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Fig. 1. A trawl ready to unload its catch

OCEAN HARVEST

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BEFORE 1947, fisheries research and development in India were considered the main responsibility of the then provinces and states. The Government of India had no direct interest in fisheries. The state departments of fisheries were mainly concerned in collecting revenue and very little effort was made to develop an understanding of the living marine resources. Most of the earlier studies were of a faunistic nature, and these were carried out by the Zoological Survey of India. Of the then existing maritime states, Madras and Bombay were the only states where some fundamental work related to regional fisheries was done. During the Second World War, the lack of good quality fish, especially for the British and American military personnel, led the Government of India to formulate a policy of research, development and conservation of fishery resources similar to those of agriculture, forestry and veterinary.

The Central Marine Fisheries Research Institute was started in February 1947, the year of Independence.

One of the important achievements in marine fisheries has been the development of a statistical system to assess the marine fish production of the country. Before the CMFRI was established, we had no reliable mechanism of estimating the fish production of the country. In 1947 the fish production was roughly estimated at 4 lakh tonnes. The assessment of fish production is made not only in terms of total quantity, but also in the species composition, age and size groups entering the fishery, seasonal abundance and the total effort involved in relation to landings, including catch per unit effort. Some relevant information of a general nature pertaining to fishery industry of India is as follows.

Fish production along west coast	= 76% of the total
Fish production east coast	= 24% of the total
Number of marine fishing villages	= about 1,800
Number of fish landing centres	= about 3,200
Total fishermen population	= over 1 million
Number of active fishermen	= about 250,000
Number of fishing craft	= about 100,000
Number of mechanised boats	= about 10,000
Total revenue to the country from marine fishery in 1971	= about Rs. 1200 million (120 crores)
Total foreign exchange earnings from fishery products 1971	= about Rs. 400 million (40 crores)

During 1970 the marine fish production in the country for the first time crossed one million tonnes and was estimated at 1,085,607 tonnes, and in 1971 it was approximately 1.2 million tonnes. The following Table (on page 105) gives the state-wise marine fish production in tonnes during the last three years.

Fig. 5a gives the composition of important fisheries in the total catch. Fig. 5b indicates the contributions of maritime states in the sea harvest. The total landings for the country during the past 22 years have been shown in Fig. 6. From 1950 to 1964 the total yield was of a fluctuating nature, but during 1964 and 1965 the catches became somewhat

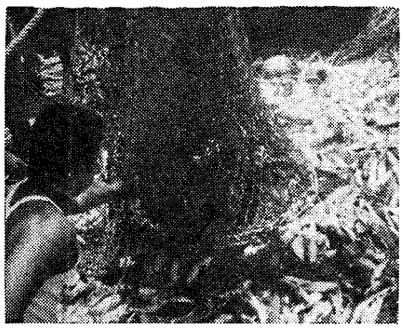


Fig. 2. Harvested fish on the deck of a fishing vessel

State	Years		
	1969	1970	1971
West Bengal & Orissa	22,879	31,403	27,255
Andhra Pradesh	77,526	74,459	83,289
Tamil Nadu	151,876	155,516	160,214
Pondicherry	10,637	10,624	10,453
Kerala	294,787	392,880	445,605
Mysore	75,793	116,936	103,978
Goa	27,559	20,736	21,000
Maharashtra	168,720	192,361	216,340
Gujarat	82,248	89,027	84,941
Andaman	412	500	569
Laccadives	1,193	1,165	1,200
Total	913,630	1,085,607	1,154,844

stable and recorded a sharp increase from 1966 onwards (Fig. 6).

The marine resources of the country can broadly be divided into two main groups: (1) pelagic and (2) demersal.

Pelagic Resources

Pelagic resources are those which are found within the water column both in the regions of the continental shelf and in the open ocean. These collectively constitute the largest harvest, about 63% of the total, and include sardines, mackerel, Bombay duck, tunas, billfishes, oceanic squids, etc. Of these, the two major fisheries, oil sardine and mackerel, form about 32% of the total annual catch.

Oil Sardine. The species which constitute the fishery is *Sardinella longiceps* and is known as *Chala* or *Mathi* in Malayalam and *Tarali* in Marathi. The region for maximum abundance of this species is from Ratnagiri in the north to Quilon in the south. It constitutes, nearly 24% of the total marine fish landings (average of recent years=2.5 lakh tonnes). Since ancient times this fishery is being exploited by the indigenous craft and gear. The gear employed is large boat seine operated within the 50 metre depth zone. The fishery on the west coast generally commences in August and continues till about April. In addition to the considerable importance of the oil sardine as food, its oil has several uses in jute, leather and soap industries. The fertilizer "guano" from this fish is used in coconut, coffee, tea and other plantations. Fig. 7 shows the landings of oil sardine for the past 22 years. From 1950 to 1963, the fishery has been of a fluctuating nature recording the worst setbacks in 1956 and 1963. It achieved a phenomenal revival from 1964 onwards.

