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COMMUNITY STRUCTURE OF THE DECAPOD CRUSTACEANS IN THE MIDDLE BATHYAL ZONE OF THE SARDINIAN CHANNEL

BY

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ABSTRACT

A series of experimental catches between 500 and 1050 m was carried out in the Sardinian Channel (mid-western Mediterranean sea) to obtain information on the distribution of several species of decapod crustaceans. The collections were made by bottom trawls in two different periods, summer and winter, during the years 1989, 1990, and 1991. Forty-seven species of Decapoda were collected. The most common species caught in all the strata examined are *Aristeus antennatus, Plesionika martia, P. acanthonotus*, and *Polycheles typhlops. Acanthephyra eximia* and *Cymonomus granulatus* have been caught in this area for the first time. Thirty-four percent of the species show a seasonal variation in bathymetric distribution. Below 650-700 m the species-composition changes and the number of species decreases.

RIASSUNTO

Una serie di pescate sperimentali effettuate nel Canale di Sardegna tra 500 e 1050 m di profondità, ha permesso di ottenere informazioni sulla composizione faunistica e sulla distribuzione batimetrica dei Crostacei Decapodi presenti in quest'area. E' stata utilizzata una rete a strascico con maglie del sacco di 15 mm di lato, munita di copri-sacco con maglie di 5 mm. Le osservazioni sono state effettuate in due periodi, giugno-luglio e gennaio-febbraio, negli anni 1989, 1990 e 1991. Complessivamente sono state raccolte 47 specie di Crostacei Decapodi. Il 34% delle specie raccolte mostra una variazione stagionale nella distribuzione batimetrica. La composizione delle specie cambia in modo netto dopo i 600-650 m di profondità e in modo più graduale dopo i 750 m di profondità. In *Aristeus antennatus* e *Aristeomorpha foliacea* la sex-ratio varia con la profondità con un incremento del numero di maschi in entrambe le stagioni. In *Plesionika martia* e *P. antigai* il rapporto sesso si sposta in favore delle femmine, con l'aumento della profondità solo nel periodo estivo. Una migrazione di femmine di *Macropipus tuberculatus* verso fondi più profondi nel periodo della riproduzione sembra essere possibile dato il ritrovamento nel periodo ionvernale di femmine ovigere alle maggiori profondità considerate.

INTRODUCTION

Data on the structure and faunistic composition of benthic communities in the deep waters of the mid-western Mediterranean are still few and fragmentary. They are limited to the epibathyal and partially to the mesobathyal levels, which since long have been subjected to an intense trawl fishing. The available observations on the deep-water decapod crustaceans of the Sardinian Channel mostly regard species captured by trawling above 700-750 m, the maximum

(Senna, 1902; Maurin, 1961, 1965; Manning & Froglia, 1982; Mura, 1984), fisheries results (Cau & Mura, 1978; Relini et al., 1990) and of some papers dealing with biological aspects of species of interest to fisheries (Azouz, 1973; Cau et al., 1982, 1984; Mura & Cau, 1989).

The present paper contains a study of the faunistic composition and bathymetric distribution of the decapod crustaceans present in the lower part of the mesobathyal zone of this area down to 1050 m.

MATERIALS AND METHODS

On the northern slope of the Sardinian Channel in the Algiers-Provençal Basin, a series of experimental trawlings has been carried out in five bathymetric intervals, 500-550 m, 600-650 m, 700-750 m, 850-900 m, and 1000-1050 m, on deep mud bottoms (fig. 1). Bottom trawls consisting of Italian type nets with 5 mm cod en mesh size have been used. The observations were made in daytime in two periods, June-July and January-February, in the years 1989, 1990, and 1991. Fifty-eight trawl hauls were made equally distributed in the different bathymetric zones. Carapace length (c.l.) was measured in millimeters from the orbit (in shrimps and Macrura Reptantia), or from the base of the rostrum (in Galatheidea and Brachyura), to the posterior margin of the carapace; shield length (s.l.) was measured in Paguridea.

