CEPHALOPODA 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*

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ABSTRACT

A comprehensive treatise on the Cephalopoda of the Indian Seas is wanting. The only noteworthy works with specific reference to this area are those by Goodrich (1896: *Trans. Linn. Soc. London*, 7, 1–24), Massy (1916: *Rec. Indian Mus.*, 12: 185–248), and Adam (1939, *Ibid.*, 41: 61–110), based on collections in the Indian Museum. Little attention has been paid to the study of the biology and fishery of Indian cephalopods. The only detailed account we have is the one on *Sepioteuthis arctipinnis* Gould reported on by Rao (1954: *Indian J. Fish.*, 1: 37–66). Other sources of information are stray records or accounts in expedition reports. In the light of these it is evident that there is need for more information on the Cephalopoda of the Indian Seas.

The present account deals with the dibranchiate cephalopods (Decapoda, Vampyromorpha and Octopoda) collected by the author during the research cruises of the Indo-Norwegian Project Research Vessel *VARUNA* from off the west coast of India and the Laccadive Sea. Samples were obtained in the course of the operation of different fishing gears and plankton nets as follows: Over 215 otter trawl collections made from different parts of the continental shelf and the continental slope to a maximum depth of 380 metres; 101 mid-water trawl collections made with the Isaacs-Kidd mid-water trawl from depths between 20 and 350 metres from the south-west coast of India and the Laccadive Sea; 92 drift net collections made in the same area; about 2,363 plankton samples from 0–200 m. and 38 deep-water plankton collections made with the Indian Ocean Standard net from depths from 250 to 1,300 metres. In addition, at night, collections of oceanic squids (Ommastrephidae) were made by dip-netting also using a night light at the side of the ship. Stomach inclusions of some of the pelagic fishes, especially tunas obtained in drift nets, were also examined for cephalopod remains.

The families chiefly dealt with in this account are Ommastrephidae, Sepiolidae, Sepiidae, Loliginidae, Enoploteuthidae, Cranchiidae, Chiroteuthidae, Bolitaenidae and Octopodidae. In addition, to facilitate reference, a list of the Cephalopoda known to occur in the Indian Ocean is included.

INTRODUCTION

A COMPREHENSIVE treatise on the Cephalopoda of the Indian Seas is wanting. The only noteworthy works with reference to this area are those by Goodrich (1896), Massy (1916), and Adam (1938, 1939 *b*). The Cephalopoda around Ceylon was reported on by Winckworth (1926, 1936). Hoyle (1906), and Robson (1921) studied the material from the Laccadive and Maldive Archipelagos.

Noteworthy works on Cephalopoda from other parts of the Indian Ocean are those by Chun (1910, 1914, 1915), Adam (1939 *a*, 1939 *c*, 1954, 1960), Wulker (1920), Massy (1927), Robson (1924 *a*, 1924 *b*, 1929, 1932), Thore (1949), and Adam and Rees (1966). Several important works on the Cephalopoda of the Pacific and Atlantic Oceans also deal with Indian Ocean species and in this connection special mention should be made of the works of Pfeffer (1912), Berry (1912), Sasaki (1929), Hoyle (1886), Verrill (1881, 1882), Pickford (1946, 1949), Roper (1966), and Voss (1956, 1963),

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The classification adopted here is that given by Thiele (1935) with slight modifications as given by Voss (1956, 1963). A list of the nominal species of Cephalopoda, both valid species and synonyms so far recorded or described from the Indian Ocean is given in the second part of this paper to facilitate reference.

MATERIAL

Since January 1962, R. V. *VARUNA* has been carrying out hydrographic work as well as exploratory fishing off the west coast of India and the Laccadive Sea, with a few cruises undertaken as far south as the Equator and in the Bay of Bengal. A total of 2,363 plankton samples (including 138 duplicate hauls) collected during the first 75 cruises of R. V. *VARUNA* were examined for Cephalopoda. Most of the samples are from vertical tows made with the Indian Ocean Standard Net from 200 metres to surface or from 5 metres above bottom (in the continental shelf area) to surface. In addition to these, 45 horizontal surface tows made with the same net for 15 minutes

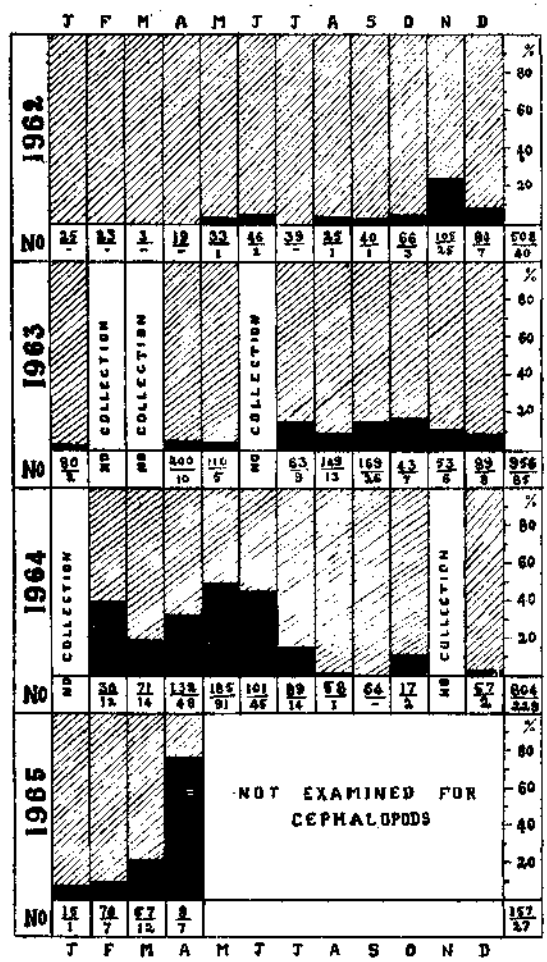

FIG. 1. Percentage of R. V. *VARUNA* plankton tows (vertical upto 200 m to 0 m) with cephalopods in relation to the total number of tows taken during each month for the period January 1962 to April 1965.

duration between 20·00 and 22·00 hours and 38 deep-water open tows from depths upto 1,300 metres were also examined for Cephalopoda. Besides these, cephalopods from 101 Isaacs Kidd Mid-water Trawl collections from various depths from surface to 350 metres taken in the same area also studied. The exploratory fishing were programme of R. V. *VARUNA* included otter trawling from shallow neritic waters to a depth of about 400 metres off the edge of the continental drift-netting from both neritic and oceanic waters. Cephalopods were obtained during fishing shelf and special study was made of the material obtained in drift nets.

CEPHALOPODA OF R. V. *VARUNA* PLANKTON COLLECTIONS

Of a total of 2,363 plankton samples examined for Cephalopoda, 383 (16·21%) (Fig. 1) were found to contain mostly larvae and juveniles of species of the families Sepiidae, Loliginidae, Enoploteuthidae, Histioteuthidae, Bathyteuthidae, Ommastrephidae, Chiroteuthidae, Cranchiidae, Bolitaenidae, Octopodidae and Argonautidae. The species most abundant in the collections are:

Abralia andamanica Goodrich

Abraliopsis gilchristi (Robson)

Thelidioteuthis alessandrinii (Verany)

Bathyteuthis abyssicola Hoyle

Calliteuthis reversa Verrill

Symplectoteuthis oualaniensis (Lesson) (*Rhynchoteuthis* 'Stage')

Larval 'Doratopsis Stage' of *Chiroteuthis* sp.

Liocranchia valdivia Chun

Liocranchia reinhardti (Steenstrup)

Japetella diaphana Hoyle

Larvae of Octopodidae (Several species)

?*Argonauta hians* Solander

Larvae of Sepiidae and Loliginidae (In neritic collections)

The distribution and abundance of Cephalopoda in the net plankton based on Indian Ocean Standard Net collections have been studied. The estimated abundance of cephalopods (all species in the plankton) in 1000^3 metres of water strained is shown for the years 1963 and 1964 in the accompanying Figs. 2 and 3. The quantitative distributions have been shown by contouring the standard contour intervals based on a logarithmic scale to the base 10. Greater abundance is noticeable in the continental shelf, especially off Cochin and in the Wadge Bank area off Cape Comorin during the year 1963. During the same year, cephalopods were very scarce in the neritic collections north of Cochin except off Mangalore. As in 1963, the area immediately south of Quilon was found to be poor in cephalopod larvae in 1964. Greater abundance was noticed in the Wadge Bank and between Quilon and Mangalore, the bulk of the material composed of larvae of Octopodidae, Sepidae, Loliginidae and Enoploteuthidae.

The relative abundance of cephalopods in the day hauls and night hauls both in the neritic (shelf area) and oceanic areas is shown in Table I. It will be noted that the number of specimens taken in night hauls in the neritic and oceanic areas is more or less the same (210 *versus* 211 in 98 and 99 hauls with cephalopods respectively). However, day hauls indicate that a slightly greater number of specimens were captured in the neritic than in the oceanic area (217 *versus* 171 respectively).

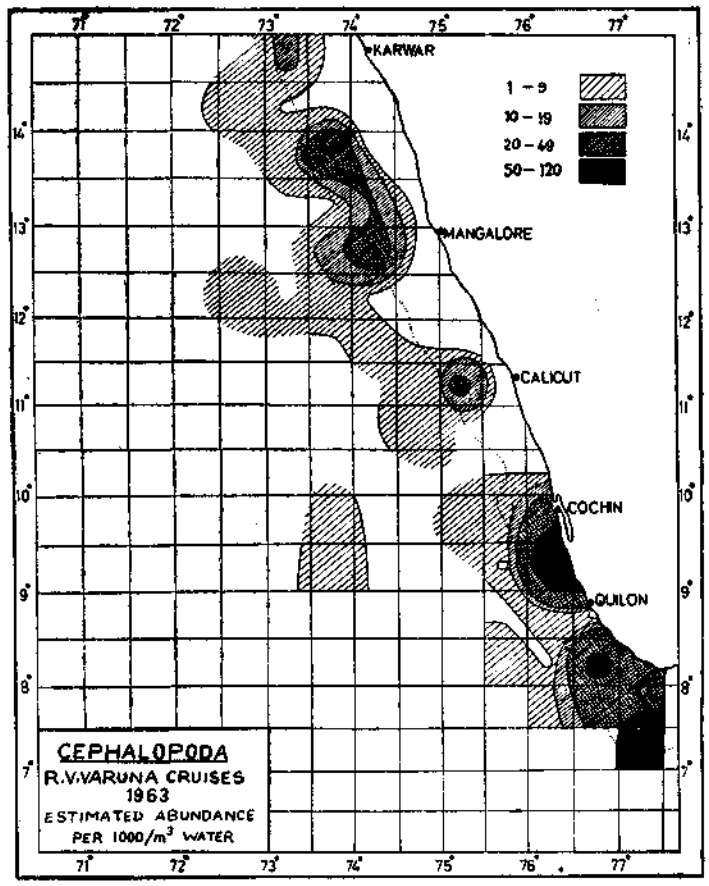

FIG. 2. Estimated abundance of cephalopods in the r 1963.

No closing device was used for the Indian Ocean Standard Net and as such it would be rather difficult to comment on the vertical distribution of the pelagic species, some of which are also known to be mesopelagic and bathypelagic. However, a depth-wise analysis is given (Table II) which may give some idea of the distributional patterns in the neritic area. For instance, there were more samples with cephalopods in hauls taken from 50–0 m. onwards to 100–0 m, while fewer hauls from 10–0 m onwards to 40–0 m contained cephalopods. The reasons for this apparent abundance in the 55 m to 105 m depth zone are not quite clear.

In Tables III to IX, the tows containing cephalopods during each month and the total number of specimens caught are shown for the period January 1962 to May 1965. In Fig. 4, the combined frequency of occurrence of the different species of cephalopods in the net plankton is indicated. From these, the following are evident:

1. The maximum number of cephalopods were taken during the months April to July and in the months November and December.

2. The larvae of *Abralia andamanica* were taken in greater numbers than other species.

3. Larvae of *A. andamanica* were more common in the months June–July (especially in 1964) when compared to *Abraliopsis gilchristi* the largest number of which were taken in the month of May (especially in 1964).

4. *Abraliopsis gilchristi* evinces a more oceanic distribution when compared to *Abralia andamanica* which was well represented in the continental shelf area.

5. Most of the ommastrephid larvae (*Rhynchoteuthis*-type) have been identified as belonging to the species *Symplectoteuthis oualaniensis*. They were more abundant in the months March–April and November-December. Some stages in development are illustrated in Fig. 5.

6. Larvae of Octopoda (all species) were present more abundantly in the months April–May, and they were more frequently taken in the neritic waters.

7. Larval 'Doratopsis stage' of *Chiroteuthis* spp., larvae of Cranchiidae and larvae of *Japetella diaphana* also occurred more frequently in the months April–May and November-December.

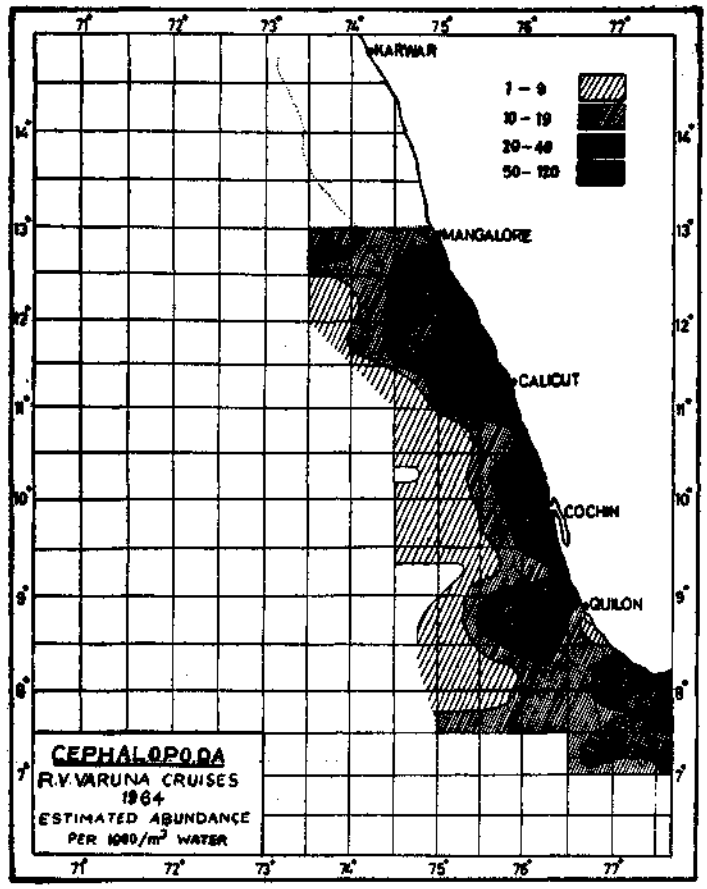

FIG. 3. Estimated abundance of cephalopods in the plankton for the year 1964.

TABLE I

Frequency of occurrence of cephalopods in R. V. VARUNA plankton collections from the neritic and oceanic areas off the west coast of India and the Laccadive Sea (January 1962 to May 1965)

Particulars	Neritic	Oceanic	Total
No. of plankton hauls	1605	758	2363
No. of samples with cephalopods	207	176	383
Percentage of samples with cephalopods	8·76	7·44	16·20
No. of day hauls with cephalopods	109	77	186
Percentage of day hauls with cephalopods in total number of samples	4·61	3·25	7·87
Percentage of day hauls with cephalopods in relation to total number of samples from neritic and oceanic areas ..	6·79	10·15	
No. of night hauls with cephalopods	98	99	197
Percentage of night hauls with cephalopods in total number of samples	4·15	4·19	8·34
Percentage of night hauls with cephalopods in relation to total number of samples from neritic and oceanic areas ..	6·11	13·06	
Total number and (per cent) of specimens caught ..	427 (52·78)	382 (47·22)	809
No. and (per cent) of specimens in day hauls (% of 388) ..	217 (55·93)	171 (44·07)	388
No. and (per cent) of specimens in night hauls (% of 421) ..	210 (49·88)	211 (50·12)	421

TABLE II

Occurrence of cephalopods in the plankton samples in relation to depth of haul

Depth (M)[1]	Total No. of samples	Day hauls: No. of samples with cephalopods	Day hauls: Percentage of hauls with cephalopods	Day hauls: No.	Day hauls: No. with cephalopods	Day hauls: % in total day hauls	Day hauls: No. of specimens	Night hauls: No.	Night hauls: No. with cephalopods	Night hauls: % in total night hauls	Night hauls: No. of specimens
10–0	108	3	2·77	..	..	..	..	58	3	5·17	4
20–0	151	3	1·98	78	2	2·56	2	73	1	1·36	1
30–0	246	19	7·72	124	9	7·25	13	122	10	8·19	10
40–0	183	15	8·19	98	4	4·08	6	85	11	12·94	24
50–0	265	41	15·47	136	21	15·44	33	129	20	15·50	36
60–0	103	17	16·50	61	12	19·67	27	42	5	11·90	14
70–0	58	9	15·51	30	3	10·00	6	28	6	21·42	8
80–0	151	19	12·58	100	15	15·00	35	51	4	7·84	8
90–0	35	9	25·71	13	6	46·15	27	22	3	13·63	3
100–0	107	10	9·34	56	7	12·50	11	51	3	5·88	6
110–0	8	2	25·00	3	1	33·33	1	5	1	20·00	2
120–0	5	..	..	1	..	..	..	4	..	..	..
130–0	5	2	25·00	2	1	50·00	2	3	1	33·33	D*
140–0	2	..	..	2	..	..	..	..	..	..	..
150–0	72	19	26·38	32	4	12·50	5	40	15	37·50	60
160–0	12	5	41·66	7	3	4·28	6	5	2	40·00	3
170–0	17	8	47·05	14	5	35·71	12	3	3	100·00	6
180–0	47	12	25·53	26	7	26·92	12	21	5	23·80	5
190–0	30	14	46·66	20	9	45·00	19	10	5	50·00	20
Total for shelf area	1,605	207	12·90	803	109	13·57	217	752	98	13·03	210
Oceanic 200–0	758	176	23·21	369	77	20·86	171	389	99	25·44	211
TOTAL ..	2,363	383	16·21	1,172	186	15·87	388	1,141	197	17·26	421

[1] All hauls between 11 and 20 metres have been included in the 20–0 m group, and so on,

* Damaged bits of specimens and hence number not indicated,

TABLE III

Occurrence of larvae of Abraliopsis gilchristi *in the IOS Net collections made during the cruises of R. V.* VARUNA *off the west coast of India and the Laccadive Sea (January 1962 to May 1965)**

Year	J	F	M	A	M	J	J	A	S	O	N	D
1962	—	—	—	—	—	—	—	—	—	—	2 (2)	1 (1)
1963	—	—	—	1 (1)	1 (1)	—	—	—	—	—	1 (1)	1 (1)
1964	—	—	1 (1)	4 (4)	16 (27)	—	1 (1)	—	—	—	—	—
1965	—	—	—	—	—							
Combined frequency	—	—	1 (1)	5 (5)	17 (28)	—	1 (1)	—	—	—	3 (3)	2 (2)

* In Tables III to IX the number of positive hauls during each month is indicated followed by the total number of specimens. The area and the period of observations (1962 to May 1965) are the same for the species and larval types given in these tables and hence are not repeated in the titles.

TABLE IV

Occurrence of larvae of Abralia andamanica *in the IOS Net collections*

Year	J	F	M	A	M	J	J	A	S	O	N	D
1962	—	—	—	—	—	—	—	—	—	—	2 (3)	2 (3)
1963	—	—	—	3 (3)	—	—	8 (56)	1 (1)	—	—	2 (7)	1 (1)
1964	—	1 (1)	6 (6)	8 (9)	18 (42)	26 (91)	9 (14)	—	—	—	—	1 (3)
1965	—	1 (1)	1 (1)	—	—							
Combined frequency	—	2 (2)	7 (7)	11 (12)	18 (42)	26 (91)	17 (70)	1 (1)	—	—	4 (10)	4 (6)

TABLE V

Occurrence of larvae of Ommastrephidae (Rhynchoteuthis *larvae) in the IOS Net collections*

Year	J	F	M	A	M	J	J	A	S	O	N	D
1962	—	—	—	—	—	—	—	—	—	1 (1)	9 (15)	8 (18)
1963	1 (2)	—	—	3 (4)	—	—	1(1)	—	1 (1)	2 (2)	—	9 (15)
1964	—	5 (7)	11 (17)	11 (13)	17 (28)	—	—	—	1 (1)	—	—	—
1965	—	—	4 (5)	—	—							
Combined frequency	1 (2)	5 (7)	15 (22)	14 (17)	17 (28)	—	1 (1)	—	2 (2)	3 (3)	9 (15)	17 (33)

TABLE VI

Occurrence of larval 'Doratopsis Stage' of Chiroteuthis *spp. in the IOS Net collections*

Year	J	F	M	A	M	J	J	A	S	O	N	D
1962	—	—	—	—	—	—	—	—	—	—	—	1 (1)
1963	—	—	—	—	—	—	—	—	1 (1)	1 (2)	1 (1)	—
1964	—	—	1(1)	1 (1)	3 (3)	1 (1)	1 (1)	—	—	—	—	—
1965	—	—	1 (1)	—	—							
Combined frequency	—	—	2 (2)	1 (1)	3 (3)	1 (1)	1 (1)	—	1 (1)	1 (2)	1 (1)	1 (1)

TABLE VII

Occurrence of Cranchiidae (larvae and adults) in the IOS Net collections

Year	J	F	M	A	M	J	J	A	S	O	N	D
1962	—	—	—	—	—	—	—	—	—	1 (1)	1 (1)	—
1963	—	—	—	—	—	—	1 (1)	2 (2)	—	—	1 (1)	—
1964	—	1 (1)	—	2 (3)	6 (8)	1 (1)	—	—	—	—	—	—
1965	—	2 (2)	—	—	—							
Combined frequency	—	3 (3)	—	2 (3)	6 (8)	1 (1)	1 (1)	2 (2)	—	1(1)	2 (2)	—

TABLE VIII

Occurrence of larvae of Octopoda in the IOS Net collections

Year	J	F	M	A	M	J	J	A	S	O	N	D
1962	—	—	—	—	1 (1)	—	—	—	1 (1)	—	—	2 (2)
1963	—	—	—	2 (2)	2 (2)	—	1 (1)	5 (22)	—	1 (1)	3 (4)	—
1964	—	7 (9)	3 (4)	10 (23)	27 (43)	9 (13)	1 (1)	—	1 (2)	—	1 (1)	1(1)
1965	—	1 (1)	3 (4)	—	—							
Combined frequency	—	8 (10)	6 (8)	12 (25)	30 (46)	9 (13)	2 (2)	5 (22)	2 (3)	1 (1)	4 (5)	3 (3)

TABLE IX

Occurrence of Japetella diaphana *in the IOS Net collections*

Year	J	F	M	A	M	J	J	A	S	O	N	D
1962	—	—	—	—	—	—	—	—	—	—	4 (4)	2 (2)
1963	—	—	—	2 (2)	—	—	—	—	—	—	1 (1)	1 (1)
1964	—	—	—	1 (1)	1 (1)	—	—	—	1 (1)	—	—	—
1965	—	—	—	—	—							
Combined frequency	—	—	—	3 (3)	1 (1)	—	—	—	1 (1)	—	5 (5)	3 (3)

In Figs. 6-11, the occurrence and distribution of these species in the area where R. V. *VARUNA* worked are indicated.

CEPHALOPODS TAKEN IN ISAACS KIDD MID-WATER TRAWL DURING CRUISES OF R. V. *VARUNA*

A three metre (board) Isaacs Kidd Mid-water trawl was used during cruises of R. V. *VARUNA* and 101 samples collected between 1963 and December 1967 were examined for cephalopods. Of these 68 tows (67·4%) contained cephalopods (larvae and adults). Twenty-six of these tows were made during day-time (06·00–18·00 hrs.) yielding 83 specimens, while 42 night tows contained 199 specimens. A depth-wise analysis of the tows and the number of specimens obtained are shown in Table X. As no closing device was used for the net, the hauls have been shown as from 50 metre intervals to surface.

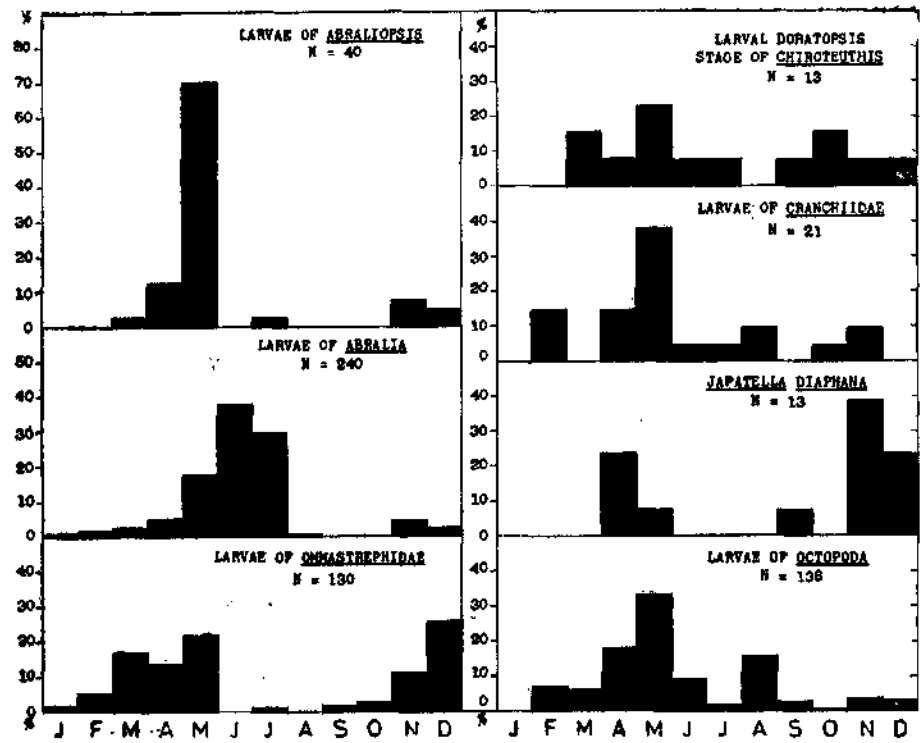

FIG. 4. Monthly occurrence and abundance of seven of the more frequently occurring cephalopod larvae in the IOS Net collections off the south-west coast of India and the Laccadive Sea (May 1962–April 1965).

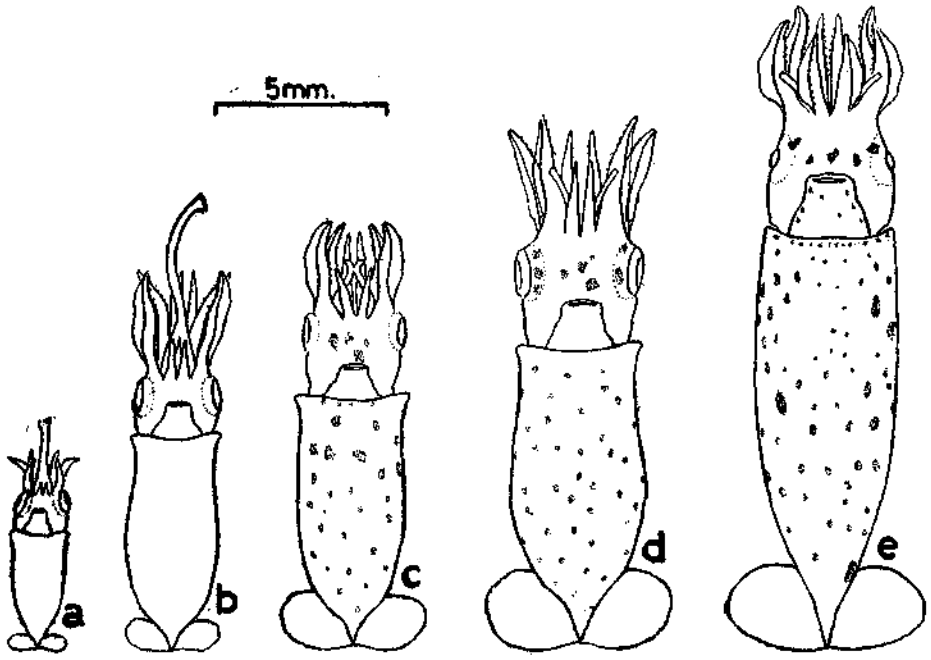

FIG. 5. "*Rhynchoteuthis* larvae" and early juveniles of *Symplectoteuthis oualaniensis* (Lesson) from R. V. *VARUNA* plankton collections.

