy a minor position in the population. The group declined slightly, accounting for less than 1 lb/A, or 0.2% of the biomass. Only 2 food fish per acre were recovered from the samples; 9 per acre were taken in 1963.

No species belonging to the predatory fish group were taken in either the 1964 or 1965 population studies.

The panfish group, composed primarily of bluegill, with longear sunfish the minor component, showed decided improvement in all aspects. Nearly 29 lb/A (9%) of the biomass, and 688 f/A (13%) of the total population, was

* See Appendix Table 1 for species and size classifications.

composed of panfishes. Compared to the previous year, the relative abundance and biomass of the intermediate-size panfishes more than doubled. Numerically, the harvestable size class increased only slightly; but their biomass almost doubled, meaning that more panfish larger than the 6-inch minimum required for classification as harvestable size were present in the population.

The commercial fish group (suckers, carp, and bullheads), dominated almost completely by large carp, was less abundant in 1964, but contributed more than twice as many pounds to the biomass as it did in 1963. Commercial fishes averaged 16 to the acre, or 0.3% of the total population. Their share of the biomass was 32 lb/A (10% of the standing crop).

The forage fish group (6 families represented) outnumbered and outweighed all the other groups combined. Intermediate-size gizzard shad contributed heavily to the group's relative abundance and biomass, which was 4239 f/A (81% of the population) and 229 lb/A (74% of the standing crop). The rising dominance of gizzard shad could not be foretold by inspection of the 1963 population study data, which indicated that only 550 fingerling-size shad per acre were present for potential growth into the intermediate size class during 1964.

The same three coves were again sampled in 1965. Production was 291 lb/A in June (Clark's Branch Cove), 127 lb/A in July (No. 36 Cove) and 454 lb/A in August (McGuire Branch Cove). The average standing crop of the combined samples was 277 lb/A. The percentage contributed to the biomass by the weight of harvestable-size fish decreased to 22%. Intermediate-size gizzard shad again dominated the population. Nearly 3900 of the 5110 f/A standing crop and about 190 of the 277 lb/A biomass were 4- to 7-inch shad.

The fish population structure showed little improvement during 1965, following the 5-stage drawdown in the fall of 1964 (Appendix Table 3). Game fishes made up 6% of the standing crop, or 15 lb/A. Numerically they made up 6% of the population, or 297 f/A. Harvestable-size game fishes averaged

8 f/A and 5 lb/A. The food fishes, represented by channel and flathead catfishes, continued to occupy a minor position in the population (3 f/A and 2 lb/A). The panfishes (bluegill and longear sunfish) exhibited little change; 13%, or 665 f/A and 7%, or 20 lb/A of the population belonged to this group. Commercial fishes (suckers, carp, and bullheads) averaged only 0.5% of the population, or 24 to the acre, but they accounted for 10% of the standing crop, or 35 lb/A. The forage fishes (6 families, including gizzard shad) outnumbered and outweighed all the other groups combined. While the 1964 drawdown thinned intermediate-size shad from 4239 to 3840 f/A and from 229 to 190 lb/A, this size class still comprised 75% of the total population and 69% of the standing crop.

A list of the fishes collected from Dewey Lake during the 1964 and 1965 population studies is given in Table 3. This list comprises 8 families, 17 genera, and 26 species. Nomenclature used in the table, and throughout this bulletin, complies with recommendations of the American Fisheries Society.

Threadfin Shad Stocking and Spot-Sampling: 1959 - 1966

Whitney has reviewed in detail the quite extensive fish stocking history of Dewey Lake (EWW, 1962). As shown in Table 1, fish have been stocked practically every year since impoundment. Indigenous species, principally largemouth bass, have been stocked to replace and supplement those unavoidably killed during the gizzard shad poisoning operations. Stocking of non-indigenous species such as northern pike, walleye, sauger, white bass, black crappie, redear sunfish, threadfin shad, mosquitofish, and emerald shiner has met with little success. Black crappie and white bass have become well-established species; threadfin shad have had very limited success; the other species have failed to establish themselves.

Threadfin shad were first introduced into this reservoir in October 1959. The initial stocking of 200 adult threadfin shad, obtained from the tailwater

Table 3. List of fishes collected from Dewey Lake during the course of routine population studies conducted in 1964 and 1965.

CLUPEIDAE	
Dorosoma cepedianum (LeSueur)	Gizzard shad
Dorosoma petenense (Gunther)	Threadfin shad
CYPRINIDAE	
**Campostoma anomalum* (Rafinesque)	Stoneroller
**Carassius auratus* (Linnaeus)	Goldfish
Cyprinus carpio Linnaeus	Carp
Pimephales notatus (Rafinesque)	Bluntnose minnow
Pimephales promelas Rafinesque	Fathead minnow
CATOSTOMIDAE	
Catostomus commersoni (Lacepede)	White sucker
Hypentelium nigricans (LeSueur)	Northern hog sucker
**Moxostoma anisurum* (Rafinesque)	Silver redhorse
***Moxostoma duquesnei* (LeSueur)	Black redhorse
Moxostoma erythrurum (Rafinesque)	Golden redhorse
ICTALURIDAE	
Ictalurus melas (Rafinesque)	Black bullhead
Ictalurus natalis (LeSueur)	Yellow bullhead
Ictalurus punctatus (Rafinesque)	Channel catfish
Noturus miurus Jordan	Brindled madtom
Pylodictis olivaris (Rafinesque)	Flathead catfish
SERRANIDAE	
Roccus chrysops (Rafinesque)	White bass
CENTRARCHIDAE	
Lepomis macrochirus Rafinesque	Bluegill
Lepomis megalotis (Rafinesque)	Longear sunfish
Micropterus punctulatus (Rafinesque)	Spotted bass
Micropterus salmoides (Lacepede)	Largemouth bass
Pomoxis annularis Rafinesque	White crappie
Pomoxis nigromaculatus (LeSueur)	Black crappie
PERCIDAE	
Percina caprodes (Rafinesque)	Logperch
ATHERINIDAE	
Labidesthes sicculus (Cope)	Brook silverside

* Taken in 1964 only.
** Taken in 1965 only.

of Kentucky Lake, over-wintered successfully because Whitney recovered 74 adult threadfin the following summer during routine population sampling. He was probably correct in his assumption that all the over-wintering threadfin were killed in his 1960 studies, since no threadfin were observed during his 1961 studies (EWW, 1962).

In June 1962, 250 adult threadfin from the tailwater of Tennessee's Fort Loudon Reservoir were stocked in Dewey. Apparently none of this stocking survived the hard winter of 1962-63, for no threadfin were recovered from the 1963 population studies (JKA, 1964). Attempts by departmental personnel to procure threadfin for stocking purposes that year were unsuccessful.

In April 1964, 85 threadfin shad from Cumberland Lake were stocked in Dewey Lake (past experience suggests that this strain may be more winter-hardy than other strains). These fish were the survivors of a lot that transported poorly, suffering 62% mortality en route, and according to Anderson (personal conversation), were in very poor condition when stocked. Subsequent population sampling during the summer and fall of 1964 indicated that this species again had failed to become well established. Only 8 threadfin shad were recovered from the last of 3 different population studies; none were recovered or observed during the first 2 studies. September spot-sampling with dilute rotenone emulsions at widely scattered locations in Dewey turned up only two (1" and 1.5") threadfin. The spot-samples did confirm the abundance of brook silverside in all sections of the reservoir, as well as the over-abundance of intermediate-size gizzard shad. Relatively few threadfin shad were observed in the November-December 1964 tailwater population studies that followed each stage of the 5-stage drawdown.

In late April of 1965, 1467 threadfin shad from the Beaver Creek area of Cumberland Lake were re-introduced into Dewey Lake. These fish hauled extremely well — none of the 2- to 4-inch fish died in transit during the

7-hour trip across the state. Threadfin shad were recovered from 2 of the 3 routine population studies conducted that summer: a single 3-inch specimen from the July study, and 20 specimens ranging between 2 and 4 inches from the August study. If threadfin reproduction occurred in 1965, it was very limited.

