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Evolution of *Posidonia oceanica* seagrass meadows and its implications for management

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ABSTRACT

Results of the monitoring network of the *Posidonia oceanica* meadows in the Valencia region in Spain are analysed. For spatial comparison the whole data set has been analysed, however, for temporal trends we only selected stations that have been monitored at least 6 years in the period of 2002–2011 (26 stations in 13 localities). At the south of the studied area, meadows are larger, and they have higher density and covering than that in the Valencia Gulf, excluding Oropesa meadow. Monitoring of *P. oceanica* meadows in the Valencia region in Spain indicates that most of them are stationary or they are increasing their density and covering while no decline was observed in the studied meadows. These results indicate that there is not a general decline of *P. oceanica* meadows and that the decline of *P. oceanica*, when it has been observed in other studies, is produced by local causes that may be managed at the local level. This study also reflects the importance of long series of direct data to analyse trends in the population dynamics for slow-growing species.

1. Introduction

Seagrasses support marine food webs and provide essential habitat for many coastal species, playing a critical role in the equilibrium of coastal ecosystems and human livelihoods (Short et al., 2011). A wide range of population dynamics strategies is found in seagrasses from small, fast-growing, pioneer species to large, slow-growing, climax species (Marbà and Duarte, 1998). *Posidonia oceanica* is a slow-growing species endemic of the Mediterranean Sea, where it is the dominant seagrass. Several studies have indicated that seagrass habitat is declining worldwide (Short et al., 2011; Waycott et al., 2009). In the Mediterranean, *P. oceanica* decline has been proved in response to human impacts that produce changes in water quality (Cancemi et al., 2003; Delgado et al., 1997, 1999; Dimech et al., 2000; Ruíz et al., 2001); mechanical erosion (Francour et al., 1999; García Charton et al., 1993; Martín et al., 1997; Milazzo et al., 2004; Sánchez Lizaso et al., 1990, 2002); or burial (Fernández Torquemada et al., 2005; González Correa et al., 2008, 2009; Manzanera et al., 1998). However, while some authors think that a global process of decline is occurring (Jorda et al., 2012; Pérès, 1984), other studies show that the decline is due to an accumulation of local impacts (González Correa et al., 2007a). This aspect is relevant for seagrass management, since it is possible to act upon these local causes that produce local decline (González Correa et al., 2005; Pergent-Martini et al., 2002) but a global degradation caused by global processes could not be stopped by management of coastal areas and even if it were possible, the time needed to solve the problem would exceed human time scales (González Correa et al., 2005).

For slow-growing species like *P. oceanica*, population dynamics is mainly based on reconstructive techniques or direct measurements over a few numbers of years. While some reconstructive techniques are biased (González Correa et al., 2007b), the extrapolation of trends obtained over short time periods may also give an incorrect pattern. In order to establish evolution of *P. oceanica* meadows, monitoring networks have been established in different regions of the Mediterranean (Lopez y Royo et al., 2010; Sánchez Lizaso, 2009). In this paper, we used the results of the monitoring network of the *P. oceanica* meadows in the Valencia region in Spain in the period of 2002–2011 to analyse the evolution of the meadows in the warmest part of Western Mediterranean, since it may be useful to detect if a global decline is occurring.

2. Material and methods

Monitoring of *P. oceanica* meadows in the Valencia region commenced in 2002 and it was done on an annual basis on up to 24 localities. However, the monitoring period is different at each locality. Table 1 indicates the available data for each locality. Monitoring has been done during summer months each year. Monitoring was carried out by volunteers

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Table 1
Monitoring years at each locality.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Alcossebre		X								
Oropesa						X	X	X		
Castellón			X							
Moncofar				X	X					
Canet			X			X	X	X		
El Puig		X	X	X						
Cullera				X						
Denia	X	X		X	X	X	X	X		
Javea						X	X	X	X	X
Moraira	X	X	X	X	X	X	X	X		
Calpe	X	X	X	X	X	X	X	X	X	X
Altea	X	X	X	X	X	X	X	X	X	X
Cala Mina			X	X	X	X	X	X	X	X
Benidorm	X	X	X	X	X	X	X	X	X	X
Racó Conill			X	X			X	X	X	X
Paradís	X	X	X		X	X				
El Campello	X	X	X	X		X	X	X		X
Cabo Huertas	X	X	X	X	X	X	X		X	X
Postiguet Coco	X									
Postiguet	X	X	X	X	X	X	X	X	X	X
Carabassí		X	X	X	X	X	X	X	X	X
Tabarca La Nao	X	X	X	X	X	X	X	X	X	X
Tabarca Escull Negre	X	X	X	X	X	X	X	X	X	X
Torrevieja	X	X	X	X	X	X	X	X		

