

DISTRIBUTION OF CEPHALOPODS FROM PLANKTON SURVEYS AROUND THE BRITISH ISLES

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ABSTRACT

Cephalopods (n = 515) were identified from a series of plankton and fine meshed mid-water trawls, taken between 1977 and 1999, around the British Isles. The collections were not directed at cephalopods, but provide valuable information on the distribution of planktonic species and on the paralarvae of the benthic species. The most abundant species in neritic areas were the octopod *Eledone cirrhosa* and the sepiolids, *Sepietta oweniana* and *Sepioloatlantica*. *Eledone cirrhosa* were common in samples to the north and west of Scotland, particularly in early summer. The mantle lengths of *E. cirrhosa* were 4–8 mm, indicating a brief planktonic existence or, perhaps, net avoidance by larger specimens. In the shelf-break collections from the west of Scotland and Ireland the squids *Brachioteuthis* spp., *Gonatus* sp., *Teuthowenia megalops* and rynchoteuthions of the Ommastrephidae were abundant. Two types of rynchoteuthion were found and were probably *Todarodes sagittatus*, *Illex coindetii* or *Todaropsis eblanae*. Despite the abundance of *Loligo forbesi* around the British Isles, it was rarely taken in plankton collections, probably indicating that it does not have a planktonic paralarva.

Unlike the other mollusc classes, the cephalopods do not have a true larval stage, hatching instead into miniature versions of the adults known as paralarvae (Boletzky, 1974; Vecchione, 1987). Recent work has done much to elucidate the ecology and distribution of the adult stages of many cephalopod species, particularly those of commercial interest, but in most cases little is known about the paralarval stages. The rapid growth of most cephalopods (Forsythe and Van Heukelem, 1987) means that the paralarval stage is probably brief. Coupled with the strongly seasonal reproduction seen in most temperate species, this means that the paralarvae may only be available for a limited time. In many species the egg stages are known but data are lacking from hatching until recruitment into trawl catches. Growth during the paralarval phase is highly temperature sensitive in some species (Forsythe, 1993) which will have a significant impact on the final size of individuals. Knowledge of the paralarval stage is thus important in full understanding of cephalopod life-cycles.

Around the British Isles the main cephalopod of commercial interest is the loliginid squid, *Loligo forbesi*, which is caught in demersal trawls at depths to 400 m all round the coast (Pierce et al., 1994). There is also increasing interest in the exploitation of the northern octopus *Eledone cirrhosa* and ommastrephid squids such as *Illex coindetii* and *Todaropsis eblanae* off the west coast of Ireland (Lordan, 2001). These species, together with the small loliginid squid *Alloteuthis subulata*, the sepiolids *Sepioloatlantica* and *Sepietta oweniana* and the octopod *Eledone cirrhosa* are the most abundant cephalopods around the coast. The distribution and ecology of the adult stages of these species has been intensively studied (e.g., Boyle, 1983; Collins et al., 1995a; Holme, 1974; Lum Kong et al., 1992; Rodhouse et al., 1988; Stephen, 1944), but the juvenile or paralarval phase remains largely unknown.

The principal aim of the present study was to investigate the distribution of the planktonic stages of cephalopod species and in particular the commercially important squid *L. forbesi*. Lack of knowledge about the distribution of cephalopod paralarvae precluded directed surveys, here instead we have opportunistically obtained specimens from routine surveys or surveys directed at commercially important fish species. Cephalopods have been extracted and identified from collections obtained from a variety of areas and gear types around the British Isles and this study represents the first attempt to describe the planktonic cephalopod fauna around the British Isles.

MATERIALS AND METHODS

Samples of plankton collected as part of other projects, using a variety of gears and from different geographic locations, were examined for cephalopod paralarvae. Details of all the research cruises from which material was obtained, together with gear used and depth fished are given in Table 1 (see also Fig. 1).

All the English Channel Surveys used a modified Gulf III sampler called a Nackthai (Arnold, 1959; Nellen and Hempel, 1969), which was typically fished in double oblique hauls to near the seafloor and back. The International Young Fish Surveys (YFVS) and the Ace Herring Survey in the North Sea used a Methot net, fished obliquely from the surface to the sea-floor, whilst the Poseidon cruise used a Nackthai sampler (double oblique hauls) and the ANTON DOHRN cruise used an Isaac Kidd Midwater Trawl (IKMT). A Gulf III sampler, or a Nackthai, was used for the POSEIDON, ARDENT and ALKOR cruises. Most of the samples from Shetland waters were collected with a Nackthai sampler, but the CHALLENGER 1995 survey used a dual IKMT fished from the surface to 50 m and 51–200 m (or the sea-floor) and the Ardent survey used a Methot net. Samples from the SW of Ireland came from either a Nackthai sampler or a Multi-net (MCN, Wiekert and John, 1981). A working party net (WP3) was used on the Scotia west coast surveys and a dual IKMT (0–50; 51–200 m) on the G.O. Sars survey.

