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Development of Hatchery Technology for Marine Ornamental Damsel Fishes with Special Reference to in Captivity

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Abstract: The study was carried out to develop a successful hatchery technology for an exclusively coral reef associated marine ornamental fish, using estuarine water (fist time attempt) and also to assess suitable tank (cement / FRP tanks) in captivity. Nine species of damsel fishes were reared for a period of one year in the cement tanks (setup I) and FRP (Fiber Reinforced Plastic) tanks (setup II). Both types of experimental setups were provided with sand filtered, UV treated estuarine water and hiding places for fishes. All the nine species were kept as species wise with similar stocking density in both types of tanks. In all the experimental setups, feeding practiced thrice per day and physico-chemical parameters *viz*. salinity 22-26 ppt, temperature 25-30° C, dissolve oxygen 4.5-6.5, pH 7.5-8.5, ammonia less than 0.1ppm were maintained. In present study it was observed that compared to FRP tank (setup II), cement tank (setup I) was found better survival and growth rate. In setup I spawning commenced earlier than setup II.

Key words: Brood stock · Damsel fish · Water quality and Estuarine water

INTRODUCTION

Ornamental fishes are the most fascinating creatures of the aquatic environment. Bright colour, interesting behaviour and their ability to adapt in captive condition are the main reasons for this popularity. The hobby of keeping salt water aquaria has experienced an increase in world popularity since 1990 [1]. In recent years, the spurts in the trade of marine ornamental fishes are increased significantly, with direct negative repercussion on coral reefs and marine ecosystem.

In marine ornamental fish trade, family pomacentridae is the most dominated [2] and these are the major occupiers of reef communities [3] contains 350 species distributed on worldwide [4]. A vast majority of these species have been reported from the tropical Indo-West pacific region and 41 species were recorded in Indian waters [5]. Juvenile and adult fishes are hunted mostly and it paves way for rapid depletion of wild stock.

During the last two decades there is a gush in marine ornamental fish trade and there is a urgent need to develop breeding technology for these fishes. For conserving the coral reef ecosystem and sustainable ornamental fish trade culture practice is the only eco friendly way. It is also helpful in employment generation in the coastal regions.

The popularity of Pomacentrid fishes among the aquarists all over the world is due to their tiny size, hardy nature, attractive colour, high adaptability to live in captivity, diversified feeding habits and interesting display behavior. The present study is a preliminary work on the suitable tank for the breeding of these bountiful ornamental fishes in captivity. The present study gives an idea about suitable tank for brood stock development, water quality, feeding etc related to damsel fishes.

MATERIALS AND METHODS

Collection and Acclimatization of Experimental Animal: Fishes were procured from different aquarium shop of Madapam, Rameshwarem Islands, India and brought to the ornamental fish hatchery of CAS in Marine Biology. fishes were acclimatized based on wet lab condition for 15 days, where continuous aeration and different feed was supplied thrice per day. In the acclimatization tank a canister filtration system was also provided. During this period, behavior of the fishes and feeding were keenly observed. The species which were collected and acclimatized for the study were Domino damsel (*Dascyllus trimaculeatus*), Humbug damsel (*Dascyllus aruanus*), Blue damsel (*Pomacentrus caeruleus*), Yellow tail damsel (*Neopmacentrus nemurus*), Regal damsel

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Table 1: Survival the number of fishes in both tanks (Setup I and Setup II)

