ACSA Publications Listing
No. 11 – June 2020
List moderator: Amy Slocombe

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.

If you are interested in obtaining a copy of one of the papers below, you can email the lead author who may send you a copy at their discretion.

Amy Slocombe

Abstracts of recently published journal articles

The small home ranges and large local ecological impacts of pet cats

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Domestic cats (*Felis catus*) are a conservation concern because they kill billions of native prey each year, but without spatial context the ecological importance of pets as predators remains uncertain. We worked with citizen scientists to track 925 pet cats from six countries, finding remarkably small home ranges (3.6 ± 5.6 ha). Only three cats ranged > 1 km^2 and we found no relationship between home range size and the presence of larger native predators

(i.e. coyotes, *Canis latrans*). Most (75%) cats used primarily (90%) disturbed habitats. Owners reported that their pets killed an average of 3.5 prey items/month, leading to an estimated ecological impact per cat of 14.2-38.9 prey ha^{-1} yr^{-1}. This is similar or higher than the per-animal ecological impact of wild carnivores but the effect is amplified by the high density of cats in neighborhoods. As a result, pet cats around the world have an ecological impact greater than native predators but concentrated within ~100 m of their homes.

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doi: https://doi.org/10.1111/acv.12563

Our collaborators in the US have made this video that explains the paper:
https://youtu.be/SYJATBgQlY0

Estimating the spatial coverage of citizen science for monitoring threatened species

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Monitoring threatened species is vital for effective conservation, and citizen science can fill information gaps where professionally derived monitoring data are unavailable or guide where further survey efforts may be warranted. Yet the geographic and taxonomic coverage of citizen science projects is poorly understood. Using a snapshot in time approach, we reviewed citizen science monitoring and survey projects in Australia in 2017 and identified 133 projects contributing to threatened species monitoring or conservation action in both terrestrial and marine environments. Most projects (61%) are relevant for 10 or fewer threatened species. Relevant citizen science projects tend to be concentrated along the more densely populated eastern and south-western coasts, while relatively few projects occur in northern regions of Australia. Our findings show a high convergence between citizen science project densities and threatened species richness in many terrestrial areas, although they also highlight areas with potential to expand citizen science, and indicate areas where professional monitoring is unlikely to be augmented by citizen science.

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Sustaining Citizen Science beyond an Emergency

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This commentary explores lessons learned about aspects of citizen science sustainability, such as open data reuse after a project ends or after the urgency of a disaster. It is framed to be consistent with emerging research about how the 2020 pandemic relates to the sustainable development goals (SDGs). It argues for the importance of open data in citizen science, both in platform design and in citizen science outputs, to support sustainability beyond a funding cycle or emergency. This commentary discusses open datasets developed during the Ebola outbreak response in 2014 and the role of collaborative repositories in enabling uses beyond a single project. How citizen scientists can creatively contribute in ways aligned with humanitarian disaster response aims is explored.

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Conservation value of a subtropical reef in south-eastern Queensland, Australia, highlighted by citizen-science efforts

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Subtropical reefs are important habitats for many marine species and for tourism and recreation. Yet, subtropical reefs are understudied, and detailed habitat maps are seldom available. Citizen science can help fill this gap, while fostering community engagement and education. In this study, 44 trained volunteers conducted an ecological assessment of

subtropical Flinders Reef using established Reef Check and CoralWatch protocols. In 2017, 10 sites were monitored to provide comprehensive information on reef communities and to estimate potential local drivers of coral community structure. A detailed habitat map was produced by integrating underwater photos, depth measurements, wave-exposure modelling and satellite imagery. Surveys showed that coral cover ranged from 14% to 67%. Site location and wave exposure explained 47% and 16% respectively, of the variability in coral community composition. Butterflyfishes were the most abundant fish group, with few invertebrates being observed during the surveys. Reef impacts were three times lower than on other nearby subtropical reefs. These findings can be used to provide local information to spatial management and Marine Park planning. To increase the conservation benefits and to maintain the health of Flinders Reef, we recommend expanding the current protection zone from 500- to a 1000-m radius.