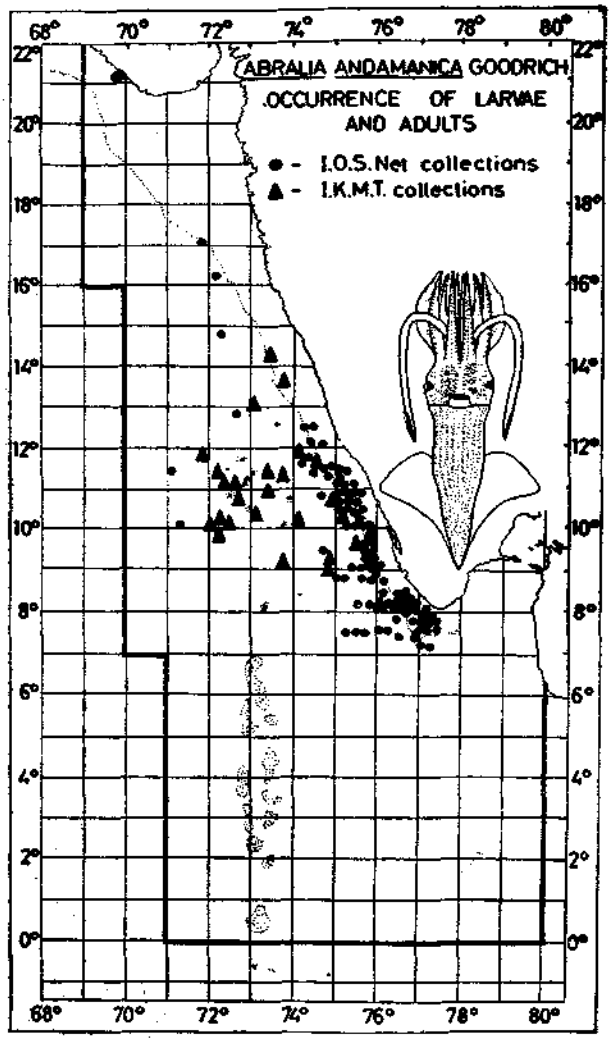

FIG. 6

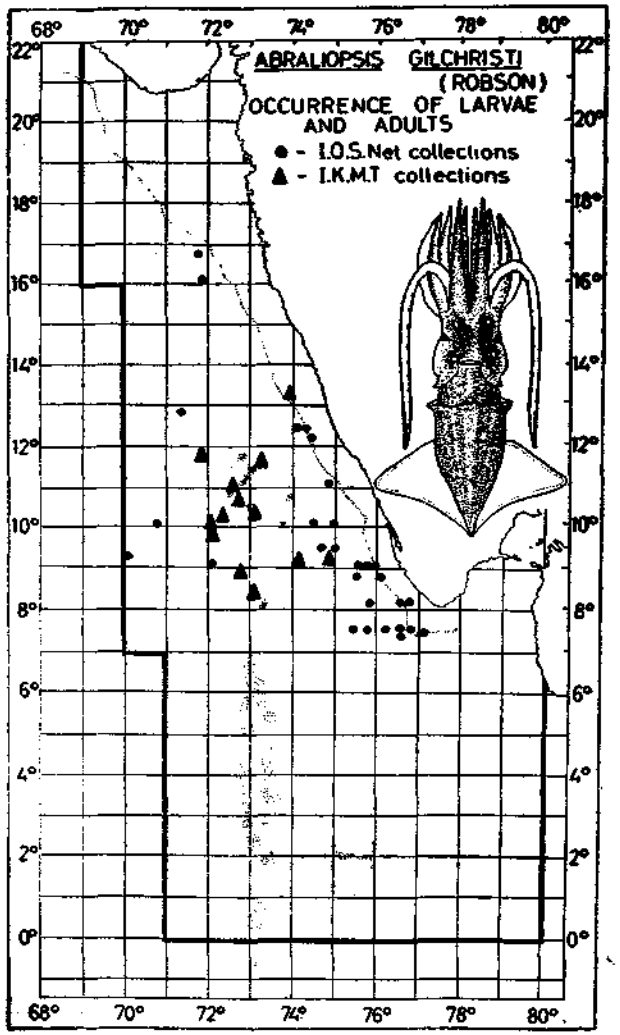

FIG. 7

FIGS. 6–7. Fig. 6. Map showing the places from where larvae and adults of *Abralia andamanica* were collected during R. V. *VARUNA* cruises. In Figs. 6–12, the dark line delimits the area covered during R. V. *VARUNA* cruises. Fig. 7. Map showing the places from where larvae and adults of *Abraliopsis gilchristi* were collected during R. V. *VARUNA* cruises.

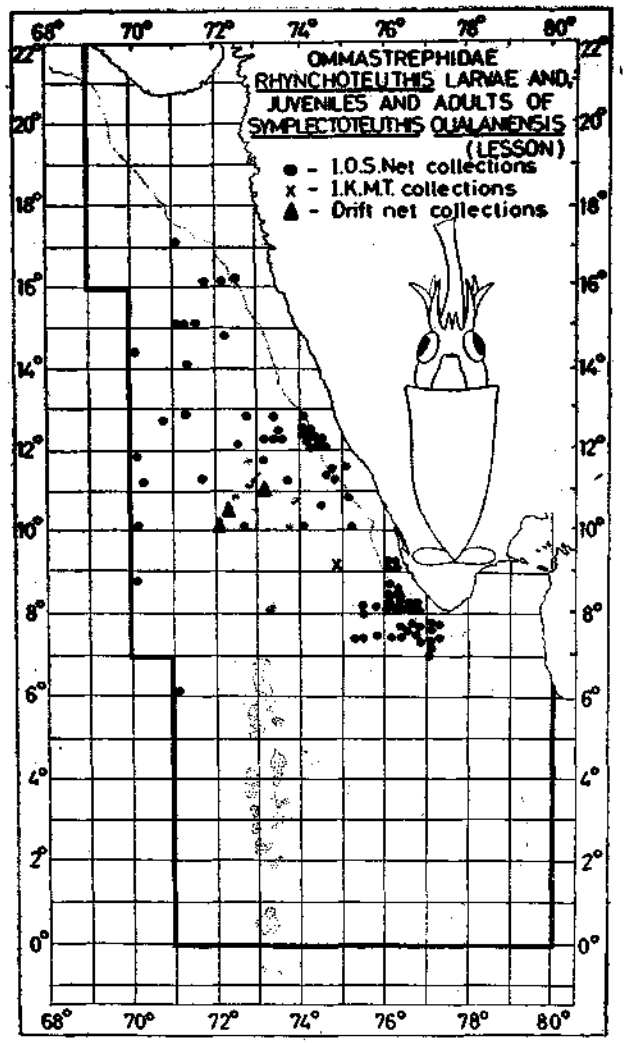

FIG. 8

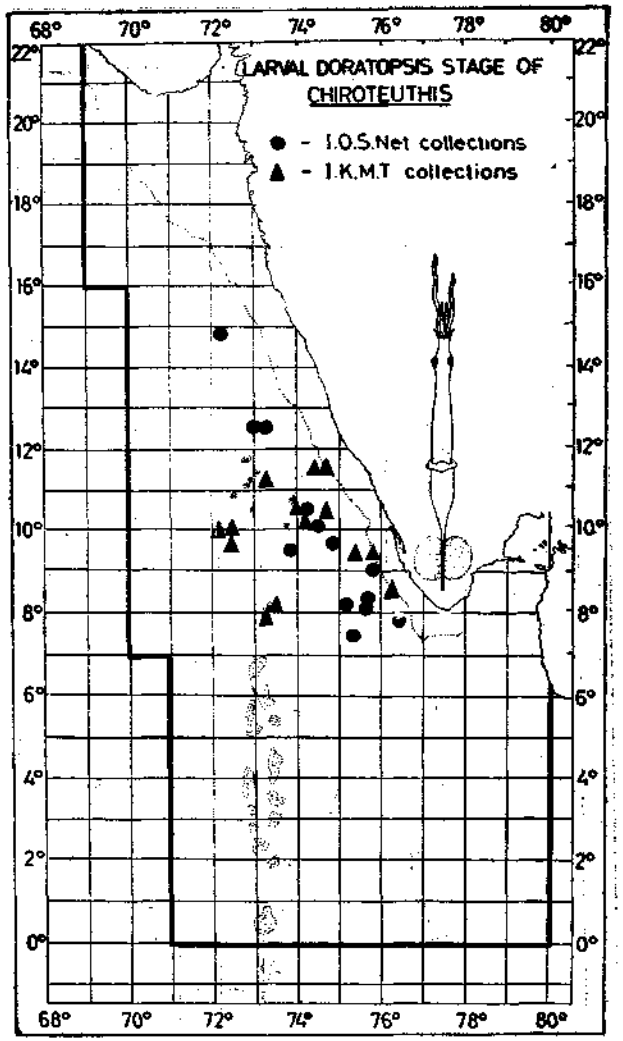

FIG. 9

FIGS. 8–9. Fig. 8. Map showing the places from where "*Rhynchoteuthis* larvae", juveniles and adults of *Symplectoteuthis oualaniensis* were collected during R. V. *VARUNA* cruises. Fig. 9. Map showing places from where larval doratopsis stage of *Chiroteuthis* spp., were collected during R.V. *VARUNA* cruises.

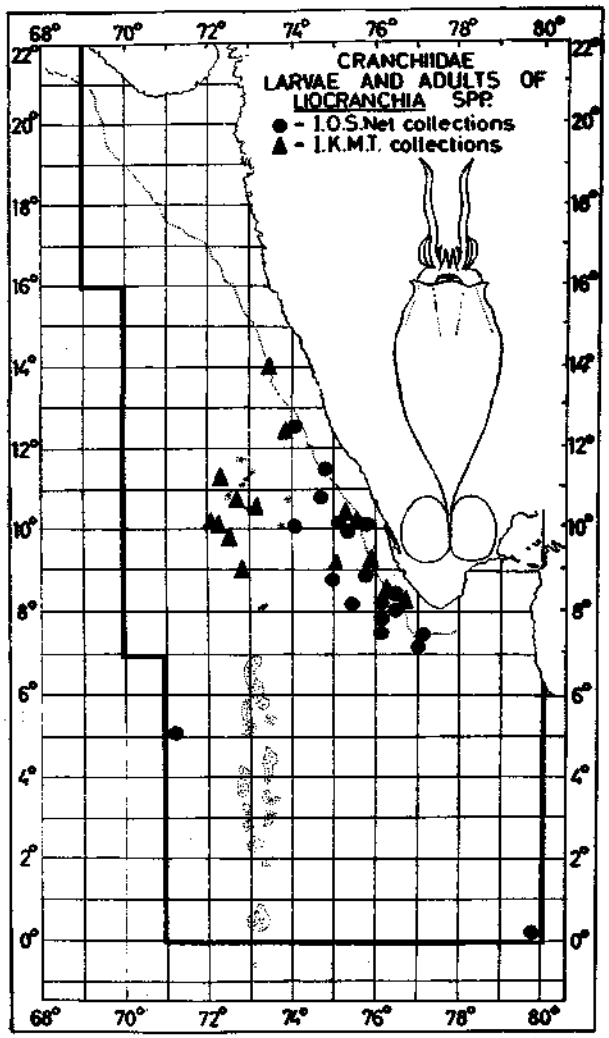

FIG. 10

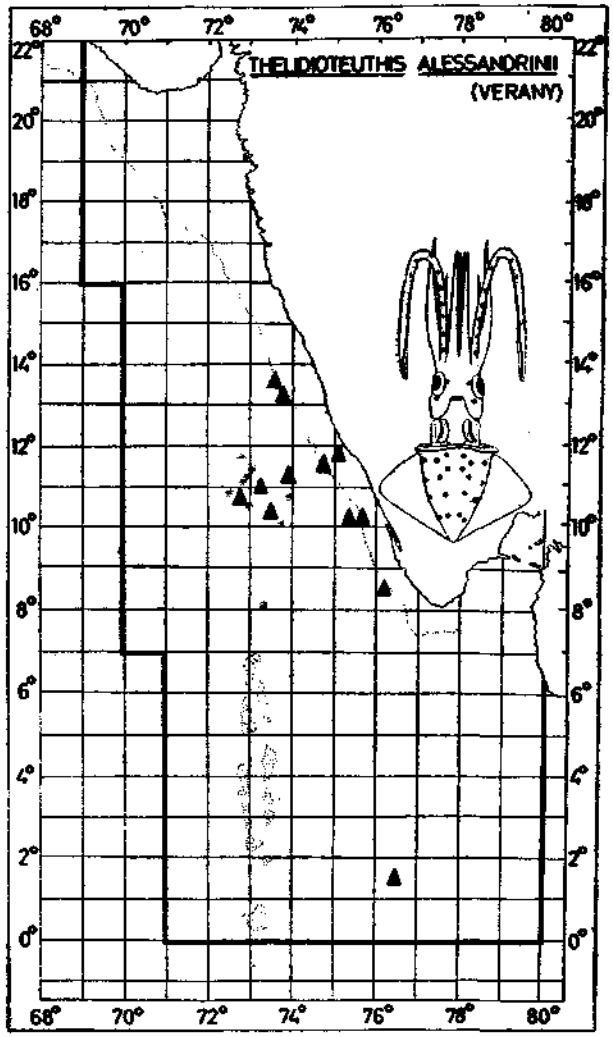

FIG. 11

FIGS. 10-11. **Fig. 10.** Map showing places from where larval and adult *Liocranchia* (Cranchiidae) were collected during R. V. *VARUNA* cruises. **Fig. 11.** Map showing places from where *Thelidioteuthis alessandrinii* larvae were collected during R. V. *VARUNA* cruises.

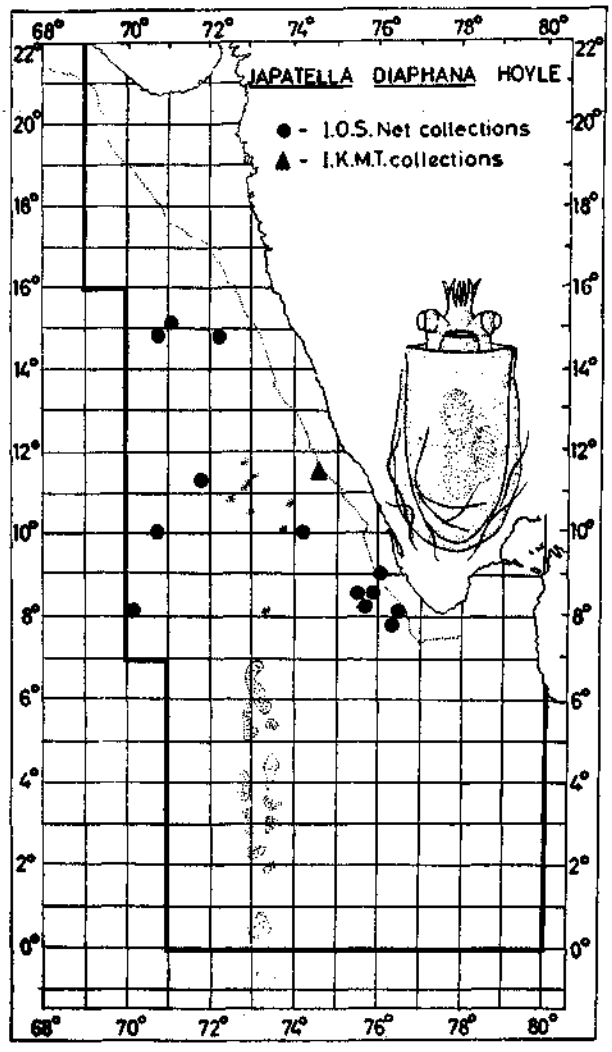

FIG. 12. Map showing places from where *Japetella diaphana* larvae were collected during R.V. ***VARUNA*** cruises.

TABLE X

Cephalopods in Isaacs Kidd Mid-water Trawl collections

Depth Range	Total No. of tows	Tows without cephalopods	Tows with cephalopods	Number of specimens
50–0 m	39	20	19	55
100–0 m	42	11	31	170
150–0 m	14	1	13	40
200–0 m	2	—	2	4
250–0 m	—	—	—	—
300–0 m	2	..	2	11
350–0 m	2	1	1	2
TOTAL ..	101	33	68	282

Besides the species obtained in the IOS Net, one interesting addition is a third representative of the family Enoploteuthidae, namely, *Thelidioteuthis alessandrinii* (Verany). This species is represented by a number of juveniles and three adults in the collections. The distribution of this species is shown in Fig. 11.

CEPHALOPODS IN IOS NET SURFACE TOWS

In some of the surface tows taken with the IOS Net generally between 20·00 and 22·00 hours during R. V. *VARUNA* cruises larvae of *Symplectoteuthis oualaniensis* are well represented, a single haul at Stn. 3365 containing as many as 38 larvae. On the other hand larvae of *Abralia* and *Abraliopsis* which were more frequently seen in vertical tows were relatively scarce.

As will be seen from Table XI, more cephalopod larvae occurred in surface tows taken during February.

TABLE XI

Cephalopods in IOS Net surface tows

Year	Month	Total No. of tows	No. of tows with cephalopods	No. of specimens
1966	February ..	21	12	154
	December	10	1	4
1967	February ..	13	8	35
	March ..	4	2	2
	April ..	3	1	8
	June ..	3	1	1
	September ..	4	2	3
	October ..	3	—	—
	November	5	—	—
	December ..	3	1	1
	TOTAL ..	69	32	208

CEPHALOPODS IN DEEP-WATER OPEN TOWS WITH THE IOS NET

The IOS Net was also used for making 38 deep-water vertical open tows from depths between 250 m to surface and 1,300 m to surface. These collections have not yielded many specimens of cephalopods, probably as the speed of hauling (about 45–50 m/minute) was too slow to capture specimens of cephalopods as compared to 55 to 60 m/minute in vertical tows with the same net from depths upto 200 m reported earlier.

The occurrence of cephalopods in the deep-water collections are shown in Table XII.

TABLE XII

Cephalopods in IOS Net deep-water collections

Year	Month	Total No. of tows	No. of tows with cephalopods	No. of specimens
1963	November ..	8	2	4
	December ..	9	2	3
1964	March	5	3	5
	April ..	1	—	—
	October ..	1	—	—
	December ..	1	—	—
1965	February ..	2	1	1
	March ..	1	—	—
	November ..	2	—	—
1966	February ..	8	—	—
	TOTAL	38	8	13

OTHER COLLECTIONS

1. *Drift net fishing.*—In the course of exploratory fishing with drift nets of varying mesh sizes on a number of occasions specimens of *Symplectoteuthis oualaniensis* have been caught in net sections with mesh size of 3 cm. Very often 15 to 20 specimens are found in a small section of the net indicating the shoaling habit of this species. As the nets are hauled in at dawn, on many occasions live specimens entangled in nets have been caught. Like other ommastrephids, *S. oualaniensis* is also known to leap out of water. On a number of occasions at night whole schools have been seen leaping out of water in pursuit of fish and other planktonic organisms attracted by light to the side of the research vessel. On 7-2-1966, while shooting the drift net, one specimen 23 cm in total length 'flew' and landed on the main deck of the vessel.

2. *Otter trawl collections.*—Material of cephalopods from the trawling grounds have been collected and the following were found to occur more commonly: *Sepia aculeata, Sepia pharaonis, Sepiella inermis, Loligo duvaceli,* and *Octopus macropus.* These collections made from depths upto 400 metres have not been fully worked out.

Figure 13 shows some of the species commonly met with in the IOS Net collections, Isaacs Kidd Mid-water Trawl collections and drift-net collections.

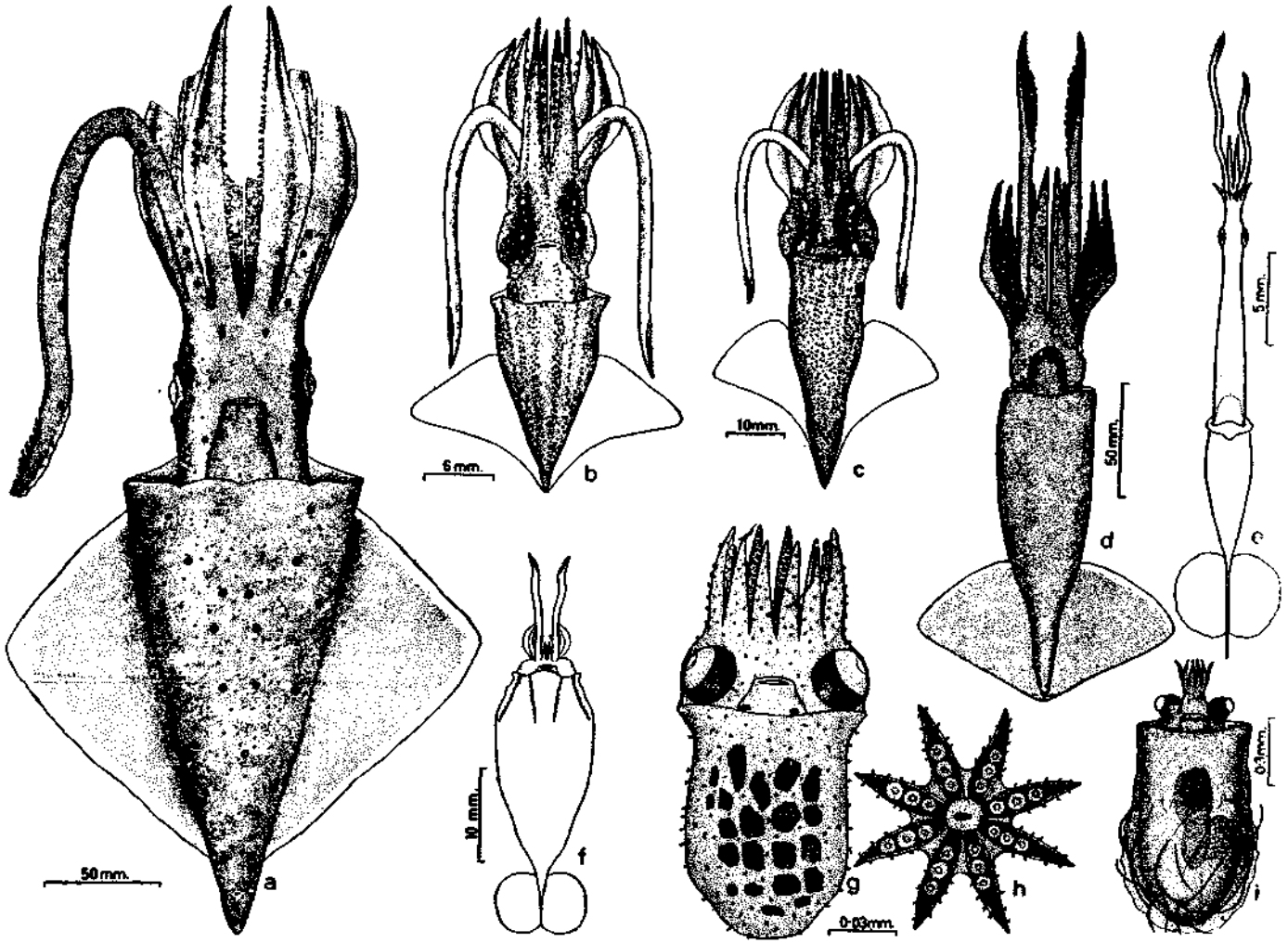

FIG. 13. Some of the more common species of cephalopods occurring in the plankton collections, mid-water trawl collections, and drift net collections off the south-west coast of India and Laccadive Sea. (*a*) *Thelidioteuthis alessandrini*, adult female; (*b*) *Abraliopsis gilchristi*; (*c*) *Abralia andamanica*; (*d*) *Symplectoteuthis oualaniensis*, adult; (*e*) Larval 'doratopsis stage' of *Chiroteuthis* sp.; (*f*) *Liocranchia reinhardti*; (*g*) Larval *octopus* and (*h*) arrangement of web and suckers in the same; (*i*) Larval *Japetella diaphana*. The thread-like structures seen over the body are not connected to the mantle but are embeded in the gelatinous covering and mucus surrounding the mantle.

PRELIMINARY CATALOGUE OF CEPHALOPODA KNOWN FROM THE INDIAN OCEAN

Up to now no attempt has been made to bring out a catalogue of the Cephalopoda of the Indian Ocean. Several cephalopods, especially the neritic squids and cuttlefishes are economically important as they form seasonal subsistence fishery in some places bordering the Indian Ocean. The same is true of several species of octopuses which are also consumed. Many of the cephalopods are important links in the trophic chain and pelagic cephalopods, especially some of the oceanic squids, are important as forage for pelagic fishes such as tunas, billfishes, lancet fishes, and for the toothed whales. Some of the epipelagic and bathypelagic species are useful indicators of water masses. In spite of their usefulness, the Cephalopoda of the Indian ocean has not received its due share of recognition. There are vast areas which have not been explored for their cephalopod fauna. The present catalogue, in addition to facilitating reference, will also give us a picture as to what is known about this interesting group on an ocean-wide basis. A catalogue of this nature involves a considerable amount of compilation and in this connection, the revisional works cited in the introductory part of this work have been helpful. Due to limitation of space, a complete bibliography is not given here, for which the references given in the papers listed at the end should be consulted. For instance, Adam and Rees (1966: pp. 156–159) have given an exhaustive list of references pertaining to the family Sepiidae.

On the basis of available literature brief remarks are given under each species and important references dealing with the species are cited. I will be most thankful if my attention could be drawn to any omissions or errors.

Class **CEPHALOPODA**

Subclass **NAUTILOIDEA**

Family NAUTILIDAE

Genus *Nautilus* Linnaeus, 1758

1. ***Nautilus pompilius*** Linnaeus, 1758, p. 709 (Type locality: 'Habitat in India'). Shells are widely distributed and may be washed up along coasts far removed from the natural habitat of the animal.

   Distribution: Indian Ocean; Western and Central Pacific (Philippines to Australia and Polynesia).

   Remarks: The species has been described by Owen (1832), Willey (1902), Griffin (1900) and others and its economic importance and ecology studied by Dean (1901).

Subclass **COLEOIDEA**

Order *SEPIOIDEA*

Family SPIRULIDAE

Genus *Spirula* Lamarck, 1801

2. ***Spirula spirula*** (Linnaeus, 1758), p. 710 (Type locality: 'America').

   Synonyms: Nautilus spirula Linnaeus, 1758 (As above); *Spirula australis* Lamarck, 1816; *Spirula prototypos* Peron and Lesueur, 1807; *Spirula peronii* Lamarck, 1822; *Spirula reticulata* Owen, 1848; *Lituus laevis*,

Gray, 1849; *Spirula blakei* Lönnberg, 1896; *Spirula australis* Chun, 1914; and *Spirula peronii* Hidalgo.

Distribution: Widely distributed in the different oceans and shells are washed ashore on beaches. The species inhabits depths between 200–1,500 metres.

Remarks: For detailed information on the morphology, anatomy and biology of this species reference is invited to Chun (1914), Kerr (1931), and Bruun (1943).

Family SEPIIDAE

Genus *Sepia* Linnaeus, 1758

3. ***Sepia aculeata*** Ferussac and d'Orbigny, 1835–1848, p. 287 (Type locality: Java).

Synonyms: Acanthosepion aculeatum Rochebrune, 1884, p. 101; *Acanthosepion hasselti*, Rochebrune, 1884, p. 101; *Sepia blainvillei* Ferussac and d'Orbigny, 1848 *nec* Deshayes, 1835; *Sepia indica* Ferussac and d'Orbigny, 1848, p. 281, pl. 21; *Acanthosepion indicum* Rochebrune, 1884, p. 112; *Acanthosepion javanicum*, 1884, p. 110; *Sepia microcotyledon*, Ortmann, 1891, p. 673, pl. 46, fig. 1; and *Sepia esculenta* var.? Robson, 1932, p. 29.

Distribution: Indo-Pacific. Adam and Rees (1966) record this species from the following areas in the Indian Ocean: Bombay, Cochin, Karwar, Mannar, Ennur, Madras, Dighe, Hambantota (Ceylon); Singapore, Penang. Outside the Indian Ocean they record it from Batavia, Sarawak, and Sasaki (1929) reports it from as far north as Formosa.

