

# *Coryphaena hippurus* Linnaeus, 1758

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## IDENTIFICATION

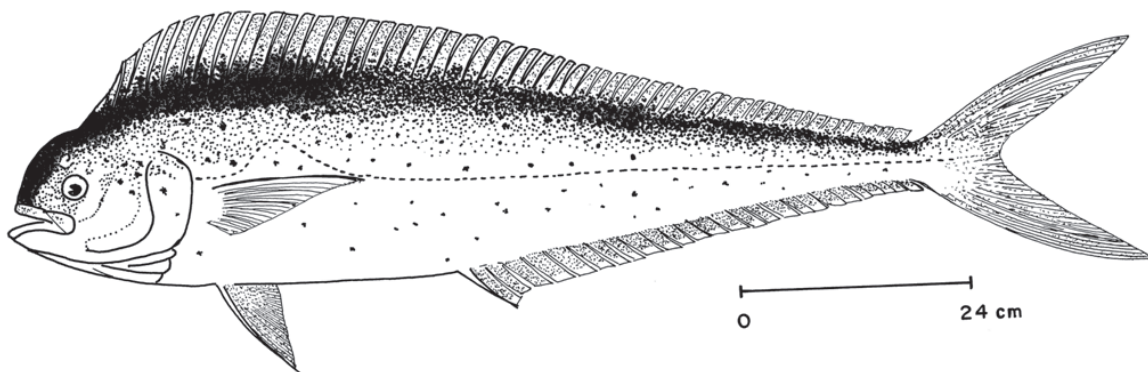
Order	: <b>Perciformes</b>
Family	: <b>Coryphaenidae</b>
Common/FAO Name (English)	: <b>Mahi-mahi</b>



**Local names:** Himra machhi (**Gujarati**); Popat masa, Abanoos, Himra masa (**Marathi**); Thondrotte (**Kannada**); Avoli, Karuvoli, Vellavoli, Rocket fish, Affunosi, Pullimodha, Padalan, Chain cover (**Malayalam**); Badahlan, Koppurai-kulavanna, (**Tamil**); Hylesu, Babbaasipara (**Telugu**); Baal (**Oriya**)

## MORPHOLOGICAL DESCRIPTION

The common dolphinfish is an elongate and compressed fish with small cycloid scales. The mouth is large with fine teeth arranged in bands. There is a small oval tooth patch on the tongue. The lateral line is straight with an upward curve over the pectoral fin. The dorsal fin is very long, extending from the nape to the tail and has 58-66 soft rays. The anal fin is also very long, extending from behind the anus to the tail and has 25-31 soft rays. Neither of the two fins has any spine. The pelvic fins fit into a groove on the ventral part of the body. The pectoral fin has 19-21 rays. The caudal fin has 17 principal rays with 10-14 upper and lower secondary rays. The species is brilliantly coloured with golden colour laterally, metallic blues and greens dorsally and white and yellow ventrally. Smaller fishes have conspicuous vertical bars on the sides of the body. In juveniles, tips of the caudal fin are white and the pelvic fins are black.



## PROFILE

### GEOGRAPHICAL DISTRIBUTION

The common dolphinfish is widely distributed in tropical and subtropical waters and is commonly found in the Atlantic, Indian and Pacific oceans. It is available all along the Indian coast with large abundance in the southern region. Its distribution ranges from 47° N - 38° S and 180° W - 180° E and between temperatures of 21-30 °C.

### HABITAT AND BIOLOGY

Juveniles often form schools and adults are distributed in open oceanic waters. In early life stages it feeds on zooplankton and later, on all forms of fishes, crustaceans and squids. Mature fishes exhibit sexual dimorphism with males possessing a prominent bony crest in front of the head. It attains sexual maturity at around 40 cm size and produces 1,50,000-2,00,000 eggs/kg body weight of female per spawning. It spawns almost round the year. Eggs and larvae are pelagic.

## BREEDING IN CAPTIVE CONDITIONS

The research on artificial breeding and culture of common dolphin fish started in 1975. Breeding of the fish in captivity has been achieved successfully in Waikiki Aquarium and Oceanic Institute, Hawaii, USA. Broodstock was raised in confined environment using large live healthy fishes caught by barbless hooks. Best survival was achieved for fishes stocked at less than 45 cm fork length. However, the most dependable way to get broodstock was to raise them from eggs as it ensured no parasites, and was adapted to water quality in the tank, food quality and tank design. Broodstock raised in circular tanks gave good survival than the ones maintained in rectangular tanks. Females spawned on every other day throughout the year. By the time males were 15 kg (15 months or less), captive females were 4.5 kg, and produced at least 2,00,000 eggs on every second day. It spawned in captive tanks without hormone induction, but in some cases hormone was used. The spawning activity was recorded during night at Hawaii, where as in other places, spawning of the fish was reported during dusk time i.e. 15:35 to 17:45 hrs.

