

Epinephelus malabaricus (Bloch & Schneider, 1801)

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IDENTIFICATION

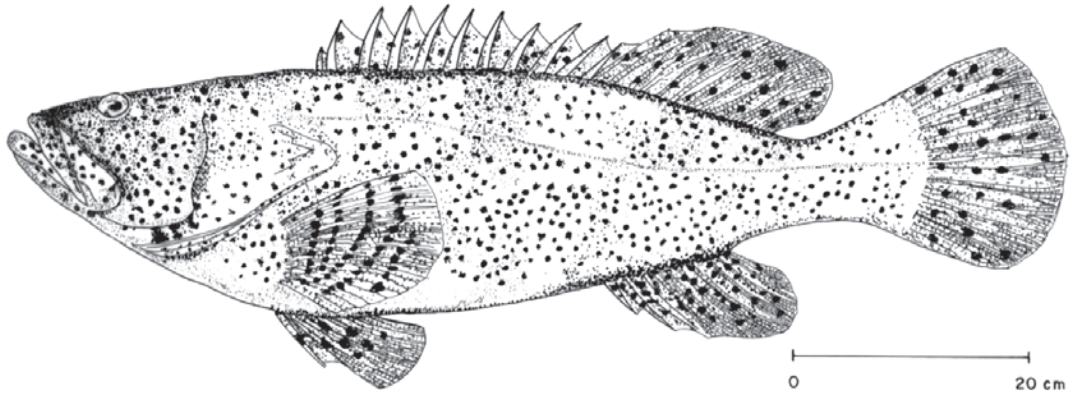
Order	: Perciformes
Family	: Serranidae
Common/FAO Name (English)	: Malabar grouper



Local names: Wekhanu (**Gujarati**); Hekaru, Gobra (**Marathi**); Gobri (**Konkani**); Gopra, Muni meen (**Kannada**); Pulli kalawa, Kalawa (**Malayalam**); Kalava, Punni-kalava, Azhuka (**Tamil**); Kodi punju, Bontha (**Telugu**); Bhala (**Oriya**)

MORPHOLOGICAL DESCRIPTION

Body is elongate with body depth 3.0 to 3.7 in standard length (for fish of 15 to 69 cm standard length). The interorbital area is flat or slightly convex and the preopercle is sub-angular, with enlarged serrae at the angle. The maxilla extends past the rear edge of the orbit. There are 8-11 gill rakers on the upper limb and 14-18 on the lower limb. Dorsal fin has 11 spines and 14-16 rays, the third to fifth spines are slightly longer than posterior spines. The anal fin has 3 spines and 8 rays, the third spine is usually the longest. The pectoral fin has 18-20 rays. The caudal fin is rounded. The lateral-line has 54-64 scales. Pyloric caecae are numerous with more than 80 branches. Head and body brownish, covered with small, well-separated, blackish brown spots which extend onto chest, lower jaw and gular area and roof of mouth; head and body also with scattered white spots and blotches; 5 irregular, oblique, dark brown bars (more or less interrupted by pale spots) often visible on body; fins with scattered small black spots.



PROFILE

GEOGRAPHICAL DISTRIBUTION

The species is distributed in the Indo-Pacific area. It occurs in continental and insular localities: off Gulf of Aqaba, Sudan, Saudi Arabia, Djibouti, Ethiopia, Kenya, Zanzibar, Tanzania, Mozambique, Oman, Madagascar, Comoros, Seychelles, India, Sri Lanka, Indonesia, Singapore, Philippines, Taiwan, China, Papua New Guinea, New Ireland, Caroline Islands, New Caledonia and Tonga. In Australia, it occurs from the Northern Territory to New South Wales. This species is common along the west coast of India and in the Gulf of Mannar. It has been reported all along the Indian coast except from Odisha and West Bengal.

HABITAT AND BIOLOGY

A common species found in a variety of habitats such as coral and rocky reefs, tide pools, estuaries, mangrove swamps and sandy or mud bottom from shore to depths of 150 m. Juveniles of the species are found near shore and in estuaries. The fish feeds primarily on fishes and crustaceans and occasionally on cephalopods.

