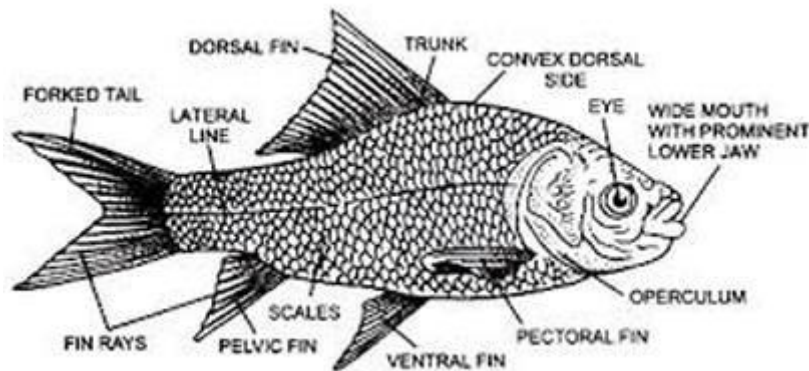


## *Catla catla*



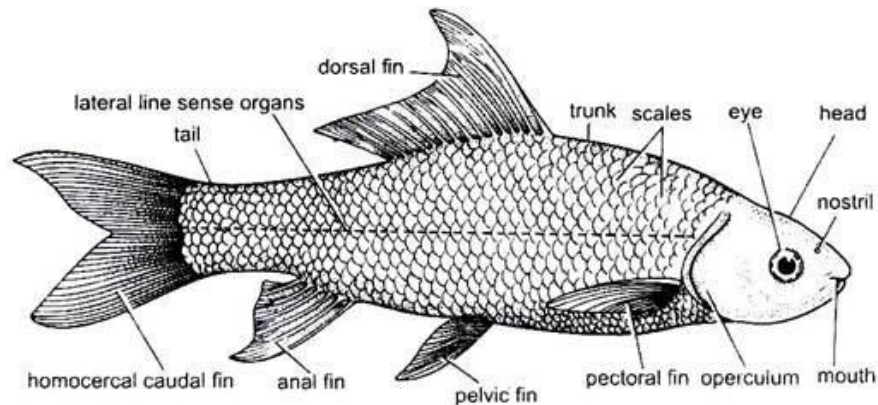
In nature, the fish is found in lakes, ponds, rivers and reservoirs. It breeds only in running waters that is in rivers. It breeds in natural habitat during southwest monsoon and seeds are available from May to August and could be collected from the breeding grounds. Due to the success in induced breeding, this fish now can easily breeds in stagnant waters in fish farms.

It is a highly suitable fish for composite culture along with fishes that are column and bottom feeders. Catla breeds in flooded fields and can also breed by stimulating riverine condition in special ponds called dry bunds. The fingerlings feed on zooplankton and the adults are also consuming meroplanktons and vegetable matters. The mouth of Catla is wide upwardly directed. As the mouth is upwardly directed, it is surface feeder. Head is large and the body is comparatively very deep. The lower jaws are protruding. The colour of the body is black, fins and tails are dusky grey while belly is silvery white. In some species, fins are also dark black in colour. It attains maturity by the end of second year. Catla is the fastest growing, attaining a maximum size of 63 kg. It contributes about W-60% to the total production from polyculture systems and is in great demand. However, the main disadvantage is its large head which reduces the portion of edible meat per unit weight. In well-managed farms it attains maturity in 18 months. The fecundity of female fish ranges from 24000 to 42 thousand eggs. The fries can be collected by the natural sources or induced breeding. Catla feeds mainly on Zooplankton at the upper zone of the water body.

Distribution of *Catla catla*, which starts from the Ganga river network in the north to the Krishna river down south of India, Pakistan, Bangladesh and Burma. It is also found in Nepal. The fingerlings of catla, introduced into the Cuddapah-Kurnool canal from river Godavari in 1909 found their way into river Penna and the connected waters in the Nellore district of the state of Andhra Pradesh. Catla

fingerlings were also introduced in Cavery River during 1920s. Later the species was introduced into Periyar lake, Powai lake. Catla fingerlings have been also exported to Israel in 1954 and to Japan, and Mauritius in the 1960s. Catla has also been distributed to other countries like Zimbabwe, Israel, Bhutan, Philippines, Former USSR, Japan, Sri Lanka, Laos, Pakistan, Malaysia, Thailand, Vietnam and Mauritius.

