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Research Article

Brood Stock Development, Breeding and Larval Rearing of Three Spotted Frog Fish (Lophiocharon Trisignatus Richardson, 1844) in Captivity

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Abstract

Purpose of this study is to find the best food which helped the breeding of three spotted frog fish (*Lophiocharon trisignatus*) together with live food for three spotted frog fish larvae. Breeding of three spotted frogfish was attempted using four feeds such as freshwater prawn (Macrobrachium rosenbergii), vannamei shrimp (*Litpopenaues vannamei*), white baits and capelin. Frog fishes fed with with vannamei, freshwater prawn and white baits released mass of unfertilized eggs, which settled at tank bottom. Frog fishes fed with capelin had eggs attached to the dorsal side of female frogfish after successful mating. It was found that capelin had positive effects on breeding. Fecundity of frog fish was 66. Eggs were white in colour for first two days and later changed to dark colour. The eggs started hatching after a period of twenty five days and hatching was completed in 25 days. Hatchlings were black in colour and had clearly visible orange red coloured yolk sac. Hatchlings mostly stayed at the bottom of the tank and had rare upward swimming movements. Yolk sac absorption was complete in one week. Frog fish juveniles were fed with enriched artemia nauplii for first one week after yolk absorption. As the babies started growing, they were fed with two days old artemia naulplii and later with adult artemia. This study showed the importance of feed in successful breeding of three spotted frog fishes and successful larval rearing was done with live artemia. Breeding of frog fishes will help to increase the trade in aquarium industry by conserving the wild stock.

Keywords: Frogfish; Fresh Water Prawn; White Baite; Vannamei; Capelin; Artemia; Enriched Artemia Nauplii

Introduction

There is considerable interest in breeding new species of marine fishes to reduce fishing pressure on wild populations due to the increasing demand for fishes in the marine aquarium trade [1]. The three spotted frogfish (*Lophiocharon trisignatus*) is a popular hardy marine fish for marine aquarium keepers belonging to the family Antennariidae of the order Lophiiformes. Despite their increasing popularity in the aquarium trade, studies of frogfish breeding are virtually non-existent [2]. There is less research happened on the breeding and larval rearing of three spotted frog fish in captive conditions. Increasing our knowledge of frogfish breeding can reduce the catches of wild specimens for the aquarium trade and also to try breeding of other frog fishes. Nutrition plays an important role in reproduction of fishes [3]. Different types with different nutritional components were tried and capelin with more fat content was found to have positive result in breeding. Larval

rearing of three spotted frog fish was done by feeding enriched artemia.

Materials and Method

Frog fishes

Three pairs of spotted frog fishes (Lophiocarion trisignatus) having a length of 15 to 20 cm in and age two year were selected for breeding experiment. Healthy and bigger brooders were selected as there is no authentic information about the age of maturity of three spotted frog fish are available.

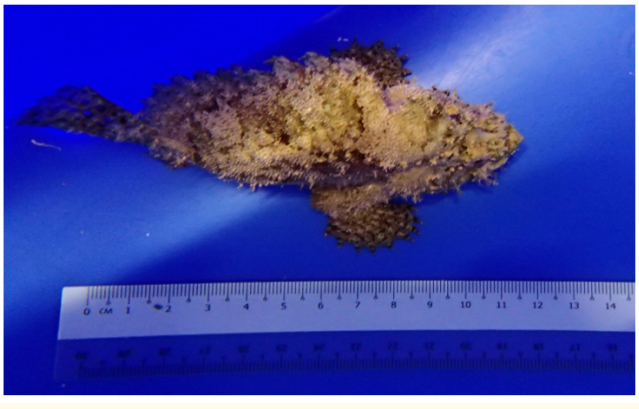

Figure 1

Holding tank

Adult frog fishes were reared in 1000L FRP tanks. The artificial and natural decoration materials were provided as hiding places. Rearing tanks were provided with life supporting system consisting of a break tank of 1600L capacity, a protein skimmer, bag filters, uv and ozone [4]. Flow rate of water in the tank was 4 L/s and top up was done with treated sea water for the lost water. Photoperiodicity of the rearing tank was adjusted to 12 hours. Water quality parameters of holding tank.

