CEPHALOPOD FISHING

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INTRODUCTION

CEPHALOPOD resources are distributed in several areas along the Indian coasts and are exploited since a very long time for food or use as bait and in the case of cuttlefish also for their calcareous cuttlebones. Until the middle of this century, squids and cuttlefishes were exploited in conventional fishing gear including some specific gear in a few areas (Rao 1954, 1969, Silas *et al* 1985, Alagarswami, and Meiyappan 1989). The squids and cuttlefishes were eaten by people in coastal areas or used as bait in hook and line fisheries. Often they were discarded lest they discoloured quality fin fishes and prawns along with which they were got. From 1973 they are caught in steadily increasing quantities mostly in trawl nets operated by mechanised vessels. With the growing demand from export trade, squids and cuttlefishes are collected, cleaned, processed, frozen and exported to several countries profitably. In Japan, Republic of Korea, Spain, Canada and U.S.A. cephalopod fisheries are advanced with modern fishing technology. In this context cephalopod fishing in India and prospects for stepping up production by adoption of specialized gear are of importance and are dealt with in this paper.

FISHING METHODS

Shore Seines

The squid, *Sepioteuthis lessoniana* is fished in Palk Bay in a small shore seine known as *Ola valai* with split palm leaves tied to the wing ropes of the seine. The palm leaves serve as flares due to which squids swim into the net. There is a regular fishery from beginning of the year upto March to June for *Sepioteuthis lessoniana* in Palk Bay in Mandapam Rameswaram area with *Ola valai* with a minor fishing season in September-October (Rao, 1954). A maximum of 30-80 kg of squids are got in one operation of the net. In addition fishermen operate hand lines in shallow waters in the area and catch the squids. In earlier times fishermen used to fish *S. lessoniana* sitting at night at the top of a tree branch erected in the coastal water and operating a jig which consisted of a long wooden pole at the end of which four hooks were tied in grapnel manner (Hornell, 1917). Tree branches with leaves were kept in the water below the sit out. When squids came towards the leaf clusters to take shelter or deposit egg capsules the jig was pushed down and squids got entangled in the hooks of the jig.

Squids and cuttlefishes in coastal waters are caught in small quantities in shore seines operated along both east and west coasts of India for finfishes in inshore waters. The shore seines are conical bag nets of varying size and design and are known by different names viz., *Sarini jal* in West Bengal, *Pedda vala* and *Alivi vala* in Andhra Pradesh, *Kara valai* and *Peria valai* in Tamil Nadu, *Kara vala, Kara madi* and *Kamba vala* in Kerala and *Rampan* and *Yendi* in Karnataka. Small to moderate

numbers of squidsor cuttlefishes are caught in the shore seines. In the last two decades there is fall in operation of shore seines with the fishermen taking up trawling for fishing.

Boat seines

Small quantities of squids and cuttlefish are caught in conical shaped boat seines operated using two canoes or catamarans for finfishes in subsurface waters. The boat seines are *Iraga vala* in Andhra Pradesh, *Turi vala* in Tamil Nadu and *Thattu madi, Kolli vala* and *Paithu vala* in Kerala.

Dol net

The *Dol* net used in Maharashtra and Gujarat is a funnel shaped bag net tied to stakes held in position with floats and sinker stones. The net is kept in horizontal position facing tide for prawns and Bombay Duck in coastal waters. Small quantities of *Loligo duvaucelii* and sometimes *Sepia aculeata* are caught in small numbers in *dol* nets off Maharashtra coast.

Hooks and lines

Squids and cuttlefish are caught in different types of hooks and lines, long lines, trolling lines, hand lines, hand jigs operated for finfishes. The number and size of hooks and the length of lines differs from place to place in the various maritime states. Cephalopods are caught in large quantities in hooks and lines in Kanyakumari District in southern Tamil Nadu and Southern Kerala.

