

CEPHALOPODA FROM THE TROPICAL EASTERN ATLANTIC OCEAN

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ABSTRACT

Ten species of Cephalopoda are described. One species, *Leachia atlantica* (Degner, 1925), is reported for the first time since the original description. Most of the specimens are larvae or juveniles.

The Galathea Deep-Sea Expedition of 1950-52 collected 16 specimens of cephalopods, pertaining to ten species, off the West African coast. The station list and species collected are given in Table 1. Since the tropical eastern Atlantic has been fairly well sampled (see Clarke 1966, fig. 1) the present collection contains no new species. However, one of the species described, *Leachia atlantica* (Degner, 1925) is reported for the first time since the original description.

Most of the specimens in the present collection are larvae or juveniles. This may be due to the ability of cephalopods, and especially of the larger animals, to avoid nets. In this respect it is of interest to note that all the types of fishing gear listed in

Table 1, with the exception of the shrimp otter trawl, have an opening of 3 m or less. It is also interesting that six species (10 specimens) of cephalopods were collected at Station 8, as opposed to only one species (1-3 specimens) at each of the other stations, since the haul at Station 8 was carried out after dark whereas the others were made by daylight (Table 1).

The abbreviations used in the text and in Table 1 are as follows:-

HYDR	Hydrographic gear.
I, II, III, IV	Dorsal, dorsolateral, ventrolateral and ventral arms, respectively.
MLd	Dorsal mantle length, in mm.
MW	Metres wire out.
S 200 C	Stramin net, circular opening, diameter 200 cm.
SOT	Shrimp Otter Trawl.
ST 300	Sledge Trawl, 3 m wide; single bag.

For further details of fishing gear, see Bruun (1959).

ENOPLOTEUTHIDAE

Abraliopsis sp.

(Fig. 1)

Material:

St. 31: 1 juvenile, MLd 7 mm.

Description: Mantle elongate conical, anterior margin produced dorsally, emarginate ventrally; with two longitudinal rows and a third incomplete

intermediate row of photophores on either side of the ventral midline.

Fins terminal, fairly large, length 57 %, combined width 86 % MLd.

Head with three longitudinal rows and several scattered photophores, the median row branching posteriorly, the two lateral rows continuing along the lateral aboral surfaces of arms IV. A row of 6-7

Table 1. List of stations and the species collected.

Station	Locality	Position	Bottom depth in m	Date	Hour	Gear	Metres wire out	Species collected
8	Tenerife -Dakar	16°58'N, 18°16'W	3070	3.11.50	2000-2100	S 200 C	400-1200	<i>Liocranchia reinhardti</i> , 2 juvs <i>Leachia atlantica</i> , 1 larva ? <i>Cranchia scabra</i> , 3 juvs <i>Teuthowenia megalops</i> , 2 larvae unidentified oegopsid, 1 larva <i>Octopus</i> sp., 1 larva
30	Monrovia -Takoradi	0°42'N, 5°59'W	5160	18.11.50	1000-1105	ST 300	7000	<i>Enoploteuthis</i> sp., 1 specimen
31	Monrovia -Takoradi	1°56'N, 4°37'W	4930	19.11.50	0925	HYDR	3000	<i>Abraliopsis</i> sp., 1 juv.
52	San Tomé -Cameroon	1°42'N, 7°51'E	2550	30.11.50	1200-1250	SOT	4500	<i>Japetella diaphana</i> , 1 ♂
137	Off S.W. Africa	20°04'S, 11°56'E	537	23.12.50	1130-1230	ST 300	1000	<i>Histioteuthis reversa</i> , 3 ♀

photophores also present around each eyelid, and in addition there are five photophores on the ventral

