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Breeding behaviour of Malabar Butter Catfish, *Ompok malabaricus* (Valenciennes 1840), under captivity

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ABSTRACT

Induced breeding of a silurid catfish *Ompok malabaricus* (Valenciennes 1840) was successfully carried out in captivity, using Wova-FH @0.5 ml/kg- body weight. Sexual dimorphism, courtship behaviour, and egg-guarding activity by brooders were documented. The experiment was also carried out to determine the role of parents in improvising the hatchability of the eggs. Eggs kept along with brooders showed a 100% hatching rate, whereas eggs kept without brooders didn't hatch out. In the present study, it was observed that the eggs guarded by the parents remained clean and showed an increased hatching rate. Thus, the study reveals that parental care is present in *Ompok malabaricus*.

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1. Introduction

Catfishes of the genus *Ompok* (La Cepède, 1803) are medium-sized members of the family Siluridae, and they are usually found in lakes and large rivers throughout India and Southeast Asia; apart from this, they form a very important group of fishes having immense commercial importance (Ng and Hadiaty, 2009). The Malabar butter catfish *Ompok malabaricus* (Valenciennes,1840), is endemic to the rivers originating from the Western Ghats Mountain range of peninsular India, and they are locally known as *Chotta vala* (Abraham, 2011).

Due to the incomparable variability of reproductive and social patterns, fishes are unique among vertebrates (Taborsk, 1999; Setu and Ajithkumar, 2010). Courtship behaviour is an important nature of brooders, which varies from simple swimming of the pairs together to complex act of nest building and the strong struggle of the males is essential in group spawning (Paray *et al.,* 2013). Spawning failure is reported without courtship behaviour (Marimuthu *et al*., 2001). Size of the body, skin colour, environmental parameters, breeding history, maturity stage of the female, aggressive behaviour of Male, etc., are the factors that affect the courtship behaviour in several species (Arockiaraj *et al.*, 2004; Deaton, 2008; Marimuthu *et al.*, 2001).

Guarding eggs is a general form of parental care (Clutton-Brock, 1991), and in most species, only one parent is involved in parental care. Among the teleost, parental care by males is more prominent than parental care by females, with 61% against 39%, and biparental care is observed in less than 25% (Gross and Shine, 1981). Increased hatchability and survival rate are the major benefits of parental care (Baylis, 1981).

A good number of workers have taken up trials on the captive breeding of *Ompok pabda* (Bhowmick *et al*., 2000; Chakrabarty *et al*., 2005, 2007; Chakrabarti *et al*., 2009; Mukherjee *et al*., 2002; Purkayastha *et al*., 2012; Sarkar *et al*., 2005), however, a few attempts have been made on *Ompok bimaculatus*, (Banik, 2010; Banik *et al*., 2011; Raizada *et al*., 2013and Sridhar *et al*., 1998).

O. malabaricus is bred for the first time under captivity, and no literature is available regarding their breeding behaviour. The objective of the study is to observe the breeding behaviour and to check the hatchability of eggs with and without parents. The present study illustrates the spawning behaviour of the Malabar butter catfish *O. malabaricus* induced with the synthetic hormone Wova-FH.

2. Materials and Methods

The sampling site was selected based on the presence of submerged roots of trees and shrubs and a canopy cover greater than 75%. Considering the nocturnal behaviour of the species fish trap filled with chicken viscera is placed in to the deep pools of River Periyar (10°07'50.2"N 76°45'29.0"E), during the late afternoon for the collection of sub adults of *O. malabaricus*. Fish entrapped were transferred safely in to the hatchery for broodstock development.

2.1 Experimental set-up

The broodstock were maintained in glass aquarium (75X45X45 cm) of 150 Litre (L) capacity with a filled volume of 100 L. The tanks were equipped with a biofilter system. The water quality parameters were maintained in the optimum range for the broodstock (Aneesh *et al*.,2013). The tanks were exposed to a natural photoperiod of 12L:12D

2.2. Experiment 1

The broodstock was taken out of the water for the injection and transferred into a spawning tank after injection. The spawning tank (FRP) of 1000 L capacity is filled with 500 L of filtered fresh water. A submerged aquatic plant *Ceratophyllum demersum* was provided in the spawning tanks to mimic the natural condition. A 15 cm diameter and 30 cm length PVC pipe was provided as a hideout for the broodstock. The spawned eggs were kept along with the parents in the spawning tank.

