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Growth and feed utilization in *Potamon ebonyicum* (Crustacea; Brachyura) fed domestic catfish feed in South East Nigeria

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Abstract

Evaluation of growth performance of *Potamon ebonyicum* (mud crab) fed ready analyzed domestic catfish feed for a period 6 weeks was carried out in intensive system. Two treatments established during the experiments were replicated 3 times. Mean weight of the females was 55.04g and that of the males was 50.80 cm. Catfish feed (9mm pellet) with 38 per cent crude protein was fed once daily. Each and every treatment received a pellet in the evening. Growth rate was not significant ($p>0.05$) but systematically progressive. Food conversion ratio was higher in small crabs than in the big ones. Conversion-efficiency values for the small female and male crabs in the present investigation were 19.95 and 32.16 respectively. The conversion-efficiency values for the big female and male were 33.47 and 73.34 respectively. Significant increase in crude protein or use of feed with higher crude protein than the estimated percentage might substantially reduce the efficiency value.

Keywords: Mud crab, catfish feed, domestic, Nigeria, food conversion, growth performance

1. Introduction

Studies on semi aquatic organisms such as identification, isolation, acclimatization, feeding and growth performance of mud crab are at their infancy globally. *Potamon ebonyicum* are abundant at Ebonyi river basin south east Nigeria, where they could be enticed from their muddy holes with edible insects and piece of polyethylene material (Akpaniteaku 2013) [1]. Aquaculture potentials have been evaluated, and cultivability of various species of crabs and use of formulated feed are considerably at early stage of development (FAO, 2011, Akpaniteaku 2013 and Akpaniteaku 2014) [2, 1, 3]. Capacity of the *P. ebonyicum* to respond to feeding in captivity and its suitability for aquaculture have been investigated (Akpaniteaku 2013) [1]. Research reports on mud and river crabs have suggested the need for further investigation on methods of handling, feed formulation and growth performance (Akpaniteaku 2016) [4]. Aquaculture in the country is mainly dependent on foreign floating fish feed for a long time, and there was need to avoid over dependence on non-domestic sources of nutrition (Ibiyo *et al.* 2011) [5]. Preliminary investigation on feeding of crab has been conducted with foreign fish feed. Catfish feed from Vietnam and Israel has been experimented on with relative positive results (Akpaniteaku, 2013 and Akpaniteaku, 2016) [1, 4]. In Nigeria, catfish are the preferred aquaculture species due to high level of acceptance in the market, (Ayinla, 2007) [6]. There was need for systematic development of crab aquaculture with standard, indigenous and readily available feed. The need to look inward therefore resulted in the study of food utilization and growth performance of *P. ebonyicum* with ready analyzed domestic catfish feed. The commercial catfish feed is readily available for aquaculture. Besides, catfish and mud crab are omnivorous and can derive nutrients from the same stuff.

2. Materials and Methods

The study was carried out for 6 weeks in Ebonyi State. Ebonyi State is one of the five south eastern states of Nigeria. It lies on latitude 6°17'79.73"N longitude 7°95'92.86"E with a total area of 5,533km². Crab specimens used for the experiments were collected from two locations: Ugbona-Ishieke community in Ivo Local Government area and Okpoto in Ishielu Local Government area.

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The specimens from Ishieke were collected from crab hunters, and those from Okpoto were caught around Okpurukpu stream on Evangel University take-off campus by methods of Akpaniteaku (2014) [3]. A total of 36 crabs including female and male (mean weights 55.04g and 50.80g respectively) were collected and transported dry to the research laboratory. Equal numbers of active female and male were randomly selected for acclimatization. They were acclimatized in 7 liter calibrated, experimental plastic receptacle. The depth of water was 9cm, and each receptacle contained a crab. The specimens were acclimatized for 48hrs. Hydrogen ion concentration (pH) of the water was 6.5 and mean temperature 29.5 °C.

