

A survey-based assessment of seagrass status, management and legislation in Europe

Carmen B. de los Santos¹, Ragnhildur Sigurdardottir², Alexandra Cunha³, Kevan Cook⁴,
Jozef Wiktor⁵, Agnieszka Tatarek⁵, Rui Santos⁶.

¹ CIIMAR-CIMAR – Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Porto, Portugal.

² Reykjavik Academy, Reykjavík, Iceland.

³ Joint Nature Conservation Committee, Peterborough, United Kingdom.

⁴ Natural England, Truro, England, United Kingdom.

⁵ Department of Marine Ecology, Institute of Oceanology of the Polish Academy of Sciences, Sopot, Poland.

⁶ CCMAR-CIMAR – Centre of Marine Sciences, University of Algarve, Faro, Portugal.

Publication information:

Conference: IMMR | International Meeting on Marine Research 2014, Peniche, Portugal, 10 Jul – 11 Jul, 2014.

Presentation Type: Poster Presentation

Topic: Biodiversity, Conservation and Coastal Management

Citation: de los Santos CB, Sigurðardóttir R, Cunha A, Cook K, Wiktor JM, Tatarek A and Santos R (2014). A survey-based assessment of seagrass status, management and legislation in Europe. Front. Mar. Sci. Conference Abstract: IMMR | International Meeting on Marine Research 2014.

Received: 26 Jun 2014; Published Online: 18 Jul 2014.

doi: 10.3389/conf.FMARS.2014.02.00027

ABSTRACT

Seagrass meadows are ranked amongst the most productive ecosystems on Earth, providing high-value ecosystem services in coastal areas. Yet, seagrass habitats are declining worldwide at an unprecedented rate as a consequence of both anthropogenic and natural pressures, which suggests an inefficient management. Seagrasses are widespread along European coasts and the knowledge on their conservation status and management has been increased in the last decade although an overall view for the whole Europe is lacking. The general aim of this survey-based study was to assess the present status of seagrass habitat conservation, management and legislation in Europe based on the expert judgement of 25 participants from 19 coastal European countries. We specifically assessed the seagrass ecological status and their major threats; the level of awareness; the effort in mapping, monitoring and restoration; and the state of management plans and policy in each country. We furthermore reviewed the legislation for seagrass habitats in order to assess the protection status of seagrasses in Europe. The survey-based assessment revealed great differences among seagrass species and countries regarding their awareness, ecological status, mapping, monitoring and management. Several good examples of seagrass management, in cooperation with scientists, were identified although many countries still lack the fundamental tools for a proper management. A consistent body of legislation was compiled for most European countries, yet their implementation was reported to be rather variable and weak. The results of this study will provide guidelines for a more effective seagrass management and policy in Europe.

Keywords

Seagrass management, seagrass legislation, seagrass monitoring, *Zostera noltei*, *Zostera marina*, *Cymodocea nodosa*, *Posidonia oceanica*

INTRODUCTION

Seagrass meadows are common ecosystems along the European coastline (Green and Short, 2003), providing a wide range of valuable ecosystems services (e.g. Barbier et al., 2011, Cullen-Unsworth et al., 2013). Four native species are found in Europe: *Zostera marina* and *Z. noltei* occurs in all regional waters, *Posidonia oceanica* is endemic of the Mediterranean Sea, and *Cymodocea nodosa* is mainly found in the Mediterranean but also occurs in the Southern Atlantic. The increasing concentration of human population in European coastal areas entails an increasing pressure on seagrass ecosystems, eventually causing their loss and degradation (EEA, 2013). Seagrasses are, in fact, amongst the most threatened global coastal ecosystems due to past and present human pressure (Orth et al., 2006, Waycott et al., 2009), compromising the ecosystem services they provide. An effective seagrass management is therefore essential to mitigate their decline. Despite the poor attention received in the last decades (Duarte 1999, Duarte et al. 2008), the importance of seagrass ecosystems and the knowledge on their status, awareness and management in Europe has recently increased (e.g. Borum et al., 2004, Marbà et al., 2014), although an overall picture of seagrass management for the whole Europe is lacking. The COST Action ES0906 “Seagrass Productivity: from genes to ecosystem management” (2010-2014) was an EU-based project that involved 19 European countries and over 130 seagrass researchers and aimed at creating links between researchers and managers to increase awareness and to aid in more effective management based on scientific knowledge. Within that framework, we sent a questionnaire to the participants of the project and other European experts with the objective of assessing the present research-based status of seagrass status, management and legislation in Europe, in order to promote guidelines for a more effective seagrass management.

