

The Cumacea of the Atlantic phase of the Balgim Cruise.

N.S. Jones

Port Erin Marine Laboratory (University of Liverpool), Isle of Man.

Abstract : Of 69 species of Cumacea found at the Atlantic stations of the Balgim cruise, 20 were also found at the western Mediterranean stations (Ledoyer 1988). Their vertical distribution is discussed and compared with that in the Mediterranean. Species diversity was greater in the Atlantic than in the Mediterranean. No significant differences in numbers of species or specimens were found between northern and southern stations in the Ibero-Moroccan Bay, nor between stations within the outflow from the Mediterranean and those outside it, but the species composition was certainly affected by the outflow.

Résumé: Des 69 espèces de Cumacés rencontrées dans le matériel des stations atlantiques de la campagne Balgim, 20 ont déjà été trouvées dans des stations de la Méditerranée (Ledoyer, 1988). La répartition bathymétrique est ici comparée à celle de la Méditerranée. La diversité des espèces a été plus grande dans l'Atlantique que dans la Méditerranée. Aucune différence significative n'a été trouvée entre le nombre des espèces ou des exemplaires dans les stations nord et sud de la baie ibéro-marocaine, ni entre les stations du courant d'eau méditerranéen et les stations hors de ce courant. Cependant la composition des espèces était certainement affectée par le courant du passage de Gibraltar.

INTRODUCTION

The chief aims of the Balgim cruise were the study of the faunal relationships between the Atlantic and Mediterranean through the Straits of Gibraltar and the correlation between the composition of the benthos and the origin of the water masses.

The outflow of water from the Mediterranean takes place through the Straits at a depth of 200 m, below the surface inflow, and down to the sill at 280 m. From the Straits it flows down below the less dense Atlantic water and is pushed northwards under the influence of the Coriolis force. To the south of Portugal the Mediterranean water reaches equilibrium at 1200-1300 m and is then held as a sandwich between the Atlantic water masses (Minas *et al.* 1984). The distribution of the cumaceans from the western Mediterranean phase of the Balgim cruise has been discussed by Ledoyer (1988). Those from the Atlantic phase are the subject of the present paper.

METHODS

The material was collected in May-June 1984 on board R.V. "Cryos" during the cruise conducted for the Centre National de la Recherche Scientifique (PIROCEAN), under the direction of Dr. P. Bouchet. It was sorted at the Centre National de Tri d'Océanographie Biologique (CENTOB), Brest. (Fig. 1) shows the locations of stations at which Cumacea

