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EFFECT OF SORTING SIEVES ON THE SURVIVAL AND GROWTH PERFORMANCE OF CATFISH (*CLARIAS GARIEPINUS*) IN TARPAULIN PONDS

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ABSTRACT

Sorting sieves were introduced into the hatchery management of *Clarias gariepinus* fry in Lagos State to improve on the survival rate and growth performance of *C. gariepinus* from fry to juvenile stage. The trials were set up in six farms across the State. Two hatching troughs served as Treatment 1 (T1) and Treatment 2 (T2) in each farm. T1 utilized sorting sieves while T2 used hand manual sorting. Broodstocks of 1500 ± 10.52 g were used for breeding. Fertilized eggs were shared weight for weight between T1 and T2 and normal management procedures were followed. Sorting of fish were done on the 14th, 21st, 28th, 42nd, 56th and 70th day after hatching. The percentage hatching was high, 78.33 ± 4.08% and 76.92 ± 3.19% in T1 and T2 respectively but not significant ($P > 0.05$). 70.76 ± 6.70% (T1) and 60.69 ± 7.52% (T2) fry survived to fingerling stage in the 6th week. Survival rate from fingerlings to juveniles at the 10th week significantly ($P < 0.05$) reduced to 62.33 ± 12.73% (T1) and 40.55 ± 8.44% (T2) respectively. At harvest (10th week), there were more numbers of small (4 – 6 cm) and large (8 – 12 cm) sizes of juveniles in T2 than T1 whereas numbers of medium (6 – 8 cm) size juveniles in T1 almost doubled that of T2 at a significant level ($P < 0.05$). Economic analysis of the trial gave Marginal Rate of Return (MRR) of N5.50k in favour of T1. It was concluded that introduction of sorting sieves to catfish hatchery will reduce drudgery in fry sorting while increasing percentage survival and profitability at the same time.

Keywords: Sorting sieves, Manual sorting, Hatchery, Lagos State, Broodstock

Introduction

The Nigerian aquaculture sector is growing at a very exponential rate which leaves an ever widening gap on the need for viable fingerlings for continuous stocking of ponds in the country. Astronomical growth in aquaculture cannot be sustained by the traditional supply of fingerlings from the wild because this is inadequate. Akinrotimi *et al.* (2013), postulated that fish farming today is hardly possible without the artificial propagation of fish seeds of preferred cultivable fish species. Hence, to maintain a constant supply of stocking materials for fish farms, farmers resort to hatcheries to provide an all year round supply of stocking material (AgroNigeria, 2015). In hatchery, at least 65% of the eggs produced can be raised to viable fingerlings as against less than 1% survival rate in natural spawning (Dada *et al.*, 2002). Apart from being able to obtain quality seed, the artificial propagation techniques are also used to develop strains superior to existing ones by the methods of hybridization or selective breeding as desirable traits can be enhanced and undesirable traits checked or controlled. However, the proliferation of hatcheries has not been able to meet up with the fingerlings demand of the country due to two major problems – lack of standard broodstock bank in Nigeria and early fry mortality caused by poor sorting techniques among other things. Despite the increasing interest in the culture of *C. gariepinus*, causes of cannibalism in this species have not been fully investigated (Ahmed, 2006).

Most hatcheries in Nigeria carry out fry/fingerlings sorting by visual observation and hand removing of shooters. This technique is cumbersome, stressful to fish and farmers, inaccurate and time consuming. Sophisticated sorting equipments are out of reach to an average hatchery operator in Nigeria due to the high cost of such imported devices. Thus there is a need to develop cheap, affordable equipments to address this problem, hence this trial.

Materials and Methods

The trial was carried out in six locations across the State – Ayobo, Iju, Ikorodu, Agbowa, Sangotedo and Poka. A farm was chosen in each location and 2 troughs made of tarpaulin of 1 m × 2.5 m × 0.3 m dimension were utilized. Two hatching troughs served as Treatment 1 (T1) and Treatment 2 (T2) in each farm. T1 utilized sorting sieves for sorting while T2 used hand manual sorting. *Clarias gariepinus* broodstock of 1500 ± 10.52 g each were used for breeding. Male and female broodstocks of over a year old were purchased from different sources to avoid inbreeding. Induced breeding was carried out using ovaprim at a dosage of 0.5 ml/kg. Fertilized eggs were shared weight for weight between T1 and T2 and normal management procedures were followed. Feeding commenced ad libitum after yolk absorption (72 hours after hatching). Decapsulated artemia was fed for two weeks followed by imported fry feed of graduating sizes till 10th week when the experiment was concluded.