## LARVAL REARING

The fertilized eggs were 1.3-1.6 mm in diameter and they were incubated for two days in a submerged, heavily aerated, screened vessel, with 10 % seawater exchange per minute at Oceanic Institute, Hawaii, USA. The eggs hatched out in about 60 h and after hatching, the larvae was ready for first feeding in two (26-27 °C) to three days (24-25 °C). During this period, the larvae developed pigmented eyes and functional mouth parts. The best rearing tanks were gel coated fibreglass with conical bottom and central aeration (no diffusers). In larval rearing, a concentration of 0.5 to 2 x 10<sup>4</sup> algal cells/ml was maintained till day 25. Rotifers were added in the larval rearing tank at 1-2 nos./ml and were maintained the same till 6<sup>th</sup> day. Copepods were given between days 6-22; in this phase, heavy mortality was observed if larvae were not well fed prior to metamorphosis. In around 12-14 days, pelvic fins emerged, and the straight gut became twisted and several organs were added. Postlarvae (PLs) spent more time near the tank bottom.

## NURSERY REARING

At Oceanic Institute, Hawaii, USA, larvae grow rapidly and began to metamorphose at around 17 dph and after metamorphosis, it was considered as juvenile. The nursery phase was between day 20 and day 50 and high mortality rate was observed during this period. In nursery phase, larvae were acclimatized to artificial feeds. In Oceanic Institute, Hawaii, less than 15 % survival rate was observed, even at lower stocking density. Survival was exceptionally high (60 %) when continuous size grading was performed. Research from different parts of the world suggests that high density culture with low maintenance yields 30-40 % survival. In Hawaii, it was observed that during the 25

days of nursery rearing, the larvae grew 85 fold from an average of 0.05 g to 6 g wet weight. During this phase, larvae were initially fed with enriched *Artemia* nauplii and were then simultaneously weaned with artificial diet of 0.5-1 mm size. Larvae were highly aggressive and showed cannibalistic nature. Raceway culture in nursery phase was found to be successful.

## GROW-OUT

Fish grew at an average rate of 4 % per day from 40 to 180 days of culture and reached an average harvestable weight of 1.7 kg after 180 days at Oceanic Institute, Hawaii, USA. In another trial conducted for 240 days, males reached up to 4.0 kg and females up to 2.0 kg with an average mixed population weight of 2.4 kg. Fish reared in captivity at Oceanic Institute, Hawaii grew to 4.93 kg and 75.8 cm in 9.5 months from hatching. Absolute growth rates (AGR's) in weight and length were 19.18 g/day and 0.227 cm/day. During grow-out, it was fed with artificial pelleted feed having 53.75 % of crude protein and the feed conversion ratio (FCR) was 1.6 (dry feed/live fish). In another experiment, a wild-caught juvenile kept in captivity grew from less than 1 kg to nearly 16 kg in one year, with growth rates of 4.3 kg (from 0.7 to about 5 kg) in 30 days.

## FOOD AND FEEDING

In culture, larvae are fed with rotifers, *Artemia* and copepods. During grow-out, dry or semi-moist (10-30 % moisture) diets are fed containing over 50 % crude protein, 10 % crude fat (expressed on a moisture-free basis) and a high calorific content (5.0 cal/mg). In wild, it feeds on a wide variety of pelagic fishes, crustaceans and cephalopods.

## GROWTH RATE

In Hawaii, it was observed that during the 25 days of nursery period, the larvae grow 85 fold from an average of 0.05 g to 6 g wet weight. In another experiment, 1.6 g fish fed with chopped herring and squid grew to 1.3 kg after 130 days culture in circular tank. It showed different growth rates in different grow-out systems. The reported ideal growth rates being 2 kg in 6 months and 9 kg in one year when fed with fish and squid and 5.4 kg in 8.7 months when fed with commercially available pellets.

## DISEASES AND CONTROL MEASURES

Vibriosis, caused by *Vibrio alginolyticus*, occurs in cultured dolphinfish. Clinical signs include anorexia, caudal fin erosion and epidermal lesions. A 10 day treatment with 75 mg Terramycin (oxytetracycline hydrochloride)/kg body weight in the feed results in control of the disease. Red tail disease, caused by stress, is encountered in the grow-out system between 40-90 days of culture. In addition, in culture, there are reports of different parasitic infestations caused by protozoa, worms, etc.

## PRODUCTION

The total production from wild in 2014 was 1,15,658 t.

## MARKET AND TRADE

It is an exceptionally versatile fish having firm white meat and a delicate flavour. Broiled, poached, baked, sautéed, grilled, or pan-fried mahi-mahi delivers a truly sensational taste. It is generally marketed fresh and frozen and has high demand in the export market, especially in Japan and Taiwan. It is popular as a food fish and also as a game fish in the Caribbean region, south-eastern United States, east Africa, Taiwan, Japan, China, and Hawaii. The wholesale price in Hawaii is around US \$ 9/kg. In Florida, USA the price is US \$ 2.24/kg.

## CHALLENGES TO MARICULTURE

Culture of this species has not been initiated in India till date though India has good dolphinfish resources. Research needs to be focussed on broodstock development, breeding, larval survival, nutritional, environmental and other physiological requirements with respect to Indian condition. Basic reproductive biology and trophodynamics of the species needs to be studied from Indian waters.

## FUTURE PROSPECTS

It has long been recognized as a high-value pelagic fish with excellent potential for aquaculture. Like other fast growing fishes, it has a very high growth rate and a high food conversion ratio (1:1-1:1.5). Captive spawning and egg production happens naturally throughout the year. Life cycle has been established in confined systems. Additionally, it has a good international market. Therefore, developing breeding, seed production and culture technology in confined environment tailor-made for Indian conditions will bring more income generating avenues to the Indian farmer.

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