Cromileptes altivelis (Valenciennes, 1828)

Muktha M.

IDENTIFICATION

Order	:	**Perciformes**
Family	:	**Serranidae**
Common/FAO Name (English)	:	**Humpback grouper**

Local names: Kalava **(Malyalam)**

MORPHOLOGICAL DESCRIPTION

Compressed body with depth less than head length, head length 2.5-2.8 times in standard length, anterior part of head low and flattened, dorsal profile deeply concave behind eyes, pre-orbital is very narrow, canine teeth completely absent, jaws have villiform teeth, maxilla extending to rear half of eye, pre-operculum angle serrated but lacking any large spines, 2 flat spines on operculum, gill rakers are short numbering 8-11 on upper limb and 13-17 on lower limb, dorsal fin with 10 spines and17-19 soft rays, dorsal fin origin is over the opercle, anal fin with 3 spines and 9-11 soft rays, pectoral fin rounded with 17-18 rays, caudal fin rounded, scales are smooth, lateral line scales 54-62, pyloric caeca 13. Colour of the species is light with a number of dark spots on the body. Maximum size recorded is 71 cm total length (TL).

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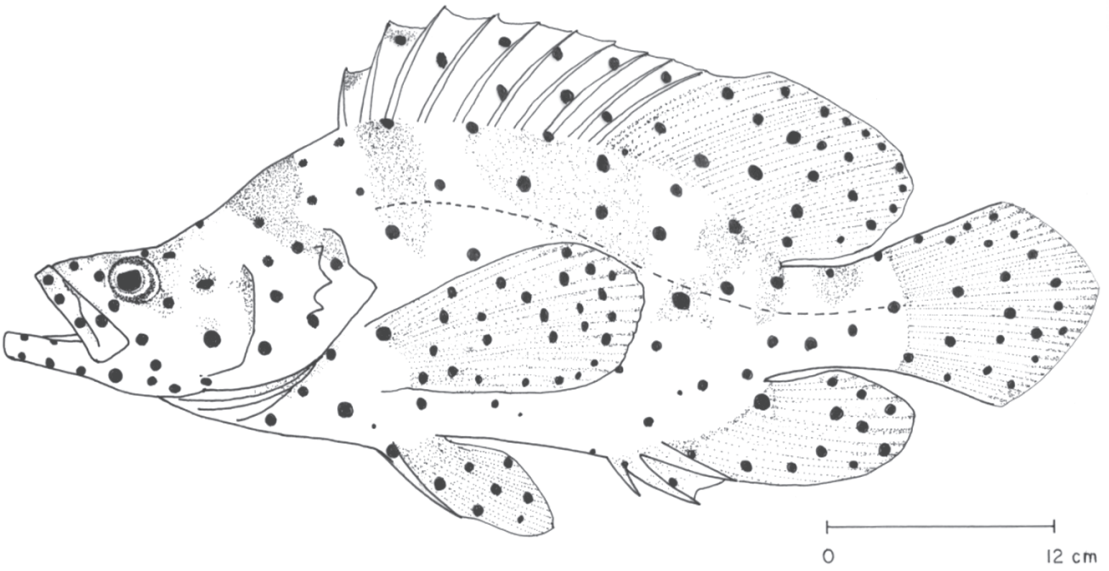

PROFILE

GEOGRAPHICAL DISTRIBUTION

Humpback grouper occurs in western Pacific from southern Japan (Ogasawara) to southern Queensland and northern western Australia and eastward to Fiji. In India, this species is rare, few specimens have been collected from Kanyakumari, Tamil Nadu and Vizhinjam, Kerala.

