PRELIMINARY DATA ON BENTHIC ENVIRONMENT MODIFICATIONS FOLLOWING THE *CAULERPA TAXIFOLIA* (VAHL) C. AGARDH, SPREAD ALONG THE STRAITS OF MESSINA SICILIAN COASTS (MEDITERRANEAN SEA)

S. Giacobbe, N. Spanò* and A. Manganaro

Dipartimento di Biologia Animale ed Ecologia Marina, Università di Messina, Italy - Spano@unime.it

Abstract

Investigations carried out in the Straits of Messina since 1980 showed as *Caulerpa taxifolia* meadows replaced the originary soft bottom biocoenosis , from 4 to 35m of depth. Hard bottoms were also covered, and *Cymodocea nodosa* formations partially replaced. At the contrary, Posidonia oceanica formations do not appear substantially damaged. Although preliminary data indicated a diversity increasing on some investigated soft-bottom communities, a reduction of diversity is probable along the middle period, due to the increasing sameness of the benthic landscape.

Key-Words: Algae, Straits of Messina, Mediterranean Sea,

Introduction

The Straits of Messina was the first southwestern locality where *Caulerpa taxifolia* (Vahl) C. Agardh has been found after its spread along the northern-western Mediterranean coasts (1). Since the first report, great expanses of sea bottoms have been covered along the Sicilian coasts, while a small number of smaller colonies have been identified along Calabrian coasts. Data concerning structure and distribution of benthic communities in the Messina Straits have been collected by our Department since 1980. This allowed to trace the most relevant chenges observed in the benthic environment following the settlement of *C. taxifolia* prairies.

Materials and Methods

Data employed for the present study were collected during various programs of research regarding the Sicilian side of the Straits of Messina. The most important of these was an investigation carried out in collaboration with the National Research Council (CNR, Messina) (2), and a further one commissioned by the Regional Administration in 1995 (unpublished data). During these investigations, more than 250 grab and dredge samples were collected from 5m to 150m depth, and almost 30 hours of ROV recognitions were recorded along about 25 Km of sea bottoms. Investigations extend up to the present day, mainly through grab samplings and scuba diving surveys, along 10 Km of the coast line .

Results and discussion

The most recent surveys, carried out up to November 2000, have shown how the *Caulerpa taxifolia* prairies extend almost continuously for at least 6 km of bottom, along the Straits of Messina Sicilian coasts; this is in accordance with recent investigations (3). The bathymetric range went from about 3m to 35m depth, although prairie upper limits can reach intertidal depths and have also been observed along the channel communicating with the Ganzirri brackish pool. Furthermore, some small *Caulerpa* patches were recorded from 40 to 65m depth, along both the Sicilian and Calabrian sides. Although *C. taxifolia* was able to colonize any hard or soft bottom type, prairies show some interruptions facing the largest currents. Probably, the high and irregular sediment inputs and soft bottoms made unstable by strong slopes, do not permit easy colonization. The entire area affected by the *Caulerpa* spread has been seen in the past in four main biocoenosis types (2;4). In fact, infralittoral soft bottoms were mainly occupied by the coarse sand and fine gravel under bottom current biocoenoses (SGCF of Pérès and Picard) (5), this being due to the very high hydrodynamic levels characterizing the Straits of Messina (6). Despite this, soft bottoms did not appear monotonous, because of the great variety of local conditions, also by hard bottoms and *Posidonia* meadows patch distribution.

In particular, various *facies* of the SGCF were identified on bottoms characterized by free-living and encrusted calcareous algae, in the "intermattes" channels and, similar to other south-Tyrrhenian localities (7), related to the hard bottom kelp communities. Furthermore, small tracts of bottom, close to the coast line, showed benthic communities identified as fine well sorted sand biocoenoses (SFBC of Pérès and Picard) (5). With regard to the hard bottom biocoenosis, great levels of complexity are known to exist for photophylous algae infralittoral communities (AP of Pérès and Picard) (5), as well as those described by Giaccone and Rizzi Longo (8), and Fredj and Giaccone (9). The most original of such algae associations, especially characterized by the *Saccorhiza polyschides* and *Phyllaria reniformis* kelps, as well as the Atlantic brown alga *Cystoseira tamariscifolia*, are at to day strongly damaged,.

Various causes could be hypothesized regarding this, also considering the fact that Cystoseira communities are well known to be in decline all over the Mediterranean. However, it must be remembered that as *S. polyschides* gametophyte development is closely dependent on *Mesophyllum lichenoides* coralline algae (10), a dense *Caulerpa* canopy could pose a strong threat of disturbance. As far as seagrass meadows are concerned, the living *Posidonia* formations do not appear damaged, although *Caulerpa* prairies cover soft bottoms around the mattes as well as the bottom of channels. Only some subfossil "mattes," from 15 to 20m depth, were covered by *Caulerpa*. On the contrary, a reduction in the expanse of *Cymodocea nodosa* was observed in several localities.

Although the clear variations on sea bottom landscapes would suggest possible strong modifications on benthic community composition, quantitative data are not available in literature. Preliminary data, regarding some soft bottom communities in the Straits of Messina, seem to indicate an increasing diversity in respect to the past (Giacobbe, work in progress). However, even if this fact should be confirmed shortly, it would not necessarily imply a real increase in biodiversity, in that, as *C. taxifolia* is in a phase of active expansion it is clear that the co-related community is still far from being stabilized.

Conclusion

Investigations carried out in the Straits of Messina after *C. taxifolia* spread have indicated that where once existed various types of biocoenoses, now there is an uniform prairie of *C. taxifolia*, with a probably β diversity decreasing. In fact, *Caulerpa* covers indifferently both the hard substrata and the soft ones, fortunately with the exception of the *Posidonia* formations with which it would seem to have integrated, and in part, shared, the habitat. With regard to this, a new research programme proposes to learn how the composition and structure of the community of the soft bottoms would change, following the stabilization of the substratum, and what effects immobilization of large quantities of organic substances, by *Caulerpa* would have on the eco-system and marine and fishing resources.

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