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## MAP OF BENTHIC VEGETATION AND SEA-BOTTOM TYPES IN THE HARBOUR AT BANYULS-SUR-MER (P.-O., FRANCE)

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MAP  
BENTHIC VEGETATION  
*POSIDONIA OCEANICA*  
POLLUTION

CARTOGRAPHIE  
VÉGÉTATION BENTHIQUE  
*POSIDONIA OCEANICA*  
POLLUTION

**Abstract** – A map of benthic vegetation and sea-bottom types in the harbour at Banyuls-sur-Mer shows the presence of a *Posidonia oceanica* (L.) Delile meadows. The area covered by this meadow is important (more than 10 % of the total area of the harbour). The *Posidonia oceanica* meadow presents a high level of vitality in spite of a visible chemical pollution which often appears responsible for the seagrass meadow decline.

**RÉSUMÉ** – Une carte de la végétation benthique et des types de fond du port de Banyuls-sur-Mer montre la présence d'un herbier à *Posidonia oceanica*. La surface couverte par cet herbier est importante (plus de 10 % de la surface totale du port). L'herbier à *Posidonia oceanica* montre une forte vitalité malgré la présence de pollutions chimiques souvent responsables de la régression des herbiers de phanérogames marines.

### PROBLEM

A *Posidonia oceanica* (L.) Delile seagrass meadow is present inside the small harbour at Banyuls-sur-Mer (Pyr.-Or., France), where more than 300 pleasure and fishing boats are berthed. There is an extensive literature devoted to the impact of pollution on *Posidonia oceanica* (Bourcier, 1976; Eugene, 1978; Cristiani, 1979, 1980; Augier *et al.*, 1984a, 1984b, 1987; Libes, 1986) and the resulting dramatic decline of seagrass meadows along the Mediterranean coastline (Augier and Boudouresque, 1970, 1972; Ben Alaya, 1972; Ghirardelli *et al.*, 1974; Giaccone, 1975; Peres and Picard, 1975; Blanc and Jeudy de Grissac, 1978; Giaccone and Calvo, 1980; Meinesz and Laurent, 1980; Boudouresque and Meinesz, 1982; Ardizzone and Pelusi, 1983; Peres, 1984).

The question is, therefore, whether this seagrass meadow is a vestige of a previously-existing meadow in the process of extinction (because of turbidity and/or pollution), or whether it shows signs of expansion. The situation at Banyuls-sur-Mer, which shows an expansive *Posidonia* bed, would tend to contradict the often hasty generalisations that have been made concerning the impact of pollution on *Posidonia oceanica* meadows.

To document the precise existing boundaries of this *Posidonia* meadow, and of other vegetation

and types of bottom in the Banyuls-sur-Mer harbour, in order that future developments can be monitored, a map was constructed.

### MATERIAL AND METHODS

The turbidity level of the waters at this site precluded the use of aerial photographs which need very clear water to be powerful. Since the area to be studied was limited (4 to 5 hectares), the transect method was used (Meinesz *et al.*, 1981).

Twenty-four transects were examined by Scuba diving between January and March 1985. The transects were marked out on the bottom with metal measuring tapes stretched between easily-identifiable points on the shore. The composition of the flora and substrates (Meinesz *et al.*, 1983) was recorded metre by metre.

The flora and substrates included in the survey are :

- *Posidonia oceanica* meadow
- Dead *Posidonia oceanica* matte
- Photophilic algal populations on rock
- Mud (< 0.0625 mm in Chamley 1986)
- Muddy sand (< 0.250 mm in Chamley 1986)



