

- Kendle, E. R. 1970. Preliminary studies of hybridization between three species in the family *Ictaluridae*. Nebr. Game and Parks Comm. D-J Proj. F-4-R-15 (Job V-a). 3 p.
- Langemeier, R. N. 1965. Effects of channelization of the limnology of the Missouri River, Nebraska, with emphasis on food habits and growth of the flathead catfish. M. A. Thesis. Univ. of Mo. 134 p.
- Lawrence, J. M. 1958. Estimated sizes of various forage fish largemouth bass and swallow. Proc. S. E. Assoc. Game and Fish Comm. 11(1957): 220-225.
- Minckley, W. L. and J. E. Deacon. 1959. Biology of the flathead catfish in Kansas. Trans. Amer. Fish. Soc. 88: 344-355.
- Paloumpis, A. A. 1963. A key to the Illinois species of *Ictalurus* (Class Pisces) based on pectoral spines. Trans. Ill. State Acad. Sci. 56(3): 129-133.
- Parrack, M. L., B. E. Brown, and G. Mensinger. 1970. A survey of the commercial fishery on four Oklahoma reservoirs. Proc. S. E. Assoc. Game and Fish Comm. 23(1969): 532-545.
- Schneidermeyer, F. and W. M. Lewis. 1956. Utilization of gizzard shad by largemouth bass. Prog. Fish-Cult. 18: 137-138.
- Summerfelt, R. C., P. E. Mauck and G. Mensinger. 1971. Alimentary tract contents of the carp, *Cyprinus carpio* L., in five Oklahoma reservoirs. Proc. S. E. Assoc. Game and Fish Comm. 24(1970): In Press.
- Swedberg, D. V. 1968. Food and growth of the freshwater drum in Lewis and Clark Lake. South Dakota. Trans. Amer. Fish. Soc. 97: 442-447.
- Swingle, H. S. 1954. Fish populations in Alabama rivers and impoundments. Trans. Amer. Fish. Soc. 83: 48-57.
- Swingle, H. S. 1967. Experiments with the flathead catfish (*Pylodictis olivaris*) in ponds. Proc. S. E. Assoc. Game and Fish Comm. 18 (1964): 303-308.

PREDATION ON STOCKED RAINBOW TROUT BY CHAIN PICKEREL AND LARGEMOUTH BASS IN LAKE OUACHITA, ARKANSAS

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ABSTRACT

In many reservoirs predation on stocked fish has been considered as one of the major limiting factors in establishing a particular population.

Following several years of water quality determinations it was found that Lake Ouachita maintained a sufficiently oxygenated hypolimnion to support trout. As a result several thousand catchable rainbow trout, *Salmo gairdneri*, were stocked into the lake. The results of this attempt to establish a trout fishery have been disappointing for a combination of reasons; however, while collect-int for brookstock chain pickerel, *Esox niger*, and from fisherman reports, it became evident that predation on the stocked trout must be very high.

Collections of largemouth bass, *Micropterus salmoides*, and chain pickerel were made with a boom-type electro-shocker during January and February, 1970. Sampling was done at night within an approximate 100-acre area adjacent to a trout stocking point. Two separate areas were collected and collections were made the date on which trout were stocked, one day after stocking, two days after stocking, and eight days after stocking.

During the collecting period a total of 14,840 nine inch trout were stocked in the two collecting areas.

Eighty-six (86) largemouth bass, weighing 162.9 pounds and twenty-four (24) chain pickerel, weighing 33.1 pounds, were collected for stomach analysis. The smallest size bass containing trout in its stomach was sixteen (16) inches total length. The smallest chain pickerel in which a trout was found was fifteen (15) inches in length.

Of all chain pickerel, fifteen inches and over, 54.5% has trout in their stomachs and 48.6% of the largemouth bass, sixteen inches and longer, contained trout. One hundred percent of the chain pickerel, nineteen inches or larger, and ten of the eleven bass, eighteen inches or larger, contained trout.

Although the size trout stocked during these collections averaged nine inches in length, 79.6% of the trout consumed were eight inches or less. No trout over nine and one-half inches was found in bass or pickerel stomachs; however, two or more trout per stomach was common and five was the maximum number of trout found in one stomach.

