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DECAPOD CRUSTACEANS AND ECHINODERMS IN INSULAR DETRITIC ENVIRONMENTS: TUSCAN ARCHIPELAGO AND PONTIAN ISLANDS

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ABSTRACT

Benthic macrofauna results obtained from soft bottom samplings carried out in the Tuscan Archipelago and at the Pontian Islands, Mediterranean Sea, during 1988-1991 are reported. A total of 506 detritic stations were sampled. In this paper are reported only the data related to 197 stations, characterized by the presence of decapod crustaceans and echinoderms. 64 are located in the Tuscan Archipelago yielding 20 species of decapod crustaceans and 21 of echinoderms, and 133 in the Pontian, where 32 species for each taxa were collected. The obtained data highlighted, for both faunistic groups, differences in the specific composition of the two archipelagoes.

Key words: detritic environment, decapod crustaceans, Decapoda, echinoderms, Echinodermata

Ključne besede: detritno okolje, raki deseteronožci, Decapoda, iglokožci, Echinodermata

INTRODUCTION

We report on the results obtained from benthic macrofauna, collected in the Tuscan Archipelago and at the Pontian Islands, in the years 1988-1991, under the MURST 40% TSM national project: Taphonomy and Sedimentary Processes on the Mediterranean Continental Shelf. The aim of the project is to study the relationships between biocoenoses and thanatocoenoses in biotopes of soft substrata, examined in detail also from the chemical, physical and sedimentological point of view (Basso *et al.*, 1990; Corselli & Giacobbe, 1992; Corselli *et al.*, 1994, 1995; Rinelli & Spanò, 1996).

The study concerns in particular the detritic biocoenoses of the circalittoral zone and the transition areas with adjacent biocoenoses. Given the need to limit as much as possible the number of variables to be considered, these insular environments have been chosen: they are affected by any substantial terrigenous inputs and are characterized by a high hydrodynamism level.

This contribution deals only with data relative to decapod crustaceans and echinoderms: these are generally rarely considered on a bionomic level, but they have already shown to be effective environmental descriptors in previous studies (Giacobbe *et al.*, 1996).

MATERIALS AND METHODS

Samples of sediment were taken, from on board R/V "Minerva", with a modified Van Veen grab having a sampling capacity of 70 dm³ volume and 0.25 m² surface area.

A total of 506 detritic stations, located between the depths of 50 m and 150 m, were sampled during eight oceanographic cruises in June and November 1988 and December 1990 in the Tuscan Archipelago (236 stations); June and November 1989, April and November 1991 at the Pontian Islands (270 stations). The sampling areas are shown in figure 1.

