in the pond for several days the striped bass which looked in fine shape, when brought in close quarters in the bag of the seine, immediately turned bellies up. There was no apparent injury, no sign of fungus, but they were dead.

On the first load, out of 27 fish that started for Arkansas, only 11 arrived in good enough shape to be released in Lake Ouachita.

With ninety percent mortality by using the gill nets, permission was granted to fish below Pinopolis Dam. Here again the method was hook and line, using white bucktails and spoons with the barb mashed flat or filed off. In less than two hours a six-barrel truck was loaded. This time not only were they transported in one part per million acriflavine, but enough ice was added to the barrels to lower the temperature to approximately 50° F., and the drivers were instructed to keep the temperature below 55° F. by adding ice in transit.

The fourteen-barrel hachery truck was loaded with 33 of the sea-run race caught below the dam and 19 of the lake race which were being held in the holding pond. As before the fish were transported in one part per million acriflavine and iced to bring the temperature to 55° F. or below.

The first load that was caught below the dam was released in Narrows Lake. The other load went to Lake Ouachita. Since Lake Ouachita was receiving both the lake race and the sea-run race, it was decided that load of entire sea-run race be stocked in a different lake in a different watershed. If reproduction is found in Narrows Lake, it will be certain that the sea-run race was responsible.

At the final tally 33 sea-run striped bass were stocked in Narrows Lake and 19 lake race plus 30 sea-run race in Lake Ouachita.

CONCLUSION

Since the hook and line method is too slow and the mortality rate is too high with gill nets, and there is a question as to whether the sea-run race will spawn in fresh water, the only logical method of securing, transporting and stocking striped bass in inland waters is by using fingerling fish.

By the control of fungus and proper handling to the small fish, a sufficient number could be caught by marginal seining at night. Also a time should be selected when the weather is cool enough to transport fish yet not cold enough to make the young striped bass move to deep water.

EXPERIMENTS WITH YELLOW BASS (Morone interrupta) IN TENNESSEE FARM PONDS

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INTRODUCTION

Fish applications, processed during recent years by the Tennessee Game and Fish Commission, indicate that more than eighty percent of the ponds in the West Tennessee District are one acre or less in area; more than fifty percent of the total number do not exceed one-half acre. Practically all of the ponds are dependent on run-off water and are subject to seasonal fluctuations. These fluctuations, which could be of decided advantage for population control in larger waters, often create adverse conditions in many ponds stocked with largemouth bass and bluegill. Since few ponds are constructed with drain pipes, controlled fluctuation for the prevention or the correction of overpopulation is not practical.

Although largemouth bass and bluegill may be expected to provide only limited fishing in many ponds of the area because of the many factors contributing to overpopulation, these two species at the present time are the only fish available to the average pond owner.

The yellow bass, *Morone interrupta,* is frequently taken in natural waters of West Tennessee with both natural and artificial bait. It is game when taken on light tackle and ranks above average as a food fish. In certain Iowa lakes the

yellow bass is the most important species taken by sport fishermen (DiCostanzo, 1954).

In view of many desirable characteristics, experiments were started in West Tennessee in 1955 to determine the adaptability of the yellow bass for stocking in farm ponds.

METHODS

Ten ponds, ranging in size from one-tenth to seven-tenths acre, were used in the experiments. Four ponds on the West Tennessee Agricultural Experiment Station at Jackson remained full of water throughout the experiments. Three ponds on the Highland Rim Agricultural Experiment Station at Springfield and three privately owned ponds near Jackson were dependent upon run-off water and fluctuated during dry periods. In general, these six were more typical of the small ponds found throughout West Tennessee.

All ponds which contained fish were treated with rotenone several months prior to stocking with yellow bass.

Although it is doubtful that the ponds used in the experiments would be classified as ideal for managed fishing, they did, in a sense, represent a cross-section of the smaller ponds in the area. The ponds located on the Agricultural Experiment Stations received a minimum of eight hundred pounds of 8-8-2 commercial fertilizer per acre annually. The remaining ponds were not fertilized.

Mature fish, captured in wire traps in Reelfoot Lake were stocked in three ponds near Jackson on April 1, 1955. The fish were from 5.5 inches to 10 inches in length. The average fish measured 7.3 inches and weighed .21 pound. The adults were stocked in order to gain information on reproduction and also it was hoped that sufficient numbers of fingerlings could be produced to stock the other experimental ponds.

It became apparent by July, 1955, that a successful spawn had not occurred in any of the brood ponds. Preparations were therefore made to seine yellow bass fingerlings from Reelfoot Lake.

Since cypress trees and other obstructions interfered with seining operations along much of the shoreline, arrangements were made with the operators of two developed swimming areas on the lake to seine on the sand beaches at night. Sufficient numbers of fingerlings, averaging two and one-half inches in length, were collected with the aid of a gasoline lantern to stock the seven ponds located on the agricultural experiment stations at Jackson and Springfield. Fish were stocked in each pond at different rates in order to determine the most efficient stocking rate for maximum growth and production.