Water quality parametrs	Average values
Salinity	32 ppt
pH	8.2
Temperature	25C
Ammonia	0 ppm
Nitrite	0 ppm
Nitrate	0 ppm

Table 1

Food for adult frog fishes

Experimental fishes were feed with four types of feeds; fresh water prawns, vannamei shrimps, white baits and capelin fish [3]. Crustaceans were selected because of their benthic sedentary nature [2]. Fresh water prawns were shocked by salt water and were motion less after few minutes; this helped the frog fishes to eat them easily. Vannamei shrimps used to swim in the tank for a while and were lured by the frog fishes. Capelin fish and white baites were cut into small pieces (2 to 3 cm thickness) and was feed with the help of a feeding stick. Feeding was done twice a day and left-over food was removed from the tank after one hour.

Freshwater prawns of 5gm to 10gm were selected for feeding. These prawns are fed with artificial pellet feeds with 30% protein content. These prawns are thoroughly cleaned with fresh water and dipped in seawater for 30 seconds for disinfection. Fresh water prawns are fed at a rate of 10 to 15 prawns per day for a pair of frog fishes.

Vannamei shrimps of 5gm to 10gm fed with artificial pellet feeds containing 30% protein content were fed to one set of frog fishes. Prawns were washed thoroughly and dipped in fresh water for disinfection. 10 to 15 vannamei prawns are fed to a pair of frog fishes per day.

White bait was cut into small of thickness 2 to 3 cm having weight of 5gm each. Cut pieces were washed thoroughly and fed to frog fishes with the help of feeding stick. Experimental pair of frog fishes ate 15 to 20 pieces a day.

Capelin fish was cut into small pieces of 5gm each after thawing. Cut pieces were washed thoroughly in running water and fed to fishes using feeding stick. 15 to 20 pieces of capelin was fed per day for a pair of frog fishes Incubation tank.

Rectangular tank of 500L capacity was used as spawning tank. Constant sea water make up and aeration was provided to maintain optimum water quality. Temperature of holding tank water was maintained at 25 to 27 OC using chiller.

Feed for frog fish larvae

Frog fish larvae were divided into four groups and were fed with four different types of foods. First group were fed with minced tilapia. Second group were fed with ocean nutrition frozen cyclops [5]. Third group were fed with ocean nutrition pellet foods (1.2mm) [6]. fourth group were fed with artemia nauplii.

Live feed

One day old enriched artemia were fed to one week old frog fish hatchlings [7]. After one week adult artemia were fed for a period of one month. Frozen mysids were fed for one month old frog fish juveniles.

Results and Discussion

Breeding of three spotted frog fish was significantly affected by the food they consume. Frog fishes are sluggish animals which stay in spot and wait for other fishes and invertebrates to come nearer to be consumed [2]. Capelin are fishes with high lipid content [10] and are caught from cold waters. Artemia are the best larval food for fish larvae [7] and showed good results with three spotted frog fishes.

Food analysis

Proximate composition of freshwater prawn was found to be protein (27%), carbohydrates (8.33%), lipids (5.38%), ash (1.61%) and moisture (74.93%) [8]. Proximate composition of vannamei protein (17.1%), carbohydrate (8.33%), lipid (1.24%), ash (1.21%) and moisture (74.93%) [9]. Proximate composition of capelin was proteins (13.1%), carbohydrates (8.33%), lipids (13.9%), ash (1.61%) and moisture (74.93%) [10]. Food analysis shows capelin have extremely high level of lipid compared to other feeds.

