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CEPHALOPODS FROM THE NETHERLANDS INDIAN OCEAN PROGRAMME (NIOP) (EXPEDITIONS 1992-1993)¹

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ABSTRACT

Cephalopods of the Red Sea, Gulf of Aden and the Western Indian ocean off Somalia are studied. A preliminary annotated list is presented. This study was based on the examination of 381 specimens captured with a Rectangular Midwater Trawl (RMT8) during three cruises of the Netherlands Indian Ocean Programme. The taxa identified represent: 22 families, 35 genera and 56 species. Two species new to science are found. Systematic position and taxonomic re-evaluation in the Chiroteuthidae, Mastigoteuthidae and Octopodidae is briefly discussed. The present collections represent a valuable contribution to the species composition from the Western Indian Ocean and to cephalopod juvenile morphology.

INTRODUCTION

Cephalopods from the Western Indian Ocean are studied, based on the collections from the Netherlands Indian Ocean Programme (NIOP) carried out between May 1992 and April 1993 (Baars, 1994).

The fauna from the Indian Ocean has been stud-

ied by Chun (1910), and Silas (1968) among others. Recent studies have focused on the abundantly represented groups such as Enoploteuthidae (Tsuchiya *et al.*, 1991). Piatkowski & Welsch (1991) improved the knowledge of the species composition and biogeography of cephalopods from the Arabian Sea.

The present paper is a preliminary list of the species identified. Besides the taxonomical importance of the collections from this area, two scientific values are recognized: firstly, the average size of the specimens ranges between 6-40 mm, and some up to 100 mm mantle length (ML), which enables the study of development of juveniles, chiefly in enhanc-

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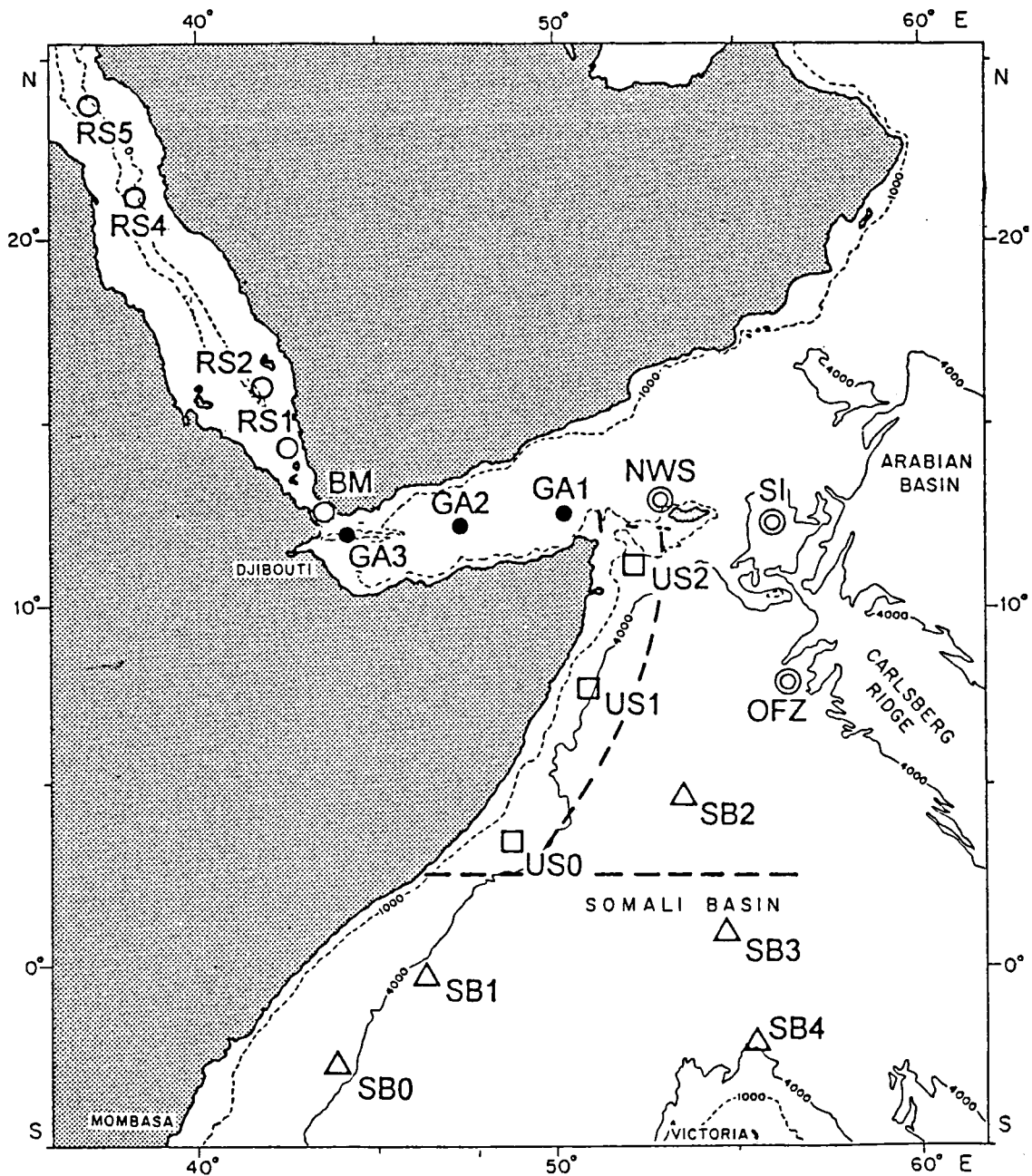