One pond on the Springfield Station was stocked in combination with largemouth bass and bluegill. The remaining ponds were stocked exclusively with yellow bass.

Several other ponds were originally included in the stocking plans but were not included in the project because of the unusually high mortality suffered as a result of handling and transporting the fish during mid-summer.

RESULTS

A. Adult Stocking

The three brood ponds, being new and in the process of stabilization, remained muddy throughout the spring months of 1955. The ponds were seined periodically but no yellow bass fingerlings were collected. At the termination of the experiments the ponds were treated with rotenone in order to evaluate the results.

One pond was treated with rotenone on July 14, 1956 and the fish in the two remaining brood ponds were eradicated on August 8, 1957. The spawning success and survival of the yellow bass stocked in these ponds are summarized in Table I. All three ponds, as indicated in the table, were inadvertently stocked with bluegills and largemouth bass during the fall and spring of 1955-56.

B. Ponds Stocked with Fingerlings

Three of the experimental ponds stocked with fingerling yellow bass were treated with rotenone for evaluation after one year. The rate of growth and survival of the fingerlings are shown in Table II. At the end of two years

TABLE I

THE SPAWNING SUCCESS AND SURVIVAL OF 179 ADULT YELLOW BASS STOCKED IN THREE FARM PONDS ON APRIL 1, 1955

Pond Number	*1 E*	*2 E*	*3 E*	*Total or Average*
Area (Acres)	0.38	0.77	0.23	1.38
Number Stocked	83	77	19	179
Number Per Acre	249	100	76	130
Date Eradicated	6–14–56	8–8–57	8–8–57	
Number Recovered	13	4	1	18
Percent Survival	16	5	5	10
1956 Year Class	0	19	1	20
1957 Year Class	0	2	0	2
Largemouth Bass *	27	5	1	33
Bluegills †	28	82	76	186

* Stocked by mistake, Spring 1956.
† Stocked by mistake, Fall 1955.

the fish in the remaining four ponds were eradicated and the data are presented in Table III.

DISCUSSION

Production of Fingerlings: The failure of the adult yellow bass to spawn during the spring of 1955 was probably due to handling and moving the fish near the beginning of the spawning season. The turbid waters in all the ponds also could have contributed to the spawning failure.

The heaviest spawn, and the only spawn of any consequence, occurred in pond 2 E during the spring of 1956 (Table I). Since the water exchange in all ponds during the late winter and spring months was high, the spillways at times afforded a means of escape for fish of all sizes. However, since pond 2 E was considerably larger and also had a proportionately low water exchange, it is possible that fish loss in this pond could have been less than in the other two ponds.

The effect of the bass and bluegill on the spawning success of the yellow bass is fairly obvious, since the most successful spawn occurred in the spring of 1956 when the bluegills were small and before bass had been stocked. Furthermore, spawning occurred in 1957 but only two yellow bass fingerlings survived. It seems logical to assume that the presence of any egg or fry-eating species would prove detrimental in hatchery ponds, and particularly in the production of a species such as the yellow bass which offers no protection to eggs or young.

TABLE II

THE RATE OF GROWTH AND SURVIVAL OF YELLOW BASS IN THREE FARM PONDS AT THE END OF ONE YEAR

Pond Number	*1 J*	*2 J*	*6 J*	*Total or Average*
Area (Acres)	0.10	0.14	0.13	0.37
Number Stocked	28	39	67	134
Number Per Acre	280	279	536	362
Number Recovered	1 *	8	2 *	11
Percent Survival	3.5	20	3 †	8
Average Length (Inches)	7.25	7.42	7.25	7.37
Average Weight (Ounces)	3	3.4	3	3.3

* Green Sunfish abundant.
† Unknown number removed by unauthorized fishing.

Growth Rates: The yellow bass reached an average length of 7.37 inches and an average weight of 3.3 ounces at the end of one year in the experimental ponds (Table II). At the end of the second year, the average yellow bass in the experimental ponds was 9.27 inches in length and weighed 6.5 ounces (Table III). These averages, although based on relatively small numbers of fish probably approach the maximum rate of growth which would normally be

TABLE III

THE RATE OF GROWTH, SURVIVAL AND REPRODUCTION OF YELLOW BASS IN FOUR FARM PONDS AT THE END OF TWO YEARS

Pond Number	*3 J*	*1 S*	*3 S*	*4 S*	*Total or Average*
Area (Acres)	0.13	0.18	0.10	0.44	0.85
Number Stocked	92	43	46	27 †	208
Number Per Acre	707	239	460	61	245
Number Adults Recovered	10	..	10 *	1	21
Percent Survival	10.8	..	21	3	10
Average Length (Inches)	9.5	..	9.0	9.75	9.27
Average Weight (Ounces)	6.7	..	6.4	6.4	6.5
Young-of-the-Year	30	..	71	0	101

* One largemouth bass and one white crappie recovered.
† Stocked in combination with 44 largemouth bass and 440 bluegill.

attained by this species in small ponds. The growth rate during the second year might possibly have been increased if small forage fish had been available. During the first year, however, yellow bass grew slightly faster when alone (pond 2 J) than when in ponds infiltrated by small forage fish such as green sunfish (Table II).

