and that no artificial markets for fish seed were created. Adoption will continue to be monitored with on-farm trials during the third and final year of the project and extension materials will be further refined for use by government and nongovernment extension agencies.

Acknowledgement

This on-going collaborative study was made possible by a grant from the Overseas Development Administration (ODA), UK.

References

AIT. 1990a. A description of small-scale aquaculture in the project areas prior to intervention. AIT Outreach Project Working Paper 6. Asian Institute of Technology, Bangkok, Thailand. 28 p.

AIT. 1990b. Nursing fry in nylon hapas. AIT Outreach Project Working Paper 2. Asian Institute of Technology, Bangkok, Thailand.

Edwards, P., H. Demaine, D.C. Little, N.L. Innes-Taylor, D. Turongruang, A. Yakupitiyage and T.J. Warren. 1990. Towards the improvement of fish culture by small-scale farmers in northeast Thailand. Paper presented at the Asian Farming Systems Research and Extension Symposium on 'Sustainable Farming Systems in 21st Century Asia', 19-22 November 1990, Bangkok, Thailand.

Sirisai. 1988. Development of fish culture methods for small-scale farmers in rainfed areas of Banna district, Nakhon Nayok province, Thailand. Asian Institute of Technology, Bangkok, Thailand. M.Sc. thesis.

Sodsook, S. 1989. Nursing juvenile fish in nylon hapas suspended in earthem ponds. Asian Institute of Technology, Bangkok, Thailand. M.Sc. thesis.

Simple Method for Year-Round Breeding of *Clarias gariepinus*

W.O. ALEGBELEYE
J.A. ADETAYO
T. OGUNMOROTI
Nigerian Institute for Oceanography and Marine Research
P.M.B. 12729, Victoria Island
Nigeria

Introduction

Clarias gariepinus has become widely cultured in Nigeria. It is easily bred in captivity but there are insufficient fingerlings to meet farmers' demands. A fishery for wild-spawned fry has constituted the major alternative source but is unreliable as *C. gariepinus* exhibits seasonal spawning (Bruton 1979; van Oordt and Goos 1987). Wild fry and fingerlings are available only in the rainy season (May to October).

This also applies to captive breeding. Induced spawning works only in the wet season (Huisman and Richter 1987). There have been attempts to simulate in captivity the conditions under which *C. gariepinus* spawns in the wild, with the aim of having year-round supply of fish seed. These have included manipulation of photoperiod and temperature (Huisman and Richter 1987) and simulation of flood and rain conditions, as suggested by Bruton (1979) and used successfully by Areerat (1987) for *C. batrachus*.

This communication describes a simple method for the year-round production of *C. gariepinus* fry in homestead concrete tanks. The work was part of a training program for Higher National Diploma (HND) students of the Federal Fisheries School of the Nigerian Institute for Oceanography and Marine Research (NIOMR).

The fish-rearing facility of the Federal Fisheries School of the Nigerian Institute for Oceanography and Marine Research (NIOMR). The reservoir is in the background. (Photo by Segun Alegbeleye)

Installations d'alevinage de l'Ecole fédérale de pêches de l'Institut nigérian de recherches océanographique et marine (NIOMR). Le bassin est à l'arrière plan. (Cliché : Segun Alegbeleye)

Methods

The facilities consisted of nine gravity-fed concrete tanks: six rectangular (5 x 4 x 1 m), two circular (12.6 m^3) and a reservoir (8 x 5 x 1.5 m). The rectangular tanks were arranged in two parallel rows, connected to a central drainage canal. One row (tanks A, B, C and D) was prepared with a 4-cm deep fine sand bottom and was then filled to about 60 cm depth with aged tap water (piped water was allowed to stand in the reservoir for 72 hours prior to its release into the rearing tanks).

Wild and hatchery-bred *C. gariepinus* were selected based on size: 120 males and 240 females, ranging from 29 to 42 cm standard length and 237 to 619 g. Ninety fish (30 males and 60 females) were placed into each rectangular tank and fed *ad libitum* on a mixture of trash fish and formulated feed (NIOMR formula). Spawning surfaces were provided in the form of 'kakabans' made from polyethylene strands.

Rain and flood conditions were simulated twice weekly for tanks B and D; A and C were the controls. Rain was simulated by attaching shower caps to the raised inlet pipes of the tanks. Flooding was simulated by drawing down the water level in a tank to about 5% of its volume while simultaneously filling up the adjacent tank to about 95% of its volume. When the valve linking the tanks was opened, the water movement from the filled tank to the empty one created a sudden 'flood' over a two-hour period. The procedure was then repeated in the other tank. Flooding simulation was carried out in the evening (1630 to 1830 hours) so as not to stress the fish. The tank water temperature was monitored daily. Water hyacinth *(Eichhornia crassipes)* was added in March for shade and to reduce temperature.

