ASPECTS OF THE REPRODUCTIVE BIOLOGY OF HATCHERY–REARED *Clarias gariepinus* (BURCHELL 1822) IN ANAMBRA STATE, NIGERIA II: EGG DIAMETER

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ABSTRACT

The egg diameter distribution frequency of four batches of hatchery–reared gravid Clarias gariepinus with 10 fish per batch of varying fish weights per batch, namely: 60 ± 0.09 g, 125 ± 0.11 g, 250 ± 0.14 g and 500 ± 0.12 g was studied. Eggs from paired ovaries hardened with 1% formalin in 0.6% saline solution for 3 weeks to become non-clumping were graded through a stack of eight sieves with mesh sizes: 0.3 mm, 0.5 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm, 1.8 mm and 2.0 mm. The different batches of similar sized eggs retained at each sieve were counted. The mean egg counts of diameters of 0.3 mm, 0.5 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm and 1.8 mm were 402.35 ± 70.85, 682.90 ± 104.40, 65.775 ± 10.82, 364.70 ± 69.26, 1829.0 ± 378.36, 78.0750 and 18.45 ± 5.64 eggs, respectively. Of the seven (7) egg diameter frequencies (0.3 mm, 0.5 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm and 1.8 mm) monitored, the mean egg diameter frequency of 1.2 mm showed the highest egg peak and that of 1.8 mm showed the least egg peak. There were bimodal peaks occurring at 0.5 mm and 1.2 mm in the egg distribution frequency chart indicating that C. gariepinus can spawn more than once in a breeding season.

Keywords: Gravid *Clarias gariepinus*, Hatchery–reared, Egg diameter, Bimodal peaks, Mesh size

INTRODUCTION

Aquaculture in Nigeria is not making any serious impact in fish production accounting only for about 6 % of the total domestic fish production owing to low rate of financial return to the aquaculture venture. Numerous fish farms and single ponds are currently abandoned throughout Nigeria as a result of this poor return on investment. Egwui (1999) implicated lack of fast growing indigenous fingerlings as the cause of the low fish yield experienced by farmers. Lagler *et al.* (1977) and Viveen *et al.* (1985) had earlier separately demonstrated that an egg batch from the same brood *Clarias gariepinus* contains eggs of varying diameters. Lagler *et al.* (1977) reported that the larger the egg with larger amounts of nutrient, the greater the egg potentials and the greater the chances of survival of the resulting larva. These facts must have compelled some workers to investigate the egg diameters of wild *C. gariepinus* with particular emphasis on grading the eggs into varying sizes. Clay (1979) found *C. gariepinus* to have egg size distribution to range from 0.3 mm to 1.7 mm and bimodal peaks occurring at 0.3 mm and 1.2 mm. Ezenwaji (1998) reported *C. albopuntactus* from the flood plain of the River Anambra, Nigeria to have egg size distribution ranges from 0.35 mm to 1.75 mm with bimodal peaks occurring at 0.35 mm and 1.21 mm. Clay and Clay (1981) reported bimodal peaks in *C. gariepinus*. Nawar and Yoakim (1962) found the diameter of *C. gariepinus* ripe eggs to range from 0.902 mm to 1.250 mm with a unimodal egg distribution and

suggested a single annual spawning. Raji *et al.* (2003) reported that the ripe egg capsule diameter of *Mystus montanus* ranged from 1.2 mm to 1.3 mm. Most reports on egg diameter distribution are on wild *C. gariepinus*. The aim of this work is to find out the egg diameter distribution of hatchery–reared gravid *Clarias gariepinus* of varying weights.

MATERIALS AND METHODS

Experimental Fish: Four batches of gravid *C. gariepinus* with 10 fish per batch of varying weights (60 ± 0.09 g, 125 ± 0.11 g, 250 ± 0.14 g and 500 ± 0.12 g) were selected from Felisenco fish farm, Anambra State, Nigeria. Each of these fish was weighed (g) with a 1 kg top loading balance. The brood fish were electroanaesthetized by passing electric current through a bath of water in which they were kept. Each fish was dissected and the paired ovary removed and preserved in 1 % formalin in 0.6 % saline solution (Shahedah *et al*., 1973) for 3 weeks prior to fecundity and ova diameter studies. The solution hardened the eggs and removed any clumping of the egg.