Epinephelus malabaricus is a monandric protogynous hermaphrodite species. The size at first maturity in females is 78.6 cm in coastal waters of Tanzania and 76.2 cm to 83.9 cm from north-western Australia. Sex change from female to male has been reported at size ranges of 105.5 cm to 114.7 cm at corresponding age of more than 10 years. Spawning aggregations have been reported from Andaman Islands. The spawning season is from September to February. Eggs are spherical, smooth and floating in nature.

The species has a very low resilience to fishing, with a minimum population doubling time more than 14 years. This species is solitary in nature. The maximum recorded total length is 150 cm which corresponds to a weight of 53 kg.

BREEDING IN CAPTIVE CONDITIONS

Seed production technology of grouper is being developed at National Institute of Coastal Aquaculture (NICA) since 1984 using techniques similar for seabass, *Lates calcarifer*. Mass propagation was reported at NICA since 1990-1996, with inconsistent production. In India, experimental culture of groupers was initiated two decades back by CMFRI, Kochi. Success was achieved in broodstock development, sex inversion and captive spawning of *E. malabaricus*. Broodstock development and sex inversion of the species was carried out at the mariculture laboratory at Vizhinjam Research Centre of CMFRI, India.

Broodstock development and seed production of *E. malabaricus* was carried out at NICA hatchery, Thailand. Broodfishes were transported from net cages to a 150 t outdoor tank at the hatchery. The broodfish were fed fresh sardines at the rate of 1-2 % of body weight each day. Vitamin E at the rate of 400 mg was added to 1 kg of feed once a week. The broodstock feed was supplemented with vitamin C, premix and fish oil at the rate of 0.3, 0.3 and 0.35 g/week. The salinity and temperature of water was 30-31 g/l and 28-30 °C respectively. Aeration was supplied to the water at the rate of 4-5 l/m³/sec continuously. Water exchange (50-80 %) was carried out every day. The broodfishes were induced to spawn by two methods viz., by water manipulation and by hormone induction. Water manipulation involved changing 80 % of the water over a period of 5 days before new moon or full moon. Subsequently, new water was added to the tank with continuous flow through until dusk each day. Fish spawned during the beginning of new moon or full moon and once spawning started, it continued for 7-10 days. In the second method, spawning was induced by hormone injection. Puberogen hormone was used at the rate of 100 IU/kg and 50 IU/kg for female and male brooders, respectively. In Taiwan, the males and females of *E. malabaricus* were injected with gonadotropin hormone to induce maturation and ovulation. Both male and female were stripped for milt and ova and artificial fertilization was followed. The egg production and spawning frequency of broodfishes injected with hormone were higher than those treated by water manipulation. The grouper lay eggs at night from 21:00-24:00 hrs. The following morning, fertilized eggs were collected and transferred to a funnel fibreglass tank (500 l) at a stocking density of 1,000-2,000 eggs/l. The fertilized eggs hatched within 17-19 h at a water temperature of 26-29 °C and salinity of 30-31 g/l.

LARVAL REARING

A cement tank measuring 4m x 6m x 1.5 m containing 25 t of water was used as larval rearing tank. The hatched out larvae were stocked in larval rearing tank at 10-15 nos./l. Screened rotifers of less than 125 µm were added to the larval rearing tank after 48 h of hatching. In Taiwan, 96 h old larvae were fed with oyster trochophore followed with rotifers, copepods, *Artemia* nauplii, eel meat and frozen mysids. From day 5 onwards, unscreened rotifers were used for larval rearing. *Artemia* nauplii were added in the larval rearing tank from day 15 onwards. In about a month's time, postlarvae reached a length of 1.5 cm and after 3 months they reached 8 cm with an average survival of 14 %.

NURSERY REARING

Epinephelus malabaricus fry (1.0-2.5 cm) either from the wild or from fish hatchery needs nursing before stocking to pond or cage. Concrete tanks, nylon net cages and earthen ponds can be used for nursing facilities. Round or rectangular-shaped concrete ponds or tanks with a water capacity of 1-30 t were stocked at densities of 15-50 nos./m³ and earthen ponds with areas ranging from 800 m² up to 3200 m² were stocked at 25-100 nos./m² and were fed with trash fish. Grading based on size was needed for homogenous growth and minimizes losses due to cannibalism. The fishes can be partially or fully harvested by seine and sold or transferred to culture. The survival rates of harvested fingerling were low in earthen pond when compared to concrete tanks.

