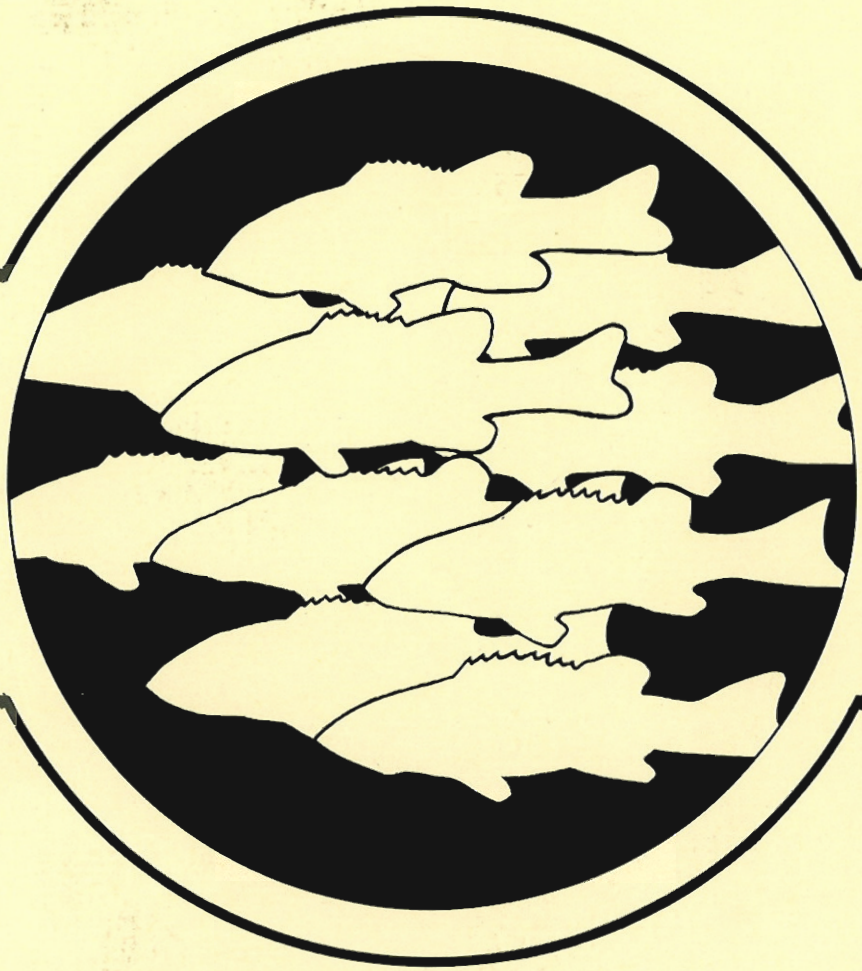

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An Evaluation of Striped Bass Introductions in Herrington Lake

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AN EVALUATION OF STRIPED BASS INTRODUCTIONS IN HERRINGTON LAKE

by

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C O N T E N T S

A B S T R A C T

Herrington Lake was stocked with sub-adult striped bass in 1958 and 1960-62. One- to two-inch fingerlings were introduced in 1969-70 and 1973-78. The fingerling stocking rate in 1973-78 was about 20 fish per acre. Evaluation studies such as water quality determinations, fish population sampling with gill nets, electrofishing, rotenone, food habits, creel surveys, a mail-in survey, and age and growth surveys were conducted in 1973-78 to determine the success of stockings in those years. The purposes of stocking striped bass in Herrington Lake were to utilize the open-water habitat that most of the lake represented, utilize the abundant gizzard and threadfin shad populations, and develop a put-grow-take fishery that would, in part, provide trophy-size fish to Kentucky anglers. The first two objectives were accomplished, and part of the third goal was achieved by providing trophy-size fish. A striped bass fishery did develop, but only during the summer months, if one describes the fishery as that in which an angler fishing for striped bass could expect to catch one. The best harvest was 0.25 pound per acre in 1978. A one percent increase in the sport fish harvest was accomplished in 1975 due to the addition of striped bass to the creel. Two limiting factors, a lack of fishing interest for striped bass and a high natural mortality period for adult striped bass in late summer, prevented a fishery from developing. Future striped bass stockings after 1978 were not recommended. A hybrid between the striped bass and white bass was recommended for annual stocking, instead. Management objectives of developing a put-grow-take fishery where at least one pound of fish is harvested per acre and an increase of the sport fish harvest by at least ten percent were not accomplished by stocking striped bass. These objectives, however, are expected to be achieved by introductions of the hybrid.

I N T R O D U C T I O N

Herrington Lake is located in central Kentucky on the Dix River (Figure 1). This lake was the first major reservoir impounded in Kentucky, when it was formed in 1925. Kentucky Utilities operates the dam for hydropower production. This lake is 2,610 acres at summer pool elevation of 740 feet msl, about 35 miles long, and surrounded by limestone bluffs along much of its shoreline. This lake is one of the deepest lakes in the state, with a maximum depth of 230 feet and an average depth of 70 feet at summer pool. The hydro-intake structure is below 268.25 feet msl.

