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FUNDAMENTAL RESEARCH GRANT**

**STUDIES ON DEVELOPMENT OF SENSORY ORGANS  
AND BEHAVIOURAL CHANGES IN THE LARVAE OF  
GROUPERS AND OTHER SPECIES OF  
AQUACULTURE IMPORTANCE**

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## ABSTRACT

### **Asian seabass, *Lates calcarifer***

This study was conducted to clarify the development of free neuromasts with growth of the Asian seabass, *Lates calcarifer*. A pair of free neuromasts was observed behind the unpigmented eyes in newly hatched yolk feeding larvae with a mean total length of 1.93 mm, and two-hour-old yolk feeding larvae could respond to an approaching pipette. At 2 days after hatching, the egg yolk sac was mostly consumed, the eyes were pigmented, and the larvae commenced feeding on rotifers. Free neuromasts increased in number with growth and commenced developing into canal neuromasts in Asian seabass 15 days old with a mean total length of 8.07 mm. The average length of the major axis of the trunk free neuromasts attained approximately 12.9–15.5  $\mu$  m, and the number of sensory cells was 15.4–17.5 at 15–20 days old. Developed cupulae of free neuromasts were observed in 1-day-old yolk feeding larvae. The direction of maximum sensitivity of free neuromasts, determined from the polarity of the sensory cells, coincided with the minor axis of the lozenge-shaped outline of the apical surface of the free neuromasts. The polarity of trunk neuromasts was usually oriented along the antero-posterior axis of the fish body, but a few had a dorso-ventral direction. On the head, free neuromasts were oriented on lines tangential to concentric circles around the eye.



## **Brown-marbled grouper, *Epinephelus fuscoguttatus***

The present study was conducted to understand the development of sensory organs and behaviour, to get useful knowledge for understanding the early life history and improving larval rearing methods of brown marbled grouper, *Epinephelus fuscoguttatus*. In newly hatched larvae, eyes were not pigmented and inner ears were oval-shaped vesicles with two otoliths. A pair of well-developed free neuromasts was located behind the eyes. The larvae were suspended motionless in water column, but they could escape from an approaching transparent pipette. The free neuromasts thus would play an important role to escape from predators. In 3-day-old larvae, the eyes were morphologically completed without rod cells. They commenced feeding on rotifers. Three semicircular canals of inner ears were formed, and the larvae swam horizontally. Taste buds were observed in the buccal cavity of 20-day-old larvae, and they commenced feeding on *Artemia* nauplii. The taste buds surely allow the larvae to eat other feed besides rotifer. In 50-day old fish, rod cells in retina were formed. Canal organs were formed on the head and trunk. They showed completion of morphological metamorphosis and settled down to substrates at the bottom of the tank. Brown marbled grouper spawn eggs at coastal areas during spring tides. The eggs and early larvae were speculated to move to less predator areas following tidal currents. After the sensory organs sufficiently developed, they settled down to substrates such as sea grass in coastal area. Accordingly, long periods of pelagic life style must be the strategy to survive in their habitats.



## **African catfish, *Clarias gariepinus***

African catfish *Clarias gariepinus* hatched with morphologically immature features; however, sensory organs developed rapidly with fish growth. Although the eyes of newly hatched larvae were immature without pigment, in 2 day-old larvae, the retina of the eyes had already developed except for the rod cells. No free neuromasts were observed in newly hatched larvae. In 1 day-old larvae, however, free neuromasts were observed on the head and trunk. Free neuromasts increased with larval growth. Newly hatched larvae had simple round-shaped otic vesicles; however, all sensory epithelia of the inner ear were observed until the larvae were 3 days old. Two day-old larvae swam horizontally, had sharp teeth, commenced ingesting rotifers and also artificial feed (small-size pellets) under both light and dark conditions; by then the larvae already had many taste buds. Three day-old larvae showed negative phototaxis and cannibalism by eating their conspecifics. Most of the free neuromasts observed in this study had the peculiar feature of many microvilli around the sensory cells on the apical surface. Detected free neuromasts as ordinary type lateral-line organs were not observed in previous reports in teleosts. In 10 day-old larvae, there were two lines of free neuromasts on the flank and lower edge of the trunk; presumptive canal neuromasts were oval shaped and had begun to sink under the skin. The direction of maximum sensitivity of the neuromasts was parallel with the longitudinal axis of their elliptical apical surface.

