# CMFRI

# Course Manual

*Winter School on*

***Recent Advances in Breeding and Larviculture of Marine Finfish and Shellfish***

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# BROODSTOCK DEVELOPMENT, BREEDING AND LARVAL REARING OF DAMSELFISHES

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## Introduction

In recent years it has been reported that nearly 1500 species of marine ornamental fishes are traded globally and most of these species are associated with coral reefs. Nearly 98% of the marine ornamental fishes marketed are wild collected from coral reefs of tropical countries. The damaging fishing methods which destroy the fragile corals and over harvesting of the species in demand are the vital problems associated with the trade. It is widely accepted that the ultimate answer to a long term sustainable trade of marine ornamental trade can be achieved only through the development of hatchery production technologies. In this context it is imperative to develop commercially viable seed production techniques of species which are in demand for the long term sustainability of the trade.

Among the most commercially traded families of reef fishes, family Pomacentridae dominates, accounting for nearly 43% of all fish traded. The damsel family contains about 235 species worldwide . The most widely traded pomacentrids in the international market in the recent past include the humbug damsel (*Dascyllus aruanus* ), the three spot damsel (*Dascyllus trimaculatus*), the blue damsel *Pomacentrus caeruleus* and the sapphire devil *Chrysiptera cyaenea.* Methodologies for breeding and seed production of damselfishes were developed and several trials of seed production were carried out in CMFRI and the methodologies are standardized. The methodologies can be scaled up to commercial level production.

## Broodstock development

Broodstock development was done in 1t FRP tanks in which biological filter was fitted to maintain the water quality to the optimum level. The filtration rate was about 200 L per hour. Six to eight fishes collected by traps were introduced in each tank for broodstock development. Water in the broodstock tanks was exchanged @30% once in a week. The broodstock tanks were kept under translucent roofing in order to reduce the light intensity. Feeding of the fishes was done once in a day @ 5-10% of the body weight. Various types of feeds like finely chopped fishes, shrimps and molluscan meat were given to the broodstock fishes. Substrata were provided in the broodstock tanks for the attachment of eggs during spawning.

All the damsel species were spawned in captivity after 4-8 months of maintenance in the broodstock tanks. Previous day before spawning the parent fishes actively cleaned the site for attaching the eggs by rubbing it with their pelvic fins and picking off any loose particles or algae with their mouths. During spawning, females attached their eggs on the cleaned site, which were immediately fertilized by the males. Spawning occurred during the morning hours. The development of egg took place in 3 days at 28 $^0$C. During this period the parent fishes took care of the eggs by protecting them and by fanning them with the pectoral fins and tail.

The mature fish of *D.trimaculatus* ranged in total length from 9-10 cm. Breeding was observed during early morning hours. Approximately 12000 to 15000 eggs were present in a single spawning. The oval eggs were attached either to the sides of the tanks or on the substrata provided inside the broodstock tanks and the average periodicity of spawning was 2 weeks. Parental care by the male was noted.

The mature fish of *D.aruanus* ranged in total length from 7 -8 cm. Spawning was observed during early morning hours. Approximately 8000-10000 eggs were present in a single spawning. The oval eggs were attached either to sides of the tanks or on the substrata provided inside the broodstock tanks. The average periodicity of spawning was 2 weeks. Parental care by the male was noted.

The mature fish of *P.caeruleus* ranged in total length from 7-9 cm. Spawning was noted during early morning hours. Approximately 5000-6000 eggs were present in a single spawning. The oval shaped eggs were attached on the substrata provided inside the broodstock tanks. The average periodicity of spawning ranged between 3 and 12 days. Parental care by the male was noted.

The mature fish of *C.cyanea* ranged from 5.0 - 6.5cm. The number of eggs per spawning ranged from 2000 - 2500. The interval between successive spawning ranged from 5-20 days. The eggs were either attached to the sides of the broodstock tank or on the substratum provided in the broodstock tank. The eggs were oval shaped and measured around 1.3mm in length and 0.6mm in width. Parental care by the male was noted. Hatching occurred on the night of the third day of incubation. The larvae were altritial type but with mouth opening at the time of hatching. The length of newly hatched larvae averaged to 2.5mm and the mouth gape around 150µ.

**Hatching and larval rearing**

The substratum with egg clutch was transferred to the larval rearing tanks containing sea water having the same physicochemical characteristics of the parent tank. A gentle air flow was created over the eggs by placing an air stone near to the egg clutch and left in darkness. Generally, hatching took place on the night of 3rd day of incubation. In some cases, the eggs were hatched in the broodstock tank and the newly hatched larvae were introduced into larviculture tanks. Larval rearing was carried out in 5 t FRP tanks. The inner side of the tank was light blue in colour in order to have a better contrast between the live feed and the surroundings.

Green water technique using microalgae *Nanachloropsis sp.* was adopted for the larval rearing of damselfishes. The adults of two species of copepods *viz*. *Euterpina acutifrons* and *Pseudodiaptomus serricaudatus* were inoculated into the green water. When the copepods have started their growth phase, as was noted by counting the number of egg bearing copepods and nauplii, the newly hatched larvae were introduced into these tanks.

The most critical aspect of larviculture of pomacentrids other than clownfishes is the underdeveloped state of larvae at hatching and the consequent problems of starter feed. The four species of damselfishes studied were with altritial type of larvae and the mouth gape of newly hatched larva ranged from 150 – 200 µ. Trials on feeding with the available strain of the rotifer *B. rotundiformis* as starter feed were not successful. The co-culturing of the selected two species of copepods *viz. P.serricaudatus* and *E.acutifrons* in green water along with larvae yielded positive results. The small size of the first naupliar stages of the copepods employed and the availability of different sizes of nauplii during the initial phase of larviculture had initiated and sustained the first exogenous feeding of the larvae. The initial stages of nauplii noted in the larviculture system measured from 60 – 80 µ, which is suited for the first feeding of the larvae. The high EPA, DHA and ARA content of copepods also would have facilitated the larval survival and growth.

It is also noted that the critical phase of larviculture was over by 15 – 20 dph . After 15-20 dph, the mouth gape had reached around 450µ and can be fed with freshly hatched *Artemia* nauplii. The absence of any mortality from this stage onwards indicated that once the starter feed problem is solved, the larviculture of these species could be accomplished easily with conventional live feeds.