FISHERY RESOURCES OF THE INDIAN ECONOMIC ZONE

By

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1. INTRODUCTION

The present marine fish production in India is about 1.5 million tonnes of which the lion's share is from the nearshore waters, within less than 50 m depth and probably from an area of about 100,000 sq km which is only 25% of the area of the continental shelf and 5% that of the economic zone. The programme of offshore and deep sea fishing has gathered momentum now with the Government's decision on permitting import of a significant number of vessels. Being highly capital-intensive, the entrepreneurs desire to have full information on the resources and economics of operation before venturing into such programmes, on their own. India, like many other maritime developing countries, has only limited capabilities to survey or exploit all the fishing grounds and hence information on all aspects of fishery resources is either not available or found inadequate. However, research and survey efforts of our Research Institutions and Exploratory Organisations have made it possible to arrive at some estimates of potential

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resources and achieve certain amount of mapping and charting of fishing grounds. These efforts, however, require significant step-up to assist the fishing industry for exploiting the resources beyond the present fishing grounds.

It has been observed that all the 200 mile Exclusive Economic Zone would constitute 40% of the world oceans and that 90% of the traditional fishing grounds and 70-80% of the global catch would be confined to this zone. With the declaration of Indian Economic Zone early this year, India has assumed not only exclusive jurisdiction but also a great responsibility for the optimum exploitation of her living and non-living resources from about 2 million sq km area. An attempt is made in this paper to give a brief review on the present status of the exploited fishery resources in the Indian Ocean and along the Indian coast; to quantify the potential of the Indian Economic Zone region-wise and variety-wise, as a first approximation ever made to indicate the possibilities of further exploitation of the resources in the various regions of our waters. It is hoped that this would answer some of the major queries raised by the fishing industry on the prospects of intensified exploitation of our marine living resources. While all efforts have been made to take advantage of every available information. it is possible that there may be some inadvertent omissions. Again, although a large number of publications have been consulted, only the most relevant ones are cited in the text. The observations made in this account are purely in the individual capacities of the authors, not necessarily reflectirg the views of the Government of India.

2. FISHERIES OF THE INDIAN OCEAN

During the recent. years (1971–75) the total world fish production from both inland and marine waters ranged from 66.2 to 70.9 million t* with an average of 68.9 million t. Out of this, the marine fish production ranged from 56.9 to 60.7 million t with an average of 58.6 million t. The FAO (Gulland, 1971) have estimated the potential yield of the conventional marine varieties (excluding molluscs) as 107 million t as against the present day catch of about 51 million t. A large portion of the increase is credited to the Indian Ocean which is expected to increase its demersal resources yield by about five times, from the present 1.5 to, 7.4 million t, nearly 30% of the world's increase. Regarding the pelagic resources, the increase is expected to be a little less than four times from the present level of 1.6 to 6 million t, the contribution of Indian Ocean in the overall gap of 34 million t being about 13%. However, there seems to be some re-thinking at present that the Indian Ocean's contribution would be much less than the projected one.

As per the latest figures, India ranks eighth in the global marine fish production; the top seven countries

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* The abbreviation 't' is used for tonnes.

being Japan, USSR, Peru. USA, Norway, China and Spain.

2.1 **Present Status of exploitation**

The break-up of catches for the major groups of fish resources of the Indian Ocean (Antartic region excluded) for the years 1971 to 1975 together with the averages are shown in Table I. (FAO Year Book on Fishery Statistics relating to 1975; the unclassified marine fishes were apportioned on pro-rata basis and added to the pelagic or demersal groups of fishes.)

It is seen that, during the recent years, the Indian Ocean's catch has ranged from 2.55 to to 3.17 million t. maximum production with in 1974. Out of average catch of 2.87 million t, western part of the Indian Ocean contributed 68% and the east 32. Taking the surface area of the ocean, it is found that, on the basis of 1975 catch, the average catch per sq km is 63 kg on the west, 35 kg on the east and 50 kg for the entire Indian Ocean. As compared to these rates, the yield from the Atlantic Ocean is 235 kg and from the Pacific, 170 kg. Based on the shelf area, the yield from the three Oceans are 1.1, 3.0 and 3.6 t respectively.

It may be seen from Table I that on an average. the pelagic fishes form the largest component with 53%, while the share of the demersal fishes is 35%, the crustaceans 10% and others 2%.

The individual importance of the various species caught in the Indian Ocean is mainly due to the substantial contribution made by the Indian coast. Thus, on the western region, two-thirds of oil sardine come from India; of the rest, the bulk is produced by Democratic Yemen and the balance by Pakistan. Ninety per cent of the mackerel catch comes from India, the rest being taken by Yemen Arab Republic and the USSR. The Bombay duck and ribbon fishes are almost exclusively from India. Two-thirds of the cat fishes are obtained from the Indian coast, the remainder being the contribution by Pakistan and the USSR. The anchovies catch is predominantly from India. Of the croakers, 80% is from India and a major portion of the balance by Pakistan. Similarly, 90% of the pomfret catch comes from India and the balance from Pakistan. Nearly 80% of prawns and shrimps is landed by India, while the other important producers are Pakistan and Saudi Arabia.

On the eastern sector of the Indian Ocean, the silver bellies and ribbon fishes are almost exclusively produced by India. About 90% of croakers and cat fishes are also obtained from the Indian coast. The mackerel catches are shared between India and Indonesia. About two-thirds of thc catch of prawns shrimps are from the Indian waters and the rest, mostly from Indonesia and Australia.

With regard to tunas, cuttle fishes and squids which are of oceanic character, India's contribution is negligible, In the western region, the major portion of the catch of yellow-fin and big eye tuna is taken by Japan and the Republic of Korea, that of skipjack by Maldives and Sri Lanka and that of southern bluefin by Japan. On the eastern side, the yellowfin and big eye tuna are mainly taken by Japan. and Australia. The main countries exploiting the cuttle fishes and squids on the western sector are Japan, Democratic Yemen and the U S S R. and on the eastern sector Australia and Indonesia.

The annual average catches (1971-75) of some of the important countries which exploit the Indian Ocean fishery resources are illustrated in Fig 1. In this figure, the catches of the Gulf countries (Iran, Iraq, Kuwait, Bahrain, Qatar, Oman, Saudi Arabia and United Arab Emirates) are pooled together. The share of important countries other than those bordering the Indian ocean is also indicated. India makes bulk of the contribution on the western sector of the Indian ocean, nearly 50%, followed by the Gulf countries, Pakistan, Sri Lanka, Democratic Yemen and Somalia. On the eastern side, Burma takes a slightly larger catch than India, followed by Bangladesh, Australia, Thailand and Indonesia. From the total Indian ocean catch, India with its share of 44% is followed by Burma, Gulf countries, Pakistan, Democratic Yemen, Sri Lanka, Bangladesh, Australia, Thailand, Somalia and Indonesia. The catches of the three important Countries outside Indian Ocean area *viz.* Japan, the Republic of Korea and the USSR amount to about 210,000 t, forming 7.3% of the entire Indian ocean catch besides 1.5% by other foreign fleet.

2.2 **Potential yield**

Various projections of potential yield of Indian ocean have been made in the past. The FAO (Gulland, 1971) have estimated the potential yield as 14.3 million t, distributed as 7.4 million t of demersal fish, 6.0 million t of shoaling pelagic fishes, 0.7 million t of large pelagic fishes of tuna and allied fishes, 0.25 million t of crustaceans and several hundreds of thousand t of squids. (Fig. 1) Based on the assumption that the catch rates of the three areas *viz.* Pacific, Atlantic and Indian Ocean should be roughly comparable, Marr *at el.* (1971) indicated that the minimum potential yield for the entire Indian Ocean is 14.4 million t and for the shelf region 9.6 million t and a maximum of 28.8 million t and 19.2 million t respectively. Based on organic productivity and current level of exploition, the estimates of Prasad *et al.* (1970) is 11.0 million t. Jones and Banerji (1973) estimated the potential yield for the Central Indian Ocean as 4.1 million t; extrapolated for the entire region, the yield would then be 10.3 million t, close to the estimates of Prasad *et al.* (1970). Besides these, Cushing (1971) estimated the annual tertiary production from the upwelling areas in the Indian Ocean as 9.3 million t. Taking 50% of this, the harvestable yield would be about 4.8 million t for the upwelling areas alone, and if we add twice this amount as a possible yield from the remainder, 95% of the area, the total yield may be roughly 14 million t. Thus, in general, the potential yield of the Indian ocean appears to be between 10 and 14 million t.

3. FISHERIES OF THE INDIAN ECONOMIC ZONE

3. 1 Economic Zone – the legislation, the area and the approach for exploitation

3.1.1 The Legislation

The 41st amendment to the Constitution enacting "The Territorial Waters, Continental Shelf, Exclusive Economic Zone and Other Maritime Zones Act, 1976' came into force on the 25th August, 1976. The portions of the Act relating to the contiguous zone and the exclusive economic zone were given effect from the 15th January, 1977. The Act defines the various zones and the rights and jurisdiction in respect of these zones. The salient features of the Act with regard to these are as follows:–

3.1.1.1 Territorial Waters

The limit of the Territorial Waters extends to a distance of 12 nautical miles from the appropriate base line. The sovereignity of India extends to these waters with the right of innocent passage for all foreign ships but only with the Government's permission for foreign warships.

3.1.1.2 Contiguous Zone

The area beyond and adjacent to the territorial waters and extending to a distance of 24 nautical miles from the appropriate base line shall form the contiguous zone. The Govefnment of India has exclusive jurisdiction in this area to take measures with regard to the security of the country in immigration, sanitation, customs and other fiscal matters.

3.1.1.3 Continental Shelf

The continental shelf extends to the outer edge of the continental margin or to a distance of 200 nautical miles from the appropriate base line. In this area, India has sovereign rights for the purpose of exploration, exploitation, conservation and management of all resources, living and non-living, exclusive rights for construction and operation of installations and other structures necessary for exploration and exploitation of the resources, or for any other purpose, exclusive jurisdiction over scientific research and over preservation and protection of the marine environment.

3.1.1.4. Exclusive Economic Zone

The exclusive economic zone is an area beyond and adjacent to the territorial waters with a limit of 200 nautical miles from the base line. In addition to the rights and jurisdiction mentioned above under the Continental Shelf, India will have sovereign rights for producing energy from tides, winds and currents and such other rights as recognised by International Law.

3.1.1.5 Maritime Boundaries

The maritime boundaries between India and any State whose coast is opposite or adjacent to that of India shall be determined by mutual agreement between the two countries. Pending such agreement, the maritime boundary between India and such States shall not exceed beyond the line which is equidistant from either coast line.

India has reached agreements regarding the maritime boundary with Sri Lanka, Maldives and Indonesia; talks are currently going on with Thailand. Agreements are yet to be concluded with Pakistan, Bangladesh and Burma.

3.1.2 Area

The provisional estimate of the area under Exclusive Economic Zone, without prejudice to the agreements to be concluded with the above - mentioned countries is 5.876 lakh sq. nautical miles, *viz.* about 2 million sq. km comprising of 0.86 million sq km off the west coast (including the Laccadives), 0.56 million sk km off the east coast and 0.60 million sq km around the Andaman and Nicobar islands (Fig. 2). The Indian EEZ would, thus, represent about 2.8 per cent of the surface area of the Indian ocean (excluding Antartic).

3.1.3 Approach for exploitation

The enactment of the above Act is an important milestone in the Fishery Development policies of the country. Fears have been expressed that unless the exclusive zones are quickly brought to full and optimum production by the Coastal States, it could adversely affect the global production of fish.

