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QUALITATIVE AND QUANTITATIVE DISTRIBUTION OF PLANKTONIC CEPHALOPODS IN THE EXCLUSIVE ECONOMIC ZONE OF THE WEST COAST OF INDIA

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ABSTRACT

The cephalopod larvae and juveniles in plankton samples collected during the first 10 cruises of FORV *Sagar Sampada* off the west coast of India from February to December, 1985 have been studied for their qualitative and quantitative distribution. The samples were obtained in Bongo net operations carried out in an extensive area covering Lat. 4° to 23° N and Long. 65° to 77° E. Out of the total 258 stations sampled, cephalopods were obtained in 110 stations in varying numbers. The estimated number of cephalopods per haul ranged between 1 and 112. Of the total number of hauls in which cephalopods obtained, 51% occurred in night hauls and the rest in day hauls. The density per haul during night was 22, whereas it was 13 in day haul. Cephalopods belonging to families Sepioidae, Sepiidae, Enoplateuthidae, Onychoteuthidae, Ommastrephidae, Cranchiidae and Octopodidae were the important components. Among the identified cephalopods, larvae and juveniles of Ommastrephid squids were by far more abundant and occurred more frequently. The occurrence, distribution and abundance of different species of cephalopods in the study area in relation to oceanographic conditions are discussed.

INTRODUCTION

Cephalopods, comprising of cuttlefish, squid and octopus, are one of the important seafood items. They are in great demand in export trade because of their delicacy and nutritive value. Recently Silas *et al.* (1986) have reviewed the studies carried out so far on this group in the Indian Ocean and stressed the need for further studies on the ecology of larval, juvenile and adult phases of neritic and oceanic species of cephalopods. Silas (1968) observed the quantitative and qualitative abundance and distribution of neritic and oceanic planktonic cephalopods off west coast of India. Much emphasis has been given to the studies pertaining to the quantitative aspects of planktonic cephalopods (Silas, 1969; Sakthivel and Aravindakshan, 1971; Aravindakshan and Sakthivel, 1973 and Meiyappan *et al.*, 1989). In the present paper, the results of quantitative and qualitative analysis of planktonic cephalopods obtained in the Bongo net during the cruises of FORV *Sagar Sampada* along the west coast from February to December, 1985 are presented.

MATERIAL AND METHODS

The planktonic cephalopods were sorted out from the zooplankton samples collected in 10 minutes oblique hauls by Bongo 60 net in a depth range of 150 - 0 m. The description of the net and

details of operation have been described elsewhere. Totally 258 hauls were made during the cruise No. 1, 2, 3A, 3C, 5, 6 to 9, 9A and 10 in the area lying between latitudes 04° 59'N and 23° 30'N and longitudes 65° 10'E and 77° 30'E. Based on the aliquote sample drawn from each haul, the qualitative and quantitative data on major planktonic groups were estimated including cephalopods. The number of cephalopods contained in each fractional sample was raised to the total volume. The pooled data were used for the seasonal and distributional studies. Since it is obvious that the identification of larvae and juvenile cephalopods is difficult, specimens were identified generally upto family and wherever possible upto genus and species level. The measurements (in mm) of the specimens mentioned in the text denote the Dorsal Mantle Length (DML) and Total Length (TL).

OBSERVATIONS

Cruise-wise abundance

The details of cruise-wise hauls and number of cephalopods obtained are given in Fig. 1. Totally 258 hauls were made, of which, 110 hauls (42.6%) contained cephalopods. The total number of cephalopods amounted to 1758, the greater number (> 100) came from the cruise No. 2, 3A, 3B, 6, 7, 9 and 10, while the number per haul varied from 0 to 65

in other cruises. The number per haul varied from 1 to 34. The abundance of cephalopods per haul showed a direct relationship on the total number of cephalopods in a particular cruise.

