

# COMMERCIAL PRODUCTION OF RED CATS (SPECKLED BULLHEADS) IN PONDS

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The speckled bullhead (*Ameiurus nebulosus marmoratus*) is variously known as the marble cat, speckled cat and red cat. The latter name comes from the red color of its flesh and is used in areas where the dressed fish are sold commercially. Since this is the accepted commercial name, it will be used in subsequent references to this species. Experiments on its culture on a commercial basis have been conducted at Auburn over the past 7 years. In a previous paper,<sup>1</sup> it was reported that production of marketable sized speckled bullheads up to 745 pounds per acre was obtained with supplemental feeding. The cost per pound of fish produced in this experiment was 48 cents; however, it was pointed out that the elimination of feeding during the winter while water temperatures were below 60° F. should result in more economical production.

The commercial production of this species was facilitated by the fact that reproduction occurred readily in ponds and that fingerlings for stocking were easily raised. At the same time, the fact that reproduction occurred in ponds was a handicap because feeding in the commercial production ponds during the spring and summer months caused such heavy reproduction that small fish (3- to 4-inch) made up 59 to 70 per cent of the total weight of fish produced. The method of commercial production found most successful was to stock fry or small fingerlings in the spring, fertilize the pond until fall, feed the fish during fall and spring months, and drain the pond before reproduction could occur. Such a procedure, while successful, limited the usefulness of this fish as a commercial species and made it a seasonal crop. It was obvious that a method for the prevention of reproduction in commercial ponds was needed.

In past years frequent kills occurred in ponds in which the red cat was being raised commercially and for a period threatened to prevent its commercial culture. However, these troubles were overcome partly by the control of parasites and partly by using a feed mixture that more nearly approached a balanced diet.

In this report, the advances made in the solution of these problems and the methods developed for the commercial production of this species are summarized.

Since feeding and treatments for control of parasites and diseases are used at various times in the management procedures, these subjects will be discussed first.

## FEEDING

In early experiments, supplemental feeding was employed, using soybean cake or peanut meal. Many fish kills during this period were suspected as being due to the unbalanced nature of this feed and especially due to vitamin deficiencies. Survivals as low as 3.6 to 49.2 per cent of the stocked fish sometime resulted.

Better results were obtained using as a supplemental feed a mixture of 6 parts soybean meal or peanut meal to 1 part fish meal; however, as the pounds per acre of the red cat increased, this mixture also appeared inadequate as evidenced by inefficient conversions and occasional kills or ulcers on the fish. These latter were suspected of being caused either by disease or by avitaminosis similar to that found by Zobairi<sup>2</sup> in carp due to B-vitamin deficiencies.

Consequently, a mixed feed containing distillers dried solubles as a source of B-vitamin, which was devised by E. E. Prather of this Station for use in minnow production, was tried as a supplemental feed for commercial production of red cats and other species and was found to give satisfactory results. This mixture, designated as Auburn No. 1 fish feed, contains the following materials:

Soybean Oil Meal .....	35 per cent
Peanut Oil Meal .....	35 per cent

<sup>1</sup> Swingle, H. S. Experiments on commercial fish production in ponds. Proc. Southeast. Assn. Game and Fish Comm. 1954:69-74.

<sup>2</sup> Zobairi, A. R. K. Incidence of B-complex avitaminosis among common carp reared in troughs. Prog. Fish-Cult. 18(2):88-91, 1956.

Fish Meal .....	15 per cent
Distillers Dried Solubles .....	15 per cent

This was devised as a supplemental feed for increasing fish production in ponds where some natural feeds were also available.

The above materials were mixed thoroughly and the dry mixture put into the water at several locations in the pond. Feeding was daily, six days per week, in all experiments. The cost of the mixed feed varied from 4.3 to 5.0 cents per pound depending upon fluctuations in prices of the various ingredients.

Efficient feed conversions (below 3.0) and better survivals of the stocked fish (79.9 to 97.8 per cent) were obtained with this feed. However, part of the increase in survival was also due to the measures taken to control parasites and disease.

#### CONTROL OF PARASITES AND DISEASE

Control of parasites and disease was principally accomplished by disinfection of brood fish, fry, and fingerlings before stocking. All fish were transported to and from ponds in tanks or aluminum cans containing 1 to 2 p.p.m. acriflavine to prevent spread of disease from one fish to another.

