

strubation and Preliminary Evaluation of the State of the *Posidonia oceanica* Meadows on the Coasts of Alicante (Spain, Western Mediterranean)

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The studied area includes the coasts of Alicante between San Antonio Cape and south of Roig Cape.

The *P. oceanica* meadows are widely represented along this coast, and there are also several works about their distribution and state. Some of these works are focused on certain specific places (7) (8) and some others are more extensive (3). With this work we try to give more recent information about the meadows in this area, that can also be useful to show what the evolution is in the last 50 years.

The work in the sea was developed during last two years. It consisted of the allocation of perpendicular transects to the coast in scuba-diving with an one-m hydroplane from the level 0 to 20 m depth. In cliff areas, 27 m approximately, are sometimes reached.

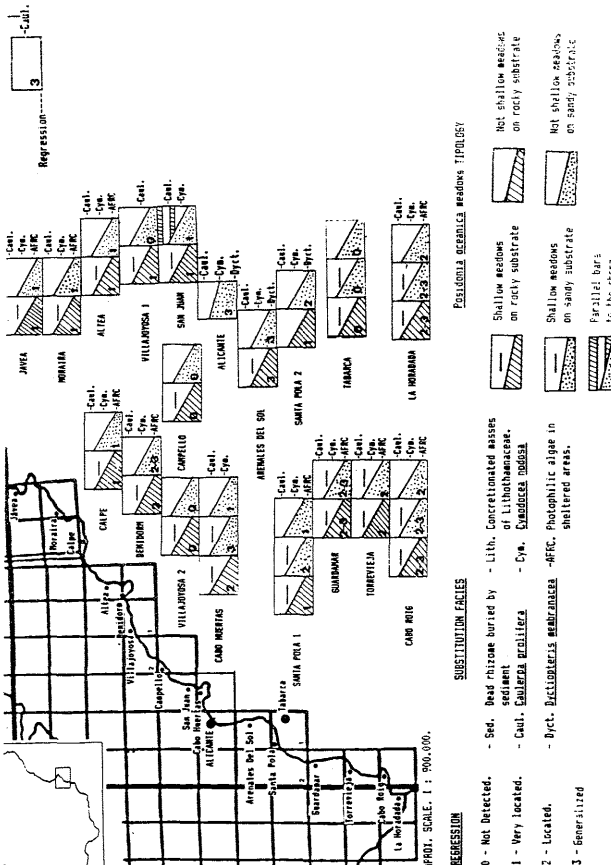
Along the coast of Alicante the meadows are broadly distributed and there are many places where this biocoenosis reaches its climax state. This agrees with localities that not only have less density of human population but also have a all industrial activity or even none. The Marine Reserve of Tabarca, Negrope-Calpe sector and south of Benidorm-Campello can be pointed out.

In general, the superior limits of the meadows start nearly in the shoreline. In this way, important *P. oceanica* recoveries can be already found in the first meters of the infralittoral zone on sandy and rocky coasts of a smooth slope. These shallow zones of the meadows are the most degraded, and substitution facies corresponding to photophilic algae in sheltered areas, facies of *Codium membranacea* (4) (5), of *Caulerpa prolifera* and of *Cymodocea nodosa* are settled on them. *C. prolifera* and *P. membranacea* form very dense and large recoveries in Arenales del Sol and south of Santa Pola. Apart from these iterations of the upper limits, these meadows are in very good conditions in deeper areas. In the plunging type cliffs this phanerogam grows from the bases of the rocky wall itself.

The places where the lower limits of the meadows are above 20 m depth are not a few. Although the coverings with mud from this depth is very common, and meadows are more deteriorated.

Except certain localities, several symptoms of alterations can be observed along the coast. Whereas in many places these alterations are local, in others they are getting quite generalized like in the Alicante-Arenales del Sol sector for example.

It is important to mention that meadows form barrier-reefs (5) in some places of this coast, although they all are in clear regression.



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*Posidonia oceanica* Barrier-Reefs at Spanish Eastern Coasts. Preliminary Data

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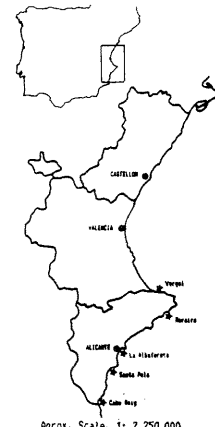
INTRODUCTION.

*Posidonia oceanica* meadows form, at shallow waters, some formations known as barrier-reefs, which are described by several authors from diverse areas of the Mediterranean (MOLINIER & PICARD, 1952; MOLINIER, 1959; PERES, 1967). According to CAMP (1989) there is not this kind of formation at the Spanish Mediterranean coasts, although RAMOS (1983) denoted the existence of one barrier-reef in the south of Huertas Cape.