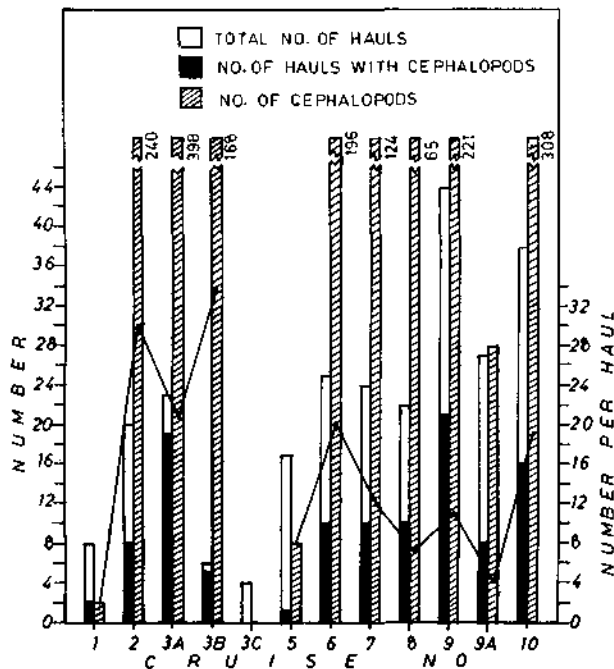


Fig. 1. Cruise-wise abundance of planktonic cephalopods.

Month-wise abundance

The month-wise abundance of cephalopods during February to December '85 is indicated in Fig. 2. In the months of March, April and August to December, 33 to 86% of hauls contained cephalopods, while the meagre number (6 to 17%) came in February and July. There was no operation of Bongo net during May in the study area. The four hauls made in June did not yield any cephalopods. The number of cephalopods per haul during the period ranged from 1 to 26. The greater number of 6 to 26 per haul were obtained during March, April, August and December, whereas 7 to 9 per haul were caught during July, September, October and November. In February, it was only one number per haul. The record of maximum number during March, April, August and December indicates the peak abundance of cephalopods during the pre and post monsoon periods along the west coast of India.

Diurnal variation

The details of number of cephalopods caught per haul during the day and night hauls are given in Fig. 3. Total number of hauls made during day and night hours amounted to 67 and 43 respectively.

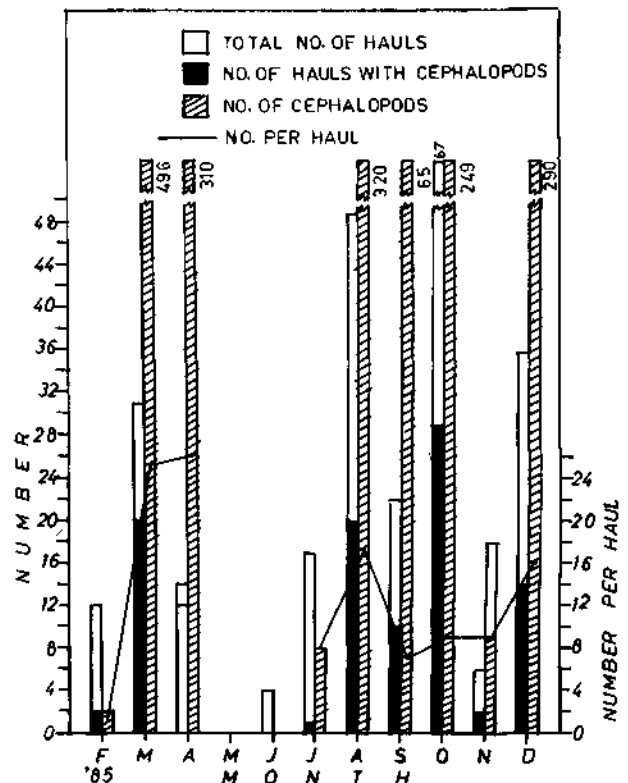


Fig. 2. Month-wise abundance of planktonic cephalopods.

The number per haul during day varied from 4 to 24, whereas it was 1 to 14 in the night hauls. The day hauls were found richer during March, April, August and December. In the case of the night hauls, the highest rate of 14 per haul was obtained in October. In the other months the number per haul ranged from 1 to 6. Generally, the number per haul was more in the dark hours (average; 20 per haul) than that of the day (13/haul) for the whole period.