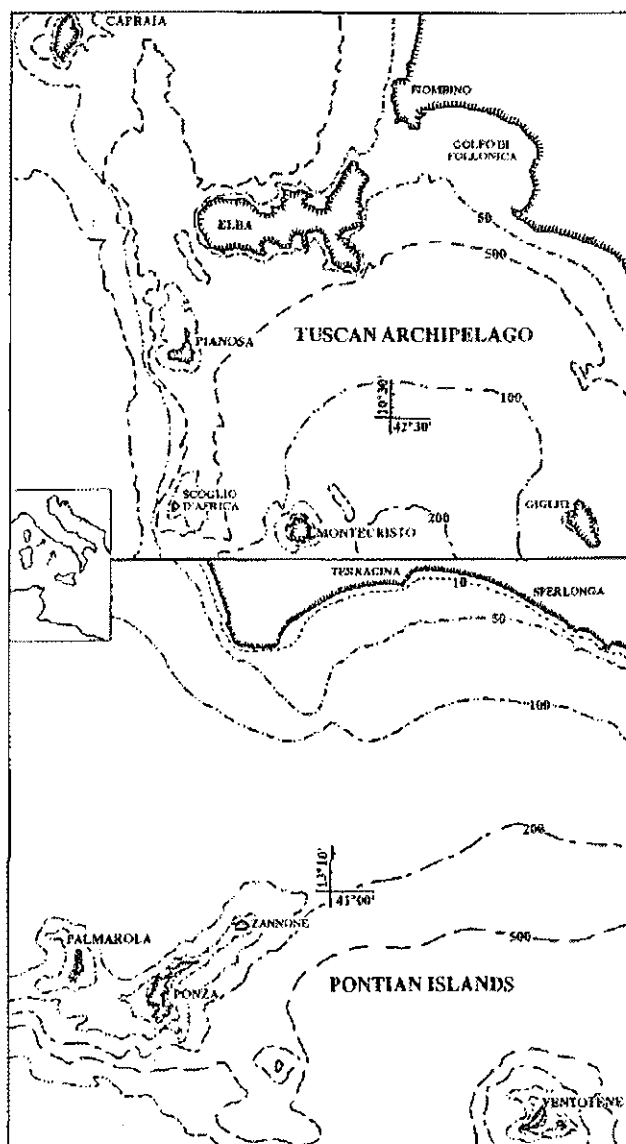


Figure 1: Location of sampling areas.
Sl.1: Lokacije vzorčenja.

From living macrofauna, obtained by sieving the sediment through a 1 mm mesh screen, the decapod crustaceans (excluding Natantia) and echinoderms were extracted and determined to specific level.

RESULTS AND DISCUSSION

The results outlined refer altogether to 197 stations. 64 are located in the Tuscan and 133 in the Pontian Archipelago, the only ones characterized by the presence of the two taxa species.

With regard to the Tuscan Archipelago (Tab. 1,) 20 species of decapod crustaceans (11 Brachiura, 8 Anomura, 1 Macrura) and 21 of echinoderms (1 Crinoi-

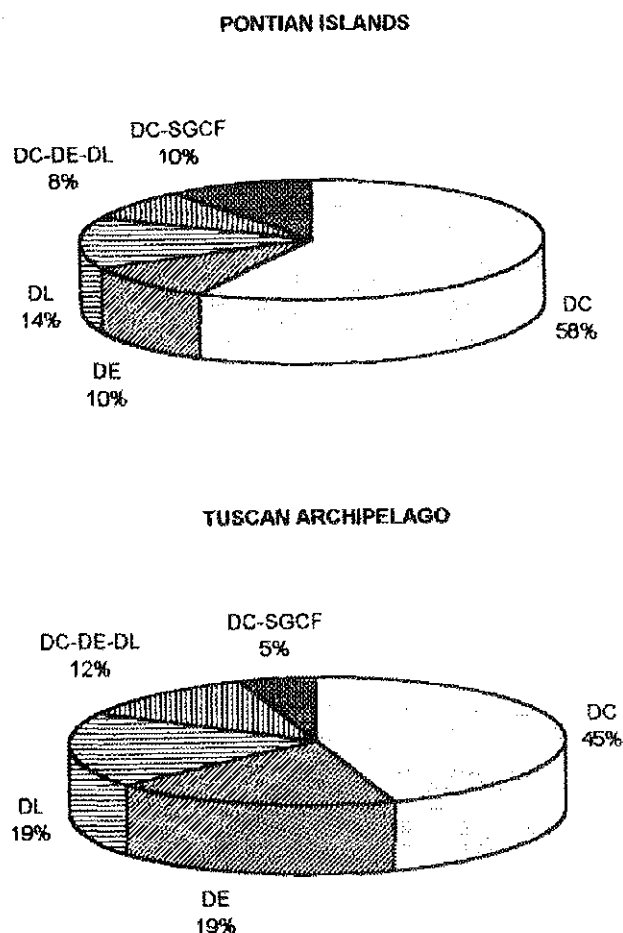


Figure 2: Percent contribution of the main biocoenotic stocks (DC: Coastal Detritic; DL: Shelf-edge Detritic; DE: Muddy Detritic Bottoms; DC-DE-DL: Mixed biode-tritic bottoms; DC-SGCF: Coastal Detritic-Coarse Sand and Fine Gravel under Bottom Currents transition).

