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THE ECONOMICS OF INDUCED BREEDING OF *Heterobranchus longifilis* (VALENCIENNES, 1840) USING HORMONAL INDUCTION AND MANUAL STRIPPING

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Abstract

The economics of two induced breeding methods-hormonal induction and manual stripping were evaluated. In a 1:1 male: female ratio. Three (3) trials were made in each method using spawners weighing 1.5kg each. In the hormonal trial, 0.5ml ovaprim was injected into each spawner and both placed in a breeding tank containing aerated water 10 cm deep. Spawning occurred overnight and eggs incubated at 26^{0}C. In the stripping method, eggs were obtained from the female by gentle pressure on the abdomen and fertilized with milt from the macerated testes of the male partner, incubated in another tank containing aerated water 10 cm deep at 26^{0}C. Hatching occurred 25 hours later in both tanks. Fingerlings raised were harvested on the 30th day with mean counts of 509 and 3,032 in the hormonal and stripping methods, respectively. Statistical analysis using the least significant difference test (LSD) showed that there was a significant difference ($p<0.05$) between the mean effect of the treatments. Economic analysis showed a loss of ₦9,089.00 and a profit of ₦64,600.00 with mean cost-returns ratios of 0.30 and 1.6 in the hormonal and stripping methods, respectively. It was therefore recommended that farmers use the stripping method in producing Heterobranchus lonifilis fingerlings.

***Key words*:** *hormonal, induced, Breeding, stripping, economics*

INTRODUCTION

The catfish *Heterobranchus longifils* is one of the most suitable fish species for aquaculture in West Africa [14,10]. Biological and ecological characteristics such as omnivorous food habit, good acceptance of commercial pellet diet, resistance to disease, pollution and tolerance to low dissolved oxygen make it an excellent candidate for aquaculture [15,7,13]. It commands high market value in West Africa because of its good flavor and ability to grow to large size [14]. In Nigeria, it also commands high market value and demand because if its meat quality and good taste. Its fast growth rate, large size, vigorous carnivorous habit and efficient controller of over-population of *Tilapia* in fish ponds, have earned it the nickname “lion in water” [16]. In spite of these good qualities, a besetting problem to a Nigerian catfish farmer in the culture of this highly cherished pond fish is a viable and economical method of obtaining its fry/fingerlings to keep him in business all-year-round. It does not reproduce freely in captivity and its ovulation is not spontaneous, hence the fingerlings are scarce [9]. Two sources of obtaining the fingerlings by Nigerian farmers are wild collection and hatchery production [8]. Parasites and diseases reduce the efficiency in wild collection [1]. This puts hatchery production to a more reliable and safer way of fry/fingerling production of this good pond fish. It also brings about high rate of fertilization and hatchability with adequate protection of eggs and larvae against predation and disease [11].

In order that the catfish farmer in Nigeria remains in business all-year-round, it is important that he has a good knowledge of how to produce his viable fry/fingerlings and cheaply too. Consequently, two methods of production are the subject of this study. They are induced breeding by hormonal induction and manual stripping without hormone. The economics of these two methods on *H. longifilis* fingerling production are evaluated to ascertain which is more economically profitable for the fish farmer.

MATERIALS AND METHODS

Breeding Tanks/Accessories

Two breeding tanks, each measuring 120.0x100.0 x 100.0 cm were used, one for each of the two methods in Abia State University's fish hatchery at Umuahia. One aerator was used in each tank. Straws were used for egg collection/incubation in the hormonal method, while hatching trays with mosquito netting bases were used for egg collection in the stripping method.

Brood stock

Twelve (12) breeders (of equal males & females) weighing 1.5 kg each, collected from the brood stock ponds of Avigram farms, Owerri, in Imo State, Nigeria were used. The females were gravid as mature eggs oozed out with the slightest pressure on the abdomen. The males were aggressive showing they were ripe for breeding.

Experimental Procedure

In a 1:1 male: female ratio, 3 trials were made in each method. In the hormonal treatment group, 0.5 ml ovaprim was administered intramuscularly on the dorso-lateral side of both sexes at an angle of 30^0 to the body of the fish at 1800 hours. The injected area was rubbed with the finger to distribute the hormone evenly in the muscle for proper circulation. Both spawners were placed in the breeding tank containing water 10 cm deep with straws for egg collection. They were allowed to spawn overnight. The hatchery room was dark and adequate tranquility maintained over the night for a successful spawning. By the following morning, spawning had taken in the breeding tank. The breeders were netted out with scoop net and the fertilized eggs were allowed to incubate. The eggs were incubated in aerated water at 26^0 C.

