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Induced ovulation and spawning of a striped snakehead murrel, *Channa striatus* (Bloch) under captive conditions

Authors:
Bilal Ahmad Paray, Haniffa MA and Manikandaraja D.

Institution:
Centre for Aquaculture Research and Extension, St. Xavier's College (Autonomous), Palayamkottai, India, Pin-627 002.

Corresponding author:
Haniffa MA.

Email:
haniffacare@gmail.com

ABSTRACT:

Induced breeding of the striped snakehead Murrel, *Channa striatus* (Bloch, 1793) was attempted during October to December 2009 (North-east monsoon). The breeding attempt was made using natural hormone Human Chorionic Gonadotropin (HCG). Two trials using fibre tanks of different capacity in triplicates were made to observe the effects of different doses of HCG on induced spawning of *C. striatus*. The fishes which received a dosage of 6000 IU/kg body weight gave satisfactory results. The ovulation was recorded after 19-29 h of the injection. The fertilization rate was observed as 40-80%. Hatching occurred within 22-36 hours after fertilization at water temperature of 27-29°C. The percentage of hatching rate varied from 55-80%. The overall breeding performance of *C. striatus* was found to be satisfactory for upscaling of murrel seed production in stakeholders farms.

Keywords:
Induced breeding, snakehead murrel, *Channa striatus.*

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INTRODUCTION

The striped murrel, *Channa striatus* commonly called snakehead (Bloch, 1793) (Channiformes: Channidae) is a commercially important ubiquitous species and along with other species of the genus, is one of the most important sources of food fish. The flesh of this fish is firm, white, practically boneless, and has a most desirable flavour. Moreover it is the main food fish in South-East Asia. The heavy dark skin and head are good for soup preparation and is usually sold separately (Davison, 1975). It is cultured in India, Pakistan and Thailand and commercially cultured in Thailand, Philippines, Cambodia and Vietnam (Wee, 1982). Its flesh is claimed to be rejuvenating, particularly during convalescence from serious illness as a post natal diet (Wee, 1980). The fish is very hardy and if kept moist, can remain alive for a long time out of water and is mostly sold alive. This fish can survive in harsh environments with low dissolved oxygen and high ammonia (Ng and Lim, 1990; Qin *et al,* 1997) and therefore are often cultured in shallow waters. This characteristic is valuable for marketing, because live snakehead fetch considerably higher prices than dead fish (Wee, 1982; Qin and Fast, 2003). Because of its hardy nature and capacity to thrive in swamps and other derelict waters, murrels have attracted the attention of the fish farmers for culture in shallow water bodies/artificial earthen ponds without much investment.

Till two decades ago murrels were available in adequate number in many water bodies in the haors, baors, beels, rivers, ponds, ditches and even in irrigation canals of India which is not the case now. The main reasons are the destruction of their breeding grounds, catching of young Juveniles and the outbreaks of ulcerative syndrome disease, use of agro-chemicals and pesticides. To obtain quality fish, fish seed is prerequisite. The fish seeds from the wild still remain the main source of seed supply in the country. But the supply of fish seeds from the natural spawning grounds is not sufficient and is also decreasing day by day. Therefore, proper management initiatives of this species should be taken to save this fish and the knowledge on proper breeding techniques is one of them.

Murrels breed naturally during southwest monsoon and northeast monsoon in flooded rivers, paddy fields and ponds in India. But monsoon failure often limits their breeding behaviour. In this regard, hypophysation is a simple practical technique but suffers from the disadvantage of gonadotropic potency of the pituitary and difficulty to standardise. Hence alternative sources viz. human chorionic gonadotropin (HCG) (Mollah and Tan 1983; Zairin *et al*., 1992; Inyang and Hettiarachchi 1994), luteinizing hormone releasing hormone (LH-RH) (Billard *et al.,* 1984; De Leeuw *et al*., 1985; Fermin 1992) and Ovaprim (Alok *et al*., 1993; Francis 1996; Haniffa *et al*., 1996) have been attempted in air-breathing fishes. *C. striatus* is now considered to be an endangered fish in Bangladesh (IUCN, Bangladesh 1998). Considering their economic as well as biological importance, the present study was undertaken to develop a simple induced breeding technique of *C. striatus.*