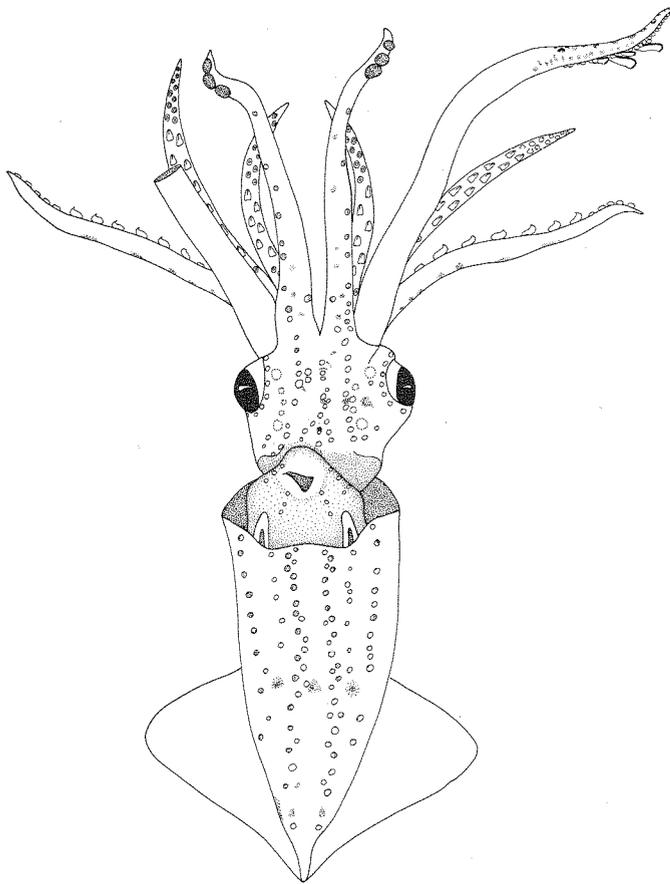


Fig. 1. *Abraliopsis* sp. juvenile, MLd 7 mm, ventral view.

surface of the eye bulbus. Of these, the two terminal photophores are much larger than the three intermediate ones.

Funnel well developed, with four rows of about three photophores. Funnel locking cartilage with a simple straight groove. Dorsal pads of funnel organ \square -shaped, with anterior angles thickened. Funnel valve present.

Arms fairly well developed, longest ventrally, shortest dorsally. Dorsal and lateral arms with one pair of suckers basally, then a number of biserial hooks (6 on I, 12 on II and III); about ten suckers present distally. Arms IV with suckers only, extending almost to arm tip. Tips of arms IV with three large black photophores, characteristic of *Abraliopsis*, the distal photophores being smaller than the others. Protective membranes well developed distally on arms I-III, supported by transverse trabeculae; protective membranes apparently absent from arms IV. Keel present distally on II and III, and laterally on IV.

Left tentacular club with five hooks on the manus: the ventral row with two large and one small distal hook, the dorsal row with two small hooks, about half the size of the large ventral hooks and equal in size to the smaller ventral hook. Distinct carpal cluster present, with four suckers and four pads; suckers on dactylus arranged in four longitudinal rows. Low protective membranes present on the club, but no evidence of keel or lateral membrane.

The photophores on head, mantle and arms are apparently incompletely developed and are partially or un-pigmented and extremely difficult to see. The large photophores on arms IV are, however, almost completely darkened. In addition scattered chromatophores are present on the mantle, head and aboral surfaces of arms and tentacles; larger and denser on dorsal surface, sparse on ventral surface.

Remarks: Two species of *Abraliopsis* have been recorded from the central Atlantic. *A. pfefferi* Joubin, 1896 and *A. morisii* (Vérany, 1837). Of the latter, Voss (personal communication, 1973) remarks: "*A. morisi*, in my opinion, is a species dubia and should be dropped from further consideration. The type is apparently lost and the original illustration and description are insufficient for identification... Chun's [1910: pls 5-10] detailed illustrations involve probably three nominal species, my new species (in MS) from the tropical Atlantic, *A. hoylei* [(Pfeffer, 1884)], and probably *A. lineata* [(Goodrich, 1896)]." *A. hoylei* is known from the Indian Ocean (Pfeffer 1884: 18) and possibly also from the Pacific (see Young 1972: 20); *A. lineata* is known only from the northeastern Indian Ocean (Goodrich 1896: 10). Hence there are still only two species known from the central Atlantic: *A. pfefferi* and Voss' new species.

Degner (1925: 28) has described the larval development of "*A. morrisii*", but the "Galathea" specimen does not fit in very well with this sequence; the development of the photophores on the ventral mantle surface seems to have occurred in a different way, since there are two longitudinal rows of photophores present on either side of the midline, with a third row developing between them, whereas according to Degner the third row develops lateral to the first two rows. On the other hand, the darkening of the large photophores on the tips of arms IV is almost complete in the "Galathea" specimen, whereas in Degner's specimens of similar size they are still only partially darkened. The club of the "Galathea" specimen also differs from those described by Degner in that, in relation to mantle length, there are fewer hooks on the manus and fewer carpal suckers, but the carpal cluster is more distinct, and more or less like the adult condition.

The arrangement of photophores on the head and mantle of the "Galathea" specimen more closely resembles that of the specimens illustrated by Chun (1910: pl. 6, fig. 2 - "*A. Morisii*", MLd 11 mm) and

Joubin (1920: pl. 12, fig. 2 - *A. pfefferi*, MLd 17 mm), although both these specimens are larger and somewhat more developed. There is clearly no point in attempting to identify the immature "Galathea" specimen further, until the taxonomy and larval development of the species of *Abraliopsis* have been clarified.

Enoploteuthis sp.

Material:

St. 30: 1 specimen, ?sex, MLd 10 mm.