In the stripping method, the gravid female was stripped immediately after handling the hormonal treatment set. The female was stripped by gentle pressure on the abdomen. Eggs oozed out into a plastic plate and fertilized with milt taken from the macerated testis of the male partner in pure saline solution of 0.7% NaCl. Drops of water were added to enhance fertilization. The fertilized eggs were placed in single layers in hatching trays for incubation in another breeding tank, also containing aerated water 10 cm deep at 26^0C. Twenty-five (25) hours later, hatching occurred in both tanks as fish larvae were seen. The straws and the hatching trays were removed seven (7) hours after the commencement of hatching. Unfertilized and eggs not hatched were siphoned out from the tanks to avoid disease infection.

Early Fry Nursing

Endogenous feeding of fry on egg yolk continued till the yolk sacs were resorbed after 2-4 days. Exogenous feeding followed with brine shrimp naupli *Artemna salina*, six times daily (between 600 hours and 1800 hours), ensuring previous rations were consumed. Feeding was sparingly carried out to avoid water contamination by excess food. Aeration was discontinued during the feeding period. Unconsumed food was siphoned out daily. Water was changed every two days and replenished with fresh one. Aeration continued after feeding and water volume progressively increased as the fry advanced in age/development.

Advanced Fry Nursing

The early fry terminated with metamorphosis into advanced fry; from this stage (usually between 10-12 days) the young fish accepted and grew well on artificial dry feed. Commercial dry feed coppens of particle size 0.35-0.50mm was fed to the young fish up to the 17^{th} day. This commercial feed was maintained with the 2mm size from the 18^{th} day until harvest on the 30^{th} day of the experiment. Water level was increased to a peak of 30cm by the 20^{th} day at which the young fish had grown into fingerlings. This final water level and feed were maintained till the 30^{th} day when the fingerlings were harvested. The same procedure for the hormonal and the stripping methods were strictly maintained in the 2nd and 3rd trials of the experiment.

Fingerling Harvesting

On the 30th day of each of the trials, the fingerlings were harvested. Harvesting was done early in the morning to minimize stress. Water in the breeding tanks were drained to very low level and the fingerlings collected with scoop nets and counted into basins containing clean water. A hundred percent (100.0%) recovery was achieved in each tank.

Cost-Returns Rationale

The fingerlings were sold at ₦30.00 each, irrespective of method of production. Economic decision was made by considering differences of gross income from items of costs (Gross margin enterprise net profit) and cost-returns ratio.

Data Analysis

The data obtained in this study were subjected to statistical analysis using the Least Significant Difference (LSD) at a probability level P=0.05 to determine the significant differences between the variables (fingerling production in hormonal and stripping methods). The Gross margin was estimated as the difference between gross income and total variable costs and net profit as the difference between the gross margin and fixed costs. Thus:

1. Gross margin= Gross Income minus Total Variable Costs;
2. Enterprise Net Profit = Gross Margin minus Fixed costs

When all costs incurred were considered as a long run variable without discounting at any interest rate, an index of cost/returns was generated for decision making.

3. The Cost-Returns Ratio (CRR) was calculated using:

$$CRR = \frac{\text{Gross Income}}{\text{Total Cost of Production}}$$

RESULTS AND DISCUSSIONS

Fingerling production in the two methods is shown in Table 1. Mean value of the trials in the hormonal method was 509, while that of stripping method was 3,032. Statistical analysis using the least significant difference test (LSD) showed that there was a significant difference (P<0.05) between the mean values of the fingerlings produced.

Low fish yield in the hormonal method is in line with the fingerlings of [9] that *H. longifils* does not freely breed in captivity. The use of hormone inducer to accelerate ovulation may have resulted in premature ovulation and release of some oocytes that had low potential hatching ability [3]. Consequently, hatching was poor resulting in very low fry/fingerling count. As growth continued, feeding still with *Artemia salina* and increased water volume, size differences were observed in this group. This may have further aggravated number of survivors as cannibalism was enhanced. This agrees with the findings of [12,17] that cannibalistic behavior is intensified by increasing size differences. However, good management practices such as efficient aeration and the siphoning away of egg shells, dead unfertilized eggs and deformed larvae enhanced survival [8], in spite of such a limiting factor. Higher fish yield in the stripping method may be as a result of efficient manual fertilization that may have occurred here. More eggs possibly got fertilized in the naturally matured eggs that were not induced to mature by hormone inducer. Size of the breeders assured large quantities of eggs. This is in line with the findings of [2] that size of brood stock influences quantity of eggs extruded. Since fertilization method was much more efficient in an optimum hatching temperature of 26^0C, hatching was more profuse here due to the same efficient management practices adopted in hormonal method.

