AQUABYTE

Editor: M.V. Gupta

Aquaculture Section
of the Network of Tropical Aquaculture
and Fisheries Professionals (NTAFP)

River-based Artificial Propagation of the African Catfish *Clarias gariepinus*: an Option for the Small Fish Farmer

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Abstract

A cheap method of propagating the African catfish, *Clarias gariepinus*, by incubating the fertilized eggs in a cage placed directly in a flowing river is described. Hatching ranged between 39 and 70%. This is not significantly different from the commonly used water recirculating flow through system. The economic advantages of the river hatching method are discussed with special emphasis on the rural fish farmers.

Introduction

In developing countries, aquaculture development has been identified as a necessity due to the rapid population growth rates and the environmental problems facing natural water bodies. Natural resources, including fisheries, are decreasing at an alarming rate and are becoming increasingly threatened. Aquaculture development has been hampered by a number of constraints. The principal one is the shortage of quality fish seed, a consequence of an inadequate number of operating hatcheries. As a result, most farmers use seed that cannot sustain their operations while others have altogether abandoned aquaculture.

In recent years, the African catfish *Clarias gariepinus* has been cultured extensively (Schoonbee et al. 1980; Hecht 1981, 1982). Production of fingerlings of *C. gariepinus* has been difficult as the fish does not spawn in captivity. This requires artificial induction of spawning and incubation of the eggs. The use of trays and water recirculating systems (Polling et al. 1987) is not feasible for the small-scale fish farmers because of investment and maintenance costs. This paper describes a cheaper propagation method targeting the rural African small-scale fish farmer.

Materials and Methods

Hatching Procedures

Brood stocks of *C. gariepinus* were obtained from the Sangoro Research Centre ponds. Ripe females were selected on the basis of their distended abdomen, while in the case of males, those which released milt on application of a little pressure on their abdomen were chosen. They were kept in tanks for two days, without feeding, before the start of the experiment. Their weights were measured and recorded. Similar sized *C. gariepinus* fish were sacrificed and their pituitaries collected for inducement of spawning. After acclimatization, each female was injected with pituitary extract collected from a similar sized fish. The extract was homogenized by mixing with 2 cc of normal saline solution prior to injection into the fish. After 12 hours, the eggs were stripped into a dry enamel bowl. Milt was obtained from the ripe males by squashing the testis of sacrificed males and mixed with normal saline for five minutes. Fertilization was by the dry method as outlined by Bok and Heard (1982). The fertilized eggs were then divided into two similar sized batches and placed in two incubation trays.

One of the trays was placed in the hatchery incubation tank with water re-circulating flow through system (Fig. 1) at a flow rate of 0.5 l per minute. Water temperatures were maintained between 19 and 22°C. The system uses the same principle as that described by Polling et al. (1987). Construction of the system requires at least one water

holding and incubation tank, pipe work and a ready source of electricity for a water pump. The costs of construction and maintenance of these systems are usually far beyond the reach of small-scale fish farmers.

The other tray was placed in a self-designed and fabricated cage (Fig. 2) which had previously been tied securely to pegs at the bank of the river Sondu Miriu, ensuring that it remained afloat during the experiment. The cage was placed directly in the incoming water currents, leaving a quarter of it under water. The cage, with dimensions of 91 x 41 cm, was constructed with locally available light materials: softwood, a mat, polythene paper, nails, thumb tacks, ropes and fine linen cloth. The cost and purpose of each of these items are listed in Table 1.

Fig. 1. Water re-circulating flow through system: incubation trays and tank with inlet and outlet pipes.

Fig. 2. Setting of cage in the river. Fine cloth in use to prevent escape of hatched larvae and entry of silt.

Results and Discussion

The river flow rate was 33 m^3/minute and Secchi readings of as high as 28 cm were recorded. Temperature fluctuated between 20°C in the morning and 23°C at 7 p.m. Eggs hatched in the two incubation methods employed and hatching percentages are shown in Table 2. Hatching was observed 43 hours after fertilization in the river and 45 hours in the hatchery. There was a highly significant correlation between hatching time and temperature in the seven trials.

The fine cloth in the cage prevented the silt from interferring with the hatching of eggs as well as escape of hatched larvae. However, the river flooded when the cage was being tested and brought in some aquatic insects and rotifers. In large numbers, these can prevent hatching. This prompted covering the upper part of the cage completely with fine cloth.

While the hatching rate was higher in the hatchery-based incubation system, the difference was

Table 1. Construction materials, their cost and purpose.

Materials	Purpose	Cost (US$)
Softwood	Making frame and tray	2
Polythene paper	Covering cage bottom	0.5
Rope	Securing cage in the river	0.5
Linen cloth	Covering cage sides	4
Mat	Preventing direct incident light from interferring with hatching	
Thumb tacks and nails	Frame fabrication	0.67
Total		7.67

Table 2. Hatching rate (%) in cage placed in river and hatchery-based incubation.

Trial	River	Hatchery
1	68	80
2	40	75
3	69	81
4	70	59
5	50	67
6	66	75
7	39	55
Average	57.43	70.29

$\bar{X}_1 = 57.43$ $\bar{X}_2 = 70.29$
$SD_1 = 13.998$ $SD_2 = 10.21$
$SE_1 = 5.29$ $SE_2 = 3.86$

not significant (p=0.01). However, it was evident that due to fluctuations in river conditions the hatching percentages were less predictable. River floods can also cause submergence of the cage but this can be taken care of by making the cage with lighter material or by attaching floaters.

The absence of hatcheries in close proximity to farmers as well as the lack of a reliable transport system has affected stocking rates in smallholder ponds (Brummett and Noble 1995). This could easily be ameliorated if some fish farmers specialized in the production of fingerlings for stocking (Huet 1975) instead of depending on government agencies. This has hitherto been difficult due to the cost of constructing a water re-circulation flow through system hatchery. It requires a water-holding tank, a piping system, a water pump, an aerator and fuel for the pump. The total cost of these ranges between $3 000 and $4 500.

As there was no significant difference in the hatching rates in the two systems described, the farmers can practice the simple hatching method without fear of potential risks or losses. The aim of the experiment was to develop a cheaper method of fry production for the small-scale farmer. Adoption of this technology by the small-scale farmers is expected to be high due to the demand for fingerlings and low investment costs. A farmer who incubates eggs of a single brood can get enough fry to stock several ponds. It is, therefore, a feasible venture for small-scale farmers.

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