The Cumberland Lake strain was again used at Dewey in mid-May of 1966, when 1881 threadfin shad between 4 and 5 inches were re-introduced. Reproductive success was evaluated by spot-sampling with dilute rotenone emulsions, since no routine population sampling was done during 1966. Five widely-separated coves were sampled in July. Spawning success was moderate to poor. The only sizeable school of fingerling threadfin (1.5 to 3.0 inches) observed was found near the central part of the lake; about 20 fingerlings were seen in another cove. Single adult specimens were found in two additional coves; none were seen in the last cove sampled.

Creel Surveys: 1951 - 1963

Adequate creel surveys provide a much better index to sport fishing quality than do fish population studies. There is much truth in the old admonition that "the proof of the pudding is in the eating". While population sampling provides the answers to many aspects of a fishery, creel surveying alone measures fishing quality — the ultimate answer to the ultimate question. Like most other fishery research techniques, over the years creel surveys have progressively become more efficient and precise.

All available creel survey data from Dewey Lake are summarized in Table 4. Fishing pressure has averaged as much as 60 man-hours per acre (1960) and as little as 40 man-hours per acre (1961). Harvest has fluctuated between 78 f/A (1960) and 30 f/A (1955). Responding to the various management techniques employed, the yield per acre has shown wide variation.

Table 4. Dewey Lake creel survey summary, 1951 - 1966. No creel surveys were conducted during years not listed, or data obtained those years were not comparable.

Year	Pressure (man-hours)		Harvest [Yield]				Catch Rate	Number of Interviewees
	Seasonal*	Per acre	Fish	No./acre	Pounds	Lb./acre	Fish per hour	
1954	[919: Interviewed anglers only:]		639	-	199	-	0.70	351
1955	58,420	53	32,715	30	5,280	4.8	0.56	2,094
1958	[1,416: Interviewed anglers only:]		1,468	-	629	-	1.04	468
1959	64,210	58	49,850	45	10,212	9.3	0.76	793
1960	65,644	60	85,337	78	18,379	16.7	1.30	798
1961	43,866	40	36,847	33	9,519	8.7	0.84	689
1962	62,958	57	54,773	50	11,272	10.2	0.87	613
1963	55,512	50	37,193	34	11,966	10.9	0.67	547
1964	61,190	56	42,833	39	10,402	9.5	0.70	980
1965	57,475	52	53,493	49	11,170	10.2	0.93	489
1966	45,008	41	38,619	35	8,323	7.6	0.86	535

* The creel survey year, most years, began on April 1 and ended on October 31, a 7-month period. The 12-hour fishing day was between the hours of 7 a.m. and 7 p.m.

Less than 5 lb/A were harvested during 1955; yield rose to nearly 17 lb/A in 1960. The annual average catch rate seldom showed stability, sometimes doubling from one year to the next. The best catch rate posted was that of 1.30 fish per hour during 1960. The poorest year was 1955, when only 0.56 fish per hour was caught by the average fisherman.

Creel Surveys: 1964 - 1966

Sport fishing quality during 1964, 1965, and 1966 was both satisfactory and unsatisfactory, considering the standing crop available for angler exploitation those years (Table 2). Despite drastic fluctuation in the fish population structure (compared to the previous year), the average catch rate of 0.70 fish per man-hour during 1964 was nearly identical to the 1963 rate of 0.67 (Table 4). The 1965 catch rate was even better: 0.93 fish per hour. It slumped slightly in 1966, going to 0.86 fish per hour. These catch rates were considered satisfactory; however, the catch rate is only one of several indices to the overall fishing quality of a fishery.

Fisherman success is another important index not only to fishing quality, but to fisherman satisfaction as well. Success was very low at Dewey all three years. Not quite 43% of the anglers caught fish during 1964. The following year about 42% of the anglers were successful in catching at least one fish. Success fell even lower in 1966, when only 34 of every 100 anglers caught fish. On an angler-success basis, fishing quality at Dewey those years must be termed very unsatisfactory.

Not as critical, but still significant to angler satisfaction and therefore to fishing quality, was the matter of the size of creeled fish (Table 5). The average fish caught during 1964 weighed 0.24 pound. This figure dropped to 0.21 pound per fish in 1965. The average fish creeled during 1966 weighed almost the same, 0.22 pound. Averages such as these, where

Table 5. Sport fishing harvest at Dewey Lake between April 1 and October 31 in 1964, 1965, and 1966.* Values were derived from expansion of data resulting from fisherman counts and from creel survey interviews with 980 anglers in 1964, 489 anglers in 1965, and 535 anglers in 1966.

Year	Man-hours fished	White bass	Black basses	Crappies	Channel catfish	Flathead catfish	Rock bass	Sunfishes	Suckers	Carp	Bullheads	Total
Fish												
1964	61,190	661	1,071	24,324	342	228	-	15,797	-	91	319	42,833
Percent of total catch		1.5	2.5	56.8	0.8	0.5	-	36.9	-	0.2	0.7	100.0
1965	57,475	231	1,068	30,990	704	128	24	18,690	69	1,589	-	53,493
Percent of total catch		0.4	2.0	57.9	1.3	0.2	t	34.9	0.1	3.0	-	100.0
1966	45,008	27	1,328	24,868	166	73	-	11,700	30	377	50	38,619
Percent of total catch		0.1	3.4	64.4	0.4	0.2	-	30.3	0.1	1.0	0.1	100.0
Pounds												
1964		425	1,311	5,897	422	129	-	1,640	-	302	276	10,402
Percent of total weight		4.1	12.6	56.7	4.1	1.2	-	15.8	-	2.9	2.7	100.0
Average weight		0.64	1.22	0.24	1.23	0.57	-	0.10	-	3.32	0.87	0.24
1965		194	1,902	3,780	599	58	5	1,731	82	2,819	-	11,170
Percent of total weight		1.7	17.0	33.8	5.4	0.5	t	15.5	0.7	25.2	-	100.0
Average weight		0.84	1.78	0.12	0.85	0.45	0.21	0.09	1.19	1.77	-	0.21
1966		7	3,302	2,486	154	44	-	1,422	29	861	18	8,323
Percent of total weight		0.1	39.7	29.9	1.9	0.5	-	17.1	0.3	10.3	0.2	100.0
Average weight		0.28	2.17	0.10	1.08	0.55	-	0.11	0.93	2.61	0.35	0.21

* The 1966 creel survey ran from March 1 to October 31.

several different species are involved, can be deceptive. However, since 93 to 95% of all fish caught at Dewey those years was crappies and sunfishes, in this instance the stated average weights are valid.

Survey data indicate that 42,833 fish weighing 10,402 pounds were taken from Dewey between April 1 and October 31, 1964. This was a yield or harvest of 39 fish and 9.5 pounds, respectively, per acre. During the same period in 1965, 53,493 fish (49 per acre) and 11,170 pounds (10.2 per acre) were removed from the lake. Corresponding to the significant drop in fishing pressure, the harvest in 1966 declined to 38,619 fish (35 per acre) and 8,323 pounds (7.6 per acre) despite the fact that an extra month (March) was added to the 1966 survey period.

Total fishing pressure varied more from one year to the next than did the catch composition (Table 5). Fishing pressure totalled 61,190 man-hours during the April - October, 1964 survey period. The next year, 57,475 man-hours were expended during the same period. The 1966 survey was expanded to include March; 45,008 man-hours were fished during the 8-month survey period. Fishing pressure over the 3-year period averaged 56, 52, and 41 man-hours per acre, respectively. The 41-man-hour figure is the second-lowest ever posted at Dewey, and would have been the lowest had March fishing been excluded from the tabulation.

As mentioned earlier, crappies and sunfishes provided the bulk of the harvest every year. White bass contributed as little as 0.1% and no more than 1.5% to the 3-year catch. Black basses were slightly more important: between 2.0 and 3.4% of all fish caught were either largemouth or spotted bass. Other species caught, their relative positions in the creel, and their average weights are shown in Table 5.

The non-uniform probability surveys employed in 1965 and 1966 permitted creel data to be tabulated on a weekly basis. These data have been grouped into monthly values, presented in Tables 6 and 7. They quite clearly show that May and June, 1965 and May, 1966 were by far the months during which the heaviest fishing pressure occurred. Expectedly, more fish were caught during those same months. The least pressure was expended during October of both years and the catch was correspondingly lowest. May of 1966 was the single most outstanding month in the 2-year period, when nearly 22,000 fish were creeled in less than 12,000 hours of fishing.