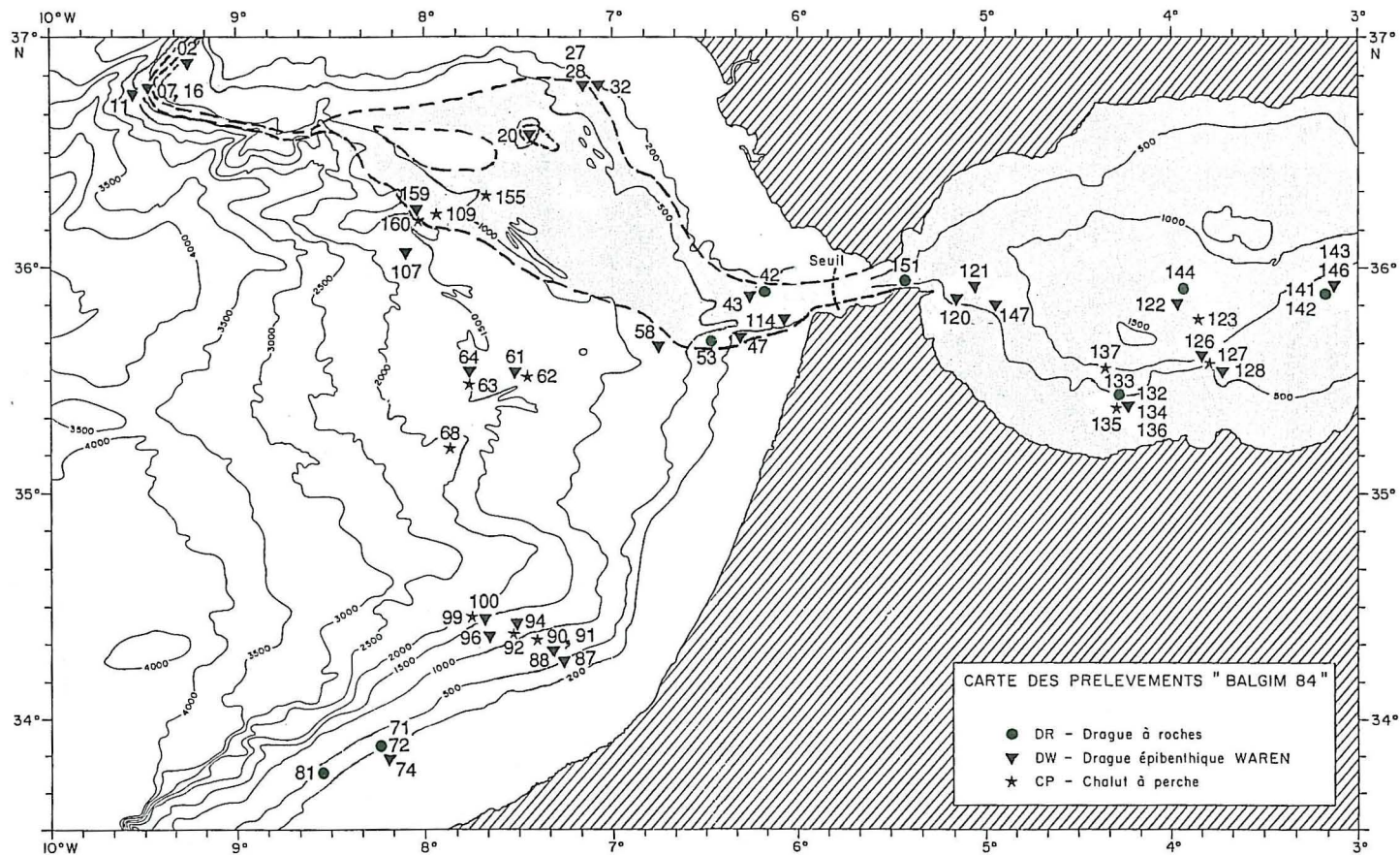


Fig. 1. Chart showing locations of stations at which more than two cumacean specimens were obtained during the Balgim cruise. The approximate course of the Mediterranean outflow is shown by interrupted lines

were collected. A few stations at which only one or two specimens occurred have been omitted. Ledoyer found 36 species (two unidentified) in the Alboran Sea and 69 were identified in the Ibero-Moroccan Bay. Names of genera and species are as in Bacescu (1988), except that I have preferred to retain *Epileucon* Bishop, 1981 as a genus rather than relegate it to a subgenus, Fage (1951), Jones (1974,1984) and Ledoyer (1988). Some species formerly in *Diastylis* are referred to *Vemakylindrus* Day (1980).

SYSTEMATIC REMARKS

A species of *Apocuma* occurred at several of the deeper stations. This will be described elsewhere. I have been unable with any certainty to distinguish *Hemilamprops normani* Bonnier, 1896 from *H. cristatus* (Sars, 1870) in these and in other collections and all specimens are referred to the latter species. Following Fage (1951) and Ledoyer (1988) *Makrokyllindrus spiniventris* Hansen, 1920 is considered to be synonymous with *M. longipes* (Sars, 1870).

DEPTH DISTRIBUTION

The species from the Atlantic phase of the Balgim cruise are arranged according to depth of occurrence in Table 1, which may be directly compared with Ledoyer's (1988) Tableau 3. It is not possible, with the greater depth distribution involved, to categorize the Atlantic species into Ledoyer's five groups, especially when their known depth range elsewhere is taken into account (Table 2) (Jones 1969,1985, 1986 and unpublished records). In the western Mediterranean there is probably a tendency for depth range to be condensed and while the lower limit is restricted to little more than 1500 m in the Alboran Sea, some species may occur there in lesser depths than in the Atlantic. This is certainly so with 6 of the 20 species from the Balgim cruise common to both areas, marked * in Table 2. On the other hand, purely abyssal species, which are scarce in the North Atlantic, are not represented among the Balgim collections. Many of the specimens in the shallower depths were immature or juvenile and, as stated by Ledoyer (1988), no adults of *Cyclaspis longicaudata* occurred at any of the Balgim Atlantic stations, while adults of *Bathycuma brevirostre* did not appear until a depth of 1870 m was reached.

