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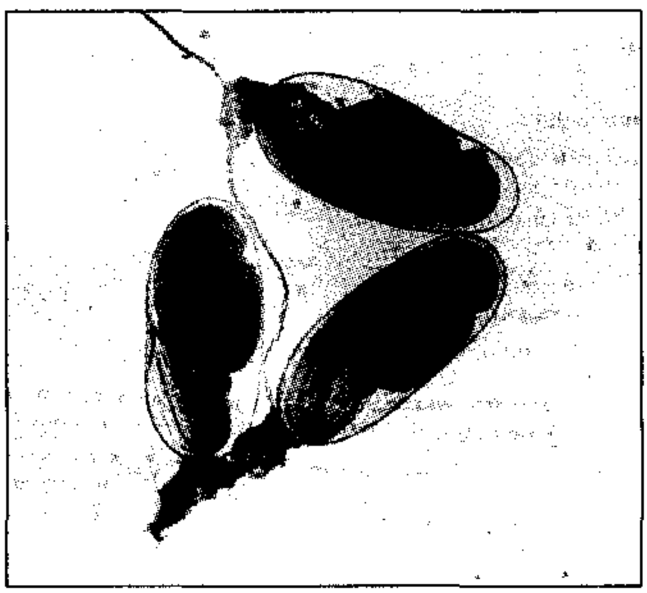
981 Breeding and larval rearing of three species of damselfishes (family: Pomacentridae)

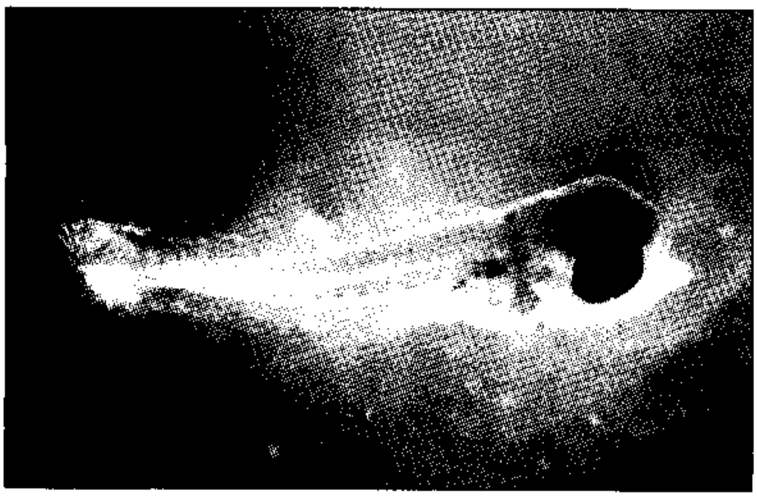
The annual world ornamental fish trade is to the tune of around 4.5 billion dollars (1995) with a growth rate of about 8%. Nearly 50% of the revenue from the trade is contributed by marine ornamental fishes. With the spread of scientific knowledge on marine aquarium management and development of an array of aquarium gadgets, there is an increased demand for tropical marine aquarium fishes in recent years and this opens up the possibility of developing a lucrative marine ornamental fish trade the worldover. Although India has a rich resource of marine ornamental fishes in the coral reef areas at Andaman and Nicobar Islands, Lakshadweep, Gulf of Kutch and Gulf of Mannar, the Indian ornamental fish trade remains at a very low profile. India's contribution to the world trade is only about 175 lakh rupees (0.02% of the world trade) and almost constituted by freshwater fishes. There is considerable scope for initiating and developing a marine ornamental fish trade in India. But the indiscriminate exploitation of ornamental fishes from the wild can cause severe damage to the delicate coral reef ecosystem. Moreover, even if safe methods which do not destory corals are employed for the capture of these fishes, the increasing demand for tropical marine ornamental fishes can lead to overexploitation and consequent depletion of their stocks. Hence, the development of technologies for their captive breeding and rearing which can lead to the production and supply of hatchery produced marine ornamental fishes offer a solution to this problem. The recent success in the hatchery production of clownfish by the Central Marine Fisheries Research Institute is one of the milestone in this direction. The present account deals with the breeding and larval rearing of three species of damselfiehs *viz. Neopomacentrus flamentosus, N. nemurus* and *Pomacentrus caeruleus.*

The damselfishes: The damselfishes constitute one of the major groups of marine ornamental fishes inhabiting tropical coral seas. Their unique behaviour, bright colours, small size, and quick acclimation to captivity make them very attractive to marine aquarists. There are about 300 species of damselfishes belonging to 22 genera under the family Pomacentridae, majority of which inhabit the Indo-Pacific region and about 100 species and 18 genera have been recorded from the Indian Ocean. More than 30 species belonging to the genera *Pomacentrus, Neopomacentrus, Chromis, Dascyllus, Abudefduf and Chrysiptera* are commonly available in Indian waters.