Sorting of fish commenced on the 14th day after hatching and it was done weekly till the 70th day after hatching in both treatment.

The parameters taken at each stage of the trial include weight of eggs after stripping, hatching percentage, percentage survival from fry to juveniles and final weight at harvest. Weight of fertilized eggs were measured using 5 kg kitchen scale.

Hydrogen ion concentration (pH) was measured using a portable ATC pH meter which was calibrated by using two buffers (4.003 and 6.864) at 25°C. The pH was measured by dipping the probe of the pH meter directly into the surface water (Opadokun, 2015) Surface water temperature was measured in degree Celcius (°C) by inserting mercury-in-glass thermometer directly to the water for measurement, according to Boyd (1979).

Dissolved oxygen was monitored using DO meter. Data collected were subjected to analysis of variance (ANOVA) with reference to Steel and Torrie (1980). Significance difference in mean were calculated according to Gomez and Gomez (1984), using Duncan's multiple range test. Economic analysis was carried out following Olaoye *et al.* (2012).

Results and Discussion

Table 1 shows that the percentage hatching of eggs was high in both treatments (77.5 ± 5.24% in T1 and 76.83 ± 4.79% in T2). The result of the effect of sorting sieves on survival and growth performance of catfish (*Clarias gariepinus*) in tarpaulin ponds in the two treatments are

Location	Weight. of egg(g)-T1 (Using sorting sieves)	Weight of egg(g)-T2 (Hand sorting)	%hatching-T1 (Using sorting sieves)	%hatching-T2 (Hand sorting)
Ayobo	150	150	80	85
Iju	200	200	80	75
Ikorodu	130	130	75	75
Agbowa	185	185	85	80
Sangotedo	250	250	70	74
Poka	200	200	75	72
TOTAL	1115	1115	465	461
MEAN	185.83 ± 42.24	185.83 ± 42.24	77.5 ± 5.24	76.83 ± 4.79

Table 1. Percentage hatching in relation to egg weight.

Location	% Survival From Fry To Fingerlings Wk 1-6		% Survial From Fingerlings To Juvenile Wk 7-10	
	Sorting Sieve	Manual	Sorting Sieve	Manual
Ayobo	70	60	60	40
Iju	67	56	65	45
Ikorodu	72	58	62	35
Agbowa	65	58	63	40
Sangotedo	72	60	59	38
Poka	72	58	64	42
TOTAL	418	350	373	240
MEAN	69.67 ± 3.01	58.33 ± 1.51	62.17 ± 2.32	40.00 ± 3.41

Table 2. Percentage survival of Clarias gariepinus from fry to juvenile

shown in Tables 2 and 3. The mean percentage survival of fry to juvenile was significantly higher (P<0.01) in Treatment 1 (62.17 ± 2.32%) where sorting sieves were utilized for sorting than in the control trough Treatment 2 (40.00 ± 3.41) that used the conventional hand / visual manual sorting. This is in line with the findings of Gabriel, *et al.* (2016) that the highest mortality was recorded in manual sorting using sorting table when compared to other tools (Figure 1).

Tables 3 shows that the number of harvested juvenile in T1 (2926.83 ± 536.89) with sorting sieves almost doubled the number of harvested juvenile in T2 (1687.17 ± 227.42) without sorting sieve. However, the mean weight at harvest was higher in T2 than T1 (Table 3) due to heavy cannibalism caused by disparity in size as a result of error in visual / manual sorting. This agrees with Melard *et al.* (1995) who observed that natural progressive sorting often limits the emergence of cannibals while giving rise to a substantial variability in individual growth patterns. Notwithstanding, there was no significant difference (P>0.05) in the average weight of harvested juvenile. The number of smaller sizes of the fish was higher in T2 (without utilization of sorting sieves) than in T1 that utilized sorting sieves (Table 3).

The FCR was 1 in both treatments but the revenue per cost of #2.36 in T1 as compared with #1.65 in T2 showed that treatment 1 (using sorting sieves) is more profitable than treatment 2 (sorting without sorting sieves). Marginal Rate of Return (MRR) is #5.50k. This implies that for additional expenditure of #1.00, an incremental benefit of #5.50k is generated thus proofing the efficiency of early sorting using sorting sieves on the survival and growth of *Clarias gariepinus* fry to juvenile stage.

