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GROWTH PERFORMANCES OF *PARACHANNA OBSCURUS* (GUNTHER, 1861) FRY REARED IN EARTHEN PONDS UNDER MONO- AND POLYCULTURE SYSTEMS

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ABSTRACT

Fry of *Parachanna obscurus* measuring 60 mm (1.1 g. wet weight) were stocked in earthen ponds (36 m^2) for study of growth in two culture systems of monoculture and polyculture for 180 days. The stocking density of species under the two systems were 7, 15, 25, 30 ind. m^{-2} . The monocultured individuals were fed with IOC farm feed I (31.66% protein); while the other relied on Oreochromis niloticus and other natural foods in the ponds for the same culture period. The polyculture ponds were adequately fertilized to take care of production of food for *Oreochromis* that were introduced earlier before *Parachanna* species were stocked. At the end of study, final total lengths averaged 106 mm in those fed IOC farm feed (monoculture) reaching a growth rate of 0.23 $mm.d^{-1}$ and 210 mm for those that relied on live fish/ natural food for survival (growth rate = 0.35 $mm.d^{-1}$). Weights of harvested fish ranged between 45.1 gm to 64.0 gm while survival rates of 6.8% to 74 % were recorded in both studies. The aquaculture implications of these are discussed.

KEYWORDS: *Parachanna obscurus*, Growth, Monoculture, Polyculture, Ponds

INTRODUCTION

Most commonly cultured catfishes in West Africa are the Clariids (*Heterobranchus longifilis*, *H. bidorsalis* and *Clarias gariepinus*). The biology and the cultural attributes of these species are adequately documented (Viveen *et al* 1986; Aguiwo, 1991; Lagendre, 1992; Oladosu *et al*, 1993). *Parachanna obscurus* have received little attention compared to works published in other closely related species. However scanty information on its biology (Ng and Lim, 1990; Wee.1982, Webber and Rioden, 1976, Bard *et al*, 1976), ecology (Reed *et al* 1969, Wee 1982, Ulelu, 1993) and some cultural attributes of some of its Asian congeners abound. Aquaculturists and researchers have continued with attempts on the rearing of the *Parachanna obscurus* (Timonli *et al* 1987, Wee, 1992, Victor & Akpocha 1991, and Qin and Fast, 1996) in West Africa.

In this report, the cultivability of *Parachanna obscurus* under two culture systems was investigated; specimens reared under monoculture and polyculture systems fed artificial and natural foods respectively. Feeding is an important aspect in animal husbandry that must be manipulated to achieve growth of cultured species. It is known that the determination of the food type of species is important in the choice of the species for culture (Miyajima (1977). Bard *et al* (1976), Jubb. (1967), and Victor & Akpocha (1991) reported on the feeding niches of *Clarias gariepinus* and P. *obscurus*. They asserted that the two species are cannibalistic as well as first class carnivore respectively (Wee, 1982). It is hoped that these results will open up avenues for more intensive study of the species to discover optimum culture techniques for its successful cultivation in West Africa.

MATERIALS AND METHODS

Specimens of *P.obscurus* measuring 60 mm (or 1.1 g. wet weight) were obtained from the wild and transported to the Institute of Oceanography, University of Calabar, Calabar, fish farm for a 14-day quarantine and acclimatization. During this time and prior to commencement of study, specimens were fed ad-libitum with chopped earthworms. On the 15^{th} day, specimens were measured (total lengths and wet weights) and stocked following two plans of culture. In the monoculture plan, specimens were stocked at a rate of 7, 15, 25, and 30 ind. m^{-2} in 4 earthen ponds each measuring $36m^2$. In the next system, specimens were stocked at the same density as in the monoculture trial but were polycultured with sub-adults (60 – 80 mm. total length) of *Oreochromis niloticus* that were stocked 60 days, during which time they spawned (95 – 105 mm total length); before the stocking of the main culture species. The polyculture ponds were adequately fertilized ensuring primary production and generation of benthos for the food fish and *P. obscurus* respectively. The stocking rate of 20 ind. m^{-2} of the *O.niloticus* was arbitrarily chosen for the four-polyculture tanks. These experiments were repeated for another 180 days in the same ponds after the end of the first 180 days of study.

Table 1: Proximate composition and energy content of the components of the IOC Farm Feed 1

Food Type	Dry weight (%)	Energy content (kjg^{-1})
Crude protein	31.66	946
Lipids	16.00	
Crude fiber	9.60	475
Ash	32.15	-
Moisture	5.05	-
NFE	5.54	376
	100	**1797**

The specimens reared under monoculture were maintained with IOC farm feed I. The proximate composition of the feed is given in Table 1. Feeding rates of 5% body weights per day was followed, shared equally into 3 rations for three feeding a day in the monoculture system. The foods were merely broadcast on the water surfaces during feeding. The monoculture ponds were not fertilized throughout the culture period to minimize interferences of foods from other sources in the ponds. In the polyculture trials, the medium was adequately fertilized with chicken manure to encourage the development and growth of natural food for *O.niloticus* and the benthos. Sampling of culture systems for growth was carried out bi-weekly. The new weights facilitated the adjustments of feeding rates for the monoculture species. At the end of each culture period of 180 days, the final weights and lengths of the specimens were measured and recorded. Water quality parameters such as dissolved oxygen; pH and T°c were monitored weekly during the period of study. The growth rates were compared using the single classification analysis of variance (ANOVA). Further test for variability was carried out to confirm the best strategy for rearing *P. obscurus*.

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RESULTS

The physico-chemical conditions of the pond for the 1culture period were; temperature = 26.3°C; oxygen =6.0 mgl^{-1} and the pH of 7.0 (mean values).