The developing countries have both advantages and disadvantages for immediate utilization of the living resources. The advantages lie mainly in the proximity of the resources, making the operation comparatively more economical. The semi-skilled and unskilled manpower readily available in developing coastal states, if properly utilised, will also significantly add to the economics of operations and in the gainful employment of their citizens. However, the handicaps of most of the developing countries to immediately replace in full the withdrawing fishing fleet and its technology cannot be minimised. The absence of a sizable and suitable fishing fleet, adequate technical manpower, and lack of adequate infra-structure facilities are some of the main constraints that have to be overcome through an accelerated programme of development of deep sea fishing. In addition, lack of clear knowledge of the distribution and abundance of commercially exploitable varieties of fish is a major handicap in promoting industrial investments. The first step to remedy this situation, is to utilise the surplus technological capacity of vessels, expertise and equipment of the developed nations by the coastal nations through joint venture programmes, thus helping both the parties. The United Nations, particularly, the Food and Agriculture Organisation and the several international funding and financing institutions and the bilateral donor countries can play a big role in improving the technolgy, in the collection of pre-investment information, in providing requisite funds for development projects and in the acquisition of necessary skills by the coastal nations. The need to maintain and improve the global production targets has to be reflected adequately in all the national and international fishery development plans.

3.2 Exploited Fishery Resources

The data on the current status of the exploited fishery resources of the country, as obtained during 1972-76, are derived from the compilation made by the Government of India based on the reports received from the State Governments and adjusted with the estimates made by the Central Marine

Fisheries Research Institute For more details pertaining to the earlier periods, reference may be made to Rao (1973) and Silas *et al.* (1976).

The average landings of the major varieties of fishes, crustaceans and molluscs separately for the five broad divisions of the indian coast, namely, north-west coast (Gujart and Maharashtra), south-west coast (Goa, Karnataka and Kerala), lower east coast (Tamil Nadu, including its small western seaboard and Pondicherry, and Andhra Pradesh) and upper east coast (Orissa and West Bengal) are given in table II.

Of the average marine fish production of 1.33 million tonnes, about 70% comes from the west coast and 30% from the east coast. The pelagic fishes contribute 46% of the total, the demersal fishes 37% and the crustaceans 17%, with the molluscs forming less than 1%.

3.2.1- **Region-wise catch**

3.2.1.1 **North-west coast** (Gujarat and Maharashtra)

Out of the total production of 414,000 t, the demersal fishes dominate with 226,000 t, the Bombay duck forming the backbone with 101,000 t. The other important varieties are the seiaenids ('Ghol', 'Koth', 'Dhoma' and other allied fishes), pomfrets, sharks, rays and allied fishes, and cat fishes. From the pelagic community, 79,000 t, of fishes are obtained, with the clupeoids (mainly 'Kati'. *Hilsa, Thrissocles* and allied fishes) forming the bulk with 45,000 t. The ribbon fishes (12,000 t) are the other important variety. In the crustacean group which yield 108,000 t, the non-penaeid prawns are more important with 72%, the penaeid prawns forming 27%.

3.2.1.2 **South-west coast** (Goa, Karnataka Kerala)

The total fish production is 531,000 t. The picture changes in this region with the dominance shifting towards the pelagic fishes which contribute 334,000 t as against 110,000 t by the demersal fishes. The pelagic harvest is heavily dependent on the oil sardine (131,000 t) and mackerel 53,000 t) which together form 55% of total pelagic fishes. The other important varieties are the other sardines (34,000 t), ribbon fishes (20,000 t), *Anchoviella* (white-baits) (17,000 t). carangids (11,000 t,), tunnies (8,000 t) and seer fishes (6,000 t). Among the demersal fishes, the cat fishes form the largest component yielding 27,000 t, followed by the sciaenids (14,000 t), elasmobranchs (14,000 t), silver bellies (12,000 t) and flat fishes (10,000 t). The crustacean landings of 85,000 t are, to a great cxtent, derived from the penaeid prawns (80,000 t).

3.2.1.3 **Lower east coast** (Tamil Nadu, Pondicherry, Andhra)

The difference between the share of pelagic and demersal fishes is not so significant as is the case in the two regions of the west coast. In the total fish production of 351,000 t, the former contributes 181,000 t and the latter 138,000 t. Among the pelagic fishes, the sardines (other than oil sardine) dominate with 50,000 t followed by the other clupeocids (52,000 t), in which *Anchoviella* (19,000 t) forms a significant part, and ribbon fishes (24,000 t). The carangids, mackerel and seer fishes are of equal importance, each yielding 12,000 t. From the demersal group, the silver bellies (34,000 t) form 25%, closely followed by the elasmobranchs (28,000 t). The catfishes and sciaenids each form 12% of the demersal catch, Of the total catch of 30,000 t from the crustacean group, a little over 50% is that of the penaeid prawns; the other crustaceans, largely the lobsters and to some extent the crabs, form a sizable portion of 37%.

3.2.1.4 **Upper east coast** (Orissa, West Bengal)

From this poorly exploited region, a total of 33,000 t. is realised with about equal quantity from the pelagic and demersal stocks. The clupeoids (8000 t.) are the important group, with *Hilsa* spp./contributing to a large share, in the former category. In the latter category, the Bombay duck, sciaenids and cat fishes together constitute a similar quantity. Pomfrets (2000 t.) are also of some importance in this region. The penaeid and non-penaeid prawn yield 4000 t, with 75% from the former. In general, the composition of catch resembles more the north west coast than its contiguous lower east coast.

3.2.1.5 **Islands**

The Laccadive group of islands yield about 3000 t. of which nearly 60% is accounted for by the tuna group, mainly the skipjack. The other fishes in this region are elasmobranchs, white baits, perches, red mullets, flying fish, half- beaks, seer fishes and cephalopods.

From Andamans, an average catch of only 900 t. is obtained; the important fishes are perches, ribbon fishes, seer fishes, mackerel, 'other sardines' and white baits. Small quantity of different varieties of tunas, lobster and molluscan resources are also exploited.

3.2.2 **State-wise catch**

The average catches (total and group-wise) of different States for the recent five-year period ('72–76) are shown in figure 3. Out of a total of 1.3 million t, about 31% is contributed by Kerala, followed by Maharashtra (19%), Tamil Nadu (16%), Gujarat (12%) Andhra Pradesh (10%) and Karnataka (7%). The share of Goa and West Bengal–Orissa comes to 2% each.

3.2.3 **Variety-wise catch**

3.2.3.1 **Pelagic fishes**

The pelagic fishes contribute 611,000 t. to the total all India catch. The clupeiods dominate with 58%. The important fishes in this group are the oil sardine (134,000 t.), the other sardines (87,000 t.), the white baits (37,000 t.), the wolf-herring 13,000 t.) *Hilsa* spp. (14,000 t.), *Thrissocles* spp. (13,500 t. and other miscellaneous clupeoids (44,500 t). Of the scombroid group (105,000 t), the mackerel is the most important segment with its individual contribution of 68,000 t; the seer fishes (24,000 t) and the tunnies (13,000 t), mainly the little tuna and frigate mackerel, form the balance, The ribbon fishes with 57,000 t is the next important variety followed by the carangids with 26,000 t. A large catch of 80,000 t is also credited to the other miscellaneous varieties of the pelagic community.

3.2.3.2 **Demersal fishes**

The demersal fishes account for 490,000 t in which the leading item is the Bombay duck (105,000 t). The other important varieties are the the sciaenids (70,000 t), sharks, rays and allied fishes (60,000 t), cat fishes (57.000 t), silver bellies (48,000 t) and the pomfrets (33,000 t). Those which are on the second line of importance are the perches (17,000 t), flat fishes (14,000 t) and the polynemids (10,000 t). The other miscelleneous varieties of demersal fishes are of the order of 76,000 t.

3.2.3,3 **Crustaceans**

Of the total catch of 227,000 t, the share of penaeid prawns is 127,000 t and that of non-penaeid prawns, 83,000 t; the other crustaceans, mainly the lobsters and crabs, contribute for the rest.

3.2.3.4 **Molluscs**

The cephalopods, principally the squids and cuttle fishes, yield about 5,000 t, largely obtained from the Kerala and Tamil Nadu coasts. The fishery for other edible molluscs like mussels, clams and oysters is only at subsistence level. The industrial fishery for pearl oyster in the Gulf of Mannar has not revived after 1961 and that for chank fishery is operational in the traditional grounds off Kutch, Trivandrum, in the Gulf of Mannar and Palk Bay.

3.3 **Exploitable resources**

3.3.1 **Total Potential Yield**

The total exploitable yield from the Indian continental shelf has been estimated as 2.3 to 2.6 million t (Prasad *et al*., 1970; Jones and Banerji, 1973; Nair *et al*. 1973; Antony Raja, 1974). For the demersal resources alone, including prawns, Joseph *et al*. (1976) indicated a potential yield of 0.61 million t, up to 40 fathom (72 m) depth, whereas, Jones and Banerji (1973) estimated 0.72 million t for the entire continental shelf. Inasmuch as the current average annual yield, which comes largely from the area within 59 m depth, is 0.73 million t of demersal resources, it is evident that these latter two estimations are too modest.

In the following paragraphs three alternatives of potential yield are considered based on different assumptions.

The first assumption is based on the average annual rate of increase in our marine fish production. The marine fish production in India during the past 25 years (1952-1976) indicates an absolute increase of 190% and an average annual growth rate of 4.5%. During the successive 5 year periods, only during 1957 to 1961 was there a negative growth rate of 2.1%, otherwise, it was 8.3% during 1952-56, and 8.6% during 1962-66, followed by 7.1% and 12,3% during the succeeding quinquennia. Although the most recent growth rate is remarkable, presuming a modest annual growth rate of 10%, during the next five years, a harvest of about 2.4 to 2.5 million t is expected by the end of the next 5 years. Growth during the years further ahead would depend on how successful our attempts are in utilizing the resources of the offshore and deeper regions. Marr *et al.* (1971) have visualised a distinct possibility of 5% or 8% growth in the Indian Ocean catch. At the lower rate, our catch could be 5.0 million t after 25 years and at the higher rate; 9 years earlier.

The second alternative takes cognizance of the reported organic productivity. Based on the present composition of landings and the oceanographic features, the Indian coast, as mentioned in the preceding section, is broadly divided into northwest coast, southwest coast, lower east coast and upper east coast. Taking into consideration the feeding habits and the trophic levels the fishes belong to, the percentage composition of the fishes feeding on the three trophic levels, and keeping the ecological efficiency at 10% level, the total biomass production was calculated based on the values of organic productivity and the shelf area given by Jones and Banerji (1973). From the resultant weight of total biomass, 60% was considered as the potential yield in the 0 50 m region and 30% for 40–200 m area. The estimates obtained are given in Table III. It is scen that that the total potential yield of 2.7 million tonnes is very close to the estimates of the earlier workers. However, the bulk of this yield, 3.5 million tonnes, gets credited to the shallower regions, and only a very small quantity to the deeper areas, from where an average of only about 40,000 tonnes is indicated from each of the four regions. It is, however, possible that either the values of organic productivity considered, or the 30% reckoning given above, or **both,** could be lower than reality.

