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Response of catfish *Heterobranchus bidorsalis* to cultured zooplankton and decapsulated artemia in the Niger Delta Nigeria

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Abstract
Study examined starter feed for Heterobranchus bidorsalis. Mixed zooplankton populations consisting of *Daphnia* and Moina species were isolated in a tank; sterilised 30 kg pig dung was used to maintain the culture. Decapsulated artemia (500g) was used. Heterobranchus bidorsalis fries were produced by hypophysation, stocked in duplicate at each three trials labelled as A1, A2 and B1, B2. Zooplankton was used to feed treatment A while decapsulated artemia was used to feed treatment B at ad- libitum, two ways Anova with Duncan multiple range test was used. The mean survival rate, specific growth rate and change in length and weight for the fish were found to be 78.8%, 8.06% 1.60 cm and 0.022g for the zooplankton fed fish and 82.0%, 6.25%, 1.17 cm and 0.17g for the artemia fed fish. The use of Zooplankton was found to give better results compared to the use of decapsulated artemia.

Keywords: Decapsulated artemia, Heterobranchus bidorsalis, Zooplankton.

1. Introduction
In the hatchery system, the development of embryos by newly hatched fry is the most sensitive and delicate part of the life history of a fish [1]. Therefore, great care must be taken to provide them with the proper enabling environment. More so [2] reported that one of the major challenges in fish hatchery management is the provision of adequate and appropriate food for fish hatchings and the success of fish hatchery operations all over the world is intricately linked to the ready availability and supply of natural food, notably zooplankton organisms and others [3]. In Nigeria and in most developing countries most fish hatcheries depend on imported artemia for their operation, neglecting the natural abundance of zooplankton of all strains in the water ways [4]. These zooplanktons could be used to substitute for decapsulated artemia which is not only costly to import but also tends to reduce the profit margin of fingerling production in fish hatcheries. The transition from endogenous to exogenous feeding is a critical period in the life of a fish and it is generally acknowledged that live food during the first few days of hatching is necessary to ensure adequate survival. Dry diets are inadequate to nourish fry during the first stages of feeding and such diets could be used successfully after the larvae has been fed on live food for some time [5, 6]. Some commonly cultured zooplankton species are Brachinous, *Daphnia*, and Monia, others are Cyclops, Copedita, and Calanoid. The use of live organisms in aquaculture has for the past few decades received tremendous attention in countries where aquaculture is well developed [4]. Noted that for the aquaculture industry to thrive apart from the development of adequate manpower there is also need to research and develop various inputs of production such as feed. The cost of feeding fish fry on artemia is very high in terms of use of only specialised personal to man the production system because of technicalities involved which only a few farmers can afford, and it adds so much to the cost of production which erodes the farmer's thin profit margin [7].
The availability of live food organisms in sufficient quantities is a major factor in the cultivation of the early stages of shellfish and finfish. Only a few live feed organisms have been used in hatcheries [8]. The zooplankton forms ideal food usually in the larva stages of prawns and in the early stage of larval stages of fish [9]. Zooplankton have been widely used for rearing fish larval stages and most studies have indicated that the fry performed better when fed live zooplankton than dry artificial diets [10, 11]. reported that the use of live feed in feeding carnivorous fish is not new in aquaculture because the natural order of carnivorous fish

like *Heterobranchus bidorsalis* encourages the fish to go for feed that they can pursue, capture and eat. This increased activity in the life of the fish also increases the ability of the fish to grow. Live feed can either be in the form of zooplankton from fresh water or capsulated artemia that requires processing. This work intends to examine the effect of live feed in the culture of *H. bidorsalis* fries.

2. Materials and Methods

2.1. Description of study Area

The experiment was carried out at the Delta State University Teaching and Research Farm, Asaba campus Nigeria between the months of January to February 2014. The entire experiment lasted for eight (8) weeks. Two major steps were involved in the experiment. They included culturing of zooplankton from pig dung and the spawning of fish along with feeding trials.

