

CEPHALOPODA OF MADEIRAN WATERS

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With 1 table

ABSTRACT. Based upon a large collection of cephalopods made during two visits to the area by the British RRS "Challenger" in 1983 and 1986, an examination of the contents of a sperm whale stomach and a reassessment of cephalopods listed from the area by REES and MAUL (1956), the list of species from Madeiran waters can be increased from 35 to 77.

INTRODUCTION

REES & MAUL (1956) listed the cephalopods from the waters around Madeira based on previous records by WHITE & JOHNSON (1885), GIRARD (1892) and NOBRE (1937) and collections painstakingly made by Sr. MAUL from local fishermen and the stomach contents of *Alepisaurus ferox* Lowe, *Aphanopus carbo* Lowe and the sperm whale, *Physeter macrocephalus* Linn. GONCALVES & MARTINS (1992) added two species of octopod to the list to bring the total to 35 species. The present collection more than doubles the cephalopod species recorded in the immediate vicinity of the island.

MATERIAL AND METHODS

Between 1959 and 1986 the first author visited Madeiran waters 10 times, on RRS "Discovery" II, RRS "Discovery" and RRS "Challenger". During these cruises many different methods of midwater fishing were employed to catch or observe cephalopods and the gear used (often within sight of the Islands) included the following: handlines, baited midwater cameras, ring nets with mouths of 1m² and 2m², Isaac-Kidd midwater trawls with a mouth of 7m² (IKMT), Rectangular midwater trawls (RMTs) with mouths of 1m², 8m², 10m², 45m², and 50m², the British Columbia midwater trawl with a mouth of approx. 250m² and the

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Engel's midwater trawl with a mouth of approx. 600m². Collection of midwater animals greatly improved during the period. Opening-closing nets were developed (CLARKE, 1969; BAKER et al, 1973) as well as sophisticated net monitoring gear to indicate depth, flow, water temperature and opening-closing. The effects of net speed, mouth area and artificial lights on the trawls were also studied. During the many hundred hauls and nights spent fishing around the Madeira Archipelago several thousand cephalopods of 69 species were caught.

The cephalopod collections obtained during these operations contain 42 new records for the area and several extremely rare and little known species. Rather than fully document all records of every species, for the present purpose, we have taken records from 1983 and 1986 collections made with RMT10s and RMT50s during tests designed to prove the effectiveness of headline lights to enhance catches of midwater animals (CLARKE & PASCOE, 1985; SWINNEY, CLARKE AND MADDOCK 1986; PASCOE, 1991). Two species which did not occur in the 1983 and 1986 catches but did occur in previous years are also included. Dorsal mantle lengths (MLs) were measured.

In 1983, 35 RMT10 hauls and 40 RMT50 hauls were used at various positions just South of Madeira at depths of 300-1800m, equipped with and without lights on the headbar. During 1986, 67 samples with an RMT50, with or without a light on the headbar, were taken along the sides of an equilateral triangle with the corners at 32° 31.5'N, 17° 14.6'W, 32° 23.4'N, 17° 09.5' W and 32° 23.5'N, 17° 15.5' W. Hauls were all fished on courses of either 30°, 150° or 270° and all hauls were started at the corners of the triangle. In all hauls 1800m of wire were payed out and the net was then towed at 2-2.5 knots for 2 hours before hauling in. This gave a fishing depth of about 800m usually but depth varied from 700 to 1200m according to the ship's course. These two series with open nets clearly sampled the great majority of midwater species in the oceanic water just South of Madeira. The few additional species taken in other years resulted from a bottom trawl, handline fishing near the surface and examination of a sperm whale's stomach contents (CLARKE 1962a; CLARKE & MACLEOD, 1974).

On a visit to Madeira in October 1993, the first author examined much of the collection of cephalopods in the Funchal Museum and was able to add several species to the list, several of which had been previously identified by G. L. VOSS (unpublished labels). MMF numbers are quoted for these.

RESULTS

The collection considered here is compared with those listed by REES & MAUL (1956) and summarised in Table 1.

Family Spirulidae

Spirula spirula LINNAEUS, 1758.

Four specimens from four hauls in 1983 and 13 from 10 hauls of RMT50s in 1986 had MLs of 10.5-28.0mm. This vindicates REES & MAUL's inclusion of the species in the faunal list which they based on shells washed up on the shore. Details of the growth and vertical distribution of the species were described by CLARKE (1970).

Family Sepiidae

Sepia officinalis LINNAEUS 1758.

Identified by REES on the basis of one specimen, Rees and Maul stated that it is very common all the year round and adult specimens measuring about 250mm. ML are often seen in the local fish market.

Family Sepiolidae

Heteroteuthis dispar (RUPPELL, 1845).

Reported as local to Madeira from stomach contents of *Aphanopus carbo* and *Alepisaurus ferox* by REES & MAUL (1956), ten were collected in 1983 and 15 in 1986 with MLs of 8.0-23.3mm.

Sepietta oweniana (d'ORBIGNY, 1839)

REES & MAUL recorded two specimens from Funchal harbour. Not surprisingly, our sampling in much deeper water did not confirm its presence but examination of REES & MAUL's material has confirmed their identification.

Family Loliginidae

Loligo vulgaris LAMARCK, 1798.

REES & MAUL (1956) based their record on seven juveniles measuring 30-35mm ML. As these are difficult to distinguish from *L.forbesi* at that length, we considered that this record required confirmation. In 1984 Sr. MAUL kindly sent us a male (ML= 235mm) with spermatophores in Needham's pouch and a partly formed hectocotylysed arm, thus confirming the presence of the species in Madeiran waters.

Loligo forbesi STEENSTRUP, 1856.

REES & MAUL (1956) recorded this as common in the market in winter months although their identification depended upon a single male specimen of 270mm ML. Our examination of their specimen confirms their identification. It is interesting that the species does not appear to reach the much greater MLs seen off the Azores (MARTINS, 1982).

Family Ctenopterygidae

Ctenopteryx siculus (VERANY, 1851)

In 1983, three individuals were caught in 9% of the RMT10 hauls and 21 were caught in 33% of the RMT50 hauls. In 1986, 53 individuals with MLs of 12.0-60.0mm and a peak at

25.0mm were caught in 22% of the RMT50 hauls.

