Participatory Research Boosts Catfish Egg, Fry Production In Cameroon

Summary:
The omnivorous African sharptooth catfish is a valuable species suitable for culture by smallholder farmers in Cameroon. A five-year research project that brought farmers together with research interests established simple, but effective approaches to increasing catfish fingerling production through improved egg handling, antipredation measures, and higher-density stocking options.

The adaptability of African sharptooth catfish makes their culture more available to low-income communities.

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The African sharptooth catfish, *Clarias gariepinus*, is a valuable species that is highly suitable for aquaculture from a biological perspective. It is appreciated by African and especially Cameroon consumers who use it for various traditional dishes. Consequently, at U.S. $3-6/kg depending on size, it is also the most expensive cultured fish – second only to the Nile perch, *Lates niloticus,* which is less suitable for aquaculture due to its highly carnivorous feeding habits.

An omnivorous scavenger that eats everything it finds, the sharptooth catfish is particularly amenable to the farming practices of smallholders, who comprise the majority of farmers in Cameroon. It is also favored for controlling tilapia recruitment because it fetches higher market prices than other "police" species. The fact that higher stocking ratios are necessary for tilapia control contributes further to farmers' profitability. However, the persistent lack and/or high price of even small catfish fingerlings in Cameroon is a major constraint to aquaculture development in the country.

To address this problem, the WorldFish Center and Cameroonian Institute of Agricultural Research for Development, with funding from the United Kingdom Department for International Development (DFID), have since 2000 been conducting joint research projects with farmers using solely the materials available to and/or purchased by the farmers to develop egg incubation and fry survival improvement techniques. Such participatory approaches have been shown to yield technologies that are inherently adoptable, as opposed to those developed under research station conditions that are alien to farmers.

Environmental Effects

In tests, catfish eggs were exposed to rainfall, sunshine, temperature variability, and water stagnation. The effects of rainfall were tested through a controlled experiment which showed that while unaffected by the impact of raindrops, the hatchability of incubating eggs could be significantly reduced by runoff-caused turbidity at concentrations of 7.5% or greater.

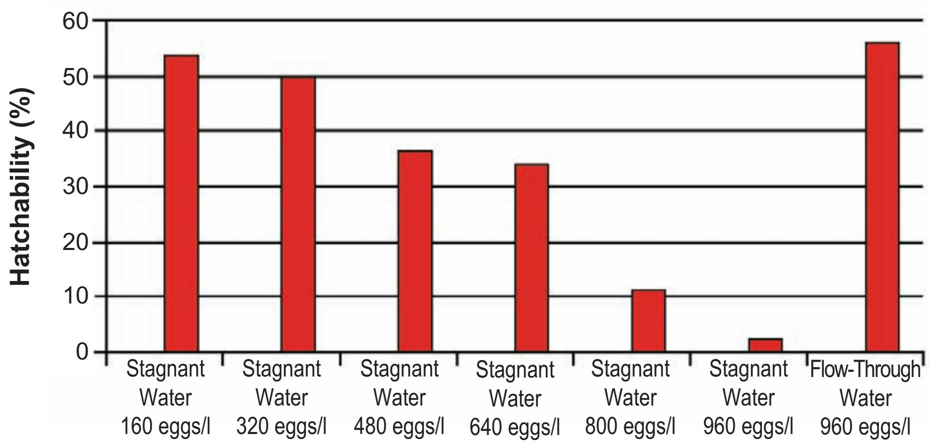

Figure 1. *Hatchability at varied egg densities in stagnant and flow-through water.*

This simple hapa incubation system is enhanced by sprays of water from the overhead pipe.

Water stagnation was only significant when the incubation density was higher than 320 eggs/l of stagnant water (Figure 1). This implied that pipeborne water is not an absolute necessity. Hatchability could be improved by covering the eggs with white, cut-open polythene bags, deeply immersing them, and/or incubating them in hapas in large ponds.

Simple, Effective Measures

Predation by frogs and toads, aquatic arthropods such as dragon fly larvae, and birds respectively account for the deaths of 28, 7, and 23% of the larvae stocked in ponds. The common practice of composting in ponds as a method of fertilization exacerbates predation by creating habitat and refuge for amphibian and arthropod predators. Fencing ponds with polythene bag sheets, stocking 10 two-day-old larvae/m^2 in open hapas, and placing bird netting over both ponds and hapas progressively improved survival (Table 1).