An interesting characteristic of the Dewey Lake fishery explored in 1964 for the first time was that of angler intent or preference. Interviewed fishermen were asked to specify which particular species they sought, or at least hoped to catch. More than one third of the anglers specified crappies and less than one fourth was after black basses. Less than one fifth was seeking sunfishes and 17% indicated they were after "anything", meaning any species that would bite that day.

Angler preference shifted during the next two years. White crappie and black bass percentages remained about the same, sunfish seekers decreased and "anything" fishermen increased. The latter category rose to 28% of all anglers in 1965 and 35% in 1966.

Success in catching the species specified varied widely, as did overall fishing success. The angler preference data in Table 8 show that in 1964 nearly 61% of the total catch was caught by crappie anglers and that 89% of all fish they creeled were crappies. Almost 27% of the total catch was accounted for by sunfish seekers, who were 93% successful in catching sunfishes. Black bass anglers caught 7% of all fish landed but only 27% of their catch was the species they had hoped to catch. The "anything" anglers caught about 4% of all fish; 16% of these anglers was successful in catching something.

The crappie anglers' share of the total catch in 1965 increased to 65% but only 50% of the fish they creeled were actually crappies (Table 9). Black

Table 6. Sport fishing harvest at Dewey Lake between April 1 and October 31, 1965. Values were derived from expansion of data resulting from fisherman counts and from creel survey interviews with 489 anglers during the 7-month period.

Month	Man-hours fished	White bass	Black basses	Crappies	Channel catfish	Flathead catfish	Rock bass	Sunfishes	Suckers	Carp	Total
					Fish						
April	4,780	-	-	3,106	170	-	-	2,670	-	343	6,289
May	14,046	-	403	6,036	-	-	-	6,168	61	184	12,852
June	13,099	163	307	7,909	270	101	24	2,743	8	922	12,447
July	5,845	-	52	1,878	-	-	-	4,484	-	-	6,414
August	6,613	-	32	3,537	-	-	-	1,146	-	114	4,229
September	8,753	55	107	6,393	135	27	-	683	-	26	7,426
October	4,339	13	167	2,131	129	-	-	796	-	-	3,236
Total	57,475	231	1,068	30,990	704	128	24	18,690	69	1,589	53,493
% of total catch		0.4	2.0	57.9	1.3	0.2	t	34.9	0.1	3.0	100.0
					Pounds						
April		-	-	283	88	-	-	236	-	601	1,208
May		-	668	1,269	-	-	-	727	80	289	3,033
June		112	549	625	190	24	5	256	2	971	2,734
July		-	68	90	-	-	-	277	-	-	435
August		-	43	313	-	-	-	92	-	573	1,021
September		55	213	943	177	34	-	58	-	385	1,865
October		27	361	257	144	-	-	85	-	-	874
Total		194	1,902	3,780	599	58	5	1,731	82	2,819	11,170
% of total weight		1.7	17.0	33.8	5.4	0.5	t	15.5	0.7	25.2	100.0

Table 7. Sport fishing harvest at Dewey Lake between March 1 and October 31, 1966. Values were derived from expansion of data resulting from fisherman counts and from creel survey interviews with 535 anglers during the 8-month period.

Month	Man-hours fished	White bass	Black basses	Crappies	Channel catfish	Flathead catfish	Sunfishes	Suckers	Carp	Bullheads	Total
					Fish						
March	3,376	-	81	1,054	10	31	324	-	-	-	1,500
April	7,031	-	86	1,948	36	-	599	30	193	-	2,892
May	11,729	-	782	16,982	-	-	4,003	-	50	-	21,817
June	8,470	27	127	2,115	100	-	3,741	-	81	-	6,191
July	4,689	-	166	1,557	-	-	784	-	-	-	2,507
August	6,181	-	53	788	-	25	1,618	-	53	-	2,537
September	2,750	-	23	-	-	-	631	-	-	-	654
October	782	-	10	424	20	17	-	-	-	50	521
Total	45,008	27	1,328	24,868	166	73	11,700	30	377	50	38,619
% of total catch		0.1	3.4	64.4	0.4	0.2	30.3	0.1	1.0	0.1	100.0
					Pounds						
March		-	127	70	20	11	24	-	-	-	252
April		-	276	164	36	-	55	29	340	-	900
May		-	2,327	1,682	-	-	648	-	80	-	4,737
June		7	138	266	89	-	397	-	295	-	1,192
July		-	334	185	-	-	95	-	-	-	614
August		-	62	61	-	21	129	-	146	-	419
September		-	26	-	-	-	74	-	-	-	100
October		-	12	58	9	12	-	-	-	18	109
Total		7	3,302	2,486	154	44	1,422	29	861	18	8,323
% of total weight		0.1	39.7	29.9	1.9	0.5	17.1	0.3	10.3	0.2	100.0

Table 8. Angler preference (intent), overall fishing success, and specific success* of 980 fishermen interviewed at Dewey Reservoir between April 1 and October 31, 1964.

Species sought	Percent of anglers seeking	Overall success (percent of total catch) Number (*)	Weight	Overall catch rate (fish per hour)
White bass	2.8	0.8 (80.0)	3.3	0.2
Black basses	23.3	7.2 (26.5)	17.8	0.2
Crappies	36.8	60.5 (88.9)	59.8	1.2
Channel catfish	0.2	0.2 (66.7)	0.4	0.2
Flathead catfish	0.2	0.0 (0.0)	0.0	0.0
Sunfishes	18.3	26.9 (93.1)	12.5	0.9
Carp	1.1	0.1 (100.0)	1.3	t
"Anything"	17.3	4.4 (15.9)	5.0	0.2
Total	100.0	100.0	100.0	Mean 0.7

Table 9. Angler preference (intent), overall fishing success, and specific success* of 489 fishermen interviewed at Dewey Lake 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	2.0	0.6 (40.0)	2.0	0.30
Black basses	22.9	7.7 (16.1)	22.4	0.28
Crappies	31.9	64.5 (50.0)	40.5	1.89
Channel catfish	0.8	- (-)	-	-
Sunfishes	12.5	18.1 (68.9)	6.5	1.40
Carp	1.6	0.5 (25.0)	11.6	0.26
"Anything"	28.2	8.5 (22.5)	16.8	0.32
Total	100.0	100.0	100.0	Mean 0.94

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

Table 10. Angler preference (intent), overall fishing success, and specific success* of 535 fishermen interviewed at Dewey Lake 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	1.3	- (-)	-	-
Black basses	18.3	6.3 (47.6)	35.2	0.19
Crappies	36.4	70.4 (87.0)	33.8	1.34
Channel catfish	0.2	- (-)	-	-
Flathead catfish	0.6	- (-)	-	-
Sunfishes	7.1	12.3 (91.9)	8.2	1.34
Carp	0.7	- (-)	-	-
"Anything"	35.3	11.1 (21.8)	22.8	0.21
Total	100.0	100.0	100.0	Mean 0.67

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

bass fishermen held their own that year but their specific success dropped to 16%. Sunfish seekers accounted for 18% of the total catch and a corresponding decrease in their specific success was noted. The "anything" group nearly doubled their relative take by catching 9% of all the fish; they were more successful too, 23% of them caught something.

Crappie angler success improved appreciably in 1966; 87% of the fish they caught was crappies (Table 10). Black bass fishermen also were much more successful; nearly half the fish creeled by this group was black basses. Sunfish angler success approached that of 1964.

The total, overall, and hourly catch rate of the various fisherman groups varied widely between species and between years. Those anglers intent on catching crappie enjoyed the highest catch rate of all: between 1.20 and 1.89 fish per hour. The sunfish seekers' rate of catch varied from 0.90 to 1.40 fish per hour. White bass and black bass anglers' catch rates were among the lowest posted, ranging from 0.19 to 0.30 fish per hour.

Miscellaneous characteristics of the fishery during the 3-year period are listed in Table 11. The typical fisherman at Dewey was a male Kentucky resident who still fished from a boat for crappies or sunfishes. Seldom did he fish over the car-body fish attractors and during only 4 trips out of 10 was he successful in catching fish.