Family Architeuthidae.

Architeuthis sp.

REES & MAUL based their record upon a specimen vomited by a sperm whale off Sao Lourenco in 1952. CLARKE (1962) obtained a mature male specimen with a mantle length of 385mm from a sperm whale flensed at Caniçal in August 1959. Taxonomy of this genus is confused but it is possible that all North Atlantic specimens should properly be referred to *Architeuthis dux* STEENSTRUP, 1857.

Family Thysanoteuthidae

Thysanoteuthis rhombus TROSCHEL, 1857.

Recorded by REES & MAUL (1956) from a single specimen of 350mm obtained from a stranding of about 20 animals. Another specimen was bought by CLARKE in 1959 in Funchal market. This is a rare squid from temperate and tropical waters.

Family Ommastrephidae

Ommastrephes bartrami (LESUEUR, 1821)

This species was not recorded by REES & MAUL (1956) due to confusion with *O. caroli* and *Sthenoteuthis pteropus*. They chose to include the ommastrephids which were not *Todarodes sagittatus* under the name of *Ommastrephes pteropus*. It is now generally accepted that *O. caroli* FURTADO, 1887 is a synonym of *O. bartrami* and the generic name *Sthenoteuthis* has been resurrected for *O. pteropus*. CLARKE can verify that *Ommastrephes bartrami* (LESUEUR) is regularly sold in Funchal market. It is common in summer months at mantle lengths of 200-350mm and occasionally large mature females with MLs of 600-800mm. Many specimens have also been caught from RRS "Challenger" with handlines near the surface within sight of Madeira.

Sthenoteuthis pteropus (STEENSTRUP, 1855)

This was recorded by REES & MAUL as *Ommastrephes pteropus* STEENSTRUP and they noted that it is very abundant in the summer months. As they mention the large lemon-shaped dorsal light organ there is no doubt that they are referring, in part, to this species under this name. Many with mantle lengths of 150-350mm have been caught on handlines within sight of Madeira by the first author.

Todarodes sagittatus (LAMARCK, 1799)

Recorded by REES & MAUL as being extremely common on the fishing grounds in March, April and May, CLARKE found it common in Funchal market in July and August 1959. Large otter trawls used in midwater by the research ships regularly caught this species. Baited cameras lowered to depths exceeding 300m photographed them striking the bait but they were not often caught on handlines near the sea surface.

Family Onychoteuthidae*Onychoteuthis banksi* (LEACH, 1817)

REES & MAUL (1956) recorded this off Madeira on the basis of 47 specimens from *Alepisaurus ferox* stomachs and three with no data. Young squid were commonly caught in research nets, particularly those with larger mouths. In 1983 and 1986, 53 with MLs of 13.9-65mm were caught in 6% of RMT10 hauls and in 38% (1983) and 30% (1986) of the RMT50 net hauls.

Ancistroteuthis lichtensteini (d'ORBIGNY, 1839)

Two specimens with MLs of 210mm and 140mm were collected from a tuna stomach on 17 January 1964 (MMF Nos. 4620 and 4621). These clearly belong to this species from all features but have one interesting difference. The ventral surface of the anterior end of the mantle has an indication of round papillae reminiscent of *Moroteuthis*. Digestion has made this indistinct but it is similar to some *Moroteuthis* from sperm whale stomachs collected by the first author in other regions.

Chaunoteuthis mollis APPELLOF, 1890

One complete female specimen with an ML of over 160mm is referable to this species. There is some discussion that members of this species are really the spent and 'gelified' females of *Onychoteuthis banksi*.

Onykia carribaea LESUEUR, 1821

REES & MAUL (1956) removed this from the list of Madeiran cephalopods published by NOBRE (1937) on the grounds that the position quoted (32° 4'N, 27° 11'W) was too far from Madeira to be included. Two specimens with MLs of 7.6 and 12.1mm were caught off Madeira in 1986. The species is not very common in North Atlantic catches and those taken are young and from the very near surface layers.

Onykia appellofi PFEFFER, 1900

One specimen (MMF No. 17964A), determined and labelled as this species by G. L. VOSS, with an ML of 42mm was collected from the stomach of an *Alepisaurus ferox* caught at Camara de Lobos on 9 December 1960. The status of this species is in doubt and the genus is in need of revision.

Moroteuthis sp.

In 1983, 37 individuals with MLs of 9.0-46.0mm were caught in 33% of the RMT50 hauls. In 1986, seven specimens with MLs of 7.0-50.0mm were caught singly in 14% of the hauls. There is some doubt concerning the independence of the genera *Onykia* and *Moroteuthis* (TSUCHIYA & OKUTANI, 1991) and these specimens could be *Onykia carribaea* at a more advanced stage than the above. Two larger specimens, with MLs of 58mm and 74mm (MMF No. 17032 and MMF 15674) were collected from *Alepisaurus ferox* stomachs on 7 April 1960 and 7 December 1959 respectively.

Family Pholidoteuthidae

Pholidoteuthis boschmai (ADAM, 1950).

Two examples one with an ML of 16.2mm were collected in 1979, one in an RMT8+7 combination and one in an RMT45.

Tetronychoteuthis massyae PFEFFER, 1912

The true relationships of this very poorly known species has long been uncertain but a specimen with an ML of 25.3mm, removed from the stomach of an *Alepisaurus ferox* on 2 March 1959 is in good enough condition to resolve its family and generic status. This specimen has the star-shaped papillae on the mantle which distinguishes *T. massyae* and also has suckers on the tentacles which have the rectangular shape typical of *Pholidoteuthis boschmai* ADAM, 1950 and *P. adami* VOSS 1956. Because *Tetronychoteuthis* PFEFFER 1900 has priority over *Pholidoteuthis* ADAM 1950 the latter should become a synonym and the family should be renamed. We hesitate to do this because the name *Tetronychoteuthis* is clearly unsuitable; the matter will be considered in detail elsewhere.

