g-Term Changes in the Northern Adriatic Marine Phanerogam Beds

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In the Adriatic Sea, due to a lack of comparable information on distributior abundance of species population, long-term fluctuations in benthic communities d seldom be appropriately explained. The previous thorough research of Benacchio 8) and our recent studies have made possible an evaluation of the changes in ributional patterns of northern Adriatic marine phanerogam species which have rred in this area over a half century span.

Research was done alonf the Istrian coast, and in a part of the Quarner ipelago, *i.e.* around the Cres, Losinj, Susak and Unije islands. At more than a red coastal transects and some peculiar stations skin and SCUBA diving methods employed. In addition, the material sampled by dredge was also considered.

Sufficient comparable data are available only for the following three erogam species: *Posidonia oceanica* (L.) Del., *Cymodocea nodosa* (Ucr.) Asch., and *era noltii* Hornem.

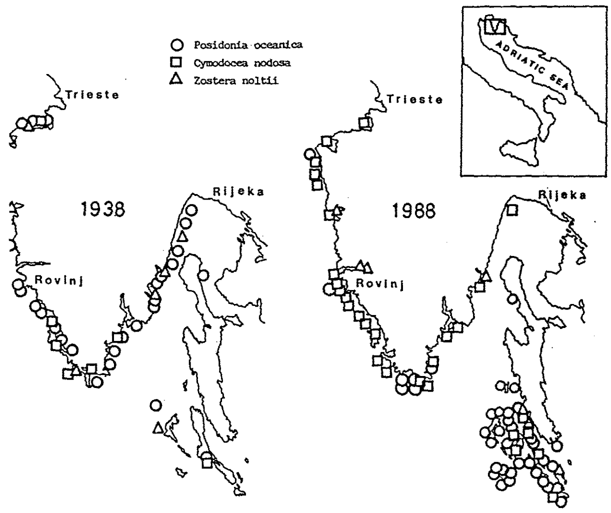
Fifty years ago *Posidonia oceanica* was a common species of many localities of area explored (Fig. 1). Nowadays, the western Istria *Posidonia* beds have ely been made extinct, except for poor remains in the environs of Umag and nj. Around the south Istrian promontory and islands studied the beds are still ly well developed although local decrease processes have been noted.

Cymodocea nodosa is at present well distributed in the entire area, except in steep sloping bottom of the Quarner area. The plants are growing well, cially at sites characterized by oozy sand and enlarged input of particulate rials.

Zostera noltii is at present limited only to a few sheltered and shallow areas acterized by sandy-oozy sediment and lower salinity conditions. Its beds are lly not dense, and in some places, during the low tide, are exposed to cation.

In comparison with the old data of Benacchio (1938) it becomes evident that the past 50 years *Posidonia oceanica* beds have drastically declined in Istrian s, and *Zostera marina* has been largely made extinct. On the other hand, *Zostera i* beds have mostly remained unaffected, while the area of *Cymodocea nodosa* has y extended. At some sites, this species has definitely occupied areas long ago ated by *Posidonia oceanica* (Zavodnik, 1983).

The reasons for the alterations described are no doubt manifold: direct tion effects, however, could be attributed only locally. A more important n lies perhaps in an increased siltation, and changed light conditions affected enlarged water turbidity as suggested by Ghirardelli *et al.* (1973).



ig. 1. Occurrences of marine phanerogams.

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Amphipods and Molluscs of the circalittoral enclaves onto dead terraces of degradated *Posidonia oceanica* Meadows on the Coast of Alboraya (Spain, Gulf of Valencia, Western Mediterranean)

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The epigraph of circalittoral enclaves refers to those structures originated by sciaphilic biogenous accretion onto soft substrate rhizomes or *P.oceanica* rhizomes remains.

On the coast of Alboraya, and in general in the Gulf of Valencia, the ascension of circalittoral biocoenosis towards shallower waters can be observed. This ascension is due to water turbidity levels, rising as a result of high anthecold pressure that this zone presents (urban, industrial, turistic and agricultural activities).In the studied area these concretionated masses use dead terraces of degradated *P. oceanica* meadows for their instaliment and the lower limit of their bathymetric range oscillates between -10 and -12 m.