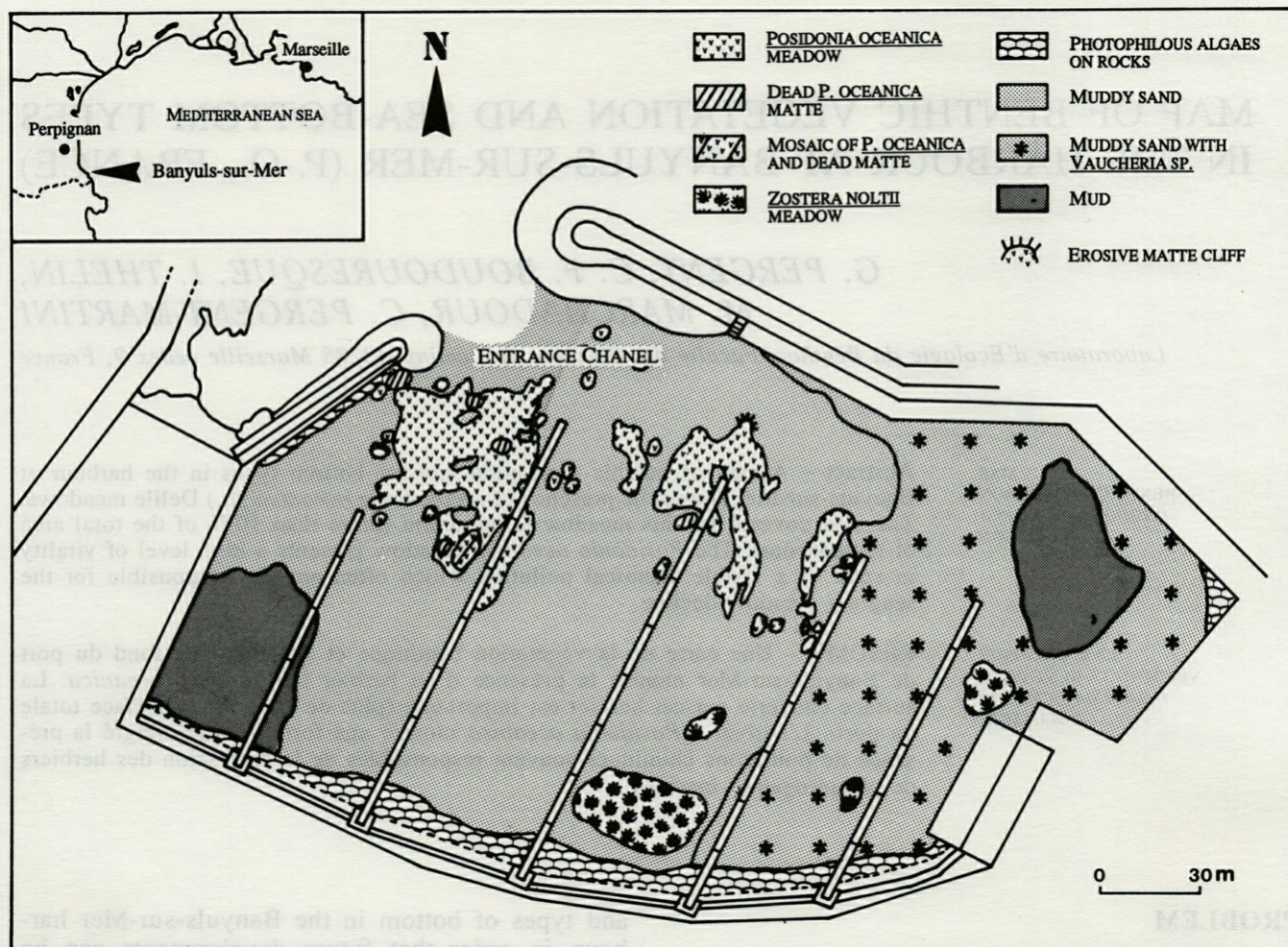


Fig. 1. — Map of benthic vegetation and sea-bottom types in the harbour at Banyuls-sur-Mer (December 1985). Above, on the left corner, localization of Banyuls-sur-Mer harbour.

— Muddy sand with *Vaucheria* sp. (Xanthophyceae)

— Muddy sand with *Zostera noltii* Hornemann (Potamogetonaceae)

## RESULTS AND DISCUSSION

The *Posidonia oceanica* meadow covers an area of 3,600 m<sup>2</sup> (between 2 and 5 meters depth), or more than 10 % of the total area of the harbour (Fig. 1).

The meadow shows signs of considerable vitality: (i) a considerable number of creeping plagiotropic rhizomes have colonised the sediment around the perimeter of the meadow; (ii) the dead matte areas are not extensive; (iii) shoot density is relatively high (350 to 500 shoots per m<sup>2</sup>); (iv) phenological examination of the leaf shoots shows that the leaves have the highest length (60 cm on average) and leaf index values (between 126 and

292 cm per shoot) recorded in this region (Pergent *et al.*, 1985; Pergent, 1987).