Striped bass were first introduced into Herrington Lake in 1958 to create a population of sport fish that would increase the sport fish harvest and utilize the abundant gizzard and threadfin shad populations and open-water area that was already inhabited with white bass. Less than 1 striped bass was stocked per acre until 1969, when 10 fish were stocked per acre (Table 1). The stocking rate was increased that year because of the larger number of fry that were available from out-of-state sources. Threadfin shad were introduced into Herrington Lake in 1959, when 550 adult fish from Kentucky Lake tailwater were delivered. This species of forage fish did not become established until the late 1960's after successive stockings of 362, 582 and 5,000 fish in 1965-67 into the 2,400-2,600 acre lake. Besides increasing the stocking rate in 1969, the presence of threadfin enhanced survival of more stocked fish to legal length of 15 inches than in past years.

The increased harvest of striped bass, as a result of the 1969 stocking, prompted the Kentucky Department of Fish and Wildlife Resources to annually stock at least 10 fish per acre in 1973. A Predator Fish Evaluation project, Dingell-Johnson (D-J) Project Number F-39, began during that year that included the study of striped bass stocked in Herrington Lake. Evaluation studies continued under

D-J Project Number F-40 in 1978. Striped bass were annually stocked at about 20 fish per acre during 1973-78. The basis for stocking at least 10 fish per acre was from the recommendation by the Striped Bass Committee of the Southern Division, American Fisheries Society, based on stocking success in other lakes throughout the Southeast. The fish stocked in 1974 were in very poor condition, and poor survival was expected. The other stockings in 1973-78 were of fish that were in good condition.

A put-grow-take striped bass fishery was anticipated from annual introductions of one- to two-inch fingerlings; natural reproduction was not thought possible due to less than 15 miles of headwater available for a spawning run in the Dix River.

METHODS

Striped bass fingerlings, one to two inches in total length, were introduced into Herrington Lake at two or more access sites during late May or early June of each study year in 1973-78, with the exception of 1975 when only one site was used. Striped bass fry were obtained from fish hatcheries in Georgia, North Carolina, South Carolina, and/or Tennessee, and reared to fingerling size for stocking at either the Frankfort National Fish Hatchery or Minor Clark Fish Hatchery near Morehead, Kentucky. Stocking rates ranged from 18 to 25 striped bass fingerlings per acre in Herrington Lake during the study years. Fingerling striped bass were siphoned through a hose from the fish transporting tanks into the lake to avoid problems of handling stress in 1975-78.

Water quality parameters of temperature, dissolved oxygen content, total alkalinity, pH, and specific conductance were measured at three stations located in the upper, middle, and lower sections of Herrington Lake in 1973-75. Temperature and dissolved oxygen profiles were also recorded at the mouth of Cane Run Creek arm during gill netting studies in October 1975 and September 1977, and near the

dam in July 1978. The 1973-75 water quality studies were conducted monthly during June-November 1973, March-October 1974, and April-September 1975. Refer to the D-J Project Number F-39 Annual Performance Reports, Segments 1-3, for these water quality determinations.

Fish population samples, using the standard cove-rotenone method, were taken in three cove areas in the upper, middle, and lower sections of Herrington Lake in July, August, and September 1973-75. The total sample area was from 5.60 to 7.51 acres during each of these years. One cove area in Rocky Fork arm near the dam was sampled in September of 1975 and 77 (1.85 a) and in August 1978 (1.88 a). Emulsifiable rotenone (2.5% or 5% active ingredient) was applied as a fish toxicant at a rate of 1 ppm in the sample area after partitioning the cove from the main lake by a 0.5-inch mesh block net. Fish were recovered during three consecutive days, during which time they were identified and measured to the nearest inch group. Fish weights were recorded during the first day and applied to fish collected during the following two days. Cove-rotenone data were classified as shown in Table 2, and presented on a per-acre basis.

The headwater area of Herrington Lake, in Dix River, was electrofished during two days in April 1974. Relative survival of each yearly stocking of striped bass fingerlings to ages 0+ and I+ was determined from catch per net day (CPND) in the fall and early winter months. This sampling procedure was recommended by the Striped Bass Committee of the Southern Division, American Fisheries Society. An experimental gill net of monofilament nylon was fished at three locations in Herrington Lake (in the upper, middle and lower sections) during each three-day set in October, November, and December 1973 and October 1974. The net was 450 feet long, 8 feet deep, and had three 150-foot panels of either 0.75-, 1.25-, or 1.75-inch mesh. In November and December 1974, this net was fished across the mouth of Rocky Fork arm where the probability of capturing striped bass was thought to be highest. The entrances to both Rocky Fork and Cane Run arms were