The species may be arranged in 6 categories but with considerable overlap :

1. Shelf species which may reach the upper slope include : *Bodotria arenosa*, *B. pulchella*, *Cumella limicola* and *Nannastacus longirostris*.
2. Species mainly from the upper slope which may extend onto the shelf and down the lower slope, sometimes reaching the continental rise : *Vaunthompsonia cristata*, *Epileucon ensis*, *Eudorella truncatula*, *Leucon macrorhinus*, *L. nasica*, *Campylaspis glabra*, *C. jonesi*, *C. legendrei*, *C. mauritanica*, *C. rostrata*, *Cumella compacta*, *Schizotrema atlantica*, *Diastylodes biplicata*, *D. serrata*, *Ekleptostylis walkeri*, *Leptostylis macrura* and *Vemakylindrus doryphorus*.
3. Species mainly from the lower slope and continental rise which occur on the shelf only as immature individuals but may extend onto the abyssal plain : *Alticum carinatum*,

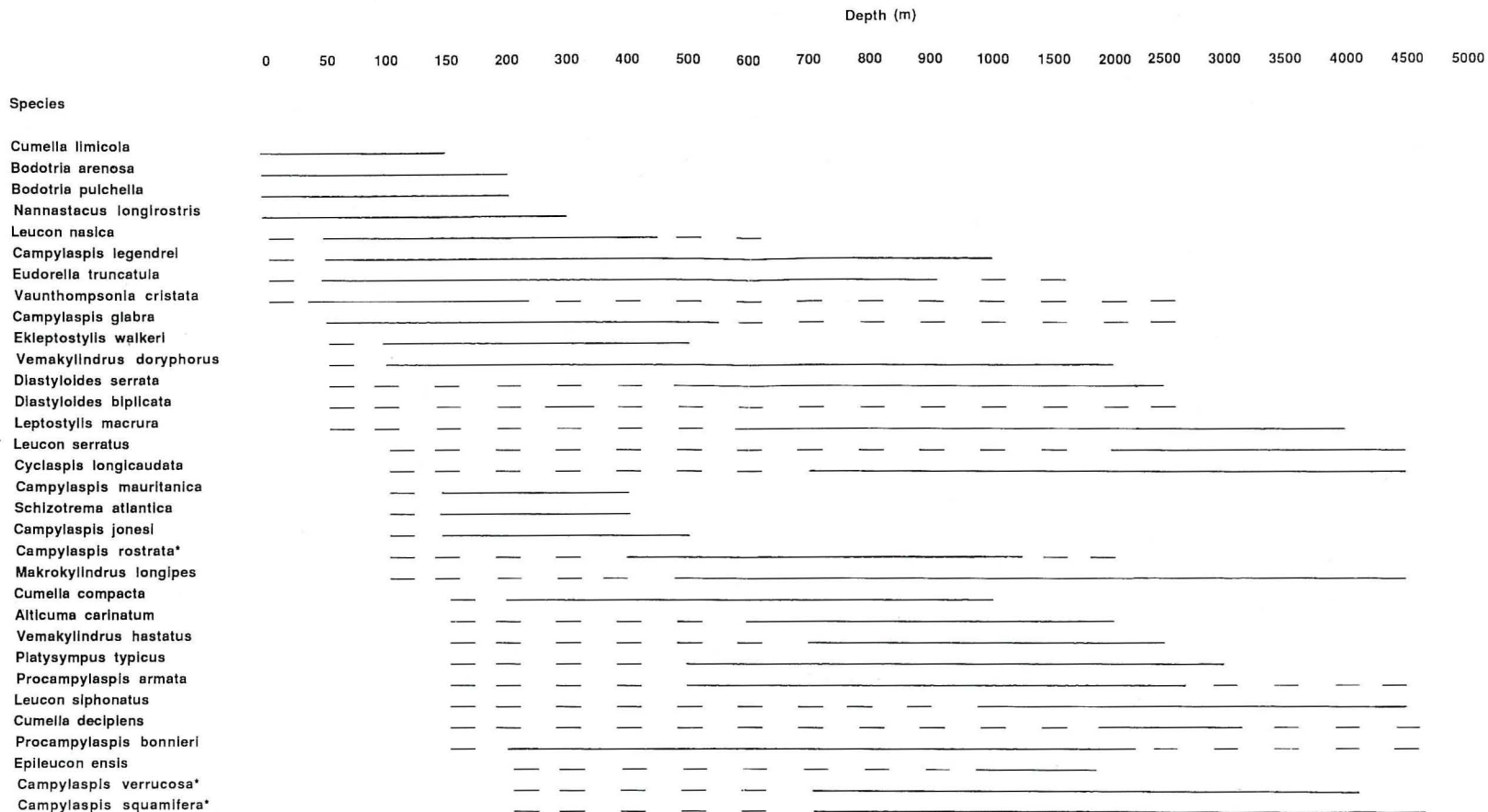
TABLE I

Distribution of cumacean species of the Balgim cruise (Atlantic phase) arranged according to depth of occurrence.

STATION Gear Used	100	to	200	173	181	250	281	309	200	to	500	452	500	
	135	150	150						155	364	370			398
	42	43	114	71	72	74	32	47	81	53	27	28	20	87
	Dr	Dw	Dw	Dr	Dr	Dw	Dw	Dw	Dr	Dw	Dw	Dw	Dw	Dw
<i>Cumella limicola</i> Sars, 1879	—	1	—	—	—	—	—	—	—	—	—	—	—	—
<i>Bodotria arenosa</i> Goodsir, 1843	—	—	20	—	—	—	—	—	—	—	—	—	—	—
<i>Cumella compacta</i> Jones, 1984	—	—	—	—	3	—	—	—	—	—	—	—	—	—
<i>Vaunthompsonia cristata</i> Bate, 1858	—	2	—	—	—	—	—	—	—	—	—	—	1	—
<i>Ekleptostylis walkeri</i> (Calman, 1907)	—	—	—	—	3	—	—	—	—	—	—	—	1	—
<i>Campylaspis jonesi</i> Bacescu & Muradian, 1972	3	7	4	2	2	82	1	8	—	2	18	2	—	—
<i>Campylaspis mauritanica</i> B & M, 1972	1	3	2	1	—	42	—	—	2	7	1	1	—	—
<i>Schizorema atlantica</i> B & M, 1972	1	3	—	—	21	—	—	2	3	1	11	5	—	—
<i>Campylaspis legendrei</i> Fage, 1951	—	7	1	—	10	—	—	1	1	1	—	—	—	—
<i>Nannastacus longirostris</i> Sars, 1879	—	1	—	—	10	—	—	2	—	—	—	—	—	—
<i>Procampylaspis armata</i> Bonnier, 1896	—	8	—	—	1	—	—	2	—	12	5	—	8	3
<i>Vemakylindrus hastatus</i> (Hansen, 1920)	—	—	—	1	—	1	—	—	—	—	—	—	—	—
<i>Leptostylis macrura</i> , Sars, 1869	—	—	—	1	—	94	—	—	—	10	3	—	1	—
<i>Leucon siphonatus</i> Calman, 1905	—	—	—	2	4	8	16	—	—	8	8	5	1	1
<i>Cumella decipiens</i> Jones, 1984	—	—	—	—	1	—	—	—	—	—	—	—	—	—
