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PROSPECTS FOR INCREASING CEPHALOPOD PRODUCTION OF INDIA

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ABSTRACT

From the order of a 1000 tonnes in 1973 the cephalopod production has risen to the order of 43,000 tonnes in 1986. With aimed fishing, it is certainly possible to increase production of squids and cuttlefishes from the presently exploited zone. Under the aegis of the Marine Products Export Development Authority certain actions have been initiated in this direction in the recent past at experimental fishing level. Going by the data of some of the chartered fishing vessels that operated in the Indian waters during the last five years, squid and cuttlefish resources in the neritic waters appear to be substantial.

Octopus production reported from Lakshadweep is very nominal, being about 16 tonnes/annum. Scope, if any, for improving this production and exploring new grounds needs detailed investigation.

From the oceanic waters of EEZ and beyond, the prospects are for the oceanic squids, considered next only to the tuna resources in importance. However, the information on the resource is more of a qualitative and indicative nature from the operation of research vessels in the Arabian Sea such as R. V. *Varuna* and R. V. *Shoyo Maru* and presently F. O. R. V. *Sagar Sampada*.

In the above background, the paper discusses the research and development needs for increasing production of cephalopods in India and suggests an organised cooperative programme among the governmental agencies concerned on the one hand and the industry on the other.

INTRODUCTION

Production of cephalopods in India showed a phenomenal increase during the last two decades from an order of a thousand tonnes in 1966 to an order of forty thousand tonnes in 1986. Even as the total marine fish production of the country stagnated between 1.2-1.4 million tonnes in the decade 1973-1982, cephalopods showed a consistent upward trend increasing from 1394 t to 15,799 t during the same period. No special fishing effort has been responsible for this, as the squids and cuttlefishes are incidentally caught by the shrimp trawl and other gears as bye-catch. It is the import needs of Japan, starting from the early seventies, that turned the table in favour of cephalopods which had till then been thrown overboard by the boats. Starting from an order of Rs 200,000 in 1973, the export earnings by cephalopods stood at Rs. 135,660,000 in 1985.

Apparently the trend suggests that the cephalopod fishery is in an expanding stage with reference to the effort. However, the neritic species of loliginids and sepiids have only a limited potential in the shelf region. In the world total fish catch, cephalopod contribution, despite industrial fisheries carried out by Japan, Spain, Italy and Republic of Korea in various areas, is only a small proportion of 1.5-2.1%. India's cephalopod contribution is already in this range and 1986 contribution was 2.5%. The additional potential in the coastal waters may be limited. The under- or unexploited pelagic ommastrephid squids seem to have a tremendous potential in the world oceans (estimated potential 60-70 million t according to Voss, 1973). A quantum jump in cephalopod contribution of India would be possible only from the EEZ. The moot question is how India proposes to meet this challenge to increase production in time when Japan's requirements for cephalopods are on the increase before other additional sources of supply are established by Japan.

GROWTH AND STATUS OF CEPHALOPOD FISHERY IN INDIA

Hornell (1950) described the 'squid machines' used for hand jigging of squid from a look-out erected in the shallow waters of

Rameswaram Island. In the same publication, he dealt with the method of fishing for octopus using *Pterocera* shell-lines in the Palk Bay. The squid and octopus were caught for use as bait in fish hooks, as these animals formed an excellent bait. Rao (1954) later described the fishery of Palk Bay squid *Sepioteuthis lessoniana*. The squid was consumed by certain class of people in the coastal areas. With the programme of mechanisation and development of shrimp fishing in the sixties, more of squids and cuttlefish were caught but not landed as they had no value in the market. Only the cuttlebones had an export market and, between 1963 and 1972, the export of cuttlebones ranged from 421 kg to 27,228 kg. Cephalopod production during the above period ranged from 260 t to 1517 t.