In some cases cephalopods were removed on board, and in others preserved plankton samples were re-examined to separate the cephalopods. Cephalopods were usually fixed in formalin and subsequently stored in ethanol. Cephalopods were examined using a dissecting microscope and identified to the lowest taxonomic level using published guides (e.g., Muus, 1963; Nesis, 1987; Roper et al., 1984; Sweeney et al., 1992) and reference material. Dorsal mantle length was measured for all specimens to the nearest 0.5 mm and for larger individuals the sex was determined either from external morphology or by making a mid-ventral incision and examining the gonads. The results were divided into five geographic regions, the English Channel, the North Sea, the Shetlands, the west coast of Scotland and the SW of Ireland.

RESULTS

GEOGRAPHIC DISTRIBUTION OF SAMPLING.—A total of 515 cephalopods were identified from samples taken around the British Isles (Tables 2–6). The English Channel (January only) and the North Sea samples were dominated by neritic species such as loliginid squid, sepiolids and octopods. The Shetlands (May–June and September–October) included a mixture of neritic and shelf break species, whilst the west-coast of Scotland (March and May) and SW of Ireland (April–June) were dominated by shelf-break forms, such as ommastrephids, cranchiids, *Gonatus* and *Brachioteuthis*. The most diverse samples were obtained from the SW of Ireland, which included some neritic species as well as shelf-break species.

Table 1. Research cruises, dates and gears from which cephalopods were obtained (IKMT is an Isaac Kidd Midwater Trawl; DIKMT is a dual IKMT; MCN is a multi-net; a Nackthai is a modified Gulf III sampler; a Methot net is a square framed net (1 or 2 m).

Area	Cruise	Date	Gear	Mesh (μm)
English Channel	ALKOR 24	January 1992	Nackthai	300
	POSEIDON 198	January 1993	Nackthai	300
	POSEIDON 203	January 1995	Nackthai	300
	POSEIDON 213	January 1996	Nackthai	300
	POSEIDON 226	January 1997	Nackthai	300
	ALKOR 122	January 1998	Nackthai	300
	WALTHER HERWIG 201	January 1999	Nackthai	300
North Sea	ANTON DOHRN	Jan/Feb 1977	IKMT	1,000
	ACE II Herring Larvae	January 1988	2.0 m Methot	2,000
	POSEIDON	September 1991	Nackthai	300
	SCOTIA IYFS	February 1993	2.0 m Methot	250
	SCOTIA IYFS	February 1994	2.0 m Methot	250
	SCOTIA IYFS	February 1995	2.0 m Methot	250
Shetland Islands	CLUPEA	May 1989	Gulf III	300
	ARDENT SANDEEL Survey	June 1990	2.0 m Methot	2,000
	POSEIDON 191	September 1991	Nackthai	300
	POSEIDON 195	Sep/Oct 1992	Nackthai	300
	ALKOR 52	Sep/Oct 1993	Nackthai	300
	ALKOR 73	September 1994	Nackthai	300
	CHALLENGER	May 1995	DIKMT	1,500
	ALKOR 88	September 1995	Nackthai	300
	POSEIDON 224	September 1996	Nackthai	300
	ALKOR 119	September 1997	Nackthai	300
	ALKOR 135	September 1998	Nackthai	300
SW Ireland	HEINKE 56	Mar/Apr 1994	MCN	300
	WALTHER HERWIG 158	Mar/Apr 1995	Nackthai	300
	HEINKE 67	Mar/Apr 1995	MCN	150
	HEINKE 70	May/June 1995	MCN	150
	HEINKE 71	Jun/Jul 1995	Nackthai	300
	WALTHER HERWIG 194	Mar/Apr 1998	Nackthai	300
West of Scotland	SCOTIA	March 1989	1 m WP3	900
	SCOTIA	March 1990	1 m WP3	1,000
	G.O. SARS	May 1994	DIKMT	300

ORDER OCTOPODA

The only octopod caught was the northern octopod *E. cirrhosa* which was common in samples in May and June around the Shetland Islands and off the west coast of Scotland. Sixty-two specimens were caught the majority being of size 4–5 mm ML (Fig. 2A), with the few larger specimens caught in the larger Methot nets that were fished close to the sea-floor.

