



# Effects of Stocking Density on the Fasting Resistance of the African Catfish *Heterobranchus longifilis* (Valenciennes, 1840) Larvae

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**Abstract** – After the artificial reproduction of catfish *Heterobranchus longifilis*, two experiments were conducted with larvae of two days with an average weight of  $2.75 \pm 0.15$  mg. The aim of the first was to evaluate the resistance of larvae at fasting depending on the density whereas the second was to determine the resistance threshold of these larvae.

The results of the first experiment showed that the density does not influence the resistance of the larvae ( $p > 0.05$ ). However, the first mortalities and the highest daily mortalities were recorded respectively at J5 and J9 for three densities. All larvae died at J11 for the density 1 and at J12 for the other densities. Moreover, the results of the second experiment showed that larvae can resist until J9 and stay alive if the fasting is broken.

**Keywords** – Fasting, *Heterobranchus Longifilis* Larvae, Mortality, Resistance Threshold.

## I. INTRODUCTION

African catfish is one of the most suitable species for aquaculture in West Africa and particularly in Côte d'Ivoire because of its biological and ecological characteristics ([13], [15], [7], [9], [3]). However, the crucial phase of production of this species is the larval rearing due to many factors including diet ([1]). Therefore, several studies were conducted on feeding catfish and particularly of *Heterobranchus longifilis* during larval rearing. The results showed that *Artemia salina* is the food most used and best suited for this species at this stage ([10], [2], [14]). But, the high cost and availability of this food ([9], [1]) increase the cost of production of these fish. Failing not to give it during the whole time of rearing, reduce its use time could help to decrease the cost of *H. longifilis* production. It's in this context that we undertake this study to determine the threshold of resistance of this species larvae and to assess the effect of stocking density on this resistance.

## II. MATERIALS AND METHODS

*Heterobranchus longifilis* larvae were obtained after artificial fertilization at the hatchery of the Centre de Recherches Océanologiques d'Abidjan using methods developed as in [12]. For this study, two experiments were conducted simultaneously with larvae of  $2.75 \pm 0.15$  mg mean weight.

During the first experiment that lasted twelve days, three (3) batches of 30, 60, and 90 larvae corresponding respectively to densities of 1, 2, and 3 larvae/ml were formed (with triplicate) in bowls to assess the effect of density on the resistance of larvae. They were not fed during the experiment. Each day, water was renewed at half in each bowl and mortalities counted. The experiment ended when all the larvae in the bowls were dead.

The aim of the second experiment is to see how long the larvae, starved, could remain alive if they were fed. For this, batches of thirty (30) larvae of the same mean weights as previously were formed into bowls and fasted. The experiment began when the first mortality was observed in one of the bowls of the first test. From that day, the first batch began to receive its first diet, then a second the next day and so on until larvae fed of last batch, could not survive despite food distribution. The experiment was stopped when all larvae fed of the last batch died the day after their first feeding.

Water temperature and dissolved oxygen were measured daily using a oxygen meter Crison (Oxi 330); pH was determined daily using a pH meter (model WTW). These measurements were performed in each bowl every morning by immersing directly the probe in the container. Statistical analyses were performed using STATISTICA 7.1 software. The results were expressed as mean  $\pm$  standard deviation. In the first experiment, an analysis of variance (ANOVA) was performed on the daily mortality related with the different stocking densities.

## III. RESULTS

### 3.1. Water quality

The mean values of temperature, pH and dissolved oxygen recorded in different bowls during the tests were respectively  $27.1 \text{ }^\circ\text{C} \pm 0.2$ ,  $7.2 \pm 0.2$  and  $5.9 \pm 0.2$  mg/l.

### 3.2. Effects of stocking density on the fasting resistance

Fig. 1 shows the daily mortality rate of larvae at three densities depending on age. The results showed that first mortalities were observed at J5 for the three densities. Mortality rates were 6.67 %, 1.67 % and 1.48 % respectively for density 1, 2, and 3. The highest daily mortality was recorded at J9 for all densities (50 % for density 1, 51.67 % for density 2 and 38.15 for density 3).