The extremely poor condition of this specimen does not permit any further identification. Two species of *Enoploteuthis* have been recorded from the eastern Atlantic, namely *E. leptura* (Leach, 1817) and *E. anapsis* Roper, 1964.

HISTIOTEUTHIDAE

Histioteuthis reversa (Verrill, 1880)

Histioteuthis reversa, N.A. Voss 1969: 745, figs 3 f-h, 5 b, 7 b-c, 11, 12, 14 a-h.

Material:

St. 137: 3 ♀, MLd 38; 21; 17 mm.

These specimens were examined and identified by N.A. Voss (1969: 745). Their locality represents the most southerly record for *H. reversa*.

Distribution: East and west Atlantic from about 55°N to 20°S; Mediterranean Sea.

CRANCHIIDAE

It has long been considered that many species and even genera of smaller cranchiids, and particularly of the taoniids, are larval stages of other genera and species based on larger specimens. The lack of well preserved specimens and the loss of many types has hampered the systematic elucidation of this complex family of squids in the past. The family is now in the process of being reviewed by N.A. Voss, and to avoid further complications in future synonymies the specimens described here have been given the names of the "species" they most closely resemble, in the cases where there is any doubt regarding the identity of larvae with adults.

Liocranchia reinhardti (Steenstrup, 1856)

(Fig. 2)

Cranchia (*Liocranchia*) *Reinhardti*, Hoyle 1886: 184, pl. 31, figs 11-14; pl. 32, figs 1-4.

Liocranchia reinhardti, Pfeffer 1912: 667, pl. 48, figs 19-21; Sasaki 1929: 332, pl. 26, fig. 16; pl. 27, figs 1-4; text-figs 154-158; Voss 1963: 145, fig. 32.

Material:

St. 8: 2 juveniles, MLd 11; 12 mm.

Description: Mantle globose, fused to head mid-dorsally and on either side of funnel ventrally. Anterior mantle margin slightly indented on either side of each of the three points of fusion with head. Mantle suddenly tapering posteriorly, immediately behind anterior fin margin, ending in a blunt point.

A row of tubercles present mid-dorsally over gladius, terminating a few mm before anterior margin of fins at point of expansion of gladius into lanceola. Ventral hyaline streaks beginning at anterior mantle margin with a tricuspid tubercle; the hyaline streaks branch, two strips diverging from each point of fusion ventrally. Each streak bears a series of about 15 simple peglike tubercles, apparently becoming more closely spaced distally.

Fins small and circular, extending beyond end of mantle. Fins separate anteriorly but fused posteriorly, with a median notch.

Head short and broad, with large sessile eyes, which are somewhat damaged in both specimens, but have at least five large photophores ventrally on bulbous. Funnel large, attaining anterior margin of eyes. Dorsal pad of funnel organ large and thick, triangular, with a papilla in posterior notch and a low ridge along each limb. Ventral pads small, reniform. Funnel valve present.

Arms small, unequal, arm length formula 3.4.2.1. Suckers globose, biserially arranged, decreasing in size distally. Sucker count in specimen of 12 mm MLd as follows:-

Arm I: 8-9 suckers	Arm III: 21 suckers on left arm (right III damaged)
II: 16-17 suckers	IV: 18-21 suckers

Details of sucker rings could not be discerned even at a magnification of 60 \times and individual suckers could not be removed without causing considerable damage to the specimens.

Tentacular stalks thick and about 3/4 mantle length. Club slightly expanded, bearing suckers in four rows, bounded on either side by well developed protective membranes. The largest suckers are very small but appear to have nodular rings and four blunt teeth. Carpal apparatus not clearly visible, but apparently extending over distal third of tentacular stalk.

Remarks: According to Voss (1963: 150): "The structure and shape of the larger specimens [of *L. reinhardti*] suggests that they belong in life to the bathypelagic fauna and are excellent swimmers as adults, probably leaving the more passive planktonic stage at 50 to 60 mm in mantle length." If Voss' supposition is correct it is probable that the present specimens of *L. reinhardti* were caught in the