The installation of these structures on *P. ceanica* meadows occurs, as is described by (18), in those deep meadows with medium leaf density or in shallow ones with high leaf density, where sciaphilic environments can be found. However the *P. oceanica* meadows, in Alboraya, presents a high regression degree with a very low shoot density (1-2 shoots/m^2 at -10 m) and is therefore unable to create sciaphilic biotopes on its own. Then the reason why these concretionated masses appear at shallow levels is because of the turbidity conditions of the sea-water. In fact, in shallower areas (2-3 m depth) Secchi disk disappears at 1m depth and in even offshore deeper areas (around -17 m) it does at 6-7 m.

These structures rise 30-40 cm from the bottom, and they are more frequent on the corniches that delimit the pot-holes and channels. Concretionated masses are built by the action of calcareous algae (*Pseudolithophyllum expansum, Lithophyllum mamillosum* and *Mesophyllum lichenoides*) and by hard structures of porifera and bryozoans, which include shell remains, sediment of diverse texture. *P. oceanica* rhizoma fibril remains, etc .. They are covered by an important sciaphilic flora (*Peyssonnelia* sp., *Udotea petiolata, Halimeda tuna, Codium bursa, Sphaerococcus coronopifolius*, etc.) and fauna (*Eunicella cavolinii, Pentapora fascialis, Myriapora truncata, Halocynthia papillosa*, etc.).

Amphipod fauna, studied by (13), shows a first stock which is formed by the species *Iphimedia serratipes, Lysianassa pilicornis* and *Pseudoprotella phasma* that have been previously mentioned from coralligenous bottoms 9, 11, 19. The second stock is constituted by *Microdeutopus algicola* a species with affinity to hard substrates with vegetal coverage. The third one is represented by species with wide ecological distribution: *Gammarella fucicola* (1) (5) (6) (10) (11) (14), and *Corophium sextonae*, which is presented in the whole biocoenoses at the studied zone except in SGCF. *Leucothoe richiardii* and *Atylus massiliensis* form a stock of species that come from biotopes around. The former comes from rhizome terraces of *P. oceanica* (3) (8), and the latter from sandy biocoenoses (2). The last stock is constituted by a form of *Maera* sp. whose peculiar features don' t allow us to assign it to any of the nine species known from the Mediterranean (7). In the studied area, *Maera* sp. appears exclusively with an important density on these enclaves.

Refering to molluscan fauna, described by (4), there is a first group formed by *Clanculus cruciatus, Diodora graeca, Raphitoma echinata, Turbona cimex, Columbella rustica, Chauvetia minima, Chama gryphoides* and *Muricopsis cristata* previously mentioned in the Coralligenous (18) (20) (15) (16). The second stock is formed by greater numerous species distributed fauna (*Tricolia pullus, Rissoa violacea, Jujubinus exasperatus, Clanculus jussieui, Venerupis pullastra, Glans trapezia*, etc..) characteristic of *P. oceanica* meadows. The third stock shows a faunistic group characterized by species with affinity to hard substrates (*Arca noae, Musculus costulatus, Gastrochaena dubia* and *Lithophaga lithophaga*).

The colonization of circalittoral populations in less deep zones is demostrated by the localization of these shallow circalittoral biogenous enclaves, and by the unusual existence between -6 and -11.5 m at the studied area, of important populations of the amphipod *Lembos angularis* species characteristic of deeper muddy bottoms (8) (3).

In the present study the lower limit of *P. oceanica* meadows, located at -25 m fifteen years ago, have been found at 17-18 m depth. This ascension of the lower limit is probably due to the increment of the turbidity conditions mentioned above. These higher sciaphilic conditions and the existence of dead terraces of *P. oceanica* rhizomes, have conditioned the gradual rising of Coralligenous towards shallower depths. In fact, wide zones with coralligenous blocks of about 2 m height, forming continous strings, are found up to the -20 m isobat.

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