Remarks: For a description of the species reference is invited to Adam (1939 *c*), and Adam and Rees (1966: pp. 12–14, pl. 4, figs. 20 & 21; pl. 42, fig. 251).

4. ***Sepia acuminata*** Smith, 1916, p. 21, pl. 2, figs. 3 & 4 (Type locality: Port Elizabeth; Tongaat Beach, Natal).

Synonyms: Rhombosepion acuminata Robson, 1924 *a*, p. 643; *Sepia* sp. A. (partim) Robson, 1924, p. 13.

Distribution: South-Western Indian Ocean (Natal coast of Union of South Africa) and doubtfully recorded from Mombasa (Adam and Rees, 1966).

Remarks: For detailed description reference is invited to Adam and Rees (1966: pp. 53–55, pl. 16, figs. 91 & 92; pl. 43, fig. 261).

5. ***Sepia apama*** Gray, 1849, p. 103 (Type locality: Port Adelaide, Australia).

Synonyms: ?*Amplisepia verreauxi* Iredale, 1926, p. 194, pl. 23, figs. 1 & 2; ?*Sepia palmata* Owen, 1881, p. 134, pls. 24 & 25; ?*Amplisepia parysatis* Iredale, 1954, p. 71, pl. 4, figs. 1 & 2; *Sepia* sp. B, Voss, 1962, p. 3.

Distribution: Indian Ocean [Shark's Bay (*A. parysatis*)]. Western Pacific Ocean (Australia from Port Adelaide, Sydney, Hobson's Bay, Melbourne, Port Jackson and Semaphore, S. Australia; Norfolk Island; ?New Zealand).

Remarks: For detailed discussion and description of this species reference may be made to Adam and Rees (1966: pp. 34–38, pl. 12, figs. 64–67, pl. 45, fig. 269).

6. ***Sepia arabica*** Massy, 1916, p. 288, pl. 23, figs. 1–5, pl. 24, fig. 10 (Type localities: Laccadive Sea 11° 14′ 30″ N, 74° 57′ 15″ E from 68 to 148 fathoms; and from Persian Gulf, 26° 20′ N, 53° 54′ E from 54 fathoms).

Distribution: Laccadive Sea, Arabian Sea, Persian Gulf, Gulf of Aden, and Adam and Rees (1966: pp. 96–97, pl. 23, figs. 152–155, pl. 46, fig. 278) also mention of its occurrence in Red Sea. The depth distribution of this species is given by these authors as 97 to 270 metres.

7. ***Sepia australias*** Quoy and Gaimard, 1832, p. 70, pl. 5, figs. 3–7 (Type locality: Agulhas Bank).

Synonyms: Sepia (*Doratosepion*) *australis* Massy, 1925, p. 214; *Rhombosepion australe* Rochebrune, 1884, p. 85; *Rhombosepion australis* Massy, 1927, p. 156; *Sepia capensis* d'Orbigny, 1845; *Rhombosepion capensis* Rochebrune, 1884, p. 85; and *Sepia sinope*, Gray, 1849, p. 106.

Distribution: Indian Ocean (Agulhas Bank; Off Cape Natal, Durban; Port Elizabeth; Mossel Bay; Grahamstown, Natal; Port Alfred; Red Sea); South-Eastern Atlantic (Cape of Good Hope; Dassen Island and adjacent areas); Pacific Ocean (?China).

Remarks: For taxonomic discussion reference is invited to Adam and Rees (1966: pp. 89–91, pl. 21, figs. 138–142; pl. 45, fig. 270).

8. ***Sepia brevimana*** Steenstrup, 1875, pp. 475, 497; 1881, pl. 1, figs. 24–26 (Type locality: Indian Ocean).

Synonyms: Sepia rostrata (partim) Ferussac and d'Orbigny, 1848, p. 284 (*nec* 1835, pl. 8); *Acanthosepion rostratum* Rochebrune, 1884, p. 102, pl. 6, fig. 1; *Sepia winckworthi* Adam, 1939 *a*, p. 1, fig. 1, pl. 1 (From Singapore); *Acanthosepion spinigerum* (partim) Rochebrune, p. 103.

Distribution: Indian Ocean (Juhu, Bombay; Mannar; Madras; Puri; Port Blair, Andaman Islands; Hambantota, Ceylon; and Singapore). Western Pacific (Java Sea; Sarawak).

Remarks: For a taxonomic discussion reference is invited to Adam (1939 *a*, 1939 *c* and 1944), and for a redescription Adam and Rees (1966: pp. 5–7, pl. 2, figs. 5–8).

9. ***Sepia burnupi*** Hoyle, 1904, p. 27, pl. 1, figs. 188, 189 (Type locality: Umkomaas, Natal, South Africa).

Synonyms: Sepia (*Doratosepion*) *incerta* Massy, 1925, p. 219, pl. 13, figs. 22, 23, 29–36, pl. 14, figs. 40 and 43 (*nec* Smith, 1916); ?*Sepia exsignata* Barnard, 1962, p. 250, fig. 3,

Distribution: Natal coast of South Africa, from about 40 to 48 metres depth.

Remarks: For a description as well as taxonomic discussion reference is invited to Adam and Rees (1966: pp. 81–83, pl. 20, figs. 127 & 128).

10. ***Sepia confusa*** Smith, 1916, p. 24, pl. 2, figs. 7, 8 (Type localities: Tongaat Beach, Natal; Port Elizabeth, Cape Colony).

Synonyms: *Sepia brunupi* Hoyle, 1904, p. 27, pl. 1, fig. 192 (partim); *Doratosepion confusa* Massy and Robson, 1923, p. 435, figs. 1–3; *D. confusum* Robson, 1924 *a*, p. 647; *Sepia* (*Doratosepion*) *confusa* Massy, 1925, p. 221, pl. 13, figs. 20, 21, 24–28, pl. 14, fig. 38.

Distribution: South-east coast of Africa (Zanzibar area from 5° 38′ 54″ S 39° 15′ 42″ E to 5° 40′ 18″ S, 39° 17′ 36″ E; Natal coast to Port Elizabeth).

Remarks: For a redescription of the species and taxonomic discussion reference is invited to Adam and Rees (1966: pp. 65–67, pl. 18, figs. 112 & 113, pl. 42, fig. 248).

11. ***Sepia dollfusi*** Adam, 1941, p. 12, pl. 2, fig. 3; 1942, pp. 3, 8; 1959, p. 138, fig. 5, pl. 4, fig. 4; pl. 6, figs. 4, 5; and pl. 7 (Type locality: Perim, Red Sea).

Synonyms: *Sepia gibbosa* Issel, 1869, p. 238 (partim) (*nec* d'Orbigny); *Sepia lefebrei* Hoyle, 1907, p. 39, figs. 1–7; *Lophosepion lefebrei* Robson, 1927, p. 322 (partim) (*nec* d'Orbigny); *Sepia rouxi* Hoyle, 1907, p. 42 (partim) (*nec* Ferussac and d'Orbigny).

Distribution: Indian Ocean (Red Sea and Suez Canal).

Remarks: For a redescription and taxonomic discussion refer Adam and Rees (1966: pp. 98–99, pl. 24, figs. 156–158; pl. 41, fig. 237).

12. ***Sepia elliptica*** Hoyle, 1885, p. 189; 1885 *a*, p. 293; 1886, p. 131, pl. 19, figs. 14–24 [Type localities: "Challenger" Stations 188 (9° 59′ S, 139° 42′ E) and 190 (8° 56′ S, 136° 05′ E) from 28 fathoms in the Arafura Sea, South of Papua)].

Synonyms: *Acanthosepion* (*Fiscisepia*) *ellipticum adjacens* Iredale, 1926 *a*, p. 239, pl. 35, figs. 5, 6; and *Acanthosepion ellipticum* Iredale, 1954, p. 77.

Distribution: Indian Ocean (Ganjam coast, Orissa; Arabian Sea); Western Pacific (Arafura Sea, S. of Papua; Queensland; Melville Island, Northern Territory, N.-W. Australia; Pellew Group, Gulf of Carpentaria).

Remarks: For taxonomic discussion refer Adam (1939 *c*), and Adam and Rees (1966: pp. 14–16, pl. 5, figs. 24–27; pl. 43, fig. 258).

13. ***Sepia elongata*** d'Orbigny, 1845, p. 289, pl. 13, figs. 7–10 (Type locality: Near Cosseir, Red Sea).

Synonym: *Doratosepion elongatum* Rochebrune, 1884, p. 97.

Distribution: Indian Ocean (Red Sea near Cosseir and Gulf of Aqaba).

Remarks: Adam and Rees (1966: pp. 86–87, pl. 21, figs. 132 & 133) have shown that the Australian records of this species should refer to *S. braggi* Verco (1907). Adam (1941 *c*) has described the male of this species till then known only from the shell.

14. ***Sepia gibba*** Ehrenberg, 1831; *vide* Adam, 1941 *b*, p. 7, pl. 2, fig. 2 (Type locality: Red Sea).

Synonyms: *Sepia gibbosa* d'Orbigny, 1845, p. 287; *Lophosepion gibbosum* Rochebrune, 1884, p. 91; *Sepia lefebrei* d'Orbigny, 1845, p. 288, pl. 91; *Lophosepion lefebrei* Rochebrune, 1884, p. 90, pl. 4, fig. 2.

Distribution: Indian Ocean (Red Sea from Eylath, and Suakin, Sudan coast).

Remarks: For a description refer Adam and Rees (1966: pp. 100–102, pl. 25, figs. 159–161).

15. ***Sepia hieronis*** (Robson) 1924 *a*, p. 645, pl. 2, figs. 9–11 (Type locality: From 4 stations from Saldanha Bay to St. Helena Bay area and not off Cape Town, as given by Robson, 1924 *a*).

Synonyms: *Sepia* sp. A., Robson, 1924, p. 13; *Rhombosepion hieronia* Robson, 1924 *a* (As above).

Distribution: Indian Ocean (Natal, Union of South Africa); South-Eastern Atlantic Ocean (Off Cape Town; Saldanha Bay—St. Helena Bay area, Union of South Africa).

Remarks: For a recent description *see* Adam and Rees (1966: pp. 112–114, pl. 30, figs. 187 & 188; pl. 43, fig. 262).

16. ***Sepia insignis*** Smith, 1916, p. 25, pl. 2, fig. 10 (Type locality: Tongaat Beach, Natal, South Africa).

Distribution: Natal Coast.

Remarks: Adam and Rees (1966: p. 114, pl. 31, figs. 189–191) remark that "This species, the animal of which is unknown, does not seem to be related to any other species hitherto described".

17. ***Sepia incerta*** Smith, 1916, p. 23, pl. 2, fig. 6 (Type localities: Tongaat Beach, Natal; Port Elizabeth, Cape Province).

Synonyms: *Sepia burnupi* Hoyle, 1904 (partim), p. 27, pl. 1, figs. 190 and 191; *Sepia* (*Doratosepion*) *burnupi* Massy, 1925, p. 215, pl. 12.

Distribution: Indian Ocean (Natal Coast to Port Elizabeth, Union of South Africa).

Remarks: Species is known only from the male, a redescription of which is given by Adam and Rees (1966: pp. 67–70, pl. 19, figs. 114 & 115; pl. 41, fig. 241). They have also shown that the description of a female given by Massy (1925) should refer to *S. burnupi*, Hoyle (1904).

18. ***Sepia joubini*** Massy, 1927, p. 161, pl. 18 (Type locality: Tugela River mouth, Cape Natal).

Distribution: Indian Ocean (Tugela River mouth, Cape Natal, Union of South Africa).

Remarks: A redescription of the male and female is given by Adam and Rees (1966: pp. 70–71, pl. 43, fig. 257). The shell of this species is practically unknown.

19. ***Sepia kobiensis*** Hoyle, 1885, p. 195; 1885*a*, p. 300; 1886, p. 142, pl. 18, figs. 7–14 (Type locality: Bay of Kobe, Japan).

Synonyms: Sepia andreanoides Hoyle, 1885, p. 193; *Sepia* (*Doratosepion*) *andreanoides* Berry, 1912, p. 423; *Sepia* (*Doratosepion*) *kobiensis* Berry, 1912, p. 423; *Sepia kobiensis* var. *typica* Sasaki, 1929, p. 206, fig. 111, pl. 19, figs. 1–4; *Sepia kobiensis* var. *andreanoides* Sasaki, 1929, p. 206, figs. 112–114, pl. 1, fig. 7, pl. 19, figs. 5–7; *Sepia kobiensis* var. *toyamensis* Sasaki, 1929, p. 209, fig. 115, pl. 19, fig. 8–12; *Sepia kobiensis* var. *beppuana* Sasaki, 1929, p. 211, fig. 115, pl. 19, figs. 13–15; *Sepia kobiensis* var. *crassa* Sasaki, 1929, p. 213, pl. 19, figs. 16–18; *Sepia kobiensis* var. *albatrossi* Sasaki, 1920, p. 195, pl. 26, figs. 2 and 3.

Distribution: Indian Ocean (All records are doubtful). ?Laccadive Sea, 11° 14′ 30″ N, 74° 57′ 15″ E from 68–148 fathoms (Massy, 1916); ?13° 36′ N, 47° 32′ N, 130 fms (Massy, 1916); ?South of Ceylon, 6° 2′ 30″ N, 81° 29′ E from 52 to 68 fms (Massy, 1916); ?Persian Gulf, 26° 20′ N, 53° 54′ E, from 53 fms (Massy, 1916); ?Off C. Negrais, Burma from 40 fms (Massey, 1916); ?Kolumadulu Atoll, from 35 fms (Hoyle, 1905). Pacific Ocean (?Poeloe Weh—*see* Adam, 1939 c; Several localities from Japan.

Remarks: Adam and Rees (1966: pp. 71–78, pl. 19, figs. 116–120; pl. 43, fig. 255; pl. 44, fig. 264) have shown that all previous records of this species from the Indian Ocean are doubtful. The varieties described by Sasaki (1929) are from Japanese waters. For detailed taxonomic discussion refer Adam and Rees (1966).

20. ***Sepia latimanus*** Quoy and Gaimard, 1832, p. 68, pl. 2 (Type locality: Port Dorey, Australia).

Synonyms: Sepia rappiana Ferussac, 1835, pl. 10; *Acanthosepion rappianum* Rochebrune, 1884, p. 105; *Sepia hercules* Pilsbry, 1894, p. 144, 1895, p. 2, pl. 1, figs. 1 & 2; *Ponderisepia eclogaria* Iredale, 1926*a*, p. 239, pl. 35, figs. 7 & 8; *Sepia eclogaria* Adam, 1939 *c*, p. 49; *Sepia harmeri* Robson, 1928, p. 8, figs. 2 & 3; and *Sepia mozambica* Rochebrune, 1884, p. 118.

Distribution: Indian Ocean (Mozambique and Singapore); Western Pacific (Malaya to Fiji and Australia to Japan).

Remarks: For taxonomic discussion reference may be made to Adam (1939 *c*) and Adam and Rees (1966: pp. 33–34, pl. 11, figs. 61–63t pl. 45, fig. 269 A).

21. ***Sepia murrayi*** Adam and Rees, 1966, pp. 63–65, pl. 18, figs. 107–111; pl. 43, fig. 260 (Type locality: John Murray Expedition Station 71, 25° 35′ N, 56° 42′ 18″ E to 25° 43′ N, 56°39′ 18″ E in Gulf of Oman at 106 m depth).

Remarks: The description is based on females and it is likely that it may be more widely distributed in the Indo-Pacific.

22. ***Sepia novaehollandiae*** Hoyle, 1909, p. 266 (Type locality: Kangaroo Island, South Australia).

Synonyms: *Sepia australis* Ferussac, 1835, pl. 7, fig. 4 (*nec* Quoy and Gaimard, 1832); *Mesembrisepia novaehollandiae* Iredale, 1926, p. 191; *Sepia (Mesembrisepia) novaehollandiae* Cotton and Godfrey, 1940, p. 428, figs. 416–418; ?*Sepia dannevigi* Berry, 1918, p. 264, figs. 51–55, pl. 73, pl. 74, figs. 1 & 2.

Distribution: Indian Ocean (? Western Australia). Western Pacific Ocean (South Australia).

Remarks: Adam and Rees (1966: pp. 48–53, pl. 15, figs. 84–90) have given a very lengthy discussion on this species. They have also commented on the following nominal species which have also been reported from Western Australia (Indian Ocean).

1. *Sepia irvingi* Meyer, 1909
2. *Sepia ostanes* (Iredale), 1954
3. *Sepia chirotrema* Berry (1918).

23. ***Sepia officinalis vermiculata*** Quoy and Gaimard, 1932, p. 64, pl. 1, figs. 1–5 (Type locality: Cape of Good Hope).

Synonyms: *Acanthosepion vermiculatum* Rochebrune, 1884, p. 113; *Acanthosepion vermiculata* Robson, 1924*a*, p. 639; ?*Sepia hierredda* Turton, 1932 (?*nec* Rang), p. 2; ?*Sepia jousseaumi* Rochebrune, 1884, p. 117.

Distribution: Indian Ocean (From mouth of Zambesi River southwards at Natal, Delagoa Bay, Isipingo, and Port Elizabeth to Knysna Estuary, Union of South Africa).

Remarks: While giving a description of the subspecies Adam and Rees (1966: pp. 30–32, pl. 10, figs. 55 & 56; pl. 45, fig. 271) have also commented on its affinities to the other subspecies known from the Atlantic and the Mediterranean, *viz.*, subsp. *officinalis* Linneaus (1758), subsp. *hierredda* Rang, subsp. *filliouxi* Lafont, and subsp. *mediterranea* Ninni. Reference is also invited to Adam (1941, 1952 and 1962).

24. ***Sepia omani*** Adam and Rees, 1966, pp. 92–94, pl. 22, figs. 143–147; pl. 41, figs. 242–244 (Type localities: Gulf of Oman from John Murray Exped. Stn. 75, 25° 10′ 48″ N, 56° 47′ 30″ E to 25° 09′ 48″ N, 56° 47′ 30″ E from 201 m.

Remarks: The species is said to show affinities to *S. prashadi* Winckworth (1936) and *S. kobiensis* Hoyle (1885).

25. ***Sepia papillata*** Quoy and Gaimard, 1832, p. 61, pl. 1, figs. 6–14 (Type locality: Cape of Good Hope, South Africa).

Synonyms: *Spathidosepion papillatum*, Rochebrune, 1884, p. 94; *Sepia tuberculata*, Hoyle, 1910, p. 265, pl. 4*a*, figs. 4–6 (*nec* Lamarck).

Distribution: Indian Ocean (Port Elizabeth, South Africa). South Eastern Atlantic Ocean (Cape of Good Hope).

Remarks: For a redescription and taxonomic discussion reference may be made to Adam and Rees (1966: pp. 108–109, pl. 28, figs. 175–178).

26. ***Sepia pageora*** (Iredale), 1954, p. 76, pl. 4, figs. 7–9 (Type locality: Keppel Bay, Queensland, Australia).

Synonyms: Sepia indica Gray, 1849, p. 108 (*nec* d'Orbigny, 1848); *Acanthosepion pageorum* Iredale, 1954 (as above).

Distribution: Indian Ocean (Port Cloates, Shark Bay, and Broome, Western Australia. Melville Island, Northern Territory, Australia, and Timor Sea which are on the border line between the Indian Ocean and Western Pacific Ocean may also be mentioned here). Western Pacific Ocean (Queensland).

Remarks: Adam and Rees (1966: pp. 20–22, pl. 7, figs. 36–37; pl. 42, fig. 253) who examined a specimen from Cape Upstart, Australia, remark that if their specimen "really belongs to *S. pageora*, this species is probably identical with *S. smithi* Hoyle."

27. ***Sepia pharaonis*** Ehrenberg, 1831 (Type locality: Tor, Sinai; Massaouah

Synonyms: Sepia rouxii Ferussac and d'Orbigny, 1841, p. 271, pl. 19; *Acanthosepion rouxii* Rochebrune, 1884, p. 108; *Sepia torosa* Ortmann, 1888, p. 652, pl. 23, fig. 2; *Sepia framea* Ortmann, 1891, p. 675, pl. 41, fig. 2; *Sepia singalensis* Goodrich, 1896, p. 3, pl. 1, figs. 4–8; *Ascarosepion singhalensis* var. *foxi* Robson, 1927, p. 325; *Sepia koettlitzi* Hoyle and Standen, 1901, p. 1, pl. 1; *Sepia formosana* Berry, 1912, p. 420, fig. 2, pl. 9, fig. 7; *Crumenasepia hulliana* Iredale, 1926, p. 239, pl. 35, figs. 1 & 2; *Sepia hulliana* Adam, 1939 *c*, p. 65; *Sepia tigris* Sasaki, 1929, p. 168, fig. 167, pl. 28, figs. 13–16; *Crumenasepia ursulae* Cotton, 1929, p. 90, pl. 15, figs. 3 & 4; *Sepia ursulae* Adam, 1939 *c*, p. 66; *Sepia* (*Crumenasepia*) *ursulae* Cotton and Godfrey, 1940, p. 434, fig. 421; ?*Sepia venusta* Pfeffer, 1884, p. 12, figs. 15 and 15 *a* (*nec* Munster, 1837); ?*Sepia venustoides* Hoyle, 1909, p. 266 (= *S. venusta* Pfeffer); *Sepia sinope* Voss, 1962 (*nec* Gray, 1849), p. 3.

Distribution: Indian Ocean (Red Sea; Suez; Suez Canal at Kabret and Port Taufiq; Muscat and Yedda, Arabia; Mukalla, S. Arabia; Mersa Fijab; Gulf of Aden; Berbera, British Somaliland; Colombo, off Point de Galle; Hambantota, Gulf of Mannar; Trincomali; Ceylon; Bombay, Rameswaram, Madras, Ennur, and Puri, India; Cottselow, Rottnest Island, Perth, Western Australia). Pacific Ocean (Howick Island, Northern Queensland, Australia; Hong Kong; Takao, Formosa; Taihoku Market, Formosa; Tokyo Bay, Japan).

Remarks: For taxonomic discussion reference may be made to Adam (1939 *c*), and Adam and Rees (1966: pp. 22–26, pl. 8, figs. 38–43; pl. 41, fig. 240).

28. ***Sepia prashadi*** Winckworth, 1936, p. 16 (Type locality: Madras).

Distribution: Indian Ocean (Madras, India; Mauritius; Madagascar; Gulf of Suez; and Gulf of Oman).

Remarks: A revised description of the species is given by Adam and Rees (1966: pp. 26–28, pl. 9, figs. 44–48; pl. 41, figs. 245 & 246).

For earlier accounts on the species reference is invited to Adam (1939 *c*, 1941 and 1959).

29. ***Sepia savignyi*** Blainville, 1827, p. 285 (Type locality: Red Sea).

Synonyms: *Sepia officinalis* Audouin in Savigny, 1827, p. 11, pl. 1, fig. 3 (*nec* Linnaeus); *Sepia savigni* Rochebrune, 1884, p. 115).

Distribution: Indian Ocean (Red Sea; Gulf of Aden; and Persian Gulf).

Remarks: For a discussion on the status of the species reference is invited to Adam (1959). The species has been redescribed by Adam and Rees (1966: pp. 10–11, pl. 3, figs. 16 & 17; pl. 4, figs. 18 & 19; pl. 41, fig. 238; pl. 42, fig. 249).

30. ***Sepia recurvirostra*** Steenstrup, 1875, p. 475, 479 (Type locality: South China).

Synonyms: *Sepia singaporensis* Pfeffer, 1884, p. 10, figs. 13, 13 *a*; ? *Sepia pagenstecheri* Pfeffer, 1884, p. 9, figs. 12, 12 *a*; *Sepia esculenta* Joubin, 1897, p. 102 (*nec* Hoyle, 1885).

Distribution: Indian Ocean (Singapore; Burma); Western Pacific Ocean (South China; Hong Kong; Borneo Bank; Santubong and Buntal, Sarawak; and Java Sea, 6° 36′ 5″ S, 114° 55′ 5″ E).

Remarks: For a taxonomic discussion and description of this species reference is invited to Adam (1939 *c*, 1965) and Adam and Rees (1966, pp. 28–29, pl. 9, figs. 49–52; pl. 10, figs. 53 & 54).

31. ***Sepia sewelli*** Adam and Rees, 1966, pp. 61–63, pl. 17, figs. 104–106; pl. 46, fig. 273 (Type locality: John Murray Expedition Station 27 at 11° 57′ 12″ N, 50° 35′ E to 11° 56′ 42″ N, 50° 39′ 12″ E near Cape Guardafui, Red Sea).

Distribution: Indian Ocean (Near Cape Guardafui, Red Sea; and from John Murray Expedition Stations 105 and 106 close to Zanzibar).

32. ***Sepia simoniana*** Thiel, 1921, p. 436, pl. 52, figs. 5–13 (Type locality: Simon's Bay, Union of South Africa).

Synonyms: *Sepia natalensis* Massy, 1925, p. 212, pl. 11, figs. 1–11; pl. 14, fig. 17; *Sepia tuberculata* Gray, 1949, pp. 101, 102 (*nec* Lamarck, 1799); *Sepia papillata* Smith, 1916, p. 22, pl. 2, figs. 1 & 2 (*nec* Quoy and Gaimard).

Distribution: Indian Ocean (Cape Henderson, Durban, Port Elizabeth, Grahamstown, off Tugela River, Natal, Isipingo, and 18 miles east of Cape Agulhas, Union of South Africa). South-Eastern Atlantic Ocean (Simon's Bay and Cape of Good Hope, Union of South Africa).

Remarks: Adam and Rees (1966: pp. 109–111, pl. 29, figs. 179–182; pl. 42, fig. 254) have given a redescription of the species.

33. ***Sepia thurstoni*** Adam and Rees, 1966, pp. 2–4, pl. 1, figs. 1–4; pl. 41, fig. 235 (Type locality: Rameswaram Island, Madras State, India).

Synonyms: *Sepia rouxii* Hoyle, 1904 *a*, p. 198 (*nec* Ferussac and d'Orbigny; *Sepia rostrata* (partim) Winckeworth, 1936, p. 16 (*nec*

Ferussac and d'Orbigny *Sepia* sp. Adam, 1939, p. 80, pl. 3, figs. 1 & 2.

Distribution: Indian Ocean (Rameswaram Island, Madras, India; Off Negombo and Hambantota, Ceylon).

34. ***Sepia trygonina*** (Rochebrune), 1884, p. 97, pl. 5, fig. 1 (Type locality: Red Sea).

Synonym: Doratosepion trygoninum Rochebrune, 1884, p. 97, pl. 5, fig. 1.

Distribution: Indian Ocean (Red Sea; Gulf of Aden; Ennur, Madras, India).

Remarks: Adam and Rees (1966: pp. 84–86, pl. 20, figs. 129–131; pl. 37, figs. 220 & 221; pl. 46, fig. 277) have given a detailed description of this species.

35. ***Sepia tuberculata*** Lamarck, 1798, p. 130; 1799, pl. 1, fig. 1 *a-b* (Type locality: Unknown).

Synonyms: Spathidosepion tuberculatum Rochebrune, 1884, p. 93, pl. 4, fig. 3; *Hemisepius* (?) *tuberculatus* Smith, 1916, p. 25.

Distribution: The type locality is unknown. Adam and Rees (1966: pp. 106–108, pl. 26, figs. 169 & 170; pl. 27, figs. 171 & 172; pl. 28, figs. 173 & 174; pl. 44, figs. 265 & 268) have recently reported this species from St. James, South Africa.

36. ***Sepia vicellius*** Gray, 1849, p. 100 (Type locality: Unknown).

Remarks: This is a doubtful species. Adam and Rees (1966, p. 32) give the distribution as "?Red Sea (Rochebrune)". They remark that Gray's specimen belongs to *Sepia officinalis* which does not occur in the Red Sea, and Rochebrune's specimens from the Red Sea may be some other form.

37. ***Sepia zanzibarica*** Pfeffer, 1884, p. 9, figs. 11, 11 *a* (Type locality: Zanzibar).

Distribution: Indian Ocean (Mombasa and East Africa; Zanzibar; Madagascar; and Natal).

Remarks: Adam and Rees (1966: pp. 7–8, pl. 2, figs. 9–11; pl. 41, fig. 247) have given the description of the female and the shell of this species which is said to be closely related to *S. thurstoni*.

