POSIDONIA OCEANICA (L.) DELILE IN SARDINIA KNOWLEDGES AND PERSPECTIVES

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Summary

A summary of the research regarding *Posidonia oceanica* in Sardinia is presented; this consists of a series of studies regarding the phenology of the plant and some considerations on the conservation of the prairies.

Finally, the Authors describe a proposition for the protection of the plant in Sardinia.

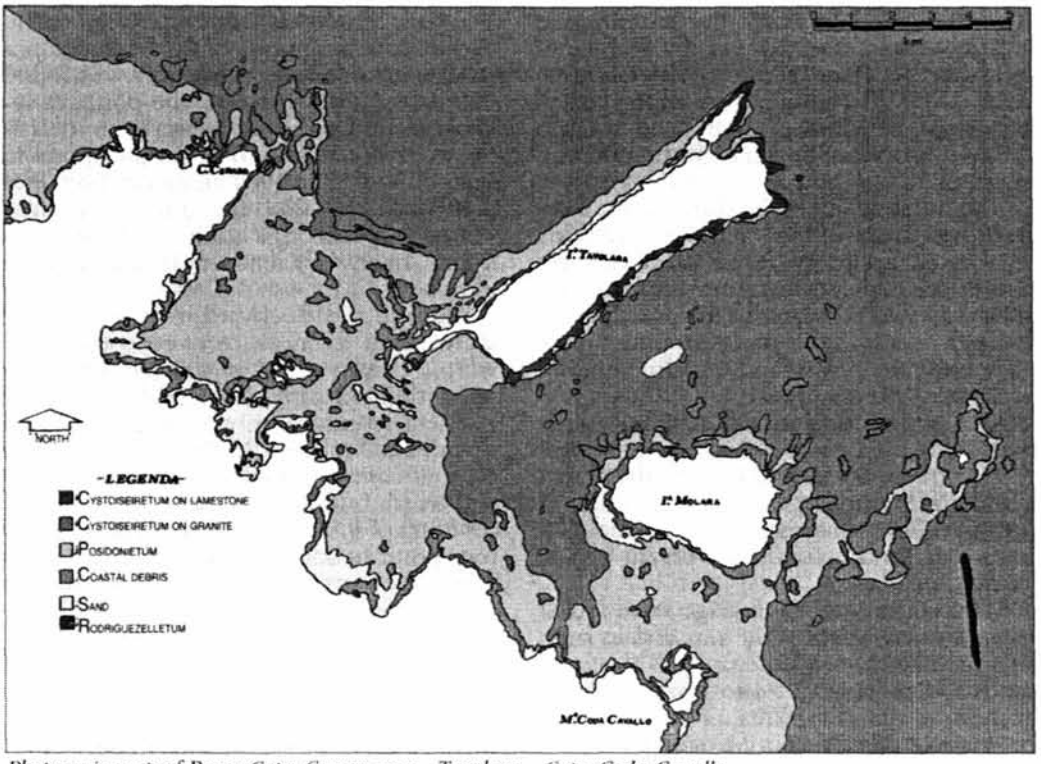
Introduction

The analogy between terrestrial prairies and those of *Posidonia* is apparent; hundreds and sometimes thousands of hectares of the sea-bottom are covered by a carpet of green and brown leaves that in the shallower depths, bend and waver following the incessant rhythm of the waves. It contains an extraordinary variety of life-forms and is considered to be one of the most extensive and productive of the mediterranean coastal strips. More than a thousand scientific articles document its importance. In the course of *Posidonia*'s evolution, there were first terrestrial plants. About 120 million years ago, it readapted itself to marine life and it followed the altering climatical events of the Mediterranean, overcoming the drying-up of this sea. After millions of years, it has arrived at a state of climax with the environment; it has become a complex eco-system in which the living elements tend to be stable and are in perfect equilibrium with each other, as happens in the virgin forests in terrestrial environments. *Posidonia* is a superior plant; it, therefore, has the following structure: roots, stem and leaves. As reproductive organs, it has flowers that produce fruit and seeds. Flowering does not always occur; only in certain particular years does it acquire an explosive and simultaneous character. Most exceptional is the fact that many *Posidonia* groves flower in synchrony. We can cite the example of 1992 when the flowering in Porto Conte coincided with that of Caglari, Baunei and Oristano. The origin of this phenomenon has not been clarified, but it does not appear to be linked to the temperature or the fotoperiodo. The transporting of the seed far away from the mother plant is accomplished by the fruit, which when mature floats and is capable of being carried by currents

to areas suitable for germination. This rarely results in germination. A site in which good germination has been observed is the marine area of S.Antioco where certains tracts were covered by young plants (Giaccone, personal communication). The reproductive capacity is delegated mainly to vegetative propogation. The modality of regrowth may be conducted essentially in two forms. One is defined as plagiotropic growth and refers to the manner of horizontal lengthening of the rootstock; the other is ortotropic, which indicates vertical growth. The vegetative development leads to the creation of a dense web of rootstocks that have become anastomosed, often resulting from the same mother plant.