Cannibalism which is a limiting factor in catfish fry/fingerling production as reported by [16] and [5] was successfully controlled by feeding the fry/fingerlings *ad libitum* with *Artemia salina* and later with commercial diet at a higher water volume that minimized stress and overcrowding [8,4] with more survivors recorded here. Also, homogenous size observed as growth continued in this group, could account for the higher number of surviving fingerling, confirming decreases in cannibalism [7].

Table 1. Fingerling Production in Hormonal and Stripping Methods

Treatment	Trials				
	1	2	3	Total	Mean
Hormonal	430	491	605	1,526	509[a]
Manual stripping	3,120	2,975	3,001	9,096	3,032[b]
Total	3,550	3,466	3,606	10,622	

Mean with superscript [a] =not significantly different from zero at P>0.05;
Mean with superscript [b] =not significantly different from zero at P<0.05;

Cost and Returns Analysis of the Fingerling Production

Table 2 showed the gross profit realized from sale of the fingerlings produced through both breeding methods.

Table 2. Analysis of Costs and returns from Hormonal and Manual Treatment Methods of Fingerlings Production

S/N	Economic Items	Treatment	
	Cost-Return Items	Hormonal	Manual Stripping
1.	Total fingerlings Produced and sold	509	3,032
	Values	(Naira)	(Naira)
2.	Unit sales price	30.00	30.00
3.	Gross income	15,261.00	90,960.00
4.	**Variable Costs**		
5.	Petrol/oil	5,000.00	5,000.00
6.	Breeders	7,000.00	7,000.00
7.	Hormone	1,000.00	nil
8.	Surgical Blade	Nil	60.00
9.	Cotton wool	Nil	100.00
10.	Towel	Nil	150.00
11.	Disposable syringe	100.00	nil
12.	Transportation	1,750.00	1,750.00
13.	Commercial feed	700.00	3.500.00
14.	**Total Variable costs**	**15,550.00**	**17,560.00**
15.	**Fixed Costs** Five years depreciated value of:		
16.	Galvanized metal tank	5,000.00	5,000.00
17.	Aerator	800.00	800.00
18.	Power generator	3,000.00	3,000.00
19.	**Total Fixed Costs**	**8,800.00**	**8,800.00**
20.	**Total Costs (14+19)**	**24,350.00**	**26,360.00**
21.	Gross Margin (3-14)	-289.00	73,400.00
22.	Net Enterprise profit (21-19)	- 9,089.00	64,600.00
23.	Costs/Returns ratio(20/3)	1.6	0.3

The table revealed that the manual stripping method gave a net profit of ₦64,600.00 (sixty four thousand, and six hundred naira) compared with ₦9,089.00 (nine thousand, and eighty nine naira) loss incurred in the hormonal method. Inputs supplies in both cases were from markets in Umuahia and Owerri while sales on demand was done in Umuahia.

The cost-returns results in the two tried methods showed a ratio of 0.30 for stripping method and a ratio of 1.60 for the hormonal method.

This revealed a huge gap in profitability in the use of the two methods as for every ₦1.00 invested by a farmer adopting the hormonal method will only yield a return of 30 kobo with a 70 kobo loss while adoption of manual stripping will allow a farmer to reap a return of 60 kobo for every one naira investment in *H. longifilis* fingerling production.

CONCLUSIONS

Hormonal induction method of producing *H. logifilis* fingerling compared poorly with manual stripping method of *H. logifilis* fingerling production. Hormonal induction method was characterized with poor egg hatching, size differences amongst hatched fingerlings, fewer fingerlings, and obvious cannibalism. The relatively fewer fingerlings in the hormonal induction method attracted lower gross enterprise income compared with manual stripping method of *H. logifilis* fingerling production.

We therefore recommended that fish farmers wishing to produce *H. logifilis* fingerlings should use the manual stripping method for better output and income.