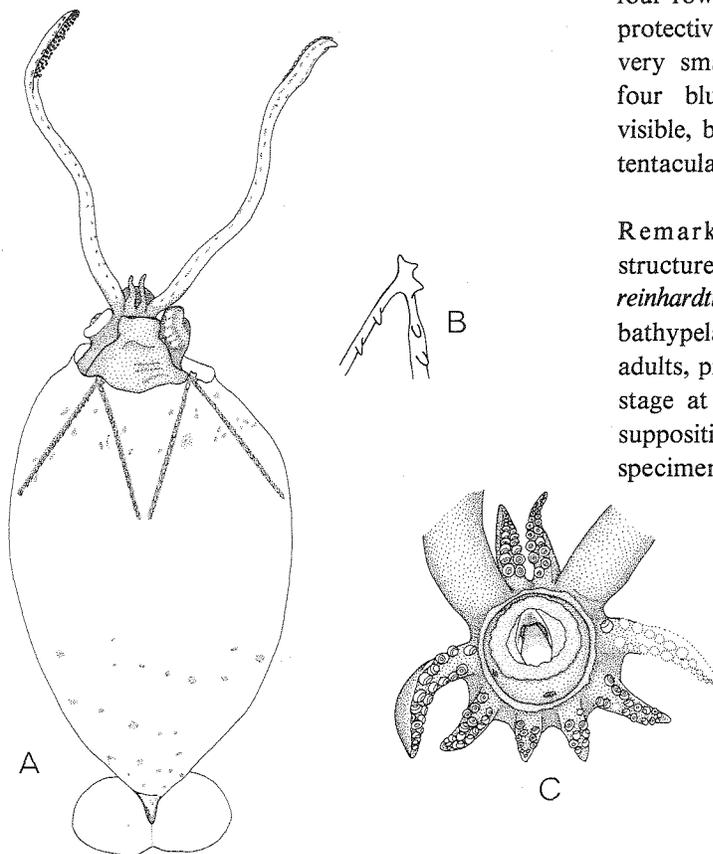


Fig. 2. *Liocranchia reinhardti* juvenile, MLd 12 mm.

A, ventral view; B, detail of anterior portion of hyaline streak; C, oral view.

upper water layers of about 130 m (400 MW) or perhaps even when the net was brought to the surface.

Distribution: Cosmopolitan in tropical and temperate waters.

Leachia atlantica (Degner, 1925)
(Fig. 3)

Pyrgopsis atlantica Degner, 1925: 54, figs 38-40.

Material:

St. 8: 1 larva, MLd 18 mm.

Description: Mantle elongate, spindle-shaped, posterior end extending a little beyond fins. Anterior mantle margin produced to a fairly strong point mid-dorsally. A single hyaline streak originating from each point of fusion of mantle with funnel ventrally. Each streak begins anteriorly with a tubercle having about four cusps; posterior to this there are 7-8 large multicuspoid tubercles with a few smaller simple tubercles interspersed between some of them. Mantle covered with sparsely scattered chromatophores.

Fins terminal, rhomboid with distinct lateral angles; the combined width only slightly greater than the length, and about 28 % MLd.

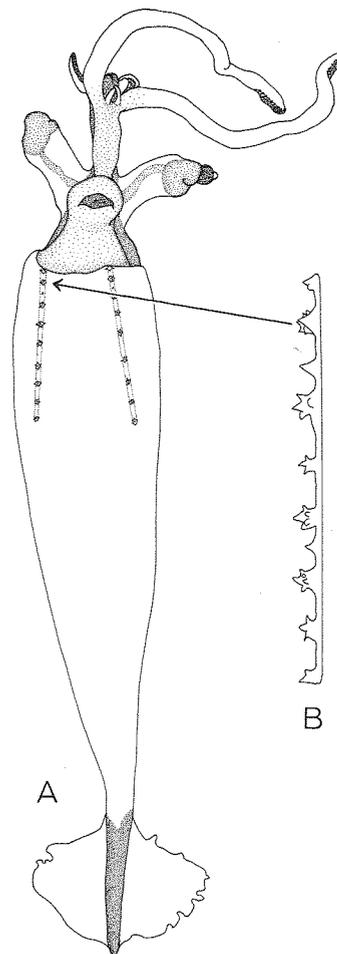
Head narrow elongate, with a long preocular proboscis which is quadrate in section. Eye stalks long, right eye bulbous missing; left bulbous intact, apparently having a lateral projection (but this may be due to distortion). No photophores visible on bulbous. Funnel long, reaching beyond bases of eye stalks. Funnel organ indistinct.

Arms III well developed, the other pairs minute. Arm length formula 3.2.4.1. Suckers biserially arranged, arm I bearing 2, arm II 4, and arm III about 26 suckers; the number of suckers on arm IV could not be determined. Protective membranes developed only on arms III, where they are narrow.

Tentacles long, with thick stalks. Clubs not expanded, bearing suckers in four rows. Carpal suckers apparently extending about halfway along tentacular stalk, biserial but widely spaced, almost uniserial, very difficult to see. Protective membranes well developed and a short keel present.

