Thunnus albacares (Bonnaterre, 1788)

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IDENTIFICATION

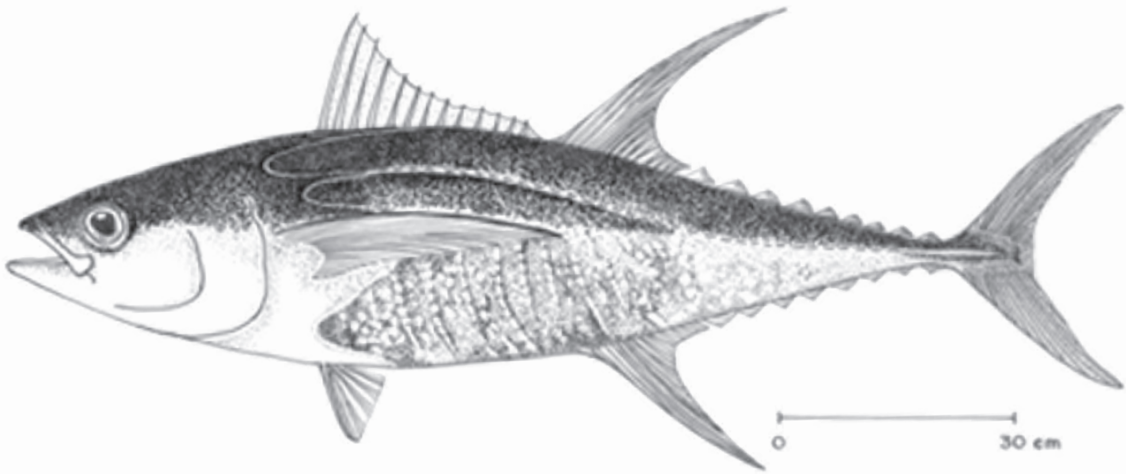
Order	:	**Perciformes**
Family	:	**Scombridae**
Common/FAO Name (English)	:	**Yellowfin tuna**

Source of image : CMFRI, Kochi

Local names: Gedar, Gedara (**Gujarati**); Bugudi, Kuppa (**Marathi**); Gedar, Kuppa (**Kannada**); Kerachoora, Manjachoora, Poovanchoora (**Malayalam**); Quintal choora, Poovanchoora, Kannchmas (**Lakshadweep**); Choora, Kelavalai, Soccer (**Tamil**); Reecasoora (**Telugu**); Baal (**Oriya**)

MORPHOLOGICAL DESCRIPTION

The yellowfin tuna is a large sized tuna with deep yellow fins and finlets. It is characterized by its fusiform shape with metallic dark blue colouration. Body is elongate, fusiform and slightly compressed, with depth less than 25 % of fork length. Caudal peduncle is very slender. First gill arch has 26-34 gill rakers. Two dorsal fins are separated by a narrow interspace. Dorsal fin is followed by 9 free finlets and anal fin is followed by 7-10 finlets. Dorsal and anal fins are very long in large specimens. Pectoral fin is moderately long, reaching beyond second dorsal fin. Body is with small scales; belly with about 20 broken, nearly vertical pale lines. Dorsal and anal fins and finlets are bright yellow.



PROFILE

GEOGRAPHICAL DISTRIBUTION

It is typically a pelagic species distributed in all warmer (tropical and subtropical) areas, except the Mediterranean Sea.

HABITAT AND BIOLOGY

It is typically an epipelagic, oceanic fish which prefers to live around the thermocline ranging between 18 to 31 °C and do not generally occur below 100 m in depth. The species aggregates around island territories, seamounts and shelf break areas of mainland coasts. Juvenile fish form large aggregations along shelf-break areas and over seamounts. It forms strong schools with the same species and also with other species of tuna. It schools primarily by size, either in mono-species or multi-species groups. It is often reported to school in association with dolphins and other large mammals, drifting objects and boats. The maximum reported length is 280 cm, with a maximum weight of 400 kg. It is one of the most popular game fishes in many countries.

Mean size in the catch along the Indian waters is 66.3 cm. The length range in the fishery varied from 22 cm to 201 cm, with majority in 44-82 cm size groups representing 80.9 % of the catch in numbers. It is a nonselective and an opportunistic feeder, feeding on available prey. It is a sight oriented predator. Studies from India indicated that its diet consists mainly of teleost fishes (69.9 %), crustaceans (17.4 %) and cephalopods (12.7 %). Carangids are dominant in the gut and are represented by *Decapterus* spp. and *Selar* spp. Coastal tunas (*E. affinis*, *A. thazard* and *A. rochei*), flyingfishes, hemiramphids, belonids, *Priacanthus*, lizardfishes, ribbonfishes, clupeids and myctophids are also preyed upon and are found frequently in the stomach contents. Crustaceans in diet are represented by pelagic (*Portunus* spp.) and demersal (*Charybdis* spp.) crabs and occasionally by deep sea prawns and *Acetes*. Oceanic squids and octopus represent the cephalopods which are consumed. All stages of gonadal development are observed throughout the year in India. It is a year round spawner with peak spawning during August to January. Size at first maturity is 57.6 cm, at an age of 13.5 months. Relative fecundity varied between 1,97,263 and 8,14,557 with a mean of 4,36,330.

