EVENT ABSTRACT

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Citizen science: advantages of shallow versus deep participation

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The participation of non-experts in the acquisition or analysis of scientific data (citizen science) is a major opportunity for environmental scientists and agencies. In recent years, web and mobile technologies have enabled the proliferation of such programmes with studies showing that they provide a range of benefits. Citizen science projects can deliver increased temporal and spatial resolutions of key environmental data that strengthen research on ecological dynamics and environmental conditions. Another major benefit is an increased engagement in environmental management by members of the public and an increased awareness of the importance of research and monitoring (Dickinson et al. 2013). A central aspiration of citizen science is to create an informed community that supports sustainable environmental management (Conrad and Hilchey, 2011).

These dual objectives, social and scientific, would initially appear to be complimentary; an increased public participation in data gathering should result in both increased social capital and an expanded information base. However, in the design of citizen science projects, an important compromise is often made between participation and data quality. For example, raising awareness through mass participation across a larger geographical / temporal space versus gaining more robust, repeat measurements from fewer "expert" citizen scientists. This trade-off assumes a learning curve, where the proficiency of the person repeating the same measurements improves along with their knowledge and understanding of the data acquired (Jaber and Glock, 2013). A project with expert citizen scientists should have a relatively higher data quality compared to projects with a higher number of participants with limited experience. On the other hand, a larger number of people involved in the data gathering results in greater public engagement and awareness.

The number of participants to include in a citizen science project, and the duration of their commitment is also an economic one. Training and equipping citizen scientists has a per capita cost, and longer term projects require feedback and post-training of citizen scientists by the project initiator (scientist, agency, association) to provide recognition and a continuous learning environment.

FreshWater Watch is a global citizen science programme exploring freshwater ecosystem dynamics in 30 local projects in 20 countries. To date, over 15,000 datasets have been collected by more than 2,000 citizen scientists working in teams (average 3.2 participants per team). These measurements support local research priorities and agency monitoring as well as comparative freshwater studies undertaken by an international network of freshwater scientists (Castilla et al. 2015).

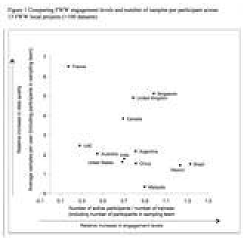
We analysed the data from FreshWater Watch to explore the relationship between projects in terms of participation (more users taking fewer measurements) and data quality (more measurements taken per user). Projects were grouped together into countries, and only projects with at least 100 datasets were considered. France, Singapore and the UK were seen to have the most measurements per user, allowing for more experience per measurement and therefore a potentially higher measurement quality. Malaysia, Mexico, Brazil, China, the US and India had relatively few repeat measurements per active participant (Figure 1). Indonesia was excluded from the present analysis as the highly elevated number of samples per user (31) was considered a far outlier.

This information becomes even more interesting when viewed from the point of view of engagement level; the number of participants active in each measurement event with respect to the number of users trained. In this case, there was an exceptionally high level of engagement in Singapore, Brazil and Mexico and a lower than average level in France, the UAE and Australia. Interestingly, many projects showed an engagement level near or above 1, where the number of persons participating in the measurement events was higher than the number of persons trained. This suggests that the programme was successful at reaching a wider audience than those originally trained.

The projects which combined above average measurements per user and wide engagement were the UK, Singapore and Canada. Projects with high levels of engagement and moderate levels of measurements per user were located in Brazil, Mexico, Malaysia, Argentina, China, India and the USA. It should be noted that relative differences in data quality between projects are only speculative, given that all data are quality controlled and corrected by users, initiators and Earthwatch once uploaded to the online database. Interestingly, projects in the UK, France and Canada allowed participants to self-select sampling sites, while sampling sites were assigned to participants by the project initiators in Malaysia, Argentina, Mexico, Brazil and China. This may indicate that self-selection favours repetition (e.g. adoption of a site) while assigned sites favour increased participation (multiple users adopting the same site).

The design of citizen science projects should consider both objectives of data quality and goals related to engagement and awareness. In the FreshWater Watch, sampling methods and training follow a common approach. However, projects showed a range of outcomes with respect to engagement and potential data quality. This is a result of differences in the sampling design between individual projects. Ultimately, a successful citizen science project balances engagement and scientifically robust data acquisition by situating itself on the nexus between the two. Providing multiple points of entry for participants interested in limited engagement as well as for those interested in more commitment provides options to meet both goals.

Figure 1



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