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The heterobranch sea slugs of Lord Howe Island, NSW, Australia (Mollusca: Gastropoda)

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The distribution of heterobranch sea slugs is generally poorly documented at a regional scale. Thus, it is currently difficult to quantify biodiversity, identify endemic and invasive species, and track range shifts at scales relevant to conservation management. For Lord Howe Island, which lies ~600 km east of the New South Wales (NSW) mid-north coast, data from a range of taxa indicate high biodiversity and endemism, but this has not been examined for heterobranch sea slugs. To address this deficit, we collated occurrence data on sea slugs from both private and public sources, including museum records, scientific literature, field guides and citizen science activities. A total of 186 nominal (formally described) species in 82 genera and 31 families were identified from intertidal and subtidal habitats. Of these, two species are endemic to Lord Howe Island, two have not been recorded elsewhere in Australia, and 28 have not been recorded on the mainland coast of NSW. These results support studies of other taxa suggesting that the relative isolation of the island has facilitated the development of diverse and unique assemblages. However, this isolation is moderated by larval transport from surrounding regions, resulting in considerable overlap of the species pool with the mainland coast of NSW and tropical areas to the north.

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Mapping citizen science contributions to the UN sustainable development goals

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The UN Sustainable Development Goals (SDGs) are a vision for achieving a sustainable future. Reliable, timely, comprehensive, and consistent data are critical for measuring progress towards, and ultimately achieving, the SDGs. Data from citizen science represent one new source of data that could be used for SDG reporting and monitoring. However, information is still lacking regarding the current and potential contributions of citizen science to the SDG indicator framework. Through a systematic review of the metadata and work plans of the 244 SDG indicators, as well as the identification of past and ongoing citizen science initiatives that could directly or indirectly provide data for these indicators, this paper presents an overview of where citizen science is already contributing and could contribute data to the SDG indicator framework. The results demonstrate that citizen science is "already contributing" to the monitoring of 5 SDG indicators, and that citizen science "could contribute" to 76 indicators, which, together, equates to around 33%. Our analysis also shows that the greatest inputs from citizen science to the SDG framework relate to SDG 15 Life on Land, SDG 11 Sustainable Cities and Communities, SDG 3 Good Health and Wellbeing, and SDG 6 Clean Water and Sanitation. Realizing the full potential of citizen science requires demonstrating its value in the global data ecosystem, building partnerships around citizen science data to accelerate SDG progress, and leveraging investments to enhance its use and impact.

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Doi: https://link.springer.com/article/10.1007/s11625-020-00833-7

Productivity, resource efficiency and financial savings: an investigation of the current capabilities and potential of South Australian home food gardens

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As the dominant form of urban agriculture (UA) in Australia, existing home food gardens potentially represent a significant resource in the context of future urban food security and sustainability. However, a severe lack of in-field data has hindered our understanding of the form and function of home food gardens which in turn may hinder innovation and improvement. We investigated the productivity, resource efficiency and potential financial savings of home food gardens in South Australia. A group of 34 citizen science participants measured and recorded inputs and outputs from their gardens. Inputs included time spent on various gardening activities, financial costs, and water use. Outputs included crop yields, from which retail value and nutritional content were then derived. The paper outlines a field-demonstrated, comprehensive methodology for continued and consistent data collection for all forms of UA. We found smaller gardens to be more intensive than larger gardens, requiring higher inputs, but also returning higher outputs per unit area. Both productivity and resource efficiency varied among the gardens, and labour requirements were significantly lower than previously estimated. Water use efficiency of the gardens were calculated and found to have comparable water use efficiency to commercial horticulture. Of the gardens involved, we calculated that 65% should break even in five or less years and save money. After applying a minimum wage almost one in five gardens were financially viable. The results represent the most comprehensive measurements on home food gardens to date, and allow practical, evidence-based recommendations for diversification, time saving and smart irrigation practices to improve garden productivity and enhance the viability of UA.

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An Evaluation of Citizen Science Smartphone Apps for Inland Water Quality Assessment

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Rapid and widespread monitoring of inland and coastal water quality occurs through the use of remote sensing and near-surface water quality sensors. A new addition is the development of smartphone applications (Apps) to measure and record surface reflectance, water color and water quality parameters. In this paper, we present a field study of the HydroColor (HC, measures RGB reflectance and suspended particulate matter (SPM)) and EyeOnWater (EoW, determines the Forel–Ule scale—an indication to the visual appearance of the water surface) smartphone Apps to evaluate water quality for inland waters in Eastern Australia. The Brisbane river, multiple lakes and reservoirs and lagoons in Queensland and New South Wales were visited; hyperspectral reflection spectra were collected and water samples were analysed in the laboratory as reference. Based on detailed measurements at 32 sites, covering inland waters with a large range in sediment and algal concentrations, we find that both water quality Apps are close, but not quite on par with scientific spectrometers. EoW is a robust application that manages to capture the color of water with accuracy and precision. HC has great potential, but is influenced by errors in the observational procedure and errors in the processing of images in the iPhone. The results show that repeated observations help to reduce the effects of outliers, while implementation of camera response functions and processing should help to reduce systematic errors. For both Apps, no universal conversion to

water quality composition is established, and we conclude that: (1) replicated measurements are useful; (2) color is a reliable monitoring parameter in its own right but it should not be used for other water quality variables, and; (3) tailored algorithms to convert reflectance and color to composition could be developed for lakes individually.