Sl. 2: Odstotkovni prispevek glavnih biocenotskih pod-lag (DC: obalno peščena; DL: prodnato grebenasta, DE: blatno-peščeno dno; DC-DL-DE: mešano biodetritno dno; DC-SGCF: obalno peščeno-grob pesek in fin prod na prehodu pod pridnenimi tokovi).

dea, 2 Holothuroidea, 9 Ophiuroidea, 9 Echinoidea) were found. In the Pontian Archipelago (Tab. 2), the number of species was higher: 32 decapod crustaceans (17 Brachiura, 12 Anomura, 3 Macrura) and 32 echino-derms (1 Crinoidea, 2 Holothuroidea, 3 Asteroidea, 12 Ophiuroidea, 14 Echinoidea).

The obtained data highlighted, for both faunistic groups, differences in the specific composition of the two archipelagoes.

As regards the carcinofauna, the species found in both archipelagoes are only twelve. In particular, 3 species of *Ebalia* genus (*E. cranchi*, *E. granulosa* and *E.*

TUSCAN ARCHIPELAGO	DC	DE	DL	DC-DE-DL	DC-SGCF
CRUSTACEANS					
<i>Astias strobilatus</i> LEACH					
<i>Dardanus arrosor</i> (HERBST)					
<i>Anagagurus laevis</i> (BELL)					
<i>Pagurus prideaux</i> LEACH					
<i>Pagurus anachoretus</i> RISSO					
<i>Pagurus sculptimanus</i> LUCAS					
<i>Galathea strigosa</i> (L.)					
<i>Galathea squamifera</i> LEACH					
<i>Galathea intermedia</i> LILJEBORG					
<i>Ethusa mascaroni</i> (HERBST)					
<i>Ebalia tuberosa</i> (PENNANT)					
<i>Homola barbata</i> (FABRICIUS)					
<i>Liocarcinus zariquiey</i> (GORDON)					
<i>Xantho pilipes</i> A. MILNE EDWARDS					
<i>Xantho incisus</i> (LEACH)					
<i>Monodactylus couchi</i> (COUCH)					
<i>Goneplax rhomboides</i> (L.)					
<i>Parthenope massena</i> (ROUX)					
<i>Eurytemora aspera</i> (PENNANT)					
<i>Libinia chiragra</i> (FABRICIUS)					
ECHINODERMS					
<i>Leptometra phalangium</i> (J. MÜLLER)					
<i>Molpadia musculus</i> RISSO					
<i>Trachythone tergestina</i> DUBEN KOREN					
<i>Ophiomyxa pentagona</i> (LAMARCK)					
<i>Amphitrite chiaiei</i> FORBES					
<i>Amphitrite filiformis</i> (O. F. MÜLLER)					
<i>Amphipholis squamata</i> (DELE CHIAJE)					
<i>Acrocalda brachiata</i> MONTAGU					
<i>Ophiotrix fragilis</i> (ABIDGAARD)					
<i>Ophiopsila aranea</i> FORBES					
<i>Ophiocentrus forbesi</i> (HELLER)					
<i>Ophiura albida</i> FORBES					
<i>Cidaris cidaris</i> (L.)					
<i>Genocidaris maculata</i> A. AGASSIZ					
<i>Echinocyathus pusillus</i> (O. F. MÜLLER)					
<i>Spatangus purpureus</i> (O. F. MÜLLER)					
<i>Spatangus inermis</i> MORTENSEN					
<i>Echinocardium cordatum</i> (PENNANT)					
<i>Echinocardium mortenseni</i> THIERY					
<i>Schizaster canaliferus</i> (LAMARCK)					
<i>Brisopsis lyrifera</i> (FORBES)					

Table 1: Faunistic list of collected species: those found only in the Tuscan (not in the Pontian) Archipelago are emphasized in boldface.