For the first time in India attempts have been made to tag the oil sardine and release them into the sea for studying their growth, migration and mortality. In order to make this venture a success, wide publicity is being given through handbills and posters in different languages soliciting cooperation of the fishermen and the general public to return the tagged fish to any of the Units, Substations and Centres of the Central Marine Fisheries Research Institute.

Indian Mackerel. The mackerel fishery comprises a single species *Rastrelliger kanagurta* which is known

Fig. 3. Sorting of harvested fish on board a fishing vessel

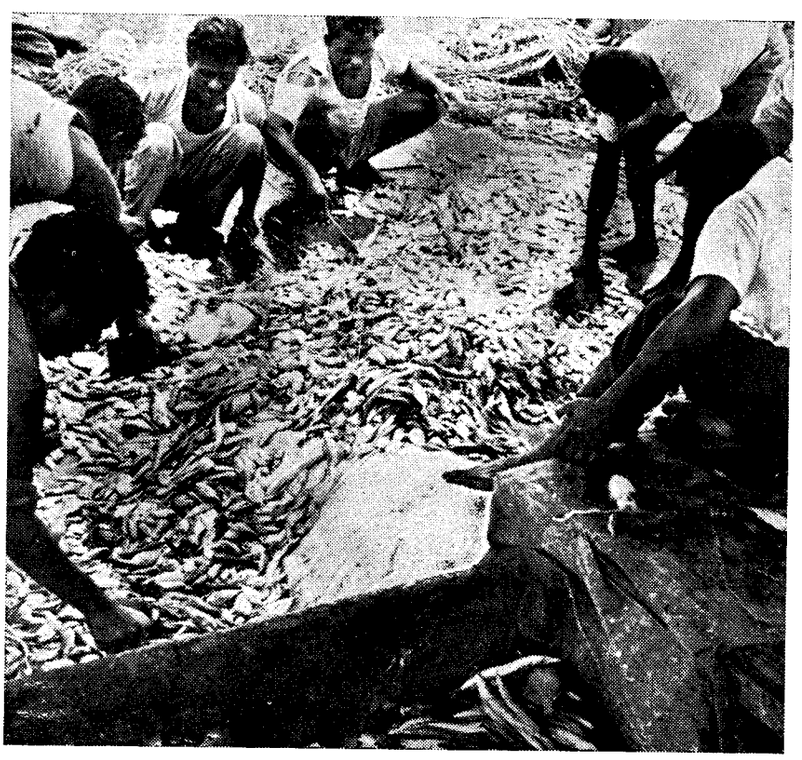


Fig . 4 Sorted fish kept in crushed ice in the hold of a fishing vessel

as *Aila* in Malayalam and *Bangara* in Marathi. This species is mostly caught along the west coast and contributes as much as 7% of the total marine fish catch. The main region for its fishery is from Ratnagiri to Cape Comorin, although the area where maximum fishery occurs is between Ratnagiri and Quilon. The fishery for mackerel is also on the east coast near Madras, Kakinada, Vishakhapatnam and in some areas off Orissa. The most common gear used for mackerel along the west coast is the shore seine called *Rampani*. It consists of 400-600 pieces of net made of hemp or cotton yarn, joined together and operated by 80 persons with the help of several boats. Total landings of mackerel from 1950 to 1971 have been shown in Fig. 8. The mackerel fishery has been of a highly fluctuating nature. In 1971 it reached an all time record of approximately 1.9 lakh tonnes. The fishing season lasts from August to March and the heaviest landings occur along the Mysore-Kerala coast. The tagging programme for this species also has been initiated on the west coast at the various Sub-stations and Units of the Central Marine Fisheries Research Institute in order