Indigenous hand jig

In Vizhinjam area, on the southwest coast of India, a kind of hand jig called *Nangooran choonda* which means anchor hook in Malayalam is used since twenty years for fishing the large size cuttlefish, *Sepia phanaonis*. The hand jig consists of three parts, a thin rod an umbrella rib 30 cm in length with two or three tiers of hooks, another rod with a weight attached to it and a 40-60 m line tied to the latter. The free and of the first rod is tied to a long nylon monofilament line 1.5 m above the rod, and another small rod 30 cm long is attached to the line parallel to it. An iron weight 100-150 g is tied at the middle of this rod with a 30 cm line. The long line is wound on a wooden line holder.

Bait usually a small piece of a small squid arm of a cuttlefish, or small fish is pierced through the single hook or tied to the rod and the jig is lowered from the catamaran into water to make the baited jig lie in a horizontal position away from the weight. The jig is enabled to move freely. Two such jigs are operated by a person one on either side of a catamaran. Two or more fishermen operate jigs from a catamaran. On seeing the bait, a cuttlefish tries to grab it and in the process gets entangled with all its arms. The fisherman feels it on the line, gently lifts the line after a short duration, and gives a jerk on the line when the cuttlefish is hooked on one or more hooks. The line is lifted up and the cuttlefish is taken with a scoop net. *Sepia pharonis* are fished with the hand jigs during the months February-April when the cuttlefish migrate to water with depth range of 30 to 50 or 75 m (Nair, 1985).

Hand jigs

In recent years prawn shaped jigs with a double circlet of hooks imported from Singapore are used by some fishermen in Palk Bay from Thondi to Rameswaram for fishing squids and cuttlefish. The jigs are operated with a hand line from catamaran or trawler during day time

and *Sepioteuthis lessoniana, Sepia aculeata* and *Sepia pharaonis* are caught. Imported jigs are operated on a small scale with hand lines by trawler crew off Tuticorin coast for fishing *Loligo durancelii* and the cuttlefish, *Sepia pharaonis.*

Trawl net

The trawl is the gear in which most of the squids and cuttlefish are captured in maximum quantities in the seas around India in commercial fisheries except in those areas where the bottom is uneven and not suitable for trawling. Two or four seam otter trawl with head line length of 7-27 m between the upper wings is the most widely used trawl in Indian waters. Bulged belly trawl, high opening trawl and out rigger trawl are used in some areas. Until 1980 trawling was confined by 24 to 30 mechanised vessels with engine of 45-80 HP mostly to 30 M depth in most areas, but since then commercial trawling is carried out by large vessels 40'-50' in length with higher Power 100-120 HP engine upto 50 metres depth and some vessels conduct fishing beyond the 50 m depth.

Octopus fishing

Long lines of gastropod shells like *Lambis lambis, Tonna dolium, Rapana bulbosa, Murex virgineus* and *Hemifusus* were commonly used as shell traps for fishing octopus along Palk Bay in Tondi, Devipatnam and Mandapam area. This mode of fishing is not in vogue now in the mainland. In Car Nicobar Island during low tides at night a large number of villagers gather on the shore of reef holding torches made up of burning coconut palm leaves and spear finfishes and octopods with spears with one or more hooks at the end from coral reef pools and crevices between dead coral masses. In Malaca Bay, Car Nicobar, fish and octopods are fished by harpooning or poisoning coral rock pools with grated seed of *Barringtonia* (Silas *et al*, 1985). In Lakshadweep Islands octopods are caught by spearing with iron rods. The exploitation is subsistence fishing.

TABLE 1. *Estimated commercial cepholopod landings of India (Tonnes). Percentage of the coastwise landings in parenthesis.*

Year	Cepholopod landings along East Coast	Cepholopod landings along West Coast	Cepholopod landings of India
1980	2,084 (18.3)	9,238 (81.5)	11,335
1981	2,300 (24.0)	7,234 (75.8)	9,548
1982	4,118 (26.1)	11,659 (73.8)	15,779
1983	4,654 (25.4)	13,685 (74.6)	18,335
1984	4,282 (20.4)	16,125 (76.9)	20,964
1985	5,134 (16.2)	26,443 (83.8)	31,577
1986	4,773 (11.2)	37,817 (88.8)	42,590
1987	5,039 (15.8)	26,836 (84.2)	31,875
1988	4,822 (12.5)	33,704 (87.5)	38,526
1989	6,256 (11.5)	48,231 (88.5)	54,487
1990	8,617 (15.3)	47,670 (84.7)	56,287
1991	9,779 (15.0)	55,558 (85.0)	65,337
1992	17,046 (18.9)	73,230 (81.1)	90,276
1993	10,500 (10.8)	86,389 (89.2)	96,889