MATERIALS AND METHODS

The experiments were conducted during the north-east monsoon, the natural breeding season of *C. striatus* (October; 2009) in fibre tanks of different capacity (1000 L and 5000 L) at the Centre for Aquaculture Research and Extension (CARE), St Xavier's College, Palayamkottai, Tirunelveli. The brooders were collected from Thamirabarani river system in Tamilnadu (8.44°N, 77.44°E) and were safely transported to CARE Aquafarm. The brooders were acclimatized to laboratory conditions for a month and were fed with semi moist feed consisting of anchovy (35%), jawala (25%), tapioca (10%), wheat flour (15%), and rice flour (15%) and chopped chicken intestine *ad libitum*. Mature healthy males (40) and females (20) were selected from the available brood

stock by sexual dimorphism. The abdomen in female fish is slightly bulged which is not observed in male fishes. Vent is pale and slit like in male, which is round in shape and reddish in colour in female fish. Anal papilla like structure appeared prominently with pointed tip in male fish; whereas a slightly reddish dot was noticed in female fish (Chakrabarty, 2006). The female fish oozed eggs while stripping whereas male never. The average weight of male and female breeders for the present experiment was 681g and 744 g respectively. The corresponding lengths were 27 cm and 29 cm. A day before the experiment the required breeders were transferred to fibre tanks (1000L and 5000L) filled with tap water (dissolved oxygen: 5.8-6.5 ppm; CO_2 5.2-6 ppm; pH 7.5-8.1; salinity 1.01-1.04%; temperature 27-29°C).

Three doses of HCG were chosen viz: low dose (2000 IU/kg body weight), medium dose (4000 IU/kg body weight) and high dose (6000 IU/kg body weight). For each dose two trials in two different size fibre tanks (1000 L and 5000 L) with triplicates were made and each dose was administered only once to male and female. Each breeding set consisted of two males and one female (2:1) (fig. 1). Injections were made intra-muscularly in the dorso-lateral region using 1 ml insulin syringe (fig. 3). After HCG injection, the breeding sets were released into fibre tanks separately. A control set was maintained for both the experiments without administration of hormone. Each breeding tank was covered by a mosquitonet and aquatic weed viz: *Hydrilla verticillata* was introduced. Breeding behaviour was observed after the breeders were injected by the hormone and spawning occurred after 24 hrs. After 3-4 days, spent fishes were removed from the breeding tanks, washed in $KMnO_4$ solution and released back into the stocking pond. Eggs were adhesive in nature which provided good protection to them. The transparent eggs were considered as fertilized ones whereas the opaque eggs were considered as dead eggs. The percentage of fertilization was calculated as number of fertilized eggs/number of total eggs × 100. After 22-30 h of fertilization, hatchlings emerged out of the egg shell and hatching was completed within the next six hours. The rate of hatching was calculated as number of hatchlings/ number of total eggs ×100

RESULTS AND DISCUSSION:

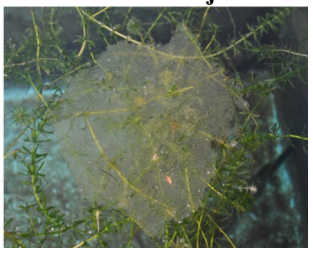
The results of breeding trials of *C. striatus* under captive conditions are summarized in Table 1 and Table 2. Each female paired with only a single male (Parameswaran and Murugesan 1976; Thakur, 1976; Moitra *et al*., 1979) and the other male was rejected. The spawning pairs were seen moving together in the breeding tank. Male showed more aggressiveness and active participation in mating. Mating was preceded by an elaborate courtship. The active male chased the female and frequently excited its movement which commenced from 10-12 h after the hormone injection, irrespective of the dosage of the hormone and capacity of

1. Breeding Set

2. HCG Vial

3. Hormonal Injection

4. Breeding Behaviour



5. Egg mass

6. Hatchlings

Plate 1

Table 1: Breeding performance of *C. striatus* injected with different doses of HCG (1000 L fibre tank)