Schoffman (1956) found that yellow bass in Reelfoot Lake attained an average weight of 3.58 ounces after two years and 7.17 ounces after four years. The yellow bass in the experimental ponds reached an average size of 3.3 ounces by the end of the first year and 6.5 ounces at the end of the second year, which represents a growth rate approximately two times as fast as in Reelfoot Lake.

Reproduction and Survival: Reproduction occurred in two of the experimental ponds at the end of the second year and a total of 101 fingerlings were recovered (Table III). The low recovery of fingerlings in pond 3 S was due, in part, to the presence of one largemouth bass (weight 2.1 pounds) and one white crappie (weight .7 pound). Since the young yellow bass had been exposed to these predators for approximately three months, their numbers were, no doubt, reduced materially.

The low survival rate in pond 3 J which contained only yellow bass, could have been due to predation on the unguarded eggs by crayfish, which were fairly abundant, or possibly to predacious insects which would prey on both eggs and fry. The small number of adult fish present apparently exerted little control on the insect population in either pond. Predation on the fingerlings by adult yellow bass cannot be overlooked as a factor contributing to the low rate of survival (Kutkuhn, 1954).

It is doubtful that the small numbers of yellow bass recovered in proportion to the numbers which were originally stocked in the ponds represent a normal survival rate. Many fingerlings were, no doubt, injured during capture and all were subject to fungus infection due to handling. Mortality was high in transporting the fish to the experimental ponds and therefore it seems reasonable to assume that the greatest losses took place in the ponds within a short period after the fish were stocked.

As is indicated in Tables I, II, and III, the lowest rates of survival were demonstrated when the yellow bass were in combination with other species. The lack of protection for eggs and fry and the vulnerability of fingerlings to predatory species would appear to be the most important factors limiting the survival of the yellow bass in many waters. The failure of the yellow bass fingerlings to survive in pond 1 S may have been due to the depth of the water, which averaged only 18 inches, and to the resulting high temperature of the water during the summer months.

Productivity: Due to high mortality in all the experimental ponds, the productivity of yellow bass was not determined. However, since forage fish are a preferred food for the large yellow bass (Kutkuhn, 1955), it is probable that the carrying capacity in ponds would be somewhat less than would be obtained with bluegills.

CONCLUSIONS

These experiments, although limited, have demonstrated that yellow bass, under certain environmental conditions, are capable of living, growing, and reproducing in farm ponds. Additional information on productivity, population control, long term survival and fishing success will be needed, however, before a satisfactory evaluation of the species can be made. The initial results would probably justify further experimentation.

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FOOD HABITS OF THREE CENTRARCHIDAE IN LAKE GEORGE, FLORIDA

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ABSTRACT

An investigation of the stomach contents of bluegill, black crappie, and redear sunfish was made from specimens collected during several months of 1948, 1949, and 1950, in Lake George, Florida. Major items found in stomachs of 432 large bluegills were: aquatic vegetation, crustacea, insecta, and fish eggs. Fifty-five stomachs from small bluegills contained, principally, Cladocera and Diptera larvae. *Dorosoma petenensis vanhyningi* (Weed) was the major food organism found in 145 black crappie. An analysis of 69 redear sunfish stomachs showed snails (*Amnicola* sp.) were the dominant food of this species.

INTRODUCTION

Concurrent with other biological investigations conducted on Lake George, examinations of stomach contents of bluegill, *Lepomis macrochirus purpurescens* (Cope), black crappie, *Pomoxis nigromaculatus* (LeSueur), and redear sunfish, *Lepomis microlophus microlophus* (Gunther) were made. There are no previously published food habit studies of these species for Lake George.

This investigation of food habits of three species was begun December, 1948 and concluded in October, 1950. Bluegill, black crappie, and redear sunfish were selected because of their importance as game fish, as is the largemouth black bass, *Micropterus salmoides floridanus* (LeSueur). The food habits of this species from the Lake George area were described by McLane (1948). In addition these species exist in such abundance their food habits are important when considering inter-specific relationships.

Lake George, one of several wide places in the St. Johns River, covers an area 73.5 square miles and has an average depth of 10 feet. The bottom is composed principally of sand, mud, and shell. Vegetation, primarily *Vallisneria americana* and *Naias guadalupensis*, occurs in varying abundance around its shores and bars.

COLLECTING METHODS AND PROCEDURE

The major collecting method of fish examined was by commercial haul seine. The seines were approximately 1,600 yards in length and consisted of a 1,500-