each spanned with an experimental gill net having 150 foot panels of 0.75-, 1.25- and 2-inch mesh during three days each month in October, November, and December 1975. The same two nets were also fished in these two arms of the lake in October 1976 and 1977. In October 1978, four 300-foot long by 8 foot deep gill nets (multifilament) of either 0.5-, 1.0-, 1.5- or 2-inch mesh were fished in Rocky Fork and Cane Run arms in October 1978. Two 300-foot long by 8 foot deep monofilament gill nets having a mesh size of 2.5 inches, were fished across the entrance to Rocky Fork arm during two days in May 1975. Two 3-inch mesh gill nets were stationed as one section across the main channel of the lake at various locations in the upper lake area during six days in April and two days in May 1976. Fish were sampled with one or two electrofishing units during four days in April 1976. Herrington Lake was fished with 3- and 4-inch mesh gill nets during 11 days in April and May 1977. Gill nets of 3-, 3.5- and 4-inch mesh were fished during 22 days in May 1978.

A Ross SL-600 C fine-line recorder was operated as a sonic device to record depths and horizontal distribution of fish that may be striped bass. On the days of July 1 and September 23, 1977, and August 29, 1978, the recorder was utilized to relate vertical fish distribution with dissolved oxygen and temperature profiles, and to describe the behavior of striped bass during the late-summer natural-mortality period of these fish larger than 4 to 6 pounds. This seasonal mortality of striped bass became pronounced in 1976, and continued to occur each August and early September in 1977-78. Fish were also recorded with the sonic device on May 17, 1978, to indicate the location of striped bass during gill netting operations.

Stomach items were visually identified from striped bass that had not survived from gill netting activities in October 1975 and 1976.

A non-uniform probability creel survey was conducted at Herrington Lake from March 1 through October 31, 1973-76. This survey was designed by statisticians

at North Carolina University, Institute of Statistics. Local conservation officers conducted the surveys by boat. A fishing day was divided into two 6-hour survey periods between 7 am and 7 pm prevailing time. Each of the fourteen 6-hour periods in a week was given a probability based on pressure count data in past years; one of these periods was randomly selected from a random numbers table and scheduled to represent a one-week period. An instantaneous count of anglers was made during 2 of the 6 hours in the period. Anglers were interviewed during the remaining 4 hours. Data was processed by computer using a Fortran IV program.

A boat dock survey of the striped bass harvest was conducted from May 1 through December 31, 1978. Boat dock operators at 6 boat docks were asked to keep a monthly record of the length and weight for each striped bass that was brought across their dock.

A mail-in survey was conducted from May 1, 1975, through December 31, 1978. Anglers were to submit a self-addressed questionnaire envelope if they caught a striped bass in Kentucky waters. Scales from each fish were to be placed within the envelope so that age and growth could be determined. A silver-plated clutch-back pin, that depicted a striped bass, was given to an angler for each fish harvested and recorded in the survey. A certificate of achievement was also given for the first walleye that was recorded caught by each angler. Information from the questionnaire included the angler's name and address, length and weight of the fish, angler intent, location of catch, fishing method, and lure or bait used.

Age and growth of striped bass were determined from reading scales belonging to fish captured by gill nets in October-December, and from mail-in survey returns. Scales were prepared on a wet-slide mount and observed on a scale projector. The Dahl-Lee direct-proportion method was applied to calculate the length of striped bass after each year of growth.

R E S U L T S

Fish Population Studies

Fish standing crop, during 1973-78, fluctuated between 217 pounds per acre (lb/a) in 1977 to 776 lb/a in 1973 at Herrington Lake (Table 4). The Y/C ratio (Table 3) of forage fish to carnivorous fish was within the most desired range of 1 to 3 in 5 of the 7 years. Forage fish standing crop was less than desirable only in 1978, when the Y/C ratio was 0.4. The presence of 116.5 lb/a of white bass caused the ratio to be at such a low value (Table 5). The A_{T1} value was below optimum range for balanced fish populations of 60 to 85.

Striped bass were collected during cove-rotenone studies in 1975-78. The striped bass population varied from 1 fish per acre (f/a) and 0.02 lb/a in 1975, to 7 f/a and 2.73 lb/a in 1977. Striped bass represented 3% of the game fish standing crop in 1976, and 13% in 1977 (Table 6). Only young-of-year striped bass were collected during cove-rotenone studies in 1975-76 and 1978. Three of 10 fish in the 1977 study were age I+, or 1976 year-class fish, and belonged to the 14- and 15-inch group.

The dominant forage fish was either gizzard or threadfin shad each year. Threadfin shad standing crop outweighed that for gizzard shad during 2 of the 6 years in 1973-78. The highest standing crop of threadfin ever recorded in the lake was 293 lb/a in 1976. Threadfin were the most utilized forage by young-of-year striped bass in late summer and fall as discussed in more detail in the Food Habits section.

Gill Netting and Electrofishing Studies

Ninety striped bass, all belonging to the 1973 year class, were captured by gill nets in April and/or May 1975-78 in Herrington Lake. This year class was of sub-adult fish when captured at age II in 1975; part of these fish became sexually mature in 1976 at age III. All of the striped bass were mature at age IV in 1977. Yearly catch of the 1973 year class in the spring of 1975-78 were 1, 45, 26, and 18 fish.

