Fish Culture in Homestead Tanks in Nigeria: Practices, Problems and Prospects

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Introduction

Nigeria has a population of over 100 illion people with an annual growth te of 3%. Annual aquaculture oduction is less than 25,000 t/year)kpanefe et al. 1984). Extensive juaculture contributes about 99% of this hile only 1% is from intensive systems Ezenwa 1987). A production target of)0,000 t/year has been set for the year)00 (Ezenwa 1988). Expansion of tensive or semi-intensive aquaculture ould help to achieve this and to meet a tional fish demand of 1.5 million t/year Sagua and Ita 1978).

Tank and raceway culture have been erfected for salmonids and channel tfish (Burrows and Combs 1968; Buss al. 1970; Allen 1972 a and b). Family-cale aquaculture is being practiced in hilippines and Ghana (Fermin 1985; safo 1986). Egwui (1986, 1987) has ecommended concrete tank homestead sh culture as one of the most conomical methods of producing fish in eveloping countries.

This paper presents summary results rom a two year study on management ractices and problems associated with aising fish in concrete tanks in Nigeria. uggestions for solutions to these roblems are highlighted.

Location and Construction of Fish Tanks

Ten fish tanks were selected for the tudy in families resident in low density reas of Lagos. The construction naterials were reinforced cast concrete nd cement blocks. Some of the tanks vere dug-in while others were erected bove ground. Expanded metal meshes were used to partition four of the tanks into two or three sections. This allowed for the growth of one fish species in each apartment. The tanks were rectangular measuring 8 x 4 x 1.5 m deep. Drainage outlets (pipes), when available, were installed at the sides. The tanks were dependent on public water supply.

The bottom of each tank was covered with a layer of fine river sand, 3 cm thick, with broken pieces of cement blocks and gravel to assist self-purification and maintain a stable pH of 7-8.

Management Practices

The species cultured were *Clarias gariepinus*, *Tilapia guineensis* and *Heterobranchus bidorsalis*. In eight of the tanks, *T. guineensis* was cultured in combination with *C. gariepinus* or *H. bidorsalis*, partly to meet the dietary needs of the two species provided by the prolific reproduction of the cichlid, thus reducing cost of feeds.

Fingerlings were obtained from hatcheries located at Nigerian Institute for Oceanography and Marine Research (NIOMR), Lagos and from State Fisheries Units. Stocking densities were not uniform varying from 4-8 fish/m^2. Broodstock of *T. guineensis* were stocked at ten pairs (1 male: 1 female) per tank.

The most common feed used was `NIOMR pelleted´ fish feed (25% protein). Fish was fed once or twice daily at 3-5% body weight. The feeds were broadcast at selected spots within the tanks. In some cases, varying quantities of feed were dumped into the tank once daily.

Plate 1. Typical homestead fish tank (8 x 4 x 1.5 m) for a Nigerian family.

Grow-out period was for six months (one cycle of production). Selective harvesting was carried out in some of the homes after a four month growth period. Larger fish (greater than 300 g) were removed for consumption leaving the smaller ones to reach the desired size. Complete harvest was carried out at the end of six months. The average net production figure for all the tanks studied was 32.3 kg/32 m^2 per 6 month cycle with a range of 28.5-37.8 kg/32 m^2.

An average growth rate of 2.49 g/day was recorded for fingerlings of *Heterobranchus bidorsalis* compared to 1.60 g/day for *Clarias gariepinus* and 0.60 g/day for *Tilapia guineensis*.

Dissolved oxygen (DO), pH and temperature of the tank were measured fortnightly between 1000 and 1300 hours. DO ranged from 0.85 to 9.80 ppm. Low values were recorded during heavy algal blooms and `die-off´ whereas higher values were obtained in well managed tanks. Fish growth is oxygen dependent. In some of the properly managed tanks, it was higher at DO's in the range 5.0-9.0 ppm, pH ranged from 6.5 to 7.8 and water temperature from 25.5-31.5°C.