RESULTS

Forty-seven species of decapod crustaceans have been captured. They have been listed in table I where they are grouped in accordance with the depth range observed (the depths found in the summer and winter being separately indicated). The number of species found decreases with the increase of depth: especially clear below 600-650 m, and then more gradually below 850 m (fig. 2). More than 78% of the species are present at all depths below 500 m. Among the species never found before below 550 m *Pagurus excavatus* (s.l. 9.3-11.0 mm, ♂; 9.3-11.7 mm, ♀) and *Pandalina profunda* (c.l. 4.0-6.2 mm, ♂; 5.0-5.5 mm, ♀) are most abundant. During the winter *Parapenaeus longirostris* (c.l. 7.0-31.5 mm, ♂; 10.0-37.5 mm, ♀) was found at depths between 500 and 550 m, in the summer going down to 650 m. In both summer and winter the major occurrence of some species of decapods was found between 500 and 650 m. In winter *Nephrops norvegicus* (c.l. 14.0-67.2 mm, ♂; 15.0-25.5 mm, ♀), *Parthenope macrochelos* (c.l. 10.0-49.8 mm, ♂; 12.0-40.5 mm, ♀), *Processa canaliculata* (c.l. 11.0-16.2 mm, ♂; 11.2-23.5 mm, ♀) and *Solenocera membranacea* (c.l. 11.2-20.3 mm, ♂; 12.0-22.5 mm, ♀), are present in this bathymetric range. In summer they show a variation of their bathymetric distribution, since they may be found even at 750 m depth.

The major occurrence of specimens of *N. norvegicus* in both seasons is between 500 and 550 m depth. During the summer two of the most common species,

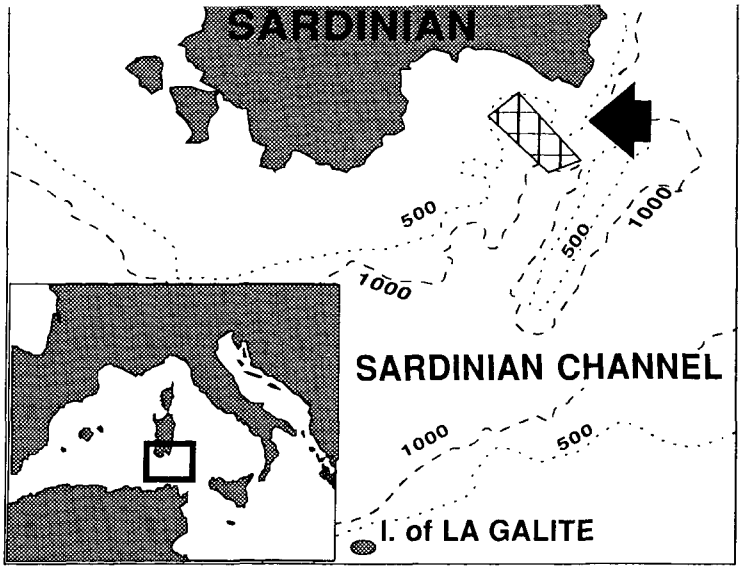

Fig. 1. Collecting zone in the Sardinian Channel.

