

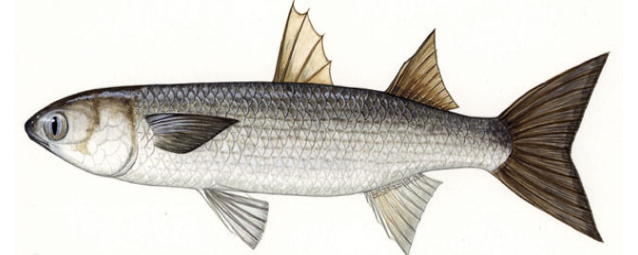

2. Brackishwater Fisheries

India has around 1.2 million ha brackishwater resources comprising of estuaries (deltaic river mouths), coastal lagoons, lakes, backwaters, tidal creeks, canals, mudflats, mangrove plants, etc. These water bodies lying between the freshwater and marine regimes have certain characteristics: (i) fluctuating water level synchronizing with the tides, (ii) wide salinity range of 0-35 ppt, (iii) higher nutrient content and productivity, (iv) serve as nursery grounds for numerous marine organisms, (v) harbour a rich diversity of flora and fauna, and (vi) support artisanal capture fisheries and provide livelihood to the coastal fishers.

The tidal currents carrying with them the juvenile fish and shrimp, and the rising and falling water level formed the basis of traditional brackishwater fish and shrimp farming practices in the *Bheries* of West Bengal and *Pokalli* paddy fields of Kerala. Scientific brackishwater aquaculture started around 1980s, wherein shrimp were cultured in well designed and managed ponds as there was high demand for them in the export market. At present around 0.16 million ha are under shrimp culture. Andhra Pradesh and West Bengal States are the chief producers of shrimp accounting for about 80% of the total country's production. However, of late, culture of high-value euryhaline marine fish species is being undertaken in brackishwater ponds and cages to meet the demand in domestic market. The most commonly cultured fish are Mulletts, Milkfish, Seabass, Pompano, Grouper, etc.

2.1. Mulletts

Thirteen species of Mulletts are found in India of which eight species contribute to the commercial catches. *Mugil cephalus* and *M. parsia* are the two cultivable species. They are euryhaline species that tolerate salinity from 0-35 ppt. They are omnivorous in feeding habit. They feed at the lowest trophic levels on plant detritus and algae. Mulletts are known for the high protein and vitamins contained in the muscle tissue. The Roe (ripe ovaries) from mature females are a delicacy, high-valued and sought after in many countries.

Fish Name	Picture
Grey Mullet <i>Mugil cephalus</i>	
Goldspot Mullet <i>Mugil parsia</i>	

2.2. Milkfish



The Milkfish, *Chanos chanos*, is the sole living representative of the family Chanidae and is widely distributed in the whole of tropical and subtropical regions of the Indian and the Pacific Oceans. The distribution coincides with coral reef areas where the water is warm, clear and shallow. It is one of the most important species cultured in South-East Asia.



Milkfish, *Chanos chanos*

2. 3. Bass

Asian Seabass, *Lates calcarifer*, commonly called the Giant Sea Perch is an economically important food fish in the tropical and subtropical regions of Asia and the Pacific. Because of its relatively high market value, it has become an attractive commodity of both large and small-scale aquaculture enterprises. The major constraint to rapid expansion of Seabass culture has been the inconsistent supply of fry collected from the wild. The Crescent Bass or Tiger Bass, *Terapon jarbua*, is common species in the Indo-Pacific; it occasionally makes its way into the aquarium trade.

Fish Name	Picture
Asian Seabass <i>Lates calcarifer</i>	
Tiger Bass <i>Terapon jarbua</i>	

2.4. Pearlspot

The Green Chromide Pearlspot, *Etroplus suratensis*, is the state fish of Kerala and locally (in Malayalam) it is called “*Karimeen*”. It being an euryhaline species is compatible for polyculture with other brackishwater / freshwater fish. It breeds naturally in confined conditions, sexes are separate and fertilization is external.