CEPHALOPOD PRODUCTION OF INDIA

The total estimated annual commercial cephalopod production of India was 1,636 t in 1968 and it more than doubled to 3,677 t in

1974 as there was demand for export purpose and squids and cuttlefish obtained as incidental catches were processed for export. From then onwards with progressive rise in export demand the production increased to as much as 31,577 t in 1985 and 42,590 t in 1986 but for a slight fall in 1980 and 1981. In 1987 and 1988 the production was lower by 18.5% and 8.7% but in the subsequent years there was recovery and there is a continuous rapid rise in catches (F.R.A.D., CMFRI, 1995) with all India production reaching 56,287 t in 1990, 65,337 t in 1991, 90,276 t in 1992 and 96,889 t in 1993 (Table 1).

The bulk of the cephalopod catches are fished off west coast of India. Production from along the coast varied from 7,234 t (75.8%) in 1981 to 26,443 t (83.8%) in 1985. With a sharp increase in catches in subsequent years the estimated landings rose to 37,817 t (88.8%) in 1986 and 86,389 t (89.2%) in 1993. The cephalopod landings along east coast ranged from 2,084 t (18.3%) in 1980 to 5,134 t (16.2%) in 1985. Due to comparatively less increase in landings in contrast to west coast in the later years, cephalopods acounted for only 18.9% (17,046 t) in 1992 and 10.8% (10,500 t) in 1993.

The cephalopod production of Lakshadweep Islands consisting almost exclusively of Octopods through subsistence fishing from 22 t in 1981 to 9 t in 1986. Estimates are not available for Andaman Islands. The catches from artisanal fishing around the Andamans consisting mostly of Octopods are very low as in Lakshadweep Islands.

Kerala and Maharashtra (Table 2) are the leading States in cephalopod production with landings of 28,471 t (29.4%) and 27,680 t (28.6%) in 1993. Gujarat and Tamil Nadu rank third and fourth with catches of 14,530 t (15%) and 8,757 t (9%) in the same year. A maximum of 16,004 t (17.7%) of cephalopod catches for the State have been fished off Tamil Nadu in 1992 (Table 3). Karnataka, Goa and Andhra

TABLE 2. *Cephalopod landings (in Tonnes) along West Coast of India.*

Year	Kerala	Karnataka	Goa	Mahara-shtra	Gujarat
1980	4244	122	210	1191	3471
1981	2376	266	94	1755	2743
1982	3536	153	166	4781	3023
1983	1727	979	394	6613	3971
1984	5422	333	408	7650	2312
1985	8283	239	304	13066	4551
1986	14987	2158	1409	12435	6828
1987	7535	2869	483	9158	6791
1988	15155	1953	390	13346	2860
1989	23488	2452	476	14472	7343
1990	24206	2287	123	15605	5449
1991	19468	3460	709	18651	13270
1992	30625	2121	1096	25982	13406
1993	28471	8873	6835	27680	14530

TABLE 3. *Cephalopod landings (in Tonnes) along East coast of India.*

Years	West Bengal	Orissa	Andhra Pradesh	Tamil Nadu	Pondi-cherry
1980	4	98	470	1472	40
1981	—	57	512	1687	44
1982	6	195	595	3238	84
1983	18	119	519	3877	121
1984	42	59	450	3694	37
1985	7	92	551	4441	43
1986	7	121	697	3905	43
1987	28	97	797	4050	67
1888	7	37	542	4208	28
1889	39	81	489	5535	112
1990	81	13	988	7434	101
1991	64	45	446	9018	206
1992	122	60	667	16004	193
1993	268	62	1380	8757	33

Pradesh account for 9%, 7% and 1.4% with landings of 8,873 t, 6,835 t and 1,380 t in 1993. The catches off West Bengal, Orissa and Pondicherry are low, 268 t, 62 t and 33 t respectively.

