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The use of *Plastlon* Net Fence as Predator Control in Catfish Nursery Ponds

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Abstract: Six culture trials were carried out in fertilized earthen ponds, using 5-day-old F1 hybrid catfish fries under two treatments (fenced and unfenced ponds). Stocking density was 70 Fry/m^2 under semi intensive culture and each culture trial lasted for a period of 21 days. The fenced ponds produced better fry survival results of 40.94% ±3.12 (SD) as against 18.78% ±3.12 (SD) in the unfenced ponds. Mean fingerling harvest was 28.66± 2.19 and 13.15± 2.20 in the fenced and unfenced ponds respectively. All the unfenced ponds produced bigger size fingerlings than those in the fenced ponds. Pond water parameters were found to be favourable for fish production in all the ponds. Mean pH was 7.88± 0.68 (SD) and 7.26±0.61 (SD) in fenced and unfenced ponds respectively while mean nitrate-nitrogen was 0.03±0.02 mg/L in both treatments.

Key words: Predators % Fish Fry % *Plastlon* Net % Survival Rates

INTRODUCTION

Insects, fish, Birds and mammals are known predators of cultured fish. Bird predation is the major source of fish loss at aquaculture facilities. Aquaculture development has been adversely affected in many developing countries due to inadequate supply of fish seed of the required species or sub-species in the required quantities [1-3]. This situation is still the case in Nigeria. Despite several research activities from catfish production through aquaculture, the demand for catfish fingerlings still exceeds the supply [4]. It has been observed that catfish production has suppressed the production of other fish species, but there is still a set-back in the production of the fingerlings in ponds. Earlier reports [5, 6] have identified inadequate use of nutritionally balance diet of adequate size (pellets), poor water quality as well as predation to be part of the major causes of poor catfish fingerling survival. There is an enormous range of predatory species, including squid, fish, turtles, reptiles, birds, mammals which can kill or wound fish, damage equipment, resulting in losses through escapes, stress fish that results in reductions in appetite that in turn causes poor growth and reduced resistance to disease. This in turn causes poor production and profitability [7]. Other studies on catfish fingerling production include those of [8] and [9].

Though the relative increase in table-size catfish production in tanks under intensive culture since in the early 2000s can be attributed to the importation of high-quality pellets feeds into Nigeria, it is also apparent that production costs of such (table-size) catfish is rather high.

It is however possible that high catfish fingerling production can be sustained in earthen ponds under cheap semi-intensive method if predation can be greatly controlled. Several methods of deterrence and exclusion have been proposed in the past. The search for effective means of controlling fish predators in culture ponds is still ongoing [10]. At its simplest level, the presence of dogs or scarecrows can deter predators and scavengers. More sophisticated approaches include the installation of scaring devices that utilize flashing lights or sounds such as recorded boat engines or loud bangs have also been used [10]. Various systems of anti-bird wires or exclusion cages are used. It has been demonstrated that netting significantly reduced mortalities and the incidence of wounding in pond-reared fishes [11-13].

As a preliminary step in our investigation of depredation, we conducted a survey with the aim of using *plastlon* (*plastic-nylon*) net material as a fence round catfish earthen nursery ponds in order to improve fingerling survival.

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MATERIALS AND METHODS

The study was conducted at the fish hatchery and pond facilities of the African Regional Aquaculture Centre (ARAC) near Port Harcourt, River State, Nigeria.

Fish: Hybrid catfish (*C. gariepinus* x *H. longifilis*) fries were produced in ARAC hatchery as described by [14]. After yolk desorption, the fries were fed with artemia for two days when they became 5-day-old and were used for this study.

Fish Ponds: Six (6) earthen ponds (170m^2 each) were used for this study. Three of these were fenced round with green *plastlon* net material (mosquito net) measuring 1.2m (high) above ground level. The other three ponds were left exposed without fence. All the ponds were filled with water that was stagnant throughout the study duration while monitoring the physico-chemical parameters of the water using standard methods [15].

Pond Preparation and Management: Prior to stocking, each pond was treated with agricultural lime ($CaCO_3$) at a dosage of 750kg/ha after which poultry manure and inorganic fertilizer, NPK (15:15:15) were applied at the rate of 750kg/ha and 40kg/ha respectively. After stocking, the fries in each pond were fed daily on wheat bran at the rate of 3kg/day. Daily ratio was administered in three equal split doses and this was increased at weekly intervals as shown in Table 1. Each pond was supplied with fresh water from the hatchery bore-hole at the rate of 48h each week in order to maintain pond water level at 0.5m and 0.9m at both ends.