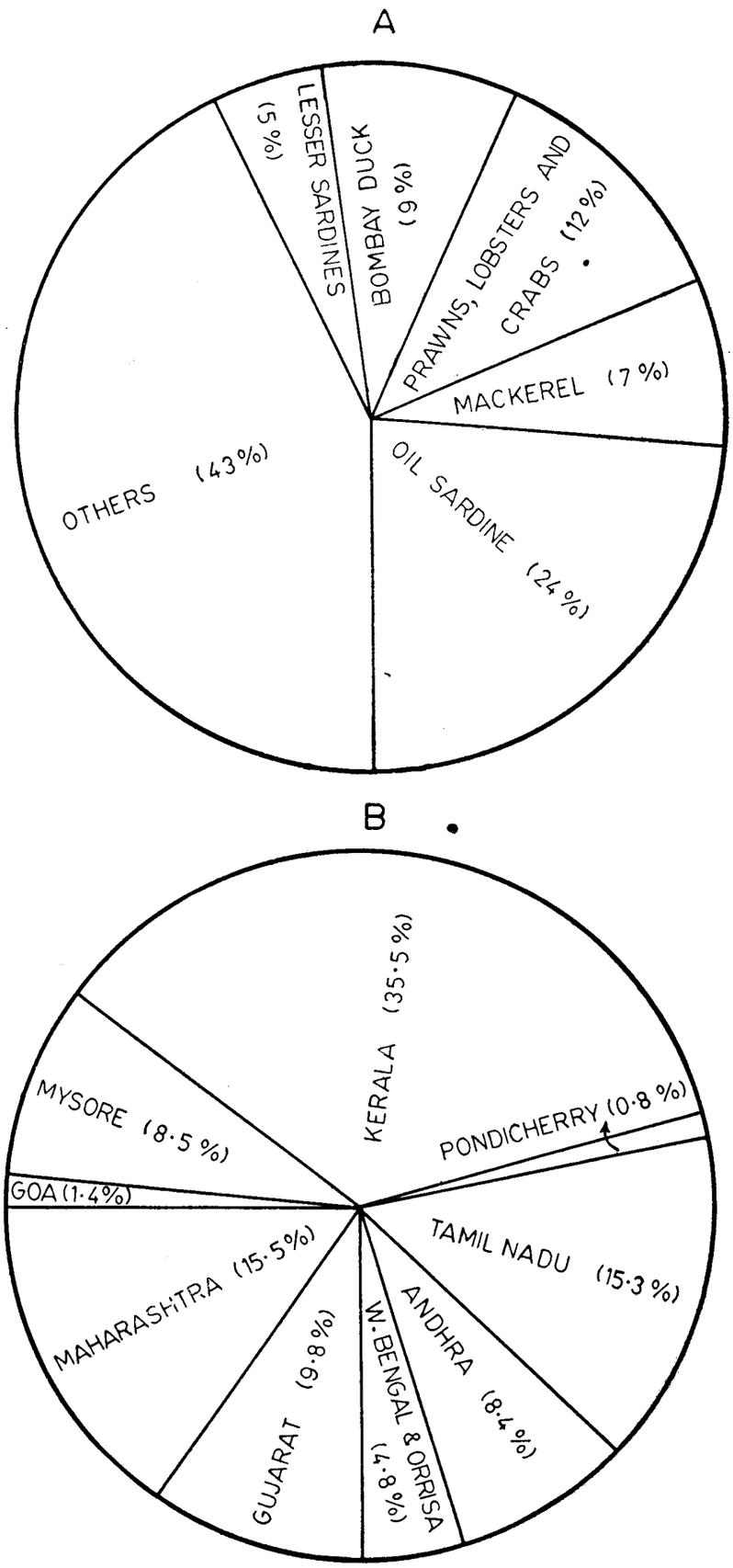


Fig. 5 A Percentage composition of six major fisheries of India
B Percentage contribution of nine maritime states of India in the total fish landings. The value in both the figures are the averages of ten years.