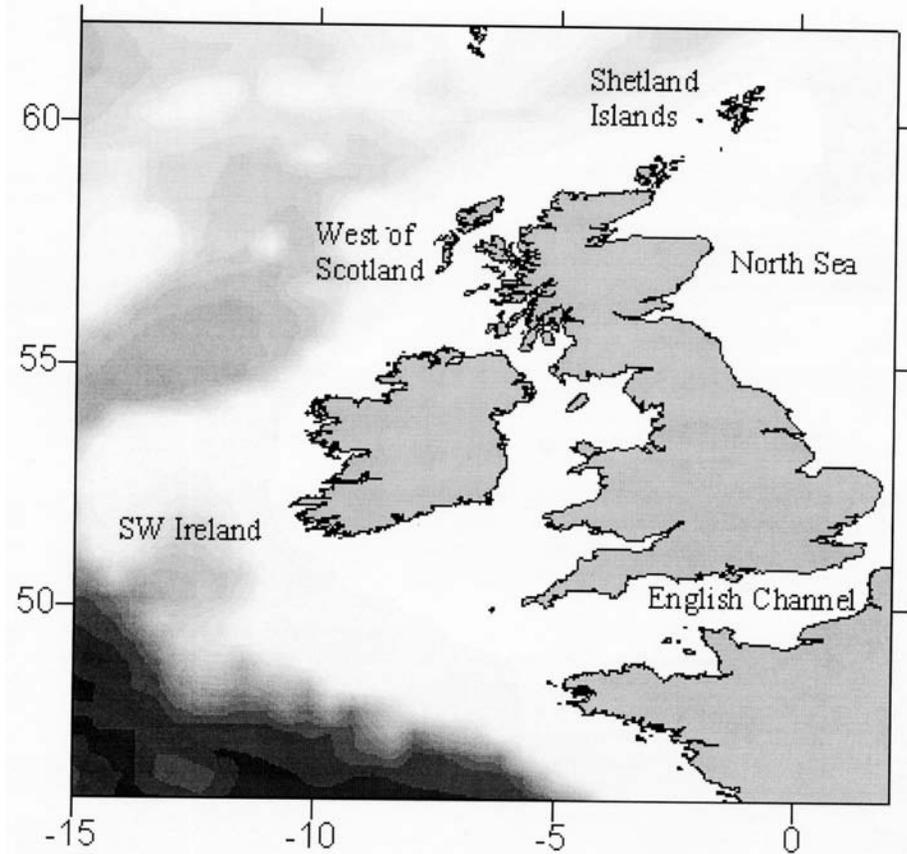


Figure 1. Map of the British Isles illustrating the approximate locations of surveys from which samples were obtained.

ORDER DECAPODA

FAMILY SEPIIDEA.—A single specimen of *S. elegans* (21 mm ML) was caught in a Nackthai sampler to the SW of Ireland (142 m depth). It was probably caught close to the sea-floor.

FAMILY SEPIOLIDAE.—The sepiolid, *S. oweniana*, was the most abundant species, with a total of 94 specimens caught. Most (70%) were caught during the months of September

Table 2. Cephalopods identified from plankton surveys in the English Channel.

Species	Alkor 24 Jan 92	Poseidon 198 Jan 93	Poseidon 203 Jan 95	Poseidon 213 Jan 96	Poseidon 226 Jan 97	Alkor 122 Jan 98	Walther Herwig 201 Jan 99
<i>Alloteuthis subulata</i>	—	—	2	—	—	—	—
<i>Loligo</i> sp.	1	1	3	4	3	—	—
<i>Sepietta oweniana</i>	—	—	3	9	—	3	—
<i>Sepiolo atlantica</i>	—	—	2	3	1	—	2
<i>Sepiolo aurantiaca</i>	3	5	1	5	—	—	—

Table 3. Cephalopods identified from plankton surveys in the North Sea.

Species	Anton Dohrn Jan/Feb 77	Ace II Herring Larvae Jan 88	Poseidon 1991 Sep 91	Scotia IYFS Feb 93	Scotia IYFS Feb 94	Scotia IYFS Feb 95
<i>Alloteuthis subulata</i>	4	3	–	10	9	9
<i>Eledone cirrhosa</i>	–	2	–	1	1	3
<i>Loligo</i> sp.	–	–	2	–	–	–
<i>Loligo forbesi</i>	–	–	–	2	1	1
Loliginidae	–	7	1	–	–	1
<i>Gonatus</i> sp.	1	–	–	–	–	–
<i>Sepietta oweniana</i>	–	1	11	3	1	1
<i>Sepiolo atlantica</i>	9	21	–	3	5	15
<i>Sepiolo aurantiaca</i>	1	1	–	–	–	–
<i>Sepiolo</i> sp.	–	–	–	–	1	–
<i>Todaropsis eblanae</i>	–	4	–	–	–	–

and October in oblique tows with the Nackthai sampler. Plotting the length-frequency (Fig. 2B) shows a peak at 4 mm ML, with only six individuals of size greater than 8 mm ML and these were all taken in the larger Methot nets.

The small bob-tail squid, *S. atlantica*, was caught in all areas, with a total of 75 specimens, mostly taken in the autumn and winter. The length-frequency showed a peak at 2–4 mm ML (Fig. 2C), but mature adult individuals (up to 20 mm ML) were also caught. As with *S. oweniana*, most of the larger specimens were caught with Methot nets, fished close to the sea-floor. Twenty-four specimens of *Sepiolo aurantiaca* (2–20 mm ML) were also taken in samples from the English Channel, North Sea, Shetlands and SW Ireland. In addition, eight specimens of the genus *Sepiolo* were caught which could not be identified to species level.

Two small paralarvae of *Rossia* (probably *R. macrosoma*) were caught in the Shetlands samples and another in the SW Ireland samples. A single *Neorossia caroli* paralarvae was taken in samples from SW Ireland.