Fig. 1. RMT8 stations of the R/V Tyro during the cruises in 1992-1993. Dashed lines indicate the border of the areas used for pooling data. Abbreviations: RS=Red Sea; BM=Bab-el-Mandab; GA=Gulf of Aden; US=Upwelling Somalia; NWS=NW of Socotra; SI=Socotra Island; OFZ=Owen Fracture Zone; SB=Somali Basin.

ing the description of juvenile morphology which is missing in several groups; secondly, the exceptional high number of taxa identified, which points to an unusual high diversity in this area. This information will provide the opportunity to compare closely related species and define their differences.

MATERIAL AND METHODS

The Netherlands Indian Ocean Programme (NIOP) is

a interdisciplinary project. During theme B called "Monsoon pelagic systems", three cruises were carried out by the R/V Tyro, and defined as follows: B0/C0 Port Said-Mombasa, 21 May-12 June, 1992; B1, Mombasa-Djibouti, 12 July-8 August, 1992 and B2, Victoria-Djibouti, 11 January-6 February, 1993. The taxonomic list follows the arrangement proposed by Sweeney *et al.* (1992). In the material examined the number of specimens, growing stage, mantle

length (ML), the jar sequence number, and the station number are indicated. The total number of specimens for every species is indicated at the end of each section. The stations position and cruise number are indicated in fig 1.

The samples were made with a Rectangular Midwater Trawl 1+8 (RMT1+8) (mesh size 4.5 mm, net opening 8 m²) from 2000 to 0 m depth. Samples were fixed in 4% formalin solution in sea water on board. They were sorted in the laboratory, measured and identified, and later transferred into 70% ethyl alcohol. Cephalopods of the "Siboga" collection from the Zoological Museum of the University of Amsterdam (ZMA) were used as a reference material for comparison and identification; especially the manual for the identification of "larval" and juvenile cephalopods by Sweeney *et al.* (1992) was consulted.

RESULTS AND DISCUSSION

In total 381 specimens were examined, belonging to 22 families, 35 genera and 56 species. Taxonomic remarks are indicated for each group. Changes in systematics of the species studied are proposed and has to be discussed together with the biogeographical, seasonal and vertical distribution data.

Suborder Oegopsida Orbigny, 1845
Family Enoploteuthidae Pfeffer, 1900

Genus *Enoploteuthis* Orbigny, 1839
Enoploteuthis sp. A.

Material examined

1 juvenile, 15 mm ML and 1 paralarva, 5 mm ML, No. 276, Sta. US0. 2 specimens.

Enoploteuthis sp.

Material examined

1 juvenile, 28.5 mm ML, No. 144, Sta. RS1; 1 paralarva, 18 mm ML, No. 485, Sta. US1.5 (3); 1 paralarva, 15 mm ML, No. 671, Sta. SB2; 3 paralarvae, 13, 6 and 4 mm ML, No. 335, Sta. US1; 2 paralarvae, 11 and 8 mm ML, No. 654, Sta. SB2. 8 specimens.

Genus *Abralia* Gray, 1849
Abralia sp.

Material examined

1 juvenile, 13 mm ML, No. 619, Sta. GA2; 1 paralarva, 11 mm ML, No. 1151, Sta. GA2; 1 paralarvae, 10 mm ML, No. 1161, Sta.

GA2; 3 paralarvae, 13, 9 and 7 mm ML, No. 812, Sta. US2; 1 paralarvae, 9 mm ML, No. 1094, Sta. GA2; 1 juvenile, 28 mm and 5 paralarvae 14, 10 and 5 (2) mm ML, No. 1226, Sta. RS1; 24 paralarvae, 12(5), 10 (9) and 8 (10) mm ML, No. 999, Sta. GA1. 40 specimens.

Genus *Abraliopsis* Joubin, 1896

Abraliopsis sp.