The lower section of Dix River above the lake was electrofished in April 1974 for striped bass, but there was none observed. However, in April 1976, 3 striped bass of the 1973 year class were captured by electrofishing in the Fairview area of the lake at sunrise in conjunction with gill netting operations.

Each of the 5 stockings in 1973-77 were captured during the 6 years of gill netting in October-December, 1973-78 (Table 7). The 1978 year class was not in the October 1978 catch. Good survival of the 1973, 1976, and 1977 year-classes to age 0+ (age 6-8 months) was indicated by the CPUE of 1.11, 2.00, and 3.00 for these year classes. The 1974 and 1975 stockings were each represented in the catch during only one netting period - in October, 1976. The highest CPUE of age I+ striped bass was 2.83 for the 1976 year class; CPUE of 0.83 for the 1977 year class ranked second. The CPUE for these 2 years of stocking indicated these fish had the best survival to age I+, at which time they were approaching legal length of 15 inches. The poor CPUE for the 1974 year-class was attributed to poor condition of the fish when stocked. The 1975 year-class did not survive well, due to the low availability of forage size (0-3.4 in) gizzard shad and threadfin shad (Table 5) in 1975.

Food Habits

Threadfin shad occurred in 11 of 13 striped bass stomachs that contained identifiable food items. Two 1.5-inch threadfin were found in the stomach of a 22-inch striped bass netted in October 1975. Food items identified in stomachs of striped bass captured in October 1976 included 1-3 inch threadfin shad from 10 stomachs, a 4-inch bluegill from the stomach of a 17.6-inch fish, and a 2-inch brook silverside from a 6.9-inch fish. A 9-inch striped bass contained 7 threadfin shad that were 2-3 inches long.

Fish Harvest

The overall fishery in terms of fish harvested per acre (lb/a) was nearly constant in 1973-76, as 18 to 23 lb/a were creeled in 3 of the 4 years (Table 8).

Thirteen lb/a were harvested in 1975, but fishing pressure was also lowest that year at 34 man-hours per acre (m-h/a). The reduction in harvest was influenced by a decline in lb/a of white bass and crappie (Table 9). Although fishing pressure has almost doubled at Herrington Lake from a mean of 24 m-h/a in 1959-61 to 46 m-h/a in 1973-76, fish harvest has not declined from over-exploitation. To the contrary, it has more than quadrupled from an average of 4.3 lb/a to 18.75 lb/a. This increase in harvest illustrates the beneficial impact of establishing a forage fish such as threadfin shad. Since the first threadfin introduction in 1959, and their self-sustaining status in the late 60's from the 1965-67 stockings, forage fish standing crop has increased from a mean of 86 lb/a in 1950-59 to 293 lb/a in 1973-78. The total standing crop of fish in Herrington Lake was improved accordingly, increasing from 153 to 805 lb/a, and also provided more pounds of game fish available to anglers - 47 lb/a compared to 30 lb/a before threadfin were stocked.

The best striped bass harvest was only 0.25 lb/a in 1978 according to a boat dock survey that year (Table 10). Many of these fish were suspected to have not been creeled but captured on the lake surface while in distress from low oxygen content and/or high temperatures in August and September. This period of stress is explained in more detail in the Discussion section. The greatest number of striped bass creeled was 105 fish in 1975. Anglers harvested 0.18 lb/a of striped bass that year, which meant an increase of 1% to the lb/a of all fish harvested. It took about 41 hours to creel a striped bass in 1975. Nearly all of the fish harvested in 1973-76 were from the 1973 year class. The mean weight of harvested striped bass increased from 2.83 lb in 1973 to 11.04 lb in 1978, as the 1973 year class continued to dominate the catch.

Mail-In Survey

Between 35 and 97 striped bass were annually recorded from Herrington Lake during the 1975-78 survey (Table 11). Although no quantitative measure of harvest

could be ascertained, other characteristics of the striped bass fishery were displayed that were not available from creel survey data. Summer months of June-August represented the period in each year of the survey when striped bass were most frequently harvested. Striped bass were apparently more concentrated during these months near the dam as indicated in Table 12. Of 210 total striped bass recorded in the 4-year survey, 121 fish (58%) were creeled within 1 mile above the dam. The next most common location of catch was in the Fairview and Mile-stretch area (Figure 1), where the main channel took the most meandering coarse. Such an area was also described by Stooksbury (1976) as an attraction for striped bass at J. Percy Priest Reservoir in Tennessee. Mean weight of recorded striped bass gradually increased from 3.82 pounds per fish in 1975 to 14.77 pounds in 1978. This was due to the dominance of the 1973 year-class in the catch throughout the study (Table 14). Twelve to 32 different anglers submitted a record of their catch each year. However, a husband and his wife caught the majority (131) of the 219 fish recorded in 1975-78.

