



# Aspects of the Reproductive Biology of *Tilapia Guineensis* (Bleeker, 1862) Under Laboratory Conditions

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## ABSTRACT

Aspects of the reproductive biology of *Tilapia guineensis* was carried out in the laboratory. Twelve ripe male and female brooders of *T. guineensis* (body length, 12.2 - 12.9cm and weight, 100 – 130g) paired 1≡: in triplicate were made to spawn naturally in glass aquaria (60 x 30 x 30cm<sup>3</sup>). Results show mean fecundity to be 1,269 eggs per female spawner with mean egg size of 1.48mm. Hatching of eggs started 47-48hours after fertilization at a mean temperature of 27.4°C. Percent hatch was 74.8% and length of hatchling as 3.8mm. Time of yolk sac absorption was observed to be 4 days with swim-up fry length, 5.7mm and weight, 1.67mg. Parental care was prominently displayed by both parents.

## Keywords:

*Tilapia guineensis*, reproduction, aquaria, brackish water

## INTRODUCTION

The brackish water zone of the Nigerian coast which includes creeks, lagoons, rivers and mangrove swamps has tremendous potential for fish farming. It is estimated that the saline swamps in the Niger Delta area alone cover 5,048km<sup>2</sup> and out of which about 3,108km<sup>2</sup> could probably be used (Scott, 1966). For the development of brackish water fish farming, several species have been considered as potential candidates. *Tilapia guineensis* is the only popular and true estuarine species that is commonly cultured in the brackish water region in Nigeria (Horsfall, 2006; Musa et al., 2006). However, experimental reports on its performance in culture are limited (Magnet and Kouassi, 1979).

*Tilapia guineensis* is a nest builder and has a great capacity to adapt its reproductive behaviour to the environment. In concrete tanks, the eggs are simply laid on the wall to which they adhere (Legendre and Ecoutin, 1989). The development of *T. guineensis* commences immediately after successful spawning and fertilization of the eggs. Isaac – Harry (1986) reported that *T. guineensis* is relatively fecund and a multiple female spawner. Fagade (1979) and Eyeson (1983) reported that *T. guineensis* reproduce all year round in West African regions. *Tilapia* lives in aquaria spawn throughout the year provided the temperature of the water is maintained at 25-30°C and other living conditions such as photoperiod and aeration are adequate (Mires, 1977). Data on the reproductive biology of *T. guineensis* in their natural environment are rather scarce and inadequate (Fagade, 1979; Legendre and Ecoutin, 1989). Therefore the purpose of this study is to provide information on the reproductive characteristics and development of *T. guineensis* to enhance management and improve the production of seeds for brackish water farming practice.

## MATERIALS AND METHODS

### Experimental Site

The study was conducted between March and April, 1989 at the Department of Fisheries Laboratory of Rivers State University of Science and Technology, Port Harcourt, Nigeria.

### Collection of Brood fish

Adult *Tilapia guineensis* broodfish (body length, 12.2 – 12.9 cm and weight, 100 - 130g) for this experiment were obtained from the University's brackish water fishponds with the aid of cast nets and wire traps. The fish collected were transported alive in plastic containers with water to the Department of Fisheries Laboratory. Individual brooder was identified, hand sexed and separated into separate larger containers. The fish were

fed a locally compounded feed of 30% crude protein, twice daily at the rate of 3% of their total weight for 7 days prior to using them for spawning.

### Natural Spawning in Aquaria

Three separate glass aquaria measuring 60 x 30 x 30cm<sup>3</sup> were used to spawn *T. guineensis* in the laboratory. Each aquarium was filled with filtered and aerated saline water to the 40-l mark. Opposite sexes of the broodfish were paired and introduced into each aquarium at 1:1 ratio in triplicate. The pairs were allowed to spawn and fertilize the eggs produced.

The broodfish were not fed during the spawning period but the water was changed daily at 0730 hours and aerated. Fish were observed to spawn after 2 days of pairing. The eggs were observed 12- hourly, counted and a sample of 10 eggs taken and sizes measured. The eggs were allowed to incubate and hatch inside the aquaria through constant mechanical aeration. The male broodfish removed and the sac fry counted by siphoning them into a bowl.

Samples of 10 hatchlings were taken and their body lengths and weights measured using a metal rule and a balance. Percent hatch was calculated as

$$\frac{\text{Number of hatched fry}}{\text{Total number of eggs}} \times 100.$$

The female broodfish was also removed from the aquaria 4 days later when the fry attained swim-up stage of development. The body lengths and weights of the swim-up fry were also determined similarly as the hatchlings. Water temperatures and salinities were recorded three times daily with a mercury-bulb thermometer (0-100°C) and salinity refractometer respectively. Dissolved oxygen was determined by methods described by Boyd (1979).