Brood fish, prior to stocking in spawning ponds, were treated in troughs with 10 p.p.m. potassium permanganate for 1 hour, followed by rapid dilution with fresh water, for the control of fungus, bacteria and external parasites. They were then treated with 15 p.p.m. formalin for 4 to 6 hours for control of external protozoan parasites and gill flukes. Since they can live indefinitely in this concentration of formalin, they were often kept overnight in tanks containing 15 p.p.m. formalin plus 1 p.p.m. acriflavine.

Fry, prior to transfer into holding ponds, were treated with 15 p.p.m. formalin for 2 to 12 hours and transported to and from ponds in 1 to 2 p.p.m. acriflavine.

Fingerlings, prior to stocking into holding ponds or into growing ponds, were disinfected in the same manner as the brood fish.

Where fish kills occurred in holding ponds or growing ponds due to such parasites as flukes and protozoans, the entire pond was treated with 2 p.p.m. potassium permanganate (5.4 pounds per acre-foot of water). This was applied by dragging sacks containing the crystals with a boat and motor until the entire pond was treated. The cost of chemical for a pond treatment was approximately \$1.50 per acre-foot of water.

#### PRODUCTION OF FINGERLING RED CATS FOR STOCKING

The fastest growing individuals should be selected for brood fish each year as the commercial ponds are drained. Red cats from 0.5 to 1.5 pounds were found satisfactory for brood fish; fifty fish per acre stocked in spawning ponds any time from January to July gave satisfactory results. The Auburn No. 1 mixed feed was added to the spawning pond at the rate of 5 pounds per acre daily for 6 days per week, or the pond was fertilized about once monthly with 100 pounds 8-8-2 per acre. With either treatment, approximately 30,000 to 35,000 young cats per acre were produced.

Red cats excavated holes in the bank in which the eggs were deposited. The first young hatched when the water temperature was approximately 80° F., at a 1-foot depth. The newly-hatched fry rose to the surface in dense schools and remained in schools for a week or more. Where feeding was used, spawning continued at intervals from June until September.

It was found best to pick up the schools of cats as soon as the young fish reached a size of  $\frac{3}{4}$  to 1 inch in length and transfer them to holding ponds at rates up to 60,000 per acre. After the schools broke up, it was found necessary to partly drain the spawning pond to capture the fingerling cats. Subsequently, the spawning pond was refilled and spawning continued at intervals until September, where feeding was used.

After the fish had been transferred to holding ponds, food was provided by fertilization once a month until October with 100 pounds 8-8-2 per acre per application. Subsequently, the fingerling cats were fed at the rate of 1 per cent of their estimated weight per day for 6 days per week, using the Auburn No. 1 fish feed. Feeding at this rate caused a very slow rate of gain, but maintained the fish in a healthy condition until needed for stocking the growing ponds.

Rapid growth of fingerlings is undesirable in the holding ponds because it is essential that these fish remain sexually immature until after they are stocked in the commercial production ponds. Feeding was discontinued during the winter while the water temperatures remained below 60° F. and resumed again in the spring.

### PRODUCTION OF MARKETABLE FISH

It was found that restaurants preferred to buy red cats weighing 0.2 to 0.5 pound live weight so that one or more fish could be included in one serving. Fish weighing 0.7 to 1.0 pound were considered too large.

It appeared that the problem of how to prevent reproduction in commercial production ponds might be solved by increasing the number of cats stocked to a point where a repressive excretion from these fish might act to prevent reproduction similar to the repressive effect found in goldfish, carp, and buffalo populations.<sup>3, 4</sup>

It had previously been found that the red cat spawned at stocking rates of 1,000 and 2,000 per acre. Increased stocking rates from 2,000 to 6,000 per acre were tried in subsequent experiments. It was found that a repressive effect preventing reproduction did occur with stocking rates of 3,000 to 6,000 red cats per acre, providing the size of the fish stocked was from 1 to 4 inches. Where 7-inch or larger red cats were stocked, reproduction occurred shortly after stocking before a repressive effect could be built up.

It then became possible by use of small fingerlings and these higher rates to stock at any time of year and to operate the commercial production ponds throughout the summer without interference from spawning.