All larvae died at J11 for density1 and at J12 for the two other densities. The results obtained in this study showed no significant difference in daily mortality for triplicates at each density, neither at all densities over the entire duration of the experiment ( $p > 0.05$ ).

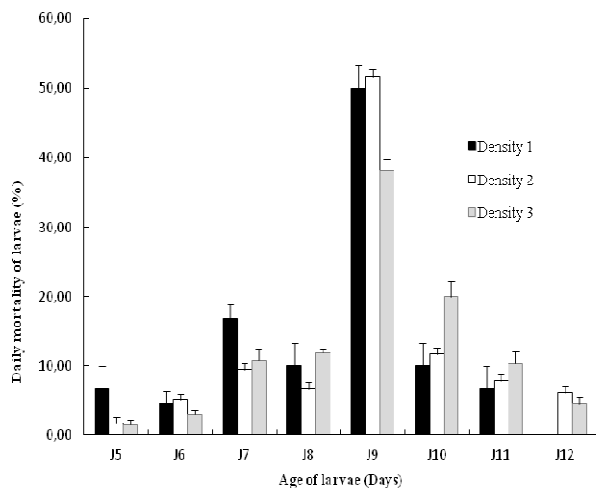


Fig.1. Daily mortality rate of *H. longifilis* larvae at three rearing densities according to age

### 3.3. Determination of larval threshold of resistance

The results of larval threshold of resistance and their survival rate are reported in Table I and Fig. 2. In this experiment, despite the fasting, some larvae fed from J5 to J8 survived. In contrast, those fed at J9 all died the day after their first feeding. At the end of the experiment (J13), respectively 15, 13, 16, and 10 larvae remained alive in the first, second, third, and fourth batch fed. The largest number of alive larvae was observed in the batch III (16), I (15), II (13), and finally the batch IV with only 10 individuals.

Fig.2 gives the survival rate of larvae for each batch fed after the fasting. The survival increased with the time until the third batch fed (from J7) that gave the highest rate (61.54%). The lowest survival rate was recorded in larvae of the fifth batch fed at J9. This rate is zero (0%).

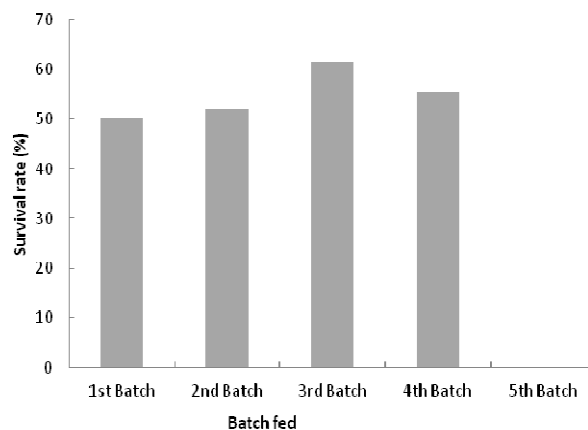


Fig.2. Survival rate of *H. longifilis* larvae in each batch fed

## IV. DISCUSSION

During our study, the physico-chemical parameters such as temperature, dissolved oxygen and pH varied very little and did not really influence our results. They were in the range recommended by many authors for juvenile catfish rearing ([5], [11], [16]). It is from 10 to 35 °C for the temperature, higher than 3 mg/l for dissolved oxygen and 6.5 to 8.0 pH ([17], [6]). The stability of these factors could be explained by the daily replacement of substantially all of the water in the bowls. This one remained relatively clean due to the non-distribution of food on a relatively long period.

