

EXPLOITED AND POTENTIAL CAPTURE FISHERY RESOURCES IN THE INSHORE WATERS OF INDIA

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India has a coastline of about 6100 km with nearly 2000 fishing villages along the coast. The marine fish caught from the inshore waters by indigenous as well as mechanised vessels are landed during almost all hours of the day and often at night round the year at about 1400 fish landing centres. About one million active fishermen use indigenous crafts and gears in the traditional fisheries. This sector contributes to about 65 per cent of the total marine fish production of the country. The pelagic as well as mid-water fish catches are almost entirely landed by the traditional fishery.

Prior to the introduction of mechanised fishing boats, the entire marine fish catch of the country was produced by traditional fishing methods. In 1974, traditional fisheries landed an estimated catch of 8,43,961 tonnes out of the total marine fish catch of 12,17,797 tonnes. In 1975, the contribution of this fishery was 915,058 tonnes in the total marine fish production of 14,22,673 tonnes. The return per unit of investment of non-powered boats has been found to be twice that of the powered boats and generate almost seven times more direct employment opportunities than the mechanised boats. Hence, this sector has been recommended about 15 per cent of the outlay on marine fisheries development. The present paper reviews the status of exploited and potential capture fishery resources in the inshore waters of India.

EXPLOITED FISHERIES

It is well known that the inshore waters where the traditional fisheries operate contain the highly productive fishing grounds. The present area of exploitation extends to 10 to 15 km from the shore and depths up to about 50 m. The gears such as shore seines and drag nets are operated from the beach, while boat seines, drift nets, traps, hooks and lines are operated from boats at sea. Bag nets and stationary types of nets are fixed in the tidal region in the estuaries, backwaters and coastal waters with stakes or with floats and sinkers. Cast nets are operated from shore as well as in the sea. The best fishing season for the country as a whole is the fourth quarter, from October to December. The coastal waters of the country yield a wide variety of fishes, crustaceans and molluscs. Of these, some groups or species are commercially very important while others are of lesser importance. Some of them are exploited up to the optimum level while others are under exploited. The relative productivity of different areas is shown in Fig. 1. Recently studies have indicated that there are, in addition, recognisable sources of unexploited and potential fisheries resources also in the seas around India. Rao (1973), Banerji (1973) and Silas *et al.* (1976) reviewed the major exploited fisheries resources of the country.

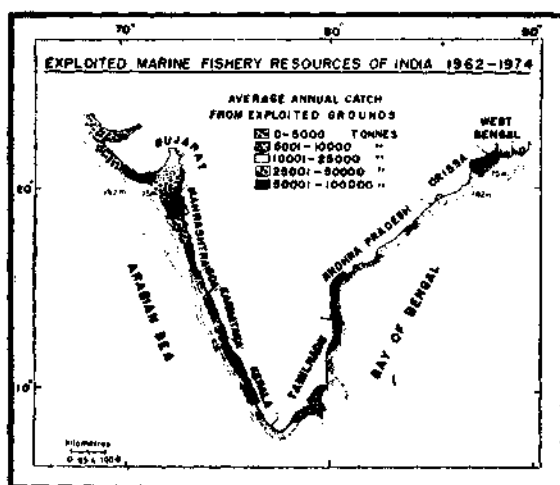


Fig. 1 The relative productivity of different areas.

The major groups or species of the pelagic fishes along the Indian coast consist of the oil sardine, lesser sardines, *Chirocentrus* spp., *Hilsa* spp., *Stolephorus* spp., *Thrissocles* spp., other clupeids, Bombay-duck, half beaks, gar fishes, flying fishes, ribbon fishes, carangids, mackerel, seer fishes, tunnies, barracudas, mullets, and *Bregmaceros* sp. The demersal fishes include elasmobranchs, eels, cat fishes, perches, lizard fishes, red mullets, polynemids, sciaenids, silverbellies, *Lactarius* sp., pomfrets, and soles. Other demersal groups are prawns, lobsters and crabs and cuttle fishes. In Lakshadweep, the bulk of the catch consists of tunas, particularly the skipjack. Perches and anchovies form the major fishery in the Andaman Islands.

The average annual catch composition for the period 1966 to 1976 is shown in Table 1. The fisheries whose landings are more than 35,000 tonnes on an average per year are the oil sardine (*Sardinella longiceps*), other sardines, the Bombay-duck (*Harpodon nehereus*), crustaceans (chiefly the penaeid and non-penaeid prawns) the mackerel (*Rastrelliger kanagurta*), elasmobranchs (sharks, skates and rays), sciaenids, cat fishes, ribbon fishes, silverbellies and miscellaneous fishes. Among the fishes whose landings are between 15 to 35 thousand tonnes are white bait, carangids, other clupeid fishes, perches, seer fishes and pomfrets. Those between 10 to 15 thousand metric tonnes are *Thrissocles*, soles and other crustaceans. Rest of the fishes contribute to less than 10 thousand tonnes. The average annual figures for the period 1961 to 65 given by Rao (1973) are also shown in the table, for comparison