It is possible that *T. massyae* is a juvenile form of *Pholidoteuthis boschmai* ADAM but further material is required to resolve this. A poorly preserved mantle (ML=20.5mm) caught in 1986 is covered by star shaped papillae and also belongs to this species .

Family Enoploteuthidae

Enoploteuthis anaspis ROPER, 1964

REES & MAUL (1956) recorded three specimens of "*Enoploteuthis leptura* LEACH". In 1964 ROPER made two of these specimens (Nos. 2963 and 3487) paratypes of his new species *Enoploteuthis anaspis*.

Eight specimens with MLs of 14.0-49.5mm were caught in 1983 (1) and 1986 (7).

E. leptura (LEACH, 1817)

Two individuals of this species with MLs of 13.7 and 18.0mm were collected in 1983

Abraliopsis pfefferi JOUBIN, 1896

In 1983, 19 were collected in 29% of RMT10 hauls and 57 in 60% of RMT50 hauls. In 1986, 300 sub-adult and mature specimens were collected in 81% of the RMT50 hauls. Up to 32 were in a single haul and the species was by far the most common species in the hauls. Mantle lengths varied from 9.0 to 37.0mm with a sharp unimodal peak at 20mm.

REES & MAUL (1956), on the basis of six squids from *Alepisaurus ferox* stomachs, with MLs of 8-25mm, recorded the presence of *A. morisii* which was ill defined and has since been split into more than one species. Re-examination has shown that their specimens are *A. pfefferi*.

Abralia redfieldi VOSS, 1955

Ten specimens with MLs of 10.7 to 31.2 mm were caught in two hauls in 1986.

***Abralia veranyi* (RUPPELL, 1844)**

Examination of REES & MAUL's specimens confirms the presence of this species although it was not caught by the 1983 and 1986 RMT series being considered. Four specimens in Funchal Museum (MMF No.2964), with MLs of 33.0, 37.0, 37.6 and 41.0mm have no data but also belong to this species.

Family Pyroteuthidae***Pyroteuthis margaritifera* (RUPPELL, 1844)**

This species was recorded by REES & MAUL from two specimens (MLs 35mm) taken from *Alepisaurus ferox* stomachs. This was among the commonest species taken. In 1983, two were caught in RMT10s and 34 in 40% of RMT50 hauls and in 1986, 69 were caught in 59% of RMT50 hauls. MLs ranged from 9.0 to 44mm and they included fully mature adults.

***Pterygoteuthis gemmata* CHUN, 1910**

In 1983, 18 individuals were caught in 34% of RMT10 hauls and 72 in 65% of RMT50 hauls. In 1986, 84 were caught in 49% of RMT50 hauls. They included mature individuals and their MLs ranged from 11.0 to 29.0mm.

***Pterygoteuthis giardi* FISCHER, 1896**

In 1983, 14 and in 1986, 7 individuals were caught. They included mature individuals and had MLs of 10.2-18.3mm.

Family Ancistrocheiridae***Ancistrocheirus lesueuri* (d'ORBIGNY, 1839)**

Beaks of this species were collected from a sperm whale by CLARKE (CLARKE & MACLEOD, 1974) at Caniçal. These were from squids with MLs of about 180mm. Although these could have been carried to the area by the sperm whales, the occurrence of small individuals in nets makes it likely that adults (which may reach over 350mm ML) are present locally. Single small specimens were collected in trawls in 1986 and 1976. One had an ML of 22.3mm. Six young individuals were also caught in 1961. The small individuals could be referred to *Thelidoteuthis alessandrini* (VERANY, 1851) which should probably be considered a synonym of the species.

Family Brachioteuthidae***Brachioteuthis riisei* (STEENSTRUP, 1882)**

Recorded by REES & MAUL on the basis of a specimen noted by NOBRE at 31° 45'N, 20° 17'W the species can now be established as truly Madeiran from 31 individuals caught during 1983 and 1986. These had MLs of 17.0-76.4mm and were caught in 32% of the RMT50 hauls in both years. On two occasions two were caught in a haul but only single individuals were caught in all other hauls.

The taxonomy of this genus requires revision but this material all appears to belong to one species and agrees with descriptions of *B. riisei*.

Family Histioteuthidae*Histioteuthis bonnellii* (FERRUSAC, 1835)

While dismissing the record of NOBRE (1937) as too far from Madeira, REES & MAUL recorded the species (as *Histioteuthis bonelliana*) from Madeira on the grounds of one small individual from an *Aphanopus carbo* stomach and a photograph of a large brachial crown taken from a sperm whale's stomach. CLARKE (1962) collected 20 specimens from the stomach of a sperm whale flensed at Caniçal in 1959) which had MLs of 90-155mm. It is remarkable that this species was not caught in the RMT nets.

Histioteuthis dofleini (PFEFFER, 1912)

In 1983, 16 individuals were caught in 29% of the RMT10 hauls and 117 in 70% of RMT50 hauls. In 1986 73 individuals were caught in 58% of the RMT50 hauls. In 1986 they had MLs ranging from 5.0 to 150.0mm. The "? *Calliteuthis* sp." found by CLARKE in a sperm whale in 1959 was probably this species.

Histioteuthis meleagroteuthis (CHUN, 1910)

In 1983, three individuals and, in 1986, two individuals were caught in RMT10 (2) and RMT50 (3) hauls. Their MLs were 0.7-91.0mm.

Histioteuthis celetaria celetaria (VOSS, 1960)

Nine individuals were caught in 1983, eight in RMT50 hauls and one in an RMT10 haul. Their MLs were 14.8-34.7mm.

Histioteuthis corona (VOSS & VOSS, 1962)

One male (MMF No. 5583) with an ML of approx. 70 mm was collected from the stomach of an *Aphanopus carbo* on 2 May 1955 and identified by G. VOSS.

Histioteuthis reversa (VERRILL, 1880)

One specimen (MMF No. 9795) in poor condition with an ML of approx. 85mm was removed from an *Aphanopus carbo* stomach in September 1956. This was identified by VOSS & VOSS (1962) as *H. elongata* (VOSS & VOSS, 1962) which is now regarded as a synonym (Rodhouse, personal communication).

