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RESULTS OF THE DIVA-1 EXPEDITION OF RV "METEOR" (CRUISE M48/1)

A short note on the cephalopods sampled in the Angola Basin during the DIVA-1 expedition

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Abstract

Five cephalopods, all belonging to different species, were identified from deep-sea trawl samples conducted during the DIVA 1-expedition of RV "Meteor" in the Angola Basin in July 2000. These were the teuthoid squids *Bathyteuthis abyssicola*, *Brachioteuthis riisei*, *Mastigoteuthis atlantica*, *Galiteuthis armata*, and the finned deep-sea octopus *Grimpoteuthis wuelkeri*. The present study contributes information on size, morphometry, biology and distribution of the species form this unique cephalopod collection.

Keywords: Cephalopoda; Deep-sea; Angola Basin; Cirrate octopods

Introduction

Cephalopods in the bathyal and abyssal ecosystems have been the subject of only a limited number of studies due to the obvious difficulties involved in collecting them adequately at such great depths (Voss 1967; Villanueva 1992). A further drawback relates to their delicate bodies, which are frequently damaged almost beyond recognition in trawl samples. If specimens have been collected in good condition they become easily deformed by preservatives when they are stored in laboratories and museums. All these problems have created disarrays in the taxonomy of many cephalopod groups, which inhabit the deep sea. Recently, in situ photographs and videos in deep-sea habitats have provided spectacular information on remarkable cephalopods and their behaviour (Villanueva et al. 1997; Vecchione et al. 2001). An appropriate species identification, however, has not been possible and identity of the observed specimens remains obscure until they are captured. These circumstances demonstrate the great scientific value of any cephalopod sampled from deep-sea habitats. The abyssal plains still belong to the most unknown regions in the oceans. One of these plains, the Angola Basin was sampled during the RV "Meteor" expedition in 2000. In the present study, we provide information on a small collection of cephalopods which have been caught during the expedition and which include some of the largest invertebrate organisms in the bathyal and abyssal megafauna.

Material and methods

Five cephalopods were identified and measured from a series of deep-sea trawls, taken during the DIVA1-expedition of RV "Meteor" to the Angola Basin in July 2000. They were sampled with an Agassiz trawl with a cod end mesh size of 10 mm. The Agassiz trawl was used at 13 stations to investigate the macrobenthos diversity of the abyssal plain at depths exceeding 5300 m. Total time of each haul lasted approximately 12 h including

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the long phases of veering and heaving the gear and sampling for ca. 3 h at the seafloor with a ship's speed of 2 knots. Cephalopods occurred at only four stations. After capture they were fixed in 4% formalin-seawater solution. In the home laboratory, they were transferred into 70% ethanol. In 2002, they were shifted to the Institut für Meereskunde, Kiel. There they were photographed, basic measurements were made and the specimens were identified following the guidelines of Nesis (1987). The partly poor condition of the animals and their long time in preservation liquid complicated identification.

Results and discussion

A total of five specimens were captured. The cephalopods collected comprised five species in five families. All the species recorded are known from the Atlantic Ocean. Four species belonged to the order Teuthida Naef, 1916, one species to the order Octopodida Leach, 1818. In the following photographs of the five specimens are provided as well as morphometric notes and remarks on their distribution pattern.

Order Teuthida

Family Bathyteuthidae Pfeffer, 1900

***Bathyteuthis abyssicola* Hoyle, 1885**

Specimen examined: 40 mm mantle length (ML) (Fig. 1d), sampled at sta. 347; 16°14.9′S, 5°26.7′E, above 5433 m depth. 20 mm mantle width (MW); mass 7.2 g; 7 mm fin length (FL); 17 mm fin width (FW); 9 mm left arm I length (AI); 9 mm left arm II length (AII); 10 mm left arm III length (AIII); 11 mm left arm IV length (AIV); 32 mm left tentacle length (TL); arm formula IV > III > II = I.

Remarks: This small cold water squid lives in all oceans at depths between 500 and 3000 m (Nesis 1987). The monotypic family with currently three valid species is easily recognised by a red-brown body coloration. Our specimen adds little information to what is known of the distribution of this species presented by Roper (1969).

Family Brachioteuthidae Pfeffer, 1908

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

Specimen examined: 35 mm ML (Fig. 1a), sampled at sta. 347; 16°14.9′S, 5°26.7′E, above 5433 m depth. 8 mm MW; mass 0.9 g; 18 mm FL; 18 mm FW; 4 mm AI; 16 mm AII; 15 mm AIII; 11 mm AIV; 29 mm TL; arm formula II > III > IV > I.

Remarks: *B. riisei* is a cosmopolitan species; the young stages are found in epipelagic and mesopelagic zones. Adults attain a mantle length of normally 80 mm. The mantle is muscular but generally rather thin. The tentacular clubs are unusual: The dactylus is normal (four sucker series) but the proximal part of the manus is greatly expanded and carries numerous small suckers on long stalks. Little is known about the biology of brachioteuthids although Roper and Vecchione (1996) describe an accumulation observed from a submersible near the ocean floor at a depth of about 800 m. The taxonomy of the family Brachioteuthidae is badly in need of revision. Therefore, the species name *B. riisei*, should be taken with caution and may not be correct. Identification and taxonomy followed Nesis (1987).

