Journal of Experimental Marine Biology and Ecology xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Experimental Marine Biology and Ecology

journal homepage: www.elsevier.com/locate/jembe

Natural recovery of *Zostera noltii* seagrass beds and benthic nematode assemblage responses to physical disturbance caused by traditional harvesting activities

Jordana Branco [a], Sílvia Pedro [b], Ana S. Alves [a], Carlos Ribeiro [c], Patrick Materatski [d], Ricardo Pires [b], Isabel Caçador [b], Helena Adão [a,*]

[a] MARE, University of Évora, School of Sciences and Technology, Apartado 94, 7005-554 Évora, Portugal
[b] MARE, Faculty of Sciences of the University of Lisbon, 1749-016 Lisbon, Portugal
[c] Geosciences Department, University of Évora, School of Sciences and Technology/Institute of Earth Sciences, 7000-671 Évora, Portugal
[d] ICAAM, Instituto de Ciências Agrárias e Ambientais Mediterrânicas, Universidade de Évora, Apartado 94, 7005-554 Évora, Portugal

ARTICLE INFO

Article history:
Received 28 November 2016
Received in revised form 20 February 2017
Accepted 8 March 2017
Available online xxxx

Keywords:
Sediment digging
Benthic nematodes
Extracellular enzymatic activity (EEA)
Zostera noltii
Natural habitat recovery
Field experiment

ABSTRACT

In the intertidal seagrass beds of *Zostera noltii* of Mira estuary (SW, Portugal) the harvesting practices are frequent. The traditional bivalve harvesting not only affects the target species as the remaining biological assemblages. The main aim of this study was to assess the disturbance caused by sediment digging in the recovery of the seagrass beds habitat, through an experimental fieldwork. The responses of the seagrass plant condition, the sediment microbial activity and the nematode assemblages were investigated after the digging activity in seagrass beds. A total of four experimental plots were randomly demarcated *in situ*, two plots were subjected to the disturbance - "Digging" - while other two were "Control"; the sampling occurred in five occasions, from May to October: T_0–before digging; T_1–14 days after digging; T_2–45 days; T_3–75 days; and T_4–175 days. The environmental variables measured in the sediment and the photosynthetic efficiency (α) of the *Z. noltii* plants in each plot and sampling occasion registered similar values, throughout the experiment. The extracellular enzymatic activity (EEA) clearly presented a temporal pattern, although no significant differences were obtained between digging and control plots. Nematode assemblages registered high densities, revealing the absence of the digging effect: control plots maintained similar density and diversity throughout the experiment, while the density and diversity between digging plots was significantly different at T_0 and T_4; the trophic composition was similar for both control and digging plots, characterized mainly by non-selective deposit feeders (1B) and epigrowth feeders (2A).Organic matter, nitrate and mean grain size explain a significant amount of the variation in the nematode genera composition. This study demonstrated the capacity of the seagrass habitat to recover under low intensity physical disturbance associated to harvesting.

1. Introduction

Seagrass beds comprise some of the most heterogeneous landscape structures of shallow-water estuarine/marine ecosystems in the world and are reported to be declining worldwide (Hughes et al., 2009). These beds have important ecological roles in coastal ecosystems providing high-value ecosystem services compared to other marine and terrestrial habitats. They are typically considered as ecosystem engineers playing an important role in structuring pelagic and benthic assemblages (Bos et al., 2007). Many studies reported seagrass beds as having higher biomass, abundance, diversity and productivity of benthic organisms than the unvegetated sediments (Boström et al., 2006; Fonseca et al., 2011; Orth et al., 2006). They are also effective carbon sinks in the biosphere (Duarte et al., 2010). Their high sensitivity to environmental deterioration and widespread geographical distribution make seagrasses useful as "miner's canaries" for the coastal deterioration (Marbà et al., 2006; Orth et al., 2006). Moreover, they are important habitats to a large set of fauna, providing nutrients, shelter against predators and nursery for the juveniles (Barbier et al., 2011; Orth et al., 2006).

Bivalve harvesting is a very common activity in European estuarine ecosystem (Carvalho et al., 2013; Johnson et al., 2007; Kaiser et al., 2001). In Portugal bivalve harvesting has a long tradition, with an estimated consumption rate *per capita* of 58.5 kg/year (Oliveira et al., 2013). While the traditional harvesting activities affect solely the targeted species, the digging of the sediments cause physical disturbances with effects on the remaining biological assemblages by

* Corresponding author.
E-mail address: hadao@uevora.pt (H. Adão).

http://dx.doi.org/10.1016/j.jembe.2017.03.003
0022-0981/