38. ***Sepia (Hemisepius) typica*** (Steenstrup), 1875, p. 469, pl. 1, figs. 1–10; pl. 2, fig. 1 (Type locality: Table Bay, South Africa).

Synonyms: Hemisepius typicus Steenstrup, 1875 (as above); *Hemisepion typicum* Rochebrune, 1884, p. 78, pl. 3, fig. 1; *Hemisepius typicus* var. *chuni* Thore, 1945, p. 50.

Distribution: Indian Ocean (Off Cape Natal, S. Africa). South-Eastern Atlantic Ocean (Hout Bay, False Bay, and Saldahana Bay, Union of South Africa).

Remarks: Adam and Rees (1966: pp. 117–118, pl. 32, figs. 192–195; pl. 33, figs. 196 & 197) have given a description of this species and

do not consider var. *chuni* to be different from *S.* (*H.*) *typicus*. Chun (1914) recorded this species from 'Valdivia' Stn. 100 at Agulhas Bank (34° 9′ S, 24° 59′ E).

39. ***Sepia* sp.** Adam and Rees, 1966, p. 111, pl. 30, figs. 183 & 184; pl. 46, fig. 276.

Distribution: Indian Ocean (John Murray Exped., Stn. 27, 11° 57′ 12″ N, 50° 35′ E to 11° 56′ 42″ N, 50° 39′ 12″ E near Cape Guardafui; Stn. 106, 5° 38′ 54″ N, 39° 15′ 42″ E, 5° 40′ 18″ N, 39° 17′ 36″ E, Zanzibar area).

Remarks: Adam and Rees (1966, p. 111) remark that the specimens are closely related to *Sepia simoniana* (= *S. natalensis*), but differing in the structure of the tentacular club.

Genus *Sepiella* Gray 1849

40. ***Sepiella cyanea*** Robson, 1924, p. 13; 1924 *a*, p. 648, figs. 25–27, pl. 2, fig. 6 (Type locality: Natal, South Africa).

Synonyms: ? *Sepiella obtusata* Massy, 1928, p. 95 (*nec* Pfeffer, 1884); *Sepias* p.A, Voss, 1962, p. 3.

Distribution: Indian Ocean (Durban, Natal coast, Port Elizabeth, Algoa Bay, Isipingo, South Africa; Nosy N'Tangam; Ambavanibe, Madagascar).

Remarks: For detailed description *see* Adam and Rees (1966: pp. 122–124, p. 36, figs. 208–215).

41. ***Sepiella inermis*** (Ferussac and d'Orbigny, 1835–1848), 1835, pl. 6 *bis*; 1848, p. 286, pl. 20, figs. 1–9 (Type localities: Batavia, Bombay, Pondicherry, Coromandel Coast).

Synonyms: *Sepia inermis* Ferussac and d'Orbigny (as above); *Sepia* (*Sepiella*) *inermis*, Tryon, 1879, p. 196, pl. 91, fig. 423, pl. 92, figs. 424–429; *Sepiella inermis* Rochebrune, 1884, p. 88; *Sepia* (*Sepiella*) *microcheirus* Gray, 1849, p. 107; *Sepiella microcheirus* Adam, 1939 *c*, p. 105; *Sepiella curta* Pfeffer, 1884, p. 13, figs. 16, 16 *a*; *Sepiella maindroni*, Rochebrune, 1884, p. 89; *Diphtherosepion martini* Rochebrune, 1884, p. 81; *Sepia tourannensis* Eydoux and Souleyet, 1852, p. 33, pl. 3, figs. 6–12; *Rhombosepion touranense* Rochebrune, 1884, p. 84; *Sepia affinis* Eydoux and Souleyet, 1852, p. 35, pl. 3, figs. 13 & 14 (*nec* Ferussac, 1826); *Sepiella affinis* Adam, 1939 *c*, p. 107.

Distribution: Indian Ocean (Red Sea; Aden; Mukalla, South Arabia; Juhu, Bombay, Laccadives, Cannanore, Tellicherry, Palk Bay, Rameswaram Island, Madras, Ennur, Chilka, Puri, Gopalpur, Orissa Coast, Sandheads, River Hooghly, Bengal, Pondicherry, Andamans, India; Penang, Malaya; Sumatra, Java; Singapore; Galle, Pearl Banks, Ceylon; Akyab, Mergui, Hainze Basin, Burma). Western Pacific Ocean; Santubang and Buntal, Sarawak; Rade de Semarang, Java; Banka; Touranne Bay, Vietnam).

Remarks: Adam (1939 *c*) should be consulted for exhaustive list of localities from where this species has been recorded. A description

of the species as well as a taxonomic discussion is given by Adam and Rees (1966: pp. 123–128, pl. 38, figs. 222–227, pl. 40, figs. 233 & 234). They have also commented on the close resemblance of *Sepiella melwardi* Iredale (1954) from Condon Bay, Melville Island, Northern Territory, Australia, to *S. inermis*. Adam (1944) may also be referred for nomenclatorial discussion.

42. ***Sepiella ocellata*** Pfeffer, 1884, p. 13, figs. 17, 17 *a-b* (Type locality: Java).

Remarks: This species is known from only a single male, the type of which was redescribed by Adam (1939 *c*). According to Adam and Rees (1966) the shell of this species strongly resembles that of *S. ornata* known from West Africa from Mauritania to Angola.

43. ***Sepiella weberi*** Adam, 1939 *c*, pp. 98–101, 114, pl. 4, figs. 1–2; text-figs. 6–8 (Type localities: Soemba, 119° 56′ E, 10° S; Rade de Koepang, Timor).

Remarks: Adam and Rees (1966: p. 128, pl. 37, figs. 216–219) remark on the strong resemblance of this species to *S. cyanea* from South Africa.

The type localities of *Sepiella ovata* Pfeffer (1884), and *Sepiella obtusata* Pfeffer (1884) are unknown and Adam (1939 *c*) who studied the types considers them as doubtful synonyms of *Sepiella japonica* Sasaki (1929). According to him, the types of the former two species are in poor state which makes it difficult to express a definite opinion regarding their validity. Adam and Rees (1966) have shown that the specimens reported by Massy (1928) from Tongaat Beach, Natal as *S. obtusata* probably belongs to *S. cyanea*. Thus at present four species of the genus *Sepiella* are known to occur in the Indian Ocean, one of which, *S. ocellata* is very poorly known.

Family SEPIADARIIDAE

Genus *Sepiadarium* Steenstrup, 1881

44. ***Sepiadarium kochii*** Steenstrup, 1881, p. 214, p. 11, figs. 1–10 (Type locality: Deep Water Bay, Hong Kong).

Synonyms: Sepiadarium malayense Robson, 1932.

Distribution: Indian Ocean (Andamans, India; Ceylon; Malaya; Western Australia); Pacific Ocean (Australia; Amboina; Hong Kong; Japan).

Remarks: Records from the Indian Ocean are by Goodrich (1896), Robson (1914, 1932 *a*). Recently, Voss (1963) while redescribing the species *S. grasilis* from Philippines has given a taxonomic discussion on the genus and also a key for the identification of five species (pp. 38–40), namely, *S. auratum* Robson (1914), *S. gracilis* Voss (1962), *S. austrinum* Berry (1921), *S. kochii* Steenstrup (1881), and *S. nipponianum* Berry (1932).

Family SEPIOLIDAE

Subfamily SEPIOLINAE

Genus *Sepiola* Leach, 1817

45. ***Sepiola penares*** (Gray, 1849), p. 95 (Type locality: Indian Ocean).

Synonyms: *Fidenas penares* Gray, 1849 (as above); *Sepiola penares* Tryon, 1879, p. 157.

Distribution: Indian Ocean? Singapore.

Remarks: This species is very poorly known. It would appear from Joubin's brief notes on it (Joubin, 1902, p. 95) that many of the diagnostic details are not known for the species.

Genus *Euprymna* Steenstrup, 1887

46. ***Euprymna berryi*** Sasaki, 1929, pp. 143–146, pl. 15, figs. 12 & 13, and text-fig. 88 (Type locality: Not indicated. But Sasaki remarks that this species is the "commonest sepiolid occurring in Japan, being found in both the Japan Sea and the Pacific Ocean.... the northern limit of distribution appearing to be the northern part of Honshu".

Synonyms: *Inioteuthis morsei* Hoyle, 1886 (*nec* Verrill, 1881); Goodrich, 1896; Joubin, 1902; *Sepiola bursa* Pfeffer, 1884; *Eupremna morsei* (*nec* Verrill, 1881) Steenstrup, 1887; Hoyle. 1904 *a*, 1904 , 1905; Sasaki, 1914, 1920.

Distribution: Indian Ocean (Ceylon; Kolumadulu Atoll, Indian Sea, Andamans); Western Pacific Ocean [Japan, Formosa, Hong Kong, Philippines (?)].

Remarks: I have followed Sasaki (1929, pp. 143–146) in listing this species from the Indian Ocean. Sasaki has listed this from numerous localities from Japanese waters as well.

47. ***Euprymna morsei*** (Verrill), 1881, p. 417, footnote (Type locality: Tokyo Bay, Japan).

Synonyms: *Inioteuthis morsei,* Verrill, 1881 (as above); *Euprymna similis* Sasaki, 1913, 1914; *Euprymna morsei* Adam, 1954; ?*Euprymna morsei* Voss, 1963.

Distribution: Indian Ocean (No definite record as yet); Pacific Ocean (Japan, Indonesia, Makassar, Amboina and probably also Philippines, though there is no definite record from the latter area).

Remarks: The type locality of this species is given by Voss (1963) as "Yeddo Bay, Japan". It has been reported from 'Siboga' stations (Adam, 1954) close to the limits of the eastern Indian Ocean and this as well as the confusion regarding the identity of this species from different areas are the main reasons for including it in this list.

48. ***Euprymna stenodactyla*** (Grant), 1833, p. 42 (Type locality: Mauritius).

Synonym: *Sepiola stenodactyla* Grant, 1833 (as above).

Distribution: Indian Ocean (Mauritius). Pacific Ocean (Rangiora, Tuamotus; Faunafuti, Ellice Islands; Tarawa, Gilbert Islands; Arno Atoll, Marshall Islands; Bikini Atoll, Marshall Islands; Tumindao Anchorage; Panabutan Bay, Sulu Sea, Mindanao; Ulugan Bay, Palawan Island; ?Philippines).

Remarks: Voss (1963, pp. 52–56, fig. 8 *a, b*) has redescribed this species and has also given a taxonomic discussion to which reference is invited.

Genus *Inioteuthis* Verrill, 1881

49. ***Inioteuthis japonica*** Verrill, 1881 *c*, p. 418, footnote (Type locality: Tokyo Bay, Japan).

Synonym: Sepiola japonica Joubin, 1902.

Distribution: Indian Ocean (Port Blair, Andamans); Pacific Ocean (Japan; Taiwan).

Remarks: The inclusion of this species is based on Massy's (1916, pp. 16–17) record of three specimens from Port Blair, Andamans, assigned by her to this species.

50. ***Inioteuthis maculosa*** Goodrich, 1896, pp. 2–3, pl. 1, figs. 1–3 (Type locality: Andaman Islands).

Distribution: Indian Ocean (Andaman Islands; 'Investigator' Stn. 556, off Burma Coast; Puri Beach, Orissa Coast; Persian Gulf); Pacific Ocean (Indonesia from four 'Siboga' stations; Cubugao Anchorage, Catanduanes Id.; Ragay Bay, Ragay Gulf, Luzon, Philippines).

Remarks: Reference is invited to a recent redescription of the species by Voss (1963: pp. 59–62, fig. 9).

Subfamily ROSSIINAE

Genus *Rossia* Owen, 1834

51. ***Rossia enigmatica*** Robson, 1924, pp. 635–639, pl. 1. fig. 4 (Type locality: Off Cape Town, South Africa).

Synonym: Semirossia sp. Robson, 1924.

Remarks: This species has been included in this list as there has been some confusion regarding station positions off South Africa, Robson's specimens having come from "Stn. 63 (female), Cape Town, in 220 fathoms; and Stn. 6 (male), Cape, in 151 fathoms". Its listing here is provisional.

52. ***Rossia mastigophora*** Chun, 1914, pp. 405–408, pl. 62, figs. 1–3, pl. 63, figs, 1–6 (Type locality: "Valdivia" Stn. 253, 0° 27′ S, 42° 47′ E in Indian Ocean).

Remarks: Further reference to this species is made by Chun (1915, pl. 63, fig. 5). Sasaki (1920) described *Rossia bipapillata* from Suruga Bay, Japan and remarked that it stands closest to *Rossia mastigophora* Chun. While recording *R. bipapillata* from Philippine waters, Voss (1963: pp. 40–42, figs. 4 *c-e*) again remarks on the close affinities of these two species. He also states that "....inasmuch as the male is unknown, the two species may be identical and if so, Chun's name would have priority".

Subfamily HETEROTEUTHINAE

Genus *Heteroteuthis* Gray, 1849

53. ***Heteroteuthis hawaiiensis*** var. ***dagamensis*** Robson, 1924, p. 11; 1924, pp. 632-635 (Type localities: Natal Coast and Cape Town, South Africa).

Remarks: This is the only known representative of the genus from the Indian Ocean.

Joubin (1902: pp. 113–114) described a species *H. weberi* from the 'Siboga' Expedition Stn. 38 (7° 35′ 04″ S, 117° 28′ 06″ E) from close to the eastern limits of the Indian Ocean.

Order **TEUTHOIDEA**

Suborder *MYOPSIDA*

Family LOLIGINIDAE

Genus *Loliolus* Steenstrup, 1856

54. ***Loliolus investigatoris*** Goodrich, 1896, pp. 8–9, pl. 2, figs. 29–37 (Type locality: Bay of Bengal).

Distribution: Indian Ocean (Orissa Coast; Sandheads, River Hooghly; Near Mud Point, R. Hooghly; off Frazergunge, Sunderbunds; off Hooghly estuary; Karnaphuli River, Chittagong; Mouth of Tavoy River; Mergui Archipelago; Penang). Western Pacific Ocean (Bagan Api Api, Sumatra; Cote Nord d'Atjeh; Deli, Sumatra; Java).

Remarks: The following works may also be referred: Massy (1916), Adam (1939 *b* and 1954).

55. ***Loliolus affinis*** Steenstrup, 1881 (Type locality: Tranquebar, India).

Remarks: More information is needed on this nominal species. Adam (1954) has opined that *L. affinis* and *L. investigatoris* may be conspecific.

56. ***Loliolus rhomboidalis*** Burgress, 1967, pp. 319–329 (Type locality: R. V. *ANTON BRUUN* Stn. 47 B at 19° 50′ N, 92° 32′ E, from 22–23 metres).

Distribution: Indian Ocean [From type locality and from *ANTON BRUUN* Stns. 37 (13° 28′ N, 97° 19′ E), and 46 (21° 00′ N, 91° 59′ E)].

Remarks: This is the third species of the genus to be described from the Indian Ocean. The presence of several large globular suckers on the right ventral arm of the male easily distinguishes it from its congeners.

A fourth species, *Loliolus typus* Steenstrup (1856) which was originally inadequately described was redescribed by Grimpe (1932) from Indonesian waters (Panaroekan, East Java, aud Soerabaya) which lie close to the limits of the Indian Ocean in this area.

Genus *Loligo* Lamarck 1798

57. ***Loligo duvauceli*** d'Orbigny, 1835, p. 318, pl. 14, pl. 20, figs. 6–16 (Type locality: ?).

Synonyms: *Loligo indica* Pfeffer, 1884; *Loligo galatheae* Hoyle, 1885; ?*Loligo oshimai* Sasaki, 1929.

Distribution: Indian Ocean (Natal Coast, South Africa; Coast of India, Burma, Andaman Islands; Malaya). Pacific Ocean: Indonesian waters; Philippines to Formosa).

Remarks: For details reference may be made to: Adam (1954), and Voss (1963). This is the most common species of the genus in the Indo-Malayan Region. The genus is badly in need of a revision. Voss (1963) has pointed out that Massy's *Loligo indica* may not be identical with this species though Adam (1954) had placed it in its synonymy. Specimens of *L. duvauceli* from the Philippines are characterised by two light organs buried in the ink sac, as is also the case in *L. oshimai* from Japan, but apparently has not been verified for Indo-Malayan specimens.

The following species of *Loligo* are also reported from the Indian Ocean, but hardly any critical study has been made to evaluate their status:—

58. ***Loligo* sp.** Massy (1916, p. 222) from Madras; Pamban, Ramnad District; Gulf of Mannar, Kilakarai; and from 'Investigator' Stn. 565 at 11° 57′ 30″ N, 98° 19′ E.

59. ***Loligo* sp.** B, Robson, 1924, pp. 653–654 from Natal Coast, South Africa.

60. ***Loligo kobiensis*** Hoyle (1885) and reported from Kolumadulu Atoll, Maldives (Hoyle, 1905) and also mentioned by Sasaki (1929, p. 116).

61. ***Loligo forbesii*** Steenstrup, 1856, p. 5, pl. 1, fig. 2.

A species known along European coast of Atlantic and Mediterranean, it is doubtfully recorded from the Red Sea (Ile Abulat) and Djibouti by Adam (1958: p. 188, pl. 50, fig. 2; 1959: p. 155, fig. 10 *bis* A-C).

Genus *Sepioteuthis* Blainville, 1824

On the basis of his critical study of the Indo-Pacific genus *Sepioteuthis* Blainville, Adam (1939) has shown that the many nominal species described under this genus are referable to four species, namely, *S. lessoniana* Lesson, *S. australis* Quoy and Gaimard, *S. loliginiformes* (Ruppell and Leuckart), and *S. sepioidea* Blainville, the last-mentioned species occurring in the Western Atlantic. On the basis of this revision, only three Indo-Pacific species may be recognised, and of these *S. australis* does not occur in the Indian Ocean. *S. lessoniana* is subject to considerable variation, especially in colour from place to place which no doubt has been responsible for the descriptions of at least thirteen nominal species which are considered its synonyms.

62. ***Sepioteuthis lessoniana*** Lesson, 1830, p. 244, pl. 2 (Type locality: "Dorery").

Synonyms: *Sepioteuthis hemprichii* Ehrenberg, 1831, p. (?) (Type locality: Tor, Red Sea); *Sepioteuthis guinensis* Quoy and Gaimard, 1832, p. 72, pl. 3 (Type locality: Nouvelle-Guinee); *Sepioteuthis lunulata*

Quoy and Gaimard, 1832, p. 74, pl. 3, figs. 8–13 (Type localities: Vanikoro; Nouvelle-Guinee); *Sepioteuthis mauritiana* Quoy and Gaimard, 1832, p. 76, pl. 4, figs. 2–6 (Type locality: Ile Maurice); *Sepioteuthis sinensis* Ferussac and d'Orbigny, 1835–1848, p. 304 (Type localities: Japon; Chine); *Sepioteuthis doreiensis* Ferussac and d'Orbigny, 1835–1848, pl.3, fig. 2(=*S. guinensis* Q.& G. and *S. lunulata* Q. & G.); *Sepioteuthis arctipinnis* Gould, 1852, p. 137, pl. 26, fig. 1 (Type localities: Ile Maui, Ile Sandwich); *Sepioteuthis brevis* Owen, 1881, p. 137, pl. 26, fig. 1 (Japanese Sea); *Sepioteuthis neoguinaica* Pfeffer, 1884, p. 4, fig. (Type locality: Nouvelle-Guinee); *Sepioteuthis indica* Goodrich, 1896, p. 5, pl. 1, figs. 9–19 (Type locality: Andaman Islands); *Sepioteuthis sieboldi* Joubin, 1898, p. 27 (Type locality: Waigeou, Japon); *Sepioteuthis malayana* Wülker, 1913, p. 478, figs. 7 *a-f* (Type localities: Sumatra; Sabang, Poeloe We; Celebes; St. Mathias; Samoa); *Sepioteuthis krempfi* Robson, 1928, p. 28, figs. 3–4 (Type localities: Poelo Condor; Baie de Danon a Port Dayot; Golfe de Siam); ?*Sepioteuthis* sp. Rees and Stuckey, 1952, p. 18, pl. 29, figs. 3–4.

Distribution: One of the most widely distributed loliginids in the Indo-Pacific.

Remarks: References—Sasaki (1929), Adam (1939, 1959), Voss (1963).

63. ***Sepioteuthis loliginiformis*** (Ruppell and Leuckart, 1828), pl. 6 (Type locality: Mohila, Mer Rouge).

Synonyms: Chondrosepia loliginiformis Ruppell and d'Orbigny, 1829 (as above); *Sepia loliginiformis* Ehrenberg, 1831.

Distribution: Indian Ocean (Mohila and Mersa tal Kad Yayah, Red Sea; ?Djeddah; ?Zanzibar).

Remarks: Refer also Adam (1939, 1959).

64. ***Sepioteuthis madagascariensis*** Gray, 1848, p. 80 (Type locality: Madagascar).

Remarks: Subsequent references to this species are by Tryon (1879, p. 152), Hoyle (1886, p. 27), Wulker (1913, p. 408), and Adam (1939). Adam (pp. 25–26) considers this a doubtful species.

Genus *Lolliguncula* Steenstrup, 1881.

65. ***Lolliguncula abulati*** Adam, 1955, p. 185, pl. 50, fig. 1 (Type locality: Ile Abulat, Red Sea).

Remarks: Adam (1959, pp. 152–154) has again given a description of the type material.

Genus *Doryteuthis* Naef, 1912

66. ***Doryteuthis arabica*** (Ehrenberg, 1831), p. (?) (Type locality: 'Ile Ketumbal, entre Gumpuda et Poheca, mer Rouge).

Synonyms: Pteroteuthis arabica Ehrenberg, 1831, p. (?); *Ommastrephes arabicus* Ferussac and d'Orbigny, 1835–1848, p. 353.

Distribution: Indian Ocean (Red Sea, Gulf of Suez).

Remarks: For descriptions of this species reference is invited to Adam (1941 *d*: p. 2, pl. 1, fig. 2; 1942: pp. 3, 12; 1959: pp. 159-163, figs. 13-16).

67. ***Doryteuthis sibogae*** Adam, 1954, pp. 146–149, text-figs. 16–18; pl. 1, fig. 4 (Type locality: S.-E. Coast of Soemba Id: Holotype is from this locality).

Distribution: Indian Ocean (Soemba Id., Indonesia). Western Pacific (Siboga Stn. 193 at Baie de Sanana, Cote, orientale de Sula Besi; Cote Sud de la partie orientale de Flores, 122° 18′ E).

68. ***Doryteuthis singhalensis*** (Ortmann, 1891), p. 676, pl. 46, fig. 3 (Type locality: Ceylon).

Synonyms: Loligo singhalensis Ortmann, 1890 (as above); *Loligo singhalensis* var. *berylae* Robson, 1928, p. 15, figs. 4–10.

Distribution: Indian Ocean (Ceylon; Sandheads, River Hooghly, Bengal; Bay of Bengal). Western Pacific (Siboga Stn. 142, and Amboine, Indonesia; Balamban, Negros, Batangas, Cebu, Onol, Mindano, Philippines).

Remarks: Adam (1939) considered *Loligo spectrum* Massy (*nec* Pfeffer) from Arakan coast as a doubtful synonym of this species. Recent descriptions are by Adam (1939, 1954), and Voss (1963). Adam (1954) opines that *D. spectrum*, *D. arabica* and *D. singhalensis* may represent geographical races of one species and on this Voss (1963) comments that much more work must be done before their status can be decided.

It may be mentioned here that at present 7 species of *Doryteuthis* are known from the Indo-Pacific: *D. arabica* (Ehrenberg, 1831); *D. spectrum* (Pfeffer, 1884), *D. singhalensis* (Ortmann, 1891), *D. bleekeri* (Keferstein, 1866), *D. sibogae* Adam, 1954; *D. pickfordi* Adam, 1954; and *D. reesi* Voss, 1962. Of the species not already discussed, *D. spectrum* (Pfeffer) is known from the Marquesas Ids., *D. bleekeri*, from Japan, *D. pickfordi* from "Cote Sud de la partie orientale de Flores, 122° 39′ E and 122° 18′ E", and *D. reesi* from Port Maricaban, Southern Luzon, Philippines.

The genus *Uroteuthis* Rehder (1945) is represented by a single species *U. bartschi* Rehder (1945: p. 22, figs. 1–3). (Type locality: Jolo Harbour, Jolo, Philippines), which has subsequently been recorded by Adam (1954) from Flores Straits (122° 39′ E). Voss (1963) has given a redescription of the type material of this species.

Suborder *OEGOPSIDA*

Family LYCOTEUTHIDAE

Genus *Lycoteuthis* Pfeffer, 1900

69. ***Lycoteuthis diadema*** (Chun, 1900), p. 532 (Type locality: South side of Benguela Current, 31° 21′ S, 15° 58′ E).

Synonym: Enoploteuthis diadema Chun, 1900 (as above). *Thanmatolampus diadema* Chun, 1903.

Distribution: Indian Ocean [This species is included here on the strength of one record indicated by Clarke (1966: p. 192, fig. 37) from th

Southern Indian Ocean close to the zone of subantarctic convergence south of Australia. Its distribution is the Westwind Drift, makes it reasonable to expect more records of the species in the Southern Indian Ocean]. Atlantic Ocean (Benguela Current; Gulf of Mexico). Pacific Ocean (West Coast of South America).

Remarks: I am in no position to comment on the species described by Robson (1924 *a*) as *Lycoteuthis* sp. A, or *Leptodontoteuthis inermis* Robson (1924 *c*) from Natal, South Africa.

Chun (1910, 1914) has given an excellent description and illustrations of this rare squid from 'Valdivia' Stns. 89 and 118 and Voss (1956) has supplemented the description with more details. Chun (1910, p. 59) has also included *Lycoteuthis Jattai* Pfeffer (1900) as a doubtful synonym of this species.

Family ENOPLOTEUTHIDAE

Genus *Enoploteuthis* d'Arbigny, 1839

70. ***Enoploteuthis dubia*** Adam, 1960, pp. 12–16, figs. 2 *a-e* (Type locality: Eylath, Gulf of Aqaba).

Remarks: On account of the partly damaged condition of the specimen Adam (1960) described this as *E. dubia* with a query. However, in a revision of the genus *Enoploteuthis*, Roper (1966) confirms *E. dubia*, as a valid species of the genus, especially as the number and arrangement of ocular light organs and the arrangement of light organs on the ventral mantle, funnel, head, and arms are as for the genus, though in the holotype the tentacles are missing and there is a dorsal attachment to the ventro-lateral buccal connectives.

Genus *Abralia* Gray, 1849

71. ***Abralia andamanica*** Goodrich, 1896, p. 9, pl. 2, figs. 38–45 (Type locality: Andaman Sea).

Synonyms: Asteroteuthis andamanica Pfeffer, 1912; *Abralia* (*Asteroteuthis*) *andamanica* Voss, 1963.

Distribution: Indian Ocean (Andaman Sea; and present records from Arabian Sea and Laccadive Sea). Pacific Ocean (Philippines; Japan and Hawaiian Islands).

Remarks: The disposition of the light organs in this species is very characteristic. There are nine or ten rows on the ventral side of the head. On the ventral periphery of the eye there are five light organs, the three in the centre being smaller (*see* Fig. 13 *c*) and those anterior and posterior to these considerably larger. As the latter two photophores are not clearly visible through the skin they are not indicated in Fig. 13 *c*. In some of the preserved specimens the arrangement of the light organs on the ventral side of the head is irregular, but if carefully examined, nine rows can be made out.

Berry (1912 *c*) has drawn attention to the close affinities of his species *A. trigonura* to *A. andamanica*. Sasaki (1929) has given a good description of *A. andamanica* from Sagami Bay, Japan. While

recording and describing this species from the Philippines, Voss (1963, p. 105) remarks that "It appears that *andamanica* may be separable into several subspecies throughout its range, with one form occurring in Japan and another in the Hawaiian Islands". The larvae and adults of this species from the present collections (reported in the earlier part of this paper) are being studied in detail.

72. ***Abralia lucens*** Voss, 1963, pp. 105–111, figs. 22 and 23 (Type locality: Port Dupan, Leyte).

Synonym: Abralia (*Stenabralia*) *lucens* Voss, 1963 (as above).

Distribution: Indian Ocean (Clarke, 1967, p. 172, fig. 30) SW of Sumatra and slightly north of Christmas Id.). Western Pacific (Line Islands, Oceania; and Philippines).