MATERIAL AND METHODS

We analysed 25 questionnaires received in February-March 2012 from 19 countries (number of questionnaires by country between brackets when more than one): Croatia, Denmark, Estonia, Finland, France (2), Germany, Greece (3), Iceland, Ireland, Israel, Italy, Malta, Norway, Poland, Portugal (2), Spain (3), Sweden, The Netherlands, and

United Kingdom. As for the rest of the European countries, seagrass records do not exist or researchers or managers were not reached. The answers were based on “scientific knowledge” or “educated guesses”. Thus, the accuracy of the responses may vary considerably among countries depending on the actual knowledge of the seagrasses, although the evaluation of this was out of our scope. The questionnaire was composed of 3 blocks with yes/no or rating questions. In block (a), experts ranked the ecological status of the seagrass species from “very poor” to “excellent”; evaluated major disturbances threatening seagrass beds on the scale of 1 (not a threat) to 10 (a major threat); and ranked awareness of public, managers and policymakers on the importance of seagrass ecosystems (from “very poor” to “excellent”). In the second block (b) participants were asked: about seagrass mapping effort in their country (from “very poor” to “excellent”), monitoring programs, and restoration efforts. In the last block (c), participants were asked about the existence of legislation on seagrass protection at different levels (international, European Union and country- or regional-specific), the existence of management plans and their effectiveness (from “very poor” to “excellent”), and about positive or negative perceptions about the interaction of researchers with managers. Results were shown as number of surveys (independently of having several surveys for the same country) or integrated by country. Scores given to threats were presented as the sum of scores from all surveys.

RESULTS AND DISCUSSION

Perception of the ecological status of European seagrasses varied greatly among species and countries. *Z. noltei* and *Z. marina* got low scores in most of the countries whereas *P. oceanica* was rated from “moderate” to “very good” and *Cymodocea nodosa* got very dissimilar scores (Fig 1). Coastal development and eutrophication were reported as the mayor threats to seagrasses (Fig 2), in agreement with recent global or regional assessments (Grech et al., 2012, Marbà et al., 2014). Some of the respondent underlined the limited research background to score seagrass threats or their local particularity. Seagrasses have been reported as uncharismatic ecosystems (Duarte et al., 2008) and this was reflected in our results: scores were low for the public and policy makers and variable for managers (Fig 1). Some respondents highlighted a differential awareness

among species (higher for *P. oceanica* than for other co-existing species). Several management and conservation instruments are, however, increasing the seagrass awareness in Europe, such as the use of seagrasses as indicators in the Water Framework Directory (WFD) and the existence of volunteer-based monitoring programmes, which typically include outreach initiatives for the general public and interactions with managers (e.g. www.lifepositoniandalucia.es, www.famar.wordpress.com).

