

Channel catfish hatchery and fry production practices in the U.S. catfish industry

JAMES A. STEEBY¹ AND BRUCE A. WAGNER²

In 1997, the United States Department of Agriculture's (USDA) National Animal Health Monitoring System (NAHMS) released *Catfish '97*—the first in-depth study of the Nation's catfish industry. Some six years later, *Catfish 2003*³ was released. Like its predecessor, *Catfish 2003* was designed to provide participants and industry with valuable information about health and management practices on U.S. catfish operations.

For *Catfish 2003*, operations from the nation's four major catfish-production states: Alabama, Arkansas, Louisiana and Mississippi, were targeted. Those four States accounted for 73.4 percent of all USA catfish operations as of January 1, 2003, 95.5 percent of 2002 national catfish sales and 95.5 percent of water surface acres used for catfish production from January 1 through June 30, 2003. Study response was remarkable, with 600 hundred of the four states' estimated 825 catfish operations responding to the study's initial survey³.

Catfish Breeding, Hatchery and Fingerling Operations

A small percentage of catfish operations (14.2 percent) in the four participating states bred catfish. A slightly smaller percentage of operations (12.8 percent) operated hatcheries. The difference can be attributed to the fact that a few of the operations that bred catfish allowed eggs to hatch in ponds, and a few of the operations that operated hatcheries did not breed catfish but purchased eggs. Combining data

from the National Agricultural Statistics Service (NASS) and NAHMS, it is estimated that 106 hatcheries produced fry for the four state industry. In contrast, 29.9 percent of all operations grew fry to fingerlings. The remaining 70.1 percent of operations were exclusively foodfish growout operations and purchased fingerlings from suppliers.

Broodfish

The majority of operations maintained some genetically improved broodfish lines, including Goldkist, NWAC 103, and on-farm "mass-selected" improved fish. Only 34.8 percent of operations used "pond run fish" or unimproved large catfish for breeding. Pond-run broodstock accounted for 33.4 percent of all broodstock in breeding operations. Hatchery operators preferred younger broodfish, inasmuch as only three percent of broodfish were more than six years of age. Approximately 75 percent of broodfish were aged four years or less. Considering the time and capital investment represented by broodfish—and the fact that good egg output is expected from fish three years and older—producers should use brooders until the fish are at least five years old.

The annual sorting of broodfish by sex and culling of inferior fish are



Channel catfish eggs

also recommended (Kelly 2004). In 2002, 16.3 percent of all broodstock, relative to the January 1, 2003 broodstock inventory, were culled. However, over half of operations (54.5 percent) did not cull any broodfish in 2002. This may be due, in part, to the fact that most broodfish were less than five years of age, and culling and sorting by sex are unnecessary when broodfish are completely replaced.

Producers estimated that they lost approximately 14 percent of their broodfish annually. Males fight frequently when competing for spawning cavities and females, and fighting was the single largest factor for broodfish losses. Consequently, the combination of losses and culling represented close to one-third of the broodstock inventory.

Most operations had regular feeding regimes for broodfish (Figure 1), and about a third supplemented feed

with some type of forage fish, such as fathead minnows or golden shiners. Forage-fish supplementation is strongly encouraged and should be more widely practiced throughout the industry because it helps ensure good egg quality and spawning success. Producers should be aware of the health status of the forage fish being introduced into their ponds to avoid accidental disease introduction.

Catfish Breeding

In the wild, channel catfish spawn during spring and early summer, usually in log or bank cavities. To procure their spawns, breeders place mature male and female broodfish in large, open ponds in early spring and provide spawning containers that serve as cavities. When the daytime water temperatures averaged near or above 25° C, spawning containers were checked every two to three days for egg masses, which were removed and taken to the hatchery.