Table 2 presents growth data of the specimens in the two systems of monoculture and polyculture. Survival rates were lower in monoculture than in the polyculture systems.

Table 2: Growth and survival of *Parachanna obscurus* reared for 180 days in earthen ponds under monoculture and polyculture systems.

Treatment	stocking density (ind. m^2)	Total lengths (cm) Initial	Final	Total weight (g) Initial	Final	Growth rates $mm.d^{-1}$	$g.d^{-1}$	Survival rates (%)	FCR	PE
Monoculture	7	60	148	1.1	45.1	0.24	0.24	6.8	6.4	0.13
	15	60	135	1.1	75.6	0.41	0.41	36.0	7.8	0.06
	25	60	133	1.1	50.4	0.40	0.28	4.8	7.3	0.20
	30	60	132	1.1	48.6	0.40	0.36	4.5	7.0	0.20
Polyculture	7	60	124	1.1	57.6	0.35	0.32	74	0.0	0.74
	15	60	126	1.1	63,2	0.37	0.35	70	0.0	0.69
	25	60	126	1.1	64.0	0.37	0.36	70	0.0	0.70
	30	60	118	1.1	61.0	0.32	0.34	65	0.0	0.65

- FCR = food conversion rate
- PE^2 = Production efficiency

ANOVA $F_{(2,24)}$ = 1.76($p > 0.05$) showed that the growth rates in the strategies were different. Further comparisons using test for variability indicated that the polyculture treatments were better than monoculture in terms of production efficiency and survival rates. However, the polyculture systems produced larger individuals at harvest than those from the monoculture ponds.

DISCUSSION

In general, high protein food encourages high growth rates in organisms (Wedemeyor and Maiery, 1981; Wutz, 1992). In some aquatic organisms growth is depressed drastically with meals containing high protein levels e.g. *Macrobrachium vollenhovenii* that were starved and fed after a period of time showed poor growth with rich protein meals (Udo and Umoyo, 2001;Udo, 2004). In a related study, Malecha *et al* (1981), and Stanley and Moore (1983) independently reported that *Macrobrachium rosenberghii* requires low protein and easily fragmented compounded feeds for optimal growth. In the study involving *Heterobranchus bidorsalis* and *Clarias gariepinus* cross- breed larvae fed for 15 days with protein rich egg yolk, Arazu and Aguiwo (2004) stated that they responded negatively to feeding showing depressed growth. In this study, juveniles of *P.obscurus* fed with food containing 31.66 % protein at low density did not respond adequately to the feed. It is possible that apart from poor food acceptability, and other known factors like space and competition as well as genetic factors, can contribute to the low growth in the species. It is well known that space, competition and gene types exert great influence on growth of species, even humans (Vines and Rees, 1972;Malecha, *et al* 1984) In this study, the author is convinced that farming system have contributed to low growth and survival in the species studied. Growth rates were better in polyculture than in the monoculture systems. Statistics have shown that the rearing of *P. obscurus* in polyculture with *O.niloticus* will lead to better production than when species are monocultured and fed artificially (Table 2).

The higher growth and survival rate of the polyculture milieu, most likely, was encouraged by the abundant natural food (originating from *Tilapia* fry's and benthic production, as well as the rich primary production of phytoplankton and zooplankton) within the ponds (Table 2). On the other hand, the quality of artificial food given to the monoculture species alongside with the scarce natural food sources could have affected both the growth and survival rates of specimens. It could as well be argued that, *P.obscurus* preferred to cannibalize on themselves, and probably did not accept the artificial food, although of high quality. It was noticed that cannibalism led to development of out growers (jumpers) that might have out -competed the rest as a result of size differences in the monoculture ponds. Doyle and Talbot (1986) stated that allocation of space and food resources controls growth rates of species, the consequence of disproportionate share of food resources that placed the superior competitors (out-growers) ahead of others with a subsequent faster growth. Koebele (1980) had earlier asserted that where there is no disproportionate food acquisition there would be no size difference effects in species population. In other words, with the establishment of size differences in a population, smaller individuals are inhibited from satisfactory feeding due to the presence of larger ones. Therefore, it is assumed that the higher survival rates recorded in polyculture was encouraged by the abundance and availability of natural food in the system and non- competition for foods by species while the low rates of survival in monoculture was probably associated with predation and cannibalism.

The growth rates reported in this study for the two strategies are low (Table 2) compared to available records from similar species. A ranged of 0.34$g.d^{-1}$ to 0.66 $g.d^{-1}$ is given for *Ictalarus punctatus, Clarias gariepinus and Celossoma sp.* (Elliot, 1975; Wedemeyor and Malery, 1981, Wutz, 1992; Reed *et al*, 1969). For example, the growth rates of 0.24 and 0.41 $g.d^{-1}$ recorded in this study for species in monoculture ponds and 0.32 to 0.36 $g.d^{-1}$ in polyculture are comparable with those given above. The minor differences can probably be accounted by two reasons; genetic factors, in which two different species can not grow equally (Vine and Rees, 1972); and that of environment of growth (Sarver *et al*, 1982).

From the results of this study, better growth of *P. obscurus* is obtained from specimens reared under polyculture. If monoculture is the option, individuals should be stocked at uniform sizes and regularly inspected to ensure the extraction of out growers from the system. The administration of good and acceptable diets to fish should be ensured. The quality of food (in terms of protein content) administered to species was sufficient to produce good growth except feed was not accepted by fish. Gutherie and Tarver (1981) asserted that unacceptable diets fed to cultured species also affects their growth rates.

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