FAMILY LOLIGINIDAE.—Two species of loliginid squid, *A. subulata* and *L. forbesi* were identified, although many *Loligo* paralarvae could not be identified to the species level and may have been *L. forbesi* or possibly *L. vulgaris*. *A. subulata* (37 specimens) was only caught in the English Channel and North Sea and most were juveniles and sub-adults caught with Methot nets (Fig. 3A). *Loligo* sp. were caught in small numbers from all areas, with approximately 19 paralarvae (<8 mm) caught in the Nackthai samplers from all areas (Fig. 3B). Four juvenile *L. forbesi* were caught in the North Sea IYFS surveys in methot nets. A small number of unidentified loliginids (either *A. subulata*, *L. vulgaris* or *L. forbesi*) were also caught.

FAMILY OMMASTREPHIDAE.—Rhynchoteuthion paralarvae of the family Ommastrephidae were caught off the west of Ireland, west of Scotland and around the Shetlands. At least two forms were caught, but could not be positively identified to the species level. Three species of adult ommastrephids, *Todarodes sagittatus*, *I. coindetii* and *T. eblanae*, are

Table 4. Cephalopods identified from plankton samples from Shetland Island cruises.

Species	Clupea	Ardent Sandeel Survey	Poseidon	Poseidon	Poseidon	Alkor	Alkor	Chall.	Alkor	Poseidon	Alkor	Alkor
	May 89	June 90	Sep 91	Sep/Oct 92	Sep/Oct 93	Sep 94	May 95	May 95	Sep 95	Sep 96	Sep 97	Sep 98
<i>Eledone cirrhosa</i>	4	1	-	-	3	1	17	17	-	1	2	-
<i>Loligo</i> sp.	-	1	2	-	1	-	-	-	-	-	1	9
Ommastrephidae	-	-	-	-	-	-	-	-	-	-	-	3
Ommastrephidae Type 1	-	-	-	-	-	-	-	-	1	-	10	-
Ommastrephidae Type 2	-	-	-	-	-	-	-	-	2	-	1	-
<i>Rossia</i> spp.	-	-	-	-	-	-	1	1	-	-	-	-
<i>Sepietta oweniana</i>	-	-	11	10	2	4	1	1	3	4	12	7
<i>Sepioteuthis atlantica</i>	1	-	-	-	-	-	-	-	-	2	3	5
<i>Sepioteuthis aurantiaca</i>	1	1	-	1	1	-	-	-	-	-	2	-
<i>Sepioteuthis</i> sp.	-	1	-	-	-	-	2	2	-	-	-	-
<i>Teuthowenia megalops</i>	-	-	-	-	-	-	1	1	-	-	-	-