2.3. Experiment 2

The broodstock was maintained in the spawning tank, as mentioned in experiment 1. In the second experiment, the eggs were carefully siphoned just after spawning from the spawning tank into a Nylon mesh of size 500µ. The eggs were transferred to a prepared hatching tank. Hatching tanks were HDPE crates of 50 L capacity filled with 40 L. The water quality was maintained in optimum condition as experiment1 by providing a custom-made flow-through system.

A single pair of broodstock was used for the experiment. The experiment was repeated for 6 consecutive spawning. The hatchability experiments were conducted in custom made tanks with and without parents. The water quality was maintained in optimum range (Table 1).

The hatching percentage was calculated and compared between both experiments after the hatching (22-24h). The present study has two sets of treatments, (T1, T2, T3)- eggs without parents and (T4, T5, T6)- eggs with parents. The data is presented as a table (Table 2).

Filtered freshwater (dissolved oxygen: 6.5 ppm; pH: 7.5; temperature: 29°C) was collected in the spawning tanks. A submerged aquatic plant *Ceratophyllum demersum*, and PVC pipe with a diameter of 7.5 cm were provided as a hideout. Water was filled in a plastic tray, and flow-through at a rate of 300 ml/minute was maintained. Matured healthy males and females for induced breeding were selected after observing the sexual dimorphic characters.

3. Results and Discussion

Broodstock was selected by observing the sexual dimorphic characters, and identification of sex has a great role in successful captive breeding. The presence of pointed genital papilla with a pink colouration at the tip can identify ready-to-spawn males (Fig. 1). Females have blunt button-shaped genital papillae, and the ovary occupies 3/4th of their body cavity (Fig. 2).

Broodstock of *O. malabaricus* was injected with Wova-FH at 0.5 ml/kg body weight during the night at 11.00 pm and released to the spawning tanks (Fig.3). Soon after the released fish were seen to be hiding beneath the floating vegetation, *Ceratophyllum demersum* and 6" PVC pipes. Courtship behaviour started after seven hours of injection, and the fish were found to be swimming together and forming various postures (Fig. 4 a-f).

Initially, they stay face to face by touching one other's barbell, and this posture continues for 30 minutes. Later, they stay opposite each other by connecting caudal fins, and in between, they are found swimming around the tank. Nineth-hour post-injection male started to chase down the female and nip in the genital region. Following the intermittent nipping male bends like a horseshoe around the head of the female and apply pressure on the body from head to belly. This process repeats until spawning completes ie: -10 hours of injection, and eggs are scattered all over the tank (Fig. 5).

The spawning movements were observed similarly in all the sets instead of the fact that the female fish spawned eggs or not. Initially, the eggs are small in size; after ten minutes, the size of the egg is increased, and a transparent membrane is found over the chorionic membrane, which helps the eggs to spread evenly without clogging (Fig. 6). Fertilized eggs are demersal, non-sticky, and brown in colour with a size range of 1.50 mm to 1.83 mm.

After spawning, the eggs were evenly scattered in the bottom of the tank, and parents were found to aerate the eggs. This significantly helped to increase the hatching rate to 100%, whereas in the flow-through system, the hatching failed as the development ceased following the blastula stage. Similar results were reported on the spawning behaviour

Table 1. Details of Water quality parameters

Water quality parameters	Broodstock tank (Mean±SD)	Spawning tank (Mean±SD)	Incubation tank (Mean±SD)	Larval rearing tank (Mean±SD)
Temperature (℃)	29±1	29±1	29±1	29±1
pH	7.5±0.6	7.5±0.6	7.5±0.1	7.5±0.2
Alkalinity (ppm)	35.8±4	35.8±4	35.8±4	35.8±4
Total Hardness (ppm)	58.12±9	58.12±9	58.12±9	58.12±9
Ammonia (ppm)	0	0	0	0
Nitrite (ppm)	0.01±0.04	0.01±0.04	0.01±0.04	0.01±0.04