Net cage (1 m x 1 m x 1.5 m) nursing exhibited better results than concrete ponds. Stocking of fingerlings of size 5.7 cm (3.1 gm) at 300-500 nos./m³ and feeding with trash fish for 75 days produced 14.1 cm (49.9 gm) with survival rate of 91.1 %.

GROW-OUT

The Malabar grouper is cultured in ponds and cages, however generally, cage culture is preferred for grow out. A good fish pond for grow-out should have an area of about 800-1600 m² with 1.5-2.0 m water depth. Ponds were prepared and fertilized. Once the natural feed (plankton) was abundant, juveniles were stocked in to the pond. During culture, 40-70 % of water exchange was performed daily. FCR for pond culture of Malabar grouper was high (3.2-3.6:1).

Different shapes and sizes of cages are used for culture. The net mesh size depends on size of fish to be cultured, ranging from 1-2.5 cm for nursery and 5-7 cm for grow out. The stocking density recommended is 15 fish/m² but can be stocked at higher densities ranging from 30-200 fish/m². Cage culture was performed for six months in Gulf of Mannar along south-east coast of India. A study on the grow-out production of the Malabar grouper was carried out by CMFRI in indoor FRP tanks of 5 t capacity, with re-circulating sea water systems, using indigenously made *in situ* biofilters in the field mariculture laboratory at Kochi Fisheries Harbour in 1999.

FOOD AND FEEDING

Majority of fish farmers use low value fish for feeding groupers. These fishes prefer the yellowstripe trevally (*Selaroides leptolepis*), threadfin bream (*Nemipterus hexodon*), fringescale sardine (*Sardinella fimbriata*) and round scad (*Decapterus russelli*) which can be minced, chopped, cut or whole fed depending on size of fish to be fed.

GROWTH RATE

They can grow from egg to 600 g in about 1 year with cage grow out system. Fingerlings of size 3.1 g fed with low value fish grew to 49.9 g in 75 days.

DISEASES AND CONTROL MEASURES

Disease/Causative agent	Measures
Viral Diseases	
Piscine nodavirus of the genus Betanodavirus	Strict husbandry management in the hatchery phase
Fish Lymphocystis Disease virus (FLDV)	Avoid skin damage and quarantine of new fish; Early detection of viral pathogens in the hatchery
Bacterial Diseases	
<i>Vibrio parahaemolyticus</i> , <i>V. alginolyticus</i> , <i>V. vulnificus</i> , and <i>V. carchariae</i>	Oxalinic acid mixed with feed (20 mg/kg of feed); Terramycin to feed (7.5 g/kg for first 5 days followed by 3.75 g/kg for the next 5 days)
<i>Streptococcus</i> sp.	Oxalinic acid mixed with feed (20 mg/kg of feed)
<i>Cytophaga</i> sp., <i>Flexibacter</i> sp. or <i>Flavobacterium</i> sp.	Oxalinic acid mixed with feed at 20 mg/kg of feed and oxytetracycline at 75 mg/kg of feed/day for 10 days; Acriflavin dip at 100 mg/l for 1 min and potassium permanganate bath at 2-4 mg/l
Parasitic Diseases	
<i>Cryptocaryon irritans</i>	Vaccination; Freshwater bath for 1 h for 2-3 days; 0.5 mg/l copper sulphate (CuSO ₄) treatment for 5-7 days with strong aeration
<i>Trichodina</i> , <i>Trichodinella</i> and <i>Tripartiella</i>	Freshwater bath for 1 h for 3 days; 200 mg/l formalin treatment for 30-60 min with strong aeration; 25-30 mg/l formalin treatment for 1 - 2 days
<i>Benedenia epinepheli</i> , <i>Benedenia</i> spp., <i>Neobenedenia girellae</i> and <i>Neobenedenia</i> spp.	Freshwater bath for 5-30 min; 150 mg/l hydrogen peroxide (H ₂ O ₂) treatment for 10-30 min
<i>Pseudorhabdosynochus</i> spp., <i>Megalocotyloides</i> spp. and <i>Diplectanum epinepheli</i>	200 mg/l hydrogen peroxide treatment for 1 h; 100-200 mg/l formalin treatment for 30-60 min