Material examined

2 juveniles, 25 mm, 10 paralarvae, 21(1), 18 (2), 15 (1), 12(2), 9(2) and 7(2) mm ML, No. 1029, Sta. GA1; 4 paralarvae, 18, 14, 12 and 9 mm ML, No. 927, Sta. SI; 2 paralarvae, 10 (2) mm ML, No. 619, Sta. GA2; 2 paralarvae, 8 and 6 mm ML, No. 648, Sta. SB2; 1 paralarvae, 13 mm ML, No. 173, Sta. US2; 2 paralarvae, 10 and 8 mm ML, No. 654, Sta. SB2; 1 paralarvae, 8 mm ML, No. 639, Sta. SB3; 3 paralarvae, 13 and 11(2) mm ML, No. 1084, Sta. GA2; 1 paralarvae, 17 mm ML, No. 953, Sta. SI; 5 specimens, 26, 18, 13(2) and 6 mm ML, No. 812, Sta. US2; 4 paralarvae, 14(4) mm ML, No. 681, Sta. SB2; 1 paralarvae 17 mm ML, No. 1064, Sta. GA1; 1 paralarva 10 mm ML, No. 414, Sta. US2; 2 juveniles, 20 mm ML, No. 741, Sta. US1; 8 specimens, 1 juvenile, 27 mm, 1 paralarva 11 mm and 6 paralarvae 6 mm ML, No. 763, Sta. US1; 2 juveniles, 23(2) mm ML, No. 1109, Sta. GA2; 18 specimens, 1 juvenile 20 mm, 14 (6) and 10(11) mm ML, No. 1009, Sta. GA1; 4 specimens, 2 juveniles 21(2) and 2 paralarvae, 5(2) mm ML, No. 945, Sta. SI; 3 paralarvae, 13 (2) and 10 mm ML, No. 671, Sta. SB2; 1 paralarvae, 9 mm ML, No. 260, Sta. US0; 5 paralarvae, 10(5), mm ML, No. 567, Sta. GA2; 5 paralarvae, 19, 14(3) and 10 mm ML, No. 872, Sta. US2; 14 specimens, 22(1), 16(1), 14(3), 11(9) mm ML, No. 1094, Sta. GA2. 112 specimens.

Family Ancistrocheridae Pfeffer, 1912

Genus *Ancistrocheirus* Gray, 1849

Ancistrocheirus sp.

Material examined

1 juvenile, 50 mm ML, No. 550, Sta. GA1; 1 paralarva, 19 mm ML, No. 1219, Sta. RS1; 2 paralarvae, 17 and 14 mm ML, No. 123, Sta. RS1; 1 paralarva, 15 mm ML, No. 1270, Sta. RS2. 5 specimens.

Family Pyroteuthidae Pfeffer, 1912

Genus *Pyroteuthis* Hoyle, 1904

Pyroteuthis sp.

Material examined

1 juvenile, 21 mm ML, No. 776, Sta. US1; 1 paralarva, 13 mm ML, No. 485, Sta. US1.5(3); 1 paralarva, 10 mm ML, No. 450, Sta. SB2; 2 paralarvae, 12 and 9 mm ML, No. 238, Sta. US0. 5 specimens.

Family Histioteuthidae Verrill, 1881

Genus *Histioteuthis* Orbigny, 1841

Histioteuthis cf. *oceanii* (Robson, 1948)

Material examined

immature female, 40 mm ML, No. 1051, Sta. GA1. 1 specimen.

Histioteuthis cf. miranda (Berry, 1918)**Material examined**

1 juvenile, 17 mm ML, No. 1119, Sta. GA2. 1 specimen.

Histioteuthis cf. celetaria (G. Voss, 1960)**Material examined**

2 paralarvae, 17 and 11 mm ML, No. 1109, Sta. GA2; 1 paralarva, 5 mm ML, No. 485, Sta. US1.5 (3); 1 paralarva, 12 mm ML, No. 450, Sta. SB2. 4 specimens.

Histioteuthis cf. corona (N. Voss & G. Voss, 1962)**Material examined**

1 paralarva, 14 mm ML, No. 319, Sta. US1; 1 juvenile, 14.5 mm ML, No. 450, Sta. SB2; 2 paralarvae, 7.5 and 7 mm ML, No. 619, Sta. GA2; 1 juvenile, 10 mm ML, No. 1051, Sta. GA2; 1 paralarva, 5 mm ML, No. 485, Sta. US1.5(3); 2 paralarvae, 7.5 and 5 mm ML, No. 414, Sta. US2. 8 specimens.

Histioteuthis cf. cerasina Nesis, 1971**Material examined**

1 paralarva, 8 mm ML, No. 335, Sta. US1; 1 paralarva, 8 mm ML, No. 1039, Sta. GA1; 1 paralarva, 5 mm ML, No. 393, Sta. US2; 1 paralarva, 13 mm ML, No. 260, Sta. US0; 1 paralarva, 5 mm ML, No. 367, Sta. US2; 2 paralarvae, 8 and 8.5 mm ML, No. 1064, Sta. GA1. 7 specimens.