73. ***Abralia renschi*** Grimpe, 1931, p. 149, figs. 1–8 (Type locality: Indes equatoriales).

Synonym: Abralia (*Stenabralia*) *renschi* Grimpe, 1931 (as above).

Distribution: Indian Ocean (Clarke, 1966, p. 172, fig. 30, has indicated the occurrence of the species off the west coast of Sumatra). Western Pacific (Stat. Koer; and Poeloe Weh of 'Siboga' Exped.).

Remarks: See also Adam (1954, pp. 152–153).

74. ***Abralia steindachneri*** Weindl, 1912, p. 271 (Type locality: Shadwan, Red Sea).

Distribution: Indian Ocean (Shadwan, and l'ile Abulat, Red Sea).

Remarks: Grimpe (1931) has placed this species in the subgenus *Stenabralia*. Adam (1942, pp. 3, 13; 1955, p. 190, pl. 50, figs. 3–4; 1959, pp. 164–165) has added to the description of this species from the Red Sea.

It may be mentioned here that Grimpe (1931) described *Abralia spärcki* from Sawrude Island, Amboina, and a redescription of this has been given by Voss (1963, pp. 112–116, figs. 24 and 25), who also records it from "Bagacay Bay, Escarpada Id., Naranjon between Samar and Masbate" in the Philippines. It will not be surprising if this species is also encountered in the Indian Ocean.

Genus *Abraliopsis* Jouhin, 1896

75. ***Abraliopsis gilchristi*** (Robson, 1924 *a*), pp. 3–4; 1924, pp. 601–606, pl. 1, fig. 1, and text-figs. 6–7 (Type locality: Off Natal Coast, South Africa).

Synonyms: Abralia gilchristi Robson, 1924 *a*; ***Enoploteuthis noezelanica*** Dell, 1959.

Distribution: Indian Ocean (Off Natal Coast, South Africa; Present records from the Arabian Sea and the Laccadive Sea reported in the earlier part of this paper). Pacific Ocean (Off Kahu Rocks, east coast of Wellington, New Zealand).

Remarks: A detailed study of the larvae, juveniles and adults of this species collected during cruises of R. V. *VARUNA* is being carried out,

Dell (1959) was wrong in describing the specimen from New Zealand under *Enoploteuthis*. His description and drawings of the specimen (pp. 6–8, figs. 11–13) clearly indicate that he was dealing with a species of *Abraliopsis*. Roper (1966) has also commented on this and he remarks that "According to Voss (personal communication) the species is *A. gilchristi* (Robson)".

76. ***Abraliopsis morisii*** (Verany, 1837), pp. 2, 100, pl. 2 *a*.

Synonyms: *Onchoteuthis morisii* Verany, 1837; *Abralia morisii* Gray, 1849; *Abraliopsis morisii* Adam, 1954.

Distribution: Indian Ocean ['Valdivia' Stns. 254 (0° 29′ S, 42° 47′ E), 256 (1° 49′ N, 45° 29′ E), and 265 (6° 24′ N, 49° 31′ E) from off Somalia Coast, East Africa; and Agulhas Bank, South Africa]. The species is also known from the Atlantic and the Mediterranean, and Adam (1954) records it from 3 'Siboga' stations (210 *a*, 214, 297) from Indonesian waters (Western Pacific).

Remarks: Chun (1914, p. 78) considers *A. hoylei* and *A. lineata* as synonyms of *A. morisii*. Until a revision of the genus on a global basis is carried out, it will be better to list these two nominal species, also known from the Indian Ocean, separately.

77. ***Abraliopsis hoylei*** (Pfeffer, 1884), p. 17, pl. 3, figs. 22, 22 *a*, 22 *b* (Type locality: Mascarenes).

Synonym: *Enoploteuthis Hoylei* Pfeffer, 1884 (as above).

Distribution: Indian Ocean (Clarke, 1966, p. 175, fig. 31 has indicated the two localities in the Indian Ocean, south of the Equator from where this species has been recorded).

78. ***Abraliopsis lineata*** (Goodrich, 1896), p. 10, pl. 3, figs. 46–50 (Type locality: Bay of Bengal).

Synonym: *Abralia lineata* Goodrich, 1896 (as above).

Distribution: Indian Ocean (North of Andamans, and off Orissa Coast, Bay of Bengal).

It should be mentioned here that larval stages and juveniles of *Abraliopsis* have been given specific names by some authors. Chun (1914, p. 78) lists the following: *Teleoteuthis carribbaea* Jatta (1896, pp. 100–102, pl. 13, figs. 35–41); *Micrabralia lineata* Pfeffer (1900, p. 167); and *Compsoteuthis Lönnbergi* Pfeffer (1900, p. 167); Chun (1910, pls. 6 & 7) has illustrated the '*Micrabralia*-Stage' and the '*Compsoteuthis*-Stage'.

Genus *Thelidioteuthis* Pfeffer, 1900

79. ***Thelidioteuthis alessandrinii*** (Verany, 1851), p. 99, pl. 35, figs. *f-h* (Type locality: Mediterranean).

Synonyms: *Loligo alessandrinii* Verany, 1851 (as above); *Enoploteuthis polyonyx* Troschel, 1857; *Abralia megalops* Verrill, 1883; *Enoploteuthis pallida* Pfeffer, 1884; *Calliteuthis alessandrinii* Appellöf, 1889; *Thelidioteuthis polyonyx* Pfeffer, 1900.

Distribution: Indian Ocean ('Valdivia' Stations 218, 223, and 235; Present record from R. V. *VARUNA* collections from the Arabian Sea and the Laccadive Sea). Pacific Ocean (Indonesia; Japan; Polynesia). Atlantic Ocean and Mediterranean.

Remarks: The larvae and adults of this species obtained during R. V. *VARUNA* cruises are being studied in detail.

Descriptions of the species are available in Degner (1926), Sasaki (1929), and Chun (1910, 1914—juveniles).

Genus *Pterygioteuthis* Fischer, 1895

80. ***Pterygioteuthis giardi*** Fischer, 1895, p. 205, pl. 9.

Synonyms: *Pterygioteuthis margaritifera* Ruppell. juv. Pfeffer, 1900; *Pterygioteuthis* sp. Chun, 1903; *Pyroteuthis* (*Pterygioteuthis*) *giardi* Pfeffer, 1912.

Distribution: Indian Ocean ['Valdivia' Stns. 215 (7° 1′ N, 85° 56′ E), 217 (4° 56′ N, 78° 15′ E), and 218 (2° 29′ N, 76° 47′ E); and from Agulhas Bank area—*See* Clarke, 1966, p. 181, fig. 33]. Pacific Ocean, Atlantic Ocean and Mediterranean Sea.

Family OCTOPODOTEUTHIDAE

Genus *Octopodoteuthis* Ruppell, 1884.

I have not been able to consult Ruppel's work in original, but note that Chun (1910, 1914), Sasaki (1929), and Thiele (1935) have used the generic name *Octopodoteuthis* Ruppell and not *Octopodoteuthis* Krohn 1845, for the species *Octopoteuthis sicula* Ruppell. I have followed Thiele (1935) in placing this species under the genus *Octopodoteuthis*, though recently Adam (1952), Voss (1936) and Clarke (1966) have treated it as *Octopoteuthis sicula* Ruppell.

81. ***Octopodoteuthis sicula*** (Ruppel, 1844), p. 135 (Type locality: Messina).

Synonyms: *Octopoteuthis sicula* Ruppell, 1844 (as above); *Verania sicula* Krohn, 1847; *Onychoteuthis* (*Verania*) *sicula* Verany, 1851; *Octopodoteuthis* Chun, 1910.

Distribution: Worldwide from warm and temperate seas. In Indian Ocean larvae have been recorded from four 'Valdivia' stations: 102 (34° 31′ S, 26° 0′ E, Agulhas Current), 190 (0° 58′ S, 99° 43′ E west of Sumatra), 215 (7° 1′ N, 85° 56′ E Indian North Equatorial Current), and 271 (13° 2′ N, 46° 41′ E, Gulf of Aden).

Genus *Octopodoteuthopsis* Pfeffer, 1912

82. ***Octopodoteuthopsis*** **sp.** Robson, 1924 *a*, p. 4; 1924 *b*, pp. 606–607, pl. 1, fig. 2, text-fig. 3.

Distribution: Known from SS 'Pickle' Stn. 347 off Cape Town, South Africa.

Remarks: Robson (1924 *b*) has pointed out that his specimen differs from *Octopodoteuthopsis megaptera* Verrill, and *Cucioteuthis*,

Genus *Taningia* Joubin, 1931

83. ***Taningia danae*** Joubin, 1931 (Type locality: Atlantic at 14° 52′ N, 28° 04′ W),.

Synonyms: ?*Enoploteuthis molinae* Harting, 1861 (*nec* d'Orbigny); *Cucioteuthis unguiculatus* Joubin.

Distribution: Indian Ocean and Atlantic Ocean.

Remarks: Records from the Indian Ocean are by Harting (1861) and by Clarke (1966) from off Durban, South Africa.

The genus *Cucioteuthis* Steenstrup (1882) which is also a representative of the family Octopodoteuthidae is represented by a single species *C. molinae* (d'Orbigny, 1845) (= *C. unguiculata* Steenstrup, 1882) may have a cosmopolitan distribution, as it has been recorded from the Pacific by Hoyle (1886) and Mediterranean by Joubin (1900). Specimens have been obtained from the stomach contents of whales.

Family ONYCHOTEUTHIDAE

Genus *Onychoteuthis* Lichtenstein, 1818

84. ***Onychoteuthis banksii*** (Leach, 1817), p. 141 (Type locality: ?).

Synonyms: *Loligo banksii* Leach, 1817 (as above; 1818, p. 13), pl. 18, fig. 7; *Onychoteuthis aequimanus* Gabb, 1868; *Onykia angulatus* Lesueur, 1821; *Loligo angulatus* Ferussac, 1823; *Onychoteuthis angulata* d'Orbigny, 1826; *Loligo bartlingii* Lesueur, 1821; *Onychoteuthis bartlingii* Gray, 1849; *Onychoteuthis bergii* Lichtenstein, 1818; *Loligo bergii* Blainville, 1823; *Onychoteuthis bergii*, Middendrof, 1849; *Loligo bianconii* Verany, 1846; *Ommastrephes bianconii* Gray, 1849; *Onychoteuthis borealijaponicus* Okada, 1927; *Teleoteuthis caroli* Joubin, 1900; *Loligo felina* Blainville, 1823; *Onychoteuthis felina* d'Orbigny, 1826; *Onychoteuthis fleuryi* Renaud, 1830; *Onychoteuthis fusiformis* Gabb, 1862; *Onychoteuthis krohnii* Verany, 1846; *Teleoteuthis krohnii* Carus, 1889; *Teleonychoteuthis krohnii* Pfeffer, 1900; *Ancistroteuthis lichtensteinii* (partim) Jatta, 1896; *Loligo lessonii* d'Orbigny, 1826 (*nomen nudum*); *Onychoteuthis lessonii* Lesson, 1830; *Onychoteuthis lobipennis* Dall, 1872; *Enoploteuthis margaritifera* (partim) Jatta, 1896; *Onychoteuthis molinae* Lichtenstein, 1818; *Onychoteuthis raptor* Owen, 1881; *Onychoteuthis rutilus* Gould, 1852; *Teleonichoteuthis rutilus*, Jatta, 1904; *Loligo uncinata* Quoy and Gaimard, 1824; *Onychoteuthis uncinata* d'Orbigny, 1826; *Onychoteuthis* sp. Hoyle, 1906, Robson, 1921.

Distribution: Cosmopolitan. The up-to-date records of this species from the Indian Ocean has been shown by Clarke (1966: p. 142, fig. 19).

Remarks: As would be seen from the list of synonyms, this species has been dealt with by several authors. For detailed synonymy reference is invited to Adam (1952), who has also given a description of the species. Recent descriptions are also given by Voss (1956, 1963). Records from the Indian Ocean are by Goodrich (1896), Pfeffer (1912) and Rees (1949).

Genus *Onychia* Lesueur, 1821 (as *Onykia*)

85. ***Onychia caribaea*** Lesueur, 1821, p. 98 (Type locality: ?).

Synonyms: *Onykia carribaea* Lesueur, 1821 (as above); *Teleoteuthis* (*Onychia*) *agilis* Verrill, 1885; ? *Loligo laticeps* Owen, 1836; ? *Ommastrephes laticeps* d'Orbigny, 1835–1848; ? *Onychia cardioptera* Gray, 1849; ? *Loligo plagioptera* Eydoux and Souleyet, 1852.

Distribution: Cosmopolitan in tropical and temperate seas. In the Indian Ocean, Pfeffer (1912) records this species from off Zanzibar and from the northern part of the Bay of Bengal. Clarke (1966: p. 150, fig. 22) indicates an additional record from the Agulhas Bank area off South Africa.

Remarks : Voss (1956) has shown that *T.* (*O.*) *agilis* which was considered by Pfeffer (1912) to be distinct from are conspecific. Pfeffer (1912) listed two other species under the genus, namely, *O. intermedia* and *O. appellöfi*.

It may also be mentioned here that Robson recorded (1921) *Onychoteuthis* sp. (young specimens) from between Maldives and Chagos; and Salomon and Diego Garcia, Chagos, remarking that "These examples are very immature, but they exhibit considerable resemblance to young examples of this species figured by Pfeffer". He also records *Teleoteuthis* sp. from six examples, two of which were taken from Amirante Bank, but remarks that these ".... examples have been referred to this genus with much hesitation". As no drawings or descriptions of these specimens are given, their systematic position remains uncertain.

Genus *Moroteuthis* Verrill, 1881

86. ***Moroteuthis lönnbergii*** Ishikawa and Wakiya. 1914, p. 445, pls. 15, 16 (Type locality: Misaki, Japan).

Distribution: Indian Ocean (Northern and Central Indian Ocean), Pacific Ocean (Sagami Bay, Japan).

Remarks : For a detailed description of this species reference is invited to Sasaki (1929: pp. 235–237, pl. 20, fig. 13, text-fig. 119). It is recorded by Filippova (1967) from the Indian Ocean.

87. ***Moroteuthis robsoni*** Adam, 1962

Synonym: *Moroteuthis* sp. A. Robson, 1924 *a*, p. 2; 1924 *b*, pp. 595–599, figs. 1, 2.

Distribution: Indian Ocean (Off South Africa).

Remarks: Robson (1924) obtained one adult from S.S. 'Pickle' Stn. 530 off Cape Town, which was given a specific name by Adam (1962). Clarke (1966: p. 146, fig. 21) records this species as an important item in the diet of the sperm whales caught off Durban, S. Africa.

88. ***Moroteuthis robusta*** (Verrill, 1876), p. 236 (Type locality: Off Alaska).

Synonyms: *Ommastrephes robusta* Verrill, 1876 (as above); *Onychoteuthis robusta* Verrill, 1880; *Lestoteuthis robusta* Verrill, 1880; *Ancistroteuthis robusta* Steenstrup, 1882.

Distribution: Indian Ocean (Doubtful. *See* Remarks). Pacific Ocean (South of Tsugaru Straits and off Abashiri and Muroran, Hokkaido; Bering Sea; Northern parts of North Pacific and California Current).

Remarks: According to Clarke (1966) "A large squid identified from a description of this species was seen off South India" by Baccialona, 1919. La calmar a griffes. *Riviera Scient.*, **6** (2): 104–105.

Genus *Tetronychoteuthis* Pfeffer, 1900

89. ***Tetronychoteuthis dussumieri*** (d'Orbigny), 1839 (Type locality: North of Mauritius, obtained from stomach of dolphin).

Synonyms: *Tetronychoteuthis* sp. Robson, 1926*c*; ?*Tetronychoteuthis massaye* Pfeffer, 1912 (probably young of this species).

Distribution: Indian Ocean (North of Mauritius and off South Africa). Atlantic Ocean (Off Cape Town; and from 48° N, 15° W).

Remarks: Clarke (1966) has obtained a number of specimens from the stomachs of sperm whales caught off Saldanha Bay and Durban, South Africa.

The family Gonatidae is presently known from two genera, *Gonatus* Gray (1849) and *Gonatopsis* Sasaki (1920) and the known species are subarctic or circumpolar (Northern Hemisphere) in distribution. However, recently Dell (1959) has recorded *Gonatus fabricii* (Lichtenstein, 1818) from New Zealand waters. This species is known to occur in the northern parts of North Pacific, Bering Sea, Southwards from Alaska to California, North Atlantic and the Mediterranean. It is not unlikely that members of this family may be represented in the Indian Ocean sector of the Antarctic.

Adam (1950) described a new family Pholidoteuthidae, with a new genus and species, *Pholidoteuthis boschmai* from 'Snellius' Station 192 (5° 58′ N, 121° 32′ E). A second new species of the genus has been described by Voss (1956) as *Pholidoteuthis adami* from the Upper Gulf of Mexico east of the Mississippi Delta and off the coast of Texas. The family is likely to be represented in the Indian Ocean as well.

Family ARCHITEUTHIDAE

Genus *Architeuthis* Steenstrup, 1857

90. ***Architeuthis sancti-pauli*** Velan, 1877 (Type locality: St. Paul Island, Southern Indian Ocean).

Distribution: Indian Ocean (St. Paul Island).

91. ***Architeuthis*** sp. Clarke, 1966, p. 98.

Remarks: Clarke (1966) records this from the stomachs of sperm whales caught near Durban Bay and Saldanha Bay, South Africa.

A number of species of *Architeuthis* have been described from the different oceans under different generic names (*Megaloteuthis* Kent, 1874; *Dinoteuthis* More, 1875; *Megateuthis* Hilgendrof, 1880; *Plectoteuthis* Owen, 1881; and *Dubioteuthis* Joubin, 1900), and Bruun (1945) made an attempt to bring together all information known about these giant squids and gave it under one specific name, *Architeuthis dux* Steenstrup, the genotype. In addition to strandings, Clarke (1966) reports on material taken from the stomach-contents of sperm whales. Much remains to be known about these giant squids.

Family HISTIOTEUTHIDAE

Genus *Histioteuthis* d'Orbigny, 1839

92. ***Histioteuthis bonelliana*** (Ferussac, 1835), taf. 66 (Type locality: Western Mediterranean at Nice).

Synonyms: *Cranchia Bonelliana* Ferussac, 1835 (as above); *Histioteuthis Ruppellii* Verany, 1851; *Histioteuthis collinsi* Verrill, 1879; *Histioteuthis atlantica* Hoyle, 1885.

Distribution: Indian Ocean (S.S. 'Pickle' Stations 343 and 542 off South Africa; South of Madagascar; South-west Australia). Atlantic and Mediterranean.

Remarks: Specimens were described from South African waters by Robson (1924 *b*, 1926 *c*), and the Southern Indian Ocean by Thiele, 1921 (p. 452 from South of Madagascar); and Dell, 1959.

The nomenclature and status of several of the histioteuthid squids are steeped in confusion and this has been repeatedly drawn attention to by various authors (Chun, 1910; Pfeffer, 1912; Dell, 1952; Voss, 1956, 1963). Pfeffer's (1912) monographic review gives a diagnosis of what may be considered the typical *Calliteuthis* which has three rows of light organs on the ventral arms, a large broad row lodged ventrally and with one row of light organs in the remaining arms. Attempt at further subdivision of the genus into two groups (on the nature of the rings of the arms and the tentacular suckers) *Calliteuthis* and *Stigmatoteuthis* has been an artificial one leading to considerable confusion. As Dell (1951) has pointed out "Practically every new species obtained requires a new generic name". According to Voss (1956), the many specimens referred to *Calliteuthis* and *Stigmatoteuthis* by different workers may well belong to a single variable species showing geographical speciation. Voss (1963) opined that *Meleagroteuthis* Pfeffer (1900) should be placed in the direct synonymy of *Calliteuthis* Verrill (1880) which has priority. He further points out that "It is even possible that future study may show that all should be united under the genus *Histioteuthis*, but this step does not seem advisable at present". Until such time that a revision of the family could be undertaken, the listing of the species of *Calliteuthis* given below can be only considered provisional.

Genus *Calliteuthis* Verrill, 1880

93. ***Calliteuthis hoylei*** (Goodrich, 1896), p. 15, pl. 4, figs. 62–71 (Type locatliy: Andaman Islands).

Synonyms: *Histiopsis hoylei* Goodrich, 1896 (as above); *Stigmatoteuthis Hoylei* Pfeffer, 1900.

Distribution: Indian Ocean (Andaman Sea and Indian Ocean South Equatorial Current, Amiranti at 4° 34′ S, 53° 42′ E).

Remarks: I wish to cite here the extract from Voss's (1963) discussion pertinent to this species. He states that "Whether *Meleagroteuthis*

is considered a synonym of *Calliteuthis* or a subgenus, several changes must take place. The only one pertinent to this study, however, is the specific name *hoylei*, which was first used by Goodrich for his species *Histiopsis hoylei* Goodrich, 1896. Pfeffer (1900) has shown that this species is *Stigmatoteuthis hoylei* (now *Calliteuthis hoylei*). In the erection of the genus *Meleagroteuthis* he designated (by monotypy) the type of his new genus as *hoylei*. Chun, however, in 1910 had renamed this *Calliteuthis* (*Meleagroteuthis*) *meleagroteuthis* because of the submersion of both *Stigmatoteuthis* and *Meleagroteuthis* as subgenera. Chun's nomenclature must now stand, and unfortunately the well-known *Meleagroteuthis hoylei* is ground into oblivion.... it now seems unavoidable that we call this species by the name *Calliteuthis meleagroteuthis*...." *Calliteuthis meleagroteuthis* Chun (1910) has a wide distribution in the Pacific Ocean and Eastern Atlantic.

94. ***Calliteuthis reversa*** Verrill, 1880, p. 393.

Remarks: Goodrich (1896, p. 16) has given ? *Calliteuthis reversa* Verrill. It is highly unlikely that this species occurs in the Indian Ocean as Voss (1956) mentions that it would appear to be restricted to the Northern and Western North Atlantic and the Gulf of Mexico. Chun (1914, p. 174) records 1 juv. from 6° 19′ S, 73° 18′ E, the specific status of which needs re-examination.

95. ***Calliteuthis japonica*** (Massy, 1916) (*nec* Pfeffer, 1912).

Remarks: Massy (1916, pp. 242–243) described a specimen of *Calliteuthis* from the 'Investigator' collections, Stn. 374 (Andaman Sea, 11° 37′ N, 95° 57′ E) as *Stigmatoteuthis japonica* Pfeffer. Its status is uncertain.

96. ***Calliteuthis miranda*** Berry, 1918

Remarks: Originally described from Off Victoria, Australia. A record of this is available from Southern Indian Ocean (Dell, 1959 *a*).

Genus ? *Histiochromius* Pfeffer, 1912

97. ***Histiochromius chuni*** Pfeffer, 1912 from Indian Ocean based on '*Brachioteuthis*' from Indian Ocean South Equatorial Current given by Chun (1910). *See* Thiele (1935, p. 970).

Family PARATEUTHIDAE (= ALLUROTEUTHIDAE)

Genus *Parateuthis* Thiele, 1921

98. ***Parateuthis tunicata*** Thiele, 1921

Remarks: This species is included in the list as it was described from the Indian Ocean Sector of the Antarctic (64° 29′ S, 85° 27′ E and 65° 15′ S, 80° 00′ E). The description is based on apparently juvenile specimens.

Genus *Alluroteuthis* N. Odhner, 1923

99. ***Alluroteuthis antarcticus*** Odhner, 1923

Remarks: This species was originally described from 63° 25′ S, 45° 39′ W and 64° 1′ S, 50° 30′ W. It was recorded from the Indian Ocean Sector of the Antarctic by Dell (1959 *a*) from 64° 32′ S, 75° 55′ E; 66° 35′ S, 61° 13′ E; and 63° 51′ S, 54° 16′ E. Clarke (1966) opines that *Parateuthis tunicata* Thiele (1921) may represent the juvenile stage of this species.

Family BRACHIOTEUTHIDAE

Genus *Brachioteuthis* Verrill, 1881

100. ***Brachioteuthis riisei*** (Steenstrup, 1882)

Synonyms: *Tracheloteuthis riisei* Steenstrup, 1882; *Verrilliola gracilis* Pfeffer, 1884; *Verrilliola nympha* Pfeffer, 1884; *Entomopsis velaini* Rochebrune, 1884; *Entomopsis clouei* Rochebrune, 1884; *Tracheloteuthis*? sp. Hoyle, 1886 *a*; *Entomopsis alicei* Joubin, 1900; and *Brachioteuthis riisei* Greg, 1924.

Remarks: There are four records of this species from the Indian Ocean by Hoyle (1905) and Pfeffer (1912). *See* Clarke (1966: p. 163, fig. 26).

101. ***Brachiteuthis picta*** Chun, 1910 *a* (Type locality: Benguela Current at 5° 6′ N, 9° 58′ W).

Remarks: Dell (1959 *a*) has recorded this from the Southern Indian Ocean from 43° 19′ S, 93° 56′ E. Detailed drawings of this species are given by Chun (1910, pp. 207–212, pl. 29, fig. 11; pl. 30, figs. 4 & 5; pl. 31, figs. 1–3, 5, 7 & 8; pl. 32).

Family BATHYTEUTHIDAE

Genus *Bathyteuthis* Hoyle, 1885

102. ***Bathyteuthis abyssicola*** Hoyle, 1885, p. 272, fig. 108 (Type locality: Between Morion Island and Isles Crozets; Southern Indian Ocean).

Synonyms: *Benthoteuthis megalops* Verrill, 1885

Distribution: Indian Ocean ['Valdivia' Stations 207 (5° 23′ N, 94° 48′ E), 217 (4° 56′ N, 78° 15′ E), and 221 (4° 5′ S, 73° 24′ E); 'Investigator' Stations 393 (7° 21′ 6″ N, 85° 7′ 15″ E), and 426 *a* (9° 8′ N, 87° 25′ E) from the Bay of Bengal; and three R.S.S. 'Discovery' records (South of Agulhas Bank off South Africa; South-east of Madagsacar; and off Somali Coast, E. Africa] given by Clarke (1966: p. 168, fig. 28). Atlantic Ocean (East Coast of United States; Gulf of Mexico; Gulf of Panama).

Remarks: On the basis of the date of publication of the descriptions of *B. abyssicola* Hoyle and *B. megalops* Verrill, Chun (1910, p. 186) considered the latter to have priority as it was published in 'April 1885' and Hoyle's account in May 1885'. Later authors have considered *B. abyssicola* Hoyle as valid. Voss (1956) who had examined the type of Verrill's *Benthoteuthis megalops* could not find any light organs present in the species, while this has been reported for some

of the Indian Ocean material (Chun, 1910; Massy, 1916). Hoyle's description also does not mention any light organs. Apparently, as Voss (1956) has pointed out, two species may be confused in literature as the presence or absence of light organs may be considered to be of at least specific importance.

Genus *Ctenopteryx* Appellof, 1889

103. ***Ctenopteryx sicula*** (Verany), 1851, p. 75, pl. 27 (Type locality: Messina, Mediterranean).

Synonyms: *Sepioteuthis sicula* Verany, 1851 (As above); *Chtenopteryx fimbriatus* Appellof, 1889; *Chtenopteryx cyprinoides* Joubin, 1894; *Calliteuthis neuroptera* Jatta, 1896; *Ctenopteryx sicula* Pfeffer, 1900; *Ctenopteryx cyprinoides* Joubin, 1900; *Ctenopteryx neuroptera* Jatta, 1904.

Distribution: Indian Ocean (Northern and Central parts); Mediterranean and N. Atlantic.

Remarks : Refer also Chun (1910, pp. 199–201, pl. 27, figs. 9–11); Degner (1926, pp. 5–7, fig. 1), and Adam (1967, p. 72). Filippova (1967) records this species from the Indian Ocean.

Genus *Indoteuthis* Grimpe, 1922

104. ***Indoteuthis minima*** (Robson, 1921), p. 432, pl. 65, fig. 2 (Type locality: One example, sex indeterminate from between Alphonse and Providence Island from 900 fathoms).

Synonym: *Chunoteuthis minima* Robson, 1921 (as above).

Distribution: Indian Ocean (Known only from Type locality).