Age and Growth

Striped bass from gill net catches in 1973-78 were from the 1973-77 year-classes (Table 13). Growth of all but the 1975 year-class fish was to 10-12 inches in length by age I. The one 1975 year class fish grew to only 5.2 inches at age I. Slow growth of this fish was caused by the low standing crop of threadfin shad and forage-size (0-3.4 in) gizzard shad that year (Table 5). The 1973 year-class fish surpassed legal length of 15 inches during their second year of growth at age I+.

Age and growth of striped bass from the mail-in survey in 1975-78, as shown in Table 14, revealed that the 1973 year-class dominated the fishery each year. The 1974 year-class fish grew slower from age I to age II than did fish from the 1969 and 1973 year-classes. This was because of the low crop of threadfin shad and forage-size gizzard shad available as forage in 1975. The 1969, 1973,

1974, and 1976 year-class striped bass reached legal length of 15 inches when age I+.

D I S C U S S I O N

Striped bass fingerlings were introduced into Herrington Lake in 1958 to utilize both open water habitat that made up most of the lake, and control of the abundant gizzard shad population. Fish managers discovered in the late 1960's that striped bass can be expected to utilize, not control, gizzard shad populations. The concept of controlling shad populations by stocking striped bass was found to be invalid according to Bailey (1974). When threadfin shad became abundant in the late 1960's in Herrington Lake, the potential for developing a fishery was enhanced. The increased stockings of about 20 fingerling striped bass per acre in 1973-78 were at a rate accepted by most fishery agencies in the southeast. Another objective of developing a striped bass fishery was to increase the sport fish harvest and provide a unique fishery to Kentucky anglers. However, the best harvest rate was 0.25 lb/a in 1978. A seasonal fishery did develop during the summer months if one uses the definition of a fishery by the Striped Bass Committee as a fishing opportunity where an angler can fish for striped bass and expect to catch one (Stevens 1974). The highest percent by which the annual striped bass harvest improved the lb/a of all fish harvested was 1%, which was in 1975. This was far short of the management objectives of 1 to 2 pounds of striped bass per acre or $\geq$ 10% increase to the lb/a harvested of all fish. The goal of at least 1 lb/a was realistic since Jenkins (1976) described 10 striped bass fisheries in Southeastern reservoirs as having a mean harvest rate of 1 lb/a. The Striped Bass Committee has recently reported creel data, including lb/a creeled in 22 lakes throughout the Southeast; the mean lb/a of striped bass harvested in 21 lakes, excluding Herrington Lake, was 1.37 lb/a (to be published). If either one of these objectives had been achieved, the striped bass introductions

would have been successful, and warranted a continuation of annual stockings to maintain the put-grow-take fishery.

Two major problems limited the striped bass fishery from developing to an accepted level. First of all, not enough anglers were attracted to fish for this species. The highest fishing pressure by anglers during the creel surveys in 1973-76 was only 0.6 m-h/a in 1976. Although an annual average of 22 different anglers caught striped bass according to the 1975-78 mail-in survey, one man and his wife caught the majority - 131 of 210 fish recorded.

Another limiting factor was the natural mortality of adult striped bass larger than 4-6 pounds in August and September 1976-78. This phenomenon had also occurred in other impoundments in the Southeast. By observing the temperature-oxygen profile and vertical fish distribution from graph recordings with a Ross SL-600 C depth recorder, evidence was given toward a temperature preference by striped bass that reached adult size. The depth range (28-32 ft) at which the larger fish were located in September 1977 contained temperatures of 73-74°F (Table 15). During August 1977, the zone of insufficient dissolved oxygen content quickly moved down lake to the area immediately above the dam. Fish thought to include striped bass were recorded at depths of 30 to 62 ft in this area in July. These fish could not survive the reduction of oxygen content and/or temperature increase when they were forced to find more shallow depths having sufficient oxygen levels. Mortality of this nature appeared to increase as the fish stocked in 1973 grew to larger size ln 1977-78. A similar cause of mortality was described by Coutant (personal communication) at Cherokee Lake in Tennessee. The loss of trophy-size striped bass because of their temperature preference appeared to significantly reduce the amount of fish that would otherwise be available to the angler.

RECOMMENDATIONS

Striped bass will not provide a consistent fishery that approaches in any one year the harvest of 1 lb/a or ≥ 10% increase to the total fishery in Herrington Lake for reasons discussed in the Discussion section. Therefore, a continuation of striped bass stockings after 1978 is not recommended. The striped bass (male) x white bass (female) hybrid should be stocked instead. This hybrid, because of its faster growth during the first 2 or 3 years, better survival expectancy, and success in lakes in the Southeast where striped bass were not, should surpass the management objectives not achieved by stocking striped bass. Ware (1974) reported that where both striped bass and hybrids had been stocked, the hybrid provided a more superior sport fishery in almost every lake. Also, the late summer mortality of adult striped bass had not been documented to be a characteristic of the hybrid. Studies similar to those conducted to evaluate striped bass stockings should be implemented to fully evaluate hybrid stockings in Herrington Lake.

