THE USE OF RECONSTRUCTIVE METHODS IN COMBINATION WITH "BEYOND BACI" DESIGNS: THE CASE STUDY OF CAPO FETO (SW SICILY, ITALY)

Giuseppe Di Carlo * , Fabio Badalamenti, Claudia Passalacqua
IRMA-CNR, sez. di IAMC, Laboratorio di Biologia Marina, Castellammare del Golfo (TP), Italy

Abstract

Changes in leaf production and rhizome elongation rates of *Posidonia oceanica* have been evaluated by means of reconstructive methods to evaluate the response to a dredging carried out in 1993. Asymmetrical sampling design "beyond BACI" was used to detect the impact with a single sampling as dating methods obviated lack of pre-impact data. Leaf production and rhizome elongation rates were reconstructed for 4 years before 4 years after the impact. Rhizome elongation almost doubled after the impact. Control sites did not present any significant variations from before to after the impact. Results suggest a pulse disturbance, since leaf production did not change and internodal length increased in a short-time scale.

Keywords: Posidonia oceanica; reconstruction methods; impact

Introduction

P. oceanica meadows are recognized to be key ecosystems in the marine environment. In the last decade a regression of *P. oceanica* beds has been reported due to anthropogenic causes (1,2). A submerged pipeline was deployed at Capo Feto (SW Sicily, Italy) in 1993. This caused an increase of water turbidity and sedimentation rate. Vertical rhizomes overcome burial process by increasing internodal length, but when the balance between sedimentation and plant growth is lost, the plant suffocates (3). This study utilises a "beyond BACI" sampling design (4) in combination with reconstruction methods (5) to assess the response of the seagrass *P. oceanica* to the impact caused by a coastal dredging.

Material and Methods

144 vertical shoots shoots of *P. oceanica* were randomly sampled in October 2000 at depths of maximum shoot density both at impact (Capo Feto) and control sites (Tonnarella). The length of all internodes was measured using a stereomicroscope (5). The 1:1 relationship between leaf and vertical internode allows the number of vertical internodes between two consecutive minima in length to be used as a surrogate for the number of leaves produced during a time period. Asymmetrical analyses of variance were used to examine temporal differences between the potentially impacted meadow and the average of control meadows (6). Data were examined by Cochran's *C* test for homogeneity of variances. Appropriate transformations, whenever necessary (7). ANOVA was performed using GMAV5 (University of Sydney).

Results

The results show that there is no evident variation in leaf production rate from before to after pipeline deployment both at Capo Feto and Tonnarella (impact/controls). However, annual rhizome elongation rates were found to be significantly different from before to after the impact at Capo Feto (impact), while no difference was recorded at both control sites (Tonnarella) (Fig. 2). Indeed, an increase of internodal length was recorded at the impacted site starting from 1994. Such increase in rhizome elongation seen after the disturbance could reflect an integrated response of the plant at a different magnitude of response to the impact (6).

Discussion

In *Posidonia oceanica* vertical growth has been demonstrated to be sensitive to sediment dynamics (8,9,10). Internodal length is strictly related to burial and erosion processes (10). In this study, an excess in sedimentation rate lead to an increase vertical growth to overcome burial. Reconstructive methods represent a useful procedure to assess seagrass dynamics, proving a tool for the assessment and management of coastal ecosystems (11). The combination of dating methods with "beyond BACI" designs can be considered an excellent approach to evaluate environmental impacts, especially when pre-impact data are lacking.

Fig. 1. Study area.

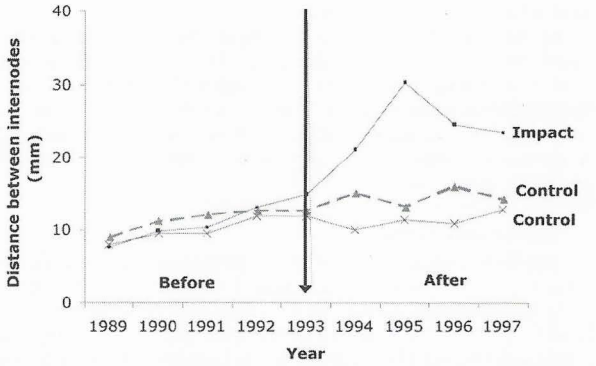

Fig. 2. Rhizome elongation rate variation before and after the putative impact at Capo Feto.

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