Composition of planktonic cephalopods

The present collection consisted of both neritic and oceanic cephalopods belonging to 11 families, namely, Sepiidae, Sepiolidae, Loliginidae, Enoploteuthidae, Octopoteuthidae, Ommastrephidae, Cranchiidae, Onychoteuthidae, Gonatidae, Brachio-teuthidae, and Octopodidae. The family-wise contribution of cephalopods is indicated in Fig. 4. Among the eleven families, those belonged to Ommastrephidae shared 50.1% by number, followed by Enoploteuthidae (15.9%), Cranchiidae (9.9%), Loliginidae (6.3%), Octopodidae (4.1%), Sepiolidae (3.7%), Onychoteuthidae (3.5%), Gonatidae (0.8%), Sepiidae (0.5%), Octopoteuthidae (0.3%) and Bra-

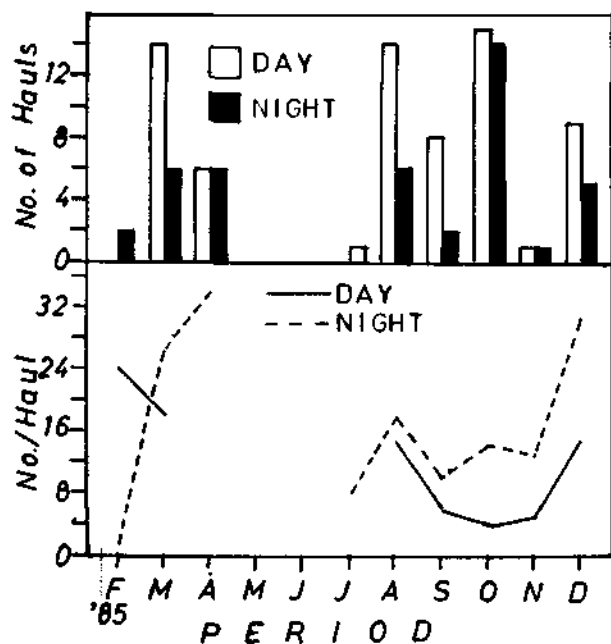


Fig. 3. Diurnal variations in the abundance of planktonic cephalopods.

chioteuthidae (0.3%). The cephalopod fragments constituted 4.6%.

Seasonal abundance of different families

The family-wise number per haul obtained in

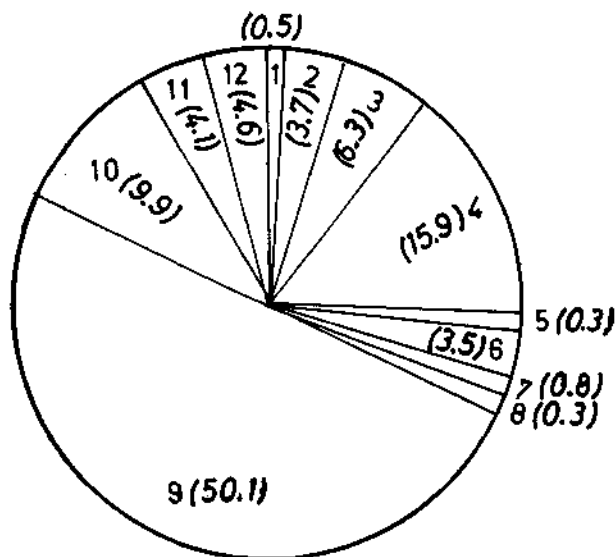


Fig. 4. Family-wise composition of planktonic cephalopods. 1. Sepiidae, 2. Sepiolidae, 3. Loliginidae, 4. Enoploteuthidae, 5. Octopoteuthidae, 6. Onychoteuthidae, 7. Gonatidae, 8. Brachioteuthidae, 9. Ommastrephidae, 10. Cranchidae, 11. Octopodidae 12. Unidentifiable fragments of cephalopods

the day and night hauls during the period February to December, '85 is given in Fig. 5.

Sepiidae : Only 8 numbers were taken in a single day haul in February.

Sepiolidae : Caught during February, March and August; day hauls with a minimum of 8 in August and a maximum of 48 in March and a single night haul in February with only one number.

Loliginidae : Represented in March, April, July, August, October and December; day hauls in March, April, August and December yielded 6 to 24 and night hauls in July with 8 and in October with 3.

Enoploteuthidae : Members of this family occurred in February-March and August to October and December; day hauls with 3 to 12 and night hauls with 5 to 11.

Octopoteuthidae : Represented in a single day haul (4 number) in August.

Onychoteuthidae : Present during February, March, September, October and December; day hauls with 1 in February, 2 in March, 4 each in September, October and December and night hauls with 8 in October and December and 10 in February.

Gonatidae : Represented in the day hauls (4 each) in August, September and October.

Brachioteuthidae : Present only in a day haul (6 number) in March.

Ommastrephidae : Well represented in March, April and August to December; day hauls with 4 (October) to 20 (March) and in other months 5 to 15 and night hauls with 1 (February) to 38 (April) and in other months 6 to 22.