Aristaeomorpha foliacea and *Munida tenuimana* can be captured in levels deeper than the ones in which they are found in winter. *A. foliacea* in both seasons shows the most frequent occurrence of specimens between 550 and 650 m; males had c.l. 12.3 to 42.3 mm, females 12.0 to 65.0 mm. Males *M. tenuimana* had c.l. 10.2 to 17.8 mm, females from 10.8 to 24.0 mm. On the contrary, *Plesionika edwardsii* (c.l. 11.0-26.0 mm, ♂; 13.6-28.9, ♀), *Plesionika martia* (c.l. 7.2-22.2 mm, ♂; 9.0-23.5 mm, ♀) and *Macropipus tuberculatus* (c.l. 12.9-25.5 mm, ♂; 12.1-27.8 mm, ♀) occurred at greater depths in the winter. In the winter all 27 specimens of *M. tuberculatus* captured between 700 and 1050 m consists of ovigerous females (c.l. 17.9-24.6 mm). *Plesionika antigai* (c.l. 8.0-14.6 mm, ♂; 9.6-15.5 mm, ♀), *P. edwardsii* and *P. martia* are the most common pandalids on mud bottoms. The first two species have the highest concentration of specimens between 500 and 550 m in both summer and winter, while *P. martia* is found between 600 and 650 m. Among the benthic or nektobenthic species only six reach their greatest depth in both seasons: *Aristeus antennatus* (c.l. 10.8-32.4 mm, ♂; 11.0-60.5 mm, ♀), *Plesionika acanthonotus* (c.l. 4.8-15.0 mm, ♂; 4.7-16.5 mm, ♀), *Polycheles typhlops* (c.l. 14.0-30.2 mm, ♂; 13.4-45.8 mm, ♀), *Paromola cuvieri* (c.l. 102.0-128.6 mm, ♂; 95.0-101.2 mm, ♀), *Pontocaris lacazei* (c.l. 6.5-12.2 mm, ♂; 5.7-13.8 mm, ♀) and *Ergasticus clouei* (c.l. 11.0-12.6 mm, ♂; 10.8-13.5 mm, ♀). The first three are the most common species. *A. antennatus* and *P. acanthonotus* are most frequent between 600 and 650 m, while *P. typhlops* between 700 and 750 m in summer, and between 600 and 650 m in winter. Apparently only *Geryon longipes* (c.l.

Bathyal decapod crustaceans captured in the Sardinian Channel between 500 and 1050 m, with the bathymetric range observed. The observations have been effected in two summer and winter periods, in 1989, 1990, and 1991. When depth range in winter and summer are different, they have been separately indicated.

	Winter	Summer
Dardanus arrosor (Herbst, 1796)	500-550	
Pagurus axcavatus Herbst, 1791	500-550	
Calappa granulata (L., 1758)	500-550	
Pandalina profunda Holthuis, 1946	500-550	
Parapandalus narval (Fabricius, 1787)	500-550	
Parapenaeus longirostris (Lucas, 1846)	500-550	500-650
Liocarcinus depurator (L., 1758)	500-650	
Chlorotocus crassicornis (Costa, 1871)	500-650	
Ebalia nux A. Milne Edwards, 1883	500-650	
Ligur ensiferus (Risso, 1816)	500-650	
Latreillia elelgans Roux, 1830	500-650	
Munida intermedia A. M. Edwards & Bouvier, 1899	500-6540	
Pagurus alatus (Fabricius, 1775)	500-650	
Philocheras echinulatus (M. Sars, 1861)	500-650	
Nephrops norvegicus (Linnaeus, 1758)	500-650	500-750
Parthenope macrochelos (Herbst, 1790)	500-650	500-750
Processa canaliculata (Leach, 1896)	500-650	500-750
Solenocera membranacea (Risso, 1816)	500-650	500-750
Anamathia rissoana (Roux, 1828)	500-750	
Monodaeus couchii (Couch, 1851)	500-750	
Pasiphaea sivado (Risso, 1816)	500-750	
Plesionika antigai Zariquiey Alvarez, 1955	500-750	
Plesionika gigliolii (Sennam, 1903)	500-750	
Plesionika edwardsii (Brandt, 1851)	500-750	500-650
Aristaeomorpha foliacea (Risso, 1827)	500-750	500-900
Bathynectes maravigna (Prestandrea, 1839)	500-750	700-1050
Munida tenuimana G. O. Sars, 1872	500-900	500-1050
Pontophilus spinosus (Leach, 1815)	500-900	
Sergestes arcticus Krøyer, 1855	500-900	
Aristeus antennatus (Risso, 1816)	500-1050	
Plesionika acanthonotus (Smith, 1882)	500-1050	
Paromola cuvieri (Risso, 1816)	500-1050	
Polycheles typhlops Heller, 1862	500-1050	
Pontocaris lacazei (Gourret, 1887)	500-1050	
Sergia robusta (S. I. Smith, 1882)	500-1050	
Ergasticus clouei Studer, 1883	500-1050	
Macropipus tuberculatus (Roux, 1830)	500-1050	500-650
Plesionika martia (A. M. Edwards, 1883)	500-1050	500-900
Pasiphaea multidentata Esmark, 1866	500-1050	600-1050
Geryon longipes A. M. Edwards, 1881	500-1050	600-1050
Gennadas elegans (Smith, 1882)	500-1050	700-1050
Acanthephyra pelagica (Risso, 1816)	500-1050	850-1050
Dorhynchus thomsoni Thomson, 1873	600-1050	
Pontophilus norvegicus (M. Sars, 1861)	600-1050	
Cymonomus granulatus (Thomson, 1873)	850-1050	—
Sergestes arachnipodus Cocco, 1832	850-1050	500-750
Acanthephyra eximia S. I. Smith, 1886	1000-1050	—