Most operations (80.8 percent) used three or fewer females for every male. Not all female catfish spawn, so this ratio should be adequate if annual broodfish sexing was carried out and male losses are balanced. There were 894,000 broodfish on hand in January 2003 with an average weight per fish of 2.17 kg (USDA-NASS 2003). The Catfish 2003 study estimated that hatcheries averaged 1,712 spawns per operation in 2002. Using these data, it could be estimated that the four participating States produced 181,472 spawns in 2002. The industry-best average spawning percentage is about 40 percent if half the brooders are female. At a 2:1 female-to-male ratio, the percentage would drop to a 30 percent female spawning success.

Excellent broodpond water quality is essential for sustained egg mass harvest. To ensure timely and adequate egg mass yields, hatchery managers should strongly consider placing brooders in well dried or newly renovated ponds each spring, just before the onset of spawning season. Well dried, renovated or new ponds make excellent brood ponds because typically they maintain dissolved oxygen concentrations above 5 mg/L, even during early morn-

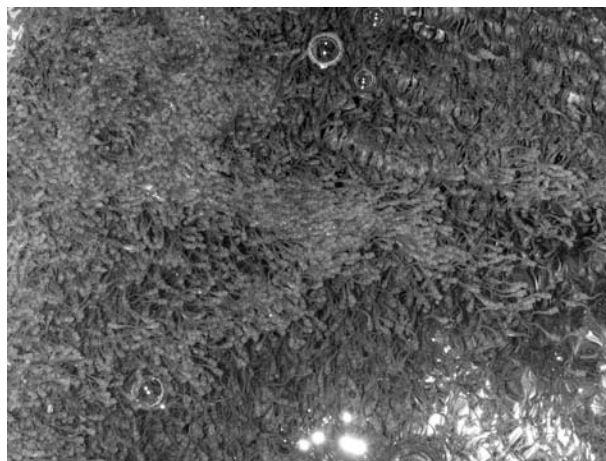
ing hours. The majority of operations (79.0 percent) drained brood ponds within a three year period. It is recommended that broodfish stocking densities not exceed 1344 kg/ha; 41.6 percent of operations equaled or exceeded that density (Table 1).

Hatchery Management

Typically, egg masses are placed in hatching troughs (metal or fiberglass water tanks) with continuous water-flow rates of 3.8 to 19 liters per minute. Slow-turning paddles provide aeration and water movement until eggs are hatched (Steeby *et al.* 2004). Most hatcheries (81.0 percent) used well water for hatching. Depending on water temperature, eggs hatch within five to seven days. At that time, the yellow-colored fry that emerge still have yolk sacs attached and are not yet fully developed. In three to four days, yolk-sac fry turn black and swim up the side of the tanks. These swim-up fry may be fed a high protein diet for an additional three to four days before being placed in prepared ponds, where they grow to fingerlings by the end of the first year.

Industry Egg Production

It is generally accepted that one kilogram of egg mass produces 22,050 eggs, and that females produce 6,615 eggs per kilo of body weight (Avery and Steeby 2004). Those estimates coincide with data from the NASS and NAHMS reports. Producers reported that spawns averaged 0.63 kg, and according to NASS the average weight



Channel catfish fry

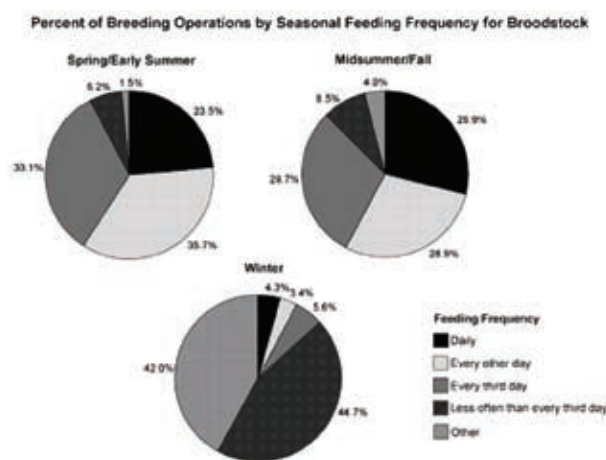


Fig. 1. Percent of breeding operations by seasonal feeding frequency for broodstock.