During 1985-93, the quarterwise cephalopod landings were highest (34.4%) in Kerala in the third quarter with the fourth quarter next in importance (28.5%). In Maharashtra over half of the catches (50.7%) were landed in fourth quarter with first quarter accounting for 32%. In Gujarat the highest catches were landed in last quarter (40.2%) and first quarter (38.9%). In Karnataka the maximum catches were landed in first quarter (34.9%) with third quarter landing 25.7%. In Goa the best catches (65%) are obtained in fourth quarter with the first quarter (25.2%) next in importance.

Over half of the cephalopod catches (50.1%) were landed in Tamil Nadu in third quarter, and the second and fourth quarters accounted for 19.7% and 18.2% respectively. In Andhra Pradesh the landings were slightly higher 26.2% and 26.0% in fourth and first quarters than in the second and third quarters (24.9% and 22.9%). In West Bengal the maximum catches were obtained in fourth quarter while in Orissa the maximum landings were got in first quarter (48%) with the last quarter accounting for 36%.

Commercially Important Cephalopods

The commercial cephalopod fisheries of India are supported by neritic squids and cuttlefishes and octopods. Among squids, *Loligo duvaucelii* is predominant species in quantitative abundance forming 97%. It occurs all along the east and west coasts and caught in large quantities in trawl nets *L. uyii* is a minor species in the trawl catches in Madras area. *L. investigatoris* occurs sporadically off Madras, Kakinada and Visakhapatnam. The squids *Doryteuthis sibogae* and *D. singhalensis* are caught in artisanal fishing in Vizhinjam area on the Southwest coast and in trawl catches off Visakhapatnam and Madras. *Sepioteuthis lessoniana* is common only in Palk Bay. Stray individuals of this species are caught in far flung areas off Tuticorin, Vizhinjam, Lakshadweep and Veraval.

The most common cuttlefishes supporting commercial fisheries are *Sepia pharaonis* and *Sepia aculeata* which are distributed along both coasts of India. *Sepia elliptica* supports the trawl fishery in Veraval and Cochin areas. *S. brevimana* is found off Visakapatnam, Madras and Mandapam and *S. prashadi* off Madras coast. *Sepiella inermis* is distributed along both east and west coasts. *Euprymna stenodactyla* occurs in small numbers off Madras and Porto Novo coasts.

Thirty eight species of octopods occur in Indian waters and the common species are *Octopus dollfusi, O. cyaneus, O. aegina* and *cistopus indicus*. The octopods are distributed in shallow coastal waters of mainland and around Lakshadweep and Andaman and Nicobar Islands in intertidal and subtidal zones among rocks, stones or corals in crevices and interspaces.

Offshore Resources

The exploitation of cephalopods is mostly confined to 50 m depth. Exploratory fishing carried out by Pelagic Fisheries Project, Fishery survey of India and other organizations have revealed the existence of cephalopods in several areas on the continental shelf along Indian Coasts which could be exploited.

Squid and cuttlefish catch rates of 20 kg/hr. off Wadge Bank and 22 kg/hr. off Kerala have been recorded by the exploratory trawling by Fishery Survey of India. In the investigations conducted off the Wadge Bank, cephalopods amounted to 6.6% of total catches. *Sepia pharanois* was dominant and formed 80%. *S. aculeata* and *Sepiella inermis* occured in small numbers. *Loligo duvaucelii* was the predominant species among squids. Depthwise catch rates were high in 10 - 25 fm (17.5 kg/hr) and were lesser with increasing depth being 5.5 kg/hr in 25 - 40 fm, 3.1 kg/hr in 40-70 fm, 0.7 kg/hr in 70 - 100 fm and 0.9 kg/hr in 100 - 125 fm (Joseph *et al.*, 1987).