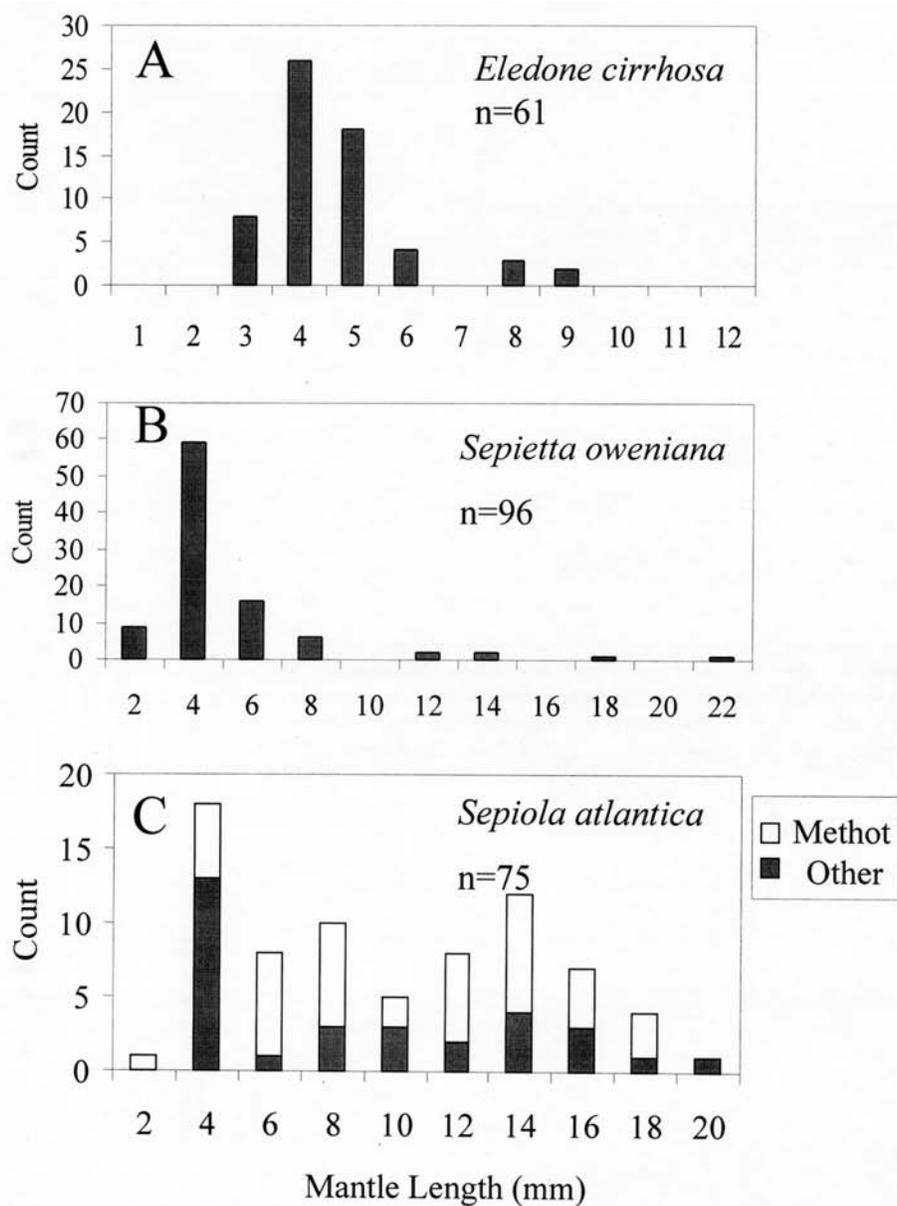


Figure 2. Length-frequency of the octopod *Eledone cirrhosa* (A), *Sepietta oweniana* (B) and *Sepiolo atlantica* (C) captured in plankton nets and other gear around the British Isles.

common around the British Isles and the paralarvae almost certainly belong to two or all three of these species. The Type 2 paralarvae were predominantly caught off the SW coast of Ireland and the Type 1 only in the Shetlands samples. All the paralarvae were small (Fig. 4A) and most were caught in early summer. Four juvenile *T. eblanae* (7–22 mm ML) were also caught in the North Sea.

FAMILY GONATIDAE.—Paralarvae and juveniles of the genus *Gonatus* (32 specimens) were caught from the west coast of Scotland and SW of Ireland (Fig. 4B). Some of the specimens were identified as *G. fabricii* on the basis of the chromatophore pattern on the ventral side of the head (Falcon et al., 2000), but many specimens could not be identi-

Table 6. Cephalopods identified from plankton samples from west of Scotland.

Species	Scotia Mar 89	Scotia Mar 90	G.O. Sars May 94
<i>Brachioteuthis</i> sp.	–	–	4
<i>Eledone cirrhosa</i>	–	3	13
<i>Gonatus fabricii</i>	–	–	4
<i>Gonatus</i> sp.	–	–	10
<i>Loligo forbesi</i>	–	–	1
<i>Sepietta oweniana</i>	2	–	–
<i>Sepiolo atlantica</i>	1	–	–
<i>Sepiolo</i> sp.	–	–	4
<i>Teuthowenia megalops</i>	–	–	11

fied with confidence. All were taken in dual IKMT or multi-nets at depths of 0–50 and 51–200 m.

FAMILY BRACHIOTEUTHIDAE.—Fifty-six specimens of *Brachioteuthis* were caught off the west coast of Scotland and SW Ireland. Most were small (Fig. 4C) and taken in the surface waters over the continental slope (>200 m depth). This family is in need of revision and the specific identities of both adults and juveniles cannot be determined (Vecchione, pers. comm.). Morphological differences were detected between individuals, indicating that more than one species was present.

FAMILY CRANCHIIDAE.—Two species of cranchiid squid, *Teuthowenia megalops* and *Galiteuthis armata*, were caught in samples from the west coasts of Scotland and Ireland. *T. megalops* (26 specimens) was the more abundant, most were between 2 and 8 mm ML, with a single large (96 mm ML) specimen also caught. A single specimen of *G. armata* was caught over deep-water to the west of Ireland.

FAMILY HISTIOTEUTHIDAE.—Fifteen small specimens of *Histioteuthis* (ML 1.8–6.4 mm) were identified from samples from the SW of Ireland and were only found in samples over deep water (454–1242 m). Three of the larger specimens were positively identified as *H. reversa*, the smaller specimens could not be positively identified, but may also have been *H. reversa*.

FAMILY THYSANOTEUTHIDAE.—Two specimens of *Thysanoteuthis rhombus* (ML 6.4 and 5.1 mm) were caught from the SW of Ireland.

DISCUSSION

Overall numbers of cephalopods collected from the surveys were small, which may be due to low abundance or the ability of cephalopods to avoid nets (Clarke, 1977; Vecchione, 1987). The small numbers collected, together with the limited seasonal and geographic coverage make it difficult to draw many conclusions about patterns of distribution or to quantify abundance. However the study does provide considerable new data about seasonal occurrence and size frequency of the paralarvae of neritic and oceanic species collected in small nets.