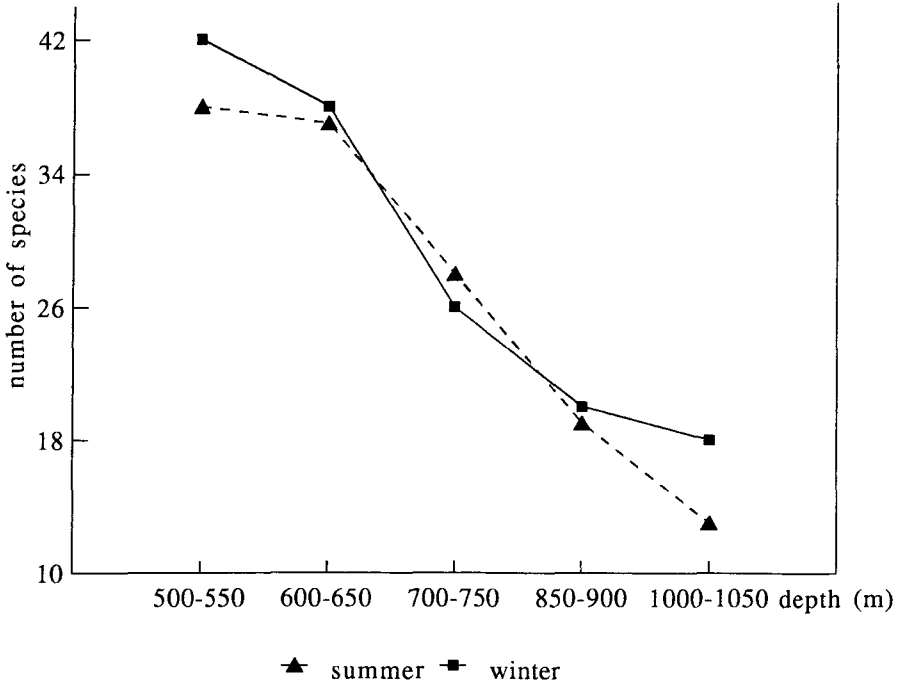

Fig. 2. Occurrence of species along with depth increase.

32.4-56.7 mm, ♂; 34.6-41.6 mm, ♀) shows a bathymetric range that starts at lesser depths in the summer. Another brachyuran crab, *Bathynectes maravigna* (c.l. 23.6-40.6 mm, ♂; 25.0-30.7 mm, ♀) ranges deeper in the summer (700-1050 mm) than in the winter (500-750 m). Among the bathypelagic species captured *Sergia robusta* (c.l. 14.3-16.2 mm, ♂; 13.8-19.2 mm, ♀), *Sergestes arcticus* (c.l. 7.0-9.2 mm, ♂; 7.0-12.7 mm, ♀) and *Pasiphaea sivado* (c.l. 7.6-20.2 mm, ♂; 7.5-21.5 mm, ♀) do not show any seasonal variations in their daytime bathymetric distribution. The other bathypelagic species are found over a greater depth range during daytime in the winter than in the summer, except for *Sergestes arachnipodus* (c.l. 7.4-16.3 mm, ♂; 12.6-17.8 mm, ♀), which shows completely different distributions in the two seasons. In only few species of decapod crustaceans the sex-ratio was found to clearly change with depth. In *A. foliacea* and *A. antennatus* the percentage of males increases with depth (fig. 3). In *A. foliacea* the change in the sex-ratio in the summer is most evident below about 700 m depth. It is beyond 750 m that in *A. antennatus* the sex-ratio changes in favour of the males, reaching higher values in the greatest depths in summer than in winter.