Cranchiidae : Caught in March, April, August, September and December; day hauls during April, August and December with 2 to 9 and night hauls ranging 6 in December to 8 in March-April.

Octopodidae : Members of this family represented in March, April, August, October and December; day hauls ranging from 3 in October to a maximum of 19 in August; and night hauls ranging from 2 in October to 36 in August.

Distribution of different families

Since the present observation is confined to a short period i. e. February to April and July to December, '85, the occurrence of specimens of

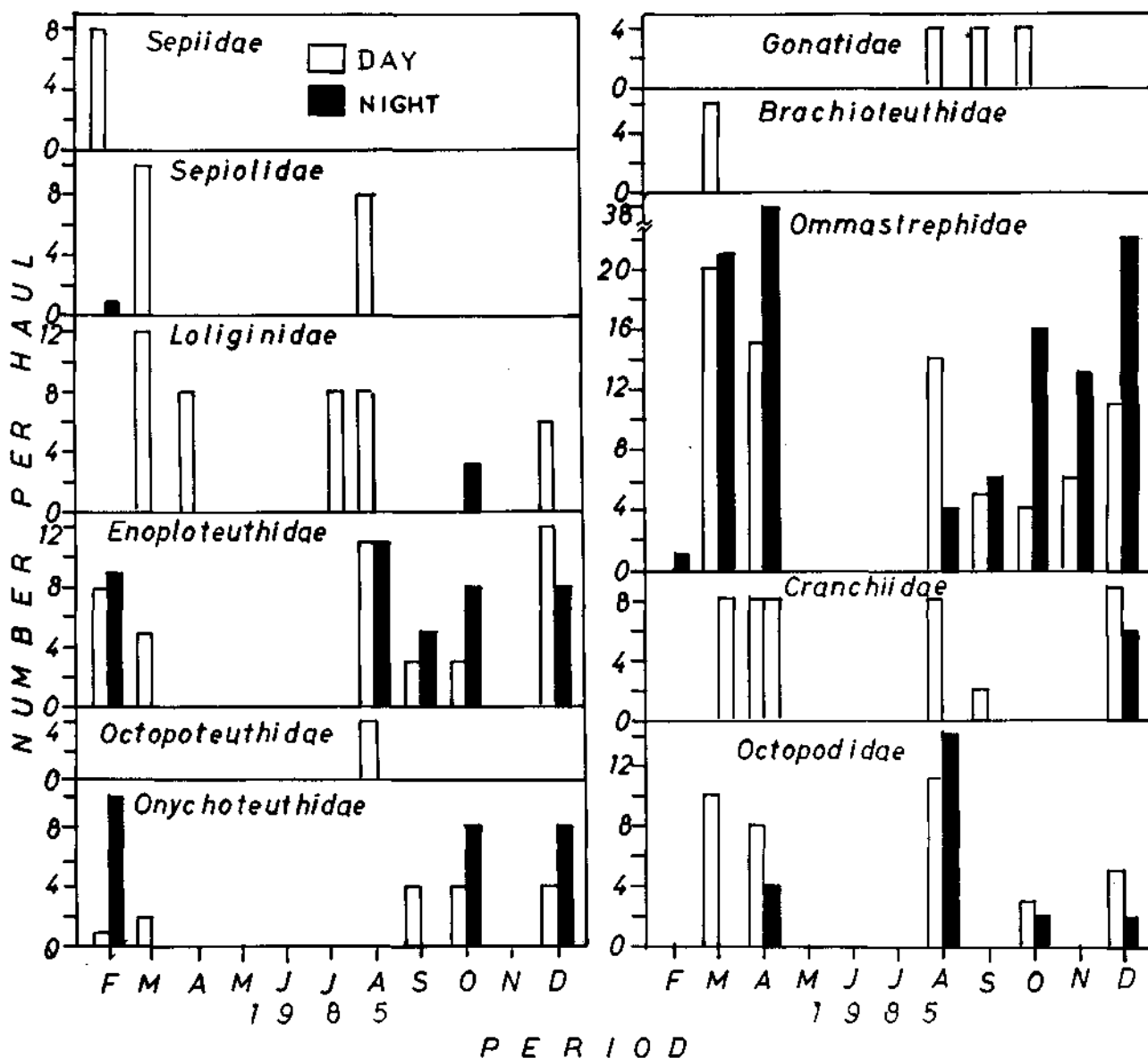


Fig. 5. Seasonal abundance of planktonic cephalopods.

different families in the study area is indicated briefly in the following account based on the area of operation of the Bongo net.