<i>Gonapodasmius epinepheli</i>	Elimination of intermediate hosts (gastropod molluscs)
<i>Philometra</i> sp., <i>Anisakis</i> sp. and <i>Raphidascaris</i> sp.	Elimination of intermediate hosts (copepods), Drying the pond bottom; Disinfecting the culture
<i>Caligus epidemicus</i> , <i>Caligus</i> sp. and <i>Lepeophtheirus</i> sp.	Sufficient water exchange
Isopod	Manual removal of parasite
Leeches	200-250 mg/l formalin treatment for 1 h

PRODUCTION, MARKET AND TRADE

PRODUCTION

Malabar groupers have been cultured mainly in Taiwan, Thailand, Philippines and Singapore. The reported global production was 84 t and 57 t in 2006 and 2007 respectively.

MARKET AND TRADE

Groupers, in recent years, have assumed commercial importance in view of their good quality meat and high consumer demand, in local and export markets. The largest market for live grouper is in Asia, traditionally Hong Kong but now China and Singapore are the major markets. *Epinephelus malabaricus* is one of the 13 principal species in the live-fish export trade from the Indo-Pacific region. The price of the item in domestic market is around ₹ 450/ kg in India.

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. However, for obtaining males from the wild for spawning is cumbersome because groupers are protogynous hermaphrodites (ii) Larval rearing protocol: standardization of larval rearing by environmental and nutritional manipulations (iii) Standardization of techniques for nursery rearing and grow-out culture (iv) Disease and feed management.

FUTURE PROSPECTS

Groupers are ideal candidate species for intensive aquaculture particularly in the Asia-Pacific region because of high consumer demand, desirable taste and hardiness in a crowded environment, fast growth and efficient feed conversion. Groupers are popular fish with a high market demand in many parts of the world, such as in Kuwait, Indonesia, Singapore, Malaysia, Thailand, Philippines, Hong Kong, Taiwan, China, Mexico, Japan, and USA. Malabar grouper being a popular food fish, domestically and internationally, offer a good source of income for farmers culturing it.

SUGGESTED READING

Badhul-Haq, M. A., Srinivasan, M., Vignesh, R., Shalini, R. and Brajamani, M. K. H. 2011. Cage culture of *Epinephelus malabaricus*, Bloch and Schneider, 1801, in Mandapam Coastal waters, Southeast Coast of India. J. Environ. Sci., 3: 166-172.

Badhul-Haq, M. A., Vignesh, R., Srinivasan, M. and Brajamani, M. K. H. 2011. A report on the length and weight relationship of grouper *Epinephelus malabaricus*, Bloch and Schneider, 1801 from Mandapam coastal waters Southeast Coast of India. Arch. Appl. Sci. Res., 3: 166-172.

CMFRI, 1999. Annual Report 1998-99. Central Marine Fisheries Research Institute, Cochin, p. 45-47.

Craig, M. T., Sadovy de Mitcheson, Y. J. and Heemstra, P. C. 2011. Groupers of the World: A Field and Market Guide. NISC (Pty) Ltd., Grahamstown, South Africa, 424 pp.

Eleonor A. T. and Celia R. L. P. 2004. Bacterial diseases. In: Nagasawa, K. and Cruz-Lacierda, E. R. (Eds.) Diseases of cultured groupers. Southeast Asian Fisheries Development Center, Aquaculture Department, Iloilo, Philippines, p. 19-24.

Froese, R. and Pauly, D. 2013. *Epinephelus malabaricus* in FishBase. December 2013.

Gaspere, L. and Bryceson, I. 2013. Reproductive biology and fishery-related characteristics of the malabar grouper (*Epinephelus malabaricus*) caught in the coastal waters of Mafia Island, Tanzania. J. Mar. Biol., p.11.

Gopakumar, G., Madhu, K., Madhu, R., Ignatius, B., Krishnan, L. and Mathew, G. 2009. Broodstock development, breeding and seed production of selected marine food fishes and ornamental fishes. Mar. Fish. Info. Serv. Tech. Ext. Ser. (201): 2.

