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Factors Affecting the Reproduction of Bluegill Bream and Largemouth Black Bass in Ponds

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ONE of the principal problems involved in raising fish in ponds is the management of the population so that the maximum number reach a desirable size each year. For the first year in new ponds this condition can be produced by proper stocking, while in subsequent years it can be maintained only when there is a proper balance between forage species and carnivorous species. For instance, in a bluegill-largemouth bass combination, bluegills must reproduce sufficiently to provide replacements for the adults which are removed by fishing or other causes and also enough young fish to feed the bass. On the other hand, there must be a sufficient number of bass to reduce the number of young bluegills so that an overcrowded condition will not develop, and, at the same time, there must not be so many bass that no young bluegills survive for replacements, or so many that the bass themselves are overcrowded and unable to grow. Fortunately for fish culturists, nature has worked out methods for maintaining this balance after a pond has once been properly stocked. Any factor, however, which prevents reproduction by adequate numbers of either the forage species or the carnivorous species prevents the establishment and maintenance of this natural balance and eventually results in poor fishing. The factors affecting reproduction are therefore of greatest importance and must be understood if ponds are to be properly managed.

During the past eight years, from 20 to 100 ponds at the Alabama Agricultural Experiment Station have been stocked in various ways, given different management treatments for a period of from one to three years, then drained, and the number and weight of fish produced determined. Some of the factors which were found in these experiments to affect the reproduction of bluegills and largemouth black bass are summarized in this circular.

REPRODUCTION OF BLUEGILL BREAM (*Lepomis macrochirus* Raf.)

The eggs of bluegills required a relatively short time for development within the fish. As a rule, no development was discernible in the late fall. The egg-sacs of well-fed fish began to swell in December, but where the food supply was less abundant little or no development was discernible until the water warmed up in the spring. The eggs developed rapidly during the spring months and the first ones usually were laid in April

or May. If sufficient food was available after the first spawning, more eggs were matured at intervals throughout the summer.

Bluegills apparently preferred to lay their eggs on fine gravel, but where this was not available, any firm surface, such as clay, sand, roots, or pine needles was utilized. The eggs were deposited in "nests" which were formed by fanning away the loose soil and trash until a suitable surface was exposed. From four or five to several hundred nests were constructed close together, forming a "bed". The nests usually occurred in water from 6 inches to 4 feet deep; however, where a dense growth of weeds occupied this shallower area, nests have been found in 8 to 10 feet of water. Bluegills have been found to reproduce successfully under widely varied conditions and the construction of special spawning areas by the pond owner was unnecessary.

Bluegills may spawn at less than one year of age. In experiments conducted in 1938 and again in 1941, bluegills which hatched during the first part of June were removed to separate ponds where food was extremely abundant. Some of these fish reproduced the following September, at which time they weighed from 1 to 2 ounces and were approximately 4 months old. Spawning rarely occurred, however, at such an early age. Most bluegills spawned first at approximately one year of age if, at that time, they weighed one-half ounce or more.

The time of year at which spawning occurred varied widely, depending on the food available for the adult fish. Where bluegills and bass were in proper balance, bluegills in ponds at Auburn, Alabama, spawned at irregular intervals each month from April to October. If the pond became overcrowded with bluegills after the first spawning in the spring, no more young were produced until fall; if the bass feeding on the young bluegills kept them thinned down sufficiently, egg-laying occurred each month until frost. When a pond was badly overcrowded with bluegills during the winter and spring, no young were produced before August or even September. It is apparent from this brief discussion that those who believe that it is necessary to protect bluegills during their spawning period have quite a problem on their hands in determining just when to establish a closed season. For instance, during the same year within a 5-mile radius from Auburn, bluegills began to spawn in one pond in April and were observed spawning again during May, June, July, August and September; in another pond they spawned in May and again in September; in another the first spawning occurred in September. With such a long period during which spawning is possible, protection during the spawning period would certainly appear unnecessary. It is significant that nowhere in the United States have carefully controlled experiments shown that such protection is necessary for bluegill bream.

When sufficient food was not available, bluegills commonly ate their own eggs. Each year the earliest eggs laid were usually eaten by the male bluegills with the result that, although eggs

were often laid in April at Auburn, few or no bluegills were produced from the earliest spawning. When food became plentiful, few eggs were eaten. The egg-eating habit was apparently not detrimental as this species never failed to produce an adequate number of young fish during its spawning period. This habit may, in fact, be beneficial by preventing the hatching of small fish during periods when food is not available for their growth.