The productions per acre in approximately one year with various stocking rates and with fertilization plus supplemental feeding were:

Rate Stocking	Pounds Fish Produced *	Pounds Feed Used	Cost of
			Fertilizer and Feed Per Pound Fish Cents
1,000 .....	564.2	3,840	79.0
2,000 .....	745.9	5,964	48.0
3,000 .....	903.4	1,930	11.6
3,500 .....	853.1	2,505	14.6
6,000 .....	1,238.4	3,620	15.3

\* Stocked in June and drained in July of following year.

The feed used for the stocking rates of 1,000 and 2,000 per acre was a mixture of peanut meal (or soybean meal) and fish meal (6-1), while for the other rates of stocking was the Auburn No. 1 fish feed. The cost per pound of fish includes only the cost for fertilizer and feed.

Various rates of feeding were tried in 1-acre ponds. Fish kills from low oxygen resulted if feeding rates of 30 or more pounds per acre per day were used from May to September. The maximum safe feeding rate for this period was 25 pounds per acre per day.

From the information available, it appeared that the most economical production was obtained by the stocking rate of 3,000 cats per acre June 11, followed by 5 applications of 8-8-2 at monthly intervals until fall, and feeding at the following rates using the Auburn No. 1 fish feed:

5 pounds/acre/day .....	August 22 to October 14
10 pounds/acre/day .....	October 15 to November 15
10 pounds/acre/day .....	March 12 to April 3
20 pounds/acre/day .....	April 4 to April 30
25 pounds/acre/day .....	May 1 to June 1

It will be noted that feeding was discontinued during the period November 15 to March 12, while the water temperature remained below 60° F. This rate

<sup>3</sup> Swingle, H. S. A repressive factor controlling reproduction in fishes. Proc. Eighth (1953) Pacific Science Congress. (In press.)

<sup>4</sup> Swingle, H. S. Experiments on commercial fish production in ponds. Proc. Southeast. Game and Fish Comm. 1954:69-74.

of stocking also resulted in red cats of the most desirable size for sale—between 2 and 3 fish per pound.

### PREPARATION FOR MARKET

There was only a limited market for live red cats, but a good demand for the dressed fish, both fresh and quick-frozen. The loss on dressing was as follows:

2,442 Cats Live Weight .....	610.5 pounds
2,442 Cats Dressed Weight .....	356.7 pounds (58.4 per cent)
Loss .....	253.8 pounds (41.6 per cent)

Dressing included skinning and removal of heads and viscera. This species dressed out 58.4 per cent of the live weight.

Records were also kept on the labor involved in dressing these fish. On the average it required 1 man-hour to dress 25 fish. Where cats were raised to a size of 4 per pound live weight (6.8 per pound dressed weight), at 50 cents per hour for labor the cost of dressing was 2 cents per fish, or 13.6 cents per pound dressed weight. Where cats were 2.7 per pound live weight (4.6 per pound dressed weight), the cost of dressing was 9.2 cents per pound dressed weight. It can be seen, therefore, that the cost of labor per pound of dressed fish rises sharply as the number of fish per pound increases.

In the above experiment, with a stocking of 3,000 red cats per acre, the cost per pound live weight was 11.6 cents. Considering the 41.6 per cent loss on dressing, the dressed fish cost 19.9 cents per pound plus 9.2 cents for dressing, making a total cost to the producer of 29.1 cents per pound. They were sold for 50 cents, giving a return of 20.9 cents per pound dressed weight or \$110.25 per acre for other labor and capital costs of production.