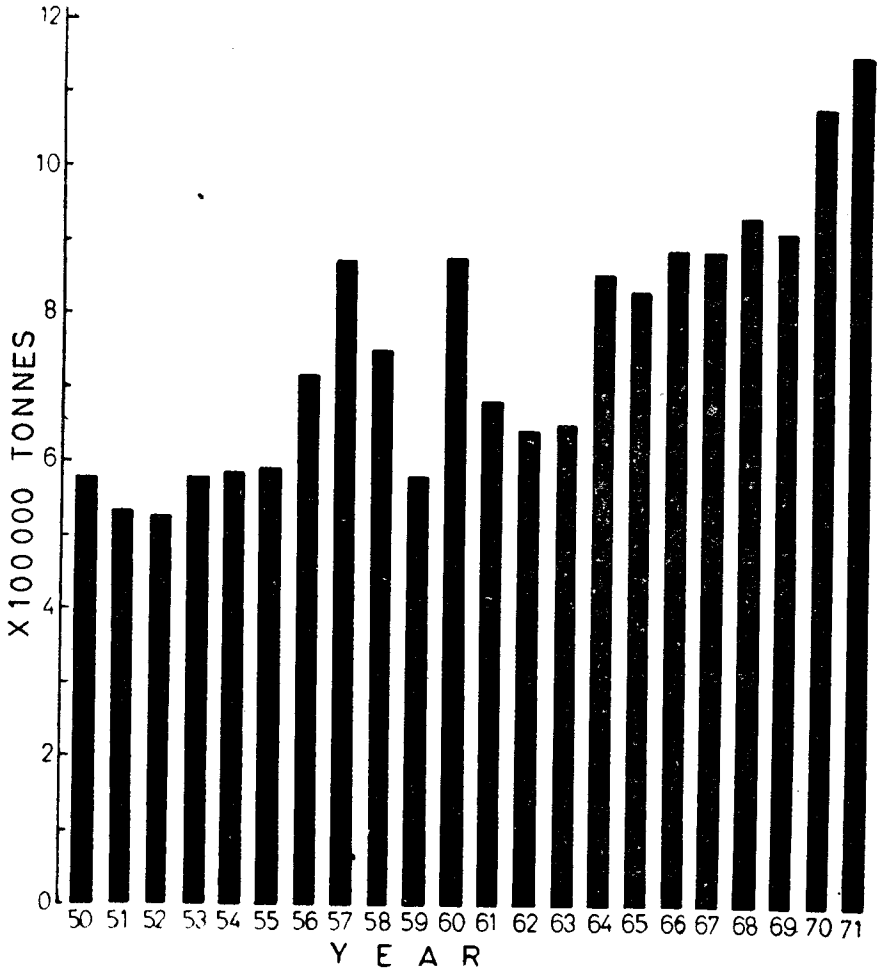


Fig. 6 Total landings of marine fish in India during the past 22 years. (1950 to 1971)

to study its rate of growth, migration and mortality.

Bombay-Duck. The Bombay-duck fishery is supported by a single species, *Harpodon nehereus,* popularly known as *Bombil* in Maharashtra. The main regions for its fishery are Gujarat and Maharashtra coasts on the west and along the Andhra and Orissa coasts on the east. On the west coast, the fishing is mainly done by the bag nets locally known as "Dol", but on the east coast it is caught by the boat seine. The fishing season lasts from September to April. The total landings are of the order of 1 lakh tonnes which constitute about 9% of the total marine fish landings. The landings of this fish for a period of 22 years have been shown in Fig. 9. The fish is consumed both in fresh and dried state.

Tunas. At present there is no organised fishery for tunas except for the traditional pole and line fishery for the skipjack in Minicoy and in some of the islands of Laccadives (Kavarathi and Agathi). During the last 5 years small mechanised boats have been constructed for pole and line fishing in the Laccadives and at present about 30 such boats are in operation in addition to the indigenous tuna fishing boats at Minicoy.

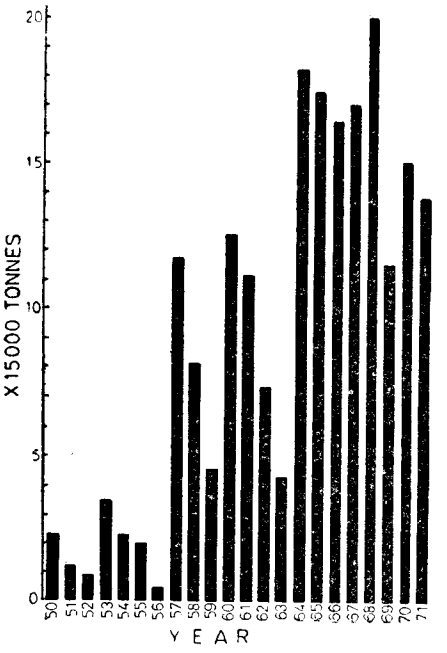
The Central Marine Fisheries Research Institute has already drawn attention to the need for developing tuna fishery in the country, particularly as an additional source for earning foreign exchange. The extensive fishing operations carried out by the Japanese in the Indian Ocean using long line have proved that this method gives very fruitful results. The same method of fishing has been adopted by several other countries such as Taiwan, South Korea and Singapore. At present the annual yield of tuna from the Indian Ocean is about 175 thousand tonnes. The bulk of this is landed by the Japanese tuna long line vessels. The total tuna catch by the Indian vessels is only about 5 thousand tonnes per year.

Demersal Resources

Demersal resources are those which are found at or near the bottom of the sea. The exploitation of these resources using power driven vessels and highly mechanised gears such as trawl has started only within the last two decades. Different organisations at present are engaged in large scale exploratory and commercial fishing operations from different bases. The important species harvested are: Dara *(Zolydactylus indicus);* Koth *(Otolithoides brunneus);* Ghol *(Pseudosciaena diacanthus);* Wam (eels); Karkara *(Pomadasys hasta);* Shende *(Polynemus heptadactylus);* carangids, silver bellies and prawns.