INTRODUCTION

Predation on fish stocked in a reservoir already containing an established fish population has been considered by many workers as being one of the major limiting factors in the success of the stocking. This is particularly true in the clearer lakes, in lakes that have high predator fish populations, and when the stocked fish are fry or small fingerlings. Also, it has generally been considered that stocking catchable size fish reduces predation to an insignificant amount. However, it has become apparent that even the catchable size rainbow trout is very susceptible to predation if the trout are not of a sufficient size.

During the winter months when catchable size rainbow trout were being stocked into Lake Ouachita, adult chain pickerel, were being collected from this lake and transported to other lakes in the state. Each time a load of pickerel was hauled, numerous regurgitated trout would be found in the hauling containers. Also, bass fishermen frequently remarked about finding trout in the stomachs of their catch. As a result, a small scale study was initiated to determine to what extent largemouth bass and pickerel were feeding on trout.

HISTORY OF LAKE OUACHITA'S TROUT PROGRAM

Lake Ouachita, located near Hot Springs, Arkansas, has a surface area of approximately 40,000 acres at power pool elevation. It has a maximum depth of over 200 feet with an outlet depth of 80 feet at power pool elevation.

Periodic oxygen - temperature profiles have been made in the lower end of the reservoir since 1965, and as a result it was determined that the hypolimnion remained sufficiently oxygenated throughout the critical summer months to support trout. (Keith and Hulsey 1967).

The stocking of trout into Lake Ouachita began in the winter of 1966, and the following numbers and sizes were subsequently stocked:

DATE	NUMBER	SIZE
1966-67	85,025	6-10 inches
1967-68	80,520	9-9½ inches
1968-69	37,974	9-10 inches
1969-70	78,350	8-9 inches

The few trout caught which had been in the lake for a year or longer have demonstrated excellent growth of the fish; however, the overall fishermen harvest of trout, disregarding the period during stocking, has been disappointing. Some of the possible reasons for the disappointing trout program on Lake Ouachita include (1) failure of the fisherman to use the proper fishing technique

during the summer stratification period (2) high initial harvest of stocked fish and (3) too small fish being stocked resulting in extensive predation by the large predator fishes in the lake.

COLLECTION PROCEDURES AND SITES

Collections for stomach analysis of largemouth bass and chain pickerel were made with a three-electrode, boom-type, boat mounted shocker powered by a 220-volt, Homelite generator. Collecting was done after dark during January and February 1970.

The collection sites were primarily the shoreline of a 75 to 100-acre area adjacent to a trout stocking point. Around brush piles, tree-tops, and stumps were the most productive spots for collecting the desired fish.

Stunned fish were dipped from the water and placed in an ice box. Length, weight, and stomach contents of each predator fish were recorded, and the total length of each trout found in a stomach was recorded. The stage of digestion of these trout was very early, and there was little difficulty in determining the length of trout to the nearest one-half inch. In a few cases length was determined by comparing a whole trout with comparable body shape and size to a partially digested trout.

In order to determine if there was a significant variation in the extent of predation over a period of time, collections were made the date on which trout were stocked, one day after stocking, two days after stocking, and eight days after stocking.

The shocking-rig often turned-up large numbers of trout at various locations along the shoreline. Large concentrations were also found near the back of small bays or pockets and up intermittent tributary streams.

RESULTS

A total of 86 largemouth bass weighing 162.9 pounds and 24 chain pickerel weighing 33.1 pounds was collected. With the exception of trout, the majority of fish seen while collecting was the larger bass and pickerel. Relatively few intermediate size fishes were observed. This may have been a result of the existing minimum, winter water temperatures resulting in most of the fish avoiding the shallow, shoreline areas.

None of the bass under 16 inches contained trout in their stomachs; however, 48.6% of the bass 16 inches or larger had trout in their stomachs. Of all bass collected, which were 17 inches and over, 82.3% contained trout, and 90.9% of the bass 18 inches or larger had consumed trout.

Figure 1 shows that 51.4% of all bass collected, which were of the size containing trout, were in the 16 to 17 inch size group. This size group consumed only 10.7% of the total number of trout found in bass stomachs. In contrast, 17 to 20 inch bass comprised 48.6% of the number of bass large enough to have consumed trout, but they consumed 89.3% of the trout found in bass stomachs.

The occurrence of various organisms in the stomachs of all sizes of bass collected was as follows: empty - 32.6%; threadfin shad - 25.6%; trout - 19.8%; silversides - 17.4%; crayfish - 16.3%; and others - 10.7% (includes unidentified fish remains, bream, and gizzard shad). Of all bass collected during the project, 59.3% were smaller than the 16-inch minimum size in which trout were found.