Fecundity and Eggs Diameter: After 3 weeks, fecundity was determined for the forty (40) females by counting sub samples of eggs contained in each of the paired ovary, the total number of eggs per paired ovary determined volumetrically (Salt and Hollick, 1944). Eggs in each paired ovary were graded through a stack of eight sieves of mesh sizes: 0.3 mm, 0.5 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm and 1.8 mm. The sieves were stacked in descending order of pore size with the 2.0 mm on top and 0.3 mm at the bottom. The mesentery of each paired ovary was removed by pulling the ovary apart in a stream of water over a stack of the eight graded sieves. The mesentery and other tissues were held on the 2.0 mm sieve, while the largest eggs were collected on the 1.8 mm mesh sieve. Eggs smaller than each mesh size passed through it progressively until the smallest sized eggs were caught at the 0.3 mm sieve. The graded eggs from each paired ovary were separately stored in 1 % formalin in 0.6 % saline solution for counting using modified Salt and Hollick (1944) volumetric method. All the eggs contained in each mesh sieve were added into a 25 ml capacity measuring cylinder and water was added to the cylinder to bring the volume to the mark. The egg content was poured into a small beaker and mixed thoroughly by constant agitation. During the agitation, three samples of 2.4 ml were drawn into a standard micropipette and delivered into three clean Petri dishes and separately counted by means of eye aided by a hand lens. The mean egg count of the three samples was taken as the number of eggs (n) in the 2.4 ml sample (v). The egg count in each mesh was calculated by the formula: $N = V \times n/v$, where N = total egg counts in each mesh, V = total volume of eggs in each mesh, n = mean number of eggs in the sub sample and v = volume of eggs in each sub sample. The egg diameters of 10 eggs from each sub sample were confirmed by the use of graduated ocular micrometer. The same operation was carried out for the 40 fish samples under study.

Data Analysis: The mean egg counts obtained from the seven mesh sieves were presented. The mean egg counts were subjected to analysis of variance (ANOVA) for significant differences at 5 % probability. Any significant differences found were partitioned with the Duncan's New Multiple Range Test (DNMRT) multiple comparisons.

RESULTS AND DISCUSSION

The relationship between fecundity and egg diameter distribution frequency in a population of 40 brood *C. gariepinus* indicated that the mean egg counts for mesh sieves 0.3 mm, 0.5 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm and 1.8 mm were 402.35 ± 70.85, 682.90 ± 104.40, 65.78 ± 10.82, 364.70 ± 69.26, 1829.0 ± 378.36, 78.0750 ± 15.64 and 18.45 ± 5.64 eggs, respectively (Figure 1). The DNMRT multiple comparisons partitioned the mean egg counts at different mesh sieves into three subsets revealing that the mean egg count at 1.2 mm gave the highest number of counts. It also revealed that there was no significant

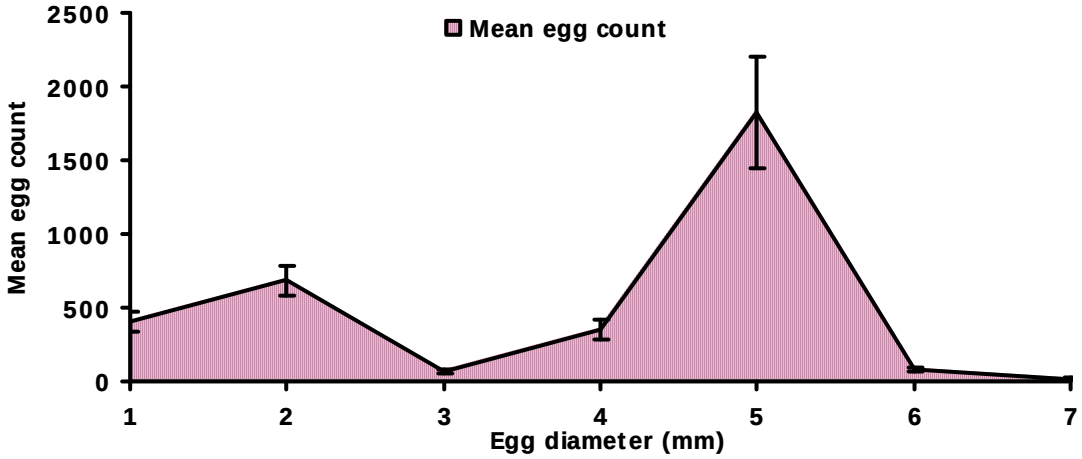

Figure 1: Mean fish egg count per egg diameter of hatchery–reared Clarias gariepinus (Burchell 1822)

difference (P > 0.05) between mean egg count in 0.3 mm mesh sieve and 1.0 mm (Figure 1). Also, there was no significant difference (P > 0.05) between mean egg count in 0.8 mm mesh sieve and the mean count in 1.4 mm and 1.8 mesh sieves. However, there were significant differences (P < 0.05) between the mean egg count in 0.5 mm mesh sieve and the rest of the eggs collected at the other mesh sieves and between the mean egg count in 1.20 mm mesh sieve and the rest of the mesh sizes.