Table 2. Details of Breeding experiments of *Ompok malabaricus* in two systems

Treatment	Sex	Average Body Weight (g)	Hormone dose in (ml)	Fertilization Rate (%)	Hatching Rate (%)	Survival
T1	Male	44	0.022	95	0	0
	Female	72	0.036			
T2	Male	44	0.022	92	0	0
	Female	72	0.036			
T3	Male	44	0.022	96	0	0
	Female	72	0.036			
T4	Male	44	0.022	96	100	0.26
	Female	72	0.036			
T5	Male	56	0.028	99.86	100	0.72
	Female	90	0.045			
T6	Male	56	0.028	99.9	100	3.6
	Female	90	0.045			

Fig. 1. *O. malabaricus*, Male with pointed genital papillae

Fig. 2. *O. malabaricus*, Female with button-shaped genital papillae and bulged abdomen

Fig. 3. Injection of *O.malabaricus*, Broodstock with Wova-FH

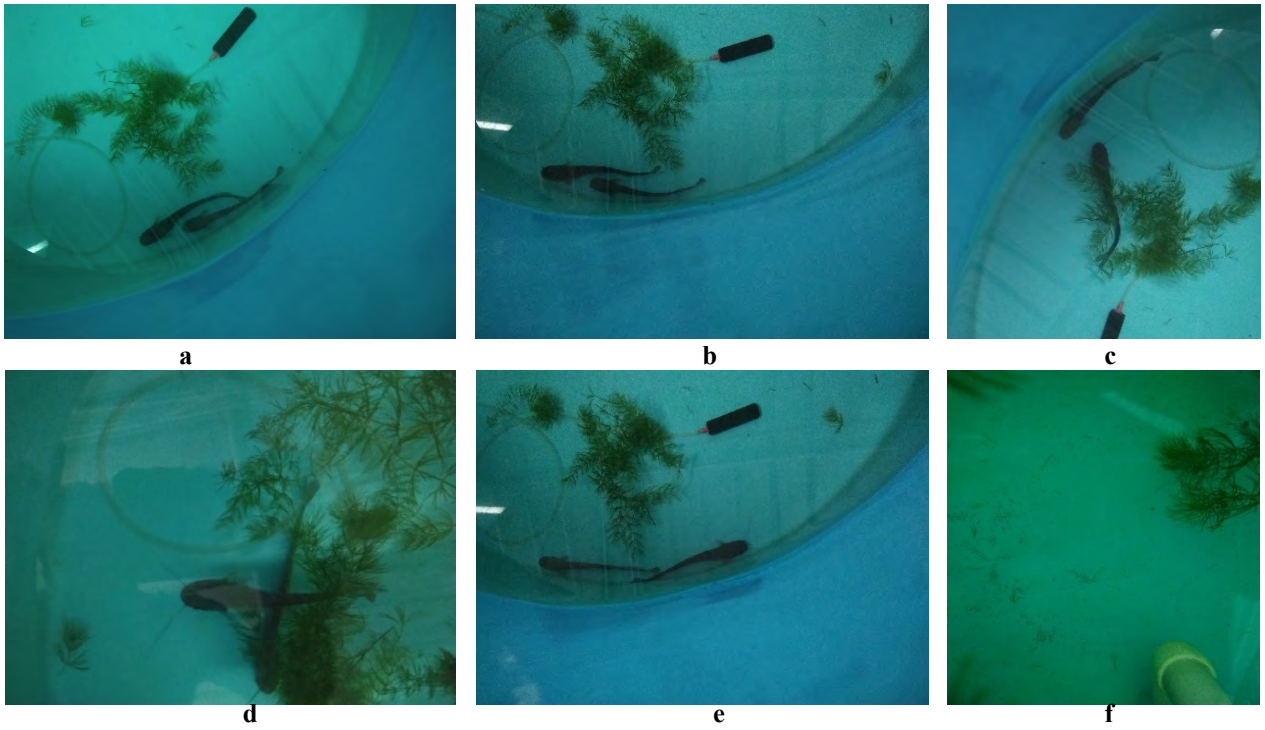

Fig. 4 a-f. Courtship behaviour of *O. malabaricus*

Fig. 5. DSpawned eggs of *O. malabaricus*

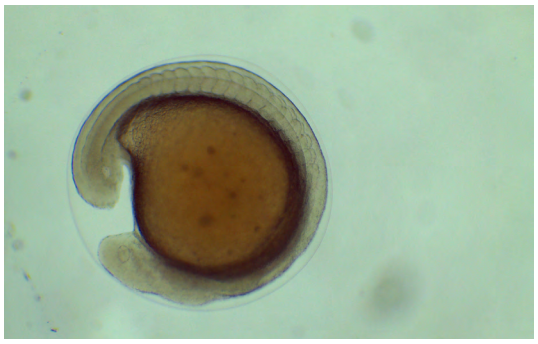

Fig. 6. Microscopic image of the egg of *O. malabaricus*

of *Channa punctatus* (Haniffa *et al.*, 2004), *Channa striata* (Paray *et al*.,2 013), *Clarius batracus* (Moitra *et al.,* 1979), *Mystus montanus* (Arockiaraj *et al.*, 2003) *Heteropeneustes fossils* (Marimuthu *et al.*, 2000; Thakur, 1976) and *Hoplias malabaricus* (Prado *et al.,* 2006).

Padmakumar *et al*. (2011) used polyvinyl chloride (PVC) pipes of 30–40 cm as hideouts inside the breeding tank of *Horabagrus brachysoma*. These shelter substrates were most effectively utilized by the spawners. Raizada *et al*. (2013) have reported on the arousal of breeding stimulus in *O. bimaculatus*, after around 6 h of giving hormone injection, the fishes started moving all around the tank with short resting at the bottom corners of the tank and occasional chasing by dominant/bigger male to smaller ones.

In the case of catfish, stripping is impossible in males due to the peculiar anatomy of their tubular testis (Pandian and Koteeswaran, 1998). A good number of workers have taken up trials on the captive breeding of *O. pabda* (Bhowmick *et al*., 2000; Chakrabarty *et al*., 2005, 2007; Chakrabarti *et al*., 2009; Mukherjee *et al*., 2002; Purkayastha *et al*., 2012;