In *P. martia* and *P. antigai* the sex-ratio changes with depth in the summer only. In the two species of *Plesionika* however, the percentage of males decreases

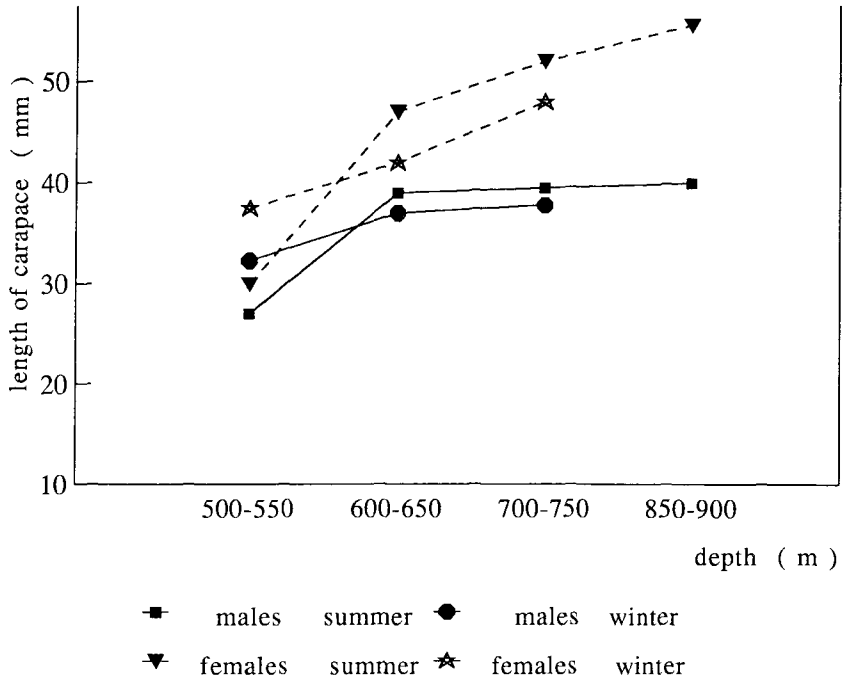

Fig. 3. Variation of sex-ratio in *Aristeomorpha foliacea* and *Aristeus antennatus* according to depth.

with depth. In the aristeid shrimps *A. antennatus* and *A. foliacea* the average carapace length changes with depth. In the females of *A. antennatus* the average carapace length is smaller, due to a smaller number of large females beyond 750 m depth. In the males the average size increases with depth in both seasons (fig. 4). In males and females of *A. foliacea* the average carapace length increases with depth between 500 and 650 m (fig. 5).

CONCLUSIONS

The present paper is a first contribution to the study of the bathymetric distribution and faunistic composition of the decapod crustaceans of the mesobathyal level in the mid-western Mediterranean. Clearly, the present results are influenced by the characteristics of the gear used to capture the specimens. Anyway it is possible to locate a bathymetric range, between 650 and 750 m in which there is a distinct change in the faunistic composition of decapod crustaceans. In this range the populations of *Munida tenuimana, Plesionika acanthonotus* and *Polycheles typhlops* take the place of those of *M. intermedia, P. antigai* and *Nephrops norvegicus*. The overlap of these populations starts between 500 and

