ACSA Publications Listing

No. 8 – August 2019

List moderator: Colleen Foelz

Journal Articles - *Conference Proceedings Articles* *Dissertations* - *Books & Chapters*

From the moderator

Thank you to everyone who contributed to this issue of the ACSA Publications Listing.
The ACSA Publication Listing is a quarterly electronic listing of publications in the field of citizen science within the Australian community. The listing is intended to share information with those interested in the Australian citizen science community. The deadline for contributions is announced two weeks prior to the listing. Contributions may be submitted at any time.
Please only submit those publications where you are the author (to prevent duplication) and only include those that have been accepted for publication.

Colleen Foelz

Abstracts of recently published journal articles

FrogID: Citizen Scientists Provide validated Biodiversity Data on Frogs of Australia

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There is an urgent need for comprehensive global biodiversity data, particularly for highly threatened taxa such as frogs. Some of the most dramatic frog population declines, globally, have occurred in Australia, but logistical difficulties of surveying frogs (i.e., the large size of Australia and remoteness within it) have limited our knowledge of biodiversity. Citizen science projects have recently facilitated the collection of broad-scale biodiversity data, but the application of citizen science data collection to frogs has lagged behind other taxa. Citizen science projects targeting frogs have been successful in collecting occurrence data, but typically rely on species identification via user-submitted photographs. Photographs of frogs can be difficult to identify to species and may also inadvertently

encourage handling of frogs. We developed FrogID, an expert validated biodiversity database of frog occurrences in Australia, reliant on acoustic validation. FrogID uses smartphone technology, allowing participants to submit recordings of calling frogs, providing a biodiversity database with geo-referenced frog species records, and a digital collection of frog calls. In a short time, FrogID has allowed us to collect data on rare and threatened frog species, document the decline of native frog species from parts of their range, and detect invasive species, including native species that have established populations outside their native range. In this paper, we (1) introduce FrogID, including technical details, (2) highlight preliminary findings, and (3) identify potential future uses of the data.

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Does citizen science have the capacity to transform population health science?

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Citizen science engages members of the public in research design, data collection, and analysis – in asking and answering questions about the world around them. The United States, European Union, and Australia have placed citizen science at the forefront of national science policy. Journals such as Science, Nature and Bioscience regularly feature projects conducted by citizens. Citizen science engages millions of people worldwide. However, to date, population health science has not relied heavily on citizen contributions. Although community-based participatory action research remains a strong foundational method to engage those affected by public health problems, there is additional potential to mainstream population health through wider, less intensive opportunities to be involved in our science. If we are to tackle the complex challenges that face population health then new avenues are needed to capture the energy and attention of citizens who may not feel affected by public health problems, i.e. to engage the 'by-standers' in population health science. Particular types of citizen science methods have the potential to do this. But simply increasing the breadth and volume of scientific evidence will not be enough. Complex, intractable, macro-level problems in population health require change in how our journals and funding bodies respond to data generated by the public. Of course, democratisation of science and the potential decentralisation of scientific authority will bring deep challenges. But potentially it brings a future where population health science is better known, understood and respected, with benefits for the types of public policies that derive from this science.

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Redmap Australia: Challenges and Successes With a Large-Scale Citizen Science-Based Approach to Ecological Monitoring and Community Engagement on Climate Change

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Citizen science includes a suite of research approaches that involves participation by citizens, who are not usually trained scientists, in scientific projects. Citizen science projects have the capacity to record observations of species with high precision and accuracy, offering the potential for collection of biological data to support a diversity of research investigations. Moreover, via the involvement of project participants, these projects have the potential to engage the public on scientific issues and to possibly contribute to changes in community knowledge, attitudes and behaviors. However, there are considerable challenges in ensuring that large-scale collection and verification of species data by the untrained public is a robust and useful long-term endeavor, and that project participants are indeed engaged and acquiring knowledge. Here, we describe approaches taken to overcome challenges in creation and maintenance of a website-based national citizen science initiative where fishers, divers, and other coastal users submit opportunistic photographic observations of 'out-of-range' species. The Range Extension Database and Mapping Project (Redmap Australia) has two objectives, (1) ecological monitoring for the early detection of species that may be extending their geographic distribution due to environmental change, and (2) engaging the public on the ecological impacts of climate change, using the public's own data. Semi-automated 'managed crowd-sourcing' of an Australia-wide network of scientists with taxonomic expertise is used to verify every photographic observation. This unique system is supported by efficient workflows that ensures the rigor of data submitted. Moreover, ease of involvement for participants and prompt personal feedback has contributed to generating and maintaining ongoing interest. The design of Redmap Australia allows co-creation of knowledge with the community – without participants requiring formal training – providing an opportunity to engage sectors of the community that may not necessarily be willing to undergo training or otherwise be formally involved or engaged in citizen science. Given that capturing changes in our natural environment requires many observations spread over time and space, identifying factors and processes that support large-scale citizen science monitoring projects is increasingly critical.