There also exists a type of propagation by scion. Certain rhizomes by means of erosion may become detached from the Posidonia grove and carried to other areas. In this case, if the substrata proves suitable, they can take root and start a new population.

The prevalence of vegetative over gamic reproduction is interpreted as being an index of the aging of the species. It is clear that this is a distinct limitation; in fact, the rate of recolonization is very slow and has been estimated as being around 10 cm a year. *Posidonia*, as we have already noted, grows in both a horizontal and vertical direction, the latter is in relation to the sedimentary regime of the site. In sheltered environments, with a low hydrodynamic regime, a rate of vertical growth of 1 cm a year has been measured. If the rate of sedimentation exceeds the growth capacity of the plant, it becomes suffocated and may be replaced by a more dynamic community. The opposite process, highly dynamic sea-floor currents, may undermine the development as well. The removal of sediment provokes a denudation of the root apparatus of the plant, detaching the border of the population. This process may be progressive and reduce considerably the dimensions of entire prairies. The effects of the dynamic action of water are particularly evident in straits in exposed zones like those of Fornelli, between the islands of Asinara and Piana (Cossu *et al.*,1992). In this



Phytogenic map of Parco Capo Ceraso area - Tavolara - Capo Coda Cavallo.

area the currents have modelled the matte (vegetation, foilage) in a series of islands with an orientation longtitudinal to the coast-line. The density of the strips of matte maintains values between 500 and 600 strips per sq.m. The islands of *Posidonia* present an eroded type of matte on the side exposed to the currents with a net limit of height that varies between 20 and 60 cm. On the opposite side the limit is of a progressive type.

As a result of the indications derived from the ortothropic and plagiotropic relationship associated with the granulometric measurements of sediment, has been obtained useful information about the dynamics of sedimentation in the gulf of Porto Conte (Cossu, unpublished data).The anchoring of boats used for recreational purposes, as well as certain types of professional fishing, also detachs fragments of rhizomes creating a discontinuity in the solidity of the prairies. In recent years numerous oceanographic cruises conducted in the area east of Sardinia, aimed at the study of both the geomorphical character of the sea-floor and it's biological communities, have demonstrated clearly the devastating action performed by the tools of trawling, illustrating a type of exploitation by those not yet sensitive to the correct management of marine resources. These wounds are rarely healed by the plant and often tend to get worse with time. Alterations are evident at Tavolara, in the archipelago La Maddalena, in the area facing the southern sector of Spargi, and in the canal between La Maddalena, Santo Stefano and Caprera, documented by studies for the creation of these marine parks. In the area included between Tavolara, Capo Ceraso e Capo Coda Cavallo the prairie extends in a more or less uniform manner until about two miles from the coast, mainly a sandy substrata. This extension is interrupted in the channel of Tavolara by a deep muddy paleo-bed. As

regards distribution limits, the superior one is regressying in the area in front of the mere of San Teodoro, while the inferior one, found to be on average between the bathymetrics of 30÷35 m, is regressying at Capo Ceraso, in front of Spalmatore di Terra and south of Molara.

The homogenity of the distribution is interrupted locally by granite outcrops between Capo Ceraso, Spalmatore di Terra and Punta Pedrosu there are also present. Intermattes of noteworthy dimensions, colonized by *Caulerpa prolifera* and *Cymodocea nodosa* (Cossu and Gazale, unpublished data) are also present.

In the archipelago of La Maddalena, within the area projected for definition of the International Marine Park of the Straits of Bonifacio, the largest distribution are in the south-eastern versant of the island, in particular on the southern versant of Caprera.

Major indications of damage were found in the internal parts of the rias and in such as ports like; La Maddalena, Cala Lunga in the island of Razzoli, Porto Pozzo and Arzachena in island Sardinia, or in the depths between Caprera and La Maddalena (Passo della Moneta and Stagnali), where the dominant phytocoenosis is made up of *Caulerpa prolifera*. In the same area there are two récif-barriéres, at Passo degli Asinelli (between Santa Maria and Razzoli) and at Passo della Moneta in front of Giardinetti (Cossu and Gazale, unpublished data).