All-India production of cephalopods

The export market for cephalopod marine products commenced in 1973 for frozen cuttlefish, 1974 for frozen cuttlefish fillets and in 1975 for frozen squids. Thereafter those caught in the trawlers and other gears were saved and the landings showed steady increase. The growth in Cephalopod production since 1973 is shown in Fig. 1. Except for the decrease in 1980 and 1981, the curve has been an ascend-

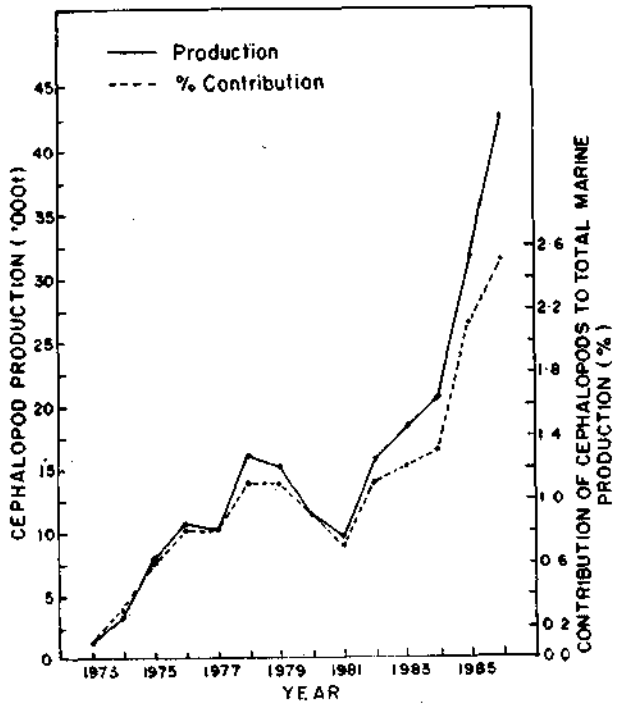

FIG. 1. Growth in cephalopod production and its contribution to total marine production.

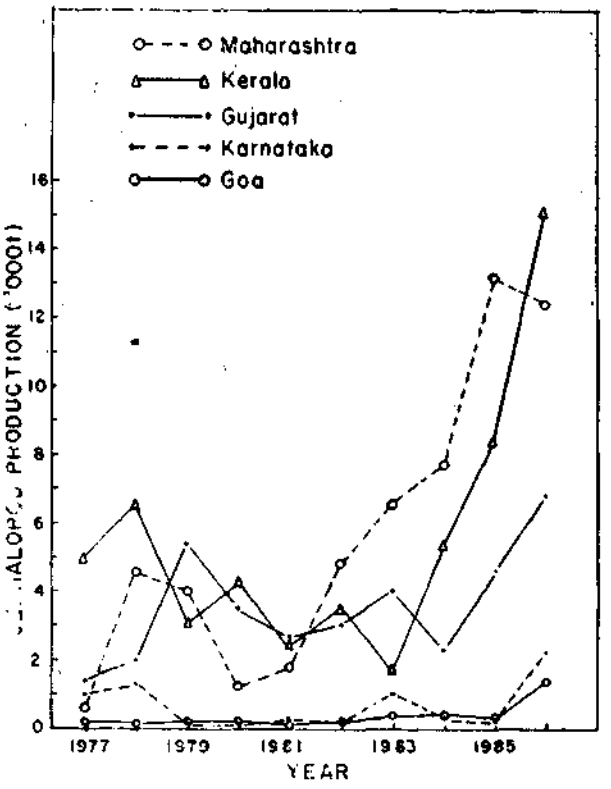

FIG. 2. Trend in cephalopod production in maritime States along the west coast.