From the table it is evident that the average figures for the period 1966 to 76 are higher than those for the period '61 to 65 for all the categories, except for the Bombay-duck, eels, *Chorinemus* and *Bregmaceros* which show a decline. Significant increase in average catch was seen for other sardines, *Thrissocles*, other clupeid fishes, lizard fishes, cat fishes, flying fishes, perches, polynemids, sciaenids, ribbon-fishes, silver-bellies, mackerel, seer fishes, tunas penaeid prawns, other crustaceans and cephalopods. The trends in catches of the most important species or groups during the period 1966 to 1976 are shown in Figs.2 and 3.

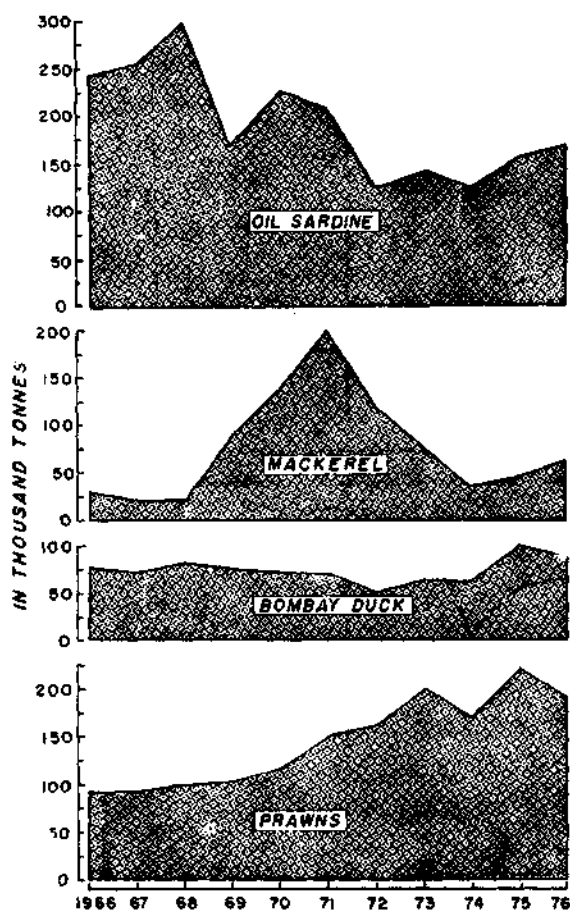


Fig. 2 The trends in catches of most important species

Species composition and seasonal abundance

Oil sardine : Forms the most important single species fishery, touching about one-third the total marine fish production. The annual fluctuations in the catches of no other species of commercial fish are so marked as those of this species. These fluctuations are due to fishery independent factors and the variations in the

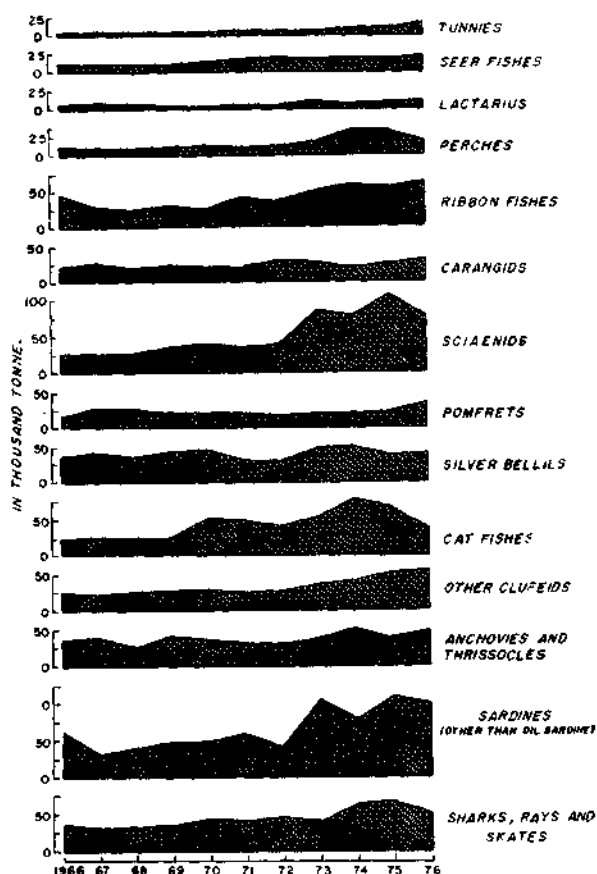


Fig. 3 The trends in catches of important species.

numerical strength of newly recruited year-class to the fishery. The coastal areas between Quilon in Kerala and Ratnagiri in Maharashtra are the traditional fishing grounds for the species. The two states of Kerala and Karnataka produce the bulk of the catch, the former state occupying a unique position in the oil sardine fishery of India. The landings in both the states are highest in the fourth quarter according to calendar year). The fishery starts immediately after the south-west monsoon and lasts from August to March with peak during September-December period. The fishery is supported by 10-16 cm fish which are 0-year and 1 year old fish.