A C K N O W L E D G M E N T S

The efforts of all members of the Division of Fisheries who assisted D-J Project F-39 Assistant Charlie Gorham and me during 1973-78 at Herrington Lake were greatly appreciated by both of us. The one person who deserves special recognition is Charlie Gorham for his performance throughout the 6 years of study, especially when most of the field work had to be under his supervision in 1978. I am grateful for the efforts of Conservation Officers Marion Key, Tom Mathews, and Mike Fisher, who devoted part of their duties toward serving as creel clerks during the 1973-76 creel surveys.

L I T E R A T U R E C I T E D

Bailey, W. M. 1974. An evaluation of striped bass introductions in the southeastern United States. Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm. 28:54-68.

Jenkins, R. M. 1976. Prey-predator relations in the predator-stocking-evaluation reservoirs. Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm. 30:141-157.

Stevens, R. E. 1974. Current and future considerations concerning striped bass culture and management. Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm. 28:69-73.

Stooksbury, S. W. 1976. A biotelemetry study of the striped bass (*Morone saxatilis*) Walbaum of J. Percy Priest Reservoir. TN Wildl. Res. Agency Prog. Rep. 39 pp.

Ware, F. J. 1974. Progress with *Morone* hybrids in fresh water. Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm. 28:48-54.

A P P E N D I X

(Figure 1, Tables 1-15)

Table 1. Striped bass introductions in Herrington Lake.

Date	Number of fish	Size (in)	Stocking rate (no/acre)	Lake area when stocked (acres)
1958	95	9-13	< 1	
1960	69	9-13	< 1	
1961	118	9-13	<1	
1962	254	9-13	<1	
1968	145	2	<1	
1969	21,872	2-3	10	2,300
1970	9,555	2-3	4	2,300
1973	39,800	1-2	18	2,205
1974	51,000	1-2	23	2,268
1975	54,450	1-1.25	21	2,640
1976	64,500	1-2	25	2,577
1977	50.490	1-2	19	2,592
1978	51,231	1-2	19	2,646

Table 2. Standard form used by Kentucky Division of Fisheries for reporting fish population study data. A_{T1} ("legal total availability") applies only to those species that have a legal size limit. The black bass A_{T1} changed to 12 inches in 1978.

GROUP/species	Fingerling size Range (inch group)	Intermediate size Range (inch group)	Harvestable size Range (inch group)
GAME FISHES			
Rainbow trout	0-4	4-7	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
Striped bass	0-4	5-14	15 (A_{T1})
Sauger	0-4	5-11	12
Walleye	0-4	5-14	15 (A_{T1})
Largemouth bass	0-4	5-9	10 (A_{T1})
Smallmouth bass	0-4	5-9	10 (A_{T1})
Spotted bass	0-4	5-9	10 (A_{T1})
Black crappie	0-4	5-7	8
White crappie	0-4	5-7	8
FOOD FISHES			
Blue catfish	0-4	5-9	10
Channel catfish	0-4	5-9	10
Flathead catfish	0-4	5-9	10
PREDATORY FISHES			
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
Spotted gar	0-4	5-23	24
Bowfin	0-4	5-13	14
Americal eel	-	8-15	16
PANFISHES			
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 FISHES			
Sturgeons	0-7	8-23	24
Paddlefish	0-7	8-23	24
Buffalofishes	0-4	5-11	12
Carpsuckers	0-4	5-11	12
Northern hogsucker	0-4	5-11	12
Redhorses	0-4	5-11	12

Table 3. Classification of fishes that represent the forage group (Y) and carnivorous group (C) for determination of the Y/C ratio in Kentucky lakes. The forage fish size ranges (inch group ranges) were arbitrarily selected according to what the average size predator (9.5-in largemouth bass) can swallow (Lawrence 1957). Weights of Y and C fish groups are used to determine the Y/C ratio.

	Forage fish size range (in group)	Carnivorous fish size range
Esox sp.	0-6	all sizes
White bass	0-4	all sizes
Striped bass	0-4	all sizes
Sauger	0-5	all sizes
Walleye	0-5	all sizes
Black basses	0-5	all sizes
Crappie	0-4	> 8 in group
Blue catfish		> 3 lb
Channel catfish		>2 lb
Flathead catfish		>8 lb
Gar	0-6	
Panfishes	0-3	
Redhorses	0-4	
Suckers	0-4	
Carp	0-3	
Bullheads	0-4	
Freshwater drum	0-4	
Shads	0-4	
Shiners	0-5	
Misc. cyprinids	0-5	
Top minnows	0-5	
Darters	0-5	
Brook silverside	0-5	
Sculpins	0-4	

Table 4. Standing crop, A_{T1}, and Y/C values of the fish population derived from cove-rotenone studies at Herrington Lake in 1973-78.

