THE RESULTS OF A FIVE-YEAR FISH MANAGEMENT EXPERIMENT IN A SMALL LIMESTONE QUARRY IN KENTUCKY

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ABSTRACT

Small limestone quarries may be found in many parts of the nation. In the Blue Grass Region of Kentucky these quarries frequently fill with water when abandoned. An effort was made to manage one such one-fourth acre pond for fishing. The pond was poisoned in 1958, and then stocked with largemouth bass and bluegill bream the spring of 1959. For the next five growing seasons a heavy plankton bloom was maintained with commercial fertilizer. Hook and line fishing began in the spring of 1960 and continued through four growing seasons. For the first three years the bluegill fishing was excellent, the catch in pounds being 128, 121, and 75 respectively. This would be equivalent to catches of 300 to 500 pounds per acre. The bluegill catch dropped to 28 pounds the last year because of imbalance. Too many largemouth had been removed the year before. The largemouth grew rather slowly, and no fish weighing more than 1 pound was caught until the last year. Not only was imbalance indicated by poor fishing the last year, but also by plankton and bottom organism composition.

Introduction

Small limestone quarries may be found in many parts of the nation. In the Blue Grass Region of Kentucky these quarries frequently fill, or partially fill, with water when abandoned. If any individual goes to fish in one of these rock ponds, he will more than likely find it to be 1/10 to ½ acre in size, and it will have a lot of small sunfish and bullhead catfish in it. If he goes in the spring he may take home a string of small fish. As summer progresses, the quarry will more than likely become covered with duckweed; and there will be plenty of algae underwater to foul the hook. Generally speaking, poor fishing is all that can be expected even though the farmer on whose property the quarry might be located has had bass and bream put into the water.

There is one Kentuckian who decided that quarry ponds did have possibilities, and he deliberately selected such an eye-sore and place of hazard around which to build his house. He believed that such a locale had landscaping possibilities, and he further felt that the quarry could be managed to produce good fishing for his family and neighbors. The following story gives part of the results of "operation quarry" as it extended over a period of five years.

First Two Years of the Management of "Allen's Pond"

In October, 1958, the area of the quarry was determined and the water sounded to get the average depth. It was found to have an almost uniform depth of 6 feet, with only a small shallow area at the north end; the total area was ¼ acre. (The average native will tell you that a quarry is 30 to 40 feet deep.) Derris powder was applied, and about 25 pounds of sunfish and bullheads were removed; there was also a handful of shiner minnows and one goldfish. During the last week of October and the first week of November, 50 fingerling bluegill were seined out of a neighboring farm pond and placed in the

quarry. Cold weather prevented the seining of the desired 250 fingerling bluegill needed to properly stock the pond. The remaining bream were secured during mid-May, 1959. Thirty largemouth bass fry were stocked June 1.

The first fertilizer application was on May 9; other applications were made whenever necessary to maintain a good plankton bloom. Ten applications of 20-20-5 were made during the season, the last one being on October 24 which may not have been necessary for it had little favorable effect. At each application 10 pounds of the above mix were applied by hand around the edges. It was hoped that an early plankton bloom would keep the duckweed from developing. The fertilizer did exactly the opposite; the duckweeds came out of hibernation and practically covered the pond by the middle of June. Someone mentioned that ducks liked duckweed; and in desperation three ducks were purchased, and they eradicated the duckweed in less than a month. As the duckweed disappeared, the plankton bloom became richer.

The house beside the quarry was started in April, 1959, and the family moved in on September 1. By the middle of October, the bluegill weighed 3½ to 4 ounces, and the largemouth bass were 7 to 9 inches long. No fishing was done in 1959.

In 1960, fertilization was begun on March 15; these earlier applications practically eliminated the development of any filamentous algae. A warm spell in early May enabled the bass to spawn before they were one year old.

Fishing in the quarry was permitted for the first time on May 30, and from then until the last fish was caught in October, 533 harvestable fish were pulled ashore, 512 bluegills and 21 bass. Most of the bass were caught in early June before they had attained a good size and the majority of them were returned to the water. Anyone was allowed to fish that agreed to keep the rules. All bream caught had to be kept; those weighing less than 2½ ounces could be thrown over the fence. Bass could be fished for and caught and then released, unless special permission had been given to keep some. All fishermen had to report at the back door to have fish counted and weighed. (It was known that the fishermen were already there, for they had had to report to get the key.) By the latter part of the summer the bluegill from the original stocking were weighing 7 to 9 ounces each. Most of the other bream caught weighed around 4 ounces. Thus, 125 pounds is a conservative figure for the total catch in this ¼-acre quarry.