Mackerel: This species (*Rastrelliger kanagurta*) supports fisheries on both the coasts, although the bulk of the catch (about 90%) is obtained from the west coast between Quilon and Ratnagiri. The fishery is of great importance in Karnataka and Goa. The fishing season starts by July-August and lasts up to April, the peak season being November-December. The landings are highest in the fourth quarter in Mahara-

shtra, Karnataka and Kerala. In Tamil Nadu, the catches are highest in third quarter, in Andhra Pradesh they are more or less uniform in all the quarters. In West Bengal and Orissa they are poor all through the year. The fishery is supported by immature fish 16 to 20 cm believed to be mostly of 0-year class. Wide fluctuations in the catch from year to year are also characteristic of the species, resulting from the fact that the stock consists mainly of a single year class susceptible to large variations in recruitment and mortality.

Bombay-duck: Supports a very important single species (*Harpodon nehereus*) fishery along the north-west coast of India. Gujarat and Maharashtra yield the highest catches. There are practically no landings in Karnataka, Kerala and Tamil Nadu, thus showing a discontinuous distribution. The catches are highest in the fourth quarter. Fluctuations in annual landings are common. The commercial fishery is mainly supported by the 0-year class.

Other clupeoid fishes: These, including the lesser sardines, anchovies and related fishes, are found all along the coasts and form about 12 per cent of the total marine fish catch. The species under the genera *Sardinella*, *Kowala*, *Ilisha*, *Hilsa*, *Opisthopterus*, *Anadontostoma*, *Dussumieria*, *Stolephorus*, *Megalops*, *Chanos* and *Chirocentrus* contribute to the bulk of the catches of this group.

The lesser sardine and anchovy catches are obtained almost entirely from Andhra Pradesh, Tamil Nadu and Kerala. The fishery lasts from October to April. About 70% of the catches of whitebait (*Stolephorus*) come from the region between Cape Comorin and Quilon. The fishing seasons are June, July and October-November along south-west coast, May to November along Tamil Nadu coast and November to April along the Andhra Pradesh coast.

Tunas and allied fishes: Tunas (Genera *Auxis*, *Sarda*, *Gymnosarda*, *Thunnus*, *Euthynnus*, *Katsuwonus*) spear fishes (*Tetrapturus*, *Makaira*) sail fishes (*Istiophorus*) and the sword fish (*Xiphias*) are economically important food fishes. They range in size from 60 cm to about 450 cm. Although there is no organised fishery along the coast, these fishes are obtained as incidental catches in gears operated for other fishes. Kerala ranks first, followed by Tamil Nadu where the maximum yields are in the fourth quarter. In

Andhra Pradesh, highest catch is obtained in the second quarter. The species obtained from inshore waters are commercially less important than those from the high seas.

Seer fishes : The king seer (*Scomberomorus commerson*), the streaked seer, (*S. lineolatus*) and the spotted seer (*S. guttatus*) and the Wahoo *Acanthocybium solandri* are the common species under this group. Major portion of the catches comes from Tamil Nadu, Andhra Pradesh and Kerala. Fair quantities are also landed in Maharashtra and Karnataka. The fishing season extends from October to March. Peak catches are landed in the fourth quarter. Gill nets and hooks and lines account for the major portion of the catches.

Barracudas : The common species of barracudas are *Sphyræna commersoni*, *S. obtusata* and *S. jello*, which attain a maximum size of 150 cm. They are caught commonly on hook and line in coastal waters. Although they do not form any sizeable fishery, these fishes are caught in small quantities along both the coasts, especially around islands in coastal waters.

Carangids and allied fishes : These fishes, comprising several genera and species, are caught all along the coast in a wide variety of gear. Important genera are *Megalaspis*, *Decapterus*, *Alectis*, *Selaroides*, *Selar*, *Carangoides*, *Chorinemus*, *Trachynotus*, *Rachycentron* and *Choryphaena*. While a few species grow to large sizes (over 60 cm), majority are under 30 cm. Highest yields are obtained from Tamil Nadu, followed by Kerala. In both the states, third quarter yields highest catches. In Gujarat and Karnataka, highest yields are obtained in the fourth quarter, and in Andhra Pradesh in second quarter. Carangid catches are poor in other states.

Ribbon fishes : They are of particular abundance in the States of Kerala, Tamil Nadu and Andhra Pradesh, though captured all along the coast. In the states, the landings are highest in the third quarter. Four species mainly contribute to the fishery, of which *Trichiurus lepturus* is the most dominant. This species, which attains a length of over one metre moves in large schools in coastal waters between July and September contributing to peak commercial catches at various places along the southern peninsula.