Table 1. Average broodstock stocking densities.

Stocking Density (kg/ha)	Operation (Percent)	Broodstock (Percent)
Less than 896	22.7	7.0
896 to 1,119	11.5	7.0
1,119 to 1,343	38.9	44.4
1,343 or more	26.9	41.6
Total	100.0	100.0

of broodfish was 2.17 kg. A 2.17 kg female producing 6,615 eggs per kilo of body weight would yield over 14,300 eggs. Similarly, based on the accepted value of 22,050 eggs per kilo of egg mass and the reported 0.63-kilo average egg-mass weight, it is estimated that, on average, a successfully spawning female catfish produces about 14,000 eggs. In Catfish 2003, hatcheries reported an average of 972.3 kilo of eggs at 22,050 eggs per kilo of egg



Channel catfish spawn collection

Percent of All Eggs (Weighted by Number of Spawns) that Typically Did Not Hatch, by Cause

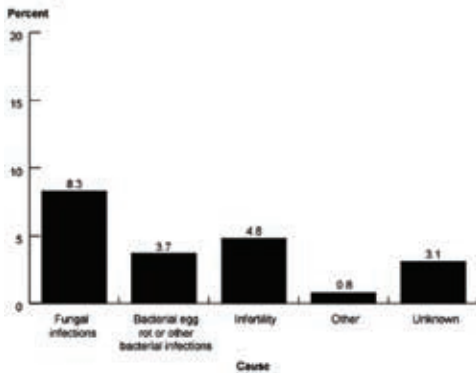


Fig. 2. Percent of all eggs (weighted by number of spawns) that typically did not hatch, by cause.

mass, which equals 21,440,000 eggs placed in troughs. Overall egg hatch was 79.3 percent. Based on eggs placed in hatching troughs and hatching success, the average fingerling production per hatchery should be approximately 17 million. This estimate of fry production is very close to the producer reported average number of fry per hatchery (17.2 million fry). Using the 106 hatchery estimate and the average reported fry output, it is estimated that approximately 1.8 billion fry were produced in hatcheries in 2002 in the four participating states.

Overall, hatcheries appeared to have excellent egg survival rates. Fungal infections accounted for the highest percentage of egg loss (Figure 2). Egg treatments are available to help control this type of loss. Also, hatchery managers should note that well water usually needs to be degassed before it enters the hatchery, and surface water or well water held in ponds should be run through sand filters to exclude silt and insects.

Fingerlings

As reported in Catfish 2003, the average percentage survival of fry from stocking in fingerling ponds to harvest as fingerlings was 69 percent. Although producers reported that 18.4 percent of their fry losses were due to unknown causes, 27.3 percent and 24.8 percent of their fry

losses were reportedly due to enteric septicemia of catfish (ESC) and columnaris. In combination, 76 percent of all operations reported at least some fingerling losses due to ESC and columnaris.

The high percentage of fingerling losses and the larger percentage of operations with at least some losses due to ESC and columnaris would seem to imply an increased reliance on the use of medicated feeds as treatments. However, in 2002 only 27 percent of operations used either of the two approved antibiotics, which are added to feed, for treatment of the diseases. More than half of the operations (54.7 percent) reported that their primary treatment for outbreaks of ESC was to withhold feed from fish.

While a small percentage of fingerling operations (1.9 percent) reported problems with trematode parasites, the trend toward increasing visits from the parasite carrier, white pelicans, was noted in 2004. Producers observing pelicans in their areas should monitor snail populations closely and consider treatments for snail control.