Prawns. One of the most important demersal resources harvested

Fig. 7. Landings of oil sardines during the past 22 years (1950 to 1971)



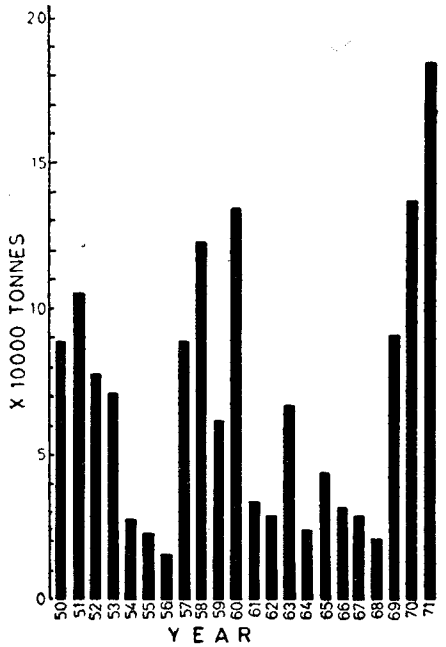
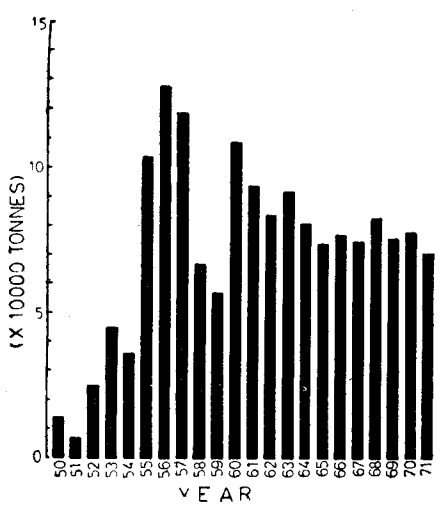


Fig.8. Landings of mackerel in India during the past 22 years

in India is prawn. The expansion of export trade of frozen and canned prawns has given a very great impetus to mechanised fishing for prawns. The average annual marine prawn landings in the country is more than 1 lakh tonnes which is about 12% (including lobsters) of the total annual fish catch. Marine prawns belong to two major groups viz., penaeid and non-penaeid. Penaeid prawns are relatively large sized and form an important commodity for export to countries such as the United States and Japan (see Fig. 10). The other important item for export is the deep-sea lobster, *Puerulus sewelli* (see Fig. 11). The fishing season generally starts from October and ends in May. In recent years the processing of prawns by freezing and canning has improved considerably and most of the Indian seafood products have strict quality control and are well accepted in the world market. Fig. 12 gives the total landings of prawns from 1958 to 1971. Unlike the fisheries of oil sardine and mackerel, the prawn fishery has been of a stable nature and from 1965 onwards it recorded a steady rise. The total prawn production in the world is about 7 lakh tonnes, of which India's contribution is about 1.4 lakh tonnes. This places India as the largest prawn producing country in the world. Fig. 13 gives the export of total marine products (prawns, lobsters, etc.) to different countries and their values in Indian rupees. The B part of Fig. 13 gives the export of prawns alone. From 1962 onwards our export has been constantly on the increase, and the value of the Indian seafood in the world market has also been rising steadily.

Fig. 9. Landings of Bombay duck during the past 22 years



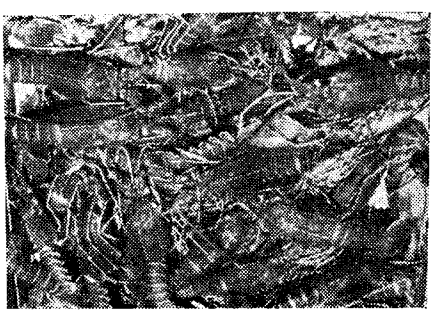
Molluscs. Molluscan species such as clams, oysters, mussels and squids are utilized as food in different-parts of India. A survey of resources, methods of their exploitation and the possibilities of their culture by employing suitable techniques are being undertaken at present in great detail. Extensive underwater surveys of pearl and chank beds off Tuticorin have been made by the scientific staff of the Central Marine Fisheries Research Institute using aqualung and regular charting of molluscan resources is being carried out. The fishing season varies from region to region. Fishing by skin-diving is the method practised along the south-east coast of India. The introduction of modern diving equipment has given a great impetus to our knowledge of the molluscan resources (see Fig. 14).