HABITAT AND BIOLOGY

Cromileptes altivelis inhabits shallow waters of coral and rocky reefs and is also found in tidal pools. Juveniles are found in inshore areas, lagoons, fringing reefs and sea grass beds. It feeds on bottom-living invertebrates and fish. It is a monandric protogynous hermaphrodite and moves in pairs or as individuals and does not form large spawning aggregations. The maturity of females is between 30 and 40 cm TL. The first age of sexual maturation in females has been reported at 155 mm standard length (SL) at 1.5 years age. First maturation at 2 years has been reported from Australia. Length at which 50 % of the population is male was estimated to be 547 mm fork length

(FL) in Australia. It has been reported that females are more numerous among smaller and younger fish and males in larger and older fish. Transitional individuals occur over a number of ages indicating a flexible sex-change process in this species. Spawning round the year has been reported from Indonesia and for restricted months (October-January) from Australia. Multiple spawning has been reported in a single season. The spawning pattern follows a lunar rhythm. Spawning occurs for 7-10 days around each new moon day in most cases. Maximum size recorded is 71 cm. Sizes of 350 to 710 mm FL have been determined to be between 1 and 19 years old.

PRODUCTION SYSTEMS

BREEDING IN CAPTIVE CONDITIONS

Due to its high demand the first spawning trial was conducted as early as 1979 in Indonesia. However its first larval rearing cycle was successfully completed at Gondol, Indonesia in 1996. The first time mass seed production (> 1,00,000 seed) of humpback grouper was achieved at Gondol, Indonesia during 1999-2000.

In Indonesia wild collected mature male and female fish were kept in 100 t circular tanks for acclimatization. Water was maintained at a depth of 2 m with 200-300 % daily water exchange. Mature male fish were 2.9-3.4 kg and female fish were 1.48-2.3 kg size. The male female ratio was 1:5. The fish were fed sardines, squid and vitamin-mineral mixture. Natural spawning occurred generally during new moon phase. The number of eggs released ranged from 0.4-4.2 million per spawning event. The fertilization rate was 80-98 %. The fertilized eggs after spawning were transferred to 1-2 t capacity hatching tanks. The hatching rate was 10.3-88.8 %. Water salinity was 33-34 g/l and temperature was 28-30 °C. Incubation period was 18-20 h. In another study in Indonesia hatching time ranged from 18 h 41 min to 20 h 29 min. Hatching rate was higher for eggs at densities less than 1,500/l than those stocked at higher densities. Hatching rate was also higher for eggs which had 200 % or more daily water exchange as compared to lower water exchange rates. Aeration rate also affected hatching with increased aeration rates enabling higher hatching rates and larval survival. This study concluded that for good hatching rates for humpback grouper egg density of 500/l with water exchange of 200 % per day at aeration rates of 600 ml/min was optimal.

LARVAL REARING

Larval rearing is difficult since the humpback grouper larvae are very sensitive to the environment during the metamorphosis stage and hence show high mortalities. Newly hatched larvae were stocked in 10 t tanks at stocking rates of 10-15 larvae/l. Salinity of seawater was 33-34 g/l with temperatures of 28-30 °C. *Nannochloropsis* sp. was added into the tanks within 24 hours of larval stocking at densities of 2-3 x 10^5 cells/ml and the same was maintained till the 20th day. SS-type rotifers were introduced from the 2nd day and maintained till the 5th day at densities of 7-10 nos./ml. S-type rotifers were introduced on the 5th day and maintained till the 15th day at densities of 10-15 nos./ml. This was discontinued after the 20th day. Newly hatched *Artemia* nauplii were supplied from 15th day onwards at densities of 0.1 nos./ml which was increased to 0.2 nos./ml by

the 18th day. From the 18th to 45th day density of *Artemia* was increased to 0.5 nos./ml. Commercial feed was also started from the 20th day onwards. Feed size was increased from 230 µm to 820 µm from day 20 to 50. The average size at the end of larval rearing of 50 days was 2.44 cm. The survival rate of larvae was 2.63-5.13 %. A study in Indonesia has reported that water temperature influenced the growth, spine development, feeding and survival of humpback larvae significantly. The study found that larval growth was best in water temperature of 31 °C. The study found that spine development occurred faster at higher water temperatures. Feeding rates were highest at 28 °C and 31 °C. Survival was highest at 28 °C. Artificial lighting (1000 to 1500 lux) was provided during the larval rearing period.