One head (MMF No. 13994) was removed from the stomach of an *Aphanopus carbo* in May 1958.

Family Bathyteuthidae*Bathyteuthis abyssicola* HOYLE, 1885

One individual was caught in an RMT10 and one in an RMT50 haul in 1983 and two were caught in 1986. Their MLs were 10.4-45.7mm.

Family Neoteuthidae*Neoteuthis* sp.

Four individuals were caught in 1983 and eight in 1986 in RMT50 hauls. They had MLs of

19.2-62.7mm The only named species is *Neoteuthis thielei* NAEF, 1921 from the Antarctic. The genus is not well known and specimens from outside the Antarctic have not been referred to any species (ROPER, 1992).

Family **Cycloteuthidae**

Discoteuthis discus YOUNG & ROPER, 1969

Two individuals having MLs of 20.0 and 70.0mm were caught in RMT50s in 1986.

Discoteuthis laciniosa YOUNG & ROPER, 1969

One individual with an ML of 99.6mm was caught in 1983 in an RMT50 haul. Two specimens were collected from *Aphanopus carbo* stomachs, one in November 1956 with an ML of 67mm (MMF No. 10405) and one in December 1956 with an incomplete mantle (10683).

Family **Octopoteuthidae**

Octopoteuthis sicula RUPPELL, 1844

In 1983, one individual and in 1986, six individuals having MLs of 19.8-88.0mm were caught in RMT50s.

An *Octopoteuthis* having a DML of 42.0mm was taken from the stomach of *Aphanopus carbo* on 5 September 1955 (MMF No. 6267) and fits the description of the Pacific species *O. deletron* YOUNG, 1972. However, in view of the condition of the specimen and the previous known distribution, this identification needs verification from more material.

Taningia danae Joubin, 1931

Recorded by REES & MAUL (1956) as *Cucoteuthis unguiculata* (MOLINA) on the basis of a record by JOUBIN from 32° 32'N, 19° 24'W and a brachial crown floating near the west shore of Madeira, a specimen with an ML of 1400mm and in very good condition was collected from a sperm whale's stomach which was processed at Caniçal on 10.8.59 and later described in detail (CLARKE, 1962a, 1967). In 1983 two individuals and in 1986, one individual were caught in RMT50 hauls. They had MLs of 24.5-37.0mm.

Family **Mastigoteuthidae**

Mastigoteuthis magna JOUBIN, 1913

In 1983, 22 individuals were caught in 31% of the RMT10 hauls and 25 were caught in 30% of the RMT50 hauls. In 1986, 83 individuals were caught in 48% of the RMT50 hauls. They had MLs ranging from 18.0 to 135.0 mm

Mastigoteuthis glaucopsis CHUN, 1908

In 1983, six individuals and in 1986, two individuals were caught in RMT10 (2) and RMT50 (6) hauls. They had MLs of 37.0-90.4mm.

Mastigoteuthis hjorti CHUN, 1913

In 1983, one individual and in 1986 four individuals with MLs of 94.5-121.0mm were caught

in RMT50 hauls.

Mastigoteuthis schmidti DEGNER, 1925

REES & MAUL (1956) tentatively recorded *M.schmidti* DEGNER on the basis of an individual from an *Alepisaurus ferox* stomach. In 1983, eight individuals and in 1986, ten individuals with MLs of 36.6 -107.8mm were caught in RMT10 (1) and RMT50 (17) hauls. They were all caught singly except for three in one net.

Family **Chiroteuthidae**

Chiroteuthis veranyi (FERRUSAC, 1835)

REES & MAUL (1956) recorded the species from one doratopsis larval form caught at the surface in 1948. In 1983, six individuals and in 1986, four individuals with MLs of 44.5-95.0mm were caught in RMT10 (1) and RMT50 hauls. Fourteen doratopsis larvae, probably belonging to this species, were also caught in 1983 and 1986. They had MLs of 28.0-95.0mm.

Chiroteuthis sp.

A specimen with an ML of 115mm was collected from the stomach of an *Aphanopus carbo* on 4 June 1958 (MMF no. 14041A) and was identified as *Chiroteuthis (Chirothauma) picteti* JOUBIN, 1894 by G. VOSS. However, it differs in several respects from this and descriptions of other *Chiroteuthis*.

Valbyteuthis sp.

In 1983, four individuals having MLs of 42.0-118.4mm were caught. They were in too poor a condition to identify to species

Family **Joubiniteuthidae**

Joubiniteuthis portieri (JOUBIN, 1912)

One juvenile (ML= 34mm) was reported from an *Aphanopus carbo* stomach, collected in Madeira, by YOUNG & ROPER (1969). In 1983, five individuals and in 1986 eight individuals were collected from RMT10 (2) and RMT50 hauls. They had MLs of 25.0-84.7mm.

Family **Grimalditeuthidae**

Grimalditeuthis bonplandi (VERANY, 1837)

In 1986, two individuals in poor and two in good condition, the latter with MLs of 98.0 and 32.0mm were caught.

Family **Lepidoteuthidae**

Lepidoteuthis grimaldii JOUBIN, 1895

REES & MAUL (1956) recorded the species from the stomachs of sperm whales in Madeira, but gave no details. Later, CLARKE & MAUL (1962) described eight bodies with MLs of 155.0-970.0mm from stomachs of sperm whales, *Aphanopus carbo* and *Germo obesus* collected at Madeira. One body of a young individual with an ML of 55.0mm was caught in

an RMT50 in 1986.

Family Cranchiidae

Cranchia scabra LEACH, 1817

REES & MAUL (1956) recorded two individuals (MLs = 105 and 110mm) from *Alepisaurus ferox* stomachs and one from Funchal harbour at night. In 1983, ten individuals and in 1986, eleven individuals were caught in RMT10 (4) and RMT50 hauls. They had MLs of 9.2-78.2mm.

Liocranchia reinhardti (STEENSTRUP, 1856)

This species was the second most common. In 1983, 5 were caught in 14% of RMT10 and 35 were caught in 43% of RMT50 hauls. In 1986, 142 individuals were caught in 76% of the RMT50 hauls. MLs ranged from 10.0mm to 141.0mm with a peak at 10-35mm.