<i>Leucon serratus</i> Norman, 1879	—	—	—	—	—	12	4	—	—	11	14	1	1	1
<i>Diasityloides serrata</i> (Sars, 1865)	—	—	—	—	—	1	2	—	—	—	55	5	—	1
<i>Diasityloides btipicata</i> (Sars, 1865)	—	—	—	—	—	35	—	1	—	4	20	2	1	6
<i>Procampylaspis bonnieri</i> Calman, 1906	—	—	—	—	—	1	—	—	—	32	31	1	—	2
<i>Leucon nasica</i> (Kroyer, 1841)	—	—	—	—	—	—	1	—	—	—	—	—	—	—
<i>Eudorella truncatula</i> (Bate, 1856)	—	—	—	—	—	—	7	—	—	1	2	2	—	2
<i>Epileucon ensis</i> Bishop, 1981	—	—	—	—	—	—	5	—	—	—	—	—	—	1
<i>Bodotria pulchella</i> (Sars, 1878)	—	—	—	—	—	—	—	2	—	—	—	—	—	—
<i>Campylaspis glabra</i> Sars, 1879	—	—	—	—	—	—	—	1	—	—	—	—	—	—
<i>Plarysypus typicus</i> Sars, 1870)	—	—	—	—	—	—	—	1	—	—	—	—	2	—
<i>Campylaspis rostrata</i> Calman, 1905	—	—	—	—	—	—	—	—	3	16	—	—	1	—
<i>Campylaspis verrucosa</i> Sars, 1866	—	—	—	—	—	—	—	—	—	5	—	—	—	—
<i>Hemilamprops cristatus</i> (Sars, 1870)	—	—	—	—	—	—	—	2	—	27	—	—	19	—
<i>Bathycuma brevisrostre</i> (Norman, 1879)	—	—	—	—	—	—	—	—	—	2	—	—	1	—
<i>Makrokylinndrus longipes</i> (Sars, 1871)	—	—	—	—	—	—	—	—	—	11	—	—	8	—
<i>Cumella gracillima</i> Calman, 1905	—	—	—	—	—	—	—	—	—	—	—	—	1	—
<i>Makrokylinndrus josephinae</i> (Sars, 1871)	—	—	—	—	—	—	—	—	—	—	—	—	2	—
<i>Epileucon longirostris</i> (Sars 1871)	—	—	—	—	—	—	—	—	—	—	—	—	—	15
<i>Cyclaspis longicaudata</i> Sars, 1865	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ceratocuma horridum</i> Calman, 1905	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Epileucon pusillus</i> Bishop, 1981	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Epileucon spiniventris</i> (Hansen, 1920)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Procampylaspis omnimidion</i> Jones, 1984	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspis spinosa</i> Calman, 1906	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspis vitrea</i> Calman, 1906	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cumelopsis puritani</i> Calman, 1906	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Paracampylaspis platycarpus</i> Jones, 1984	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Makrokylinndrus longicaudatus</i> (Bonnier, 1896)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspis horridoides</i> Stephensen, 1915	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Makrokylinndrus