Sepiidae : This family was represented in a single day haul in the oceanic waters southwest of Veraval.

Sepiolidae : Members of this family were obtained only in day hauls in the neritic and oceanic waters in the stations located south of Veraval and oceanic waters of northwest of Mangalore.

Loliginidae : The loliginids were obtained in

both day and night hauls from the Wadge Bank. The day hauls taken northwest of Veraval, Lakshadweep Sea and off Cochin also yielded specimens. A single night haul off Mangalore also contained specimens.

Enoploteuthidae : Among the enoploteuthids, three genera, namely, *Abralia*, *Abraliopsis* and *Enoploteuthis* were represented. The species belonging to *Abralia* were obtained from the oceanic waters of the Wadge Bank in the south to Veraval in the north in both day and the night hauls. Among the specimens examined, 2 were found belonging to

Abralia andamanica, of which, one was taken in the day haul and the other in the night, off Mangalore. Those belonged to *Abraliopsis* were obtained in the day hauls off Veraval, Goa, Mangalore and Cochin. *A. gilchristii* was caught off Veraval in a day haul. Specimens belonging to *Enoploteuthis* were drawn from the oceanic waters of Kandla, Mangalore, Cochin and Cape Comorin in the day hauls and off Kandla, Veraval, Bombay and Lakshadweep islands in the night hauls. The maximum number occurred in the area south of Cape Comorin in the day hauls.

Octopoteuthidae : Specimens of *Octopoteuthis* were obtained from a station west of Cape Comorin in a single day haul.

Onychoteuthidae : A single genus *Onychoteuthis* was represented. They were obtained from west and northwest of Veraval and from the neritic waters off Vizhinjam in the day hauls. The samples obtained in the night hauls came from Veraval, Cochin and southwest of Cape Comorin. *O. banksii* was represented in a day haul taken southwest of Lakshadweep Islands.

Gonatidae : *Gonatus* sp. was obtained only in the day hauls taken off southwest of Kandla, west of Karwar and southwest of Cape Comorin.

Brachioteuthidae : The members of this family occurred in a single haul off Quilon.

Ommastrephidae : Most of the specimens belonging to this family were in early and advanced rhynchoteuthis, while a few of them were identified up to the genera, namely *Simplectoteuthis* and *Ommastrephes*. Most of the rhynchoteuthis specimens were obtained off Veraval, Bombay, Ratnagiri, Goa, Trivandrum and Cape Comorin in the day collections. The night hauls taken off Veraval and Cochin were found rich in number. A few numbers belonging to *Ommastrephes* were obtained off Trivandrum, while those of *Simplectoteuthis* were taken in the oceanic waters off Trivandrum and Cape Comorin. The members of this family were comparatively richer in the night hauls. The overall size range for rhynchoteuthis larvae was 0.7 to 5.5 mm in DML and 1.3 to 1.6 mm in DML for the genus *Simplectoteuthis*. Majority of rhynchoteuthids were in the size range of 1 to 2 mm in DML. Although majority of the specimens were caught from the oceanic waters, a few were from the neritic waters.

Cranchiidae : Specimens belonging to the genera *Cranchia*, *Sandalops* and *Taonius* were pres-

ent, of which, the first one dominated by number. Those belonged to *Cranchia* were obtained off Veraval, Ratnagiri, Cochin, Trivandrum and Cape Comorin, while that of *Sandalops* were caught off Cape Comorin. The specimens belonging to *Taonius* were caught off Cochin. Greater number of specimens of *Cranchia* were taken by the day hauls. The size recorded for *Cranchia*, *Sandalops* and *Taonius* was 7.3 mm, 11.4 mm and 11.0 mm in DML respectively.

Octopodidae : Specimens belonging to the genera *Octopus* and *Eledone* were represented. Those belonged to *Octopus* were caught off Veraval, Ratnagiri, Goa, Cochin, Trivandrum and Cape Comorin, while that of *Eledone* were obtained from a single station off Veraval. The size range for *Octopus* was 1.1 to 2.0 mm and 1.5 mm in DML for *Eledone*.

