Nine pairs of brood fish were transferred May 18 to wire pens in a ¼-acre pond. Each pen contained a wooden spawning box as previously described. Eggs were found in three of these boxes on May 25, May 31, and June 16. Although the boxes were checked every 2 or 3 days through July, no other spawns were found.

The five pairs of brood fish left were those that appeared either to have spawned previously or not likely to spawn. These were returned to the holding pond from which they were taken. Only one later spawn, found June 6, was observed in this pond.

The white catfish laid eggs in masses very similar to those of channel catfish. However, the individual eggs of the former were slightly larger than those of channel catfish. The time required for the eggs to hatch was 6 to 7 days at water temperatures between 75° and 85° F. The egg masses from these 2-pound females were relatively small. A total of 4,000 fry was counted from one of the larger spawns, while the count was 2,500 from one of the smaller spawns. White catfish fry became progressively darker after hatching, and at 4 days of age they were a dark brown color except on the belly. Several of the spawns were successfully hatched in a paddlewheel trough, while the majority was left to hatch in the spawning boxes. The males apparently "fan" the eggs the same as channel catfish, but did not appear to be as ferocious when disturbed as the latter species.

SUMMARY

Two-year-old white catfish were spawned successfully in ponds and in wire spawning pens constructed in ponds. Usually the eggs were laid in the provided wooden spawning boxes, although some fish spawned either in muskrat burrows or in holes they made in the pond banks. The spawning season at Auburn, Alabama extended from May 11 to June 16. Surface water temperatures in early morning at the beginning of the spawning season were about 68° F. No spawning occurred when early morning surface water temperatures were 80° F. or higher.

Two-pound female white catfish produced between 2,500 and 4,000 fry per spawn. Where water temperatures averaged 80° F., the eggs required 6 to 7 days to hatch. Eggs hatched successfully if left in spawning boxes and also when transferred to a paddlewheel hatching trough.

With supplemental feeding white catfish fingerlings stocked March 25 at a rate of 2,000 per acre gave a net production of 1,558.4 pounds in 202 days, whereas 3,000 fingerlings stocked May 4 gave a net production of 2,187.0 pounds in 205 days. Mortality averaged 1.8 percent; *S* conversion factors ranged from 1.7 to 2.0, and gains per acre per day ranged from 6.5 to 10.7 pounds. The quality of the meat was as good as that of channel catfish. In addition, both white catfish fingerlings and adults lived exceptionally well during harvesting operations under conditions of muddy water, hot weather, and low oxygen concentrations. Because of these characteristics, this species appears to be a very promising pondfish, especially for commercial production. Further data are needed on baits and methods of fishing to determine the value of this species as a sport fish.

SPAWNING OF CHANNEL CATFISH BY USE OF HORMONE

BEN A. NELSON, *Lonoke, Arkansas*

ABSTRACT

Early in 1958, due to the tremendous demand for channel catfish fingerlings, the decision was made to construct a separate hatchery for the production of same. Several hatcheries were visited, and methods observed to determine those best suited for our use. Our aim for this hatchery was production in large numbers at minimum cost.

Considerable time was spent at the experimental station at Tishomingo, Okla., where Mr. Kermit Snead was in charge. We felt the methods used at this station, though in the early stage, appeared to be most applicable for mass

production. Thus the system of glass aquaria for spawning and troughs for hatching was put into use. By the use of the buffalo fish pituitaries and mamalian hormone, we hatched spawns of one-hundred-thirty-five pair of channel catfish from May 18th to June 28th, 1960.

METHODS FOLLOWED

The spawning aquaria, which we constructed, were framed by 1x¼ inch angle iron which held four glass sides cut from 7/32 sheet glass, and marine plywood ¾ inches thick formed the bottom. Sealing compound used was aquarium cement. In one corner of the bottom, a hole was drilled and a one-half inch coupling inserted. Into this coupling, was placed the overflow and drain cut from one-half inch pipe the height of same being three-fourths inches below that of the aquaria. This type of drain allowed a continuous flow of water through the aquaria during the time fish were contained. The size of these aquaria was 24x24x14 and will accommodate fish weighing ten or twelve pounds. As a preservative measure, the plywood bottoms were painted with black asphaltum and the metal frames with aluminum. A piece of slate roofing cut to aquaria size was placed on the bottom to assist in the moving of eggs to the hatching troughs.