As mentioned earlier, anglers who fished over the fish attractors in 1963 numbered 5% of all interviewed fishermen, while they caught 14% of all fish creeled. Again in 1964, 5% of the interviewed fishermen were attractor anglers. All but one of them, who was casting, were still fishermen (used live bait). Their catch was comprised of black basses (1%), sunfishes (63%), and crappies (36%). They enjoyed a catch rate of 1.3 fish per hour, or nearly double that of the overall reservoir catch rate that year. They creeled 0.24 pound per hour, as opposed to the overall rate of 0.17 pound. The attractor anglers' catch amounted to 7.9% of all fish caught; it made up 6.2% of the total weight creeled by the interviewees.

The additional car bodies placed at the better attractor sites in late 1964 did not lure additional anglers to these sites during 1965. In fact, only 3.7% of the interviewed fishermen utilized the attractor sites. Their success was very poor: 0.8% of all fish caught by the interviewees, at a rate of 0.3 fish and 0.03 pound, per hour.

The fish attractors were utilized more in 1966 when 5.8% of the interviewees were found fishing over them. The attractor anglers that year fared only a little worse than the average reservoir angler. They expended 5.7% of the total fishing effort and creeled 5.1% of all fish caught. Except for a single sunfish, their catch was composed of crappies.

Table 11. Miscellaneous characteristics of the Dewey Lake fishery, 1964 - 1966.

Characteristic	1964 (%)	1965 (%)	1966 (%)
Sex			
Male	85.6	87.3	82.6
Female	14.4	12.7	17.4
Residency			
Resident	89.9	91.4	92.4
Non-resident	10.1	8.6	7.6
Method Used			
Still fishing	70.1	74.8	76.7
Casting	24.4	19.6	19.9
Fly fishing	-	0.2	0.2
Trolling	5.4	4.5	1.7
Jig fishing	-	0.8	1.5
Fishing Success			
Successful	42.8	41.5	37.4
Unsuccessful	57.2	58.5	62.6
Fished Over Fish Attractors	4.9	3.7	5.8
Location			
Bank	-	-	43.1
Boat	-	-	56.9

Several of the car-body fish attractors in the lower section of the lake, and a few of the brush shelters in a cove up-lake, were inspected by departmental personnel using SCUBA gear. Diving in June 1966, B. T. Carter and J. P. Henley observed fingerling black basses, bluegill, and crappie at most of the sites inspected. The shallower attractors (at or near the upper limit of the thermocline) appeared to be utilized by fishes more than those located well within the much colder water of the thermocline. The brush shelters (actually trees) were occupied by essentially the same species and size classes. Despite the apparent transparency of the surface layer of water in Dewey, the divers reported very poor visibility (2 to 3 feet) that lessened the nearer they approached the thermocline. Visibility in the thermocline proper was very limited because of its turbidity.

Five-Stage Drawdown: 1964

A pre-drawdown population study, conducted two days prior to the first stage of the drawdown, revealed that a dense fish population existed in the emergency spillway chamber (described earlier). The 2671 fish weighing 486 pounds taken from the 0.15-acre chamber was equivalent to a standing crop of 17,807 fish and 3241 pounds. The A_T value was 73.3; the F/C ratio was 4.1. (Since the study area was so small, conversion of actual fish numbers and pounds to a per-acre basis would have resulted in wholly unrealistic figures. Consequently, actual values, as opposed to per-acre values, are used throughout this section of the report.) A wide variety of species, typical of a below-dam fish population, was found in the pre-drawdown study.

The composition of the pre-drawdown population is summarized in Appendix Table 4, which shows that the game fish group and the forage fish group together accounted for the bulk of the population. Species comprising the game fish group included white bass, largemouth bass, spotted bass, black crappie and white crappie, but intermediate-size crappies (particularly whites) dominated the group by number and by weight. The forage fishes included several species, but intermediate- and "harvestable"-size gizzard shad were the principal components of the group. The third most abundant group of fishes in the chamber was panfishes, represented chiefly by bluegill. The food fishes ranked fourth in numerical abundance, with channel catfish the sole member represented. The least abundant group was commercial fishes, which was made up of various suckers (mainly spotted). The predatory fish group was not represented in the pre-drawdown, nor in any of the post-drawdown, spillway chamber studies.

Results of the five post-drawdown population studies conducted in the emergency spillway chamber are summarized in Table 12. Considering the discharged fish population as a whole, rather than as 5 separate segments, the summary shows that 13,219 fish which weighed 992 pounds entered the spillway chamber. (The assumption has been made, of necessity, that the chamber studies gave a true index to the composition of the discharged fish population; however, they represent an unknown fraction of the total population that passed out of the reservoir during the drawdown.) The piscivorous to non-piscivorous ratio was about 1 to 3. The principal piscivorous species were intermediate-size black and white crappies. The principal non-piscivorous species, in order of abundance, were intermediate-size gizzard shad, harvestable-size bluegill, and intermediate-size spotted sucker. The fingerling size class, as expected for that time of year, was weakly represented, accounting for only 5% of the total number and 1% of the total weight. The bulk of the discharged fish was composed of intermediate-sized specimens; 87% and 76%, respectively, of the total number and total weight were in that size class. Harvestable-size fishes made up only 8% and 23% of the discharged population.

More than half (56%) of the fish in the post-drawdown studies was 4- to 7-inch gizzard shad, the species whose overabundance in the reservoir prompted the drawdown. The discharged shad made up nearly 48% of the total weight. Black and white crappies together were next in abundance, 25% of all fishes and 28% of the total weight being accounted for by these two species. White crappie outnumbered the blacks about two to one, with the intermediate-size class of both predominating. It was hoped that the drawdown would thin out this size class, resulting in better growth of the remaining crappie. Bluegill, principally harvestable-size, was the next most abundant species. Slightly more than 9% of the discharged fish, and nearly 16% of their total weight, was bluegill. None of the other individual species made up as much

Table 12. Composition of the post-drawdown fish population found in the emergency spillway chamber below Dewey Dam following each stage of the 5-stage drawdown. Sampling was done on November 1, 11, 18, 25, and December 2, 1964.

Group	Fingerling size		Intermediate size		Harvestable size		Total		Percent of total population	
	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Biomass
Game Fishes (principal species: black crappie and white crappie)										
First stage	121	3.2	1,102	95.2	22	7.7	1,245	106.1	9.4	10.7
Second stage	273	6.4	849	78.0	29	12.1	1,151	96.5	8.7	9.7
Third stage	31	0.9	358	32.7	16	5.4	405	39.0	3.1	3.9
Fourth stage	18	0.5	100	8.9	9	4.4	127	13.7	1.0	1.4
Fifth stage	65	1.6	391	34.6	19	9.5	475	45.7	3.6	4.6
Subtotal	508	12.5	2,800	249.4	95	39.0	3,403	300.8	25.7	30.3
Food Fishes (principal species: channel catfish)										
First stage	-	-	5	0.7	2	2.7	7	3.4	0.1	0.3
Second stage	-	-	1	0.1	-	-	1	0.1	t	t
Third stage	-	-	2	0.3	1	0.4	3	0.7	t	0.1
Fourth stage	-	-	-	-	-	-	-	-	-	-
Fifth stage	-	-	-	-	1	0.3	1	0.3	t	t
Subtotal	-	-	8	1.1	4	3.5	12	4.6	0.1	0.5
Panfishes (principal species: bluegill)										
First stage	7	t	109	7.6	406	64.3	522	71.8	3.9	7.2
Second stage	8	t	90	5.1	130	19.7	228	24.9	1.7	2.5
Third stage	-	-	70	4.7	184	29.8	254	34.4	1.9	3.5
Fourth stage	3	t	21	1.5	63	9.5	87	11.0	0.7	1.1
Fifth stage	17	0.1	68	4.2	66	9.4	151	13.7	1.1	1.4
Subtotal	35	0.2	358	23.0	849	132.7	1,242	155.9	9.4	15.7

Table 12. (continued)

