

Reproductive Success of Channel Catfish in a Farm Situation

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Abstract: Three thousand pair of hand selected, 3-year-old channel catfish (*Ictalurus punctatus*) were stocked in 4 ponds used for brood production in in Humphreys County, Mississippi. From 1 May to 13 July 1981, data were obtained on spawning in the ponds. As the water temperature increased, so did the number of spawns up to a maximum of 498 on 30 May. Total spawns and spawning rate were 603 (86%) -pond 9; 523 (75%) -pond 10; 440 (55%) -pond 11; 550 (69%) -pond 12.

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Commercial production of farm-raised catfish has increased greatly in the last few years. Research in feeds and nutrition, water quality, diseases, and genetics is currently on-going.

Studies on breeding of channel catfish (*Ictalurus punctatus* Rafinesque) and blue catfish (*Ictalurus furcatus* Lesueur) are not new. Guidice (1966), Dupree and Green (1969), Goodman (1973), Smitherman and Pardue (1974), Dunham et al. (1982), and others have conducted research in this area.

If catfish farming is to have an impact on the economy in this decade, then fish with an increased growth rate, higher dressing percentage, lower oxygen tolerance, and increased tolerance to disease and stress are needed for the industry to continue its expansion. The hybrid catfish, channel female x blue male, exhibits such characters. The reason the hybrid is not used in commercial production is the inconsistent success obtained when mating these 2 species (Tave and Smitherman 1982).

The purpose of this study was to evaluate a pure-strain cross of channel catfish with respect to spawning rates and temperature influences in a farm situation. Often, studies conducted in aquaria, tanks, and ponds of small area

do not extrapolate well for larger commercial pond situations. This study will aid in future research with other strains of channel catfish and the hybrid itself by helping to establish a baseline of consistent results for reference of farm situation studies.

Methods

The 4 ponds involved in this study are owned by Sandling and Stephens Fisheries, Inc. They are located near Silver City, Humphreys County, Mississippi (T-14-N, R-3W, Sec. 34, and SW $\frac{1}{4}$). The 4.05-ha rectangular ponds used in this study are part of a series of 12. These have a minimum depth of 1.22 m in the shallow end and 1.52 m in the deep end. Ponds in this study received water from 1 25.4-cm well.

Ponds 9, 10, 11, and 12 were selected to receive a total of 3,000 pair of brood channel catfish. Each fish was hand selected for good general body formation and sexed. Females were chosen on the basis of abdominal fullness and genitals that were swollen and reddish. Males were selected on the basis of a heavily muscled head, dark jaw pigmentation, and protruding genital papilla. After filling the ponds with water in January 1981, ponds 9 and 10 each received 700 pair of brood fish and ponds 11 and 12 each received 800 pair. All brood fish were 3 years old and had a mean weight of 1.70 kg per fish.

Due to suspected inbreeding depression with catfish available for broodstock in the Mississippi Delta area, fish were chosen from a source in northeast Arkansas, and has been termed the Digman strain. This strain originated in 1973 with stock from Lake Erie and has been maintained as a pure-strain (2-4 generations).

Fish were fed 2% of their body weight twice weekly from January through March and every other day from April through 13 July 1981.

During the third week of April 1981, 200 spawning containers were placed in each of the 4 ponds. Water temperature was measured by a standard Fahrenheit thermometer and converted to Celsius prior to inspecting containers. All containers were then inspected and egg masses removed at 2 to 5 day intervals (except from 10 May to 17 May). Spawning began 1 May and continued through 13 July 1981 when spawning ceased.

Eggs were incubated in an artificial hatching system. Fry were subsequently stocked in ponds for growth and later sold.

Results

Temperatures varied seasonally and ranged from 18.9° C on 21 May to 31.1° C on 13 July (Table 1).

Spawning began on 1 May at 23.7° C and continued through 13 July when the water temperature reached 31.1° C (Table 1). Peak spawning activity occurred between 24.4° C on 25 May and 27.2° C on 30 May (Table 1).

Table 1. Temperature and number of spawns for complete runs in ponds 9–12 with 3,000 pair of brood fish at 2–5 day intervals, 1 May–13 July 1981.