PRODUCTION SYSTEMS

BREEDING IN CAPTIVE CONDITIONS

Attempts to breed yellowfin tuna in captivity started in 1969 in Japan. Initial trials were made by stripping the mature fishes from the wild. Since 1970s several attempts for breeding, seed production and culture in captivity has been carried out by different organisations in different countries. At present, technology has been standardised for broodstock development, breeding and seed production.

Rearing of yellowfin tuna larvae was first conducted at the Shirahama Fisheries Laboratory of Kinki University, Japan in 1970. In Japan Sea-Farming Association (JASFA), spontaneous spawning of yellowfin tuna was observed in floating net pens in 1992, and subsequently rearing trials for larvae and juveniles was conducted. However, the survival rate of the larvae was very low because of heavy mortalities during developmental stages.

The Inter-American Tropical Tuna Commission (IATTC) has been spawning yellowfin tuna successfully in captive condition, since 1996. For broodstock development, pre-adults from local stocks ranging in size from 2-8 kg caught by trolling line are transported to the broodstock rearing unit in small fibreglass boats, equipped with a 400 l fibreglass 'live-well'. After transportation, the fishes are administered with an injection of the antibiotic, Oxytetracline at 50 mg/kg weight. The antibiotic is primarily used to stain the fish's otolith (ear bone), which helps to accurately estimate the age when the fish dies and also provides an added benefit of reducing bacterial infections. After transferring to broodstock tank, the average survival time in captivity is two years and most deaths are the result of wall strikes. Injuries due to wall strikes are common problems associated with broodstock maintenance, especially when the stocking density is greater than 0.75 kg/m^3. To avoid the problem, the wall of brood-stock tanks is painted with black stripes to improve the contrast and help the tuna see the wall. An approximate loss of 30 % of the broodstock is due to wall strikes.

Yellowfin tuna mature at two years of age and at a size of approximately 15 kg. Sub-adults of 2 to 6 kg took 6 to 8 months in captivity for reaching maturity. Once fish matured, depending on water temperature, spawning occurred naturally (without hormone induction) on an almost daily basis. Water temperature was the main external factor controlling the occurrence and timing of spawning in yellowfin, with regular spawning recorded at water temperatures above 23.3 °C. Broodstock were very sensitive to rapid changes in temperature, even 0.5 °C temperature drop from the optimum range of 24 to 28 °C affected the spawning activity. When the temperature was greater than 25 °C, broodstock spawned in the evening (18:00-22:00 hrs) and spawning occurred in the afternoon or early evening (14:00-18:00 hrs), when the temperature was less than 25 °C. The buoyant fertilised eggs were collected from the tank, and the fertilised eggs measured 950-1,000 µm in diameter with a 220 µm oil globule. Eggs hatched out after 28 h at temperatures below 25 °C, whereas at 29 °C, incubation lasted only for 18 h.

LARVAL REARING

Hatching rate was usually above 90 %, but less than 50 % hatching was also observed. The newly hatched larvae measured 2.5 mm in length and 30 µg in weight. Larvae were stocked into the tank at a density of 15 larvae/l. Feeding commenced on 2nd dph. Larvae at first feeding averaged 3.3 mm in length and 22 µg in weight. The commonly used first feed was rotifer (enriched with commercially available enrichment medium) and preserved microalgae paste (*Nannochloropsis* sp.). Rotifers were maintained in the larval rearing tank at a fairly low density of 4-5 nos./ml. A mixture of micro algae (*Nannochloropsis* sp., *Thalassiosera* sp. etc) was used to maintain cell density at approximately 2 x 10^6 algal cells/ml in the rearing tank water. The density was high when compared to that used in the culture of other marine fish larvae. It was to improve the visual contrast of the prey, and also to minimise cannibalism among the larvae. When the larvae reached 4.5 mm in length (typically 9-11 dph), they were transitioned from rotifers to *Artemia* nauplii over a two-day period. When the larvae reach 6 mm in length (approximately 14 dph), newly hatched tuna larvae were also introduced as a food source for the more advanced larvae. It was believed that in this stage they became piscivorous in the wild and hence newly hatched larvae were introduced as feed. Feeding of enriched *Artemia* was continued till 24 dph. At approximately 60 days, newly hatched larvae as feed were slowly withdrawn and were replaced with finely chopped trash fish. Unlike other marine finfishes, weaning of larvae with artificial pellets was not successful. Tuna larvae sank at night causing mortality at the initial stages. Photoperiod regulation involving 12 h of light and 12 h of darkness was able to control the sinking mortality at night to an extent.