Forty-one and two tenths percent (41.2%) of the bass containing trout had two or more trout in their stomachs; one bass contained five trout.

The smallest chain pickerel in which a trout was found was 15 inches total length. Fifty-four and five tenths percent (54.5%) of the chain pickerel 15 inches and larger had consumed trout. Of all the pickerel 17 inches and over, 58.8% contained trout. Nine pickerel were collected which were 19 inches or larger; all of these had one or more trout in their stomachs.

Figure 2 shows that 59.1% of all pickerel which consumed trout were in the 15 to 19 inch size group. This size group consumed only 14.3% of the trout. However, the remaining 40.9% of the pickerel, which were 19-24 inches, consumed 85.7% of the trout found in pickerel stomachs.

Of all pickerel collected, trout occurred in 50% of the stomachs, threadfin shad in 25%, 16.7% were empty, and 25% contained either crayfish, sunfish, or unidentified fish remains. Only two pickerel were collected which were smaller than 15 inches.

Fifty percent (50%) of the pickerel found to have eaten trout had consumed two or more trout. The maximum number of trout in a pickerel was three; this occurred in three pickerel.

The following table shows the variation in the percentage of bass (16 inches or larger) and pickerel (15 inches or larger) which contained trout in collections made at various times following trout stocking.

TIME OF COLLECTION	PERCENT OF PROPER SIZE BASS AND PICKEREL CON- TAINING TROUT
Date of Stocking	71.4
One Day After Stocking	41.7
Two Days After Stocking	69.2
Eight Days After Stocking	37.5

Also, 23 days after a trout plant had been made in one of the routine collecting areas, eight chain pickerel, 14-20 inches, were collected to be used as brood stock at the Lake Hamilton State Fish Hatchery. The tanks in which the fish were transported to the hatchery contained eight regurgitated trout when the fish were unloaded.

Although the size trout stocked were supposed to average nine inches in length, there seemed to be a great variation in the size range, and of all trout found in the stomachs of bass and pickerel, 87.8% were in the 6 to 9 inch size group. Figure 3 gives the relationship of the numbers of trout in each one-half inch size group which were consumed by both bass and pickerel. This figure also demonstrates the greater predation on the smaller trout and to some extent the availability of more trout in the 6 to 9 inch size groups as compared to the numbers in the 5, 5½, 9½ and 10 inch size groups.

SUMMARY AND CONCLUSIONS

1. Extensive predation by largemouth bass and chain pickerel on rainbow trout stocked in Lake Ouachita has occurred during the period of minimum, winter water temperatures.

2. Sixteen inch bass and 15-inch pickerel were the smallest sizes found to have consumed trout.

3. All chain pickerel collected, which were 19 inches or larger, contained trout in their stomachs and almost 91% of the bass 18 inches or larger had consumed trout.

4. Very little difference in the extent of trout predation between bass and pickerel could be observed; however, over 90% of the pickerel collected were in the size group which was found to have consumed trout; whereas, just over 40% of the bass collected were in the trout consuming size group.

5. Seventeen to twenty inch bass consumed the majority of trout taken by bass, and 19 to 24 inch pickerel were the major trout predators among all sizes of pickerel.

6. Almost all trout found in the stomachs of pickerel and bass were in the 6 to 9 inch size group. Very few trout smaller than this were available and decreasing numbers larger than 9 inches were available, these larger sizes are also nearing the maximum size trout capable of being consumed by anything except the largest size predator fishes.

7. No significant relationship was observed between the numbers of trout consumed in the collections made at various intervals following trout stocking. This was probably a result of an insufficient number of samples being taken at each of the time intervals.

8. Since there are varying sizes of trout both larger and smaller than the average size trout being stocked, trout averaging no less than 10 inches should be stocked. This would almost completely eliminate any trout smaller than nine inches being stocked and would thereby reduce predation to a minimum.

BIBLIOGRAPHY

American Fisheries Society. 1960. A List of Common and Scientific names of Fishes from the United States and Canada. Special Publication No. 2. Second Edition. 102 p.

Keith, William E. and Andrew H. Hulsey. 1967. The Possibility of Developing a Trout Fishery in Lake Ouachita, Arkansas. An Administrative Report to the Arkansas Game and Fish Commission. 8 p.