Sarkar *et al*., 2005). However, a few attempts have been made on *O. bimaculatus*, where captive breeding has been carried out either by stripping or using aquatic substrata like *Eichhornia crassipes* and *Hydrilla verticellata* (Banik, 2010; Banik *et al*., 2011; Sridhar *et al*., 1998). However, stripping requires a lot of manpower and may lead to the sacrifice of the male fish.

O. malabaricus is listed as Least Concern in view of its wide distribution, presumed large overall population, and because it is unlikely to be declining fast enough to qualify for listing in a more threatened category. Most areas of the species' habitat are under threat from pollution caused by solid waste disposal, discharge of acids from rubber estates, sewage disposal, sand mining and dynamite fishing. The species is not used as an ornamental fish, but it is commonly hunted as a local delicacy.

During the present study, the males were selected based on secondary sexual characters; hence males were not sacrificed during the experiment. Maturity and breeding behaviour are only noticed during the monsoon season May – November. The present study is the first of its kind to report the guarding of eggs by *O. malabaricus* brooders. Moreover, guarding of eggs by *Ompok* spp. was not reported elsewhere from India. The eggs guarded by the parents remained clean and recorded an increased hatching rate. In the flow-through system, the eggs were infected with the fungal attack. Thus, it can be concluded that parental care is present in *Ompok malabaricus.*

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Author contribution

Mr. Arjunan V M conducted the research and wrote the scientific paper. Dr M K Sajeevan -designed the research study, helped in the analysis and interpretation of results, and corrected the manuscript.

Conflict of Interest

The authors declared that they do not have any conflict of interest.

Ethical approval

Not required

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