Procedure: Six (6) pond culture trials were carried out, using 5-day-old hybrid catfish in both fenced and unfenced ponds. The semi-intensive culture method was employed in all cases. During each culture trials, the fries were stocked at a density of 70 Fry/m^2. Culture duration was 21 days for each trial with a total of six culture trials after which all the fingerlings were harvested.

Harvest: Fish from each pond were counted and the number noted. The smallest and largest fingerlings were individually measured and weighed in order to determine the fingerling size range. A random sample of 500 fingerlings was in batches taken from each pond and total weight was determined using a digital Sartorius balance and the mean weight was calculated as:

Table 1: Feeding Regime of Catfish fry and fingerling in earthen ponds

Weeks	Time and amount (kg) of daily ration: 8 am	1 pm	5 pm	Total weekly ration (kg)
1st (7-3p)	1.00	1.00	1.00	21.00
2nd (11)	1.50	1.50	1.50	31.50
3rd (11)	2.00	2.00	2.00	42.00
TOTAL				94.50

$$\frac{\text{Total fish weight (g)}}{\text{Total fish number}}$$

Data Analysis: Fish survival rate (%) was also determined for each pond and *Student t-test* was used to compare rates among both treatments (fenced and unfenced ponds) and physico-chemical parameters of the water of the fenced and unfenced ponds.

RESULTS

Physico-Chemical Parameters: The result of physico-chemical parameters in the catfish nursery ponds is presented in Table 2. In all the ponds, water temperature ranged from 24.0 to 30.0°C while dissolved oxygen concentration was between 5.60 and 8.80 mg/l. Mean Ammonia-nitrogen values were 0.62±0.90 and 0.76±0.61 in the fenced and unfenced ponds respectively.

Fish Fingerling Harvest

Treatment

Fenced Pond: The six harvests gave production figures ranging from 4,306 to 5,385 fingerlings, with a mean production value of 4,875 ± 372 fingerlings per pond. Mean production per m^2 was 28.66 ± 2.19 fingerlings/m^2 (Table, 3). Fingerling survival rate ranged between 36.2 and 45.3%. Overall fingerling size range was between 0.30 and 5.00g. Mean weight values ranged from 2.27±1.45 to 2.84 ± 1.60 g during all the harvests.

Unfenced Ponds: In the unfenced ponds, fingerling harvests ranged between 1,867 and 2,768 fish per pond. This gave the mean production value of 13.15±2.20 fingerling/m^2 (Table 3). Fingerlings survival rate ranged between 15.70% and 23.26%. Weight range of the hybrid was between 1.00 and 7.00g (Table 3) while mean weight of fingerlings from each separate harvest samples ranged from 3.57 ± 1.77 to 4.26 ± 1.37 g.

Pests and Predators: Various pests and predators were observed and identified in the catfish ponds and they include the following:

Table 2: Physico-chemical parameters of water in fenced and unfenced catfish nursery ponds

Parameters	Fenced ponds	Unfenced ponds	t-test value	Probability
Temperature (°C)	26.56±1.90	26.85±1.95		
	(24.0-30.0)	(24.6-30.2)	0.43	p>0.05
pH	7.88 ±068	7.26 ± 0.61		
	(7.00-8.20)	(6.87-8.50)	0.90	p>0.05
Dissolved Oxygen Concentration (mg/L)	7.32± 0.90	6.12 ± 1.04		
	(5.60-8.80)	(5.82-7.60)	0.87	p>0.05
Ammonia-nitrogen (mg/L)	0.62 ± 0.90	0.76 ± 0.61		
	(0.30-0.95)	(0.40-1.03)	1.23	p>0.05
Nitrate-nitrogen (mg/L)	0.38 ± 0.21	0.37 ± 0.20		
	(0.02-0.68)	(0.07-0.65)	0.92	p>0.05
Nitrite-nitrogen (mg/L)	0.03 ± 0.02	0.03 ± 0.02		
	(0.00-0.08)	(0.00-0.08)	0.08	p>0.05

Table 3: Fingerling Production of African catfish F_1 hybrid reared in fertilized earthen ponds in fenced and unfenced ponds

Treatments	Mean harvest (number per treatment)	Mean harvest (no. per pond m^2)	Fingerling weight range (g)	Survival rate (% mean ± SD)
(Fenced ponds)	4875.00 ± 372.26	28.66 ±2.19	0.30-5.00	40.94 ±3.12
(Unfenced ponds)	2234.83 ± 371.93	13.15 ±2.20	1.00-7.00	18.78 ±3.12

Aquatic Insects:

Different life stages of the following insects were observed

Taxa	
Coleoptera	*Dytiscus marginalis*
	Gyrinus sp
Diptera	*Culex* sp.
	Anopheles sp.
Hemiptera	*Ranatra* sp.
	Appasus sp.
	Belostoma sp.
	Nepa sp.