Cephalopods were obtained in significant quantities in trawl catches of Fishery Survey of Indian Vessels. On the west coast they formed 8.3% in 20-40 m depth, 6.1% in 40-60 m depth, 10.3% in 60-80 m depth and 8.7% in 80-100 m depth at Latitudes 8-10°N. Similar abundance was recorded in 11-13°N, 14-17°N and 18-23°N. Along the east coast they formed 1.7% in 20-40 m depth, 1.8% in 40-60 m and 3.2% in 60-80 m at Latitudes 10-14° N and 0.9% at 40-60 m at Latitudes 15-19°N. In the Gulf of Mannar squids and cuttlefish accounted for 0.6% in depth of 20-40 m and 0.7% in 40-60 m (Sudarsan *et al*, 1988).

The foreign chartered vessels which operated in Exclusive Economic Zone of India have fished very good quantities of squids and cuttlefish of 60-80% in total catches declared by them. The cephalopod catch rates of some of the chartered vessels were as high as 61.9 kg/hr in latitudes 7°-9°N, 106 kg/hr in 10-12°N, 76.2 kg/hr in 13°-14°N and 100.6 kg/hr in 16-17°N. One chartered vessel caught a total catch of 106 kg/hr in depth range 60-80 m (Joseph, 1986).

OCEANIC SQUIDS

The Oceanic squids, *Symplectoteuthis oulaniensis, Ommestrephes bartrami, Thysanoteuthis rhombus, Onychoteuthis banksii* and *Notatodarus sloari* are distributed in the Indian Ocean (Silas *et al* 1968, Filippova 1968, Silas *et al* 1985). A significant stock of the large purple flying squid, *Symplectoteuthis oulaniensis* which is widely distributed in Indo-Pacific region has been recorded by R. V. SHOYA MARU of Fishery Agency of Japan in North Arabian Sea (Fishery Agency, 1976). The oceanic squid has been caught in 15-20 numbers in drift nets operated by R. V. KALAVA off southwest coast (Silas, 1969). It has been obtained in small numbers in pelagic trawl at several stations with depth of 1,000-3,100 m during several cruises of F. O. R. V. SAGAR SAMPADA off Gujarat and Maharashtra, Goa and Kerala in Arabian Sea and off Andhra and Orissa coasts in Bay of Bengal (Nair *et al*, 1990). The species is characterized by strong phototaxis and comes in small schools of about thirty numbers near the vessel attracted by her lights. There is scope for fishing *S. oulaniensis* after an intensive survey of the resources, study of the habits biological and ecological aspects and use of suitable gear like jigs with light attraction. *Ommestrephes bartrami* occurs between latitudes 23° and 37° S and Long. 60° and 113° E in subtropical region of Indian Ocean. *Onychoteuthis banksii* is found from surface waters upto 150 m in several areas of Indian Ocean.

POTENTIAL PRODUCTION

The potential cephalopod production from Indian Ocean has been estimated by Voss (1973) to be 5,00,000 tonnes. George *et al* (1977) estimated the total potential of India's Exclusive Economic Zone to be 1,80,000 tonnes of which 55% is to be from North east coast, 11% from

southeast coast and northwest coasts and 20% from southwest coast. Chikuni (1983) who estimated the cephalopod potential of Indo-Pacific region as 1.1 to 1.4 million tonnes, estimated the potential production of Bay of Bengal to be 50,000 to 1,00,000 t and that of East Arabian Sea 100,000 to 150,000 t. The estimated cephalopod production of India in 1993 was 96,889 t including 10,500 t from Bay of Bengal and 86,389 t from Arabian Sea. The resources in several areas beyond 50-70 m in the outer parts of the continental shelf are not exploited. Further specific gear like mid water trawl and jigs are not used. Therefore the total potential cephalopod production of India is considered to be 180,000 t with 20,000 t to come from off east coast and 160,000 t from off west coast of India.