Tank water was sometimes partly exchanged on a weekly basis. Complete draining and refilling with freshwater was done monthly. Thorough cleaning of the tanks was carried out monthly in some family units and quarterly in others. Fertilization of the tanks to stimulate plankton growth was not practised in any of the tanks.

Problems and Prospects

Major problems identified in this study included incidence of `broken skull´ (crack-head) disease in *C. gariepinus*, poor water quality, high maintenance costs and differential growth rates of *C. gariepinus* and *H. bidorsalis*. Poor water quality occured in some tanks after some weeks of feeding due to poor installation of the drainage pipes and non-removal of `foul´ water on a monthly basis. Maintenance costs in such tanks were high since they use pumps to remove water. Lock (1973) also reported that in such a system, diseases increased when fish were crowded, feed costs increased because a complete feed must be used, water pumping costs increased and several producers lost their entire crop of fish due to pump or power failure.

The problems identified in this study were related to management skills. Proper water quality, management and education of the operators in simple tank culture techniques can solve most problems. In tanks with DO less than 2.0 ppm, fish mortalities of up to 45% were recorded. In such tanks, heavy incidence of broken skull disease of *C. gariepinus* was also observed. Other losses encountered could be due to predation, including cannibalism. However, in tanks with DO above 5.0 ppm, mortalities were less than 1% and there was no incidence of broken skull disease.

Frequent renewal of water and monthly cleaning of tanks improved water quality and reduced or prevented incidence of broken skull disease. Sorting and grading of *C. gariepinus* and *H. bidorsalis* minimised the problem of differential growth and cannibalism. Partial harvesting appears to increase survival growth and feed conversion efficiency and tanks with lower stocking densities (4-5 fish/m^2) produce larger fish than ones with 7-8 fish/m^2. This agrees with Egwui (1987) who observed an inverse relationship between stocking density and the daily average increase in weight for *C. gariepinus*.

From the studies carried out in this project, there are bright prospects for family-based tank culture. Government policy makers estimate that 105,000 such units could produce 6,720 t/year: a very significant contribution to fish protein supply.

The result of this study show that *C. gariepinus, H. bidorsalis* and *T. guineensis* grow well in tanks built within the family environment. Previous work concentrated on tank monoculture of *C. gariepinus*. The introduction of the faster growing *H. bidorsalis* and *T. guineensis* as food in a polyculture system is a significant advance. These three species find ready acceptance in most homes in Nigeria. Future research emphasis will be on production economics, tank design and construction, and the nutritional requirements of the selected three species.

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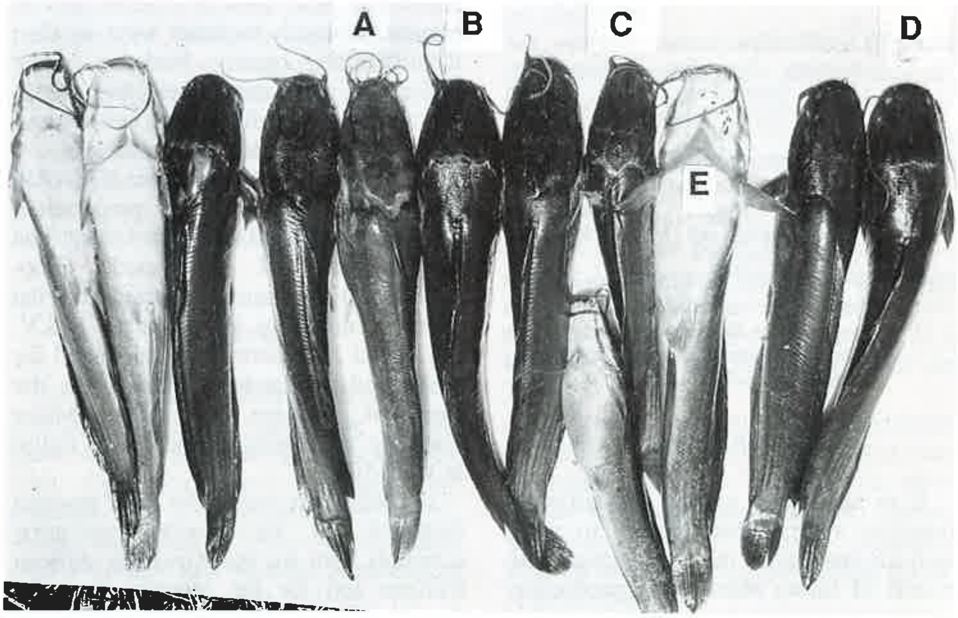

Plate 2. "Broken skull" (crack-head) disease of *Clarias gariepinus* raised in a homestead fish culture tank in Nigeria: A, B, C – dorsal view of fully developed broken skull disease; D – early stage of the diseased condition; E – ventral view of developed disease condition.