The spawning activities of bluegills should be watched, therefore, as they directly reflect conditions within the pond. When little or no spawning occurs, the pond is suffering from an overcrowded condition and bluegill fishing is relatively poor. When spawning occurs at intervals throughout the summer, the pond is usually in proper balance and fishing is at its best.

REPRODUCTION OF LARGEMOUTH BLACK BASS (*Huro salmoides* Lac.)

The eggs of largemouth black bass required a relatively long period for development within the fish. Where adequate food was available, the egg sacs began to swell in September and eggs could readily be seen in the sacs in October. These eggs continued to develop during the winter and early spring months and were laid in April, May or June. After spawning, no more eggs were developed until the following fall.

Largemouth bass swept out nests very similar to those of bluegills, except that the nests of the former never occurred in groups. Each nest was guarded by one male bass, while on the bluegill bed, as a result of grouping, any one nest was protected from intruders by males from this and adjacent nests. The bass nests were found in water from 6 inches to 4 feet in depth. The eggs were laid on gravel, sand, firm clay, leaves, roots, brush or similar materials. This species was able to find suitable spawning areas in all ponds, and the construction of special spawning areas was unnecessary.

The time at which spawning occurred was found to vary widely, apparently being dependent upon the physical condition of the bass and somewhat upon the transparency of the water. Small bass usually spawned later than larger bass, and muddy water retarded egg-laying. In 1942, for example, within a 5-mile radius from Auburn, spawning began in the middle of April in one pond, during May and June in others, and during the first week in July in another. It was evident that there was no particular temperature of the water at which egg-laying began.

In experimental ponds at this Station, largemouth bass never have spawned at less than 10 to 12 months of age. The smallest bass which have spawned were between 5 and 6 ounces in weight. Year-old bass weighing less than 4 ounces have always failed to spawn.

If fingerling bass are to be used in stocking a new pond, therefore, they should be stocked sufficiently early and in proper numbers to reach a size of approximately 5 to 6 ounces by spawning time the next spring. In a combination of bluegills and bass only, this has necessitated stocking during August, September, or October. During the fall and spring months, these small bass made sufficient growth for successful reproduction on a diet of insects and tadpoles. When minnows, such as Gambusia or golden shiners were available during the early spring as food for the bass, fingerling bass stocked as late as January or February have made sufficient growth to reproduce the following May or June.

Whereas small fingerling bass found a diet of aquatic insects and tadpoles adequate for reproduction, larger bass (1 pound or more) lost weight on such a diet and failed to reproduce. For instance, a 2-acre pond was stocked in December, 1936 with 10 adult bluegills (average weight 5.3 oz.), 10 adult white crappie[1] (average weight 9.2 oz.), 10 adult bullheads[2] (average weight 11.5 oz.), and 10 adult largemouth black bass (average weight 1 lb.). None of the fish added were small enough for the bass to eat and no young fish were hatched in the pond sufficiently early to serve as food for the bass prior to their spawning period. The bass, therefore, were limited to insects and tadpoles for food during this critical time. After one year the pond was drained and the following numbers of young fish recovered: 20,615 bluegills, 3,848 crappie, 668 bullheads, and 0 young bass. Large bass (1 pound or more) always failed to reproduce in ponds unless they had an adequate supply of small fish for food during the fall and spring months preceding the spawning period.

In addition to being unable to reproduce if sufficient food was lacking, bass often failed to reproduce if food was too abundant. In a 2-acre experimental pond with a largemouth bass-bluegill combination, the bass during a 3-year period gained weight at the rate of 2 pounds each year, but during this entire time only 3 young bass were produced in the pond. In a 12 acre pond, bass under similar conditions failed to reproduce over a 4-year period. Such results were puzzling until it was found that the bass were making extremely rapid growth because the ponds were overcrowded with bluegills, and that, where bluegills were overcrowded, they ate bass eggs. Male bass were unable to guard their isolated nests successfully when surrounded by large numbers of hungry bluegills. While a bass was chasing one bluegill away, four or five others dashed into the nest from other directions. As a result most of the eggs were eaten before they hatched. The hungry bluegills also ate some of the newly-hatched fry, with the result that practically no young bass were produced in these overcrowded ponds. This

[1]**Pomoxis annularis** Raf.
[2]**Ameiurus natalis** LeS.

has been found in other experiments to be a common occurrence in bluegill-bass combinations. Reports on the habits of golden shiner minnows and other forage fish (Hubbs, 1933; Wiebe, 1935) would seem to indicate that if overcrowded, many other species might be expected to interfere similarly with the reproduction of largemouth bass.