Remarks: According to Voss (1967: 79) the status of the various species in the genus *Pyrgopsis*, and the genus itself, is in dispute. Young (1972: 82) has

Fig. 3. *Leachia atlantica* larva, MLd 18 mm. A, ventral view; B, right hyaline streak, in profile.



shown that at least one species of *Pyrgopsis* is a larval form of *Leachia* and synonymizes the two genera. He has also discussed the confusion in the systematics of the eight nominal species of *Pyrgopsis*, of which "none can be presently identified with any certainty" (Young 1972: 82). Of the four species with well developed arms III, only *P. schneehageni* (Pfeffer, 1884) and *P. atlantica* Degner, 1925 have rhomboidal fins, but no differences between these two species are apparent, apart from their widely separate type localities. N.A. Voss, who is reviewing the Cranchiidae, considers (personal communication) that *P. schneehageni* should be regarded a species dubia, as it is unidentifiable from description or illustration, and the type is apparently lost. *P. atlantica* she considers to be a valid species.

The "Galathea" specimen is the first record of this species since the original description and extends the known range of the species southwards (type locality: 36°13'N, 9°44'W, 65 MW).

Distribution: Northeast Atlantic.

?Cranchia scabra Leach, 1817

(Fig. 4)

?Fusocranchia alpha Joubin, 1920: 73, pl. 14, figs 5-9.

Material:

St. 8: 3 juveniles, MLd 6,4; 5,5; 4,3 mm.

Description: Mantle membranous, cigar-shaped, widest a little beyond midway posteriorly; covered with scattered chromatophores and multicuspoid tubercles which are densest ventrally over the anterior half, less dense antero-dorsally.

Fins small, rectangular, terminal, not narrowing basally but on the contrary there sometimes appears to be a thickening at the point of attachment. Fins attached to part of the postero-lateral margin of lanceola of gladius.

Head short and broad, without a preocular

proboscis, usually withdrawn within the mantle as far as anterior level of eyes. Eyes sessile, spherical, with no apparent photophores. Funnel large and broad, extending anteriorly beyond bases of arms. Funnel organ and valve not discernible.

Arms scarcely developed. Only one lateral pair, possibly II, developed to some extent, bearing six suckers each. Arms I bear one or two relatively large suckers. A fairly large gap present between II and the tentacle. No indication of arms III and IV.

Tentacles short, broad basally and tapering distally, having the appearance more of arms than of tentacles. Tentacular stalk with about 8-10 relatively large suckers which suddenly decrease in size distally where the club apparently begins; club with four rows of minute suckers, the tip apparently bare, but surrounded by fairly wide protective membranes; a small keel present opposite club suckers.