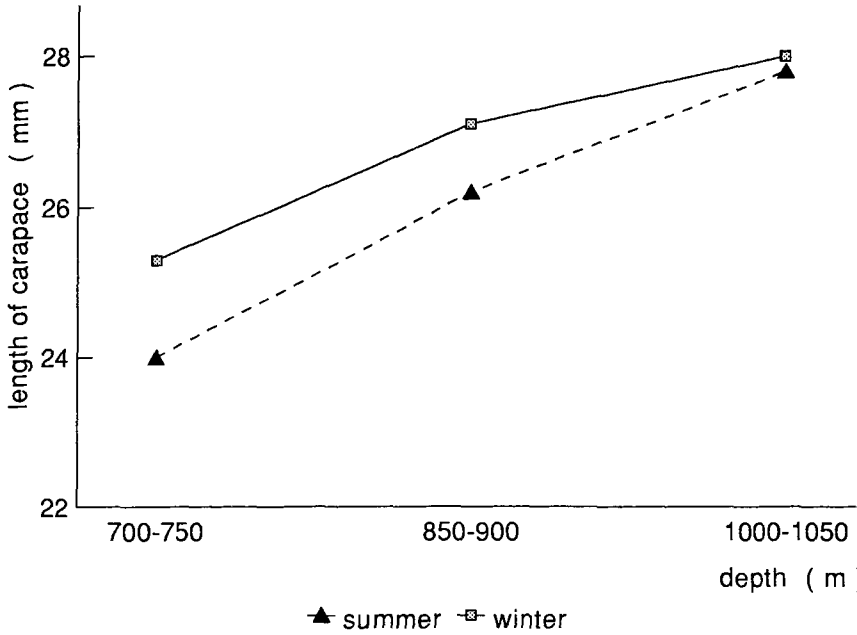

Fig. 4. Variation of the average length of carapace according to depth in males of *Aristeus antennatus*.

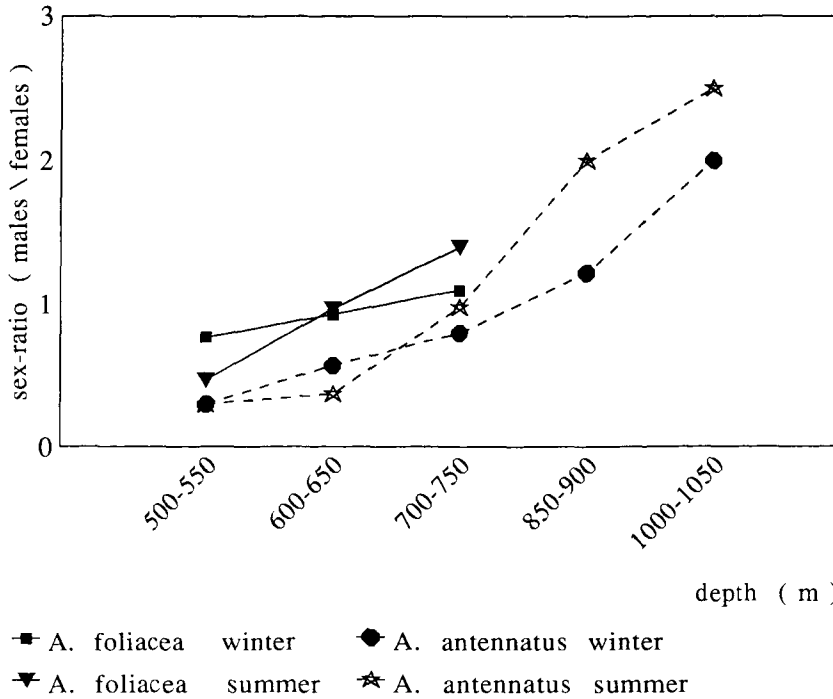

Fig. 5. Variation of the average length of carapace according to depth in males and females of *Aristeomorpha foliacea* in summer and winter periods.

limit between the upper and middle bathyal zone in this area.

Other bathymetric successions of decapod crustaceans can be found here. Some species of crangonoid shrimps disappear one by one with the increase of the depth: *Philocheras echinulatus*, *Pontophilus spinosus*, and *Pontophilus norvegicus*. *Geryon longipes* replaces the other brachyuran crab *Monodaeus couchii*. The caridean shrimp *Acanthephyra eximia* takes the place of the demersal aristeids. The two species captured for the first time in this area, *Cymonomus granulatus* and *Acanthephyra eximia*, seem to be characteristic of the deepest levels investigated. Other characteristic species of the lower horizon of the bathyal plain, however, have not been found by us; such species are *Stereomastis sculpta* and *Nematocarcinus exilis*, recorded by Senna (1902) from this area at 1600 m depth. Finally it is worth mentioning the presence of ovigerous females of *Macropipus tuberculatus* at the greatest depth examined in the winter season. A female of *M. tuberculatus* has been found by Abelló & Valladares (1988) between 1430 and 1433 m in the Catalan Sea. The great bathymetric variability found in this species is probably due to a migration of females towards deeper water in the reproduction period.

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