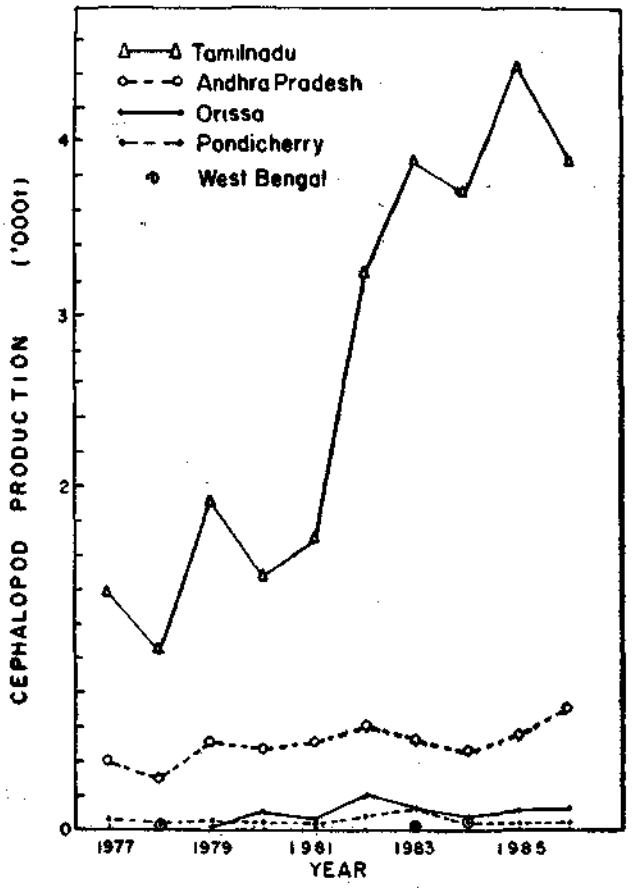

FIG. 3. Trend in cephalopod production in maritime States along the east coast.

ing one, from 1394 t in 1973 to 42,638 t in 1986. The share of cephalopods in total marine fish production steadily increased from 0.1% in 1973 to 2.5% in 1986.

State-wise production

Production along the west coast (Fig. 2) has dominated the cephalopod landings of India with 69-91% contribution as compared to 9-31% from the east coast (Fig. 3) during the recent decade 1977-1986. On the west coast the average annual landings of the decade were as follows.

	Annual production of cephalopods (t)	% contribution to total cephalopod production of India
Maharashtra	5661	29.7
Kerala	5510	29.0
Gujarat	3565	18.7
Karnataka	664	3.5
Goa	335	1.8
Total West coast	15745	82.7

Production figures for the eastern coastal States are given below:

	Annual production of cephalopods (t)	% contribution to total cephalopod production of India
Tamil Nadu	2664	13.9
Andhra Pradesh	502	2.6
Orissa	77	0.4
Pondicherry	56	0.3
West Bengal	11	0.1
Total East coast	3310	17.3

Octopod production comes only from Lakshadweep and the annual average was 16t.

Gear-wise production

The average annual production of cephalopods during the three-year period 1982 to 1984 was 18,192 t of which the trawlers contributed 13,127 t (73%). On the same percentage basis, the average annual production of cephalopods by trawlers in India during the subsequent two-year period 1985 and 1986 would be 27,112 t which is double at of the previous 3 year period.

Regarding the traditional gears accounting for 27% of total cephalopod production, data are not available to work out the gear-wise contribution. However, Vizhinjam where there have been no trawler landings and the entire fish production of the centre came from the artisanal sector, the average annual cephalopod production during the five-year period from 1982-83 to 1986-87 was 578 t. The contribution of different gears to the above has been 76.5% by boat seine, 23.3% by hook & line and 0.1% by shore seine. The data show that boat seine is the second most important gear for cephalopod capture and the primary one among the artisanal gears.

Group/species production

Group/species-wise production of cephalopods is not available except for the trawler catch at selected centres. The observations made at the fisheries harbours at Veraval, Bombay, Mangalore, Cochin, Rameswaram, Madras and Visakhapatnam showed that the cuttlefish contributes to 57.2% and squids to 42.8% of total cephalopod landings. Since 73% of the total cephalopod production of the country is by trawlers, the above proportion can be generally used to arrive at the cuttlefish and squid components of total all-India cephalopod production. Accordingly, out of the average annual production of 25,771 t of cephalopods during 1982-1986 period, the cuttlefish were 14 741 t and squids 11,030 t.