Helicocranchia pfefferi MASSY, 1907

In 1983, 19 individuals were caught, one in an RMT10 and the rest in RMT50 hauls. In 1986, 101 individuals were caught in 58% of the RMT50 hauls. ML's ranged from 16.0-78.5mm. Two adults with MLs of 78.3 and 78.5mm were unlike previous descriptions and will be described elsewhere.

Leachia cyclura LESUEUR, 1821

Recorded by JOUBIN from 32° 34'N, 17° 45'W its presence was confirmed by REES & MAUL (1956) with two individuals (MLs 23 and 145mm) from stomachs of *Alepisaurus ferox*. Only six examples were caught in 1983 and 1986 and those were all in poor condition. Their MLs were 16.5-88.3mm. The largest was a male.

Bathothauma lyromma CHUN, 1906

In 1983, seven individuals and in 1986, 14 individuals were caught in 20% of RMT50 hauls. All were caught as single individuals except in one net in which two were caught. Their MLs were 17.0-145.6mm.

Megalocranchia abyssicola (GOODRICH, 1896)

We refer 49 individuals to this species although we recognise that the genus is in process of revision (N. VOSS et al, 1992) and the specific name may have to be changed in the light of future work. In 1983, 13 individuals were caught, two in RMT10 hauls and 11 in 20% of RMT50 hauls. In 1986, 38 were caught in 35% of the RMT50 hauls. Their ML's were 21.0-185.0mm.

Phasmatopsis cymoctypus ROCHEBRUNE, 1884

Recorded by REES & MAUL (1956) as *Taonius cymoctypus*, this species was described on the basis of a single individual found dead and floating at the sea surface within sight of Madeira. A second specimen, also found dead at the sea surface was collected 200 miles west of Madeira and was referred to this species and described by CLARKE (1962b). Although

VOSS, in her generic revision of the Cranchiidae (1980) stated that *Phasmatopsis* is a *nomen dubia*, VOSS et al (1992) have expressed doubt regarding the validity of the generic independence from *Megalocranchia* of these two specimens and we feel we must await further argument before removing *Phasmatopsis* from the nomenclature. The MLs of de ROCHBRUNE's specimen was 790mm and that of CLARKE's was 810mm.

Teuthowenia megalops (PROSCH, 1849)

In 1983, one individual was caught in an RMT10 and in 1986 two individuals were caught in RMT50 hauls. Their MLs were 12.0-70,3mm.

Taonius pavo LESUEUR, 1821.

REES & MAUL (1956) recorded this species from one macerated specimen (ML= 275mm) taken from the stomach of *Alepisaurus ferox*. In 1983, 16 individuals were caught in 40% of RMT10 hauls and 7 in 10% of RMT50 hauls. In 1986, 131 individuals were caught in 60% of the RMT50 hauls. MLs ranged from 12.0 to 480mm and in 1986 MLs had a peak at 95.0mm.

Family **Vampyroteuthidae**

Vampyroteuthis infernalis CHUN, 1903

In 1983, ten individuals were caught, two in RMT10s and eight in 17% of the RMT50 hauls. In 1986 four were caught. They had MLs of 18.0-110.0mm.

Family **Bolitaenidae**

Bolitaena microcotyla STEENSTRUP, 1886.

Three specimens were collected 3 December 1954 and 14 April 1959 (MMF Nos. 4831, 15675, 15677), one from the stomach of *Alepisaurus ferox* and two from *Aphanopus carbo*. They had MLs of 31.0, 34.0, and approx. 35mm.

Japetella diaphana HOYLE, 1885

REES & MAUL (1956) reported 12 individuals (50-85mm) in the stomachs of seven *Alepisaurus ferox*. In 1983, 20 individuals were caught in 29% of RMT10 hauls and 44 individuals were caught in 46% of RMT50 hauls. In 1986, 89 individuals were caught in 52% of the RMT50 hauls. Their MLs ranged from 6-36mm. Seven of those caught in 1983 had the transient circumoral light organs found in females.

Eledonella pygmaea VERRILL, 1884

REES & MAUL recorded one specimen with an ML of 150mm from the stomach of *Alepisaurus ferox*. In 1983, one was caught in an RMT10 and six were caught in three RMT50 hauls. In 1986 one individual was caught. Their MLs were 32.8-60.0mm.

Family **Vitreledonellidae**

Vitreledonella richardi JOUBIN, 1918

NOBRE recorded the species near 33° 40'N, 19°W which was accepted as a Madeiran record

by REES & MAUL. In 1983, one individual was caught and in 1986, four were caught. Their MLs were 12.2- 69.1mm.

Family **Tremoctopodidae**

Tremoctopus violaceus DELLE CHIAJE, 1830

REES & MAUL recorded three individuals with total lengths of 305, 480 and 510mm. One specimen was caught in 1983.

Family **Argonautidae**

Argonauta argo LINNEUS, 1758

REES and MAUL noted that females with MLs of 20-100mm are found in *Alepisaurus ferox* stomachs in large numbers.

Argonauta hians SOLANDER, 1786.

One individual and one head were collected in 1983. The ML of the complete specimen was 13.0mm.

Family **Ocythoidae**

Ocythoe tuberculata RAFINESQUE, 1814

Two males with MLs of 11.9 and 12.0mm were caught in RMT50 hauls in 1986.

Family **Alloposidae**

Alloposus mollis VERRILL, 1880

REES & MAUL recorded nine females from *Alepisaurus ferox* stomachs and one other (ML= 115mm).

A re-examination of eight of these (Nos. 2960, 3491, 3494 and 3804) show them to be either *Pteroctopus tetracirrhus* or, in one case (3494), another octopodid. The identity of the remaining two specimens could not be checked. However the presence of the species off Madeira can be confirmed as one *Alloposus mollis*, was caught on a cruise in 1979. The species contributed 0.8% of the lower beaks collected from a sperm whale in 1959 (see CLARKE & MACLEOD, 1974).

Family **Octopodidae**

Octopus vulgaris LAMARCK, 1798

Recorded by REES & MAUL from a number of specimens.

