Siganus canaliculatus (Park, 1797)

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IDENTIFICATION

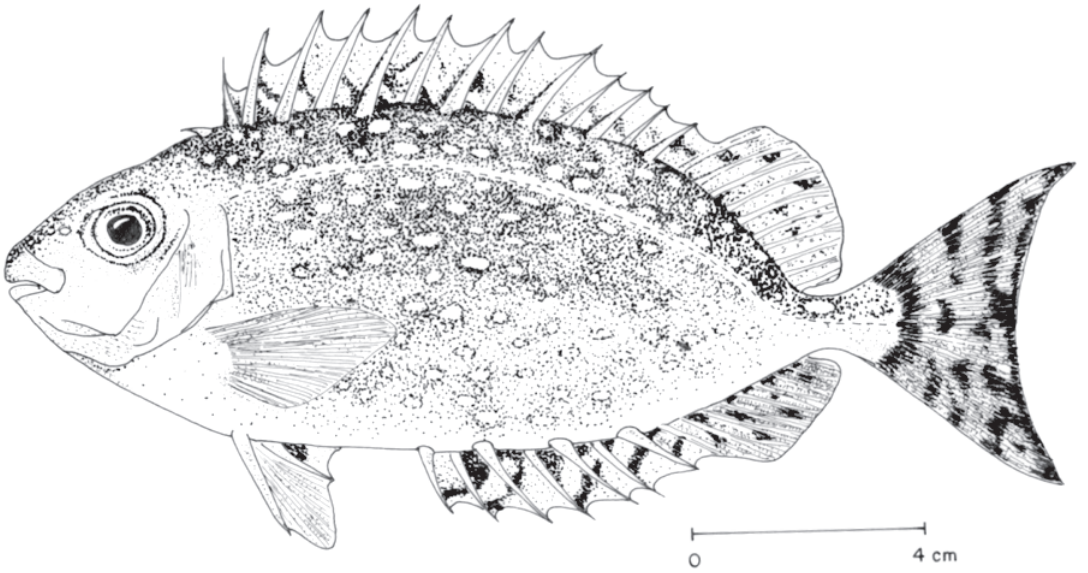
Order	:	**Perciformes**
Family	:	**Siganidae**
Common/FAO Name (English)	:	**Rabbitfish**

Local names: Kutri, Dhagavir (**Marathi**); Marapaiya (**Kannada**); Karadu meen, Kattara, Poola (**Malayalam**); Oora, Orameen (**Tamil**); Warawah (**Telugu**)

MORPHOLOGICAL DESCRIPTION

The body is compressed and slender. Snout is blunt and anterior nostril has a long flap in juveniles which disappears in adult fish. A forward-directed spine is present in front of dorsal fin. Dorsal fin rays are banded. The caudal fin is almost emarginated in specimens under 10 cm standard length and forked in larger fish. Scales are minute with 21-27 scale rows between lateral line and base of anterior dorsal spines. Cheeks are scaleless. The fish is greenish-grey dorsally and silver ventrally and nape and sides are covered with whitish-blue spots in horizontal rows. Caudal fin is either plain grey or irregularly barred with pale and dark grey.

Source of image : fishbase.org



PROFILE

GEOGRAPHICAL DISTRIBUTION

The rabbitfish is distributed widely in the Indo-West Pacific region extending from the Persian Gulf to Western Australia. It has been reported form east and west coast of India.

HABITAT AND BIOLOGY

The species inhabits inshore areas, algae reefs, estuaries, river mouths with sea grass beds and lagoons with algae-rubble habitats. Juveniles form very large schools in shallow bays and coral reef flats. Adults form smaller schools of 20 fish. Adult fishes occur in offshore, deep, clear waters. This species is mostly herbivorous in nature, feeding on benthic algae and to some extent on sea grass. However, it has also been reported to feed on amphipods, copepods, sponges, foraminifera, crustaceans and brittle stars suggesting that it may be opportunistic omnivores. It is active during the day. In India, the occurrence of this species is high and its sizes vary from 20-25 cm, with a maximum of 45 cm in length. They are

able to tolerate a wide range of water quality parameters; salinity (17-37 g/l), temperatures (23-30 °C), dissolved oxygen at least 2 mg/l and pH up to 9.