NURSERY REARING

Little information is available on nursery rearing, as it is not commonly practiced. Early-larval growth (the first 2 weeks) in length and weight is exponential (< 0.35 mm/day in length and 20 to 35 % body weight/day), increasing significantly during the late-larval and early-juvenile stages (> 0.6 mm/day and 30 to 50 % body weight/day). Yellowfin larvae become piscivorous at around 6.5

mm in length, with the piscivorous ones growing more rapidly than individuals that are zooplanktivorous.

GROW-OUT

Grow-out of yellowfin tuna has been carried out since 1970 at Kagoshima Prefectural-Fishery laboratory and Kinki University laboratory, Japan using wild caught juveniles in circular or octagonal floating cages of 8-30 m diameter. Anchovies, sand eel and jack mackerel are used for feeding the young tuna while raw or frozen sardine, saury and horse mackerel are mostly given as feed for the bigger fishes. After two years and four months of rearing, young fishes attain a length of 85 cm and a weight of 11 kg. In Oman, wild fishes collected from purse-seining are cultured in towing cages and fattening cages (48 m diameter and 30 m net depth). The wild fishes weighing 25-40 kg are shifted to fattening cage for culture. Fishes are fed with sardines for enhancing the fat content and are then harvested.

FOOD AND FEEDING

During early larval stages, in captivity, it is fed with rotifer, copepods and brine shrimp. As juvenile are piscivorous, it starts feeding on trash fishes. In grow-out, it is fed with sardines, anchovies and herrings. Broodstock are fed on equal ratios of squid and sardine. A vitamin and mineral premix is added at 0.5-1.5 % of feed weight. Feed is applied at several places around the tank to prevent collisions between the actively feeding fish. Broodstock fishes are fed daily on a fixed ration depending on their weight and water temperature. Daily ration ranges from approximately 5 % for smaller fishes in warm water to 1 % for larger fishes in cooler water. FCR ranges from 10.9 to 34.6.

GROWTH RATE

Yellowfin tuna grows very fast and attain 30 cm in 6 months. After two years and four months of rearing, young fishes attain a length of 85 cm and a weight of 11 kg.

DISEASES AND CONTROL MEASURES

Yellowfin tuna hosts more than 50 species of parasites in the wild. Endoparasite infection from broodstock tank water to the larvae through the eggs is reported. It is controlled by a formalin (25-100 mg/l) bath to the eggs, just after fertilization. Good water exchange and sanitation is essential to avoid the spread of parasites. A protozoan disease, Coccidiosis, caused by *Goussia auxidis* is reported. Blood fluke infection caused by *Cardicola ahi* is also reported.

PRODUCTION, MARKET AND TRADE

PRODUCTION

It is the most dominant oceanic tuna species landings by coastal and oceanic fishing fleets. The average annual landing in India in 2012 was 27,269 t. Global catch is more than 1 million metric t. Commercial culture operations of yellowfin tuna is still in infancy. In 2007, 1,210 t was produced through aquaculture from Mexico and Oman. No culture production data is available for the subsequent years.

MARKET AND TRADE

Market and trade is dependent on wild capture. It is ideal for the preparation of high quality sashimi. It is marketed fresh, frozen, dried, canned and also smoke dried. In Mexico and Oman, yellowfin tuna produced through aquaculture were sold at prices equivalent to ₹ 550/kg.

CHALLENGES TO MARICULTURE

Though breeding and seed production has been initiated and achieved to an extent in confined environment, large scale larval rearing is a major issue. Weaning the larvae to artificial feed is an area of concern in nursery rearing. More basic research is required before embarking on commercial seed production. Cost effective onshore and offshore cage culture technologies are required. The major researchable issue for India are development of protocol for domestication, broodstock maturation, breeding and larval rearing.

FUTURE PROSPECTS

Initial success of seed production and culture of yellowfin tuna shows the possibility of future expansion. Yellowfin tuna because of its smaller size, early maturing nature and availability of easy management options are easier to farm than bluefin tunas. High growth coupled with consumer preference has lead to their over exploitation. Tuna ranching can be used as a tool to enhance the population in the wild. In the above context, breeding and seed production in captivity and developing commercial-scale hatchery techniques is essential to satisfy the demand and to alleviate the subsequent fishing pressure on wild stocks.

SUGGESTED READING

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