Remarks: Robson's genus *Chunoteuthis* (Robson, 1921, p. 432) is preoccupied by the Octopoda genus *Chunioteuthis* Grimpe (1916) and as such *Indoteuthis* was proposed for it by Grimpe (1922). The systematic position of the species itself is highly problematic. At first sight, the illustrations of the species given by Robson would appear to be that of a juvenile specimen, but he remarks that 'The adult condition is testified by the length of the arms, both sessile and tentacular'. The description is wanting in specific details as "it arrived in a very shrivelled up condition, apparently having suffered desiccation at some time, and in consequence a good many of its external features have been obliterated". Its placement under the family Benthoteuthidae is thus provisional and only the rediscovery of the species will help to settle this problem.

Family OMMASTREPHIDAE

Subfamily ILLICINAE

Genus *Illex* Steenstrup, 1880

105. ***Illex illecebrosus coindeti*** (Verany, 1837), p. 94, pl. 4; 1851, p. 110, pl. 36.

Synonyms: ***Loligo coindetii*** Verany, 1837 (as above); *Ommastrephes coindetii* Tryon, 1879; *Ommastrephes* (*Illex*) *coindetii* Girard, 1890;

Illex coindetii Steenstrup, 1880; *Illex coindeti* Carus, 1890; *Illex illecebrosus coindeti* Grimpe, 1921; *Ommastrephes sagittatus* (partim) d'Orbigny, 1845; Ferussac and d'Orbigny, 1848; Gray, 1849; *Ommatostrephes sagittatus* (partim) Jeffreys, 1862; *Loligo sagittata* (partim) Blainville, 1825; *Loligo brogniartii* Blainville, 1823; *Loligo pillae* Verany, 1851; *Todaropsis veranyi* (male) Jatta, 1896.

Distribution: Indian Ocean (Red Sea). Mediterranean and Eastern Atlantic.

Remarks: Illex illecebrosus (Lesueur, 1821) and *Illex coindeti* (Verany, 1837) have been considered by some workers as two distinct species. I have followed Adam (1952) in considering the latter as a subspecies of *I. illecebrosus*, and the typical form is known from Northern Europe as far south as the English Channel; East Coast of United States; Gulf of Mexico and Cuba. A second subspecies, *I. illecebrosus argentinus* is known from the S-W. Atlantic.

Adam (1942, pp. 3, 13; 1959, pp. 165–168, figs. 17,18) recorded and described *Illex illecebrocus coindeti* from the Red Sea. There have been no subsequent records of it from the Indian Ocean. For detailed synonymy and description of this subspecies from different parts of its distributional range, reference is invited to Adam (1952: pp. 80–94, figs. 32–40) wherein he has also given a detailed comparison of the two subspecies, *I. i. illecebrosus* and *I. i. coindeti.*

Genus *Todaropsis* Girard, 1890

106. ***Todaropsis eblanae*** (Ball, 1841), p. 363, figs. 1–7 (Type locality: Dublin Eay, Irish Sea).

Synonyms: Loligo eblanae Ball, 1841 (as above); *Ommastrephes eblanae*, Gray, 1849; *Ommatostrephes eblanae* Steenstrup, 1892; *Illex eblanae* Hoyle, 1892; *Loligo sagittata* (partim) Verany, 1851; *Todaropsis veranyi* Girard, 1880; *Ommastrephes* (*Todaropsis*) *veranyi* Girard; and *Todaropsis veranii* Nobre, 1936.

Remarks: Robson (1924, p. 5; 1924, pp. 614–617) has recorded this species from South African waters off Cape Town. Subsequently, it has also been recorded from Cape Point, by Thore (1945). It is widely distributed in the Eastern Atlantic and the Mediterranean. The species is included in this list, as it is a borderline case, which could occur in the Indian Ocean Sector of South Africa as well.

Subfamily TODARODINAE

Genus *Todarodes* Steenstrup, 1880

107. ***Todarodes sagittatus*** (Lamarck, 1799)

Synonyms: Loligo sagittatus Lamarck, 1799; *Loligo todarus* Verany, 1851; *Ommastrephes sagittatus* Pfeffer, 1912; *Todarodes sagittatus* Rees and Maul, 1956.

Distribution: Indian Ocean (East Africa, off Durban, South Africa), North-Eastern Atlantic and Mediterranean.

Remarks: Clarke (1966) identified this species from the stomach-contents of sperm whales caught off Durban, South Africa. For the distribution of the species in the Indian Ocean, Clarke (1966: p. 128, fig. 13) may be referred to.

108. ***Todarodes pacificus*** Steenstrup, 1880, pp. 83, 90, fig. 1 (Type locality: Hakodate, Japan).

Synonyms: Ommastrephes pacificus Appellof, 1886; *Ommatostrephes sagittatus* var. *sloani*? Wulker, 1910; *Ommastrephes sloani* Berry, 1912; *Ommatostrephes sloani pacificus* Pfeffer, 1912; *Ommastrephes sloani pacificus* Sasaki, 1929.

Distribution: Indian Ocean (One record from west of Australia shown by Clarke (1966: p. 128, fig. 13). Pacific Ocean, especially from Japanese waters from Southern Kyushu northwards to Okhotsk Sea.

Remarks: The name *Ommastrephes sloani pacificus* is widely used in Japanese literature to indicate this species, which nomenclaturally is incorrect. This problem has been discussed at length by Voss (1963: pp. 132–133). He has shown that *sloani* is referrable to the genus *Nototodarus* for which "There appears to be a distinct cline within the species of *N. sloani*, following a curve from New Zealand through Australia, the Philippines and Hawaii. Along this curve are *sloani sloani* in New Zealand, *sloani gouldi* in Australia, *sloani philippinensis* in the Philippines and *sloani hawaiiensis* in the Central Pacific and Hawaii". At present the genus *Todarodes* is known from only two species, *T. sagittatus* and *T. pacificus.*

Genus *Nototodarus* Pfeffer, 1912

109. ***Nototodarus sloani gouldi*** (McCoy, 1888) (Type locality: Off Victoria and New South Wales, Australia).

Synonyms: Ommastrephes gouldi McCoy, 1888; *Ommastrephes sloani* (partim) Pfeffer, 1912.

Remarks: Berry (1918) records this from the Indian Ocean Sector off Western Australia. There appears to be no definite records of this from the Indian Ocean since then.

The genus *Ornithoteuthis* of the subfamily Todarodinae presents the most interesting pattern of distribution. It is represented by two species, *O. volatilis* (Sasaki, 1915: described by Sasaki as *Ommastrephes volatilis*) from Sagami Bay, Japan, and by *O. antillarum* Adam, first described as a subspecies of *O. volatilis* from the island of Guadeloupe, in the Antilles (Adam, 1957). The latter has been shown to be specifically distinct from *O. volatilis* by Voss (1957), based on material from the Bahama Islands. It is most likely that this genus may also be represented in the Indian Ocean.

Subfamily OMMASTREPHINAE

Genus *Ommastrephes* d'Orbigny, 1839

110. ***Ommastrephes bartrami*** (Lesueur, 1821), pp. 90–92, pl. 7 (Type locality ?)

Synonyms: Loligo bartramii Lesueur, 1821 (as above); *Stenoteuthis bartrami* Verrill, 1880.

Distribution: More or less cosmopolitan being known from the tropical and warm temperate waters of the Indo-Pacific and the Mediterranean. Voss (1956) remarks that no specimens of this species have been obtained from Florida or the Gulf of Mexico.

Remarks: Records of this species from the Indian Ocean are by Pfeffer (1912) from South Africa, and (?) Robson (1921) from Chagos Islands. Its congener, *O. pteropus* Steenstrup (1885), is known from the Atlantic Ocean. A description of *O. bartrami* from the Indian Ocean based on good series of material is wanting.

The description of *Stenoteuthis bartrami* given by Robson (1921) is very incomplete and his specimens could very well have been *Symplectoteuthis oualaniensis* (Lesson).

Genus *Symplectoteuthis* Pfeffer, 1900

111. ***Symplectoteuthis oualaniensis*** (Lesson, 1830), p. 240, pl. 1, fig. 2 [Type locality: Oualan (= Kusaie, Caroline Islands)].

Synonyms: *Loligo oualaniensis* Lesson, 1830 (as above); *Loligo vanicoriensis* Quoy and Gaimard, 1832; *Loligo brevitentaculata* Quoy and Gaimard, 1832; *Ommastrephes oualaniensis* d'Orbigny, 1835; *Ommastrephes oceanicus* Ferussac and d'Orbigny, 1835–1848; *Ommatostrephes oualaniensis* Steenstrup, 1880; *Symplectoteuthis oualaniensis* Pfeffer, 1900.

Distribution: Indo-Pacific. From Indian Ocean (Red Sea; Arabian Sea; Laccadive Sea (Present collections reported in earlier part of this paper); Bay of Bengal, East of Ceylon; Off Natal coast, South Africa; off East Africa; Cocos Island; and West of Australia. The general distribution is shown by Clarke (1966: p. 114, fig. 9). Pacific Ocean (Japan, Okinawa, Taiwan, Philippines, South Seas, and west coast of South and Central America).

Remarks: Weindl (1912) first recorded this species from the Red Sea, and subsequent records of it from the Red Sea are by Adam (1942, pp. 3, 14; 1959, pp. 168–169; 1960, pp. 8–11, fig. 1). Adam (1954, p. 157) records this species from nine 'Siboga' Expedition Stations from Indonesia. Recent descriptions of this species from the Pacific Ocean are by Sasaki (1929), Voss (1963).

Roper (1963) has shown that *S. oualaniensis* bears subcutaneous photophores of the same type and in the same positions as are found in *Ommastrephes pteropus* and *Dosidicus gigas*. As its name implies, the only other recognised species of the genus, *S. luminosa* Sasaki (1915) known from the Japanese Seas, is also characterised by subcutaneous photophores, but of a smaller size than those in the species mentioned above.

112. ***Symplectoteuthis luminosa*** Sasaki, 1915, p. 144, pl. 4, figs. 7–13, text-fig. 4 (Type locality: Off Misaki, Japan); 1929, pp. 293–295, pl. 24, figs. 4 & 5, text-fig. 140.

Synonyms: *Symplectoteuthis oualaniensis* Watase, 1906 (*nec* Lesson, 1830); *Eucleoteuthis luminosa* Berry, 1916.

Distribution: Indian Ocean (Northern and Central parts); Pacific Ocean (Japanese Sea).

Remarks: Roper (1963) has commented on the light organs (subcutaneous photophores) in this species. The species is recorded from the Indian Ocean by Filippova (1967).

Genus *Dosidicus* Steenstrup, 1857

113. ***Dosidicus gigas*** (d'Orbigny, 1835)

Synonyms: Ommastrephes gigas d'Orbigny, 1835–1848; *Ommastrephes giganteus* d'Orbigny, 1835–1848; *Dosidicus Eschrichtii*, Steenstrup, 1857; *Dosidicus Steenstrupii* Pfeffer, 1884.

Remarks: This species which is known from the west coast of South America is included here only on account of a record of it from Perim Island, Red Sea by Brazier (1892), which is highly doubtful.

Rhynchoteuthis Larvae

Chun (1910) has given drawings of *Rhynchoteuthis* larvae of Ommastrephidae from the following 'Valdivia' Stations from the Indian Ocean: 125, 173, 175, 215, 228 and 236. More than one species may be present in the 'Valdivia' material of *Rhynchoteuthis* illustrated by Chun. *Rhynchoteuthis* was first described as a genus by Chun (1903) and as the name was preoccupied (*Rhynchoteuthis* d'Orbigny, 1847) Pfeffer (1908) proposed *Rhynchoteuthion* for the former. *Rhynchoteuthis chuni* Hoyle (1904) also represents *Rhynchoteuthis* stage of an Ommastrephid.

The *Rhynchoteuthis* larvae obtained during the R. V. *VARUNA* cruises from the Arabian Sea and Laccadive Sea are under sudy.

Family THYSANOTEUTHIDAE

Genus *Thysanoteuthis* Troschel, 1857

114. ***Thysanoteuthis rhombus*** Troschel, 1857, p. 70, pl. 4, fig. 12; pl. 5, figs. 1–4 (Type locality: Mediterranean).

Synonym: ? Thysanoteuthis nuchalis Pfeffer, 1910.

Remarks: The known distribution of the species would lead one to surmise that this is a cosmopolitan species of warmer waters. Voss and Erdman (1959) have given details of the distribution of this species in the Atlantic and Pacific Oceans. Very few adults have been examined and one was stranded at the Cape of Good Hope and reported on by Barnard (1934). In view of this record so close to the Indian Ocean Sector of South Africa and on account of the otherwise known distribution of the species it is included in this catalogue. Voss and Erdman (1959) remark that "Despite the paucity of records of adult specimens, this is almost certainly a common pelagic species. A preliminary examination of the cephalopods collected by the *Dana* expeditions in the North Atlantic has revealed numbers of thysanoteuthid larvae and the lack of capture of adults is probably due to their size and speed."

Genus *Cirrobrachium* Hoyle, 1904

115. ***Cirrobrachium filiferum*** Hoyle, 1904 (Type locality: Eastern Pacific at 0° 50′ N, 137° 54′ W).

Remarks: Thiele (1921) refers one specimen from the Indian Ocean collected at 25° S, 57° 7′ E to this species. However, in 1935 (p. 974) he has listed the genus *Cirrobrachium* with a query (?).

Family CHIROTEUTHIDAE

Subfamily CHIROTEUTHINAE

Genus *Chiroteuthis* d'Orbigny, 1839

Subgenus *Chirothauma* Chun, 1910

116. ***Chiroteuthis (Chirothauma) imperator*** Chun, 1910, pp. 240, 241, 281, pl. 38; pl. 39, figs. 1–10; pl. 40, figs. 2–5, 7; pl. 41; pl. 42, figs. 1–4, pl. 43, and and pl. 44, figs. 3, 6–16 (Type locality: 'Valdivia' Station 194, West of Sumatra at 'Nias-Sud-Kanal', 0° 15′ N, 98° 8′ E).

Distribution: Indian Ocean [In addition to the type locality: 'Investigator' Stations 281 (Bay of Bengal, 11° 15′ 15″ N, 8° 7′ E), 297 (Gulf of Oman, 25° 11′ 30″ N, 57° 15′ E), and 366 (Arabian Sea, 24° 45′ N, 63° 50′ 15″ E). Pacific Ocean (Japan, Philippines and Amboine)].

Remarks: Joubin (1924) discussed the close affinities and the status of the three species *C. picteti* Joubin (1894), *C. macrosoma* Goodrich (1896), and *C. imperator* Chun (1910). Voss (1963) has also suggested that there is a great possibility that *C. macrosoma* and *C. imperator* may be synonyms of *C. picteti*, but only an examination of the types will help to settle this problem. Hence *C. macrosoma* is listed separately in this account.

117. ***Chiroteuthis (Chirothauma) macrosoma*** Goodrich, 1896, p. 12, pl. 3, figs. 51–57 (Type locality: 12° 50′ N, 81° 30′ E in the Bay of Bengal).

118. ***Chiroteuthis pellucida*** Goodrich, 1896, p. 14, pl. 4, figs. 58–61 (Type locality: Bay of Bengal).

Larvae of *Chiroteuthis:*

1. ***Planctoteuthis***—Stage: Pfeffer, 1912; Robson, 1924, as *Chiroteuthis, Doratopsis* Stage A from Durban, South Africa.

2. ***Doratopsis sagitta*** Chun, 1908 from North Atlantic and Indian Ocean (30° 6′ S, 87° 50′ E).

3. ***Doratopsis exophthalmica*** Chun, 1908; 1910, p. 290 from Southern Indian Ocean at 34° 13′ S, 80° 30′ E; Robson, 1921, p. 434, from between Peros and Salomon, Chagos Islands, Indian Ocean.

The family Valbyteuthidae was created by Joubin (1931) to accommodate an unusual squid he described from the Bay of Panama as *Valbyteuthis danae* in 1931. The family has been listed by Thiele (1935). However, recently Roper and Young (1967) have shown that *Valbyteuthis* does not warrant inclusion in a separate family, but should be placed in the Chiroteuthidae *sensu stricto*. At present *Valbyteuthis* is known from the Atlantic Ocean and the Eastern Pacific. The larval stages of *Valbyteuthis* and the 'doratopsis' type of larvae of *Chiroteuthis* resemble each other very

closely. It is not unlikely that *Valbyteuthis* may be found to have a wider distribution than known at present.

Subfamily MASTIGOTEUTHINAE

Genus *Mastigoteuthis* Verrill, 1881

119. ***Mastigoteuthis cordiformis*** Chun, 1908, p. 88 (Type locality: South of Pulo Nias, Sumatra).

Distribution: Indian Ocean ('Valdivia' Station 194, South of Pulo Nias, Sumatra, 0° 15′ N, 98° 8′ E). Pacific Ocean (Java Sea; Philippines; and Suruga Bay, Japan).

Remarks: For descriptions of the species reference may be made to Chun (1910), Sasaki (1929), Adam (1954), and Voss (1963).

120. ***Mastigoteuthis glaukopsis*** Chun, 1908, p. 88; 1910, p. 233, pl. 33, figs. 1, 2; pl. 35, figs. 2, 15, 16; pl. 37, fig. 1 (Type locality: 'Valdivia' Station 261 from Indian Ocean at 4° 63′ N, 48° 37′ E). The distribution of *M. cordiformis* and *M. glaukopsis* (= *M. glaucopsis*) has been shown by Clarke (1966, p. 207, fig. 42).

121. ***Mastigoteuthis sp.*** A. Robson, 1924, p. 5; 1924, pp. 617–619, fig. 13.

Remarks: One specimen obtained from S.S. 'Pickle' Station No. 277 was described by Robson (1924), who remarks that the specimen is in a very poor condition and some of the details seen indicates its affinities to *M. flammea* Chun (1910), a species known from the South-Eastern Atlantic (Benguela Current and Guinea Current).

Family CRANCHIIDAE

Subfamily CRANCHIINAE

Genus *Cranchia* Leach, 1817

122. ***Cranchia scabra*** Leach, 1817, p. 140 (Type locality: Off the Congo, Africa).

Synonyms: *Philonexis eylais* d'Orbigny, 1839; *Cranchia tenuitentaculata* Pfeffer, 1884; *Cranchia hispida* Pfeffer, 1884.

Distribution: Indian Ocean ('Valdivia' Station 217 at 4° 56′ N, 78° 15′ E; Off Natal Coast, South Africa; and other records given by Pfeffer (1912) and Thiele (1921). This species has a cosmopolitan distribution being also known from tropical to warm temperate waters of the Mediterranean, Atlantic Ocean and Pacific Ocean. *See* also Clarke (1966, p. 218, fig. 46).

Remarks: Robson (1924), Sasaki (1929), Voss (1956, 1963) have given good descriptions of this species.

Genus *Liocranchia* Pfeffer, 1884

123. ***Liocranchia gardineri*** Robson, 1921, pp. 434–435, pl. 65, fig. 1; text-figs. 1 & 2 (Type locality: From off Desroches Atoll, Indian Ocean).

124. ***Liocranchia intermedia*** Robson, 1924, pp. 6–8; 1924, pp. 623–624, pl. 1, fig. 5 (Type locality: Off Natal Coast, South Africa).

Remarks: In the second paper mentioned above, Robson has added to the description of the species.

125. ***Liocranchia reinhardti*** (Steenstrup, 1856), p. 200 (Type locality: Azores, Atlantic Ocean).

Synonyms: *Leachia reinhardti* Steenstrup, 1856 (as above); *Loligopsis* (*Perotis*) *reinhardti* Tryon, 1879; *Cranchia reinhardti* Brock, 1882; *Perothis reinhardtii* Rochebrune, 1884; *Liocranchia brockii* Pfeffer; 1884; *Liocranchia* cf. *reinhardti* Pfeffer, 1884; *Cranchia brockii* Joubin, 1894; *Liocranchia reinhardti* Pfeffer, 1900; *Cranchia* (*Liocranchia*) *globosa* Berry, 1909.

Distribution: Cosmopolitan in all tropical and temperate seas. Records from the Indian Ocean are by Chun (1910) from 'Valdivia' Stations 215 (7° 1′ N, 85° 56′ E), and 217 (4° 56′ N, 78° 15′ E); from Natal, South Africa given by Robson (1924, p. 622); present records from R. V. *VARUNA* collections are given in the earlier part of this paper. *See* also Clarke (1966, p. 220, fig. 47).

126. ***Liocranchia valdiviae*** Chun, 1906, p. 84 (Type locality: Indian Ocean. First mentioned 'Valdivia' Station 182, at 10° 8′ S 97° 14′ E). Chun (1910, pp. 337–342, pl. 48, figs. 3 & 4; pl. 51, figs. 1–4, 8–14; pl. 60, figs. 7–11. In addition to 'Valdivia' Station 182 mentioned above, it is also taken from the following stations: 221 (4° 5′ S, 73° 24′ E), 226 (4° 5′ S, 70° 1′ E), 237 (4° 45′ S, 48° 58′ E), 239 (5° 42′ S, 43° 36′ E), and 258 (2° 58′ N, 46° 50′ E).

Remarks: Sasaki (1920, 1929) has recorded this species from off Kii Province, Japan. Comparing the bathymetric distribution of *L. reinhardti* and *L. valdiviae*, Robson (1924, p. 622) remarks that though both species are found in the same area, the former is found generally in depths under 1000 metres.

Genus *Pyrgopsis* Rochebrune, 1884.

According to Clarke (1966), *Pyrgopsis* is characterised by several larval characters, such as the very short arms, an elongated 'rostrum' to the head and protruding eyes. While it is likely that species of *Lechia* and *Drechselia* pass through a *Pyrgopsis*-like stage, Sasaki (1929, p. 330, pl. 27, fig. 12) has shown the presence of a hectocotylus on a male of *P. pacifica* which suggests that all species of *Pyrgopsis* are not larval forms.

127. ***Pyrgopsis pacificus*** (Issel, 1908), p. 223, pl. 10, figs. 33–44 (Type locality: Between Tahiti and Pango-Pango, South Pacific).

Synonyms: *Zygaenopsis pacifica* Issel, 1908 (as above); ?*Loligopsis zygaena* Verany, 1851; ?*Zygocranchia zygaena* Hoyle, 1909; *Euzygaena pacifica* Chun, 1910.

Distribution: Indian Ocean (Natal, South Africa). Pacific Ocean (Sagami Bay and Misaki, Sagami Province, Japan; Between Tahiti and Pango-Pango; Off Three Kings Ids; Off North Island, New Zealand). Atlantic (0° 29′ N, 18° 57′ W).

Remarks: Robson (1924, pp. 619–622) has given a brief description of the single specimen obtained off Natal, South Africa and discussed the systematic position of *P. pacifica* with the other known species of the genus. Earlier, Chun (1910) considered *Loligopsis xygaenae* Verany, *Pyrgopsis rhynchophorus* Rochebrune (1884), and *Loligopsis schneehageni* Pfeffer (1884) as doubtful synonyms of *Euzygaena pacifica*. Pfeffer (1912, p. 657) has tried to separate these four species giving an artificial key. In view of the uncertainty as to their systematic position, one more species described under this genus from the Indian Ocean is included in this list.

128. ***Pyrgopsis rhynchophorus*** Rochebrune, 1884, p. 17, pl. 2, figs. 1–6 (Type locality: Agulhas Bank, South Africa).

Synonym: *Zygaenopsis zygaena* Pfeffer (1900).

Distribution: Indian Ocean (In addition to the type locality, also reported by Pfeffer, 1912, from St. Paul).

Remarks: As already mentioned, this species may be a synonym of *P. pacificus* (Issel, 1908).

Genus *Lechia* Lesueur, 1821

129. ***Lechia cyclura*** Lesueur, 1821, p. 90, pl. 6 (Type locality: *See* under Remarks).

Synonyms: *Loligopsis cyclurus* Ferussac, 1832; *Loligo leachii* Blainville, 1823; *Perothis pellucida* Rathke, 1832; *Loligopsis cyclura* d' Orbigny 1835–1848; and *Lechia ellipsoptera* Steenstrup, 1861.

Remarks: Lesueur (1821) mentions the habitat of this species as "Inhabits the Pacific Ocean" and adds that "This description is taken from a drawing made by Mr. Petit, from a specimen obtained in the Pacific Ocean, in lat. 37° South, and long. 33° East". This places the type locality in the south-western Indian Ocean off South Africa and not in the "Pacific Ocean". d'Orbigny (1835–1848), Gray (1849), and Steenstrup (1861) refer to its occurrence in the Indian Ocean. However, while recording two specimens of *L. cyclura* obtained from the stomach of the lancet fish *Alepisaurus ferox* from Madeira, Rees and Maul (1956) mention that "This species has rarely been captured in the Atlantic, and since it was described from the Atlantic coast of N. America by Lesueur (1821)...." There appears to be some confusion about the type locality. Other records of the species from the Atlantic Ocean are by Joubin (1920), and Voss (1960). Strangely, there appears to be no definite record of this species from the Indian Ocean, since its original description.

Genus *Sandalops* Chun, 1906

130. ***Sandalops melancholicus*** Chun, 1906, p. 86 (Type locality: South Atlantic, north of Tristan da Cunha).

Distribution: Indian Ocean (North and Central parts); South Atlantic.

Remarks: Refer also Chun (1910, p. 379, pl. 56, figs. 6–8). Filippova (1967) records this species from the Indian Ocean.

Subfamily TAONIINAE

Clarke (1966) has pointed out that most of the genera of Taoniinae may be based on various larval stages and as such the status of the genera *Taonius* Steenstrup (1861), *Megalocranchia* Pfeffer (1884), *Desmoteuthis* Verrill (1881) (Given as synonym of *Taonius* by Thiele, 1935, p. 980), and *Heliocranchia* Massy (1907) (Given as subgenus of *Henseniotеuthis* Pfeffer by Thiele, 1935, p. 982) are not settled. Adam (1962), Muus (1956), and especially Voss (1960) may also be referred to].

Genus *Crystalloteuthis* Chun, 1906

131. ***Crystalloteuthis glacialis*** Chun, 1906, p. 85; 1910, p. 272, pl. 53, figs. 2–9; pl. 54, fig. 18 (Type locality: Indian Ocean Sector of the Antarctic from 'Valdivia' station. 145, at 59° 16′ S, 40° 13′ E—West Wind Drift).

Remarks: Dell (1959) has recorded this species from the Southern Indian Ocean and the Australian Sector of the Antarctic from 44° S and 65° S respectively.

A second species of the genus, *C. behringiana* Sasaki (1920) is known from the Alleutians; La Perouse Strait; off Bering Island and off Hokkaido in the north North Pacific.

Genus *Corynomma* Chun, 1906

132. ***Corynomma speculator*** Chun, 1906, p. 85; 1910, p. 367, pl. 55; pl. 60, figs. 13–16 (Type locality: First record listed as 'Valdivia' Station. 32 at 24° 43′ N, 17° 1′ W South of Canary Islands, North Atlantic).

Distribution: Indian Ocean ('Valdivia' Station 237 at 4° 45′ S, 48° 58′E).

Remarks: Chun (1910) considered *Liguriella podophthalma* Issel a synonym of *C. speculator*. Massy (1925) has also recorded this species from South Africa.

Voss (1960) described a new genus and species, *Carynoteuthis oceanica* from off Bermuda and remarked on the possibility of this being the adult of *Corynomma speculator*, which has been incompletely described by Chun. A graded series of specimens which may help to throw light on changes associated with growth may help to solve this problem. Incidentally, Voss (1960) has given reasons for considering *Megalocranchia abyssicola* Joubin (1924) (*nec* Goodrich, 1896) from Azores as a synonym of *Carynoteuthis oceanica*.

Genus *Teuthowenia* Chun, 1910

133. ***Teuthowenia antarctica*** Chun, 1910, pp. 376–379, pl. 54, figs. 1–5; pl. 57, figs. 3–7 (Type locality: 'Valdivia' Station 136 at 55° 57′ S, 16° 14′ E).

Synonym: '*Owenia* n. sp.' Chun, 1903.

Remarks: The inclusion of this species in the present list is only on the presumption that it could occur close to the subtropical convergence. Dell (1959) has recorded this from 64° 21′ S, 116° 02′ E; and 65° 10′ S, 109° 32′ E.

Genus *Toxeuma* Chun, 1906.

134. ***Toxeuma belone*** Chun, 1906, p. 86; 1910, pp. 380–382, pl. 56, fig. 10; pl. 58, figs. 1–5 (Type locality: 'Valdivia' Station 182 at 10° 8′ S, 97° 14′ E).