myriamae</i> Reys, 1974	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspis alba</i> Hansen, 1920	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Chalarostylis elegans</i> Norman, 1879	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Epileucon craterus</i> Bishop, 1981	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Leucon macrorhinus</i> Fage, 1951	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Procampylaspis lutensis</i> Jones, 1984	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Procampylaspis bituberculata</i> Hansen, 1920	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Procampylaspis macronyx</i> Hansen, 1920	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Leptostylis bacescoi</i> Reys, 1972	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspis laevigata</i> Jones, 1974	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cumella dayae</i> Jones, 1984	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspides grandis</i> Fage, 1929	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cumelopsis laevis</i> Jones, 1984	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cyclaspoides sarsi</i> Bonnier, 1896	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspis squamifera</i> Fage, 1929	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cumella spicata</i> Jones, 1984	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Paralamprops orbicularis</i> (Calman, 1905)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Campylaspis exarata</i> Jones, 1974	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Eudorella intermedia</i> Hansen, 1920	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cumella echinata</i> Jones, 1984	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Leucon profundus</i> Hansen, 1920	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Platycuma holti</i> Calman, 1905	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Alicuma carinatum</i> (Zimmer, 1921)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Apocuma</i> sp. DJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Vemakylindrus doryphorus</i> (Fage, 1940)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total specimens	5	32	27	7	7	324	36	20	11	150	168	24	48	32