Fig.10 . Harvested prawns from the sea form an important item of export

Harvest of Vegetable Food From Sea

In many countries, marine algae, which are popularly known as "seaweeds", are utilized as human food (see Fig. 15). In Japan, some twenty different kinds of algae are being consumed. In Philippines and Hawaii also several species of algae are regularly eaten. There are several species of seaweeds which contain gelatin. This product is used for the preparation of jelly and jam. Dried seaweeds (known as China grass) are regularly used in domestic cookery for making sauces, soups, puddings, etc. The active ingredient in such seaweeds, which thickens the fluid, is agar. Algin or sodium alginate, which is a product of the algae, is also used as a gelling substance. In addition to these products, some of the seaweeds

Fig.11. Deep-sea lobster is a luxury food item and is largely exported



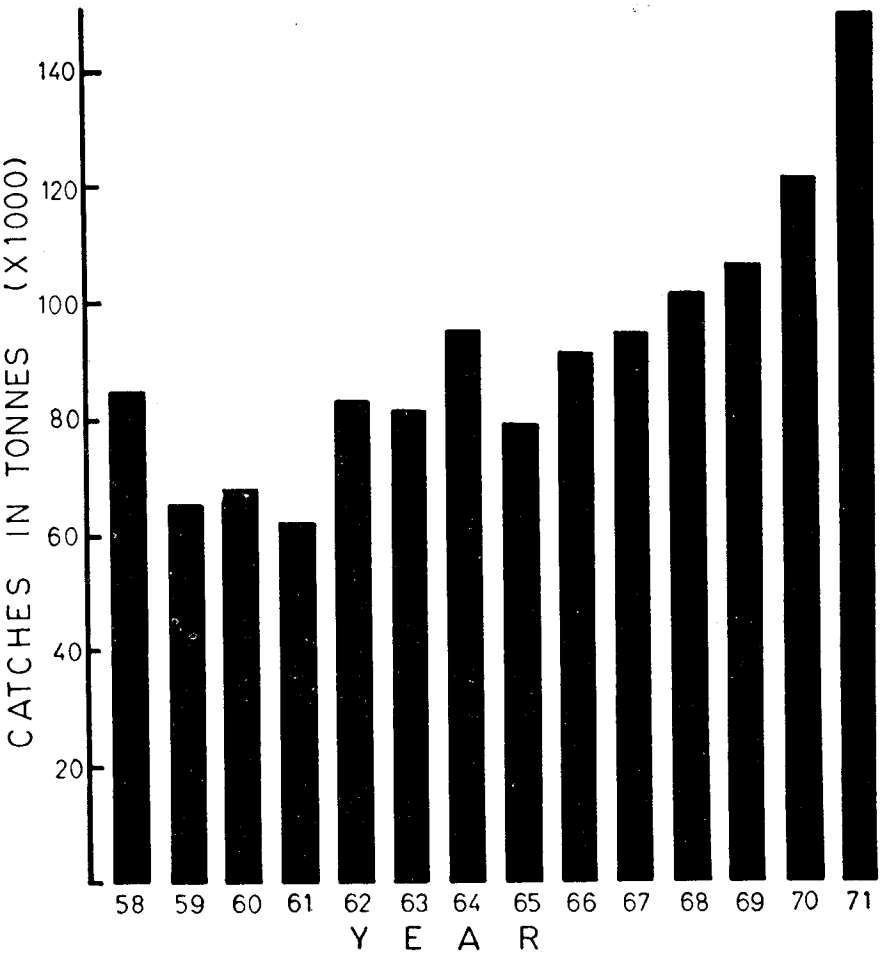


Fig. 12. Landings of Prawns during the last 14 years (1958 to 1971)

serve as a source of mineral such as iodine, manganese and iron. Several of these are being cultivated on ropes in sheltered areas of the sea. A few years ago India used to export seaweeds and the products from seaweeds such as agar and alginates used to be imported. Nowadays, the country has become almost self-sufficient in the seaweed products. Several factories are producing agar, gelatin and alginates and the demand of seaweeds is becoming greater every day. The seaweeds are no longer going out of the country.

Besides the larger algae, a tiny, invisible, unicellular alga, called *Chlorella*, has also been used as human food. This organism is so small that about 40 million cells can live in a tumbler full of water. It has an incredibly fast growth rate, and has the capacity to grow in any type of water. It has a fantastic yield of about 40 tonnes a year in an acre of water. By fertilizing the water with nutrient salts such as nitrate and phosphate, it can easily be cultured on a large scale.