Synonym: *Cranchiidarium* Chun, 1903.

Distribution: Indian Ocean (Known from type locality only).

Genus *Megalocranchia* Pfeffer, 1884.

135. ***Megalocranchia abyssicola*** (Goodrich, 1896), p. 17, pl. 5, figs. 72–80 (Type locality: Laccadive Sea).

Synonym: *Taonius abyssicola* Goodrich, 1896 (as above).

Distribution: Indian Ocean (Laccadive Sea).

Remarks: This species is based on a single specimen, the type of which (In the Indian Museum, Calcutta) is said to be in such poor condition that nothing of value could be determined from it (Voss, 1960). Joubin's record of *Megalocranchia abyssicola* from the Azores (Joubin, 1924) is based on mis-identification as discussed by Voss (1960, p. 437).

136. ***Megalocranchia maxima*** Pfeffer, 1884, p. 24, figs. 32, 32 *a* (Type locality: Cape of Good Hope).

Synonyms: *Taonius maximus* Hoyle, 1886; *Desmoteuthis maxima* Pfeffer, 1900.

Remarks: This is included in the list as a doubtful record. *M. maxima* is known to also occur in the Japanese Seas west of Osumi Group, Kiushiu (Sasaki, 1920 and 1929, pp. 322–323, pl. 25, figs. 7–9, and text-fig. 148).

Genus *Anomalocranchia* Robson, 1924

137. ***Anomalocranchia impennis*** Robson, 1924, pp. 9–10; 1924, pp. 628–632, pl. 1, fig. 3, and text-figs. 17–20 (Type locality: Off Cape of Good Hope).

Remarks: Nothing has been added to the description of this species since it was first described from a single specimen.

Genus *Henselioteuthis* Pfeffer, 1900

138. ***Henselioteuthis joubini*** Pfeffer, 1912, pp. 747–748, pl. 48, figs. 12–16 (Type locality: 31° 7′ N, 43° 6′ W, Sargasso Sea, Atlantic Ocean).

Synonyms: *Teuthowenia* (*Henselioteuthis*) *joubini* Pfeffer, 1912 (as above); Massy, 1916, p. 245.

Distribution: Indian Ocean ('Investigator' Station 462 *a* at 9° 8′ N, 87° 25′ E in the Bay of Bengal), Atlantic Ocean.

Remarks: Massy's record of the species from the Bay of Bengal is based on a partly damaged specimen in which the tentacles are mutilated, but she has identified it on the nature of the chromatophores and the very distinctive eyes.

Genus *Taonius* Steenstrup, 1861

139. ***Taonius pavo*** (Lesueur, 1821), p. 96 (Type locality: Sandy Bay, Mass., U.S.A.).

Synonyms: Loligo pavo Lesueur, 1821 (as above); *Loligopsis pavo* d'Orbigny and Ferussac, 1839; *Desmoteuthis hyperborea* Verrill, 1881).

Distribution: It has been taken from the stomach of the Albatros *Diomedea fulginosa* at 'Valdivia' Station 146 (58° 52′ S 43° 0′ E) (Chun, 1910, p. 366). In the Pacific Ocean it is known from Northern Mindoro, Philippines and near Kashiki, Kiushiu, Japan. In the Atlantic Ocean in addition to the type locality it has been recorded from the Gulf Stream, and Madeira.

Remarks: This species has been included in this list on account of its wide distribution in the Atlantic and the Pacific and the lone record from the Indian Ocean Sector of the Antarctic. Its occurrence in other areas of the Southern Indian Ocean may be expected. For descriptions and notes on the species reference is invited to Chun (1910), Joubin (1900), Sasaki (1929), Rees and Maul (1956), and Voss (1963).

Genus *Galiteuthis* Joubin, 1898

140. ***Galiteuthis armata*** Joubin, 1898, p. 279 (Type locality: Nizza).

Distribution: Robson (1924, p. 8; 1924, pp. 627–628) reported on a specimen from off Cape Town, South Africa. In the Atlantic Ocean the species is known from the Guinea Current; and in the Mediterranean from Messina and Nizza; In the North Pacific it is known from the Kurile Chain, Bering Sea and west coast of North America.

Synonyms: Galiteuthis (*Taonidium*) *suhmii* Chun, 1910; *Galiteuthis phyllura* Berry, 1911; ? *Taonius pavo* Akimushkin, 1954.

Remarks: In view of its distributional pattern and occurrence in South Africa, this species is included in this list.

Order ***OCTOPODA***

Suborder *VAMPYROMORPHA*

Family VAMPYROTEUTHIDAE

Genus *Vampyroteuthis* Chun 1903

141. ***Vampyroteuthis infernalis*** Chun, 1903, p. 88, text-fig. (Type locality: 'Valdivia' Station 65 at 1° 56′ 7″ S, 7° 40° 6″ E from Guinea Basin, Atlantic Ocean).

Synonyms: Pickford (1949) has shown that *Danateuthis schmidti* Joubin (1929, 1937); *Hansenoteuthis lucens* Joubin (1929, 1937); *Melanoteuthis anderseni* Joubin (1931, 1937); *Melanoteuthis lucens* Joubin (1929, 1937); *Melanoteuthis schmidti* Joubin (1929, 1937) and *Retroteuthis pacifica* Joubin (1929, 1937) based on 'Dana' material represent different developmental stages of *Vampyroteuthis infernalis* Chun. So also are the types of *Cirroteuthis macrope* Berry (1911) [= *Hymenoteuthis macrope* Thiele (1916); Robson (1932)]; and *Watasella nigra* Sasaki (1920, 1929). Robson (1932) placed *Laetmoteuthis lugubris* Berry (1913, 1914) [= *Chiroteuthis* (?) sp. Berry, 1909] under a separate subfamily Laetmoteuthinae of the family Vampyroteuthidae on account of differences in the structure of the radula and other characters. Pickford (1949) remarks that "*Laetmoteuthis lugubris* is not a Vampyromorph, but the condition of the specimens discourage further attempts at identification".

Distribution: Pickford (1959) has mapped the known distribution of *V. infernalis* in all the oceans. According to this there are fifteen records from the Indian Ocean. It has been collected from several more stations in the Atlantic Ocean, but fewer stations in the Pacific Ocean. From the Indian Ocean the records are: 'Investigator' Stn. 107; 'Dana' 1928–30 Exped. Stns. 3828 V, 3909 II, 3917 IV, 3904 II, and 3933 I; 'Discovery' Stns. 1578, 1739, 1764; and 'Galathea' Stns. 190, 279, 301, 314, 318, and 471.

Remarks: Pickford (1949) has considered "*Hymenoteuthis macrope* Berry" recorded by Massy (1916) from Indian Seas (off Gulf of Mannar) as a synonym of *V. infernalis*, representing probably stage IV of this species. For detailed work on this species reference may be made to Pickford (1939 *a*, *b*; 1940; 1946; 1948; 1949; 1950; 1952; and 1959).

Suborder *CIRROMORPHA*

Family STAUROTEUTHIDAE

Genus *Grimpoteuthis* Robson, 1932

142. ***Grimpoteuthis grimaldii*** (Joubin), 1896, p. 247, text-fig. 7 (Type locality: N.N.W. Fayal, Azores, and Gulf of Gascony—45° 09' N, 30° 18' W).

Synonyms: ?*Cirroteuthis Caudani* Joubin, 1896; *Cirroteuthis grimaldi* Joubin, 1903 (As above); ?*Cirroteuthis grimaldi* Massy, 1916.

Distribution: Indian Ocean ('Investigator' Stns. 233 (13° 17' N, 93° 10' 25" E); 332 (10° 21' N, 92° 42' 15" E) from Andaman Sea; 333 (6° 31' N, 79° 38' 45" E, S.-W. of Ceylon); 361 (13° 9' 27" N, 46° 45' 15" E from Arabian Sea); and 381 (18° 8' N, 93° 40' E, off Akyab, Burma). Atlantic Ocean.

Remarks: Robson (1932) is of the opinion that Massy's specimens are not correctly identified. He has drawn attention to several differences between the Indian Ocean and Atlantic material (typical form). It is likely that Massy's specimens may be specifically different from *G. grimaldii*.

Thiele (1935) considers *Grimpoteuthis* Robson a synonym of *Cirroctopus* Naef (1923).

Robson (1924, p. 690, figs. 49–50 and p. 682, fig. 51) described *Cirroteuthis* "A", and *Cirroteuthis* "B" from off Cape Town, South Africa, which he later (1932, pp. 155–156) placed under the genus *Grimpoteuthis*. Although several species have been described or assigned to the genus *Grimpoteuthis*, it is clear that the genus is badly in need of revision.

Robson (1924) also described *Cirroteuthis gilchristi* based on a single specimen from off Cape Town, South Africa, and later (Robson, 1932, pp. 158–160) he has relegated this under the genus *Chunioteuthis* Grimpe (1916).

Hoyle (1885, p. 233) described *Cirroteuthis magna* from 'Challenger' Station 146 at 46° 46′ S, 45° 31′ E between Prince Edward Id., and Crozets. Robson (1932, p. 162) doubts the generic identity of the holotype and has designated the species as *Cirroteuthis* (?) *magna* Hoyle.

Family OPISTHOTEUTHIDAE

Genus *Opisthoteuthis* Verrill, 1883

Subgenus *Teuthidiscus* Berry, 1918

143. ***Opisthoteuthis (Teuthidiscus) extensa*** Thiele, 1915, p. 573, pls. 94 and 95 (Type locality: 'Valdivia' Stn. 189 at 0° 57′ S, 99° 51′ E off west coast of Sumatra).

Synonyms: *Opisthoteuthis* sp., Chun (1903); *Opisthoteuthis extensa* Thiele (1915) (as above).

Distribution: Indian Ocean (as type locality).

144. ***Opisthoteuthis (Teuthidiscus) medusoides*** Thiele, 1915, p. 538, pls. 94 and 95 (Type locality: 'Valdivia' Stn. 243 at 6° 39′ S, 39° 30′ E off Dar-es-Salaam, E. Africa).

Synonym: *Opisthoteuthis medusoides*, Thiele (1915) (as above).

Distribution: Indian Ocean (From type locality).

Suborder *INCIRRATA*

Family BOLITAENIDAE

Genus *Japetella* Hoyle, 1885

145. ***Japetella diaphana*** Hoyle, 1885, p. 232 (Type locality: North of Papua, 147° E, 42′ S).

Synonyms: *Eledonella diaphana* Hoyle, 1886; *Boiltaena diaphana* Chun, 1911; *Chunella diaphana* Sasaki, 1920, 1929; *Iapetella diaphana* Robson, 1932; ?*Eledonella sheardi* Alan (1945).

Distribution: Cosmopolitan in deep water from tropics to warm temperate waters. In Indian Ocean (Four 'Valdivia' Stations—182, 217, 231, and 232; 'Investigator' Stn. 273 (Massy, 1916); 'Investi-

gator' Stns. 293, and 462 *a* (Thore, 1949); 'Dana' Stations 3814 I, 3817 II, II, 3824 VI, 3828 V, IX, 3829 II, 3830 V, 3847 I, II, 3850 I, 3860 XVII, XX, 3869 V, VI, 3894 I, 3903 II, 3904 I, III, V, 3905 II, 3906 I, II, IV, 3908 II, 3909 I-V, 3912 II, 3913 I, II, 3914 II, 3915 II, 3917 II, IV, VI; 3918 III, 3919 III; 3920 IV, VII, VIII; 3921 I, II; 3922 III; 3924 II; 3925 II; 3926 I; 3928 I; and 3933 I. (Nos. in Roman indicate number of positive haul); Present records from R. V. *VARUNA* collections from the Arabian Sea and Laccadive Sea reported in earlier part of this paper.

Remarks: Thore's (1949) excellent and exhaustive work should be consulted. He has shown that Massy's (1916) one specimen from 'Investigator' station 315 South of Andaman islands (10° 6′ N, 92° 29′ E) to be *Eledonella pygmaea* and two of the three specimens she has given as *Eledonella* sp. (pp. 214–215 from 'Investigator' Stns. 293 and 462 *a*) to be *J. diaphana.* The third specimen given by Massy (1916, p. 214) as *Eledonella* sp. (Reg. No. M 8110/1 from Arabian Sea, 947 fatohms) is considered by Thore (1949) to be a specimen of *Vitreledonella richardi* Joubin. Dell (1952, p. 75) finds that *E. sheardi* Allan is superficially close to *J. diaphana,* but its position needs reviewing.

Genus *Eledonella* Verrill, 1884

146. ***Eledonella pygmaea*** Verrill, 1884, p. 145, pl. 32, fig. 2 (Type locality: 'Albatross' Stn. 2949 at 37° 12′ 20″ N, 69° 39′ W).

Synonyms: Japetella prismatica Hoyle, 1885; *Eledonella diaphana* (partim) Massy, 1916; *Eledonella massyae* Robson, 1924; (?) *Bolitaena massyae* Robson, 1932; *Bolitaena massyae* subsp. *purpurea* Robson, 1930; and *Eledonella ijimai* Sasaki, 1929.

Distribution: Cosmopolitan species known from warm and temperate seas. In the Indian Ocean is known from 'Investigator' Stn. 315 (10° 06′ N, 92° 29′ E); 'Valdivia' Stn. 190 (0° 58′ 2″ S, 99° 43′ 2″ E); and 'Dana' Stns. 3909 I, III (5° 31′ N, 80° 38′ E), 3915 I (3° 14′ N, 75° 21′ E) and 3920 (1° 06′ N, 62° 25′ E).

Remarks: For detailed description and distribution of the species reference is invited to Thore (1949, pp. 39–49, figs. 30–41).

Family AMPHITRETIDAE

Genus *Amphitretus* Hoyle 1885

147. ***Amphitretus pelagicus*** Hoyle, 1885, p. 235 (Type locality: 'Challenger' collection from 29° 55′ S, 178° 14′ W off Kermadec Island).

Synonyms: ?'*Amphitretus pelagicus* Hoyle' Thiele, 1915; *Amphitretus thielei* Robson, 1930.

Distribution: Cosmopolitan (?) from tropical to cool temperate seas. In Indian Ocean from 'Valdivia' Stn. 102 at 34° 31′ 2″ S, 26° 02′ E, from Agulhas Stream; 'Dana' Stns. 3817 III (2° 15′ S, 98° 55′ 5″ E), 3828 V (1° 42′ N, 96° 05′ E), 3903 (5° 50′ N, 93° 28′ E), 3908 III (4° 28′ N, 82° 13′ E), 3918 III (0° 35′ N, 66° 09′ E), and 3921 III, VI (3° 36′ S, 58° 19′ E).

Remarks: For detailed information on the taxonomy and distribution of this species reference is invited to Thore (1949). His studies show that except for the 'Discovery' specimen described by Robson (1930) from off Cape of Good Hope, this species is thus far known only from the Indo-Pacific. This species is rare in collections and in addition to the seven records from the Indian Ocean listed above Thore (1949) refers to five other records (2 of 'Dana' Exped., and 3 earlier records) of this species from the Pacific Ocean.

Family VITRELEDONELLIDAE

Genus *Vitreledonella* Joubin, 1918

148. ***Vitreledonella richardi*** Joubin, 1918, p. 1, text-figs. (Type locality: Monaco Exped., 1912, Stn. 3223 at 30° 50' N, 25° 43' E).

Synonyms: Vitreledonella Alberti Joubin, 1924; *Vitreledonella Ingeborgae* Joubin, 1929; *Vitreledonella translucida* Robson, 1930; *Vitreledonella richardi* Thore, 1949.

Remarks: This species known from the Atlantic Ocean (Joubin, 1918, 1929; Robson, 1932; Thore, 1949), and the Pacific Ocean (Thore, 1949, Dell, 1952) is listed here as Thore (1949) has indicated that one of the specimens described by Massy (1916, p. 214) as *Eledonella* sp. from the Arabian Sea belongs to *Vitreledonella richardi* Joubin. Thore's (1949) work thus indicates the occurrence of this species in all the three major oceans.

Family OCTOPODIDAE

Subfamily OZENINAE

Genus *Eledone* Leach, 1817

149. ***Eledone moschatus*** (Lamarck, 1798), p. 130 (Type locality : ? Mediterranean).

Remarks: Robson (1932) remarks that there is a specimen from the Red Sea in the Paris Museum and Wulker (1920, p. 52) records a dubious form from the Red Sea, which he is inclined to regard as *cirrosa*. In the list of synonyms on p. 259, Robson (*l.c.*) mentions this as "? *Moschites moschata* or *cirrosa* Wulker". Rees (1956) notes that *E. moschatus* is a Mediterranean species with a few rare records outside the Mediterranean from the Bay of Cadiz (Fisher and Joubin, 1907) and African Coast at Baie du Levrier, Port-E'tienne, Mauritania (Adam, 1941). However, Adam (1967, p. 74) reviewing the cephalopoda of the Mediterranean mentions that *E. moschatus* is found only in the Mediterranean and records of it from the Red Sea and the Atlantic are doubtful. In view of the uncertainty of its occurrence in the Red Sea, this species is included in the present list.

Genus *Velodona* Chun, 1915

150. ***Velodona togata*** Chun, 1915, pp. 479–485, pls. 75 & 76, text-figs. 47–50 (Type locality: 'Valdivia' Stn. 249 (?) just north of Zanzibar, East Africa).

Distribution: Indian Ocean (as type locality).

Remarks: Robson (1932, pp. 284–285) may be seen for more details.

151. ***Velodona togata*** subsp. ***capensis*** Robson, 1924, p. 655, text-figs. 30–32 (Type locality: Natal Coast, South Africa from 'Pickle' Stns. 99, 162 and 396).

Synonyms: Velodona togata var. a Robson, 1924, p. 206, fig. 207; *Velodona togata* var. *capensis* Robson, 1924 (as above).

Subfamily OCTOPODINAE

Genus *Octopus* Lamarck, 1798

Subgenus *Octopus* sensu stricto

152. ***Octopus (Octopus) aegina*** Gray, 1849, p. 7 (Type locality: ?).

Synonyms: Octopus kagoshimensis Ortmann, 1888; *Polypus granulatus* Sasaki (*nec* Lamarck) 1929; *Polypus boscii* (Lesueur) Hoyle (partim), 1904; *Octopus rugosus* Adam (*nec* Bosc), 1942; ?*Octopus dollfusi* Robson, 1928.

Distribution: Indian Ocean (Red Sea; Gulf of Suez; Karachi Coast, West Pakistan). Pacific Ocean (Kagoshima, Japan; China; Amoy; Thailand).

Remarks: Refer also Robson (1928, p. 113) and Adam (1954, pp. 166–168, fig. 30, pl. 2, figs. 2–3; 1959, pp. 171–172).

153. ***Octopus (Octopus) arborescens*** (Hoyle, 1904), p. 189, pl. 2, figs. 8, 9, and 12; pl. 3 (Type locality: Cheval Pearl Bank and Periya Paar, Gulf of Mannar, Ceylon).

Synonyms: Polypus arborescens Hoyle, 1904 (as above); *Octopus (Octopus) arborescens* Robson, 1929, pp. 151–152.

Distribution: Indian Ocean (In addition to type locality; Hulule, Mahe Atoll; Felidu Atoll, Maldives; Fadifolu Atoll; South Male Atoll, Maldives; Zanzibar Harbour; Cargados Atoll; and Ross Island, Port Blair, South Andamans).

Remarks: Refer also Hoyle (1907, p. 107); Massy (1916, p. 207); Robson (1921, p. 438, pl. 66, fig. 3; 1925, p. 104); Winckworth (1926, p. 328), and Adam (1938, pp. 11–14, fig. 4; figs. 5 B, C). Adam (1954, p. 178) records this speciet from 'Siboga' Stn. 282 (Nusa Besi et la pointe N.E. de Timor, 8° 25′ 2″ S—127° 18′ 4″ E) and from Sanguisiapo, Indonesian waters.

154. ***Octopus (Octopus) areolatus*** d'Orbigny, 1835–1848, p. 65 (Type locality: Japan).

Synonyms: Octopus rugosus (partim) Robson (*nec* Bosc), 1929, p. 64.

Distribution: Indian Ocean [Massy (1916) records this species from the gulf of Martaban)] Most of the records of this species are from the Pacific Ocean (Japan: Polynesia; New Guinea; Banda; Hong Kong).

Remarks: Adam (1954, pp. 177–178) considers a female specimen Robson (1929, p. 64) listed from the Birtish Museum Collections under *O.* (*O.*) *rugosus* from 'Amirante Atoll' as "var. *ovulum*" of *O. areolatus*. *Polypus ovulum* was described by Sasaki (1917) from the Tokyo Fish Market and Robson (1929, pp. 123–124, pl. 2, fig. 2) relegated it as a distinct variety of *O. areolatus*. Relevant details of the variety are:

155. ***Octopus* (*Octopus*) *areolatus*** var. ***ovulum*** (Sasaki), 1917, p. 364 (Type locality: Japan).

Distribution: Indian Ocean (Amirante Atoll; Vargat Reef, East Africa) Pacific Ocean (Japan; Macclesfield Bank, China).

Remarks: Refer also Robson (1929, pp. 123–124); Adam (1941, pp. 1–5; 1954, pp. 177–178). Robson (1929) has given a long list of synonyms, for *O.* (*O.*) *areolatus*, the status of many of which are doubtful. Voss (1963, p. 161) remarks that Dr. Pickford in her unpublished monograph on Indo-Malayan octopods considers *O. ovulum* tentatively as a synonym of *O. membranaceus* Quoy and Gaimard (1832).

156. ***Octopus* (*Octopus*) *berenice*** Gray, 1849, p. 11 (Type locality: ?).

Synonyms: Octopus berenice Gray, 1849 (as above); *Octopus rugosus* Adam (*nec* Bosc), 1934.

Remarks: It is one of the insufficiently characterised species, the type locality of which is 'unknown'. Robson (1929, p. 110) remarks that "It is practically impossible to discuss this form with any profit, as the type is in such bad condition. It seems to have affinity with *O. rugosus*, though for a young *rugosus* the web is very short. The web is more like that of *O. horridus*. The size and order of the arms differ from those of *O. horridus* and the funnel organ and locking ridge are unlike those of both *O. horridus* and *O. rugosus*. Recently, however, Adam (1954, pp. 169–170, pl. 1, fig. 7; pl. 2, figs. 4 and 5) has given a description of this species from several 'Siboga' stations and other localities from Indonesian waters from which it would appear that the species is quite common in the area and may also occur in the adjacent Indian Ocean Sector.

157. ***Octopus* (*Octopus*) *cyaneus*** Gray, 1849, p. 15 (Type locality: ? Coast of New Holland).

Synonyms: Octopus cyanea Gray, 1849 (as above); *Octopus cyaneus* Adam, 1938; *Octopus vulgaris* Goodrich (*nec* Lamarck) 1896; *Polypus cyanea* Massy, 1916; *Polypus herdmani* (*nec* Hoyle) 1916; *Octopus marmoratus* Sasaki, 1929; *Octopus horsti* Joubin, 1898; *Polypus horsti* Hoyle, 1907.

Distribution: Indo-Pacific. In Indian Ocean it is known from several localities in the Red Sea (Djeddah; Suakim; Senafir, Sherm Sheik; Ile Abulat); Zanzibar; Coetivy Atoll, Indian Ocean; Ceylon; Madras; Akyab, Burma; Port Blair, S. Andamans; Aves Id., N. Andamans; and west of Sumatra. In the Pacific Ocean it is known from Indonesian waters; and Australia to Japan; ? Hawaii.

Remarks: Refer also Robson (1929, pp. 94–98, text-figs. 21–23); and Adam (1938, pp. 5–7, fig. 2; 1954, pp. 171–172; and 1959, pp. 172–173). Robson (1929) described one variety of this species from India.

158. ***Octoptus (Octopus) cyanea*** var. ***gracilis*** Robson, 1929, p. 98 (Type locality: Madras, India).

Remarks: The variety is based on a single female which is said to differ from the *forma typica* in the very narrow oblong mantle, the width-length index of which is 46; and the colouration, which in the arms appear as unbroken sinuous lines due to the confluence of the ventral spots. In addition, the funnel is freer and the eyes more prominent.

159. ***Octopus (Octopus) defilippi*** Verany, 1851, p. 30, pl. 2, figs. D, E (Type locality: Nice, Mediterranean).

Remarks: In addition to giving a long list of synonyms, mostly pertaining to earlier descriptions of the species from the Mediterranean, Robson (1929, pp. 135–136, text-figs. 45–49) has also included in the list *Polypus defilippi* Massy (1961, p. 196), *Octopus defilippi* Winckworth (1926, p. 321), two specimens from Calcutta and one from, Masquat, Arabia. He agrees with Massy's identification of the specimens from Mergui as belonging to this species, while Winckworth's record gives very few details. He has referred the two specimens from Calcutta (male and female) to this species with great hesitation while he finds the specimens from 'Aden' very much like the Mediterranean *O. defilippi*. Robson concludes that he is inclined to believe that the species occurs in the Indian Ocean "though it is very remarkable that there are so few records of its occurrence outside the Mediterranean". The problem is not so simple, as recently Adam (1967, p. 75) considers the occurrence of *O. defilippi* in the Indian Ocean as doubtful.

160. ***Octopus (Octopus) filamentosus*** Blainville, 1826, p. 188 (Type locality: ? Mauritius).

Synonyms: ? *Octopus (Octopus) filamentosus* d'Orbigny, 1826; *Octopus aranea* d'Orbigny, 1840; *Polypus aranea* Wulker, 1913.

Distribution: Indian Ocean (Mauritius; Mozambique). Pacific Ocean (Celebes Id.; Adelaide, Australia).

Remarks: Refer also Robson (1929, p. 143). Speaking of another species, *O. niveus* Lesson, he remarks (p. 141) that "it is very closely allied to *O. filamentosus* and it may be necessary to treat it as a synonym of the latter, especially as Wulker....has obtained specimens of *filamentosus* with cirrous skin". Recently, however, Adam (1959, pp. 176–178, text-fig. 21) has considered *Octopus niveus* Ferussac (1826) *et* Lesson (1830) as a doubtful synonym of *Octopus horridus* Ferussac (1826). In view of the dubious status of *O. niveus*, and its reported widespread occurrence in the Indo-Pacific, it is listed separately in this catalogue.

161. ***Octopus (Octopus) fusiformis*** Brock, 1887, p. 601, pl. 16, figs. 1 & 2 (Type locality: Amboina).

Synonyms: *Octopus fusiformis* Brock, 1887 (as above); *Octopus pisiformis* (sic) Hoyle, 1897; *Polypus fusiformis* Massy, 1916.

Distribution: Indian Ocean (Palk Strait, S. India). Pacific Ocean (Amboina, Indonesia).

Remarks: Refer also Massy (1916, p. 203), and Robson (1929, p. 132). This species poses a nomenclatural problem. In general facies it is *Loligo*-like without fins which led Massy (1916, p. 204) to doubt whether the species may not be identical with the specimen of '*Cistopus indicus*' (d'Orbigny), the species description of which is based on two different species. Robson points out that this possibility is remote as neither of the specimens of *Cistopus* illustrated by d'Orbigny is narrow enough to suggest identity.

162. ***Octopus (Octopus) gardineri*** (Hoyle, 1905), p. 976, figs. 144 & 145 (Type locality: Hulule, Male Atoll).

Synonyms: *Polypus gardineri* Hoyle, 1905 (as above); *Octopus gardineri* Robson, 1925.

Distribution: Indian Ocean (Hulule, Male Atoll; Minicoy, Laccadives; Coetivy Island; Ceylon). Pacific Ocean (?Rotuma, Fiji).

Remarks: Hoyle (1905) suggested that *O. gardineri* could be the juvenile of either *O. fontanianua* or *O. tonganus* which view according to Robson (1929) is untenable. Regarding the Pacific record of the species Robson (1929, p. 167) remarks that "I am a little inclined to be skeptical concerning Hoyle's specimen from Rotuma (near Fiji). Seeing that *gardineri* is, as far as we know, a distinctive species, it was an astonishing coincidence that in the sets of material concurrently studied Hoyle should have obtained representatives of the same new species from two places as remote from each other as the Maldives and Rotuma!"

163. ***Octopus (Octopus) globosus*** Appellöf, 1886, p. 7, pl. 1, figs. 4 & 5 (Type locality: Japan).

Synonyms: *Octopus globosus* Appellöf, 1886 (as above); *Octopus (Octopus) globosus* Robson, 1929.