However, in recent explorations, five of these formations have been detected in the coast of Alicante (Vergel, Portet de Moraira, Albufereta de Alicante, Santa Pola and Roig Cape-Pilar de la Horadada). Also has been confirmed their absence in the coasts of the Gulf of Valencia.

The characteristics considered by us to recognize this barrier-reefs are the following:

- The rhizome stratum at the upper limit of *P. oceanica* meadow rises up from the sedimentary substrate, reaching to such a level that the leaves of *P. oceanica* are close to the water surface.
- These elevated terraces form the reef front with a parallel disposition to the coast, and located at some distance from shoreline (50-100 m).
- The reef front acts as a breakwater, leaving behind it a sheltered area rather like a lagoon. This lagoon is characterized by a high mud and sandy-mud deposition rate, and (usually are present) by the frequent existence of *Caulerpa prolifera* and *Cymodocea nodosa* recoveries.



RESULTS.

VERGEL.- At this locality, the barrier-reef forms a continuous bar parallel to shoreline along 5-6 Km, from Punta de los Molinos to the east of the harbour of Denia. The breakwaters of this harbour are located onto the same reef front, breacking its structure.

The reef front is 100 m far from shoreline. The rhizome terraces reach 3 m height and are crossed by channels of different dimensions.

This barrier-reef shows a general regression process due to pollution, intensive touristic pressure and recent beach regeneration works. In most of its extension only remain disperse high density patches of alive shoots (1200 sh/m<sup>2</sup>), prevailing substitution facies of *Caulerpa prolifera* and photophilic algae populations recovering the dead rhizomes. However the high development of the rhizome terraces of the front maintains the barrier-reef structure.

In some areas the lagoon reaches 4 m depth and there are some dense *Cymodocea nodosa* meadows. Recently the sedimentation rate has been increased by the beach regeneration works, producing an important mud deposition.

The most important feature of this barrier-reef is its location at an open coast with high hydrodynamic conditions, by its direct exposure to the prevalent (east) and strongest (north, northeast) winds.

PORTET DE MORAIRA.- This small bay is lightly closed by a width extension of shallow rhizome terraces of less than 1 m height, that form a low defined reef front. In this barrier-reef the sedimentary channels runs through both sides of the bay. The lagoon is very shallow and does not present vegetal recovering. This bay is used as a natural harbour and the anchorage of sportive boats damages the *P. oceanica* barrier-reef.

SANTA POLA.- The barrier-reef forms a continuous banner of 50 m width and 3 km length, parallel to shore. The prerificial lagoon has been artificially filled with fine sediments to improve turistic use of the beach causing a serious damage to the structure. Most of the lagoon populations have been directly burrowed under the sediment and the abundant mud fraction is easily carried out by water movement producing a high water turbidity that limits photosynthetic activity of *P. oceanica*. Moreover deposition of mud burrows the alive shoots at the reef front.

At the inner part of the reef the dead rhizome are recovered by *Caulerpa prolifera*, photophilic algae and disperse *Cymodocea nodosa* patches. At the reef front there are several sedimentary pot-holes, with important mud deposits in the bottom (up to 70 cm) and dense patches of *Caulerpa prolifera* recovering the rhizome walls.

ALBUFERETA DE ALICANTE.- This barrier-reef was extended from the south of Huertas Cape to the Albufereta beach, forming a bar parallel to the coast (RAMOS, *op. cit.*). Nowadays it is very regressed, only remaining some dead rhizome terraces near the Albufereta sportive harbour, and a small front at the western part of the Huertas Cape.

The construction of the harbour and the enlargement of the Almadraba beach have contributed to the regression of the *P. oceanica* barrier reef, due to they have been realized onto the reef front.

ROIG CAPE-PILAR DE LA HORADADA.- At this area the barrier-reef is formed by rhizome terraces of 3 m height with abundant sedimentary pot-holes and channels. At the north sector there are areas of alive shoots between width extensions of dead rhizome terraces which are recovered by photophilic algae, and by *Cymodocea nodosa* and *Caulerpa prolifera*. The latter is very frequent in the pot-holes. Towards south the terraces form a continuous front parallel to the coast, with less amount of dead rhizome on which is settled the recovering mentioned above.

At the lagoon exists an important mud deposition and a *Cymodocea nodosa* and *Caulerpa prolifera* cover. This barrier-reef shows a good conservation stage, although nowadays the regression symptoms are very apparent due to the increase of urban pressure.

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