### *Labeo rohita*

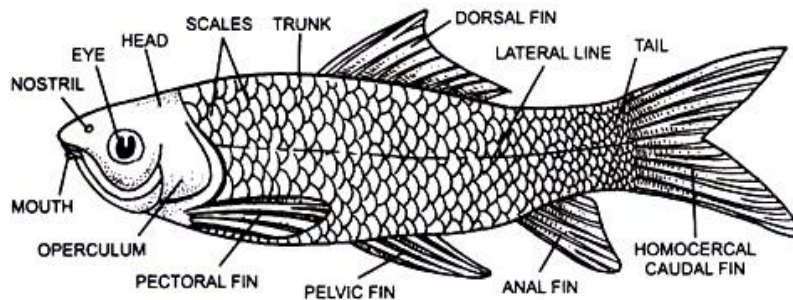


*Labeo rohita* is common in North India, Orissa and Bengal and is called Rohu but in Assam it is known as Rohiti. The body is elongated; dorsal profile is more convex, the colour of the body is bluish above and silver y at the flanks. Eyes are reddish. In juvenile stage, it possesses dark band at the caudal peduncle. It has reddish tinge at the dorsal, pelvic, anal and caudal fins. The distinguishing feature is that the lips are fringed and the maxillary barbells are prominent.

As far as the distribution is concerned, it is available throughout nation in rivers and ponds. It is most delicious and, therefore, there is a great demand of this fish. It breeds in monsoon in rivers. Like other *Cypriniformes*, it does not breed in stagnant water. During breeding season the fish before breeding moves along with current of water, then take a turn and moves against the current of water and breeds in shallow water. It can successfully breed by induced methods. It grows fairly large in size but in comparison to *Catla catla* the growth is less. The fish becomes sexually mature in one year or so. The fecundity is 1.5-2.00 (lac/g body weight). The fry and fingerlings could be obtained from the breeding grounds. Induced breeding in fish farms can successfully breed it. Adult as well as fingerlings feed on vegetable debris, *Daphnia* and decomposed water material. Other species of *Labeo* could also be cultured but from the economic point of view *Labeo rohita* and *Labeo calbasu* are profitable.

The medium-sized carp, *Labeo fimbriatus*, which is endemic to peninsular rivers, is a choice fish in the region due to its excellent flavour and meat quality. It is easy to induce this species to spawn.<sup>8</sup> Because of its slow growth rate as compared to major carps, it is generally not included in polyculture systems. Day (1878 and 1889). reported that the species is distributed in freshwaters of Sindh and Punjab (Pakistan), through India, Assam, Bangladesh and Burma. He also stated that rohu is not found in South India. the occurrence of this species in many other places, viz., Sabarmati drainage, in the rivers Narmada, Tapti, Godavari, Mahanadi etc. though it is more common in plains of North India. It is also distributed in other neighbouring countries such as Bangladesh, Burma and Nepal.

### *Cirrhinus mrigala*



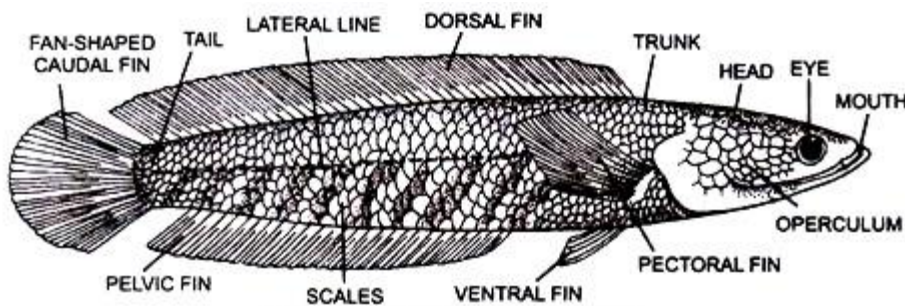
The common Indian species is *Cirrhinus mrigala*, but other species like *C. cirrhosa*, *C. latia*, *C. reba* and *C. fulungee* are also found in India.. The body of *Cirrhinus mrigala* is streamlined; the abdomen is round with deeply forked caudal fin. The snout is depressed, mouth is broad, transverse and obtusely round and the upper lip is entire. Barbels are two in number. The body colour is coopery, the flank is white with tinge of golden colour.