Garfishes and half-beaks : These fishes of the genera *Belone* and *Hamirhamphus* are comparatively more abundant in Tamil Nadu where the catches are highest in the second quarter.

Flying fishes : Belonging to the genera *Exocoetus*, *Parexocoetus* and *Cypselurus*, these fishes are caught in small quantities along with other fishes. They support an important fishery from May to August along the Coromandel coast.

Elasmobranchs : The states of Tamil Nadu, Kerala, Andhra Pradesh, Gujarat, Maharashtra, Karnataka, West Bengal and Orissa produce large quantities of elasmobranchs. The genera and species constituting the catches on both the coasts are the same. Species of *Scoliodon*, *Carcharhinus*, *Sphyrna*, *Pristis*, *Dasyatis*, *Aetobatus*, *Rhinoptera* are the more common. Along the east coast, the third quarter's catch is usually the highest while along the west coast, the fourth quarter's catch is the highest.

Cat fishes : Species of the genera *Tachyurus* and *Plotosus* contribute to the catches. The catches are highest in Kerala, where the second quarter yields the maximum catch. Maharashtra, Tamil Nadu, Gujarat, Andhra Pradesh, Karnataka, Orissa and West Bengal also yield catfish catches.

Eels : The common commercial species of eels are *Anguilla bengalensis*, *A. bicolor*, *Muraenesox talabanoides* and *M. cinereus*. While the first two species are common along the east coast, the latter two are common along the north-western region. *M. talabanoides* attains a size of about two metres.

Perches : The commercially important genera of perches include *Lethrinus*, *Lutianus*, *Epinephelus*, *Lates*, *Psammoperca*, *Sillago*, *Nemipterus*, *Pomadasys* and *Siganus*. These fishes are most abundant in Tamil Nadu, other states of importance being Kerala, Maharashtra and Andhra Pradesh. Perches are abundant in coastal waters, particularly around coral reefs and rocky areas. They are effectively captured on hook and line, in gill nets and baited basket traps. Highest catches are obtained in Maharashtra and Karnataka in the fourth quarter, in Kerala and Tamil Nadu in third quarter and in Andhra Pradesh in second quarter.

Polynemids : These occur in all coastal waters and frequent backwaters and estuaries.

Eleutheronema tetradactylum, *Polydactylus indicus*, *Polynemus heptadactylus*, *P. paradesius* and *P. sextarius* mainly support the fisheries. The fishery is most important in the north-western region, covering Bombay and Saurashtra areas. The catches are high in the first two quarters in this region.

Sciaenids : Represented by a large number of species in coastal waters, these fishes occur all along the Indian coast. While species like *Pseudosciaena diacanthus*, *Otolithoides brunneus*, *Otolithus ruber* and *O. argenteus*, attain large sizes, a number of other species (*Johnius*, *Sciaena*) are small sized but abundant. The states of Maharashtra, Tamil Nadu, Andhra Pradesh and Gujarat are important for the fishery. Peak catches are obtained in the fourth quarter (Maharashtra), third quarter (Tamil Nadu) and in first quarter (Andhra Pradesh and Gujarat).

Red mullets : Represented by several species under two genera *Upeneus* and *Parupeneus*, these fishes are common in coastal waters along both the coasts.

Silverbellies : Small, coastal water fishes belong to the three genera, *Leiognathus*, *Secutor* and *Gazza*. They occur together and contribute to major commercial catches in the states of Tamil Nadu, Andhra Pradesh and Kerala. Heavy landings are obtained along the south-east-coast, around Mandapam. Peak catches are obtained in the third quarter in Tamil Nadu and Kerala and in the first and second quarters in Andhra Pradesh.

Pomfrets : Three species, *Parastromateus niger*, *Pampus argenteus* and *P. chinensis* represent this group. They are best obtained in the fourth quarter of the year in Gujarat, Maharashtra and Kerala. They are not so abundant in the other states.

Grey mullets : The grey mullets represented by the genera, *Mugil*, *Valamugil*, *Liza*, *Rhinomugil*, *Sicamugil*, *Plycomugil*, *Ellochelon* and *Crenimugil* are more abundant along the east coast than along the west coast. Some of them grow to a maximum size of 25 to 45 cm. The more common species like *M. cephalus*, *L. macrolepis*, *L. parsia*, *L. tade*, *L. seheli* and *V. buehanani* contribute to coastal fisheries of great economic importance. They often enter estuaries and backwaters. They are captured in

a variety of gear, the most important of which are stake nets, cast nets and gill nets.

Bregmaceros : The species, *Bregmaceros maclellandi*, growing to about 13 cm, supports a seasonal fishery around Bombay, from October to March. Along other coastal regions, it is of limited occurrence. The landings are highest in the fourth quarter.