PERIOD OF CULTURE	DURATION OF LIGHT (hrs)
Day 2	08:00 to 20:00
Day 3 to Day 5	05:45 (Just before sunrise) to 22:00
Day 6	05:45 to 21:00
Day 7 to 10	05:45 to 20:00
Day 11 onwards	05:45 to 19:00 (30 min after sunset)

NURSERY REARING

Nursery rearing of humpback grouper involves rearing the 2-3 cm sized larvae to fingerling sizes of 5-10 cm which can then be stocked in cages for grow-out. Tank rearing has been found to suit humpback grouper the best during nursery rearing. Tanks can be of any shape with illumination of 600 lux is suitable. Good quality seawater which is exchanged daily at the rate of 300 % is required. The optimum water quality parameters for nursery rearing of humpback grouper are temperature 27-32 °C, salinity 25-35 g/l, DO 6-8 mg/l, pH 7.8-8.3 and unionized ammonia < 0.02 mg/l. Nursery rearing of humpback grouper was also carried out in cages in Indonesia. Net cages of size 1m x 1m x 1.5 m are used for rearing the groupers to 9-12 cm sizes. The nursery rearing of humpback grouper in net cages lasted for 3-4 months at stocking densities of 150-200/cage. Fish were fed 3-4 times daily with a mix of trash fish and commercial diets *ad libitum*. Net was changed every 7-10 days to maintain water quality and prevent disease attacks. Once fish reached 15-17 cm, stocking density was reduced to 75-100 nos./cage.

GROW-OUT

Grow out of humpback grouper was carried out in floating net cages in Indonesia of sizes 3m x 3m x 3m. The fish of size 15-17 cm were stocked in cages at densities of 50-75 fish/cage. They were fed trash fish and pellet feed incorporated with Vit. C and minerals 1-2 times daily *ad libitum*. The market size of 500 g was reached after culture of 16-19 months. The survival of humpback grouper was 50-90 %. The FCR varied from 5.44-13.52.

FOOD AND FEEDING

Fingerlings of humpback grouper of less than 50 g have been shown to require feeds of 50-56 % crude protein and 9-15 % fat. In grow-out system, fish were fed with trash fish and pellet feed. The pellet feed should not have less than 53 % crude protein and 10-12% lipid.

GROWTH RATE

Humpback grouper grew to a size of 20-29.5 g after 14 weeks of culture from 4.1 g. They attained a size of 400-600 g after 18-20 months of culture.

DISEASES AND CONTROL MEASURES

The rapid development of humpback grouper culture led to the incidence of infectious diseases caused by bacteria, parasites and viruses that have become more and more severe which has resulted in serious economic losses in farms and hatcheries. The list of disease causing organisms reported in *C. altivelis* and their control measures are listed below.

Disease & Causative agent	Control measures
Bacterial diseases	
Fin rot (*Flexibacter maritimus)*	Freshwater bath for 10-15 min
Viral infections	
Nervous necrosis virus (Betanodavirus)	Screening of Broodstock both pre- and post-spawning; disinfection of fertilized eggs using ozone or iodine; proper hatchery management; vaccination of fish
Fungal disease	
Ichthyophoniosis *(Ichthyophonus* sp.*)*	Caution when using trash fish as feed
Parasitic disease	
Amyloodioniosis (*Amyloodinium ocellatum*)	Use of filtered and disinfected water; freshwater bath, bath in 0.5 mg/l copper sulphate for 3-5 days or 200 mg/l formalin for 30-60 min
Cryptocaryonosis (*Cryptocaryon irritans*)	Maintain 1 h in freshwater over 2-3 days; treatment with 0.5 mg/l copper sulphate for 5-7 days with strong aeration
Trichodiniosis (*Trichodina* sp., *Trichodinella* sp. and *Tripartiella* sp.)	Freshwater bath for 1 h for 3 days; chemical treatment using 200 mg/l formalin for 30-60 min with strong aeration or 25-30 mg/l formalin for 1-2 days