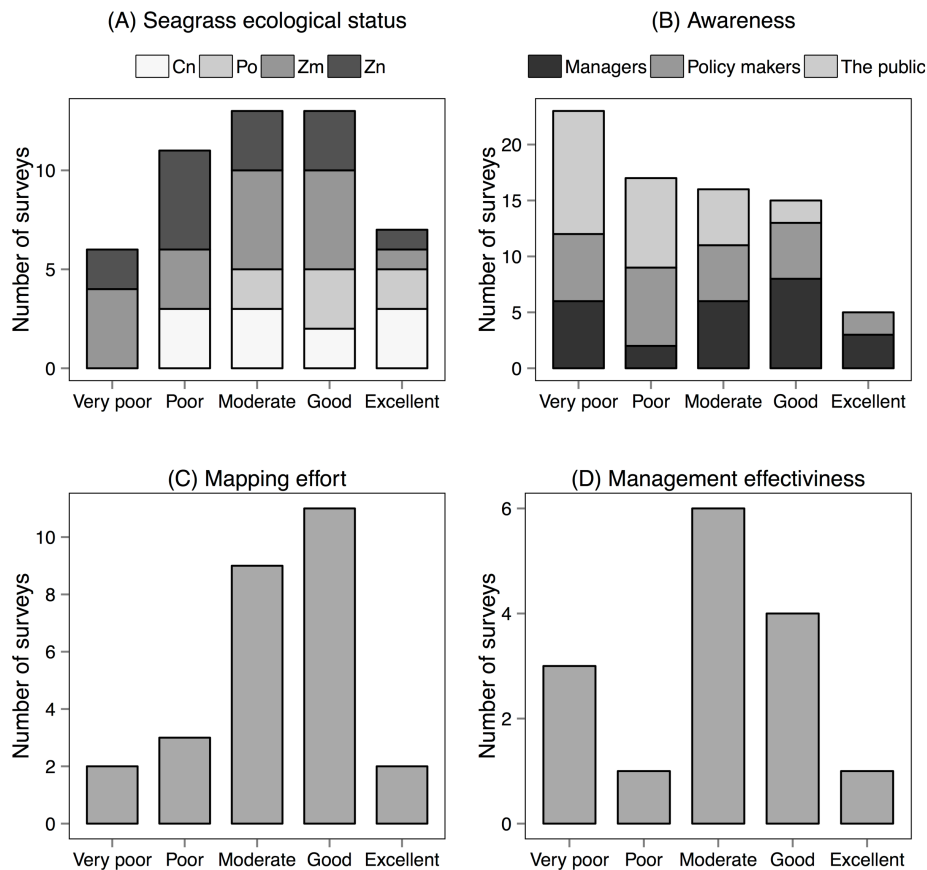


Figure 1. Results from the survey regarding seagrass ecological status, awareness, mapping effort and management effectiveness.

Borum et al. (2004) stated that “several countries already have established comprehensive and advanced monitoring programmes for seagrasses, but in many European countries programmes are virtually absent”. After a decade, our survey showed that seagrass monitoring effort, although increasing, is still variable or absent in some countries (Figs 1 & 3). Similarly, the mapped area of seagrass beds is very poor in many countries (Fig 1), or only presence/absence data or roughly theoretical

estimations of total area are available. Seagrass mapping and/or monitoring were reported to be unorganised (specially when various local groups and/or regional agencies are involved) and without standardised methodologies in some countries, and the information was said to be inaccessible sometimes. Several attempts of seagrass recovery were reported in Europe (Fig 3), mainly for *Zostera* spp, although most of them were described as experimental, in early stage to determine their success, or with “poor” or “very poor” success. Although restoration programmes are considered as a feasible solution to seagrass recovery, efforts towards natural restoration potential has been recommended (Cunha et al., 2012).