The colour of eye is golden. It attains an average length of about 40 cm. and is found in rivers and lakes of northern India. It is also well acclimatized in South India for aquaculture. It breeds during monsoon months. It is most suited for induced breeding and now available throughout India. More than five inter-generic hybrid fries are available for culture. The fingerlings and adult feed more on animal protein. Both male and female mature at the age of two years. It is said that the induced breed fish mature only at the age of one year. *C. mrigala* breeds during

monsoon. The fingerlings are available from natural grounds from July to November. The fish breeds naturally in rivers or induced riverine conditions due to the effect of pituitary hormone or other synthetic hormones.

As per Day (1878 & 1889) Mrigal inhabits rivers and tanks (water bodies much larger than ponds) in Bengal (undivided which includes Bangladesh) Deccan, North-West provinces, Punjab, Sindh (Pakistan), Cutch (partly in Pakistan and partly in Gujarat, Rajasthan provinces of India) and Burma and in the major river systems of India, including river Godavari in the south.

### *Channa punctatus*



The body is distinctly cylindrical in cross-section, but appears slightly flattened dorso-ventrally. Large scales on the top of the cranium are arranged in a pattern similar to that on the head of a snake. It has 29-32 dorsal fin soft rays, 20-23 anal fin rays and 12-14 caudal fin rays. There are 53-55 scales on the lateral line.

The males have black spots on a yellow under-belly. The female usually has a swollen abdomen and may also be distinguished by diffused black blotches in the ventral region. Spotted snakeheads, the ventral fins originate slightly in front of, or behind, the dorsal fin and their posterior ends show considerable variation. In adult

females, the ventral fins are shorter and never reach the vent, whilst in males the ventral fins extent to, or a little beyond the vent.

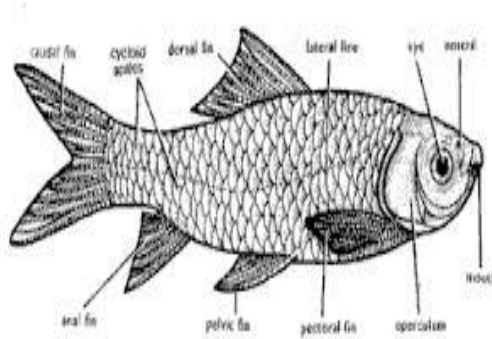
On the body, the upper (olive) and lateral section (greenish-yellow) markings consist of a well-defined black shoulder mark above the pectoral fin and 6-7 dark transverse triangular bands, descending from base of dorsal fin to the lateral line.

The top and bottom fins are a pale yellow-dark olive colour with a light gold border (also caudal) and a shiny green-gold overlay. The dorsal markings are 4-5 longitudinal rows of spots. Along the sides of the anal (bottom) fins there are 3-4 rows of spots. The pale yellow to dark olive, rounded caudal fin has 4-5 dark transverse bands with a light olive transverse band. The round caudal fin is also spotted. Five transverse bands are arranged on the pectorals. The throat is sometimes bluish green in colour. On the head there is a well-defined brown stripe running from the mid-eye to the top corner of opercle, and another running downwards from the eye to the corner of the mouth, extending to the opercle

In India, the 20-day-old fry are iridescent lemon yellow and have dull longitudinal blotched bands. By the time they reach 15 cm in length, the fish are dark brown on the upper sides and a lighter creamy colour lower down. The fish are covered in blotches and spots and a shiny green/gold overlay  
In Sri Lanka, the young have a chocolate-coloured body with three yellow stripes (which are lighter on the ventral side). There is also a golden lateral stripe from the snout, through the eye to the middle of the caudal fin. When the fish reach 13 mm in length, black body scales appear along with three dark bands on the caudal fin. Adult coloration is seen in specimens of 70 mm and upwards

The spotted snakehead is suitable for extensive cultivation in tropical or subtropical areas where availability of fresh water may be limited and dissolved oxygen is low. Air-breathing fish may have significant advantage for aquaculture as they survive in shallow waters with low oxygen. Considering its tolerance to low dissolved oxygen, it can be cultivated at high density in intensive tanks, but size grading is needed to reduce cannibalism.

## *Mugil cephalus*



*Mugil cephalus* is cosmopolitan in the coastal waters of most tropical and subtropical zones. In the western Atlantic Ocean, it is found from Nova Scotia, Canada south to Brazil, including the Gulf of Mexico. It is absent in the Bahamas and the Caribbean Sea. In the eastern Atlantic Ocean, the striped mullet occurs from the Bay of Biscay (France) to South Africa, including the Mediterranean Sea and the Black Sea. The eastern Pacific Ocean range includes southern California south to Chile.