No significant expanse of dead matte was found buried in the sand (digging was carried out to a depth of at least 20 cm), which would seem to suggest that there has been no recent recession of the meadow.

The meadow is probably of ancient origin, since there are cliffs formed of dead matte in the harbour entrance channel, which is regularly dredged. In places, these cliffs reach a height of 1 m. It is known that the vertical growth rate of rhizomes rarely exceeds 5 cm/year (Boudouresque *et al.*, 1984; Boudouresque and Jeudy de Grissac, 1983); over longer periods, an approximate matte thickness growth rate of 1 m per century is generally accepted (Molinier and Picard, 1952). A matte of this thickness therefore indicates that the meadow must have already existed before the construction of the harbour. Pruvot (1894) mentioned a *Posidonia oceanica* meadow in the Banyuls-sur-Mer bay, but on his map all shoreline deposits (gravel beds, sand, seagrass meadows) are grouped together, so that it is impossible to determine the exact position.



On the available evidence, there is nothing to exclude the hypothesis that the surface covered by the meadow has been stable since the construction of the harbour.

Various factors might explain the apparent stability, except in the entrance channel, and high level of vitality of the meadow, which might otherwise seem unlikely in the setting of a harbour: (i) the major causes of the decline of *Posidonia oceanica* in the Pyrénées-Orientales, sedimentary deficiency and vigorous water movements (Molinier and Picard, 1952; Pergent *et al.*, 1985), do not apply within the harbour; (ii) the Banyuls-sur-Mer harbour is relatively small (350 moorings) and the occupancy rate is relatively low outside the tourist season (below 60 %); (iii) no major outlet or watercourse discharges into the harbour, so there is no significant decrease of salinity; (iv) the exposure of the harbour and the hydrological patterns mean that the level of water renewal is high, especially in the vicinity of the entrance channel, where the meadow displays the greatest vitality.

Nonetheless, the level of chemical pollution in the Banyuls-sur-Mer harbour (antifouling paint, detergent, hydrocarbons), particularly during the tourist season, seems at least as high as that recorded at many open sites where seagrass meadow recession has been attributed to pollution: e.g. Port-Cros (Augier and Boudouresque, 1970; Augier *et al.*, 1976; Monnier-Besombes, 1983), Porquerolles (Augier, 1981), Gulf of Marseilles (Peres, 1984). It would appear, then, that the conclusions drawn from data in the literature regarding the extreme vulnerability to pollution of *Posidonia oceanica*, have been hastily drawn. The degree of vulnerability has never been proved experimentally for the content levels actually found in the field (Monnier-Besombes, 1983; Augier *et al.*, 1984b; Libes, 1986; Augier *et al.*, 1987), are perhaps a little hasty. The recession of *Posidonia oceanica* meadows, which has indeed been observed in the vicinity of sources of pollution (Bourcier, 1976; Pergent *et al.*, 1988), might be related to more indirect consequences of pollution or to the effects of synergy between various possible pollution types.

It should nonetheless be pointed out that the Banyuls-sur-Mer harbour constitutes a special case; these remarks should not be taken to apply to harbour environments in general, since they concern an area where the harbour happens to modify certain local conditions which are harmful to the seagrass meadow.