Tabela 1: Favnistični seznam zbranih vrst: tiste, ki so bile najdene samo v Toskanskem otočju, so označene z debelimi črkami.

PONTIAN ISLANDS	DC	DE	DL	DC-DE-DL	DC-SGCF
CRUSTACEANS					
<i>Astias strobilatus</i> LEACH					
<i>Callinassa subterranea</i> (MONTAGU)					
<i>Upogebia pusilla</i> (PETAGNA)					
<i>Paguristes eremita</i> (L.)					
<i>Clibanarius erythropus</i> (LATREILLE)					
<i>Dardanus arrosor</i> (HERBST)					
<i>Anagagurus petiti</i> DECHANCE' E FOREST					
<i>Anagagurus laevis</i> (BELL)					
<i>Pagurus alatus</i> FABRICIUS					
<i>Pagurus prideaux</i> LEACH					
<i>Pagurus bernhardus</i> (L.)					
<i>Pagurus anachoretus</i>					
<i>Risso Pagurus cuanensis</i> BELL					
<i>Galathea bolivari</i> ZARIQUIEY ALVAREZ					
<i>Galathea intermedia</i> LILJEBORG					
<i>Ebalia tuberosa</i> (PENNANT)					
<i>Ebalia cranchi</i> LEACH					
<i>Ebalia granulosa</i> A. MILNE EDWARDS					
<i>Ebalia edwardsi</i> COSTA					
<i>Thira scutellata</i> (FABRICIUS)					
<i>Bathynectes longipes</i> (RISSO)					
<i>Liocarcinus zariquiey</i> GORDON					
<i>Liocarcinus pusillus</i> (LEACH)					
<i>Liocarcinus corrugatus</i> (PENNANT)					
<i>Xantho pilipes</i> A. MILNE EDWARDS					
<i>Xantho poiressi</i> (OLIV)					
<i>Xantho incisus</i> (LEACH)					
<i>Parthenope massena</i> (ROUX)					
<i>Eurytemora aspera</i> (PENNANT)					
<i>Pisa nodipes</i> (LEACH)					
<i>Inachus dorsettensis</i> (PENNANT)					
<i>Inachus thoracicus</i> (ROUX)					
ECHINODERMS					
<i>Leptometra phalangium</i> (J. MÜLLER)					
<i>Holothuria tubulosa</i> GMELIN					
<i>Labidoplax digitata</i> (MONTAGU)					
<i>Astropecten aranciatus</i> (L.)					
<i>Luidia sarsi</i> DUBEN-KOREN					
<i>Echinaster sepositus</i> (REIZIUS)					
<i>Ophiomyxa pentagona</i> (LAMARCK)					
<i>Amphitrite chiaiei</i> FORBES					
<i>Amphitrite mediterranea</i> LYMAN					
<i>Amphitrite apicula</i> CHERBONNIER					
<i>Amphitrite acurigera</i> (DUBEN-KOREN)					
<i>Amphitrite filiformis</i> (O. F. MÜLLER)					
<i>Ophiotrix fragilis</i> (ABIDGAARD)					
<i>Ophiopsila aranea</i> FORBES					
<i>Ophiopsila annulosa</i> (M. SARR)					
<i>Ophiocentrus longicaudum</i> (REIZIUS)					
<i>Ophiocentrus forbesi</i> (HELLER)					
<i>Ophiura albida</i> FORBES					
<i>Cidaris cidaris</i> (L.)					
<i>Genocidaris maculata</i> A. AGASSIZ					
<i>Sphaerechinus granularis</i> (LAMARCK)					
<i>Echinus acutus</i> LAMARCK					
<i>Psammochinus microluberculatus</i> BLAINVILLE					
<i>Echinocyathus pusillus</i> (O. F. MÜLLER)					
<i>Spatangus purpureus</i> (O. F. MÜLLER)					
<i>Spatangus inermis</i> MORTENSEN					
<i>Echinocardium cordatum</i> (PENNANT)					
<i>Echinocardium mediterraneum</i> (FORBES)					
<i>Echinocardium mortenseni</i> THIERY					
<i>Schizaster canaliferus</i> (LAMARCK)					
<i>Brisopsis atlantica mediterranea</i> MORTENSEN					
<i>Brisopsis unicolor</i> (LESKE)					

Table 2: Faunistic list of collected species: those found only in the Pontian (not in the Tuscan) are emphasized in boldface.