Body weights were obtained using golden-mettler USA electronic scale, and carapace width measured with flexible, plastic tape. Weights of the females at stocking ranged from 63.4g to 66.8g, and those of the males ranged from 52.2g to 53.9g. The carapace width measured from 3.5cm to 5.6 cm and 3.5cm to 4.0 cm respectively. They were fed with vital fish feed (9mm pellet) produced by Grand Cereal (UAC) Nigeria. The catfish feed composed of nutrient elements derived from fish meal, wheat meal, rice grains, fish oil, vegetable, mineral/trace element which analysis is shown in Table I.

Table 1: Nutrient Composition of the Fish Feed

Nutrient/Element	Percentage	Remarks
Protein	38.00	Maximum
Moisture	8.00	Maximum
Fat	12.00	Maximum
Crude fiber	5.00	Maximum
Calcium	1.80	Maximum
Ash	10.00	Maximum

Source: Vital fishfeed-Grand Cereal (UAC) Nigeria (Undated)

The crabs were feed in the evening between 5.00 and 6.00 pm by dropping a pellet (weight range: 5.11g to 5.48g) in each of the containers. Weights of the feed were measured with the Golden-mettler electronic scale before feeding. The pellets were dropped in such a way that the crab could sense the presence of an intruder. Water was changed in the morning every other day, till the end of the experiment.

The specimens were measured fortnightly with the flexible tape, and their weight taken with trap and the electronic scale.

Table 2: Mean weight gain and food-utilization rate of *Potamon ebonicum* fed domestic catfish feed for 6 weeks

Replicate	T ₁ (Female)					T ₂ (Male)				
	IW(g)	FW(g)	WG(g)	FCR	FCE	IW(g)	FW(g)	WG(g)	FCR	FCE
1	63.49	–	–	–	–	52.23	53.97	1.74	9.28	57.46
2	34.79	39.80	5.01	3.24	19.95	46.99	50.10	3.11	5.21	32.16
3	66.84	67.34	0.50	21.02	133.37	53.19	54.80	1.61	9.83	73.34

T=Treatment, IW = Initial weight, G = Gramm, FW = Final weight, WG=Weight gain, FCR=Food conversion ratio, FCE=Food conversion efficiency.

There was a strong correlation (r = 1.0) between weight gain and carapace-width increment in both female and male. Growth rates (Table 3) were significantly (P< 0.05) low, but systematically progressive (replicates 1 – 3) during the experiments. Carapace width of the male had the highest increment (0.50cm). The least growth (0.14cm) was recorded by the female crab.

The weights were obtained by subtracting weight of the trap from the weights of the specimen and trap:

$$WC = WTC - WT$$

WC = Weight of crab

WTC = Weights of trap and crab

WT = Weight of trap

Nutritional value of the feed was consider by adaptation of formula:

$$FCR = \frac{FC}{TWH - TWS}$$

FCR = Food conversion ratio

FC = Food consumed

TWH = Total weight at harvest

TWS = Total weight at stocking

Efficiency of conversion was also appraised:

$$FCE = \frac{TWG}{TWF} \times 100$$

FCE = Food conversion efficiency

TWG = Total weight gain

TWF = Total weight of feed intake

Descriptive statistics was carried out with generated data.

Correlation analysis was also performed to determine relationships between measured variables.

3. Results

The crabs moved away as the pellet dropped in the water. They moved around for sometimes before clinging on it with their pincers. They could pick pieces of feed on the bottom of the container with their pincers. When the water deteriorated, they raised their heads on the surface and gulped air until the water was changed. Casualty was recorded in the first treatment 8 days after stocking. The rate at which the feed was utilized for nourishment and growth is shown in Table 2. The female crabs gained more weight than the males. The highest weight (5.01g) was gained by the smallest female at conversion ratio of 3.24. In the male, highest weight gain (3.11g) was recorded by the smallest crab at conversion ratio of 5.21. The least weight gain (0.50g) was recorded by the heaviest female at conversion ratio of 21.02. Food conversion was more efficient in smaller crabs than the big ones. Efficiency values for the smallest female and male were 19.95 and 32.16 respectively. The conversion efficiency value of the biggest crab was 133.37.

