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Oceanic squids - their distribution, abundance and potential in the EEZ of India and contiguous seas

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ABSTRACT

FORV Sagar Sampada collected a good number of oceanic squids belonging to several families from the Indian EEZ and contiguous seas. Of these, the most important species was the purpleback flying squid *Symplectoteuthis oualaniensis* which forms a potential oceanic squid resource. This species was caught in pelagic trawl at depths up to 200-250 m from surface in the oceanic areas. Though the squid is known to be distributed throughout India's oceanic waters, it frequently occurred in comparatively more abundance, up to 318 squids per haul, in the northneastern Arabian Sea. There was wide variation in the size of this squid (from 20 mm to 472 mm), the largest individual weighing 4.5 kg. The diamondback squid *Thysanoteuthis rhombus*, the largest specimen of which measured 585 mm in length and 5.3 kg in weight, was also caught from a few stations. Besides these large species, several others belonging to families such as Onychoteuthidae, Histioteuthidae, Enoploteuthidae and Cranchiidae are also distributed in the EEZ. A large number of oceanic squids were collected at night, which is indicative of their diel vertical migration towards surface layers during night hours.

INTRODUCTION

The importance of oceanic squids as a potential resource in the Indian waters has been well recognised. The occurrence and distribution of different species of oceanic squids have been recorded by many workers since late 60's (Filippova, 1968; Silas, 1968, 1969; Okutani, 1973; Yamanaka *et al.* 1976, 1977; Roper *et al.* 1984). Some of these authors indicated that a few species, especially the purpleback flying squid *Symplectoteuthis oualaniensis*, are potential resources which offer vast scope for exploitation. Initial studies by *Sagar Sampada* since 1985 provided additional information on the distribution, behaviour and biology of this squid, and on the distribution of other oceanic squids and mesopelagic cephalopods (Meiyappan & Nair, 1990; Meiyappan

et al. 1990; Nair *et al.* 1990; Sarvesan & Meiyappan, 1990; Sreenivasan & Sarvesan, 1990). Nair *et al.* (1992) gave an account of the experimental squid jigging operations on the west coast of India, in which the purpleback flying squid was one of the components of the catch. Nair *et al.* (1992) provided some information on the biology of this squid based on the samples collected in the same experimental fishing. One of the objectives of the cruises of *FORV Sagar Sampada* was to locate and identify the stocks of exploitable resource of oceanic squids (as well as other resources) in the EEZ.

MATERIALS AND METHODS

The oceanic squids collected in pelagic trawl operations onboard *FORV Sagar Sampada* in the Exclusive Economic Zone and its contiguous seas during 1985-1992 formed the data base for this study. Pelagic trawl was used in 40 cruises, mostly in oceanic waters beyond the continental shelf but occasionally in shallow waters of <100 m depth. The gears used were the German-type rectangular midwater trawls of CIFT design. These nets were operated for about 30-60 minutes duration for each haul in depths up to 420 m. The cephalopods collected in each haul were sorted for qualitative studies with regard to temporal distribution of different species of oceanic squids. Whenever direct observations onboard were not possible, log data of the cruise reports were consulted and preserved samples were studied. The length of squid always refers to the dorsal mantle length (DML). Since the catches of oceanic squids taken in each haul were very poor or insignificant, often a few grams in weight, quantitative estimation was not possible. Therefore the present study is limited to the distribution of component species and their relative abundance in different regions of the EEZ. In the absence of sufficient data, the earlier estimates of potential oceanic squid resources have been discussed in the light of the new information gathered by *Sagar Sampada* cruises.