S: No	Species Name	Number of animals		Initial average length (cm) and weight (gm)				Final average length (cm) and weight				Survival rate in experimental setup(days)	
				Setup I		Setup II		Setup I		Setup II			
		Setup I	Setup II	Lt	Wt	Lt	Wt	Lt	Wt	Lt	Wt	Setup I	Setup II
1.	*Dascyllus trimaculeatus*	10	10	3.1	5.8	3.4	6.2	5.1	10.1	4.6	8.9	9.2	4.9
2.	*Dascyllus aruanus*	10	10	1.8	2.8	2.0	3.1	3.0	4.8	2.6	3.2	6.8	4.7
3.	*Pomacentrus caeruleus*	10	10	2.4	3.8	2.6	3.8	4.5	9.5	4.2	8.6	8.3	6.4
4.	*Neopmacentrus nemurus*	10	10	3.4	6.6	3.5	6.8	6.5	8.5	6.2	8.3	10	10
5.	*Neopomacentrus cyanomus*	10	10	4.1	6.4	4.4	6.5	6.1	8.5	5.7	8.3	6.9	4.2
6.	*Abudefduf saxatilis*	10	10	6.1	11.4	6.6	11.5	8.6	18.3	8.3	16.2	7.6	5.6
7.	*Amblyglyphidodon melanopterus*	10	10	4.2	8.4	4.5	8.5	6.7	12.5	6.4	11.9	4.5	2.6
8.	*Neoglyphidodon*	05	05	3.4	6.5	3.6	6.8	6.1	10.0	5.8	9.5	9.2	6.3
9.	*Chrysiptera cyanea*	05	05	2.5	4.0	2.6	4.2	5.1	9.6	5.0	8.8	6.5	5.5

(*Neopomacentrus cyanomus*), Sergeant major (*Abudefduf saxatilis*), White green damsel (*Amblyglyphidodon melanopterus*), Javanese damsel (*Neoglyphidodon oxyodon*) and Blue devil damsel (Chrysiptera *cyanea*).

Experimental Setup: In present study, two types of tanks *viz*. cement tank (setup I) and FRP tank (setup II) with one ton water holding capacity was kept. In both the type of experimental setup Sand filtered, UV treated estuarine water, continuous aeration, under water filtration and some artificial submerged hiding places such as earthen pot, PVC pipe, tiles etc. were provided. In both setup equal numbers of acclimatized fishes were transferred and maintained over 12 months.

Water Collection and Maintenance of Quality in Rearing Tanks: Water quality parameters such as temperature, salinity, pH, dissolved oxygen (DO) and ammonia were maintained in different level and later it was standardized based on estuarine water condition. The temperature and salinity measured using Eutech salinity meter, pH by pH tester, ammonia by ammonia analyzer and DO by DO meter respectively. For maintaining good water quality, under water filtration set up was kept. The filtration setup was made by small plastic bucket, PVC pipe, ceramic rings, activated carbon, charcoal, pebbles and coral sand. In both the experimental setup same water quality parameters were maintained.

Brood Stock Development: For development of brood stock in both the experimental setup similar number of fishes, hiding places were kept equal. Similar water quality parameters were maintained in both the setups. The fishes were fed thrice per day in a routine manner. The major constituent of feed includes boiled meat of clam, mussel, prawn, squid, octopus and trash fishes. In addition, live polychaete worms and *Acetces* were also provided weekly twice. The growth and survival in both setups were depicted in Table 1. Spawning starts after 6 months rearing.

RESULTS AND DISCUSSION

Coral reefs are the most diverse biological system on earth and supplying hundreds billion of dollar in goods and services to humans in the form of shoreline protection, recreation, tourism, as a source of food, pharma and revenue. Most of the reef associated fishes used in marine ornamental fish trade. In trade most demanded fish group is Pomacentridae. In recent year due to destructive, over collection of these ornamental fishes a negative drumming created. For sustainable trade management an eco-friendly way should be adopted and that may be the development of breeding technology of these fishes. For development of hatchery production technology of these fishes fish behavior, feeding, suitable tank for breeding is pre-requisite.

The brood stock development pattern and breeding in the present study was reliable with the general pattern of pomacentrids. After stocking in rearing tanks it was observed that the fishes started to make territory. In a group it was observed that the functional males were defending their territory aggressively whereas other fishes are not that much. There are various studies revealed that the use of space or food resource, habitat partitioning between species within particular families.

