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SEED PRODUCTION OF MARINE ORNAMENTAL FISHES FOR TRADE

The marine ornamental fish industry has been expanding in recent years and the global marine ornamental fish trade is estimated at US $ 200-330 million. Nearly 98% of the marine ornamental species marketed are wild-collected mainly from coral reefs of tropical developing countries. This has been threatening the long term sustainability of the trade due to indiscriminate exploitation of coral reef areas. India has a vast potential for the development of a marine ornamental fish trade and the hatchery production of selected marine ornamental fishes is the only option for the development of a long term sustainable trade. The Central Marine Fisheries Research Institute (CMFRI) has been focusing on this vital aspect for the past few years. During 2005-07 the Institute was able to develop hatchery production methods of the following eight species of ornamental fishes which are in high demand in the international trade.

1. *Amphiprion percula* - Orange clown
2. *A. ocellaris* - False clown
3. *Premnas biaculeatus* - Maroon clown (spine cheek anemone fish)
4. *Pomacentrus caeruleus* - Blue damsel
5. *Dascyllus trimaculatus* - Three spot damsel
6. *Dascyllus aruanus* - Humbug damsel
7. *Chromis viridis* - Bluegreen damsel
8. *Neopomacentrus nemurus* - Yellowtail damsel

Captive spawning of the false clown *Amphiprion ocellaris* was achieved and methods of hatchery production of juveniles were standardised. The spawning time was during early morning hours and the frequency of spawning ranged from 12 to 15 days. The clutch size per spawning ranged from 300 to 1000 eggs. Hatching was on the evening of 8th day of incubation and the newly hatched larvae measured from 3.2 to 4.0mm in length. The larviculture protocols were developed and during the 15th to 17th day of hatching the larvae metamorphosed into juveniles.

Hatchery produced false clown fish

Note: Species status ratification of morphologically similar *Amphiprion percula* and *A. ocellaris* using molecular taxonomy is pending – Editor

Silvery eggs of false clown fish

Spawning of the orange clown *Amphiprion percula* was obtained and methods of hatchery production were standardized. The spawning was during day time (0600 - 1530 h) and the spawning interval ranged from 14 to 18 days. The clutch size per spawning ranged from 112-557 eggs. The hatching was on the evening of the 8th day of incubation and the length of the newly hatched larvae ranged from 1.91 to 2.02 mm. The larviculture protocols were developed and during the 19th - 20th day of hatching, the larvae metamorphosed into juveniles. Captive breeding and seed production of the maroon clown (spine-cheek anemonefish) was also achieved. The broodstock was developed in 500 litre FRP tanks fitted with biological filtration and by providing special broodstock feeds. The spawning was during day time. The number of eggs per spawning ranged from 150 to 1000 numbers and the spawning interval was 15 to 20 days.

Six month old juveniles of false clown fish

A pair of spine-cheek anemonefish with newly spawned eggs deposited on tiles

Hatching occurred on the evening of the 6th day of incubation. The newly hatched larvae measured from 350 to 410 µ. Greenwater technique was employed for larval rearing and feeding protocols with enriched rotifers and newly hatched *Artemia* nauplii were developed. At 15th to 17th day of post hatch, the size of the juveniles ranged from 12 to 16mm.

Broodstock development and larval rearing were achieved for five species of damselfishes *viz.* the three spot damsel (*Dascyllus trimaculatus*), striped damsel (*Dascyllus aruanus*), the blue

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(Seed production of ..... Contd. from page 1)

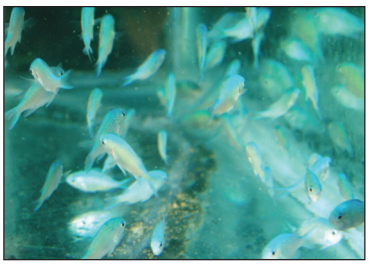
damsel (*Pomacentrus caeruleus*), the bluegreen damsel (*Chromis viridis)* and the yellowtail damsel (*Neopomacentrus nemurus)*. Four successful experiments on hatchery production of *D. trimaculatus* were conducted and the methods were standardised. The mature fish ranged in total length from 9-10cm. The clutch size in a single spawning ranged from 12000 – 15000 eggs. The average periodicity of spawning was two weeks. The average length of newly hatched larva was 2.5mm. The green water technique with sufficient nauplii of copepods were the key factors for the success of early larval rearing. The larvae started metamorphosing from 35th day of hatching and all larvae metamorphosed by the 40th day. The just metamorphosed young one measured 12-13mm in length. The second generation matured and spawned in the hatchery at eleven months of age.