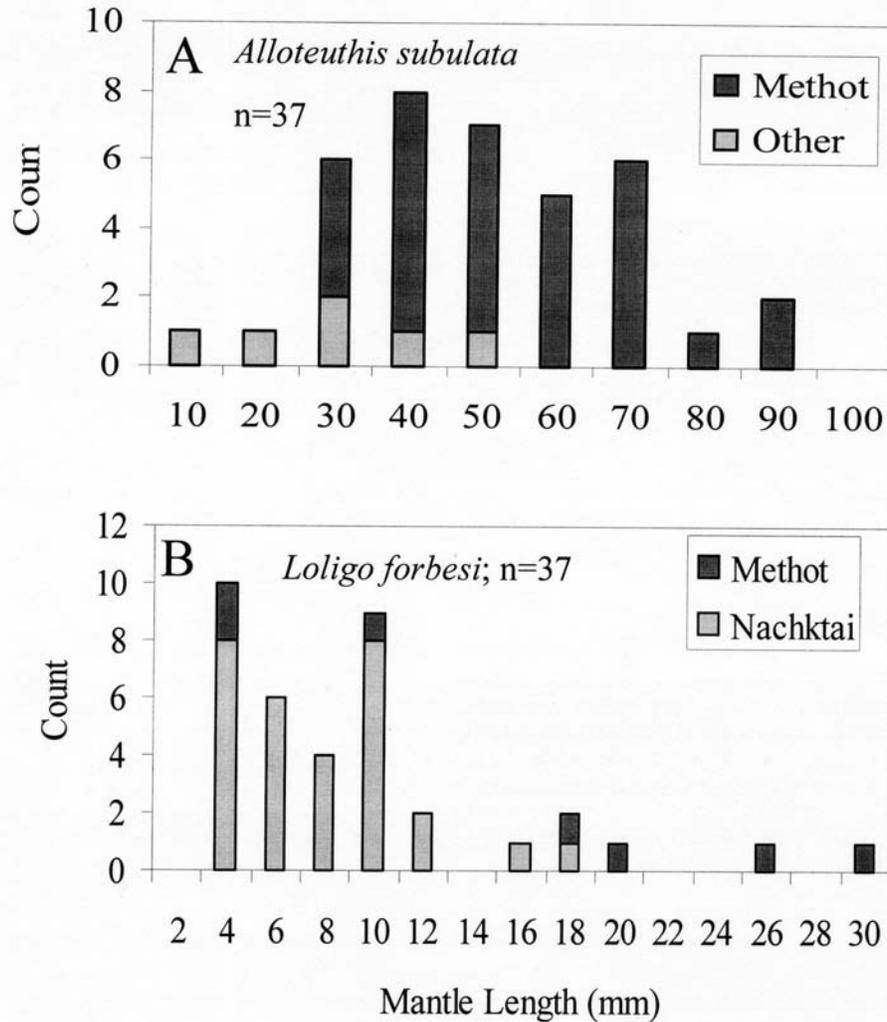


Figure 3. Length frequency of *Alloteuthis subulata* (A) and *Loligo forbesi* (B) taken in plankton nets and other gear around the British Isles.

The most abundant species in neritic areas were the sepiolids, *S. oweniana* and *S. atlantica* and the octopod *E. cirrhosa*. Paralarvae of *E. cirrhosa* were relatively common in catches in the northern North Sea and around the Shetland Islands in May and June, which, based on embryonic development times, suggests that the peak in reproduction occurs in the winter. Although the peak in incidence of mature *E. cirrhosa* occurs between July and September (Boyle and Knobloch, 1983), which is not entirely compatible with the present observations, mature individuals were found throughout the year and Stephen (1944) reported the presence of paralarvae in all seasons. The eggs of *E. cirrhosa* are rarely found deposited in the wild, with the only authentic record given by Rees (1955) from the Shetland Island. *Octopus vulgaris*, which is also known from the waters around the British Isles and has been reported as far north as St. Kilda (Ellis et al., 1996), was not found in any of the collections. *O. vulgaris* is essentially a southerly species and