TABLE II

Depth ranges of Balgim Atlantic cumaceans from known records. Interrupted lines indicate extensions of range where records are few in number.



Hemilamprops cristatus
*Cumella gracillima**
*Leucon macrorhinus**
Campylaspis exarata
*Campylaspis spinosa**
Makrokyllindrus josephinae
Epilleucon longirostris
Bathycuma brevisrostris
Cumellopsis puritani
Campylaspis vitrea
Campylaspis horridoides
Paralamprops orbicularis
Leucon profundus
Campylaspis alba
Leptostylis bacescoi
Apocuma sp. DJ
Campylaspis laevigata
Epilleucon pusillus
Ceratocuma horridum
Procampylaspis ommdion
Epilleucon spiniventris
Cyclaspoides sarsi
Cumella dayae
Paracampylaspis platycarpus
Makrokyllindrus longicaudatus
Procampylaspis lutensis
Makrokyllindrus myrlamae
Epilleucon craterus
Chalarostylis elegans
Campylaspides grandis
Cumella echinata
Procampylaspis bituberculata
Procampylaspis macronyx
Cumellopsis laevis
Cumella spicata
Eudorella intermedia
Platycuma holti



Apocuma sp. DJ, *Ceratocuma horridum*, *Epileucon pusillus*, *Leucon profundus*, *Campylaspides grandis*, *Campylaspis exarata*, *C. horridoides*, *C. laevigata*, *C. spinosa*, *C. verrucosa*, *C. vitrea*, *Cumella dayae*, *C. decipiens*, *C. echinata*, *C. spicata*, *Cumellopsis puritani*, *Paracampylaspis platycarpus*, *Procampylaspis bituberculata*, *P. bonnieri*, *Paralamprops orbicularis* and *Platysympus typicus*.

4. Eurybathic species which only penetrate to the shelf occasionally as juveniles but reach the abyssal plain : *Cyclaspis longicaudata*, *Bathycuma brevirostre*, *Leucon serratus*, *L. siphonatus*, *Campylaspis squamifera*, *C. verrucosa*, *Procampylaspis armata*, *Hemilamprops cristatus* and *Makrokylindrus longipes*.

5. Species mainly occurring on the lower slope and continental rise: *Cyclaspoides sarsi*, *Epileucon longirostris*, *E. spiniventris*, *Campylaspis alba*, *Cumella gracillima*, *Procampylaspis lutensis*, *P. ommidion*, *Leptostylis bacescoi* and *Makrokylindrus josephinae*.

6. Species mainly from the continental rise and abyssal plain, extending onto the lower slope : *Epileucon craterus*, *Eudorella intermedia*, *Cumellopsis laevis*, *Platycuma holti*, *Procampylaspis macronyx*, *Chalarostylis elegans*, *Makrokylindrus longicaudatus* and *M. myriamae*.

GEOGRAPHICAL DISTRIBUTION

A total of 83 species, excluding two unidentified, were found during the Balgim cruise. Of these 20 (24 %) were common to both Atlantic and Mediterranean stations, 49 (59 %) were found only in the Ibero-Moroccan Bay and 14 (17 %) were confined to the western Mediterranean stations.

Atlantic only

<i>Alticuma carinatum</i>	<i>Campylaspis exarata</i>	<i>Platycuma holti</i>
<i>Apocuma</i> sp. n. DJ	<i>C. horridoides</i>	<i>Procampylaspis bituberculata</i>
<i>Bodotria arenosa</i>	<i>C. jonesi</i>	<i>P. bonnieri</i>
<i>B. pulchella</i>	<i>C. laevigata</i>	<i>P. lutensis</i>
<i>Cyclaspoides sarsi</i>	<i>C. mauritanica</i>	<i>P. macronyx</i>
<i>Vaunthomsonia cristata</i>	<i>C. vitrea</i>	<i>P. ommidion</i>
<i>Epileucon craterus</i>	<i>Cumella compacta</i>	<i>Schizotrema atlantica</i>
<i>E. ensis</i>	<i>C. dayae</i>	<i>Chalarostylis elegans</i>
<i>E. pusillus</i>	<i>C. decipiens</i>	<i>Hemilamprops cristatus</i>
<i>E. spiniventris</i>	<i>C. echinata</i>	<i>Paralamprops orbicularis</i>
<i>Eudorella intermedia</i>	<i>C. gracillima</i>	<i>Leptostylis bacescoi</i>
<i>Leucon nasica</i>	<i>C. limicola</i>	<i>Makrokylindrus josephinae</i>
<i>L. profundus</i>	<i>C. spicata</i>	<i>M. longicaudatus</i>
<i>L. serratus</i>	<i>Cumellopsis laevis</i>	<i>M. myriamae</i>
<i>Ceratocuma horridum</i>	<i>C. puritani</i>	<i>Vemakylindrus doryphorus</i>
<i>Campylaspides grandis</i>	<i>Paracampylaspis</i>	<i>V. hastatus</i>
<i>Campylaspis alba</i>	<i>platycarpus</i>	