Stocking Density, Intensification

Increasing the stocking density of the predator-free system from 10 to 40 fry/m^2 correspondingly increased yields to an average of 27 fingerlings/m^2, but no tests yielded more than 29 fingerlings/m^2, the recommended maximum in low-input systems. The density increase also reduced survival from 96.7 to 66.7%, which could arguably be attributed to a shortage of food. These results meant that on-farm handling of predation and food shortage is feasible to smallholders, who can therefore fight the persisting lack of fingerlings themselves.

A cost/benefit analysis of these fingerling production techniques showed a direct relationship between profitability and intensification, an indication that extension to those who have a higher investment capacity could be more productive. Studies to determine whether empowerment of small and medium-size enterprises would trickle down to smallholders could yield decisions to reorient development efforts.

Table 1. Average weight, number of fingerlings harvested, survival, and growth of African sharptooth catfish nursed for 42 days in earthen ponds in Yaoundé, Cameroon.

Treatment	Final Average Weight (g)	Fingerlings Harvested/m^2	Survival (%)	Growth Rate (%)
Unfenced ponds	11.2 8.8 9.0 9.66 ± 1.30	3.7 4.6 3.6 3. 97 ± 0.54	37.0 45.9 36.1 39.66 ± 5.42	14.7 14.2 14.2 14.37 ± 0.31
Ponds fenced with poly sheets	9.2 8.4 5.4 7.65 ± 2.03	6.5 6.6 5.3 6.11 ± 0.74	84.4 66.0 52.6 67.67 ± 15.97	14.3 14.1 13.0 13.76 ± 0.69
Open hapas	9.8 8.0 5.3 7.68 ± 2.25	7.0 8.0 7.0 7.33 ± 0.58	70.0 80.0 70.0 73.33 ± 5.77	14.4 13.9 13.0 13.76 ± 0.74
Ponds with netting	3.9 2.3 3.6 3.27 ± 0.85	21.7 23.4 20.7 21.93 ± 1.37	54.1 58.6 51.9 54.87 ± 3.42	17.4 16.6 17.5 17.17 ± 0.42
Netted hapas in ponds with netting	6.4 5.4 5.7 6.05 ± 0.51	10.0 10.0 9.0 9.50 ± 0.58	100.0 100.0 90.0 96.67 ± 5.77	13.4 13.0 13.1 13.26 ± 0.21

Feeding

Higher stocking density produced higher profits, but sufficient amounts of quality feeds were required. In the absence of such feeds, recycling of tilapia recruits and amphibian tadpoles (considered aquaculture pests) was tested.

It was possible to increase stocking densities 1-4 fingerlings/m^2 by supplementing brewery wastes with tilapia recruits, but further density increase necessitated the use of compound feed pellets. Pellets made by farmers could support a stocking density of 40, 10-g fingerlings/m^2 but performed significantly worse than when complemented with live tadpoles.

Inspiration, Potential

After observing the greater profitability, participating farmers spontaneously engaged in hatchery production and further adapted the original techniques. One farmer developed an effective aeration method based on regular drops of water from a tin suspended above his incubation tank.

This was a breakthrough in Cameroon, where 21 government hatcheries have existed since the 1960s but never inspired farmers to improve their production systems. It is also a confirmation of the fact that participatory research could be the tool for sustainable introduction of aquaculture into many regions of Africa.

The five-year DFID-WorldFish-Cameroon project demonstrated the efficiency of collegial work in the transformation of aquaculture potential into fish yields. Using catfish

Basins of different colors were compared for their effects on egg hatchability.

fingerlings as a fuel for monoculture and polyculture systems, it engendered an increase in production of 407% to over 2,000 kg/ha of mostly *C. gariepinus*.

Cameroon has significant water resources that could yield aquaculture production estimated at 20,000 mt/year in extensive production and more under intensive methods. Further success lies in continuing such work, not only until introduced innovations are firmly enrooted all over the country, but spread to neighboring countries, as well.