The third alternative takes into consideration the average rate of fish production per unit area during the recent years (1972–76). Since the current fish production is almost exclusively from the 0–50 m region, the average rate of production per sq km (in tonnes) is as follows :–

1.	Gujarat	2.5		
2.	Maharashtra	10.0	North west coast	4.6
3.	Goa	8.1		
4.	Karnataka	11.9	South west coast	22.7
5.	Kerala	32.9		
6.	Tamil Nadu	9.4		
7.	Andhra Pradesh	8.0	Lower east coast	8.8
8.	West Bengal & Orissa	1.2	Upper east coast	1.2

Taking the above figures and the broad picture of primary, secondary and tertiary production (Cushing, 1971) and the distribution of fish eggs and larvae (Peter, 1969), it is obvious that the most productive area is the south west coast followed by the upper east coast, lower east coast and north west coast in that order. For the inshore region, it is herein envisaged that the south west coast should be capable of yielding a minimum of 30 tonnes per sq km, which is a little less than the present average harvest of Kerala, and which could be easily attained; if on the Goa-Karnataka region, where the fishing is largely shore-based, the fishing is diversified and intensified. A production rate of 20 tonnes is envisaged for the upper east coast since the reported productivity of this region is two-thirds of the southwest coast. The lower east coast is credited with 12 t, an increase of about one-third over the present production, due to its narrower inshore belt as compared to the northwest coast, for which an increase of 50% over the present production, amounting to 6 t per sq km, is assigned. In the remaining offshore region of the continental shelf, the exploitable rate could be taken as 50% of the above rates for the respective regions. The estimated potential obtained in the above manner is presented in Table IV. It is seen that the total potential yield is 3.7 million t of which the major portion, 2.25 million t would be realised from the inshore waters and 1.45 millions t from the offshore waters. It is also seen that the only region, where the offshore resources are as large as the inshore resources, is the southwest coast; in the other regions, the offshore resources appear to be about one-third to a little over one-half of the shallower area.

From the above three alternatives, a harvestable potential ranging from 2.7 to 5.0 million t is indicated. Essentially however, the choice is between the latter two projections, i.e., between 2.7 and 3.7 million t for the continental shelf region around the mainland of India. In order to find out which could be more reliable, perhaps a comparison with the results of the Pelagic Fishery Project on the southwest coast, where extensive surveys have been carried out during the last 6 years, can be attempted. The surveys have indicated that for the years 1972–75, there was an average stock of 2.0 million tonnes of columnar fishes. If the ground fish resources are also added, the stock could be easily anywhere between 3.0 and 4. 0 million t. In 1976, in the depth zone 20–120 m, the total biomass was estimated as 3.1 million t excludiug the surface shoaling fishes and "shallow water mix", but including the demersal resources (Anon., 1977 a). If the entire shelf is taken into consideration, perhaps the standing stock would have been at least one and a half times, if not more *viz.* 4.5 million t. Thus a total biomass of 3.5 to 4.5 million t. of both demersal and pelagic resources is indicated with a harvestable yield of about 2.0 million t. Our estimations based on the second and third assumptions for the southwest coast is almost mutually alike *viz.* 1.3 to 1.4 million t., indicating that either one could not be an over-estimate. However, this does not help us to make a choice between the two estimations. In the second alternative considered, the offshore exploitable resource level is indicated only as 0.05 million t. for this region which appears to be rather very small as compared to the tertiary production of the area (Cushing, 1971), the estimated biomass by the Pelagic Fishery Project and 0.7 million t. indicated by the third alternative. As mentioned earlier, this may be due to under-estimation in the second alternative. The third alternative which indicates a roughly similar amount of yield from the inshore and offshore waters of southwest coast could be a more reliable picture. This may apply for the other regions as well and we may, hence, reasonably presume an yield of 3.7 million t. as the potential harvest from the continental shelf region of the mainland.

The production from the groups of Islands in the Arabian Sea and Bay of Bengal and also in the residual area of the Indian Economic Zone may be added to this estimate. The tertiary production picture of Cushing (1971) indicates a roughly similar picture for the lower east coast and the Andaman–Nicobar area. Therefore, a rate of about 10 tonnes per sq. km for the area of Andaman & Nicobar group of Islands would not be an overestimate, which would indicate a potential yield of about 160,000 t. Around the Laccadives, Cushing's (1971) indicated figures compare favourably with the southwest coast. The island area as a whole, in spite of having a very narrow shelf, has rich resources of skip jack and other tunas. An estimate of 90,000 t for the shelf area at the rate of 20 t per sq. km. for the entire Laccadive sea is arrived at. Thus a potential yield of 3.97 million t comprising of 3.72 million t off the mainland and 0.25 million t from the Islands is obtained. The residual area of the Indian Economic Zone roughly amounts to 1.6 million sq. km. On the basis of a rather moderate figure of 0.3 tonne per sq. km. an amount of about 500,000 t is the harvestable resource. Thus, the Indian Economic Zone is estimated to contribute to about 4.5 million t of harvestable living resources, which, consist of both conventional and non-conventional elements.

It is seen that in the Indian Ocean, one-third of tertiary production of its upwelling areas, namely, 3 million tonnes, is estimated to come from the Indian waters, (Cushing, 1971). The potential yield from the Indian Ocean production has been projected by the FAO as 14.3 million t, one-third of which would be 4.8 million t. In view of the fact that at present as large as 44% of the Indian ocean catch is realised from Indian waters. the Indian contribution should be about 6.3 million t if the present level could be maintained. Thus, the above projection of 4.5 million t appears modest, but it is a great challenge for achievement against the present yield of 1.5 million t. Although the FAO has envisaged a larger share to come from the other regions of the Indian Ocean, India, being one of the leading fishing countries of today, not only in the quantum of catch but also in the capacity to produce the required technical expertise, is expected to realise the present estimate before the turn of this century.

3.3.2 **Potential – Regionwise**
(Fig 4& Table V)

3.3.2.1 **North–west coast**

The fiishery survey of the North-west coast carried out with Polish assistance, when completed, would give us an indication of the abundance and characteristics of the resources in the northwest coast between 50 and 200 m. The potential yield. of about 540,000 tonnes, up to 50 m, may have to be largely realised from the currently exploited varieties, which amount to about 314,000 tonnes. Additional landings from varieties such as sciasenids, cat fishes, pomfrets ribbon fishes, miscellaneous clupeoids and non–penaeid prawns have to be raised through increased exploitations of the outer periphery of the currently exploited areas. The resources which are lying beyond and which amount to about 340,000 tonnes, would largely be of cat fishes, ribbon fishes, carangids, especially the horse mackerel; perches, particularly *Nemipterus*, as revealed by the preliminary reports of M.T. *Murena* (Dwivedi *et al* 1977 a, b, c) and other unidentified varieties. The survey results of "Dr. Fridtjof Nansen" (Anon., 1977c) and *R, V. Shoyo Maru* (Yamanaka *et al.*, 1976) from the adjacent waters of Pakistan coast also confirm the availability of these varieties in appreciable quantities. Beyond 200 m depth, there are also chances of good potential for the frigate mackerel and the oceanic squid, off the extreme north, adjacent to Pakistan coast; in fact, Yamanaka *et al*. (1976) have observed that the resources level of the oceanic squid may be ten times of all other fish. Generally, as far as the offshore resources are concerned, the Gujarat coast, especially off Dwaraka and further north, is likely to be richer than the southern region.

3.2-2.2 **South–west coast**

As mentioned earlier, the findings of the Pelagic Fishery Proect indicate an average pelagic biomass of 2.0 million t in this region. Of this, besides the conventional popular resources of oil sardine and mackerel (650,000 t), whitebaites 400,000 t), ribbon fishes and cat fishes (420.000)t, carangids, (130,000 t) and 'other fish' (400,000 t) are the under-exploited resources. Recently the project has also found that out of 3.1 million t of total biomass, the pelagic stock is about 1.7 million t, the balance being the demersal stock, The former dominated in the region south of Calicut and the latter, north of Calicut. Surveying the continental shelf edge and the upper continental slope, Silas (1969) has indicated large potential of deep water fishes and prawns off this coast with an estimate of 75,000 t of potental yield from the demersal resources alone. There are rich "Kalava" (rock cods and snapper) grounds in the rocky chain at 70–130m depth as seen from the studies of Silas (1969), Menon and Joseph (1969), and Menon *et al* (1977). Tholasilingam *et al* (1973). Silas (1969) has also drawn particular attention on the availablility of threadfin bream *Nemipterus*, in the 75 to 100 m depth zone. Mohammed and Suseelan (1973) estimated 5,3000 t as potential resource of deep water prawn and lobsters in the continental slope especially between Quilon and

Allepey. It was tentatively estimated by Rao and George (1973) that the potential resources of deep sea spiny lobster would be 108 t in the "Quilon bank" alone. Further, they also made a qualitative reference to the availability of lobsters in commercial concentration south of Calicut up to Colachel.

Rich areas of fish eggs and larvae have been noticed off Kerala coast (Peter, 1959). The larval collections made by the Pelagic Fishery Project indicate dominance of clupeid larvae, especially those of white-baits, the other important larvae were those of Indian mackerel, frigate mackerel and carangids (Anon., 1975).

We have projected a potential of about 700,000 t within 50 m depth and about 720,000 t for the region beyond up to 200 m. To the present exploited level of an average of about 530,000 t, additional resources are expected to come by more intensified exploitation on the Goa-Karnataka region for the conventional varieties like the oil sardine and mackerel and through white baits, cat fishes and carangids all along the coast. Further beyond in the shelf and slope, we may have an exploitable potential of 15-20,000 t of deep water prawns and lobsters especially south of Cochin, about 120,000 t of white baits, about 80,000 t each of carangids, ribbon fishes and cat fishes, about 50,000 t each of tuna-like fishes, rock cods, snappers and threadfin bream and deepwater fishes and about 30,000 t of cephalopods.

3.3.2.3 **Lower east coast**

There is a clear lack of information on new grounds except for the Palk Bay, Gulf of Mannar and Wadge Bank regions. Recently *R. V. Gaveshani* of the National Institute of Oceanography collected planktonic larvae of deepwater prawns in the sea off Pondicherry and between Kakinada and Machilipatnam (Anon., 1976 b).

The results of the survey of Pelagic Fishery Project have indicated that there is a total stock of about 550,000 tonnes around the peninsular curve including the Wadge Bank, Gulf of Mannar and Palk Bay, basides the seasonal piling up of the white-baits resources in the Gulf of Mannar. Of the above estimate, the demersal stock is of the order of 285,000 t distributed as 16,000 on the eastern seaboard of Tamil Nadu, 73,000 t in the Wadge Bank area, 83,000 t in the Gulf of Mannar region and 113,000 t in Palk Bay.

The Wadge Bank has been largely exploited by vessels of other countries, particularly of Sri Lanka, Thailand, Taiwan and USSR. The area is credited with permanent resident high quality perches and migrant varieties of sharks, *Caranx* spp. cat fishes and balistids during the southwest monsoon. Shomura (1971) citing the works of Mendis (1965), Sivalingam (1966) and Fernando (1970) indicated a potential yield of 7800 t. of bottom fishes. From the tertiary production picture given by Cushing (1971), could be surmised that, when calculated on 50% basis, and at the rate of 6.5 tonnes per sq km the potential yield is 87,750 t. This may be compared with a stock of 73,000 t. demersal fishes alone estimated by the Pelagic Fisheries Project for the Wadge

Bank area. Silas (1969) reported that, on the continental slope bordering Wadge Bank and extending into the Gulf of Mannar, there was large concentration of deep sea echinoid resource in the 280-360 m depth. This may be considered as a commercially potential resource in view of the importance of its mature ovaries for making fish paste.