Amphibians:

- *Dicroglossus occipitalis* Adults/tadpoles
- *Bufo regularis* Adults/tadpoles

These were very abundant in unfenced ponds, although very few in the fenced ponds.

Fish Were Found in Fenced Ponds:

C Bigger sizes of catfish hybrids preyed on the smaller sized in both pond treatments (fenced and unfenced). The rate of cannibalism however, depended on the population of the bigger fingerlings (shooters) in each pond. These occurred in both fenced and unfenced ponds but more in unfenced ponds.

Reptiles: The common reptilian predators that were presents in the earthen ponds where the monitor lizard and snakes. The common snakes were *Naja* sp. and the water snake. These occurred in the unfenced ponds.

Birds: Various piscivorous birds were observed to frequently visit the earthen ponds (both fenced and unfenced). The net did not prevent the birds from entering the ponds. Such birds included: *Scopus umboetta, Halcyon malimbicus, Egretta alba,*Wild ducks, Crows

DISCUSSION

The results of our investigation showed that the use of *plastlon* net material to fence round the ponds led to better catfish fingerling survival than in ponds that were not fenced. During the present study, the fence material had very small mesh size (mosquito netting) and was relatively high above ground level (1.2m). These qualities helped to reduce the passage of fry predators into the culture ponds.

One of the important causes of poor fingerling production in ponds is the incidence of predation. Fish pond predators usually include toads, frogs, snakes, aquatic insects and piscivorous birds. Wellborn *et al.*, [16] had earlier pointed out that for successful fingerling production, the ponds should be prepared in such a way those aquatic insects and trash fish must be controlled. Insects, toads/frogs and snakes are known to live in holes within fish pond areas and generally invade the ponds upon impoundment. The use of agricultural lime at a high dosage during pond preparation was to create an alkaline condition (within the pond bottom and sides) that will not encourage the presence of these predators before introducing water for fish culture. Pond pH values above 9.0 are known to inhabit the presence of fish and other aquatic fauna. The present results showed that the values of the physico-chemical parameters were similar in ponds under both treatments. This was obvious from the fact that the process of pond preparation and maintenance were similar for both treatments and the use of fence material did not affect the water quality in any way.

The relatively high level of the fence also prevented many frogs/toads, snakes and some insects from entering the ponds easily. Since the main water sources were from the bore hole as well as from rainfall, it was not possible that eggs of trash fish were accidentally introduced into the fenced ponds. It was however, not always possible to prevent piscivorous birds from entering the ponds. Bird predation at aquaculture facilities can have a significant economic impact on operations. Besides consuming fish, birds can injure fish, disrupt their feeding activity, disturb broodstock and contribute to the spread of diseases and parasites in aquaculture ponds. Open water and high fish stocking densities at aquaculture facilities are natural attractants to many bird species [17]. Cultured fish can be more or less susceptible to bird predation depending on the physical location, design and construction of an aquaculture facility. To understand potential damage and to implement proper bird control methods, one may need to correctly identify the bird species. In this investigation, *Scopus umboetta*, *Halcyon malimbicus* and the cattle egret (*Egretta alba*) frequently visited the unfenced fish ponds and occasionally present in the fenced ponds.

The only assurance of eliminating bird predation at aquaculture facilities is total exclusion of birds from fish holding facilities [17]. Total exclusion was however not impracticable in this investigation due to the size of operation (several ponds), expense and interference with management activities such as during feeding and general care of the fingerlings. Satisfactory results may be obtained with the use of partial exclusion and non-exclusion barriers, if combined with other control methods as was the case in this investigation. Which control method(s) to use depends on a number of factors, including the number and species of birds involved, the severity of the predation problem and the type and size of facility to be protected. Appropriate mesh size must be chosen and curtain nets installed at a sufficient distance from the cage bag that predators cannot reach the caged stock. The nets must be kept taut as birds rapidly learn that poorly tensioned nets offer little protection to fish. Melotti *et al.*, [12, 13] have demonstrated that netting significantly reduced mortalities and the incidence of wounding in pond-reared sea bass and sea bream. The presence of thousands of tadpoles, several frogs and toads, various types of aquatic insects accounted for the low fingerling production in all the unfenced ponds.

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