Family Bathyteuthidae Pfeffer, 1900

Genus *Bathyteuthis* Hoyle, 1885*Bathyteuthis bacidifera* Roper, 1968**Material examined**

2 paralarvae, 12 and 6 mm ML, No. 691, Sta. SB2; 1 immature female, 40 mm, 1 paralarva 5 mm ML, No. 1109, Sta. GA2; 1 juvenile, 23 mm ML, No. 969, Sta. SI; 3 paralarvae, 5(3) mm ML, No. 1142, Sta. GA2; 1 juvenile 20 mm ML, No. 461, Sta. SB2; 1 immature female, 30 mm ML, No. 251, Sta. US0; 1 juvenile, 21 mm ML, No. 882, Sta. US2; 1 paralarva, 6 mm ML, No. 1051, Sta. GA1; 1 juvenile, 25 mm ML, No. 471, Sta. SB2; 1 immature female, 30 mm, 1 paralarvae, 3 mm ML, No. 931, Sta. SI; 1 paralarvae, 3 mm ML, No. 1103, Sta. GA2; 1 paralarva, 4 mm ML, No. 1135, Sta. GA2; 1 paralarva, 6 mm ML, No. 1064, Sta. GA1; 2 paralarvae, 7(2) mm ML, No. 503, Sta. SI; 1 paralarva, 17 mm ML, No. 631, Sta. GA2; 1 juvenile, 27 mm ML, No. 1161, Sta. GA2; 2 paralarvae, 3.5 (2) mm ML, No. 1017, Sta. GA1; 1 paralarva, 7 mm ML, No. 574, Sta. GA2; 1 paralarva, 4 mm ML, No. 1019, Sta. GA1. 33 specimens.

Family Neoteuthidae Naef, 1921

Genus *Neoteuthis* Naef, 1921*Neoteuthis* sp.**Material examined**

1 paralarva, 15 mm ML, No. 550, Sta. GA1; 1 paralarva, 10 mm ML, No. 367, Sta. US2; 2 paralarvae, 17(2) mm ML, No. 574, Sta. GA2. 4 specimens.

Family Ommastrephidae Steenstrup, 1857

Genus *Ommastrephes* d'Orbigny, 1830*Ommastrephes* sp.**Material examined**

2 paralarvae, 10(2) mm ML, No. 335, Sta. US1; 1 paralarva, 7 mm ML, No. 1226, Sta. RS1; 3 paralarvae, 7(2) and 4(1) mm ML, No. 639, Sta. SB3. 6 specimens.

Genus *Stenoteuthis* Verrill, 1880*Stenoteuthis* sp.**Material examined**

1 paralarva, 6.5 mm ML, No. 276, Sta. US0; 1 paralarva, 11 mm ML, No. 496, Sta. SI; 2 juveniles, 20(2) mm ML, No. 681, Sta. SB2. 6 specimens.

Family Ctenopterygidae Grimpe, 1922

Genus *Ctenopteryx* Appellof, 1889*Ctenopteryx siculus* (Verany, 1851)**Material examined**

1 immature female, 55 mm ML, No. 833, Sta. US2; 1 paralarva, 10 mm ML, No. 1084, Sta. GA2; 7 paralarva, 10 (7), mm ML, No. 574, Sta. GA2; 1 paralarva, 10 mm ML, No. 550, Sta. GA1; 1 paralarva, 10 mm ML, No. 1109, Sta. GA2; 1 paralarva, 10 mm ML, No. 639, Sta. SB3. 12 specimens.

Ctenopteryx spec.

(will be described fully in the future as
a new species)

Material examined

1 mature male, 43 mm ML, No. 1103, Sta. GA2; one immature female, 58 mm ML, No. 776, Sta. US1. 2 specimens.

Comments

This species differs from the two known species by the body shape, eyes, funnel and visceral photophore size, and also the fins morphology. This is probable a pygmeus species.

Family Onychoteuthidae Gray, 1849

Genus *Onychoteuthis* Lichtenstein, 1818*Onychoteuthis* sp.**Material examined**

3 paralarvae, 14(2) and 9 mm ML, No. 1109, Sta. GA2; 1 juvenile, 15 mm ML, No. 654, Sta. SB2; 2 paralarvae, 10 and 7 mm ML, No. 1029, Sta. GA1; 1 paralarva, 7 mm ML, No. 993, Sta. GA1; 2 paralarvae, 5.5 and 3.5 mm ML, No. 900, Sta. US2; 5 paralarvae, 7(2), 5(2) and 3.5 (1) mm ML, No. 432, Sta. SB2; 1 paralarva, 3.5 mm ML, No. 674, Sta. SB2; 1 juvenile, 12.5 mm ML, No. 516, Sta. SI. 16 specimens.

Comments

These specimens are very closely related to the *O. banksi* complex.

Family Gonatidae Hoyle, 1886

Genus *Gonatus* Gray, 1849

Gonatus cf. *ursabrunae* Jefferts, 1985

Material examined

1 paralarva, 6.5 mm ML, No. 540, GA1. 1 specimen.