The result revealed that the egg count at the 1.2 mm mesh sieve had the highest peak and that 1.8 mm mesh sieve had the least peak. Furthermore, our result showed clearly that bimodal peaks occurred at 0.5 mm and 1.2 mm (Figure 1). A modal peak is adjudged to occur when a peak in between two other peaks is higher than the peaks on either side. The existence of bimodal peaks in this study agreed with the findings in wild gravid *C. gariepinus* of Clay (1979), Clay and Clay (1981), Ezenwaji (1998) and Eyo and Mgbenka (1992) but the modes however, occurred at points that did not agree with these workers. Whereas, Clay (1979), Clay and Clay (1981), Eyo and Mgbenka (1992) obtained their modal peaks at 0.3 mm and 1.2 mm and Ezenwaji (1998) recorded the peaks at 0.35 mm and 1.21 mm, the modal peaks in this study occurred at 0.5 mm and 1.2 mm. The existence of bimodal peaks suggested that *C. gariepinus* can spawn more than once in a breeding season. This was in agreement with the findings of Corbet (1960), Clay (1979) and Ezenwaji (1998) for wild *C. gariepinus*; spawning more than once in a breeding season. This attribute may be of interest to fish breeders since it allows the possibility of spawning the same fish more than once within a breeding season even in aquaculture condition.

When the occurrence of eggs at 0.3 mm and 0.5 mm for the four batch weights in this study was compared (Table 1), it was observed that the ratio of number of eggs at 0.3 mm to 0.5 mm for the 60 g was about 1:1.

Table 1: Fecundity and egg diameter distribution frequency in a population of 40 *Clarias gariepinus* brood fish[1]

Egg diameter (mm)	Egg range
0.3	58 - 1985
0.5	107 - 2455
0.8	7 - 273
1.0	11 - 1542
1.2	218 - 11098
1.4	5 - 477
1.8	0 - 134

[1]Means followed by the same superscripts are not significantly different (P > 0.05).

When this comparison was done for 125 g fish, the ratio increased to about 1 : 1.2 in favour of 0.5 mm eggs. On comparing the ratio of the 250 g fish, the ratio was about 1 : 1.3 in favour of 0.5 mm. Finally, when the ratio of 0.3 mm eggs to 0.5 mm eggs was compared for the 500

g fish, the ratio further increased to about 1 : 1.5 still in favour of 0.5 mm eggs. This indicated that as the weight of the gravid fish increases, the ratio of 0.3 mm eggs to 0.5 mm eggs also increased. From the results of this study on egg diameter distribution, it appeared that the hatchery-produced brood *C. gariepinus* possessed larger eggs (1.8 mm) than the wild stock (1.4 mm) reported by Eyo and Mgbenka (1992). It, therefore, indicates that the hatchery-reared *C. gariepinus* might be a better brood fish than wild stock in producing fingerlings for farmers' grow-out ponds.

The occurrence of a modal peak at 0.5 mm egg diameter in this study instead of at 0.3 mm egg diameter for wild *C. gariepinus* as reported by Clay (1979), Clay and Clay (1981), and Eyo and Mgbenka (1992) is a strong indicator that if eggs from 1.0 mm to 1.7 mm are spawned (Clay, 1979) the 0.5 mm size eggs will mature faster into ripe eggs than the 0.3 mm eggs making it more possible for the fish to spawn more than once in a breeding season. This would make hatchery-produced brood stock preferred to the wild stock by fish breeders who can spawn the same fish more than once in a breeding season. Hatchery-raised fish tend to be better fed than wild fish hence the enhanced ovarian larger diameter. From earlier works, wild *C. gariepinus* eggs with diameter up to 0.75 mm were said to belong to stage II (unripe) catfish (Eyo and Mgbenka, 1992; Mgbenka and Eyo, 1992). These eggs occur either as the fish matures from stage I (immature) catfish or recovers from being spent. This group of eggs had been hormonally manipulated with 0.5 IU of purified human chorionic gonadotropin (HCG) per g body weight of fish. Our present study indicates that the limit of this category of unripe eggs occur at an upper limit of 0.8 mm (Figure 1), implying that the hatchery-raised fish could attain maturity under hormonal treatment much earlier.

The seven egg diameter distribution of the 40 gravid hatchery-produced *C. gariepinus* showed the highest egg peak at 1.2 mm indicating that the critical egg diameter of the fish is 1.2 mm. The egg diameter differed from the critical egg diameter of 0.3 mm for the wild stock reported by Eyo and Mgbenka (1992). The occurrence of a lower modal peak at 0.5 mm in this study differs from the lower modal peak at 0.3 mm reported by Eyo and Mgbenka (1992) for the wild stock. The largest egg diameter of 1.8 mm for the hatchery-reared brood *C. gariepinus* in this study differs from the largest egg diameter of 1.4 mm reported by Eyo and Mgbenka (1992) for the wild stock.

The low occurrence of largest eggs (1.8 mm) in the egg population of *C. gariepinus* indicates that very few largest larvae (shooters) would be present in a larval population of the fish under study; Lagler *et al.* (1977) stated that large eggs produce large larvae. It is hereby recommended that more workers should investigate the egg diameter distribution frequency in a population of hatchery-reared *C. gariepinus* of known weights. The information obtained would enable a meaningful comparison between the situation in the wild stock and the tamed stock.

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