Breeding Set	Weight of Breeders (gms)		HCG dosage IU/Kg BW	Latency Period (h)	Fertilization Rate (%)	Incubation Period (h)	Hatching Rate (%)
	Male	Female					
1	680 650	700	2000	29	40	34	60
2	650 690	720	2000	-	-	-	-
3	770 710	830	2000	-	-	-	-
4	730 770	790	4000	24	70	26	65
5	740 680	750	4000	-	-	-	-
6	740 610	780	4000	23	75	30	70
7	690 710	720	6000	21	80	22	75
8	720 710	750	6000	21	75	24	75
9	650 640	690	6000	19	75	24	80
10	630 690	710	Control	-	-	-	-

the breeding tanks. In all the sets, the important observation was that the male was more actively involved in the courtship and spawning irrespective of the dosage of the hormone and capacity of the breeding tanks. It was also observed that the male was hitting the snout and vent region of the female more frequently. The mating pair inclined slightly to one side, keeping the anal regions close to each other, forming an X-shaped appearance (fig. 4). At the time of courtship, the male bent its body close to the female and the breeders joined together which ultimately resulted in the release of the milt from the male and the eggs from the female followed by external fertilization.

It has been observed that early spawning (19-24 h) occurred in the fishes injected with the doses of 4000 and 6000 IU/kg body weight, as compared to lower dose (2000 IU/kg); it took 27-29 h for spawning. Francis (1996) too reported high latency period for *Heteropneustes fossilis* and *Clarias batrachus* due to low potency of the hormone (Legendre, 1986). The latency period available in the literature is 24-30 h in *Channa punctatus* (Marimuthu *et al*., 2009) 22-25 h for *H. fossilis* (Kohli and Goswami 1987) and 16-20 h (Munshi and Hughes 1991) for *Clarias gariepinus.* Higher latency period in HCG injected breeders at the dose of 2000 IU/kg of body weight indicates the difference in the mode of action of the hormone. The difference in the latency period was irrespective of the breeding tank capacity. No marked differences in breeding and spawning behaviour were observed in case of males, with varied dosages of the hormone. The eggs were straw yellow in colour and spherical in shape. The fertilized eggs (1.3±0.05 mm) were adhesive and found to stick on to the aquatic weeds (fig. 5). The fertilization rate varied from 40-80%. Low rate of fertilization was recorded (40-50%) in the case of lower dose (2000 IU/kg) whereas not much difference was observed in the other two doses of HCG. The eggs hatched out

Table 2: Breeding performance of *C. striatus* injected with different doses of HCG (5000 L fibre tank)

Breeding Set	Weight of Breeders (gms)		HCG dosage IU/Kg BW	Latency Period (h)	Fertilization Rate (%)	Incubation Period (h)	Hatching Rate (%)
	Male	Female					
1	670 680	760	2000	-	-	-	-
2	650 630	710	2000	27	50	36	55
3	660 640	760	2000	-	-	-	-
4	660 670	750	4000	22	70	27	60
5	640 690	750	4000	24	70	29	60
6	650 690	760	4000	-	-	-	-
7	680 710	780	6000	22	75	22	70
8	660 650	720	6000	24	70	26	70
9	710 700	730	6000	-	-	-	-
10	690 650	720	Control	-	-	-	-

between 22-36 h after fertilization. The incubation period showed a decrease as a function of increase in the dosage of the hormone in both the experiments. The changes in colour of eggs and other characteristics were noticed during embryonic development. The hatching percentage ranged from 55-80%. Hatching rate in both the experiments was comparatively higher for the dose of 6000 IU/kg body weight. Throughout the hatching period male attended fanning over the eggs, keeping the eggs aerated and guarding eggs and hatchlings.

CONCLUSION:

In the present study among the 20 breeding sets, 11 sets responded spawning. No breeding activity was observed in the control sets indicating that inducing agent is necessary for breeding under captivity. Based on our findings HCG dose of 6000 IU/kg body weight could be recommended for seed production of *C. striatus* under captivity using fibre tanks. The successful development of protocols for captive breeding is likely to pave the way towards commercialization of the technology for upscaling of seed production at stakeholders farms.

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