Family Mastigoteuthidae Verrill, 1881

***Mastigoteuthis atlantica* Joubin, 1933**

Specimen examined: 87 mm ML (Fig. 1b), sampled at sta. 337; 18°18.9′S, 4°42.7′E, above 5439 m depth. 25 mm MW; mass 24.8 g; 56 mm FL; 60 mm FW; arms and tentacles damaged or lost, respectively.

Remarks: This juvenile Atlantic whiplash squid was in a poor condition. Adults attain a mantle length of 150–300 mm (Nesis 1987). The family Mastigoteuthidae contains a single genus, *Mastigoteuthis*, with 19 poorly known nominal species. All species are deep-water pelagic or benthopelagic squids that are morphologically distinctive, some are benthic. Tentacles have a characteristic appearance but are often lost in capture. They are poorly muscled, almost lacking the transverse muscles used by many other squids to extend the tentacles rapidly forward. The tentacles are elongate and whip-like with tentacular clubs that are covered with thousands of extremely small suckers that, depending on the species, may be invisible to the naked eye.

Family Cranchiidae Prosch, 1847

***Galiteuthis armata* Joubin, 1898**

Specimen examined: 110 mm ML (Fig. 1c), sampled at station 334; 19°13.5′S, 3°50.1′E, above 5471 m depth. 16 mm MW; mass 7.4 g; 50 mm FL; 15 mm FW; 15 mm AI; 18 mm AII; 25 mm AIII; 32 mm AIV; 67 mm TL; arm formula IV > III > II > I.

Remarks: This meso-bathypelagic and benthic-bathyal glass or cranchiid squid is common in the tropical Atlantic. According to the generic revision of the Cranchiidae by Voss (1980) the genus *Galiteuthis* currently comprises five valid species and does not occur deeper than 1500 m. Thus, we assume that the specimen was captured when the Agassiz trawl was hauled in. Cranchiids are small (*Helicocranchia*: ca. 100 mm ML) to large (*Mesonychoteuthis*: ca. 2000 mm

Fig. 1. Cephalopods captured in the Angola Basin during the DIVA 1—expedition. (a) *B. riisei*, (b) *M. atlantica*, (c) *G. armata*, (d) *B. abyssicola*, (e) *G. wuelkeri*.

ML) squids that possess a large buoyancy chamber and, hence, the common name "bathyscaphoid squid." In general appearance they often appear to have bloated bodies and short arms. The mantle is generally thin but muscular. Several species have been observed in deep water from submersibles to exhibit a peculiar posture (cockatoo posture) with the arms and tentacles folded back over the head (Vecchione and Roper 1991). Cranchiid early life stages are common in near-surface waters and many remain in this habitat until reaching a rather large size (ca. 50–100 mm ML). Most species occupy progressively deeper waters as they grow larger (ontogenetic descent). Cranchiids are one of the more speciose families of squids with about 60 species, many of which are undescribed (Voss et al., 1992).

Order Octopodida

Family Opisthoteuthidae Verrill, 1896

***Grimpoteuthis wuelkeri* (Grimpe, 1920)**

Specimen examined: ca. 45 mm ML (Fig. 1e), sampled at station 351; 16°25.2′S, 5°27.2′E, above 5430 m depth. Mass 216 g; 152 mm AI; 124 mm AII; 117 mm AIII; 114 mm AIV; arm formula I > II > III > IV.

Remarks: The genus *Grimpoteuthis* belongs to the family Opisthoteuthidae, a group of finned deep-sea octopuses. Currently, 14 nominal species are included in this genus. They are reported from the north-east Atlantic in depths between 2000 and 5000 m (Collins et al. 2001). The genus *Grimpoteuthis* is presently under revision (M.A. Collins, pers. comm. 2003). *G. wuelkeri* is a species that has been described from the abyssal of the subtropical Atlantic (Nesis 1987). Among the recent cephalopods the finned octopuses or cirrates are one of the most peculiar groups that live in all oceans. They generally occupy depths from about 100 to over 5000 m although they have been found in surface waters in polar regions. Their maximum known depth of occurrence is over 7000 m, the deepest record for any cephalopod (Voss 1988). The animals are taken at great depths, often near the seafloor but sometimes away from it. The enormous arms and web can be spread to give a medusoid form but the animals also swim horizontally mainly using the fins. They are gelatinous and perhaps neutrally buoyant, and can almost certainly hover in the medusoid form. Deep-water photography and filming has shown the swimming behaviour of these animals (Roper and Brundage 1972; Villanueva et al. 1997). They are supposed to be planktophagous animals, but little is known about their habits in general. Their reproductive biology is virtually unknown.

Although the collections of the DIVA 1—expedition were not directed at cephalopods, they provide valuable information on the distribution of meso- and bathypelagic species. Three of the five cephalopods, the squids *Bathyteuthis abyssicola*, *B. riisei* and *Galiteuthis armata* are typical mesopelagic species, which do not occur close to the seafloor. Probably they were caught while the net was lifted to the surface. The two other species taken from the samples, the squid *Mastigoteuthis atlantica* and the cirrate octopod *Grimpoteuthis wuelkeri* are bathypelagic species which can be found close to the sea bottom. Our present findings can only be regarded as a snapshot of the widely unknown cephalopod fauna of the deep-sea and the abyssal plains and emphasise that further investigations of these habitats are necessary to elucidate the role of cephalopods in these remote parts of the world ocean.

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