Wilkins, Price, Leon Kirland, and Andrew Hulsey. 1968. The Management of Trout Fisheries in Reservoirs Having a Self-Sustaining Warm Water Fishery. Reservoir Fishery Resources Symposium. 9 p.

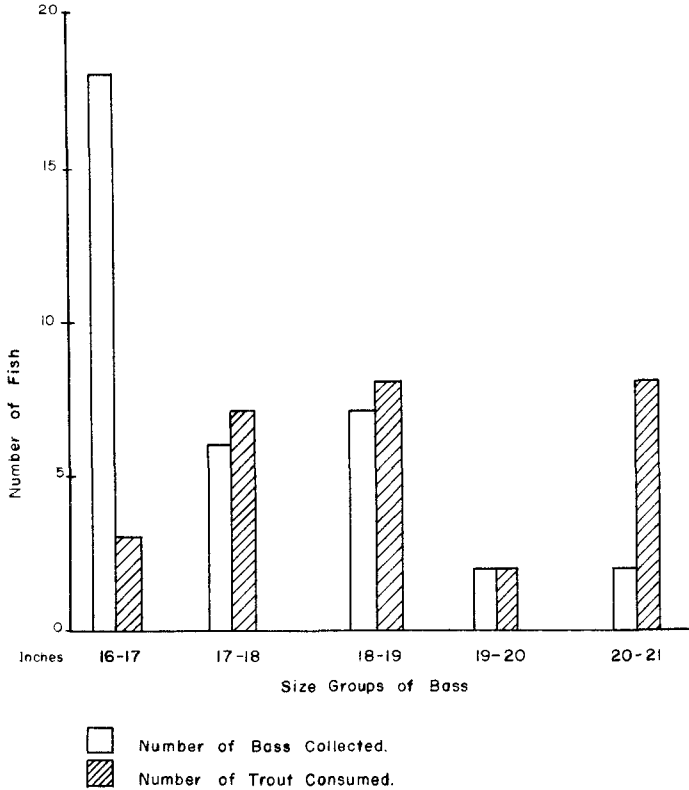


Figure 1

The Relationship of the Number of Trout Consumed by the Size Groups of Bass Collected