Family Brachioteuthidae Pfeffer, 1908

Genus *Brachioteuthis* Verrill, 1881

Brachioteuthis sp. A.

Material examined

2 paralarvae, 20 and 10 mm ML, No. 1109, Sta. GA1; 1 paralarva, 10 mm ML, No. 432, Sta. SB2. 3 specimens.

Brachioteuthis sp. B.

Material examined

1 paralarva, 10 mm ML, No. 602, Sta. GA2; 1 paralarva, 20 mm ML, No. 931, Sta. SI; 1 paralarva 8 mm ML, No. 178, Sta. SB0. 3 specimens.

Family Cycloteuthidae Naef, 1923

Genus *Discoteuthis* Young & Roper, 1969

Discoteuthis sp.

Material examined

1 paralarvae, 14 mm ML, No. 414, Sta. US2; 1 paralarva, 3 mm ML, No. 167, Sta. US2. 2 specimens.

Family Octopoteuthidae Berry, 1912

Genus *Octopoteuthis* Ruppel, 1844

Octopoteuthis cf. *megaptera* (Verrill, 1885)

Material examined

1 adult male, 95 mm ML, No. 823, Sta. US2; 1 adult male, 85 mm ML, No. 1039, Sta. GA1; 1 adult male, 85 mm ML, No. 402, Sta. US2. 3 specimens.

Octopoteuthis sp. A.

Material examined

2 paralarva, 10 and 8 mm ML. No. 1109, Sta. GA1; 1 paralarvae, 14 mm ML, No. 485, Sta. US1.5 (3); 1 paralarvae, 18 mm ML, No. 776, Sta. US1. 4 specimens.

Genus *Taningia* Joubin, 1931

Taningia cf. *danae* Joubin, 1931

Material examined

1 juvenile, 22 mm ML, No. 1009, Sta. GA1. 1 specimen.

Family Chiroteuthidae Gray, 1849

Genus *Chiroteuthis* Orbigny, 1841 [in 1834-1848]

Chiroteuthis cf. *calyx* Young, 1972

Material examined

1 immature female, 85 mm ML, No. 663, Sta. SB2. 1 specimen.

Chiroteuthis cf. *veranyi* (Férrusac, 1835)

Material examined

1 juvenile unsexed, 80 mm ML, No. 319, Sta. US1. 1 specimen.

Chiroteuthis capensis Voss, 1967

Material examined

1 juvenile unsexed, 100 mm ML, No. 776, Sta. US1; 1 juvenile unsexed, 55 mm ML, No. 1039, Sta. GA1; 1 juvenile unsexed, 53 mm ML, No. 1017, Sta. GA1. 3 specimens.

Chiroteuthis picteti Joubin, 1894

Material examined

1 juvenile unsexed, 80 mm ML, No. 763, Sta. US1; 1 juvenile, 70 mm ML, No. 1109, Sta. GA2. 3 specimens.

Comments

Based on the examination of the available material in the present collections and the reference specimens in the ZMA of the University of Amsterdam and the Royal Institute of Natural Sciences of Belgium in Brussels (IRSNB), it is suggested to create a sub-generic division for the genus *Chiroteuthis*.

Chiroteuthis s. str. will include *Ch. veranyi* and *Ch. calyx*, characterized by two rows of photophores in the eyeball, straight nuchal cartilage, enlarged suckers in arms, wide membrane in the tentacular club, and presence of enlarged teeth in the center of the distal margin in tentacular suckers. The second, new subgenus, will include *Ch. picteti* and *Ch. capensis*, characterized by three rows of photophores in the eyeball, spatulate nuchal cartilage, lack of enlarged suckers, absence of wide membrane in the tentacular club and absence of enlarged teeth in the tentacular sucker margins. Diagnoses and naming of the subgenera is required.

Two "*doratopsis*"-like specimens are identified, one of them resembling *Ch. acanthoderma*; however, the features indicated in the description by Lu (1977) for the tentacular club and the adjacent fins does not fit with the present specimens. Its re-description is required.

Genus *Asperoteuthis* Nesis, 1980
Asperoteuthis sp.

Material examined

1 paralarva, 18 mm ML, No. 639, Sta. SB3; 1 paralarva, 22 mm ML, No. 640, Sta. SB3. 2 specimens.

Genus *Echinoteuthis* Joubin, 1933
Echinoteuthis danae Joubin, 1933

Material examined

1 paralarva, 28 mm ML, No. 409, Sta. US2; 3 paralarvae, 13 and 12(2) mm ML, No. 503, Sta. SI. 4 specimens.

Comments

These specimens were easily identified by the small cartilaginous tubercles all over the body and arms. It is suggested to transfer *E. danae* to the family Chiroteuthidae for the reason the position of its luminous organs in eye ball and ink sac, since these features were overlooked in the original description by Joubin (1933). Nonetheless, these were found without tentacles, it is possible to indicate that, by its morphology from Joubin's (1933) original description, this is not a member of the mastigoteuthid family.

