

# First report on successful captive breeding of peacock eel, *Macragnathus aral*

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Ornamental fish are economically important for employment generation and livelihood development in many developing countries. India's share of the international trade is estimated to be around Rs. 158 lakhs (US\$ 197 million) which is only a small part of the world trade. Indigenous wild-caught ornamental fishes contribute the most towards India's exported ornamental fishes. North-eastern states and West Bengal have a rich freshwater fish biodiversity resource with a high ornamental value. Among these, freshwater peacock eels have enormous opportunities, not only in the domestic ornamental fish market but globally, also. Peacock eels are now widely preferred by aquarists and presently they are exported. As peacock eel species are hardy and compatible with other ornamental species, their importance is growing by the day. However, they are not yet fully incorporated in inland culture systems; the main reasons behind this are lack of information on the captive induced breeding, inadequate availability of natural fry and absence of commercial hatchery production.

The peacock eel *Macragnathus aral* belongs to the family Mastacembelidae. This is both a potential food fish as well as an indigenous ornamental fish.



*The peacock eel, Macragnathus aral.*

*M. aral* is classed as "Low Risk near threatened" (LRnt-category) in the CAMP report. The species is distributed in the Eastern Ghat region of India and has found a place in the IUCN Red List. The presence of 2-7 ocelli at the base of the dorsal fin and a long stripe on the dorsal part of the body can easily distinguish this species from others. *M. aral* mainly inhabits shallow waters in plains, floodplain wetlands, canals, paddy fields, beels, ponds and slow-moving rivers with vegetation in India, Pakistan, Sri Lanka, Bangladesh, Nepal, and Myanmar. The fish mainly prefers to feed on zooplankton, fish and insect eggs and larvae, crustaceans, annelids,

molluscs, and algae. Although detailed study on the sex ratio, gonadosomatic index, ova diameter and fecundity of *M. aral* have already been conducted there is no report on the captive breeding of *M. aral*. The eels are unique choice for the hobbyist and a valuable species for entrepreneurs to export, but they are also in demand as food fish across the country and hence are a candidate for aquaculture. The captive breeding of these freshwater eels is the only way to protect the wild stock and fulfill demand. Hence, the present study aimed to develop captive breeding techniques for *M. aral*.

*Cast net and trap (overleaf) for collection of peacock eel.*



## Collection of wild *M. aral* for captive rearing

The eels for captive breeding trials were collected from North and South 24 Parganas, Nadia and Bankura districts of West Bengal. Fish were mainly found in weed-choked wetlands, swamps, lakes and ponds with water depth of less than 1.5 m and a muddy bottom. The fishes were generally collected using bamboo traps in swampy areas, cast nets as well as hook and line in wetlands. The water parameters in natural habitats ranged between 24-32°C, pH 6.8-7.48, alkalinity 136-185 PPM and dissolved oxygen 4.9-7.0 mg/l. A total of 600 live specimens were collected and acclimatised for captive breeding.

## Maintenance

Tanks were provided with aquatic weeds and bamboo or PVC pipes for hides. The base was filled in with mud or sand to simulate natural conditions. The morphometric and meristic characteristics of *M. aral* was studied to identify the species. The food and feeding behaviour of the fishes were studied and they found to be omnivorous in nature, preferring live feed.

Peacock eels are very capricious in choosing food, so their daily diet needs to be varied and adapted to the preferences of individuals. Often there are situations when this fish will eat any food with pleasure, and the next day completely refuses the same. Therefore, to maintain the fish in captivity, they were fed with invertebrates, earthworms, crustaceans, mosquito larvae and small fish. Their preferred food was tubifex.

## Reproductive biology

The reproductive biology was studied during the month from April to September, and it was observed that 48% fishes were maturing stage (stage II), 36% mature (stage III) and 12% ripe



stage (stage IV). Out of total fish collected, the male: female ratio was found to be 3:1. The average weight of the gonads of males and females were 0.17 g and 1.94 g respectively. The ripe ova were dark green in colour with average ova diameter of 0.74 mm and fecundity of 1,250 eggs.

In captive conditions they preferred to stay inside any artificial hideout or amongst aquatic plant roots or the mud bottom. The preferred water temperature varied between 18-28°C. The suitable water quality parameters are mentioned below.

### Suitable water quality parameters.

Parameter	Range
pH	7.5-8.33
Alkalinity	136-185 ppm
Total dissolved solids	1,012 mg/l
Dissolved oxygen	9.77 mg/l

### Sexual dimorphism.

Male	Female
Stripe on the body is darker in males than females. Dorsal side is brownish in colour.	Females are quite larger than males. The belly of mature females is fully oranges. Dorsal side is greenish in colour.