An estimate of 480,000 t. for the inshore area and 200,000 t. for the offshore region is made for this long but narrow shelf region. The present indications are that most of the additional yield of 130,000 t. from the inshore waters may come from white baits, ribbon fishes, silver bellies and sardines and to some extent from lobsters and cephalopods. For the offshore exploitation, the main area would be the Wadge Bank and Gulf of Mannar region, where the important resources are the Perches, white baits deep sea prawns and lobsters. A potential resource that should be looked for all along the coast is the squids and cuttle fishes. In view of the reported rich grounds of fish larvae along the lower east coast (Peter, 1969), large but yet unidentified resources could be expected. The major portion of this additional resources may, however, belong to low priced varieties such as white baits, flat fishes, small carangids and *Bregmoceros* and oceanic forms like lantern fishes and light fishes as seen from the recent larval collections (Anon., 1977 b)

3. 3. 2. 4 Upper east coast

Although, this is the least exploited area of the Indian coast yielding at present only an average of 33,000 t, the potential seems to be enormous. The exploitable resources would also have a large precentage of high-grade varieties like penaeid prawns, quality demersal fishes like perches, polynemids and pomfrets and cephalopods. From the large ingress of young penaeid prawns, especially, the larger varieties, into the Chilka lake and the deltaic region of West Bengal, the recently located prawn grounds off Calcutta by the Exploratory Fishery Project which indicates an exploitable potential of at least 10,000 t of prawns off West Bengal (Sudersan and Joseph, *MSS.*) and the reported economical operations of private fishing companies in this area, would, indicate in no unmistakable terms, the presence of rich prawn grounds. It is observed from the report of West (1973) on the Bangladesh waters that the exploitable demersal resources are about 300,000 t and that the pelagic resources are quite large but virtually unexploited. Since the upper Bay of Bengal is credited with a uniform high organic production, we can expect that the above observations could hold good for the upper east coast of India also. The minimum demersal resources potential available in the shelf region of upper east coast could be, on this basis, about 270,000 t besides a minimum yield of an equal amount from the pelagic realm. However, we are of the opinion that this amount of 540,000 t could come, by and large, from the inshore region itself. From the inshore belt, the major resources on the demersal side are prawns, perches, polynemids, sciaenids, pomfrets, cat fishes, elasmobranchs and Bombay duck. From the pelagic side, sardines, hilsa, mackerel, carangids and the squids and cuttle fishes are expected to make the bulk of the contribution. From the potential offshore harvest of 200,000 t, the cephalopods are likely to dominate with additional contribution from cat fishes, sciaenids, sharks and rays, pomfrets, carangids, and tuna-like fishes. The crustacean group is expected to yield about 15,000 t.

3.3.2.5 **Andaman & Nicobar**

One of the important upwelling areas of the Indian Ocean is around the Andaman and Nicobar group of Islands. Cushing (1971) has estimated 100,000 t as the potential yield. The estimation of 50,000 t by Kumaran (1973) is on the lower side because of errors of evaluation. Jones and Banerji (1973) have made a conservative estimate of 12,000 t.

There are coral reefs around the Nicobar Islands and a barrier reef west of Andamans. Cushing (1971) is of the opinion that there must be considerable quantities of sardines and mackerel resources over coral areas of the Indian ocean, although they may exist in local concentrations. The presence of good concentration of fish larvae in this area (Peter, 1969), intense fishing activity by foreign fleet especially in the Nicobar area and the fact that the region, especially the eastern Andamans, is very productive due to upwelling, leave no doubt on the availability of large exploitable resources.

The most important resource is the tunas and tuna-like fishes, especially in the region around and south of Car Nicobar. A stock of 25,000 t of yellowfin tuna and big eye tuna and 50,000 t of skipjack has been postulated for this region (Anon, 1976 a). Sivasubramaniam (1975) has a estimated 270 t of tuna, 150 t of spear fish and 60 t of shark as an average catch for a 80 ft. vessel operating in these waters.

The other important resources that could be successfully and economically exploited are sardines, mackerel, perches, tunas and allied fishes, sharks and lobsters. There are extensive trawling grounds on the eastern side and considering that the west coast of Thailand and Burmese coast, south of Irrawaddy delta yielded some of the best trawling results (Tiews, 1966), the same could justifiably be expected in the neighbouring area on the eastern side of Andamans.

With this background information, it is believed that the projected potential yield of about 160,000 t is certainly attainable with about 100,000 t from tunas and allied fishes, 40,000 t from small shoaling pelagic fishes and 20,000 t from the demersal stock.

3.3.2.6 **Laccadives**

The only organised fishery for tunas is conducted in the Laccadives, particularly from Minicoy, for skipjack. As already stated, Laccadive sea has a very good rate of tertiary production almost equivalent to the southwest coast. There have been frequent reports of foreign long liners, operating in this area. After mechanisation of the tuna pole and line fishing, returns of traditional fishermen have considerably increased during the recent years. The tuna resources around the Laccadives is estimated to be about 50,000. Along with the tunas, it is also known that there is quite a good measure of shark resources in this area. Silas (1969) has also drawn attention to sizable quantity of cephalopod resources in this region. Recently, *R V. Gaveshani* has made plankton collections of deepwater prawns in the area between Androth and Kalpeni islands (Anon., 1976 b). Our total estimation of about 90,000 t is a modest one and this would be largely contributed by the tunas, their allied species and the elasmobranchs.

3.3.3. **Potential-Variety-wise**

3.3.3.1 **Tunas**

The recent annual average Indian ocean catch of the principal market tunas *viz*, skipjack, albacore, southern bluefin, Yellowfin and big eye amounts to 110,000 t consisting of 25,000 t of skipjack and 85,000 t of large tunas. While the FAO's estimation of exploitable yield from the Indian ocean is 100-150,000 t of large tunas and 160-300,000 t of skipjack (Gulland, 1971), Fullenbaum (1970) has estimated a larger yield of about 260,000 t each of these two groups. With the declaration of exclusive economic zones by different countries of the Indian ocean, a decline in the fishing pressure by the foreign fishing vessels is expected. Even otherwise, there is a clear justification and scope for increased skipjack production which is expected to dominate the future Indian Ocean tuna catch. Further, the bill fishes, marlin and sailfishes in the oceanic region and the smaller tuna-like fishes such as bonito, frigate mackerel and little tunas in the coastal region, forming a fairly large, yet unassessed potential, offer a good scope for further development. If India is to enter high sea tuna fishing at least in a modest way, attempts of exploitation will have to be made to begin with around Andaman-Nicobar Islands and in the Laccadives sea. In these two areas the projected exploitable potential is 100,000 t of skipjack and 25,000 t of tunas and an equal amount of allied forms. Besides these, from the coastal region off the mainland about 90,000 t could be harvested, two-thirds of which is expected from the southwest coast.

3.3.3.2 **Prawns/shrimps**

The FAO's estimated potential of this resource for the Indian ocean is 250-300.000 t. The latest figure of 296,000 t for 1975 and the average of 257,000 t for the last five years clearly show that the fishery has expanded at a much higher rate than was anticipated. Around the Indian coasts, the fishing pressure is sufficiently high on the stocks of the west coast from where about 80% of the Indian catch of penaeid prawns is realised. With regard to the non-penaeid prawns, the share of of the west coast - chiefly by Maharashtra - is still higher. The increase in prawn production from the east coast is a welcome sign and there is still plenty of scope for accelerating the exploitation on the east coast, especially on the upper east coast. It is estimated that the potential yield of both penaeid and non-penaeid prawns would be a little less than 300,000 t, two-thirds from the former, as against the present yield of 210,000 t. The additional yield from the penaeid prawns could be only about 55,000 t, of which 60% is expected from the upper east coast and good part of the rest from deep-water grounds. It would, hence, be clear that there are less prospects for any large scale exploitation possibility for coastal penaeid prawns in the traditional grounds. Actually the coastal penaeid shrimp stock is reaching a level of stabilisation and any further expansion of efforts for this resource in these areas is fraught with the danger of over-exploitation, leading to uneconomic operations. From the non-penaeid prawn resources, the yield level may be greater than we have estimated; but, for the present an additional amount of 20,000 t is expected, mostly from the northwest coast and the balance from its corresponding area on the upper east coast.

Our knowledge on deep water prawns is increasing with the location of this resource off the southwest coast and the peninsular curve with indications of their occurence in the Laccadive sea and off certain regions of lower east coast.

3. 3. 3. 3 **Lobsters and crabs**

Our estimation from other crustaceans is 40,000 t but we have given more importance to the lobster resource yielding 75% to 85% of this amount. The recent catches from this resource around the Indian coast is about 3,000 t mainly from Gujarat. George (1973) envisaged only one-third of this amount as the exploitable potential; obviously the level of the resource is much larger. From the trend of distribution of lobster resources around the Indian coast, it appears that the exploitation could be stepped up along the coast of West Bengal, Tamil Nadu, Kerala, Maharashtra, Gujarat and around the islands in order to realise about 25,000 t from the inshore areas and about 5-10,000 t from the regions beyond, including the deepwater varieties. Rao *et al.* (1973) have estimated the potential of marine crabs within 50m depth as nearly 30000 t. Swarms of deep sea crab have been reported by Silas (1969) and also observed recently by research vessels of the Pelagic Fishery project.

3. 3. 3. 4 **Cephalopods**

The present day harvest of cuttle fishes/ squids in the Indian ocean, mostly taken by Japan and Democratic Yemen is about 11,000 t, 9,000 t from the west and 2,000 t from the east. Around India, at present, these resources are obtained as only incidental catch from the trawling operations for prawns. There has been recently a sudden increase in the landings of the cephalopods which were till 1974 averaging an annual catch of 1,000 t, In 1976, the landings have shot up to about 14,000 t.

At present most of the catches are from the Tamil Nadu and Kerala coast. The International Indian Ocean Expedition reports indicate rich resources of cuttle fishes and squids in the Bay of Bengal, southwest coast of Sri Lanka and off the Kutch coast of Gujarat. Silas (1969) has drawn attention to the occurrence of large quantities of squids off the southwest coast of India within and outside the shelf waters and in the Laccadive sea. The Pelagic Fishery

Project has also located on the southwest coast large quantum of cephalopods. Yamanaka *et al.* (1976) have indicated a resource level of ten times of all the fishes for the oceanic squid beyond 200 m depth off the Pakistan coast. Since it is reported that the squid completes its life cycle and dies within one year, a high fishing pressure is necessary to take advantage of this resource. It is estimated that there could be a potential yield of about 180,000 t, 55% of which from the upper east coast, 11% each from the lower east coast and North west coast and 20% from the southwest coast.

3. 3. 3. 5 **Sardine and mackerel**

For the years 1960–71, Sekharan (1975) has estimated a total stock of 950,000 t of oil sardine and mackerel, with a standing stock of 460,000 t. The finding of Pelagic Fishery Project during 1972–76 indicate that the stock of sardines and mackerel on the southwest coast is about 650,000 t. These two fisheries show wide natural fluctuations due to variations in recruitment rates. It is also seen that these resources are largely confined to the coastal waters and are not available in the deeper regions of the shelf. While on the Kerala coast these resources are fairly intensively exploited, the same cannot be said with regard to the northern region of their distribution from where there are good prospects for more catches. It is, however, not known whether increased catches from this region would affect the returns from the southern region. Visualising that such an event would not take place, it is expected that the average yield could be 200,000 t for the oil sardine and 100,000 t for the mackerel.

3.3.3.6 **Anchoviella**

The current exploited quantum of about 37000 tonnes appears to be very low as compared to the average stock abundance of 500,000 t on the southwest coast and in the Gulf of Mannar region. This resource piles up in large quantity in the Gulf of Mannar area during the southwest monsoon. During the other times of the year they are found spread out on the southwest coast. However, the subsequent survey of the Pelagic Fishery Project in 1976 (Anon., 1977 a) did not record much of this resource. Nevertheless, the fact remains that fishable concentrations of white baits are available all along the southwest and lower east coast. From the report of Yamanaka *et al.* (1976), it appears that we may have an inshore stock of white baits off north Gujarat coast as well. We are making only a modest estimation of 250,000 t for this resource.

3.3.3.7 **Other clupeoids**

The estimated potential of this coastal resource comprising of *Chirocentrus*, *Hilsa*. *Thrissocles*, *Pellona* etc. is about 160,000 t of which 50% would be the additional harvest, roughly shared equally between the three regions other than the southwest coast.