Octopus macropus RISSO, 1826

REES & MAUL confirmed the record of WHITE & JOHNSON (1860) by listing six more individuals.

Octopus defilippi VERANY, 1851

One "macrotritopus" stage with an ML of 17.0mm was caught in 1986. The taxonomic status of this larval form was discussed by HOCHBERG et. al (1992).

Scaevurgus unicolorrhus (d'ORBIGNY, 1840)

The species was recorded for Madeira from a juvenile female with an ML of 20mm caught on 14 August 1990 at 32° 41.70' N, 16° 45.73' W in a dredge fished at 150m depth (GONCALVES & MARTINS, 1992).

Pteroctopus tetracirrhus (delle CHIAJE, 1890)

The species was first recorded for Madeira from a mature male with an ML of 98mm caught on 26 May 1991 at 32° 37.00' N, 16° 50.75' W at a depth of 791 m. with the manipulator arm of a submersible (GONCALVES & MARTINS, 1992).

A re-examination of seven females of the *Alloposus mollis* recorded by REES & MAUL (Nos. 2960, 3491 and 3804) show them to be *Pteroctopus tetracirrhus*. They had total lengths of 80-117mm.

Family **Opisthoteuthidae***Opisthoteuthis agassizi* VERRILL, 1883

One individual weighing 1.22Kg. was caught in 1976 at Discovery Station 8977 in an OTSB14 bottom haul.

DISCUSSION

The present collection increases the list of Madeiran cephalopods from 35 species to 77 species; an increase of 42 records. This is not surprising since much midwater trawling has been carried out in the close proximity of Madeira since REES & MAUL's 1956 paper. As there is no barrier to species movement between the area described and the open Atlantic, one would expect the list to include all species present in oceanic waters at about that latitude (32°N) in the eastern North Atlantic as well as inshore species such as the *Loligo* and *Octopus* species. It is therefore pertinent to compare the present list with the extensive sampling, of 618 cephalopods described by CLARKE & LU (1974) at 30°N, 23°W. The species not collected off Madeira, up to now, but recorded at 30°N, 23°W are *Cycloteuthis sirventi* Joubin, 1919, *Pyrgopsis pacifica* (ISSEL, 1908), *Galiteuthis triluminosa* LU & CLARKE, 1974 and *Selenoteuthis scintillans* VOSS, 1958. Of these *Pyrgopsis pacifica* (in the Atlantic) is now regarded as young stages of *Leachia atlantica* (see N. VOSS et al, 1992) and the *Galiteuthis triluminosa* is regarded as a synonym of *Taonius pavo* (see N. VOSS, 1980). *Cycloteuthis sirventi* and *Selenoteuthis scintillans* are very rare and their absence is easily accountable. Thus from this comparison, the only oceanic species which may be expected in Madeiran oceanic waters, which have not yet been found, are *Cycloteuthis sirventi* and *Selenoteuthis scintillans*. G. VOSS labelled two badly digested specimens "*Cycloteuthis* sp." in the Funchal Museum (MMF Nos. 10405, 10683) but their lower beaks clearly show these to be *Discoteuthis laciniosa* and we have included them under that heading.

Species common in net hauls but not recorded by REES & MAUL (1956) are *Pterygioteuthis gemmata*, *Histioteuthis dofleini*, *Mastigoteuthis magna*, *Liocranchia reinhardti* and *Helicocranchia pfefferi*.

The paucity of *Histioteuthis bonnellii* in the net hauls is remarkable since remains including beaks were very numerous in the diet of the whale sampled; it comprised over 88% of all lower beaks. The whale probably catches the species close to the bottom in the deep canyons fringing the islands and possibly this accounts for so few being caught by nets which are fished to avoid such hazardous areas.

REES & MAUL (1956) divided the species in their list according to general habitats. More recent data suggests the following groups are present in the fauna.

1. Inshore fauna:

Sepia officinalis, *Heteroteuthis dispar*, *Sepietta oweniana*, *Loligo vulgaris*, *L. forbesi*, *Octopus vulgaris*, *O. macropus*, *O. defilippi*, *Scaevargus unicirrhus*.

2. Associated with the deeper island slopes mainly for spawning:

Architeuthis sp., *Todarodes sagittatus*, *Pholidoteuthis boschmai*, *Ancistrocheirus lesueuri*, *Taningia danae*, *Histioteuthis bonnellii*, *Lepidoteuthis grimaldii*, *Alloposus mollis*, *Opistoteuthis agassizi*, *Pteroctopus tetracirrhus*.

3. Near surface:

Onychia carribaea, *Argonauta argo*, *A. hians*.

4. Oceanic, Epipelagic:

Cranchia scabra, *Liocranchia reinhardti*, *Helicocranchia pfefferi*, *Ocythoe tuberculata*, *Tremoctopus violaceus*.

5. Mesopelagic (some also epipelagic at night):

Spirula spirula, *Ommastrephaes bartrami*, *Sthenoteuthis pteropus*, *Onychoteuthis banksi*, *Ancistroteuthis lichtensteini*, *Choanoteuthis mollis*, *Moroteuthis* sp., *Thysanoteuthis rhombus*, *Enoploteuthis anaspis*, *E.leptura*, *Abraliopsis pfefferi*, *Abralia redfield*, *Pyroteuthis margaritifera*, *Pterygioteuthis gemmata*, *P.giardi*, *Brachioteuthis riisei*, *Histioteuthis dofleini*, *H.reversa*, *H.meleagroteuthis*, *H.corona*, *H.elongata*, *H.reversa*, *H.celetaria*, *Ctenopteryx sicula*, *Bathyteuthis abyssicola*, *Neoteuthis* sp., *Discoteuthis discus*, *D.laciniosa*, *Octopoteuthis sicula*, *Mastigoteuthis magna*, *M.glaucopsis*, *M.hjorti*, *M.schmidti*, *M.grimaldii*, *Chiroteuthis veranyi*, *C.picteti*?, *Valbyteuthis* sp., *Joubiniteuthis portieri*, *Grimalditeuthis bonplandi*, *Leachia cyclura*, *Bathothauma lyromma*, *Megalocranchia abyssicola*, *Phasmatopsis cymoctypus*, *Teuthowenia megalops*, *Taonius pavo*, *Vampyroteuthis infernalis*, *Japetella diaphana*, *Bolitaena microcotyl*, *Vitreledonella richardi*, *Eledonella pygmaea*.