The flathead grey mullet is catadromous, frequently found coastally in estuaries and freshwater environments. Adult mullet have been found in waters ranging from zero salinity to 75‰, while juveniles can only tolerate such wide salinity ranges after they reach lengths of 4–7 cm. Adults form huge schools near the surface over sandy or muddy bottoms and dense vegetation and migrate offshore to spawn in large aggregations. The larvae move inshore to extremely shallow water, which provides cover from predators as well as a rich feeding ground. After reaching 5 cm in length, these young mullet move into slightly deeper waters.

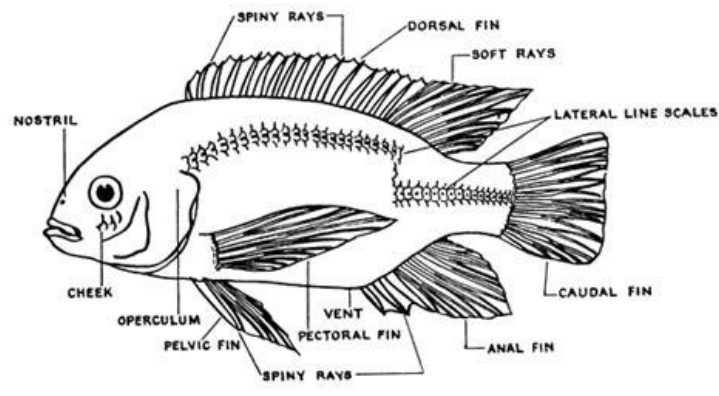
Flathead grey mullet is a diurnal feeder, consuming mainly zooplankton, dead plant matter, and detritus. Mullet have thick-walled gizzard-like segments in their stomach along with a long gastrointestinal tract that enables them to feed on detritus. They are an ecologically important link in the energy flow within estuarine communities. Feeding by sucking up the top layer of sediments, flathead grey mullet remove detritus and microalgae. They also pick up some sediment which functions to grind food in the gizzard-like portion of the stomach. Mullet also graze on epiphytes and epifauna from seagrasses as well as ingest surface scum containing microalgae at the air-water interface. Larval flathead grey mullet

feed primarily on microcrustaceans. Copepods, mosquito larvae, and plant debris have been found in the stomach contents of larvae under 35 mm in length. The amount of sand and detritus in the stomach contents increases with length, indicating that more food is ingested from the bottom substrate as the fish matures.

Trials on the artificial propagation of flathead grey mullet have been carried out, but most of the commercial aquaculture production of flathead grey mullet still depends on fry collected from the wild, which is cheaper.

## Tilapia

Tilapia is the generic name of a group of cichlids endemic to Africa. The group consists of three aquaculturally important genera *Oreochromis*, *Sarotherodon* and *Tilapia*. Several characteristics distinguish these three genera, but possibly the most critical relates to reproductive behaviour. All tilapia species are nest builders; fertilised eggs are guarded in the nest by a brood parent. Species of both *Sarotherodon* and *Oreochromis* are mouth brooders; eggs are fertilised in the nest but parents immediately pick up the eggs in their mouths and hold them through incubation and for several days after hatching. In *Oreochromis* species only females practice mouth brooding, while in *Sarotherodon* species either the male or both male



and female are mouth brooders

The main cultured species of tilapia usually can be distinguished by different banding patterns on the caudal fin. Nile tilapia have strong vertical bands, Blue tilapia have interrupted bands, and Mozambique tilapia have weak or no bands on the

caudal fin. Male Mozambique tilapia also have upturned snouts. Colour patterns on the body and fins also may distinguish species. Mature male Nile tilapia have gray or pink pigmentation in the throat region, while Mozambique tilapia have a more yellow colouration. However, colouration is often an unreliable method of distinguishing tilapia species because environment, state of sexual maturity, and food source greatly influence colour intensity.