Many damselfishes are known to have polygynous mating systems with protogynous sex change. But damselfishes include gonochorists



Almost fully grown larvae of *N. filamentosus* fish inside the egg capsules with pre-determination of sex, protogynous and protandrous hermaphrodites in which the gonadial primordium bears both types of gonia. With a few exceptions, the polydomous species are primarily gonochorists and the monodomous ones are hermaphrodites, in which sex determination is socially controlled depending on the type and composition of the surrounding group of conspecifics. A technology for breeding and larval rearing of three species of damselfishes viz. the filamentous tail damsel (*Neopomacentrus flamentosus*), the yellow tail damsel (*Neopomacentrus nemurus*) and the blue damsel (*Pomacentrus caeruleus*) was developed at the Vizhinjam Research Centre of Central Marine Fisheries Research Institute. The species investigated are monodomous and protogynous hermaphrodies in which the larger fishes establish territories and finally become males. The mating system was promiscuous in which both males and females spawn with several mates.



Newly hatched larvae of *N. filamentosus*

Broodstock development: The fishes for broodstock development were collected using a small encircling net from Vizhinjam Bay. Broodstocks were maintained in rectangular cement tanks of one tonne capacity. The number of fish of one speices introduced into each tank ranged from 6-15. The fishes were fed *ad libitum* with boiled and finely chopped mussel meat twice daily. Continuous aeration was provided, excess feed removed and about 10% of water exchange was made. Small partially broken earthen pots were kept in the tanks which served as shelter for fish as well as substratum for the deposition of eggs. The length of mature fishes ranged from 7-11 cm, 8-10 cm, 6.5-7.5 cm for *N. filamentosus*, *N. nemurus* and *P. caeruleus* respectively. Breeding groups were developed in the tanks for these three species. Several mature females and males were developed in each tank.

Spawning: Polygamous mating behaviour was noted. The male parent drove out fishes other than its mate intruding into its territory. The egg laying was mainly during early morning hours, rarely extending up to noon. The clutch size of eggs ranged from 2400-5200, 1500-6300 and 3500-4000 for *N. filamentosus*, *N. nemurus* and *P.caeruleus* respectively. The eggs were attached either to the earthen pots placed in the tanks or to the sides of the tank. Females deposited eggs in the territories occuped by the males and one male fertilized one or more batches of eggs and guarded them simultaneously. The male parent continuously guarded the eggs and fanned the eggs with its fins and mouth.

Hatching of the eggs: The freshly laid eggs were yellowish, translucent, stalked and capsule shaped. The average lengths of the eggs were 1.15mm, 1.08mm and 0.96mm for *N. filamentosus*, *N. nemurus* and *P. caeruleus* respecitvely. The eggs were allowed to hatch in the broodstock tanks. The yellowish colour of the freshly laid eggs bacame whitish translucent from the second day. The duration of incubation ranged from 82-106 hours. On the day of hatching the egg capsule became very thin and transparent. The time of hatching was between 1900 to 2100 hrs. The larvae broke the egg capsule and came out. Normally the hatching rate was almost 100%. But sometimes partial hatching or no hatching was noted mainly in clutches deserted by the parent. Hatching failure was also noted due to damage of the eggs caused by ciliates.

Larval rearing: The length of newly hatched larvae ranged from 1.62 to 2.0 mm (average 1.90mm) for *N. filamentosus*, 1.50 to 2.0mm (average 1.72mm) for *N. nemurus* and 1.6 to 2.1mm (average 1.85mm) for *P. caeruleus*. The mouth gape of freshly hatched larvae ranged from 117-188µm (average 158µm) for *N. filamentosus*, 76-130µm (average 110µm) for *N. nemurus* and 115-167µm (average 144µm) for *P. caeruleus*. The newly hatched larvae were transferred carefully to rectangular cement tanks of one tonne capacity each. The inner sides of the tanks were coated with FRP of light green colour. Sufficient aeration was provided not only for exygenation but also for generating a slight water turbulence in the tanks. The larvae were fed *ad libitum* with ciliates (30-50µm size) cultured in microalgal waste. From the fourth day onwards boiled and finely smashed mussel meat which was filtered through 70µm sieve was provided frequently. From the tenth day, boiled and finely smashed mussel meat filtered through 120µm was provided *ad libitum*. After two weeks in addition to finely smashed mussel meat, the larvae were fed *ad libitum* with cultured *Moina micrura*. During the entire larval rearing period excess feed were removed and nearly 100% water exchange was provided daily. Larvae were active swimmers which exhibited zig zag movement. Larval habitat was almost near to the surface of water during the first three weeks and thereafter they moved towards the bottom of the tank. At the time of metamorphosis the larvae were inhabiting near the bottom of the tank except during feeding time when they swam up at the surface and the entire water column. The larvae metamorphosed and the characteristic colour pattern of the adults appeared within 30-40 days. The length of just metamorphosed fish larvae ranged from 18-20mm. The survival rate was 3-4% for the three species.

Conclusion: The present methodology needs refinement for commercial level production of damselfishes in hatcheries. The major areas of research to be focussed for improving the larval survival rate are (i) identification of suitable live feeds and of techniques for their mass culture (ii) evolving suitable feeding strategies at the various stages of larval rearing (iii) maintaining water quality of larval rearing tanks and (iv) development of standard larval rearing systems suited to each species. A technology for commercial level production of clownfish in hatchery is available, and the present methodology for the production of damselfishes also could be improved for commercial production.

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