This genus have been synonymized to *Mastigoteuthis*, by Young (1991) and Salcedo-Vargas & Okutani (1994). After examination of these specimens I have resurrected this genus.

Family Mastigoteuthidae Verrill, 1881
Genus *Mastigoteuthis* Verrill, 1881
Mastigoteuthis agassizi Verrill, 1881

Material examined

1 immature female, 44 mm ML, No. 718, Sta. SB2. 1 specimen.

Comments

The paralarvae of *Mastigoteuthis* can be recognized by the eye sinus photophore, funnel-mantle connectives, and by the fin size and shape (Salcedo-Vargas, 1993). This specimen can be identified by the photophores in the ventral side of the head and mantle, the size of the eyes and the small photophore in the eye sinus. The identification key by Sweeney *et al.* (1992), is not satisfying for identification of this specimen.

Mastigoteuthis glaukopsis Chun, 1908

Material examined

3 juveniles, 35(3) mm ML, No. 882, Sta. US2; 1 juvenile, 44 mm

ML, No. 984, Sta. SI; 1 juvenile, 32 mm ML, No. 842, Sta. US2; 1 juvenile damaged, No. 806, Sta. US1. 6 specimens.

Comments

Easily separable from *M. agassizi* by the larger size of the eyes, the eye sinus photophore, and by the funnel cartilage morphology.

Mastigoteuthis sp.

(probably a species to be defined as new)

Material examined

4 paralarvae, 20(4) mm ML, No. 485, Sta. US1.5(3). 4 specimens.

Comments

This species is identified by the additional photophore below the one in the eye sinus. Funnel and nuchal cartilages also differ from the known species. A closely related species, was described by Joubin (1933) based on a single specimen. The presence of "spiny tubercles" as in the *Echinoteuthis* are observed.

Family Cranchiidae Prosch, 1849
Genus *Cranchia* Leach, 1817
Cranchia scabra Leach, 1817

Material examined

2 juveniles, 14 and 11 mm ML, No. 213, Sta. SB1. 2 specimens.

Genus *Liocranchia* Pfeffer, 1884
Liocranchia cf. reinhardtii (Steenstrup, 1856)

Material examined

2 juveniles, 95 and 80 mm, 1 paralarvae, 10 mm ML, No. 441, Sta. SB2; 1 juvenile, 80 mm ML, No. 402, Sta. US2; 2 juveniles, 50 and 45 mm ML, No. 205, Sta. SB1; 1 juvenile, 60 mm, 4 paralarvae, 13 and 8(3) mm ML, No. 276, Sta. US0; 3 juveniles, 35(1), 33(2) and 1 paralarva, 10 mm ML, No. 238, Sta. US0; 17 paralarvae ranging from 8 to 10 mm ML, No. 232, Sta. US0; 1 juvenile, 33 mm ML, No. 178, Sta. SB0; 2 paralarva, 14(2) mm ML, No. 335, Sta. US1; 1 paralarva, 10 mm ML, No. 213, Sta. SB1. 35 specimens.

Comments

This species is one of the most abundant in the collection from the Arabian sea (Piatkowski & Welsch, 1991) as well as in the present study. The gelatinous appendages mentioned by Piatkowski & Welsch (1991) which cover the eyes are observed. Morpho-functional properties should be investigated.

Liocranchia sp.**Material examined**

3 paralarvae, 10(3) mm ML, No. 327, Sta. US1. 3 specimens.

Comments

These specimens does not fit with the known species. Further revision has to clarify its taxonomic position.

Genus *Heliocranchia* Massy, 1907*Heliocranchia* sp. A.**Material examined**

1 juvenile, 23 mm ML, No. 335, Sta. US1; 1 juvenile, 20 mm ML, No. 485, Sta. US1.5 (3); 3 juveniles (only mantle), 30, and 15(2) mm ML, No. 700, Sta. SB2. 5 specimens.

Comments

Closely related to *H. joubini*.

Heliocranchia sp. B.**Material examined**

2 paralarvae, 12(2) mm ML, No. 602, Sta. GA2. 2 specimens.

Comments

Body totally soft, jellyfish-like. By this feature it differs from *Heliocranchia* sp. A.

Genus *Sandalops* Chun, 1906*Sandalops* cf. *melancholicus* Chun, 1906**Material examined**

1 juvenile, 42 mm ML, No. 1009, Sta. GA1; 1 paralarva, 15 mm ML, No. 178, Sta. SB0; 2 paralarvae, 13 and 10 mm ML, No. 655, Sta. SB2. 4 specimens.

Genus *Taonius* Steenstrup, 1861*Taonius* cf. *pavo* (Lesueur, 1821)**Material examined**

4 juveniles, 50, 40(2) and 35 mm ML, No. 1094, Sta. GA2. 4 specimens.