The fish is a multiple spawner, larger fish spawn more than once in a spawning season. Peak spawning season is April and May. Spawning is correlated to lunar cycle in nature. Absolute fecundity ranges from 42,253 to 10,00,000. Tidal level is the most important factor impacting the natural spawning in fish. Lunar cycle influences the natural spawning in the fish with spawning observed mostly in the lunar phase, 2-4 days after new moon during midnight or early morning. Natural spawning of the fish as observed in different months from different countries are January-April with a peak in February-March in Singapore, January-April in Philippines, March-June in Hong Kong and March-May in southern Arabian Gulf. Juveniles arrive from the fringing reefs, to the patch reefs and associated seaweed beds and finally onto the seagrass.

PRODUCTION SYSTEMS

BREEDING IN CAPTIVE CONDITIONS

Different species of *Siganus* including *Siganus canaliculatus* were tried for breeding in captivity in late 1970's in different countries. The fishes brought from the wild were conditioned in confined environment and injected with different hormones like hCG, LHRH, etc for spawning. The fish spawned with single or multiple injections of hCG. The doses of hormone used ranged from 250 to 300 IU/kg body weight. Multiple injections were given at 24 h interval. Stripping, 5-10 h after the final injection has also been reported for females of this species. Fish implanted with LHRHa silastic pellets spawned ten days in advance. The response of the fish to hormonal injection depended on the stage of oocytes development. Stress and excitement due to handling also triggered spawning in hormone treated fish. Fish was also found to spawn naturally in confined environment without hormonal inducement.

The fertilized eggs were demersal, adhesive, small and spherical with many oil globules. The reticulation on the egg membrane was responsible for the adhesiveness of the eggs. Fertilised eggs measured 420-700 µm in diameter and took 18-35 h to hatch at 22-30 °C. Hatching time was also dependent on egg size and incubation salinity.

LARVAL REARING

The newly hatched out larvae aggregated near the surface and stayed in water column with its head down. They started feeding from second day onwards. While feeding, larvae fed at the sides and bottom of the rearing container. It was observed that the larvae on day 12 nibbled on algae growing on walls of the tank and on day 15 showed aggressive feeding behaviour. Larvae on day 18, began to stay deeper in the water column and on day 23 onwards started metamorphosis. Cannibalism, in some cases, has been reported before metamorphosis. Metamorphosis was accompanied with rapid and obvious changes in external appearance. The larval stage, when the body was highly transparent and

the abdomen was silvery gave way to the juvenile stage, when the entire body turned light brown as that in the adult. This transformation starts on day 23 to 25 for this species. The eggs and larvae of the fish were able to tolerate salinity ranging from 15.8 to 32.2 g/l. Temperature and salinity of 30 °C and 32 g/l were found optimum for larval rearing.

NURSERY REARING

Larvae attained the juvenile stage once they acquired the complete spines and fin rays characteristics of the adult. Juveniles also closely resembled the adults in body shape and colour, but may or may not live in the same habitat as the adults. The initial size of the juvenile was around 20-24 mm, after a 2-3 months period. The rate of transformation was affected by temperature, type of food given, etc. The juvenile stage lasted for 6 to 9 months, until they attained first sexual maturity. The juveniles could tolerate high variation in the water quality parameters. They could survive at least 5 g/l salinity, 2 mg/l dissolved oxygen and 23 °C temperature. Their optimum growth was recorded at 10-15 g/l salinity and 26-30 °C temperature. In general, the growth varied in the nursery and it depended on culture system and diet.

In floating cages, juveniles weighing 10 g attained 114 g within 5 months with weight gain of 6.5 g/ week. In concrete tank, the fish attained 7.85 g from 0.34 g in 3 months with weight gain of 0.63 g/ week. In another floating cage, juvenile reached 60.97 g from 29.8 g in a month with weight gain of 7.79 g/week. The stocking density varied from 30 to 60 nos./m^3 at 15-20 g weight. Fish stocked at 30 nos./m^3 (13 g) showed maximum growth with pelleted feed at 2.3 % body weight. Contrarily, fish stocked at 50 nos./m^3 showed maximum growth with rice bran and lab-lab (a complex of blue-green algae, diatoms, bacteria others) as feed.

GROW-OUT

The fish has been cultured in brackish water ponds in Philippines and in embanked lagoons in Mauritius. In Malaysia, Singapore, Guam and Hong Kong, experimental culture in floating net cages, pens, ponds and raceway systems has been tried. In coastal ponds of Philippines, the fish has been reported to attain a marketable size of 150 g within 5-7 months. This species is preferred for culture because of its herbivorous feeding habits, fairly good growth and economic value. In grow-out ponds, the fish is reared for 4-6 months at a stocking rate of 1500-2000 fingerlings/ha depending on the volume of food in the pond and the size of fish at stocking. Fish reared in cages in Mandapam, east coast of India, reached marketable size of 20 cm within six months using pelleted feed. In cages, fish can be stocked at densities of up to 150 fish/m^3 with no risk of cannibalism, where the fish attained a market size of 100 g in 4-5 months.