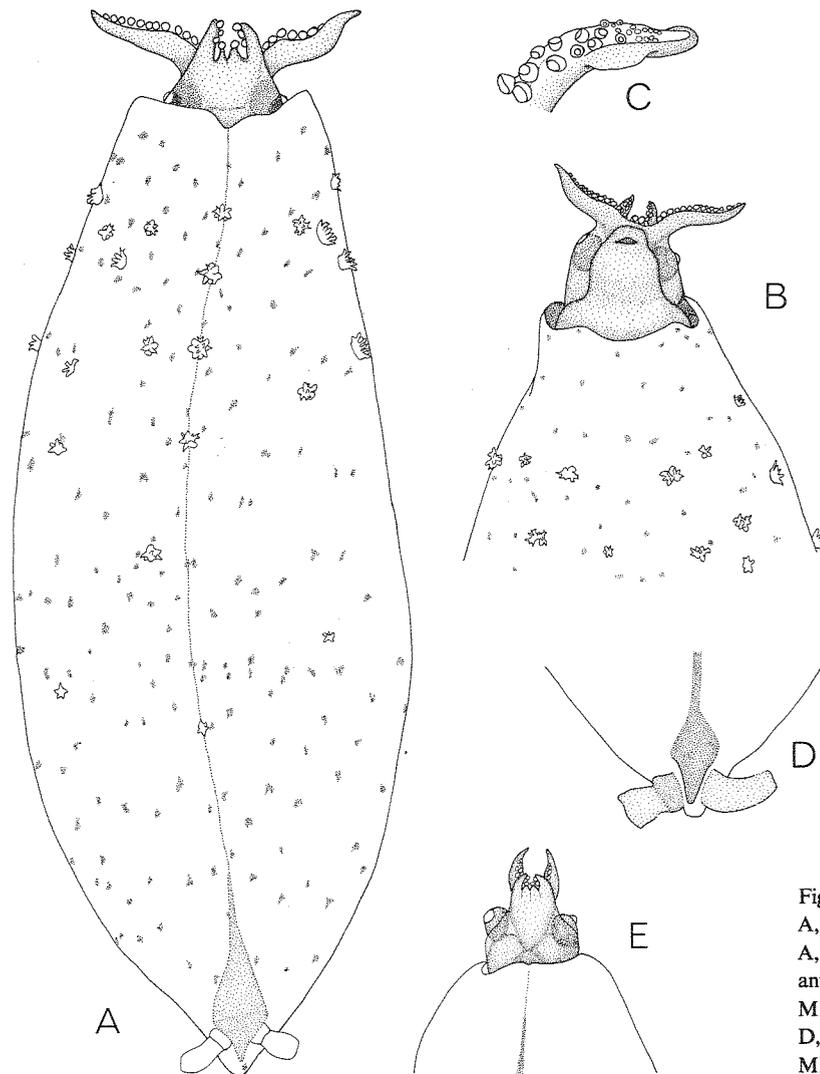
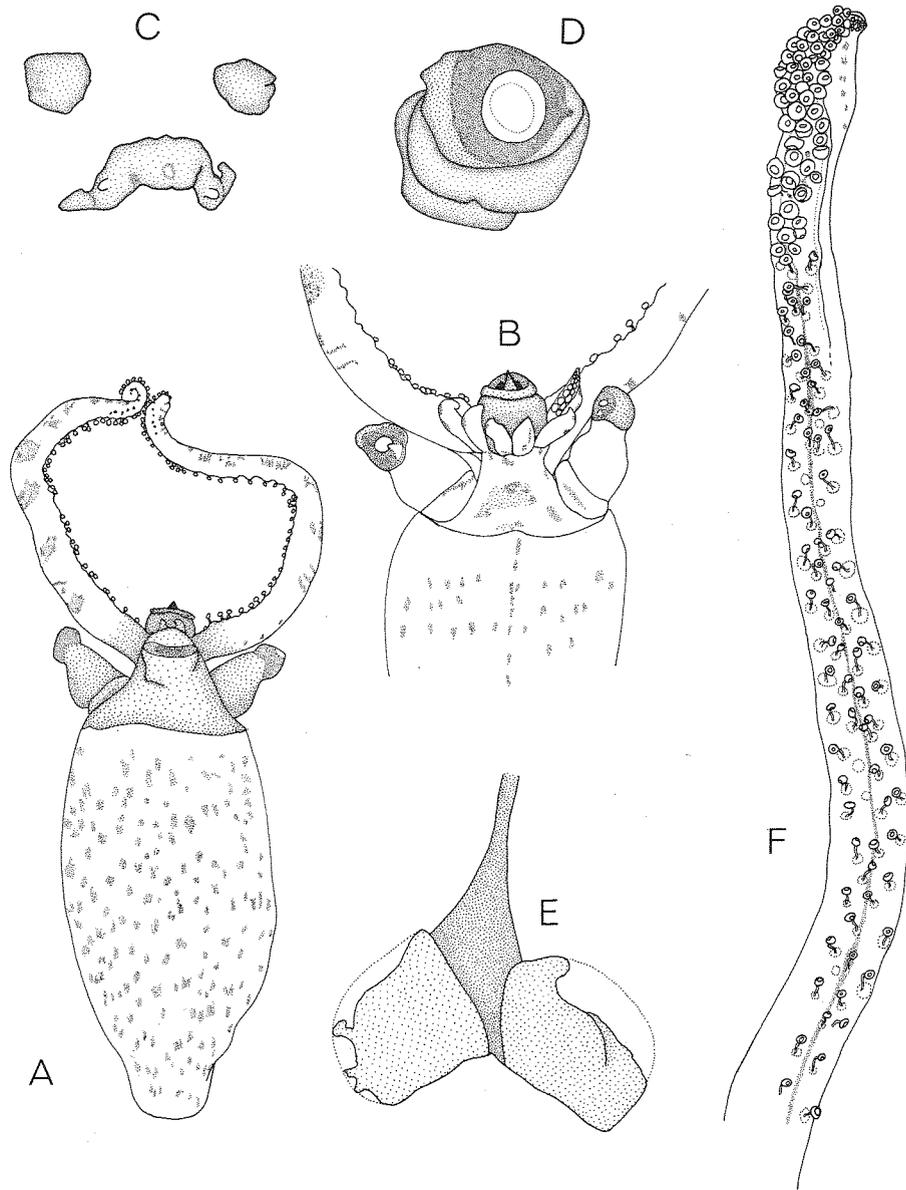


Fig. 4. *?Cranchia scabra* juveniles.

A, B, largest specimen, MLd 6,4 mm: A, dorsal view; B, ventral view of anterior part. C, D, medium specimen, MLd 5,5 mm: C, left tentacular club; D, fin attachment. E, smallest specimen, MLd 4,3 mm: dorsal view of head.

Fig. 5. *Teuthowenia megalops* larvae.

A, B, small specimen, MLd \pm 8 mm: A, ventral view; B, dorsal view of head and arms. C-F, larger specimen, MLd \pm 9 mm: C, funnel organ; D, end-on view of eye; E, fin attachment; F, right tentacle.