Hamsa, K. M. S. A. and Kasim, H. M. 1992. Growth and production potential of young grouper *Epinephelus tauvina* (Forssk&l) reared in fixed net cages. J. Mar. Biol. Ass. India, 34 (1& 2): 271-276.

Heemstra, P. C. and Randall, J. E. 1986. Serranidae, Subfamilies Ephinephelinae and Serranidae. In: Fischer, W. and Bianchi, G. (eds.) FAO species Identification sheets, Western Indian Ocean Vol. 4, 241 pp.

James, P. S. B. R., Soundararajan, R., Rodrigo and Xavier, J. 1982. Preliminary studies on culture of finfishes in cages in the coastal waters of Palk Bay at Mandapam. In: Proceedings of the Symposium on Coastal Aquaculture, Part 3; MBAI, 12-18 January 1980, Cochin, p. 718-731.

Kirubasankar, R., Dam Roy, S., Grinson, G., Sarma, K., Krishnan, P., Ram Kumar, S., Kaliyamoorthy, M. and Gouthambharathi, M. P. 2013. Fishery and Exploitation of Malabar Grouper, *Epinephelus malabaricus*, Bloch and Schneider 1801, from Andaman Islands, Asian Fish. Sci., 26: 167-175

Manojkumar, P. P. 2005. Fishery of the spinycheek grouper, *Epinephelus diacanthus*, Valenciennes, off Calicut along the Malabar Coast. J. Mar. Biol. Ass. India, 47 (1): 63-69.

Mathew, G., Sanil, N. K., Venugopal, K. M. 2000. Observations on the growth of *Epinephelus malabaricus*, Bloch and Schneider, in the onshore recirculating sea water system. J. Mar. Biol. Ass. India, 42 (1&2): 190-193.

Murata, R., Karimata, H., Alam, M. A. and Nakamura, M. 2010. Precocious sex change and spermatogenesis in the under yearling Malabar grouper *Epinephelus malabaricus* by androgen treatment. Aquacult. Res., 41: 303- 308.

Pember, M. B., Newman, S. J. and Hesp, S. A. 2005. Biological parameters for managing the fisheries for Blue and King Threadfins, Estuary Rockcod, Malabar Grouper and Mangrove Jack in north-western Australia. Fisheries Research and development corporation report, Australia, 176 pp.

Pillai, V. N., Murthy, V. S. R. and Mathew, G. 2002. Grouper Aquaculture in India. Report of the Regional Workshop on Sustainable Seafarming and Grouper Aquaculture, Medan, Indonesia. 17-20 April, 2000. Network of Aquaculture Centres in Asia Pacific, Bangkok, Thailand, 224 pp.

Pyle, R. and Myers, R. 2010. *Epenephelus malabaricus*. IUCN Red List of Threatened Species. Version 2012 (2).

Rimmer, M. A. 2004. Advances in Grouper Aquaculture. In: Rimmer, M. A. and McBride, W. K. C. (Eds.) ACIAR Monograph 110. Australian Centre for International Agricultural Research, Canberra, Australia, 134 pp.

Ruangpanit, M., Boonliptanon, P. and Kongkumnerd, J. 1993. Progress in the propagation and larval rearing of grouper, *Epinephelus malabaricus*. Proceedings of grouper culture, Nov 30-Dec 1, 1993 at NICA, Songkhla, Thailand, p. 32-42.

Sadovy, Y. J., Donaldson, T. J., Graham, T. R., McGilvray, F., Muldoon, G. J., Phillips, M. J., Rimmer, M. A., Smith, A. and Yeeting, B. 2003. While stocks last: The live reef food fish trade. Asian Development Bank Pacific Studies Series. Manila, Philippines, 147 pp.

Sujatha, K., Aiswarya Deepti, V. A. and Padmavathi, P. 2008. Species diversity and exploitation of groupers (Pisces: Serranidae) off Visakhapatnam, east coast of India. In: Natarajan (Eds). Glimpses of Aquatic Biodiversity. Rajiv Gandhi Chair Spl. Publ., 7: 1-9.