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Survival of native seedlings planted by volunteers: The Lower Cotter, ACT case study

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Volunteer labour is often used for planting native seedlings for revegetation projects. The survival of such plantings is seldom monitored and reported. The overall survival of seedlings at three years of age was assessed for eight years of plantings established by nearly 15,000 volunteers in the Lower Cotter River catchment in the Australian Capital Territory. Mean survival was 66.8% across all years. We conclude that volunteers can be effectively integrated into large-scale revegetation projects if they are well trained and organised.

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Abstracts of recently published Conference Papers

Exploration of Aural & Visual Media About Birds Informs Lessons for Citizen Science Design

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Acoustic sensing has been hailed as a game-changer for detecting furtive wildlife, but uptake has been constrained by the laborious process of reviewing resultant torrents of audio data. To inform the design of interactive interfaces for reviewing audio recordings, we explored how people interact with aural and visual media about birds. We observed how twelve participants with different levels of interest in birds engaged with vocalization recordings, visualizations of bird calls, photographs, and range maps of three species. By conducting thematic analysis, we identified a variety of Challenges of Exploration and Benefits of a Media Assortment. We contribute lessons for designing to Bridge Knowledge & Context and to Facilitate Long-term Engagement with audio in ways that are fun, accessible, and informative. We provide explicit guidance for designers to diversify how citizen scientists interact with nature through audio as they move from engagement to conservation action.

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Citizen Science: a tool for ecology, conservation and science communication

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Australia is a big country. Despite our best efforts, scientists and practitioners simply can't get to every place in Australia to survey, monitor or manage biodiversity. Citizen science is growing in popularity in Australia as a method for monitoring and sometimes managing biodiversity and other environmental variables at temporal and spatial scales that would not be possible otherwise. Citizen science provides a fantastic way for researchers and scientific institutions to 'open the door' to nonscientists and facilitate community education and engagement in limitless ways. Citizen science projects can provide examples of the best of science communication, the media love citizen science stories, and by definition the public are passionate and involved.Ongoing challenges for implementing successful citizen science programs include perceived risks with data quality, community willingness and capacity to engage, and return on investment. This symposium will showcase new tools, techniques and methods of citizen science data collection and analysis. Through different case studies, we highlight the benefits and challenges of different citizen science approaches and programs for building ecological knowledge, informing biodiversity management decisions, facilitating education, and fostering community engagement with nature.

Themes to explore:

- Key factors in successful projects which engage, educate and enrich community members while also delivering data that is useful for scientific research and/or planning and policy.

- Recent growth in the popularity of citizen science can largely be attributed to technology. Mobile apps and online training and support allows scientists to design and implement monitoring protocols.

- What can we do as citizen science practitioners and participants to instil confidence in the research and academic community that citizen science derived data is suitable for informing research and management?

While citizen science is not an appropriate tool for all ecological studies or researchers, it has many varied uses and we believe there is an appetite in the ecological community for information on how citizen science is useful to individuals or labs for data gathering and community education and outreach. Citizen science can formalise community input to scientific studies; public opinion and interpretation is highly valuable for ecological studies, and the expertise of amateur naturalists is often an untapped or underutilised resource. Citizen scientists can provide rapid and broadscale assistance to researchers and practitioners when faced with sudden environmental or anthropogenic change that needs an urgent response.

Abstracts of recently published Books

Handbook of Citizen Science on Ecology and Conservation

Christopher A Lepczyk[1] (Editor), Owen D. Boyle[2] (Editor), Timothy L.V. Vargo[3] (Editor)

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Handbook of Citizen Science in Ecology and Conservation is the first practical and comprehensive manual for creating, implementing, or improving natural science research and monitoring projects that involve collaboration between scientists and the general public. As citizen science projects become increasingly common, project leaders are seeking information on concrete best practices for planning and implementing projects—practices that allow them to guide and gauge success while also ensuring the collection of high-quality data and rewarding experiences for volunteers. In this handbook, citizen science practitioners from around the world and with decades of experience provide step-by-step instructions, insights, and advice, and they explore real-world applications through case studies from a variety of citizen science projects. This is the definitive reference guide for anyone interested in starting or improving a citizen science project with ecological or conservation applications, from professors and graduate students to agency staff and nongovernmental organizations.

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https://www.ucpress.edu/book/9780520284791/handbook-of-citizen-science-in-ecology-and-conservation