Genus *Galiteuthis* Joubin, 1898*Galiteuthis* sp.**Material examined**

1 juvenile, 40 mm and 1 paralarvae 13 mm ML, No. 485, Sta. US1.5(3). 2 specimens.

Comments

Damaged specimens. Difficult to identify to species level.

Genus *Liguriella* Issel, 1908*Liguriella* sp.**Material examined**

1 juvenile, 13 mm ML, No. 485, Sta.US1.5(3); 12 paralarvae ranging from 2 to 5 mm ML, No. 503, Sta. SI. 13 specimens.

Comments

Due to the condition and size of the specimens is not possible at present to identify them to species level.

Order Octopoda Leach, 1881

Suborder Cirrata Grimpe, 1916

Family Opistoteuthidae Verrill, 1896

Genus *Grimpoteuthis* Robson, 1932*Grimpoteuthis* sp.**Material examined**

1 juvenile, 50 mm ML, No. 890, Sta. US2. 1 specimen.

Suborder Incirrata Grimpe, 1916

Family Amphitretidae Hoyle, 1886

Genus *Amphitretus* Hoyle, 1885*Amphitretus* sp.**Material examined**

2 paralarvae, 13 and 10 mm ML, No. 218, Sta. SB1; 1 paralarva, 10 mm ML, No. 335, Sta. US1. 3 specimens.

Family Bolitaenidae Chun, 1911

Genus *Japetella* Hoyle, 1885*Japetella* sp.**Material examined**

1 damaged paralarvae, 6 mm ML, No. 253, Sta.US0. 1 specimen.

Genus *Eledonella* Verrill, 1884*Eledonella* sp.**Material examined**

1 paralarva, 7 mm ML, No. 213, Sta. SB1; 1 paralarva, 8 mm ML, No. 654, Sta. SB2. 2 specimens.

Family Vitreledonellidae Robson, 1930

Genus *Vitreledonella* Joubin, 1918*Vitreledonella* sp.**Material examined**

1 paralarva, 6 mm ML, No. 298, Sta. US0. 1 specimen.

Family Tremoctopodidae Tryon, 1879
Genus *Tremoctopus* Chiaje, 1830

Family Alloposidae Verrill, 1882
Genus *Alloposus* Verrill, 1880
Alloposus mollis Verrill, 1880.

Material examined

1 paralarva, 3 mm ML, No. 574, Sta. GA2; 1 paralarva, 10 mm ML, No. 918, Sta. SI; 1 paralarva, 8 mm ML, No. 975, Sta. SI; 1 paralarva, 11 mm ML, No. 842, Sta. US2; 1 juvenile, 13 mm ML, No. 931, Sta. SI; 1 juvenile, 15 mm ML, No. 574, Sta. GA2; 1 juvenile, 18 mm ML, No. 1051, Sta. GA1; 1 juvenile, 20 mm ML, No. 969, Sta. SI. 8 specimens.

Comments

Specimens larger than 10 mm ML show body growth ventro-laterally rather than antero-posteriorly. Body papillae are present in specimens from 11 mm ML. Body pigments get darker with age.

Tremoctopus cf. violaceous Chiaje, 1830.

Material examined

1 male, 9 mm ML, No. 639, Sta. SB3. 1 specimen.

Family Octopodidae Orbigny, 1840
Genus *Octopus* Lamarck, 1798

Octopus cf. macropus (type I) Naef, 1923

Material examined

1 paralarva, 8 mm ML, No. 1211, Sta. RS1; 1 paralarva, 7 mm ML, No. 101, Sta. RS1; 1 paralarva, 6 mm ML, No. 1199, Sta. RS1; 3 paralarvae, 11 and 5(2) mm ML, No. 1219, Sta. RS1; 1 paralarva, 12 mm ML, No. 1288, Sta. RS2; 2 paralarvae, 7(2) mm ML, No. 1242, Sta. RS2; 2 paralarva, 10 and 6 mm ML, No. 40, Sta. RS2; 2 paralarva, 9 and 3 mm ML, 1278, Sta. RS2. 13 specimens.

Comments

Body elongate, becoming suddenly conical, a spine-like in the posterior end of the mantle. At this point the tissue is softer than the rest of the body, so that this part is easily modified or overlooked. Arms short and equal until 8 mm ML, later arms start growing unequally as body becomes thicker. Eyes moderate in size in Y-position. Small suckers, not enlarged ones. Two suckers in one row next to the mouth.

Octopus cf. macropus (type II) Naef, 1923

Material examined

1 paralarva, 6 mm ML, No. 574, Sta. GA2; 2 paralarvae, 17(2) mm ML, No. 776, Sta. US1; 1 paralarva, 15 mm ML, No. 784, Sta. US1; 1 paralarva, 17 mm ML, No. 327, Sta. US1; 1 paralar-

va, mantle damaged, arm I 33 mm ML, No. 975, Sta. SI. 7 specimens.

