Nigerian Journal of Ecology (2007) 8: 12-15.

ISSN: 1116-753X

Fish culture trial in free flow bore hole pond in the northeastern arid zone of Nigeria.

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(Accepted 29 October, 2007)

ABSTRACT
Evaluation of fish culture trial in a free flow borehole in the North East Arid zone of Nigeria, (Maiduguri) Borno State , was carried out, Polyculture trial of *Clarias gariepinus* and *Oreochromis niloticus* were studied from May to December, 2005, in Monguno Local Government Area of Maiduguri. 240 *Clarias gariepinus* fingerlings of mean weight of 25.0g and mean length of 10cm were stocked at the same time with 960 fingerlings of *Oreochromis niloticus* of mean weight of 35.0g and length of 6.5cm. The physical chemical characteristics of the ponds were monitored during the culture trial. The implication of trial productivity, strongly suggest that the free flow borehole pond is maintaining eutrophics status and is not polluted. The result of the cultured fish pond showed that *O. niloticus* fingerlings grew from an initial mean w eight of 35.0g to 245g with daily mean weight gain 0.87g/day, while *Clarias gariepinus* fingerlings grew from an initial mean weight of 25.0g to 285g and daily gain weight of 1.13g/day.

Key words: Arid zone, free flow borehole, *Oreochromis niloticus gariepinus, Clarias gariepinus* Productivity, Eutrophic Status.

INTRODUCTION

Water is a scarce commodity in the northern part of Borno State with hardly any perennial rivers. Underground water is main source of water for human and animal consumption. It is also used for various human activities in the zone. The climate regime is characterized by single long dry season followed by a shorter wet season. The mean annual rainfall is less than 500mm and may fall to 250mm (Kawal and Knabe, 1972, Idowu *et al* 2004). Potential evaporation exceeds rainfall except for the few months in June, July, August and September.

Excessive evapotranspiration in the zone leads to water deficit for most part of the year resulting in less leaching of the soil, (Nwoko, 1991). The arid zone has witnessed a tremendous increase of ground water development due to the need for portable water. An estimated 200 boreholes have been sunk over the years in the state (Jiddah *et al*, 1985). Each of these boreholes provides drinking water for the local community and livestock and support small scale irrigated agriculture. Despite high evaporation, this borehole water remains underutilized. It becomes necessary, therefore, to use the available free flow borehole ponds for fish culture for increased fish production.

Hepher (1976) observed that increased fish population in ponds in order to obtained higher fish yield is possible by increasing the utilization of existing natural food or increasing natural food production by fertilization and aiding supplementary feeding. Summers (1984) suggested that success or failure of aquaculture in ponds depends largely on its location; management techniques and that careful thought should be devoted for proper site. *Clarias* and *Oreochromis* species are very popular indigenous culture species in Nigeria , and their findings are in high demand. The aim of this study was, therefore, to test the efficiency of the fish culture in free flow borehole pond and monitor the growth and survival of the polyculture trial.

MATERIALS AND METHODS

Fish culture trial of *Clarias gariepinus* and *Oreochromis niloticus* fingerlings was studied between May and December, 2005 (for 240 days).

The Study Area

There is no available map of the study are except that of Monguno Local Government Area, as no fisheries research or any known scientific research has been carried out at the site. The free flow borehole site, situated at Lawanti is about 150km along Maiduguri – Monguno road. It is located between latitude 13^{o}N and 14^{o}N and longitude 12^{o}E and 13^{o}E. Being located in North – East arid zone, the climate is sahelian with three distinct seasons. The rainy season starts from July to October, cold dry harmattan winds from November to February and a very hot dry season with extreme temperature of about 42^{o}C from March to June (CBDA, 1986). The borehole was sunk by the

Borno state Government in 1992, for the villagers of the area for their domestic activities as well as for drinking spot for the cattle and domestic animals. The borehole has an adjacent burrow pit, where water that runs from the tap flows in directly, this forms a pool of water around the borehole. It is about $300m^2$.

Pre-stocking Assessment and stocking of fingerlings to reduce competition, and predation, pre-existing (non-experimental) organisms found in pond were thoroughly searched for and removed from the pond using Siene net, before the fingerlings were stocked.