2.2. Culturing of Zooplankton

A mixed zooplankton population made up largely of *Daphnia* sp and Monia sp were isolated and cultured in a concrete tank using a slight modification to the techniques as reported by [12]. The zooplanktons used were identified by viewing water samples under an Olympus Tokyo (HSB 376700) microscope and using the identification keys given by [13]. Pig dung weighing 30kg was collected, wrapped in foil paper and autoclaved for sterilisation at 100 ^{0}C at the Delta State University Fisheries Research Laboratory. The sterilised pig dung was then tied in a sack in its cool state and suspended in a tank containing 180 litres of water. It was kept outside under illumination by the sun in order to encourage photosynthesis, and was covered with a mosquito net to avoid unwanted organisms from breeding in the dung. It was allowed to fertilise for three days before the Inoculation of the zooplankton. To ensure a continuous supply of zooplankton, the pig dung was discarded and replaced periodically and the medium was constantly aerated with an aerator.

2.3. Spawning of Fish

Spawning refers to the procedure that fish go through in order to give birth to their fry. The brood stock used for spawning was procured from a well-established farm in Asaba. After the procurement, the brood fish were disinfected with formalin. The sexes were kept separately to avoid indiscriminate spawning and were acclimatised for 24 hours.

2.3. Brood Stock Selection

The male brood stock was selected based on the following criteria:

1. Aggressiveness to other males
2. Extruding papilla that touches the base of the pectorial fin
3. Reddish reproductive organ
4. Brood stock of weight 2kg and 13 months of age

The female brood stock was selected based on the following:

5. swollen soft abdomen
6. Reddish or pinkish urogenital organ
7. Release of eggs on slight pressure to the abdomen.

2.4. Administration of Hormone

The female fish was injected intra-muscular above the lateral line just below the dorsal fin at the rate of 0.5ml of hormone (Ovaprim) to 1kg of body weight of fish. The male fish were not injected. All the broodstock were returned to solitary confinement for a latency period of nine hours.

2.5. Stripping

The male fish were sacrificed and dissected to obtain the milt. The female fish were stripped off their eggs after the nine hour of latency period, and at a time when the eggs were freely oozing out on a slight touch. The eggs were stripped into a clean receptacle and care was taken while stripping to guard eggs and milk from coming into contact with water and blood.

2.6. Fertilisation

Milt solution was prepared by macerating the milt with mortar and pestle, and mixing the extract with saline solution (0.09%). The milt solution was mixed with the eggs and mechanically shaken for one minute. The eggs were then spread out on the hatching mat.

2.7. Hatching

Hatching is simply the mechanical enzymatic process of breaking the egg shells and the release of the larva. Hatching of the eggs occurs after a fertilisation process of about 26 hours after incubation. The hatchlings have the yolk sac attached to them for periods of about three to four days when they begin to swim as fry. The fry spend 10 days in the nursery and are fed with artemia.

2.8. Experimental Design

The already acclimatised fish were counted (1000) and stocked in different tanks (A^1A^2 and B^1B^2). Tank A was fed with decapsulated artemia while tank B was fed with zooplankton (*daphnia*) on a daily basis throughout the period of experimentation.

2.8.1. Fish Sampling

The initial mean weight and total length of the fry were taken using a sensitive analytical balance and meter rule before commencement of feeding. Subsequently, the weight and total length of the fish in the experiment were observed on a weekly basis throughout the culture period of two weeks.

2.8.2. Weight Determination

The samples to be weighed were removed at random from each experimental tank and kept alive in a small plastic bowl and weighed collectively on weighing days. The fish were not fed until the whole exercise was completed. After the measurement, the fries were returned to the rearing tank to await the subsequent weight measurement. The individual mean weight gain was determined according to the formula:

$$\text{Weight gain (WG)} = \frac{W1 - Wf}{D}$$

Where WF is the Final mean weight gain (Mg), W1 is the Initial mean weight gain (Mg), D is the nursing period in days.

2.8.3. Specific Growth rate

This was estimated from the logarithm difference and initial mean weight of fingerlings according to the formula as cited by [14].

SGR = LogWz/T2 – Log W1 T1. 100

Where, W2 is the Final weight of the fish, W1 is the initial weight of the fish T2 is the Final time and T1 is the Initial time.

2.9. Statistical Analysis
Data collected and computed from the experiment was analysed with two-way ANOVA using the Duncan multiple Range Test (DMRT) to separate the mean at the 5% level of significance.

3. Results
The production parameters for the various feeding samples for the trials are presented in Table 1, Table 2 and Table 3.

Table 1: Mean production parameters of the three trials of cultured zooplankton

Feeding Sample	Treatments	WG (g)	LG (cm)	SGR (%)	SR (%)
Cultured zooplankton	1sttrial	0.019	1.37	8.20	79
	2nd trial	0.024	1.63	8.40	78
	3rd trial	0.024	1.90	7.60	60

The table above shows the weight gain (g), length gain (cm), specific growth rate (%) and survival rate (%).