The first test showed that the resistance of larvae to the fasting does not depend on the rearing density. Indeed, whatever the density, first mortalities occurred at J5 on the third day of fasting. These mortalities can concern likely the feeblest larvae. They increased gradually as the fasting lasted until J9, where the highest daily mortality was recorded for the three densities. This could be explained by the fact that the larvae have exhausted their yolk sacs and used their body reserves to survive until J9. As these were exhausted, the majority of larvae died. Furthermore, all larvae died at J11 for density 1 and at J12 for the densities 2 and 3. These mortalities related to the most resistant larvae, having exhausted their yolk sacs and body reserves, were able to resist another two to three days before dying. According to the law of nature, in a lot of individuals of the same age living in the same conditions, there is always the weakest and the strongest. In the case of our study, the weakest larvae were the first to die at J5 and the strongest were those who could stand up to J11 and J12. These results might suggest delaying the first feeding of *Heterobranchus longifilis* larvae.

The second test revealed that after the fasting, the larvae were able to survive if the fasting was broken at J8, evidenced by the high number of alive larvae the next day after the feeding of each batch and at the end of the experiment. Indeed, the larval survival obtained at the end of the experiment, gradually increased until the third batch before declining for the fourth. This decrease in survival could be explained by the weakening of larvae due to the duration of fasting. Moreover, these results confirmed those of the first experiment which showed that for all

Table I: Resistance threshold *Heterobranchus Longifilis* larvae according to time

Age of larvae	1 <sup>st</sup> Batch			2 <sup>nd</sup> Batch			3 <sup>rd</sup> Batch			4 <sup>th</sup> Batch			5 <sup>th</sup> Batch		
	NAL	DM	TM	NAL	DM	TM	NAL	DM	TM	NAL	DM	TM	NAL	DM	TM
J5	30*	0	0	29	1	1	27	3	3	29	1	1	29	1	1
J6	22	8	8	25*	4	5	26	1	4	23	6	7	22	7	8
J7	21	1	9	22	3	8	26*	0	4	21	2	9	22	0	8
J8	18	3	12	19	3	11	25	1	5	18*	3	12	20	2	10
J9	17	1	13	17	2	13	24	1	6	15	3	15	16*	4	14
J10	16	1	14	15	2	15	20	4	10	13	2	17	0 <sup>n</sup>	16	30
J11	15	1	15	14	1	16	18	2	12	12	1	18			
J12	15	0	15	13	1	17	17	1	13	11	1	19			
J13	15 <sup>n</sup>	0	15	13 <sup>n</sup>	0	17	16 <sup>n</sup>	1	14	10 <sup>n</sup>	0	20			

- DM: Daily Mortality

- TM: Total Mortality

- NAL: Number of Alive Larvae

- \*: Number of alive larvae at the first feeding

- <sup>n</sup>: Number of alive larvae at the end of experiment

densities, the highest daily mortality was observed at J9 which is in fact, the threshold of resistance of *Heterobranchus longifilis* larvae to the fasting. During this second test, all the larvae fed at J9 died the next day because they were very weak and exhausted. They therefore could not survive to the prolonged fasting. These results were also due to the fact that, after a certain degree of fasting called "point of no return" weakened animal became unable to feed and was condemned to perish even in the presence of food ([8]). It also seems that food deprivation enhance the DNA content of the larva as is the case for the species *Dicentrarchus labrax* ([4]). That could possibly be check for *Heterobranchus longifilis* larvae in future work.

## V. CONCLUSION

At the end of this study, we can say that the resistance to fasting of *Heterobranchus longifilis* larvae did not depend on the rearing density. The first mortalities occurred at J5, whereas the majority of larvae died at J9 considered as the threshold resistance to fasting of these larvae. The best survival rate was obtained with larvae of batch 3 fed at J8. In view of these results, we could delay the first feeding to J4 or to J5 in order to economize Artemia. In addition, further work could afford to see the influence of this delay on the survival and larval growth of *Heterobranchus longifilis*.

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