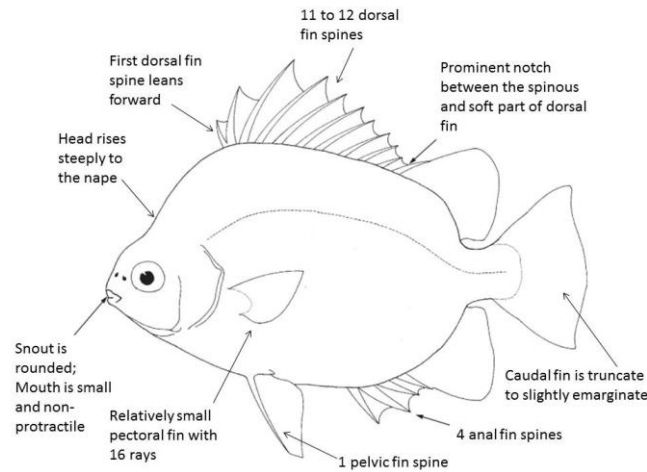
Sexual maturity in tilapia is a function of age, size and environmental conditions. The Mozambique tilapia reaches sexual maturity at a smaller size and younger age than the Nile and Blue tilapias. Tilapia populations in large lakes mature at a later age and larger size than the same species raised in small farm ponds. For example, the Nile tilapia matures at about 10 to 12 months and 3/4 to 1 pound (350 to 500 grams) in several East African lakes. Under good growth conditions this same species will reach sexual maturity in farm ponds at an age of 5 to 6 months and 5 to 7 ounces (150 to 200 grams). When growth is slow, sexual maturity in Nile tilapia is delayed a month or two but stunted fish may spawn at a weight of less than 1 ounce (20 grams). Under good growing conditions in ponds, the Mozambique tilapia may reach sexual maturity in as little as 3 months of age, when they seldom weigh more than 2 to 4 ounces (60 to 100 grams). In poorly fertilised ponds sexually mature Mozambique tilapia may be as small as 1/2 ounce (15 grams).

Tilapia ingest a wide variety of natural food organisms, including plankton, some aquatic macrophytes, planktonic and benthic aquatic invertebrates, larval fish, detritus, and decomposing organic matter. With heavy supplemental feeding, natural food organisms typically account for 30 to 50 percent of tilapia growth. (In supplementally fed channel catfish only 5 to 10 percent of growth can be traced to ingestion of natural food organisms.) Tilapia are often considered filter feeders because they can efficiently harvest plankton from the water.

Tilapia are more tolerant than most commonly farmed freshwater fish to high salinity, high water temperature, low dissolved oxygen, and high ammonia concentrations. Tilapia are a good fish for warm water aquaculture. They are easily spawned, use a wide variety of natural foods as well as artificial feeds, tolerate poor water quality, and grow rapidly at warm temperatures.



## *Lates calcarifer*



Body elongated, compressed, with deep caudal peduncle. Head pointed, with concave dorsal profile becoming convex in front of dorsal fin. Mouth large, slightly oblique, upper jaw reaching to behind eye; teeth villiform, no canine teeth present. Lower edge of preoperculum with strong spine; operculum with a small spine and with a serrated flap above original of lateral line. Dorsal fin with 7 to 9 spines and 10 to 11 soft rays; a very deep notch almost dividing spiny from soft part of fin; pectoral fin short and rounded; several short, strong serrations above its base; dorsal and anal fins both have scaly sheath. Anal fin round, with three spines and 7–8 soft rays; caudal fin rounded. Scale large ctenoid (rough to touch).

Seabass is a euryhaline and catadromous species. Sexually mature fish are found in the river mouths, lakes (e.g. Songkhla lake) or lagoons where the salinity and depth range between 30–32 ppt and 10–15m, respectively. The newly-hatched larvae (15–20 days old or 0.4–0.7cm) are distributed along the coastline of brackishwater estuaries while the 1-cm size larvae can be found in freshwater bodies e.g. rice fields, lakes, etc. (Bhatia and Kungvankij 1971). Under natural condition, seabass grows in freshwater and migrates to more saline water for spawning.

Seabass spends most of its growing period (2–3 years) in freshwater bodies such as rivers and lakes which are connected to the sea. It has a rapid growth rate, often attaining a size of 3–5 kg within 2–3 years. Adult fish (3–4 years) migrate

towards the mouth of the river from inland waters into the sea where the salinity ranges between 30–32 ppt for gonadal maturation and subsequent spawning. The fish spawns according to the lunar cycle (usually at the onset of the new moon or the full moon) during late evening (1800–2000 hours) usually in synchrony with the incoming tide. This allows the eggs and the hatchlings to drift into estuaries.