Soles : These are represented in the coastal region by a number of genera, *Psettodes*, *Poecilopsetta*, *Bothus*, *Pseudorhombus*, *Solea*, *Paraplagusia* and *Cynoglossus*. Of these, *Psettodes erumei* along the Bombay-Saurashtra coast and *Cynoglossus macrostomus* along the Kerala and Karnataka coasts are the most important from the fishery point of view. However, bulk of the soles are landed in Kerala, little in Karnataka and Tamil Nadu. In all the three states, the third quarter's landings are the highest.

The malabar sole, *C. macrostomus* grows to a maximum size of about 18 cm. The fishery from August to December is supported by one year old fish. Boat seines, cast nets and shore seines account for the bulk of the catch.

Crustaceans : Among the crustaceans, the penaeid prawns form the major component, followed by non-penaeid prawns and other crustaceans. Maharashtra ranks first and Kerala second in total production. For penaeid prawn production, Kerala stands first followed by Maharashtra and for non-penaeid prawn production Maharashtra stands first followed by Andhra Pradesh. In the other states, the catches are less. In Gujarat and Maharashtra, the catches are highest in the second quarter. In West Bengal and Orissa, they are highest in fourth quarter. In the rest of the states, the catches are highest in the third quarter.

The penaeid prawns of commercial importance are *Penaeus indicus*, *P. monodon*, *Metapenaeus dobsoni*, *M. affinis*, *M. monoceros*, *M. brevicornis*, *Parapenaeopsis stylifera*, *P. sculptilis*, *P. hardwickii* and *Solenocera indicus*. The important species of non-penaeid prawns are *Palaemon tenuipes*, *p. styliferus*, *Hippolytina ensirostris* and *Acetes* spp. While prawns are captured all along the coast, certain species are dominant in certain regions.

Species comparatively less abundant but nevertheless of high local importance are *Penaeus semisulcatus* (east coast), *P. penicill-*

atus (Maharashtra), *P. merguensis* (Karwar, Ratnagiri), and *P. canaliculatus* (Madras Pulicat and Bombay).

The giant freshwater prawn, *Macrobrachium resenberghii* is obtained in good quantities in Kerala backwaters in the monsoon and post-monsoon months and from December to July along the east coast from similar environments.

Species of *Acetes* constitute good fisheries along both east and west coasts. *A. indicus*, *A. erythraeus* and *A. serrulatus* occur in large schools in inshore waters.

The fishing seasons for prawns extend from November to May (west coast) and from December to August (east coast). Prawns are fished in large quantities from the mud bank areas of Kerala in June and July. A monsoon fishery for prawns exists in the Gulf of Kutch. Prawns are captured from coastal waters in stake nets, boat seines, cast nets, dip nets and trawl nets.

Other crustaceans include the lobsters and crabs. The lobsters inhabit rocky bottom areas along both coasts. The common species are *Parulirus polyphagus*, *P. ornatus* and *P. homarus*. They attain about 30 cm length. They are captured in gill nets, baited traps and anchor hooks.

Of the crabs, *Portunus pelagicus*, *P. sanguinolentus* and *Scylla serrata* are the commercially important species. While the first two species contribute to an important commercial fishery in the Palk Bay and Gulf of Mannar, the third species is caught in fair numbers from the brackishwater lakes and estuaries along both the coasts.

The state-wise catch of important groups of fishes and crustaceans is indicated in Table. 2.

Molluscs: The chief exploited molluscan resources include mussels, oysters, clams and other bivalves, gastropods and cephalopods.

Two species of mussels, the green mussel *Perna viridis* and the brown mussel, *Perna indica* are commercially important. The former is found in rocky regions all along the east and west coasts, while the latter is restricted to south-west coast. They grow up to about 13 cm.

Along the Kerala coast, they are fished from October to May.

The oysters, *Crassostrea madrasensis*, *C. gryphoides*, *C. cucullata*, *C. discoidea*, *C. cristagalli*, *C. cornucopia*, *C. glomerata* and *C. belcheri* occur along the coast, the first four forming large fishable beds. *C. madrasensis* is found in estuaries and backwaters along the east coast but is confined to the southern region along the west coast. *C. cucullata* is found on intertidal rocks of both coasts. *C. gryphoides* is found in muddy creeks and bays from Kutch to Honavar along the west coast. *C. discoidea* occurs in deep waters of the littoral zone.

Clams, represented by several genera and species, are much greater in abundance than mussels and oysters. Though they are widely used as food by the coastal population, the vast resource is inadequately used due to conservative food habits and prejudices. The clams thrive in all estuaries, backwaters and bays. They constitute sustenance fisheries, the important zone being the central and northern parts of the west coast. *Meretrix meretrix* growing to about 7 cm in length, supports good fisheries along the entire Maharashtra coast and the North Kanara coast. *M. casta* is common along the east coast and the southern regions of west coast. Species of *Villorita* are confined to backwaters and estuaries of west coast. Other bivalves of commercial importance belong to the genera *Paphia*, *Katelysia*, *Gafrarium*, *Anadara*, *Mesodesma*, *Donax* and *Solen*.