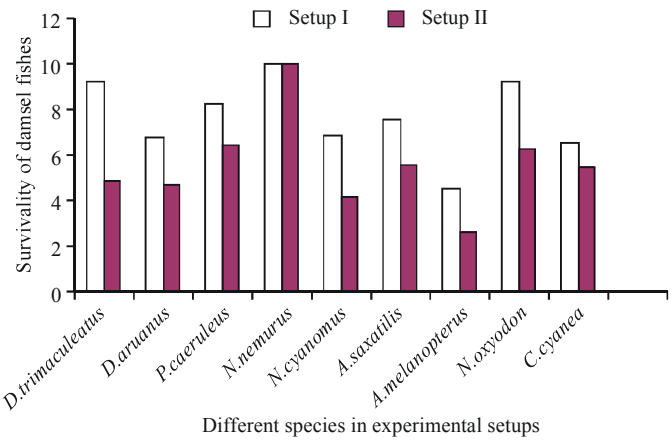

Fig. 1: Survival rate of damsel fishes in experimental setups

Ochi [6] also studied that the Soon after settlement, pomacentrid juveniles established social hierarchy and the post settlement growth of the juveniles was affected by the aggressive interaction among the conspecifics of the same colony. For brood stock development healthy individual were selected and similar report were revealed by Olivotto *et al*., [7].

Water quality is the major concern of marine fin fish and shell fish rearing system. Damsel fishes are inhabitant of reef ecosystem [4,5] and rearing of these in captivity using estuarine water is susceptible due to different water chemistry. The major difference in coral environment and present study tanks water quality was salinity and pH. In present study, water quality parameter such as salinity 24-28 ppt, temperature 24-32°C, dissolve oxygen 4.5-6.5, pH 7.5-8.5 and ammonia level less than 0.1 ppm. Olivotto *et al*. [7] had described the suitable water quality parameter for brood stock rearing of Yellow-tailed damsel fish, *Chrysiptera parasema* were temperature 27-28°C, salinity at 28-30 ppt and pH at 8.2 using sea water. In present study it was observed that the addition of under water filtration very much useful to retain the water quality, especially to control the ammonia level in the bottom and to maintain sufficient DO level.

The present revealed that, in the experimental setup I overall survival rate were 4.5±1.76 (mean±SD) where as in setup II survival rate was 2.6±2.3 (mean±SD) months. The different survival rates were observed in present study it may be due to the tank type. Ostrowski [8] studied the nature of rearing tank. Similar studies were carried out by Southgate and Kavanagh [9]. Damsel fishes are known to be very aggressive towards conspecifics or heterospecifics entering in their territories also [10] the present study also showed that in the tank condition also damsel fishes were showing territorial behaviour. In present study it was observed that the in setup I fish started to breed Black damsel (*Neopomacentrus cyanomus*), Blue damsel (*Pomacentrus caeruleus*), Yellow tailed damsel (*Neopmacentrus nemurus*) and Domino damsel (*Dascyllus trimaculeatus*) comparatively earlier than setup II. In setup I *N. cyanomus*, *N. nemurus*, *P. caeruleus*, *D. trimaculeatus* bred in 3.3, 3.5, 3.6, 3.3 months respectively where as in setup II it bred on 4.8, 5.2, 6.2, 4.2 months respectively. The survival rate of damsel fishes were statistically analyzed and showed (Fig. 1). Fishes were bred after brief courtship with male initiation.

CONCLUSION

Damsels are very beautiful marine ornamental fish. There is for a gut need to develop a breeding hatchery for these species. The present study showed the cement tank gives better survival rate than FRP tank. Cement tank reared fishes starts to spawn first, where compared to FRP tank. Setting of underwater filtration setup was giving very promising result to maintain the water quality and it also help to minimize the ammonia level in tank. This could be helpful in the future study of breeding of these fishes.

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