Our hatching troughs were constructed from a sheet of fourteen gauge metal forty-two inches wide and ten feet long. This made a trough twenty inches wide and ten inches deep. A division was placed in the trough for two reasons; first, to reinforce the trough, and second, giving an opportunity to hold eggs in separate compartments while they are hatching. A one-inch collar and nipple were placed in each section to serve as drain and overflow. Gravity flow water, with a three-foot head, carried by one-half inch pipe was directed into each section. Bearings were placed at either end and central division of trough affording the use of a shaft of one-half inch pipe. To this shaft paddles, made of galvanized tin, were attached. Spacing between paddles to accommodate three baskets twelve inches wide and seventeen inches long per section of trough. Baskets were made of one-fourth inch hardware cloth, three inches deep and divided into four sections; hung by wire from sides of trough, water line just below basket top. Paddles were long enough to reach below the depth of baskets, thus giving sufficient surge to the water. Paddles were pulled by a one-fourth H. P. electric motor. The R. P. M. was gained by the combination of one and one-half inch pulley to ten and a one and one-half inch pulley to twelve, thus giving thirty R. P. M.

By the use of this hatching trough, a ninety-eight percent hatch was possible. General procedure for removing fry was once every twenty-four hours. But during the peak of our hatching period, they were removed each morning and evening. Being a commercial hatchery, we cannot leave number to chance or estimate; therefore, as the fry were removed from the troughs they were measured in a cup by water displacement and stocked as a given number of ounces per acre. As a result of such stocking, in a clean pond and with a definite feeding program, we have for the past two years harvested one thousand fingerlings per ounce of fry stocked. Our first pond this season was stocked with 123 ounces of fry and from this amount 130,000 fingerlings were sold.

CARE OF BREEDING STOCK

Immediately following our 1959 spawning season, our breeding stock were placed into ponds at the rate of one-hundred-fifty per acre. Previous to this time, these same ponds had been stocked with fathead minnows with good reproduction. A feeding program was started using a pelleted feed five pounds per acre six days a week. The basis for this feeding being previous experience had proven that properly fed channel catfish will not eat their eggs. And upon the examination of two females, one in August and two in September, we found that the egg mass was already developing for the coming year. These fish were not removed from the ponds until the tenth to fourteenth of May. Our feeding was governed, during the winter months, by the weather and activity of the fish. Catfish under these conditions will feed in water down to forty-five degrees Fahrenheit; the amount consumed is less so for best results our feeding was done during the warmest part of the day. It was also learned

that fighting among the fish can be controlled by ample feed and proper concentration. This report may contradict other reports on catfish but experience is a good teacher.

For a comparison of feeding results, breeding stock was checked as they came from fed ponds or reservoirs with forage feed. In our opinion, the most crucial time for feeding is the first ninety to one-hundred-twenty days after spawning. Our check of brood stock this year was made the fifteenth of August and tenth of September and revealed the formation of the egg mass. Fish fed throughout the summer of 1959 gave large spawns of medium size eggs. Breeders fed only in the spring months gave fairly large spawns with extremely large eggs thus less in number. Fish taken from large ponds with forage feed gave smaller spawns of medium size eggs. From the information gathered, it appears that the number of eggs spawning will be governed by the type and quantity of feed available when the egg mass is started.

On May 10th, 1960 our breeding stock was checked and found to be ready for spawning. Therefore, they were removed from the large ponds and placed in smaller ones, males and females respectfully. At this time forty pair of fish were selected and placed in the pens. Twenty pair were chosen to be placed in the aquariums after females were injected with one milligram of pituitaries per pound of fish. The second injection was given twenty-four hours later. As a result of the second injection, ten pair reacted; these were replaced immediately. Of the thirty pair injected the results were as follows: six reacted to one injection, twelve to two injections, two to three injections and two to four injections, thus making a total of twenty-two spawns. The dosage was increased on five pair as an experiment. As a result, we lost four females with adhesions and had one partial spawn. At this time all fish were removed and aquariums cleaned ready for fresh brood stock.

This new stock was injected with A. P. L. due to the fact that we had not found a source of supply of the hormone desired which is mamalian (Chorionic Gonadotropin obtained from human). The hormone was obtained through a veterinarian with a cost much less than that of others. We injected one-hundred-sixty-five pair with this mamalian hormone and had reactions from one-hundred-fifteen. Of this number thirty-five were from pens and eighty from the aquariums. Our results from the use of this hormone were very good as we had eighty-six reactions from a single injection and twenty-nine with the second.