Squids: In the class Cephalopoda, order Teuthoidea represent the squids. This order consists of four families, namely Loliginidae, Onychoteuthidae, Ommastrephidae and Thysanoteuthidae. In the presently exploited Indian waters, only the following Loliginid squids are represented: *Loligo duvaucelii, L. uyii, Loliolus investigatoris, Doryteuthis sibogae, D. singhalensis* and *Sepioteuthis lessoniana*. Of these, *L. duvaucelii* is the most dominant species. *L. uyii* forms an insignificant component (less than a tonne) at Madras. *L.*

investigatoris is caught in small quantities at Madras, Kakinada and Visakhapatnam (together less than a tonne). *D. sibogae* and *D. singhalensis* form a good artisanal fishery at Vizhinjam and also occur in the trawler landings at Visakhapatnam. The fishery for *S. lessoniana* is confined to Palk Bay although recorded from Vizhinjam, Veraval and Lakshadweep. Out of the annual average squid production of 11,030 t, *Sepioteuthis* and *Doryteuthis* together would contribute an estimated 300 t, and *L. duvaucelii* to the rest of 10,730 t, *i. e.* about 97% of the squid production is by this single species.

Cuttlefish: The taxonomic order Sepiidae (Sub-class Coledidae) is comprised of 2 families namely Sepiidae and Sepiolidae. The latter family is represented by a single species *Enprymna stenodactyla* which occurs as stray catches (not more than about 200 kg/year) at Madras and Proto Novo. Family Sepiidae is the most dominant in the coastal waters and is represented by two genera *Sepia* and *Sepiella*. The cuttlefish species occurring in the fishery with their percentage contribution are as follows: *Sepia aculeata* -52.7%, *S. pharaonis*-37.4%, *S. elliptica*-7.6% S. *brevimana*-0.3%, *S. prashadi*-0.1% and *Sepiella inermis*-1.8%. The occurrence of *Sepia trygonina* and *S. arabica* has been recorded. *Sepia aculeata*, *S. pharaonis* and *Sepiella inermis* are landed in all the maritime States. *sepia elliptica* forms fishery at Veraval and Cochin; *S. brevimana* at Visakhapatnam, Madras and Mandapam and *S prashadi* at Madras.

Catch-per-unit-effort

The proportion of cephalopods in the trawler landings and CPUE at some of the observation centres are given in Table 1. The data would indicate the predominant position of Bombay and Veraval on the north-west coast, Sakthikulangara on the south-west coast, Madras on the south-east cost and Visakhapatnam on the north-east coast for cephalopod production. Both New Ferry Wharf and Sassoon Docks in Bombay emerge as the leading cephalopod landing centres in the country.

TABLE 1

Cephalopod landings by trawlers with catch-per-unit effort at some fisheries harbours (Annual average of 1982-1984).

Centre	Cephalopod component in total trawler landings (%)	CPUE of Cephalopods (kg/trawler-day)
Veraval	4.7	53.8
Bombay New Ferry Wharf	6.7	112.5
Bombay Sassoon Docks	9.2	133.4
Mangalore	2.2	5.3
Cochin	1.0	2.4
Sakthikulangara	4.4	15.2
Rameswaram	1.0	2.4
Mandapam	1.5	2.0
Nagapattinam	1.0	2.4
Cuddalore	2.0	5.7
Madras	4.1	11.0
Kakinada	1.0	3.4
Visakhapatnam	3.1	6.7

Export of cephalopods

The export items of cephalopods include cuttlebone, frozen cuttlefish, frozen cuttlefish fillets, frozen squid and dried squid. The cuttlebone had been exported from very early times and the last 10 years' stands at average 26 t. The dried squid is a recent product since 1984.