DISCUSSION

The present study on the planktonic cephalopods collected by Bongo 60 net along the west coast of India has indicated their seasonal abundance and distribution in the areas. Greater abundance of planktonic cephalopods was noticed during the pre and postmonsoon months, which agreed with the earlier observations by Silas (1968) and Aravindakshan and Sakthivel (1973). Among the day and night hauls, the number per haul was more (29/haul) in the dark hours than that of the day (13/haul), which confirmed the remarks by Silas (1968), who reported a greater representation of cephalopods in the Isaacs-Kidd Midwater Trawl collections taken during the night.

Among the eleven families represented in the present collection, those belong to Ommastrephidae formed 50.1% by number, followed by Enoploteuthidae (15.9%). However, Silas (1968) recorded those belonged to Enoploteuthidae as the dominant group from the west coast of India. Filippova (1968) has listed the members of the family Ommastrephidae as one of the commonest inhabitants of the Indian Ocean.

The present study also has indicated the dominance of planktonic cephalopods belonging to the families, namely, Enoploteuthidae, Onychoteuthidae and Ommastrephidae in the night hauls and Sepiidae, Sepiolidae, Loliginidae, Cranchiidae and Octopodidae in the day hauls. According to Clarke (1966) and Clarke and Lu (1974, 1975) the abundance of planktonic cephalopods in the colum-

nar water is related to species-specific. The present study has some limitations, since the materials on hand did not contain a complete series of stages in most of the families examined. Such lacunae can be overcome if additional materials are obtained in other suitable gears which could probably collect all the stages of planktonic cephalopods as done by Okutani and McGowan (1969), Young (1972) and Roper and Young (1975), who have described the complete stages of many of the families of planktonic cephalopods.

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REFERENCES

- ARAVINDAKSHAN, P. N. AND M. SAKTHIVEL 1973. The location of cephalopod nurseries in the Indian Ocean. *IOBC Hand Book V* : 70-75.
- CLARKE, M.R. 1966. A review of the systematics and ecology of oceanic squids. *Adv. Mar. Biol.*, 4 : 91-300.
- CLARKE, M. R. AND C. C. LU 1974. Vertical distribution of cephalopods at 30° N 23° W in the North Atlantic. *J. mar. biol. Ass. U. K.*, 54 : 969-984.
- CLARKE, M.R. AND C. C. LU 1975. Vertical distribution of cephalopods at 18°N 25°W in the North Atlantic. *J. mar. biol. Ass. U. K.*, 55 : 165-182.
- FILIPPOVA, J. A. 1968. New data on the cephalopoda of the Indian Ocean. *Proc. Symp. Mollusca, Mar. Biol. Ass. India*, pt. 1: 257-264.
- MEIYAPPAN, M. M., R. SARVESAN AND K. P. NAIR 1989. Preliminary studies on the distribution and abundance of planktonic cephalopods in the Indian Exclusive Economic Zone and adjacent seas. *First Workshop on Scientific Results of FORV Sagar Sampada*, June 1989, Abstract No. 34.
- OKUTANI, T. AND J. A. MCGOWAN 1969. Systematics, distribution and abundance of the epipelagic squid (Cephalopoda, Decapoda) larvae of the California current. *Bull. Scripps Inst. Oceanogr., Univ. California*, 14 : 1-90.
- ROPER, C. F. E. AND R. E. YOUNG 1975. Vertical distribution of pelagic cephalopods. *Smithsonian Contr. Zool.*, No. 2090: 1-51.
- SAKTHIVEL, M. AND P. N. ARAVINDAKSHAN 1971. Distribution of planktonic Mollusca of the Indian Ocean. *IIOE Plankton Atlas*, 3, Fasc. 2. *IOBC, India*.
- SILAS, E. G. 1968. Cephalopods of the west coast of India collected during the cruises of the Research Vessel Varuna with a catalogue of the species known from the Indian Ocean. *Proc. Symp. Mollusca, Mar. Biol. Ass. India*, Part 1 : 277-359.
- SILAS, E. G. 1969. Exploratory fishing by R. V. Varuna. *Bull. Cent. Mar. Fish. Res. Inst.*, 12 : 86 pp.
- SILAS, E. G., K. P. NAIR, M. M. MEIYAPPAN AND R. SARVESAN 1986. Resume of the work on cephalopods of the Indian Ocean. *Bull. Cent. Mar. Fish. Res. Inst.*, 37 : 5-12.
- YOUNG, R. E. 1972. The systematics and areal distribution of pelagic cephalopods from the seas off Southern California. *Smithsonian Contrib. Zool.*, 97 : 1-159.