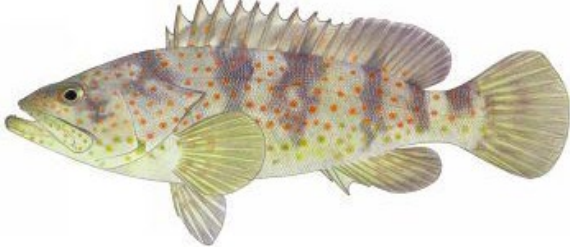
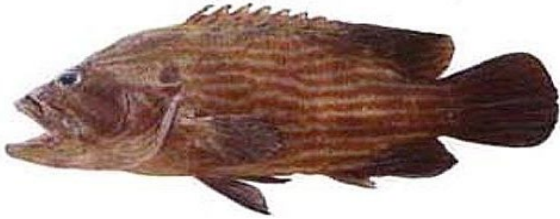


Pearlspot, *Etroplus suratensis*

2. 5. Grouper

There are more than 64 species of groupers found in the Indian waters. Groupers are important and economically valuable aquaculture species in Southeast Asian countries. Though groupers are sea fish, juveniles of some groupers are found in coastal waters, mangroves, estuaries and sandy bottoms. Groupers are ideal candidate species for intensive aquaculture particularly in the Asia-Pacific Region because of high consumer demand, desirable taste, hardiness in a crowded environment, efficient feed conversion, and rapid growth. Commonly found species in Indian waters are Greasy Grouper (*Epinephelus*

tauvina), Orange-spotted Grouper (*E. coioides*), Brown-lined Reef Cod (*E. undulosus*) and Brown-spotted Reef Cod (*E. chlorostigma*).

Fish Name	Picture
Greasy Grouper <i>Epinephelus tauvina</i>	
Orange-spotted Grouper <i>Epinephelus coioides</i>	
Brown-lined Reef Cod <i>Epinephelus undulosus</i>	

2.6. Scat



Spotted Scat, *Scatophagus argus*, is a euryhaline subtropical fish widely distributed in Indian-Pacific waters. It occurs in two basic colour morphs which are called Green Scat and Ruby or Red Scat and lives in coastal muddy areas, including estuaries, mangroves, harbours, and the lower courses of rivers. It is an important aquaculture food fish with high economic value and is also a popular aquarium species due to its colourful appearance, hardiness, slow growth, and calm behaviour.



Spotted Scat, *Scatophagus argus*

2. 7. Catfish

Nuna Tenggara or the Long Whiskers Catfish, *Mystus gulio*, is a common and popular fish because of its nutritional value and taste. Primarily a brackish water fish that enters and lives in freshwater. In freshwater, adults occur mainly in larger water bodies (rivers and streams) with mud or clay substratum, and rarely found in smaller streams. It forms schools of 10 to 25 individuals. *Mystus vittatus*, the Striped Dwarf Catfish is found in brackishwater systems with marginal vegetation in lakes and swamps with a mud substratum.

Fish Name	Picture
Long Whiskers Catfish <i>Mystus gulio</i>	 A photograph of a Long Whiskers Catfish (Mystus gulio) showing its characteristic long, thin whiskers and striped pattern on its body.
Striped Dwarf Catfish <i>Mystus vittatus</i>	 A photograph of a Striped Dwarf Catfish (Mystus vittatus) showing its shorter whiskers and distinct vertical stripes on its body.

2. 8. Pompano

The Silver Pompano, *Trachinotus blochii* belongs to the family Carangidae; it resembles the much sought after Silver Pomfret (*Pampus argenteus*). It is a tropical species, distributed in the Indo-Pacific Region, inhabits shallow coastal waters. It is one of the most promising species for coastal aquaculture as its growth rate is high, meat quality is good and fetches high price in the market.



Silver Pompano, *Trachinotus blochii*

3. Marine Fisheries

India has a 8,118 km long coastline stretching along 9 Maritime States and 4 Union Territories. The nine Maritime States are Gujarat, Tamil Nadu, Kerala, West Bengal, Maharashtra, Odisha, Andhra Pradesh, Karnataka and Goa. The 4 Maritime Union Territories are Daman & Diu, Puducherry, Lakshadweep Islands and the Andaman & Nicobar Islands. The country has also a 0.53 million km² Continental Shelf and 2.02 million km² of Exclusive Economic Zone (EEZ). The annual potential yield from the EEZ is estimated as 3.93 million tonnes of fish. The Marine Fisheries has been playing a pivotal role in the Indian Fisheries Sector. The major marine catches comes from the coast of Gujarat, Tamil Nadu, Kerala, West Bengal and Maharashtra.