TABLE 2

Cephalopod production and exports during 1981-1985

Year	Cephalopod landings (t) in India	Cephalopod Products* exported (t)	Approximate landed weight of the exorted quantity (t)
1981	9548	2802	4670
1982	15799	3235	5392
1983	18355	4024	6707
1984	20421	3128	5213
1985	31642	7623	12705
Average	19153	4162	6937

*Cuttlebones not included.

Total cephalopod production exported during the five years 1981-85 are given in Table 2. The yield of squids and cuttlefishes is assumed to be an average 60% and the landed weight of exported quantity has been calculated on this basis. It is evident from the data (Table 2) that a large amount of cephalopods landed is under- or unutilised while the domestic consumption is negligible.

SURVEY OF CEPHALOPOD POTENTIAL IN OFFSHORE AND OCEANIC WATERS

One of the major resources projected for exploitation in the Exclusive Economic Zone of India and the adjacent sea is the cephalopods. This has two components, the one on the continental shelf waters (neritic benthic and pelagic) and the other in the oceanic waters. The shelf component would include the additional resources of squids and cuttlefishes that are available in waters beyond the present fishing limits and also increased catches that would result in the event of directed fishing for these species. The oceanic component would comprise the oceanic squids.

Present grounds

As has been seen earlier, the entire cephalopod production of India today comes as bye-catch of demersal trawl, boat seine, shore seine and hook & line fishery. In the presently exploited inshore waters upto 50 m depth, there seems to be further scope to increase production of cephalopods. During the last 10 years the cephalopod landings have grown steadily in spite of the slump in overall marine fish production. The annual average cephalopod production increased to 17,740 t during 1981-85 from 12,626 t during 1976-80. The estimated 1986 production was around 43,000 t. Based on the stocks (1978-80 data) estimated at a few centres namely Madras, Cochin and Vizhinjam for the three major species *Loligo duvaucelii, Sepia aculeata and S pharaonis*, the projected all-India average annual stock of of these species has been given as 56,984 t (Silas *et al.*, 1986).

In the recent years subsequent to the introduction of the high-opening bottom trawl (HOBT) at some centres in Tamil Nadu and Gujarat through the extension demonstration of Bay of Bengal Programme and followed up by Central Institute of Fisheries Nautical and Engineering Training in Gujarat, there appears to be a possibility of increasing cephalopod production. In Gujarat, high incidence of squids and cuttlefish was noticed in this new net and in some operations squids formed as high as 24.1% of the catch off Dwarka in the depth range 20-25 fathoms (Swaminath and Vethabothagam, 1987). While the conventional shrimp trawl has hardly 1-1.5m vertical opening, the HOBT has an opening of 3.5-4.5 m facilitating capture of columnar-fishes.

Squid jigging and stick-held dipnet are two standard cephalopod fishing gears used in the Japanese fisheries for the pelagic squid *Todarodes pacificus*. In India, an experimental programme for testing these gears for the coastal cephalopods, was carried out in 1985 by the Marine Products Export Development Authority with the help of a Japanese expert. The experiments carried out at Cochin and Vizhinjam with manual squid jigging machine and stick-held dipnet on board a 43 ft (13m) vessel yielded a catch rate of 102 squids/hour (Yamasaki, 1985) indicating the technical feasibility of operating such gears in the coastal waters. The work has not, however, been followed up subsequently. If cephalopod production has to show a quantum jump, it is inescapable to introduce fishing methods directed for the squids and cuttlefish.

Offshore resources

The cephalopod resources in the grounds beyond 50 m depth have hardly been touched so far. Pelagic trawling by the erstwhile Pelagic Fisheries Project's vessels off the south-west coast of India and Gulf of Mannar in the seventies has shown considerable concentration of squids and cuttlefishes in the central and southern sectors of the region. The squids formed 4% of the catch in 20-49 m, 34% in 50-80 and 13% in depth beyond 80 m during 1974 between Quilon-Cape Comorin and the Gulf (UNDP/FAO, 1976).