## BIBLIOGRAPHIE

- ARDIZZONE G.D. & P. PELUSI, 1983. Regression of a Thyrrenian *Posidonia oceanica* prairie. *Rapp. P.V. Réun. Commiss. internation. Explor. sci. Médit.* 28 (3) : 175-177.
- AUGIER H., 1981. Etude et cartographie des peuplements benthiques de l'île de Porquerolles (Méditerranée, France). II. L'anse de Port-Fay et la calanque de la Grotte. *Trav. sci. Parc nation. Port-Cros* 7 : 103-117 + 1 carte h.t.
- AUGIER H. & C.F. BOUDOURESQUE, 1970. Végétation marine de l'île de Port-Cros (Parc national). V - La baie de Port-Man et le problème de la régression de l'herbier de *Posidonies*. *Bull. Mus. Hist. nat. Marseille* 30 : 145-164.
- AUGIER H. & C.F. BOUDOURESQUE, 1972. Pollution et protection de la mer. *Ann. Soc. Sci. nat. Archéol. Toulon* 24 : 111-119.
- AUGIER H., C.F. BOUDOURESQUE, J.G. HARMELIN, J. LABOREL & P. TAILLIEZ, 1976. Rapport scientifique concernant l'état de l'herbier de *Posidonia oceanica* dans les eaux du Parc National de Port-Cros et les possibilités d'aménagements maritimes. Doc. ronéotypé, Parc National de Port-Cros, Hyères : 11 p.
- AUGIER H., Y. GIGLIO & G., RAMONDA, 1987. Peintures anti-fouling et herbier à *Posidonia oceanica*. G.I.S. Posidonie, Fac. Sci. Luminy, Marseille : 1-94.
- AUGIER H., G. GILLES & G. RAMONDA, 1984a. L'herbier de *Posidonia oceanica* et la pollution par le mercure sur le littoral des Bouches-du-Rhône et du Var (France). International Workshop on *Posidonia oceanica* Beds, Boudouresque C.F., Jeudy de Grissac A. et Olivier J. eds., GIS Posidonie publ., 1 : 399-406.
- AUGIER H., G. MONNIER-BESOMBES & G. SIGOILLIOT, 1984b. Influence des détergents sur *Posidonia oceanica* (L.) Delile. International Workshop on *Posidonia oceanica* Beds, Boudouresque C.F., Jeudy de Grissac A. et Olivier J. eds., GIS Posidonie publ., 1 : 407-418.
- AUGIER H., G. MONNIER-BESOMBES & J.C. SIGOILLIOT, 1987. Etude préliminaire sur l'influence des borates constitutifs des détergents sur la phanérogamie marine *Posidonia oceanica* Delile. *Rev. intl. Océanogr. méd.* 86/87 : 75-81.
- BEN-ALAYA, 1972. Répartition et conditions d'installation de *Posidonia oceanica* Delile et *Cymodocea nodosa* Ascherson dans le golfe de Tunis. *Bull. Inst. Océanogr. Pêches Salambô* 2 : 331-416.
- BLANC J.J. & A. JEUDY DE GRISSAC, 1978. Recherches de géologie sédimentaire sur les herbiers à *Posidonies* du littoral de la Provence. Centre nation. Exploit. Océans édit. : 1-185.
- BOUDOURESQUE C.F. & A. JEUDY DE GRISSAC, 1983. L'herbier à *Posidonia oceanica* : les interactions entre la plante et le sédiment. *J. Rech. océanogr.* 8 : 99-122.
- BOUDOURESQUE C.F., A. JEUDY DE GRISSAC & A. MEINESZ, 1984. Relation entre la sédimentation et l'allongement des rhizomes orthotropes de *Posidonia oceanica* dans la baie d'Elbu (Corse). International Workshop on *Posidonia oceanica* Beds, Boudouresque C.F., Jeudy de Grissac A. et Olivier J. eds., GIS Posidonie publ., 1 : 185-191.