3.3.3.8 **Carangids**

Although the current production indicates a large share from the lower east coast, the carangids, especially the horse-mackerel and scads, have a large potential along the westcoast. The Northwest coast survey and the Pelagic Fishery Project Survey have indicated that especially off Dwarka, Mangalore and Calicut, these resources are found in plenty. A large addition of about 240,000 t is envisaged for this resource, 4% from the southwest coast, about 5% from the lower east coast and the balance shared between the northern regions of the two coasts.

3.3.3.9. Ribbon Fishes

As a result of the surveys carried out so far on the west coast, a large potential resource of ribbon fishes can be indicated. From the offshore waters, the expected yield is about 150,000 t and from the inshore region, about 125,000 t which would represent a little over double the the present harvest. Region-wise potentials are 90,000 t for northwest, 110,000 t for the southwest, 45,000 t for the lower east and 25,000 for the upper east coast.

3.3.3.10 Elasmobranchs

The four regions of the coast are expected to yield, roughly at the rate of 40,000 t, a total of 160,000 t. The island groups may countribute 10,000 t each. The sharks, and allied forms, being important components of trawling and tuna fishing operations, no difficulty is anticipated in realising these expected yields.

3.3.3.11 Cat Fishes

This is yet another resource with a very great potential as brought out by the surveys on ths west coast. In the Bangladesh waters, the largest component of demersal resources comes from cat fishes (West, 1973). Sekharan (1973) has indicated the importance of these resources along the upper east coast and the Andhra Pradesh coast. Considering all these as well as the reports of the operations of the Exploratory Fisheries Project on the east coast (Joseph *et al.* 1976), we have projected a harvestable potential of over 300,000 t, about 150,000 t from the inshore area and 16,000 t from the offshore area. The largest catch of about 120,000 t is expected from the southwest coast and about 90,000 t from the northwest coast. Of the remaining 100,000 t, the upper east coast is expected to yield 75%.

3.3.3.12 Bombay Duck

Although the present average annual harvest from this resource is 105,000 t, because of its yield fluctuations and lack of indication of any additional resource from northwest coast, we do not expect any significant increase from this coastal resource. However, from the fact that the Bangladesh waters are credited with high catch rate of Bombay duck in some areas (West, 1973), there appears to be some scope for increased landings on the upper east coast, which may perhaps offset any decline in the production from the northwest coast.

3.3.3.13 Sciaenids

With increasing mechanised fishing efforts in the inshore waters of northwest coast, the returns from this resource are increasing rapidly in the recent years. It is felt that there is still scope for augmenting production from this area to about three times the present harvest. Among the other regions, the upper east coast offers the best ground as is gathered from the reports of West (1973) and Joseph *et al.* (1976). Beyond 50 m depth, we do not have any evidence of large scale availability and hence only 40,000 t is envisaged as the total production from the offshore area as compared to 210,000 t from the shallower waters.

3.3.3.14 Perches

The present average catch of about 17,099 t is very low in the light of possible yield. Most important varieties in this group are the rockcods. snappers, threadfin bream and lethrinids. We may also have longspined sea-bream *(Argyrops)* from the upper northwest coast (Yamanaka *et al*. 1976). The presence of numerous 'Kalava' grounds has already been drawn attention to. The resources of Wadge Bank are generally dominated by the perches. The perch resources of Gulf of Mannar are under-exploited whereas those on the western side of Andamans remain unexploited. These are the main potential areas for exploitation for this group of fishes. One variety which remains virtually untapped beyond 50 m depth is the threadfin bream, *Nemipterus japonicus*. The availability of this resource on the southwest coast has been brought to light by Silas (1969). Similarly in the north-eastern Arabian Sea predominance of this species has also been recorded (Zupanovic and Mohuddin, 1975 Yamanaka *et al*., 1976: Anon., 1977 c) which is further supported by the findings of the present Northwest coast survey. The recent survey of the Pelagic Fishery Project (Anon, 1977 a) has also indicated sizable quantities of this resource on the Karnataka coast in the depth of 40 to 100 metres. The studies of Krishnamurthy (1973) indicate that this fish forms about 40% in the trawl catches of Andhra Pradesh and Orissa coast. Silas (1969) is of the opinion that the resource along the east coast is as high as along the west coast but sufficient fishing efforts have not been expended in the depth zone in which this species is abundant, namely 70 to 150 m. We believe that intensified fishing efforts beyond 50 m, especially upto 150 m depth would yield a large amount of this resource. All evidence taken together, the exploitable potential yield of threadfin bream could be about 100,000 t and that of other larger perches about 150,000 t; the bulk of the latter would come from the Wadge Bank region and from the southwest coast.

3.3.3.15 Leiognathids

The silver bellies, almost exclusively contribute to about 48,000 t which are largely obtained from the lower east coast. West (1973) has indicated that this resource is potentially the largest component of the demersal resources of the shelf area of the upper east coast of of India. We anticipate an yield of 30,000 t from the upper east coast and about 50,000 t from the lower east coast, with an over-all production of 100,000 t an increase of about 50% over the present yield.

3.3.3.16 Other resources

These resources include the large stocks of balistids (Venkataraman and George, 1961; Anon., 1977 a) and large quantities of swimming crabs (Silas, 1969), both of which could be diverted for fish meal production. Some of the deep water fishes on the shelf edge and slope, like the butter fish, would be acceptable for human consumption. The others, like the boar fishes. snake mackerel, rat-tails etc. are perhaps suitable for industrial reduction. In the oceanic region, the dominant forms certainly appear to be the lantern fishes and light fishes (Silas, 1969; Anon., 1977b & c; Yamanaka *et al.*, 1976), the utilization technology for which is yet to be developed. The resources would also include the oceanic squids and other miscellaneous fishes, known and unknown. The total magnitude of all these resources would be in the order of about 1.0 million t, 50% of which is expected in the oceanic region; of the rest, roughly equal quantity is expected from the inshore and offshore regions.

3.3.3.17 Remarks

The above observations on the region-wise and variety-wise potential yield in the inshore and offshore regions are summarised in Table V along with the current average yield. It is possible that some groups, like the sciaenids, might have been over-estimated and some, like white-bait underestimated. While we are fairly confident of the nature of yield distribution on the west coast and a part of the lower east coast, thanks to the present surveys both national and international, we have relied largely on the exploited resources of our waters and the waters of Bangladesh and Burma for other regions, especially the upper east coast, and the reported abundance of tuna group of fishes around the two groups of islands. Table V would indicate that the greatest increase will have to come from the tuna and cephalopod resources, several times the present harvest. The catches from perches will have to be increased by 15 times, carangids 10 times, white baits 5 times and cat fishes and ribbon fishes 5 times each. The heavily exploited varieties like the oil sardines, Bomby duck, mackerel and penaeid prawns will have only limited increase ranging up to 59% of the current harvest. The other resources are expected to have an increase ranging from 2 to 4 times.

4. EXPLORATION, EXPLOITATION AND UTILIZATION

4.1 Exploration

4.1.1 Tunas

The undisputed availability of tunas, small and large, and the allied fishes would appear to indicate that no survey is necessary for tuna fishing. Nevertheless in order to build up local fishing expertise and to infuse confidence in the private entrepreneurs, it would be perhaps advisable to undertake commercial survey of the Laccadive Sea as well as Andamans Sea through pole and line fishing, long lining and purse seining. The pole and line fishing survey could be undertaken with a 40 to 45 m size boat; although, a much smaller boat of about 17 m size would be sufficient for this type of fishing, a larger boat is recommended to assess the extent and abundance of the skipjack resources around the Islands, by staying for a longer time from the port. This boat would have to be supported by two smaller size boats of 10 to 12 m and 17 m size for the purpose of working out the economics.

The survey for larger tunas could be undertaken by a tuna long liner-cum-trawler of the size of about 35 m length. This boat could conduct a survey for an year around the Laccadives and for another year around the Andaman Sea. A large purse-seiner of the size cf 60 to 70 m could be employed for undertaking a survey of the surface fishery for tunas in both these regions.

Japan and the Republic of Korea have been successfully conducting pole and line fishing and long lining in the Indian Ocean for skipjacks and larger tunas. Elsewhere, the USA has established its superiority in purse-seining operations for these fishes.

4.1.2 Cuttle fish-Squid resources

Although a number of publications have indicated the availability of larger concentrations of cephalopods off Gujarat coast, the lower southwest coast and the Bay of Bengal in general, it would be necessary to demonstrate the economic feasibility of a new venture oriented exclusively for exploitation of this resource. Jigging has been demonstrated as the most efficient method; it may, hence, be worthwhile to engage a few squid jigging boats of 17 m size and carry out surveys in all the projected areas of abundance. At present, Japan has been successfully employing this technique in Indian Ocean and in other areas.

4.1.3 Pelagic and semi-pelagic resources

Although our surveys have indicated a large amount of pelagic and semi-pelagic resources on the southwest coast as well as in the Gulf of Mannar/ Palk Bay region, these results are yet to be confirmed by commercial type of operations. The lower east coast also suffers from lack of information due to absence of any organised survey. Hence it appears worthwhile to undertake a survey employing a large seiner-cum-trawler to cover the lower southwest coast and the lower east coast by a vessel of about 40 m length capable of operating large and small purse seines and mid-water trawl. Since a combination vessel has less fishing efficiency as compared to an exclusive type, and in order to work out the economic viability of different types of boats, it would be necessary to employ boats of different sizes and from various ports for supportive fishing.

4.1.4 Upper east coast

Although exploratory surveys have been carried out in the past and are still continuing in this region, in view of the fact that this region requires a very large amount of developmental effort, an exploratory survey should be undertaken by a multipurpose type of boat of 60 to 70 m length. While it is desirable to procure vessels & equipment from abroad to meet immediate demands, expertise for carrying out scientific survey has to be pooled from within the country. At the same time utilization of service of fishing technicians and master fishermen for limited periods to be replaced by Indian counterparts will quicken the programme and bring in better results. Ancillary support for this vessel could be given from two 53 m boats, one for exploiting demersal resources and the other for pelagic resources in order to work out the economics.

4.2. Exploitation

4.2.1 Northwest coast

In order to achieve the 30% increase from the inshore resources, intensified efforts of mid-water trawling and purse-seining are necessary. Beyond 50 m depth, it appears that mainly, mid-water trawling would contribute for the the exploitation of the located resources of cat fishes, ribbon fishes, carangids, threadfin bream and others.

4.2.2. Southwest coast

From the inshore belt, increased efforts through purse-seining would augment the catches of the principal pelagic fishes as well as the other under-exploited ones, especially in the Goa and Karnataka region. Purse-seining has to be introduced for exploiting all the major pelagic species. Simultaneously, mid-water trawling and high-opening bottom trawling are to be introduced employing larger boats for the located resources of cat fishes, carangids, ribbon fishes, and white baits in the offshore region. Trap and line fishing for the perches and trawling for the deep water prawns and lobsters are other lines of action for enhancing the production.

4.2.3 Lower east coast

Wadge Bank region should be intensively exploited through trolling, long lining, trawling and trap fishing in addition to mid-water trawling in a planned manner so that both the resident varieties as well as the migrant groups could be fully exploited. From the Gulf of Mannar–Palk Bay region. mid–water trawling bottom trawling with high opening trawls, and purse–seining efforts would contribute for harvesting the under–exploited resources of white baits, sardines, coastal tunas and carangids. For the northern parts of the lower east coast, introduction of both mid-water trawling and purse-seining would help in augmenting the returns from all the conventional varieties; for exploiting the cephalopods, mechanised jigging operations have to be taken up.

4.2.4. Upper east coast

By far the greatest quantum of fishing input is required for this region, in order to elevate its fisheries status and do full justice to the available potential. In fact, any type of mechanised effort, bottom trawling, mid–water trawling, purse–seining, long lining, jigging etc. is bound to bring in reasonable returns. In view of the limited traditional fishing and the slow pace in the introduction of mechanised coastal boats, it appears that the mechanisation programme with smaller vessels should be stepped up along with the programme for training of coastal fishermen. This would enable the present traditional fishing efforts to increase both in duration as well as in range of operation. Small boats of 10 to 12 m size could operate, besides shrimp trawling, purse-seining as well as pelagic trawling. The medium sized vessels of about 23 m size can venture into further areas for bottom trawling, mid-water trawling and purse–seining, To fish still more distant grounds, much larger boats of size 30 m and above; would be required.