Fish fingerlings of *Clarias gariepinus* and *Oreochromis niloticus* were produced from Marama Dam in Borno State . 240 *Clarias gariepinus* of mean weight 25.0g and mean length 10cm were stocked at the same time with 960 fingerlings of *Orechromis niloticus* of mean weight 35.0g and mean length 6.5cm, after all necessary morphometric measurement were taken.

Following stocking, monthly sampling of stocked fish species for growth performance was carried out till the end of the trial period. Fish growth was determined by measuring individual body weight, and the fish growth performance was computed using Reich (1975) expressed as follows:

Net fish Yield (NFY) =
Total final weight–Total initial Weight

ii. Daily Weight Gain (DWG) =
Mean Weight Gain
Number of Culture Days

iii. Mean Weight Gain (MWG) =
Mean Final Weight - Mean Initial weight.

iv. Percentage Survival (%) =
No. of Fish stocked – No. harvested x 100
No. of fish stocked

The mean growth rate (MGR) was computed using Ruther (1977) expressed thus:

$$\frac{W_1 - W_2}{0.5(W_1 - W_2)t} \times \frac{100}{1} \text{g/day}$$

Where W_2 = Final Weight
W_1 = Final Weight
T = Period of rearing in a day
0.5 = Constant

Some vital physico-chemical parameters affecting the quality of the water was monitored during the trial. The parameters determine were depth, temperature, p^H, Biochemical oxygen demand (BOD), conductivity, dissolved oxygen as described by APHA (1980); Idowu *et al*, (2002, 2004). All data on the physical chemical studies were assessed for normality and homogeneity of variance. Non-normal data were transformed using one way analysis of variance (ANOVA). When the effect are significant, Fishers LSD test were used to distinguish differences between means at 5% level $P<0.05$.

RESULTS

Table one shows the mean monthly variation on the physical and chemical parameters of the free flow borehole pond monitored during the cultural trial period. The mean temperature varied between 26^oC to 29^oC in July and August to 29^oC in June. No significant difference was observed. The p^H values were between 6.0 to 7.0. The mean values for dissolved oxygen ranged between 3.7 to 5.3 mg/l. the value of biochemical oxygen demand (BOD) was between 2.32 and 3.95.

There was no significant difference between the values recorded for the conductivity in July to November but there were significantly different from values recorded in May, June and December.

The growth performance of *Oreochromis niloticus* (Table II) shows an increase from the initial weight of 35.0gn to 245g with daily weight gain (DWG) of about 0.87gm/day, *Clarias gariepinus* fingerlings also grew from the mean initial weight of 25.0g to 285.5g and mean daily weight gain of 1.13g per day. The mean daily weight gain of *Oreochromis niloticus* varied between 0.20g – 0.89g, while the *Clarias gariepinus* varied between 0.7g – 15g. The percentage survival calculated for these months was 45.5% of *O.niloticus* while 86% was recorded of *Clarias gariepinus.* Table III shows the summary of growth performance of *Oreochromis niloticus* and *Clarias gariepinus*from stocking to harvesting period. The total number of *Oreochromis niloticus* harvested was 933, while 233 *Clarias gariepinus* were harvested' from the pond. The total final weight recorded for *Oreochromis niloticus was 188.4kg while 128kg was recorded for Clarias gariepinus.*

The mean final weight of *Oreochromis niloticus* ranged from 180.0 – 300.5g, while that of *Clarias gariepinus* ranged from 480 – 600.2g (see table III). The Net yield of 154.8 unit was recorded for *Oreochromis niloticus,* while 123.2 was observed for Clarias gariepinus. The total and overall percentage survival for the whole periods of the study to harvesting period was 79.1% of *C. gariepinus.*

Table 1: The mean monthly variation of the physical chemical parameters of the free borehole in monguno