Prospects for stepping up Cephalopod Production

The present cephalopod production of India is about 100,000 t. There has been almost continuous increase in the catches of both squids and cuttlefishes from Indian along both east and west coasts during the past over two decades. The increase in the last four years is particularly very high. Much of the production, about 90% comes from west coast and the rest from the east coast. Four distinct regional cephalopod fisheries are distinguished, the foremost, off Kerala coast with annual production of about 30,000 t, the second off Maharashtra with a production of 28,000 t, the third off Gujarat with landings of 15,000 t and fourth off Tamilnadu with landings of 9000-16,000 t. There is no information on squid and cuttlefish catches of large trawlers and chartered vessels. The companies owning the vessels have to furnish data to enable assessment of resources and suggest management resources. Almost the entire production consists of squids and cuttlefishes obtained as incidental catches of trawlers operating shrimp trawl or fish trawl. An important factor influencing the abundance of squids and cuttlefishes in trawling grounds is the plentiful occurrence of small and medium size fish and prawns which form the food of the highly predatory, carnivorous cephalopods. Another factor responsible for the large increase in catches is that fishing extends upto 50 m depth range and upto 70 m by some vessels unlike in previous years when it extended only upto 30 m depth. The trawlers also stay on sea for four or five days enabling making a number of hauls and thus getting much higher catches.

Although there is very good demand from export agencies for squids and cuttlefish, specific gear is not employed in most areas for catching the cephalopods. Cephalopods are fished in several countries using different kinds of gear like midwater trawls, set nets, gill nets, purse seines, hand jigs and automatic jigs. In India squids are caught sometimes in good quantities in gill nets laid for the fin fishes. Midwater trawling enables capture of schools of squids present in column waters at different depths.

Originally jigging has been practised in Japan with a simple device of a pole and line jig using a burning pine root for light attraction for squids. The burning torch has been replaced by kerosene and acetylene lamp and still later by electric lamps in series at the top of the vessel and jigging is done with hand jig, or serial jigs namely operated with drum and line reels. The serial jigs are operated most effectively at night on board fishing vessels of ranging size 10-30 T or 100 T and large quantities of neritic squids or oceanic squids

are caught by operating jigs released from a jigging machines fixed on the side of jigging vessels. Jigging has become popular in Australia, New Zealand, West Africa and east coast of North America also.

Jigs of different shapes sizes and colours are used for fishing squids and cuttlefish. Some have short stem and others long stem. At the base of each jig there is a single or double circlets of steel hooks around which the arms of squids or cuttlefish get entangled. The stem of some jigs has the shape of fish or prawn. In experimental jigging conducted by Fishery Survey of India in collaboration with Central Marine Fisheries Research Institute, four species of squids, *Loligo duvaucelii, Doryteuthis sibogae, D. singhalensis* and *Symplectoteuthis* oulaniensis were jigged (K.N.V. Nair *et al* 1992, K.P. Nair *et al* 1992). The squid concentrations were found to be higher in Vizhinjam-Muttom area than in Mangalore and Ratnagiri areas.

If active efforts are made to exploit the squid and cuttlefish resources by conducting otter trawling in 50-100 m depth range, mid water trawling in areas rich in the resources and jigging with hand jigs and automatic jigs cephalopod production of India could be further raised substantially to obtain maximum sustainable yield which will help increase the cephalopod exports much further than the present level and earn valuable foreign exchange. There are also possibilities for exploitation of octopods and oceanic squids.

REFERENCES

ALAGARSWAMI, K. AND M. M. MEIYAPPAN., 1989. Prospects for increasing cephalopod production of India. *In* : National Symposium on Research and Development in Marine Fisheries Mandapam Camp 16-18, 1987. Papers presented at Sessions I and II. *Bull. Cet. Mar. Fish. Res. Inst.* 44 (1) : 146-154.

CHIKUNI, S. 1983. Cephalopod resources in the Indo-Pacific Region. *In* : Caddy, J. F. (Ed). Advances in assessment of world cephalopod resources. *FAO Fish. Tech. Pap. (231)* : 264-305.

FILIPPOVA, J. A. 1968. New data on the cephalopods of the Indian Ocean. *Proc. Symp. Mollusca*, Mar. Bol. Ass. India. Pt. I : 257-264.