The *Posidonia* is extremely sensitive to alterations in the environment and, in particular, to the reduction of water transparency. This is a direct result of the phenomenum of pollution in the whole of the Mediterranean.

A symbolic example is the case of the area in front of the industrial port of Porto Torres. In 1979 a survey was conducted to determin the chemical, physical and biological characteristics of the area of sea around the industrial port. At that time, this area of the sea was subject to the discharges of a petro-chemical plant and deposition of material dredged from the dockyard. The results (Barone *et al.*, 1985; Giaccone *et al.*, 1980) show that a large area of sea was affected in varying degrees. The data relative to *Posidonia* were included in the cartography of the bentonici populations; a serious regression was found in the *Posidonia* groves in the port area relative to neighbouring areas. Even the latter were not found to be in an optimum state of health. In 1984 an association filter plant was installed and after only three years of operation, a study confirmed that it has been efficient in its cleaning-up efforts.

Outside the dockyard area the prairie showed an average recovery of 80-90% with a density equal to 300÷350 strips per sq.m. defined as harbour prairie (Giraud, 1977). The colonization of leaf epiphytes was notably modest. In the port area ,also, a significant regrowth of *Posidonia* was registered, but in this case, as well, the covering of the epiphytes of the leaves was very poor. In some areas, there was a prolounced a population of alga, which had attached itself to the dead rhizomes of the *Posidonia* and had replaced it completely.

It is evident, therefore, that projects aimed at safeguarding the environment produce improvement even to areas particularly subject to environmental impact. Similarly, it is clear that recovery is a very slow process, and a successful out come is not always guaranteed. The problem of the dispositon and ottimate use of the territory cannot be dealt with on a sectorial basis, not even on a small or medium-size scale, or be delegated casually or to the civil community. Although there are evident inprovements in the methods of safeguarding the environment today, throught laws and a better awaveness of the problems, it is still difficult to find an approach that views the problem globally. The solution must be derived by a process of identification and classification of the single territorial units.

It appears that environmental awareness is so crucial that it must extend beyong the scientific and technical spheres to the interest of the entire civil society. Often grave problems are not addressed mainly because of the separation that is created between these two worlds. However, changemay be taking place today; in the specific case of Posidonia one can find articles oriented

toward an explanation of the subject, an example being «Decouverte de l'herbier de posidonie» by the authors Prof. C. F. Boudouresque and Prof. A. Meinez; and also «Le praterie sommerse del Mediterraneo» released by the Ecology laboratory of the Benthos of Ischia in which many of the current problems are summarized; *Posidonia* is widely discussed also in «Il Mediterraneo e la sua vita» by Gazale and Porcheddu and in «The sea of the Province of Sassari-The west coast» by various authors.

The divulgence conducted by the environmental associations is equally important; a noteworthy international campaign for the safeguarding of *Posidonia* was conducted by the association Marevivo. There was active participation by the Italian Military Navy in 1991 through an informative cruise with the two school-ships, *Palinuro* and *Vespucci,* which covered the most important ports in the Mediterranean, including La Maddalena. This provided an occasion for various meetings and scientific debates on the theme of *Posidonia.*

Other cooperative activities include a Sardo-Corsican work-group recently established to conduct research on the *Posidonia* groves in the two regions. In terms of structure and extension this is one of the most important in the whole of the Mediterranean.

Some work has also been done on lepidochronology, the accumulation of traces of heavy metals in the *Posidonia,* with new methods of computerized cartography by remote sensors. A preliminary ordering of methodology has been carried out (Pergent *et al.*, 1995).

Nevertheless we are convinced that every type of human activity must be placed within a framework of territorial planning, that is not subordinate to the logic of maximum profit. Required are a base of information of a global and sectorial character and a model of administration in which it is possible to predict the effects of certain types of choice. In conclusion, we would like to recognize the limits of our knowledge about the prairies of *Posidonia* in Sardinia in comparison to their large overall extension.

It would be desirable that the draft of the law presented to the Regional Council of the President of the special Commission, with the technical support of the authors and the pressure of the association Marevivo, take action as soon as possible. It consists of a series of arrangements for the protection of the *Posidonia* and, above all, of a prompt census of the meadows presence in Sardinia.

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