## RESULTS

### Spawning Behaviour

In the laboratory, the pair of male and female breeders in the aquarium was observed to flay their tails and nip each other. Both sexes were always found together and aggressive. During spawning, the female laid the eggs at one corner in rows while the male spread milt on the eggs as it swam over them.

### Hatching of Eggs

Table 1 gives detail of the spawning data during this experiment. The mean number of eggs produced was 1,269 and these hatched within 47-48hours at a mean

water temperature of 27.4°C. The mean diameter of an egg was 1.48mm. Guarding and ventilation of eggs was effected by both the male and female parents. Percent hatch of the eggs was calculated as 74.9%. The parents were also observed to occasionally pick the weak hatchlings into their mouths and threw them to a distance. This action probably got the hatchlings detached from their shells.

### Water quality measurements

Table 2 shows the summary of the water quality data obtained during this study. Temperature ranged 26.0-28.0°C with a mean value of 27.4°C. Mean salinity and dissolved oxygen values were 19.5ppt and 5.5mg/l respectively.

**Table 1: Spawning results of *Tilapia guineensis* in glass aquaria**

Parameter	Values
Pairing ratio of brood fish for spawning	1:1
Mean total body length of brood fish :	12.9 cm 12.2 cm
Mean weight of brood fish :	130 g 100 g
Time of spawning	2 days (after pairing)
Mean Number of eggs produced/ brood fish	1,269
Mean egg diameter	1.48 mm
Egg hatching time after fertilization	47-48 hrs
Mean number of hatchlings (sac fry)	950
Percent hatch	74.9%
Length of fry at hatching	3.8 mm
Time of yolk absorption	4 days
Length of fry at swim-up stage	5.7 mm
Weight of fry at swim-up stage	1.67 mg
Parental care	Yes (both parents)

**Table 2: Mean and Range values of water quality parameters during spawning of *Tilapia guineensis* in glass aquaria**

Parameter	Values
Temperature, °C	27.4 (26.0 – 28.0)
Salinity,ppt	19.5 (19.0 – 20.0)
Dissolved oxygen, mg/l	5.5 (4.5 – 6.2)

Figures in bracket are range values of parameters.

### DISCUSSION AND CONCLUSION

The result of the study on the reproductive behaviour of *T. guineensis* showed that prior to spawning, the breeders cleaned the corners of the aquaria of any dirt. This is a corresponding activity they perform in the wild (Campbell, 1987). The observed egg size for *T. guineensis* in this study fall into the range observed for *Tilapia zilli* eggs, 1.1-2.0mm (Jegade and Fawole, 2006). Holden and Reed (1972) stated that these two species may be very similar and only variants. The body length of *T. guineensis* hatchling was observed to be 3.8mm in this study. Campbell (1987) reported in a review of the biology of *T. guineensis* that at temperatures greater than 26°C, the eggs hatch in 2 days and the yolk sac

absorbed 4-5 days later. This information corroborated the results obtained for *T. guineensis* on corresponding hatching time and temperature.

Uka and Sikoki (2011) reported that the salinity range of 0-17 ppt was favorable in the spawning and hatching of fertilized eggs of *T. guineensis*. The 19.0-20.0 ppt salinity range observed in this study was slightly higher indicating that *T.guineensis* could tolerate more than earlier reported. The dissolved oxygen mean value of 5.5 mg/l equally favoured the performance of *T.guineensis* during spawning, fertilization of eggs and development into full embryo.

The observations of Hanon (1975) on egg and larvae sizes of 2.7mm and 5.0-5.5mm respectively were slightly higher than values obtained in this study. This

could be due to differences in sizes of fish used for spawning (De Martini, 1991) and the environmental or ecological conditions before and during spawning exercise (Jegade and Fawole, 2006). The report on parental care exhibited by both male and female parents on eggs and hatchlings corroborated the activities of *T. guineensis* spawners in the wild (Holden and Reed, 1972). This action is vital to the survival of the hatchlings and their early life orientation which is to aggregate together.

The successful breeding of *T. guineensis* in a glass aquarium other than pond environment pave the way to a practice that would prevent the infiltration of different species into the breeding stock completely. Hence experiments to find clues to the perennial problem of prolific spawning behaviour of Tilapias could be conducted easily.

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