There is one other factor which has great bearing on the reactions of the female, that being the Ph of the water. Our water supply to the aquaria was gravity flow from two different ponds. It was necessary to drain one pond and before it could be replenished the Ph of the water in the other rose to 9.2. Ten pair were in the aquaria at this time and injections were given on schedule but with no results. Five fish were removed leaving the other five for trial basis. The remaining aquaria were filled with fifteen pair, eleven of which reacted to one injection and two with the second. The five pair left in the aquaria had no reaction after five injections though the eggs were developed; during the excitement of handling these eggs were released spasmodically. The same results were had from ten pair in pens, these were given four injections and remained in pens for ten days. I believe that additional study needs to be made with reference to the possible relationship of water Ph and good spawning conditions of catfish.

Our methods using hormone injections followed very closely the recommendations of Sneed and Clemens. However, we have learned that the selection of properly developed females is most important and should be the gauge of the amount of hormone necessary. Spawns were had from injections ranging from three-hundred to eight-hundred units per pound of body weight. The selection of ripe females is as difficult to explain as to accomplish. We encountered difficulty when feed had been recently consumed as the abdomen was rounded and soft. An examination revealed the large amount of feed consumed thus accounting for the softened condition of the body. We recommend holding the females in two separate ponds feeding every other day with the selection to be made previous to feeding. However, the most important factor governing the selection of breeders in proper condition is the raised and inflamed genitals. A female fed throughout the year carrying a heavy load of

eggs and having the appearance of being ripe will be thick back past the pelvics and almost to the genital orifice.

We agree with the report of Sneed and Clemens on the type of males needed for spawning. We prefer, and whenever possible, choose a male slightly larger than the female and with a wide well-muscled head. Brood males were divided between two ponds, having completed a spawn they were released back into the pond for a rest of a week to ten days. After such time they could be used with good success for the second spawn. We found that by allowing the female to be in the aquarium or pen two to three hours previous to the introduction of the male their fighting was greatly reduced. As the time for spawning drew near the female was just as active as her mate in the cleaning of the spawning area and in most cases she would do the final cleaning. Another observation made possible by the use of the aquaria was being able to see the release of the sperm. Five pair were watched during the process revealing the fact that the sperm is released immediately preceding the laying of the eggs. Only approximately one-third of the females ever wrapped their tail around the male during the act of spawning and no sudden lunge on the part of the female at the finish of spawning was noticed. Movies taken during spawning at the hatchery will present same.

The use of mechanical troughs for hatching is a great asset. First, there is less chance of eggs being destroyed, mainly in pens, and second, it gave an opportunity to handle more breeding stock with less equipment. The length of spawning season is governed by several factors thus the need of speeding up the process. We found it necessary for someone to be on duty twenty-four hours a day during this time due to the variation of spawns. The length of time to complete a spawn ranged from six to twelve hours, and as the male takes over the care of the spawn the female must be removed within the hour or he will start fighting her and the eggs will be destroyed. At no time did we have a female that would make an effort to eat the eggs after the spawn was complete.

The feed used throughout our program is Darco Fish Formula No. 1. This feed is manufactured by Darragh Milling Company, Little Rock, Ark. It carries 38% protein, 5% fat and 5% fiber. Of the 38% protein slightly over 75% is animal. It also carries terramycin and nf-180 antibiotics and rather heavy on vitamins A and B12. We are having good results by feeding approximately 2% of body weight six days a week or the amount they will consume in fifteen to twenty minutes. However, we feel that further research needs to be made on the feeding program.

TWO YEARS OF CREEL CENSUS ON THREE NORTH MISSISSIPPI FLOOD CONTROL RESERVOIRS

By HARRY BARKLEY
Mississippi Game and Fish Commission
Oxford, Mississippi

ABSTRACT

The extent of the fishing pressure, harvest and fishing success on Sardis, Enid and Grenada Reservoirs, in north-central Mississippi, was undetermined in recent years. A creel census program was initiated June 15, 1958, to provide this information.

Grenada Reservoir received an estimated fishing pressure of 300,271 hours in 1958-1959 and 296,746 hours in 1959-1960. Sardis received an estimated 242,719 hours in 1958-1959 and 227,414 hours in 1959-1960. Enid received an estimated 147,605 hours in 1958-1959 and 96,297 in 1959-1960.

The catch per hour of effort on Grenada for the two years was 1.40 and 0.95, respectively, on Sardis it was 0.99 and 0.80 fish, and on Enid it was 0.82 and 1.00 fish per hour, respectively.

The percent of fishermen making a successful trip on Grenada was 91.98 percent in 1958-1959 and 90.09 percent in 1959-1960, on Sardis it was 92.76