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# Transport and Growth of Three Developmental Stages of Channel Catfish (*Ictalurus punctatus*) in Kentucky

JAMES H. TIDWELL, STEVEN D. MIMS, AND CARL D. WEBSTER

Community Research Service, Aquaculture Research Center, Kentucky State University, Frankfort, Kentucky 40601

## ABSTRACT

Eggs, yolk-sac fry, and small fingerling (1.6 g) channel catfish (*Ictalurus punctatus*) were transported from Mississippi and raised in earthen ponds in Kentucky. Growth, yield, survival, feed conversion, and production cost of each developmental stage was compared to determine the most efficious stage for production of fingerlings (>27 g) for stocking Kentucky production ponds. Survival was significantly lower ($P < 0.05$) at harvest for channel catfish transported as eggs. Average harvest size (g) and net production (kg/ha) were significantly lower ($P < 0.05$) for channel catfish transported as small fingerlings. Average production cost per fingerling produced was 2.9, 2.8, and 4.6 cents each for channel catfish transported as eggs, fry, or small fingerlings, respectively. Yolk-sac fry appear to be the optimal transport stage for production of large fingerlings for stocking in Kentucky ponds.

## INTRODUCTION

Production of channel catfish (*Ictalurus punctatus*) has become an increasingly viable option in areas outside of traditional deep-south regions (1). However, commercial production of catfish fingerlings in Kentucky has not developed substantially. Kentucky has a short growing season (180–200 days) which requires that large fingerlings (27–64 g) be stocked into production ponds if market-sized fish are to be raised in one summer (2). However, fingerlings of this size often remain prohibitively expensive.

Transport of eggs from deep-south producers has been investigated as an alternative method of producing large fingerling catfish in Kentucky (3). Advantages include elimination of inherent risks (i.e., mortality or reproductive failure) and acreage requirements of holding catfish broodstock. Shipment of eggs also can extend the growing season since eggs can be obtained from deep-south producers at least one month earlier than spawning normally occurs in Kentucky (2). We compared growth, yield, survival, feed conversion, and production cost of channel catfish transported at 3 developmental stages and reared to fingerlings in earthen ponds in Kentucky.

## MATERIALS AND METHODS

Eggs, yolk-sac fry, and 1.6 g fingerlings were purchased from a commercial fingerling producer in Mississippi (Sandling and Stevens Fisheries, Silver City, Mississippi) as early in the season as each stage was available. The study was conducted in 9 0.04-ha earthen ponds at the Aquaculture Research Center at Kentucky State University, Frankfort, Kentucky. Each treatment (developmental stage) was replicated in 3 ponds, each stocked at a density of 74,100 fish/ha.

On 16 May 1988, eggs were transported as described by Mims et al. (3) and placed into a flowing water hatching trough (27°C). Hatching began on 17 May 1988. After "swim-up" activity was observed, fry were fed a 50% crude protein commercial trout starter (Ziegler; Gardners, Pennsylvania) in tanks for 7 days prior to stocking. On 1 June 1988, fry were stocked into ponds prepared according to Jensen et al. (4).

Yolk-sac fry were transported 24 May 1988. Transport, holding, and feeding were similar to procedures for fish transported as eggs. Fry (0.08 g) were stocked on 7 June 1988.

Small fingerlings (1.6 g) were obtained 26 July 1988 and transported in an insulated hauling tank supplemented with pure oxygen and mechanical aeration. Fish were held in tanks overnight and stocked on 27 July 1988.

Fish were fed daily according to a standard feed chart (4). Estimated body weights were recalculated weekly based upon a 1.5 feed-conversion ratio. One hundred fish were seined from each pond and individually weighed each month. Feed rates, feed type, and particle size were adjusted according to fish size (5).

Ponds were monitored twice daily (0900 and

TABLE 1. Water quality data for ponds containing channel catfish transported from Mississippi as eggs, yolk-sac fry, and small fingerlings. Values are means* of three replicates (±standard error).

| Water quality parameter | Treatment | | |
|---|---|---|---|
| | Egg | Fry | Fingerling |
| Temperature (°C) | 28.1 ± 0.40a | 28.1 ± 0.40a | 27.8 ± 0.21a |
| Morning DO (mg/liter) | 6.7 ± 0.40a | 6.8 ± 0.46a | 7.3 ± 0.32a |
| Afternoon DO (mg/liter) | 11.1 ± 0.85a | 11.6 ± 0.55a | 12.8 ± 0.64a |
| pH | 8.4 ± 0.12b | 8.4 ± 0.10b | 8.8 ± 0.10a |
| Total ammonia (mg/liter N) | 0.61 ± 0.18a | 0.48 ± 0.10a | 0.32 ± 0.10a |
| Un-ionized ammonia (mg/liter N) | 0.096 ± 0.006a | 0.071 ± 0.006a | 0.096 ± 0.022a |
| Nitrite (mg/liter N) | 0.046 ± 0.015a | 0.043 ± 0.025a | 0.017 ± 0.006a |

* Means within a row followed by the same letter are not significantly different ($P > 0.05$; Fisher's Least Significant Difference Test).

1300 hr) for dissolved oxygen (DO) and temperature using a YSI Model 54A oxygen meter (Yellow Springs Instruments, Yellow Springs, Ohio). Ammonia (total and un-ionized) and nitrite were measured twice weekly using a model DREL/5 spectrophotometer (Hach Co., Loveland, Colorado) and pH was measured twice weekly using a model PHH-43 electronic pH meter (Omega Engineering, Stamford, Connecticut). Ponds were harvested 17–19 October 1988. Data were analyzed by analysis of variance using the SAS ANOVA procedure (6) with separation of means by Fisher's Least Significant Difference Test ($P = 0.05$).