4.2.5 Andaman Sea

The fishing efforts here will have to be aimed at the columnar resources such as tuna group of fishes and sharks by introduction of large tuna long liners, medium-sized liner-cum-trawler, pole and line fishing vessels and purse–

seiners without much delay. Small boats of 10 to 12 m size should also be introduced for pole and line fishing, gill netting, purse-seining, line fishing and trap fishing in order to exploit the other resources of clupeoids, scombroids, lobsters and perches.

4.2.6 Laccadive Sea

Herein also the emphasis would be on the tuna group of fishes by increasing the present mechanised fleet of small boats for pole and line fishing and introducing larger and medium-sized longliners as well as purse-seiners. Mechanised squid jigging operation should also be introduced.

4.3 Utilization

Leaving out the 0.5 million t of oceanic small fishes like lantern fishes and light fishes, development for which may have lower priority for the present, it would be seen that, of the remaining potential of four million t, about 25-30% of the varieties are high-priced as of today. About 20% may be unconventional types and the rest, though familiar, may belong to low-priced group. Unless processing technology is able to add value to these catches, intensified exploitation for these resources may not be economically viable. And, unless the fishing pressure is spread out on all the available resources, the current accelerated programme on offlshore fishing would eventually lead to over-exploitation of the existing valuable resources to the detriment of the industry as well as to the programme. The cardinal requirement, besides exploration and exploitation, is rapid development of utilization technology embracing processing techniques, shore facilities and marketing arrangements. Whithout this paramount support, all our efforts would not only be infructuous but are even fraught with a greater danger of becoming counter-productive and act as a deterrent for for further investment.

5. GENERAL CONSIDERATIONS

We are aware of a serious omission in this account of not giving any consideration for development of mangrove swamps and coral areas which is mainly because of lack of information; or, for that matter, coastal aquaculture as a means for augmenting our fish proudction, because the current ventures in this line are still in the beginning stage. Brackish water fish culture for varieties such as prawns, mullets, *'bhekti' (Lates)* and milk fish has assumed urgency in view of prevailing attractive prices in the domestic and external markets. We have nearly achieved a break through in breeding and culture of marine prawns.

For want of information on yield potential, we have also not touched upon the molluscan resources such as clams, mussels, oysters etc,, the present exploitation on which is of subsistence nature but, for which there is a good scope. When culture practices are widely adopted we can certainly expect a sizable quantity from the shell-fishes as well as from seaweed resources. There are also other living resources having industrial application which have not been dealt with in this account.

One projection of world fish production at the end of the century is about 230 million t, indicating an increase of 160 million t over the current yield, of which 40 million t is expected from the conventional varieties, 70 million t from unconventional varieties and 50 million t through aquaculture. Our estimation of marine capture fisheries envisages an increase of three million t over the most recent yield of which two million t is credited to the conventional varieties and the rest to other fishes, both known and unknown.

The present estimation of 4.0 million t for the continental shelf area of about 0.41 million sq. km. would indicate an average yield of 10 t per sq. km. This may appear rather high when compared with other productive regions of the world oceans. Except for the broad regions of northwest and south west Pacific, no major region is credited with such a potential production. Probably a finer dissection of the continental shelf areas may indicate zones of production equivalent to or greater than this figure. The fact that in the inshore area, which cannot be said to be fully exploited, the most recent production is 8 t. per sq. km and the amount of resources located in the region up to the shelf area would appear to justify our projection.

While some of the economically viable resources could be harvested by domestically owned enterprises, it cannot but be emphasised that the rate of exploitation and returns would be quicker and sustained if the local inputs are combined with foreign expertise. Joint venture approach, with built-in provision for counterpart training, for exploitation of oceanic resources like tunas and squids, offshore resources of cat fishes, ribbon fishes, carangids and perches and the continental slope resources of prawns, lobsters and fishes is the best way of not only exploiting these resources in the shortest time possible and converting them as economical marine products but also for developing local expertise in the new methods of fishing.

Future development of coastal fishery, which will be labour-intensive and which should make an approach for raising the labour wages above the subsistance level, will mainly rest on efficient organisation of fishermen co-operatives. This is a field in which results have so far been generally very discouraging. There are certainly some viable and efficient fisheries co-operatives still functioning in this country. The lack of adequate management personnel and lack of financial backing have been identified as the major bottlenecks in the healthy growth of fishery co-operatives (George, 1973). A detailed study of the fishery co-operatives and identification of the causes for the failure of many others would help in chalking out a constructive programme towards operational efficiency. Training for artisanal fishermen on diversified fishing and development of means and methods of post-harvest utilization are other spheres where efforts have to be increased.

It is not difficult to understand and appreciate the desire and anxiety of the fishing industry to have all the information on resources properly documented and the economic feasibility clearly indicated. While the importance of feasibility reports and pre-investment studies cannot be minimised, these requirements should not be over emphasised.

Fishing is an economic activity and as long as it is profitable, this activity will continue, intensify and expand irrespective of availability or otherwise of any feasibility report. The fantastic development of prawn industry in this country resulted after a propitious coincidence of small boats mechanisation, location of prawn grounds off Cochin and realisation of its export potential. This development never waited for any pre-investment studies. The present beeline of mechanised vessels towards the upper east coast for prawns is also another example; in fact, these grounds were located, by and large, by the industry itstelf. If exploitation of Wadge Bank and other offshore resources by such distantly based fishing fleet of countries such as Taiwan, Thailand and Republic of Korea could be economical, it is difficult to understand why India's industry hesitates to step in.

Today there are welcome signs of increased attention by entrepreneurs, traditionally involved in non-fishery activities, towards fisheries, and is certainly a good augury from the fisheries development point of view. It is hopefully expected that this trend picks up in the years ahead, not just for prawns alone but for all resources, so that our economic zone is fully saturated with fishing activity. An accelerated programme of offshore and deep sea fishing mainly through national efforts covering exploration, exploitation, research, training and processing, tied up with storage and distribution arrangements and involving all sectors of the industry, small, medium and large, can alone meet the challenge of timely and optimum utilization of all the living resources of our Exclusive Economic Zone.

6 SUMMARY

1. The declaration of 200 mile Exclusive Economic Zone by India has vested with her not only exclusive jurisdiction but also a great responsibility over optimum utilisation of the living resources. The area of this zone is about two million sq km, which is about five times the country's continental shelf area and probably twenty times the currently fished area. However, it should be remembered that the exploitable fishery potential cannot be raised by this factor.

2. After taking into consideration factors like the average annual growth rate of fish production, organic productivity and the current fish yield from unit area, a potential yield of 4.5 million t is estimated, which is about three times the present harvest and which could be realised before the turn of this century. This would consist of 2.5 million t from the inshore region up to 50 m depth, 1.5 million t from the offshore region up to the continental shelf and the slope and 0.5 million tonnes from the residual area of the economic zone. The pelagic fishes may constitute 2.1 million t, the demersal fishes 1.4 million t, the prawns, lobsters and other crustaceans 0.3 million

t and the cuttle fishes and squids 0.2 million t. The largest component of the yield is expected to be realised from the southwest coast (1.4 million t.) followed by the northwest coast (0.9 million tonnes), the lower east coast (0.7 million t) and the upper east coast (0.7 miilion t). The Andaman-Nicobar area is estimated to yield 160,000 t and the Laccadive sea 90,000 t. At present the first four regions respectively yield an average of only 0.54, 0.41, 0.35 and 0.03 million t. The combined harvest from the two groups of oceanic islands is only 3000 t.

3. The resources whose potential yield is between 200 and 300 thousand t are cat fishes, ribbon fishes, sciaenids, perches, white baits, tunas and related fishes. Those which are estimated to yield 100 to 200 thousand t each are oilsardine, other sardines, elasmobranchs (sharks, rays, skates), miscellaneous clupeoids, mackerel, Bombay duck and silver bellies. Other important varieties which may yield less than 100,000 t are the polynemids, pomfrets and seer fishes. The penaeid prawns have a potential yield for 180,000 t and the non-penaeid prawns 105,000 t and the lobsters, about 30-35,000 t. The potential level for cephalopods, particularly, the squids and cuttle fishes would be 180,000 t.

4. As compared to the present catches of these varieties, the largest increase has to come from the tuna group of fishes and cephalopod resources. The other significant increases are expected from perches (particularly, the rock cods, snappers, threadfin bream and lethrinids), carangids (particularly the horse mackerel and scad), white bait, cat fishes, ribbon fishes and jew fishes. The traditionally exploited varieties like the sardines, Bombay duck, mackerel and prawns will register only limited increase ranging up to 50% of their present harvest.

5. The areas which need our immediate attention are the upper east coast particularly, for prawns and cephalopods, the oceanic islands for skipjack and other tunas, the Wadge Bank for the perches, the deepwater grounds of the southwest and the peninsular curve for prawns and lobsters, the middle and outer shelf areas all along the coast for other varieties such as perches, carangids, cat fishes, ribbon fishes, white baits and the coastal waters for the underexploited segments of these and other conventional varieties as well as coastal tuna-like fishes.

6. It is suggested that pole and line, long line and purse seine fisheries have to be urgently developed for tunas and allied fishes. Mechanised jigging efforts have to be employed for exploitation of squids and cuttle fishes. Mid-water trawling and purse seining will have to be taken up all along the coast for the pelagic and columnar fishes. Trap and line fishing for the perches of the rocky grounds and trawling for deepwater prawns are the other lines necessary for enhancing the production. It also appears necessary to conduct surveys, in order to build up local expertise on these types of fishing techniques and to infuse confidence in the industry. Such surveys are required for tunas, cepha-

lopods, pelagic and columnar resources and for the entire east coast in general.

7. The cardinal requirement, besides exploration and exploitation, is a rapid development of utilization technology embracing processing techniques, shore facilities and marketing arrangements, without which all our developmental efforts would be not only infructuous but would even become counter-productive.

8. It is considered that 50% of the potential yield from the offshore resources of 1.5 million t would not have any difficulty for economically viable fishing operations. It is also realistic to take note of the quality of a sizable portion of the offshore and oceanic resources which would come under the category of "industrial fish". It is, therefore, suggested that joint venture approach with local inputs and foreign expertise and with provision for counterpart training would be the best way for speedy realisation of our objective. Future development of coastal fishery will mainly rest on efficient organisation of fishery co-operatives, development of processing technology, to add more value to those resources which at present remain under-exploited for economic reasons, and training programmes for artisanal fishermen on mechanised fishing.

9. While the industry's increased interest towards fisheries is appreciated, the industry is strongly urged to take advantage of whatever information is now available, direct or indirect, in order to help the nation to fulfil its responsibility of optimum utilization of all the resources of the economic zone.

10. A brief review of the status of the currently exploited fishery resources of the Indian ocean and the Indian coast precedes the above conclusions.

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Table I.