REFERENCES

[1]Adedire, C.O., Aytounde, E.O., Fagbenro, O.A., Owoseeni, E.A., 1992, Studies on the biology and Aquaculture potential of Feral Catfish *Heteroebranchus bidorsalis* (Geoffery St. Hilarie 1807) (Clariidae): Tropical Zoology p.69.

[2]Adikwu, A.I., Sule, O.D., 2004, Effects of Broodstock Size on eggs and larval size and survival of African Catfish, *Clarias gariepinus* under laboratory conditions *Journal of Aquatic Sciences* 19(1): 1-4.

[3]Aguigwo, J.N., 1993, Inter-and intraspecific hybridization of Clarias albopunctatus (Nicholas and

Lamoute) and *Heteroebranchus longifili* (Cuvier and Valenciennes) in natural and artificial conditions *Journal of Aquatic Sciences* (8): 45-50.

[4]Aluko, P.O., Aremu, A., Nlewadim, A.N., 2001,. Observation of fry cannibalism in *Clarias gariepinus* (Burchell, 1822). *Journal of Aquatic Sciences* (16): 1-6.

[5]Aluko, P.O., Nlewadim, A.N., Onuoha, A.C., 2004, Studies on the growth and Survival of fry and fingerlings of Clarid Catfish species: *Clarias gariepinus* (Burchell, 1822). *Heteroebranchus bi dorsalis and Heteroebranchus longifili* (Valenciennes, 1840).j. Aqua. Trop. 19(1):1-14.

[6]Atse, B.C., Kouame, P., Koumi, A.R., 2008, Growth and Cannibalism of the African Catfish *Heteroebranchus longifili* fingerlings (Valenciennes, 1840) Fed Isoproteic Diets with Partial or Total Substitution of Fish protein with Soy protein *Journal of Fisheries International* 3(3): 68-74.

[7]Bard, J.P., Kimpe, De and Lessent, P. 1976. Nouveauxpoisons et nouvelles methods d'elevage en Afrique. FAO/CIFA Technical Paper Proceedings Symposuim on Aquaculture in Africa. Accra Ghana. p.365-372.

[8]Ayinla,O.A., 1991, Spawning of selected cultivable fish species In: Proceedings of the fish seed production course (Ed. O.A. Anyinla) NIOMR/ARAC, PortHarcourt, Nigeria. p.37.

[9]Campbell, D., Delince, G.A., Janssen, J.A.L., Kutty, M.N., 1987, Seed Production Lecture Presented at African Regional Aquaculture Centre (ARAC) for the Senior Aquaculturist's course Port Harcourt, Nigeria. p. 1-37.

[10] Hem, S., Legendre, M., Oteme, Z.J., 1996, Nouvelles especes de poisons-chats pour le de'veloppment de lapisciculture Africaine, In: Legendre,M. and Proteau, J.P. (eds). The biology and culture of Catfish. Aquatic living Res., (9): 207-217.

[11]Horvath, L., Woynarovich, E., 1980, The Artificial Propagation of warm water fish: A manual foe extension. FAO Fish Tech. Paper.

[12]Hseu, J.R., 2002, Effects of Size differences and Stocking Density on cannibalism rate of juvenile grouper *Epinephelus coioides*. Fish Sci. (68):1384-1386.

[13]Legendre, M.,1983, Examen pre'liminaire de potentialities d'un silure African *Heteroebranchus longifilis* (Valenciennes, 1840) pour l'aquaculture en milieu langunire. Document Scientifique, Centre de Recherches Oceanographiques d' Abidjan, (14): 97-107.

[14]Legendre, M., 1989, Enquete pre'liminaire sur la consummation du silure *Heteroebrachus logifilis* en-Cote d'Ivoire Archieves Scientifiques, Centre de Recherches Oceanographiques d' Abidjan, (12): 1-12.

[15]Micha, J.C., 1973, Etude des Populations piscicoles de l'Ubangui et tentative de se'lection and D'adaptation de quelques especes al'eting de pisciculture C.T.F.T, Division de Recherches en Piscciculture, Paris, France, p.110.

[16]Nwachukwu, A.N., Functional Fish Hatchery Operations and Management (Ist Edition). Whytem Publishers, Nigeria. Publishers of posterity books, 96 Owerri Road Okigwe. p.31.

[17]Reay, P., Smith, C., 1991, Cannibalism in Teleost fish. Rev. Fish Biol. (1):41-46.