Microscopic view of capsule shaped eggs of spine-cheek anemonefish after 24 h of fertilization

Hatchery produced humbug damsel

Hatchery production of the striped damsel *Dascyllus aruanus* was a pioneering achievement. Several successful experiments were conducted during the period. The breeders ranged in length from 7-8cm. The clutch size in a single spawning ranged from 8000 – 10,000. The average periodicity of spawning was two weeks. The average length of newly hatched larva was 2.4mm. The larvae started metamorphosing from 25th day of hatching and all the larvae metamorphosed by 31st day.

Hatchery produced blue damsel



Hatchery produced blue green damsel

The methodology for hatchery production of blue damsel *Pomacentrus caeruleus* was also standardised and several batches were produced in the hatchery. The breeders had a length range of 7-9cm. The clutch size in a single spawning ranged from 5000-6000 eggs. The average periodicity of spawning ranged from 3 to 12 days. The average length of the newly hatched larvae was 1.2mm but the mouth gape was comparatively larger (around 200µ). Employing green-water technique and by feeding with sufficient nauplii of suitable copepods for the first ten days and thereafter with freshly hatched *Artemia* nauplii was the methodology followed. The larvae started metamorphosing from the 17th day and by 21st day all of them metamorphosed. The average length of just metamorphosed juvenile was 21mm.

Hatchery produced yellowtail damsel

Broodstock development and seed production methods were also developed for the blue green damsel *Chromis viridis* and the yellow tail damsel *Neopomacentrus nemurus*.The broodstock development of the green damsel *Chromis viridis* was carried out in 2 t FRP tanks fitted with biological filter and by feeding with special broodstock feeds. The fishes became broodstock at a total length range of 8 -9 cm. The average frequency of spawning was 5 per month with an interval of about 5 days. The egg was oval shaped and the average length was 502µ.The total number of eggs per sawning ranged from 1300 -1500 eggs. Hatching occurred on the evening of the fourth day of incubation. Larvae were altricial type with no mouth opening at the time of hatching. The average length of newly hatched larva was 2.25mm. The larvae were transferred to 5 t capacity round FRP tanks in which cultures of the harpacticoid copepod *Euterpina acutifrons* and the calanoid copepod *Pseudodiaptomus serricaudatus* were maintained in green water produced by adding *Nannochloropsis* culture. Mouth formed on the second day of hatching and the gape measured around 190µ. The larvae started feeding on copepod nauplii from the 3rd day onwards. From the 32nd day of larval rearing freshly hatched *Artemia* nauplii was also supplemented. Metamorphosis started from 30th day and completed by 49th day.

The broodstock of the yellowtail damsel *Neopomacentrus nemurus* was developed in 2 t capacity FRP tanks. The average interval of spawning ranged from 4-5 days. The length of freshly laid egg was 870µ. The eggs hatched on the evening of the fourth day of incubation. The freshly hatched larva measured 1.8mm with a mouth gape of about 100µ. The larvae were transferred to 5 t capacity FRP tanks in which mixed culture of copepods were maintained in green water produced by adding cultures of *Nannochloropsis*. The larvae started feeding on nauplii of copepods from the third day of hatching. From the 12th day onwards the larvae were also fed *ad libitum* with freshly hatched *Artemia* nauplii. From the 16th to 21st day of hatching the larvae metamorphosed into juveniles. The length of the just metamorphosed juvenile ranged from 10 to13 mm.

The methodologies developed can be scaled up for commercial level production and a hatchery based production and trade of marine ornamental fish could become a reality in the country.

(Article contributed by Dr. G. Gopakumar, Head, Mariculture Division & SIC, Mandapam Regional Centre, Dr. K. Madhu, Senior Scientist and Dr. Rema Madhu, Scientist (Senior Scale))