RESULTS

Sufficiently wide coverage was given to different regions on the east and the west coasts, including the Andaman-Nicobar waters, Lakshadweep waters and the central equatorial waters. The geographic regions, number of positive stations for oceanic squids in each of the regions, bottom depths and depths of operation of gear are given in Table 1. The maximum coverage was on the west coast, of which the centralwest region had the highest number of stations positive for cephalopods, followed by the southwest region, including the Lakshadweep waters. On the east coast, the southeast region and the centraleast region had almost equal number of cephalopod stations. The Andaman-Nicobar waters were rich in oceanic squids, with as many as 31 positive stations. In the central equatorial region 6 stations were positive for oceanic squids. In all, there were 169 positive stations.

Table 1— Number of stations positive for oceanic squids by region, based on pelagic trawl operation by *FORV Sagar Sampada*

Region	Latitude	No. of squid stations	Bottom depth (m)	Depth of gear operation (m)
Southwest	6° - 12°N	35	145-4500	20-400
Centralwest	12° - 18°N	42	62-4150	25-225
Northwest	18° to North	14	87-3444	40-1590
Southeast	6° - 12°N	18	244-3816	20-380
Centraleast	12° - 18°N	19	2578-3452	25-350
Northeast	18° to North	4	250-2100	70-100
Andaman-Nicobar	4° -15°N, 89° -95°E	31	447-4057	18-350

Most of these stations, situated within the EEZ and slightly beyond, were in the oceanic areas with depths up to 4500 m but some stations, especially on the west coast, had shallower depths up to 62 m. The gear was operated mostly within 100 m from sea surface but occasionally at deeper depths up to 420 m; at one station (21°N, 67°15'E) in the northwest region the gear was operated at a depth of 1590 m.

The geographic positions of stations from where oceanic squids were obtained are shown in Fig.1. The centralwest region and the southwest region including the Lakshadweep waters abound in oceanic squids as judged from the frequency of their occurrence. In the northwest region they are also obtained from contiguous areas beyond the EEZ. The coverage in the northeast region was poor, since there were only 16 stations where pelagic trawl was operated, out of which four were positive for oceanic squids. In the centraleast region and the southeast region there was fairly good distribution of oceanic squids, but in the Andaman-Nicobar waters their occurrence was much more frequent. In the central equatorial region, out of 12 pelagic trawl stations six were positive for oceanic squids. In general, oceanic squids are distributed in the entire EEZ and its contiguous waters, with more concentration in some areas like the northeastern Arabian Sea, southeastern Arabian Sea, Lakshadweep waters, southwestern and centralwestern Bay of Bengal and the Andaman-Nicobar waters.

Quantitywise, the catches of oceanic squids obtained in pelagic trawl from almost all stations were very poor or negligible, often 1 kg and very rarely 10 kg. In most hauls the squids occurred in very few numbers and weighed a few grams only.

A number of species of oceanic squids belonging to several oegopsid families occur but at present most of them are not used for human consumption due to their small size, unfavourable body consistency and insufficient quantity, eventhough they con-