Sea Farming

Freshwater fish farming has been in practice, in many parts of India, since ancient times. Ponds and lakes are easily manageable, as compared to estuaries and bays. It is, therefore, not surprising that true animal husbandry with sea animals has hardly been attempted until recently, and from the world-wide interest that the sea-farming has received in recent years, it appears that very soon the sea will be cultivated on a large scale. The animals which are now being cultured are shrimps, lobsters, oysters and clams. The yields of all these animals in culture are incredibly high. The regions which are well-suited for farming are the sheltered areas such as backwaters, estuaries, low-lying fields, swamps, lagoons, etc.

India has very large natural water resources, amounting to approximately 8 lakh hectares, suitable for aquaculture. In Kerala alone about 16,000 hectares of backwaters are available. How best these resources could be utilized, has been engaging the attention of scientific bodies. At the Central Marine Fisheries Research Institute, Cochin for instance, we have been conducting experiments on the rearing of young prawns for the last few years and have succeeded in culturing certain species of prawn in the laboratory. We are now going to make field trials, and very soon, the technical know-how will be available for farming prawns.

The Future

Today the world's seafood production is approximately 60 million tonnes, and from the Indian Ocean as a whole the catch is about 2.5 million tonnes; about half of it (1.2 million tonnes) is contributed by India. In the past the growth of the conventional fisheries in the world has been at the rate of about 10% every year. We hope that in future their growth will be much faster. In India the increase in fish production in recent years has been of the order of 15-20%. Nearly 60% of the population in developing countries, which comprises nearly two-thirds of the world's population, suffers from undernutrition, malnutrition or both. To meet the increasing demand for protein food, ocean harvest plays a major role and in future years, as the marine food production is expected to increase substantially, it is hoped that its cost to the consumer will possibly be reduced. Sea farming on a large scale will perhaps contribute a great