In two ponds, when bass failed to reproduce because of the overcrowded condition of the forage fish, barring all bass-fishing in one for a period of three years and in the other for five years failed to correct this condition. It could be remedied only by correction of the overcrowded condition of the forage species. In a 3-acre pond this was done within a 4-month period by fertilization to increase the food for the bluegills and by heavy fishing to reduce their numbers; the bass were then able to reproduce successfully (Swingle and Smith, 1941). When fertilization was not possible, the correction of this condition by fishing alone was an extremely slow process. In a 12-acre pond heavy fishing over a 4-year period failed to reduce the bluegills sufficiently to enable bass to reproduce. If the only corrective measure possible is the removal of the overcrowded bluegills, fishing should be supplemented by seining.

Since the overcrowded condition of the forage fish is essentially due to a lack of sufficient bass in the pond, the addition of more bass is a logical solution. In order to stock with sufficient numbers, it is necessary to use either fingerlings or fry from a hatchery. Since bluegills reproduce sparingly when overcrowded, it might appear doubtful whether small bass could secure sufficient food in an overcrowded pond to enable them to grow large enough to feed on the overcrowded bluegills. A 12-acre pond which contained only bluegills, white crappie, and yellow bullheads, became so overcrowded with the young of these species in 1939 that spawning was depressed. On June 10, 1940, 2,036 bass, from ¾ inch to 1 inch in length, were added. Many of these bass were able to find sufficient food in the pond to reach a size of 8 ounces to 1 pound by the following spring, although the overcrowded crappie were unable to gain weight during this same period. The pond was still so overcrowded in the spring of 1941 that no young bass were produced. An additional 600 small bass (¾ to 1 inch in length) were added in June, 1941. By the spring of 1942, the overcrowded condition of the pond had been sufficiently corrected by the bass and by heavy fishing so that the bass were able to reproduce successfully. The small bass in this case were able to find sufficient food not utilized by other species to enable them to grow rapidly, and eventually to balance a pond so overcrowded that adult bass could not reproduce. Much better fishing results, however, when a new pond is properly stocked and such overcrowded conditions are not allowed to develop.

To maintain the proper balance in a pond, the bass must eat not only the excess of small bluegills but also of their own young

(Swingle and Smith, 1940), leaving only the numbers which can make satisfactory growth on the available food. Where fingerling bass are used in stocking new ponds, reproduction the following spring will occur if the pond is understocked. Where this is done, however, there are then insufficient old bass to thin down properly the young produced in the pond and an overcrowded condition results among the bass which is extremely hard to correct. Where fry are used in stocking, reproduction the following spring will occur if more than the correct number is used. Under these conditions, however, the bass which are added make unsatisfactory growth. It is extremely important, therefore, that the correct number of bass be used in stocking.[1] A new pond can be considered properly stocked only when the bass reach a weight of 12 ounces to 1 pound and reproduce successfully within one year after stocking.

SUMMARY

Bluegills (*Lepomis macrochirus* Raf.) reproduced successfully under a wide variety of conditions and the construction of special spawning areas was unnecessary. They have spawned in experimental ponds at the age of four months when food was sufficiently abundant for extremely rapid growth, but usually they spawned first at one year of age. The time and extent of spawning varied widely in adjacent ponds and was dependent upon the abundance of food for the adults. Overcrowded bluegills ate their own eggs; when other food was plentiful, few eggs were eaten. In properly balanced ponds, spawning occurred at intervals during each month from April to October.

Largemouth black bass (*Huro salmoides* Lac.) did not spawn at less than 10 to 12 months of age and then only if they weighed in excess of 5 ounces. Bass in some ponds at Auburn, Alabama, began spawning in the middle of April, in others during May and June, and in one the first spawning occurred during the first week in July. They were unable to reproduce in ponds overcrowded with bluegills because the latter ate the bass eggs and newly-hatched fry. This was prevented by proper initial stocking or remedied by correcting the overcrowded condition.

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