Table 2: Mean production parameters of the three trials of decapsulated feed (Artemia) after 15 days of rearing.

Feeding Sample	Treatment	WG (g)	LG (cm)	SGR (%)	SR (%)
Decapsulated feed (Artemia)	1st trial	0.016	1.00	6.40	80
	2nd trial	0.017	1.07	5.70	80
	3rd trial	0.018	1.17	6.20	85.5

Table 3: Mean production parameters of the three trials of decapsulated feed (Artemia) and Cultured Zooplankton after 15 days of rearing

Feeding Sample	WG (g)	LG (cm)	SGR (%)	SR (%)
Cultured zooplankton	0.022	1.60	8.06	78.79
Decapsulated feed (Artemia)	0.017	1.17	6.1	82.25

Table 1, shows the mean production parameters of the three trials of the cultured zooplankton. It was observed that trail 2 and trail 3 produced the same mean weight gain (0.24g) which was higher against the figure for the 1st (0.019g) It also showed also the mean length gain with the 3rd trial showing the highest length (1.90cm) followed by the 2nd trial (1.63cm) and lastly the 1st trial had the lowest length gain (1.37cm). For the specific growth rate, the 2nd trial had the highest growth rate (8.40%), while the 1st trial had the second highest (8.20%) and the 3rd trial had the least (7.60%). The survival rate favoured the 3rd trial (80%), while the 1st and 2nd trial showed 79% and 78% respectively.

Table 2, shows the mean production parameters of the three trials (decapsulated feed). The 3rd trial had the highest mean weight and length gain at 0.018g and 1.17cm respectively, while the 1st trial showed the lowest with 0.016g and 1.00cm respectively. The 1st trial had the highest mean specific growth rate of 6.40%, while the 2nd trial had the least at 5.70%. The highest survival rate was achieved by the 3rd trial with 85.5, with the 2nd and 1st trial showing the same survival rate 80%.

Table 3, shows the mean production parameters for the various feeding samples. Cultured zooplankton had the highest weight gain and length gain of 0.022 g and 1.60 cm respectively, while the highest SGR achieved 8.06% and a slightly lower SR at 78.79% compared to the decapsulated at Artemia 85.5%

4. Discussion
Food supply during the larval stage is an important factor in achieving high survival and growth rates. The mass mortality of larval and juvenile fish will often occur if the food supply is inadequate or of a poor quality [15]. It is therefore important to use the most appropriate form of feed in raising fries as early as possible, such as when the first time feed is administered to the fish. Different species require different sequential food during the early stage of their lives. Most fresh water fish species are given Rotifer or Moina as a first feeding [16] and artificial feeds for juveniles are generally in the form of fine crumbles of appropriate particle size. The larval *Heterobranchus bidorsalis* (catfish) is no exception. It was found in this study that larval catfish of age 3 to 15 days (average total length 1.167 to 1.600cm) consumed zooplankton and gave better growth compared to those fed with decapsulated feed [17]. Inferred that in Japan, newly hatched fries greater than 2.3mm of body length were exclusively fed with live feed. When the fish reaches 7mm or more, marine copepods such as Tigriopus, Acartia, Dithona and *Paracalamus* were given. This study has also shown that larval catfish fed with zooplankton show the highest specific growth rate, and with the use of zooplankton the incidence of water pollution was reduced to a minimum because fries pick all the food made available while they joyfully swim around looking for more. In this present study, fries fed with artemia have the highest survival rate compared to those fed with zooplankton under culture this could be attributed to the fact that to catch zooplankton a little bit of motion is required, weak fry and fry that might become stunted at maturity are systematically removed from the stock even at this stage of production. This saves farmer space, energy and resources that would be wasted if these never do well fry were reared to maturity. The inferences from this study reveal that zooplankton gives better results and should be fed to the larval of catfish (*Heterobranchus bidorsalis*). It is recommended that further studies be carried on the culture and use of zooplankton as fish feed.

5. Conclusion
The use of live food in feeding carnivorous fish like *H.bidorsalis* is a necessary management procedure that would improve production and reduce famer spending on decapsulated artemia. Live food does not easily pollute water this also will reduce very close monitoring required when artemia is used.

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