Modernizing Citizen Science: Improving Data Management for Effective Resource Protection

Proposers: Molly Williams, MESM 2019

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Objectives:
The broad scope of this project is to promote the validity of citizen science as a widely applicable data collection method for research and resource management purposes. Ocean management is in need of spatially expansive, high-quality species distribution data, which can increasingly be collected by non-expert ocean users due to smartphone technology. The more focused objective of the project is to analyze how citizen science is being modernized using apps developed through NOAA and other government agencies that crowd-source observational data (including CINMS’ Whale Spotter Pro and Whale Alert). The assessment will:

- Determine quality of citizen science data collected through apps compared to other methods of data collection by performing case studies on different apps
- Improve crowd-sourced data management to make data more accessible, to inform research as well as decision-making
- Analyze the role of citizen science in policy changes, using case studies such as the movement of shipping lanes and seasonal/dynamic vessel speed reduction zones in the Santa Barbara Channel
- Contribute findings to the update of Whale Spotter Pro and Whale Alert to benefit resource management at CINMS and BOEM

Significance:
NOAA has used citizen science for decades, but its incorporation into mainstream data collection has become increasingly common recently due to the rise of smartphone mobile technology. Crowd-sourced data can be utilized strategically for addressing critical data gaps required for adaptive resource management and policymaking, and can serve to engage, empower, and educate the public (Aceves-Bueno et al., 2015). Further, public participation in science can accelerate discovery and generate data in a cost-effective manner (Burgess et al., 2014). However, proving the legitimacy of data collected by non-experts for use in research and high-stakes decision-making has proven to be challenging. Massive amounts of data are needed to effectively manage resources, and conservation strategists around the world would benefit from legitimizing citizen science as a data source. Data enhancement and effective management has the power to address many of the problems we face, and public participation in research can increase involvement and input from communities (Aceves-Bueno et al., 2015). When citizen science is rigorously designed and applied to research, it is capable of generating high-quality, sought-after data (McKinley et al., 2016). Improving citizen science data collection and data management strategies will benefit overall ecological research and could help solve both current and future environmental problems.
Background:
NOAA CINMS and BOEM are interested in incorporating citizen science projects into their research programs in ways that will inform their unique missions. In 2017, BOEM was the lead client for a Bren GP that developed a citizen science monitoring protocol for the intertidal zone, for the purpose of establishing a longterm baseline data set in the event of an oil spill or other energy-related ecological disruption. Local environmental organizations, such as Santa Barbara Channelkeeper, have taken recommendations from the project.

A current challenge for both NOAA and BOEM are the many different groups generating crowd-sourced data, which is not stored in a centralized repository. Centralizing this data would benefit a wide variety of research, beyond that being undertaken at NOAA and BOEM. BOEM doesn’t currently have an agency plan for citizen science, but would like to explore the concept as it relates to the agency mandate. Ideally, BOEM wants to be able to layer species distribution data along with marine debris sightings and oil spills. A specific research project at BOEM on the Spatial and Acoustic Ecology of Marine Megafauna (SPAM) would be informed by data collected from citizen science, and would in return support the development of citizen science infrastructure for future research initiatives.

The researchers and managers at CINMS have expressed the need to have access to species distribution data in near real time, and the traditional system of waiting years for research to be published is too long to make decisions in an adaptive management regime. The Channel Islands Naturalist Corps program has made strides in training capable citizen scientists who utilize the Whale Spotter Pro and Whale Alert apps to generate observational data. CINMS faces a challenge in that the apps are in need of an update, and the team wants to know what their options are for maintaining and even improving the functionality and effectiveness of these resource protection tools. This provides an opportunity for analysis of how government agencies can modernize using new technology, and what the best business methods are for doing so. Ideally, the data collected from these apps would be fed into a broader network, and improve overall data accessibility. Using marine spatial planning and observational data to build the repository will be applicable to many other fields, such as designing marine protected areas and environmental assessments (required for BOEM permitting).