Tabela 2: Favnistični seznam zbranih vrst: tiste, ki so bile najdene samo v Pontskem otočju, so označene z mastnimi črkami.

edwardsi) were collected only at the Pontian Islands. On the other hand, in the Tuscan Archipelago various findings of *Galathea strigosa* and *G. squamifera* in the mixed bottoms DC-DE-DL were made.

In the decapod crustaceans we can clearly show the presence of a group of species which includes *Ethusa mascarone*, *Xantho pilipes*, *X. poressa* and *Parthenope massena*: they are linked to coarse substrata closely enough to be considered coarse sediment-loving species (Spanò, 1992). Particularly important in this respect is the presence of *Ebalia* species, whose preferred habitat consists of detritic bottoms that show in effect a generic affinity to coarse substrata and require a considerable hydrodynamism level. Also interesting is *Axius stirhynchus* collected many times in both archipelagoes. The few data available in the literature note this species in a very particular environment, such as Offshore Mud (VL, Gamulin-Brida, 1974) of the Adriatic Sea, while our large findings only on detritic bottoms seem to be in complete disagreement. On the other hand, the VL biocoenosis constitutes quite a limited and very characteristic environment, for which it may not be possible to hypothesize a range for the species extending into shallower biocoenoses. It is more likely that the species tolerates sandy substrates and high hydrodynamism level.

Dardanus arrosor is a circabathyal species, fine sediment-loving, considered by Pérès & Picard (1964) as a companion species of the Biocoenoses of the Bathyal Mud (VP, Pérès & Picard, 1964). Apart from the bionomic definition, this species is quite often found in a wide range of detritic biocoenoses (Jacquotte 1963; Falconetti, 1980); a different bathymetric and bionomic location in respect to age and reproduction period can be hypothesized, as for many other species of *Diogenidae*.

Finally the findings, on detritic bottoms, of *Eurynome aspera* are characteristic: to date this species has been considered as having a wide ecological distribution (Ire, Picard, 1965), but in our opinion it is strictly linked instead to the detritic substrate complex (DC-DE-DL, Spanò, 1994).

Also as regards the echinofauna, most of the species found in both studied areas are characteristic of biode-tritic bottoms with a rather coarse texture. Differences in the faunistic composition of the two archipelagoes pertain principally to the classes Asteroidea, Ophiuroidea and Echinoidea. In particular, sea stars were found only in the Pontian Archipelago, where three species were collected: *Astropecten avranticus*, coarse sediment-loving found quite often in the Biocoenosis of Coarse Sand and Fine Gravel under Bottom Currents (SGCF, Pérès & Picard, 1964), but also abundant in North Adriatic mud bottoms, *Luidia sarsi*, sandy sediment-loving and characteristic species of the Biocoenosis of Shelf-edge Detritic (DL, Pérès & Picard, 1964) and finally *Echinaster sepositus*, which has a wide ecological

distribution (Ire), but in any case with affinity to biode-tritic substrates. Among the regular sea urchins, *Sphaerechinus granularis* and *Psammechinus microtuberculatus* were collected only at the Pontian Islands. The former is coarse sediment-loving and linked to the SGCF biocoenosis, while the latter is characteristic exclusively of the Biocoenosis of Coastal Detritic (DC, Pérès & Picard, 1964). Amongst the brittle stars, two species are worth mentioning: *Amphiura securigera*, noted only three times in the Mediterranean Sea (Guille, 1972; Zavodnik, 1973; Albertelli & Cattaneo, 1980) and by at a depth of 70 m at Ventotene and *Ophioconis forbesi*, present in both archipelagoes, little noted in the Mediterranean and exclusively characteristic of the DC biocoenosis.