Females from all tanks were examined for reproductive status after 14 days and weekly thereafter following Hogendoorn (1979). Induced spawning, using homoplastic hypophysation as described by Viveen et al. (1985), was commenced when 'running' females were observed. Males were not used as pituitary donors as their reproductive status could not be accurately predicted. When females of the same weight were not available as pituitary donors, two or more smaller females were used to match the weight of a large one.

A set of spawners consisted of two males and a female. Eggs were incubated in the circular concrete tanks with water dripping in at the rate of 0.5 l/minute for the maintenance of dissolved oxygen. Unhatched eggs were removed along with the 'kakabans'. Postlarvae were reared on a microencapsulated egg diet after yolk resorption.

Results and Discussion

Gravid females were observed in all the tanks after three weeks and thereafter throughout the year. Precocious oogenesis was also observed in 23 six-month old hatchery-reared females. None of the gravid females in the control tank responded positively to hypophysation, whereas ovulation and spawning were achieved in 54 females (58%) from the test tanks.

Males died overnight on two occasions and failed to fertilize eggs. Otherwise, about 76% of the eggs hatched. In the concrete tanks, there was complete yolk resorption after five days, accompanied by a critical period of high fry mortality that became progressively less with increased growth. This suggests poor egg quality and some egg deformities were observed.

Unequal growth was common and large fingerlings cannibalized smaller ones. Grading fry can solve this but involves increased stress and mortality. Mortality can be lessened by transferring fry to prepared nursery ponds immediately after yolk resorption (Hogendoorn 1979; A.G. Coche, pers. comm.).

The presence of gravid females in captive stocks year-round contrasts with their discontinuous appearance in wild stocks and reflects gonadotropin production and storage (Peute et al. 1984; De Leeuw et al. 1985; van Oordt and Goos 1987). Ovulation was presumably stimulated by the simulation of rain and flood conditions. The presence of males as a social stimulus (van Oordt and Goos 1987) was of no relevance.

This work suggests the possibility of year-round supply of *C. gariepinus* fingerlings through simple, cheap methods.

Acknowledgements

The authors are grateful to the Directorate of Food, Road and Rural Infrastructure for sponsoring this project; to the Director of NIOMR for the provision of the facilities; to Mr. Olaniawo, Principal of the Federal Fisheries School; and to Dr. T. Ajayi for his inspiration and provision of the trash fish for feeding the experimental fish. Mr. A. Abiodun of NIOMR and Dr. Dan Adom of Water Resources Research and Documentation Centre (WARREDOC) of the Italian University for Foreigners, Perugia, are also acknowledged for their assistance in the statistical analysis of this study. Thanks are also due to Dr. Ayinla of the Africa Regional Aquaculture Centre (ARAC), Port Harcourt, for technical advice. Finally, the authors are grateful to the HND students (1987-88) for their diligence.

References

Areerat, S. 1987. *Clarias* culture in Thailand. Aquaculture 67:355-364.

Bruton, M.N. 1979. The breeding biology and early development of *Clarias gariepinus* (Pisces: Clariidae) in Lake Sibaya, South Africa, with a review of breeding a species of the subgenus *Clarias* (Clarias). Trans. Zool. Soc. Lond. 35:1-45.

De Leeuw, R., H.J.Th. Goos, C.J.J. Richter and E.H. Eding. 1985. Pimozide-LHRHa-induced breeding of the African catfish, *Clarias gariepinus* (Burchell). Aquaculture 44:295-302.

Hogendoorn, H. 1979. Controlled propagation of the African catfish *Clarias lazera* (C. & V.) I. Reproductive biology and field experiments. Aquaculture 17:323-333.

Huisman, E.A. and C.J.J. Richter. 1987. Reproduction, growth, health control and aquacultural potential of the African catfish *Clarias gariepinus* (Burchell 1822). Aquaculture 63:1-14.

Peute, J., R. De Leeuw, H.J.Th. Goos and P.G.W.J. van Oordt. 1984. Ultrastructure and immunolabelling of gonadotrops and thyrotrops in the pituitary. Cell Tissue Res. 283:95-193.

van Oordt, P.G.W.J. and H.J.Th. Goos. 1987. The African catfish, *Clarias gariepinus*, a model for the study of reproductive endocrinology in teleosts. Aquaculture 63:15-26.

Viveen, W.J.A.R., C.J.J. Richter, P.G.W.J. van Oordt, J.A.F. Janssen and E.A. Huisman. 1985. Practical manual for the culture of the African catfish *(Clarias gariepinus)*. Directorate General, International Cooperation of the Ministry of Foreign Affairs. The Hague, The Netherlands. 94 p.