A spawning pair.



## Breeding

The maturation of peacock eel occurs at the age of three years, but they reproduce very poorly in captivity. To keep peacock eels comfortable in captivity, we tried to simulate its natural habitat to keep the fish healthy, strong, and attractive. Simulating flooding conditions encountered during the rainy season in their natural habitat was believed to stimulate breeding behaviour.

**Natural breeding in captivity:** Breeding trials of peacock eels were conducted in glass aquaria of 60 x 45 cm. Small bamboo logs and aquatic plants such as water hyacinth were provided as substrate for spawning of the adhesive eggs. A mild flow of water was maintained in the aquarium with the help of an electrical filter and aerator. The length and weight/size of females and males were 12.8-15.2 cm and 10-15 g and 12.4-13.8 cm and 10-12 g, respectively. Female to male ratio was 2:4 for breeding.

**Induced breeding:** The synthetic hormone (SGnRH + Domperidone), commercially known as Spawn Pro was administrated in different dosages (0.03-0.05 mg/kg body weight). The doses were calculated based on the body weight of the brooders and were administrated near the base of the dorsal and pectoral fin at 45° with the body. Nylon threads and aquatic plants were provided as substrate for spawning. The size of females and males were 13.5-15.8 cm and 8.4-10.2 g and 10.7-12.5 cm and 6.5-7.6 g, respectively. Different ratios of females to males was taken for induced breeding, described below.

## Breeding performance

Male and female brooders were released at the sex ratio 1:1, 1:2 and 1:3 in separate glass aquaria. Courtship behaviour started after sunset; it was monitored without disturbing the breeding pairs. Spawning response varied from 10-12 hours. A total of 50-65 fertilised eggs of diameter 2.0-2.5 mm were

collected from one pair of fish after 14 hours. The fishes proved to be batch spawners. After ovulation the adhesive eggs were observed microscopically.

## Embryonic development

The developmental stages of *M. aral* embryo were categorized into different stages viz. zygote, cleavage, blastula, gastrula, segmentation, hatching and larval stages.

- **Zygote stage:** The fertilised eggs were adhesive, dark greenish brown in colour and the diameter was recorded as 0.74 + 0.05 mm. Cytoplasmic movements started after fertilisation.
- **Cleavage stage:** Blastomeres were formed after the first cleavage, after 30-40 min of fertilisation. Simultaneously, the blastomeres completed 64 cell divisional stages within 2-3 hours. As divided at an interval of 20-30 min after the first cleavage.
- **Blastula stage:** Blastula stage was initiated while 128 numbers of cells were formed. Rearrangement of cells was observed during this stage.
- **Gastrula stage:** Three germ layers and the embryonic axis were formed due to initiation of substantial cell movements with convergence, involution, and extension. Gastrula period remained for 5 to 10 hours.

Hatching was observed after 48-56 hours of spawning. Fertilisation rate was 40-45% and hatching rate was <50% in semi-natural breeding. 7-10 hatchlings were collected from a pair. The yolk sac was absorbed after 84-96 hours. The maximum mortality of the larvae was found after the fourth day of hatching. Larvae were fed with infusoria and egg yolk.

Larval development was successful for one month. Although the number of survivors was very low the survivors were healthy.

*Hiding behaviour of the peacock eel.*



### Larval length and weight by age.

Age (days)	Length
1	5 – 7 mm
3	8 – 9 mm
5	8 – 10 mm
7	9 – 12 mm
10	1.4 – 1.6 cm
15	2.7 – 3.2 cm
30	4.5 – 5.7 cm
60	7.2 – 8 cm

## Conclusion

The maturation and captive breeding technique of *M. aral* has been accomplished successfully by maintaining the favourable environmental conditions along with different other important factors viz. condition of broodstock, sex ratio, set up of the aquarium tanks, and temperature. As the fish is a nocturnal feeder and has unpredictable food preferences, it is very important to develop proper feeding strategies to grow the fish. Scrupulous monitoring and care is also required in the post spawning period, which is very critical phase as it determine the reproductive success. This study gives an overview of the reproductive dynamics, feeding and environmental preferences of *M. aral* in captive conditions. The present study also revealed that the fish responded well with the synthetic fish breeding hormone Spawn Pro and a 2:3 female and male ratio. But the fertilisation rate did not reach above 50% and the hatching rate also varied between 40-60%. Natural breeding is a better option for *M. aral* if the captive rearing is done successfully.



Eggs attached to aquatic plants and bamboo logs.