Group	Fingerling size		Intermediate size		Harvestable size		Total		Percent of total population	
	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Biomass
Commercial Fishes (principal species: redhorses and spotted sucker)										
First stage	1	t	168	14.9	-	-	169	14.9	1.3	1.5
Second stage	5	0.1	266	19.6	-	-	271	19.6	2.1	2.0
Third stage	6	0.1	117	8.1	1	0.7	124	8.9	0.9	0.8
Fourth stage	-	-	74	5.9	-	-	74	5.9	0.6	0.6
Fifth stage	1	t	51	4.9	-	-	52	4.9	0.4	0.5
Subtotal	13	0.2	676	53.3	1	0.7	690	54.2	5.2	5.5
Forage Fishes (principal species: gizzard shad and brook silverside)										
					Above forage size					
First stage	37	0.2	953	51.5	24	9.4	1,014	61.1	7.7	6.2
Second stage	19	0.1	3,017	161.0	15	5.1	3,051	166.3	23.1	16.8
Third stage	6	t	799	47.7	38	11.7	843	59.4	6.4	6.0
Fourth stage	37	0.3	2,366	139.1	44	19.6	2,447	159.1	18.5	16.0
Fifth stage	24	0.1	471	23.3	22	7.7	517	31.1	3.9	3.1
Subtotal	123	0.8	7,606	422.6	143	53.5	7,872	476.9	59.6	48.1
Total (all groups combined)										
First stage	166	3.4	2,337	169.8	454	84.1	2,957	257.2	22.4	25.9
Second stage	305	6.6	4,223	263.8	174	37.0	4,702	307.4	35.6	31.0
Third stage	43	1.0	1,346	93.4	240	47.9	1,629	142.4	12.3	14.3
Fourth stage	58	0.9	2,561	155.4	116	33.5	2,735	189.7	20.7	19.1
Fifth stage	107	1.8	981	67.0	108	26.9	1,196	95.7	9.0	9.6
GRAND TOTAL	679	13.7	11,448	749.4	1,092	229.4	13,219	992.4	100.0	100.0

as 5% of either the total number or total weight recovered from the chamber studies. Spotted sucker ranked highest in the minor component group, 3.5% of all fish and 4.0% of their total weight was this species.

Comparison of the data in Table 12 shows that more fish were recovered from the second post-drawdown study than were recovered from any of the other four studies. Nearly 36% of the fish discharged during the 5-stage drawdown were recovered in the second-stage study. About 22% of the discharged fishes left the reservoir during the first stage. Almost 21% passed through the dam during the fourth stage. The last five feet of the drawdown reduced the reservoir to approximately 220 surface acres, and 9% of the fish that left the reservoir did so at this time. The percentage composition of the total biomass (all groups combined) discharged during each of the five stages closely matched the numerical percentage, and so ranked in the same order.

WATER QUALITY

The first water quality determinations made at Dewey Lake were performed by Smith in 1958 and 1959 (WAS, 1959; 1960). He recorded temperatures, dissolved oxygen content, and made turbidity observations at four widely-separated stations. He sampled in May, August, September, and October of 1958; his 1959 schedule included May, July, August, and September. His sampling was primarily done as an adjunct to the selective shad poisoning operations he directed those years. No other limnological data were recorded in the intervening years until 1964 and the inception of this investigation. The water quality characteristics recorded during 1964 and 1965 by project personnel represent the first essentially year-round sampling program conducted at Dewey Lake (Appendix Tables 5 - 9).

Pronounced thermal stratification was evident when the first water temperatures were taken on May 27, 1964. Surface temperatures that day varied from 79° Fahrenheit at Stations I (headwaters at German Bridge) and II (mid-lake at Brandykeg), to 75° at Station III (dam area). The maximum surface temperature recorded during the 8-month period (May - December) in 1964 was 86° on June 15 at Station I. The minimum surface temperature during the same period was 44° recorded at Station II on November 25 and at all 3 stations on December 2. The lake was essentially isothermous at each station by October 29, but a temperature differential existed between the individual stations.

A well-developed thermocline existed throughout the lake during the summer months. The epilimnetic layer thickened as summer progressed, going from 5^+ feet thick in late May to a maximum thickness of 15^+ feet in mid-August. No disruption of the thermocline was noted at Dewey Lake during 1964, as was recorded in August that year at Buckhorn Reservoir (Charles, 1967), even though Dewey is also a flood control reservoir and the lowermost sampling station was located near the dam.

The 1965 water-quality sampling began in March and was concluded in November. An isothermal condition was recorded in both late March and late April. By late May, stratification was complete at all three stations, surface temperatures varying from 79° to 84°. The maximum temperature occurred in late July at Station I (89°), exceeding the maximum of the previous year by 3°. The minimum temperature (42°) was recorded in late March. The fall overturn occurred sometime between late September and late November, but the water had cooled to only 51° when the last temperatures were taken in November. A temperature differential between stations, although not as great as found in 1964, existed in late November, even though isothermal conditions prevailed at each station.

The dissolved oxygen content at Dewey Lake varied considerably in 1964, dependent upon depth, month, and location in the lake. At Station I, D.O. content usually was deficient (less than 5 ppm) at and below 15 feet until the lake cooled in October. The critical depth at Station II ranged between 15 and 20 feet, D.O. never adequate (less than 3 ppm) at the lower depth. Dissolved oxygen concentrations were more optimum at Station III, and to greater depths, but even there depletion was evident at the 25-foot level by mid-August. D.O. content at that station, rather than tapering gradually with increasing depth as it did at the two upper stations, plunged abruptly in a thermoclinal fashion.

The dissolved oxygen content in Dewey during 1965 approximated that found the previous year, except at Station III. Optimal D.O. concentrations there ranged deeper than in 1964, extending down to 30 feet before the onset of hot weather in late July. The abrupt drop in D.O. concentration noted at Station III during 1964 was recorded only in September of 1965.

Total alkalinity in this mountain reservoir, reflecting the nature of the parent material found in the drainage basin, was relatively low most months. Man-caused disturbances on the watershed, accompanied or followed by rainfall, were thought to be responsible for the high, erratic values sometimes recorded. The vertical series of determinations at the three stations conformed generally to the normal pattern of: (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, expressed as ppm $CaCO_3$, that generally ranged between 20 and 30 ppm.

Prior to and throughout the 5-stage drawdown in November 1964, the routine water quality sampling schedule was intensified. The free carbon dioxide content of the receding reservoir was determined at the regular sampling stations.

Free CO_2 never reached critical levels at any time during the drawdown and no instances of fish mortality were observed. The maximum concentration was 23.5 ppm, recorded on the bottom (5-foot depth) at Station I after the second 5 feet of water had been released.

RECOMMENDATIONS

Ripe threadfin shad, preferably the Cumberland Lake strain, should be stocked early each spring in Dewey Lake to provide a continuous supply of acceptable-size forage for the game fish species and to act as a competitor-suppressor of gizzard shad. Future creel surveys should be of the non-uniform probability type since experience has shown this type to be more efficient in time and effort expended by the creel clerk and less subject to bias. Preferably, 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 Dewey Lake (Reservoir), an 1100-acre flood control reservoir in eastern Kentucky, has been under continuous observation and management by the Fisheries Division of the Kentucky Department of Fish and Wildlife Resources since impoundment in mid-1949. Major research and management activities conducted prior to 1964 are reviewed and summarized. The latest investigation at Dewey, reported on in detail in this bulletin, began in the spring of 1964 and continued through 1966.

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

A. Fish population dynamics, by cove rotenone sampling.
B. Fish stocking success, by spot-sampling.
C. Sport fishing quality, by creel surveying.

D. Fish habitat enhancement, by artificial cover emplacement.
E. Fish population thinning, by lake drawdown.
F. Water quality, by physico-chemical determinations.

3. Fish population studies have been conducted at Dewey every summer since 1951 — 15 consecutive years of sampling. Wide fluctuation in the fish population has occurred from year to year, in response to various population manipulation efforts, not only in relative abundance and biomass, but in the size-class structure as well. Most of the research and management activities have been directed toward suppression of a single species: gizzard shad.

4. The standing crop (biomass) during 1964 and 1965 averaged 311 and 277 pounds per acre, respectively. The percentage of the biomass composed of harvestable-size fish of all species was 26.6 in 1964 and 21.8 in 1965. The A_T^H values, derived by including only those species normally harvested, were 16.7 and 17.5.

5. Relative abundance of the game fishes (white bass, largemouth bass, and spotted bass; black crappie and white crappie) was essentially unchanged; approximately 6% of the 5000^+-fish-per-acre population both years belonged to this group. A slight shift was registered in the group's biomass, going from 7% (20 pounds per acre) of the standing crop in 1964, to 6% (15 pounds per acre) in 1965. Harvestable-size game fishes numbered 15 per acre in 1964 and 8 per acre in 1965.