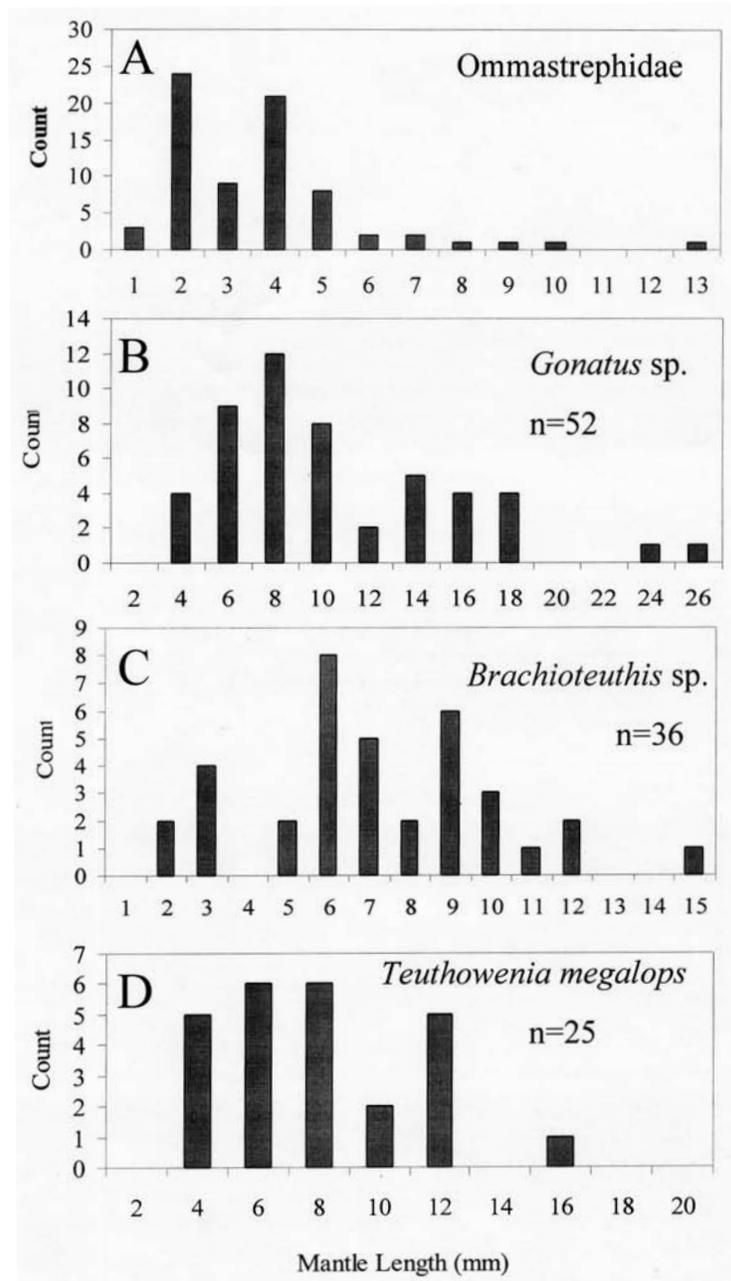


Figure 4. Length frequency of ommastrephid rhynchoteuthion paralarvae (A), *Gonatus* (B), *Brachiooteuthis* (C) and *Teuthowenia megalops* (D) captured in plankton nets and other gear around the Shetland Islands and to the west of Ireland and Scotland.

the occasional records of adults around the British coast may be due to the influx of warm water carrying the paralarvae north (Rees, 1950; Rees and Lumby, 1954).

S. atlantica is a small species found in shallow water all round the coasts of Britain and Ireland, where it is probably the most abundant of the sepiolids (Massy, 1928; Russell,

1922; Stephen, 1944; Yau, 1994). Elsewhere it is distributed over the European continental shelf from 65°N to 35°N. Yau and Boyle (1996) found that in Scottish waters *S. atlantica* has an extended spawning season, peaking in June, with the maximum size in both sexes approximately 20 mm ML. Plankton samples produced juveniles of size ranging from 1.8–4.0 mm ML, and *S. atlantica* probably settle to a benthic life-style after this size, with life span thought to be 6–9 mo (Yau and Boyle, 1996). *S. aurantiaca* is less abundant around the British Isles than *S. atlantica* and typically occurs at depths of 40–150 m (Yau, 1994).

S. oweniana was captured from all areas around the British Isles covered by the surveys. It is a small (max. 50 mm ML) nekto-benthic species distributed in shallow waters (50–600 m) all around the British Isles and in shallow waters around northern Europe, off the west African coast and in the northern Mediterranean (Bergström and Summers, 1983). Small specimens (<6 mm) were caught in the Nackthai samplers, particularly in the autumn, whereas larger individuals were caught with larger nets that fished close to the seafloor. This probably confirms Bergström and Summers' (1983) suggestion that the paralarvae have a brief planktonic habit. The peak abundance of *S. oweniana* paralarvae occurred in autumn and winter and indicates that spawning may occur in late summer. Collins et al. (1995b) found mature female *S. oweniana* in the Irish Sea in October and according to Bergström and Summers (1983) eggs are laid in masses (30–60) on hard substrate, mostly in shallow water, with hatching at 3–5 mm ML.

Two specimens of *Rossia* were caught, and though they could not be identified to the species level were probably *R. macrosoma*, which is found all around the coasts of Britain and Ireland (Muus, 1963; Roper et al., 1984). *Rossia glaucopsis* is a northern species and most British and Irish records are from north of the Moray Firth (Stephen, 1944). A single specimen of *Neorossia caroli* was identified in collections from the west of Ireland in July 1995. *N. caroli* is a deepwater species and around Britain has been recorded from deep-waters to the south-west of Ireland (Collins et al., 2001).

The identity of the *Loligo* paralarvae could not be confirmed morphologically, but those caught in the North Sea, Shetlands, west of Scotland and SW Ireland were probably *L. forbesi* as this is the only *Loligo* species present in these areas (Collins et al., 1995a; Pierce et al., 1994). Both *L. forbesi* and *L. vulgaris* occur in the English Channel so paralarvae captured there could be either species. The loliginid squid *L. forbesi* and *A. subulata* are two of the most abundant cephalopod species around the British Isles (Collins et al., 1995a, b; Pierce et al., 1994; Rodhouse et al., 1988), but paralarvae were relatively scarce in samples, particularly when compared with *E. cirrhosa* and *S. oweniana*. The scarcity of loliginid paralarvae indicates either that the timing and location of sampling was wrong, or that the paralarvae are not planktonic. Egg masses of *L. forbesi* have been recorded in shallow waters around the coasts of Britain and Ireland throughout the year (Collins et al., 1995a; Lum-Kong et al., 1992), so if the paralarvae were planktonic it is likely that more would have been caught. A benthic paralarval stage has also been indicated for other loliginid squid such as *L. gahi* (Hatfield and Rodhouse, 1994) and is probable for *L. forbesi*, which is supported by observations on hatchling behavior (PRB, unpubl.). A further possibility is that the paralarvae are found only in the neuston. Vecchione (1981, 1999) found large numbers of both loliginid and ommastrephid paralarvae in surface samples.

