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Crowdsourcing conservation: The role of citizen science in securing a future for seagrass

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ABSTRACT

Seagrass meadows are complex social-ecological systems. Understanding seagrass meadows demands a fresh approach integrating "the human dimension". Citizen science is widely acknowledged for providing significant contributions to science, education, society and policy. Although the take up of citizen science in the marine environment has been slow, the need for such methods to fill vast information gaps is arguably great. Seagrass meadows are easy to access and provide an example of where citizen science is expanding. Technological developments have been pivotal to this, providing new opportunities for citizens to engage with seagrass. The increasing use of online tools has created opportunities to collect and submit as well as help process and analyse data. Citizen science has helped researchers integrate scientific and local knowledge and engage communities to implement conservation measures. Here we use a selection of examples to demonstrate how citizen science can secure a future for seagrass.

1. Introduction

Our oceans, and biodiversity more broadly, are in crisis (Hoag, 2010; Novacek, 2008). Acting to manage many of these complex issues at play requires data and knowledge about these systems. Yet governments generally have limited capacity to generate and manage the scale of data required to respond appropriately to these challenges of environmental management in the 21st century. With growing evidence that marine research is under-resourced compared with that on land, novel solutions to these problems are sorely need (Richardson and Poloczanska, 2008).

Seagrass meadows are marine powerhouses (Lavery et al., 2013), and are a key part of that ocean biodiversity. They provide an example of a data poor habitat of global importance that are undoubtedly in crisis (Orth et al., 2006; Waycott et al., 2009). Seagrasses are flowering marine plants that grow in sheltered shallow coastal areas on sandy or muddy substrates. The meadows they form provide habitat, food and shelter for a diverse range of invertebrates, fish, mammals and birds. As such, these meadows are crucially important for juvenile and larval stages of many commercial, recreational and subsistence fish and shellfish globally (Beck et al., 2001; Heck et al., 2003; Jackson et al., 2001; Lilley and Unsworth, 2014; Short et al., 2011).

In order to protect seagrasses into the future the development of appropriate environmental management strategies at local, regional and global scales must be underpinned by understanding their distribution, what threatens them and their historical loss. Seagrass loss globally is generally the result of poor and reduced water quality, driven by unsustainable coastal development, poor integrated coastal zone management, and physical destruction. In these cases, seagrasses suffer due to lack of acknowledgment of their existence and value (Duarte et al., 2008). Despite a global understanding of the negative effects that these impacts have on seagrass ecosystem services, we know very little about smaller scale impacts (Grech et al., 2012), which are often locally specific and missed in management and practice - for example seaweed farming (Eklof et al., 2006). Obtaining such information at local scales is therefore essential but can be difficult and expensive to collect.

The cost and logistical limitations of working in intertidal and subtidal seagrass environments contribute to this lack of data. In the intertidal, short tidal periods reduce sampling time, and subtidal seagrass meadows require either the use of costly SCUBA teams, sonar equipment or towed video systems. Seagrass monitoring in many

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