FISHERY AGENCY OF JAPAN, 1976. Report on cruise of the R. V. SHOYA MARU in the North Arabian Sea Survey, in collaboration with the IOP, FAO, to assess the pelagic fish stocks. 2 October 1975-13 January 1976. Res. Dev. Div. Fish. Agen. Japan. 110 pp.

F. R. A. DIVISION, C. M. F. R. I. 1995. Marine Fish Landings in India during 1985-93, 31. pp.

GEORGE, P. C., B. T. ANTONY RAJA AND K. C. GEORGE. 1977. Fishery Resources of Indian Economic Zone. *Silver Jubilee Souvenir*, Integ. Fish. Project., October, 1977 : 79-116.

HORNELL, J. 1917. The edible molluscs of Madras Presidency. *Madras. Fish. Bull.* 11 : 1-51.

JOSEPH, K. M. 1986. Some observations on potential fishery resources from the Indian Exclusive Economic Zone (EEZ). *Bull., Fish. Surv. India.* No. 14 : 1-20.

———, P. SULOCHANAN, M. E. JOHN, V. S. SOMVANSHI, K. N. V. NAIR AND A. JOSEPH,. 1987. Demersal fishery resources of Wadge Bank. *Bull. Fish. Surv. India*, No. 12 : 1-52.

NAIR, K. P. 1985. Hand jigging for cuttlefish at Vizhinjam with a note on modern squid jigging. *In* : (E. G. Silas Ed.). Cephalopod Bionomics, Fisheries and Resources of the Exclusive Economic Zone of India.

———, K. S. RAO, R. SARVESAN, M. M. MEIYAPPAN, G. SYDA RAO, MATHEW JOSEPH AND D. NAGARAJA. 1990. Oceanic squid resources of the EEZ of India. In : (K.J. Mathew Ed.) Proc. First Workshop on Scientific Results of FORV SAGAR SAMPADA, CMFRI and C.I.F.T., Cochin, October, 1990, 403-408.

———, M. M. MEIYAPPAN, P. S. KURIAKOSE, R. SARVESAN, A. P. LIPTON, S. K. MOHAMED, P. K. ASOKAN, M. JOSEPH AND D. NAGARAJA., 1992. Biology of squids. In : Exploratory squid jigging in India with notes on biology of squids. *Bull. Fishery Surv. of India*, 23 : 27-42.

NAIR, K. N. V., T. V. NINAN, P. J. JOSEPH AND N. JAGANNADH, 1992. An account of exploratory squid jigging off west coast of India. *In : Ibid.*, **23** : 1-26.

RAO, K. V. 1954. Biology and fishery of the Palk Bay Squid *Sepioteutis arctipinnis* Gould. *Indian J. Fish.*, **1** : 37-66.

———, 1969. Distribution pattern of the major exploited marine fishery resources of India. *Bull. Cent. Mar. Fish. Res. Inst.*, **6** : 69 pp.

SILAS, E. G. 1968. Cephalopoda of the west coast of India collected during the cruises of the Research Vessel VARUNA with catalogue of the species known from the Indian Ocean. *Proc. Symp. Mollusca.* Pt. I : 277-359, Mar. Biol. Ass. India.

———, 1969. Exploratory fishing by R. V. VARUNA. *Bull. Cent. Mar. Fish. Res. Inst.*, **12**, 86 pp.

———, R. SARVESAN AND K. S. RAO. 1985. Octopod resources. *In* : (Silas, E. G. Ed.). Cephalopod Bionomics Fisheries and Resources of the Exclusive Economic Zone of India. *Bull. Cent. Mar. Fish. Res. Inst.*, **37** : 137-139.

SUDARSAN, D., T. E. SIVAPRAKASAM, V. S. SOMVANSHI, M. E. JOHN, K. N. NAIR AND A. JOSEPH. 1988. An appraisal of the marine fishery resources of the Indian Exclusive Economic Zone. *Bull. Fishery Surv. India*, **18** : 1-36.

VOSS, G. L. 173. Cephalopod resources of the World. *FAO Fish. Circ.* (149) : 75 pp.