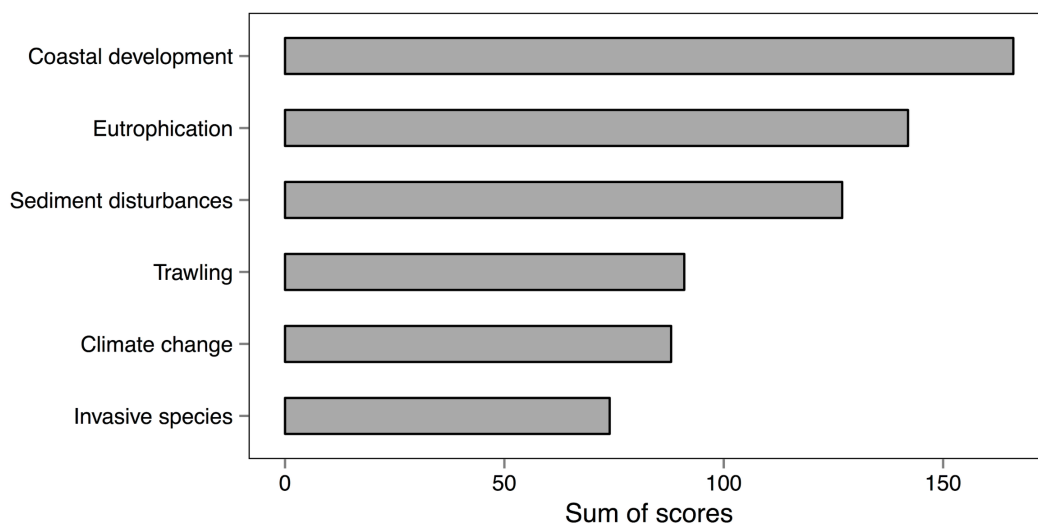


Figure 2. Mayor threats for seagrass meadows in Europe. Values shown the sum of scorers from all the surveys.

Rating of seagrass management was unequal across European countries (Fig 1). Only the 39% of the countries mentioned the existence of management plans for seagrasses, but in most cases they were not strictly aimed at seagrass ecosystems. In other regions, management plans were under construction or they only included a single seagrass species (e.g. *P. oceanica* in the Mediterranean Sea). Respondents mentioned a lack of coordination between different administrative levels (national, regional, local) dealing with seagrass management. Detailed perceptions about positive interaction with managers were only given by some respondents (Germany and The Netherlands). Other countries only mentioned that interactions were “good”, “positive” and/or “useful” although others described them as “scarce”, “ineffective” or “constrained”, or only

exclusive for monitoring issues. Some respondents pointed out that managers, and no scientists, should take the initiative in this kind of interactions, and that the WFD offers an excellent opportunity to improve the scientific-managers interface.

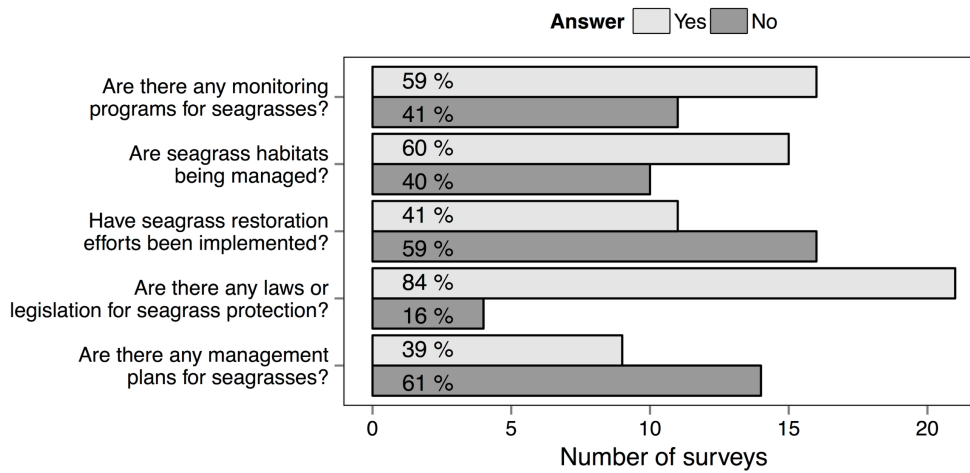


Figure 3. Results from yes/no questions in the questionnaires.

Seagrass species and habitats in Europe are subjected to different levels of protection which ranges from international directives and conventions, to national and regional regulations. Within this ample sphere of legislation to protect seagrasses, only a few of them act at a specific level. At the international level, the compiled legislative tools were: Habitat Directive (192/43/EEC), OSPAR Convention (protection of 3 of the European seagrasses in Atlantic coasts), Bern Convention (protection of seagrass species), Barcelona Convention (indirect protection of Mediterranean seagrass habitats), Ramsar Convention (indirect protection of seagrass habitats) and IUCN International Red List (considering European seagrass species as “Least Concern” although some species are locally threatened). Most of the valuable seagrass sites were reported to be under protection as Marine Protected Areas, including Ramsar sites. At the national and regional level, only 3 out of 19 analysed countries did not report any further laws reinforcing seagrass protection besides international legislation. The rest of the countries described specific national regulations, which, in most of the cases, were the transposition of Habitat and WFD directives and Bern and Barcelona Conventions. Apart from the international, regional and national regulations, indirect

measures and legislation give an important contribution to protect seagrasses, such as those related to fisheries gear use and aquaculture implementation. Despite the consistent body of legislation for most European countries, the implementation was perceived by respondents as rather variable and weak.