Atlantic and Mediterranean

<i>Cyclaspis longicaudata</i>	<i>Campylaspis legendrei</i>	<i>Platysympus typicus</i>
<i>Bathycuma brevirostre</i>	<i>C. spinosa</i>	<i>Diastylodes biplicata</i>
<i>Epileucon longirostris</i>	<i>C. squamifera</i>	<i>D. serrata</i>
<i>Eudorella truncatula</i>	<i>C. rostrata</i>	<i>Ekleptostylis walkeri</i>
<i>Leucon macrorhinus</i>	<i>C. verrucosa</i>	<i>Leptostylis macrura</i>
<i>L. siphonatus</i>	<i>Nannastacus longirostris</i>	<i>Makrokyllindrus longipes</i>
<i>Campylaspis glabra</i>	<i>Procampylaspis armata</i>	

Mediterranean only

* <i>Iphinoe serrata</i> , Norman, 1867	<i>Procampylaspis mediterraneus</i> Ledoyer, 1984
<i>Eudorella nana</i> Sars, 1879	<i>Mesolamprops denticulatus</i> Ledoyer, 1984
* <i>Leucon affinis</i> Fage, 1951	* <i>Diastylis cornuta</i> (Boeck, 1864)
<i>L. mediterraneus</i> Sars, 1879	<i>D. jonesi</i> Reys, 1972
* <i>Campylaspis macrophthalma</i> Sars, 1879	<i>Diastylodes bacescoi</i> Fage, 1940
* <i>C. sulcata</i> Sars, 1870	<i>D. carpinei</i> Bacescu, 1969
* <i>Nannastacus unguiculatus</i> (Bate, 1859)	<i>Vemakylindrus charcoti</i> (Reys, 1974)

Of the species confined to the Atlantic stations 14 have been found elsewhere in the Mediterranean than the Alboran Sea, including *Campylaspis alba* recorded by me (*Atlantis II*, Cruise 59, Sta. 211, 33° 57' N, 15° 08.2' E, 500-509 m, 2.9.70).

Of the species confined to the Mediterranean stations 6, marked *, have been recorded from the Golfe de Gascogne (Bay of Biscay) or further north in the Atlantic (Jones 1985, 1986), leaving only 8 as probably endemic to the Mediterranean, although some of the other 6 might have originated there.

Evidently, in common with other animal groups (Pérès 1962), cumacean species diversity at bathyal depths is greater in the Ibero-Moroccan Bay than in the western Mediterranean.

The Atlantic stations of the Balgim cruise at which Cumacea were found may be divided into two groups : northern comprising 02, 07, 11, 16, 20, 27, 28, 32, 42, 43, 47, 53, 58, 107, 109, 114, 155, 159 and 160, and southern, comprising 61, 62, 63, 64, 68, 71, 72, 74, 81, 87, 88, 90, 91, 92, 94, 96, 99 and 100.

The northern and southern groups had 37 species (53.6 %) in common while 16 (23.2 %) were found only in the northern group and a further 16 only in the southern group. In the northern group 11 species and in the southern group 10 species occurred as single specimens or at only one station. Of the 16 species confined to the northern group 10 have been recorded from the Golfe de Gascogne or elsewhere in the north-east Atlantic and 6 from further south in the Atlantic. Of the 16 species confined to the southern group 13 have been recorded from the north-east Atlantic and 3 from further south. However, 10 of the 16 northern group species have been found also in the Mediterranean but only two of the southern

group. Although it seems likely that the northern stations are influenced by the Mediterranean outflow, statistical analysis of the numbers of specimens and species found at stations in the northern and southern areas respectively by the Mann-Whitney and Student's t test showed no significant differences.

From data received from PIROCEAN the stations directly affected by the Mediterranean outflow include 20, 27, 28, 53, 109, 155, 159 and 160. The numbers of specimens at these stations and those at the remaining 11 stations included in the northern group containing Cumacea were not significantly different, the means being 28.7 (SD 15.4) and 62.75 (SD 62.6) respectively. However, the stations are not strictly comparable with each other as they were sampled with various sorts of gear.

The distribution of species collected at the northern group of stations with reference to their occurrence within and outside the outflow from the Mediterranean is shown in the following table (A - total number ; B - number also recorded from Mediterranean ; C - percentage recorded from Mediterranean) :

	N° of species		%
	A	B	C
At stations within outflow only	5	5	100
At stations within and outside outflow	25	17	68
At stations outside outflow only	23	9	39

Clearly the species composition in the northern part of the Ibero-Moroccan Bay is greatly influenced by the Mediterranean outflow.

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