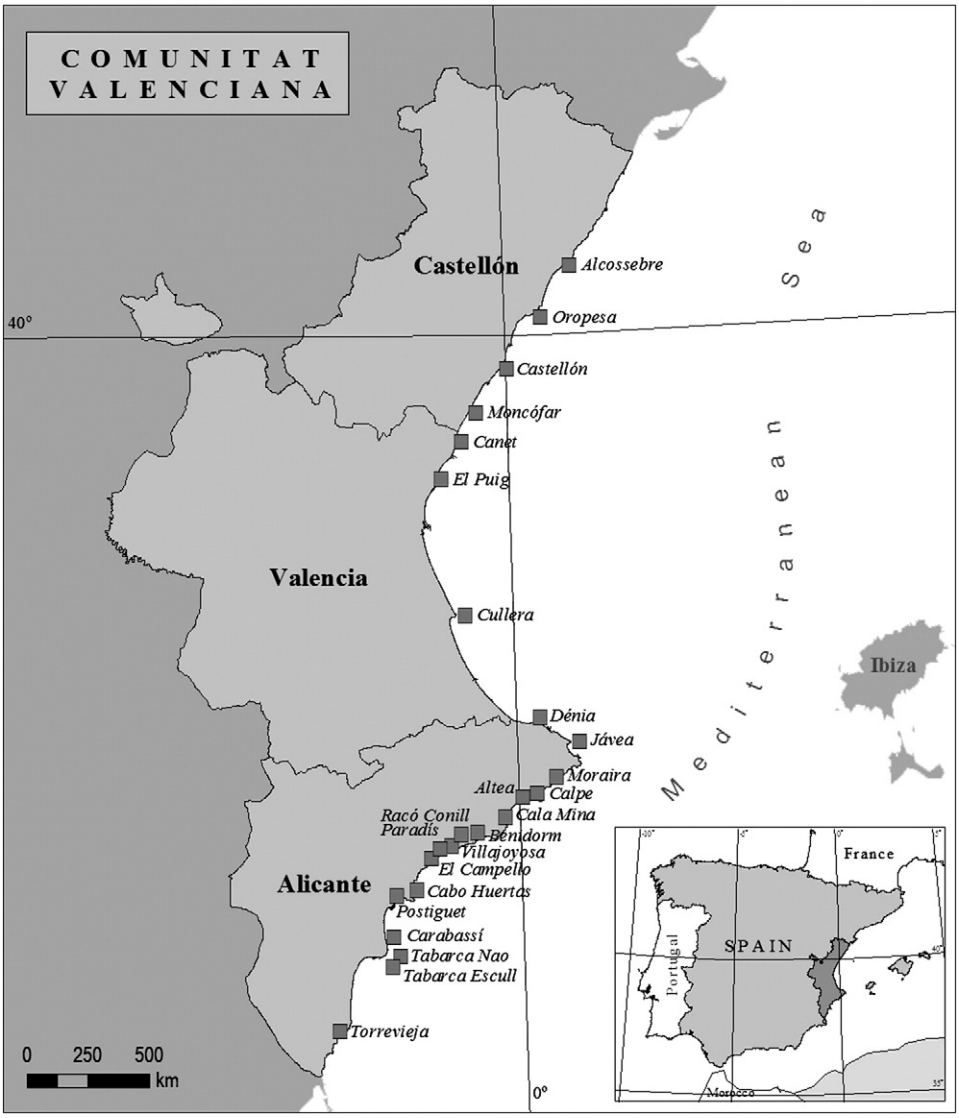

Fig. 1. Situation of studied localities.