CATCHES OF MAJOR GROUPS OF FISHES IN THE INDIAN OCEAN
DURING 1971 TO 1975 ('000 t)

Varieties	1971	1972	1973	1974	1975	Average	% of Grand Total
1. **Diadromous Fishes**	25	26	23	18	29	23	0.8
2. **Demersal Fishes**	943	861	980	1152	1086	1005	35.0
a) Soles, red fishes, Congers, Basses group	552	423	441	622	563		
b) Sharks, rays group	110	145	177	143	143		
c) Other fishes	281	293	362	387	380		
3. **Pelagic Fishes**	1566	1382	1411	1640	1604	1521	52.9
a) Jacks, Mullets, Sauries group	94	97	106	164	119		
b) Clupeoids group	475	390	372	523	529		
c) Tunas, Bonito, Bill fishes group	241	227	246	273	248		
d) Mackerel, snoeks, cutlass fishes group	272	183	137	135	148		
e) Other fishes	484	485	550	545	560		
4. **Crustaceans**	232	249	300	332	346	292	10.2
a) Prawns & Shrimp	203	215	268	303	296		
b) Others	29	34	32	29	50		
5. **Molluscs**	26	32	34	26	20	28	1.0
6. **Others**	5	4	5	3	2	4	0.1
7. **Total**	2797	2554	2753	3171	3087	2873	100.0

Table II.

AVERAGE CATCHES (1972-1976) OF PRINCIPAL VARIETIES OF FISHES ALONG THE INDIAN COAST ('000 t)

Fishes	North West Coast	South West Coast	Lower East Coast	Upper East Coast	Islands	Total	Percentage
Pelagic fishes							
Oil Sardine	2	131	1	–	–	134	10.1
Other Sardines	2	34	50	1	–	87	6.5
Hilsa spp.	7	–	4	3	–	14	1.0
Anchoviella	1	17	19	–	–	37	2.8
Other clupeoids	33	6	28	4	–	71	5.3
Ribbon fishes	12	20	24	1	–	57	4.3
Carangids	3	11	12	–	–	26	2.0
Mackerel	3	53	12	–	–	68	5.1
Seer fishes	5	6	12	1	–	24	1.8
Tunnies	1	8	2	–	2	13	0.9
Others	10	48	17	4	1	80	6.0
Sub-total	(79)	(334)	(181)	(14)	(3)	(611)	(45.8)
Demersal fishes							
Elasmobranchs	17	14	28	1	–	60	4.5
Cat-fishes	11	27	17	2	–	57	4.3
Bombay duck	101	–	1	3	–	105	7.9
Perches	3	7	7	–	–	17	1.3
Sciaenids	36	14	17	3	–	70	5.2
Polynemids	7	–	3	–	–	10	0.8
Leiognathids	1	12	34	1	–	48	3.6
Pomfrets	20	3	8	2	–	33	2.5
Soles	3	10	1	–	–	14	1.0
Others	27	23	22	3	1	76	5.7
Sub-total	(226)	(110)	(138)	(15)	(1)	(490)	(36.8)
Crustaceans							
Penaeid prawns	28	80	16	3	–	127	9.5
Non-penaeid prawns	78	1	3	1	–	83	6.2
Other crustaceans	2	4	11	–	–	17	1.3
Sub-total	(108)	(85)	(30)	(4)	–	(227)	(17.0)
Cephalopods	1	2	2	–	–	5	0.4
Total	414	531	351	33	4	1333	100.0
Percentage	31.1	39.8	26.3	2.5	0.3	100.0	

Table III.

POTENTIAL YIELD FROM DIFFERENT GEOGRAPHICAL REGIONS OF INDIA BASED ON ORGANIC PRODUCTIVITY (IN MILLION TONNES)

	0 - 50 m			50 - 200 m			0 - 200 m.
Region	Net organic production	Total wet weight of biomass	Potential yield	Net organic Production	Total wet weight of biomass	Potential yield	Total Potential yield
North west coast	23 904	1.060	0 636	2.991	0.137	0.041	0.677
South west coast	6.178	2 147	1.288	2.870	0.158	0.047	1.335
Lower east coast.	10.339	0.569	0.341	2.695	0.148	0.044	0.385
Upper east coast	7.155	0 394	0.236	2.049	0.113	0.034	0.270
Total	47 576	4.170	2.501	10.605	0.556	0.166	2.667

Table IV.

ESTIMATED POTENTIAL YIELD (MILLION TONNES) BASED ON RATE OF FISH PRODUCTION (TONNES PER SQ. KM)

Region	0 – 50 m		50 – 200m		0 – 200m
	Rate	Yield	Rate	Yield	Total
Northwest coast	6	0.542	3	0.341	0.883
Southwest coast	30	0.701	15	0.721	1.422
Lower east coast	12	0.478	6	0.196	0.674
Upper east coast	20	0.540	10	0.195	0.735
				Sub-Total	3.714
Andaman & Nicobar					0.160
Laccadive					0.090
Residual area of the Economic zone					0.500
Total					4.464

Table V.

THE POTENTIAL YIELD (P. Y.), ('000 t) FROM IMPORTANT VARIETIES OF FISHES THE CURRENT AVERAGE YIELD (C. Y.). (THE BLANK COLUMNS DO NOT, YIELD IS LESS THAN 5000 TONNES OR INFORMATION IS LACKING TO ENABLE

Varieties	North west coast			Southwest coast			Lower east coast		
	C.Y,	P.Y. 0–50	50–200	C.Y.	P.Y. 0–50	50–200	C.Y.	P.Y. 0–50	50–200
1. Elasmobranchs	17	25	20	14	15	30	28	30	5
2. Cat fishes	11	30	60	18	40	80	17	20	5
3. Bombay duck	101	80	—	—	—	—	1	—	—
4. Perches	3	5	25	7	20	100	7	15	60
5. Polynemids	7	10	—	—	—	—	3	5	—
6. Sciaenids	36	60	10	14	20	—	17	20	—
7. Leiognathids	1	—	—	12	15	—	34	45	10
8. Pomfret	20	25	5	3	—	—	8	15	—
9. Oil-sardine	2	5	—	131	180	—	1	—	—
10. Other Sardines	2	5	—	34	40	—	50	70	—
11. Anchoviella	1	—	—	17	40	120	19	30	50
12. Other Clupeoids	40	50	5	6	10	—	32	40	—
13. Ribbon fishes	12	30	60	20	30	80	24	40	5
14. Carangids	3	10	60	11	30	80	12	15	10
15. Mackerels	3	5	—	53	80	—	12	15	—
16. Seer fishes	5	5	—	6	10	—	12	10	5
17. Tunas & Allied Fishes	1	—	10	8	10	50	2	5	5
18. Penaeid prawns	28	30	—	80	80	15	16	15	5
19. Non-penaeid prawns	78	80	10	1	—	—	3	5	—
20. Other Crustaceans	2	5	—	4	5	5	11	20	—
21. Cephalopods	1	—	20	2	5	30	2	5	15
22. Other fishes	40	80	55	71	70	130	40	60	25
TOTAL	414	540	340	531	700	720	351	480	200
23. Oceanic fishes (> 200 m)		—	—	—	—	—	—	—	—

IN THE 0-50 M AND 50-200 M AREAS OF DIFFERENT REGIONS, AS COMPARED TO HOWEVER, INDICATE ABSENCE OF THE VARIETIES; EITHER THE ANTICIPATED A PROJECTION)

Upper east coast			Total P.Y.			Andamans	Laccadives	Total	
C.Y.	P.Y. 0–50	50–200	0–50	50–200	0–200	P.Y. 0-200	P.Y.	C.Y.	P.Y.
1	25	15	95	70	165	10	10	60	185
2	55	20	145	165	310	—	—	57	310
3	20	—	100	—	100	—	—	105	100
—	15	—	55	185	240	10	—	17	250
—	20	5	35	5	40	—	—	10	40
3	70	30	170	40	210	—	—	70	210
1	30	—	90	10	100	—	—	48	100
2	30	10	70	15	85	—	—	33	85
—	10	—	195	—	195	—	—	134	195
1	15	—	130	—	130	10	—	87	140
—	—	—	70	170	240	—	—	37	240
7	45	—	145	5	150	10	5	85	165
1	25	—	125	145	270	—	—	57	270
—	50	10	105	160	265	—	—	26	265
—	—	—	100	—	100	5	—	68	105
1	10	—	35	5	40	5	—	24	45
—	5	5	20	70	90	100	50	13°	240
2	30	5	155	25	180	—	—	127	180
2	5	5	90	15	105	—	—	83	105
—	—	5	30	10	40	—	—	17	40
—	40	60	50	125	175	—	5	5	180
7	40	30	250	240	490	10	20	170*	520
33	540	200	2260	1460	3720	160	90	1333*	3970
—	—	—	—	—	—	—	—	—	500
								Grand Total	4470

* The catches of Laccadives and Andamans included.

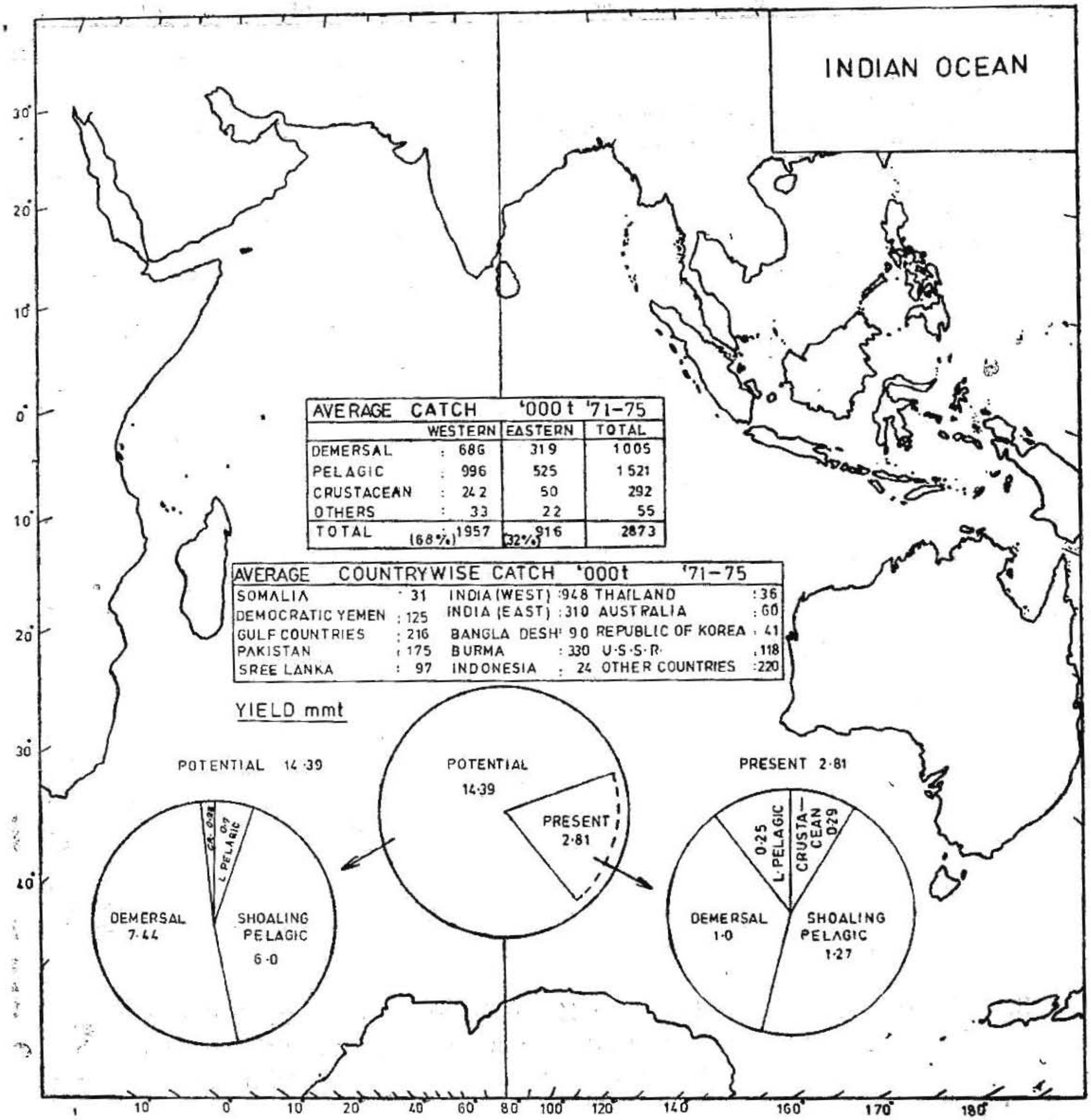


Fig. 1. Indian ocean map showing the average catches, variety, sector and country-wise – pie diagrams show the potential and present yield apportioned variety-wise.

