## Notes on the development and invertebrate colonization of *Sabellaria Alveolata* reefs in N/W Sicily

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Either the sudden outburst of a peculiar benthic community or its elimination are evidence of major changes occurring in the coastal environment of the Mediterranean Basin. Increase in eutrophication and mismanagement in most coastal biotopes of Sicily have resulted in massive growths of filter feeders and fouling-like biotic assemblages. Replacement of extant littoral photophilous algal communities by extensive mussel beds and/or other filter feeders has occurred since the end of the '70ies in the Gulf of Castellammare, western Sicily, as a consequence of the massive disposal of rough sewage and nutrient-rich sludge by an industrial plant for the treatment of vines (RIGGIO *et al.*, in press). They added up to the organic burden of the littoral waters due to the outfalls of some polluted streams, to the sewers of small and medium-size coastal towns and holiday resorts as well. As a result the **BODs** and **COD** of nearshore waters in proximity of the outlets have risen respectively to as much as **18.000mgl$^{-1}$ and 24.000mgl$^{-1}$** (CALVO and GENCHI, 1989). These values decrease according to an E-W gradient of dispersion. An outburst of the Polychaetous worm *Sabellaria alveolata* was recorded together with the spreading of *Mytilus galloprovincialis* beds, that in a few years gave rise to a long series of reefs parallel to the coastside in the most polluted portion of the gulf. The *Sabellaria* colonies protrude from the soft bottom as mushroom-shaped or reef-like outcrops rooted to rocky boulders ("hermelles", *sensu* GRUET, 1969-70; 1988); in this last case they can grow as high as 3m and as broad as 2m, by far exceeding the size reported in mid Tyrrhenian (TARAMELLI RIVOSECCCHI, 1961) or elsewhere in the Mediterranean. These bioconstructions range ca. 2km west of the most polluting outfall becoming smaller and more loosely aggregated as far as the pollution decreases.

Three sites (stat **1H, 2H, 3H**) were chosen along an E/W transect in the course of a survey of the "hermelles" and their biotic communities. Station **1H**, highly polluted, is near the outfall of Nocella creek ; **stat. 2H** is less polluted, however heavily affected by silting ; station **3H** is in nearly clean waters, with the Sabellarian colonies growing together with *Posidonia oceanica* and tightly intermingled to the seagrasses. Standard 8dm$^3$ cubes were sampled from the "hermelles" at the depth of ca. 1.5m. Samplings had a seasonal periodicity. Population densities, individual sizes and humid weights of the worms were recorded. The invertebrates inhabiting the sandy reefs were sorted out, counted and taxonomically determined.

As many as **13.190** individuals of S. *alveolata* were hand sorted in a total volume of **98dm$^3$**, resulting in a density of **1096 individuals/dm$^3$**. The following mean densities were recorded : stat. **1H = 1295** ± 340.4 indiv./dm$^3$ ; **2H = 1037** ± 100.4/dm$^3$ ; **3H = 965** ± 220.9/dm$^3$. Mean humid weights of the worms were : **54.36g ± 7.76 at 1H ; 30.92 ± 10.99 at 2H ; 33.7 ± 14.18 at 3H**. The Crustacea were 69.4% of the total invertebrate population inhabiting the reefs : 12% were Decapoda mainly represented by the genus *Alpheus*. Higher abundances were recorded at stat. **3H** . The 88% Peracarida were subdivided into : 4.8% Isopoda ; 15.2% Tanaidacea ; 68% Amphipoda. This last group was much more frequent at stat. **2H**, whereas the Tanaidacea were most frequent at **3H**. The Amphipoda *Maera inaequipes* with as many as 262 individuals and *Corophium acutum* with 189 were dominant, however unequally distributed. C. *acutum*, a typical component of harbour fouling, was mostly found at stat. **1H** ; *M. inaequipes* was instead more abundant at 3H. *Jassa marmorata* was concentrated at **3H**, with 70 individuals. The Tanaidacea *Leptochelia savignyi* and *Apseudes* spp. were recorded during the autumn - winter and were complementary to the Amphipoda whose presence was restricted to spring and summer. *Cyathura sp.* was the most frequent Isopod exclusive of stat. **2H**. As many as **657 molluscan** individuals were counted, **64% Bivalvia** and **36 % Gastropoda.** The **Opistobranchia** were found only at stat. **3H**, where their presence was as high as **10 %.** The **Bivalvia** were by far more abundant at stat. **1H** in mid- and late summer : *Mytilaster minimus* carpeted the reef surfaces, associated to *Mytilus galloprovincialis, Musculus subpictus, Gregariella opifex* and *Ostrea edulis*. All these species are dependent on the high organic content and the massive loads of particulate matter dumped on the seaside. *Thais haemastoma* and other dominant scavengers are indicators of a heavy environmental disturbance. Burrowing and suspensivorous taxa as *Lima lima, Lopha steantina* and *Anomia ephippium*, closely related to sandy concretions, were exclusively found at stat. **2H**. Their abundance should be interpreted as a recovery from the dystrofication of **1H**. This observation was further enhanced by the high diversity of the Gastropoda, dominated by *Hinia incrassata, Columbella rustica* and *Pisania sp.* The molluscan populations of **3H** were typical of *Posidonia* meadows, with *Tricolia pullus, T. speciosa, Alvania* spp. and *Turbona* spp. as the most representative taxa. The above picture does not change when the Polychaete component was taken into account. *Nereis falsa, Capitella capitata* and other taxa related to anoxyc reducing conditions in a sediment-rich bottom characterized stat. **1H**. Syllidae and Phyllodocidae -typical of cleaner waters- were instead dominant at stat. **2H**. The exclusive presence at stat. **3H** of carnivorous Aphroditids and Glyceridae was evidence of environmental recovery (Figs. 1, a; b).