Date	Total fish population		Striped bass		A_{T1}	Y/C
	No/a	Lb/a	No/a	Lb/a		
1973	30,470	776			70	2.4
1974	15,234	278			57	1.8
1975	8,499	540	1	0.02	43	1.0
1976	26,428	470	7	0.48	20	18.9
1977	6,903	217	7	2.73	50	1.8
1978	7,457	486	1	0.07	54	0.4

Table 5. Fish standing crop for game fishes and shads, based on cove-rotenone studies conducted in 1973-78 at Herrington Lake.

Date	White bass Lb/a	Striped bass Lb/a	Black bass* Lb/a (F-I-H)	Large-mouth bass Lb/a	Small-mouth bass Lb/a	Spotted bass Lb/a	Black Crappie Lb/a (F-I-H)	White Crappie Lb/a (F-I-H)	Gizzard shad Lb/a (F-I-H)	Threadfin shad Lb/a
1973	10.5		2.3 11.1 13.1	18.7		7.7	t 0.5 0.4	0.1 2.3 1.0	6.1 44.9 452.2	119.9
1974	1.6		0.8 5.9 26.3	27.9		5.1	t t 0.1	1.2 1.2 1.8	1.5 9.8 32.0	62.2
1975	2.3	t	0.5 2.4 8.2	9.2		1.9	t t 0.3	1.0 4.7 3.4	0.4 243.0 73.7	13.1
1976	0.4	0.5	0.5 1.9 10.5	8.7	0.8	3.4	t 0.2 1.6	t 1.2 2.2	35.1 42.3	293.1
1977	0.4	2.7	0.9 4.5 12.1	10.0		7.5	t	t	0.3 4.9 55.5	31.8
1978	116.5	0.1	2.0 8.9 9.0	13.1	0.2	6.6		0.3 2.0 2.2	1.9 5.1 185.4	31.6

F = forage size, I = intermediate size, and H = harvestable size (refer to Table 2).

t < 0.05 lb/a.

* Black bass standing crop was influenced in 1978 by a change in length limit from 10 to 12 inches.

Table 6. Fish standing crop data from cove-rotenone studies conducted at Herrington Lake in 1973-78.

Date	Total	Game Fish		Food Fish		Predatory Fish		Panfish		Commercial Fish		Forage Fish	
	Lb/a	Lb/a	%	Lb/a	%	Lb/a	%	Lb/a	%	Lb/a	%	Lb/a	%
1973	775.6	42.7	5.5	16.7	2.2	0.8	0.1	48.9	6.3	42.8	5.5	623.6	80.4
1974	278.3	38.8	13.9	10.1	3.6	1.0	0.4	56.1	20.2	66.8	24.0	105.5	37.9
1975	539.6	22.8	4.2	18.5	3.4	1.8	0.3	37.0	6.9	128.9	23.9	330.5	61.3
1976	469.6	18.9	4.0	20.8	4.4			47.9	10.2	30.0	6.4	380.8	79.0
1977	217.5	20.7	9.5	19.0	8.7			68.2	31.4	16.5	7.6	93.1	42.8
1978	486.5	140.9	29.0	11.3	2.3			60.0	12.3	49.9	10.3	224.4	46.1

Table 7. Catch per net day* and total catch (in parentheses) for each year class of striped bass taken with gill nets in October or October-December 1973-78 at Herrington Lake.

Netting period	Striped bass year classes				
	1973	1974	1975	1976	1977
OCT-DEC 73	1.11 (10)				
OCT-DEC 74	0.11 (1)				
OCT-DEC 75	0.17 (3)				
OCT 76	0.17 (1)	0.17 (1)	0.17 (1)	2.00 (12)	
OCT 77				2.83 (17)	3.00 (18)
OCT 78					0.83 (5)

* A net day was equivalent to a 24 hr set with a 450-ft long 8-ft deep, monofilament gill net having three 150-ft panels of different mest sizes of either 0.75, 1.25, and 1.75 inches, or mesh sizes of 0.75, 1.25, and 2 inches.

Table 8. Fishery data derived from creel surveys at Herrington Lake from March 1 through October 31, 1973-76.

	Man-hours per acre	Trips per acre	Fish per acre	Pounds per acre	Fish per hour	Pounds per hour
1973 (2,658 a)	46	16	79	23	1.73	0.50
1974 (2,313 a)	42	16	52	18	1.24	0.44
1975 (2,599 a)	34	14	41	13	1.22	0.40
1976 (2,520 a)	62	25	47	21	0.91	0.33

Table 9. Creel survey results for the most harvested species of fish, striped bass, and all fish caught by anglers fishing for "anything" at Herrington Lake in 1973-76.