Marine Fisheries Resources of India

Length of Coastline (km)	8,118
Exclusive Economic Zone (EEZ) (sq. km)	2,020,000
Continental Shelf (sq. km)	530,000
Territorial Sea (up to 12 nautical miles) sq.km	193,834
Number of Fish Landing Centres	1,537
Number of Fishing Villages	3,432
Number of Fishermen Families	874,749
Fisher-folk Population	4,056,213

The important Marine Fisheries can be grouped into the following categories:




1. **Surface-water Fish (Pelagic):** Sardines, Anchovies, Ribbonfish, Mackerel, Seerfish, Tuna, etc.
2. **Mid-water Fish (Pelagic):** Bombay Duck, Cobia, Silver Bellies, Horse Mackerel, etc.
3. **Bottom-water Fish (Demersal):** Perches, Catfish, Pomfrets, Flatfish, Eels, etc.

3.1. Sardines

Sardines are one of the two most important commercial pelagic schooling fishes in India (the other being Mackerel). Fourteen species of Sardines are found in the Indian waters. Out of the 14 species, the Oil Sardine *Sardinella longiceps* alone contributes to the largest single-species fishery in the country, comprising about 15% of the total marine fish catches. The Indian Oil Sardine is one of the most regionally limited species of *Sardinella* and can be

found in the northern regions of the Indian Ocean. Oil Sardine landing is maximum during post-monsoon season followed by monsoon and pre-monsoon.




The other 13 species are termed as “Lesser Sardines”, comprise all the species of Sardines (*Sardinella spp.*) other than the Indian Oil Sardine, and contribute about 3-7% to the total marine fish catch. They are known to inhabit mostly the near-shore waters up to 25-30 m depth zone. Nine species of Lesser Sardines occurring in Indian waters, in the order of abundance, are *Sardinella gibbosa*, *S. fimbriata*, *S. sirm*, *S. albella*, *S. dayi*, *S. sindensis*, *S. clupeoides*, *S. melanura* and *S. jonesi*. Four regions of Lesser Sardine concentrations are noticed along the Indian coasts, viz., Goa, Karnataka, Kerala, Tamil Nadu, Pondicherry, Andhra Pradesh and Orissa.

Sardines	
Fish Name	Picture
Indian Oil Sardine <i>Sardinella longiceps</i>	
Goldstripe Sardine <i>Sardinella gibbosa</i>	
Fringescale Sardine <i>Sardinella fimbriata</i>	

3. 2. Anchovies



Anchovies are small fish having greenish-blue reflections due to a silver-coloured longitudinal stripe that runs from the head to base of caudal (tail) fin. They are found in scattered areas throughout the world's oceans, but are concentrated in temperate waters, and are rare or absent in very cold or very warm seas. Anchovies contributes around 6% to

the total pelagic fish landings of India. 28 species of Anchovies are recorded in the Indian waters. Anchovies mostly feed on zooplankton. Andhra Pradesh and Tamil Nadu along east coast and Kerala along west coast are the three coastal states of India which support 95% of the average annual catch of anchovies in the country. There are two fishing seasons: January to May and September to November, the latter period being the peak season for anchovy catches. Major contribution to the fishery is by the genera: *Stolephorus*, *Engraulis*, *Thryssa*, *Setipinna* and *Coilia*.

Anchovies	
Fish Name	Picture
Indian Anchovy <i>Stolephorus indicus</i>	
Goldspotted Grenadier Anchovy <i>Coilia dussumieri</i>	
Malbar Anchovy <i>Thryssa malabarica</i>	

3. 3. Mackerels

Mackerel is a common name applied to a number of different species of schooling epipelagic fish of the family Scombridae. They are found in both temperate and tropical seas, mostly living along the coast or offshore in the oceanic environment. Mackerels typically have: rows of longitudinal bands or spots along upper half of body, dorsal and anal finlets, keels on caudal peduncle and a deeply forked caudal fin. Mackerels found in Indian waters are the Indian Mackerel (*Rastrelliger kanagartha*) and the Indian Chub Mackerel (*Scomber indicus*).