Parameter	May	June	July	August	September	October	November	December
Depth (m)	1.7± 0.0^{b}	1.7±0.0^{b}	1.85±0.01^{b}	1.11±0.2^{b}	2.0±0.01^{b}	1.95±0.01^{b}	1.9±0.01^{b}	1.8± 0.01^{b}
Temperature ^{o}c	28.0±0.0^{a}	29.0±0.1^{a}	26.0±0.2^{a}	26±0.2^{a}	26±0.01^{a}	27±0.03^{a}	28.5±0.0^{a}	26.0±0.01^{a}
PH	6.5±0.0^{c}	6.0±0.0^{c}	7.0±1^{c}	7.0±0.0^{c}	6.8±0.02^{c}	6.5±0.01^{c}	6.5±0.00^{c}	6.3±0.01^{c}
Conductivity ohms/cm	42.57±0.03^{x}	49.6±0.01^{x}	65.38±0.07^{y}	68.75±0.06^{y}	65.85±0.01^{y}	61.57±0.04^{y}	63.50±0.04^{y}	53.0±0.02^{x}
Biochemical oxygen Demand (BOD)	2.64±0.0^{0}	2.50±0.03^{0}	3.20±0.04^{0}	2.32±0.00^{0}	2.50±0.01^{0}	3.75±0.04^{0}	3.99±0.02^{0}	2.89±0.01^{0}
Dissolved oxygen (mg/I)	4.5±0.01^{x}	4.8±0.01^{x}	3.7±0.01^{x}	3.5±0.02^{x}	4.2±0.01^{x}	5.3±0.01^{x}	5.00±0.02^{x}	4.8±0.01^{x}

The mean values with the same superscript on the same row are not significantly differently of $p<0.05$.

Table 2: Growth performance of *o. niloticus* and *c. gariepinus* in free flow bore hole pond,in monguno.

Fish species	Mean install weight	Mean initial weight (g)	Mean daily weight gain (g)	No of fish sampled	% survival	Cultured period
o.*niloticus* range	35±.2.47 28.0-37.5	245±13.33 180.0-3000	0.87±0.01 0.20-0.89	200 1200	64.50	240
Clarias gariepinus range	25±1.25 13.0-16.5	285±15.4 22.0-306.0	1.13±0.03 0.7-1.5	100	86%	240

Table 3: Summary of the growth performance of *o.niloticus* and *c.gariepinus* from stocking to harvesting period

		O. niloticus	**Range**	***C.garicpinus***	**Range**
Stocking	Total number of fish stocked	960	-	240	-
	Total initial weight in (KG)	33.6	-	4.8	-
	Mean initial weight (g)	35.0±2.47	-	25.0±2.08	-
Harvest	Total no. of fish invested	933	-	190	-
	Total final weight(kg)	188.4	-	128.0	-
	Total weight final weight (g)	245±1.83	180.0-300.5	285±0.63	480.0-600.2
	Mean weight gain (g) 1g fish per day	154.8		123.2	
Survival	Percentage total survival	97.1		79.1	

DISCUSSION

The quality of the water in the pond was favorable to the fish; this could be attributed to high level of hygiene maintained around the borehole pond. The physical and chemical characteristics studied shows that the temperatures, dissolved oxygen, conductivity, PH, were all within tolerable limit that could favor fish production. The relative low level of dissolve oxygen may be due to the decomposition of the faecal dropping by the cattle, and organic materials brought into the pond through runoff during the rainy season.

The growth performance of *Oreochromis niloticus* and *Clarias gariepinus* as observed in this study shows as a steady increases in terms of weight of an average daily weight gain of about 0.87g for *Orechromis niloticus* and 1.13g for C. *gariepinus.* This is higher than 0.81g/day obtained by Okoye and Wonah (1993) in earthen ponds in middle belt zone of Nigeria after 150 days culture period. Otubusin (1992) recorded a lower value of 0.2g/day over a culture period of 250 days in floating net cages. The study also agrees with Hepher (1976) who observed the higher fish yield is possible by utilizing the existing natural food or increasing natural food

production by fertilization. The presence of the cattle dung in this pond for the production of natural food for the fish since trial culture was carried out without supplementary feeding.

The polyculture trial in the free flow borehole for this study also agrees with the findings of Tang (1970) and Reich (1975) who observed that diverse water biota found in tropical aquatic system could lead to high fish yield as shown in the values recorded for the weight increase and Net yield in this study.

Based on the culture of fish in this free flow borehole, it is concluded that free flow borehole pond is the potential for fish pond culture in the study area; The adoption of this technology will enhance fish production particularly in North-east Arid zone part of Nigeria. The pond could also support diverse communities' aquatic organisms despite the tendency of stress that may be imposed by reduction in water level of the pond, due to the arid nature of the environment.

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