Available data:
Primary data collection will not be required for this project, as NOAA has access to rich marine mammal observational database (collected from both apps and prior paper data sheets), which will be used for the main case study for this project. NOAA also has back-end and shore-based data, as well as access to relational data collected by apps focused on tide pools, kelp, and fish identification.

Possible approaches:
• Analyze modernization of long-term monitoring data and citizen science programs that have migrated to app-based data collection
• Consider different ways to visualize data for presentation to both experts and the public (look at whale alert west coast site – needs work)
• Feasibility pilot study: bringing in diverse data and sending back out as an alert, especially to industries that are important to BOEM and NOAA
  o Reduce risk of ship strikes on whales by sending out data as a real-time alert
• Compilation of best practices learned through analysis of data from citizen science apps at NOAA and beyond, as well as those learned in the 2016 Bren citizen science project led by BOEM, + literature review
• Perform cost-benefit analysis on commonly used apps, and determine whether there is a distinction in data quality between custom-built native apps and web apps
  o Cost comparison to include design, implementation and maintenance of app and database.
• Collaborate with the Channel Islands Naturalist Corps to conduct interviews with citizen scientists to investigate how they interact with the apps
• Analyze how both front-end and backend data that are useful for conservation management are being stored and accessed

**Deliverables:**
• In-depth review of how crowd-sourced data are being used and stored, and resulting recommendations for improving the database
• Modernize apps being used to collect marine mammal sightings data to be scalable and widely applicable
• Improve/establish citizen science data quality standards that improve data quality and quantity for management and maximize use of technology
• Finalized cost-benefit analysis and recommendation based on best practices for app-based data collection strategies
• Make recommendations for how to design research experiments that incorporate crowd-sourced data to maximize data usability

**Internships:**
• Internship available with NOAA CINMS office (small stipend likely available (<$1,000);  
• BOEM citizen science team is headquartered in DC - summer internship possible, funding for internships to be determined based on federal budget;  
• Camarillo BOEM office can offer unpaid internship, and provide a workspace and professional development opportunities  
  o Intern could be shared with CINMS  
  o In the case of the current GP on Ocean acidification, the California Ocean Protection Council actually hosted the intern; a similar partnership shared-hosting situation could occur here

**Budget:**
$1300 should be sufficient for all project needs. Expected costs are limited at this time to printing, short-distance travel, and other presentation-related fees.

**Supporting Materials:**


January 26, 2018

Bren Group Project Review Committee
Bren School of Environmental Science and Management
2400 Bren Hall
University of California, Santa Barbara
Santa Barbara, California 93106-5131

Dear Bren Group Project Review Committee:

The Channel Islands National Marine Sanctuary (CINMS) has enjoyed a long-standing partnership with the Bren School of Environmental Science and Management. We are again excited to serve as a co-client for the proposed group project thesis – Modernizing Citizen Science: Improving Data Management for Effective Resource Protection. What is unique about this proposed group project is an alliance with the Bureau of Ocean Energy and Management (BOEM) to investigate the growing reliance on citizen science collected and managed data to better inform federal resource management actions on ever increasingly complex ocean management challenges.

As the client of the project, we will ensure that data and other information made available to the students will be provided with no stipulation for a nondisclosure agreement or restriction to publication of their report.

In addition to providing relevant data, consultation and supervision our office plans to host one to two student interns, and provide a stipend, if funds are available. This project and the internship(s) will allow Bren student(s) to work directly within CINMS and BOEM to improve and advance our citizen science data collection initiatives and to support real world ocean resource management.

Thank you in advance for your favorable review of this proposal. We look forward to deepening our partnership with Bren and the advancement of citizen science proposed by this group project. Please contact me at (805) 893-6424, sean.hastings@noaa.gov if you have questions or additional information needs.

Sincerely,

Sean Hastings
Resource Protection Coordinator
Channel Islands National Marine Sanctuary