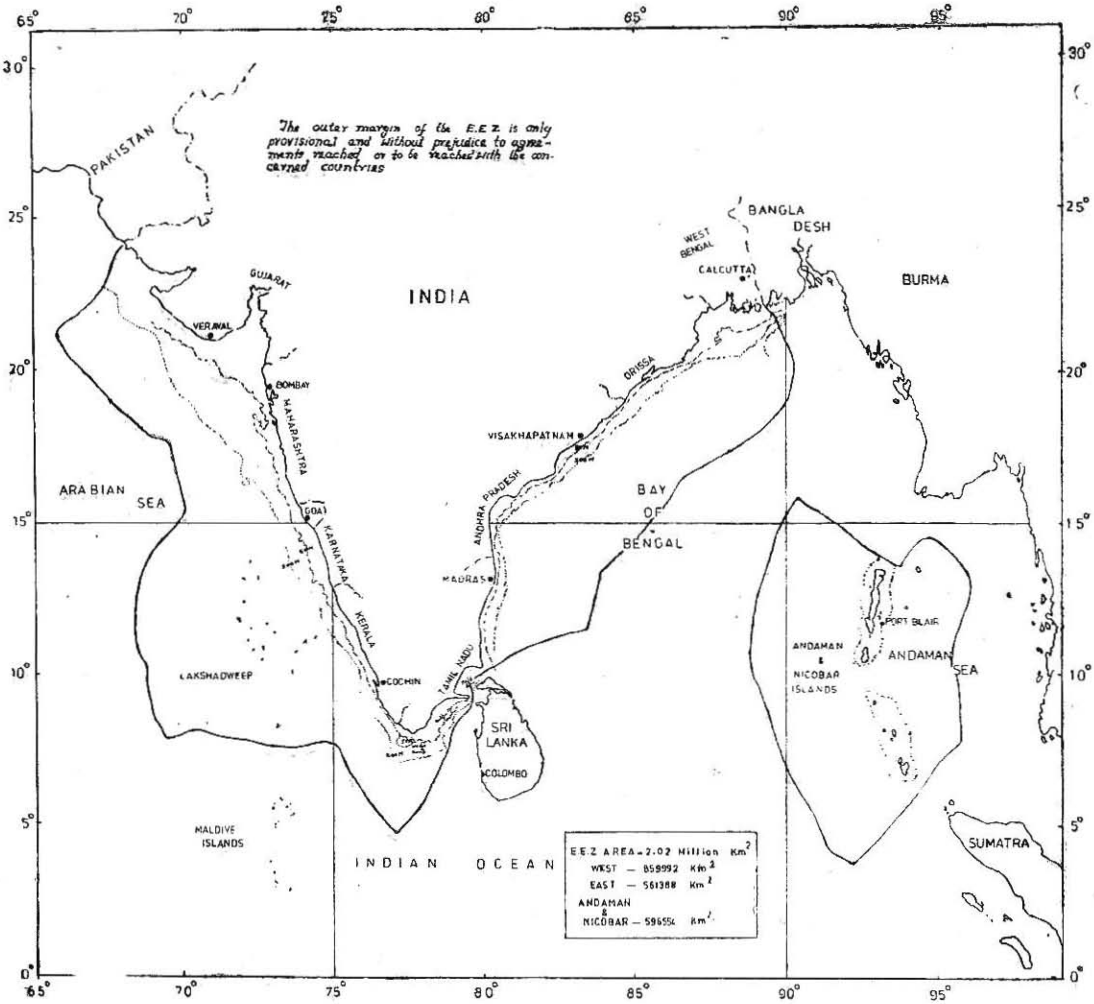
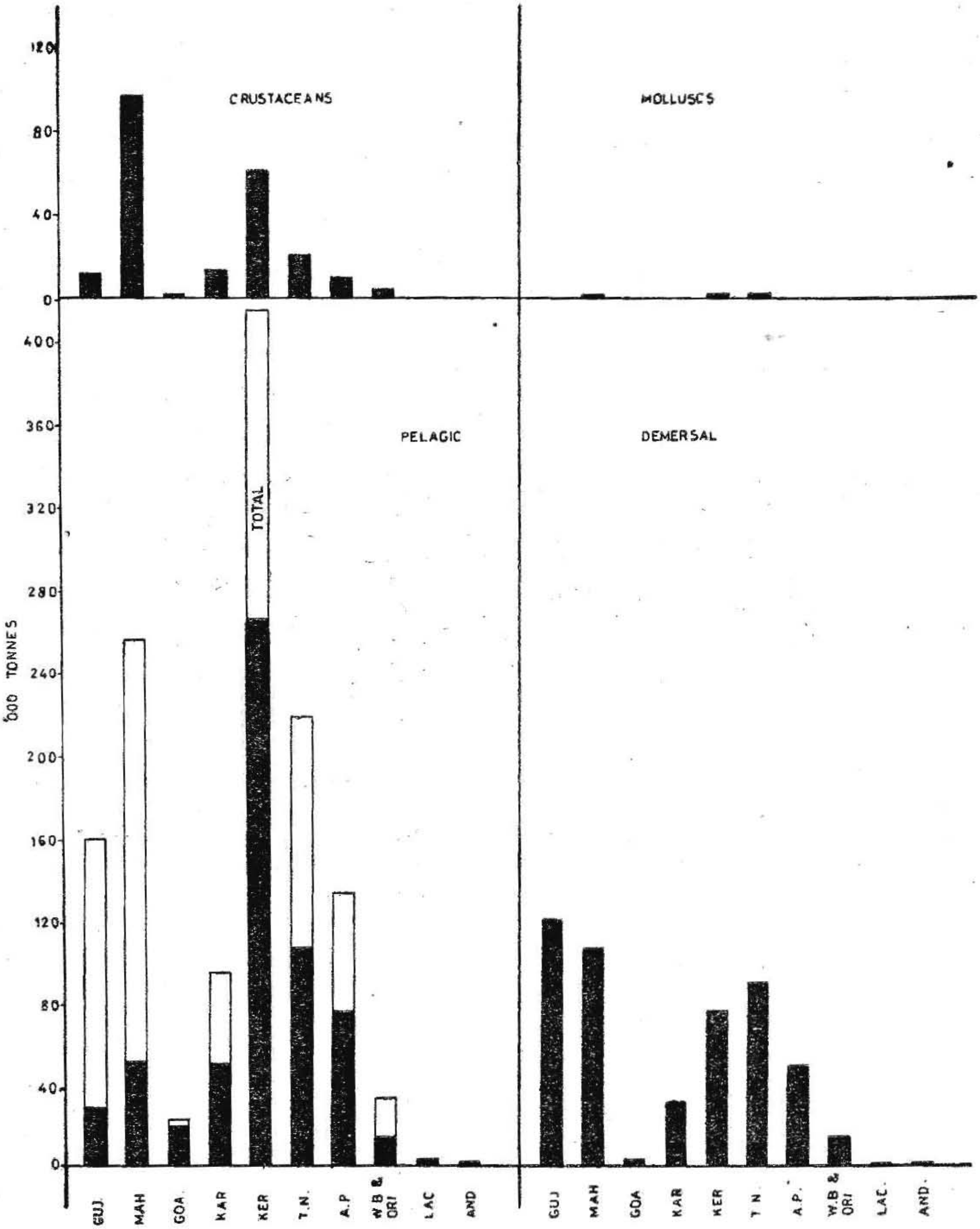


Fig. 2. Map of the Indian Economic Zone showing the boundaries and area. The outer margin of the economic zone is only provisional and without prejudice to agreements reached or to be reached with the eoncerned countries.



GUJ. GUJARAT   MAH MAHARASHTRA   KAR KARNATAKA   KER KERALA   TN TAMIL NADU
A.P. ANDHRA   W.B WEST BENGAL   ORI ORISSA   LAC LACCADIVES AND ANDAMANS

Fig. 3. Average catch (1972-76) - total and group wise for different states of India.

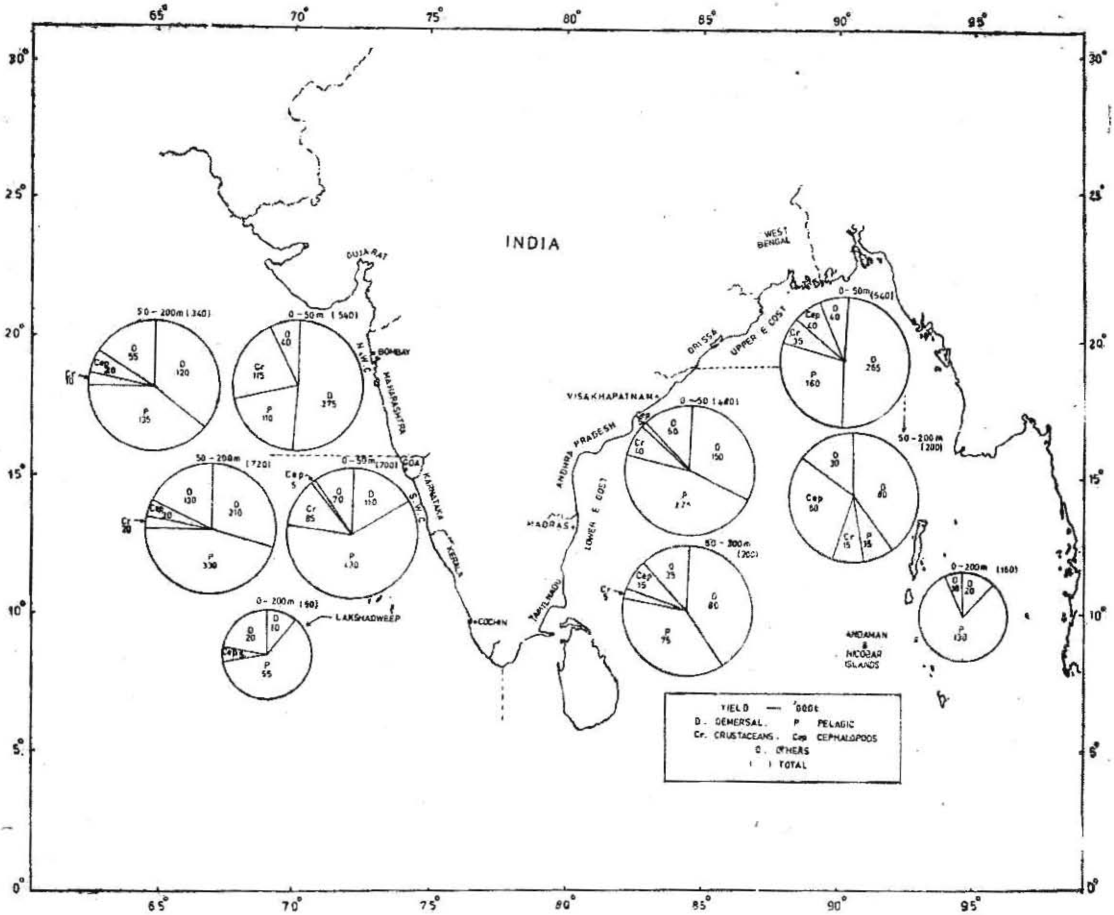


Fig. 4. Estimated potential yield '000 t. upto 200 m, for the different coastal sectors of India – figures in brackets against depth zones indicate the total potential yield – groupwise figures are shown inside the pie.