The operations of vessels of the Fishery Survey of India have provided information on the cephalopod resources of the offshore waters. The survey vessels have recorded a catch rate of 20kg/hour of squids and cuttlefish from Wadge Bank and 22 kg/hour from Kerala Coast (Joseph, 1986). The results of operation during October 1981-April 1983 on the Wadge Bank showed an overall cephalopod content of 6 6% of the demersal catch, next only to that of perches (36 3%), Nemipterids (23.8%) and rays (10.1%). *Sepia pharaonis* was the dominant species with 80% composition and *S. aculeata* and *Sepiella inermis* formed stray catches. Among the squids *Loligo duvaucelii* was the important species, with occasional catch of *Sepioteuthis lessoniana* The depth-wise catch rates showed high density in 10-25 fm (17.5kg/hour), thereafter decreasing progressively to 5.5 kg/hour in 25-40 fm, 3.1 kg/hour in 40-70 fm, 0.7 kg/hour in 70 100 fm and 0.9 kg/hour in 100-125 fm (Joseph *et al.*, 1987). The same authors have estimated the standing stock of cephalopods in the first four depth zones above, respectively, as 952 t, 404 t, 219 t and 30 t totalling to 1605 t for the Wadge Bank as a whole, out of a total fish biomass of 38,330 t. Exploratory data on cephalopods of the east coast are scanty and the available data have shown a poor catch rate of 3 kg/hour (Joseph, 1986).

The foreign trawlers which operated in the recent years under charter in the Indian EEZ, had concentrated on squids and cuttlefish, more particularly on the latter group, besides shrimps and perches. Joseph (1986) reported that the chartered vessels were taking sizeable quantities of squids and cuttlefish ranging from 60-80% of the total catch declared by them. The cephalopod catch rates by some vessels along the west coast were 61.9 kg/hour in the latitudes 7°-9°N, 106.0 kg/hour in 10°-12°N, 76.2 kg/hr in 13°-14°N and 100.6 kg/hr in 16°-17°N. It has also been reported that recently one of the chartered vessels had a catch rate of 106 kg/hr of cephalopods with a total catch of 120 t in the depth range 60-80 m (Joseph, 1986).

M. T. *Murena* which explored the resources of the north-west coast of India during 1977 caught a total of 1015 kg of cephalopods, 761 kg from demersal trawl and 254 kg from pelagic trawl, forming 0.2% of total fish catch of the vessel on its survey. The major species were *Sepia aculeata, S. pharaonis* and *Loligo duvaucelii*. The catch rates in demersal trawl were 2.14 kg, 1·73 kg and 1.50 kg per hour from depth zones 55-90, 91-125 and 126-360 m respectively (Bapat et al., 1982). The pelagic catch was the highest in the depth 55-90 m.

Since 1985, the Fishery and Oceanographic Research Vessel *Sagar Sampada* has carried out fishery resources survey in the EEZ of India. The operations were in the depth zone of 50-200 m with a few exceptions of deep water trawling. *Sepia pharaonis* and *Loligo duvaucelii* were the dominant species. The stations where the cephalopod component was more than 40% of the catch with the depth are given below:

	Position		Depth (m)	Dominant Species
West Coast				
1.	08°43'N	76°10'E	80	*S. pharaonis*
2.	11°40'N	74°56'E	63	,,
3.	12°22'N	74°26'E	127	,,
4.	13°51'N	73°17'E	213	,,
5.	14°31'N	73°24'E	101	,,
6.	15°02'N	73°34'E	58	*L. duvaucelii*
7.	15°30'N	73°15'E	70	*S. pharaonis*
8.	18°01'N	71°37'E	93	,,
9.	18°58'N	71°02'E	86	*S. pharaonis* and *L. duvaucelii*
10.	21°26'N	68°58'E	70	*S. pharaonis* and *S. trygonina*
East Coast				
11.	10°35.7'N	80°11.02'E	72	*L. duvaucelii*

The exploratory and commercial data presented above would indicate that, as in the case of inshore waters, the offshore areas between depth 50-200 m off the west coast have much greater resources of cephalopods than those of the east coast.