Results of the Last Three Years of Management

The owner naturally wondered if the second year of fishing would bring as good catches as during the 1960 season. The management procedures were practically the same. The first fishing was allowed in March, and by the end of October 485 bluegill had been removed by hook and line. A good bass spawning occurred about June 1. As hard as the fishermen tried, there was only one bass caught during the season; it weighed ½ pound. Table 1 is a summary of the monthly bluegill bream catch for the years 1960-1963. The 485 bluegill caugth in 1961 weighed 121 pounds.

In 1962, the owner and his family spent the summer at Highland Biological Station, and a key to the gate was left with two of the best fishermen of the preceding season. They were instructed to remove a few bass if possible, and to do like they had always done with the bluegill. In the ten weeks the owner was away these fishermen caught 181 bluegill and 35 bass. The total catch for the year was 75 pounds of bluegill and 19 pounds of bass—94 pounds in all. Table 2 summarizes the bass catch.

Too many bass were evidently removed in 1962 or were destroyed by winter kill to allow good fishing the next season. There were only 91 edible bluegill caught during the spring and summer. The average

weight was 5 ounces. Twelve of them weighed 8 ounces each. Several hundred ½ ounce to 1½ ounce bluegill were caught and thrown over the fence. Despite all this removal, the rest did not grow. Four bass were caught; all weighed from 1 to 1½ pounds. Thus 91 bream and 4 bass weighed 33 pounds. Table 2 summarizes the bass catch for the four-year period.

Table 1. Monthly catch of table-sized bluegill bream from Allen's Quarry, ¼ square acre in size, for the years 1960-1963.

Total number and number weighing more than 4 ounces

Month	1960	1961	1962	1963
March	—	28 (5)	—	—
April	—	66 (7)	11 (8)	74 (50)
May	—	90 (45)	56 (43)	16 (9)
June	123 (16)	185 (71)	180 (20)	—
July	99 (5)	36 (1)	11 (1)	—
August	254 (33)	50 (2)	—	1 (1)
September	30 (1)	30	—	—
October	6	—	43 (5)	—
Total Number	512 (55)	485(131)	301 (77)	91 (60)
Total weight in pounds based on average weight of 4 ounces per fish; 5 ounces in 1963	128	121	75	28

Because of this imbalance the owner asked the Kentucky Department of Fish and Wildlife Resources if it would consider conducting a population study on the pond as a Field Biology and Ecology class project. This they gladly did, and Table 3 gives the results of the study. The table shows how effective hook and line fishing may be; there were only four edible-sized fish in the pond. It also indicates how quickly imbalance can occur in a small pond when too many predatory fish are removed. Plans now are to start all over in May 1964, using a bluegill, shellcracker, largemouth bass combination.

To extrapolate the annual catch each year from a ¼-acre basis to a 1-acre basis would give the following catches: 521, 484, 376, and 132 pounds. This is an average annual production of 378 pounds of fish per acre, which compares favorably with results obtained in fertilized ponds in other parts of Kentucky and of the Southeast. The Kentucky Department of Fish and Wildlife Resources stated in 1961, that fertilized ponds in Kentucky produced from 150 to 200 pounds of fish per acre compared to about 35 pounds for unfertilized (Ky. Dept., 1961). In Alabama the catch varied from 150 to 300 pounds with an annual average of 200 pounds per acre (Swingle, 1952). In nearby 1,600-acre Herrington Lake, population studies conducted in the period 1956-1961 showed that the standing crop of harvestable fishes increased from 81 pounds to 293 per acre after management practices were instigated (Whitney, 1962). Of the 293 pounds in 1961, only 31 pounds consisted of game and pan fish; and the actual sport fishery catch was much lower than that.

Table 2. Monthly catch of largemouth bass from Allen's Quarry, ¼ square acre in size, for the years 1960-1963.

