Ornamental Fish

Breeding, Farming and Trade

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Captive Breeding and Seed Production of Marine Ornamental Fishes of India

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Abstract

Successful captive breeding of true clown or common clown Amphiprion percula, false clown Amphiprion ocellaris, orange anemone fish Amphiprion sandaracinos, Amphiprion sebae, three spot damsel Dascyllus trimaculatus, humbug damsel Dascyllus aruvanus, Chrysoptera unimaculata, Blue damsel Pomacentrus caeruleus, peacock damselfish Pomacentrus pavo, Neopomacentrus filamentosus, Neopomacentrus nemurus has been achieved in India. Mass scale captive production of juveniles of Amphiprion ocellaris and Amphiprion percula showed that through various management procedures form broodstock management to larval rearing process, 90 to 95% larval survivability can be obtained and juvenile production of clown fish species can be initiated in India. Since the captive bred clown fishes reaches marketable size within 3 to 6 months and fetches high value, the potential for the commercial breeding of this fish species seems obvious for accelerating the ornamental fish trade. The paper also provides an out look to the different clown fishes of India and various aspects of pair formation, brood stock development, breeding, feeding, rearing of larvae, juvenile and adults of clown fishes and their mass scale juvenile production under captive condition. Through several experimental trials, majority of hurdles in captive breeding, egg hatching, larval rearing and juveniles production have now been successfully over come.

Keywords: *Marine ornamental fishes, captive breeding, seed production*

1. Introduction

The marine ornamental fishes are one of the most popular attractions in world wide due to their adaptability to live in confinement. Over the past decade, globally the marine aquarium industry has undergone a significant transformation and this industry is readily growing day by day due to their high commercial value. Thus the hobby of marine ornamental aquarium keeping have increased quiet a lot and more and more entrepreneurs are interested in this lucrative trade. In olden days, keeping marine ornamental fish was an impractical proposition due to its complexity in maintenance. But the recent developments in aquarium technology and better understanding of the biology and ecology of aquarium inhabitants made these organisms within the reach of aquarists. Current trends and forecasts indicate that the hobby will continue to grow.

Ornamental fish production is one of the leading cash crops in the aquaculture economy of the United States of America which is estimated to make up 60% of the demand and over US$ 1000 million worth of ornamental fish are imported to USA every year which is the largest market followed by Europe, Japan, Taiwan and Australia (Wabnitz et al., 1992). Singapore is the leading exporter of tropical ornamental fish and the average price achieved form each marine ornamental fish exported was five times than that of fresh water species. Even though India is endowed with enormous marine ornamental resources, this trade is in infancy.

Survey of marine ornamental in India recorded that more than 200 varieties of ornamental fishes are harbouring in the eastern part of Indian Ocean and out of these more than 50 varieties are very bright and have export potential. Among the marine ornamental fishes, the sea anemone fishes belonging to the family Pomacentridae, sub family Amphiprioninae comprising of genera *Amphiprion* and *Permnas* are commonly known as clown fishes, and are one of the most popular attractions in the international marine aquarium fish trade. Out of the 27 clown fish species of *Amphiprion* and one species of *Premnas* reported so far from the different geographical locations of the world, Andaman and Niocbar islands harbouring 15 varieties of sea anemone fishes which are very bright and colourful, and have high export values in the world market (Madhu and Madhu 2000). Among the different anemone fishes, *Amphiprion percula* is ranking first in the aquarium trade due to their attractive colouration, peaceful nature, hardiness, proclivity to live in association with sea anemones and display interesting behaviour, and have high demand in the marine aquarium trade of Singapore, America, Malaysia, Australia, and fetches A $ 30 per pair in Australia (Job et al., 1997) and in USA its cost ranges from $ 22 to $149.99 depending upon the size. Much of this money flows into developing countries where the majority of popular tropical marine species such as the percula clownfish (*Amphiprion percula*) and the emperor angelfish (*Pomancanthus imperator*) are found. But most of the countries sustain the trade through wild collected species which have serious implications in the long run and various literature point out depletion of ornamental fish stocks due to the wild collection (wood, 1985). This scenario stimulated interest in the development of an industry based on the captive propagation and rearing of ornamental fishes in many parts of the world to reduce their exploitation from the wild and more over this will also help in the sea ranching programme to sustain their population in the wild. Madhu and Madhu (2000) reported that the numerical majority of *Amphiprion percula* also showed a decreasing trend in Andaman waters due to continuous exploitation for the exhibition and entertainment to the public. Hence development of a hatchery technology for the most sought species for its trade is felt very essential.

There are a few very important steps to breeding of marine ornamentals. Providing a suitable environmental condition is one of the most important aspect of captive breeding. Selection and feeding of broodstock , feeding, egg hatching techniques, larval rearing, juvenile feeding are also the major steps involved in captive breeding. The environmental factors on the physiology and metabolic rates plays an important role in the success of keeping the marine ornamental fishes alive during captive rearing.