FOOD AND FEEDING

Food and feeding habits varies according to the life stage of the fish. The larvae are zooplankton feeders, the juveniles and adults are primarily herbivorous. During larval rearing, they fed on rotifers (*Brachionus* sp.) of less than 90 micron in size at density of 10-20 individuals/ml, copepod nauplius and

mixed planktons like *Isochrysis, Chlorella*, etc. Additionally, in the hatchery, rabbitfish larvae were also fed with *Artemia* nauplii and artificial diet. They feed by nibbling on the marine vegetation, often browsing in schools with heads directed downwards during the day and in the evening. The recommended food in the rearing pond includes filamentous algae like *Cladophora linum*, *Chaetomorpha* sp., and *Enteromorpha tubulasa*. In grow out system, they are fed with rice bran, algal mat and pelleted feed.

Under captivity, the fish consumes both vegetable and animal origin feeds, including pellets. Feeding trials have suggested that the dietary protein requirement for this species is above 30 %. Fish fed with high dietary protein grew faster than fish fed with less proteins or live seaweed.

GROWTH RATE

Many studies on the growth of rabbitfish have conflicting results perhaps due to variations in culture system and diet. Growth of fry and fingerlings is generally slow and the average growth rate of the same species varies with the holding system. In floating cages, juveniles weighing 10 g attained 114 g within 5 months with weight gain of 6.5 g/week. In concrete tank, the fish attained 7.85 g from 0.34 g in 3 months with weight gain of 0.63 g/week. In another floating cage in Indonesia, juvenile reached 60.97 g from 29.8 g in a month with weight gain of 7.79 g/week. It grows to a mean length of 8 cm in about 3 months, 10 cm in about 4-5 months and 14 cm in 7-8 months.

DISEASES AND CONTROL MEASURES

A monogenetic trematode causing tissue ischemia, a respiratory disease, was reported in *S. canaliculatus*. Microsporidian infestation of the gills leads to death in the species. Exophthalmia, bloated stomach, body lesions and fin rot are also encountered in captive reared fishes. Mass mortality of cultured fish in cages was reported from the north-east coast of Singapore. Some fishes changed body coloration, moved sluggishly and later became blind. Prior to death, the fish exhibited violent movement, convulsion, and seizure. Mortality was due to a Gram-positive bacterium with characteristics similar to those of *Streptococcus faecium*.

PRODUCTION, MARKET AND TRADE

PRODUCTION

Siganus canaliculatus is one of the most economically important herbivorous fishes captured in the Palk Bay and Gulf of Mannar in Tamil Nadu coast, India. Farming of this species in Saudi Arabia and United Arab Emirates yielded 9 t in 1986. The world aquaculture production of the fish in 2006 was around 1 t. However, the production data after 2006 is not available.

MARKET AND TRADE

Traditional rabbitfish fishery existed in countries such as Guam and the Philippines, where the market value of the fish was high. In general, during the Chinese new year, their market price in Singapore

market increases by at least twenty-thirty fold. This is because of Chinese superstitious belief that rabbitfish is a symbol of good fortune. During this period, most of the rabbitfishes caught contain running roe, the fish tastes sweeter and their meat is more tender.

CHALLENGES TO MARICULTURE

The available information on the economics and socio cultural aspects of rabbitfish farming is scanty. Mass production of seed is yet to be achieved. Wild seeds are available in great quantities in different periods. However, methods for their capture, handling, and transport need to be standarised. Fry collecting grounds should be identified and described. In addition, protocol for broodstock development; breeding and larval rearing has to be developed for mass scale culture of the species.

FUTURE PROSPECTS

Results obtained worldwide have shown that cage culture of rabbitfish can yield high returns. So it has to be attempted and standardized in India. Based on the report available, the fish has got wide distribution in the areas where seaweeds are abundant. Therefore, seed collection needs more concentration in these areas for supply to other parts for culture. Since the fish is omnivorous in nature, it could be cultured in cages or ponds without much investment for feed. Their habit of feeding on algae coupled with good demand makes it a suitable fish for culture in the region where larger quantities of seaweeds are available.

SUGGESTED READING

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