Mackerels	
Fish Name	Picture
Indian Mackerel <i>Rastrelliger kanagurta</i>	
Indian Chub Mackerel <i>Scomber indicus</i>	

3.4. Seerfishes

Another group of commercially important fishes, belonging to the family Scombridae, are the Seerfishes represented in Indian coastal waters by Narrow-barred Spanish Mackerel *Scomberomorus commerson* and Indo-Pacific King Mackerel *Scomberomorus guttatus*.






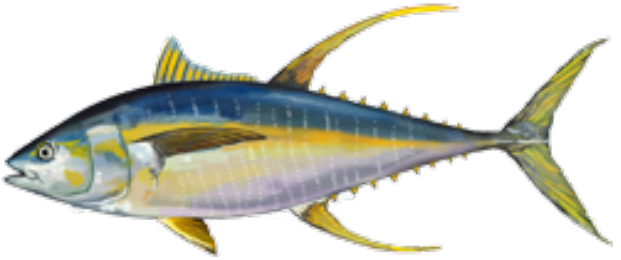


Seerfish, *Scomberomorus commerson*

3.5. Tunas

Tunas (family Scombridae) are among the largest, most specialized and commercially important of all fishes. They are found in temperate and tropical oceans around the world and account for a major proportion of the world fishery production. Tunas are unique among fishes because they possess body temperature several degrees higher than the ambient waters and have high metabolic rate that enables them to exhibit extraordinary growth rate. They have streamlined bodies and vary widely in size, colour and fin length.

Around 19% of the global tuna catches are from the Indian Ocean. The waters of Andaman Islands are known to have the world's richest stocks of Tunas with 100,000 tonnes of Coastal Tunas and 82,000 tonnes of Oceanic Tunas available for exploitation. In Lakshadweep the stocks of Tunas are estimated to be around 50,000-90,000 tonnes, and Tunas contribute around 85% of the total marine fish landings in Lakshadweep Islands. Tunas commonly found in Indian waters are Little Tunny (*Euthynnus affinis*), Frigate Tuna

(*Auxis thazard*), Oriental Bonito (*Sarda orientalis*), Yellowfin Tuna (*Thunnus albacares*), Bigeye Tuna (*Thunnus obesus*), Skipjack Tuna (*Katsuwonus pelamis*), etc.

Tunas	
Fish Name	Picture
Little Tunny <i>Euthynnus affinis</i>	
Frigate Tuna <i>Auxis thazard</i>	
Oriental Bonito <i>Sarda orientalis</i>	
Yellowfin Tuna <i>Thunnus albacares</i>	
Bigeye Tuna <i>Thunnus obesus</i>	
Skipjack Tuna <i>Katsuwonus pelamis</i>	

3. 6. Bombay-duck

Bombay-duck *Harpodon nehereus*, found in the mid-water column, distributed in the Indo-West Pacific, is a white, soft and delicate fish, predatory in habit; it contributes to a major fishery along the Maharashtra and Gujarat coasts and occurs sporadically along the east coast. It is captured using a characteristic bag-net known as 'dol' that is operated against tidal currents. It is a popular food-fish along the north-west coast of India; it is marketed fresh, dried or salted.



Bombay-duck, *Harpodon nehereus*

3.7. Cobia

Cobia, *Rachycentron canadum*, is found throughout the water column and occurs in warm-temperate to tropical waters of the West and East Atlantic, throughout the Caribbean and in similar zones in the Indo-West Pacific region of India, Australia and Japan. The fish is a carnivore and congregates at reefs, ship wrecks, harbour-buoys and other submerged structures in search of food. Juveniles may enter estuaries and mangroves in search of prey. It is dark brown in colour, young ones have alternate black and white horizontal stripes, it grows up to 2 m length and 50 kg weight. It is one of the fast-growing and high-value marine fish that is being farmed in Sea Cages, in India.



Cobia, *Rachycentron canadum*