	Man-hours per acre fishing for				Total pounds per acre				Total fish per acre				Fish harvest (no) per hour			
	1973	1974	1975	1976	1973	1974	1975	1976	1973	1974	1975	1976	1973	1974	1975	1976
White bass	4.0	0.3	2.9	6.9	4.7	3.4	1.9	2.7	11.1	5.2	2.4	4.0	2.46	0.70	0.75	0.47
Striped bass			0.3	0.6			0.2	t			t	t			0.02	0.00
Black basses	13.3	13.6	11.8	18.6	7.5	5.9	4.9	4.1	6.9	5.7	5.1	4.1	0.46	0.37	0.38	0.19
Crappies	4.8	7.5	2.9	11.8	1.6	3.3	0.8	6.5	4.3	8.4	2.0	13.5	0.82	1.09	0.58	1.10
Sunfishes	16.6	8.8	7.6	9.7	7.5	3.7	3.8	4.3	55.4	30.3	29.5	31.9	2.95	2.75	2.93	2.42
Fishing for "anything"	6.7	5.2	7.6	13.3	1.4	1.5	1.9	2.7	7.0	6.0	8.0	9.1	1.04	1.15	1.05	0.69

$t < 0.05$.

Table 10. Striped bass harvest based on a non-uniform probability creel survey from March 1 through October 31, 1973-76, and a boat dock survey from May 1 through December 31, 1978.

	Number creeled	Pounds creeled	Pounds per acre	Mean length per fish (in)	Mean weight per fish (lb)	Man-hours after striped bass	Harvest	
							Fish/hr	Hours/fish
1973	0	0	0	-	-	0	-	-
1974	83	236	0.10	18.4	2.83	0	-	-
1975	105	465	0.18	22.4	4.41	899	0.02	41
1976	22	89	0.04	22.0	4.04	1,611	0	0
1978	56	618	0.25	28.1	11.04	*	*	*

* These values could not be determined from the boat dock survey.

Table 11. Mail in survey returns of striped bass creeled at Herrington Lake from May 1, 1975, through December 31, 1978.

	1975		1976		1977		1978	
	No	Lb	No	Lb	No	Lb	No	Lb
JAN								
FEB								
MAR								
APR	6	17.62	9	52.00	5	44.25	1	13.50
MAY	21	60.38	3	16.75	1	10.75	2	16.00
JUN	3	25.00	1	7.38	8	86.25	17	217.80
JUL	14	49.88			21	205.25	6	69.75
AUG	26	94.25	36	221.00			3	42.00
SEP	10	45.19	2	12.26	4	36.25	7	172.50
OCT	15	68.50			13	113.50		
NOV	2	9.50			2	15.00		
DEC								
Total	97	370.32	51	309.38	54	511.25	36	531.55
Mean weight (lb)		3.83		6.07		9.47		14.77

Table 12. Month and location of catch for creeled striped bass recorded during the mail-in survey at Herrington Lake from May 1, 1975 through December 31, 1978.

	Number creeled per area				
	Dam to 1 mi above	Rocky Fork Arm	Cane Run Arm	5-7 mi above dam	Total
JAN					
FEB					
MAR					
APR	2	7	2	6	17
MAY	11		3	11	25
JUN	19			8	27
JUL	39	1		1	41
AUG	29			31	60
SEP	11	1	6	2	20
OCT	8	1	2	5	16
NOV	2	1	1		4
DEC					
Total	121	11	14	64	210

Table 13. Age and growth of striped bass captured in gill nets at Herrington Lake in 1973-78. Number of fish aged to determine each length is in parentheses.

Year class	Total length (in) at age		
	I	II	III
1973	12.1 (5)	18.0 (2)	22.0 (1)
1974	10.1 (1)	13.8 (1)	
1975	5.2 (1)		
1976	9.9 (11)		
1977	12.2 (5)		

Table 14. Year class distribution and age-growth data of striped bass from mail-in survey returns at Herrington Lake in 1975-78.

Year creeled	Year class	Number of fish	Total length (in) at age					
			I	II	III	IV	V	VI
1975	1973	93	12.3	18.8				
1975	1969	3	12.6	19.6	23.2	26.4	28.6	30.6
1976	1974	1	10.2	16.6				
1976	1973	50	11.2	18.5	22.8			
1977	1974	4	9.9	15.3	19.1			
1977	1973	50	12.0	18.8	22.3	26.2		
1978	1977	2	11.3					
1978	1976	4	10.4	18.2				
1978	1974	1	10.2	15.4	19.2	23.4		
1978	1973	28	11.3	18.3	22.7	26.8	29.4	

Table 15. Profile of temperatures and dissolved oxygen content at the entrance to Cane Run arm at Herrington Lake on September 23, 1977.

Depth (m)	Depth (ft)	Temperature (°F)	Dissolved oxygen (ppm)
0	0	76	7.4
1	3.3	75	7.5
2	6.6	75	7.4
3	9.8	75	7.4
4	13.1	75	7.3
5	16.4	75	7.3
6	19.7	75	7.2
7	23.0	75	7.2
8	26.2	75	6.3
9	29.5	74	5.3
10	32.8	73	3.8
11	36.1	72	0.6
12	39.4	71	0.6
13	42.7	70	0.6
14	45.9	67	0.7
15	49.2	65	0.8
20	65.6	56	1.4
25	82.0	53	2.3
30	98.4	52	4.3