Breeding of frog fishes

Experimental fishes readily accepted four types of food and were found healthy. Female frog fishes fed with freshwater prawns, vannamei shrimps and white baits showed signs of ovary development. Mating behavior was shown by male and female frog fishes. After mating behavior females released eggs in bunch which were found on the bottom of the tank. These eggs were collected and incubated in continues water flow and aeration for more than a month. Eggs remained unhatched and didn't show any sign of development.

Female frog fishes fed with capelin showed signs of ovary development. Male and female fishes performed mating behavior. Eggs were found attached to the dorsal side of the female frog fish after successful mating. Female frog fish carrying eggs was removed from the experimental tank and kept in incubation tank till hatching.

Figure 2: Frog fish with eggs below the dorsal fin.

Eggs

Unfertilized eggs were seen as egg mass at the bottom of the tank. Egg mass was white in colour and had a length of around 10 cm in the shape of a wound ribbon. Eggs measured around 0.5 to 1mm in diameter.

Figure 3: Unfertilised three spotted frog fish eggs.

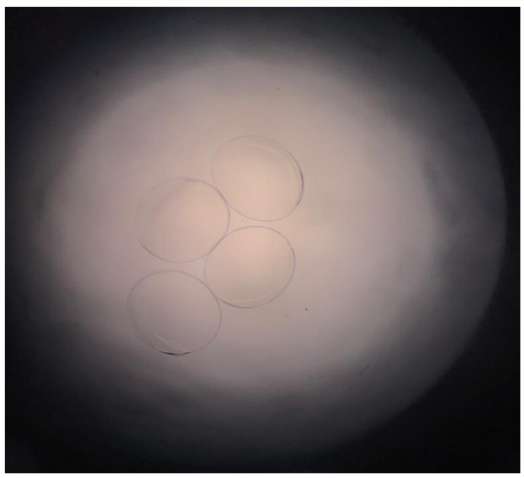

Figure 4: Unfertilised eggs under microscope.

Fertilized eggs were white in colour and were attached below the dorsal fin of female frog fish [2]. Fertlised eggs had a diameter of 2 to 3mm after spawning and increased to around 5mm after 20 days. Frog fish babies with yolk sac were visible inside the egg membrane after 20 days.

Figure 5

Hatching

Hatching started 25 days after spawning and extended till 30th day after spawning. Hatchlings were black in clour with large orange red coloured yolk sac. Hatchlings remained motionless at the bottom of the tank most of the time with rare upward swimming movements. Length of the hatchlings was 6mm on average. Yolk sac absorption was complete In one week and juveniles were transferred to rearing tank.

Hide outs were provided in the rearing tank for the baby frog fishes with artificial corals and pebbles. Baby frog fishes were ran-

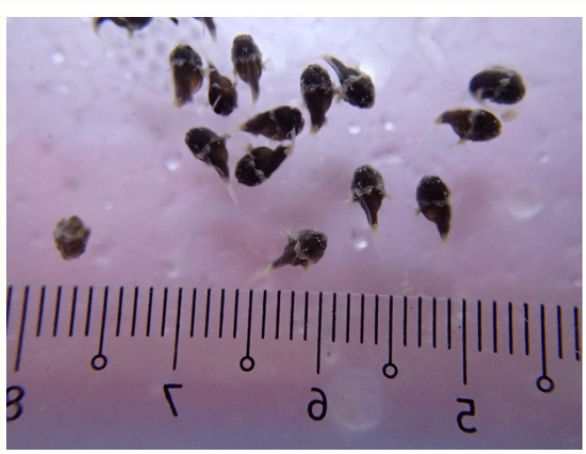

Figure 6A: Hatchling on first day.

