Ocean & Coastal Management 115 (2015) 77–87

Contents lists available at ScienceDirect

Ocean & Coastal Management

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

Making marine and coastal citizen science matter

John A. Cigliano [a, *], Ryan Meyer [b], Heidi L. Ballard [c], Amy Freitag [d], Tina B. Phillips [e], Ann Wasser [f]

[a] Department of Biological Sciences, Cedar Crest College, 100 College Drive, Allentown, PA 18104, USA
[b] California Ocean Science Trust, USA
[c] School of Education, University of California, Davis, USA
[d] Virginia Sea Grant, USA
[e] Cornell Lab of Ornithology, 159 Sapsucker Woods Road, Ithaca, NY 14850, USA
[f] Pacific Grove Museum of Natural History, USA

ARTICLE INFO

Article history:
Received 16 December 2014
Received in revised form
4 June 2015
Accepted 9 June 2015

Keywords:
Citizen science
Marine conservation
Coastal conservation
Toolkit

ABSTRACT

Against the backdrop of a dramatic increase in citizen science activity worldwide, we convened a combined symposium and focus group at the 2014 International Marine Conservation Congress to consider the challenges and opportunities for mobilizing citizen science in the marine and coastal environment. Highlighting the diversity of existing models and approaches to citizen science, participants focused on six different conservation-related outcomes that citizen science projects can potentially support: policy, education, community capacity building, site management, species management, and research. We provide two example case studies of projects and summarize the key themes and recommendations associated with each of those outcomes. The result is a series of "toolkits" that can help to guide new and existing citizen science projects that aim to support management and conservation of ocean resources, as well as providing insights and recommendations to stimulate further research on and assessment of marine and coastal citizen science programs. Citizen science is an effective approach to conservation and it is time for this underutilized resource to become a more prominent approach for marine and coastal conservation.

© 2015 Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

The number of projects globally that engage the public in scientific research (i.e, citizen science) has dramatically increased in recent years (Conrad and Hilchey, 2011). Citizen science can be defined as scientific research and monitoring projects for which members of the public collect, categorize, transcribe or analyze scientific data (Bonney et al., 2014). Although not as prevalent as in other systems (Theobald et al., 2015), citizen science projects in marine and coastal systems worldwide provide opportunities for individuals to engage in marine conservation-related activities, such as monitoring reef systems (Pattengill-Semmens and Semmens, 2003) and species (Cigliano and Kliman, 2014), categorizing whale calls (Shamir et al., 2014), and tracking marine debris (Hidalgo-Ruza and Thiel, 2013; Smith and Edgar, 2014) and invasive species (Delaney et al., 2008). The use of citizen science in marine and coastal contexts can impact marine conservation more broadly by influencing management (of, e.g., fisheries) and policy, improving stewardship, and strengthening community capacity to address environmental problems (Conrad and Hilchey, 2011; Danielsen et al., 2013).

1.1. Challenges for marine and coastal citizen science

Roy et al. (2012) put forward a framework focused on the scale of participation (local to mass participation) and degree of investment (from simple to thorough, referring to both project managers and participants). In a broad international survey of more than 200 citizen science projects, they found that marine and coastal citizen science is underrepresented in general (comprising only 14% of their sample), and biased toward either thorough and local programs, or simple mass participation programs. This result, they argue, suggests an opportunity for marine citizen science to expand and diversify.

* Corresponding author.
E-mail address: jaciglia@cedarcrest.edu (J.A. Cigliano).

http://dx.doi.org/10.1016/j.ocecoaman.2015.06.012
0964-5691/© 2015 Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

There are many explanations for the pattern they observed, some rooted in the challenges of the marine environment. Citizen science projects in marine contexts encounter challenges not faced in terrestrial systems. The primary challenges are logistical, stemming from the fact that humans, at best, spend only part of their life on the water. In many contexts, access for citizen scientists is more challenging than on land, often requiring expensive boats, diving gear, or transportation to the coast. Safety and liability issues of marine-based data collection can also be prohibitive and costly, especially when involving children. Relatedly, it is still uncommon in some cultures to learn to swim or incorporate marine activities into daily life, so it may be difficult to recruit citizen scientists in some regions without extensive training accompanying a cultural shift toward becoming more comfortable with the ocean. Other potential factors include unclear resource rights and the lack of visibility and site definition, i.e., it may be harder for citizen scientists to "take ownership" of a site without obvious demarcations or recognizable boundaries. These and other factors may contribute to the apparent under-representation of marine and coastal projects in citizen science in general (Roy et al., 2012, Theobald et al., 2015).

1.2. Why work with citizen scientists in marine and coastal conservation research?

The purpose of this paper is to demonstrate a variety of ways in which citizen science can be an effective and rigorous method for advancing marine conservation and management, using case studies of citizen science projects that have successfully fulfilled their conservation-related goals and outcomes as examples. We also provide a typology of marine conservation outcomes that can be effectively addressed using citizen science and scientists, and, finally, a set of "toolkits" for each category of marine conservation outcome through which citizen science can be implemented. Our goal is to make it feasible and useful for marine conservation scientists and practitioners to use citizen science, and to discern when citizen science is appropriate to address marine conservation and management issues.