6. Food fishes (channel and flathead catfishes) were weakly represented in the sampled population. They contributed between 1 and 2 pounds per acre to the annual biomass.

7. Species belonging to the predatory fish group (e.g., mooneyes, bowfin, gars, etc.) were not recovered from the coves sampled in 1964 and 1965.

8. Bluegill and longear sunfish comprised the panfish group. The panfishes exhibited little change between years, accounting for 13% of the population and from 7 to 9% of the biomass.

9. The commercial fishes (suckers, redhorses, carp, and bullheads) were relatively scarce in the population samples. Less than 1% of all fish recovered both years belonged to this group; however, these were large specimens which accounted for 10% (32 pounds per acre) of the 1964 standing crop and for 13% (35 pounds per acre) of the 1965 biomass.

10. The forage fishes, normally the most abundant single group in a large reservoir, completely dominated the population both years. Gizzard shad, mostly 4 to 7 inches, comprised 77% (about 4000 per acre) of the sampled population in 1964 and 1965. Shad biomass both years was equivalent to 73% of the standing crop, or 227 pounds per acre in 1964 and 203 pounds per acre in 1965.

11. Threadfin shad, first introduced into this reservoir in 1959 to provide continuous and acceptable-size forage for the game fishes, have had sporadic success in becoming established in Dewey Lake. The species was re-introduced in 1962, 1964, 1965, and 1966. Reproductive success, determined by spot-sampling with dilute rotenone emulsions, was moderate to poor in 1964, 1965, and 1966.

12. Sport fishing quality between 1964 and 1966 was judged to have been both satisfactory and unsatisfactory depending upon the parameters used: the annual average catch rate ranged between 0.70 and 0.93 fish per man-hour, considered moderately good; fisherman success during the same 3-year period ranged from 34% to 43% successful anglers, considered rather poor.

13. The average weight of fish creeled during the 3-year survey fluctuated between 0.21 and 0.24 pound. Crappies and sunfishes together comprised between 93 and 95% of all fish caught each year.

14. Annual yield or harvest was calculated to be 42,833 fish in 1964, 53,493 in 1965, and 38,619 in 1966. The pounds harvested those same years were 10,402 or 9.5 per acre, 11,170 or 10.2 per acre, and 8,323 or 7.6 per acre.

15. Total fishing pressure between years varied more than did the catch composition. Fishing pressure totalled 61,190 man-hours during the April-October, 1964 survey period. The next year, 57,475 man-hours were expended during the same period. The 1966 survey was expanded to include March; 45,008 man-hours were fished in that 8-month period. On a per-acre basis, fishing pressure over the 3-year period averaged 56, 52, and 41 man-hours.

16. May and June, 1965 and May, 1966 were by far the months experiencing the heaviest fishing pressure. The least amount of pressure was expended during October of those years.

17. 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. Shifting in angler preference was noted between years, but the species most often mentioned was crappie, followed by black bass. Anglers who stated they had no preference numbered 17% of the interviewees in 1964, 28% in 1965, and 35% in 1966.

18. The typical fisherman at Dewey Lake was a male Kentucky resident who still fished from a boat for crappies. Seldom did he fish over the car-body fish attractors and during only 4 trips out of 10 was he successful in catching fish.

19. The lakebed at Dewey Lake was clear-cut prior to impoundment; consequently to enhance the habitat for both the fish and the fisherman, 4 used automobile bodies were clumped at each of 50 sites in the lower half of the lake in 1963. An additional 250 used car bodies were placed at 25 of the better locations in 1965. Each site was marked by a numbered, wooden float cabled to the center body in the cluster.

20. Fishermen at Dewey have been reluctant to fish over the car-body attractors. Since 1963, never more than 5% of the interviewed anglers have utilized the fish attractors; as few as 3.7% of the interviewees fished over them in 1965. Attractor anglers caught 14% of all fish creeled in 1963; their success in succeeding years was much less, dropping to a low of 0.8% of all fish caught in 1965.

21. Attempting to thin out the gizzard shad and white crappie populations in Dewey Lake, the lake level in October, 1962 was lowered rapidly from 650 feet to 625 feet. Results of the rapid drawdown, evaluated by population sampling the following summer, were quite satisfactory. A second drawdown was accomplished in November, 1964, when the lake was lowered 25 feet in 5-foot decrements. The 5-stage drawdown did not achieve the desired results; in fact, gizzard shad were nearly as abundant the following year as they had been before the drawdown.

22. Water quality determinations at three widely separated stations, made for the first time on a monthly, year-round basis in 1964 and 1965, documented physical and chemical characteristics well within expected ranges. Thermal stratification was typical and well defined during the warmer months.

23. Dissolved oxygen content usually was deficient (less than 5 ppm) at and below 15 feet in the upper section of the lake. The critical (less than 3 ppm)

depth in the middle section ranged between 15 and 20 feet. Depletion in the lower section was evident at the 25-foot level by July or mid-August.

24. Total alkalinity, reflecting the nature of the parent material in the drainage basin generally ranged between 20 and 30 ppm (as $CaCO_3$).

25. Free carbon dioxide content, determined only during the 5-stage drawdown, never reached critical concentrations. The maximum concentration was 23.5 ppm, recorded on the bottom (5-foot depth) in the upper lake after the second 5 feet of water had been released.

26. Recommendations made were: (a) Ripe threadfin shad, preferably the Cumberland Lake strain, should be stocked early each spring to provide desirable forage and to act as a competitor-suppressor of gizzard shad; (b) future creel surveys should be of the non-uniform probability type since experience has shown this type to be more efficient in time and effort expended by the creel clerk, and less subject to bias; (c) 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.

DEWEY LAKE BIBLIOGRAPHY*

1956 Carter, Ellis R. Investigations and management of the Dewey Lake fishery. Fisheries Bulletin No. 19, Kentucky Department of Fish and Wildlife Resources. [Final report of Dingell-Johnson Project F-8-R, 1954 and 1955.]

1959 Smith, William A., Jr. Project Progress Report for Dingell-Johnson Project F-11-R. Ky. Dept. Fish & Wild. Res. [Covers project year 1958.]

1960 Smith, William A., Jr. Project Progress Report for Dingell-Johnson Project F-11-R. Ky. Dept. Fish & Wild. Res. [Covers project year 1959.]

1962 Whitney, Eugene W. Investigations and management of the fisheries of Herrington Lake and Dewey Lake, Kentucky. Ky. Dept. of Fish & Wild. Res. [Final report for Dingell-Johnson Project F-11-R, 1958 - 1961.]

1962 Whitney, Eugene W. Project Progress Report for Dingell-Johnson Project F-19-R. Ky. Dept. Fish & Wild. Res. [Covers project year 1961.]

1963 Whitney, Eugene W. Project Progress Report for Dingell-Johnson Project F-19-R. Ky. Dept. of Fish & Wild. Res. [Covers project year 1962.]

1963 Carter, James P. Experimental Crappie Removal. Ky. Dept. of Fish & Wild. Res. [Final report for Dingell-Johnson Project F-21-R, 1962.]

1964 Anderson, Jon K. Project Progress Report for Dingell-Johnson Project F-19-R. Ky. Dept. Fish & Wild. Res. [Covers project year 1963.]

1965 Charles, James R. Project Progress Report for Dingell-Johnson Project F-22-R. Ky. Dept. Fish & Wild. Res. [Covers project year 1964.]

* Technical publications only are listed; administrative, semi-technical, and non-technical reports and articles are not included in this compilation.

OTHER LITERATURE CITED

Charles, James R. 1967. The Buckhorn Reservoir fishery during the fourth, fifth, and sixth years of impoundment. Ky. Fish. Bull. No. 46, Ky. Dept. Fish & Wild. Res.

Henley, James P. 1967. Lake Cumberland Investigations. Ky. Fish. Bull. No. 28, Ky. Dept. Fish & Wild. Res.

Lambou, Victor W. 1961. Determination of fishing pressure from fishermen or party counts with a discussion of sampling problems. Proc. Fifteenth Ann. Conf., S.E. Assoc. Game & Fish Comm.

Pfeiffer, Peter W. 1966. The results of a non-uniform probability creel survey on a small state-owned lake. Proc. Twentieth Ann. Conf., S.E. Assoc. Game & Fish Comm.