Rhynchoteuthion larvae of the ommastrephids occurred in the samples from the west of Ireland in June–July 1994 and 1995. Two distinct types of paralarvae were found, Type

1 were only found around the Shetland Islands, while Type 2 were found off the west coast of Ireland and around the Shetlands. Type 2 were thought to be of the sub-family Illicinae and were likely to be either *I. coindetii* or *T. eblanae*, while Type 1 may be *Todarodes sagittatus*. Adult *Illex* are abundant off the west coast of Ireland, south of 53°N, and spawning is believed to occur in the late spring (Lordan, 2001), which could produce paralarvae in the early summer. Mature *T. sagittatus* are found off the west coast of Ireland and Scotland and this species is occasionally abundant off the Shetlands (Lordan et al., 2001), where the Type 2 paralarvae were caught. It may be possible to utilize genetic methods to discriminate between *T. sagittatus*, *I. coindetii* and *T. eblanae* and then provide morphological descriptions of the paralarvae.

Squid of the genus *Gonatus* were among the most common cephalopods captured in mid-water trawls in oceanic water to the west of the British Isles. Specific identification of *Gonatus* proved difficult, although Falcon et al. (2000) recently demonstrated morphological differences between paralarvae and juveniles of the two species, which enabled separation of well preserved specimens. Some specimens were identified as *G. fabricii*, but it is likely that some *G. steenstrupi* were also present. *G. steenstrupi* is reported to have a more southerly distribution than *G. fabricii*, which is widely distributed in arctic and sub-arctic waters (Kristensen, 1981), where it is the most abundant squid species (Kristensen, 1983) and provides a major food source for sperm whales (Santos et al., 1999). Lu and Clarke (1975) found *Gonatus* (reported as *G. fabricii*) to be the most abundant cephalopod at 60°N, 20°W and the second most abundant at 53°N, 20°W, and suggested that *G. fabricii* hatched at depth, then ascended to spread through the water column, before returning deep to spawn.

T. megalops was the most abundant of the cranchiid species and was commonly caught in oceanic areas to the west of Scotland and Ireland. *T. megalops* is distributed throughout the North Atlantic (Muus, 1956; Nixon, 1983) and is thought to hatch in deep water and undergo an ontogenetic ascent through the water column, growing to 400 mm ML. The majority of animals are taken from the surface to 25 m in daylight and from 25–100 m at night, but specimens have been taken from depths of up to 1300 m (Lu and Clarke, 1975). Lu and Clarke (1975) found *T. megalops* to be the most abundant cephalopod in captures at 53°N, 20°W with combination RMT nets and it was also abundant at 60°N, 20°W. Massy (1928) reported four records of this species from Irish waters. A single *G. armata* was collected in the present study from the west of Ireland. This species is occasionally found in midwater trawls in the NE Atlantic and has previously been recorded at various localities around the British Isles (Massy, 1913; Russell, 1909). According to Clarke (1966) the majority of specimens have been taken between 500 and 2000 m.

Specimens of the monogeneric family, Brachioteuthidae were found in samples collected from shelf-break areas, most notably the collections from west of Ireland. The taxonomy of the *Brachioteuthis* genus is poorly known, but it is likely that most of the specimens belong to the widely distributed species *Brachioteuthis riisei*, however the family requires a major revision (Vecchione, pers comm.). *B. riisei* is essentially oceanic (Clarke, 1966) and does not reach large size. Lu and Clarke (1975) reported 64 specimens of this species at 53°N, 20°W at sizes ranging from 1.7–14.6 mm ML and found that larger specimens were only found close to the surface, while smaller ones were found down to 300 m, indicating possible deep hatching. *Brachioteuthis picta* is also reported from the west of Ireland (Massy, 1928) and it is possible that some of the specimens

belong to this species. A third species, *B. bowmani*, is only known from the type specimen, taken north of Scotland, which has been lost (Nesis, 1987).

Fifteen specimens of the family Histioteuthidae were collected and the only specimens that could be identified were *H. reversa* (N. Voss, pers. comm.). This species has previously been recorded in the area (Massy, 1928). *H. reversa* is reported to be widespread in deep-water in oceanic areas. Adult *H. bonnellii* have been recorded off the coast of Ireland (Collins et al., 1997), but no specimens of this species were found in the plankton collections. The Thysanoteuthidae are nektonic squids represented by a single species, *T. rhombus*, which grows to large size (1000 mm ML) is cosmopolitan in tropical and subtropical waters (Clarke, 1966; Nesis, 1987).

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