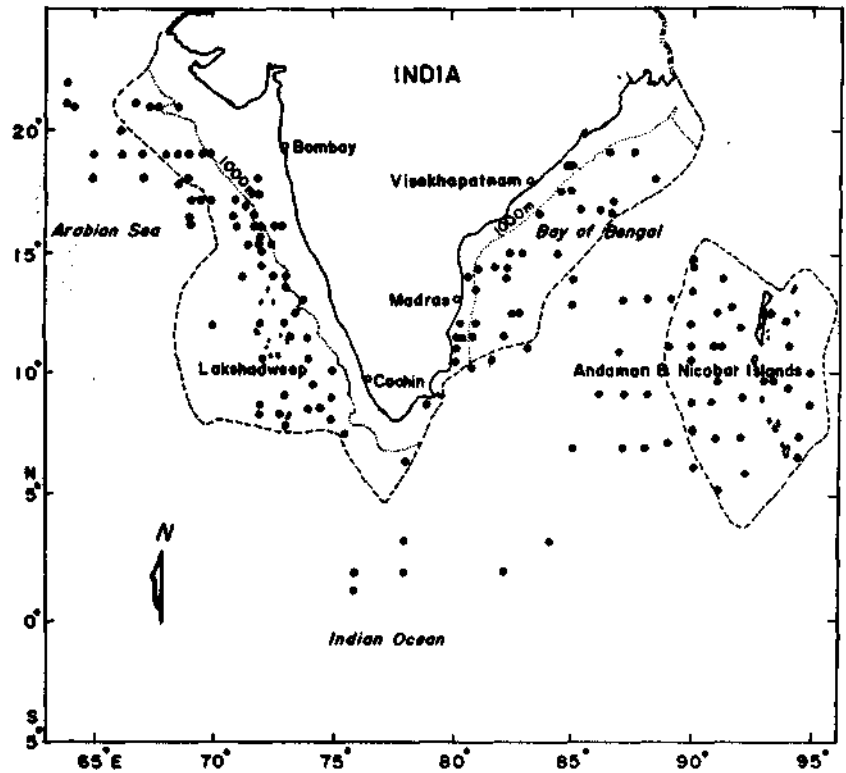

Fig. 1- Distribution of oceanic squids (dots) in the EEZ of India and contiguous areas, based on pelagic trawling by *FORV Sagar Sampada* (broken line is the outer boundary of EEZ)

stitute an important forage item to many fishes in the oceanic areas. The most important among the oceanic squids is the purpleback flying squid *Symplectoteuthis oualaniensis* which belongs to the commercially significant oceanic squid family of the world, Ommastrephidae. It is a large-sized squid occurring in commercial quantities in the Gulf of Aden, northern Arabian Sea, Japan, Taiwan and Hawaian Islands where it is collected in moderate to heavy quantities by jigging and dipnet fishing. Earlier surveys indicated the occurrence of this squid in many parts of the Indian waters with concentration in some areas, especially in the northern Arabian Sea. The cruises of *Sagar Sampada* further confirmed this and provided additional information on the distribution of this in many other areas.

The pelagic trawl operations did not reveal any fishable concentration of medium and large-sized *S.oualaniensis* at most of the stations, as the maximum number obtained from a single station was only 318 squids of <200 mm length with 115 mm modal size, weighing 20 kg; the next highest number from another station was 74 with the same modal size. In all other stations the squids collected were few in number and smaller in size, with some exceptions. From station 517, situated northeast of Car-

Nicobar Island, 3537 juvenile squids of 13-26 mm were obtained in one hour of pelagic trawling. The largest squid, measuring 472 mm in length and 4.7 kg in weight, was collected from station 774 in the northwest region. Five more squids measured >400 mm from the same station, all caught at depths of 110-250 m. A large squid of 425 mm weighing 4.5 kg was obtained from station 1225 in the northwest region.

Another large species of oceanic squid rarely obtained in *Sagar Sampada* cruises is the diamondback squid *Thysanoteuthis rhombus* of the family Thysanoteuthidae. Most of the specimens of this species collected were small in size and stray in occurrence and on no occasion any fishable concentration of this squid was observed. The largest squid obtained was a female measuring 585 mm in length and weighing 5.3 kg, caught from Andaman-Nicobar waters. All other specimens collected from different parts of the EEZ were small in size, measuring 40-105 mm in length.

Most other oceanic squids collected by *Sagar Sampada* were small species, except for some species such as the common clubhook squid *Onychoteuthis banksii*. Small and medium-sized squids of this species measuring 28-100 mm length occurred at some stations on the west coast, while in the Bay of Bengal its occurrence was sparse. In the Andaman-Nicobar waters its distribution was more frequent and as many as 82 squids of 32-195 mm length were taken in pelagic trawl from 9 stations in a single cruise. Young squids (85-100 mm) of another large species, *Ancistrocheirus lesueri*, were collected in stray numbers from the west coast and from Andaman-Nicobar waters.