A P P E N D I X

(Tables 1 through 9)

Appendix Table 1. Kentucky's Standard Form for reporting fish population study data. The A_{T1} or "legal A_T" applies to only those species having a legal size limit.

GROUP (species)	FINGERLING SIZE Range	Number per acre	Pounds per acre	INTERMEDIATE SIZE Range	Number per acre	Pounds per acre	HARVESTABLE SIZE 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_{T1})		
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_{T1})		
Largemouth bass	0-4			5-11			12 (A_{T1})		
Smallmouth bass	0-4			5-11			12 (A_{T1})		
Spotted bass	0-4			5-11			12 (A_{T1})		
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		

Appendix Table 1 (continued)

GROUP (species)	FINGERLING SIZE Range	Number per acre	Pounds per acre	INTERMEDIATE SIZE Range	Number per acre	Pounds per acre	HARVESTABLE SIZE Min. inch group	Number per acre	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		

Appendix Table 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		

Appendix Table 2. Species composition, relative abundance, and biomass composition of the fish population at Dewey Lake during 1964, the fifteenth year of impoundment. Values were derived from sampling 3 coves (4.90 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	t	t	14	1.9	1	0.6			0.3	0.8
Largemouth bass	20	0.2	7	0.9	4	3.7			0.6	1.5
Spotted bass	62	0.4	7	0.7	3	2.6			1.4	1.2
Black crappie	14	0.4	2	0.1	-	-			0.3	0.2
White crappie	35	0.5	114	6.8	7	1.6			3.0	2.8
Total	130	1.4	144	10.3	15	8.4	290	20.2	5.5	6.5
FOOD FISHES										
Channel catfish	-	-	t	0.1	1	0.4			t	0.2
Flathead catfish	t	t	t	t	t	0.3			t	0.1
Total	t	t	1	0.1	1	0.7	2	0.8	t	0.3
PANFISHES										
Bluegill	177	1.1	424	15.2	66	11.3			12.7	8.9
Longear sunfish	1	t	21	1.0	t	t			0.4	0.3
Total	177	1.1	445	16.2	66	11.3	688	28.6	13.1	9.2
COMMERCIAL FISHES										
Hogsucker	-	-	t	t	-	-			t	t
Redhorses	-	-	2	0.8	2	2.4			0.1	1.1
White sucker	-	-	t	t	t	0.2			t	0.1
Carp	-	-	-	-	8	28.1			0.1	9.0
Bullheads	3	t	1	0.1	1	0.7			0.1	0.3
Total	3	t	3	1.0	11	31.4	16	32.3	0.3	10.4

Appendix Table 2. (continued)

Group	Fingerling size Number per acre	Fingerling size Pounds per acre	Intermediate size Number per acre	Intermediate size Pounds per acre	Above forage size Number per acre	Above forage size Pounds per acre	Group total Number per acre	Group total Pounds per acre	Percent of total population Number	Percent of total population Biomass
FORAGE FISHES										
Lampreys	-	-	t	t	-	-			t	t
Gizzard shad	1	t	3,950	196.1	98	30.8			77.3	72.9
Threadfin shad	t	t	1	t	-	-			t	t
Misc. cyprinids	39	0.1	t	t	t	0.4			0.8	0.2
Brindled madtom	60	0.4	3	t	-	-			1.2	0.1
Logperch	10	0.1	53	1.1	-	-			1.2	0.4
Brook silverside	5	0.1	18	0.2	-	-			0.4	0.1
Total	115	0.7	4,026	197.5	98	31.2	4,239	229.3	81.0	73.7
GRAND TOTAL	426	3.2	4,618	225.0	191	82.9	5,235	311.1	100.0	100.0

Standing crop: 5,235 fish per acre; 311 pounds per acre. A_{T1} = 26.0

Appendix Table 3. Species composition, relative abundance, and biomass composition of the fish population at Dewey Lake during 1965, the sixteenth year of impoundment. Values were derived from sampling 3 coves (4.90 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	1	t	t	t	4	2.8			0.1	1.0
Largemouth bass	105	0.5	8	1.4	1	1.7			2.2	1.3
Spotted bass	55	0.2	5	0.8	5	0.2			1.2	0.5
Black crappie	1	t	14	1.1	t	0.1			0.3	0.4
White crappie	24	0.2	75	5.9	2	0.3			2.0	2.3
Total	187	0.9	102	9.3	8	5.1	297	15.4	5.8	5.5
FOOD FISHES										
Channel catfish	-	-	-	-	1	1.2			t	0.4
Flathead catfish	t	t	t	t	1	0.9			t	0.3
Total	t	t	t	t	2	2.1	3	2.1	0.1	0.8
PANFISHES										
Bluegill	369	1.1	227	10.1	56	8.4			12.7	7.1
Longear sunfish	-	-	14	0.8	-	-			0.3	0.3
Total	369	1.1	241	10.8	56	8.4	665	20.3	13.0	7.3
COMMERCIAL FISHES										
Hogsucker	-	-	t	t	-	-			t	t
Redhorses	-	-	2	1.0	5	4.8			0.2	2.1
White sucker	-	-	t	0.2	-	-			t	0.1
Carp	-	-	2	1.3	10	27.6			0.2	10.4
Bullheads	1	t	1	0.2	1	0.4			0.1	0.2
Total	1	t	6	2.7	16	32.7	24	35.4	0.5	12.8

Appendix Table 3. (continued)

Group	Fingerling size		Intermediate size		Above forage 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
FORAGE FISHES										
Gizzard shad	56	0.3	3,840	190.3	33	12.1			76.9	73.1
Threadfin shad	1	t	3	0.1	-	-			0.1	t
Misc. cyprinids	103	0.4	t	t	-	-			2.0	0.1
Brindled madtom	35	0.2	11	0.2	-	-			0.9	0.2
Logperch	2	t	30	0.5	-	-			0.6	0.2
Brook silverside	8	t	t	t	-	-			0.2	t
Total	205	0.9	3,885	191.0	33	12.1	4,122	204.0	80.7	73.6
GRAND TOTAL	761	2.9	4,235	213.8	115	60.5	5,110	277.2	100.0	100.0

Standing crop: 5,110 fish per acre; 277 pounds per acre. A_{T1} = 21.8

Appendix Table 4. Composition of the pre-drawdown fish population in the emergency spillway chamber below Dewey Dam, October 30, 1964.

Group	Fingerling size		Intermediate size		Harvestable size		Total		Percent of total population	
	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Biomass
Game Fishes	139	3.1	925	54.1	15	15.9	1,079	73.1	40.4	15.0
Food Fishes	-	-	92	10.0	31	11.4	123	21.3	4.6	4.4
Predatory Fishes	-	-	-	-	-	-	-	-	-	-
Panfishes	17	0.2	132	6.8	84	13.1	233	20.1	8.7	4.1
Commercial Fishes	5	0.1	102	9.1	3	4.6	110	13.8	4.1	2.8
Forage Fishes	20	0.2	728	46.4	378	311.3	1,126	357.8	42.2	73.6
TOTAL	181	3.5	1,979	126.4	511	356.2	2,671	486.1	100.0	100.0

Appendix Table 5. Water temperatures (° Fahrenheit) at Dewey Lake, 1964. Temperatures were taken once each month, except during the 5-stage November drawdown, at Stations I (German Bridge), II (Brandykeg), and III (Dam). Existing lake elevations (msl) are shown in parentheses. Normal summer pool elevation was 650 feet.