Year and month	Number Caught	Number Released	Average Weight In Ounces
1960			
May	3	—	9
June	14	13	8
August	4	3	10
TOTALS	21	16	2 pounds
1961			
March	1	—	½ pound
1962			
April	15	—	5
May	11	—	5
June	35	—	5
TOTALS	61	—	19 pounds
1963			
May	2	—	18
August	1	—	24
September	1	—	20
TOTALS	4	—	5 pounds

Plankton Production And Bottom Organism Production

No systematic sampling for bottom organisms or for plankton production was carried on during the experiment. In most instances a Sachi disc was used to determine when fertilizer should be applied. In the first three years it was observed that a phytoplankton bloom followed soon after fertilization, and this phytoplankton bloom was soon followed by a zooplankton bloom. When samples were taken this bloom seemed to be due to a build up of *Euglena* and several species of colonial flagellates. In a little over a week after fertilization, the water would begin to turn brown and would remain a greenish-brown to brownish-green color for a couple of weeks, gradually becoming less turbid. The change from the green always indicated that the zooplankters were increasing. Cladocera and copepods seemed to greatly outnumber the ostracods.

In the period 1959-1961, the bottom organisms were quite numerous. Any rock or stick picked up in the shallow end was covered with chironomid houses, and as anyone walked around the pond in the evening, he would almost become covered with midges.

Table 3. Summary of rotenone population study of Allen's Quarry, September 30, 1963. Total area ¼-square acre.

Species	Fingerling Size Range	No.	Wt.	Intermediate Size Range	No.	Wt.	Harvestable Range	No.	Wt.
Bluegill Bream	0-2	11,701	31.38	3-5	1,566	17.66	6-9	3	0.80
Largemouth Bass							11-14	1	1.26

Total bluegill population.....13,270
Total largemouth population..... 1
Total population 13,271

Total weight of bluegill.....49.84
Total weight of largemouths..... 1.26
Total wt. of population....51.10

No plankton or bottom organism observations were made during the summer of 1962; however, normal cycles of pulses were occurring in the spring.

In 1963, the year the fish in the pond were not in balance, no normal pulse could be initiated. The rate of fertilization was doubled, and still only a short-lived phytoplankton bloom resulted.

Plankton net hauls detected no zooplankters in the water. An examination of rocks and sticks showed only scattered chironomid houses and a dearth of Anisoptera and Zygopters nymphs, and Coleoptera larvae and adults.

Teleologically and part ecologically speaking, the 13,000 bluegills cut their own throats. They nipped their own food chain near the bottom. By eliminating the zooplankters, they stopped the flow of energy at the base of the food pyramid; and they had to watch decaying *Euglena* and *Pandorina* percolate to the bottom of the quarry, there to be attacked by bacteria and the stored energy lost for them. They likewise did not let the 4 bass spawn, and was that wise or unwise? Maybe it's the owner who was the unwise one. Why would he desire to manage energy flow in the first place? His wife wanted ducks.

The Over-all Value of the Pond

Since the owner and his family have lived beside Allen Pond many additional benefits have accured to them they did not anticipate when they moved there in 1959. The old quarry has:

1. brought relaxing sport to many individuals.
2. put fresh meat on the table of numerous folks.
3. served as a workshop for General Biology, General Ecology and Field Biology classes at Asbury College.
4. provided Protozoa, Algae, and Micro-crustacea for the Biology Department.
5. served as a swimming pool for those who did not mind plankton in their eyelashes and hair.
6. served as a source of water for lawns and flowers.
7. provided a place to play winter sports.
8. given the owners and neighbors many hours of esthetic delight.

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AN ATTEMPT TO IMPROVE STREAM FISHING BY* MANIPULATING THE LAKES IN THE STREAM BASIN

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ABSTRACT

In the summer of 1963, 18 of the 21 old river lakes in the Saline River basin, comprising 168 acres, were completely eradicated using rotenone. These lakes were subsequently overstocked with game fishes from our state-owned hatcheries. The theory being that fish from crowded populations will emigrate during overflow periods, providing desirable fish as stocks for the river. These fish were stocked early enough in the year to allow them to grow to sub-adults and to become acclaimed by the time of the first flood water.

INTRODUCTION

The field of fish management in the Southeast has almost entirely ignored the problem of deteriorating stream fishing. The inability of the fishery manager to control several factors in the watershed, as well as the increasing tendency to let the U. S. Government bury these problems under huge impoundments, has led to this de-emphasis on stream fishing.

In the face of increasing fishing pressure; changing patterns of land use; more pollution from sewage systems already overloaded; silt from highway construction and dredging operations; an ever increasing load of pesticides and industrial wastes, who would blame the fishery manager for throwing up his hands?

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