Smaller species recorded were *Abralia andamanica, Abraliopsis gilchristii, Cranchia* spp, *Liocranchia* spp, *Leachia* spp, *Enoploteuthis* sp., *Chiroteuthis* sp., *Octopoteuthis* sp., *Histioteuthis* sp, *Ctenopteryx* sp., and *Japatella* sp. Among squids *Abralia, Abraliopsis* and *Cranchia* occurred more frequently in maximum number of stations. Apart from squids, some octopods (*Octopus* spp and *Argonauta* sp.) were also obtained.

The number of squids obtained during night were much higher than during day, and about 65% of the oceanic squids were collected at night, indicative of their diel vertical migration towards surface layers during night hours.

DISCUSSION

The pelagic trawling operations conducted by *Sagar Sampada* in the Indian EEZ and in some areas contiguous to it have corroborated earlier observations on the distribution of oceanic squids in general, and the purpleback flying squid *Symplectoteuthis oualaniensis* in particular (Filippova, 1968; Silas, 1968; Zuev, 1971; Okutani, 1973; Yamanaka *et al.* 1976, 1977). Dense concentrations were observed in exploratory surveys in the north Arabian Sea, and medium and large-sized squids up to a size of 500 mm were caught in jigging operations. Though a few large- sized squids were taken in pelagic trawl by *Sagar Sampada*, the occurrence of such large squids was extremely rare. Even the smaller squids were few in number except the

instance of over 3500 juveniles caught at a station in Andaman-Nicobar waters. In the exploratory squid jigging operations with light-attraction system off the southwest and centralwest coasts, purpleback flying squid was observed at a rate of 33 kg (576 squids) per night (Nair *et al.* 1992); the highest areawise catch recorded was 1438 squids (75 kg) per night. This shows that squids are present in Indian waters and can be fished by jigging. Jigging was not possible from *Sagar Sampada*, and the only one available was pelagic trawling, the performance of which was very poor throughout the cruises. Therefore, pelagic trawling operations did not give much information about the stock position or potential of not only oceanic squids but also any other pelagic fishery resources.

Though the picture of the extent of the oceanic squid resource and its potential has not emerged, the cruises provided new information on the distribution of *Symplectoteuthis oualaniensis* in Indian waters. Earlier studies have indicated the occurrence in some areas, especially in the northern Arabian Sea (Yamanaka *et al.* 1976, 1977) and off the southwest coast of India (Silas, 1968). The occurrence of jeveniles in the pelagic trawl collections, the observation on many occasions of shoals of medium and large-sized squids aggregating near the ship attracted by its light, and the exploratory squid jigging operations on the southwest coast of India (Nair *et al.* 1992) have further confirmed this. The *Sagar Sampada* cruises have revealed the distribution of this squid in the Bay of Bengal, especially off the southeast coast and the centraleast coast. The occurrence of juvenile squids, particularly that of over 3500 numbers at a single station in the Andaman-Nicobar waters (Sreenivasan & Saevesan, 1990) indicates that this region is rich in oceanic squid resource, and that this may be one of its breeding and nursery grounds.

All these point towards the importance of the purpleback flying squid as a potential resource in the Indian waters, and there is need for exploiting the resource in the light of the high unit price of squids in the export trade. Chikuni (1983) indicated the possibility of commercial fishery for this squid in the eastern Arabian Sea. Realising the scope for exploitation of this squid, Silas (1986) gave the projection that about 2500 t could be harvested by 1990, and somewhere between 25000 t and 50000 t would be the exploitation by the year AD 2000. However, there is still no fishery for this squid in India, nor there is any information on the fishery in Indian waters by other countries under any charter agreement. The main reason for this is probably the lack of suitable catching technique to fish in distant waters away from the conventional neritic region. Pelagic trawling has proved ineffective, but jigging seems to be the ideal method in the absence of any other suitable technique. Jigging takes advantage of the squid behaviour of getting attracted towards artificial light. Another advantage of jigging is that only the medium and large-sized squids are jigged, and the juvenile population is not affected. However, the economics of jigging operations in Indian waters is yet to be proved.

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