This paper is the product of a combined symposium and focus group, *Making Marine Citizen Science Matter*, held at the 3rd International Marine Conservation Congress (IMCC). The symposium consisted of seven presentations by an interdisciplinary group of researchers and practitioners that provided an overview of marine citizen science and case studies of projects that have successfully fulfilled their conservation-related goals. The symposium set the foundation for the accompanying focus group that was attended by 35 participants ranging from deeply experienced practitioners and scholars of citizen science to relative newcomers to the field. The focus group built on the discussion from the symposium to apply and further refine a typology of marine conservation outcomes that could be addressed using citizen science and scientists. The focus group discussion was framed by six types of conservation outcomes determined to be related to conservation effort success: policy, education, community capacity-building, site management, species management, and research (Kapos et al., 2009). Using discussion notes from the focus group, we developed "toolkits" for each of the conservation outcomes to further support the development or adoption of citizen science in marine contexts.

In the next section we describe two of the seven case studies from the symposium to demonstrate the variety of cases that were presented in terms of structure and conservation-related goals and outcomes. We then move on to the toolkits developed from focus group discussions that involved more than 35 participants over the course of a full day.

2. Case studies

2.1. Engaging citizen scientists in surveying and monitoring queen conch (Strombus gigas) in Belize

Fisheries around the world are in decline (FAO, 2012). One such fishery is queen conch, *Strombus gigas*, a large marine gastropod found throughout the Caribbean from Venezuela to southern Florida, Bermuda and throughout the Caribbean (Theile, 2001). In response to this decline, most countries have imposed management regulations on the harvest of queen conch, primarily minimum length, gear restrictions, and seasonal closures. In Belize, management of the queen conch fishery consists of size limits (at least 17.75 cm in length with a minimum weight of 86 g for cleaned meat), a closed season corresponding to peak reproduction (July 1 – September 30), and a prohibition on the use of SCUBA (Pérez, 1997). Belize has also established a network of 13 marine protected areas (MPAs) to protect queen conch and other fisheries (Cho, 2005). One such MPA is the Sapodilla Cayes Marine Reserve (SCMR), a 119 km^2 reserve located at the southern end of the Mesoamerican Barrier Reef. The SCMR is a zoned-reserve with varying levels of protection: (1) General Use Zone (GUZ): commercial extractive activities are allowed but managed; (2) Conservation Zones (CZ): no commercial extractive activities are allowed; and (3) Preservation Zone (PZ): entry is prohibited except with a special permit for research. The reserve was declared in 1996 but was not enforced until April 2009 (J. Finch, pers. comm).

Because there had been no systematic survey of queen conch populations in the SCMR, the project team conducted a shallow-water survey of conch aggregations from 2006 to 2012 inside and outside protected zones before and after enforcement began. Shallow-water sites are important to the life history of queen conch as nursery areas (Stoner, 1997; Posada et al., 1999). The project was developed during a community workshop convened in May 2005 by Earthwatch Institute and the Toledo Association for Sustainable Tourism and Empowerment (TASTE; now Southern Environmental Association [SEA]), the NGO responsible with co-managing the reserve with the Department of Fisheries. This workshop brought together key stakeholders, scientists and research organizations to prioritize issues relevant to the sustainability of the SCMR and to formulate research questions to address these issues. Thirty-five individuals representing 19 organizations participated in the workshop. The queen conch survey project was an outcome of this workshop. The conservation goals of this project included: (1) determining the effectiveness of the SCMR in protecting and replenishing queen conch populations, (2) providing information for adaptive management of the reserve, and (3) building capacity in stakeholders.

Citizen scientists, participating through the Earthwatch Institute, were engaged in most aspects of this co-created project. Co-created projects are designed by scientists and members of the public together with some of the public participants actively involved in most or all steps of the scientific process (Bonney et al., 2009; Shirk et al., 2012). In addition to collaborating on the planning of the project, local citizen scientists (fishers, Department of Fisheries officers, TASTE) helped locate sample sites (current and historical aggregation sites) and both the local (including undergraduate students from the University of Belize Natural Resource Management program) and international citizen scientists surveyed transects, either while snorkeling or diving, and recorded size (length) and age (lip thickness) of conch, and also tagged conch with unique alphanumeric tags (Floy Tag Inc.).

One benefit to using citizen scientists in marine conservation projects is the ability to increase the temporal and spatial scale of a project (Miller-Rushing et al., 2012; Ward et al., 2015) and this was

Download English Version:

https://daneshyari.com/en/article/8061413

Download Persian Version:

https://daneshyari.com/article/8061413

Daneshyari.com