REFERENCES

BAKER A DE C., CLARKE, M. R. & HARRIS, M. J.:

1973. The N.I.O. combination net (RMT 1+8) and further developments of rectangular midwater trawls. *J. Mar. Biol. Assoc. of the U.K.* **53**, 167-84.

CLARKE, M. R.:

- 1962a. Stomach contents of a sperm whale caught off Madeira in 1959. *Norsk Hvalfangst-Tidende*.(5), 173-91.
- 1962b. A large member of the squid family Cranchiidae, *Phasmatopsis cymoctypus* de Rochebrune 1884. *Proc. Malac. Soc.* **35**, 27-42.
1967. A deep sea squid, *Taningia danae* JOUBIN, 1931. *Symp zool. Soc. Lond* No.19, 127-143.
1969. A new midwater trawl for sampling discrete depth horizons. *J. Mar. Biol. Assoc. of the U.K.* **49**, 945-60.
1970. Growth and development of *Spirula spirula*.. *J. Mar. Biol. Assoc. of the U.K.* **50**, 53-64.

CLARKE, M. R. & LU, C. C.:

1974. Vertical distribution of cephalopods at 30°N 23°W in the North Atlantic. *J. Mar. Biol. Assoc. of the U.K.* **54**, 969-984.
1975. Vertical distribution of cephalopods at 18°N 23°W in the North Atlantic. *Ibid*, **55**, 165-182.

CLARKE, M. R. & MACLEOD, N.:

- 1974 Cephalopod remains from a sperm whale caught off Vigo, Spain. *Ibid*, **54**, 1-10.

CLARKE, M. R. & MAUL, G. E.:

1962. A description of the "scaled" squid *Lepidoteuthis grimaldi* Joubin 1895. *Proc. zool. Soc. Lond.* **139**, 97-118.

CLARKE, M. R. & PASCOE, P. L.:

1985. The influence of an electric light on the capture of deep-sea animals by a midwater trawl. *J. Mar. Biol. Assoc. of the U.K.*, **65**, 373-393.

GIRARD, A. A.:

1892. Les cephalopods des iles Acores et de l'ile de Madere. *J. Cien Math. Fis.*

Na. Lisboa, Vol 1892.

GONCALVES, J. M. & MARTINS, H. R.:

1992. Additions to the Octopoda (Mollusca: Cephalopoda) fauna of Madeira. *Bocagiana Funchal Mus.*(157), 1-10.

HOCHBERG, F. G., NIXON, M. & TOLL, R. B.:

1992. Order Octopoda Leach, 1818. In: "Larval" and juvenile cephalopods: A manual for their identification. SWEENEY, M., ROPER, C.F.E., MANGOLD, K., CLARKE, M. R. & BOLETZKY S.v, (Eds). *Smithsonian Contributions to Zoology*, 513 p.168-171

MARTINS, H. R.:

1982. Biological studies of the exploited stock of *Loligo forbesi* (Mollusca: Cephalopoda) in the Azores. *J. Mar. Biol. Assoc. of the U.K.*, 62, 799-808.

NESIS, K.:

1985. Cephalopods of the World. T.K.H. publications Ltd. Ascot England. 351pp.

NOBRE, A.:

1937. Moluscos testaceos marinhos do Arquipelago da Madeira. *Mem. Mus. Zool. Univ Coimbra*, 1937 (1) No. 8, 1-101.

PASCOE, P.:

1991. Light and the capture of marine animals. In *Light and Life in the Sea*. HERRING, P. J., CAMPBELL, A. K., WHITFIELD, M. & MADDOCK, L. (eds). p. 229-244

REES, W. J. & MAUL, G. E.:

1956. The Cephalopoda of Madeira. *Bull. Brit. Mus. (Nat. Hist.). Zool.* 3, 257-281.

ROPER, C. F. E. & CLARKE, M. R.:

1992. Joubiniteuthidae. Family accounts. In "Larval" and juvenile cephalopods: A manual for their identification. SWEENEY, M., ROPER, C.F.E., MANGOLD, K., CLARKE, M. R. & BOLETZKY S.v, (eds). *Smithsonian Contributions to Zoology*, 513: 179.

SWEENEY, M. ROPER, C. F. E., MANGOLD, K., CLARKE, M. R. & BOLETZKY, S.V.:

1992. "Larval" and Juvenile Cephalopods: A Manual for Their Identification.

Smithsonian Contributions to Zoology. (513). Institution Press. Washington, D. C. 282pp.

SWINNEY, G. N., CLARKE, M. R. & MADDOCK, L.:

1986. Influence of an electric light on the capture of deep-sea fish in Biscay. *J. Mar. Biol. Assoc. of the U.K.*, **66**, 483-496.

TSUCHIYA, K & OKUTANI, T.:

1991. Growth stages of *Moroteuthis robusta* (VERRILL, 1881) with the re-evaluation of the genus. *Bull. Mar. Sci.* **49**, 137-147.

VOSS, N.:

1980. A generic revision of the Cranchiidae (Cephalopoda; Oegopsida). *Bull. Mar. Sci.* **30** (2), 365-412.

VOSS, N. A., STEPHEN, S. J. & DONG, Z. H.:

1992. Cranchiidae Prosch, 1849. Family accounts. In: "Larval" and juvenile cephalopods: A manual for their identification. SWEENEY, M., ROPER, C.F.E., MANGOLD, K., CLARKE, M.R. & BOLETZKY S.v, Eds). Smithsonian Contributions to Zoology, **513**: 187-211.

TABLE 1 - List of species from Madeiran waters. Asterix = new records for the area. Last column indicates years specimens were caught during cruises by RRS "Discovery" and RRS "Challenger" other than in 1983 and 1986. The collections in 1959 were made by the first author during a visit to Madeira.