Depth (feet)	May 27 (650')			June 15 (650')			July 14 (650')			Aug. 18 (650')			Sept. 8 (650')			Oct. 29 (650')		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
0	79	79	75	86	81	83	80	83	83	80	78	81	80	83	80	57	56	62
5	76	78	76	80	79	82	79	80	82	75	77	78	78	79	80	55	56	62
10	74	73	73	72	77	81	73	79	81	71	77	77	76	78	79	53	56	60
15	65	65	67	67	68	70	71	73	74	71	75	76	72	76	79	53	56	60
20		62	62	63	64	65	71	66	69		70	68		71	71		56	60
25			58		61	62		63	63		64	62		65	66		56	59
30			57			57		60	60		62	59		64	62		56	59
35									57			56			57			58
40									55			54						

Depth (feet)	Nov. 2 (645')			Nov. 10 (645')			Nov. 12 (640')			Nov. 18 (635')			Nov. 25 (630')			Dec. 2 (625')		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
0	56	61	60	55		57	56	54	56	56	57	57	49	44	50	44	44	44
5	56	58	60	50		57	56	54	56	56	57	57	46	44	49	44	43	44
10	56	58	59	50		57		54	56		57	57		43	49			43
15		57	58			57			56			57			49			
20		57	58			57			56			57						
25			58			57			56									
30			58			57												

Appendix Table 6. Water temperatures (° Fahrenheit) at Dewey Lake, 1965. Temperatures were taken once each month at Stations I (German Bridge), II (Brandykeg), and III (Dam). Existing lake elevations (msl) are shown in parentheses. Normal summer pool elevation was 650 feet.

Depth (feet)	March 24 (645')			April 27 (651')			May 26 (650')			June 23 (650')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	48	42	44	63	63	63	82	84	79	83	81	82
5	48	43	44	63	63	63	76	80	80	80	79	82
10	48	44	44	62	63	62	70	71	77	73	75	80
15		44	44	62	63	60	65	64	65	70	68	67
20			44	60	62	60	63	61	60		61	61
25			44		60	59		58	59		60	59
30			44			56		58	57			56
35						54			55			56

Depth (feet)	July 27 (650')			August 24 (649')			September 22 (649')			November 23 (645')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	89	87	84	84	82	83	80	83	82	51	52	54
5	83	86	84	83	82	83	80	82	82	51	52	54
10	76	82	81	80	82	82	78	80	82	51	52	54
15	75	75	76	76	80	79	73	77	78		52	54
20		72	70		74	73		74	76		52	54
25		64	65		70	66		68	68		52	55
30		60	60			62		66	62			55
35			57			60			59			

Appendix Table 7. Dissolved oxygen and total alkalinity content of Dewey Lake, 1964. Determinations were made once each month, except during the 5-stage November drawdown, at Stations I (German Bridge), II (Brandykeg), and III (Dam). All values are expressed in parts per million. Existing lake elevations (msl) are shown in parentheses (normal summer pool was 650 feet).

Depth (feet)	May 27 (650')			June 15 (650')			July 14 (650')			Aug. 18 (650')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	7.6	8.2	8.4	8.2	8.7	8.4	7.6	8.2	8.1	8.8	7.8	8.0
	25	15	7	31	20	11	33	24	13	30	25	18
5	7.4	8.8	8.2	7.0	9.2	8.6	6.9	8.4	8.5	8.3	7.4	7.0
	-	-	-	33	19	23	35	23	14	31	26	21
10	3.6	8.4	9.8	5.4	8.9	8.7	6.7	7.4	8.4	5.2	8.2	8.0
	33	16	16	39	21	23	34	23	7	37	27	18
15	2.2	4.4	8.8	0.9	6.0	10.5	5.6	1.6	9.8	3.5	5.9	8.2
	-	-	-	38	22	26	29	31	15	39	26	20
20	2.2	2.2	7.0	0.8	2.8	9.0		0.0	8.8		1.3	8.2
	-	20	18	53	25	18		38	10		40	19
25			6.2		1.6	6.2		0.0	3.6		0.0	2.0
			-		26	21		45	15		70	16
30						2.8		0.0	1.1		0.0	0.7
						13		49	15		80	23
35												0.0
												37
40									0.5			0.0
									24			34

Appendix Table 7. (continued)

Depth (feet)	Sept. 8 (650')			Oct. 29 (650')			Nov. 2 (645')			Nov. 10 (645')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	8.3	7.8	9.4	11.6	10.0	9.2	6.2	10.0	9.3	9.8		9.8
	31	27	21	30	25	23	56	25	24	61		26
5	8.1	8.0	8.8	9.6	9.5		5.7	10.0		7.8		
	29	25	20	35	25		57	26		57		
10	5.6	8.0	8.0	7.6	9.9	8.6	6.1	9.8	8.8	7.4		10.8
	35	24	22	45	24	24	57	26	23	56		25
15	0.0	3.2	8.4		9.5							
	63	25	23		23							
20		2.6	7.2		9.7	7.6		9.0	8.4			8.7
		35	20		24	24		25	25			24
25		0.0	1.6		9.1							
		68	20		24							
30		0.0	0.5		7.7	7.4			8.1			9.3
		64	26		26	23			27			24
35			0.0			6.6						
			49			26						

Depth (feet)	Nov. 12 (640')			Nov. 18 (635')			Nov. 25 (630')			Dec. 2 (625')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	7.8	12.0	10.4	9.6	9.6	10.6	11.0	11.2	10.0	14.0	11.0	10.6
	70	29	26	56	43	26	33	56	27	30	47	23
5	7.2	10.4	10.2	9.6			11.4		10.8	13.0	11.0	10.4
	72	29	25	59			32		29	26	48	20
10		10.6	10.4		9.8	10.2		11.0	10.0			10.7
		29	23		44	26		52	29			20
15			9.8						10.2			
			24						30			
20			9.2			11.4						
			23			25						
25			10.1									
			22									

Appendix Table 8. Dissolved oxygen and total alkalinity content at Dewey Lake, 1965. Determinations were made once each month at Stations I (German Bridge), II (Brandykeg), and III (Dam). All values are expressed in parts per million. Existing lake elevations (msl) are shown in parentheses (normal summer pool was 650 feet).

Depth (feet)	March 24 (645')			April 27 (651')			May 26 (650')			June 23 (650')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	13.6	13.4	12.0	8.8	8.6	9.2	8.6	7.2	8.0	9.0	8.2	7.8
	12	12	11	9	13	10	23	20	13	24	15	15
5		13.0					8.0	7.2	8.0	8.0	7.8	
		11					36	13	13	27	17	
10	13.6	13.0	12.0	7.8	8.4	9.4	6.4	7.0	7.8	5.6	8.6	8.0
	13	11	11	9	13	11	41	17	13	35	17	13
15							3.2	5.8	8.6	1.6	3.0	9.0
							42	17	14	45	20	14
20			12.0	7.8	8.0	8.8	0.8	4.6	7.4		2.0	8.6
			10	11	15	11	43	19	13		22	13
25									7.8		0.6	
									13		23	
30			12.0			8.8		4.0	6.4			5.6
			10			11		24	9			13

Depth (feet)	July 27 (650')			August 24 (649')			September 24 (649')			November 23 (645')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	9.0	8.6	8.0	7.8	6.6	8.0	7.6	8.8	8.0	6.8	6.0	6.2
	25	22	16	31	27	24	35	30	24	34	30	27
5	6.4											
	32											
10	4.6	3.4	8.0	3.2	8.0	7.4	5.4	8.6	8.4	6.8	6.4	6.2
	38	31	17	42	26	23	41	32	24	35	28	29
15	5.6			0.6	2.4							
	-			70	32							
20		1.1	9.0		0.6	6.2		0.6	2.6		6.0	6.8
		39	16		80	20		42	27		28	31
25								0.0				
								60				
30		0.0	3.2			1.8			0.4			
		63	16			22			23			

Appendix Table 9. Free carbon dioxide content (ppm) of Dewey Lake before (October 29) and during the 5-stage November drawdown, 1964. Existing lake elevations are shown in parentheses. Station I: German Bridge, II: Brandykeg, III: Dam.

Depth (feet)	October 29 (650')			November 2 (645')			November 10 (645')			November 12 (640')		
	I	II	III	I	II	III	I	II	III	I	II	III
0	4.5	4.0	4.0	17.0	4.0	3.5	12.5		5.8	20.0	5.0	4.0
5	5.5			17.0						23.5	5.0	
10	16.0		5.0	20.0		5.0	13.5		5.8		4.5	
15		4.0										
20			7.0		4.0	4.0			5.8			
25												5.7
30		6.0	7.0			6.5			5.5			
35			7.0									

Depth (feet)	November 18 (635')			November 25 (630')			December 2 (625')		
	I	II	III	I	II	III	I	II	III
0	9.0	8.5	4.0	4.0	17.5	4.0	3.0	19.0	4.0
5	10.0			4.0			3.0	18.5	
10		9.0			18.0				3.5
15						4.0			
20			4.0						