From a comparison of the detritic biocoenotic stocks of the bottoms examined in the two different archipelagoes (Fig. 2) it is evident that in both cases the highest percentage is made up of DC biocoenosis (45% in the Tuscan and 58% in the Pontian Archipelago). A significant difference is noted between the two areas studied with regard to biocoenoses of coarser granulometry, principally represented in the Pontian Islands. In particular the DC-SGCF transition shows frequency values of 5% in the Tuscan and of 10% in the Pontian Archipelago. On the other hand, biocoenoses characterized by finer texture sediments, Biocoenosis of Shelf-edge Detritic and of the Muddy Detritic Bottoms (DE, Pérès & Picard, 1964) are more widespread in the Tuscan Archipelago. Specifically the DE biocoenosis in this area shows percentual values equal to about double those that characterize the Pontian Islands. The DL biocoenosis is present in the Tuscan Archipelago with values (19%) which diverge little from those of the Pontian (14%). The percentual incidence of mixed stock DC-DE-DL is comparable in the two archipelagoes.

CONCLUSION

The bionomic analysis of the collected species revealed that most of them are consistent with the detritic environments studied, especially with regard to substratum affinity.

Ultimately the echinoderms, which are less vagile than decapods, assume a clearer role in terms of bionomic description. In contrast, species from the carcinofauna supply more detailed information on edaphic factors which characterize various biotopes locally.

Based on the critical examination of the collected data, it is worth underlining the necessity to revise some bionomic definitions which to date have been attributed to the echinofauna or carcinofauna. In particular, the rigorous definition of biocoenoses is restricted by inadequacy of sampling and disperse data. General conclusions have often been wrongly drawn from a few local studies.

POVZETEK

Avtorici poročata o rezultatih vzorčenja bentoške favne na mehkem dnu v Toskanskem in Pontskem otočju v Sredozemskem morju med letoma 1988 in 1991. Vzorčenje je bilo opravljeno na 506 detritnih postajah, v tem delu avtorici navajata podatke le s 197 postaj, značilnih po deseteronožcih in iglokožcih, ki tam živijo. 64 od teh je bilo v Toskanskem območju, kjer je bilo zabeleženih 20 vrst deseteronožcev in 21 vrst iglokožcev, 133 pa v Pontskem otočju, kjer je bilo zbranih po 32 vrst za oba taksona. Zbrani podatki za favnistični skupini kažejo na razlike v specifični sestavi dveh otočij. Kar zadeva rake, je bilo v obeh otočjih najdenih samo 12 vrst. Tri vrste iz rodu *Ebalia* (*E. cranchi*, *E. granulosa* in *E. edwardsi*), značilne za peščeno dno, so bile najdene samo v Pontskem otočju, medtem ko je bilo na mešanem dnu DC-DE-DL v Toskanskem otočju najdenih več primerkov vrst *Galathea strigosa* in *G. squamifera*. Kar zadeva iglokožce, je večina vrst, najdenih v obeh preučevanih območjih, značilna za bolj grobo biodetritično dno. Razlike v favnistični sestavi dveh otočij gredo v glavnem na račun razredov Asteroidea, Ophiuroidea in Echinoidea.

Ob primerjavi biodegretnih biocenoznih podlag na dnu dveh različnih raziskanih otočjih je jasno, da največji odstotek v obeh primerih sestavljata biocenozi DC. Ob kritičnem pregledu zbranih podatkov avtorici poudarjata, da bi bilo treba na novo pregledati bionomske definicije, ki so bile do danes pripisane favni iglokožcev in deseteronožcev.

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