Internally there is no large transverse liver, as is usual in the cranchiids. A very small ink sac is present, surmounted by the bilobed anal opening of the rectum.

Remarks: N.A. Voss, who has seen the preliminary description and illustrations of these specimens, suggests (personal communication) that they are probably very early stages of *Cranchia scabra*, as they are identical to her specimens at these sizes. On the other hand, these specimens agree well with Joubin's (1920: 73) description and figures of *Fusocranchia alpha*, except that no trace could be found of the grey streaks on the ventral mantle surface, or of the bridle between the fins. If Voss' suggestion should prove true, and a complete

developmental series would be necessary to show this, it would seem likely that Joubin's specimens of *F. alpha* were also juveniles of *C. scabra*. The fact that Joubin did not notice the tubercles is not remarkable, as they are very transparent and inconspicuous and were only noticed by the author when the specimens were removed from the alcohol and allowed to dry somewhat during examination.

Teuthowenia megalops (Prosch, 1849)

(Fig. 5)

Teuthowenia megalops, Pfeffer 1912: 742, pl. 48, figs 5-11, 17-18.

Desmoteuthis megalops, Muus 1956: 1, figs 1-9.

Megalocranchia megalops, Voss 1960: 433.
Taonius megalops, Clarke 1966: 234.

Material:

St. 8: 2 larvae, MLd + 8 and 9 mm.

Description: Mantle muscular, elongate barrel-shaped, widest about halfway down, ending bluntly. In both specimens the posterior tip of the mantle is bent ventrally, and the anterior margin has turned outward to form a collar.

Fins small, terminal, attached to postero-lateral margins of gladius; not pedunculate.

Head short and broad, forming a short pyramidal proboscis between eyes and arms. Funnel large, extending beyond bases of eyes and arms. Funnel valve absent. Dorsal pad of funnel organ reminiscent of that of *T. elongata* (Sasaki 1929: pl. 26, fig. 9), \neg -shaped; central part of dorsal pad extending posteriorly into a longitudinal limb on either side, the tips of which are curved laterally. The dorsal pad apparently bears three short thick papillae, though the median papilla has been lost, leaving an irregular base. Lateral pads of funnel organ circular to quadrangular, with no obvious notches. Eyes borne on short thick stalks, with no marked ventral process; no photophores could be discerned, but the smaller specimen has a pale triangular area on each eye.

Arms short, arm length formula 3.2.4.1. The dimensions and sucker counts as follows:

	Length	Number of suckers
Arm I	0,8 mm	12
II	1,1 mm	14
III	1,4 mm	\pm 18
IV	0,9 mm	\pm 16

Protective membranes present. Suckers largest basally, gradually decreasing in size distally. Sucker rings broad, covered with many papillae; inner edge irregular but not toothed.

Tentacles long and thick; tentacular clubs not expanded, bearing suckers in four rows. Median and marginal suckers subequal. Rings of median suckers covered with long papillae; inner edge of ring with five blunt teeth distally and a few low irregular teeth proximally. Club keeled, and bearing protective membranes which continue for a short distance along the stalk. Tentacular stalk with four rows of suckers almost to the base. These suckers are borne on long stalks, each arising from a dis-

tinct basal hump on the tentacle, and are arranged in two rows along either side of a median longitudinal groove. Basally the four rows become very oblique, so that the last 8-10 suckers appear to be biserially arranged.

Mantle covered with small closely scattered chromatophores. Larger, more isolated chromatophores present on head, arms and tentacles.

Remarks: Muus (1956) has shown that *Teuthowenia megalops* is a larval stage of *Desmoteuthis hyperborea* (Steenstrup, 1856) and changed the name of the species to *Desmoteuthis megalops*, at the same time making a very sweeping synonymy. The species *megalops* has been variously attributed to the genera *Desmoteuthis* (by Muus 1956), *Megalocranchia* (by Voss 1960), and *Taonius* (by Clarke 1962). In addition there has been considerable confusion in the literature between this species and *Verrilliteuthis hyperborea* (Steenstrup, 1856). Since the present specimens are immature they have been left in the larval genus *Teuthowenia* to avoid further complication, until such time as the *Desmoteuthis/Megalocranchia/Taonius/Verrilliteuthis* confusion is clarified.

Distribution: Northern Atlantic (only specimens described as *Teuthowenia megalops*).

Unidentified oegopsid

(Fig. 6)

Material:

St. 8: 1 larva, MLd 10 mm.

Description: Mantle conical, much wider anteriorly than head.

Fins small, terminal, ?triangular.

Head with quadrangular preocular proboscis; neck normal, not elongate. Eyes missing. Funnel short and stout, attaining posterior level of eyes. Funnel-locking apparatus well developed, with a simple straight groove. Funnel valve apparently missing; dorsal pad of funnel organ ω -shaped. The buccal connectives apparently attaching ventrally to arms IV.