## RESULTS AND DISCUSSION

Water temperature, DO, total ammonia, un-ionized ammonia, and nitrate levels were not significantly different ($P > 0.05$) among treatments (Table 1). Ponds stocked with channel catfish transported as small fingerlings had significantly higher ($P < 0.05$) pH than other ponds; but measured water quality variables remained within limits for optimal growth in channel catfish (7, 8).

Survival of fish transported as eggs averaged 66% and was significantly lower ($P < 0.05$) than survival of fish transported as fry or fingerlings (85% and 93%, respectively) (Table 2). A high incidence of filamentous algae in ponds stocked with channel catfish transported as eggs may have entrapped some fry.

At harvest, fish transported as small fingerlings averaged 21.5 g (Table 2) and did not attain the minimum target size (27 g) required for growout in 180–200 days (2). Mean harvest weight for these fish was significantly lower ($P < 0.05$) than harvest weights for fish transported as eggs or fry (67.8 g and 54.5 g, respectively) (Fig. 1). The lower average weight of fish transported as fingerlings may be due to high densities maintained by commercial fingerling producers (125,000–625,000 fry/ha) (9).

Net production in fish transported as small fingerlings was significantly lower ($P < 0.05$) than for fish transported as eggs or fry. Net production in fish transported as fry (3,458 kg/ha) was slightly higher than in fish transported as eggs (3,245 kg/ha), though differences were not significant ($P > 0.05$). There were no significant differences ($P > 0.05$) in feed-conversion ratios for the 3 treatments. All were

TABLE 2. Harvest data for channel catfish transported from Mississippi as eggs, yolk-sac fry, and samll fingerlings. Values are means* of three replicates (±standard error).

| Production parameter | Treatment | | |
|---|---|---|---|
| | Egg | Fry | Fingerling |
| Average size at harvest (g) | 67.8 ± 8.1a | 54.5 ± 9.1a | 21.5 ± 0.9b |
| Survival (%) | 65.6 ± 13.0b | 85.0 ± 6.9a | 93.3 ± 1.2a |
| Net production (kg/ha) | 3,245.6 ± 321.1a | 3,458.0 ± 829.9a | 1,368.4 ± 44.5b |
| Feed conversion ratio | 1.3 ± 0.1a | 1.2 ± 0.2a | 1.2 ± 0.1a |

* Means within a row followed by the same letter are not significantly different ($P > 0.05$, Fisher's Least Significant Difference Test).

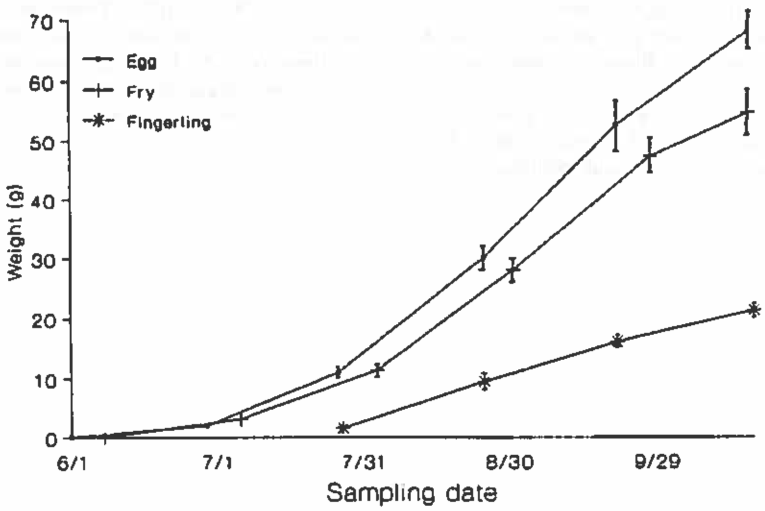


FIG. 1. Individual body weights (g) of channel catfish transported from Mississippi as eggs, yolk-sac fry, and small fingerlings. Values represent means of three replicate ponds (n = 100 fish/pond).

lower than 1.5, indicating that no overfeeding occurred.

Production costs were calculated for each treatment. Average costs of $300/ton of feed and $90 for transportation were used. Purchase price per individual, survival, amount of feed, water, electricity, and equipment required varied for each treatment. Costs for water, electricity, and equipment were based on values calculated by Hebicha (10).

Average cost per individual produced was 2.9, 2.8, and 4.9 cents for fish transported as eggs, fry, and fingerlings, respectively. Fish in all treatments did not reach the same harvest size and costs also were calculated on a per-inch basis (a common price basis in the industry). Costs for fish transported as eggs and fry were 0.35 and 0.34 cents per inch, respectively. For fish transported as fingerlings, the cost was 0.93 cents per inch, an increase reflecting higher initial cost per individual.

In summary, pond survival of channel catfish transported as eggs was significantly lower than fish transported as fry or small fingerlings. Channel catfish transported as small fingerlings did not attain minimum growout size. Production costs were lower for transported fry than for transported eggs or fingerlings, and fry are not subject to the risks and expenses associated with hatching eggs. Transporting yolk-sac fry from Mississippi appears to be a viable alternative for producing large, economical channel catfish fingerlings in the short growing season in Kentucky.

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