	REES and MAUL, 1956	1959	1983	1986	New
<i>Spirula spirula</i>	shells		4	13	
<i>Sepia officinalis</i>	Common				
<i>Heteroteuthis dispar</i>	29°2'N, 14°49'W		10	15	
<i>Sepietta oweniana</i>	2 individuals				
<i>Loligo vulgaris</i>	few small	Market			
<i>L. forbesi</i>	common	?			
<i>Ctenopteryx siculus</i>			24	53	* and in 1975, 76, 79
<i>Architeuthis</i> sp.	1 from vomit of sperm whale	Sperm whale			
<i>Thysanoteuthis rhombus</i>	school of about 20	1 market			
<i>Ommastrephes bartrami</i>	<i>O. caroli</i>	market		2	*
<i>Sthenoteuthis pteropus</i>	many mixed with <i>O. bartrami</i>	surface/market		4	
<i>Todarodes sagittatus</i>	Many	market	3	12	
<i>Onychoteuthis banksi</i>	47 from <i>Alepisaurus</i>	Sperm whale	25	28	
<i>Ancistroteuthis lichtensteini</i>	(Funchal Museum, Tuna 1964)				
<i>Chaunoteuthis mollis</i>			1		* and in 1976
<i>Moroteuthis</i> sp.			37	7	*
<i>Onykia carribea</i>	31°N, 27°W			2	*
<i>Onykia appellofi</i>					* 1 in 1960
<i>Tetronychoteuthis massyae</i>	(Funchal Museum, <i>Alepisaurus</i> , 1959)			1	* 1 in 1979
<i>Pholidoteuthis boschmai</i>					* 2 in 1979
<i>Enoploteuthis anaspis</i>	<i>E. leptura</i>		1	7	*
<i>E. leptura</i>			2		
<i>Abraliopsis pfefferi</i>	<i>A. morisii</i>		76	300	*
<i>Abraila redfieldi</i>	<i>A. veranyi</i>			10	*
<i>A. veranyi</i>	<i>A. veranyi</i>				
<i>Pyroteuthis margaritifera</i>	2 from <i>Alepisaurus</i>		36	69	
<i>Pterygoteuthis gemmata</i>			90	84	*
<i>P. giardi</i>			14	7	*
<i>Ancistrocheirus lesueurii</i>		sperm whale		1	* 1 in 1976 & 6 in 1961
<i>Brachioteuthis riisei</i>	<i>B. riisei</i> , 31°45'N, 20°17'W		16	15	
<i>Histioteuthis bonnellii</i>	<i>H. bonnelliana</i> , 1 from <i>Alepisaurus</i>	Sperm whale			in 1975
<i>H. dofleini</i>			133	73	*
<i>H. meleagroteuthis</i>			3	2	* and in 1979
<i>H. celetaria</i>			9		*
<i>H. corona</i>					* 1 in 1955
<i>H. reversa</i>					* 1 in 1956 & 1958
<i>Bathyteuthis abyssicola</i>			2	2	* and in 1979
<i>Neoteuthis</i> sp.			4	8	* and in 1979
<i>Discoteuthis discus</i>				2	*
<i>D. laciniosa</i>	2 from aphanopus		1		*
<i>Octopoteuthis sicula</i>			1	6	*
<i>Taningia danae</i>	<i>Cucoteuthis unguiculata</i>	Sperm whale	2	1	
<i>Mastigoteuthis magna</i>			47	83	*
<i>M. glaucopsis</i>			6	2	*
<i>M. hjorti</i>			1	4	
<i>M. schmidti</i>	1 from <i>Alepisaurus</i>		8	10	
<i>Chiroteuthis veranyi</i>	1 <i>Doratopsis</i> larva		6	4	
<i>Chiroteuthis</i> sp.					1 in 1958
<i>Doratopsis</i>			7	7	
<i>Vafhyteuthis</i> sp.			4		*

(Cont.)	REES and MAUL, 1956	1959	1983	1986	New
<i>Joubiniteuthis portieri</i>			5	8	*
<i>Grimalditeuthis bonplandi</i>				4	*
<i>Lepidoteuthis grimaldii</i>	from sperm whale	sperm whale		1	
<i>Cranchia scabra</i>	1 + 1 from <i>Alepisaurus</i>		10	11	
<i>Liocranchia reinhardti</i>			40	142	*
<i>Helicocranchia pfefferi</i>			20	101	*
<i>Leachia cyclura</i>	2 from <i>Alepisaurus</i>		3	3	22 in 1979
<i>Bathothauma lyromma</i>			7	14	* 21 in 1979
<i>Megalocranchia abyssicola</i>			13	38	*
<i>Phasmatopsis cymoctypus</i>	<i>Taonius cymoctypus</i> , 1	Phasmatopsis			
<i>Teuthowenia megalops</i>			1	2	*
<i>Taonius pavo</i>	1 from <i>Alepisaurus</i>		23	131	
<i>Vampyroteuthis infernalis</i>			10	4	*
<i>Japetella diaphana</i>	12 from <i>Alepisaurus</i>		64	89	
<i>Bolitaena microcotyla</i>			5		3 in 1954 & 1959
<i>Eledonella pygmaea</i>	1 from <i>Alepisaurus</i> Nobre record		7	1	
<i>Vitreledonella richardi</i>	Nobre record		1	4	
<i>Tremoctopus violaceus</i>	3 individuals		1		
<i>Argonauta argo</i> L.	From <i>Alepisaurus</i> and shells				1 in 1975
<i>A. hians</i>			1		*
<i>Ocythoe tuberculata</i>				2	*
<i>Alloposus mollis</i>	(from <i>Alepisaurus</i>)	Sperm whale			1 in 1979
<i>Octopus vulgaris</i>	<i>O. vulgaris</i>			1	
<i>O. macropus</i>	6 individuals				
<i>O. defilippi</i>				1	*
<i>Scaevargus unicolor</i>					* 1 in 1990
<i>Pteroctopus tetracirrus</i>	7 Incorrectly named <i>Alloposus</i>				* 1 in 1991
<i>Opisthoteuthis agassizi</i>					* 1 in 1976
Total number			2767	3377	