Date	Water temperature (° C)		Number of spawns	
	Range	Mean	Range	Total
1 May	23.7–23.7	23.7	2– 10	23
4 May	22.2–23.3	22.8	1– 07	17
7 May	20.6–20.6	20.3	2– 23	40
10 May	19.4–20.0	19.9	0– 08	13
17 May	20.0–20.6	20.3	15– 54	117
21, 22 May	18.9–21.1	19.9	12– 57	115
25, 26 May	24.4–24.4	24.4	86–117	405
30 May	27.2–27.2	27.2	100–142	498
2, 4 Jun	26.7–28.9	27.8	33– 89	234
6, 9 Jun	27.2–27.8	27.5	23– 46	127
10, 13 Jun	27.8–29.4	28.6	7– 28	62
14, 16 Jun	29.4–29.4	29.4	7– 17	51
17, 19 Jun	30.0–30.0	30.0	8– 12	42
22, 23 Jun	29.4–30.0	29.6	5– 32	75
25, 26 Jun	30.0–30.6	30.3	5– 18	46
29, 30 Jun	30.6–30.6	30.6	5– 20	55
2, 3 Jul	30.0–30.0	30.0	4– 22	40
6 Jul	30.6–30.6	30.6	13– 26	81
9 Jul	30.6–30.6	30.6	8– 20	54
12, 13 Jul	31.1–31.1	31.1	2– 07	21

The number of egg masses from the 4 ponds during any complete run ranged from 13 on 10 May to 498 on 30 May (Table 1). Total spawns and spawning rate were 603 (86%)-pond 9; 523 (75%)-pond 10; 440 (55%)-pond 11; and 550 (69%)-pond 12 (Table 2). This represents a total of 2,116 egg masses from all 4 ponds with an overall spawning rate of 70.5%.

Discussion

Temperature did have an effect on the number of egg masses collected at any one time. Usually channel catfish spawn between 21.0° C and 29.5° C with an optimum temperature of about 27.0° C (U.S. Bur. Sport Fish. and Wildl. 1973). However, the fish in this study did not begin spawning until the water temperature reached 23.7° C on 1 May. When the temperature dropped to 18.9° C on 21 May, spawning continued. The temperature drop hindered collection of egg masses for 7 days (10 May to 17 May) but no spawns were missed due to the longer incubation period at the lowered temperatures.

Peak spawning began at approximately the same temperature (24.4° C) that initial spawning began (23.7° C) and continued on to the optimum of about 27.0° C. The 20-day period between was marked by temperatures at or below 23.7° C (Table 1). The brood fish continued to spawn during this time even down to 18.9° C because the temperature had been high enough

long enough that the slightly lowered temperature did not interfere with their initial start-up. However, it had a delaying effect on peak spawning activity.

Spawning continued up to 31.1° C. According to the U.S. Bureau of Sport Fisheries and Wildlife (1973), spawning activity ceases above the temperature of 29.5° C and at incubation temperatures above that, many deformed fry are produced. No deformed fry were noticed from the spawns collected at temperatures above 29.5° C. This could be due to the fact that the egg masses did not remain in the containers long enough for the increased temperatures to have a detrimental effect.

The results of this study along with research from the U.S. Bureau of Sport Fisheries and Wildlife (1973) and Horn (1981) indicated differences in spawning success and temperature effects among various strains of channel catfish. The higher spawning success in ponds 9 and 10 (Table 2) could possibly be attributed to differences in water quality or less competition due to a lower stocking rate.

Although water quality was not monitored during the study due to the low standing crops involved (587 kg/ha in 9 and 10; 672 kg/ha in 11 and 12), it was noticed that 9 and 10 remained consistently green whereas 11 and 12 were muddy. Once again, the increased number of brood fish in ponds 11 and 12 could be a factor in its color. At no time did the fish show any signs of stress.

According to the U.S. Bureau of Sport Fisheries and Wildlife (1973), stocking rates of up to 370 brood fish/ha are common. Exceeding that rate by 25 in ponds 11 and 12 may have had some effect.

Brood fish from the geographic region of northeast Arkansas were chosen by the authors due to previous work experience in the area and an attempt to avoid suspected inbreeding depression by selecting an area with a strain different from those available in the Mississippi Delta. The Digman strain of channel catfish was selected because of its history of favorable traits—uniform morphology, low incidence of diseases, no indication of any CCVD, and good growth rates.

The authors were pleased with the performance of these brood fish. Perhaps these results obtained from the use of large groups of brood fish in a farm situation study will more closely resemble true farm situation results. These results will help in giving a more realistic and consistent view into the

Table 2. Combined spawn totals and spawning rate from ponds 9, 10, 11, and 12 for the 1981 season.

Pond	Spawn total	Spawning rate (%)
9	603	86
10	523	75
11	440	55
12	550	69

reproductive success of channel catfish and heighten the insight into future studies with other strains of channel catfish as well as the hybrid in farm situations.

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