Oceanic resources

The data available on oceanic squid resources around India are qualitative and indicative of a vast potential. The information is from the surveys of research vessels of India as well as of other countries which worked in the Arabian sea and Bay of Bengal on international programmes. R. V. *Varuna* of the erstwhile Indo - Norwegian Project which worked on the programmes of the Central Marine Fisheries Research Institute brought out the early direct information on the occurrence and abundance of oceanic squids in Lakshadweep Sea and south-eastern Arabian Sea (Silas, 1969). The occurrence of the Ommastrephid squid *Symplectoteuthis oualaniensis* in the Indian waters was highlighted in the above work. Filippova (1968) reported the occurrence of several species of oceanic squids in the Indian Ocean with their distributional range. *S. oualaniensis* inhabits tropical waters up to 20°S. Further south, it is replaced by *Ommastrephes bartrami* and *Todarodes sagittatus engolensis* up to 37°S.

R. V. *Shoyo Maru* of the Japanese Fishery Agency, in co-operation with IOP and FAO, carried out surveys of the North Arabian Sea off Pakistan and Central part of the south Arabian Sea during 1975-77 (Fishery Agency of Japan, 1976, 1977). The vessel gave special attention to the distribution and behaviour of the oceanic squid *S. oualaniensis* in the area by acoustic survey and sampling by hand-lines. Dense echo records of the squid in the offshore waters of 200 m depth or more were received by the vessel. The squids caught ranged 17.4-48.8cm in mantle length, the largest weighing about 4 kg.

In 1986, a single specimen of *S. oualaniensis* of 43.4 cm mantle length and 2.46 kg weight was caught in drift gill net at a depth of 80 m off Mangrol in Gujarat (Raje, pers. comm.)

FORV *Sagar Sampada* has recently caught *S. oualaniensis* during her survey in the Indian EEZ. The squid in large numbers have been observed on many occasions congregating around the vessel in the night, attracted by her lights. Since the vessel is not equipped for squid fishing, the squids could not be caught except on rare occasions by handline. However, on her cruise No. 22 in October, 1986, the vessel caught about 700 oceanic squids in 10 Pelagic/midwater hauls, along with mesopelagic fishes, off the north west coast of India (Lat. 18°-22°N, Long 64°-69° E). The squids were caught in trawling depth of 40-250 m and bottom depth of 2496-3444m. The squids measured 6.5-47.2 cm in mantle length and the largest weighed 3.5 kg. Clear indications of availability of oceanic squids in the Indian EEZ have thus become available.

POTENTIAL ESTIMATES

Voss (1973) estimated the cephalopod potential of Indian Ocean region at 500,000t. George *et al.* (1977) estimated the potential for Indian EEZ to be around 180,000 t of which 55% is to come from the upper east coast, 11% each from lower east coast and north-west coast and 20% from the south-west coast. Recently Chikuni (1983) estimated the potential of Indo-Pacific region to be about 1.1 to 1.4 million tonnes as against a catch of 0.3 million tonnes. His estimates for Bay of Bengal and Eastern Arabian Sea respectively are 50,000-100,000 t and 100,000-150,000 t. Silas (1986) cosidered Chikuni's (1983) estimates too low for the area as compared to the estimates for the neighbouring regions such as the Yellow Sea, East China Sea and South China Sea. Silas (1986) estimated India's potential harvest by 2000 A. D. by small scale neritic sector at 50,000 t and oceanic sector at 25,000-50,000 t.

RESEARCH & DEVELOPMENT NEEDS

The cephalopod production in India has shown a steady growth since the exports began in 1973. However, considering the potential of the resources as well as demand for export, India can do much better.

