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ADAPTED SEAGRASS WATCH PROTOCOL TO EVALUATE *POSIDONIA OCEANICA* HEALTH, IN THE EASTERN AEGEAN SEA, GREECE

Abstract
Seagrass meadows, in particular Posidonia oceanica (Linnaeus,1813) play an important role within Mediterranean coastal systems, providing numerous key ecosystem services, while also ensuring the maintenance of physical, chemical and biological conditions. P. oceanica acts as an ecosystem architect to provide a habitat for many different species, as a breeding, nursery and foraging ground. Its ecological importance and vulnerability to a variety of anthropogenic influences has resulted in an increasing interest in using P. oceanica as a health indicator of Mediterranean coastal systems. P. oceanica health was evaluated at 10 sites around Lipsi island in order to determine the health status and the impact of various anthropogenic activities. The Seagrass Watch Protocol was partly modified and implemented to assess biological and environmental data. Concentrations of phosphorus and nitrite were determined at each site, as indicators of eutrophication, potentially influencing seagrass health. Through the modification of the seagrass watch protocol with additional simple data measurements such as phosphorous and nitrite levels of the sea water, a more accurate assessment of seagrass health can be achieved with little additional sampling effort and cost.

Key-words: *Posidonia oceanica*, ecosystem health, citizen science, Eastern Aegean

Introduction

P.oceanica is highly sensitive to disturbances and has a wide distribution along the Mediterranean coast. The well-known biology and ecology of the species, response to specific disturbances of both plant and associated ecosystem, to make it a good model to be used as a Biological Quality Element (BQE) (Romero*et al.*, 2007). In order to analyse seagrass health, it is important to assess the epibiota which is mainly controlled by the nutrient availability, the physical constraints and biological interactions. The discharge of products from anthropogenic activity such as industrial effluence, mining wastes, fish farming, drilling fluids, sewage and agricultural runoff and effluents from desalination plants can be factors influencing epibiota (Martínez-Crego *et al.*, 2010). In addition, a healthy status of seagrass meadow health is reflected by high coverage of *P. oceanica*, whereas an unhealthy status is typically associated with a low coverage (Boudouresque *et al.*, 2009). Moreover, the expected response to the presence of anthropogenic disturbances is increased nitrite and phosphorus values and as a result, an increase in the percentage of leaves colonised by epiphytes and a decrease in blade length (Romero *et al.*, 2007).

Materials and methods

P. oceanica was assessed at 10 different sites on Lipsi Island, Greece with varied, touristic influences, boat traffic presence and topography. Surveys were completed between May and August 2018 by freediving following a partly modified version of the Seagrass Watch protocol (McKenzie *et al*., 2007). At each site, three 50m long linear transects were set, starting from the first seagrass patch found closest to the shore (transect line 1, T1). Transect lines 2 and 3 (T2 and T3, respectively) were laid out parallel to T1, 25 m apart from each other and perpendicular to the shore line. Along these transects, quadrats (50 x 50 cm) were placed at 5 m intervals in order to analyse: (1) depth (m); (2) sediment composition, described by grain size; (3) algae cover, percentage cover on sediment; (4) percentage cover of *P. oceanica*, on sediment; (5) seagrass species composition of *Posidonia oceanica, Cymodocea nodosa and Halophila stipulacea*; (6) *P. oceanica* blade length; and (7) percentage of epiphyte cover on *P. oceanic* blades. In addition, the shoot density was counted within a 20 x 20 cm quadrat placed at random, 3 - 10 times in each *P. oceanica* patch inside the transect. The phosphorus and nitrite concentrations were measured with three replicates per site.

Results

Overall as *P.oceanica* percentage cover increased, the blade length and the shoot density per m^2 also increased. Epiphyte cover was higher in the shortest blades, whereas certain sites with long blades showed a relatively low percentage cover of epiphytes. Sites with a higher number of touristic pressure, in terms of tourists, restaurants and boat traffic, had the highest phosphorus values, lowest percentage cover, shorter blades and

lower shoot density. In contrast sites with little anthropogenic disturbances and rather sheltered topography had the highest percentage cover, longest blades and high shoot density.

Discussion and Conclusion

As underlined by the results of this study, there are different anthropogenic parameters that influence *P. oceanica* meadows, such as high nutrient concentrations caused by land-based activities, sewage run-off and coastal infrastructures (Brodersen *et al*., 2018). Especially high concentrations of phosphorus inhibit *P. oceanica* growth (Castejón-Silvo *et al*., 2012). Besides, high touristic pressure also causes physical loss where boats anchor in the seagrass meadows (Francour *et al*., 1999). The methodology proposed is a modified version of an already existing citizen science project that is easy and cost effective and could be widely implemented to improve the knowledge informing the status of this species which is crucial in the Mediterranean Sea.

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