Gastropods of commercial value are the sacred chank, *Xancus pyrum* (Palk Bay and Gulf of Mannar), *Trochus niloticus* and *Turbo marmoratus* (Andaman and Nicobar Islands) and a variety of smaller gastropods (Palk Bay and Gulf of Mannar).

The common species of cephalopods include cuttle fish (*Sepia roxii*, *S. aculeata*, *S. rostrata* and *Sepiella inermis*), squids *Sepioteuthis arctipinnis*, *Loligo indica*, *L. hardwickii* and *L. affinis*) and octopuses (*Ocropus globosus*, *O. rugosus*, *O. octopodia*, *O. herdmanni* and *O. hongkongensis*). These are caught in nets operated for fishes. *S. arctipinnis* supports an important seasonal fishery in the coastal waters of Palk Bay (March to June) and Gulf of Mannar.

Pearl oysters are represented by *Pinctada fucata*, *P. margaritifera*, *P. chemnitzii*, *P. anomioidea* and *P. atropurpurea* in the seas around India, of which the first species alone supports the pearl fisheries in Gulf of Mannar. Pearl oysters are also found in the Gulf of Kutch. The windowpane oyster, *Placenta placenta* available in the Gulf of Kutch, Bombay and Andhra Pradesh also yields pearls.

UNDER-EXPLOITED AND POTENTIAL RESOURCES

The inshore region has been fished intensively all along and has been supporting important coastal fisheries. The fishing activity extends to about 50 m in certain regions. In recent times, the emphasis has been on shrimp trawling in inshore areas resulting in under-exploitation of certain other resources. Such resources include the threadfin bream, *Nemipterus japonicus* (beyond 50 m. on the shelf along both east and west coasts), the pomfrets and seer fish along the west coast. It is known that in the traditional inshore fishing grounds, an increase in the fishing effort will not yield any increase in the catch of the oil sardine and mackerel. The average annual stock for the period 1960-1971 has been estimated to be 57,000 tonnes for the mackerel and 400,000 tonnes for the oil sardine from the present fishing grounds. The aerial and acoustic surveys along the west coast of India by UNDP/FAO Pelagic Fishery Project have confirmed that both oil sardine and mackerel schools occur in neritic waters particularly between 19 and 40 fathoms. There are also indications that in depths up to 40 m, along the west coast, potential resources of oil sardine, mackerel, white bait, ribbonfishes, cat fishes, silver bellies and lesser sardines are available for exploitation. These resources could be exploited by bringing in diversification of fishing by the small mechanised boats concentrating at present on catching shrimp. These resources are said to be almost completely unexploited, the biomass being largest just prior to south-west monsoon season. Based on these resources, a small vessel fishery with pelagic trawls could be developed round the year, if disposal and utilization of the catches could be organised. Similar resources of white bait, lesser sardines, cat fishes and ribbon fishes are also known to occur along the east coast.

Along the east coast, two species of mackerel, *R. kanagurta* and *R. faughni* are known to occur. The resources of the latter are unknown. The mackerel resources of Andamans (*R. kanagurta* & *R. brachysoma*) are also under exploited. There are also indications of good pelagic resources of mackerel and oil sardine along the Maharashtra coast. The flying fish fishery along the south-east coast can be developed further on modern lines. Considerable resources of barracudas, needle fishes and half beaks are known to be available along both the coasts constituting potential resources for future development.

NON-CONVENTIONAL RESOURCES

Cuttle fishes and squids form 2 to 11% of the by-catch in trawl nets along south-east and south-west coasts up to 40 m depth. These are, also captured in other gears in small quantities along with fishes. Apart from their meat which has high export value, the cuttle bone has both internal and external market.

Ancillary resources like the holothurians, echinoids, sponges, corals and seaweeds are abundant in coastal areas, which though being exploited to a limited extent, can further be developed and utilised for various purposes. The horse-shore crabs, *Limulus gigas* and *moluccanus* occurring in the Bay of Bengal which form valuable raw material for the manufacture of colour films and medicines are not commercially exploited at present.

In Indian seas myctophids form an important constituent of the deep scattering layers (Silas, 1972). Large concentrations of these fishes occur along the west coast. These fishes have high Vitamin 'A' content and oil. Good concentrations of grenadiers and macrurids are also known to be available along the upper continental slope off the west coast of India (Silas, 1969).

Large quantities of the swimming crab, *Charybdis (Goniohellenus edwardsi)* have been found along the continental edge of the south-west coast as well as on the east and north-west coast (Silas, 1969). This may be an important source of crab meal.

Exploitation of such resources as mentioned above which are at present not being fished, can lead to diversification of fishing and a balanced development of the fishing industry.