Arms well developed, subequal in length, bearing biserial suckers. A sucker from arm II had a single row of blunt widely spaced teeth in the middle of the horny ring (not at its inner edge).

Tentacles with four rows of suckers on manus, two rows in carpal region which extends at least half way down the stalk. Suckers of manus have horny rings with about 20 widely spaced blunt teeth.

Remarks: This small and rather damaged specimen resembles larvae of *Brachioteuthis* as illustrated by Hoyle (1886: pl. 31, figs 6,7) and Pfeffer (1912: pl. 26, figs 12-14) but the arms are better developed and the head is elongated in the preocular and not in the neck region.

Octopus sp.

Material:

St. 8: 1 larva, MLd 5 mm.

Description: One small larva, covered with minute bristles and with sparse chromatophores scattered ventrally on mantle, and in two rows on arms. A transverse row of four chromatophores on head dorsally, of which the two median are smaller than the lateral ones. Deeper chromatophores present dorsally on head, around eyes, at bases of dorsal arms and in neck region. Chromatophores absent dorsally on mantle.

Mantle short and broad but longer than wide. Mantle distinctly marked off from head region below the transparent dermis.

Head short and broad, with prominent eyes which have protruded beyond the eyelids.

Arms short, subequal, bearing 16-20 biserial suckers each, the two proximal suckers uniserial.

Web low, about 38 % arm length.

Gills with about four filaments per side.

Funnel organ w-shaped, with thin but distinct limbs.

Remarks: This small specimen has not yet developed the adult characters and hence is not identifiable to species level. Naef (1923: 687) considered that the bristles have a function in hatching and may also have a use in the planktonic life of the larva. Considering the fishing depth (400-1200 MW = 130-600 m) and the bottom depth (3070 m) at this station, it is probable that the larva was still in the planktonic stage.

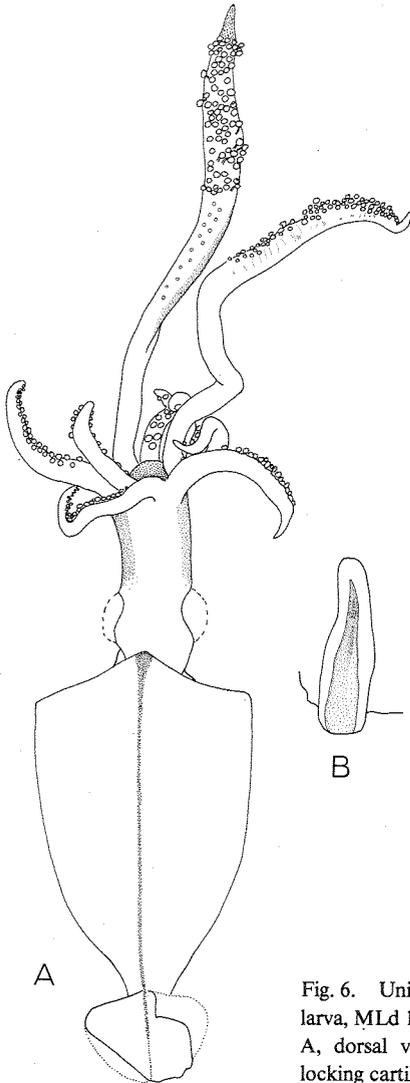


Fig. 6. Unidentified oegopsid larva, MLd 10 mm. A, dorsal view; B, left funnel locking cartilage.

Japetella diaphana Hoyle, 1885

Bolitaena diaphana, Thiele 1915: 493; Chun 1915: 494, pl. 82, pl. 83 figs 1,2, 6-10, pl. 84, pl. 85 figs 1-5, pl. 86 figs 1, 4, 6-9, pls 87-89.

Japetella diaphana, Thore 1949: 4, figs 1-22.

Material:

St. 52: 1 ♂, MLd 13 mm, total length 21 mm.

Description: One rather damaged specimen, with characteristic fibrous coating; head small, with large lateral eyes and short optic nerves (peduncular ganglion adjacent to optic ganglion). Third arms longest, with nine large suckers and about 3-5 much smaller ones distally. Suckers uniserial, web well developed.

The male genitalia recognisable but apparently not yet completely developed, as there is no divert-

iculum on the penis. The alimentary tract as illustrated by Chun (1915: pl. 87 figs. 1-3).

Remarks: According to Thore (1949: fig. 11) most *J. diaphana* larvae of 25 mm (?total length) or less live at 100-330 m, below the discontinuity layer, but specimens of this size group (into which the present specimen comes) have been found as deep as 2500 m.

Distribution: Bathypelagic, cosmopolitan in tropical and warm temperate waters.

Acknowledgements

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