### SUMMARY OF MANAGEMENT PROCEDURES FOR COMMERCIAL PRODUCTION OF RED CATS

1. Select for brood fish the fastest growing red cats (speckled bullheads) each year when ponds are drained.
2. Disinfect the brood fish with 10 p.p.m. potassium permanganate for 1 hour, followed by 15 p.p.m. formalin plus 1 p.p.m. acriflavine for from 4 to 12 hours.
3. Stock the brood fish in spawning ponds between January and July, using 50 fish per acre weighing from 0.5 to 1.5 pounds each.
4. Fertilize the spawning pond once monthly, using 100 pounds 8-8-2 per acre.
5. Feed the brood fish 1 pound per acre per day using the Auburn No. 1 fish feed (containing 35 per cent soybean oil meal, 35 per cent peanut oil meal, 15 per cent fish meal, and 15 per cent distillers dried solubles) until after fish have spawned.
6. The first schools of young cats will be found in June to July after the water temperature has reached 80° F. Additional spawning will occur until September if feeding is adequate.
7. Remove schools of fry as the small fish reach a length of 0.7 to 1.0 inch; disinfect, and store them in holding ponds at rates up to 60,000 per acre.
8. Increase daily feeding in spawning pond to 5 pounds Auburn No. 1 fish feed to allow extra feed if the fry and fingerlings remain in the spawning pond.
9. Fertilize the holding ponds once monthly with 100 pounds 8-8-2 per acre per application until October.
10. Beginning in October, feed the fingerling cats in the holding pond at 1 percent of their estimated weight per day, 6 days weekly. Cease feeding while the water temperatures remain below 60° F. during November to March. (To estimate the weight of the fish in the pond, remove a sample by seining or trapping and determine their average weight. Multiply by the number of fish stocked to determine the estimated pounds of fish in the pond.)

11. Before stocking, remove fingerlings from the holding ponds and disinfect with 15 p.p.m. formalin plus 1 p.p.m. acriflavine for 4 or more hours. Then stock in the commercial production ponds at the rate of approximately 3,000 per acre at any time of year that ponds are available. Use only 1- to 4-inch fingerlings for stocking during the period March to October, and the larger fingerlings for stocking only after October to prevent reproduction in the commercial ponds.
12. Fertilize the commercial production ponds once monthly for 4 months using 100 pounds 8-8-2 per acre per application if stocking occurs between February and October.
13. Do not feed when water temperatures are below 60° F. While temperatures are higher, feed Auburn No. 1 fish feed at rates between 3 and 5 per cent of the body weight of fish per day, six days per week. Do not feed at rates above 25 pounds per acre per day.
14. For fish stocked in July, the following schedule for fertilization and feeding was successful:
  - a. Fertilize once monthly in July, August, September and October using 100 pounds 8-8-2 per acre per application.
  - b. Feed as follows:
    - 5 pounds/acre/day in September
    - 10 pounds/acre/day in October
    - 10 pounds/acre/day March 15 to April 1
    - 20 pounds/acre/day in April
    - 25 pounds/acre/day in May and June
15. Cease feeding about 1 week before draining. This procedure should yield approximately 900 pounds fish per acre at a cost of about 12 cents per pound for the fertilization and feeding.

## PRELIMINARY RESULTS ON THE COMMERCIAL PRODUCTION OF CHANNEL CATFISH IN PONDS

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The channel catfish (*Ictalurus punctatus*) has been used for a great number of years as a sport fish in ponds in the West,<sup>1</sup> but little work has been published on its production on a commercial basis. Reported are per acre yields of 71 to 92 pounds of channel cats from fertilization and an average of 238.6 pounds when the fish were fed soybean cake.<sup>2</sup>

In 1955-56, additional experiments on commercial production of channel cats were conducted at Auburn with fingerlings furnished by the Osage Springs Minnow Farm of Rogers, Arkansas. Since results from these experiments indicate that this species is promising as a commercial fish, a preliminary report on this work is given here.

### PRODUCTION OF CHANNEL CATFISH

Prior to stocking, the channel catfish were treated with 10 p.p.m. potassium permanganate for 1 hour, 15 p.p.m. formalin for 12 hours, followed by 1 p.p.m. acriflavine for 12 hours. In addition, they were treated with dibutyl tin oxide in the feed to remove intestinal parasites.<sup>3</sup>

<sup>1</sup> Toole, Marion. Utilizing stock tanks and farm ponds for fish. Texas Game, Fish and Oyster Comm. Bul. 24, 53 pp., 1950.

<sup>2</sup> Swingle, H. S. Experiments on commercial fish production in ponds. Proc. Southeast. Assn. Game and Fish Comm. 1954:69-74.

<sup>3</sup> Allison, Ray. A preliminary note on the use of di-n-butyl tin oxide for removing tapeworms from fish. Progressive Fish-Cult. (In press.)