PROSPECTS FOR DEVELOPMENT

The trend in the catch of pelagic fishes along the west coast of India shows wide fluctuations in the catches of the three important fisheries, viz., oil sardine, mackerel and Bombay-duck. Since these are composed of single species, their fluctuations are seriously felt along the west coast unlike those on the east coast where multiple species are involved. For this reason, the impact of mechanisation towards increase in overall production could be more easily seen along the east coast, compared to the west coast.

However, hardly anything is known about the pelagic fishery resources of the north-west coast and of the east coast. There are indications of occurrence of mackerel, sardine, lesser sardines, anchovies and other important groups of pelagic fishes. Epipelagic and mesopelagic fishes such as *Myctophidae* and oceanic squids may also form important components in these areas. An increase in the catch may be expected with more intensive fishing from the inshore waters along the east coast.

The demersal fisheries show an increasing trend, particularly for penaeid and non-penaeid prawns, sciaenids, silver bellies and pomfrets.

There are localised, seasonal sustenance fisheries like the flying fish fishery along the Coromandel coast, lobster fishery of the south-west coast of Kerala, Tirunelveli and Kanyakumari Districts of Tamil Nadu, the mussel fishery of south and central Kerala coast, and the clam fishery of the South Kanara and south Maharashtra coast which could further be developed by intensive and organised exploitation.

As indicated in Fig.1, certain regions of the coastal waters are more productive compared to other regions. Highly productive areas, yielding an average annual catch of 50 000 to 1,00,000 tonnes have been found off the coasts of Kerala, Maharashtra and Gujarat. Banerji (1973) indicated that most of the pelagic stocks are being exploited efficiently. However, since the same generalised gear are used for the capture of various species, their influence on different stocks has to be monitored while attempts are made to increase the catch. From studies conducted so far on the coastal stocks,

it is clear that only a fraction of the pelagic stock may be entering the inshore waters, the fraction probably being small. The entry of the stocks into coastal waters is also subjected to biological and physical influences. Though the magnitude of the abundance of each pelagic stock outside the presently intensively exploited region is not known, real increase in the yield is expected to come from outside the present area of fishing. In this context it may be mentioned that, based on observations on primary production in the coastal waters, an estimated annual yield of 3 to 4 million tonnes of fish has been derived for the seas around India, which is about three times the present yield (Anon., 1977). Recent catch trends (Fig.2) indicate that promising fisheries may be those of elasmobranchs, anchovies, cat fishes, silver-bellies, ribbon fishes and perches. Some of these resources and others like the horse mackerels, pomfrets, seer fishes, tunas and related fishes, barracudas, needle fishes, half beaks and molluscs are under exploited and hence constitute potential resources.

For a balanced development of the marine fishing industry and for rational exploitation of the coastal fisheries resources, there is urgent need for diversification of fishing in coastal waters to release pressure on shrimp trawling. It has already been suggested that the existing small mechanised vessels could profitably be utilised for fishing by employing pelagic and midwater trawls and purseseines with suitable modifications, where necessary. A 'small vessel' fishery can thus be developed for fully exploiting the under exploited resources as well as some of the potential and non-conventional resource. One way of bringing in development in this direction is to impose a quota system for shrimp trawling by mechanised boats. This would serve the dual purpose of conserving the shrimp stocks and diversification of fishing in coastal waters.

Future development in the coastal fisheries should take note of the impact of generalised fishing gears on individual fisheries since the same gears account for the capture of more than one species, some of the species being already fished to the optimum level. Hence, a continuous monitoring of coastal stocks is stressed. Another important aspect is the impact of modern developments including mechanisation, on

the indigenous gear and the resultant increase or decrease of catch from the coastal waters. The question, whether the coastal resources which were hitherto very efficiently exploited by indigenous gears (e. g. drift net fishing for several pelagic fishes) should continue to be exploited to the same degree or not should also be examined in detail to ensure that the resources are not left unexploited. While a watch on the exploited resources of the inshore region is necessary, attempts at diversification of fishing in coastal waters to exploit the underexploited and non-conventional resource should be intensified for achieving a rational exploitation of the resources of the inshore areas and for maintaining a balance between the mechanised and non-mechanised fishing.

In conclusion, an optimistic note may be sounded for stepping up fish production from coastal waters in view of the development of modern fishing harbours and the provision of infrastructural facilities for handling, storage, transportation and marketing of fish and fish products at all the major fish landing centres along both the coasts of the country. Mechanisation and modernization of the marine fishing industry should not be at the expense of obliterating the traditional fisheries, some signs of which are evident in some parts of the coast (south-east coast, Karnataka coast etc). Modern developments should, however, go hand in hand with the encouragement that is due to the small scale fishermen for the improvement of their capability in harvesting the coastal resources. With all the modern developments taking place, the small scale fishermen and their traditional methods still remain the backbone of the marine fishing industry of the country.