2. Broodstock management and feeding

The major technological hurdle of fish breeding is the selection of suitable breeding pairs. The temperature in all the breeding tanks to be maintained between 25 to 27°C and the water is to recirculated to ensure good water movement and high levels of oxygen. Suitable environmental condition has been provided during the rearing period and the broodstocks need to be fed with nutritionally adequate feed to accelerate ova development and successive breeding.

3. Spawning

Depending upon the habitat and nature of the of the target spawning habitat and aggregations need to be provided in the controlled system. As far as possible breeding conditions to be maintained so that no obstacles hinder the spawning activity of the species. Studies on the reproduction of reef fishes have revealed that 36 families have pelagic eggs, 13 have demersal eggs, scattering eggs in Siganidae and Tetraodontidae, benthic broadcasting in Muraenidae and live bearing in Brotulidae and Clinidae (Thresher 1984). Johannes (1978) reported three types of spawners, migratory spawners, non-migratory spawners with pelagic eggs and non-migratory spawners with demersal eggs. For the success of the captive breeding, substrate need to be provided in the brood stock tanks for the deposition of egg mass if the target species is having attached eggs. Spawning behaviour in reef fishes with planktonic egg and larvae are described for Pomacanthids and Chaetodontids by Lobel (1978). Once the spawning is taken place it is very necessary to understand the incubation period of the target species and depending upon the incubation period, the day and time of hatching can be ascertained and necessary steps need to be provided for the larval rearing.

In the case of clown fishes, each breeding pairs bred at an interval of every 15 to 20 days. Mostly the spawning occurs during day time between 06:00 h to 09:00 h and 13:00 h to 17:00 h and each female laid 300 to 2000. Each pair of fishes deposited capsule shaped eggs on the sides of the tank or the tiles or earthen pots nearly in rounded patches, and the egg size ranged between 1.9 mm to 2.8 mm long with a width of 0.8 to 1.0 mm and adhered to the sides of tank with stalk. The newly spawned eggs were light orange in colour on first day of spawning and it turned to bright orange on 2^{nd} day. Subsequently as the embryo develops, these were turned to black on 3rd day. The eggs became still darker on 4^{th} to 6^{th} day of incubation and the eyes of the developing larvae inside the egg capsule was clearly visible when viewed from a short distance. On 7^{th} day of incubation the eggs became silvery and the glowing of larval eyes were clearly visible. During incubation period, both the parents carefully looked after the eggs and it involved two basic activities fanning and mouthing. Fanning was achieved by fluttering the pectoral fins and it helped to reduce the decaying of eggs. By mouthing, the parents removed the dead or weakened eggs and dust particles. Male assumed nearly all responsibility of caring for the eggs and spent a higher percentage of time at the nest than the females did which increased gradually up to 70% of time as the day of hatching approached. On the final evening, males spent most of their time for fanning and mouthing whereas female spent a low but relatively constant percentage of time at the nest throughout the incubation period.

4. Hatching and larval rearing

The larvae broke the egg capsule and the hatchling emerged tail first on 7^{th} day of incubation. The first larvae come out immediately after the sun set (1830hrs) and the peak hatching took place between 19:00 to 22:00 h. The newly hatched larvae measured 3 to 5 mm in length each had a transparent body, large eyes and a small yolk sac. The newly hatched larvae remained at the bottom of the tank for a few seconds and soon after became free swimming. As the newly hatched larvae had only little quantity of yolk material it started feeding in the following morning after hatching. The larvae were initially fed with rotifer up to 4th day. From 5th day onwards the larvae were weaned onto newly hatched artemia nauplii along with rotifer.

The first sign of normal colouration appeared on 8^{th} to 9^{th} day of hatching. At day 15 to 17, most of the larvae metamorphosed to juveniles which resembled to juvenile adult fish and its size were measured to 8 mm. The larvae began to shift form partially pelagic to epibenthic and started eating minced fish flesh, clam meat and formulated diets.

During larval rearing period from the day of hatching to 5th day, it was found that "head butting syndrome" the phenomenon in which the larvae will swim towards any light reflected off to the sides or bottom of the rearing tank and will continue to hit on the sides of the tank until they eventually die. In order to reduce this behavior, measures have been taken to prevent light reflection from the sides and bottom of the tanks. Light intensity was another critical factor not only during day but also at night. A low intensity diffused light was provided suspended well above the tank during the night which helped to keep the larvae swimming towards the water column rather than sinking to the bottom and also to ensure visibility to locate the food. Under laboratory condition 90 to 95% larval survivability was obtained through different feed management. Conducting several experimental trials, majority of the hurdles in captive breeding, egg hatching, larval rearing and juveniles production have now been successfully over come. The experience gained in the captive breeding and seed production of these fish species can also be helpful to develop a technique for spawning and larval rearing of other valuable marine ornamental fishes as future holds great potential for tropical marine ornamentals in India.

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