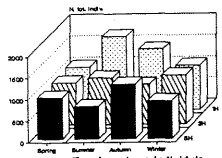

Fig. 1a - Trend numbers individuals *Sabellaria alveolata*

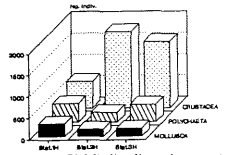


Fig. 1b - Distribution the major groups

As a conclusion, the outburst and rapid expansion of *Sabellaria alveolata* reef-like colonies is an effective means of the coastal environment to convert and temporarily store surplus waste energy, and ultimately have a stabilizing effect on the ecosystem. The "hermelles" are a major refuge to invertebrates and a source of food for the fish, thereby locally increasing the diversity. The structure and composition of the fauna associated to the worms are a reliable spotty indicator of a whole set of environmental conditions, that range from those favouring the settlement of fouling assemblages to those supporting communities adapted to a moderate eutrophication. Availability of seston and grain-size of sands are however crucial. The changes now occurring in the coast of Sicily, are likely to give a clue to a better understanding of some biotic processes that have been developing in the past in other parts of the Mediterranean coastal system causing its present features.

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## Grain size and amphipod distribution in the North Aegean Sea

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Amphipods, in spite of their important role in the benthic ecosystem, are very little studied in the Greek seas. Furthermore, several studies have implicated grain size as an important determinant of amphipod distribution (FINCHAM 1973, etc.), although other authors (e.g. ROBERTSON *et al.*, 1989) consider factors like organic carbon as more important.

The present paper deals with the relationship between the grain size and the distribution of the amphipods collected during benthic surveys in the North Aegean Sea Samplings were made in three gulfs (Thermaikos, Strymonikos and Kavala), either using a Charcot-Picard dredge, or a Van Veen grab, in 180 stations, at depths of 0.9 to 86.4 m, in soft substrata. Certain physico-chemical parameters were measured. Particle size analysis was conducted combining dry shieving of the sand fraction and pipette analysis of the silt-clay fraction, as described by BUCHANAN (1984).

119 amphipod species were totally found in the three gulfs (71 in Thermaikos, 58 in Strymonikos and 59 in Kavala). The most widely distributed are the 18 species given in Table I. In this table, the fluctuation of the Median diameter (Md) of the sediment in which each of these species was found is presented.

The preferences of the various species concerning the grain size of the sediment are much better illustrated in the triangular diagrammes of Fig. 1. In these diagrammes, the sampling stations in which each amphipod species was found, are set depending on the clay-silt-sand fractions. In the present paper, only representative diagrammes are given, for 8 of the most widely distributed species in the three gulfs.

As indicated in the above diagrammes, three basic groups of amphipod species are distinguised. The first group includes species that occur in almost the whole range of sediment types, according to our data. In this group the species of the genus *Ampelisca, A. pseudospinimana* BELLAN-SANTINI & KAIM-MALKA and *A. diadema* (A. COSTA) are included, which, however, seem to have a slight preference in silty sediments (Fig. 1). The second group comprises of species preferring substrata with relatively big grain diameter, for example the species of the genus *Atylus, A. guttatus* (A. COSTA) and *A. vedlomensis* (BATE & WESTWOOD) which appear in stations where the sand fraction is greater than 75%. The third group includes species showing a preference in sediments with small grain diameter (mainly silty or clay-silty), having for this reason a very limited range of distribution. Such species are *Maera schmidtii* STEPHENSEN, *Leucothoe oboa* KARAMAN and *Hippomedon bidentatus* CHEVREUX. Finally, *Metaphoxus fultoni* (SCOTT) seems to prefer sand-silty sediments.

Table I. Median diameter (Md) fluctuation for certain amphipod species.

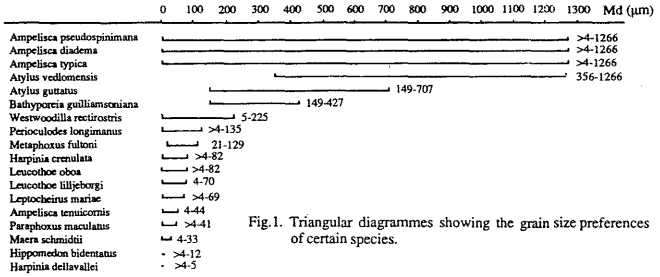





Fig.1. Triangular diagrammes showing the grain size preferences of certain species.

These specific data confirm the general information given up to day, and give further details on the type of substratum these certain species prefer (BELLAN-SANTINI *et al.*, 1982, 1989; LINCOLN, 1979; CHEVREUX & FAGE, 1925; LEDOYER, 1970; BELLAN-SANTINI & LEDOYER, 1972; DAUVIN & TOULEMONT, 1988; etc.).

Although the results of this study show that in this certain area grain size plays an important role in amphipod distribution, the importance of other factors in the distribution of the above species should also be examined.

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