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Editor's footnote

It is heartening to see a small-scale intensive system that appears to work well for families on the urban fringe. The results of future research on production economics are eagerly awaited. From this preliminary account it would seem to be highly advantageous to build tanks above the ground to facilitate water exchange and draining, since these are crucial to water quality. Water exchange difficulties and costs seem to be major constraints. A simple external stand-pipe would be quite adequate for tanks of this size. However, the economics of above ground and in ground construction and operation must first be studied.

Translation: An Essential Activity in Research and Development

Under its cooperation and development policy, the French Government grants a yearly financial contribution to ICLARM to support its activities in francophone Africa, specifically for the transfer of appropriate aquaculture technologies. Part of this contribution is allocated to provision of key information by translation into French and distribution in francophone countries of scientific and technical literature. The translation activities started in 1988 with the hiring as translator of Ms. Catherine Lhomme-Binudin, a French national. This has allowed the production of this regular African feature in Aquabyte in French and in English, and the translation from English into French of the ICLARM book "Tilapia Genetic Resources for Aquaculture" edited by Dr. Roger S.V. Pullin and first published in English in 1988. This book is a compilation of the discussions of a workshop, held in Bangkok in 1987, which dealt with such aspects as the natural distribution of tilapias, research methods used in their identification, gene banks, culture collections and future research needs. It is a major source for tilapia technicians, breeders and genetic conservationists.

French translations of other ICLARM aquaculture texts are in preparation: Research and Education for the Development of Integrated Crop-Livestock-Fish Farming Systems in the Tropics edited by P. Edwards, R.S.V. Pullin and J.A. Gartner, is scheduled for 1990; and A Hatchery Manual for the Common, Chinese and Indian Major Carps by V.G. Jhingran and R.S.V. Pullin in 1990-1991.

ICLARM has received a lot of positive feedback on its French translation activities both for the Aquabyte African features and for the genetics book. A future major venture will be the Third International Symposium on Tilapia in Aquaculture (ISTA III) scheduled to be held in Côte d'Ivoire in 1991 (dates to be announced in the next Aquabyte issue). ISTA III will be bilingual French and English throughout its proceedings and all its papers will be published in both languages.

ICLARM recognizes the important role that translation of scientific and technical texts has to play in research and development work which is based to a great extend on information, the provision of which is often hindered by language barriers. NTAS members are invited to send in their views on language barriers and expansion of translation activities to remove these. French speaking NTAS members are also invited to send contributions to Aquabyte in French.

Fish Farming Potential in Tanzania

Tanzania, particularly areas in the south and north of the country, has high potential for fish farming. The most important requirements, however, are information and correct advice to farmers, and sources of high quality fingerlings. Adequate transport is also needed to enable government fishery workers to visit village farmers. Although trout and carp farming have been tried, Nile tilapia *(Oreochromis niloticus)* either local species or imported from Kenya still remains the most suitable species. Aside from the American Peace Corps fisheries volunteers, the Anglican Church project, the Fish Farming Development Programme (FFDP) supports the farmers. The FFDP has distributed 50,000 tilapia fingerlings and has set up demonstration/production fish-duck earthponds. Fish production from duck-fertilized ponds is over 5 t/ha/year and is supplemented by production of duck eggs and meat.

Source: Fish Farmer 12(4): 34-35. Jul/Aug 1989.

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These proceedings document a 1987 workshop held in Bangkok, Thailand, to discuss the documentation, conservation and utilization of tilapia genetic resources and their future use in aquaculture.