Skin monogeneans (*Benedenia epinepheli*, *Benedenia* spp., *Neobenedenia girellae* and *Neobenedenia* spp.)	Freshwater bath for 5-30 minutes; treatment with 150 mg/l hydrogen peroxide for 10-30 min with strong aeration
Gill monogeneans (*Pseudorhabdosynochus* spp., *Megalocotyloides* spp. and *Diplectanum epinepheli*)	Bath with 200 mg/l hydrogen peroxide for 1 h; 100-200 mg/l formalin treatment for 30-60 min with strong aeration
Nematode induced infections (*Philometra* sp., *Anisakis* sp. and *Raphidascaris* sp.)	Avoid feeding with infected trash fish; eliminate intermediate hosts (*copepods*); dry the pond bottom; disinfect the culture facilities with quicklime to destroy the eggs of the nematode
Sea lice Infection (*Caligus epidemicus*, *Caligus* sp. and *Lepeophtheirus* sp.)	Sufficient water exchange; Freshwater bath for 10-15 min; chemical treatment using 150 mg/l hydrogen peroxide for 30 min or 200-250 mg/l formalin for 1 h with strong aeration
Leech induced infections	Use of filtered water, manual removal using wet cloth, bath with 200-250 mg/l formalin for 1 h with strong aeration; culture facilities must be cleaned; disinfected with chlorine and exposed to intense sunlight for several weeks prior to use to eliminate cocoons of the parasite.
Nutritional disease	
Lipodosis Fish scurvy	Proper handling and storage of feed use of stable form of ascorbic acid in diet in required quantities
Nutritional myopathy accompanying ceroidosis	Proper food management; rancidity to be prevented by frozen storage of food; use of anti-oxidants; enrichment of food with vitamin complex
Thiamin deficiency	Long-term feeding with only sardine or anchovy should be avoided; enrichment of food with vitamin complex

Environmental disease	
Swim bladder stress syndrome	Harvest; if market size fish is affected, remove small affected fish to prevent infections; remove gas by piercing the abdomen of brooders followed by treating the site with 0.1 % acriflavine

PRODUCTION, MARKET AND TRADE

PRODUCTION

Global production was 3 t and 1 t in 2006 and 2007 respectively.

MARKET AND TRADE

It is the most priced fish in the live reef food fish trade in Hong Kong. The volume of humpback grouper imported into China during 1997-2005 ranged from 133 kg to 8,700 kg with an estimated peak value of US $ 1,276,000. During 1999-2002 its retail price ranged from US $ 82-118/kg in Hong Kong. In addition, juveniles of humpback grouper have high demand in the aquarium trade as ornamental fish. Juveniles of 5-10 cm size fetched US $1 in Indonesia and US $ 8-10 in Singapore and Australia. As part of the aquarium trade this species is exported from Indonesia to USA, Singapore and Hong Kong. Larger humpback groupers occupy the prominent spot in the live reef food fish industry. The major exporting countries are Indonesia, Vietnam, Taiwan, Philippines, Thailand and Australia.

CHALLENGES TO MARICULTURE

The main researchable issues, which have to be sorted out for this species in India are (i) Broodstock development protocol: mature broodstock of both sexes is required simultaneously for reliable seed production of grouper. However obtaining males from the wild for spawning is difficult because groupers are protogynous hermaphrodites (ii) Larval rearing protocol: standardization of larval rearing by environmental and nutritional interference (iii) Disease and feed management (iv) Selective breeding for enhancement of growth rate since this species is naturally slow growing.

FUTURE PROSPECTS

Humpback grouper is a popular fish with a high market demand in many parts of the world, such as Indonesia, Singapore, Malaysia, Thailand, Philippines, Hong Kong, Taiwan and China. It fetches a very high price (US $ 82-118/kg) in the international market (Hong Kong and other south-east Asian countries). In addition, it has a very good market demand as ornamental fish. It thrives well in

ponds as well as cages. So it can be an ideal species for Indian mariculture, though the growth rate is slow, which can be compensated by the higher price.

SUGGESTED READING

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