Conclusions and Recommendations

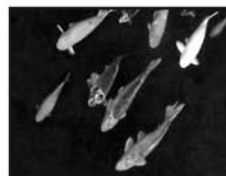
The U.S. commercial catfish industry maintains about 900,000 broodfish averaging 2.17 to 2.26 kilos each and typically less than six years of

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age. Generally, broodfish are from improved or superior fish lines. Using improved genetic lines or on-farm mass selection is recommended for early spawning and good growth and body confirmation.

Average egg production for the estimated 106 hatcheries was some 975 kg of eggs per operation or about 21 million eggs. Between 30 to 40 percent of broodfish females spawn successfully in a given year. To increase and ensure female spawning success, broodfish should be placed in well prepared ponds with excellent water quality and forage fish. Except in rare instances, broodfish should not be stocked for spawning at densities greater than 1,344 kg/ha. However, they may be held at higher densities during the post-spawning period (August-February). To control costs, broodfish should be utilized until they are at least five years of age. Keeping a variety of broodfish ages, but holding them by age groups, also is recommended to ensure good spawning success.

The percentage of eggs that hatched was excellent but could be improved in the future by controlling fungal infections. In the fingerling stage, prudent use of antibiotics should be considered, especially in the case of columnaris infections not controlled with feeding withdrawal. Vigilance in keeping snail populations at minimal levels by controlling vegetation and applying routine treatments is recommended, especially in areas where pelicans land or fly. Channel catfish fry exposed to ESC while infected with even a light trematode infestation suffer extreme mortalities.

Given the very thin profit margin experienced in the catfish industry during the last five years, producers continue to improve their production practices to keep costs under control. Every aspect of hatchery management and fingerling production is being considered for improvement.

Notes

¹Extension Aquaculture Specialist, National Warmwater Aquaculture Center, PO Box 239
Belzoni, Mississippi USA 39038.

²Mathematical Statistician, USDA:APHIS:

Journal seeks candidates for managing editor

The World Aquaculture Society is seeking candidates for the position of Managing Editor for the *Journal of the World Aquaculture Society* (JWAS). JWAS is an international scientific journal that publishes original peer-reviewed English-language papers concerned with the culture of aquatic plants and animals.

The Managing Editor is responsible for the daily operations of the editorial office and oversees the processing and peer review of over 150 manuscripts per year. Additional responsibilities include frequent communications with the publisher, management of the Editorial Board (currently 36 Associate Editors), communicating with the WAS home office on budgetary matters and interacting with the WAS Board of Directors on policy and reporting.

The successful candidate should be a current member of the World Aquaculture Society, a native English speaker and a respected scientist in an aquaculture-related field. Prior experience on an editorial board or service as an editor of a scientific journal is highly desirable. The candidate must have reliable access to high-speed internet service and a strong working knowledge of electronic communication via email. **Candidates should be willing to commit to serving as editor for a minimum period of 5 years.**

Interested candidates should submit a two-page curriculum vitae along with a cover letter describing the reasons for your interest in this position and a letter of recommendation from another scientist in your field. Send this information via email to Harry_Daniels@ncsu.edu.

VS:CEAH, 2150 Centre Avenue, Bldg. B-2E7, Fort Collins, Colorado USA 80526-8117.

³This article includes findings from Catfish 2003's Part 1: Reference of Fingerling Catfish Health and Production Practices in the United States, 2003.

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2005 Census of Aquaculture

The United States Department of Agriculture is planning to update the data collected in its 1998 Census of Aquaculture. From 1974 to 1998 the value of U.S. aquaculture had grown from \$45 million to \$978 million. The agency wants to determine its value in 2005. Data will be collected on production, sales, methods of production, sources of water, point of first sale outlets and aquaculture production for uses other than human consumption. A new series of questions on farm employment is being added to the 2005 census.

The results will be of use to growers, government, suppliers, the media, drug companies, finance companies and others involved or interested in the aquaculture industry. Reports will be available on the National Agricultural Statistics Service at www.nass.usda.gov. Additional information is currently available on the web site under the heading *News and Coming Events*.