Abubakar *et al.*, (2015), stated that Catfish of the family Claridae are the most commonly cultivated fish species in Nigeria; also *Clarias gariepinus* juveniles exhibits a high cannibalism rate which could be controlled by sorting frequencies. Cannibalism among *Clarias gariepinus*, *Tilapia*, *Heterobranchus longifilis* fry and fingerlings have been identified as one of the major problems by small – scale hatchery operators (Royle, 2001). The act of killing and consuming the whole or major part of an individual belonging to the same species, irrespective of its stage of development is called cannibalism. This phenomenon is common throughout the animal kingdom (Hecht & Pienaar, 1993; Smith and Reay, 1991). Young fish usually exhibit allometric growth patterns showing high growth potentials than the older ones and according to David *et al.*, (2010), the intensity of cannibalism is highest in the early weeks or months of growth when the individual growth variability would be maximum; thus, sorting at early weeks or months of growth is very important. Social dominance in fish is caused by heterogeneous size distributions, which often results in aggressive behaviour and cannibalism (Hecht and Appelbaum, 1988). Cannibalism is thus facilitated by

Location	Sorting Sieve Small (4-6 cm)	Sorting Sieve Medium (6-8 cm)	Sorting Sieve Large (8-12 cm)	Sorting Sieve Total	Manual Small (4-6 cm)	Manual Medium (6-8 cm)	Manual Large (8-12 cm)	Manual Total
Ayobo	86	2479	250	2815	150	1468	303	1921
Iju	150	3103	64	3337	122	1083	156	1361
Ikorodu	141	2093	113	2347	136	1179	171	1486
Agbowa	130	2854	89	3073	170	1356	255	1781
Sangotedo	170	3213	280	3663	148	1298	222	1668
Poka	95	2111	120	2326	130	1520	256	1906
TOTAL	772	15853	916	17561	856	7904	1363	10123
MEAN	128.67 ± 32.47	2642.17 ± 488.56	152.67 ± 89.71	2926.83 ± 536.89	142.67 ± 17.10	1317.33 ± 167.15	227.17 ± 55.86	1687.17 ± 227.42

Table 3A. Number of harvested juvenile.

Location	Sorting sieve (G) Small (4-6 cm)	Sorting sieve (G) Medium (6-8 cm)	Sorting sieve (G) Large (8-12 cm)	Manual (G) Small (4-6 cm)	Manual (G) Medium (6-8 cm)	Manual (G) Large (8-12 cm)
Ayobo	4.1	8	14	5.6	10	16.5
Iju	4.9	15.54	36	5	19.08	39
Ikorodu	5.2	9.3	16.74	5.3	12.5	17.74
Agbowa	4.4	9	15	5.8	11	17
Sangotedo	5.1	16.2	37	5.2	20.02	40
Poka	5.4	9.5	17.82	5.7	13.1	18
TOTAL	29.1	67.54	136.56	32.6	85.7	148.24
MEAN	4.85 ± 0.50	11.26 ± 3.62	22.76 ± 10.73	5.43 ± 0.31	14.28 ± 4.23	24.71 ± 11.48

Table 3B. Average weight of Clarias gariepinus at harvest

Treatment	Yield Kg/ M^2	Production Cost (#)	Revenue (#)	Net Benefit (#)	Marg. Revenue (#)	Marg. Cost (#)	R/Cost (#)	Fcr	Marginal Rate of Return
Sorting Sieves	34.48	24,342.32	57,405.00	33,062.68	24,575.00	4,470.24	2.36	1	5.5
Manual	23.32	19,872.08	32,830.00	12,957.92			1.65	1	

Table 4. Economic analysis of the effect of early sorting on survival and growt performance of *clarias gariepinus* fry.

Figure 1. 3mm, 5mm & 7mm sorting sieves.

Figure 2. 10mm, 15mm & 20mm sorting sieves.

size heterogeneity wherein the smallest fish are consumed by the larger ones, and thus be viewed as a cause or consequence of heterogeneity.

Conclusion

To achieve a high fry survival rate, manual hand sorting might have to be on a daily basis and this can be highly stressful, time consuming and a waste of fund. This drudgery however can be reduced by the utilization of sorting sieves. Sorting sieves utilized in this trial is cheap (made of plastic) with uniform mesh sizes (Plate 1). It is therefore recommended for hatchery operators.

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