Table 3: Mean growth values of *Potamon ebonicum* fed domestic catfish feed for 6 weeks

Replicate	T ₁ (Female)			T ₂ (Male)		
	Carapace width (cm)			Carapace width (cm)		
	Initial	Final	Gain	Initial	Final	Gain
1	3.50	–	–	3.50	4.04	0.50
2	4.60	4.80	0.15	4.80	5.05	0.25
3	5.60	5.70	0.14	4.00	4.20	0.20

T = Treatment, cm = Centimeter

4. Discussion

Catfishes could gulp whole pellet during feeding (Per. obs.) unlike mud crabs, which nibble at it with the aid of the pincers. Feed pellet (9mm) used in the present investigation may seem to ensure better grip by the pincers (Pers. obs.). NACA (1989)^[7] reported that food conversion ratio of the same feed varied with fish species and age, and was even lower for the adult fish. The FCR recorded in the present investigation (Table 2) may seem to be lower in the juvenile than the adult crab, probably because of the amount of trace elements and level of crude protein in the feed. Although food protein was not analytically compared with protein intake, such conversion and efficiency factors as were consider in the present investigation could be regarded as interim. Akpaniteaku (2013)^[1] has reported that more food particles than faeces were observed on the bottom of the receptacle 3 weeks after commencement of feeding. The feeding habit may seem to be responsible for disintegration of a portion of the pellet in the water. Preliminary adaptation of formula was probably necessitated by the nature of the experimental feed. Owing to possible variation in the resultant effects of feeding habit and digestion in the present investigation, digestibility was not consider. NACA (1989)^[7] reported that the same ration could have various digestibility when fed to fish species with different feeding habit and digestive enzyme. The females gained more weights than the males (Table 2) probably because of energy spent in the struggle to escape. Akpaniteaku (2016)^[4] has reported that neither the female nor male river crab (*Potamonaut ebiaensis*) struggled to escape, but none of them responded to catfish feed as quick as the mud crab. Catfish feed from Israel was used in the study and the report was a confirmation that fish feed from any parts of the globe could be used to feed crab. Small crabs seem to add more weight than the big ones (Table 2) probably because of the latent growth reserve (LGR) in the juveniles. Azra *et al.* (2016)^[8] reported that quality of crab feed generally determines the viability of juvenile and maturation process. Perhaps weight gain is dependent on sex, age and weight of the crab. Weight-gain differential of about 70% between 25g and 54g female and male crab was reported by Akpaniteaku (2013)^[1]. In the present investigation, females gained more weight than the males (Table 2), probably because more energy was spent by males than the females. Lower weight-gain in the males could also be attributed to the initial weight at stocking (Akpaniteaku, 2013)^[1]. As crabs socialize and search for food in the night, males could spend more energy, probably because of their inherent agility. Perhaps the females are less active than the males especially at night. The bigger ones seem to be less efficient in converting pelleted feed (Table 2), and decrease in efficiency level may probably be attributed to reduction in metabolic rate. However, an inference could be drawn because growing crabs seemed to be more efficient converters of feed pellet than the mature ones. The FCR and FCE followed a definite pattern in the present investigation, and seemed to serve as alternative factors for determining food quality.

5. Conclusion

Food utilization and growth study in the mud crab were experimented on equal nutritional treatments. Sampling of specimens did not lead to adjustment of feeding rate during the period. Insignificant but systematically progressive growth values were recorded during the experiments. Nutritional quality of the fish feed has justified however the

reason for preliminary nature of the study. Subsequent investigation might consider fish feed with higher crude protein than the 38 percent stuff. Adjustment of the feed quantity might enhance conversion efficiency of the crabs.

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