- BOUDOURESQUE C.F. & A. MEINESZ, 1982. Découverte de l'herbier de Posidonies. *Cahier Parc nation. Port-Cros* 4 : 1-79.
- BOURCIER M., 1976. Economie benthique d'une baie méditerranéenne largement ouverte et des régions voisines, en fonction des influences naturelles et humaines. Thèse Doct. Etat Sci. nat., Univ. Aix-Marseille II : 1-161 + 1-50.
- CHABERT D., N. VICENTE & W. HUANG, 1984. Pollution par les composés organochlorés dans les rades du Parc National marin de Port-Cros. II. - Contrôle pluriannuel. *Trav. sci. Parc nation. Port-Cros* 10 : 51-67.
- CHAMLEY H., 1987. Sédimentologie. Dunod édit., i-xv : 1-175.
- CRISTIANI G., 1979. Espèces indicatrices de pollution littorale par les métaux lourds au débouché d'un émissaire urbain. *Vie marine* 1 : 38-51.
- CRISTIANI G., 1980. Biomasse et répartition de l'herbier de *Posidonia oceanica* de la côte bleue (B.d.Rh., France) et pollution marine par les métaux lourds. Thèse doct. 3<sup>e</sup> cycle, Univ. Aix-Marseille III : 1-159 + 1 carte h.t.
- EUGENE C., 1978. Etude de l'épifaune de *Posidonia oceanica* (L.) Delile du littoral français. Thèse Doct. 3<sup>e</sup> cycle, Univ. Aix-Marseille II : 1-117.
- GHIRARDELLI E., G. GIACCONE & G. OREL, 1974. Evolution des peuplements benthiques du Golfe de Trieste. *Rev. internation. Oceanogr. méd.* 35-36 : 111-114.
- GIACCONE G., 1975 : Effetti dello smaltimento delle acque residue del comune di Sanremo sulle associazioni vegetali marine. Comune di Sanremo édit. : 1-27.
- GIACCONE G. & C. CALVO, 1980. Restaurazione del manto vegetale mediante trapianto di *Posidonia oceanica* (Linneo) Delile. Risultati preliminari. *Mem. Biol. mar. Oceanogr. Suppl.* 10 : 207-211.
- LIBES M., 1986. Etude de la toxicité à court terme d'un détergent anionique sur l'assimilation photosynthétique de *Posidonia oceanica* (Phanérogame marine) et de ses épiphytes. Contrat G.I.S. Posidonie / Parc nation. Port-Cros, N°83017-83400PC : 1-49.
- MEINESZ A., C.F. BOUDOURESQUE, C. FALCONETTI, J.M. ASTIER, D. BAY, J.J. BLANC, M. BOURCIER, F. CINELLI, S. CIRIK, G. CRISTIANI, I. DI GERONIMO, G. GIACCONE, J.C. HARMELIN, L. LAUBIER, A.Z. LOVRIC, R. MOLINIER, J. SOYER & C. VAMVAKAS, 1983. Normalisation des symboles pour la représentation et la cartographie des biocénoses benthiques littorales de Méditerranée. *Ann. Inst. océanogr.* N.S. 59 (2) : 155-172.
- MEINESZ A., M. CUVELIER & R. LAURENT, 1981. Méthodes récentes de cartographie et de surveillance des herbiers de phanérogames marines. Leurs applications sur les côtes françaises de la Méditerranée. *Vie Milieu* 31 : 27-34.
- MEINESZ A. & R. LAURENT, 1980 : Cartes de la limite inférieure de l'herbier de *Posidonia oceanica* dans les Alpes-Maritimes (France). Campagne Posidon 1976. *Ann. Inst. océanogr.* Paris, N.S. 56 : 45-54.
- MOLINIER R. & J. PICARD, 1952. Recherches sur les herbiers de phanérogames marines du littoral méditerranéen français. *Ann. Inst. océanogr.*, N.S. 27 : 157-234.
- MONNIER-BESOMBES G., 1983. Etude de la contamination de la Posidonie (*Posidonia oceanica* L. Delile) et de son milieu par des composants de détergents synthétiques. Thèse Doct. 3<sup>e</sup> cycle, Univ. Aix-Marseille II : 1-162.
- PERES J.M. & J. PICARD, 1975 : Causes de la raréfaction et de la disparition des herbiers de *Posidonia oceanica* sur les côtes françaises de la Méditerranée. *Rec. Trav. Stn. mar. Endoume* 31 : 1-137.
- PERES J.M., 1984. La régression des herbiers à *Posidonia oceanica*. International Workshop on *Posidonia oceanica* Beds, Boudouresque C.F., Jeudy de Grissac A. et Olivier J. eds., GIS Posidonie publ., 1 : 445-454.
- PERGENT G., 1987. Recherches Lépidochronologiques chez *Posidonia oceanica* (Potamogetonaceae). Fluctuations des paramètres anatomiques et morphologiques des écailles des rhizomes. Thèse doct. Oceanographie, Univ. Aix-Marseille II : 1-853.
- PERGENT G., C.F. BOUDOURESQUE & B. VADIER, 1985. Etude préliminaire des herbiers à *Posidonia oceanica* (L.) Delile de la côte des Albères (Pyrenées-Orientales, France). *Ann. Inst. océanogr.*, N.S. 61 : 97-114.
- PERGENT G., C. PERGENT & P. FRANCOUR, 1988. Cortiou état zéro : reconnaissance des herbiers. Mise en place des balisages. D.E.T.S.E. et GIS Posidonie, Marseille : 1-107.
- PRUVOT G., 1894. Essai sur la topographie et la constitution des fonds sous-marins de la région de Banyuls-sur-Mer, de la plaine du Roussillon au golfe de Rosas. *Arch. Zool. exp. gén.* 3 : 599-672.

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