Distribution: Indian Ocean (Straits of Malacca; Kabusa Islands, Nicobar Islands; Port Blair, S. Andaman; Mergui, Burma; Bombay; ?Madras; Gopalpore, Orissa; Ceylon). Pacific Ocean (Ternate; Amboine; Batavia; Nagasaki, Japan).

Remarks: Refer also Robson (1929, pp. 93–94, fig. 20), and Adam (1938, pp. 3–5, fig. 5A; 1954, pp. 170–171).

164. ***Octopus (Octopus) hardwickei*** Gray, 1849, p. 8 (Type locality: Indian Ocean ? Singapore).

Synonym: *Octopus hardwickei* Gray, 1849 (as above).

Distribution: Indian Ocean. Known only from the Type locality.

Remarks: Robson (1929, p. 115) has pointed out that Gray's original description of the species is defective and it has not been redescribed or recorded until Robson (*l.c.*) gave a description based on 2 specimens (male and female) from the Indian Ocean.

165. ***Octopus (Octopus) herdmani*** Hoyle, 1904, p. 187, pl. 1 (Type locality: Ceylon)

Synonyms: *Polypus herdmani* Hoyle, 1904 (as above); *Octopus herdmani* Winckworth, 1926.

Distribution: Indian Ocean (Galle; Periya Paar and Cheval Paar, and Pearl Banks, Gulf of Mannar, Ceylon; and Zanzibar).

Remarks: Robson (1929, p. 87) has stressed on the very close resemblance of this species to *O. cyanea*. He feels that as the type specimen of *O. herdmani* is not traceable 'the only satisfactory means of deciding whether *herdmani* should be included in the synonymy of *cyanea* are not available'. Fresh collections of topotypes to settle this question should not be difficult.

166. ***Octopus (Octopus) horridus*** Ferussac, 1826 *in* d'Orbigny, 1826, p. 144 (Type locality: Red Sea).

Synonyms: *Octopus horridus* Ferussac, *in* d'Orbigny, 1826 (as above); *Polypus horridus* Hoyle, 1907; *Octopus argus* Krauss, 1848; *Octopus fimbriatus* Ferussac and d'Orbigny 1835–1848 (Ruppell MS); ? *Octopus aculeatus* Ferussac and d'Orbigny, 1835–1848; ? *Octopus macropus* Goodrich (*nec* Risso; partim), 1896; *Octopus harmandi* Rochebrune.

Distribution: Indo-Pacific. Indian Ocean (Several records from the Suez Canal, Gulf of Suez and Red Sea (Savigny, 1827; Wiendl, 1912; Ferussac and d'Orbigny, 1835–1848; Ehrenberg, 1831; Issel, 1869; Robson, 1927; Boone, 1938; Hoyle, 1907; Wulker, 1920; Vaillant, 1865; Robson, 1929; Gruvel, 1936; Rees and Stuckey, 1952; Adam, 1955, 1959, pp. 176–178, fig. 21); Zanzibar (Hoyle, 1907); South Africa (Krauss, 1848); Amarantie (Robson, 1921); Maldives (Hoyle, 1905); Ceylon (Hoyle, 1904; Winckworth, 1926, 1936); Ross Id., Port Blair, S. Andaman (Adam, 1938). Pacific Ocean [(? Viet Nam (*O. harmandi*); Philippines (Voss, 1963)].

Remarks: Robson (1929) has given a taxonomic discussion on this species to which the observations made on this species by Adam (1959) may also be considered. I have not included *O. niveus* as a doubtful synonym of this species for reasons mentioned elsewhere [*see* Remarks under *O.* (*O.*) *filamentosus* Blainville]. Voss (1963, p. 163) mentions that in an unpublished monograph, Dr. Pickford has made a detailed study of the relationships of *O. horridus*, *O. filamentosus* and *O. niveus* and places the latter two in synonymy. We shall look forward for an early publication of this monograph clarifying the formidable taxonomic problems relating to *O. horridus* and other nominal species.

167. ***Octopus (Octopus) macropus*** Risso, 1826, p. 3 (Type locality: Mediterranean).

Synonyms: *Octopus macropus* Risso, 1826 (as above); *Polypus macropus* Hoyle, 1907; *Octopus cuvierii* d'Orbigny (? 1826) and *Octopus Leche-*

naultii d'Orbigny (?1826) *in* Ferussac and d'Orbigny, 1835–1848, p. 18, pl. 4 and pl. 1 respectively; *Octopus macropodus* Sangiovanni, 1829; *Octopus alderii* Verany, 1851.

Distribution: Tropical and warm temperate seas throughout the world. Indian Ocean (For the several records from the Red Sea and Gulf of Suez, reference is invited to Adam (1959, pp. 174–175); Persian Gulf, East Africa; Mauritius; Ceylon; Pondicherry; Penang; Malayasia). For records from the Pacific and Atlantic Oceans and Mediterranean reference is invited to Robson (1929, p. 105).

Remarks: For further details *see* Robson (1929), Adam (1954; 1959), and Voss (1963).

168. ***Octopus* (*Octopus*) *medoria*** Gray, 1849, p. 14 (Type locality: ?).
Synonym: Octopus medoria Gray, 1849 (as above).

Remarks: This is one of the insufficiently characterised species and is said to be very likely *O. macropus* (Robson, 1929). Adam (1954, p. 172) has placed this tentatively as a synonym of *O. macropus*. This species is mentioned in this list on account of its unknown locality and uncertain taxonomic status.

169. ***Octopus* (*Octopus*) *membranaceus*** Quoy and Gaimard, 1832, p. 89 (Type locality: New Guinea).

Synonym: Octopus membranaceus Quoy and Gaimard, 1832 (as above).

Distribution: Indo-Pacific. Indian Ocean (Red Sea; East Africa). Pacific Ocean (Amboina; New Guinea; Philippines; Central Pacific and Japan).

Remarks: Robson (1929, p. 122) tentatively placed this as a synonym of *O. areolatus*. However, Adam (1941) and more recently Voss (1963) consider this as a valid species. According to Voss, Dr. Pickford in her monographic revision of the Indo-Malayan octopods (unpublished) considers this as a valid species with *O. ovulum* as a probable synonym.

170. ***Octopus* (*Octopus*) *microphthalmus*** Goodrich, 1896, p. 20, pl. 5, figs. 83 & 84 (Type locality: Port Blair, Andamans).

Synonyms: Octopus microphthalmus Goodrich, 1896 (as above); *Polypus microphthalmus* Massy, 1916.

Distribution: Indian Ocean (Port Blair, Andamans; Karnaphuli River, Chittagong, East Pakistan).

Remarks: Also refer Massy (1916, p. 205), and Robson (1929, pp. 89–90, fig. 17).

171. ***Octopus* (*Octopus*) *nierstrazi*** Adam, 1938, pp. 14–18, figs. 6 A, 7 A-B, 8 & 9 (Type locality: Aves Island, North Andamans).

Synonym: Octopus nierstraszi Adam, 1938 (as above).

Distribution: Indian Ocean (Andamans).

172. ***Octopus* (*Octopus*) *niveus*** Lesson, 1830, p. 329, pl. 1, 1*bis* (Type locality: Bora Bora Island).

Synonyms: *Octopus niveus* Ferussac *in* d'Orbigny, 1826, p. 144 (nomen nudum); *Octopus aculeatus* Goodrich (*nec* Ferussac and d'Orbigny), 1896; *Octopus macropus* (partim) Goodrich, 1896; *Polypus aculeatus* Massy, 1916.

Distribution: Indo-Pacific (Red Sea, Indian Ocean, and eastwards to Gilbert Islands and Fiji Islands).

Remarks: As discussed earlier under *O. horridus*, this species along with *O. filamentosus* may be conspecific with *O. horridus*. *See* for further remarks Voss (1963, p. 163).

Adam (1939, pp. 89–96) has also commented on the very close resemblance of specimens he described as *O. niveus* and *O. horridus* as known from literature.

173. ***Octopus* (*Octopus*) *pallida*** Hoyle, 1885, p. 223 (Type locality: New South Wales and Bass Straits, Australia).

Distribution: According to Robson (1929, p. 126) it is known from the Indo-Pacific. Hoyle (1904) records this from the Pearl Banks of Ceylon, and Massy (1916) from Persian Gulf; west of Ceylon; Palk Strait; and Madras.

Remarks: This is yet another species of *Octopus*, the taxonomy of which is steeped in utter confusion. Robson (1929) has attempted a clarification, but the status of this species in the System needs more detailed investigation.

174. ***Octopus* (? *Octopus*) *prashadi*** Adam, 1939, pp. 103–105, pl. 2, figs. 1–3, text-fig. 24 (Type locality: Port Blair, Andamans).

Synonym: *Octopus prashadi* Adam, 1939 (as above); *Polypus levis* (*nec* Hoyle) Massy, 1916.

Distribution: Indian Ocean (Andamans).

Remarks: The species is based on two specimens described by Massy (1916) as *Octopus levis* (*nec* Hoyle), which on account of the reported absence of an ink-sac, Robson (1929) placed in the genus *Benthoctopus*. Adam (1939) who had occasion to re-examine Massy's specimens found well-developed ink-sacs in the specimens which would automatically separate it from *Benthoctopus levis* (Hoyle). Adam (1939) remarks that *O. prashadi* shows several abyssal characters, but as the male is unknown, it is not possible to discuss its exact generic or subgeneric position. Hence its placement here may also be considered tentative.

175. ***Octopus* (*? Octopus*) *robsoni*** Adam, 1941, pp. 1–5 (Type locality: Gulf of Suez).

Synonyms: *Octopus robsoni* Adam, 1941 (as above); *? Octopus areoplatus* Weindl (*nec* Ferussac and d'Orbigny), 1912.

Distribution: Indian Ocean (Gulf of Suez, Red Sea).

Remarks: Refer also Adam (1942, pp. 4, 16; 1959, pp. 178–179, pl. 9, fig. 1; text-fig. 22).

176. ***Octopus* (*Octopus*) *rugosus*** (Bosc, 1792), p. 24, pl. 5, figs. 1& 2 (Type locality: Senegal, West Africa).

Synonyms: *Sepia rugosa* Bosc, 1792 (as above); *Octopus granulatus* Lamarck, 1798; *Octopus granulatus* (partim) Goodrich, 1896; *Polypus granulatus* Hoyle, 1907.

Distribution: Cosmopolitan in tropical to warm temperate waters. From the Indian Ocean (Red Sea; Persian Gulf; Mauritius; Grand Comoros; along the Indian Coast from Kerala Coast; Rameswaram, Sandheads, River Hooghly; Madras; Andamans; Mergui; Gulf of Martaban; Makassar; Malacca Strait; Great Cocos Island).

Remarks: Pickford (1955) has shown that specimens earlier identified from Natal, S. Africa as *O. rugosus* are *O. vulgaris*. There has been confusion in the identity of these two species and it is quite likely that as experienced by Pickford (1955) in the Atlantic, there may be mis-identifications from some of the localities mentioned above. For further details reference may be made to Robson (1929, pp. 64–72), Adam (1939, 1959) and Pickford (1955).

177. ***Octopus (Octopus) taprobanensis*** Robson, 1926, p. 165, fig. 7 (Type locality: Pearl Banks, Periya Paar, Gulf of Mannar, Ceylon).

Synonyms: *Octopus taprobanensis* Robson, 1926 (as above); *Octopus* sp. Winckworth, 1926.

Distribution: Indian Ocean (Known from the type locality and Port Blair, Andamans).

Remarks: Refer also Robson (1929, p. 108, pl. 6, fig. 2), and Adam (1938, pp. 7–9, figs. 5 D-E, and fig. 3).

178. ***Octopus (Octopus) tonganus*** Hoyle, 1885, p. 225.

Synonyms: *Octopus tonganus* Hoyle, 1885 (as above); *Polypus tonganus* Massy, 1916.

Distribution: Indian Ocean (Maldives and Arabian Sea). Pacific Ocean (*see* Robson, 1929, p. 77).

Remarks: The species closely resembles *O. rugosus* and according to Robson (1929) it may be a variety of that species.

179. ***Octopus (Octopus) vulgaris*** Lamarck, 1798, p. 130 (Type locality: ?).

Synonyms: For detailed list of synonyms *see* Robson (1929, pp. 57–58).

Distribution: Cosmopolitan in all but cold seas. In the Indian Ocean it has been recorded from the Red Sea; South Africa; Mauritius; St. Paul Island; and Andaman Islands.

Remarks: Refer also Goodrich (1896), Wulker (1920), Thiele (1915) and Adam (1959).

Subgenus *Macrotritopus* Robson, 1928

180. ***Octopus (Macrotritopus) bandensis*** (Hoyle, 1885), p. 227 (Type locality: Banda, Indonesia).

Synonyms: *Octopus bandensis* Hoyle, 1885 (as above); *Polypus bandensis* Massy, 1916.

Distribution: Indian Ocean (S.-W. of Colombo from 'Investigator' Stn. 152). Western Pacific (Banda; ?Ternate).

Remarks: Refer also Massy (1916) and Robson (1929).

181. ***Octopus (Macrotritopus) elegans*** Brock, 1887, p. 597.

Synonyms: *Octopus elegans* Brock, 1887 (as above); *Octopus (Macrotritopus) elegans* Robson, 1929; ?*Octopus amboinensis* Brock, 1887.

Distribution: Indian Ocean (Ross Island and Port Blair, South Andamans; Avis Island, North Andamans; Soemba, Indonesia); Western Pacific (Amboina; Cream; Indonesia).

Remarks: For more details reference is invited to Robson (1929, p. 171, figs. 61 & 62), Adams (1938, pp. 18–22, figs. 10 & 11; 1954, pp. 175–177, pl. 2, fig. 7 and text-fig. 31).

Robson (1929) recognised three other subgenera of genus *Octopus*, namely, *Tritaxeopus* Owen, 1881; *Marcroctopus* Robson, 1928; and *Enteroctopus* Rochebrune and Mabille, 1889. However, these have not been recorded from the Indian Ocean.

There are a few instances where unidentified species are listed as *Octopus* sp., or *Polypus* sp., *e.g.*, Massy (1916: as *Polypus* sp. 3 forms), Adam (1938: as *Octopus* sp. A and *Octopus* sp. B), Adam (1939: as *Octopus* sp. 2 forms), etc. These are not listed here separately.

Genus *Eledonenta* Rochebrune, 1884

182. ***Eledonenta microsicya*** Rochebrune, 1884, p. 158 (Type locality: Clos-Bay, Red Sea).

Synonyms: *Eledonenta microsicya* Rochebrune, 1884 (as above); *Moschites (Eledone)* sp., Wulker, 1920; *Eledonenta (?Eledone) microsicya* Robson, 1929.

Distribution: Indian Ocean (Red Sea).

Remarks: Robson (1929) who re-examined the type of this species concluded that "*microsicya* is in all probability a specimen of *Eledone*, though the only specimens being female it is impossible to make certain to what species we should refer it". The smooth skin led him to suggest that it may be the same as *E. moschata*. The systematic position of the species in the System is doubtful and tentatively it is retained here under *Eledonenta*, the genotype of which *E. filholiana* Rochebrune (1884) was shown by Robson (1929) to be a species of *Octopus*. Though he suggested that *Eledonenta* be abandoned and *microsicya* be placed in *Eledone*, he himself did not do this, as may be noted from the synonym given above.

Genus *Cistopus* Gray, 1849

183. ***Cistopus indicus*** (d'Orbigny, 1840), p. 24, pl. 26 (Type locality: Celebes)
Synonyms: *Octopus indicus* d'Orbigny, 1840 (as above).

Distribution: Indian Ocean (From Bombay southwards along Indian Coast; Gulf of Mannar; Mozambique). Pacific Ocean (Poulo Condore, Vietnam; Celebes; China; Philippines).

Remarks: See Robson (1929, pp. 182–184, fig. 70), and Voss (1963, pp. 165–166). The latter author (p. 164) mentions that Dr. Pickford

in her Indo-Malayan octopods (unpublished) considers *Octopus teuthoides* Robson as the young of *Cistopus indicus*.

Genus *Robsonella* Adam, 1938

184. ***Robsonella fontaniana*** (d'Orbigny, 1835), p. 28, pl. 2, fig. 5 (Type locality: Subantarctic and antiboreal region of South America).

Synonyms: *Octopus fontanianus* d'Orbigny, 1835 (as above); *Polypus fontanianus* Robson, 1921; *Joubinia fontanian* Robson, 1929; *Robsonella fontaniana* Adam (1938).

Remarks: Massy (1925) described a specimen from Natal, South Africa, which has been considered by Robson (1929) to be a local variety. Pickford (1955) after re-examining the specimens in the British Museum collections has given a lengthy discussion of the status of the genus *Robsonella* as well as its species.

185. ***Robsonella fontaniana*** var. ***africana*** (Massy), 1925 (Type locality: Natal' South Africa).

Synonyms: *Polypus fontaniana* var. *africana* Massy (As above); *Joubina fontaniana* var. *africana* Robson, 1929.

Distribution: Indian Ocean (Natal Coast, South Africa).

Genus *Scaeurgus* Troschel, 1857

186. ***Scaeurgus unicirrhus*** d'Orbigny, 1840, p. 70.

Synonyms: Refer list given by Robson (1929, p. 192).

Distribution: Mediterranean; tropical and subtropical Atlantic; Indo-Pacific.

Remarks: Refer also Adam (1967, p. 76).

Genus *Macrochlaena* Robson, 1929

187. ***Macrochlaena winckworthi*** (Robson, 1926), p. 161, figs. 1–6 (Type locality: Tuticorin, Gulf of Mannar, India).

Synonym: *Octopus winckworthi* Robson, 1926 (as above).

Distribution: Indian Ocean (Known only from Type locality).

Remarks: Refer also Robson (1929, pp. 193–195, figs. 75 & 76).

Genus *Paroctopus* Naef, 1923

188. ***Paroctopus hongkongensis*** (Hoyle, 1885), p. 224 (Type locality: Hong Kong).

Synonyms: *Octopus hongkongensis* Hoyle, 1885 (as above); *Polypus hongkongensis* Massy, 1916.

Distribution: Indo-Pacific. Indian Ocean (Andaman Sea; S. of Ceylon; Tamblegam and Venkali Reef, Ceylon; Gulf of Mannar). Pacific Ocean (Hong Kong; Inoshima Islands, Japan; Aburatsubo; Kamschatka).

Remarks: Refer also Massy (1916, p. 197), Winckworth (1926, p. 326), Channappayya (1927, p. 109), and Robson (1929, pp. 197–201, figs. 80 & 81),

Genus *Hapalochlaena* Robson, 1929

189. ***Hapalochlaena fasciata*** (Hoyle, 1886), p. 96, pl. 8, fig. 3.

Synonyms: *Octopus pictus* var. *fasciata* Hoyle, 1886 (as above); Goodrich, 1896 (p. 19, pl. 5, fig. 82); *Hapalochlaena maculosa* (partim) Robson, 1929, p. 211.

Distribution: Indo-West Pacific. Indian Ocean (Mulaku Atoll; ?Ceylon). Pacific Ocean (Australia; Ternate; Lombok; Japan).

Remarks: Adam (1939, pp. 98–100, figs. 20 & 21) has given reasons for treating *fasciata* considered by some early workers as a variety of *Octopus pictus* (= *Hapalochlaena maculosa*) as a distinct species.

Genus *Berrya* Adam, 1939

190. ***Berrya hoylei*** (Berry, 1909), p. 407, fig. 1 (Type locality: Hawaii).

Synonyms: *Polypus hoyle* Berry, 1909 (as above); 1914, p. 296, pls. 47, 48 & 55; Massy, 1916, p. 207; *Octopus hoylei* var. *annae* Robson p. 219, fig. 89.

Distribution: Indo-Pacific. In Indian Ocean ('Investigator' Stn. 379 at 28° 59′ N, 50° 3′ E from Persian Gulf; Stn. 360 at 13° 36′ N, 47° 32′ E from Arabian Sea; Stn. 464 at 6° 2′ 30″ N, 81° 29′ E South of Ceylon; and 13° 17′ 15″ N, 93° 10′ 25″ E from Andaman Sea). Pacific Ocean (Hawaii).

Remarks: Although Robson (1929) found Massy's specimens of *Polypus hoylei* to be sufficiently different from the description of Berry's specimens from Hawaii, Adam (1939, pp. 100–103, figs. 22 & 23) found that the creation of a special name for the Indian Ocean material was not necessary. However, Robson's opinion that Massy's specimens may belong to a distinct genus has found agreement with Adam, who has placed it under *Berrya*, which seems to be closely related to Bathypolypodinae.

191. ***Berrya keralensis*** Oomen, 1966, pp. 51–60, figs. 1–6 (Type locality : From 200 to 400 m dep.h off Kerala Coast, India).

Distribution : Indian Ocean (Known from deeper waters off the south-west coast of India).

Family BATHYPOLYPODINAE

I have followed Thiele (1935) in placing the following genera known from the Indian Ocean under this subfamily.

Genus *Benthoctopus* Grimpe, 1921

192. ***Benthoctopus thielei*** Robson, 1932, pp. 233–235, figs. 37–39 (Type locality: Gazelle Harbour, Kerguelen Island).

Synonyms: "*Polypus levis*, Hoyle" Thiele, 1915; (?) *Polypus levis* Theile, 1920.

Distribution: Known from only the type locality.

Remarks: Robson (1932) has given sufficient reasons to show that Thiele's specimens are different from *B. levis* (Hoyle). Both species

are, however, known from very inadequate material. Perhaps, more material may throw light on their proper generic position as well. This species is included in this list as it occurs in the Indian Ocean Sector of the Antarctic close to the limits of the Southern Indian Ocean.

193. ***Benthoctopus profundorum*** Robson, 1932, pp. 237–241, pl. 4, fig. 1; text-figs. 33, 42 (Type locality: Yokohama, Japan).

Synonyms: *Octopus januarii* (partim) Hoyle, 1885; *Polypus januarii* (partim) Berry, 1912; *Benthoctopus januarii* (partim) Robson, 1929 (p. 14); ? *Polypus januarii* (partim) Massy, 1916.

Distribution: Indo-Pacific. In Indian Ocean (10° 21′ N, 92° 46′ E) and 13° 27′ N, 93° 14′ E in Andaman Sea). Pacific Ocean (Off Yokohama; Bungo Suido, Japan; Off Kii Province; Aleutian Ids.)

Remarks: The grouping of specimens from the Pacific and the Indian Ocean under this species by Robson is an artificial one. Perhaps more than one species is involved and good series of material from the different areas should help to solve this puzzle. Reference is invited to the discussion given by Robson (1932: pp. 236–237) as well.

Adam (1954, pp. 184–188) has recorded *Benthoctopus* sp. A, B, C and D from Indonesian waters. Some of the species, especially from the Indo-Pacific described under this genus are based on very inadequate material.

Genus *Teretoctopus* Robson, 1929

194. ***Teretoctopus indicus*** Robson, 1932, pp. 249–251, pl. 3, fig. 2; text-fig. 46 (Type locality: Arabian Sea, 24° 45′ N, 63° 50′ E. This is the first locality mentioned by Robson).

Synonyms: "*Polypus pricei* Berry" Massy, 1916, p. 209, pl. 28, figs. 7–8, in error; "? *Octopus pricei* (Berry)" Winckworth, 1926; "*Polypus pricei* (?)" Robson, 1929, pp. 41, 218–219; *Teretoctopus indicus* Robson, 1929, p. 608.

Distribution: Indian Ocean (Type locality from where Massy's specimens were obtained; ?Pearl Banks, Ceylon).

Remarks: Robson (1932), p. 251 has given reasons for considering Massy's specimens (*Polypus pricei* Massy) as deserving the status of a new genus and species.

195. ***Teretoctopus alcocki*** Robson, 1932, pp. 251–253, pl. 3, fig. 3; text-fig. 47 (Type locality: Andaman Sea. First mentioned locality by Robson).

Synonyms: ? *Octopus januarii* Goodrich, 1896; *Polypus januarii* (partim) Massy, 1916.

Distribution: Indian Ocean (? Andaman Sea; Bay of Bengal; and Gulf of Oman at 25° 11′ N, 57° 15′ E, and 23° 46′ N, 58° 31′ E).

Remarks: Refer also Robson (1932, pp. 240, 251–253).

Genus *Bathypolypus* Grimps, 1921

196. ***Bathypolypus valdiviae*** (Thiele, 1915), p. 485, pl. 80, text-figs. 52 & 53 (Type locality: Agulhas Bank, South Africa).

Synonyms: ?*Octopus capensis* Eydoux and Souleyet, 1852; *Polypus valdiviae* Thiele, 1915 (as above); *Bathypolypus* ? *valdiviae* Robson, 1924; *Bathypolypus grimpei* Robson, 1924; *Bathypolypus valdiviae* Massy, 1926; "Undetermined Polypods", Robson, 1924.

Distribution: Indian Ocean (Aghulas Bank; Coast of Natal and off Cape Town; Cape Point—just outside Indian Ocean limits).

Remarks: Robson (1932) has added to the description of this species and has also given a taxonomic discussion on it.

Family TREMOCTOPODIDAE

Genus *Tremoctopus* Della Chiaje 1830

197. ***Tremoctopus violaceus*** Della Chiaje, 1830, pl. 70 (Type locality: Mediterranean).

Synonyms: Robson (1932, pp. 206–208 has given a long list of synonyms.

Distribution: Cosmopolitan, known from all warm and temperate seas.

Remarks: Robson (1932, p. 208) has examined two specimens from Muscat in the British Museum Collections. Wulker (1920) found it at Cosseir in the Red Sea. Adam (1959, pp. 184–186, fig. 25) has given a description of this species from the Red Sea.

Family ARGONAUTIDAE

Genus *Argonauta* Linnaeus, 1758

198. ***Argonauta argo*** Linnaeus, 1758, p. 708 (Type locality: "Pelago, M. Indico, Mediterraneo."

Synonyms: A long list of synonyms is given by Robson (1932, pp. 181–184).

Distribution: Cosmopolitan, in warm and temperate seas.

Remarks: In the Indian Ocean it has been recorded from the Red Sea (Wulker, 1920; Adam, 1959); Cape Agulhas and Simon's Bay, South Africa (Robson, 1932). The distribution data given by Robson (1932) is provisional as he mentions that "....it is naturally uncertain if the world-wide distribution given.... is correct."

199. ***Argonauta bottgeri*** Maltzan, 1881, p. 163 (Type locality: ?).

Synonyms: Reference may be made to Robson (1932, p. 195).

Distribution : Indo-Pacific. Records from the Indian Ocean are from the Andaman Sea (Massy, 1916), Mauritius and Chagos Islands (Robson, 1932).

200. ***Argonauta hians*** Solander, 1786, p. 46 (Type locality: ?).

Synonyms: Robson (1932, pp. 192–193) gives an exhaustive list of synonyms.

Distribution: Cosmopolitan in warm and temperate seas. It occurs in the R.V. *VARUNA* plankton collections reported in the earlier part of this paper. Other records from the Indian Ocean are: Red Sea (Woodward, 1856, Robson, 1932; Adam, 1959); Perisan Gulf (Robson, 1932); Masquat (Robson, 1932).

201. ***Argonauta nodosa*** Solander, 1786, p. 96 (Type locality: ?).

Synonyms: Robson (1932, pp. 198–199) has given an exhaustive list of synonyms.

Distribution: Indo-Pacific. ?Atlantic.

Remarks: Records from the Indian Ocean are from the Mozambique and "Les Grandes Indes" (d'Orbigny, 1826; Robson, 1932).

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DISCUSSION

Mr. M. J. Sebastian: Do you think that the plankton collection made could give a realistic picture of abundance?

Dr. E. G. Silas: As you are probably aware, we have yet to design the perfect sampler for capturing all planktonic organisms when towed. In our investigation, we have used the Indian Ocean Standard Net in open tows, which has certain limitations. We have also used the Isaacs-Kidd Mid-water Trawl for obtaining samples of juveniles and adults of fast-moving organisms. Several of the oceanic squids are very quick in movement and could easily avoid capture by these nets. However, many are susceptible to capture, especially the larval stages on which most of the present investigation is based. Moreover, as these investigations have been carried out regularly over a period of 5 years, a reasonable picture could be given.

Dr. M. C. Mercer: Was any closing device used in the Isaacs-Kidd Mid-water Trawl?

Dr. E. G. Silas: No.