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Maximising the potential for citizen science in New South Wales

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Citizen science is growing rapidly in Australia and globally, and presents valuable opportunities to engage with the community and amplify scientific research. The recent growth in citizen science is largely attributed to technology and has resulted in citizen science now recognised as having the potential to augment and enhance traditional scientific research and monitoring. Citizen science can deliver a level of spatial granularity often not possible with conventional research. This, coupled with its potential to engage the public meaningfully in science, uniquely positions citizen science to monitor and thereby effect genuine scientific outcomes. However, the rapid growth in citizen science has also resulted in some data and information challenges that need to be overcome. Here we present a general overview of citizen science and some of the opportunities and challenges associated with its rapid growth, with a focus on Australia. We use case studies of successful citizen science projects in New South Wales to demonstrate its potential across areas such as cost efficiency and scalability. Overall, these examples show how citizen science has the potential to provide a monumental shift in our ability to monitor the environment while simultaneously increasing understanding and trust in science within the broader community.

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Pelagic citizen science data reveal declines of seabirds off south-eastern Australia

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Many seabird communities are declining around the world, a trend frequently linked to climate change and human impacts on habitat and prey. Time series observations of seabirds away from breeding colonies are generally rare, which limits our understanding of long-term changes for conservation actions. We analysed a dedicated citizen science dataset of pelagic seabird abundance (86 species – 30 used for modelling analysis - from 385 trips) from two locations over 17 years (2000–2016) and a third for seven years, over the continental shelf and slope of south-eastern Australia. To estimate temporal trends and environmental drivers, we used generalised additive modelling and species archetype modelling for groups. Almost half (43%) of the most abundant seabird species declined in our study area over the 17 years. The declines may be associated with human-induced ecosystem change and represent poleward shifts in distribution out of our study area, changes in population abundance, or both. Winter-dominant groups, primarily species rarely frequenting warmer water, were often negatively associated with *SSTanom*, while summer-dominant groups, composed of species more tolerant of temperate and tropical environments, were generally positively associated with *SSTanom*. Widespread local declines in seabird populations are of increasing concern. Understanding the extent to which these observed declines represent real declines in abundance, or range shifts, should be a priority. Changing sea temperatures are probably contributing to both. These results from the coast of south-eastern Australia need to be placed in the context of the highly mobile study organisms and the vast spatial scale of the ocean. Long-term citizen science observations, from an array of locations around the world, promise to provide valuable insights into seabird ecology, playing a key part in seabird conservation.

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Comparing science communication theory with practice: An assessment and critique using Australian data

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Scholars have variously described different models of science communication over the past 20 years. However, there has been little assessment of theorised models against science communication practice. This article compares 515 science engagement activities recorded in a 2012 Australian audit against the theorised characteristics of the three dominant models of deficit, dialogue and participation. Most engagement activities had objectives that reflected a mix of deficit and dialogue activities. Despite increases in scientific controversies like climate change, there appears to be a paucity of participatory activities in Australia. Those that do exist are mostly about people being involved with science through activities like citizen science. These participatory activities appear to coexist with and perhaps even depend on deficit activities. Science communication scholars could develop their models by examining the full range of objectives for engagement found in practice and by recognising that any engagement will likely include a mix of approaches.

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Crowd surveillance: estimating citizen science reporting probabilities for insects of biosecurity concern

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Many seabird communities are declining around the world, a trend frequently linked to climate Data streams arising from citizen reporting activities continue to grow, yet the information content within these streams remains unclear, and methods for addressing the inherent reporting biases little developed. Here, we quantify the major influence of physical insect features (colour, size, morphology, pattern) on the propensity of citizens to upload photographic sightings to online portals, and hence to contribute to biosecurity surveillance. After correcting for species availability, we show that physical features and pestiness are major predictors of reporting probability. The more distinctive the visual features, the higher the reporting probabilities—potentially providing useful surveillance should the species be an unwanted exotic. Conversely, the reporting probability for many small, nondescript high priority pest species is unlikely to be sufficient to contribute meaningfully to biosecurity surveillance, unless they are causing major harm. The lack of citizen reporting of recent incursions of small, nondescript exotic pests supports the model. By examining the types of insects of concern, industries or environmental managers can assess to what extent they can rely on citizen reporting for their surveillance needs. The citrus industry, for example, probably cannot rely on passive unstructured citizen data streams for surveillance of the Asian citrus psyllid (*Diaphorina citri*). In contrast, the forestry industry may consider that citizen detection and reporting of species of the large and colourful insects such as pine sawyers (*Monochamus spp*.) may be sufficient for their needs. Incorporating citizen surveillance into the general surveillance framework is an area for further research.

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Abstracts of recently published essays

Improving big citizen science data: Moving beyond haphazard sampling

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Citizen science is mainstream: millions of people contribute data to a growing array of citizen science projects annually, forming massive datasets that will drive research for years to come. Many citizen science projects implement a “leaderboard” framework, ranking the contributions based on number of records or species, encouraging further participation. But is every data point equally “valuable?” Citizen scientists collect data with distinct spatial and temporal biases, leading to unfortunate gaps

and redundancies, which create statistical and informational problems for downstream analyses. Up to this point, the haphazard structure of the data has been seen as an unfortunate but unchangeable aspect of citizen science data. However, we argue here that this issue can actually be addressed: we provide a very simple, tractable framework that could be adapted by broadscale citizen science projects to allow citizen scientists to optimize the marginal value of their efforts, increasing the overall collective knowledge.

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Abstracts of recently published dissertations