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TABLE 1
Average annual marine fish catch composition (in tonnes)
for the periods 1961 to 1965 and 1966 to 1976

Name of the species/group	1961-65	1966-76
Elasmobranchs	36,851	45,209
Clupeiform fishes:		
a) Oil sardine	175,605	191,879
b) Other sardines	29,931	69,008
c) <i>Hilsa hilsa</i>	2,096	2,628
d) Other <i>Hilsa</i>	7,278	9,046
e) <i>Anchoviella</i>	23,904	27,068
f) <i>Thrissocles</i>	5,594	11,235
g) <i>Chirocentrus</i>	7,641	9,862
h) Other clupeid fishes	15,463	33,271
Bombay-duck and <i>Saurida</i> :		
a) <i>Harpodon nehereus</i>	84,977	75,515
b) <i>Saurida</i> and <i>Saurus</i>	983	5,130
Cat fishes	17,893	43,660
Eels	6,727	4,435
<i>Balone</i> and <i>Hemirhamphus</i>	1,360	1,617
Flying fish	1,536	3,589
Perches	10,808	17,922
Red mullets	2,369	3,842
Polynemids	3,403	7,592
Sciaenids	26,759	86,626
Ribbon-fishes	24,873	43,722
Carangids:		
a) <i>Caranx</i>	18,403	22,119
b) <i>Chorinemus</i>	3,154	2,972
c) <i>Trachynotus</i>	34	71
d) Other carangids	147	355
e) <i>Coryphaena</i>	299	248
f) <i>Elacate</i>	—	308
Silver-bellies:		
a) <i>Leiognathus</i>	21,413	41,749
b) <i>Gazza</i>	110	229
<i>Lactarius</i>	7,539	8,051
Pomfrets	19,379	23,856
Mackerel	41,505	19,179
Seerfish	10,420	16,044
Tunnies	4,651	6,974
Barracudas and grey mullets:		
(a) <i>Sphyræna</i>	1,471	2,488
b) <i>Mugil</i>	1,515	2,915
<i>Bregmaceros</i>	4,338	2,528
Soles	10,027	11,524
Crustaceans		
a) Penaeid prawns	45,976	91,306
b) Non-penaeid prawns	34,422	54,888
c) Other crustaceans	2,417	10,824
Cephalopods	236	2,850
Miscellaneous fishes	21,358	49,203

TABLE 2

Average annual landings of the important species or groups of fishes and crustaceans in various states during the period 1962 to 1974 ('000 tonnes)

Species / group	Gujarat	Maha- rashtra	Karnataka	Kerala	W. Bengal & Orissa	Andhra Pradesh	Tamil Nadu
1. Elasmobranchs	5.92	4.84	1.85	6.99	0.59	6.51	13.36
2. Eels	0.70	3.17	—	—	—	—	—
3. Cat fishes	3.74	7.01	2.38	9.85	0.40	5.15	5.57
4. <i>Chirocentrus</i>	—	—	—	0.49	0.58	1.77	3.82
5. Oil sardine	—	—	29.97	161.66	—	—	—
6. Other sardines	—	—	—	15.29	2.12	14.08	15.77
7. <i>Hilsa</i>	—	—	—	—	—	—	2.80
8. Other clupeids	4.46	8.38	0.64	1.57	2.18	4.52	2.97
9. <i>Harporodon & Saurida</i>	45.45	27.95	—	—	0.97	0.77	—
10. <i>Hemiramphus & Belone</i>	—	—	—	—	—	—	1.12
11. Flying fishes	—	—	—	—	—	—	3.07
12. Perches	—	1.96	0.17	4.00	—	1.37	5.62
13. Polynemids	1.22	1.43	—	—	—	—	1.10
14. Sciaenids	7.20	10.48	1.82	4.85	1.42	5.11	7.58
15. Ribbon fishes	1.11	6.47	—	10.69	0.79	6.09	9.37
16. Carangids	0.70	—	0.87	7.46	—	3.04	9.35
17. <i>Leiognathus & Gazza</i>	—	—	—	10.82	0.72	3.13	18.68
18. <i>Lactarius</i>	—	—	—	2.56	—	1.22	2.31
19. Pomfrets	6.30	7.54	—	1.94	0.50	3.09	1.52
20. Mackerel	—	4.89	21.97	27.07	0.27	20.0	4.13
21. Seer fish	—	1.45	0.97	2.03	0.46	3.48	3.85
22. Tunnies	—	—	—	21.6	—	0.48	0.96
23. <i>Sphyraena</i>	—	—	—	—	—	—	1.00
24. <i>Bregmaceros</i>	—	3.39	—	—	—	—	—
25. Soles	—	—	0.73	8.40	—	—	0.81
26. Prawns	4.13	57.41	4.58	36.19	3.77	6.32	5.19
27. Other crustaceans	0.09	0.70	0.39	0.58	0.01	0.45	4.71
28. Miscellaneous	12.46	15.76	11.88	24.49	4.38	14.91	22.21