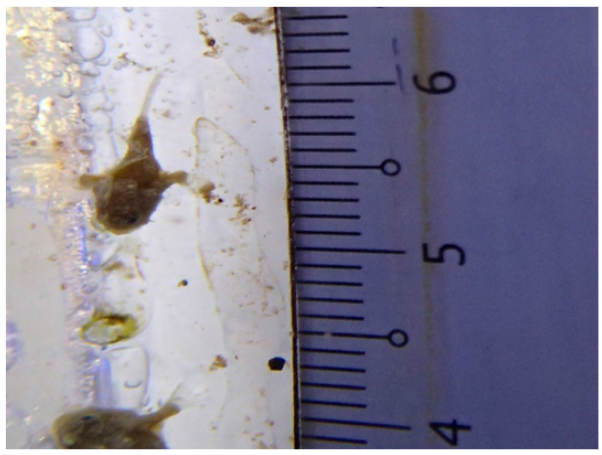

Figure 6B

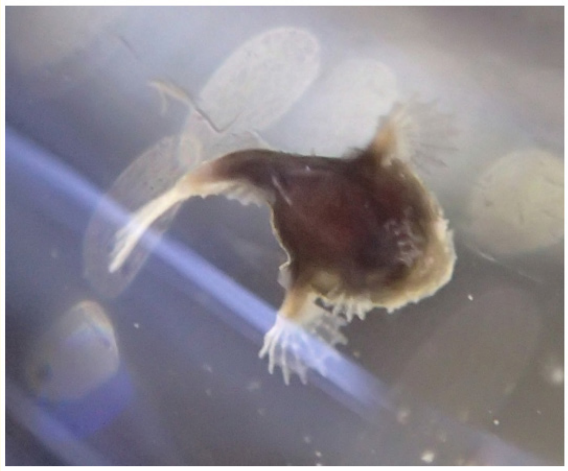

Figure 6C: Hatchlings on the bottom of the tank.

domly selected and divided into two groups and fed with two types of food such as 1- live food and 2- frozen foods.

Live food

Baby frog fishes were fed with newly hatched artemia nauplia when yolk absorption was complete for the first one week. After first week baby frog fishes were fed with adult artemia for one month. One-month old frog fishes were fed with small sized vannamei shrimp and fresh water prawns. Baby frog fishes fed with minced tilapia and pellet foods doesn't show any interest for food and started dying and complete mortality happened after first week of yolk absorption. Baby frog fishes fed with frozen cyclops showed interest for food for the first two days and mortality happened after second week.

Growth of frog fish young ones

Frog fish hatchlings had a length of 7cm after hatching. Frog fish babies that were fed with artemia nauplii reached a length of 9 cm after one week when yolk absorption was complete. Frog fish babies were fed with artemia nauplie for one week and reached a length of 12cm after one week. Adult artemia was fed to the babies after one week to one month period. After one month the average length was found to ne 2 cm for the frog fish babies while one frog fish measured 2.3cm which was the biggest in the batch.

Survival rate

Frog fish babies fed with artemia nauplii showed excellent survival rate with no mortality. No mortality was reported for the first month except for occasional cases of cannibalism. One juvenile in particular that was growing faster than the others was repeatedly observed eating the small ones. Baby frog fishes fed with minced tilapia and pellet food had complete mortality on the second week of hatching and baby frog fishes fed with frozen cylops had complete mortality by third week of hatching.

Weaning

Baby frog fishes fed with artemia grew in size and had good susrvival. Bigger sized fishes were removed and placed in separate tanks and were fed with adult artemia and small sized white leg shrimp (*Litopenaeus vannamei*).

Conclusion

Findings of this study suggest that frog fishes need fish food like capelin with high lipid content and other compounds in capelin for successful fertilization and attachment of eggs to the surface of female fishes. Female frog fishes incubate the eggs for a period of 25 to 30 days and are seen attached to the body of female frog fish [2]. Frog fish hatchlings subsist on egg yolk for a period of one week. Baby frog fishes starts feeding after one week and can be fed with newly hatched artemia nauplii [7] and later with two-day old enriched artemia. Frogfish babies are hardy and can be grown using enriched adult artemia after a period of one week.

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