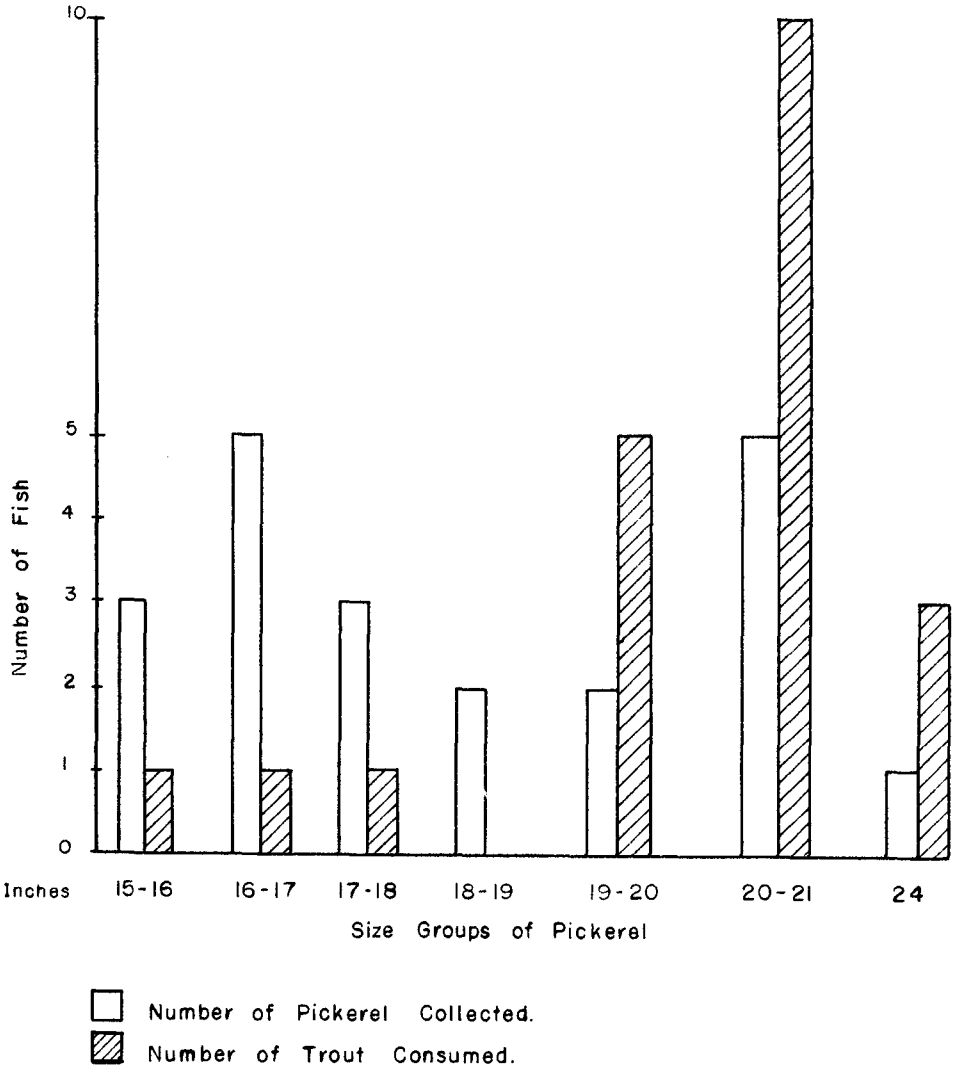


Figure 2
 The Relationship of the Number of Trout Consumed
 by the Size Groups of Pickerel Collected

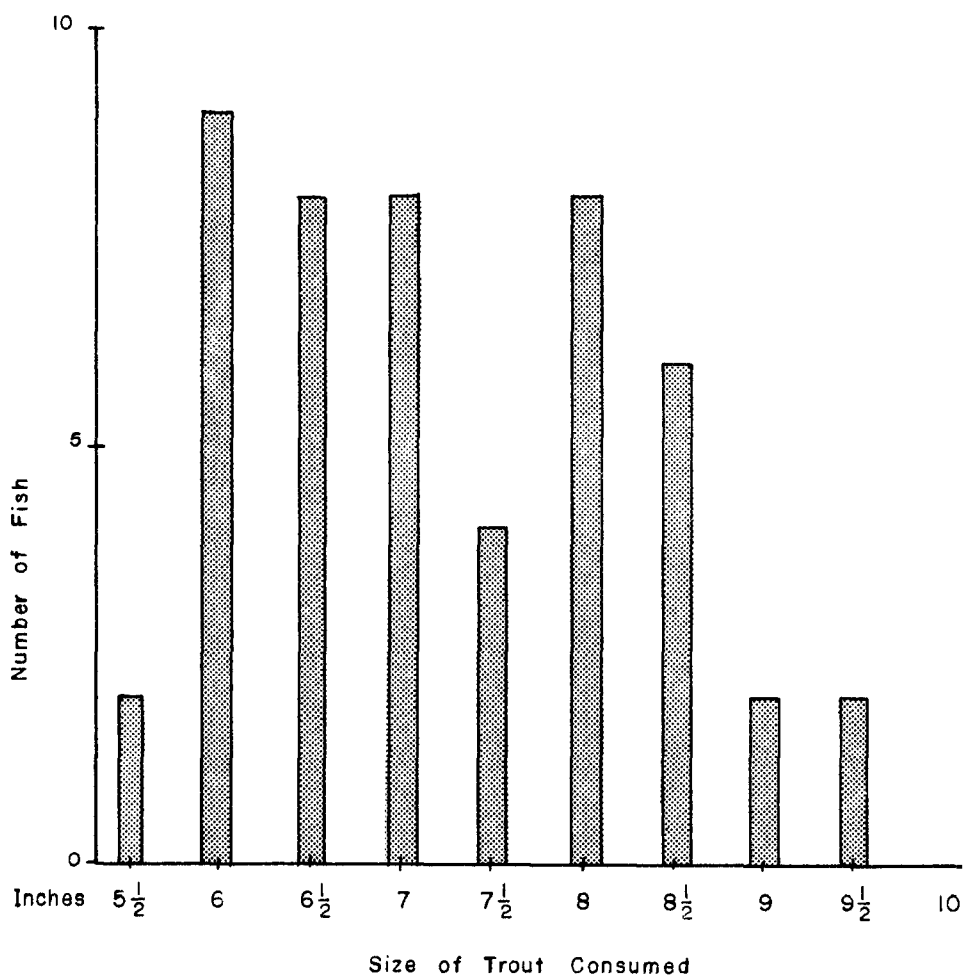


Figure 3

Number of Trout Consumed for each Size Group Collected