Comments

Body ovate with a conical posterior end, covered with a thin transparent membrane, chromatophores on the body and on the membrane. Arms short and equal, thinner and softer than the ones in type I. Web about 50% of the arms length. A single sucker next to the mouth, the rest biserially arranged, no enlarged ones present. Beyond the web limit no suckers are developed. Small eyes.

The differences between paralarvae of the Type I and II suggest that there are two different species.

Octopus cf. defilippi (type I) (Rees, 1954)

Material examined

1 paralarva, 8 mm ML, No. 1109, Sta. GA1; 1 paralarva, 5 mm ML, No. 1029, Sta. GA1; 2 paralarvae, 9 and 5 mm ML, No. 999, Sta. GA1. 4 specimens.

Comments

Arm III three times the mantle length. Arm formula III>II>IV>I. Arm III stronger and thicker than the others, suckers in its middle part slightly larger than other suckers in the same and in other arms.

Octopus cf. defilippi (type II) (Robson, 1929)

Material examined

1 paralarva, 9 mm ML, No. 574, Sta. GA2; 1 paralarva, 9 mm ML, No. 619, Sta. GA2. 2 specimens.

Comments

Body soft and more elongated than in type I. Differs also by the arms length which are longer and thinner than in type I. Arm formula: III>II>IV>I.

Octopus cf. defilippi (type III)

Material examined

2 paralarvae, 10 and 7 mm ML, No. 123, Sta. RS1; 1 paralarva, 8 mm ML, No. 1226, Sta. RS1. 3 specimens.

Comments

Arm III the longest, but shorter than in type I and II. Body globular and strong. Arms thinner than other types, not enlarged suckers. Arm formula: III>II>IV>I. Arm III slightly longer than Arm II. Small eyes. Chromatophore patterns in arms very distinctive from

types I and II. (see *Macrotritopus kemp* Robson, 1929).

Octopus cf. defilippi (type IV) (Rees, 1954)

Material examined

1 paralarva, 7 mm ML, No. 1029, Sta. GA1. 1 specimen.

Comments

Arm III slightly longer than the other arms. Arm formula: III>II>IV>I. Body strong and robust, also the arms are more robust than in the types I, II and III, though shorter. Funnel smaller than in type I.

The criteria to separate these four types is based on chromatophores pattern, eyes size and sucker arrangement, in specimens ranging from 7 to 9 mm ML.

From the examination of the present material it is possible to establish clear differences in some of the species which are included into the *Macrotritopus* group. Robson (1929) suggested a subgeneric division for five species. Hanlon *et al.* (1985) claimed that the "macrotritopus problem" for the Atlantic species is solved. With the present material it will be possible to make some progress in the clarification of the species of the *Macrotritopus* octopods from the Indian Ocean.

Octopus cf. vulgaris (Rees, 1950)

Material examined

1 paralarva, 6 mm ML, No. 953, Sta. SI. 1 specimen.

DISCUSSION

Tsuchiya *et al.* (1991) and Piatkowski & Welsch (1991) stated that the poor knowledge of the biology and species composition of cephalopods from the Indian Ocean is due to the strong swimming ability and net-avoidance of oceanic cephalopods. However, in order to support completely this statement, it is important to take in consideration the population dynamic factors as well as the technical constraints, such as opening of the net, the depth of sampling, the time of the day and the season of the year.

During the present expeditions by using larger rectangular midwater trawl net (RMT8), the number of species recorder has increased tremendously in comparison with other expeditions in which the Isaacs-Kidd midwater trawl (IKMT) has been used,

like in the expeditions in the Arabian Sea (Piatkowski & Welsch, 1991). At the moment, it is just possible to indicate that there is a strong correlation between the type of net used and the size of the specimens captured. The species composition, thus, may reflect the type of net used, which should be considered with caution in concluding swimming ability of cephalopods. Previous studies in the Banda Sea, Indonesia (Schalk, 1988) and the present study (cruises report unpublished) indicate that the number of species recorded is influenced by the monsoon seasons and by upwelling conditions rather than by the frequency of the sampling process in different seasons or by the size or type of the net.

Taxonomic remarks

The specimens examined were identified using a minimum number of characters such as: cartilage components (funnel, mantle, nuchal) photophores and chromathophores patterns, suckers, arms, fins and eyes size. The identification manual by Sweeney *et al.* (1992) was used as a main reference. Full description, illustration and definition of species will follow this paper.

The clear differences in the growth stages of some groups as the Bathyteuthidae, Ctenopterygiidae, Cranchiidae, Enoploteuthidae, Chiroteuthidae and Octopoteuthidae in the present collections indicate a year-round spawning. The brief comments on some species are preliminar conclusions from previous observations of collections in diverse museums, universities and laboratories by the author.

The meso-bathypelagic cephalopod fauna from the Western Indian Ocean based on the *Tyro* collections emerge as the most complete and interesting one hitherto studied.

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