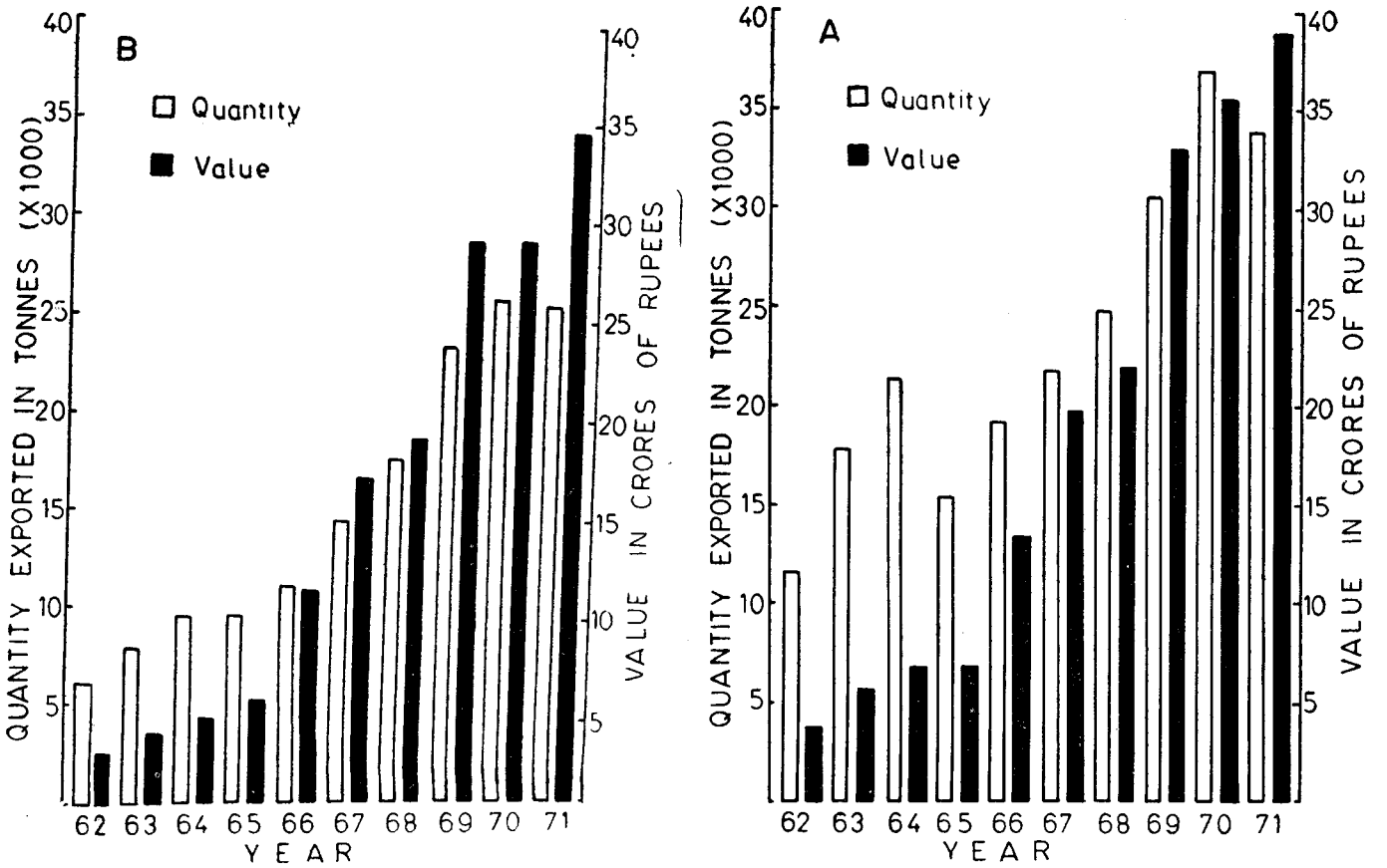


Fig. 13. Export figures of sea food from India from 1962 to 1971.
A. Total quantities of all sea food with value.
B. Total quantities of prawns and their value. Export of sea food started only in 1962.

deal to the lowering of the cost of seafoods.

A few years ago, the United Nation's technical agencies, such as the UNESCO and FAO had fostered far-reaching international co-operation for finding and exploiting marine resources. The International Indian Ocean Expedition (IIOE) was one of them, which gathered hundreds of scientists, from 25 nations, on a common platform and put 40 research vessels into sustained operation for 5 years. The IIOE thus became the first multi-national attempt to explore the sea—a unique example of international co-operation in science. India had its own programme during the IIOE. The programme started in 1962 and

Fig. 14. A scientist from CMFRI doing SCUBA diving. Underwater survey of sea beds forms a part of the Institute's programme.

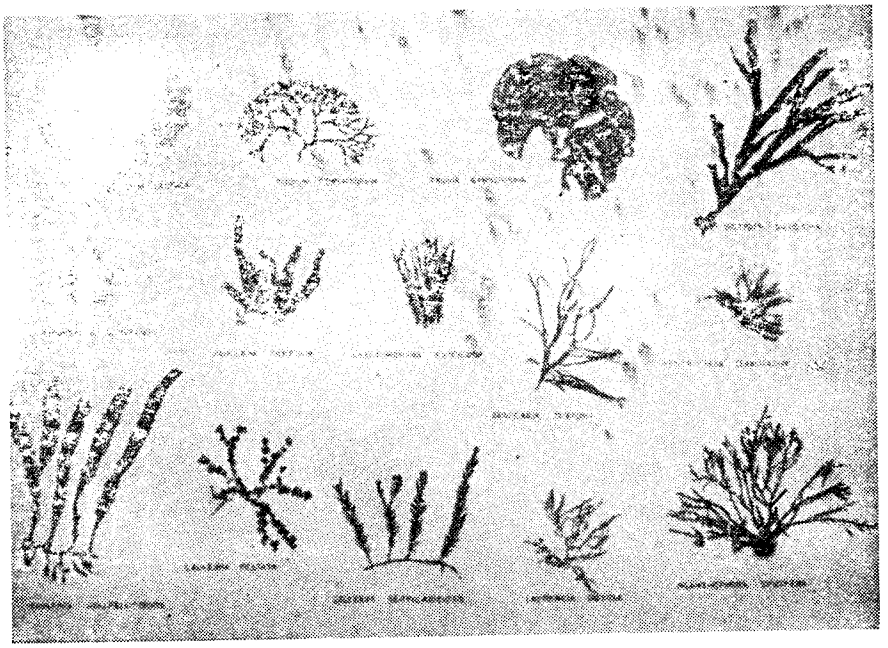


Fig. 15. Different varieties of edible seaweeds along the shores of India. A survey of seaweed resources for food and industrial purposes is being undertaken by the Institute

ended in 1965. The active participation of India in the expedition was of great value to the oceanographic and fishery researches in the country. India played host to scientists from many nations and many participating foreign ships provided facilities of shipboard and research to many Indian scientists.

We hope that in future years the ocean harvest, aided and enlarged by modern technological advances, will not only increase substantially, giving a boost to our export many times greater, but would also be able to provide this high quality protein food to the neighbouring undernourished nations also. India, being the leading nation among the countries bordering the Indian Ocean, must continue to pay as much attention towards the sea harvest, as it rightly deserves.