On a global scale cephalopods accounted for an annual average of 1.60 million t during 1981-82. The percentage contribution has ranged from 2.1-5% of total world marine fish production. The squids with 1.16g million t

contributed to 72.22% total cephalopod production, followed by cuttlefishes (232,000t and 14.52%) and Octopus (212,000 t and 13.26). The major cephalopod fishing areas in the world are in the North West Pacific (Japan, ROK, China, Taiwan, USSR), Central East Atlantic (Western Africa), North West Atlantic (Canada), Mediterranean (Spain, Italy), South West Pacific (New Zealand), South West Atlantic (Latin America) and Central East Pacific (U. S. A., California) (Worms, 1983). The most dynamic cephalopod fishery in the world exists in Japan with an annual average production of 577,866 t (1982-85 period), of which squids formed 90.4%, cuttlefish 2.3% and octopus 7.3%. Republic of Korea with 175,508 t and Spain with 104,552 t are behind Japan. The cephalopod fisheries are carried out on an industrial or semi-industrial scale in Japan, Korea, Canada, U. S. A. (California), Italy and Spain and in other countries the fishery is of a very local food character (Worms, 1983). Distant Water fishing fleets of Japan, Korea, Spain and U. S. S. R. operate in several important cephalopod fishing grounds of the world and, in fact, the development is due to such fishing activities under licensing arrangements or joint ventures.

In India, it has been very well realised that cephalopods are one of the resources of future but very little has been done to improve the fishery. The increase in landings reaching the order of 40,000 t in 1986-87 is not due to any specific development programme but a natural increase in the bye-catches of the trawlers and other artisanal gear. The only attempt that has been made was the experimental fishing carried out by the Marine Products Export Development Authority in 1985 which has not been followed up so far. A squid jigging vessel which has been in India for the last several years has not carried out any work on this line for want of expertise and for having fixed the priority to tuna long lining over squid jigging, as it is a combination vessel. Recently some interest in developing the octopus fishery in Lakhadweep was evinced but it was soon realised that the resource is very limited for taking up any worthwhile programme in the lagoons of the islands. Thus India is yet to make a beginning towards exploitation of cephalopods on modern lines and on an industrial basis.

Silas (1986) has elaborately dealt with the perspectives, priorities and targets for 2000 A.D. with regard to cephalopod resources of India The potential harvest by 2000 A. D. has been given as 50,000 t from the small-scale fisheries operating in the neritic regime and 25,000-50,000 t of oceanic squids from the oceanic regime. The inshore production through bye-catch has, after the above article was written, already reached the order of 32,000 t in 1985 and 43,000 t in 1986. There have been no landings of cephalopods from the 50-200 m depth zone. This zone has good cuttlefish potential as has been shown by the operation of chartered vessels early this decade, although accurate data on these resources and grounds have not been made available. It stands to reason, therefore, that the neritic potential can be much higher than the 50,000 t projected by Silas (1986).

With regard to the oceanic squid resources it remains open until systematic surveys are carried out in the EEZ. The results of FORV *Sagar Sampada* referred to earlier are still indicative, perhaps a slight improvement over the acoustic results given by R. V. *Shoyo Maru* (Fishery Agency of Japan, 1976, 1977) and the earlier data of R. V. *Varuna* (Silas, 1969) and the U. S. S. R. survey vessels (Filippova, 1968). Systematrc quantitative data on oceanic squid resources can come only from survey by vessels rigged for appropriate light fishing with automatic jigging gear. Both Australia and New Zealand had arrangement with Japan for exploring their cephalopod resources upon which New Zealand has developed a successful squid fishery. West African States and Canada had to enter into arrangements with industrial squid fishing countries for developing their cephalopod fishery.

India has the institutional framework for undertaking a major programme on cephalopod research and development. It would need outside technical assistance initially to launch a meaningful programme. Within the country, there is need for an unified approach. This can be achieved only through a well-planned

mission-oriented cooperative R & D programme among the agencies now engaged in cephalopod work. In such a programme the Fishery Survey of India, the Marine Products Export Development Authority, the Central Institute of Fisheries Technology and the Central Marine Fisheries Research Institute should be represented under a single line of leadership. The resources from each of these organisations may be pooled and augmented to the necessary extent. This will be an experiment in the fisheries sector and if it works well the concept could be extended to other major resources.

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