The overall picture drawn from this assessment showed a wide, yet uneven, effort in seagrass management, monitoring and mapping in Europe. Differences among species and countries indicated that more coordinated efforts, within and among countries, are needed for the implementation of effective measures for seagrass conservation and management in Europe. This approach may include the inclusion of seagrass sites in Marine Protected Areas, the development of a common legal framework to accommodate the unique nature of seagrass ecosystems, a long-term comparable scientific monitoring network in Europe, and the cooperation of society, managers and scientists.

Acknowledgement

CBS is grateful for the COST Action ES0906 for being granted with a Short-Term Scientific Mission.

References

- Barbier, E., Hacker, S., Kennedy, C., Koch, E., Stier, A., and Silliman, B. (2011). The value of estuarine and coastal ecosystem services. *Ecol. Monogr.* 81(2), 169–193.
- Borum, J., Duarte, C. M., Krause-Jensen, D., and Greve, T. (2004). European seagrasses: an introduction to monitoring and management. The M&MS project.
- Boström, C., Baden, S., Bockelmann, A.-C., Dromph, K., Fredriksen, S., Gustafsson, C., and others (2014). Distribution, structure and function of Nordic eelgrass (*Zostera marina*) ecosystems: implications for coastal management and conservation. *Aquat. Conserv. Mar. Freshw. Ecosys.* 24(3), 410–434.
- Cullen-Unsworth, L. C., Nordlund, L. M., Paddock, J., Baker, S., McKenzie, L. J., and Unsworth, R. K. F. (2013). Seagrass meadows globally as a coupled social-ecological system: Implications for human well being. *Mar. Poll. Bull.* 83(2), 387–397.
- Cunha, A., Marbà, N., van Katwijk, M. M., Pickerell, C., Henriques, M., Bernard, G., Ferreira, A., Garcia, S., Garmendia, J., and Manent, P. (2012). Changing paradigms in seagrass restoration. *Restor. Ecol.* 20(4), 427–430.

Duarte, C. M. (1999). Seagrass ecology at the turn of the millennium: challenges for the new century. *Aquat. Bot.* 65(1), 7–20.

Duarte, C. M., Dennison, W., Orth, R., and Carruthers, T. (2008). The charisma of coastal ecosystems: addressing the imbalance. *Estuar. Coast.* 31(2), 233–238.

European Environment Agency (2013). Balancing the future of Europe's coasts. Knowledge base for integrated management. Technical Report 12/2013.

Grech, A., Chartrand-Miller, K., Erfteimeijer, P., Fonseca, M., McKenzie, L., Rasheed, M., Taylor, H., and Coles, R. (2012). A comparison of threats, vulnerabilities and management approaches in global seagrass bioregions. *Environ. Res. Lett.* 7(2), 024006.

Green, E. P. and Short, F. T. (2003). *World Atlas of Seagrasses*. University of California Press.

Marbà, N., Díaz-Almela, E., and Duarte, C. M. (2014). Mediterranean seagrass (*Posidonia oceanica*) loss between 1842 and 2009. *Biol. Conserv.* 176, 183–190.

Orth, R., Carruthers, T., Dennison, W., Duarte, C., Fourqurean, J., Heck Jr, K., Hughes, A., Kendrick, G., Kenworthy, W., Olyarnik, S., et al. (2006). A global crisis for seagrass ecosystems. *Bioscience*, 56(12), 987–996.

Waycott, M., Duarte, C. M., Carruthers, T. J. B., Orth, R. J., Dennison, W. C., Olyarnik, S., and others (2009) Accelerating loss of seagrasses across the globe threatens coastal ecosystems. *Proc. Natl. Acad. Sci.* 106 (30), 12377–12381.